

Vermont's Wildlife Action Plan

November 22, 2005

Approved by the US Fish & Wildlife Service 11/22/2005



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Main Document

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I. Acknowledgments

Just over a year ago we asked local, state and national agencies, non-governmental organizations, sportsmen, conservationists, academics, land managers and other wildlife experts to join together in the development of an all-state, all-species wildlife conservation strategy. The response to this ambitious challenge was an extraordinary and unprecedented outpouring of collaborative effort resulting in Vermont's Wildlife Action Plan (formally the Comprehensive Wildlife Conservation Strategy). We thank the many participating Conservation Partners (Table 1-1) for responding to the call despite already busy schedules. Moreover, our appreciation goes out to the individuals serving on the eight technical teams (Table 3-1) charged with the nitty-gritty details of conducting species and habitat assessments, integrating the varied and complex needs of many wildlife species and crafting a report for all Vermonters interested in wildlife conservation.

We gratefully acknowledge the help of the International Association of Fish and Wildlife Agencies, and in particular Dave Chadwick, who provided tireless and invaluable 24-7 assistance, coordination and encouragement to Vermont and the other states and territories. We are grateful to the US Fish & Wildlife Service, particularly Colleen Sculley and the rest of the staff at the Region 5-Federal Assistance office, for their ongoing guidance and support.

We thank Vermont's congressional delegation who helped create the opportunity for this Wildlife Action Plan (WAP) and for establishing and maintaining the State Wildlife Grants program that funds WAP development and implementation. State Wildlife Grants together with the other federal wildlife conservation funding programs are vital to keeping common species common.

We humbly note that our goal would have been unattainable without a solid foundation—the rich legacy of Vermont's wildlife conservation history—the observations, stories, data, research, planning efforts, conservation, education and wildlife-recreation programs, institutions and traditions established and nurtured by those passionate about wildlife and Vermont's natural heritage over the past two centuries.

Finally, to all those furry, finned, feathered, scaled, slimy and shelled creatures—the charismatic megafauna and the enigmatic microfauna—that so fascinate and enrich our lives and economies, we look forward to a bright and healthy future together in the Green Mountain State.

Funding

Funding for the development of the Vermont Wildlife Action Plan was provided by the State Wildlife Grant Program, Vermont Fish & Wildlife Department, voluntary contributions to Nongame & Natural Heritage Program Wildlife Tax-Check-off and License Plate fund, and the many organizations, agencies, businesses and individuals who volunteered their time and expertise.

Recommended citation

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OFFICE OF THE GOVERNOR
STATE OF VERMONT

Dear Fellow Vermonters,

It is my pleasure to present to you this report: *Vermont's Comprehensive Wildlife Conservation Strategy* (CWCS). It was prepared by the Vermont Fish & Wildlife Department in collaboration with representatives of more than 60 local, state and national partner organizations and agencies. The CWCS represents the beginning of a historic conservation effort -- never before has Vermont undertaken such a comprehensive review of its wildlife.

Wildlife is important to Vermont and Vermonters. Wildlife is integral to the functioning of the ecosystems upon which we all depend, and two-thirds of Vermonters take part in wildlife-associated recreation. These Vermonters, along with tourists coming to Vermont to enjoy our wildlife, add close to $400 million to our economy annually.

We have a rich heritage of wildlife conservation going back more than 225 years to the appointment of our first game wardens in 1779. In 1864, George Perkins Marsh of Woodstock changed the way people around the world thought about land and land stewardship with his book *Man & Nature*. In the early 1900's, sportsmen played pivotal roles in the return of Vermont's wildlife icon the white-tailed deer, and later moose, beaver and salmon. And this year, all Vermonters can join me in celebrating the recovery of the common loon, peregrine falcon, and osprey to the point where they have been removed from the state's endangered species list.

The Comprehensive Wildlife Conservation Strategy marks the start of a new era in wildlife conservation, one where we can keep common species common. Furthermore, the CWCS complements my Clean & Clear Action Plan for Lake Champlain and the recently released Northern Forest Land Council 10th Anniversary Forum's Final Report: *Recommendations for the Conservation of the Northern Forest* to conserve the public and private forest lands and improve the economic viability of communities within our northern forests.

Together, these efforts support healthier wildlife populations and Vermont's reputation for a high quality of life and conservation of natural resources.

Sincerely,

The Honorable James Douglas

III. A User's Guide to Vermont's Wildlife Action Plan

Vermont's Wildlife Action Plan is a statewide, all-species conservation strategy to conserve wildlife and vital wildlife habitat before species become more rare and more costly to protect. The Action Plan is chock full of recommended actions, wildlife and habitat information and helpful resources for implementing conservation at many scales—from the very local to the statewide and beyond. All people, organizations, businesses and agencies (local, state and federal) are encouraged to take part.

Though the Action Plan contains an enormous amount of information, and it may seem easy to get lost in the details, the following information will help you stay on track:

1) **Introduction and Overview:** Regardless of how you intend to apply the information in the Action Plan (whether for research, education, grant writing, or on-the-ground conservation and management) begin by reading chapter one, the introduction, and the first half of chapter two, the Vermont Overview. These sections provide a science-based foundation for understanding the issues involved in addressing wildlife needs and puts conservation actions into a broader perspective to enhance the value, effectiveness and impact of your conservation work.

2) **Assess your goals:** Use the Wildlife Action Plan to identify how your or your organization's mission and goals relate to the needs of wildlife and wildlife habitat identified in the Action Plan. Questions to consider include: What strategies, in what part of the state, could I or my organization best implement? Which would provide the greatest long-term benefits?

   For example do you prefer to work locally (e.g., maintaining and improving wildlife habitat on your own land), within your community (e.g., incorporating wildlife conservation into your town plan), within a landscape or watershed (e.g., maintaining or improving the connectivity of a river and its tributaries), or at the statewide level (e.g., reducing the economic pressures on landowners that drive land conversion and fragmentation or working to reduce acid precipitation and mercury deposition into Vermont waters).

   - **If you are interested in conservation and management of a particular property or habitat type:** As an example, if you are developing a management plan for your woodland property in northern Vermont, you might be interested in the habitat and community types most likely to occur there and the Species of Greatest Conservation Need (SGCN) generally found in each. Thus, you might want to "enter" the Action Plan at page 4:35 (for landscape forests and major waterways) or appendix B (for other habitat types). There you'll to find habitat type descriptions, SGCN lists, descriptions of the problems impacting those habitat types as well as priority conservation actions, and potential partners funding sources.

   - **If you are interested in the conservation a particular species or species group**: "Enter" the document at page 4:12 for overviews of species by taxonomic group (e.g., birds, fish, invertebrates, mammals, reptiles and amphibians). Go to Appendix A to for detailed information about each Species of Greatest Conservation Need (SGCN). For example, if you are interested in conserving reptiles and amphibians you can go straight to page 4.30, if you are particularly interested in wood turtle conservation go to appendix A5 for the wood turtle Species Assessment Report.

   - **If you want to address the overarching problems impacting wildlife across the state and region:** "Enter" the document at chapter 1:9-Statewide Themes for Action. Here you will find actions designed to address the big picture issues and problems impacting all of Vermont's wildlife and wildlife habitat and that are most effectively addressed at the state, regional/national and international levels. For example, habitat loss along migration routes and the economic pressures that drive habitat fragmentation.

3) **Focus resources at conservation opportunity areas**: These are the lands and waters where the likelihood of successful conservation is strongest and the conservation needs of SGCN would best be met. For example, conserving large forest blocks, connectivity between blocks and connectivity of waterways is a foundational theme of Vermont's Wildlife Action Plan. To identify these opportunity areas use data sets available from the Fish & Wildlife Department and others such as contiguous forest blocks, wildlife linkage habitat, conserved lands, wildlife management areas, species richness and state significant community occurrence. Areas falling outside of conserved lands may be particularly vulnerable and provide opportunities for conservation.

   Recommended actions for these areas include, where appropriate, providing technical assistance to landowners and community planners, maintaining and expanding financial incentives to landowners, supporting programs to retain open space and minimize sprawl and poorly planned development, utilizing permitting processes such as Act 250 to address critical habitat considerations, and acquiring critical habitats in fee title or easement.

Additional Considerations

Recognize the complexity of habitat management: By its nature, managing habitats can positively affect some species while negatively affecting others. This is to be expected, and land managers have long wrestled with how best to balance the needs of multiple species and habitats for a variety of conservation and economic uses. There is no single "right" way to manage lands– just different ways resulting in different outcomes. It is often beneficial to approach such complexity by looking beyond a specific property and examining how a project fits into the larger landscape. Try also to incorporate not only ecological opportunities but also economic issues, social needs, and political factors.

The Wildlife Action Plan is a guidance document, not a regulatory one. It provides a menu of actions for conserving Vermont's wildlife; some actions may be more or less appropriate at any given place or point in time.

Integration with other plans: Finally, as comprehensive as it is, the Wildlife Action Plan is not without limitations. For example, it focuses only on wildlife. Additional work is required to integrate the Action Plan with other natural resource conservation and management plans, recreation plans, forest management plans, transportation plans and town plans to name just a few.

Additional Resources for Action Plan Implementation

Implementation Partners and Funding: A list of potential partners and funding sources can be found in each habitat summary in the Action Plan. Summaries begin on page 4:35 (landscape forests, landscape waterways and shorelines) and appendix B (for other habitat types).

Conserving Vermont's Natural Heritage*: a Guide to Community-Based Planning for the Conservation of Vermont's Fish, Wildlife and Biological Diversity*, available from VFWD is specifically designed to help towns plan for and conserve their wildlife www.vtfishandwildlife.com/library.cfm.

Wildlife Habitat Incentives Program (WHIP), a partnership between the Natural Resources Conservation Service and VFWD, provides technical and financial assistance to landowners to create and enhance wildlife habitat on their lands. Contact 802-241-3700 or fwinformation@state.vt.us

Landowner Incentives Program (LIP): a voluntary program of VFWD funded by the US Fish & Wildlife Service, LIP provides cost-share assistance to private landowners to protect, enhance, and restore habitat for rare, threatened, and endangered species. Contact 802-241-3700 or fwinformation@state.vt.us

Landowner's Guide to Managing Wildlife Habitat will be available from the VFWD in early 2007. Contact 802-241-3700 or fwinformation@state.vt.us to check on its status.

Wildlife Action Plan Coordinator: 802-241-3652, jon.kart@state.vt.us

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For use by the USFWS National Advisory-Acceptance Team (NAAT)

Congress requires that each state complete a Comprehensive Wildlife Conservation Strategy (CWCS) by October 1, 2005 if it wishes to remain eligible for State Wildlife Grant funds. There are eight congressionally required elements that each CWCS must address to be approved. Congress designated the Director of the US Fish & Wildlife Service (USFWS) to make approval determinations. The USFWS assembled a team of USFWS personnel and representatives from state fish and wildlife agencies and the International Association of Fish & Wildlife Agencies under the title National Advisory Acceptance Team (NAAT) and charged this group with reviewing each CWCS and making recommendations to the USFWS Director regarding CWCS approval.

According to USFWS guidance documents supplied to states, the NAAT "believes it must make an affirmative finding that all of the eight required elements are satisfactorily fulfilled in order for an "approval" recommendation to be made to the Director of the U. S. Fish and Wildlife Service."

This document is provided to help NAAT reviewers understand how Vermont addressed each of the eight congressionally required elements for a CWCS and where that information can be found in the report. It begins with an overview of how the report is organized and is followed by the eight elements and specifics as to where information satisfying the element can be found in the CWCS.

Report Development & Organization

Vermont took a linear approach to developing its CWCS (fig IV-1). We began by gathering stakeholders, experts and other agencies, organizations and individuals interested in wildlife conservation to finalize the development process and staff CWCS technical teams. Technical teams assessed the state's wildlife populations and then selected Species of Greatest Conservation Need (SGCN). For each SGCN the teams then delineated habitats, identified problems, research and monitoring needs and crafted conservation strategies. The SGCN were then assigned to one or more of 120 habitat categories, aquatic and natural communities and landscapes. These were then organized into 24 major habitat categories. Summaries of the status of each major habitat category were then developed. Statewide strategies and major themes for action were then identified to address those problems that impact many SGCN and habitats. Finally, a plan for the development of a statewide wildlife monitoring and adaptive management program was created.

Though development of this CWCS followed a bottom-up arc from individual species and populations to state and region-wide problems and solutions, its presentation in this report follows a different path. A user-friendly format, that includes five main chapters and 17 appendices, was selected to first provide readers with context, a big-picture view of wildlife conservation in the state, before diving deep in to the specifics of more 300 SGCN. Additionally, because we anticipate that most users of this 1,000-page document will only read sections of it there is some redundancy in the report. Reviewers will find information to help complete their assessment in the locations noted in Table IV-1.

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[1] **Acknowledgement:** We thank the CWCS developers in Michigan and North Dakota for sharing their CWCS reviewer guides which we have adapted here, and the USFWS Region 5 Federal Assistance staff for their support and assistance.

[2] **CWCS is the Action Plan:** Comprehensive Wildlife Conservation Strategy was the working title of the Wildlife Action Plan during it's development. The CWCS name was changed to Wildlife Action Plan after receiving federal approval on 11/22/2005.

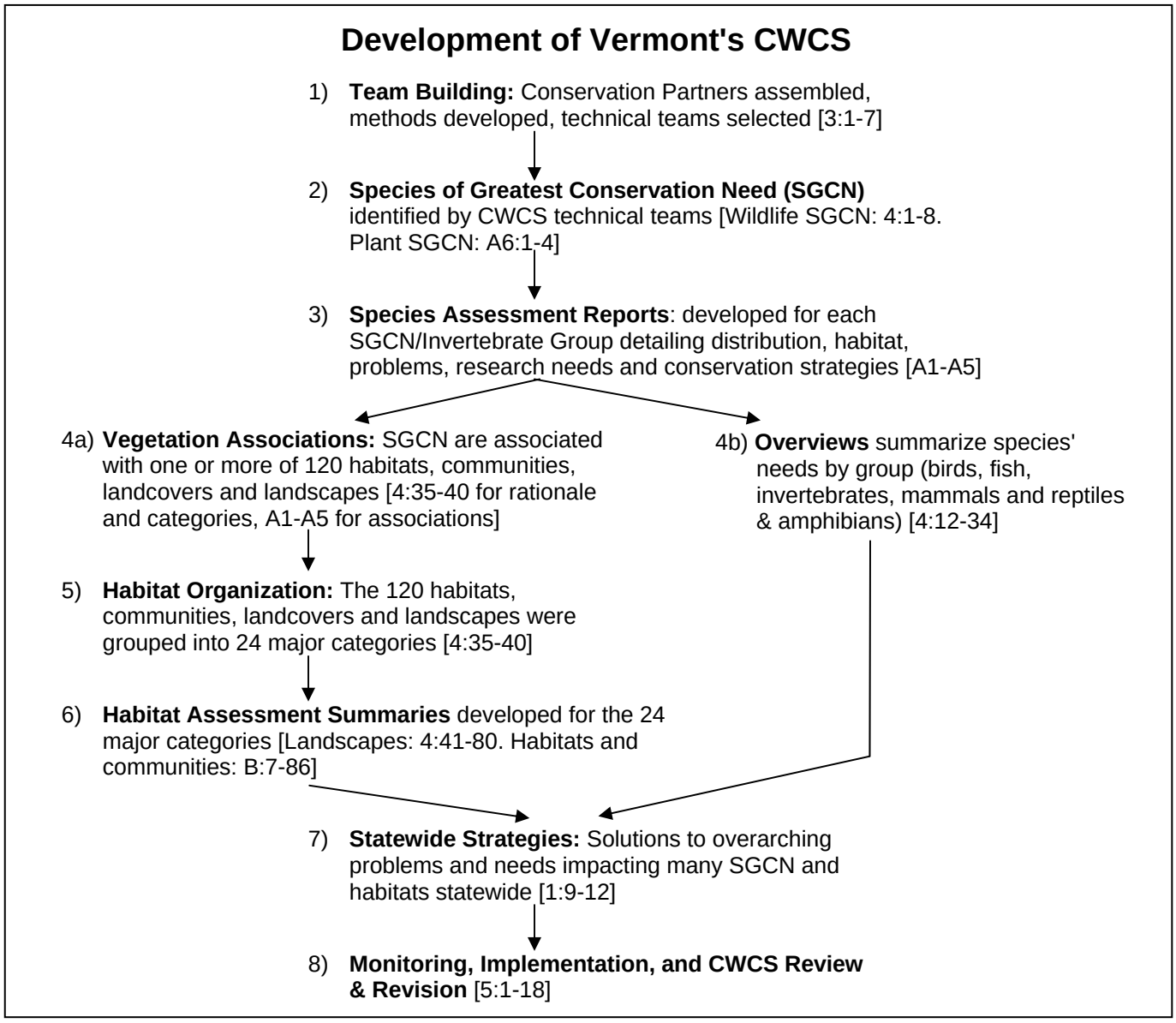

Fig 1: Development of Vermont's CWCS (Locations beginning with a letter (e.g., "B") refer to appendices. Appendix "A" contains subsection A1 through A6, one each of the six wildlife taxa examined in the CWCS (e.g. A3:1-6 refers to pages one through six if of appendix A3)

Table 1: Organization of Vermont's CWCS Report (Locations beginning with a letter (e.g., "B") refer to appendices. Appendix "A" contains subsection A1 through A6, one each of the six wildlife taxa examined in the CWCS (e.g. A3:1-6 refers to pages one through six if of appendix A3)

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Element 1. Information on the distribution and abundance of species of wildlife, including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife.		
NAAT Guidance	**Chapter/Page**	**Detail**
1A. The Strategy indicates sources of information (e.g., literature, data bases, agencies, individuals) on wildlife abundance and distribution consulted during the planning process.	4:3-8 A6:1-4 3:9-13 A1-A5:all	List of VT's wildlife Species of Greatest Conservation Need List of VT's plant Species of Greatest Conservation Need Vermont used the best available science and information on wildlife abundance and distribution including databases and records maintained by NNHP*, Natureserve, universities and research facilities, regional and national monitoring efforts & the knowledge of technical experts. Together this represents the Vermont's current of state of species knowledge. For information sources for each SGCN see Species/Invertebrate Group Assessment Report bibliographies
1B. The Strategy includes information about both abundance and distribution for species in all major groups to the extent that data are available. There are plans for acquiring information about species for which adequate abundance and/or distribution information is unavailable.	A1-A5:all A.3all A1-A5:all 5:1-14	Abundance is noted by State rank & distribution by biophysical region and 8-digit watershed on the first page of each Species/Invertebrate Group Assessment Report. Abundance and distribution data came from NNHP* databases and was augmented by technical team experts. A distribution narrative is also included in the Species/Group Reports. Due to the dearth of data on invertebrate species, invertebrate SGCN are treated by taxonomic and habitat groupings rather than individually. Research needs for each SGCN and SGCN Group are detailed in the Research & Monitoring section of each Species Assessment Report. A plan-wide data gathering monitoring program is outlined in chapter 5.
1C. The Strategy identifies low and declining populations to the extent data are available.	3:9-10 A1-A5:all I:1 (for rank definitions) A1-A5:all A1-A5:all	VT's CWCS focused on low and declining populations. Our SGCN list includes federal and state threatened and endangered species, species ranked S1 and S2, and species identified by our technical team experts, partners and scientific literature. SGCN with low populations are identified with a State Rank of S1 (very rare) or S2 (rare) in the Conservation Assessment section of each Species Assessment Reports. The "Regionally Rare" field provides an indication of rarity in the Northeastern US and adjoining Canadian provinces based on regional and national research, BBS routes, other monitoring and consensus within technical teams. Declining populations are noted in the "State Trend" field of the Species Assessment Reports (see Conservation Assessment section). This field records population trends as "Stable," "Fluctuating," "**Declining**," "Increasing," or "Unknown." In many cases "unknown" was selected because of knowledge gaps. The "Assessment Narrative" field provides details where available. Research and monitoring needs are identified for species whose population trends are unknown or poorly known in the Research & Monitoring section of each Species Assessment Report.

* *NNHP: Nongame & Natural Heritage Program of the Vermont Fish & Wildlife Department*

Element 1. Information on the distribution and abundance of species of wildlife, including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife.		
NAAT Guidance	**Chapter/Page**	**Detail**
1D. All major groups of wildlife have been considered or an explanation is provided as to why they were not (e.g., including reference to implemented marine fisheries management plans). The State may indicate whether these groups are to be included in a future Strategy revision.	3:9-10 A2 4:20-23 A3	VT's CWCS process considered all major groups of wildlife including, birds, fish, herptiles invertebrates, mammals, *and* plants. There are no marine environments with or adjacent to Vermont's borders. Several anadromous and catadromous fishes are on the VT SGCN list. Appropriate references are included in the Species/Invertebrate Group Assessment Reports for these species. Our knowledge of VT invertebrate is the most limited of all taxa. Research designed to augment our knowledge of invertebrates is included in the Invertebrate Overview and Invertebrate Group Reports
1E. The Strategy describes the process used to select the species in greatest need of conservation. The quantity of information in the Strategy is determined by the State with input from its partners, based on what is available to the State.	4:3-8 A6:1-4 3:9-13, 4:1-2 3:11, 4:12-34 3:11, 4:20-23 A3:all	List of VT's wildlife Species of Greatest Conservation Need List of VT's plant Species of Greatest Conservation Need See chapter 3 for selection procedure details. In general, expert input was incorporated through our CWCS technical teams (six Species Teams, Integration Team and Conservation Strategy Review Team). Additional input was solicited from Conservation Partners during Partner meetings and through individual and group correspondence Taxon specific selection procedures: Species Teams (technical experts for each of the six taxa listed above) selected SGCN based on criteria and guidance developed by our interdisciplinary Integration Team. There was some variation between teams in the threshold used for selection as SGCN (e.g. the herpitile team was the most conservative in selecting SGCN and the mammal team selected the most SGCN based on the need to address data gaps). This being Vermont's first CWCS our priority was not to ensure parity in numbers across taxa but rather to ensure that experts within each taxon were in accord regarding the species selected. The shear number of invertebrate species in VT (15,000-36,000) combined with our lack of knowledge of invertebrate biology and life-histories limited invertebrate SGCN selection. Whereas SGCN in other taxa are generally those species about which we know the *least*, invertebrate SGCN are generally those we know *best*. Future CWCS directed research and surveys will help expand our knowledge of this taxon.

NAAT Guidance	Chapter/Page	Detail
2A. The Strategy provides a reasonable explanation for the level of detail provided; if insufficient, the Strategy identifies the types of future actions that will be taken to obtain the information.	3:15	Protocols for describing habitats were developed by our multidisciplinary Integration Team in consultation with Species Teams.
	4:35-39 & repeated at B:1-5	Because no habitat classification system satisfactorily integrated the aquatic and terrestrial communities, successional stages, cultural habitats and landscapes used by VT's SGCN, a hybrid of several classification systems with more 120 types organized into 24 major habitat categories was created
	A1-A5:all	Habitat descriptions for each SGCN and Invertebrate SGCN Group are in the Species/Invertebrate Group Assessment Reports. Each includes a narrative, general habitat preferences, landscape requirements and assignment to one or more habitat type.
	4:41-80, B:7-86, 5:7, 1:11	Strategies to address habitat location and condition data gaps are included with habitat summaries, in the monitoring/ adaptive management plan for CWCS implementation and as statewide strategy (#3).
2B. Key habitats and their relative conditions are described in enough detail such that the State can determine where (i.e., in which regions, watersheds, or landscapes within the State) and what conservation actions need to take place	A1-A5:all	Key habitats for each SGCN are described in the Species Assessment Reports. Descriptions include a narrative and associations with 120 habitat, community and landscape categories.
	4:41-80 & B:7-86	Detailed assessments of the 24 major habitat categories comprising the 120 habitat types were created. Each contains descriptions, location, **current and desired conditions**, priority problems, research and monitoring needs and priority conservation strategies.

Element 3. Descriptions of problems which may adversely affect species identified in the 1st element or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats.		
NAAT Guidance	**Chapter/Page**	**Detail**
3A. The Strategy indicates sources of information (e.g., literature, databases, agencies, or individuals) used to determine the problems or threats	3:10-11 A1-A5:all	Vermont used the best available science and information to identify priority problems for SGCN and their habitats including records maintained by NNHP, Natureserve, universities and research facilities, PIF, PARC & the knowledge of technical experts. Teams identified only those factors posing significant and potentially significant problems for a species or habitat (not exhaustive lists of all possible problems).
	A1-A5:all	See the bibliography in each Species/Invertebrate Group Assessment Report for additional sources used.
	4:41-80, B-7-86	See the bibliography in each Habitat Summary for additional sources used. Technical team and expert knowledge played a significant role in the identification of problems.
	3:10-16	Identifying and addressing problems for SGCN generally began at the Species Teams level. However Integration Team and the Conservation Strategy Review Team also played important roles.

Element 3. Descriptions of problems which may adversely affect species identified in the 1st element or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats.		
NAAT Guidance	**Chapter/Page**	**Detail**
3B. The threats/problems are described in sufficient detail to develop focused conservation actions	C:1-6	Definitions for problem categories are in appendix C: Species Teams assigned each problem to one of 22 habitat related and non-habitat related problem categories. These categories were adapted from the wildlife conservation planning component of the Forest Plan Revision developed by the USFS Green Mountain National Forest in 2004. Categories are not mutually exclusive and depending on the problem and the species it impacts a problem could at times be placed in tow or more categories.
	A1-A5:all	Priority problems impacting a SGCN are listed in the Problem section of each Species/Invertebrate Group Assessment Report. This section contains a habitat-related and a non-habitat related problem list each followed by a narrative description of problems for that SGCN. Better known species generally have fuller problem descriptions. For some poorly understood SGCN descriptions of problems were more difficult. Species Teams have in some cases provided consensus recommendations of problems to provide a starting place to future researchers.
	4:12-34	Taxon-wide problems are described in the taxa overviews
	4:41-80 B:7-86	Problems impacting habitats are addressed in the Problem section of each Habitat Summary. The table includes a category field (for organizing problems), a "detail" field and a rank field (high, medium, low).
	3:14-15 table 3-5	Problems were assessed and ranked using methods adapted from Salafsky et al (2003) as many other states have done in their CWCS development.
	2:8-12	Major problems impacting species and habitats are summarized here.
3C. The Strategy considers threats/ problems, regardless of their origins (local, State, regional, national and international), where relevant to the State's species and habitats.	2:8-12, 4:9-10 C1-6	Problems, regardless of cause or origin, were considered. For example broad scale problems such as global warming and acid deposition as well as local problems such as the impact of recreational trails were all considered.
	3:15-16 C:1	Technical teams were instructed not to develop exhaustive lists of problems but rather to focus on the significant problems impacting a species or habitat.
3D. If available information is insufficient to describe threats/problems, research and survey efforts are identified to obtain needed information.	A1-A5:all	The Research & Monitoring Needs section of the Species/Invertebrate Group Assessment Reports includes a "threats and their significance" data field. In some cases research is also identified in the conservation strategies section of the Species/Invertebrate Group Assessment Reports.
	4:12-34	Taxon overviews note research needs that came up repeatedly.
	4:41-80 and B:7-86	Habitat summaries contain a "Problem and Information Needs" table that includes insufficient information problems.
	2:8-12	Data needs were identified as one of the major problems limiting our ability to conserve wildlife.

Element 3. Descriptions of problems which may adversely affect species identified in the 1st element or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats.		
NAAT Guidance	**Chapter/Page**	**Detail**
3E. The priority research and survey needs, and resulting products, are described sufficiently to allow for the development of research and survey projects after the Strategy is approved.	A1-A5:all	Priority research and survey needs are described for each SGCN in the Research and Monitoring section of the Species/Invertebrate Group Assessment Reports. Five research and monitoring categories were selected to help manage data collection (Habitat Requirements, Threats and Their Significance, Habitat Change, Monitor Threats, and Other Monitoring Needs). Technical Teams provided a narrative description of the research or monitoring need, and a priority rank of low, medium and high. As noted earlier teams were directed to focus on significant problems (medium and high). For most SGCN distribution and abundance data is the primary need.
	4:12-34	Priority research and survey needs applicable taxon-wide are broadly described in the taxa overviews
	4:41-80 B:7-86	Priority research and survey needs are described for each habitat category in the Problem and Information Needs section of each Habitat Summary
	5:1-12	Research and survey needs spanning multiple species and taxa will be addressed in the statewide wildlife monitoring and adaptive management program that will begin with CWCS implementation.
	1:11	The need for a wildlife monitoring and adaptive management program is identified as a fundamental statewide strategy

Element 4 Descriptions of conservation actions determined to be necessary to conserve the identified species and habitats and priorities for implementing such actions.		
NAAT Guidance	**Chapter/Page**	**Detail**
4A. The Strategy identifies how conservation actions address identified threats to species of greatest conservation need and their habitats.	C:7-10	Vermont's CWCS is a strategic document rather than an operational one and therefore focused on conservation strategies, not actions. We have been as explicit as possible in developing and describing conservation strategies while at the same time strategies are intentionally broad, directional, and nonspecific so as not to constrain our selection of actions for implementing strategies. Actions will be developed in the coming months and years during operational planning by the Fish & Wildlife Department and conservation partners. Generally, the connection between the problems and conservation strategies identified in the CWCS are intuitive and self-evident (e.g. habitat threatened by encroaching development would be targeted through a suite of strategies including technical assistance to developers and municipal planning authorities, conservation easements and efforts to increase funding for land acquisition).
	e.g. A2:81	Strategies are included to address immediate localized problems as well as broader, diffuse stressors and problems that may cause or exacerbate the localized problems (e.g. riparian habitat restoration to improve stream water temperatures and regional efforts to address climate change). Strategies are primarily voluntary and incentive-based.

Element 4 Descriptions of conservation actions determined to be necessary to conserve the identified species and habitats and priorities for implementing such actions.		
NAAT Guidance	**Chapter/Page**	**Detail**
4B. The Strategy describes conservation actions sufficiently to guide implementation of those actions through the development and execution of specific projects and programs.	3:14-16 C:7-10 4:11 C:7 5:13-15 1:9-12 4:12-34 A1-A5:all 4:41-80, B7-86	Technical teams developed conservation strategies to address priority problems to SGCN and their habitats identified. Strategies are organized using categories adapted from Salafsky et al (2005) Strategies balance the need to guide implementation with the need to maintain relevance and flexibility through the life of the CWCS (~10 years) and therefore are broad and directional. This allows for different approaches to providing that assistance, leaves the door open to a variety of potential implementers and allows for adaptation in response to changing conditions and new information. Where strategy implementation is to be funded by the State Wildlife Grant program the approach will be consistent with the mission and strategic plan of VT Fish & Wildlife Dept, and precise procedures will be detailed in operational plans once the CWCS is finalized. Conservation strategies are found in the following locations of the CWCS: 1) Statewide Strategies (strategies that appeared repeatedly across taxa and habitats, and strategies to address statewide, regional, and national problems). 2) Taxon-wide strategies 3) Species and invertebrate group specific strategies 4) Habitat and landscape strategies
4C. The Strategy links conservation actions to objectives and indicators that will facilitate monitoring and performance measurement of those conservation actions.	A1-A5:all 4:41-80 B:7-86 1:11 5:5-8	Performance measures are included for every conservation strategy in the Species/Invertebrate Group Assessment Reports and in the Habitat Summaries. Because of the inefficiencies (and impossibilities) inherent to monitoring every conservation action generated during CWCS implementation, the need for an effective plan-wide CWCS monitoring and adaptive management program is needed. Such a program could not be designed in time for inclusion in this CWCS but has been identified as statewide strategy (1:11). Guidelines and development recommendations are in chapter 5.
4D. The Strategy describes conservation actions (where relevant to the State's species and habitats) that could be addressed by Federal agencies or regional, national or international partners and shared with other States.	1:7 4:11 6:1 A1-A5 all 4:41-80 B7-86	Vermont's CWCS is predicated on the need to engage all possible organizations, agencies and individuals in wildlife conservation efforts and therefore contains conservation strategies that these entities can address. Moreover, partners may be the more logical and appropriate leaders for implementation of some strategies found in this report. Conservation partner definition Each conservation strategy in Species/Invertebrate Group Assessment Reports and Habitat Summaries includes a list of potential partners that could help implement it. No attempt is made to assign strategies to any partners and neither is implementation limited to this list.

Element 4 Descriptions of conservation actions determined to be necessary to conserve the identified species and habitats and priorities for implementing such actions.		
NAAT Guidance	**Chapter/Page**	**Detail**
4E. If available information is insufficient to describe needed conservation actions, the Strategy identifies research or survey needs for obtaining information to develop specific conservation actions	A1-A5 all	Research and survey needs are identified for each SGCN in its Species/ Invertebrate Group Assessment Report (in the Research & Monitoring Needs section and in some cases in the Conservation Strategies section)
	4:41-80 B7-86	Research and survey needs for habitats are described in the Priority Conservation Strategy section of each Habitat Summary
	e.g.A4:49	There are cases where so little is known about a SGCN that surveys and research are needed before species specific conservation actions can be recommended here. Where this occurs (e.g., red bat, other small mammals and invertebrates), the recommended surveys and research are described in the Research and Monitoring Needs section of each Species/Invertebrate Group Assessment Report and the Conservation Strategies section does not appear.
4F. The Strategy identifies the relative priority of conservation actions.	3:15	All strategies selected for inclusion in VT's CWCS are deemed "priority" strategies and are ranked "medium" or "high" priority (low priority strategies were dropped from consideration). No further prioritization is included here. The rationale is that no prioritization that would satisfy all partners and their varied missions and interests. Detailed discussions with the Conservation Strategy Review team focused prioritization efforts on problems impacting SGCN and habitats rather than on strategies.
	A1-A5:all	For species-level conservation, strategy ranks are found in the Species Strategies section of each Species/Invertebrate Group Assessment Report.
	4:41-80 and B:7-86	For habitat level conservation, all strategies found in the Priority Conservation Strategies section of habitat summaries are considered "priorities."
	5:13-15, J	Allocation of SWG funds will require additional strategy and action prioritization. This will occur in the coming months and years according to the process described in "Allocating State Wildlife Grant Funds."

Element 5. Descriptions of the proposed plans for monitoring species identified in the 1st element and their habitats, for monitoring the effectiveness of the conservation actions proposed in the 4th element, and for adapting these conservation actions to respond appropriately to new information or changing conditions		
NAAT Guidance	**Chapter/Page**	**Detail**
5A. The Strategy describes plans for monitoring species identified in Element #1, and their habitats.	A1-A5:all	Monitoring needs are described for each SGCN/SGCN Invertebrate Group in the research and monitoring needs section of each Species/Invertebrate Group Assessment Report.
	4:41-80 B7-86	Survey and monitoring recommendations are described for habitats in the Priority Conservation Strategies section Habitat Summaries.
	5:7	Due to time constraints in the development of Vermont's CWCS, the report does not contain detailed monitoring plans for SGCN and SGCN habitats.
	1:11	Development of a monitoring plan was identified as a statewide strategy (1:11) and a framework for its development is provided in chapter 5.
	5:2-5	Existing monitoring programs addressing SGCN are reviewed.
	4:12-34	Includes monitoring needs that were frequently cited for a taxon

Element 5. Descriptions of the proposed plans for monitoring species identified in the 1st element and their habitats, for monitoring the effectiveness of the conservation actions proposed in the 4th element, and for adapting these conservation actions to respond appropriately to new information or changing conditions		
NAAT Guidance	**Chapter/Page**	**Detail**
5B. The Strategy describes how the outcomes of the conservation actions will be monitored.	A1-A5:all 4:41-80 B:7-86 5:5 5:5	Performance measures are included for conservation strategies in the Species/Invertebrate Group Assessment Reports and in the Habitat Summaries. Development of the monitoring plan noted in 5A will include implementation, effectiveness and validation monitoring procedures. Some implementation and financial monitoring protocols are already in operation for State Wildlife Grant-funded projects.
5C. If monitoring is not identified for a species or species group, the Strategy explains why it is not appropriate, necessary or possible	4:35 5:8	Not every SGCN or SGCN group will be directly monitored. Attempting to do so would quickly grind VT's CWCS program to a halt. The monitoring program that will be developed as part of VT's CWCS implementation will likely include a coarse filter strategy based on key indicators and habitats that will provide an effective means of monitoring most SGCN. The monitoring plan to be developed will also identify those SGCN that cannot be served by indicator or habitat monitoring, and those that are extremely rare or threatened. These will be monitored directly.
5D. Monitoring is to be accomplished at one of several levels including individual species, guilds, or natural communities.	1:11 5:7-8	The monitoring program to be developed as part of VT's CWCS implementation will monitor SGCN, habitats threats and actions at multiple scales from species and site specific to statewide, regional and international.
5E. The monitoring utilizes or builds on existing monitoring and survey systems or explains how information will be obtained to determine the effectiveness of conservation actions.	5:2-5 A1-A5 4:12-34 5:2	Existing monitoring and survey systems are reviewed in monitoring section of chapter 5 and noted in some Species Assessment Reports and Taxa Summaries. Utilizing and where needed, building on effective existing monitoring systems will be stressed in the development of VT's CWCS monitoring program.
5F. The monitoring considers the appropriate geographic scale to evaluate the status of species or species groups and the effectiveness of conservation actions.	1:11 5:8	Monitoring of species, habitats, threats and strategies should be at scales appropriate to provide meaningful data for a broad array of users.
5G. The Strategy is adaptive in that it allows for evaluating conservation actions and implementing new actions accordingly.	5:5 5:6-7 A1-A5:all 4:41-76 B:7-86 J:5	Implementation, effectiveness and validation monitoring will be important components of VT's CWCS monitoring program and will be used to assess our efforts and to focus future conservation actions. VT's CWCS encourages adaptive management by including performance measures for strategies in the Species Assessment Reports and Habitat Summaries. Projects funded through SWG will be required to have explicit goals and objectives that can be monitored so that data can support overall plan monitoring.

Element 6. Descriptions of procedures to review the Strategy at intervals not to exceed ten years.		
NAAT Guidance	**Chapter/Page**	**Detail**
6A The State describes the process that will be used to review the Strategy within the next ten years.	5:6-7 5:17-18	Vermont's CWCS will be reviewed on a 10-year cycle. That cycle begins almost immediately as monitoring and reporting described in the CWCS and new and ongoing collaboration with partners will contribute significantly to the review of the CWCS. In 2015 we expect to show that we've reviewed and adapted VT's CWCS accordingly from the outset.

Element 7. Descriptions of the plans for coordinating, to the extent feasible, the development, implementation, review, and revision of the Strategy with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the State or administer programs that significantly affect the conservation of identified species and habitats		
NAAT Guidance	**Chapter/Page**	**Detail**
7A. The State describes the extent of its coordination with and efforts to involve Federal, State and local agencies, and Indian Tribes in the development of its Strategy.	3:7	There are no Native American tribes within the borders of Vermont that are officially recognized by the state or by the federal Bureau of Indian Affairs. Further, there are no tribal entities that manage significant land and water areas within the state or administer programs that significantly affect the conservation of Species of Greatest Conservation Need or their habitats. However all Vermonters including Native Americans were encouraged to take part in the development of the CWCS as Conservation Partners and the general public input process
	3:7-9 1:8 3:1-9	Federal, State and local agencies were invited to participate in CWCS development early in the process. Many participated in CWCS development as Conservation Partners (Table 1-1) and staff from many agencies served on CWCS technical teams (Table 3-1). Agencies (with other Conservation Partners) also previewed and provided comments on drafts of the CWCS before a draft was made available to the general public.
7B. The State describes its continued coordination with these agencies and tribes in the implementation, review and revision of its Strategy.	5:13 1:7 A1-A5:all 4:12-80 B:7-86	Effective implementation of VT's CWCS requires ongoing collaboration and coordination among partners (including local, state, and federal agencies—as well as with neighboring states and Quebec provinces). This is stressed throughout the document. Implementation of many of the conservation strategies included here will require continued coordination and collaboration with other agencies.
	3:7-8 5:16-17	The review and revision process will follow the same process used in the development of the CWCS and will include participation by agencies.

Element 8. Descriptions of the necessary public participation in the development, revision, and implementation of the Plan.		
NAAT Guidance	**Chapter/Page**	**Detail**
8A. The State describes the extent of its efforts to involve the public in the development of its Strategy.	3:1-9	Public involvement in the CWCS is described in chapter 3. Public involvement occurred particularly through non-governmental organizations and citizen committees such as the VT Fish & Wildlife Board and the VT Agency of Natural Resources' Endangered Species Committee. Public involvement began early in the CWCS development process. Many participated in CWCS
	1:8	development as Conservation Partners (Table 1-1) and staff from many NGOs served on CWCS technical teams (Table 3-1). NGO's also previewed and provided comments on drafts of the CWCS before a draft was made available to the general public.
	D:all	Charters for Conservation Partner and technical team participation are in appendix D.
	E:all	Sample correspondence with partners is in appendix E.
	3:6	General public involvement in CWCS development is described in chapter 3.
	F:all	Sample media coverage is in appendix F
	G:all	Sample outreach documents are in appendix G
		VT CWCS web address is: www.vtfishandwildlife.com/SWG_home.cfm
	3:8	The General public was invited to review and comment on a draft of the CWCS in July and August of 2005.
8B. The State describes its continued public involvement in the implementation and revision of its Strategy.	1:7 A1-A5:all 4:12-80 B:7-86	Implementation of many of the conservation strategies for SGCN and habitats will require public involvement.
	3:9	Ongoing outreach efforts will help inform and involve the public in CWCS implementation and revision.
	5:13	Effective implementation of VT's CWCS requires ongoing collaboration and coordination with the public. This is stressed throughout the document.
	5:16-17	The review and revision process will follow the same process used in the development of the CWCS and the public will again be encouraged to participate.

References

Salafsky, N., D. Salzer, J. Ervin, T. Boucher, and W. Otlie. 2003. Conventions for defining, naming, measuring, combining, and mapping threats to conservation: an initial proposal for a standard system, December 2003 Draft. Bethesda, MD.

Salafsky N., D. Salzer. 2005. Proposed Taxonomy of Conservation Actions Draft 5. January, 11 2005. Bethesda, MD.

VI. Executive Summary

Development of Vermont's Wildlife Action Plan (WAP) formerly the Comprehensive Wildlife Conservation Strategy) began in January of 2004. Completion of a WAP by October 1, 2005 is a requirement of the federal State Wildlife Grants (SWG) program. The goal of both the State Wildlife Grants program and the WAP is to prevent wildlife from becoming endangered through early, strategic efforts to conserve wildlife and habitat. SWG provides funding and the WAP provides the strategic guidance. Since 2001, Vermont has received or become eligible for more than $3 million in State Wildlife Grant funds.

This is an historic effort. Never before has Vermont undertaken such a comprehensive review of its wildlife. Moreover, every state and territory in the nation is also developing Action Plans. Combined, this is the largest wildlife conservation effort in the US—ever. Wildlife biologists, ecologists, sportsmen and other conservationists, business leaders and state and federal agencies representing more than 60 entities have signed on as Conservation Partners to work with the Vermont Fish & Wildlife Department (VFWD) to create Vermont's Wildlife Action Plan.

This report is the result of extraordinary effort. Employing a rigorous science-based process using the best available existing information WAP technical teams of VFWD staff and Conservation Partners assessed the status all of Vermont's birds (268), fish (94), mammals (61), reptiles and amphibians (42) and many, many groups of invertebrates ranging from mussels, to beetles, to butterflies (estimates of Vermont invertebrate diversity range from 15,000 to 36,000 species).

Following Congressional requirements, the WAP focuses on Species of Greatest Conservation Need (SGCN)—wildlife with declining populations; wildlife that are threatened or potentially threatened; and, wildlife that are so little known in the state that experts cannot yet ascertain their status. Congress further required that each WAP include the following eight elements:

1. Identification of the distribution and abundance of SGCN
2. Descriptions of the location and condition of key habitats
3. Descriptions of key problems and research needs for SGCN and their habitats

4. Prioritized conservation strategies
5. Monitoring plans for species, habitats and conservation actions
6. A process to review and revise the WAP at intervals not to exceed ten years
7. Coordination with other wildlife and land management plans
8. A public involvement process.

Identification of Species of Greatest Conservation Need began in May of 2004. By September 2004 technical teams had selected 143 vertebrates, 191 invertebrate and 577 plants as Species of Greatest Conservation Need. (Note that plants are not eligible for SWG funds, but our hope is that conservation of wildlife SGCN will benefit the plants).

From September 2004 through May 2005 technical teams completed element numbers two through seven above and an interim review of conservation strategies (a.k.a. the reality test) by the Conservation Strategy Review Team occurred in January and February of 2005. Review of the WAP by Agency of Natural Resources commissioners, conservation partners and the general public ran from April through July of 2005.

Problems and Solutions

The problems most frequently identified as impacting SGCN are not new concepts to those concerned about wildlife conservation, they include:

- Information needs and data gaps critical to conservation success
- Loss of habitat (from conversion, degradation, fragmentation and lack of needed successional stages in appropriate juxtaposition)
- Impacts of roads and trails
- Pollution and sedimentation
- Invasive species
- Climate change

As a wildlife conservation guide for the entire state—not just the Vermont Fish & Wildlife Department—the WAP includes some strategies that almost any individual or organization can implement. The most common strategies proposed here to alleviate problems impacting SGCN also aren't new: they include conducting habitat restoration, providing education and technical

assistance to landowner and land managers, providing financial and economic incentives and encouraging wildlife-compatible resource use.

Moreover, the recommendations in this report underscore the need for proactive, cost-effective conservation efforts and increased collaboration, coordination and sharing of data and expertise among all those interested in wildlife conservation. The WAP and its recommended strategies help realize these needs by:

- Providing a common conservation vision to guide state and federal agencies as well as sportsmen's and non-profit conservation organizations.
- Putting existing land and resource management and conservation needs into a broader context, providing recognition for the contributions that landowners and land managers are already making towards a long-term conservation strategy.
- Building a reliable, science-based data set to provide a "big picture" view (biophysical region and statewide) of Vermont's wildlife resources to establish current conditions and to measure changes into the future. These data will allow state agencies to work with the public and private sector more effectively.
- Identifying areas where conservation activities will provide the greatest benefit to cost ratio (thereby increasing the effectiveness of limited conservation resources).
- Allowing use of existing programs to more effectively provide incentives or technical assistance to private landowners for voluntary actions to conserve natural resources on private lands and identify the need for additional landowner incentive or technical assistance programs.

Finally, a monitoring program will collect new data and provide an ongoing assessment of the impact and effectiveness of conservation strategies. This information along with regular communication and coordination with conservation partners will serve as the backbone of a adaptive management program to fine-tune conservation strategies and ensure that Vermont's Wildlife Action Plan will remain a vital road map for wildlife conservation efforts.

The Future of Wildlife Conservation

State Wildlife Grants funding comes at a critical time. The traditional funding source for wildlife conservation at the state level has been sportsmen. Hunting, fishing and trapping licenses and taxes on their gear account for nearly 80% of Vermont's wildlife conservation funds. But the pressures on wildlife have changed and increased in intensity since these funding programs began in the early decades of the 1900's. Today, these funds, most of which are dedicated for game and sportfish species, are stretched thin as the Fish & Wildlife Department addresses new issues and problems such as development and Act 250 reviews, pollution, invasive species and overabundant wildlife. Furthermore there are new and expanding constituencies interested in wildlife and putting pressure on wildlife including hikers, bird watchers, and off-road vehicle users.

The State Wildlife Grants program is not intended to replace sportsmen's dollars. Rather, it will take some of the weight of conservation funding off the shoulders of sportsmen and broaden our capacity to conserve wildlife.

The task of conserving our Species of Greatest Conservation Need is challenging but we know success is possible from our history with wildlife conservation successes such as the wild turkey, white-tailed deer, moose, common loon, fisher and peregrine falcon. Conserving wildlife is in all our best interests. It means reducing the potential imposition of regulatory requirements on Vermont businesses and communities that come with threatened and endangered species listings. It means healthier ecosystems upon which we all depend. And it means a Vermont rich in wildlife which we can all enjoy.

The Wildlife Action Plan and State Wildlife Grants dollars mark the start of a new era in wildlife conservation, one where we can keep common species common.

Vermont's Wildlife Action Plan

November 22, 2005

Chapter 1 Introduction

1. Introduction

These are exciting times for wildlife conservation. All across the country, state fish and wildlife agencies are completing a Wildlife Action Plan. New funds and new initiatives are advancing a long history of conservation success.

Vermont is noted for its beautiful juxtaposition of woodlands and farms, streams and ponds—not to mention Lake Champlain and the Green Mountain chain. Fish and wildlife resources are an integral part of the Vermont experience and quality of life for Vermonters. Deer, moose, wild turkey, and geese are thriving and offer sustainable hunting and viewing opportunities. In recent years, loon, osprey, peregrine falcon populations have recovered allowing for their removal from the state threatened and endangered species list. And, many of our waters teem with outstanding fishing opportunities. The landscape and the wildlife attest to the state's meaningful conservation ethic. Vermont's Wildlife Action Plan offers an opportunity for measured engagement, by all Vermonters, in addressing new challenges, filling in knowledge gaps, and implementing management programs to keep common species common thus preventing future need to place species on threatened and endangered species lists.

Mandate, Mission and Strategic Focus

The Vermont Fish & Wildlife Department is specifically charged with promulgating rules, through the Fish & Wildlife Board, enforcing those rules and procedures, and conducting programs that implement the following policy statements.

"The inhabitants of this State shall have liberty in seasonable times, to hunt and fowl on the lands they hold, and on other lands not enclosed, and in like manner to fish in all boatable and other waters (not private property) under proper regulations. (Vermont Constitution, Chapter 2, Article 67)."

"It is the policy of the state that the protection, propagation, control, management and conservation of the fish, game, and furbearing animals in this state is in the interest of the public welfare, and that safeguarding of these valuable resources for the people of the state requires a constant and continual vigilance (10 V.S.A. Section 4081).

The Department's mission is "the conservation of all species of fish, wildlife, and plants and their habitats for the people of Vermont." The Department's dedicated professionals enforce laws, manage Wildlife Management Areas, conduct species-specific research, restoration and management actions, issue licenses, grow fish, and provide educational and outreach services. Three of the Department's planning goals are:

Conserve, enhance, and restore Vermont's natural communities, habitats, and species and the ecological processes that sustain them.

Provide a diversity of fish- and wildlife-based activities and opportunities that allow the safe and ethical viewing, regulated harvesting, and utilization of fish, plant and wildlife resources consistent with the North American model of fish and wildlife conservation.

Maintain safe fish and wildlife based activities and limit harmful human encounters with fish and wildlife species and provide general public safety service incidental to primary fish and wildlife enforcement duties.

Throughout its 100-year history, many of the Department's initiatives focused on game species, in part because of constituent interest, as well as the user-pay system of funding fish and wildlife conservation through license sales and excise taxes on hunting and fishing equipment. As our mission statement suggests, the scope of conservation challenges facing the Department extends beyond species which people choose to harvest.

Problem and Need

Historically, there have been dedicated funds available for game and sportfish species as well as Threatened and Endangered species. Unfortunately, there has not been a dedicated revenue stream supporting management for the vast majority of wild animals that do not fall within either category. For example, 269 species of birds are found in Vermont. However, only about 30 of these are hunted and only a handful (e..g., common loon, osprey, peregrine falcon) have had recovery funding.

The full status of many species is unknown in Vermont. There are many species for which very little population or distribution data exist including most reptiles, amphibians, small mammals, stream fish, and invertebrates, including insects and crustaceans. In 1985, the Nongame and Natural Heritage Program was established within the Fish and Wildlife Department. Both an income tax check-off and a conservation license plate have been important revenue mechanisms for addressing wildlife diversity management and species recovery planning generating approximately $250,000 per year, but still not sufficient to adequately meet needs.

Vermonters Care about Wildlife

Wildlife is very important to the people of Vermont. Almost anyone you talk with has a story to tell about deer hunting, hummingbirds in the garden, or geese winging south.

The 2001 National Survey of Fishing, Hunting, and Wildlife Associated Recreation conducted by the U. S. Fish and Wildlife Service documented that 67% of Vermonters went fishing, hunting, or wildlife watching. Vermont ranked second, only behind Alaska in participation (US Dept of Interior). This same survey estimates that $386 million was spent on wildlife recreation in Vermont.

A 2000 public attitude survey of 1005 Vermonters determined that the protection of fish and wildlife resources, including habitats, as well as the opportunity to engage in wildlife-dependent recreation was important to 97 percent of respondents (Responsive Management 2000).

Congress Responds

In the early 1990's state fish and wildlife agencies partnered with a variety of non-government organizations and businesses to advocate for broader federal funding to address the needs of species that were not hunted or fished and to "keep common species common." However this was never implemented. The funding initiative was labeled Teaming with Wildlife. Initially, an excise tax on wildlife–related recreational equipment, such as binoculars and wildlife viewing guides, was identified as the best funding alternative. Over time, and with congressional encouragement, a different model was developed, one utilizing

offshore gas and oil receipts. The concomitant legislation was termed the Conservation and Reinvestment Act (CARA).

Congress responded with a new annual appropriation in Fiscal Year 2001 first called the Wildlife Conservation and Restoration Program and later the State Wildlife Grants Program. Since that time, the Vermont Fish and Wildlife Department has been eligible for more than 3 million dollars of federal funds. These dollars have vastly improved our ability to fund new research, inventory, and management initiatives for species such as bobcats, timber rattlesnakes, lake sturgeon, butterflies, and the Bicknell's thrush.

Wildlife Action Plan

The receipt of federal dollars has been predicated on individual state commitment to develop a plan. These documents must be submitted to the U. S. Fish and Wildlife Service for approval by October 1, 2005. Even though the Wildlife Action Plan is expected to address the full array of wildlife in a state or jurisdiction, the focus is on "species of greatest conservation need." The federal legislation prescribes eight elements for consideration in the ACTION PLAN, as per below:

1) Identify wildlife distribution and abundance: Provide information on the distribution and abundance of species of wildlife, including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife.
2) Describe location and condition of key habitats: Describe the locations and relative condition of key habitats and community types essential to conservation of species identified in (1).
3) Describe key problems and research needs: Describe problems that may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats.
4) Describe and prioritize conservation actions: Describe conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions.
5) Monitor species, habitats and conservation actions: Describe plans to monitor species identified in (1) and their habitats; monitor the effectiveness of the conservation actions proposed in and, adapt these conservation actions to respond appropriately to new information or changing conditions.

6) Develop a plan review process: Describe procedures to review the Wildlife Action Plan at intervals not to exceed ten years.

7) Coordinate with other plans: Coordinate the development, implementation, review, and revision of the Action Plan with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the State or administer programs that significantly affect the conservation of identified species and habitats.

8) Include public participation: Describe public participation in the development, revision, and implementation of the Action Plan and projects and programs.

Plant conservation and education and law enforcement projects are not eligible for State Wildlife Grants funding. We expect that species, community and landscape level conservation will provide secondary benefits including addressing the needs of many plant Species of Greatest Conservation Need (SGCN). Furthermore, the Vermont Action Plan include some education and law enforcement-based conservation strategies under the assumption that the Action Plan will have planning and funding development beyond the requirements of the State Wildlife Grants program.

Though the secondary benefits to plants and other non-SGCN species noted above are expected to accrue from the implementation of the Action Plan, this Plan should not be viewed as a biological diversity (biodiversity) conservation plan. State Wildlife Grant funds will be targeted to conservation of SGCN. Just as historic and ongoing game management efforts benefit multiple non-target species of plants and wildlife, so to will the Wildlife Action Plan.

Expected Results and Benefits of the Wildlife Action Plan

The Action Plan should provide the following benefits:

- Provide a science-based foundation for understanding the issues involved in addressing wildlife needs.
- Reduce the risk of further Threatened and Endangered Species listings that would impose additional regulatory requirements on Vermont businesses and communities.
- Provide a common conservation vision to guide state and federal agencies as well as sportsmen's and non-profit conservation organizations, in improving prospects for effective coordination and reducing conflicts.
- Put existing land and resource management and conservation needs into a broader context, providing recognition for the contributions that landowners and land managers are already making towards a long-term conservation strategy.
- Increase the effectiveness of limited conservation resources by identifying areas where conservation activities will provide the greatest benefit to cost ratio. Encourage conservation actions to be more proactive and less reactive and improve coordination between agencies and organizations to ensure cost-effective conservation.
- Allow use of existing programs to more effectively provide incentives or technical assistance to private landowners for voluntary actions to conserve natural resources on private lands.
- Identify the need for additional landowner incentive or technical assistance programs more easily.
- Demonstrate Vermont's commitment and capacity to conserve species and habitats. Vermont's reputation for a high quality of life and preservation of natural resources—one of the state's core strengths in attracting businesses—will be maintained.
- Build a reliable, science-based data set to provide a "big picture" view (biophysical region and statewide) of Vermont's wildlife resources to establish current condition and measure changes into the future. These data will allow state agencies to work with the public and private sector to more effectively.
- Conserving Vermont's wildlife will maintain and perhaps increase the numbers of Vermonters and visitors who interact with and recreate in the outdoors.
- Vermont's eligibility for future conservation funds from State Wildlife Grants will be maintained. These funds can be used for conservation activities that benefit the environment, economy and communities of the state.

Major Conservation Partners

At the outset, it is important to acknowledge that the Vermont Wildlife Action Plan is *not* only, or simply, a Department plan. Instead, it is a blueprint for wildlife conservation *in Vermont*. The distinction is important and one that presupposes potential participation in achieving conservation strategies by a wide variety of management, education, and research entities.

Vermont has an outstanding history of citizen participation in the management of its fish and wildlife resources. This should come as no surprise given the high level of interest Vermonters have in wildlife, as noted above.

Even though sportsmen and women were at the forefront of early funding and conservation initiatives, and remain committed unto those ends, the past thirty years or so has seen the emergence of other interests including birders and nature photographers, land and habitat conservation advocates, and hikers and paddlers, to name a few. The Vermont Wildlife Action Plan has benefited from the strong, helpful, and encouraging planning assistance of many individuals and organizations (table 1-1).

Table 1-1: Wildlife Action Plan Conservation Partners

The development of Vermont's Wildlife Action Plan has been a collaboration of dozens of agencies, organizations and businesses representing diverse interests who have joined forces to better conserve wildlife. As of August 1, 2005 the following entities have signed on as Conservation Partners

American Chestnut Foundation
Association of Vermont Conservation Commissions
Audubon Vermont
Burlington Electric Department
Center for Woodlands Education
Connecticut River Watershed Council
The Conservation Fund
Consulting Foresters Association of Vermont
Ducks Unlimited
Echo
Endangered Species Committee
Fairbanks Museum & Planetarium
Forest Watch
Green Mountain National Forest
Hunters, Anglers & Trappers Assoc of Vermont
International Association of Fish & Wildlife Agencies
Keeping Track, Inc
Lake Champlain Basin Program
Lake Champlain Committee
Lake Champlain International, Inc.
Lake Champlain Land Trust
Lake Champlain Walleye Association
Lewis Creek Association
Marsh-Billings-Rockefeller NHP
National Wild Turkey Federation
National Wildlife Federation
Natural Resources Conservation Service
The Nature Conservancy
New Haven River Anglers Association
North Country Environmental & Forestry
Northern Forest Alliance
NorthWoods Stewardship Center
Ruffed Grouse Society
Ryegate Power Station
Sierra Club
Society of American Foresters
Smugglers Notch Resort
Sportsmen Inc
Trout Unlimited
US Fish & Wildlife Service, Lake Champlain Fish & Wildlife Resources Complex
US Fish & Wildlife Service, Missisquoi NWR
US Fish & Wildlife Service, Nulhegan Basin Division
University of Vermont Rubenstein School of Environment and Natural Resources
University of Vermont Botany Department
Vermont Agency of Transportation
Vermont Association of Snow Travelers
Vermont ATV Sportsman's Association, Inc
Vermont Cooperative Fish & Wildlife Research Unit
Vermont Coverts
Vermont Department of Environmental Conservation
Vermont Department of Forests, Parks & Recreation
Vermont Department of Housing & Community Affairs
Vermont Farm Bureau
Vermont Federation of Sportsmen's Clubs
Vermont Fish & Wildlife Board
Vermont Forest Products Association
Vermont Institute of Natural Sciences
Vermont Land Trust
Vermont League of Cities and Towns
Vermont Loggers Association
Vermont Natural Resources Council
Vermont Outdoor Guides Association
Vermont Regional Planning Commissions
Vermont Ski Area Association
Vermont State Grange
Vermont Trappers Association
Vermont Woodlands Association
Wildlands Project
Wings Environmental

Representative Steve Adams
Office of Congressman Sanders
Office of Senator Jeffords
Office of Senator Leahy

Statewide Themes for Action

In the course of reading or evaluating this Action Plan, it becomes apparent that there is a great deal of commonality, or unifying themes, between taxonomic groupings of species of greatest conservation need. For example, habitat conservation, improved knowledge of distribution and abundance, and education are obviously foundational, given their redundancy. Concomitantly, it is possible to make some strategy groupings that would appear to be pivotal in achieving conservation success. Before doing so, it would be helpful to make four observations.

First, in 2002, the International Association of Fish and Wildlife Agencies (IAFWA) adopted a position paper entitled "The Value of the North American Model of Fish and Wildlife Conservation" (Prukop and Regan 2005). The Vermont Fish and Wildlife Department is a member of IAFWA and has incorporated the Model into its strategic planning. Several recommendations for, or to, state agencies are instructive for thinking about wildlife conservation in the context of the Action Plan, including the need to maintain wildlife as a public trust (i.e., not owned by anyone), the need to use science to make management decisions, and the importance of regulating trade and possession of wildlife.

Second, conserving Vermont's Species of Greatest Conservation Need requires that we address problems at the appropriate scale. Recommended strategies address problems at the species level (e.g., the illegal harvest of wood turtles through education and law enforcement), the habitat level (e.g., the lack of early successional habitat through forestry), the landscape level (e.g., maintaining and restoring connectivity of riparian areas) *and* the regional/national and international levels (e.g., habitat loss along migration routes).

Third, collaborative efforts to address habitat concerns related to development, including assessment of direct and indirect impacts, avoidance and minimization of impacts and appropriate mitigation *early* in a project's planning processes can not only protect habitat from alteration, degradation, conversion and fragmentation, but can speed the project more successfully through the permit review process.

Fourth, Vermont wildlife has already benefited from a strong environmental ethic, deeply rooted connections to the land, based on traditional forestry and agricultural economies, and a very high percentage of Vermonters who engage in recreational activities that are dependent on wildlife. In other words, there are compelling and inherent reasons for optimism about the future of wildlife conservation in the Green Mountain State.

All that being said, there are state, regional, national, and international factors that are a cause for concern regarding habitat viability, clean water and air, international trade in wildlife, and a diminution of understanding about wildlife and its management, in part because of complex social factors. Each of the four sets of presuppositions above forms the backdrop for the conservation strategies presented below and throughout this document.

Habitat Themes

1) Through education, legislation, and policy improvements address issues such as sprawl, poorly planned development, and global warming that drive habitat conversion, degradation and fragmentation (The Wildlife Society[1]). Possible tools include:

   - Maintain and expand incentives for private landowners such as the Wildlife Habitat Incentives Program (WHIP), Landowner Incentive Program (LIP), and the Current Use Program (officially the Agricultural and Managed Forests Land Use Value Program) and other appropriate management agreements. Consider amending tax policies and providing tax abatement and/or other tax relief to reduce the pressures on property owners to subdivide and sell property (parcelization). Create incentives for rural landowners to enhance their land as working forests or farms. Strengthen the Current Use program to include management of land for the benefit of wildlife as a conforming use. Increase funding for the Vermont Housing and Conservation Trust fund.

   - Continue to utilize permitting processes such as Act 250 to address critical habitat considerations where appropriate.

   - Promote and enhance programs designed to manage retention of open space including forestland and agricultural land. Assist local and regional land-use planning organizations such as towns and regional planning commissions. Support plans that identify natural resources and wildlife values and take steps to conserve habitat such as the designation of growth centers that focus development in existing centralized communities. Consider restoring existing village or urban facilities and infrastructure. Increase funding for Rural Community Assistance programs.

   - Acquire critical habitats in fee title or easement. Follow Vermont Agency of Natural Resources land acquisition policies and procedures (VANR 1999) for parcels and rights therein that will be owned by the State.

[1] The Wildlife Society, the North America Section of the Society of Conservation Biology and the U.S. Society for Ecological Economics have all taken similar positions on the need to address the negative impacts of economic growth on wildlife. The American Fisheries Society and the Ecological Society of America are currently considering similar positions.

2) Through education, incentives, legislation, and policy efforts address global warming and pollutants such as mercury and acid deposition.

   - Support the recommendations of the *Climate Change Action Plan* developed by the Conference of New England Governors and Eastern Canadian Premiers (2001) and local and regional initiatives such as the Alliance for Climate Action to reverse the growth of greenhouse gas emissions in Vermont.

   - Work with state and federal agencies and legislators to ensure adequacy of and compliance with interstate emissions standards for greenhouse gases, mercury, and sulfur dioxide and nitrogen oxides that cause acid deposition.

3) Develop a collaborative, statewide and regional wildlife monitoring and adaptive management program to develop SGCN baselines, measure progress toward desired outcomes for SGCN, and to evaluate and improve the effectiveness of the conservation strategies proposed here and throughout this document. Such a program will:

   - Identify key protocols and systems for data collection and sharing.

   - Identify goals and objectives for SGCN conservation.

   - Determine SGCN distribution and abundance, identify indicators and trends, and assess habitats, natural communities and other appropriate land classification categories to provide data at scales relevant to a variety of users in order to more effectively conserve SGCN.

   - Identify conservation opportunity areas where the likelihood of successful conservation is strongest and the conservation needs of wildlife and their habitats would be best met.

Population Level Themes

4) Through policy and education support the enforcement of existing laws that protect species of greatest conservation need. For example:

   - Prevent the importation or movement of invasive, non-native species.

   - Regulate the illegal taking, trade, sale and collection of species of greatest conservation need.

Technical Assistance & Outreach Themes

5) Work to develop and implement landowner incentives, technical assistance and education for sustainable management of species of greatest conservation need, including:

   - Develop and enhance partnerships between local, state and federal agencies, non-governmental organizations, industry and private individuals to increase the focus on species of greatest conservation need and conservation of associated habitats.

- Provide outreach materials and technical assistance to encourage sound land management and compatible recreation practices (e.g., VFWD's habitat planning manual *Conserving Vermont's Natural Heritage*). Demonstrate management goals and practices on public lands, especially Wildlife Management Areas.

- Proactively collaborate with transportation planners and engineers regarding the location and design of new and expanded roadways.

- Look for opportunities to implement Action Plan strategies through existing federal cost-share programs (e.g., USDA's Conservation Reserve Enhancement Program, the USFS Forest Legacy Program and the USFWS Landowners Incentive Program).

- Disseminate ecologically sound information through appropriate media, e.g., develop a web site with information on all species of greatest conservation need in Vermont. Include information on identification, natural history, conservation, management suggestions, reporting, and contacts.

- Promote increased cooperation and communication among all agencies and groups concerned with conservation education and resource management.

- Showcase the success of the Action Plan through regular outreach to partners.

- Develop outreach and education programs that promote the conservation of SGCN and the habitats that they depend on, and increase awareness of the importance of maintaining or restoring these species.

Regional Coordination Themes

6) Provide regional coordination for conservation and management of species of greatest conservation need.

- Look for opportunities for collaborative management between jurisdictions (e.g., Lake Champlain, Atlantic Coast Joint Venture, the Connecticut River Joint Commission, the Conte National Wildlife Refuge, and the Northern Forest Lands Council).

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Vermont's Wildlife Action Plan

November 22, 2005

Chapter 2: Vermont Overview

2. Vermont Overview

Vermont Cares about Wildlife Conservation

It is no mystery why people enjoy living in and visiting Vermont. This state has what so many other once rural places have lost: a wealth of wildlife and scenic beauty, traditional working landscapes that support viable local economies, and desirable social and cultural attributes – low crime rate, helpful neighbors, and close-knit villages and towns.

Wildlife, scenic beauty, and the landscape that supports this way of life are not only vital parts of Vermont's rural character and identity, but are highly valued by Vermont residents. Based on 2001 public opinion survey results from the U.S. Fish and Wildlife Service, Vermont ranked first in the nation in percentage of residents that actively observed wildlife (60%). The results also show that hunting, fishing, and wildlife viewing expenditures in Vermont totaled $386 million, an increase of $6.42 million over the previous survey in 1997. At least 280,000 Vermont residents participate in wildlife-associated activities. This constitutes nearly 50% of the state's resident population – the highest percentage in the nation. In addition, approximately 307,000 non-residents participate in wildlife-associated activities in the state each year. These statistics represent a significant contribution to the state's economy and underscore the strong connection Vermont residents and non-residents have to the land and wildlife.

Vermont's diverse natural resources, which include forests, clean waters, vibrant fisheries, healthy wildlife populations, rare species, significant natural communities, and a working landscape, provide people with the opportunity to, among other things, hunt, fish, trap, watch wildlife, hike and work the land.

The Vermont Landscape—an Overview

Vermont's landscape is a rich tapestry of mountains, valleys, woods and wetlands, with a fascinating geological history. It is Vermont's natural landscape that enriches the lives of those who live here and draws so many visitors to the state. It is this same landscape that

provides us with clean air, clean water, and habitat for thousands of species of plants and animals.

Understanding Vermont's natural heritage requires understanding the physical landscape. The configuration of mountains, valleys, wetlands, lakes, and rivers is crucial in determining the distribution of natural communities, habitats, and native species.

The following broad environmental factors influence the distribution of species, habitats and natural communities: climate, bedrock geology, surficial geology, topography, hydrology, and land use history. These factors that comprise and influence the Vermont landscape and subsequently the flora and fauna of the state are explained below.

Climate

Vermont's lowest land point is the shore of Lake Champlain, only 95 feet above sea level. Vermont's highest point is the Chin on Mount Mansfield, which rises to 4,393 feet. The distance between Lake Champlain and the summit of Mount Mansfield is only 20 miles, but in that short distance, the climate, topography, and vegetation change considerably. On the shores of Lake Champlain, where the growing season is 150 days, shagbark hickories and sweet gum trees grow. Apple orchards are common in this environment as well as dairy farming due to the influence of climate on growing season. On the summit of Mount Mansfield, where the growing season is limited to 90 days, red spruce and balsam fir grows in stunted and contorted mats, bending to the direction of incessant winds.

Climate is major factor in determining the distribution of natural communities, habitats, plants and animals. Elevation provides a means for understanding the influence of climate on wildlife and habitats in Vermont because climate changes in relatively short distances with change in elevation. Thus the affect of climate on biota can easily be observed.

Geology

Vermont's bedrock composition is varied and thus, influences important factors such as soils, hydrology, and subsequently plant

distribution and abundance. These variations influence in part the distribution of wildlife. The rocks that comprise the Southern Green Mountains were formed more than 570 million years ago. The rocks of the Champlain Valley and the Northern Green Mountains date from a time 540 to 443 million years ago when Vermont was the edge of a warm, tropical sea. The remains of marine mammals that inhabited that sea can be found in the Champlain Valley's limestone rock. The youngest rocks in Vermont are the granites, like the stone that makes up the Barre granite quarries. These rocks were formed 200 to 400 million years ago as a result of deep underground magma welling up and hardening.

Whether the bedrock is limestone or granite – or some other kind of rock – is particularly important in the distribution of natural communities and plants because each kind of rock has its own unique physical and chemical composition. For instance, rich fens, a rare type of wetland with plants that require high levels of calcium, occur almost exclusively in areas where limestone or similar calcium-rich rock are found.

Vermont's surficial geology is defined by the sands, gravels, clays, peats, and other deposits found on top of the bedrock as a result of both glacial activity and post-glacial events (like flooding) that continue today. Bedrock and surficial geology together have a profound influence on the soils in which Vermont's plants grow.

Topography

Topography describes the physical landscape and influences the distribution of plants, animals, and natural communities. The soil on the top of a mountain tends to be shallow and dry, whereas the soil at the base of a slope tends to be deep, moist, and rich in organic matter because of the downslope movement of plant litter and soil. Cliffs, for example, offer a unique habitat for specialized groups of plants, and may offer important denning habitat for bobcat and nesting sites for peregrine falcon. Certainly, topography influences the quality and distribution of winter habitat for white-tailed deer in Vermont.

Hydrology

Water and its movement have a profound influence on animals, plants and natural communities, and ecosystem processes. Lakes, ponds, rivers, and streams provide habitat for a diversity of fish, aquatic plants, aquatic invertebrates, and other organisms. Wetlands form in waterlogged soils, either in low-lands where water collects by gravity, in uplands where impermeable soils create perched water tables, or at the highest elevations where fog and abundant rain provide a constant supply of water for wetland plants and animals.

Land Use History

Land use history has influenced the distribution of plants and animals across Vermont. For instance, the degree and type of forest cover have a great influence on the species that occur in an area. Vermont has more forest today (78%) than it had in the mid-1800s (25%), and the effect of this change on wildlife has been dramatic. Additionally, Vermont's agricultural activity also affected the soils and the plants that grow in them.

Biophysical Regions of Vermont

The five factors described previously combine to create eight distinct biophysical regions. It is important to consider Vermont's biophysical regions when assessing and planning for the conservation of wildlife (Fig 2-1). For example, what may be a common species in one biophysical region may be rare in another, thus, increasing the importance of conserving habitat for that species in the region in which it is rare. Vermont's biophysical regions are described below.

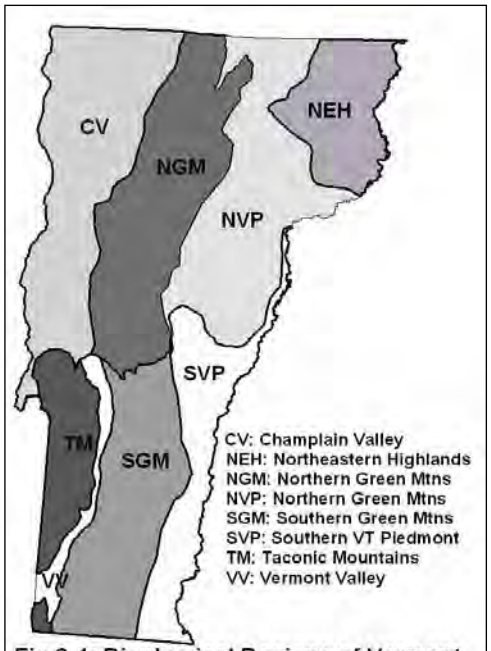

Fig 2-1: Biophysical Regions of Vermont
Data Source: VCGI

Northeast Highlands: Granite bedrock dominates this cool region, which is characterized by large wetlands, remote mountains, and lakes and ponds. Spruce and fir dominate the lowlands as well as the high elevations, whereas northern hardwoods cloak the mid-elevations.

Forty-three percent of this region is conserved, the highest percentage of any of Vermont's biophysical regions.

Northern Vermont Piedmont: Calcium-rich soils combine with a cool climate to support mixed forests and Northern White Cedar Swamps, Fend and other interesting natural communities in this region. The uplands have fine agricultural soils, but a short growing season. Eight percent of the region is conserved.

Southern Vermont Piedmont: Calcium-rich soils and rolling hills make this a good place for agriculture. The climate is average for Vermont, except in the extreme southeast where it is quite warm. Northern hardwoods and red oak dominate the vegetation. Seven percent of the region is conserved.

Southern Green Mountains: A broad plateau is dotted with a few dominant peaks and several ski areas. Climate is cold and rainfall is relatively high. Northern hardwoods, spruce, and fir dominate, and there are a number of small lakes and ponds. Thirty-three percent of this region is conserved.

Northern Green Mountains: This area has a cool climate and high elevations and is mostly forested. Northern hardwoods dominate the side slopes, whereas high elevations have spruce and fir as well as Alpine meadow habitat. Twenty-six percent of the region is conserved.

Champlain Valley: This region of Vermont has a warm climate and abundant fertile farmland. The Champlain Valley contains both northern hardwood forest and also various species of oaks and hickory. It has some of the state's most significant natural diversity and also the state's most densely populated areas. Nine percent of the region is conserved.

Taconic Mountains: The slate belt of Vermont and New York is found in this region. The Taconics are dramatic wooded hills dominated by sugar maple, beech, and yellow birch forests. Dry oak and hickory forests are found on the lower elevation knolls, while

spruce and fir occur at the highest elevations. Ten percent of the region is conserved.

Vermont Valley: The Marble Valley has marble and limestone with glacial deposits on the valley walls, abundant springs, and wetlands. About 10 percent of the region is conserved.

Vermont's Landscape—an Historical Perspective

Vermont's landscape has long been altered by people. Native cultures grew crops, harvested animals for food and clothing and lived in established settlements. During the 17th and 18th centuries, land was cleared for the development of agricultural economies. By the mid-1800s, 75% of Vermont's forests were cleared for agriculture, and in particular, sheep farming. These changes had an effect on the state's waters, forests, and wildlife. Even some species of wildlife such as beaver and deer that had been common, nearly disappeared from the land. As other influences caused people to begin to move towards the western United States, lands were abandoned and forests began to regenerate.

With the return of the forest and the work of the Vermont Fish & Wildlife Department and partners the recolonization and reintroduction of animal species, beaver, deer, wild turkey, fisher, and others that had declined have now returned and are today abundant. These species and more stand as great testament to Vermont's commitment to wildlife conservation and the resiliency of the forests and wildlife. Many species of fauna and flora, however, have not recovered. The passenger pigeon, for instance, is now extinct, and some large predators such as wolves and mountain lions that once roamed the New England forests, are no longer present.

Vermont's Contemporary Land Use

Agriculture and forestry still support Vermont's economy in significant ways. These elements of Vermont's business and economic communities offer great opportunities for wildlife conservation because they allow private landowners to realize a

financial return from their land while keeping the land in an undeveloped or natural condition. Many of these land-based business interests are excellent stewards of the land and wildlife.

Vermont non-industrial forestland owners have a long history of active engagement in the management of forest resources throughout the state. Since the advent of the Vermont Use Value Appraisal Program (a.k.a. Current Use Program) 11,000 landowners have brought almost 1.5 million acres of forestland under forest management. Many of Vermont forestland owners manage their lands for wildlife and forest resources and seek to enhance their management skill through their involvement in non-profit organizations advocating sustainable forest management such as Vermont Coverts: Woodlands for Wildlife, Inc., Vermont Woodlands Association, and the Woodland Owners Association. These stewards provide strong examples of Vermonters taking steps to conserve our wildlife resources.

The landscape of Vermont is also supporting increasing demand for residential and commercial development. The Vermont Forum on Sprawl reports that the rate of development in Vermont is 2.5 times greater than the rate of population growth. Like other New England states, residential development is often dispersed in rural and suburban areas rather than in existing village and urban communities.

Based on data from the U.S. Census Bureau, the population of Vermont in 2004 is 621,394 and has increased by 2.1% since 2000. The human population of Vermont is quite small compared to many other states.

Since 1964, Vermont has lost roughly one-third of its farms and half of its farming acreage (Pers. Comm. Vermont Dept of Agriculture 2005). Today, Vermont loses approximately 100 farms each year.

Parcelization is a term that describes the subdivision of land into smaller and smaller pieces and multiple ownerships. This phenomenon has been shown to have an impact on the ability of local forest product economies to remain sustainable. Parcelization is occurring in parts of Vermont where larger tracts of land are

subdivided into smaller multiple smaller parcels for residential development. This may have some influence on Vermont's forest products interests in the future and at the very least is something that should be considered with respect to maintaining viable forest products economies for all the positive benefits that they provide to the state and its wildlife.

Contemporary Problems Impacting Wildlife in Vermont

An extraordinary amount of work went into developing this report. Our technical teams assessed the status all of Vermont's birds (268), fish (94), mammals (61), reptiles and amphibians (42) and many group of invertebrates ranging from mussels, to beetles, to butterflies and isopods. From there Species of Greatest Conservation Need (SGCN) were selected and the technical teams then described the habitat these species used, problems impacting the species and their habitats, and strategies to conserve both species and habitats. Add to this assessments and recommendation for 25 major landscapes and community types and it's not surprising that this report tops the 1,000-page mark.

The interesting thing is this: if you take two steps back from the details to view the big picture, the view is not a grim one. Yes there are more than 300 SGCN but the picture we see is a hopeful one, a roadmap to healthy wildlife populations for Vermont's future. The reasons are repetition, economies of scale, and cooperation.

The problems most frequently identified as impacting SGCN are, loss of habitat (due to conversion, degradation, fragmentation and lack of needed successional stages), the impacts of roads and trails, pollution and sedimentation, invasive species, climate change, and data gaps and information needs. Though these are big, serious and complicated problems they are much easier to address than hundreds of smaller problems.

Loss of Habitat: Due to Degradation, Conversion, Fragmentation or Lack of Needed Successional Stages

These four categories are not mutually exclusive and problems can often logically be placed into more than one category depending on the particular stress it causes for a species or habitat.

Habitat Conversion: The complete transformation or loss of a habitat by human action (examples include: filling a wetland to create a grassy field, converting a forest stand into a parking lot, or damming a stream to create a reservoir). Though many agencies and organizations work diligently to conserve important wildlife habitats, Vermont continues to lose approximately 525 acres of significant habitat each year to regulated development alone. According to the Vermont Environmental Board, regulated development in Vermont constitutes approximately one-third of the total development that occurs on an annual basis. Significant habitats are those habitats that are addressed by various statutes, largely Act 250, and include deer winter habitat, wetlands with significant wildlife functions, habitat for rare, threatened and endangered species and several types of habitat necessary for the survival of black bears. These habitats represent only a few of the many habitats that are affected by loss due to development.

Habitat Alteration/Degradation: A lessening of the quality of a habitat by human action stopping short of complete conversion (examples include: the reduction of mast (fruit and seed) production in a forest stand, riprapping a streambank, and significant land use changes adjacent to a habitat such as replacing a forest stand on the edge of a wetland with a housing development.

Habitat Fragmentation: The breaking up of habitats into smaller, non-contiguous patches as a result of habitat conversion (e.g., housing, commercial development, roads, utility lines). Fragmentation can: 1) render important habitats inaccessible (such as isolating a den site from a feeding site), 2) isolating

populations (for example grassland butterflies, spotted salamander, and tiger beetles); and, 3) degrade remaining habitat patches through edge effects that favor edge-tolerant species such as raccoons and crows, as well as invasive exotic species that can out-compete native and rare species. The result of habitat fragmentation is often increased predation, increased mortality, reduced mobility and changes in habitat micro-climates.

Inadequate Distribution of Successional Stages: The lack of either late, mid or early successional habitat in appropriate patch size and/or juxtaposition can be a problem for some SGCN especially as fragmentation makes it harder for species to move between forest patches (examples include ruffed grouse and woodcock which prefer early successional forest stands, American marten which prefers late-successional stands and Canada lynx which depends on a mix of forest stages).

Impacts of Roads and Trails

In the last quarter of the 20th century, Vermont expanded its road system by an average of 26 miles per year to a total of about 14,251 miles. The number of vehicle miles traveled by Vermont residents is growing at seven times the rate of population growth, according to information from the Vermont Agency of Transportation (1999). Transportation systems, including some hiking and recreation trails, can cause numerous problems for SGCN including: vehicle-wildlife collisions; reducing animal and fish passage, thus limiting habitat availability and isolating populations; vehicle emissions of pollutants such as ozone and greenhouse gases; and facilitating the spread of an exotic, invasive species into otherwise healthy areas.

Pollution & Sedimentation

The introduction of exotic materials from point and non-point sources can significantly impact SGCN, particularly aquatic species. Pollutants & sediments include sands and silts, chemicals and toxins; excess nutrients from farm and municipal sewage plants; garbage and other solid waste; radioactive materials; road salt; excessive noise; excessive heat; and light pollution that disturbs animals and disrupts migration patterns. Sediments can be a problem for SGCN through their physical

presence alone. For example, soils can wash into a stream from a construction site and smother fish eggs and other aquatic species living in the spaces between rocks and gravel streambed.

Invasive Exotic Species

The introduction and spread of nuisance exotic and native species (plants and animals) may lead to the elimination of native wildlife populations, threaten long-term stability of habitats and even lead to extirpation by out-competing a native species, displacing its food source or altering a key process or function of a habitat. Invasive exotic species in Vermont include Eurasian watermilfoil, purple loosestrife, common buckthorn, Japanese knotweed, Morrow's honeysuckle, goutweed, black swallow-wort and zebra mussels. Additional information can be found in Appendix K.

Climate Change

Long-term changes linked to global warming and other climate issues can lead to major changes in habitat availability (e.g., high elevation habitats, wintering areas and migration stopovers) (Glick 2005), vegetative composition and location (e.g., the movement up in elevation or north in latitude, invasion by exotic pests), climate variability (e.g., change in snow depth, rainfall and/or natural disturbances). Many specific details as to how climate change is affecting Vermont's wildlife today is a major unknown, but the pervasiveness and scale of the problem requires that we begin planning to address it now.

Data Gaps and Information Needs

A lack of information has been identified as a principal impediment to the conservation of many Species of Greatest Conservation Need. In particular we need additional information on the distribution and abundance of SGCN and the status of local and statewide populations, a better understanding of habitat needs, life-history information, and information related to SGCN movement and migration. This information will help to fine-tune strategies and guide management for SGCN.

The Silver Lining

We noted at the beginning of this section that recurring problems actually give us hope that we can conserve Vermont's Species of Greatest Conservation Need because if we address a problem for one species we're likely to do the same for many others. Similarly, several conservation strategies outlined in this report including habitat restoration, encouraging wildlife-compatible resource use, providing education and technical assistance to landowner and managers and providing economic incentives for conservation come up again and again in this report. The good news here is that we can focus our limited conservation resources on the strategies that will provide the biggest bang for the buck.

Therefore to the list of major issues impacting Species of Greatest Conservation Need we'll add one problem that our technical teams did not identify directly in their assessments but that was often discussed during team meetings—the lack of sufficient funding for wildlife conservation. Without sufficient funding we will not be able to implement many of the conservation strategies identified in this report. The State Wildlife Grants program is a critical first step in funding SGCN conservation, but more is needed. And, to make the most of SWG funds, Vermont will have to develop the required matching stateside funds.

Conservation Success!
Keeping Common Species Common

In spite of the changes to the Vermont landscape, the fact is, Vermont remains a relatively rural state with an abundance of conserved land, private landowners who are excellent stewards of the environment, and many wildlife conservation success stories. The public opinion survey results (U.S. Fish & Wildlife Service 2001) speak volumes for the bright future of wildlife conservation in Vermont—that is, the public has a strong interest in and dedication for the conservation of Vermont's natural heritage.

Moreover a review of past and ongoing wildlife conservation efforts provides proof of our collective ability to recover and conserve wildlife and the habitats required for their survival. It also identifies the key building blocks for successful conservation.

In 1724, when the first European settlement was established at Fort Dummer, near Brattleboro, the state was primarily forested and had abundant fish and wildlife populations including passenger pigeons, fisher, wolves, deer, black bear, beaver, and salmon. However, by 1865 many of these species would be present in far fewer numbers or on the cusp of extirpation because of unregulated harvests, habitat loss and habitat degradation.

Hunting and fishing license fees, soon after the turn of the 20th century, coupled with federal wildlife and sportfish restoration act dollars, enacted in the 1930's and 1950's respectively, established a financial framework in support of conservation. These monetary resources enabled Vermont, and the other states, to conduct inventories and research, acquire habitats, and provide conservation education to the public. Today, some of the species of low abundance 150 years ago are now once again common throughout the State. Consider, for example:

White-tailed deer: Numbers were so low in the late 1800's that no open season was offered and deer were transplanted from New York. Through extensive research, harvest management, and habitat

protection, Vermont can now support in excess of 150,000 deer with 48 days of hunting opportunity, annually.

Wild turkey: This bird was extirpated from the state in the 1800's. Birds were reintroduced to the state in 1969. We now have more than 40,000 turkey and both fall and spring hunting opportunities.

Fisher: This mid-sized carnivore was extirpated from the state. Animals were reintroduced to Vermont beginning in 1959, and this predator now thrives on the Vermont landscape.

Anadromous fish on the Connecticut River: Migratory fish in the Connecticut River, including Atlantic salmon, American shad, striped bass and river herring were reduced or eliminated in 1798 by a dam built in Turners Falls, Massachusetts. With the construction of fish passage at dams, and active restoration programs shad, stripers and herring are now abundant in the lower river, and annual runs of Atlantic salmon have been restored to the lower river after a nearly two hundred year absence.

Trout and salmon in Lake Champlain: Landlocked Atlantic salmon disappeared from Lake Champlain in the 1850's, and native lake trout were gone by 1929. A restoration program was begun in the 1970's in cooperation with the State of New York and the US Fish and Wildlife Service, and these fish are plentiful once again in Lake Champlain where they support a popular fishery that brings hundreds of millions of dollars into the regional economy each year.

Lake sturgeon: A combination of dam construction, pollution and over-fishing reduced lake sturgeon populations in Lake Champlain in the early 1900's to the point that the commercial fishery was abandoned and all fishing for sturgeon was prohibited in 1967. Since this fishing closure sturgeon conservation has benefited from water quality improvements, better water flows at the dams, and outreach to anglers to release any sturgeon they catch. Recent studies have documented successful natural reproduction of sturgeon in all four of their historic spawning rivers in Vermont.

Peregrine falcon, osprey, and common loon: These birds were gone or nearly gone from the state by the mid-1900's, Through focused management (e.g., the construction of artificial nesting platforms, water level management, and public education), each of these three species has recovered sufficiently that they've recently been removed from the state's endangered species list—a first for any species in Vermont.

These success stories suggest that new dollars will produce new success stories for the future. In other words, the fish and wildlife profession has demonstrated the will and the competence to restore and manage wildlife. The Wildlife Action Plan, coupled with sustained funding and the dedicated participation of partners, will offer a template for advancing the success stories to a new suite of species.

The Importance of Education, Law Enforcement and Wildlife-Associated Recreation to Wildlife Conservation

Through the State Wildlife Grants program (SWG) Congress provides every state with critically needed funds for wildlife conservation. Congress' intention is to support proactive and strategic efforts to prevent future Endangered Species Act listings—in other words, to keep common species common. To meet Congressional intent, states are compelled to employ all of their best conservation tools including education, wildlife-associated recreation and the creation and enforcement of wildlife protection laws and regulations. These are among the most proactive, strategic and time-tested tools in any conservation tool box.

The details of the SWG program legislation, however, currently preclude states from using SWG funds for law enforcement and recreation projects. A limited amount of SWG funds can be used for conservation education, but only in a supporting role in the implementation of a conservation strategy (e.g., signage explaining the purpose of a restoration project). This poses a dilemma for states trying to implement a truly comprehensive wildlife action plan because it restricts their use of three vital conservation tools. Moreover, it limits the participation of three significant conservation constituencies from participating in Wildlife Action Plan implementation—the law enforcement, education and outdoor recreation communities.

A limited number of education and law enforcement conservation strategies specific to particular species or habitat categories were addressed in the species and habitat conservation summaries of this report (Appendices A and B). We recognize that alternative funding sources are needed for their implementation. In this section of the Wildlife Action Plan report we present additional conservation strategies based on conservation education, wildlife-associated recreation and law enforcement. It is our hope that future renderings of the State Wildlife Grants program, along with other funding mechanisms will provide for the implementation of these strategies and other others in their realms.

Conservation Education

Wildlife and human communities depend on healthy ecosystems and ecological processes. Their functions are essential for our quality of life and for the Vermont economy. Conservation strategies that follow a sound education model can foster healthy public behavior and attitudes toward land and wildlife conservation. Furthermore, strong educational programs that expand Vermonters' ecological literacy will enhance the credibility and effectiveness of other conservation efforts and build support for future efforts. Finally, the public plays a key role in influencing legislators, who in turn affect policy and funding decisions. Recommended strategies include:

- Foster and enhance educational partnerships to maximize efficiency (e.g., develop volunteers, outreach to teachers and youth group leaders to deliver programs)
- Ensure that sound messages, curricula, and best educational practices are followed to maximize our efforts (e.g., provide teacher training, curriculum support materials for teachers and students,

- Define a land stewardship message that promotes the conservation and ethical use of Vermont's fish, wildlife, and plants, and the habitats that sustain them.
- Focus outreach and education efforts to enable the public to make informed decisions on issues affecting ecosystems in Vermont such as: habitat degradation and fragmentation, threats to fish and wildlife species and their habitats, the value of working rural landscapes and other rural lands, the sustainable and ethical utilization of wildlife.

The connection between of education to wildlife conservation is recognized nationwide. The International Association of Fish and Wildlife Agencies (IAFWA) is sponsoring the development of a national strategic plan for conservation education, the resulting plan will make conservation education a top priority for state fish and wildlife agencies (Case 2005).

Wildlife-Associated Recreation

Hunting, fishing, trapping, and wildlife viewing have a long heritage in Vermont and Vermont leads the nation in wildlife viewing (US DOI 2001). By providing the means for more people to connect with wildlife, we can foster more and stronger relationships to the natural world. Applying the concept of stewardship through recreation Vermonters can become knowledgeable about and appreciate wildlife, natural communities, and conservation in ways that promote citizen interest in contributing to conservation. Recommended strategies include:

- Work with the broader community of recreation groups (e.g., outdoor guides, birders, sportsmen and women, hikers, paddlers, climbers, spelunkers, mountain bikers and snowmobile and ATV associations) to foster partnerships that build a stronger wildlife ethic among members.
- Expand educational programs on watchable wildlife, including such topics as birding, wildlife photography, animal track identification, and backyard habitat. Target population centers, with a focus on youths and families.
- Increase information available to the public on how and where to watch wildlife. Provide information to encourage watchable wildlife practices, such as viewing, photographing, and feeding, in a manner that is ethical, safe, and consistent with protecting the welfare wildlife resources.
- Foster a recreational ethic based on the concept of giving back to the natural world.
- Include an educational component in recreation activities making the connection between our actions and the impact on wildlife.
- Involve Vermonters in activities that will increase their understanding of wildlife and land stewardship and the influences of human activities on wildlife, in order to build public support for fish and wildlife conservation (e.g., citizen science projects such as the bird atlas, butterfly survey and other wildlife inventories, teacher training courses, streambank plantings, and field classrooms).
- Encourage responsible outdoor recreation through programs such as "Stop Aquatic Hitchhikers," "Leave No Trace," "Stay on the Trails," and "Be Bear Aware."

Recent projects
A joint VFWD-Vermont Federation of Sportsmen's Club project in 2003 is a good example of a wildlife-based recreation project. Using funds from the short-lived Wildlife Conservation and Restoration Program (WCRP), a predecessor to the State Wildlife Grants program, public access to the Blueberry Hill Wildlife Management Area was enhanced.

The Fish & Wildlife Department recently developed and helped implement a combined physical education/ conservation curriculum for Vermont schools.

Statewide Comprehensive Outdoor Recreation Plan (SCORP): In addition to the Wildlife Action Plan, states are developing comprehensive plans for outdoor recreation as a requirement for receiving support from the Land and Water Conservation Fund (LWCF). The National Parks Service in the U.S. Department of the Interior administers the LWCF. The National Parks Service's term for this planning process is known as the SCORP, which stands for Statewide Comprehensive Outdoor Recreation Plan. The Department of Forests, Parks & Recreation (FPR) is leading the development of Vermont's SCORP. The document will be ready in 2005

Law Enforcement

The creation and enforcement of fish and wildlife laws are among our society's oldest attempts to conserve wildlife. Vermont's first game wardens were appointed in 1779 to protect deer and were called "Deer Reeves." Law enforcement is an effective conservation tool and has been at the core of wildlife conservation ever since.

State game wardens prevent the illegal taking, trade, sale, collection and importation of wildlife by proactive enforcement of fish and wildlife laws. Game wardens also prevent and investigate the unlawful destruction of critical habitat, trespass and disturbance of refuge areas and sensitive breeding grounds and enforce the regulations and permits that govern wildlife research, education and rehabilitation.

Law enforcement professionals strive to be proactive: Game wardens are an integral part of the Fish & Wildlife Department's outreach and education programs. Wardens teach conservation at schools, civic organizations and conservation camps and are often the first, and sometimes, only contact that the general public has with a conservation professional. Recommended strategies include:

- Maintain staffing of game wardens and compliance officials statewide sufficient to ensure the adherence of all laws pertaining to fish, wildlife and habitat conservation. State game wardens conduct routine patrols providing enforcement of boat, ATV and off road recreational vehicles to address the illegal operation and destruction of sensitive habitat and wildlife areas.
- Review, update, and enforce regulations controlling the importation and possession of exotic and potentially harmful fish and wildlife species and their pathogens.

Recent projects

As people interact more and more with wildlife, the number of wildlife-human conflicts increases. In 2002 Vermont game wardens responded to more than 1,000 calls from the public on issues such as rabies and damage to property. If not adequately addressed members of the public might try to resolve the issues themselves in a manner unduly detrimental to wildlife. Many encounters require a physical response by a warden to prevent human injuries or disease exposure. Funds from the short-lived Wildlife Conservation and Restoration Program (WCRP), a predecessor to the State Wildlife Grants program, helped enhance VFWD's wildlife-human conflict management efforts through additional equipment, outreach materials and staff training. These enhancements improved responsiveness and effectiveness in addressing these real and growing needs.

All for one and one for all: Law enforcement, Education & Recreation

It should be clear to a reader by this point that not only is each of these three tools critical to the long-term conservation of wildlife, but that they are all tightly intertwined. For example, our best opportunities to instill the message of conservation in the public are when they are out in nature recreating. And, state game wardens are often the ones to deliver the message. Furthermore, outdoor guides and other recreationalists often provide tips to wardens and compliance officers regarding habitat degradation or the illegal taking of wildlife, and by doing so they send a strong message to the general public that Vermonters care about wildlife.

Vermont Department of Forests, Parks & Recreation: Current Efforts Related Wildlife Conservation

The mission of the Department of Forests, Parks & Recreation is to practice and encourage high quality stewardship of Vermont's environment by:

- *monitoring and maintaining the health, integrity, and diversity of important species, natural communities, and ecological processes;*
- *managing forests for sustainable use;*
- *providing and promoting opportunities for compatible outdoor recreation; and*
- *furnishing related information, education, and service.*

To fulfill our mission, the Department will continue to work, as we have for almost a century, for sound management and sustainable use of Vermont's forests, forest land, other natural resources, and outdoor recreation opportunities.

The Vermont Department of Forests, Parks and Recreation pleased to have had the opportunity to be involved in Vermont's first Wildlife Action Plan. As the proposed conservation strategies are implemented, this plan could have a significant impact on the management of public and private forest lands within the state.

Without healthy, sustainable forests in Vermont, attempts to conserve wildlife would be in vain. The animals and the habitat are inextricably linked… Forests should continue to dominate our state's landscape to ensure healthy wildlife populations.

The vast majority of Vermont's forests are privately owned and unless landowners can expect a reasonable return from their forest resources, maintaining land as part of a working landscape may be difficult. Equitable taxation (through programs like the Use Value Appraisal Program) and strong local markets for forest products are critical to ensure the conservation of forested habitats by this largest portion of landowners. The Department's efforts (in this respect) can be broadly categorized into program management, state lands management, information and education, forest protection and economic development.

With respect to programs which most directly effect wildlife resources, our activities include:

State Land Management: Manage in a sustainable manner state-owned land for the purpose for which it was acquired and the wishes of the public, and in cooperation with the Fish & Wildlife Department and Department of Environmental Conservation. This amounts to 348,000 acres (1999). Primary goals include protecting land and water, maintaining ecosystem integrity, maintaining or enhancing biodiversity, protecting historic and cultural sites, providing compatible recreation opportunities, and producing wood products. In accordance with long-range management plans we additionally, construct and maintain high-quality forest roads for management activities, developed parks and recreational sites, and controlled recreational access for public uses. The Department also manages and/or monitors conservation easements on over 42,000 acres (1999) of private land. Both state-owned land and easements include those purchased with assistance from the Vermont Housing and Conservation Trust Fund, federal Land and Water Conservation Fund, the Forest Legacy Program, and State Trails Fund to ensure they are maintained for the public values for which they were acquired.

The Forest Legacy Program (FLP) is a federal grant program to protect forestlands from conversion to non-forest uses. The Vermont Department of Forests, Parks & Recreation is State Lead Agency for Vermont's Forest Legacy Program. The program is entirely voluntary. landowners who wish to participate may either sell the property as fee simple title (all rights), or only a portion of the property rights and retain ownership of the land. The use of conservation easements allows the land to remain in private ownership and ensures that important public values such as wildlife habitat, natural areas, forest resources, and outdoor recreation opportunities are protected.

Use Value Appraisal (Current Use Program): Administration of the forestry portion of the use value appraisal (current use) tax program on the million + acres (1999) of actively managed, private forest land enrolled. This includes providing public information, approving management plans, and inspecting parcels to insure compliance with standards and the management plan.

Private Land Management -- Technical Assistance: Provide information and technical assistance to private landowners on how to manage their land properly. This includes helping landowners understand and evaluate the timber, wildlife, ecological, historical, and aesthetic values of their woodlands. Advising landowners on the availability of private consulting services to help them carry out their management objectives.

Acceptable Management Practices (AMPs): Provide information and materials, and monitor practices that maintain water quality -- minimizing erosion, sedimentation, and temperature changes -- on logging jobs. Assist loggers and landowners to implement AMPs. Respond to citizen complaints. Assist in fact-finding and prosecution of violations. Provide education directly and through partnerships.

Acquisition of Land/Interests in Land: Continue to provide adequate state land for conservation, outdoor recreation, timber production, and other purposes consistent with a statewide policy and plan (the Agency's Lands Conservation Plan, effective July 1999). This includes exchanges, fee-simple acquisitions, acquisitions of interests in land, and identification/disposal of surplus lands.

Forest Land Conservation: Following up the recommendations of the Vermont Forest Resources Advisory Council (FRAC) and Northern Forest Lands Council (NFLC) continue to explore ways to:

- Enhance local rural-based economies through public policies that encourage, rather than discourage, investment in forest-dependent businesses.
- Conserve tracts of undeveloped forest land.
- Explore continually-evolving issues about Vermont's forest land.

Natural Areas Designation/Protection: Continue to identify, designate, and protect areas of significant biodiversity and/or geologic interest on state land. Presently 33 areas are designated.

Forest Health Monitoring: Assess, monitor, and report on the health of Vermont's forest resources by periodic measurements of tree condition and other ecosystem parameters (e.g., soil chemistry and structure, indicator plants and animals, vegetation structure), following national, regional, and state protocols. This includes Vermont Hardwood Health Survey, North American Maple Project, National Forest Health Monitoring Program, and Forest Inventory and Assessment (FIA).

Forest Insect and Disease Management: Protect Vermont's timber, sugarbush, urban forest, Christmas tree, and non-commercial forest resources from significant loss of ecological, economic, or aesthetic value due to damage by forest insects, disease pests, or other biotic and abiotic stressors. Assess role of natural insect and disease outbreaks in overall ecosystem integrity. The Department provides information, data, and technical assistance to landowners, managers, and state and federal agencies. We also implement procedures for handling insect and disease outbreaks and assist in research conducted by other organizations.

Vermont Forest Ecosystem Monitoring (VForEM): Participate as a major partner in VForEM to: Provide information needed to understand, protect, and manage forested ecosystems within a changing global environment. Promote understanding of the conditions, trends, and relationships in the physical, chemical, and biological components of forested ecosystems in Vermont. Promote efficient coordination of multi-disciplinary environmental monitoring and research among federal, state, and private entities.

Conservation Education: Continue and improve interpretive education programs and materials for individuals, schools, groups, and state park visitors, on natural resources, their management, and other related topics. This includes the summer park naturalist program; fall park naturalist program for Vermont students; Project Learning Tree coordination; production of needed written, audio, photographic, and video materials; providing information via the Internet; networking with other educational institutions, organizations, and programs on special projects; and filling requests for natural resources career information. Continue work on alignment of curriculum materials (PLT) with "Vermont Framework of Standards and Learning Opportunities." Continue work with Vermont Institute for Science, Math, and Technology (VISMIT) and Department of Education on natural resources education. Provide information on state land.

Informal and Formal Education: Continue strong commitment throughout the Department, in all activities, on education in our informal contacts with the public, presentations, workshops and demonstrations in the field, school visits, activities on state lands, and other means. This includes continuing education and training for loggers, foresters, and others resource workers. Produce and provide printed materials and public use maps; fill requests for alternative formats. Work with the Department of Education on natural resources management education as a requirement in school curricula, including such topics as wildlife, forestry, water resources, recreation, etc.

Research and Monitoring: Participate in a variety of research and monitoring projects (often with cooperators, such as the University of Vermont and U.S. Forest Service) on important natural resources issues, such as forest health, recreational use of lakes, economic contributions of forest-based businesses, and forest practices. Make the data and information available and useful to the public and special interests.

Vermont Department of Environmental Conservation

The concept that healthy wildlife populations support healthier natural systems upon which we all depend goes to the heart of our mission at the Department of Environmental Conservation (DEC) As such, DEC as been pleased to participate in the development of the Wildlife Action Plan

The DEC is one of three departments in the Agency of Natural Resources. The Department's activities include: monitoring and ecological assessment, education, grants and regulatory oversight of the quality of air, surface water, drinking water, and groundwater, wetland and surface water ecosystems; and waste management and disposal. Department vision and mission statements describe 1) the future condition that the Department collectively wishes for Vermont and the balance that the Department seeks between Vermonters and the resources that the Department manages and 2) what the Department is working to accomplish respectively.

DEC Vision

"We envision a Vermont where people live in harmony with diverse and healthy natural systems; appreciate and enjoy our natural resources; understand the environment; work together responsibly to reduce waste and risks to human health and the environment; and prosper without significant degradation of natural systems. We envision a Vermont where people breathe clean air, drink clean water; eat safe food; and live in a sustained and healthy environment."

DEC Mission

"To preserve, enhance, restore, and conserve Vermont's natural resources, and protect human health, for the benefit of this and future generations."

The Department's work is organized into six programs: Air, Drinking Water, Surface Water, Waste, Groundwater and Earth Resources, and Management. Each of the Department's programs has identified goals developed strategies for achieving those goals. Goals and strategies that address wildlife conservation include:

Air: Goals of the Air program include *"to maintain a level of air quality in Vermont that supports a healthy, diverse ecosystem."* Strategies to achieve this goal include: maintaining base compliance, permitting, monitoring, and outreach and education programs; install air pollution control devices on regional air pollution generators having a discernable impact on Vermont; develop action plans for reducing chemicals which exceed Hazardous Ambient Air Quality standards.

Surface water: Goals of the Surface Water program include *"to maintain and enhance a level of surface water quality, quantity and stream morphology that supports the integrity of healthy ecosystems."* Strategies to achieve this goal include: maintain basic compliance, permitting, planning, monitoring, outreach, and education activities; reduce phosphorus loading to Lake Champlain through point and non-point source controls and improve municipal policies and bylaws; develop, with extensive education and public participation, watershed management plans for all major and minor watersheds that will outline strategic actions to monitor, restore, maintain and enhance the quality of waters within

each basin; provide education and technical assistance to enable communities, local organizations, and individuals to understand and minimize their impact on the watershed environment; develop assistance programs to enhance the management of dams, including removal when appropriate; develop and maintain a morphologically based stream restoration approach to river management; restore river reaches and lakes that are altered by artificial flow and water level management.

Groundwater and Earth Resources: Goals of the Groundwater and Earth Resources Program include *"to conserve Vermont's earth resources."* Strategies to achieve this goal include: maintain basic compliance, permitting, planning, monitoring, mapping, outreach, and education activities; complete investigation and remediation of contaminated sites; produce maps of all known sources and locations of contaminated groundwater.

Waste: Goals of the Waste program include *"to reduce hazardous and solid waste generation through pollution prevention, source reduction, reuse and recycling, to ensure safe management of solid and hazardous wastes that are generated, and to mitigate health and environmental impacts of improper waste disposal actions and accidental releases."* Strategies to achieve this goal include: maintain basic compliance, permitting, planning, monitoring, outreach, and education activities; provide waste prevention information, assistance and recognition; provide solid and hazardous waste facilities management and oversight; provide emergency spill response and management of contaminated sites.

The above provides a summary of Department of Environmental Conservation goals and strategies related to environmental conservation, many of which directly and indirectly benefit wildlife. Strategies include many long-established ongoing activities, including technical assistance, monitoring, grants, and regulatory services. Each program works in partnerships with citizen groups, municipalities, businesses and other government agencies including the Vermont Fish & Wildlife Dept and the US Fish & Wildlife Service. These coordinated efforts are critical to the success of making progress towards each of the program's goals. A few of those activities are described below.

Biodiversity monitoring is an ongoing activity conducted by DEC biologists. Monitoring activities are conducted to evaluate the status of selected biological species and communities. Specific activities include: 1) distributional surveys of plant and animal species listed by the Vermont Endangered Species Committee as endangered, threatened, rare, or of special concern; and 2) monitoring of biological communities or community types whose diversity is threatened (e.g., Lake Champlain mussel and cobble/shale invertebrate communities threatened by zebra mussels). Data are used to: 1) describe species distributions; 2) identify species/communities at risk; and 3) develop management plans for the protection of identified species/communities (e.g., Lake Bomoseen bladderwort relocation).

DEC biologists, in collaboration with other state and federal agencies, have been involved in a variety of activities related to the ecology of wetlands. These activities include: investigations onto the occurrence and potential causes of malformations among Northern leopard frogs in Vermont; a study of the biological communities of vernal pools; demonstrations of the use of herbivorous insects for the control of invasive exotic plant species in lakes and wetlands

The Department is increasingly using watersheds as the basis for water quality protection and management, and to determine assessment and monitoring priorities. Through the Department's educational efforts, watersheds are now the focus as people learn about their individual role in causing and controlling pollution, protecting water resources, and in preserving the land. The Department, following the "Guidelines for Watershed Planning," is conducting seven Basin Planning Processes that includes working with local land owners and other residents to restore impaired waters and formulate strategies to restore and protect waters throughout the watersheds. As part of this effort, bioassessment and biomonitoring will increasingly guide water quality management.

For more information about DEC programs and projects go to:
http://www.anr.state.vt.us/dec/dec.htm

Why is the Vermont Agency of Transportation Concerned about Fisheries and Wildlife Issues?

The Vermont Agency of Transportation (VTrans) has a productive working relationship with the Vermont Fish and Wildlife Department, and numerous activities related to fisheries and wildlife described in the following pages. There are several important reasons for this work.

1. **Safety:** Wildlife on Vermont's highways represents a significant risk to humans. Numerous lives are lost and there are billions of dollars in property damage every year nationally due to vehicle-animal collisions.

2. **Fiscal Benefits:** There are potential fiscal benefits to the state and the agency by reducing wildlife collisions and better planning for wildlife and fisheries impacts from transportation including:
   - Reduced insurance claims.
   - Increased hunting and fishing license revenues from healthier and more numerous deer and moose herds and a healthy indigenous fishery.
   - Improved planning lessens the potential for regulatory battles and thus reduces transportation project costs.
   - Reduced bridge and culvert maintenance costs. Bridges and culverts that provide fish passage are subject to fewer impacts from sediment and debris transport and erosion.

3. **Stewardship:** Protection of wildlife and improved fisheries are important issues for Vermonters. Transportation has been shown to have negative effects to fisheries and wildlife including: increased animal mortality from vehicle collisions; direct and indirect effects to habitat from the existing transportation system, increased traffic, and proposed improvements including new and expanded roadways; reducing animal and fish passage, thus limiting habitat availability and isolating populations; and the effects of pollutants from vehicles such as ozone and green house gases on the state's ecological health. VTrans needs to be a good environmental steward and respond to the public's concerns about fish and wildlife protection.

   Stewardship means better working relationships with regulatory agencies—improved trust, communication, coordination and collaboration - which all help to avoid confrontation in the regulatory process.

4. **Wise Allocation of Resources:** Hundreds of state bridges and culverts are insufficient regarding fish passage. Federal and state dollars to repair, retrofit, and replace these structures are severely limited. Planning and cooperation with the Vermont Department of Fish and Wildlife is needed to make investments that will have the most benefit to all indigenous aquatic organisms.

5. **Prudence in the Regulatory Process:**
    - Working with Fish and Wildlife biologists to better plan, predict problems, and evaluate resources in advance of project design prevents conflicts regarding specific species and habitats during regulatory processes.

    - Planning for mitigation at the watershed or bioregion level, rather than mitigating transportation impacts on a case by case basis has the potential to reduce mitigation costs and have greater wildlife benefits.

    - Transportation agency knowledge and involvement in wildlife and fisheries planning means that indirect and cumulative impacts (under the National Environmental Policy Act NEPA) are better coordinated and more easily addressed for large projects.

The National Perspective

Road ecology - the notion of accommodating wildlife and fisheries movement around and through the transportation system and minimizing habitat fragmentation - is being considered nationally through the Federal Highway Administration (FHWA) and at increasing numbers of state DOTs.

States are employing a mix of underpasses, bridge extensions, culvert installations and modifications and associated fencing and ecowalls to facilitate and guide wildlife movement. Research is also underway through the auspices of the National Cooperative Highway Research Program to investigate how to identify the best wildlife crossing alternative for a site, design guidance and standards, maintenance costs, and a tool to determine cost effectiveness.

Several states, including Vermont, a leader in the Northeast, have also been conducting research and setting policy regarding practice and design guidance for culvert installation, design and prioritization for fish passage.

Transportation planners and highway engineers, biologists, state and federal environmental regulators, and environmental interest groups have been sharing information and research for several years within the context of the biannual International Conference on Ecology and Transportation (ICOET). This first gathering of experts supported in part by the FHWA occurred in 2003 at Lake Placid, New York. The theme for the 2005 conference, which will be held later this year, is "*On the Road to Stewardship*." The conference website (www.icoet.net/ICOET2005.html) explains that:

> The 2005 "Stewardship" theme is designed to encourage conference presenters and participants to share information about projects and best practices that show how they are moving beyond regulatory requirements in order to respond to broader scientific and community-driven concerns related to the consideration of ecological concerns in transportation planning, project development, construction, operations and maintenance.

History in Vermont and Initiatives Underway

For the past several years, the Vermont Agency of Transportation has had several important initiatives related to road ecology. This work is a collaborative partnership with the Vermont

Fish and Wildlife Department and includes a Wildlife Crossing Steering Committee, chaired by VTrans' Director of Program Development. Initiatives include:

- The effects of new transportation projects on habitat and consideration of animal and fisheries passage are considered early in the project planning process. These effects are also considered in the maintenance and upgrading of the existing transportation infrastructure. One recent and very successful example of the former is agreement reached among the regulatory agencies regarding a major expansion of Route 78 through the Missisquoi National Wildlife refuge.

- The first-ever northeast regional wildlife and transportation conference held in 2004, a follow-up to the 2003 ICOET conference, and designed to forge a regional strategy regarding transportation and wildlife issues.

- VTrans and other partners on the Aquatic Organisms Steering Committee including the Vermont Fish & Wildlife and US Forest Service assessed the condition of over 200 large culverts (greater than 6' in diameter) in the Upper White River Watershed. The survey revealed that about one half of the existing large culverts under the state and interstate systems never pass fish. The remaining culverts only pass fish some of the time, and all of the structures suffered from structural damage and nearby stream degradation. Additional survey work in the Connecticut River Watershed during 2005 will help set future Agency culvert retrofit and replacement policy and priorities.

- A statewide GIS habitat database for use as a predictive model for making transportation decisions related to habitat connectivity. The database utilizes data collected by VTrans Operations and Maintenance road crews as well as data from the Vermont Fish and Wildlife Department.

- An inter-agency agreement that will create habitat for the eastern racer, a snake thought to have been extirpated from the state for at least 25 years that was recently discovered on VTrans property.

- Researchers from the University of Massachusetts Amherst have been retained to conduct a ground-breaking study on the efficacy of wildlife crossing structures being installed on the Bennington Bypass.

- VTrans and VDFW staff continue to monitor existing Interstate structures to identify potential crossing structures that are already part of the transportation system.

- Finally, VTrans staff continue their involvement in a habitat training program (recognized by AASHTO in 2003 with a National Environmental Stewardship Award nomination) that gets diverse personnel in to the field with wildlife experts from Keeping Track, Inc, the Vermont Herp Atlas, VFWD and others to learn how their work as transportation professionals can reduce impacts and reconnect habitat.

The Future

The Vermont Agency of Transportation's environmental policy adopted in 2004 recognizes the need for the agency to be proactive regarding its environmental stewardship responsibilities. The effects of the transportation system on Vermont's fisheries and wildlife are noted above. VTrans' approach in the past has included research, dialogue and partnerships with the Department of Fish and Wildlife and other interests. This work will continue in 2005 including:

- Norwich University students performing both pre-construction and post-construction aquatic studies during the summer of 2005—upstream, downstream, and within large culverts on the Agency's critical list.

- A culvert design workshop planned for July 11-15, 2005 for ANR and VTrans personnel with the goal of developing a set of design criteria that address hydraulics, debris and sediment transport, and the passage of all indigenous aquatic organisms.

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Vermont's Wildlife Action Plan

November 22, 2005

Chapter 3 Developing Vermont's Wildlife Action Plan

Developing Vermont's Wildlife Action Plan

Process and Organization

Timeline

The creation of Vermont's Wildlife Action Plan began in August 2003 when a Steering Committee of Vermont Fish & Wildlife Department directors and program leaders began regular scoping meetings. A project coordinator was hired in January 2004 and January to May 2004 was devoted to: reviewing federal guidelines, planning literature and past planning efforts; designing the Action Plan organizational structure and development process; and soliciting the support of stakeholder organizations and agencies. The identification of Species of Greatest Conservation Need (SGCN) occurred from May through September 2004. Habitat delineation for SGCN, problem assessment and strategy development occurred from September 2004 through January 2005. Integration and conservation planning ran from October 2004 through April 2005. Review and additional input by the Department, agencies and other stakeholders and the general public, ran from February though July of 2005. Final document preparation and editing occurred from May through August 2005. The anticipated submission date of the Action Plan is September 1, 2005.

The Action Plan Steering Committee identified five primary concepts during the scoping process that should frame the development of the Wildlife Action Plan:

1. Conserve, enhance and restore Vermont's wildlife and wildlife habitat.
2. Represent good science and conservation planning.
3. Identify conservation priorities yet remain flexible and open to new opportunities.
4. Be a strategy for the entire state; one that all agencies, organizations and individuals can find useful.
5. Build and support advocates for wildlife conservation.

The Action Plan Steering Committee recognized that meeting these goals required the resources, participation and ingenuity of many conservation-minded individuals, organizations and agencies. This in turn required a development process that included stakeholders and conservation partners to the greatest extent possible.

Organizational Structure

Six technical teams (Species Teams), two coordination teams (Integration Team and Steering Committee) and two advisory committees (Conservation Strategy Review Team and Conservation Partners) were created to develop the Wildlife Action Plan (Fig 3-1). Team descriptions follow below. Full charters for each team can be found in Appendix D.

Steering Committee: (Fish and Wildlife Department directors and program heads and the Action Plan Coordinator). The Action Plan Steering Committee is the executive body for Action Plan development and implementation with statutory responsibility for completion

of the Action Plan and management of State Wildlife Grant funds. The Steering Committee provides leadership and organizational commitment to ensure success of the Action Plan; encourages meaningful participation and buy-in among partners; and, appoints members to technical teams. See Table 3-1 for a list of Steering Committee members.

Wildlife Action Plan Coordinator: Manages the Action Plan project, supports activities of the technical and coordination teams, directs outreach and communications efforts, and writes website, newsletter and Action Plan content.

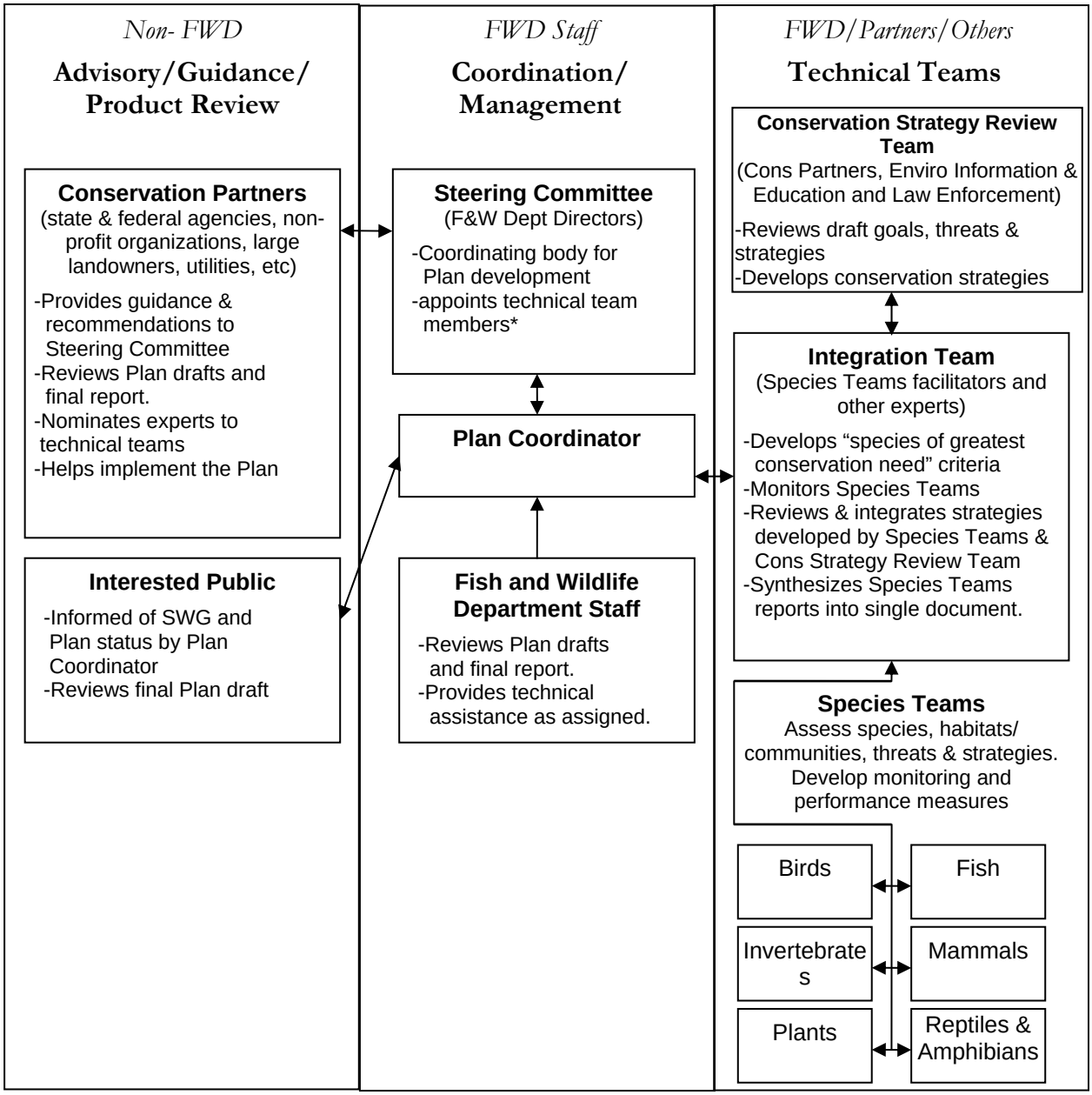

Figure 3-1: VT Wildlife Action Plan Teams and Committees

Conservation Partners: (representatives of state & federal agencies, non-profit organizations, large landowners, utilities, State legislators, academics, and others).

Conservation Partners provide guidance and recommendations to the Action Plan Steering Committee; review SGCN lists and Action Plan drafts; nominate experts for participation on Species, Integration and Conservation Strategy Review teams; and, help implement the Action Plan upon its completion. The Conservation Partners committee is open to any and all organizations that wished to participate. See table 1-1 for a list of conservation partners.

Species Teams: (selected Fish and Wildlife staff, conservation partners, and other wildlife conservation experts). There are six Species Teams: Bird, Fish, Invertebrate, Mammal, Plant, Reptile & Amphibian (Herps). These teams develop and refine lists of species of greatest conservation need; assess species distribution and abundance, identify habitats, communities, problems & strategies; develop monitoring and performance measures; recommend draft strategies for managing species of greatest conservation need; address comments made by Conservation Partners during interim review. See Table 3-1 for a list of Species Team members.

Integration Team: (Species Team leaders plus additional Fish & Wildlife staff and non-staff experts in wildlife conservation). The Integration Team develops criteria for designating species of greatest conservation need; keeps Species Teams on schedule; organizes species into groups based on habitat needs, synthesizes reports of the Species Teams and strategies developed by the Conservation Strategy Review team; identifies gaps in information and addresses special habitat and natural community needs; and prioritizes strategies and solutions to conservation challenges. See Table 3-1 for a list of Integration Team members.

Conservation Strategy Review Team: (State and federal agencies and non-profit organizations). The Conservation Strategy Review team (CSR) includes a main team as well as an Education CSR and a Law Enforcement CSR. The CSR was added to the array of Action Plan teams and committees in direct response to early feedback from Conservation Partners. Partners wanted additional opportunities to participate in Action Plan strategy development. CSR members were selected by the Steering Committee from a pool of nominees submitted by Conservation Partners. See Table 3-1 for a list of CSR members.

The Conservation Strategy Review team reviews problems and draft strategies developed by the Species Teams and the Integration Team. The CSR can also develop additional strategies as needed. These teams will also help present the draft Action Plan to Conservation Partners and the general public during review sessions. Because staffing and budget limitations made it impossible to include conservation education and law enforcement professionals on every Action Plan team and committee the Education and Law Enforcement CSRs were created to insert key perspectives and ideas into the process in a strategic and cost-effective manner. Conservation Strategy Review team members will also help implement the Action Plan upon its completion.

Table 3-1: Members of the Vermont Action Plan Steering Committee, Conservation Strategy Review Team, Integration Team and Species Teams

*Denotes chair, facilitator or co-facilitator of a team or committee

Steering Committee		**Conservation Strategy Review Team (CSR)**	
Ron Regan*	VT Fish & Wildlife Dept, Operations Director	Eric Palmer*	VT Fish & Wildlife Dept.
Tom Decker	VT Fish & Wildlife Dept, Wildlife Director	Colleen Sculley*	US Fish & Wildlife Service
Eric Palmer	VT Fish & Wildlife Dept, Fisheries Director	Rob Borowske	VT Fish & Wildlife Dept Board
Scott Darling	VT Fish & Wildlife Dept District Biologist	Gina Campoli	VT Agency of Transportation
Steve Parren	VT Fish & Wildlife Dept, NNHP Coordinator	Peg Elmer	VT Dept of Housing & Community Affairs
Tom Wiggins	VT Fish & Wildlife, Department Planner	Jamey Fidel	VT Natural Resources Council
Jon Kart	VT Fish & Wildlife Dept, Action Plan Coordinator	Roy Marble	VT Federation of Sportsmen's Clubs
		David Kelley	VT Ski Areas Association
Integration Team		Warren King	Audubon Society
Scott Darling*	VT Fish & Wildlife Dept	Sherb Lang	Hunters Anglers & Trappers of VT
Christa Alexander	VT Fish & Wildlife Dept	Leo Laferriere	Society of American Foresters
John Austin	VT Fish & Wildlife Dept	Art Menut	VT Farm Bureau
Farley Brown	VT Coverts	Julie Moore	VT Agency of Natural ResourcesPlanning Division
Doug Burnham	VT Dept of Environmental Conservation	Virginia Rasch	Assoc of VT Conservation Commissions
Dave Capen	University of Vermont	John Roe	The Nature Conservancy
Kathy Daly	Wildlands Project	Rick Schoonover	Vermont Trappers Association
Therese Donovan	VT Fish & Wildlife Coop Unit	Dave Tilton	US Fish & Wildlife Service
Paul Fredrick	VT Forest, Parks and Recreation Department	Jim Wood	North Country Environmental & Forestry
Clayton Grove	US Forest Service	Steve Wright	National Wildlife Federation
Eric Sorenson	VT Fish & Wildlife Dept	**Education CSR**	
Elizabeth Thompson	University of Vermont	Mark Scott	VT Fish & Wildlife Dept.
Keith Weaver	US Fish & Wildlife Service	Ginger Anderson	VT Forest Parks & Recreation Dept
Cedric Alexander	VT Fish & Wildlife Dept	Sally Laughlin	VT Endangered Species Committee
Ken Cox	VT Fish & Wildlife Dept	Gale Lawrence	Naturalist, writer
Mark Ferguson	VT Fish & Wildlife Dept	**Law Enforcement CSR**	
Steve Parren	VT Fish & Wildlife Dept	Bob Rooks	VT Fish & Wildlife Dept.
Bob Popp	VT Fish & Wildlife Dept	Mark Sweeny	US Fish & Wildlife Service
Kim Royar	VT Fish & Wildlife Dept	Pat Bosco	US Fish & Wildlife Service

Table 3-1 continue

Species Teams			
Bird Team		**Invertebrate Team**	
Cedric Alexander*	VT Fish & Wildlife Dept	Mark Ferguson*	VT Fish & Wildlife Dept.
Eric Derlath	US Fish & Wildlife Service	Steve Fiske	VT Dept of Environmental Conservation
Patrick Doran	Wildlands Project	Trish Hanson	VT Forest Parks & Recreation Dept
Dave Frisque	US Fish & Wildlife Service	Bryan Pfeiffer	Wings Environmental
Margaret Fowle	National Wildlife Federation	Kent McFarland	VT Institute of Natural Science
John Gobeille	VT Fish & Wildlife Dept.		
Paul Karczmarczyk	Ruffed Grouse Society	**Mammal Team**	
Mark Labarr	Audubon Society	Kim Royar*	VT Fish & Wildlife Dept.
Chris Rimmer	VT Institute of Natural Science	Pat Bartlett	Consulting Foresters Assoc VT
Allan Strong	University of Vermont	Tom Decker	VT Fish & Wildlife Dept.
		Bill Kilpatrick	University of Vermont
Fish Team		Sue Morse	Keeping Track, Inc
Ken Cox*	VT Fish & Wildlife Dept.	John Sease	US Forest Service
Doug Facey	St. Michaels College	Peter Smith	Green Mountain College
Anne Hunter	VT Fish & Wildlife Dept.	Charles Wood	University of Vermont, retired
Rich Langdon	VT Dept of Environmental Conservation	**Plant Team**	
John Lepore	VT Agency of Transportation	Bob Popp*	VT Fish & Wildlife Dept.
Craig Martin	US Fish & Wildlife Service	Dorothy Allard	Endangered Species Committee-Flora
Donna Parrish	VT Fish & Wildlife Coop Unit	Errol Briggs	VT Grange
Steve Roy	US Forest Service	Anne Bove	VT Dept of Environmental Conservation
		Mary Beth Deller	US Forest Service
Reptile & Amphibian Team		Brett Engstrom	Endangered Species Committee-Flora
Steve Parren*	VT Fish & Wildlife Dept.	Diana Frederick	VT Forest Parks & Recreation Dept
Jim Andrews	Middlebury College	Marc Lapin	Endangered Species Committee-Flora
Steve Faccio	VT Institute of Natural Science	Annie Reed	Endangered Species Committee-Flora
Chris Slesar	VT Agency of Transportation	Ned Swanberg	VT Institute of Natural Science
		Susan Warren	VT Dept of Environmental Conservation
		Mike Winslow	Lake Champlain Committee

Outreach and Public Involvement

The Vermont Fish & Wildlife Department recognized that to fully meet our goals for the Action Plan we needed the resources, participation and ingenuity of many conservation-minded individuals, organizations. To honor the efforts of the people and organizations participating in this project the following guidelines developed by the International

Association of Public Participation (IAP2 2004) were utilized in planning and implementing the public involvement process for Vermont's Action Plan:

1. Public participation includes the promise that the public's contribution will influence the Wildlife Action Plan.
2. The public participation process involves participants in defining how they participate.
3. The public participation process provides participants with the information they need to participate in a meaningful way.
4. The public participation process communicates to participants how their input affected the development of the Wildlife Action Plan.

In addition to the involvement of Conservation Partner organizations and agencies noted earlier, additional outreach and public involvement efforts focused on the following groups:

General Public: The general public has been kept informed about the State Wildlife Grants and Wildlife Action Plan several ways. These include: ongoing publications of two Department newsletters (*Fish & Wildlife Conservation News* and *Natural Heritage Harmonies*), a website dedicated to Vermont's Action Plan (http://www.vtfishandwildlife.com/SWG_home.cfm); presentations to conservation and wildlife oriented organizations, lectures at the University of Vermont; postings to listserves such as Vermont's science teacher listserve, and the general news and recreation media. Our public outreach goals were to inform the public that: wildlife may be at risk without our help and without adequate funds to conserve them; that with the financial support of State Wildlife Grants program, the Vermont Fish and Wildlife Department and Conservation Partners are developing strategies to conserve Vermont's wildlife; and; the general public can view a draft Action Plan and provide comments in spring 2005.

Endangered Species Committee: The Endangered Species Committee (ESC) is a standing citizens committee of the Agency of Natural Resources. It advises the Agency Secretary on issues concerning the State's listed and potential endangered and threatened species. The committee reviews the endangered and threatened species list and makes recommendations to the Secretary about amendments and ways to protect listed species. The ESC is supported by taxa-specific Scientific Advisory Groups (SAGs). Positions on the ESC and SAGs are filled by experts from local, state and regional organizations, agencies and education/research facilities. The Endangered Species Committee was briefed on the Action Plan early in the process. Several ESC and SAG committee members serve as Species Team members.

Fish and Wildlife Board: The Fish and Wildlife Board is a citizens committee of the Fish & Wildlife Department responsible for reviewing and approving fish and wildlife regulations in the state. The 14 members each represent one Vermont county and serves for six years. The board has been kept informed of the progress of the Action Plan via VFWD newsletters and email. Two Fish and Wildlife Department Board members were invited to the introductory Action Plan meeting and who have received regular Action Plan updates via the Conservation Partner listserve. Robert Borowske, Board Chairman was also made a member of the Conservation Strategy Review team.

Internal Constituencies: Staff of the Wildlife and Fisheries divisions and the Nongame and Natural Heritage Program of the Vermont Fish & Wildlife Dept received periodic updates and briefings on Action Plan status through division meetings, postings to the Action Plan website and through email. Leaders and members of the Integration Team, the Conservation Strategy Review team and six Species Teams included staff in all seven VFWD offices in the state. Staff was encouraged to provide input on all aspects of the process.

Coordination with Other Agencies & Native American Tribes

Congressional guidelines require that each state Action Plan "coordinate the development, implementation, review and revision of the Action Plan with federal, state and local agencies and Indian tribes that manage significant land and water areas within the state or administer programs that significantly affect the conservation of identified species and habitats."

Native American Tribes: There are no Native American tribes within the borders of Vermont that are officially recognized by the state or by the federal Bureau of Indian Affairs. Further, there are no tribal entities that manage significant land and water areas within the state or administer programs that significantly affect the conservation of Species of Greatest Conservation Need or their habitats. Therefore, in developing Vermont's Action Plan no special efforts were made to reach out to the Native American community however all Vermonters including Native Americans were encouraged to take part in the development of the Action Plan as Conservation Partners and the general public input process.

Development: State and federal agencies concerned with wildlife and land conservation and management have been highly involved in the development of Vermont's Action Plan. All are considered Conservation Partners in the development of the Action Plan. Representatives of eight state and federal agencies serve on Action Plan technical and coordinating teams (Table 3-1) of the dozen agencies serving as Conservation Partners. Several agencies provided data used in the development of the Action Plan. These agencies, as well as inter-agency groups such as the Lake Champlain Ecosystem Team, have also been kept informed of the ongoing developments in the Action Plan through email and US mail and partner meetings. Presentations and briefings were made to the commissioners of sister agencies at the State Agency of Natural Resources—the Department of Forests, Parks and Recreation, and the Department of Environmental Conservation, the Agency Secretary, the Vermont Agency of Agriculture, the inter-agency Lake Champlain Ecosystem Team, Windsor County Regional Planning Commission, and representatives of the Vermont Department of Housing & Community Development, and the US Department of Environmental Protection.

The International Association of Fish & Wildlife Agencies (IAFWA) and the Region 5 US Fish & Wildlife Service (USFWS) played significant and indispensable roles as facilitators of interstate, regional and national coordination through 1) Electronic listserves-IAFWA nationally and USFWS regionally; and, 2) Meetings of States, Federal Agencies and Partners—IAFWA nationally (two meetings) and USFWS regionally (three meetings).

Implementation, Review & Revision: All Conservation partners, including federal, state and local agencies will be encouraged to take part in the implementation, review and revision

of the Action Plan. Plans for these steps can be found in chapter 5 Vermont's Action Plan: Implementation and Review.

Outreach Events and Products

Partner Meetings: In March 2004 representatives of approximately 80 organizations and agencies interested in wildlife conservation and management were invited to an introductory Action Plan meeting. At this meeting the proposed Action Plan development process was presented. Through a series of discussions and brainstorming sessions the attendees helped the VFWD fine tune the process and focus on key issues. Participants were invited to take part in the development of Vermont's Action Plan by participating as Conservation Partners, by nominating people to serve on Species Teams and the Integration Team, and by keeping their memberships informed and engaged in the Action Plan.

In June 2005 Conservation Partners met for a second time to discuss the draft Action Plan report and Action Plan implementation. All questions, comments and suggestions were recorded and a responsiveness summary was developed and shared with all partners shortly after the meeting. The Conservation Partner comment period for the Action Plan originally ran from June 20 to July 18, 2005 but was extended to August 12, 2005 for a total of more than seven weeks.

In July 2005 a two-week public comment period and two public meetings on the final draft Action Plan were held. This comment period was three weeks to August 12, 2005 for a total comment period of five weeks. Public meetings were advertised through the Department's website, in the Department newsletter, through the news media and with the help of Conservation Partners who encouraged their memberships to attend the meetings and to provide comments on the report. Comments on the Action Plan were accepted during the meetings, via email, US mail, telephone and the Action Plan website.

The Action Plan was a significant topic of discussion among partner and potential partners during a September 2004 regional conference on Wildlife and Transportation held in Vermont.

Individual Partner Meetings: More than 40 meetings with individual partner organizations and agencies were held during the development of the Action Plan. The purpose of the meetings included keeping interested partners informed and outreach to potential partners.

Partner Correspondence: Between May 2004 and July 2005 Conservation Partners received periodic updates tracking progress in the development of the Action Plan via email and US mail. This includes the distribution of responsiveness summaries to Partner feedback, the announcement of a website dedicated to the VT Action Plan; the release of a draft list of Species of Greatest Conservation Need, the responsiveness summary to the CSR team recommendations and planning for a review meeting on the draft Action Plan report. Partners were invited to comment on any and all aspects of the Action Plan process and report in all communications. See Appendix E for a sample of correspondence and partner updates.

Species Team, Integration Team and Conservation Strategy Review team meetings: The six Species Teams and Integration Team began meeting in May 2004 with most having monthly meetings at least through January 2005. The Conservation Strategy Review team met in Dec 2004 and February and March of 2005. These meeting were open to Conservation Partners and the general public. Meeting schedules were posted to the Action Plan website.

Media: The Action Plan Coordinator managed the project's media campaign. Press advisories were released three times during the life of the project. Stories and editorials ran in two of the state's major newspapers and an unknown number of local and regional papers. The project was also covered at least twice on television and on public and commercial radio stations. Sample coverage is included in Appendix F.

Newsletters/Website: *Fish & Wildlife Conservation News* was created by the Fish & Wildlife Department specifically to inform the public about the State Wildlife Grant program and the projects it supports. Three issues were produced during the course of Action Plan development. *Natural Heritage Harmonies* produced by the Nongame and Natural Heritage program provided the public with information about Department projects, including work on Species of Greatest Conservation Need. See Appendix G for sample newsletters. During implementation of the Action Plan these newsletters will continue to inform and involve the public in SWG and Action Plan conservation efforts.

In July 2004 the Department unveiled a website dedicated to Vermont's Wildlife Action Plan (http://www.vtfishandwildlife.com/SWG_home.cfm). This site contains background on SWG, Action Plan requirements and background materials, links to Conservation Partners, SGCN lists, team and committee meeting schedules, updates and Partner correspondence, copies of press releases as well as copies of media coverage and answers to frequently asked questions. Drafts of the Action Plan were also posted to the site and an online feedback and comment form allowed people to submit comments electronically. During implementation of the Action Plan the website will continue to inform and involve the public in SWG and Action Plan conservation efforts.

Species & Habitat Conservation

Identifying Species of Greatest Conservation Need

Congress created the State Wildlife Grants program (SWG) in 2001 with the goal of preventing wildlife populations from declining to the point of requiring Endangered Species Act protections. To receive SWG funds, State Fish and Wildlife Departments agreed to develop statewide Wildlife Action Plans. Congress directed that the Action Plan identify and be focused on the "species of greatest conservation need."

Congress left it up to each state to identify their Species of Greatest Conservation Need (SGCN). The State Wildlife Grants program defines wildlife as "any species of wild, free-ranging fauna including aquatic species and invertebrates as well as native fauna in captive breeding programs intended for reintroduction within its previously occupied range." Furthermore, it was Congress' intent that SWG assist wildlife that have not previously benefited from other federal wildlife conservation and management programs (e.g., Federal Aid to Wildlife Restoration Act, Federal Aid in Sport Fish Restoration Act, or the Endangered Species Act). In Vermont, SGCN include:

- Species with declining populations;
- Species threatened or potentially threatened; and,
- Species that are so little known in the state that experts cannot yet ascertain status.

Though plants are not eligible for State Wildlife Grants Program funding, Vermont's Action Plan does include plant SGCN. It is expected that habitat conservation efforts for wildlife SGCN will benefit at least some of the plants. Plant specific conservation strategies, if and when they are implemented, will be funded through mechanisms other than SWG. Several game and sportfish species are identified here as SGCN. We expect to target other established funding programs for the conservation of these species before tapping SWG.

Vermont began its process of identifying Species of Greatest Conservation Need (SGCN) with a systematic review of all its known wildlife. The review was designed to assist the teams selecting the SGCN by equalizing the between well-known wildlife species supported by large datasets and poorly understood species.

The Integration Team was tasked with developing review criteria (Table 3-2). Six Species Teams (Bird, Fish, Herpitile (Reptile & Amphibian) Invertebrate, Mammal and Plant) conducted the reviews and selected SGCN with guidance and coordination provided by the Integration Team.

The Species Teams were provided with lists of species found in Vermont within their respective taxa (the Invertebrate team received the most up-to-date invertebrate list available but it is widely accepted that a complete list of the estimated 15,000-36,000 invertebrates in Vermont may never be possible (ANR 1995). The lists and supporting information were developed by the VFWD's Nongame and Natural Heritage Program (NNHP) using their Biotics© database and augmented with other databases, records and information from

Natureserve, universities and research facilities, regional and national monitoring efforts, published literature and the knowledge of technical experts.

Species teams met multiple times between May and September 2004 to conduct review. Data was captured in the Action Plan database.

Once the reviews were complete (Appendix A for SGCN, Appendix H for secure species) the Species Team selected SGCN using selection criteria (Table 3-3) developed by the Integration Team. Species were assigned conservation priorities of high, medium or low. Species ranked medium and high constitute Vermont's Species of Greatest Conservation Need. Low priority species were considered secure. There were a few cases where a specific Species Team approached their tasks differently:

Bird Team: An unusually rich collection of data and prior conservation planning efforts are available to bird conservators—far more than is available for other taxa. The Bird Team took advantage of this information by first focusing on species found on the watch lists of the North American Bird Conservation Initiative and Partners In Flight for Bird Conservation Regions 13 and 14 (Rosenberg 2004) as well as BBS route. Once watch list species were reviewed the team turned its attention to other species.

Invertebrate Team: It is estimated that Vermont is home to between 15,000 and 36,000 invertebrate species (VANR 1995). The vast majority are un-cataloged, un-studied and just plain unknown. Application of the review criteria to invertebrates on a species by species basis would be unproductive. Instead the Invertebrate team interviewed additional experts within Vermont, regionally and nationally to help in the identification of species and species groups of greatest conservation need.

Plant Team: The Plant Team also had to contend with a huge list of species—more than 2000 vascular plants (Flora 1993) and 600 bryophytes (Allard 2004). The team took advantage of plant conservation assessments previously conducted by the Agency of Natural Resources' Endangered Species Committee to create its list of Species of Greatest Conservation Need. All species ranked S1 (critically imperiled) and S2 (imperiled) became SGCN. Those SGCN also on the New England Plant Conservation Program list of regionally rare plants were then ranked High Priority. All others were ranked medium priority.

Table 3-2: Criteria for Reviewing Vermont's Wildlife

Category	Criterion	Allowed Response	Definition/example
Species that are rare or declining	State and/or Federally listed Threatened or Endangered species	Endangered, Threatened, Special Concern [See Appendix I for definitions of T& E status and ranks]	E: Endangered: in immediate danger of becoming extirpated in the state T: Threatened: with high possibility of becoming endangered in the near future. SC: Special Concern: rare; status should be watched
	Rare and very rare species	S-Ranks S1,S2 [See appendix I for definitions of T& E status and ranks]	S1: Critically imperiled (very rare): At very high risk of extinction or extirpation due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors. S2: Imperiled (rare): At high risk of extinction or extirpation due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors
	State Trend	Stable, Fluctuating, Declining, Increasing, Unknown	Based on research data such as BBS routes, other monitoring and best judgment of experts
	Regionally Rare	Yes/No/ Unknown	Based on regional and national research, BBS routes, other monitoring and consensus within technical teams.
	Extirpated in Vermont	Yes/No/ Unknown	
Vulnerable species at risk due to any of the following	Habitat Loss/Conversion/fragmentation	Yes-development, Yes-succession, Yes-natural causes, No, Unknown	Species negatively affected by habitat conversion, degradation, fragmentation or succession
	Life-history traits making the species vulnerable	Yes/No/ Unknown	Species with low fecundity, that take a long time to reach sexual maturity, that take a long time between reproductive events (e.g., sturgeon, wood turtle)
	Species vulnerable to taking	Yes-Regulated, Yes-Unregulated, No, Unknown	Hunting, trapping or collection, legal or otherwise.
	Species vulnerable to other deadly contact with humans	Yes/No/ Unknown	Road kill (bobcat, turtles), wind turbines (birds, bats) contaminates (fish) etc
	Species w/ limited, localized at-risk populations	Yes/No/ Unknown	Populations that cannot or do not intermix with the meta-population. E.g., non-vagile invertebrates in a sandplain community and perhaps spruce grouse.
	Species significantly impacted by exotics	Yes/No/ Unknown	Impact may lead to elimination of populations, limits to long-term stability, extirpation
Species or species groups w/ unknown status or	Unknown status-more data is needed	Yes/No/ Unknown	
	Species w/ taxonomic uncertainties	Yes/No/ Unknown	

Category	Criterion	Allowed Response	Definition/example
taxonomy			
Category	**Criterion**	**Allowed Responses**	**Definition/example**
Other factors to consider	Keystone species	Yes/No/ Unknown	Species with a disproportionately strong influence on ecosystem functioning and diversity (Power et al.1996).
	Responsibility species	Yes/No/ Unknown	Species for which Vermont has a long-term stewardship responsibility because they are not doing well regionally, even if populations are stable in Vermont (e.g., Bobolink)
	Endemic species	Yes/No/ Unknown	Species found only in Vermont
	Relationship to core population	central peripheral, disjunct, unknown	
	Requires rare or specialized habitats	Yes/No/ Unknown	A species with a very narrow niche, e.g., a species requiring a host plant found only in a handful of serpentine rock outcrops.
	Species with limited dispersal capability	Yes/No/ Unknown	Non-vagile species in dispersed habitats.
	Requires key Vermont migration stopover points	Yes/No/ Unknown	
	Species selected based on expert opinion	Yes/No	Combined opinion of the team.
	Actively managed? (if so list applicable plan(s)	Yes-Mgt plan exists, Yes-regulated, No	Does a management plan exist for the species or species group? (E.g., an osprey plan, waterfowl plan, species recovery plan.)
Secure?	Species Secure	Yes/No/ Unknown	Combined opinion of the team
	Final Assessment	High, Medium, Low Priority	

Table 3-3: Criteria for Selecting Vermont's Species of Greatest Conservation Need
Because the circumstances, issues and problems impacting each species is unique, teams were given some flexibility in assigning ranks to species.

Species (and Species Groups) of Greatest Conservation Need	**High Priority**	Species that are vulnerable (rarity is an aspect of vulnerability).
		Species with immediate limits to its survivability based on known problems and/or known impacts to the population
		Species exhibit negative population trends.
		Species may be extirpated locally (Vermont) but still exist regionally.
	Medium Priority	Species may be well distributed and even locally abundant, but populations are challenged by factors that increase mortality or habitat loss and therefore threaten the species in Vermont.
		Consider what is known about the species regionally.
		Since this may be the most difficult category to assign species to, there should be a consensus among group members.
Common Species	**Low Priority**	Species is secure for the immediate future.
		Species may be vulnerable to some mortality and/or problems (e.g., habitat degradation) but population is abundant enough to tolerate negative forces

There is some variability between Species Teams regarding thresholds used for selection as SGCN (e.g. the herpitile team was the most conservative in selecting SGCN and the mammal team selected the most SGCN based on the need to address data gaps). This being Vermont's first Action Plan our priority was not to ensure parity in numbers across taxa but rather to ensure that experts within each taxon were in accord regarding the species selected.

The list of Species of Greatest Conservation Need includes 144 vertebrate species (out of a total of 468), 192 invertebrate species or groups (out of an estimated 15,000-36,000) and 577 plant species out of approximately 2600 vascular and non-vascular species. See Table 3-4 for summary statistics on Vermont's SGCN.

Table 3-4: Summary Statistics for Vermont's Species of Greatest Conservation Need
High and medium priority ranked species constitute Vernont's SGCN.
*27,250 is the median of the estimated 15,000 to 36,000 Vermont invertebrates (ANR 1995)
** This low percentage reflects the large number of invertebrates whose conservation status is unknown

	Total species in VT	High Priority SGCN	Medium Priority SGCN	Total SGCN	% SGCN of total VT Species
Birds	269	22	35	57	21%
Fish	94	18	15	33	35%
Reptiles & Amphibians	42	12	7	19	45%
Mammals	63	16	17	33	52%
Invertebrates*	27250*	192	0	188	0.69%**
Plants	2000	200	377	577	29%
Total	29718	403	450	853	2.87%

This list was then reviewed by the Integration Team, Steering Committee and the Commissioner of the Fish & Wildlife Department. It was then made available to Vermont Fish & Wildlife staff, Action Plan Conservation Partners, the Action Plan Conservation Strategy Review team and the general pubic for feedback and comments via the Action Plan website.

Conservation of Species of Greatest Conservation Need

Fine Filter-Species

Once Species of Greatest Conservation Need were identified, technical teams set about developing individual species reports for each SGCN. Reports identified species distribution, habitat needs, problems affecting species and their habitats, research and monitoring needs and conservation strategies for each SGCN (Congressionally required elements #1-#5). Invertebrate SGCN were addressed in groups rather than as individual species. Fourteen invertebrate groups were created based on taxonomy (e.g., butterflies, crustaceans, tiger beetles) and habitat use (e.g., freshwater, grasslands, hardwood forests). Reports were not developed for plant SGCN. All data was entered into the Action Plan database.

Distribution for all SGCN was identified by biophysical region (Girton & Capen 1997) using terminology consistent with the Nongame Natural Heritage Program's element occurrence tracking procedures. Distribution of fish SGCN and some additional aquatic SGCN was also

identified by 8-digit watershed unit (NRCS 2003). Historic occurrence was noted in a narrative for some of the rarer and extirpated SGCN.
Protocols for describing habitat were developed by the Integration Team in consultation with Species Teams. Habitat descriptions for SGCN include a narrative, elevation preferences, migrant status, home range and patch size requirements and landscape requirements (e.g., corridor needs, habitat mosaics or wetland complexes, preference for managed or passively managed forest, large grasslands or developed landscapes).

Research needs for each SGCN, where needed to determine species status or to identify problems, were developed by each Species Team. Research needs were assigned "high," "medium" and "low" priorities.

Priority problems and potential risks to Species of Greatest Conservation Need were enumerated for each species. These were not exhaustive lists of all possible problems. Teams identified only those factors posing significant and potentially significant problems for a species. A narrative description was entered into the database. Species teams also assigned each problem to one of 22 habitat related and non-habitat related problem categories (Appendix C). These categories are the same as those used in Species of Concern Status Reports during the U.S. Forest Service's Forest Plan Revision process for the Green Mountain National Forest.

Species specific conservation strategies were also developed by the Species Teams. Strategies were designed to address the problems identified for each SGCN. Strategies were assigned either a "medium" or "high" priority status (low priority strategies are not included in the Action Plan) and each strategy was also assigned to a category (Salafsky 2004) to aid in organizing and review of strategies (Appendix C).

Strategies were not prioritized beyond this step. As a conservation guide for the state, Vermont's Action Plan is meant to provide guidance to organizations, agencies and individuals wishing to conserve wildlife. The varied goals and missions of the partners involved in the Action Plan span a broad spectrum of wildlife interests, skills and reach (some are local, others are state, regional and federal entities). No prioritization was found to satisfy all partners, however, the conservation need is deemed so great that there is room for everyone to select the species and habitats they find most important and implement the strategies they are most capable of working on. Detailed discussions with the Conservation Strategy Review team focused prioritization efforts on problems impacting SGCN and habitats (see below).

Coarse Filter-Conservation at Multiple Scales

To aid in the development of community and landscape level conservation strategies, all SGCN were assigned to at least one of more than 100 communities, cultural habitats and or landscapes. These elements were organized in four major groups: 1) forest and riparian/fluvial landscapes; 2) terrestrial natural communities and successional stage forests; 3) fish assemblages and lacustrine waters (lakes and ponds); and, 4) cultural habitats (see the tables 4-1 and 4-2 in the SGCN Conservation at multiple Scales section of Chapter 4). "Wetland, Woodland, Wildland - A guide to the natural communities of Vermont" (2000) by Thompson and Sorenson was used as the basis for terrestrial natural communities. Forest cover types (Eyre 1980) and U.S Forest Service Forest Inventory & Analysis types (USDA 2003) were used for early successional and managed forests. "A Classification of the Aquatic

Communities of Vermont" by Langdon et. al. (1998) was used as the basis for aquatic habitat designations and Reschke (1990) was adapted for cultural habitats.

These 100 categories were grouped into 24 major categories (see the tables 4-1 and 4-2 in the SGCN Conservation at multiple Scales section of Chapter 4) and the Integration Team developed assessments for each. Assessments included descriptions and general locations; current conditions; desired conditions based on the needs of SGCN associated with each category; a ranked list of significant problems impacting that category; conservation strategies to address each problem along with the identification of potential conservation partners and funding sources for each; and a listing of other relevant plans and planning processes.

The ranking of habitat problems was done according to a process described in Salafsky et. al. (2003) using four criteria: severity, scope, timing and reversibility (Table 3-5). This same process was employed by many other states developing Comprehensive Wildlife Conservation Strategies. Problems described in the habitat and community summaries (and in species summaries) are not comprehensive. Only those problems ranked as medium and high are included in this report. The decision to list only medium and high problems was a strategic one to focus attention on those problems determined or perceived to be most important. If additional problem(s) are later identified as significantly impacting a species or habitat it will be incorporated into the Action Plan database during project review and reporting. Strategies and actions to address additional problem(s) will also be eligible for SWG funding.

Table 3-5: Sample Problem and Information Need Assessment Tool

[1]Severity: The degree to which a problem impacts the viability/integrity of a habitat within the next 10 years.
[2]Scope: The extent of the habitat affected by the problem within 10 years.
[3] Timing: Time until a problem will start having an impact on a habitat
[4] Reversibility: Degree to which effects of a problem can be restored.
* Information needs & data gaps ranked hi/med/low based on the best available knowledge of tech teams.

Problem/ Information Need* Category *	Detailed description of information need or problem	Severity[1] 4=Serious damage/loss 3=Significant damage 2=Moderate damage 1=Little to no damage	Scope[3] 4=Throughout (>50%) 3= widespread (15-50%) 2=Scattered (5-15%) 1=localized(<5%)	Timing[4] 4=current (<1yr) 3=Imminent (1-3yrs) 2=near-term (3-10yrs) 1=Long-term (>10yrs)	Reversibility[4] 4=irreversible 3= reversible| w/difficulty 2=reversible w/ some difficulty 1=easily reversible	Score (Σ=severity + scope + timing + reversibility)	Ranks High=12-16 Med=6-11 Low=5

Once all problems for habitats were ranked it became possible to assess these problems by category across all habitats. A matrix of habitat types and problem categories was developed (Salfasky et. al. 2003). This matrix allowed the Integration Team and Conservation Strategy Review team to identify priority problems at the state level.

This assessment helped identify the scope problems across habitats. Broad scale problems, those impacting multiple habitat categories, were addressed by the Integration Team through state level conservation strategies.

Landscape Classification & Ecological Divisions

Where available distribution of SGCN was recorded by biophysical region (Girton & Capen 1997) and 8-digit watersheds (NRCS 2003). Implementation of the Action Plan will include the development of baseline information the distribution and abundance of SGCN, and on amount,

location, condition and status of habitat within each biophysical region. These landscape units were selected in part because they will integrate well with other conservation efforts within the state and regionally. In its guidance to states, IAFWA recommended the use of Bailey's Sections for landscape classification (Bailey 1995, Bailey 1998). Biophysical regions can be considered a sub-unit of the Bailey's section providing finer grain detail. Data can be integrated into Bailey's sections to aide in regional, national and international conservation efforts.

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Vermont's Wildlife Action Plan

November 22, 2005

Chapter 4 Conserving Vermont's Wildlife Resources

Vermont's Species of Greatest Conservation Need

Vermonters love their wildlife. And wildlife love Vermont. During the past century many wildlife species once rare or missing from the state have returned in larger numbers. The resurgence of Vermont's forests is a significant reason. From a low of 40% forest cover in the 1840s the state is now 78% forested. However, more trees are not the whole story. Restoring wildlife to the state also required the hard work and dedication of scientists, wildlife and habitat managers, sportsmen and other conservationists. Signature species such as deer, moose, beaver, fisher, osprey, peregrine falcon and loon, all missing or in perilously low numbers just decades ago are now faring well.

Keeping wildlife populations healthy offers a host of benefits: healthier ecosystems upon which we all depend, more wildlife to enjoy; and, fewer species on the brink of extirpation means fewer regulatory mandates.

Our work, however, is not complete. A significant number of wildlife species need attention to avoid new threats such as habitat loss, fragmentation and degradation; invasive exotic species; unregulated collecting and harvesting by people; and even natural events that could contribute to the decline of a species.

The State Wildlife Grants program is helping Vermonters meet these new challenges. Created by Congress in 2001 it provides federal funds for conservation to prevent fish and wildlife populations from becoming endangered. Per Congressional requirements, the Wildlife Action Plan is centered on the identification and conservation of "Species of Greatest Conservation Need" (SGCN).

Selecting SGCN

Vermont's list of Species of Greatest Conservation Need includes 144 vertebrate species (of 470 in the state) and includes game and non-game species, 192 invertebrate species (of an estimated 15,000-36,000) and 577 plant species (of an estimated 2000 vascular and non-vascular plant species).

In Vermont, six Action Plan Species Teams, with expertise in birds, fish, invertebrates, mammals, plants and reptiles & amphibians, met frequently between May and September 2004 to assess the status of Vermont's wildlife. They employed assessment criteria developed by the interdisciplinary Action Plan Integration Team to aid and normalize SGCN selection. Criteria included the degree of species rarity, species designated as at-risk, population trends, species whose habitat are vulnerable to loss, habitat fragmentation, habitat conversion or succession changes and species threatened by exotic plants or animals.

Teams used the best information available at the time from local, regional and national sources. However, while a wealth of information is available for some species; others (especially invertebrates, fish, small mammals and some reptiles and amphibians) are poorly known. Species were ranked with a conservation priority of high, medium or low. Those ranked medium and high constitute Vermont's Species of Greatest Conservation Need. Those ranked low priority are considered reasonably secure. It is expected that low priority species will benefit from

conservation efforts directed toward species ranked medium and high as well as from other ongoing wildlife management programs (e.g., federal aid to sportfish and wildlife).

Ongoing wildlife monitoring required by the State Wildlife Grants program will help track species and strategy progress toward greater security. Regularly scheduled Action Plan review and revision will provide opportunities to add additional species to the list as warranted and to remove those species deemed secure.

Details of the Species of Greatest Conservation Need selection process can be found in Chapter 3: Developing the Vermont Action Plan.

Plant SGCN

Vermont's plant SGCN list includes 577 of approximately 2,000 vascular and non-vascular plants found in the state. This list includes all species ranked S1 (critically imperiled) and S2 (imperiled) and a very few others that warrant concern. Those SGCN also on the New England Plant Conservation Program list of regionally rare plants will be ranked High Priority. All others were ranked medium priority. Plants are not eligible for SWG funds. The plant list can be found in appendix A6.

Use of and Changes to this List

The list of Species of Greatest Conservation Need will help prioritize the allocation of State Wildlife Grants funds and other conservation funds. The list will also provide a quick measure of our success conserving Vermont's wildlife. It should be noted that the SGCN list is not the same as the State or Federal Endangered Species List and should not be construed to function as one. Some of the species on the list may be relatively common including some game species. It is our goal to keep them that way.

The Species of Greatest Conservation Need list can be amended if and when important information becomes available about a species' status. For example, there are a number of current and pending inventory and assessment projects funded by State Wildlife Grants that could significantly increase our understanding of a species' status.

Big Game: White-Tailed Deer, Moose & Wild Turkey

Nearly 20 game and sportfish species are listed on the following pages as Species of Greatest Conservation Need (SGCN) due to concerns about population declines and loss of habitat. White-tailed deer, moose and wild turkey, however, were not selected as SGCN. Though absent or nearly extirpated from the state by the 1865, their populations are now sufficiently large and stable. And, relative to SGCN, our knowledge of deer, moose and turkey biology and management is great.

White-tailed deer, moose and wild turkey rank high among Vermont's greatest wildlife restoration successes. Still their management remains of utmost concern because of the great importance they have to Vermonters and because of the significant roles they play in their ecosystems. Fortunately, management plans (developed with significant public involvement), harvest regulations and monitoring protocols have long been in place for these species and dependable implementation funds come through license fees and the Federal Aid to Wildlife Restoration Act.

For more information about deer, moose and wild turkey go to http://www.vtfishandwildlife.com

Vermont's Species of Greatest Conservation Need

Birds 57 out of 268 Vermont bird species.

High Priority

Common Loon[2, 3]
Pied-billed Grebe[1, 2, 3]
American Bittern[1, 2, 3]
Least Bittern[2, 3]
American Black Duck[2, 3]
Bald Eagle[2, 3]
Northern Harrier[1, 2, 3]
Peregrine Falcon[2, 3]
Spruce Grouse[2, 3]
Upland Sandpiper[1, 2, 3]
Common Tern[1, 2]
Black Tern[1, 3]
Common Nighthawk[2, 3]
Whip-poor-will[1, 2, 3]
Purple Martin
Sedge Wren[1, 2, 3]
Bicknell's Thrush[1, 2, 3]
Golden-winged Warbler[1, 2, 3]
Canada Warbler[1, 2, 3]
Rufous-sided Towhee[2]
Vesper Sparrow[2, 3]
Grasshopper Sparrow[2]

Medium Priority

Great Blue Heron[2]
Black-crowned Night-heron[3]
Blue-winged Teal
Osprey[2, 3]
Cooper's Hawk[2, 3]
Northern Goshawk[2, 3]
Red-shouldered Hawk[2, 3]
American Kestrel
Ruffed Grouse[2]
Sora
Lesser yellowlegs
American Woodcock[2, 3]
Black-billed Cuckoo
Barn Owl
Long-eared Owl[1]
Short-eared Owl[1, 2]
Chimney Swift
Black-backed Woodpecker[3]
Olive-sided Flycatcher[3]
Gray Jay
Veery[2]
Wood Thrush[2, 3]
Brown Thrasher
Blue-winged Warbler
Chestnut-sided Warbler
Black-throated Blue Warbler
Prairie Warbler[3]
Bay-breasted Warbler[2]
Blackpoll Warbler
Cerulean Warbler[1, 2]
Field Sparrow
Henslow's Sparrow[1, 2]
Bobolink[3]
Eastern Meadowlark[2]
Rusty Blackbird[2, 3]

[1]Wildlife Species of Regional Conservation Concern in the Northeastern United States: Northeastern Endangered Species and Wildlife Diversity Technical Committee, *Northeast Wildlife*, 1999, 54:93-100
[2]New Hampshire Species of Greatest Conservation Need
[3]New York Species of Greatest Conservation Need
Cross listings with regional, New Hampshire and New York lists are shown for informational purposes only and include species listed as SGCN in NH and NY as of 5/12/05

Vermont's Species of Greatest Conservation Need

Fish 33 of 94 Vermont fish species

High Priority

Atlantic salmon-anadromous
Northern brook lamprey[1, 3 *]
American brook lamprey[1, 2, 3 *]
Lake sturgeon[1, 3]
American eel[3]
Artic Char[2]
Muskellunge
Brassy minnow
Bridle shiner[1, 2, 3]
Blackchin shiner
Blacknose shiner[2]
Quillback[3]
Silver redhorse
Greater redhorse[3]
Stonecat
Eastern sand darter[1]
Channel darter[1]
Sauger[3]

Medium Priority

Blueback herring (CT River only) [3]
Atlantic salmon-landlocked[3]
Silver lamprey[1, 3*]
Sea lamprey (CT River only) [*]
Mottled sculpin
American shad[3]
Mooneye[1, 3]
Cisco
Lake whitefish
Round whitefish[1, 2, 3]
Brook trout (naturally reproducing populations only) [3]
Lake trout (naturally reproducing populations only)
Redfin pickerel[2]
Shorthead redhorse
Redbreast sunfish

*This species of lamprey is not a parasite to freshwater fish

[1]Wildlife Species of Regional Conservation Concern in the Northeastern United States: Northeastern Endangered Species and Wildlife Diversity Technical Committee, *Northeast Wildlife*, 1999, 54:93-100
[2]New Hampshire Species of Greatest Conservation Need
[3]New York Species of Greatest Conservation Need
Cross listings with regional, New Hampshire and New York lists are shown for informational purposes only and include species listed as SGCN in NH and NY as of 5/12/05

Vermont's Species of Greatest Conservation Need

Mammals 33 of 58 Vermont mammal species

High Priority

Northern bog lemming[1, 2]
Water shrew
Long-tailed shrew
Pygmy shrew
Indiana bat[2, 3]
Small-footed bat[1, 2, 3]
Silver-haired bat[1, 2, 3]
Eastern pipistrelle[2]
Red bat[1, 2, 3]
Hoary bat[1, 3]
New England cottontail[1, 2, 3]
Rock vole
Woodland vole
Southern bog lemming
American marten[2]
Lynx[1, 2, 3]

Medium Priority

Masked shrew
Smoky shrew
Hairy-tailed mole
Little brown bat
Northern long-eared bat[2]
Big brown bat
Southern flying squirrel
Northern Flying Squirrel
Muskrat
Wolf[2, 3]
Common gray fox
Black bear[2]
Long-tailed weasel
Mink
Northern river otter
Bobcat[2]
Mountain lion

[1]Wildlife Species of Regional Conservation Concern in the Northeastern United States: Northeastern Endangered Species and Wildlife Diversity Technical Committee, *Northeast Wildlife*, 1999, 54:93-100
[2]New Hampshire Species of Greatest Conservation Need
[3]New York Species of Greatest Conservation Need
Cross listings with regional, New Hampshire and New York lists are shown for informational purposes only and include species listed as SGCN in NH and NY as of 5/12/05

Vermont's Species of Greatest Conservation Need

Reptile and Amphibians 19 of 42 Vermont species

High Priority
Jefferson Salamander[1, 2, 3]
Common Mudpuppy[3]
Fowler's Toad[2, 3]
Western (Striped) Chorus Frog[3]
Spotted Turtle[1, 2, 3]
Wood Turtle[1, 2]
Spiny Softshell (Turtle) [3]
Five-lined Skink[3]
Eastern Racer
Eastern Rat Snake
Eastern Ribbon Snake[1, 2, 3]
Timber Rattlesnake[1, 2, 3]

Medium Priority
Blue-spotted Salamander[1, 3]
Spotted Salamander
Four-toed Salamander
Common Musk Turtle
Northern Water Snake
Brown Snake
Smooth Green Snake[2, 3]

[1]Wildlife Species of Regional Conservation Concern in the Northeastern United States: Northeastern Endangered Species and Wildlife Diversity Technical Committee, *Northeast Wildlife*, 1999, 54:93-100
[2]New Hampshire Species of Greatest Conservation Need
[3]New York Species of Greatest Conservation Need
Cross listings with regional, New Hampshire and New York lists are shown for informational purposes only and include species listed as SGCN in NH and NY as of 5/12/05

Vermont's Species of Greatest Conservation Need

Invertebrates 192 of an estimated 15,000 to 36,000 Vermont invertebrate species.

Odonata (Dragonflies & Damselflies) (41)

Bog/Fen/Swamp/Marshy Pond Odonata Group+ (20)
Southern Spreadwing (Lestes disjunctus australis)
Subarctic Bluet (Coenagrion interrogatum)
Citrine Forktail (Ischnura hastata)
Comet darner (Anax longipes)
Mottled Darner (Aeshna clepsydra)
Zigzag Darner (Aeshna sitchensis)
Subarctic Darner (Aeshna subarctica)
Green-striped Darner (Aeshna verticalis)
Spatterdock Darner (Aeshna mutata)
Swamp Darner (Epiaeschna heros)
Harlequin Darner (Gomphaeschna furcillata)
Cyrano Darner (Nasiaeschna pentacantha)
Petite Emerald (Dorocordulia lepida)
Painted skimmer (Libellula semifasciata)
Ski-tailed Emerald (Somatochlora elongata)
Forcipate Emerald (Somatochlora forcipata)
Delicate Emerald (Somatochlora franklini)
Kennedy's Emerald (Somatochlora kennedyis)
Ebony Boghaunter (Williamsonia fletcheri)
Black Meadowhawk (Sympetrum danae)

Seep/Rivulet Odonata Group+ (1)
Gray petaltail (Tachopteryx thoreyi)

Lakes/Ponds Odonata Group+ (7)
New England bluet (Enallagma laterale)
Vernal Bluet (Enallagma vernale)
Slender Bluet (Enallagma traviatum)
Lilypad Forktail (Ischnura kellicotti)
Ringed Emerald (Somatochlora albicincta)
Lake Emerald (Somatochlora cingulata)
White Corporal (Libellula exusta)

River/Stream Odonata Group+ (14)
American rubspot (Hetaerina americana)
Blue-fronted dancer (Argia apicalis)
Rainbow bluet (Enallagma antennatum)
Spine-crowned clubtail (Gomphus abbreviatus)
Rapids clubtail (Gomphus quadricolor)
Skillet clubtail (Gomphus ventricosus)
Cobra clubtail (Gomphus vastus)
Brook snaketail (Ophiogomphus aspersus)
Riffle snaketail (Ophiogomphus carolus)
Maine snaketail (Ophiogomphus mainensis)
Rusty snaketail (Ophiogomphus rupinsulensis)
Stylurus amnicola (Riverine Clubtail)
Zebra Clubtail (Stylurus scudderi)
Stygian shadowdragon (Neurocordulia yamaskanensis)

\+ Note that each Odonata species was assigned to a single community type, even though there is sometimes overlap suggested by the description of habitat

Lepidoptera (Butterflies & Moths) (33)

Wetland Butterflies Group(7)
Bog copper (Lycaena epixanthe)
Jutta arctic (Oeneis jutta)
Dion skipper (Euphyes dion)
Black dash (Euphyes conspicua)
Two-spotted skipper (Euphys bimacula)
Mulberry wing (Poanes massasoit)
Broad-winged skipper (Poanes viator)

Grassland Butterflies Group (4)
Cobweb skipper (Hesperia metea)
Persius duskywing (Erynnis persius)
Regal fritillary (Speyeria idalia)
Dusted Skipper (Atrytonopsis hianna)

Hardwood Forest Butterflies Group (5)
West Virginia white (Pieris virginiensis)
Early hairstreak (Erora laeta)
Hackberry emporer (Asterocampa celtis)
Tawny emporer (Asterocampa clyton)
Edwards' hairstreak (Satyrium edwardsii)

Moths Group(17)
A Ghost Moth (Sthenopis thule)
Currant Spanworm (Itame ribearia)
Imperial Moth (Eacles imperialis pini)
New England Buckmoth (Hemileuca lucina)
Hermit Sphinx (Sphinx eremitus)
Plum Sphinx (Sphinx drupiferarum)
Clemens' Sphinx (Sphinx luscitiosa)
A Noctuid Moth (Xestia (Anomogyna) fabulosa)
A Noctuid Moth (Lasionycta taigata)
A Noctuid Moth (Lemmeria digitalis)
Franclemont's Lithophane (Lithophane franclemonti)
An Autumnal Noctuid Moth (Pachypolia atricornis)
Ostrich Fern Borer Moth (Papaipema sp. 2)
A Noctuid Moth (Properigea sp. 1 (P. costa))
A Noctuid Moth (Xestia homogena)
Pine Barrens Zanclognatha (Zanclognatha martha)
A Noctuid Moth (Zale submediana)

Mayflies/Stoneflies/Caddisflies Group (8)
A Mayfly (Ameletus browni)
A Mayfly (Ameletus tertius)
Tomah Mayfly (Siphlonisca aerodromia)
Roaring Brook Mayfly (Epeorus frisoni)
A Mayfly (Eurylophella bicoloroides)
A Mayfly (Baetisca rubescens)
A Stonefly (Alloperla voinae)
A Caddisfly (Rhyacophila brunnea)

Vermont's Species of Greatest Conservation Need

Invertebrates, continued

Tiger Beetles Group (6)

A Tiger Beetle (Cicindela ancocisconensis)
Cobblestone Tiger Beetle (Cicindela marginipennis)
A Tiger Beetle (Cicindela patruela)
Puritan Tiger Beetle (Cicindela puritana)
Beach-dune tiger beetle (Cicindela hirticollis)
Long-lip Tiger Beetle (Cicindela longilabris)

Ground Beetle Group (Carabidae) (73)

Sphaeroderus nitidicollis brevoorti
Agonum crenistriatum
Agonum darlingtoni
Agonum decorum
Agonum moerens
Agonum picicornoides
Agonum punctiforme
Agonum superioris
Scaphinotus bilobus
Pterostichus brevicornis
Pterostichus castor
Pterostichus lachrymosus
Pterostichus pinguedineus
Pterostichus punctatissimus
Nebria suturalis
Notiophilus nemoralis
Bembidion rufotinctum
Bembidion cordatum
Bembidion grapei
Bembidion muscicola
Bembidion mutatum
Bembidion quadratulum
Bembidion robusticolle
Bembidion rolandi
Bembidion affine
Acupalpus alternans
Acupalpus rectangulus
Diplocheila impressicollis
Diplocheila striatopunctata
Diplocheila assimilis
Pseudamara arenaria
Dyschirius brevispinus
Dyschirius erythrocerus
Dyschirius politus
Elaphropus dolosus
Elaphropus levipes
Elaphrus fuliginosus
Geopinus incrassatus
Harpalus fulvilabris
Harpalus indigens
Harpalus providens
Lophoglossus scrutator
Miscodera arctica
Notiobia sayi
Notiophilus aquaticus
Notiophilus borealis
Notiophilus novemstriatus
Olisthopus micans
Parastachys oblitus
Parastachys rhodeanus
Patrobus foveocollis
Pentagonica picticornis
Pericompsus ephippiatus
Platynus cincticollis
Platynus parmaginatus
Platypatrobus lacustris
Schizogenius ferrugineus
Sericoda obsoleta
Sericoda quadripuncata
Tetragonoderus fasciatus
Trichocellus cognatus
Atranus pubescens
Amara laevipennis
Amara erratica
Anchomenus picticornis
Apristus latens
Blethisa quadricollis
Blethisa julii
Blethisa multipuncata
Carabus goryi
Carabus maeander
Dicaelus dilatus
Dicaelus teter

Mollusca (27)

Freshwater Mussels Group (13)

Eastern pearlshell (Margaritifera margaritifera)
Dwarf wedgemussel (Alasmidonta heterodon)
Elktoe (Alasmidonta marginata)
Brook floater (Alasmidonta varicosa)
Pocketbook (Lampsilis ovata)
Fluted-shell (Lasmigona costata)
Creek heelsplitter (Lasmigona compressa)
Pink heelsplitter (Potamilus alatus)
Fragile papershell (Leptodea fragilis)
Black sandshell (Ligumia recta)
Giant floater (Pyganodon grandis)
Cylindrical papershell (Anodontoides ferussacianus)
Alewife floater (Anodonta implicata)

Snails Group (14)

Fingered valvata (Valvata lewisi)
Mossy valvata (Valvata sincera)
Squat duskysnail (Amnicola (Lyogyrus) grana)
Canadian duskysnail (Amnicola (Lyogyrus) walkeri)
Buffalo pebblesnail (Gillia altilis)
Pupa duskysnail (Lyogyrus (Amnicola) pupoidea)
Boreal marstonia (Marstonia (Pyrgulopsis) decepta)
Liver elimia (Goniobasis livescens)
Sharp hornsnail (Pleurocera acuta)
Spindle lymnaea (Acella haldemani)
Mammoth lymnaea (Bulimnea megastoma)
Country fossaria (Fossaria rustica)
Disco gyro (Gyraulus circumstriatus)
Star gyro (Gyraulus crista)

Crustaceans Group (3)

An Amphipod (Diporeia hoyi)
Taconic Cave Amphipod (Stygobromus borealis)
Appalachian brook crayfish (Camburus bartonii)

Ant Group (1)

A Slave-making Ant Leptothorax sp. 1 (L. pillagens

Problems Impacting Species of Greatest Conservation Need

Element number three of the eight congressionally required elements of a Wildlife Action Plan requires that states: describe the problems that may adversely affect Species of Greatest Conservation Need or their habitats and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats. For the purposes of this report "problem" is defined as follows:

> **Problem:** A force causing a negative impact at the species, population, habitat and landscape levels (e.g., habitat conversion, pollution, illegal pet trade). A problem can also be the lack of information or a data gap vital to the successful management of a species.

For each Species of Greatest Conservation Need in the Action Plan we identified priority problems. Priority research needed to evaluate other potential problems was also identified. Problems are detailed in short narrative descriptions in each species summary (Appendix A) in each habitat/community summary (Appendix B).

Each of the problems identified in the Action Plan was assigned to one of 22 categories roughly grouped into habitat-related factors and non-habitat-related factors. These categories make it possible to search our database for similar factors impacting other species. It also makes it easier to organize and create summaries for broad scale conservation planning. The problem categories were developed by the U.S. Forest Service during the current Forest Plan Revision for the Green Mountain National Forest.

The 22 categories are not mutually exclusive and problems can often logically be placed into more than one category depending on the particular stress it causes for a species or habitat. For example, a road can fragment the habitat of grassland nesting birds, cars traveling the road can squash amphibians crossing the road to mate in an adjacent stream, and salt spread on the road to prevent icing can wash into that stream impacting its population of brown trout. In this example the problems stemming from the road would be recorded in the "Habitat Fragmentation," "Impacts of Roads & Trails," and "Pollution" categories.

Problems are often species and/or habitat specific. What may negatively impact one species may benefit another. For example, if a cold water stream with a healthy brook trout population was dammed it might no longer support brook trout. That impact of the dam would be described as the "conversion of habitat" category. However, the reservoir created by the dam might make it more suitable for a warm water fish species.

Clearly life is too complex to be stuffed into any one box. Therefore it is important to read the full description of a factor affecting a species or habitat in the appropriate species or habitat summary. Definitions for these factors can be found in Appendix C.

Problem Categories

See Appendix C for definitions of each category. See Appendix A-SGCN summaries and Appendix B-habitat/community/landscape summaries for context.

Habitat-Related Problem Categories

- Climate Change
- Habitat Alteration/Degradation
- Habitat Conversion
- Habitat Fragmentation
- Hydrologic Alteration
- Impacts of Roads and Trails
- Inadequate Distribution of Successional Stages
- Inadequate Disturbance Regime
- Invasion by Exotic Species
- Sedimentation

Non-Habitat-Related Problem Categories

- Competition
- Disease
- Genetics
- Harvest or Collection
- Incompatible Recreation
- Loss of Prey Base
- Loss of Relationship with Other Species
- Parasitism
- Pollution
- Predation or Herbivory
- Reproductive Traits,
- Trampling & Direct Impacts

SGCN Conservation Strategy Development

Element number four of the eight congressionally required elements of a Wildlife Action Plan requires that states describe "conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions."

We identified strategies to address the problems impacting each of Species of Greatest Conservation Need (SGCN) and habitats in the Action Plan. Strategies identified in the Action Plan are based on the best science available today as well as our strategic assessment of needs and priorities of all wildlife species. In the coming years, as monitoring data on SGCN and conservation actions becomes available, as priorities change, or new problems or opportunities arise, strategies may need to be revisited. Not every strategy in this report will be eligible for State Wildlife Grant funding. Furthermore, it may not be suitable, or feasible, for the Vermont Fish & Wildlife Department to implement some of the strategies in this report, however, some conservation partners may find them fitting and practical.

Strategies are described in the Action Plan in short narratives in each species summary and in each habitat, community and landscape summary. Strategies are intentionally broad, directional, and nonspecific so as not to constrain our selection of actions for implementing them. For example, a strategy such as "provide technical assistance to landowners to maintain or improve riparian habitat for Species of Greatest Conservation Need" allows for different approaches to providing that assistance and leaves the door open to a variety of providers to implement. Where strategy implementation is to be funded by the State Wildlife Grant program the approach should be consistent with the Department's mission and strategic plan, and precise procedures will be detailed in operational plans once the Action Plan is finalized.

Vermont's Action Plan was designed to be a strategy for the state, not just the Fish & Wildlife Department. While the department may be responsible for implementing many of the strategies in this report, it will be conservation partners, however, that may be the more logical and appropriate leaders for others, due to their skills and expertise, staffing, history, location, available resources and constituencies.

Each of the strategies identified in the Action Plan were assigned to one of 27 categories in six major classes. The categories were developed by the Conservation Measures Partnership (Salafsky 2005) as a means to standardize terminology (not practices) among conservation practitioners worldwide. Many states have used these same categories to organize the strategies and actions in their Action Plan.

It should be noted that the categories are used solely for the purpose of organizing and grouping strategies developed by Action Plan teams and committees. It was not our goal to create strategies for every category. A few categories were not applicable to the species or habitats in Vermont whereas others were deemed not as effective. Definitions for each strategy can be found in Appendix C.

Conserving Vermont's Birds

Birds Team

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Team Charge

The Bird was charged with identifying Species of Greatest Conservation Need (SGCN); describing the distribution and habitat usage for each SGCN; evaluating problems impacting SGCN and their habitat; identifying priority research needs to improve our ability to conserve these species; and, developing conservation strategies to address priority problems. Details of Species Team and other Action Plan team and committee charges can be found in Appendix D of this document.

Introduction

The Vermont Fish and Wildlife Department convened the Action Plan Bird Team in May 2004. The 9-member team was composed of biologists from the VFWD, USFWS, UVM Co-op Unit, and 5 non-profit conservation organizations. The team met a total of 8 times over the ensuing 12 months. The Department is very grateful for the many days of work team members contributed to attend meetings, research and prepare spreadsheets and reports, and consult with one another between meetings.

Selecting Bird SGCN

In contrast to lesser-known taxa, the bird team benefited from the relative wealth of available data on bird distribution and abundance. Data from Vermont's original and current Breeding Bird Atlases and the USFWS Breeding Bird Surveys helped immensely in selecting our 57 SGCN. In addition to these actual data sources, ongoing bird conservation programs, including the Vermont Endangered Species Scientific Advisory Group on Birds SAG-B), Partners-In-Flight, North American Bird Conservation Initiative, National Audubon Society's Watch List, and the American Bird Conservancy's Green List all contributed to our understanding of which species belonged on Vermont's SGCN list.

Selection criteria included knowledge about current listing as endangered or threatened, population declines, rarity, vulnerability of habitat, life history traits, impacts from humans, and recent range expansion or contraction. Each species was examined across all criteria and the team developed a high, medium, and low conservation need ranking to attempt to separate species with greater need from those that may be more secure, at least in the short term.

Bird species rare in Vermont did not always make the SGCN listing. Species that have expanded their range in recent decades due to a proliferation of winter bird feeders, such as Tufted titmouse, were excluded, as we did not consider Vermont to be a geographic area of responsibility for that species. Other species for which Vermont is on the extreme periphery of their breeding range, and for which confirmed breeding records are very infrequent, such as the three-toed woodpecker, were also not selected. These 'filtering' methods are consistent with the work of Vermont's SAG-B (see Chapter 3: Developing Vermont's Action Plan, for details on selection criteria and process).

Full reports on each Species of Greatest Conservation Need are in Appendix A of this document. The following is a summary of those reports.

Birds and Their Habitat Needs

Vermont's bird SGCN utilize a variety of habitats from open and shrub-dominated wetlands, mature hardwood or coniferous forests, young regenerating forests, old fields, grasslands, and other cultural habitats such as buildings and structures. As birds are generally more mobile relative to most species from other taxa, they are usually better able to exploit smaller, more widely distributed habitat patches. However, most species benefit from the larger assemblages of similar habitat types, such as a contiguous forest area or large, agricultural (grassland) complex.

The Bird Team organized most birds into one of several habitat guilds, for which a particular conservation strategy would often be appropriate for all species in the guild. These guilds match the major habitat categories used in this report (see the section titled SGCN Conservation at Multiple Scales later in this chapter):

Northern hardwood forest & Oak-pine-northern hardwood forest
Spruce-fir northern hardwood forest
Sub-alpine krummholz & Montane spruce-fir forests (high elevation areas)
Early successional forest stages
Riparian
Lacustrine (lakes and ponds)
Wetlands-(open, shrub and forested wetlands)
Cliff & Talus
Grassland
Grassland/Edge
Urban

Discussion of Problems Impacting Bird SGCN

The problems identified most frequently as problems for Vermont's bird populations are all related to changes in habitat: conversion of habitat (49 SGCN), habitat alteration (31), habitat fragmentation (27), and distribution of successional stages (27). Many bird species find optimum habitat in young regenerating forests, which have declined statewide in recent decades. Similarly, grassland-dependent species, which are declining throughout the northeast, are finding less and less suitable habitat in Vermont as farms are managed more intensively, or sold and either developed or reverted to forestland. Increased roads, housing

units, free-roaming pets, and other attendant disturbances further fragments habitat to the detriment of most species. See appendix A for full reports on each SGCN.

Research & Monitoring Needs and Conservation Strategies

The research and monitoring needs and conservation strategies most frequently identified by the Bird Team and those best applied for multiple bird SGCN are as follows:

Research & Monitoring Needs

1. Better determine habitat requirements and habitat availability.
2. Better determine the distribution and relative abundance of populations in Vermont.
3. Better identify and evaluate problems.
4. Obtain better knowledge of basic life history traits.

Conservation Strategies

1) Habitat Restoration via efforts on public lands and conservation payments or other financial incentives, fee simple purchase, easements, management guidelines, and cooperative agreements with user groups and private landowners. Existing technical assistance/cost-share programs (WHIP, LIP, CRP) were frequently identified as potential funding sources to implement conservation on private lands. Important Bird Area designations can aid in the development of needed funds. Common habitat restoration themes include incentives and planning to slow the rate of fragmentation and development and maintain blocks of contiguous forest, grasslands, early and late-successional habitats.

2) Species Restoration projects, which may involve active translocation of individuals or eggs from a source population into suitable Vermont habitats, and/or may involve efforts to provide suitable nesting sites and reduce predation or human disturbances around nesting sites.

3) Raising awareness within the general public to build support and opportunities for conservation techniques. Important Bird Area designations can help focus public attention on opportunity areas.

4) Developing and evaluating forestry practices that can enhance habitat suitability such as maintain or increasing aspen stands or the retention of coarse woody debris and snags. Provide technical assistance to landowners and communities about best management practices.

5) Initiate an international effort to maintain large blocks of undeveloped forests linked together by habitat corridors in order to provide a network of interconnected habitats throughout northeastern New England and southeastern Canada.

6) Identify, prioritize and maintain existing contiguous forest blocks and associated linkages that allow for upward and northward movement in response to climate change.

7) Participate in existing regulatory processes (e.g., Act 250) to protect and restore critical habitats.

See Appendix A for full reports on each bird Species of Greatest Conservation Need.

Conserving Vermont's Fishes

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Team Charge

The Fish Team was charged with identifying Species of Greatest Conservation Need (SGCN); describing the distribution and habitat usage for each SGCN; evaluating problems impacting SGCN and their habitat; identifying priority research needs to improve our ability to conserve these species; and, developing conservation strategies to address priority problems. Details of the Species Teams and other Action Plan team and committee charges can be found in Appendix D of this document.

Introduction

Vermont with its estimated 7,100 miles of rivers and streams and 809 lakes and ponds supports populations of 92 fish species (Langdon et al. in press). Eighty of these are recognized as being native to the state. A native species is one that was present in the state prior to early European colonization. The remaining 12 species are non-indigenous to Vermont. These fishes were either purposely introduced, legally and illegally, to waters of the state, such as for sport fish enhancement (e.g., brown and rainbow trout), or gained access inadvertently to the state via interstate waterways, such as canals (e.g., gizzard shad). Lake Champlain has the most diverse fish community of any Vermont water with about 71 species documented to exist there.

Vermonters are probably aware of the existence of about one third of the fish species occurring in the state. Our familiarity with most of these fishes is rooted in sport fishing; that is, their recognized value as game fish and to a lesser degree their use as bait fish. As for the remaining two-thirds of Vermont species, many exist here largely out-of-sight of the general public and others are viewed more or less with ambivalence. Nonetheless, the diversity of Vermont's ichthyofauna contributes significantly to the functional ecological complexity of our aquatic systems. Many species are excellent indicators of the health of our environment, such as their sensitivity to toxic chemicals (e.g., mercury and PCBs) and habitat change. Additionally, sport fisheries, utilized and valued by the public, are dependent directly and indirectly on healthy communities and ecosystems.

Native fishes face many conservation challenges. The threats of habitat alteration, loss and fragmentation are pervasive in Vermont's rapidly changing landscape. The introduction of non-indigenous fishes, including associated aquatic pathogens and parasites, also pose risks to aquatic ecosystem health and native species conservation. Just within the past 20 years, seven non-native fishes have shown up in state and interstate waters. Whirling disease, caused by the parasite *Myxobolus cerebralis*, first appeared in native brook trout inhabiting Vermont sections of the

Batten Kill as recently as 2002. Two viral diseases have also recently appeared in Vermont waters. Largemouth bass virus was first detected in Lake Champlain in 2002 and a year later in Lake St. Catherine; and esocid lymphosarcoma infecting Lake Champlain northern pike in 2002 (http://www.vtfishandwildlife.com/fisheries_health.cfm). Unregulated or illegal transportation of fishes from out-of-state sources and between in-state waters is likely cause for the increasing incidences of disease-causing organisms appearing in Vermont fish populations.

Fish SGCN Selection

Selection criteria included 27 categories reflecting our knowledge about current listing as endangered and threatened; species rarity; population declines; vulnerability of habitats; life history traits; vulnerability to collection, harvest or other taking; other impacts from humans; and dispersal capability. Only native species were considered. Each species was examined across all criteria by the eight-person team. Based on this evaluation process the team assigned a high, medium and low rank to attempt to separate species with greater conservation needs from those with more secure status, at least in the short term. See chapter 3 of this report, "Developing Vermont's Action Plan," for details on selection criteria and process. This approach resulted in 33 species making either the rank of high conservation need or medium conservation need.

High Conservation Need: Northern brook lamprey, American brook lamprey, lake sturgeon, American eel, brassy minnow, bridle shiner, blackchin shiner, blacknose shiner, quillback, silver redhorse, greater redhorse, stonecat, muskellunge, anadromous Atlantic salmon, arctic char, eastern sand darter, channel darter, and sauger.

Medium Conservation Need: Silver lamprey, sea lamprey (Connecticut River basin population only), mooneye, blueback herring (Connecticut River basin population only), American shad, shorthead redhorse, redfin pickerel, cisco or lake herring, lake whitefish, round whitefish, landlocked Atlantic salmon, brook trout (naturally reproducing populations only), lake trout (naturally reproducing populations only), mottled sculpin, and redbreast sunfish.

Species of Greatest Conservation Need status for two species, sea lamprey and blueback herring, are limited to specific populations within the state, i.e. populations residing in the Connecticut River basin. Similarly, lake trout and brook trout are defined with limitations. One species, the arctic char, is believed to be extirpated. (It should be noted that Connecticut River sea lamprey are not parasitic in freshwater, and that neither northern or American brook lamprey species are parasitic).

Although a disproportionate number of Vermont's SGCN are at the periphery of their range, this should not diminish the importance of these species to the state's biodiversity or in terms of their ecological significance. To illustrate this, of the 80 native Vermont fish species, nearly half of these are here on the eastern edge of each of the species' natural North American range.

Full reports on each Species of Greatest Conservation Need are in Appendix A of this document. The following is a summary of those reports.

Habitat Needs

Vermont's fish species use a variety of habitats: small ponds, large lakes, rivers, streams, and wetlands. Some habitats are used year round and others are occupied seasonally, such as while spawning. Within water bodies, SGCN have specific habitat needs for example, riffles or pools in streams or deep, cold areas of lakes. Loss or degradation of any one critical habitat component can threaten the survival of the species in that particular water.

While most of our fishes are completely freshwater dependent, others spend portions of their lives in both freshwater and marine environments. Four SGCN (American eel, blueback herring, American shad and sea-run Atlantic salmon) are dependent on both. Herring, shad and salmon have anadromous life cycles, that is spawning and at least a portion of the juvenile life occurs in freshwater; to attain maturity the fish must go to sea for a period of years. In contrast, eel are catadromous. Maturity is attained in freshwater and reproduction occurs in the ocean. Consequently, whether anadromous or catadromous, these species are not only are faced with problems at the Vermont landscape level but also those at the regional and international scopes. To conserve our native fishes, and in particular SGCN, it is essential that we protect, enhance and restore habitat degradation and loss not only within Vermont but also, where appropriate, beyond our borders.

Discussion Problems Impacting Fish SGCN

Factors affecting the security of SGCN are classified as either habitat or non-habitat problems. The most frequently identified habitat related problems impacting aquatic systems are habitat alteration, habitat fragmentation, habitat conversion, invasive non-indigenous species, and climate change. Habitat alteration includes activities, which diminish the quality and/or quantity of habitat features critical to the survival and maintenance of fish populations and other biota on which SGCN are dependent, including stream flows and lake water levels, water temperature regimes, and habitat diversity. Sedimentation is a form of habitat alteration by which the composition of the stream or lake bottoms are altered by greater than normal deposition of fine materials (e.g., silt, sand, organic matter) changing the composition and suitability of substrates to the detriment of their spawning, cover and food production values. Habitat conversion results in the total or near complete loss of function as a result of extreme habitat alteration. Examples of habitat conversion are loss of active flood plains, wetland draining and on-stream impoundments. Habitat fragmentation occurs when artificial structures, such as dams, impassable bridge structures, and dewatered stream channels, interfere with the movements of fish preventing their access to critical spawning areas or seasonal refugia. Habitat fragmentation also interferes with the natural dispersal of fish and genetic flow within and between populations. Climate change threatens several SGCN at the regional scale by altering (warming) their required thermal regimes. Invasive species, such as nonnative aquatic plants and zebra mussels, can impact aquatic habitats in a variety of ways. Exotic plants represent a "double edged sword" with respect to the conservation of certain fish species requiring abundant aquatic vegetation. Invasive plant species, such as Eurasian milfoil, may displace native plant communities on which fish are dependent for refugia, food production, and spawning. And, on the other hand, invasive vegetation control programs may eliminate these functions before native plants are restored to desired levels.

While virtually all fishes identified as SGCN are impacted by one or more problems to their habitats, non-habitat related problems are generally more variable from species to species. In

some cases, non-habitat problems are a consequence of impacts on habitat. Those affecting SGCN include competition from other species, predation, loss of prey base, water pollution, disease and parasites, and over-harvest. The sea lamprey problem in Lake Champlain poses a challenging dilemma. Sea lamprey has been identified as a known or potential parasite/predator on several SGCN. On the other hand, other SGCN may be threatened by certain control methods needed to control sea lamprey abundance and parasitism rates in the lake. Further research and monitoring is required to ensure that successful control measures minimize harm to SGCN.

Research & Monitoring Needs and Conservation Strategies

The Fish Team identified priority research and monitoring projects and needs to improve our ability to conserve Vermont's fish SGCN. The Team also developed conservation strategies to address problems impacting each SGCN. Those cited most frequently and those most effectively applied for multiple fish SGCN include:

Research & Monitoring Needs

1. Better determine the distribution and relative abundance of populations in Vermont.
2. Acquire better information on species' life histories, biology and habitat requirements.
3. Monitor and assess populations and habitats for current condition and future changes.
4. Identify and monitor problems for species and their habitats.
5. Establish a centralized fish database within the Agency of Natural Resources to manage fish and other aquatic data, track permits and management projects that impact aquatic species.

Conservation Strategies

1. Protect and restore aquatic and riparian habitats through improved water quality; flow, water level and temperature regimes; sediment reduction; establishment of streamside buffers (see ANR buffer policy); and suitable aquatic habitat structure, diversity and complexity.
2. Maintain and restore aquatic organism passage and habitat connectivity at barriers (e.g., dams, culverts) to provide access to critical habitats and maintain ecological connectivity.
3. Assess, monitor and manage as appropriate potential negative and beneficial effects of the Lake Champlain sea lamprey control program on SGCN and other non-target fishes.
4. Participate in existing regulatory processes (e.g., Act 250, stream alteration permits) to protect and restore critical habitats.
5. Implement measures and programs to prevent the introduction and expansion of non-indigenous species to Vermont waters; develop and execute appropriate invasive species control programs.
6. Support and cooperate with inter-agency programs for the restoration of anadromous and catadromous fishes to the Connecticut River basin.
7. Support efforts to curb global warming and its negative impacts on SGCN.

8. Support state and regional efforts to require reduction in emissions from coal burning power plants and other sources of acid precipitation.

See Appendix A for full reports on each fish Species of Greatest Conservation Need.

References

(ANR) VT Agency of Natural Resources. 1/20/2005. Riparian Buffer Guidance, and Riparian Buffers and Corridors Technical Papers www.anr.state.vt.us/dec/dec.htm

Langdon, R.W., M.T. Ferguson, and K.M. Cox. *In press*. Fishes of Vermont. Vermont Department of Fish and Wildlife, Waterbury, Vermont.

Conserving Vermont's Invertebrates

Invertebrate Team

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Team Charge

The Invertebrate Team was charged with identifying Species of Greatest Conservation Need (SGCN); describing the distribution and habitat usage for each SGCN; evaluating problems impacting SGCN and their habitat; identifying priority research needs to improve our ability to conserve these species; and, developing conservation strategies to address priority problems. Details of Species Team and other Action Plan team and committee charges can be found in Appendix D of this document.

Introduction

The role of invertebrates in our world is fairly unrecognized by humans. But once we get beyond the buzz of mosquitoes and our annoyance with blackflies, our reliance upon these tiny animals slowly unfolds. Within cool forest streams, stonefly and mayfly nymphs consume leaves that fall from forest trees and provide a food source for brook trout and other fishes. In the gardener's corner, bees, flies, wasps, and butterflies pollinate the flowers that will later yield the anticipated fruits and vegetables. Spiders wait to ambush flies in our homes. Dragonflies patrol the stream shores for their insect prey. Beetles, flies, and other invertebrates consume the wastes produced by the human world, leaving fertile soil in exchange. Mostly unnoticed and even avoided these smallest of creatures serve an amazing array of functions that we depend upon in our everyday life. The diversity of species we are so fortunate to have is, itself, something to marvel.

Of the thousands of species that occur in Vermont, several are rare or threatened enough to be at risk of disappearing from the state in the future. The causes that lead to their predicament vary among species. One of the greatest obstacles in taking action to help conserve these "at risk" invertebrates is the scarcity of information that exists on their distribution, abundance, habitat requirements, life history characteristics, population trends, and threats. It is necessary to assess the status and needs of each species to adequately conserve populations and track the success of these actions. Obtaining baseline information is, therefore, included as a component of actions to be taken for invertebrate SGCN (Appendix A).

Selecting Invertebrate SGCN

The task of assessing the conservation needs of Vermont's invertebrates is daunting. The number of species that occur within the state is not known; however, estimates for insects alone have ranged 15,000 to 20,000 different species. In addition, many of our invertebrates have not yet been scientifically described. Life history, distribution, and abundance

information is available for a small minority of Vermont's invertebrates that would be considered as conservation targets, such as freshwater mussels and some tiger beetles. Thus the Invertebrate Team had to determine how best to assess conservation needs with limited information to draw upon. State and regional experts, as well as entomological hobbyists, have compiled a valuable knowledge base for selected groups of invertebrates over the last century. Although distributional information is often limited, an understanding of the natural history of many of these species enabled the team to move forward. It was the team's decision that identification of SGCN would focus on species and species groups for which adequate information was available. The following invertebrate groups were reviewed while compiling the SGCN list:

- Dragonflies and Damselflies (Odonata)
- Butterflies and Moths (Lepidoptera)
- Mayflies (Ephemeroptera)
- Stoneflies (Plecoptera)
- Tiger Beetles (Carabidae, in part)
- Caddisflies (Tricoptera, in part)
- Freshwater Mussels and Freshwater Snails (Mollusca, in part)
- Invertebrates currently considered to be rare within Vermont

SGCN selection criteria included knowledge about: current listing as endangered and threatened; population declines; rarity; vulnerability of habitat; life history traits; vulnerability to collection or take; population limitations; regional status; historic occurrence; disjunct populations; habitat specialization; impacts by exotics; and dispersal capability. A review using these criteria resulted in a SGCN list of 192 species. It is the Invertebrate Team's expectation that, as available information on invertebrates increases, future iterations of the Action Plan will include a review of more taxa to be considered in the SGCN list.

Full reports on Invertebrate Species of Greatest Conservation Need are in Appendix A of this document. The following is a summary of those reports.

Habitat Needs

As invertebrates are the most diverse of Vermont's animals, the breadth of habitats they occupy is great. From deep lakes and slow rivers to the alpine peaks of our highest mountains, from the leaf litter of lowland floodplain forests to treetops in upland beech stands, there are invertebrates utilizing an amazing array of niches in every corner of Vermont. Many of these species have fairly general habitat requirements, or live in natural communities that are common and secure within the state. A number of these are so abundant that they are treated as forest and agricultural pests. Such species do not normally require special conservation attention.

In contrast, habitat specialization is also a common strategy among invertebrates. Examples of habitats that host specialized invertebrates include fens, black spruce bogs, river cobble shores, large rivers, or alpine meadow. Herbivorous invertebrates will often feed on only a small number of plant hosts, exhibiting another form of specialization. While such specialization is often advantageous when the required habitat or plant host is plentiful, it

creates a risk to these invertebrates when the habitat or host is rare, widely scattered, or also at risk. In such cases, conservation attention is sometimes needed to ensure that these specialized invertebrates remain a part of Vermont's fauna.

Certain habitats or areas of Vermont support highly diverse wildlife assemblages, including SGCN invertebrates. A good example is Lake Champlain and its lower tributaries, where many of our dragonfly and freshwater mussel SGCN are located. These species rich areas provide us the opportunity to help conserve many SGCN simultaneously.

Discussion of Problems Impacting Invertebrate SGCN

The greatest problems faced by SGCN invertebrates in Vermont relate to the loss, degradation, and fragmentation of their habitats. Poorly planned construction is ever-increasing on the landscape, often whittling away the wetland and upland habitats available to these creatures when these areas are not protected. As small habitat units disappear from the landscape, the remaining ones become more distant from one another; this presents an obstacle to those invertebrates that are limited to short-distance movement. Surface runoff from developed and agricultural lands can carry pollutant and sediment loads that find their way to rivers and streams, particularly during heavy rain events. The buildup of sediments on river bottoms embeds the natural substrate and can smother the invertebrates that reside there. Other pollutants entering streams and rivers can be detrimental to sensitive aquatic species.

Exotic species are having a negative impact on several invertebrate SGCN, and will likely present increased challenges to conservation in the future as new foreign species invade our lands and waters. Freshwater snails and mussels have been eliminated from several large areas of Lake Champlain due to zebra mussel invasion. A small exotic fly originally introduced to control gypsy moths has instead preyed upon many native woodland moth species, including some of our giant silk moths. This may prompt the need for future inclusion as SGCN such species as the lunar moth, polyphemus moth, and cecropia silkmoth.

Some of the challenges faced by SGCN invertebrates stem from their dwindling numbers and their natural life history characteristics. Low natural recruitment of offspring into the adult populations can hinder population recovery when numbers are low, such as with freshwater mussels. Other factors shared by several invertebrate SGCN groups that limit or impact populations include trampling/direct impacts, limited localized populations, and the requirement of specialized habitats.

Research & Monitoring Needs and Conservation Strategies

The Invertebrate Team identified priority research and monitoring projects to improve our ability to conserve Vermont's invertebrate SGCN. The Team also developed conservation strategies to address problems impacting each SGCN. Those used most frequently and those best applied to multiple invertebrate SGCN include:

Research & Monitoring Needs

1. Define particular habitat requirements of SGCN within Vermont, utilizing current knowledge of researchers and field investigations.

2. Determine important life history characteristics when such information is lacking for particular SCGN.
3. Obtain baseline SGCN distributional and abundance data by conducting surveys throughout the state.
4. Conduct inventories to detect and gather information on new SGCN populations.
5. Assess potential and existing impacts of problems on SGCN populations and their habitats.
6. Monitor trends in SGCN population size and structure, and in habitat.
7. Monitor current and potential threats to SCGN species.

Conservation Strategies

1. Conserve high priority SGCN sites through acquisition, easements, technical assistance, and other cooperative means.
2. Protect and restore aquatic habitats on which SGCN are dependent through pollution abatement, riparian buffers (ANR 2005), flow regulation, easements, and other means.
3. Work with foresters to avoid impacts to SGCN populations and habitats during forest management activities.
4. Work with biologists to minimize impacts to SGCN invertebrate populations and habitats during and following management activities for sport fish and game wildlife.
5. Participate in existing regulatory processes (e.g., Act 250, stream alteration permits) to protect and restore critical habitats.

Conclusion

The work to conserve our invertebrate SGCN has already begun. A Butterfly Atlas project was begun in 2002 to assess the distribution and abundance of butterfly species throughout Vermont. Coordinated by the Vermont Institute of Natural Science and funded by SWG, this initiative trains and utilizes volunteers to gather the data. The Vermont Fish & Wildlife Department has been active for many years investigating the distribution and population trends of several rare, threatened, and endangered invertebrates, including the cobblestone tiger beetle, brook floater, elktoe, and dwarf wedgemussel. Cooperation among several state and federal agencies, UVM, and The Nature Conservancy resulted in the Lake Champlain Native Mussel Working Group, which is dedicated to conserving native mussel populations within the Champlain Basin in both Vermont and New York. This group has been active in monitoring populations in Champlain tributaries and addressing threats to populations, such as the zebra mussel. All these efforts provide a good base from which Action Plan can help us launch new initiatives directed at invertebrate conservation.

See Appendix A for full reports on Invertebrate Groups of Greatest Conservation Need.

References

(ANR) VT Agency of Natural Resources. 1/20/2005. Riparian Buffer Guidance, and Riparian Buffers and Corridors Technical Papers www.anr.state.vt.us/dec/dec.htm

Conserving Vermont's Mammals

Mammal Team Members

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Team Charge

The Mammal Team was charged with identifying mammals of greatest conservation need (SGCN), describing the distribution and habitat usage for each SGCN; evaluating problems impacting SGCN and their habitat; identifying priority research needs to improve our ability to conserve these species; and, developing conservation strategies to address priority problems. Details of Species Team and other Action Plan team and committee charges can be found in Appendix D of this document.

Introduction

Sixty-one mammal species presently exist in Vermont or were here just prior to European settlement. Several of these species are now believed to be extirpated (elk, wolverine, wolf, mountain lion, caribou).

Although many of Vermont's mammals are extremely adaptable and resilient (raccoon, red fox, skunk), others are sensitive to habitat loss and fragmentation (Indiana bat, bobcat, rock shrew), global warming (lynx, marten), competition (New England cottontail), and pollution (otter, mink, bats).

Some of the mammals listed as Species of Greatest Conservation Need (SGCN) presently appear to be secure but could be at risk in the next 20-30 years due to loss of critical habitats or population declines due to other environmental threats (black bear, otter, mink, little brown myotis, big brown bat). A number of species are facing immediate threats (New England cottontail, Indiana bat, marten, and lynx) and without attention could exist only as memories on the Vermont landscape. Others are listed primarily because little is known about the status and/or distribution of their populations in Vermont (hoary bat, shrews, gray fox, etc.). The Mammal Team interpreted the criteria for listing fairly broadly in hopes of preventing the decline of species that are presently secure. Funding sources for conservation may vary from federal aid to outside grants to the State Wildlife Grants program (reserved for species at greatest risk).

Selecting Mammal Species of Greatest Conservation Need

Of the sixty-one mammal species native to Vermont, the Mammal Team opted to list 23 as species of greatest conservation need and designate 3 (deer, moose, beaver) as species with ecological and/or social significance/influence.

The designation process included the completion of a matrix that identified distribution, population status, ranking, threats, and habitat/natural community requirements. Based on the results of the matrix, the Team prioritized the 61 species into high, medium, and low categories. Those species that were the most vulnerable (faced with immediate threats to survival or showing a significant population decline) were ranked as high. In addition, species that were extirpated locally but still existed regionally were included on the high list. Sixteen species were designated as having high conservation priority:

Eastern pipestrelle, hoary bat*, Indiana bat, long-tailed shrew, lynx*, marten, New England cottontail*, northern bog lemming*, pygmy shrew, red bat*, rock vole*, silver-haired bat*, small-footed bat*, southern bog lemming, water shrew*, and woodland vole.

**Listed as species of regional conservation need by the Northeast Endangered Species and Wildlife Diversity Technical Committee, 1999.*

Seventeen additional species were ranked as medium. The Team was influenced by the legislative intent of "keeping common species common" so some of the species in the medium category were those that might be well-distributed and even locally abundant at the present time, but that Team members felt were at risk in the next 20-30 years due to the increasing potential for mortality or habitat loss/fragmentation. Mammals may have been included in the medium category either because little was known about their population status, distribution, and/or trends in Vermont or they have been considered extirpated in the region. Medium conservation priority species include:

Big brown bat, black bear, bobcat, gray fox, hairy-tailed mole, little brown bat, long-tailed weasel, masked shrew, mink, muskrat, northern flying squirrel, northern long-eared bat, river otter, smokey shrew, southern flying squirrel, mountain lion, and wolf.

Three species (beaver, moose, and white-tailed deer) were relegated to a special category due to the fact that they have significant ecological and/or social influence. Beaver are a keystone species that provides habitat for many other wildlife species. Loss of beaver and beaver-created wetlands in the 1600s through the 1700s probably resulted in the decline of otter, moose, a variety of invertebrates, brook trout, and associated songbirds. The reintroduction and subsequent trap and transfer program funded by hunters and trappers and implemented by the Fish & Wildlife Department in the 1920s through the 1950s, resulted in the re-establishment of beaver in Vermont. Since then, otter populations have recovered and moose, once extirpated, now exist through the State. Maintaining beaver-created wetlands has become more challenging as human activities expand into and around wetland habitats thus increasing the potential for beaver-human conflicts.

Deer and moose are species valued by many Vermonters. They can also have a significant ecological effect on the landscape. Populations of deer and moose that exceed carrying capacity

have a huge impact on regenerating forests and the herbaceous understory and can pose serious public safety threats. Presently, all three species are carefully managed and regulated by the Vermont Fish & Wildlife Department. By listing these species in a special category, the Team did not necessarily intend for State Wildlife Grant funds be directed towards them, but to simply highlight the importance of these species to the people and systems of Vermont.

Full reports on each Species of Greatest Conservation Need are in Appendix A of this document. The following is a summary of those reports.

Habitat Needs

The habitat needs of the mammals listed as SGCN, varies widely by species. In general, however, maintaining healthy populations of Vermont's native mammals requires the conservation of critical habitats and the connective corridors that provide linkages between food, cover, and refugia habitats. In some cases, it also means conserving large blocks of contiguous forestland with corridors (including riparian buffers) to provide a network of large interconnected habitat blocks suitable for wide-ranging species such as lynx, bobcat, and black bear. Several researchers have recommended the establishment of an international effort to identify and protect biotic corridors for both the protection of biological diversity, as well as, to facilitate the movements of a variety of mammal and bird species across state and federal boundaries (Wydevan, 1998). This would require a cooperative effort between various local, state, and international governments as well as non-governmental organizations.

Discussion of Problems

The problems identified most frequently as threats to SGCN mammals were: Conversion of Habitat (24), Habitat Alteration (19), Pollution (16), and Loss of Prey Base (14). See Appendix A for full reports on each SGCN.

We do not understand all the ramifications, but the pattern seen elsewhere in the US and the world is that increased human population density, higher consumption of land and other resources, and lack of awareness of the impacts to other species can lead to devastating losses of native biota (TWS 2004). Vermont is not immune from these sorts of impacts and our landscape is continuing to be developed (DeVillars 1999). For example, Vermont lost an average of 6,500 acres of wildlife habitat is lost per year to development (Austin, pers.com). Habitat alteration and loss is a near universal challenge to many native mammal SGCN.

Pollution was also identified as a potential threat to species like mink and otter. Because they are at the top of the food chain, industrial pollutants, and heavy metals (PCBs, mercury, DDT) can build up in their bodies (Novak, 1987). Although the ramifications are not clear, it is likely that the biomagnification of these toxins negatively affects reproduction and survival. Bats are also extremely susceptible to pesticides and other environmental poisons because they store some lipophilic pesticides in brown adipose fat tissue. These stores are released as bats use their fat reserves during hibernation. Bats can, therefore, be exposed to both chronic and acute

poisoning, which can result in death. In addition, broad spectrum insecticides can deplete insect diversity and limit the food sources available for bats (loss of prey base).

Other threats that may influence the future of SGCN are global climate change, habitat fragmentation, competition, disease, impacts of roads and trails, invasion by exotic species, and trampling or direct impacts. Perhaps the biggest challenge for some species like bats, wolf, and mountain lion is the public's understanding of the conservation of these species. According to the North American Bat Conservation Partnership Strategic Plan, "Throughout North America, sensational and inaccurate presentation of public health issues involving bats has created an exaggerated fear of these ecologically important species. The resulting unwarranted public perception presents an especially serious threat to bat survival. Although general public awareness of the values of bats has increased over the past two decades, ignorance remains an important impediment to bat conservation. Medical professionals, government agencies, private industry, and educators often lack materials necessary to educate the public about how to safely share their communities with bats" (http://www.batcon.org/nabcp/newsite/index.html).

Work done in other states on wolf recovery and management highlight the same issues. The number one strategy in the Michigan gray wolf recovery and management plan states "Public support is vital for the long-term survival of wolves in Michigan. Information and education efforts designed to exchange information with Michigan residents are essential and need to receive a high priority." (Cool, 1997) It is clear that for some species recovery efforts must begin with a public outreach and education effort. To attempt recovery efforts without the support of the public is likely dooming them to failure.

Research and Monitoring Needs and Conservation Strategies

The Mammal Team developed research, monitoring, and conservation strategies for each individual SGCN species. Below is a compilation of the strategies that arose most frequently:

Research and Monitoring

1. Determine the distribution and relative abundance of populations in Vermont.
2. Determine critical habitat needs and connectivity requirements.
3. Identify and evaluate problems.
4. Determine life history requirements.

Conservation Strategies

1. Develop outreach and education programs that promote the conservation of SGCN and the habitats that they depend on, and increase awareness of the importance of maintaining or restoring these species.
2. Identify the habitat requirements of SGCN and develop strategies for conservation and protection through fee simple purchase, easements, management guidelines, and cooperative agreements with user groups and landowners, etc. (i.e. bat hibernaculums and maternity roost trees, bobcat denning sites, reverting field habitat for New England cottontail, bear-scarred beech stands, connective corridors, etc.).

3. Initiate an international effort to maintain large blocks of undeveloped forests linked together by habitat corridors in order to provide a network of interconnected habitats throughout northeastern New England and southeastern Canada.
4. Maintain riparian buffers along streams (see ANR 2005).
5. Maintain and restore habitat connectivity and minimize fragmentation of forest blocks. Identify and prioritize wildlife road crossing locations. Work with the Agency of Transportation and adjacent landowners to reduce wildlife mortality and increase the potential for movement from one side of the road to the other.
6. Work to eliminate pollution that causes acid rain, the deposition of heavy metals, and global climate change.
7. Continue to work cooperatively with landowners, towns, and communities to protect critical habitats and maintain connectivity. Provide *Conserving Vermont's Natural Heritage* to municipal and regional planners (Austin et.al. 2004)
8. Participate in existing regulatory processes (e.g., Act 250, stream alteration permits) to protect and restore critical habitats.

Vermont is at a crossroad. Due primarily to conscious choices made by her citizens in the last 100 years (restoration of deer, beaver, turkey, fisher populations, enactment of Act 250 legislation and wetland regulations, etc.), as well as, economic forces that essentially allowed the state to bypass the Industrial Revolution (Bryan, pers com), Vermont has remained predominantly rural throughout the 20th century. Many mammal species, therefore, are at population levels that are likely higher than they were prior to European settlement (fisher, red fox, white-tailed deer, raccoon, bobcat). Today, however, with Vermont's population growing, development pressures increasing and increased roads and traffic the potential for significant habitat destruction in the next ten years is high. In addition, global climate change is already influencing the potential residency of some native mammal populations in Vermont (Royar, pers com). The decisions made by Vermonters today will chart the course for the future and influence the long-term viability of our native wildlife populations.

See Appendix A for full reports on each mammal Species of Greatest Conservation Need.

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Conserving Vermont's Reptiles & Amphibians

Reptile & Amphibian Team

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Team Charge

The Reptile and Amphibian Team was charged with identifying Species of Greatest Conservation Need (SGCN); describing the distribution and habitat usage for each SGCN; evaluating problems impacting SGCN and their habitat; identifying priority research needs to improve our ability to conserve these species; and, developing conservation strategies to address priority problems. Details of Species Team and other Action Plan team and committee charges can be found in Appendix D of this document.

Introduction

For much of the year Vermont's 40 species of amphibians and reptiles, collectively known as herps or herptiles (from the Greek *Herpeton*), are secretive creatures shunning the fuss made over our more charismatic mega-fauna. But stand beside a Vermont wetland, pond or vernal pool on an early spring evening and the cacophony of calls from wood frogs, spring peepers, chorus frogs, and others and these enigmatic micro-fauna will make themselves noticed.

Vermont's reptiles and amphibians certainly deserve notice. As if their penchant for feasting on black flies, mosquitoes, garden slugs, rodents and other pests isn't reason enough to conserve them (some frogs are reported to eat as many as 3,000 insects a year), many also play critical roles in ecosystems, and serve as excellent indicators of the health of natural systems due to their sensitivity to toxic chemicals and habitat change.

Amphibians and reptiles face many conservation challenges in today's world, be it crossing high-traffic roads or the loss of habitat and connections between habitat patches. It could be argued that all 21 amphibians and 19 reptiles known to be extant in Vermont deserve Species of Greatest Conservation Need (SGCN) designation. The Action Plan Reptile and Amphibian Team took a conservative approach to selecting SGCN in order to highlight those species thought to be most in need of conservation assistance so that scarce resources can be directed toward their conservation.

Selecting Amphibian & Reptile SGCN

Selection criteria included knowledge about current listing as endangered and threatened, population declines, rarity, vulnerability of habitat, life history traits, vulnerability to collection or take, other impacts from humans, and dispersal capability. Each species was examined across all criteria and the four-person team developed a high, medium, and low conservation need ranking to attempt to separate species with greater need from those that may be more secure, at least in the short term (see Chapter 3: "Developing Vermont's Action Plan," for details on selection criteria and process). We created a numerical ranking

that assisted our assignment to high, medium, and low priority categories. This approach resulted in 12 species of high conservation need and seven of medium conservation need: **High Conservation Need:** common mudpuppy, Jefferson salamander (and hybrids), Fowler's toad, western chorus frog-E, eastern racer-T, eastern ratsnake-T, eastern ribbonsnake, timber rattlesnake-E, five-lined skink-E, spiny softshell turtle-T, spotted turtle-E and wood turtle (see Appendix I for definitions of the codes used here).

Medium Conservation Need: DeKay's brownsnake, smooth greensnake, northern watersnake, common musk turtle, four-toed salamander, blue-spotted salamander, spotted salamander.

Though some of Vermont's SGCN are at the periphery of their range (e.g., western chorus frog, common mudpuppy, fowlers toad, and mink frog], a finding that challenges conventional wisdom is that species populations have been documented to be more at risk of loss at the core of their range than at the periphery (Channel & Lomolino 2000, Lomolino 1995). This argues for us giving serious consideration to SGCN that may be peripheral in Vermont.

Full reports on each Species of Greatest Conservation Need are in Appendix A of this document. The following is a summary of those reports.

Habitat Needs

Since many reptiles and amphibians use a variety of habitats annually and over the course of their lives, maintaining healthy populations entails maintaining connectivity between habitats. Connectivity also enables individuals to find alternative cover, food sources, breeding, or over-wintering sites when natural disasters occur. Furthermore, connectivity between populations ensures vital genetic exchange and allows for the re-colonization of areas where populations have been eliminated due to drought, winterkill, disease, or anthropogenic forces. This can only occur if the landscape is permeable to these animals–that is, development proceeds in a way that allows amphibians and reptiles to move freely across the landscape. To conserve our native amphibians and reptiles, especially those considered SGCN, it will be essential to maintain a network of interconnected sites where natural processes are allowed to occur.

Discussion of Problems

The problems identified most frequently as problems Vermont's reptile and amphibian populations are all closely related: trampling and direct impacts (all 19 SGCN), the impact of roads and trails (13), habitat fragmentation (17), habitat alteration (17), and habitat conversion (14). See appendix D for full reports on each SGCN.

We do not understand all the ramifications, but the pattern seen elsewhere in the US and the world is that increased human population density, higher consumption of land and other resources, and lack of awareness of the impacts to other species can lead to devastating losses of native biota (TWS 2004). Vermont is not immune from these sorts of impacts and our landscape is continuing to be developed (DeVillars 1999). Habitat alteration and loss is a near universal challenge to native amphibians and reptiles.

Crossing roads is a real problem for both amphibians and reptiles in Vermont. Vernal migrations of salamanders and frogs to breeding pools result in many dead and wounded animals when a busy road must be crossed. At some sites in Vermont, thousands of amphibians are killed during a single night, which may overwhelm the reproductive capacity to sustain the populations and, according to the Vermont Agency of Transportation, constitutes a public safety issue (C. Slesar, VTrans, pers comm). Female turtles seeking nest sites are more at risk of being killed on roads than more sedentary males, resulting in a sex bias in some populations and raises questions about population persistence (Sheen & Gibbs. 2004, Marchand & Litvaitis 2004). The still abundant, but believed to be declining, wood turtle often encounters roads in Vermont during its annual movements along riparian corridors. Snakes emerging from hibernation often bask on warm pavement, increasing their risk of being struck by vehicles.

Other factors that may negatively impact amphibians and reptiles now and in the foreseeable future include pollution, changes in hydrology, sedimentation, and global changes such as temperature and ozone depletion as well as disease and collection. A variety of frog malformations were documented in Vermont in recent years, and parasitic trematodes (flatworms), as well as agricultural chemicals, were implicated as causative agents (DEC 2004). And, while our long winter buffers us from some diseases and exotic invasions, such risks do exist. Botulism killed many mudpuppies in the Great Lakes only a few years ago. Red leg disease, which is caused by the parasite *Aeromonas hydrophilia*, has been documented in Vermont. Finally, some species, particularly turtles, may have too narrow a reproduction margin for exploitation as food or as pets.

Research & Monitoring Needs and Conservation Strategies

The Reptile and Amphibian Team identified priority research and monitoring projects to improve our ability to conserve Vermont's reptile and amphibian Species of Greatest Conservation Need. The Team also developed conservation strategies to address problems impacting each SGCN. Those used most frequently include:

Research & Monitoring Needs

1. Better determine habitat needs, identify significant breeding sites, vernal pools and habitat connections.
2. Better determine the distribution and relative abundance of populations in Vermont.
3. Better identify and evaluate problems.
4. Monitor trends in population size, distribution and habitat.

Conservation Strategies

1. Help people better value reptiles and amphibians and to understand the essential needs of all life stages, especially upland habitat in proximity to breeding pools.
2. Encourage reports of road-killed specimens, road crossings, and road basking areas to VFWD, VTrans, and the Vermont Reptile and Amphibian Atlas Project. Develop safer crossings at significant sites when roads are being upgraded.

3. Maintain habitat through appropriate management, direct habitat disturbance and site roadways away from sensitive sites such as breeding pools.
4. Continue to work cooperatively with landowners, habitat management agencies, towns and communities to protect habitat and maintain connectivity. Develop management guidelines for owners and managers of appropriate habitat.
5. Conserve known critical habitat through fee simple purchase, development rights or easements, management agreements and education of private landowners and managers.
6. If loss of important sites is likely due to development, consider creating or enhancing other pools that might allow some adults to transfer to the new site if they encounter it or develop a new breeding population from dispersal of colonizers.
7. Protect turtle nests and adults by predator trapping.
8. Work with biologists to minimize impacts to SGCN populations and habitats during and following management activities for sport fish and game wildlife.
9. Participate in existing regulatory processes (e.g., Act 250, stream alteration permits) to protect and restore critical habitats.

Vermont's Reptiles and amphibians are fortunate for a number of reasons. We have a much less developed landscape than many states. For example, even the eastern newt, a very abundant species in Vermont, is declining in Rhode Island due to development and roads (C.J. Raithel RI Dept of Environmental Management pers comm). We have an engaged Scientific Advisory Group on Reptiles and Amphibians that provides advice to the Vermont Endangered Species Committee. We also have a well developed Reptile and Amphibian Atlas Project (http://cat.middlebury.edu/herpatlas/) that mostly though volunteer efforts has collected, and continues to collect valuable information on the distribution of reptile and amphibian species in Vermont and raises awareness of conservation need in Vermont. Some groups in Vermont sponsor 'salamander nights' helping small amphibians cross roads safely and raise awareness about the impacts of traffic. The Vermont Fish and Wildlife Department continues to work on conservation projects that benefit reptiles and amphibians, including species listed here as SGCN, and we are working with other agencies including the Vermont Transportation Agency. More needs to be done, but with the foundation we already have in place, and the awareness and strengthening of partnerships promoted by Action Plan, we expect more conservation actions in our shared future.

See Appendix A for full reports on each reptile and amphibian Species of Greatest Conservation Need.

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SGCN Conservation at Multiple Scales

Vermont's list of Species of Greatest Conservation Need (SGCN) comprises 144 vertebrate species (including chestnut sided-warbler, lake sturgeon, and spotted salamanders) as well as 192 invertebrate species (including tawny emperor butterflies, cobblestone tiger beetles, and giant floater mussels). Developing individual conservation plans for each SGCN would have been exhausting and impractical. Moreover, attempts to implement the more than 300 plans would be impossible due to insufficient resources and the high overall cost, resulting from the inefficiency of implementing many uncoordinated plans (not to mention problems reminiscent of the Keystone Cops stemming from the hundreds of biologists in the field bumping into each other).

Fortunately an easier, cheaper, and more efficient approach to addressing the needs of our Species of Greatest Conservation Need exists. That method consists of designing and implementing conservation efforts at multiple scales. For example, wildlife managers have been creating edge habitat for decades (Smith 1980) where, for example, an early successional stage of forest borders later successional forest. They do this because research shows that this improves conditions for deer, rabbit, turkey, ruffed grouse and several other species. In this example management actions were targeted at the habitat level.

Similarly, research in the 1960's and 1970's indicated that pesticides such as DDT so weakened the eggs of loon, osprey, peregrine falcons and many other birds of prey that eggs were collapsing under the weight of expectant parents. Not only did this add to nationwide population crashes, it also impeded restoration efforts because the pesticides remained in the birds for years. Action taken at the state and federal level—the regulation of pesticides—eventually helped these species and loon, osprey, peregrine falcon were finally removed from the Vermont's endangered species list in April of 2005.

Following this approach, we began at the species level by assessing SGCN individually. Then SGCN were organized by taxonomic group and by habitat usage with habitats grouped by vegetation type. This resulted in conservation strategies at five levels (table 4-1). Some species will always require specific conservation attention, such as those that are very rare, those that are declining across their range, those that aggregate for breeding, and those that require large home ranges. Their needs are addressed at the Species Level. Other species' needs can be met by the long-term conservation of high quality habitats and communities used by these species (the Community Level). Still other species will require conservation at the scale of wildlife travel corridors and large forest blocks (the Landscape Level).

Table 4-1 Organization of Conservation Information in this Report

Level	Organization	Location in this document
1) Species	144 individual species summaries & 16 invertebrates group summaries	Appendix A
2) Taxon	5 group summaries (bird, fish, invertebrate, mammal and reptile & amphibian)	Chapter 4
3) Community & Cultural Habitat Groups	120 communities & cultural habitats grouped into 18 summaries	Appendix B
4) Landscapes	6 landscape summaries (4 forest, riparian & fluvial)	Chapter 4
5) State & Region	State-level conservation strategies and action themes	Chapter 1

Selection of Classification Systems

Though great strides have been made in developing vegetation classification systems that function at the site, landscape, region and national scales (Barnes 1979, Allen and Starr 1982, Forman and Godron 1986, Cleland et. al 1997, Grossman et. al 1998) they are incomplete. In particular, no system satisfactorily integrates aquatic and terrestrial communities and cultural habitats[1] used by wildlife. The efforts of every

[1] Cultural habitats are communities and sites that are either created and/or maintained by human activities or are modified by human influence to such a degree that the physical condition is substantially different from what existed prior to human influence (adapted from Reschke 1990)

state, however, in development of their Action Plan greatly improve our prospects and plans are underway for coordination and information sharing once states' Action Plan reports are approved (IAFWA 2005).

In lieu of a unified habitat classification system, Vermont's Action Plan technical teams utilized the best features of five peer-reviewed vegetation classification systems that can be crosswalked with those used in other states to support broader scale conservation efforts—regionally, nationally, and internationally. Forest Cover Types (Eyre 1980) and U.S Forest Service Forest Inventory & Analysis Types (USDA 2003) were used for early successional stage forests. Natural Communities (Thompson and Sorenson 2000) were the basis most terrestrial vegetation. "A Classification of the Aquatic Communities of Vermont" by Langdon et. al. (1998) was adapted for aquatic community designations and cultural habitats[1] were adapted from Reschke (1990). Landscape scale communities were adapted from Poiani et.al. (2000).

One hundred 120 aquatic and natural community types, cultural habitats and land cover types, capturing most of the habitat required by SGCN were selected from the five systems (table 4-2). Each was assigned to one of 22 categories. Because Lake Champlain and the Connecticut River harbor most of the fish diversity in Vermont, these two waterbodies were broken out from the taxonomy to provide for a more targeted assessment. Technical teams then developed assessment summaries for each that includes descriptions and general locations; current conditions; desired conditions based on the needs of associated SGCN; priority problems; conservation strategies to address problems (along with the identification of potential conservation partners and funding sources); and a listing of relevant plans and planning processes pertinent to a habitat type. (Appendix B)

In addition, three landscapes were selected (forest, riparian, and fluvial/stream) to address connectivity needs of many SGCN as well as the needs of wide-ranging SGCN. Assessment summaries were also completed for each landscape (see this chapter).

Successional Stages, Species of Greatest Conservation Need & the Action Plan

Plant succession produces cumulative change in the types of plant species occupying a given area through time. It is complicated by factors such as disturbance (large and small), local conditions, seed banks and soil legacies (Oliver 1981). A highly simplified timeline begins when land is cleared. Pioneer species typically return first followed by other species generally better adapted to the new and changing conditions created by the previous suite of species. Given sufficient time and appropriate conditions the area moves roughly through early, middle, and late successional stages—often referred to as mature or old growth. A disturbance, if sufficiently large, can re-set the clock anytime and succession begins again. The best known examples are forest succession but it occurs in virtually all vegetated areas. For example, lichen communities on granite mountaintops experience successional changes (Wessels 2002).

Succession can significantly impact habitat for Species of Greatest Conservation Need and other wildlife as in the edge habitat example noted earlier. Generally as succession moves from early to late stages some wildlife will lose out (e.g., spruce grouse, woodcock, cottontail rabbit) and others will benefit (e.g., marten, northern goshawk). Others still prefer a mix of successional stages in appropriate configurations (e.g., black bear, lynx).

Over the past two centuries the mix of successional stages available to Vermont's wildlife has changed dramatically in both distribution and abundance. Though precise estimates (current and historic) are unavailable, prior to 1800 a significant percentage of Vermont's forests were in late-successional stages (>150-300 years and older). One-hundred years later early-successional stages (1-15 years) dominated the state and today mid-successional forests (60-100 years) are most abundant. Wildlife populations have responded in turn. Vermont's SGCN list contains relatively few species requiring mid-successional forests and more that thrive in early and late-successional representations.

Because the loss of late-successional forests in the eastern US occurred prior to the advent of modern wildlife biology and the current scarcity of later-successional stages (particularly northern hardwood forest types) our understanding how wildlife utilized these stages is not as advanced as our knowledge of wildlife in early successional stages. Historic records and research in late-successional areas elsewhere indicate that the distribution and abundance of some wildlife species was much greater when late-successional forests were in greater abundance—even if these species can survive without them. Given the lack of this condition on the landscape it is advisable to increase its availability to wildlife.

The habitat, community and landscape summaries that follow here and in Appendix B address habitat the needs of Species of Greatest Conservation Need that use that vegetation type in one or more successional stages. Conservation strategies address the particular successional stage needs well those species that prefer a mosaic of successional stages.

Table 4-2: Landscape, Community, Habitat & Cover Type Categories

***** Categories marked with an asterisk "*" are considered major categories for the purposes of organizing this report (24 in all). Conservation summaries were developed addressing characteristics and location, current and desired condition, SGCN using this habitat category, priority problems impacting this category, conservation strategies to address the problems and a list of other plans and planning entities with significant interest in this area.

Landscapes (adapted from Poiani et.al. 2000)

*****Landscape Forests
- Large blocks of contiguous forest
- Statewide and regional wildlife corridors and linkages
- *Spruce-Fir Northern Hardwoods
- *Northern Hardwood Forests
- *Oak-Pine-Northern Hardwoods

(These three Northern Hardwood natural communities comprise the bulk of Vermont's landscape forests)

*****Landscape Level Aquatic & Shorelines (includes riparian areas)

*****Fluvial (Riverine) (adapted from Langdon et.al. 1998)
- Brook trout
- Brook trout-slimy sculpin
- Blacknose dace-slimy sculpin
- Blacknose dace-bluntnose minnow
- Blacknose dace creek chub
- Tessellated darter-fallfish
- Blacknose dace-slimy sculpin
- White sucker-tessellated darter

Aquatic Communities (adapted from Langdon et.al. 1998)

*****Lower Connecticut River (Atlantic salmon-American shad community)

*****Lower Lake Champlain Tributaries (Redhorse-lake sturgeon community)

*****Lacustrine (lakes and ponds)
- Dystrophic lakes
- Meso-eutrophic lakes
- Oligotrophic lakes
- High elevation acidic lakes

*****Lake Champlain

Cultural Habitats (adapted from Reschle 1990)

*****Building & structures

*Mine & gravel pits

*****Grassland & hedgerows
- Grasslands
- Hedgerow
- Old field/shrub
- Orchard

Successional Stages & Forest Cover Types (Eyre 1980, US Dept of Agriculture 2003)

Stages: Seedling/Sapling Sapling/Pole Timber, Pole Timber

Cover types
- Boreal Conifers
  - Balsam fir
  - Black spruce
  - White spruce
- Boreal Hardwoods
  - Aspen
  - Pin cherry
  - Paper birch
- Spruce-Fir
  - Red spruce
  - Red spruce-balsam fir
  - Paper birch-red spruce-balsam fir
- Pine and Hemlock
  - Eastern white pine

Habitat descriptions in the Individual Species Summaries (A1-A5) note specific stage & cover type needs for SGCN

Landscape Forest Summaries (next section) incorporate stage and cover type

Table 4-2 continued: Terrestrial Natural Communities (Thompson & Sorenson 2000)

Open or Shrub Wetlands

*Open Peatlands
- Alpine peatland
- Dwarf shrub bog
- Black spruce woodland bog
- Pitch pine woodland bog
- Poor fen
- Rich fen
- Intermediate fen

*Marshes & Sedge Meadows
- Deep bulrush marsh
- Deep broadleaf marsh
- Shallow emergent marsh
- Sedge meadow
- Cattail marsh
- Wild rice marsh

*Wet Shores
- Calcareous riverside seep
- River cobble shore
- Lakeshore grassland
- Riverside sand or gravel shore
- Outwash plain pondshore
- River mud shore
- Rivershore grassland

*Shrub Swamps
- Buttonbush basin swamp
- Alder swamp
- Alluvial shrub swamp
- Sweet gale shoreline swamp
- Buttonbush swamp

Forested Wetlands

*Floodplain Forests
- Silver maple-ostrich fern riverine floodplain forest
- Lakeside floodplain forest
- Silver maple-sensitive fern riverine floodplain forest
- Sugar maple-ostrich fern riverine floodplain forest

*Hardwood Swamps
- Red maple-black ash swamp
- Red maple-northern white cedar swamp
- Calcareous red maple-tamarack swamp
- Red or silver maple-green ash swamp
- Red maple-black gum swamp
- Red maple-white pine-huckleberry swamp

*Softwood Swamps
- Northern white cedar swamp
- Spruce-fir-tamarack swamp
- Black spruce swamp
- Hemlock swamp

*Seeps & Vernal Pools
- Vernal pool
- Seep

Open Upland Communities

*Upland shores
- Riverside outcrop
- Lake sand beach
- Lake shale or cobble beach
- Erosional river bluff
- Sand dune

*Outcrops & Upland Meadows
- Alpine meadow
- Boreal outcrop
- Serpentine outcrop
- Temperate acidic outcrop
- Temperate calcareous outcrop

*Cliffs & Talus
- Boreal acidic cliff
- Boreal calcareous cliff
- Temperate acidic cliff
- Temperate calcareous cliff
- Open talus

Upland Forests & Woodlands

*Spruce-Fir Northern Hardwood Forest (included with landscape forest summary)
- Subalpine krummholz
- Montane spruce-fir forest
- Lowland spruce-fir forest
- Montane yellow birch-red spruce forest
- Boreal talus woodland
- Cold-air talus woodland
- Red spruce-northern hardwood forest

*Northern Hardwood Forest (included with landscape forest summary)
- Northern hardwood forest
- Rich northern hardwood forest
- White pine-northern hardwood forest
- Mesic red oak-northern hardwood forest
- Hemlock forest
- Hemlock-northern hardwood forest
- Northern hardwood talus woodland

*Oak-Pine-Northern Hardwood Forest (included with landscape forest summary)
- Limestone bluff cedar-pine forest
- Mesic maple-ash-hickory-oak forest
- Valley clayplain forest
- White pine-red oak-black oak forest
- Dry oak forest
- Pine-oak-heath sandplain forest
- Dry oak-hickory-hophornbeam forest
- Red cedar woodland
- Red pine forest or woodland
- Pitch pine-oak-heath rocky summit
- Dry oak woodland
- Transition hardwood talus woodland

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Landscape Forest Summary

Vermont's three primary landscape scale forests – Northern Hardwood, Spruce-Fir-Northern Hardwood, and Oak-Pine-Northern Hardwood – form the foundation of the state's forested habitat that supports many of Vermont's SGCN. These landscapes function at two different levels. First, in sum, these three forests, if maintained in large, interconnected forest blocks, meet the large scale habitat needs of Vermont's widest ranging wildlife species that move throughout the landscape. Secondly, each of the three large forests hosts numerous SGCN that may require one or more of the natural community types associated with that respective large forest. In general, habitat requirements, problems, and conservation strategies should be assessed and developed at both levels. However, in many cases, the landscape scale forest provides most of the habitat needs for many of the SGCN associated with one of the habitats or natural community types.

Characteristics and Location

Landscape Level Forest provides both the area and habitat needed by Vermont's wide-ranging wildlife species. These species use the full mosaic of diverse habitats associated with Vermont's upland forestland frequently crossing habitat boundaries. The conservation and management of Vermont's landscape level forests for wide-ranging wildlife also provides the essential habitat for all SGCN that depend on the natural communities associated with those habitats.

Habitats associated with the landscape level forest

Northern Hardwood Forest: The Northern Hardwood Forest is best developed at Vermont's middle elevations and is widespread in the state. Beech, sugar maple, and yellow birch are the prominent tree species, but hemlock, red oak, red maple, white ash, basswood, and white pine can be common as well, with some scattered red spruce. These are the dominant communities in nearly all biophysical regions, excepting for the highest elevations of the Green Mountains and the lowest elevations in the Champlain Valley.

Spruce-Fir-Northern Hardwood Forest: The Spruce-Fir-Northern Hardwood Forest is found in the coldest regions of the state. Red spruce and balsam fir are the most abundant trees at higher elevations and in low, cold, moist areas. Other conifers include white spruce, black spruce, northern white cedar, and tamarack. Warmer and better drained sites have significant amounts of hardwood, including yellow birch, sugar maple, and beech with paper birch at mid-elevations. Conifer and mixed forests of this habitat blanket Vermont's highest peaks above 2,500 feet.

Oak-Pine-Northern Hardwood Forest: The Oak-Northern Hardwood Forest is best developed in the warmer regions of Vermont—the Southern Vermont Piedmont, Champlain Valley, and the lower elevations in the Taconic Mountains. These forest communities generally occur as large patches or locally as small patches within Northern Hardwood Forests and on dry, south-facing slopes and ridgetops. In the Oak-Northern Hardwood Forest, hardwoods such as sugar maple, beech and yellow birch are common,

but warmer climate species such as red oak, shagbark hickory, and white oak can be present in significant numbers. White pine is a prominent part of this Forest.

Landscape Forest Condition

Historical Perspective: It has been estimated that 95% of Vermont was forested when Europeans first arrived in the early 1600s. The population of Native Americans in the Champlain Valley and Connecticut River valley in the early 1600s was only 8,000 and only a small amount of forestland was cleared for agriculture, primarily in the river valleys (Klyza and Trombulak 1999). Significant forest clearing began with the arrival of European settlers, however, primarily for lumber, fuelwood, potash, and agriculture. It has been roughly estimated that the percent of forest cover in Vermont was reduced to 82% by 1790, 47% by 1850, and reached a low of 37% by 1880, after which the area of forest began to increase as farms were abandoned (various sources in Klyza and Trombulak 1999). According to Harper (1918), by 1850 more than 60% of the land in New England had been cleared for agriculture.

The effect on Vermont's forests was not limited to clearing. Forests in the region that were not cleared were typically on steep slopes, stony ground, or poorly drained soils. Many of these were heavily harvested for timber and many were used as woodland pastures, with the result that virtually all of our forests have been altered by human activity (Whitney 1994). In general, our forests today are much younger than the presettlement forests. The composition of presettlement forests was also different from our present-day forests, as has been described in several studies of early land survey records that documented witness and boundary line trees (Siccama 1971, Cogbill 1998, Cogbill 2000, Cogbill et al. 2002). These studies indicate that beech was much more abundant in presettlement forests, whereas sugar maple and white pine were less abundant. Red spruce was more abundant in mid-elevation presettlement forests, whereas red maple, white birch, and poplars – species now associated with younger forests and human activity – were much less abundant in the presettlement forests (Cogbill 2000).

Prior to European settlement in the northeastern United States, natural disturbance (including wind, fire, and flooding) were the primary forces affecting the region's forests. In Vermont, wind has been the primary source of natural disturbance in upland forests, ranging from frequent local blowdowns of individual trees to infrequent hurricane events that can affect thousands of acres. A recent study, based on the review of many sources of information, provides figures on the expected percentage of the presettlement regional landscape occupied by different age classes (Lorimer and White 2003). For northern hardwood forest, the expected percentage occupied by uneven aged forest over 150 years ranges from 70 to 89 percent, depending on the assumptions and models used. In these forests, from 1.1 to 3.0 percent was occupied by early successional forests (1-15 year age class). For spruce-northern hardwood forest, the expected percentage occupied by uneven aged forest over 150 years ranges from 35 to 78 percent, depending on the assumptions and models used. In these forests, from 2.4 to 7.1 percent was occupied by early successional forests (1-15 year age class).

Current Condition: Vermont's landscape level forest for wide-ranging wildlife species is influenced by two, diverging trends in the state's forestland. First, Vermont is experiencing

increasing acreage of forest in the state. As of 1997, Vermont was estimated to be 78% forested; however, this varies greatly by biophysical region, ranging from 94% forested in the Southern Green Mountains to 40% in the Champlain Valley (Frieswyk and Widmann 2000). Second, however, Vermont's blocks of contiguous forestland have become broken into smaller and smaller units as forests are converted to other land uses, primarily new housing and commercial development and new and/or upgraded roads. Again, the availability of large blocks of contiguous forestland varies by biophysical region with the Northeast Highlands and Green Mountains having the most contiguous forest and the Champlain Valley and Vermont Valley comprised of the smaller, fragmented forests.

The landscape level forest also varies greatly in the proportion of the forest in various successional stages. In general, early successional forest is available on 10% of the state's forestland, ranging from 2.7% in the Taconic Mountains to over 19% in the Northern Vermont Piedmont (Frieswyk and Widmann 2000). The current availability of late successional stage habitat is nearly non-existent in the state, although trends lean toward an increasing availability of this habitat, particularly in the Southern Green Mountains.

In general, the highest forest elevations are more vulnerable to immediate impacts of both climate change and pollution. These areas also contain the more fragile soils. The lower elevation forests are more vulnerable to permanent conversion and to fragmentation of forest blocks.

Desired Condition (SGCN Needs): The habitat needs of wide ranging wildlife species is best met by maintaining large blocks of contiguous forest connected by linkages. Species such as black bear, marten, river otter, lynx, wolf, and others cross forest boundaries. Successful conservation and management of these wide ranging species therefore requires a landscape level approach, compounding the complexity of development and implementation of successful strategies**.** Management for early successional forest may enhance an area for some wide-ranging wildlife (e.g., black bear, lynx), while others may require that a large portion of their home range be managed for late successional forest stages (e.g., pine marten). Management schemes should therefore be designed at the landscape level in order to maintain blocks of intact, minimally roaded, forest while encouraging early successional harvests in areas that are already fragmented (Dan Harrison, pers. com. 2004). Paved roads, housing development, and other permanent conversions of forest are cumulatively detrimental to most wide-ranging wildlife.

Potential habitat for wide-ranging SGCN can be defined through the overlay of the marten habitat map (Carroll 2004), lynx habitat map (Carroll 2004), black bear habitat (Vermont Fish and Wildlife Department 1989), unfragmented forest block map (Feree 2004), contiguous forest block map (UVM spatial analysis lab 2005), and the maps describing potential wolf habitat (Harrison and Chapin 1998).

Several wide-ranging wildlife species will not persist or become re-established without linkages to other states and Canada. Therefore, regional connectivity (i.e., linkages to New York, New Hampshire, and Canada) must be maintained and statewide connectivity within Vermont be restored through the re-establishment of forest and linkages in the more fragmented biophysical regions. Linkages along riparian habitats will also provide connectivity for both semi-aquatic and upland species.

The total amount of forested area needed by wide-ranging SGCN varies greatly based on the home range requirements of a species, habitat quality, and the number of individuals needed to sustain the population. In general, some area sensitive birds may require a minimum forest block size of 7500 acres (Robbins et. al. 1989), bobcat populations of 250 breeding females require approximately 2000 square miles, and maintaining Vermont's black bear population may require as much as 6000 square miles of habitat (Vermont Fish & Wildlife Black Bear Management Plan 199__). Some species are so wide-ranging that Vermont can meet only a portion of their population's current or potential habitat needs (e.g., lynx, wolf, marten). In addition, maintaining viable populations of migrating songbirds and raptors may require conservation of wintering grounds in other parts of the country and world.

Species of Greatest Conservation Need in Landscape Level Forests

High Priority

American marten (Martes americana)
Lynx (Lynx canadensis)

Medium Priority

Red-shouldered hawk (Buteo lineatus)
Northern goshawk (Accipiter gentiles)
Wolf (Canis ?)
Mountain lion (Felis concolor)
Bobcat (Lynx rufus)
Black bear (Ursus americanus)
Northern river otter (Lutra canadensis)

SGCN Note: For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/ Information Need Category	Problem/ Information Need Detail	Rank
Habitat Conversion	Permanent conversion of large blocks of forestland to housing development, commercial development, and roads	High
Habitat Fragmentation	Break up of large forest blocks and riparian corridors into smaller block size due to forest conversion and loss of connectivity across political boundaries.	High
Impacts of Roads and Trails	Human and motorized disturbance from new roads and trails in sensitive habitats (e.g., denning sites, feeding areas)	High
Distribution of successional stages	Lack of appropriate landscape level approach to management resulting in habitat degradation (lack of either late or early successional habitat in appropriate size and juxtaposition).	High
Climate Change	Influences tree species composition and snow depths, the latter of which favors competing species	High
Pollution	Acid rain, sulfur and mercury deposition	High

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns.

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Identify and prioritize, for conservation, existing contiguous forest blocks and associated linkages that allow for upward and northward movement in response to climate change.	Number of suitable habitat patches available, miles of riparian corridors & linkages conserved.	USFWS, USFS, TNC, ANR, UVM	SWG, LIP, VHCB, FPR, TNC
Acquisition and conservation easements on high priority sites	Number of acres conserved	ANR, VLT, TNC, VHCB, and other land trusts	VHCB, VLT, LIP, USFS, USFWS, LWCF, Forest Legacy
Technical assistance to private landowners, user groups and forest managers to reduce problems and fragmentation to habitats for wide ranging species and to restore and enhance degraded habitats.	Number landowners managing for species of greatest conservation need	NRCS, TNC, VFWD, FPR, Coverts, Keeping Track, SAF VWA, NWF	LIP, SWG
Financial incentives for private landowners to reduce problems and fragmentation to habitats for wide ranging species and to restore and enhance degraded habitats	Number of acres affected/restored	VFWD, NRCS	LIP, WHIP
Technical assistance to town and regional planning organizations. Distribute *Conserving Vermont's Natural Heritage* (Austin et.al. 2004)	Number of towns contacted; No. towns incorporating wide-ranging species into planning	VFWD, RPCs, VFS, AVCC, SAF, VWA, Coverts, Keeping Track	VFWD
Technical assistance to state and federal land management agencies	Number of state and federal land management plans in the NEK providing for lynx and marten habitat	ANR, USFWS, USFS	ANR
Develop a landscape level planning effort for public/private lands that addresses the needs of late and early successional species and integrates habitat for prey species (e.g., deer, moose, beaver, snowshoe hare) according to population objectives of species management plans	Development of a coordinated effort for the development of target goals and objectives between private and public land entities.	ANR, TNC, USFS, USFWS, RGS, CT Coverts, VWA, Audubon Vermont, Keeping Track	PR, SWG, NRCS
Increase cooperation/coordination between adjacent states and provinces to support and encourage trans-jurisdictional actions to address issues such as global climate change, acid rain and connectivity.	Implementation of trans-jurisdictional actions.	USFWS, USFS, ANR, other states, VTrans, USDOT, TNC, Quebec, VTA.	USFWS, IAFWA
Work with VTrans to identify and maintain wildlife highway/road crossings	Number of functional linkages across highways/roads	VFWD, VTrans, TNC	SWG, PR, VTrans

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the lead column

Plan or planning entity	Goal/Scope of plan	Lead
Black Bear Plan	Bear population goals	ANR
USFWS Wolf Recovery Plan	Wolf recovery in eastern United States	ANR, USFWS, NWF
VT Biodiversity Project	Conserving biodiversity in Vermont	TNC
Northern Forest Bird Initiative	Landscape planning for Northern Forest birds	Audubon
Partners in Flight	Bird conservation plan	PIF, ANR, VT Audubon, USFWS

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Northern Hardwood Forest Summary

Characteristics and Location

The Northern Hardwood Forest is best developed at Vermont's middle elevations and these are widespread in the state. Beech, sugar maple, and yellow birch are the predominant tree species, but hemlock, red oak, red maple, white ash, basswood, and white pine can be common as well, and red spruce makes an occasional appearance.

These are the dominant communities in nearly all biophysical regions, excepting the higher elevations of the Green Mountains and the warmer regions of the Champlain Valley, Taconic Mountains, and Southern Vermont Piedmont. Where the natural communities serve as landscape level habitat (i.e., matrix), they should be represented in large blocks of contiguous forest (1,000 acre to 20,000 acre blocks) of various successional stages, elevation, and soils.

The natural communities that comprise Northern Hardwood forest formation habitat are found in every biophysical region of the state.

Natural communities of the Northern Hardwood Forest:

Northern Hardwood Forest: A variable community, generally dominated by beech, sugar maple, and yellow birch. This community occurs as a landscape natural community type (i.e., matrix) throughout the state.

Rich Northern Hardwood Forest: High diversity hardwood forests of sugar maple, white ash, and basswood, with excellent productivity and high herb diversity. Maidenhair fern, blue cohosh and wood nettle are characteristic herbs. This community occurs as a landscape natural community type (i.e., matrix) in the Taconic Mountains.

White Pine-Northern Hardwood Forest: Areas where white pine is a significant canopy component of Northern Hardwood Forests, usually where soils are coarser and better drained.

Mesic Red Oak-Northern Hardwood Forest: Northern hardwood species and red oak co-dominate. Mostly on south-facing slopes in the northern parts of Vermont.

Hemlock Forest: Dominated by hemlock, often on shallow soils.

Hemlock-Northern Hardwood Forest: Mixed forest of hemlock and northern hardwoods. This community occurs as a landscape natural community type (i.e., matrix) in the Southern Vermont Piedmont and the Taconic Mountains.

Northern Hardwood Talus Woodland: Characteristic species are mountain, rock polypody, red berried elder, and Northern Hardwood species.

Northern Hardwood Forest Condition

Historical Perspective: Northern Hardwood Forests have dominated the Vermont landscape for at least the last 4,500 years, a period over which there was a gradual cooling of the climate. These past forests are believed to have fairly closely resembled the composition

of forests of today. Notable differences in the presettlement northern hardwood forests were the predominance of beech, making up over 40% of the trees (Siccama 1971) and the lower abundance of sugar maple. Although red spruce has decreased in abundance since presettlement times at mid-elevations, it has increased in abundance in valleys due to regeneration in old fields (Hamburg and Cogbill 1988). Similarly, white pine is now more abundant due to its regrowth in abandoned fields (Cogbill 2000). Presettlement forests also likely had much less red maple, white birch, and poplars than the forests of today, as these species are associated with younger forests (Cogbill 2000).

Current Condition: Vermont's Northern Hardwood Habitat has become more widespread as farmland on the slopes and in the valleys has reverted to forest. However, human population growth and economic development result in forestland conversion and fragmentation that yield smaller blocks of contiguous Northern Hardwood. While much of the Northern Hardwood Forests has been cleared or logged at one time, current land management trends will likely yield less early successional habitat in the future.

Desired Condition (SGCN Needs): Northern Hardwood Forest should be represented in both large blocks of contiguous forestland that contribute to the full complement of landscape level habitat for wide-ranging species, as well as in the natural community types that serve specific SGCN associated with that type. The large, contiguous forest blocks of Northern Hardwood Forest should exist in 1,000 to 20,000 acre blocks of various successional stages, elevations, and soils and well represented within each biophysical region. Prey wildlife species supported by northern hardwoods are an important component to maintaining several of the wide-ranging wildlife. In addition, the value of hard mast as wildlife food (i.e., nuts and acorns) from northern hardwoods is important for many SGCN with stands of bear-scarred American beech being a classic example.

Species of Greatest Conservation Need in Northern Hardwood Forest

High Priority

Canada Warbler (Wilsonia canadensis)
Jefferson Salamander (Ambystoma jeffersonianum)
Fowler's Toad (Bufo fowleri)
Spotted Turtle (Clemmys guttata)
Wood Turtle (Clemmys insculpata)
Hardwood Forest Butterflies Group (Edwards' hairstreak)
Silver-haired Bat (Lasionycteris noctivigans)
Eastern Red Bat (Lasiurus borealis)
Hoary Bat (Lasiurus cinereus)
Woodland Vole (Microtus pinetorum)
Long-tailed or Rock Shrew (Sorex dispar)
Pygmy Shrew (Sorex hoyi)
Water Shrew (Sorex palustris)
Southern Bog Lemming (Synaptomys cooperi)

Medium Priority

Cooper's Hawk (Accipiter cooperii)
Long-eared Owl (Asio otus)
Red-shouldered Hawk (Buteo lineatus)
Veery (Catharus fuscescens)
Chimney Swift (Chaetura pelagica)
Black-billed Cuckoo (Coccyzus erythropthalmus)
Black-throated Blue Warbler (Dendroica caerulescens)
Wood Thrush (Hylocichla mustelina)
American Woodcock (Scolopax minor)
Chestnut-sided Warbler (Dendroica pensylvanica)
Ruffed Grouse (Bonasa umbellus)
Blue-spotted Salamander (Ambystoma laterale)
Spotted Salamander (Ambystoma maculatum)
Four-toed Salamander (Hemidactylium scutatum)
Brown Snake (Storeria dekayi)
Long-tailed Weasel (Mustela frenata)
Hairy-tailed Mole (Parascalops breweri)
Cinereus or Masked Shrew (Sorex cinereus)
Smoky Shrew (Sorex fumeus)
Common Gray Fox (Urocyon cinereoargenteus)
Mink (Mustella vison)
Black bear (Ursus americanus)

SGCN Note: Plant SGCN not listed here: 59 species. The SGCN invertebrate group listed here contains numerous species. For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/ Information Need Category	Problem/ Information Need Detail	Rank
Habitat Conversion	Permanent conversion of large blocks of forestland to housing development, commercial development, and roads	High
Habitat Fragmentation	Break up of large forest blocks, riparian corridors, and migration paths	High
Impacts of Roads and Trails	Human and motorized disturbance from new roads and trails in sensitive habitats (e.g., denning sites, breeding sites, feeding areas)	High
Distribution of successional stages	Lack of appropriate landscape level approach to management resulting in a lack of either late or early successional habitat in appropriate size and juxtaposition.	High
Climate Change	May affect species composition	Low
Pollution	Acid rain, sulfur and mercury deposition	High
Invasive Exotic Species	Introduction of exotics species such as sudden oak death, hemlock wooly adelgid, beech bark disease, emerald ash borer, and garlic mustard could affect survival of species such as marten, black bear, Edwards hairstreak, West Virginia white, small mammals songbirds, etc.	High

Incompatible Recreation	Inappropriate location of ski, hiking, snowmobile trails, illegal ATV use, rock climbing.	Medium
Habitat Degradation	Loss of key feeding areas (beech stands, riparian areas, snags, cavity trees, etc.). Loss of dead and down material, fragmentation of contiguous forests..	High
Herbivory	Excessive deer and moose browsing alters tree regeneration, composition, and ability to compete with invasive exotics	Medium

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	**Performance Measure**	**Potential Partners**	**Potential Funding Sources**
Identify and prioritize existing contiguous forest blocks and associated linkages	Number suitable habitat patches available and miles of linkages and riparian corridors conserved	USFS, USFWS TNC, ANR, UVM	SWG, LIP, VHCB, FPR, TNC
Develop a landscape level planning effort for public/private lands that address the needs of late and early successional species and integrates habitat for prey species (e.g., deer, moose, beaver, snowshoe hare) according to population objectives of species management plans	Adoption of target goals and objectives for public and private lands by private and public land entities	USFWS, USFS, ANR, NRCS	PR, SWG, NRCS, USFWS
Acquisition and conservation easements on high priority sites	Number of acres conserved	ANR, VLT, TNC, VHCB	VHCB, VLT, LIP, Forest Legacy
Provide technical assistance to private landowners, user groups and forest managers to manage for SGCN including, SGCN associated with early successional and late successional habitat.	Number landowners managing for SGCN.	NRCS, TNC, ANR, SAF, VWA, Covert	LIP, SWG
Financial incentives for private landowners to reduce problems and fragmentation to habitats for SGCN and to restore and enhance degraded habitats	Number of acres affected/restored	VFWD, NRCS	LIP, WHIP
Technical assistance to town and regional planning organizations, distribute *Conserving Vermont's Natural Heritage* (Austin et.al. 2004)	Number of towns contacted; No. towns incorporating wide-ranging species into planning	VFWD, RPCs, AVCC, VFS	VFWD
Technical assistance to state and federal land management agencies	Number of state and federal land management plans that include SGCN conservation.	ANR, USFWS, USFS	ANR, USFWS, NRCS
Work with VTrans to identify and maintain wildlife highway/road crossings and recreational user groups to avoid road and trail placement in sensitive habitat types.	Number functional linkages across highways/roads	VFWD, VTrans, VAST, GMHA	SWG, PR, VTrans
Manage deer and moose populations at levels that provide suitable harvest opportunities, but do not impair forest regeneration	Number of deer and moose/square mile.	VFWD	PR

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the lead column

Plan or planning entity	Goal/Scope of plan	Lead
Bat Conservation Plan	Bat habitat conservation	ANR
Partners in Flight	Bird conservation plan	PIF, VINS, ANR, VT Audubon, USFWS
The Vermont Forest Resources Plan 1999-2008	Conservation and management of Vermont's Forests	FP&R

References

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Spruce-Fir-Northern Hardwood Forest Summary

Characteristics and location

These forests characterize our coldest regions. At higher elevations and in low cold, moist areas, red spruce and balsam fir may dominate the canopy. Warmer or better drained sites have significant amounts of hardwoods (yellow birch, sugar maple, and beech) along with softwoods in the canopy. Human or natural disturbance can also lead to temporary dominance by hardwood species.

These forests occur where growing seasons are short, summers are cool, and winters are harsh. The conifer-dominated forests blanket our highest peaks above 2,500 feet as well as occurring in cold lowland pockets within large areas of Northern Hardwood Forest. The mixed forests of red spruce and hardwoods are more widely distributed.

Subalpine Krummholz: Low, dense thickets of balsam fir and black spruce at high elevations. Generally shallow to bedrock.

Montane Spruce-fir Forest: Dominated by red spruce and balsam fir, with occasional heartleaf birch, paper birch, and yellow birch. Higher elevations generally above 2500 feet.

Lowland Spruce-Fir Forest: Dominated by red spruce and balsam fir, with occasional white spruce, black spruce, paper birch, and yellow birch. Lowlands of Northeastern Highlands and cold valleys elsewhere.

Montane Yellow Birch-Red Spruce Forest: Mixed forest at high elevations (2,200-3,000 feet), dominated by yellow birch, and red spruce.

Red Spruce-Northern Hardwood Forest: Mixed forest of red spruce, yellow birch, sugar maple, beech, balsam fir, white ash, and other species, not associated with mountain slopes, generally below 2,400 feet elevation, sometimes up to 2,700 feet. A variable community**.**

Boreal Talus Woodlands: Rockfall slopes dominated by heart-leaved paper birch with occasional red spruce. Appalachian polypody, skunk currant, and mountain maple are often abundant.

Cold-Air Talus Woodland: Rare. Found where cold air drains at the bases of large talus areas. Characteristic plants are black spruce, abundant mosses and liverworts, foliose lichens, and Labrador tea.

Spruce-Fir-Northern Hardwood Forest Condition

Historical Perspective: In recent geologic time, forests dominated by spruce and fir became established in eastern North America only as recently as 8,000 years ago (Webb 1987). A warming trend, known as the hypsithermal interval, occurred from about 6,000 to 4,000 years ago, at which time spruce and fir dominated forests were greatly reduced in distribution. There has been a general expansion of spruce and fir since this time associated with a general cooling of climate (Klyza and Trombulak 1999).

Balsam fir has increased substantially when compared to presettlement forests, likely the result of its competitive advantage over spruce after heavy cutting (Whitney 1994). Red spruce has decreased in abundance at mid-elevation as a result of natural climate warming after the "little ice age" and forest harvesting, whereas it has increased in abundance in valley settings as a result of regeneration in old fields (Hamburg and Cogbill 1988).

Current Condition: Many of the natural communities within the spruce–fir–northern hardwood formation exist at high elevations and are often on shallow, acidic, infertile soils. They are, therefore, particularly susceptible to global climate change and acid rain. In addition, fragmentation through permanent conversion of forest blocks to roads, houses, ski trails etc. pose the most significant problems to this forest type and the species that depend on it.

Desired Condition (SGCN Needs): Many of the below listed SGCN depend upon large, contiguous, interconnected, forest blocks. Where they exist within a biophysical region, examples of large, intact blocks of appropriate natural communities should be conserved to ensure the long-term viability of the associated SGCN (i.e. Montane Spruce Fir: black poll warbler, olive-sided flycatcher, Bicknell's thrush, bay-breasted warbler; Lowland Spruce Fir: black-backed woodpecker, gray jay, bay-breasted warbler). Contiguous forest blocks will ideally exist in 1,000-20,000 acre blocks at various elevations and of various soil types. Conservation of these blocks should incorporate SCGN distribution and habitat needs.

SGCN in Spruce-Fir Northern Hardwood Forest

High Priority

Bicknell's Thrush (Catharus bicknelli)
Spruce Grouse (Falcipennis canadensis)
Canada Warbler (Wilsonia canadensis)
Jefferson Salamander (Ambystoma jeffersonianum)
Wood Turtle (Clemmys insculpta)
Tiger Beetles Group
Eastern Red Bat (Lasiurus borealis)
Hoary Bat (Lasiurus cinereus)
Lynx (Lynx canadensis)
American Marten (Martes americana)
Rock Vole (Microtus chrotorrhinus)
Woodland Vole (Microtus pinetorum)
Long-tailed or Rock Shrew (Sorex dispar)
Water Shrew (Sorex palustris)
Northern bog lemming (Synaptomys borealis)
Southern Bog Lemming (Synaptomys

Medium Priority

Cooper's Hawk (Accipiter cooperii)
Northern Goshawk (Accipiter gentilis)
Long-eared Owl (Asio otus)
Chimney Swift (Chaetura pelagica)
Black-billed Cuckoo (Coccyzus erythropthalmus)
Olive-sided Flycatcher (Contopus cooperi)
Black-throated Blue Warbler (Dendroica caerulescens)
Bay-breasted Warbler (Dendroica castanea)
Blackpoll Warbler (Dendroica striata)
Gray Jay (Perisoreus canadensis)
Black-backed Woodpecker (Picoides arcticus)
Blue-spotted Salamander (Ambystoma laterale)
Spotted Salamander (Ambystoma maculatum)
Wolf (Canis ?)
Mountain Lion (Felis concolor)
Long-tailed Weasel (Mustela frenata)
Hairy-tailed Mole (Parascalops breweri)
Cinereus or Masked Shrew (Sorex cinereus)
Smoky Shrew (Sorex fumeus)
Black Bear (Ursus americanus)

SGCN Note: Plant SGCN not listed here: 21 species. The SGCN invertebrate group listed here contains numerous species. Wolf and mountain lion utilize this spruce-fir northern hardwood forests but are addressed in the Landscape Forest Summary. For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A1-A5.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/ Information Need Category	Problem/ Information Need Detail	Rank
Habitat Conversion	Permanent conversion of large blocks of forestland to housing development, and commercial development including: quarries, wind farm, roads, and recreational development	High
Habitat Fragmentation	Break up of large forest blocks, riparian corridors, and migration paths	High
Impacts of Roads and Trails	Human and motorized disturbance from new roads and trails in sensitive habitats (e.g., denning sites, breeding sites, feeding areas) Conversion of habitat to roads and trails may interrupt movement corridors and provide habitat for competing species.	Medium
Distribution of successional stages	Lack of appropriate landscape level approach to management resulting in habitat degradation (lack of either late or early successional habitat in appropriate size and juxtaposition).	Medium
Climate Change	May alter species composition	Medium
Pollution	Acid rain, sulfur and mercury deposition may affect prey base and vernal pool chemistry	High
Habitat Degradation	Loss of concentrated food, cover, breeding habitats (deer wintering areas, vernal pools, conifer wetlands, coarse woody debris etc.).	High
Incompatible recreation	Inappropriate location of ski, hiking, snowmobile trails, illegal ATV use, rock climbing.	Medium
Herbivory	Excessive deer and moose browsing alters native tree regeneration, composition, and resistance to invasive exotics.	Medium

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Identify and prioritize for conservation, existing contiguous forest blocks and associated linkages that also considers climate change	Number of suitable blocks conserved. The number of miles of riparian corridors & linkages conserved	TNC, ANR, UVM	SWG, LIP, VHCB, FPR, TNC
Acquisition or conservation easements on high priority sites	Number of acres conserved	ANR, VLT, TNC, VHCB	VHCB, VLT, LIP
Technical assistance to private landowners, user groups and forest managers to maintain and enhance SGCN habitat in Spruce-Fir NHF.	Number landowners/user groups/forest managers managing for Spruce-Fir SGCN.	NRCS, TNC, VFWD, FPR, Coverts, SAF, VWA, Keeping Track	LIP, SWG
Financial incentives for private landowners to maintain and enhance SGCN habitat in	Number of acres affected/restored	VFWD, NRCS	LIP, WHIP

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Spruce-Fir NHF			
Technical assistance to town and regional planning organizations to maintain and enhance SGCN habitat in Spruce-Fir NHF. Distribute *Conserving Vermont's Natural Heritage* (Austin et.al. 2004)	Number of towns contacted; Number of towns incorporating the needs of SGCN in Spruce-Fir NHF into planning	VFWD, RPCs, AVCC, VFS	VFWD
Technical assistance to state and federal land management agencies to maintain and enhance SGCN habitat in Spruce-Fir NHF	Number of state and federal land management plans for Spruce-Fir NHF providing for lynx and marten habitat. Number of state and federal land management plans for Spruce-Fir NHF that include SGCN in their management objectives.	ANR, USFWS, USFS, SAF	ANR
Maintain forested buffers along stream and rivers (See ANR buffer policy)	Number of miles of streams with intact buffers	ANR, VLT, TNC, NWF, Coverts	SWG, LIP, WHIP, Trout Unlimited, NRCS
Work with VTrans to identify and maintain wildlife highway/road crossings	Number functional linkages across highways/roads	VFWD, VTrans	SWG, PR, VTrans
Work with recreational groups to reduce the number of trails in sensitive habitats	Number of sensitive habitats with limited disturbance	GMC, VAST, VT Ski Area Association	
Increase cooperation/coordination between adjacent states and provinces to support and encourage trans-jurisdictional actions to address issues such as global climate change, acid rain and other pollutants.	Implementation of trans-jurisdictional actions.	USFWS, USFS, ANR, other states, TNC, Quebec,	USFWS, IAFWA
Manage moose populations at levels that provide suitable prey, but do not impair forest regeneration	Number of moose/square mile	ANR	PR

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the lead column

Plan or planning entity	Goal/Scope of plan	Lead
Bat Conservation Plan	Bat habitat conservation	ANR
Spruce Grouse Recovery Plan	Spruce grouse reintroduction	ANR
Partners in Flight	Bird conservation plan	PIF, ANR, Audubon, USFWS
Riparian Buffer Guidance, and Riparian Buffers and Corridors Technical Papers (http://www.anr.state.vt.us/site/html/buff/anrbuffer2005.htm)	Helps in the development of recommendations and designs for Act 250-regulated projects that incorporate appropriate buffer zone widths for protecting riparian functions	ANR
VT Forest Resources Plan	Conservation and Management of VT Forests	VT FP&R

References

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Oak-Pine-Northern Hardwood Forest Summary

Characteristics and Location

The Oak-Pine-Northern Hardwood Forest is best developed in the warmer regions of Vermont—the Southern Vermont Piedmont, Champlain Valley, and the lower elevations in the Taconic Mountains. Forest communities in this formation generally occur as large patches or locally as small patches within Northern Hardwood Forests and on dry, south-facing slopes and ridgetops. In the Oak-Northern Hardwood Forest Formation, hardwoods such as sugar maple, beech and yellow birch are common, but warmer climate species such as red oak, shagbark hickory, and white oak can be present in significant numbers. White pine is a prominent part of this formation.

The natural communities that comprise the Oak-Pine-Northern Hardwood forest type are diverse in their species composition, but all have species that occur in warmer climates, or on dryer sites such as south-facing rocky ridges.

Natural communities of the Oak-Pine-Northern Hardwood Forest:

Red Pine Forest or Woodland: Maintained by fire, these small areas are dominated by red pine, have very shallow soils, and have blueberries and huckleberries in the understory. They are widespread, and often surrounded by Northern Hardwood Forests.

Pitch Pine-Oak-Heath Rocky Summit: These are fire-adapted communities on dry, acidic ridgetops where red oak, white oak, pitch pine, scrub oak, and white pine are characteristic trees. Heath shrubs (blueberries and huckleberries) are abundant.

Limestone Bluff Cedar-Pine Forest: Northern white cedar dominates these areas of shallow soils over calcareous bedrock. Red pine, white pine, hemlock, and hardwoods are also present. Characteristic herbs are ebony sedge and rock polypody. This community has suffered high degree of loss from historic levels due to shoreline development.

Red Cedar Woodland: These are open glade-like communities on ledge crests, where red cedar is native and persistent, and grasses and sedges dominate the ground layer.

Dry Oak Woodland: These are very open areas with trees of low stature on dry, south facing hilltops. Grasses and Pennsylvania sedge are dominant on the forest floor.

Dry Oak Forest: These forests occur on rocky hilltops with very shallow, infertile soils. Red oak, chestnut oak and white oak can all be present; usually other tree species are absent. Heath shrubs dominate the understory.

Dry Oak-Hickory-Hophornbeam Forest: These forests occur on till-derived soils, but they are often found on hilltops and bedrock exposures are common. Soils are well drained, but are more fertile than in Dry Oak Forests. Red oak, sugar maple, hophornbeam, and shagbark hickory are variously dominant. Sometimes sugar maple is the dominant tree, sometimes it is oak and hickory. Pennsylvania sedge forms lawns.

Mesic Maple-Ash-Hickory-Oak Forest: Sugar maple, white ash, hickories and red and white oak are present in varying abundances. This community needs better documentation.

Valley Clayplain Forest: Found on the clay soils of the Champlain Valley, this forest is variously dominated by white oak, swamp white oak, bur oak, hemlock, red maple, and shagbark hickory. Soils are poorly drained. Clay plain forests in Vermont have declined by 87.9% since pre-European settlement (Lapin 2003).

White Pine-Red Oak-Black Oak Forest: These forests are found on coarse-textured soils. Red and black oak co-dominate along with white pine. Beech and hemlock are also common. Heath shrubs are common in the understory.

Pine-Oak-Heath Sandplain Forest: This is a rare community type, found on dry sandy soils in warmer areas. Characteristic species are white pine, pitch pine, black oak, and red oak with an understory dominated by heath shrubs. Due to high development pressure, only 5% of the original 15,000 acres of sandplain forest in Chittenden County remain (Engstrom 1991).

Transition Hardwood Talus Woodland: These talus woodlands are found in warmer areas, often on limestone but occasionally on slate, schist, granite, gneiss, or other rock. Some characteristic species are red oak, basswood, white ash, sweet birch, bitternut hickory, northern white cedar, hackberry, bulblet fern, and American yew.

Oak-Pine-Northern Hardwood Forest Condition

Historical Perspective: The natural communities that we recognize now are not static – they have changed dramatically over time as component species have migrated across the landscape in response to climatic change. The Oak-Pine-Northern Hardwood Forest Formation (and its characteristic species: pine, oak, and hickory) provides a good example of how species migrations are independent of each other. After the retreat of the glaciers to the north, pine became well established in the northeastern United States by about 12,000 years ago, while oak was not well established until about 8,000 years ago, and hickory arrived in New England 2,000 to 3,000 years after the first increase in oak populations (Jacobson et al. 1987; Prentice et al. 1991).

It is often thought that white pine dominated the presettlement landscape of Vermont, but evidence from early land surveys indicates that it had a variable and restricted distribution (Cogbill 2000). Pine was abundant only in scattered areas of the Champlain and Connecticut River valleys, and was generally uncommon elsewhere. White pine has more than doubled in frequency since presettlement times, apparently due to its establishment and growth in abandoned agricultural fields (Cogbill 2000).

Current Condition: Of the three landscape level forests in Vermont, the Oak-Pine-Northern Hardwood Forest has been the most altered by human activities. The primary reason may be that this forest type is most closely associated with the Champlain and Connecticut River Valleys – Vermont's most populated and agricultural regions. The Oak-Pine-Northern Hardwood Formation occurs in the warmest region of the state that are generally the most desirable for settlement and agriculture. Human alteration of the landscape has most significantly altered some of the larger natural community types (i.e., Valley Clayplain Forest, Pine-Oak-Heath Sandplain Forest) of this forest. In fact, in the southern Champlain Valley 87.9% of the Clay Plain Forest has been lost or degraded (Lapin 2003), primarily as a result of conversion to agricultural uses. One of Vermont's rarest and most threatened natural communities is the Pine-Oak-Heath Sandplain Forest of the northern Champlain Valley. As a consequence of its high value for residential development,

it has been estimated that only 5% of the original 15,000 acres of sandplain forest now remain in Chittenden County (Engstrom 1991). Many of the rarest SGCN are directly associated with these communities.

Many of the other natural communities of this forest are small in size and often isolated. Several are found along drier ridgetops that make them less vulnerable to forestland conversion. However, fire suppression over the past 200 years or more has taken away one of the more important natural disturbances vital to regenerating this forest type. Without fire, regenerating oak following timber removal is difficult, particularly when under the influence of herbivory (i.e., deer browsing, hare and rabbit girdling). Invasive plants (e.g., honeysuckle, buckthorn) and exotic insects (e.g., gypsy moth) can have significant effects on the quality of the wildlife habitat.

Desired Condition (SGCN Needs): Oak-Pine-Northern Hardwood Forest should be represented in both large blocks of contiguous forestland that contribute to the full complement of landscape level forest for wide-ranging species, as well as in the natural community types that serve specific SGCN associated with that type. Although contiguous forest blocks are limited in size and availability, where they exist, large, contiguous forest blocks of Oak-Pine-Northern Hardwood Forest will ideally exist in 1,000 acre or more blocks of various elevations and soils. The oak component of this forest serves as important fall foods for numerous mammals, including some key prey species (e.g., deer, small mammals) for wide-ranging wildlife. Because much of the Oak-Pine-Northern Hardwood Forest has been converted to agriculture and development, the remaining fragmented blocks will ideally be maintained, if not enlarged, as well as interconnected through forested or riparian corridors.

SGCN in Oak-Pine Northern Hardwood Forest

High Priority

Jefferson Salamander (Ambystoma jeffersonianum)
Fowler's Toad (Bufo fowleri)
Spotted Turtle (Clemmys guttata)
Wood Turtle (Clemmys insculpata)
Timber Rattlesnake (Crotalus horridus)
Eastern Rat Snake (Elaphe obsolete)
Five-lined Skink (Eumeces fasciatus)
Hardwood Forest Butterflies
Tiger Beetles Group
Indiana Bat (Myotis sodalis)
Silver-haired Bat (Lasionycteris noctivigans)
Eastern Red Bat (Lasiurus borealis)
Hoary Bat (Lasiurus cinereus)
Woodland Vole (Microtus pinetorum)
Southern Bog Lemming (Synaptomys cooperi)

Medium Priority

Northern Goshawk (Accipiter gentilis)
Long-eared Owl (Asio otus)
Red-shouldered Hawk (Buteo lineatus)
Cooper's Hawk (Accipiter cooperii)
Chimney Swift (Chaetura pelagica)
Black-throated Blue Warbler (Dendroica caerulescens)
American Woodcock (Scolopax minor)
Chestnut-sided Warbler (Dendroica pensylvanica)
Ruffed Grouse (Bonasa umbellus)
Blue-spotted Salamander (Ambystoma laterale)
Spotted Salamander (Ambystoma maculatum)
Four-toed Salamander (Hemidactylium scutatum)
Brown Snake (Storeria dekayi)
Long-tailed Weasel (Mustela frenata)
Hairy-tailed Mole (Parascalops breweri)
Cinereus or Masked Shrew (Sorex cinereus)

SGCN Note: Plant SGCN not listed here: 89 species. The SGCN invertebrate groups listed here contain numerous species. For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/ Information Need Category	Problem/ Information Need Detail	Rank
Habitat Conversion	Permanent conversion of forestland to housing development, commercial development, agriculture, and roads	High
Habitat Fragmentation	Break up of large forest blocks, riparian corridors, and migration paths. Wider ranging reptiles and birds depend upon contiguous habitat mosaics of 1000 ha or more.	High
Impacts of Roads and Trails	Human and motorized disturbance from new roads and trails in sensitive habitats (e.g., denning sites, breeding sites, feeding areas)	High
Inadequate Disturbance Regime	Fire Suppression: many habitats depend upon fire.	Medium
Climate Change	Alters water temperatures and levels for amphibians and reptiles.	Medium
Pollution	Acid rain affects on amphibians.	Medium
Habitat Degradation	Alteration of tree composition and loss of large, dead trees for cavities and roosts	Medium
Herbivory	Excessive deer browsing alters tree regeneration and composition	High
Invasive Exotic Species	Fragmented forest blocks encourage invasive plant species. Gypsy moth infestations affect oak productivity and survival.	High

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here

See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Identify and prioritize existing contiguous forest blocks and associated linkages	Number forest blocks identified and assessed	TNC, ANR, Univ of VT	ANR, LIP, VHCB, TNC
Acquisition and conservation easements on high priority sites	Number of acres conserved	ANR, VLT, TNC, VHCB	VHCB, VLT, LIP
Technical assistance and/or financial incentives for private landowners, user groups and forest managers to maintain/enhance Oak-Pine NHF	Number of landowners managing land for SGCN	NRCS, TNC, ANR, SAF, VWA, VT Coverts	LIP, SWG
Financial incentives for private landowners to maintain and enhance SGCN habitat in Oak-Pine NHF	Number of acres affected/restored	VFWD, NRCS	LIP, WHIP
Technical assistance to town and regional planning organizations. Distribute *Conserving Vermont's Natural Heritage* (Austin et.al. 2004)	Number of towns & RPC's considering SGCN in their planning	VFWD, RPC's, AVCC, SAF, VWA, Coverts, VFS	VFWD
Technical assistance to state and federal land management agencies	No. state & federal land mgmt plans providing for SGCN, including use of prescribed fire	ANR, USFWS, USFS	ANR
Manage deer populations at levels that provide suitable harvest opportunities, but do not impair forest regeneration	Number of deer/square mile. Level of browse. Change in the # of wildlife road mortalities	ANR	PR
Continue working with VTrans & towns to identify and improve wildlife-highway/road crossings	Number of functional linkages across highways/roads	VFWD, VTrans	SWG, PR, VTrans
Increase cooperation/coordination between adjacent states and provinces. Develop trans-jurisdictional actions to address issues such as global climate change, acid rain & connectivity.	Implementation of trans-jurisdictional actions.	USFWS, USFS, ANR, other states, TNC, Quebec, VTA	USFWS, IAFWA

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the lead column

Plan or planning entity	Goal/Scope of plan	Lead
Bat Conservation Plan	Bat habitat conservation	ANR
ANR Long Range Management Plans	Management activities on ANR Lands	ANR
Green Mountain Forest Plan	Management activities on GMNF	USFS
Partners in Flight	Bird conservation plan	PIF, ANR, Audubon, USFWS
The Nature Conservancy Champlain Valley Ecoregional Plan	Land conservation targets for the Champlain Valley Ecoregion	TNC
Champlain Basin Plan	Conservation of Champlain Basin resources	LCBP
Watershed Management Plans	Watershed plans for the Lake Champlain Basin	DEC

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Landscape Level Aquatic and Shoreline Summary

Vermont's aquatic and shoreline landscape includes all surface waters and their adjacent streambanks, floodplains and/or lakeshores. This landscape includes lacustrine (lake) formations, fluvial (stream and river) formations, floodplain forests, and shores and marshes. This landscape also includes thousands of miles of streambank areas that are comprised of upland communities adjacent to surface waters. The aquatic and shoreline landscape is described as an interconnected system of the lacustrine, fluvial, floodplain, marsh, shore, and upland communities that comprise it for the purpose of identifying and conserving the common habitat functions these communities provide at the landscape level.

Riparian (riverbank) areas, if maintained in continuous, sufficiently wide, interconnected corridors throughout a watershed, serve as movement corridors for many of Vermont's wildlife species. Maintaining intact terrestrial communities adjacent to surface waters also serves to protect aquatic habitats. Riparian areas help protect water quality, provide organic inputs, regulate water chemistry and physical properties (such as temperature), and provide physical aquatic habitat structure (e.g., undercut banks, large woody debris). Again, because aquatic communities are often inter-connected throughout the landscape, maintaining intact riparian areas is essential to protecting aquatic communities from the headwaters to downstream receiving waters.

> "It is a well known fact that the best fishing is where a forest is near the shore, and best of all where the limbs overhang the water. Not only do the trees afford shelter, furnish food and prevent evaporation, but at the same time they keep the water clear and cool in the summer. In the winter the forests afford protection by lessening the severity of the winter frosts, and in all forest regions the changes of temperature are not so severe as in treeless countries and on the open plain: and the effect upon the water is even greater….But the forests not only regulate the flow of water, as above stated, but they purify the water."
> **- Frank H. Carleton, from the Fifteenth Biennial Report of the Commissioners of Fish and Game of the State of Vermont, 1899-1900.**

Habitat requirements, problems, and conservation strategies have been assessed and developed for both the landscape level, and the individual aquatic and terrestrial species' habitats that are associated with it. Many SGCN meet most of their habitat needs within the aquatic-terrestrial interface that the aquatic and shoreline landscape provides. These species, in particular, are discussed in this section.

Characteristics and location

Aquatic and shoreline landscapes are comprised of streams, rivers, lakes, wetlands, shorelines and floodplains that form a complex and interrelated hydrological system. This hydrological system extends up and down streams and along lakeshores from the bottom of the water table to the top of the vegetation canopy, and includes land that is directly affected by surface water (Verry 2000). Riparian areas are known for their high biological diversity. They are "characterized by frequent disturbances related to inundation, transport of sediments, and the abrasive and erosive forces of water and ice movement that, in turn, create habitat complexity and variability…resulting in ecologically diverse communities" (Verry 2000).

The landscape level includes both the terrestrial-aquatic interface and the aquatic areas found throughout Vermont, from the mountain streams to the large valley rivers and the lakes and ponds scattered throughout the landscape. The following aquatic and terrestrial areas are

associated with the aquatic and shoreline landscape (for details see the following summaries in Appendix B):

Lacustrine ("Inland" Lakes)
Lake Champlain
Lake Champlain Tributaries
Connecticut River Tributaries
Floodplain Forests
Upland Shores
Wet Shores
Swamps and Marshes

Landscape Condition

Current Condition: Nationwide an estimated 70% to 90% of natural riparian vegetation, vital to maintaining the integrity of riparian and aquatic habitats, has already been lost or is degraded due to human activities (Doppelt 1993). In Vermont, some of our rivers, streams, lakes, and wetlands still have intact riparian areas, while many others no longer have functioning riparian areas due to more than 200 years of intensive human use of the land.

In general, riparian areas in Vermont are most affected by habitat conversion, alteration, and fragmentation. Typically, steeper mountainous streams and high elevation lakes and ponds, less suited for human development, have well forested riparian areas with cold, clean water and stable stream channels and shorelines. Recreational activities and their associated development and forestry are the land uses most common in these areas that may affect riparian and aquatic species. Mid and low elevation waterbodies and their adjacent riparian areas are more likely to be impacted by human land uses, including clearing of riparian vegetation, alteration of stream channels and lakeshores, and direct inputs of toxins, excess nutrients, and sediments. These impacts are related primarily to roads, residences, commercial development, and agriculture, with agriculture being especially extensive in the lower valleys of the Champlain and Connecticut tributaries. Lacustrine areas and their associated shorelines are particularly impacted by lakeshore development, such as seasonal and permanent residences, marinas and docks, and public and private beaches. In many instances these developments have altered natural lakeshore and littoral zones resulting in the direct loss of habitats for SGCN through the addition of fill materials (sand, bottom barriers) and the removal of native aquatic vegetation.

The fragmentation of riparian habitat is extensive in Vermont, due primarily to Vermont's roadways paralleling the stream, rivers, and lakeshores, and use of rich floodplain areas for agriculture. Historic settlement and transportation patterns and ease of construction have resulted in roads paralleling the majority of Vermont's major waterbodies and thousands of associated bridges and culverts. This results in removal of riparian vegetation and fragmentation, both longitudinally and laterally between the waterbody and adjacent upland communities.

Desired Condition (SGCN Needs): Aquatic and shoreline areas provide several habitat functions for the species that inhabit them. Some species rely directly on both the aquatic and terrestrial components of the riparian-aquatic interface. For example, mink and otter use aquatic areas within 100 meters of water's edge for feeding and riparian areas for denning and as travel corridors. These species move daily between terrestrial and aquatic areas to fulfill their life needs. Other species move seasonally between the aquatic and terrestrial components of the aquatic and shoreline landscape. For example, the wood turtle uses streams and rivers for overwintering, and uses adjacent riparian areas up to 300 meters from

the water's edge for foraging, breeding, nesting, and dispersal. For those species that are strictly aquatic, the adjacent terrestrial riparian areas function to protect the aquatic areas, providing shade, organic inputs, filtering and storage of overland runoff, and bank stability.

On a landscape level, aquatic and shoreline areas provide habitat for 41 SGCN.

Species of Greatest Conservation Need in Aquatic and Shoreline

High Priority

Peregrine Falcon (Falco peregrinus)
Bald Eagle (Haliaeetus leucocephalus)
Wood turtle (Clemmys insculpata)
Common Mudpuppy (Necturus maculosus)
Silver-haired Bat (Lasionycteris noctivagans)
Eastern Red Bat (Lasiurus borealis)
Hoary Bat (Lasiurus cinereus)
Eastern Pipistrelle (Pipistrellus subflavus)
Water Shrew (Sorex palustris)
Bog/fen/swamp/marshy pond Odonata group
Freshwater Mussels group
Freshwater Snails group
Lakes/ponds Odonata group
Mayflies/Stoneflies group
River/stream Odonata group
Vernal Pool Odonata
Elktoe (Alasmidonta marginata)
American Eel (Anguilla rostrata)
American Brook Lamprey (Lampetra appendix)
Atlantic Salmon (anadromous) (Salmo salar)
Brassy Minnow (Hybognathus hankinsoni)
Bridle Shiner (Notropis bifrenatus)
Blackchin Shiner (Notropis heterodon)
Blacknose Shiner (Notropis heterolepis)
Northern Brook Lamprey (Ichthyomyzon fossor)
Stonecat (Noturus flavus)

Medium Priority

Blue-winged teal (Anas discors)
Osprey (Pandion haliaetus)
Pied-billed Grebe (Podilymbus podiceps)
Lesser Yellowlegs (Tringa flavipes)
Northern River Otter (Lutra canadensis)
Muskrat (Ondatra zibethicus)
Mink (Mustella vison)
Cinereus or Masked Shrew (Sorex cinereus
Mottled Sculpin (Cottus bairdi)
Redfin Pickerel (Esox americanus)
Brook Trout (naturally reproducing populations) (Salvelinus fontinalis)
Silver Lamprey (Ichthyomyzon unicuspis)
Redbreast Sunfish (Lepomis auritus)
Sea Lamprey (Petromyzon marinus) (Connecticut River only)
Atlantic Salmon (landlocked) (Salmo salar)

SGCN Notes: Plant SGCN not listed here include 16 species. For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/Info Need Category	Problem/Info Need Detail	Rank
Habitat Conversion	Floodplain forests, lakeshores and other riparian communities converted to agriculture, roadways, and residential/commercial development. Habitat conversion is most prevalent in low and mid elevation areas.	High
Habitat Degradation	Removal or alteration of vegetative community, ground disturbance, and manipulation of shorelines and streambanks; can lead to degradation of water quality, and loss of physical habitat structure. Habitat degradation occurs primarily in upper elevation areas, in contrast to complete habitat conversion, which is more common in mid and low elevation areas.	High
Habitat Fragmentation	Interruption of movement corridors to and from breeding, feeding, and seasonal habitats via conversion, degradation, and road mortality (herps).	High
Inadequate Disturbance Regime	Dams, drainage ditching, floodplain filling, and channel incision (floodplain abandonment) that affect flooding, erosion, and deposition processes	High
Invasion by Exotic Species	Habitat alteration from invasive plant species (e.g., Japanese knotweed, Purple loosestrife); plant inter-species competition for habitat.	High
6. Harvest or Collection, Trampling or Direct Impacts	Collection and harvest pressures; increased human activity disturbing breeding, nesting and movement.	High

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Develop a plan to identify and prioritize existing contiguous riparian corridors and associated wildlife habitat linkages	Increase in number of riparian habitat linkages identified and conserved	ANR, TNC, NWF, NRCS, FSA	EQIP, CRP, CREP
Technical assistance to private landowners to maintain and enhance SGCN habitat in riparian areas.	Increase in number of acres of riparian habitat restored and/or conserved by private landowners	NRCS, ANR, USFWS, FSA	WHIP, LIP EQIP, , CREP
Financial incentives for private landowners to maintain and enhance SGCN habitat in riparian areas.	Increase in number of acres of riparian habitat restored and/or conserved by private landowners	NRCS, ANR, USFWS, FSA	WHIP, EQIP,CRP ,REP,LIP
Technical assistance to town and regional planning organizations to maintain and enhance SGCN habitat in riparian areas. Distribute *Conserving Vermont's Natural Heritage* (Austin et.al. 2004)	Increase in number of towns incorporating riparian conservation into planning and zoning	ANR, ACCD, VLCT, AVCC, NRCS, FSA	ANR, NRCS
Technical assistance to state and federal land management agencies on riparian habitat management goals/strategies	Increase in % or number of state and federal land management plans providing for riparian conservation	ANR, VTrans, USFWS, USFS	
Work with VTrans, towns, and private landowners to identify and maintain (or restore) riparian habitat connectivity and improve aquatic organism passage	Increase in % or number of road crossings that do not impede riparian corridor movement – longitudinally and laterally	VTrans, ANR, NRCS	WHIP, VTrans, SWG
Technical assistance to landowners and conservation groups on invasive exotic management and eradication		TNC, ANR, NRCS, FSA	LIP, CRP, CREP,

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the lead column

Plan or planning entity	Goal/Scope of plan	Lead
ANR State Lands Management Plans	Management practices for ANR-owned lands	FPR, VFWD
Floodplain Forests of Vermont	Natural Community Inventory	ANR
Riparian Buffer Guidance, and Riparian Buffers and Corridors Technical Papers 1/20/2005 http://www.anr.state.vt.us/site/html/buff/anrbuffer2005.htm	Helps in the development of recommendations and designs for Act 250-regulated projects that incorporate appropriate buffer zone widths for protecting riparian functions	ANR
ANR Stream Geomorphic Assessments	Stream and riparian condition inventories	ANR

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Landscape Fluvial (Stream) Summary

Characteristics and location

There are more than 7,000 miles of rivers and streams in Vermont draining 4 major watersheds: Connecticut, Lake Champlain, Hudson, and Memphremagog. The headwater streams of the western Green Mountains drain to the large rivers of the lower Champlain Valley and eventually into Lake Champlain. The eastern slopes of the Green Mountains drain primarily to the Connecticut River. Portions of the Northeastern Highlands and Northern Piedmont drain north into Lake Memphremagog. The Taconic Mountains and southern Green Mountains drain into the Batten Kill, Deerfield, Walloomsac, and Hoosic rivers. These rivers, with the exception of the Deerfield, eventually drain into the Hudson River in New York. The Deerfield drains to the Connecticut River. Despite this diversity of landscape over which Vermont's streams and rivers flow, fluvial ecosystems can be described by three general categories based on physical stream characteristics. There are various biotic communities associated with each of these physical stream types, depending on both the physical stream characteristics and the geographic location of the waterbody. For example, the large rivers of the lower Lake Champlain watershed are similar in physical characteristics to the large tributaries feeding Lake Memphremagog, but some of the species found in these two settings differ due to the repopulation patterns of aquatic species into freshwater ecosystems post-glaciation. This summary does not include discussion of the lower Connecticut River tributaries and the lower Lake Champlain tributaries below the fall-line and/or below 150 feet elevation, as these areas are covered under separate summaries.

General types of fluvial communities:

High-elevation Headwater Streams: These streams are typically located in high elevation mountainous areas. They are small in size, having small drainage areas, and are located in steep valleys (typically > 4% slope). Valleys are confined, meaning the stream channel has little or no floodplain, and upland forest communities are adjacent to the channel, typically with no distinct riparian vegetative community present. Channel bed form is usually cascade over bedrock and boulders or step-pools over boulders and cobbles. Stream flow is fast and turbulent with white water common. Stream temperatures are typically very cold. Forest canopy completely shades the stream, and the food web of the system is based on inputs of organic material from the adjacent vegetation (e.g., leaves, twigs, branches). Large trees falling into the stream channel also provide important habitat features and channel bed stability, acting as cover and causing localized scour and deposition of stream sediments. Species that typically inhabit these streams include brook trout, slimy sculpin, northern spring salamander, northern dusky salamander, two-lined salamander, and numerous aquatic insects, including stoneflies and mayflies. SGCN species uniquely associated with these ecosystems include the water shrew, some specific mayfly and Odonata species and naturally reproducing populations of brook trout.

There are some headwater streams in high elevation areas that do not meet the above description. Small, low gradient streams are often found in ridgeline saddles and bowls. These streams are typically meandering, with alternating riffles and pools and gravel and sand substrates. Adjacent wetlands are often associated with these streams. These are typically still cold water systems, due to abundant groundwater feed and cooler climatic

conditions influenced by high elevation, and therefore often host many of the same species as the high gradient headwater streams. Invertebrate communities, however, are likely to be distinct from the higher gradient systems (Burnham 2005).

Mid-elevation Streams and Rivers: These streams are typically located in mid elevation areas where the steep mountains transition to the low gradient valleys. Stream channels are small to moderate in size, and are located in moderately steep valleys (typically 2-4% slope). Valleys are semi-confined, resulting in narrow floodplains. These floodplains may have narrow bands of distinct riparian vegetation, but quickly transition into upland forest communities. Channel bed form is typically step-pool or plane bed. Step-pool channels have short vertical drops over boulders and cobbles with channel spanning pools in between, which are typically dominated by cobbles and gravels. Plane bed systems lack distinct pools, and are primarily riffles, runs, and rapids over a mix of boulders, cobbles, and gravels. Stream flow is fast and somewhat turbulent with whitewater common. Stream temperatures are typically cold to cool. Forest canopy usually shades the stream but may not form a complete canopy over the channel. The aquatic food web in these channels is based largely on inputs of organic material from the adjacent vegetation (e.g., leaves, twigs, branches), though some mosses and algae are also present, providing primary production in the waterbody. Large trees falling into the stream channel and transported from upstream provide important habitat features and channel bed stability, acting as cover and causing localized scour and aggradation of the channel bed. Species that typically inhabit these streams include brook trout, slimy sculpin, blacknose dace, white sucker, longnose dace, northern dusky salamander, two-lined salamander, and numerous aquatic insects. SGCN species uniquely associated with this habitat potentially include naturally reproducing populations of brook trout, as well as American eel, Atlantic salmon, wood turtle, river otter, water shrew, mink, muskrat and some specific mayfly and Odonata species.

Low-elevation Large Valley Rivers: These rivers are located at low elevations in Vermont's large river valleys, such as the Winooski, Lamoille, Mississquoi, Barton, Otter, and Batten Kill. This description does not include those portions of the large Lake Champlain tributaries located below the fall-line. These river channels are moderate to large in size, and are located in low gradient valleys (typically <2% slope). Valleys are unconfined, and floodplains are broad and flat. Adjacent wetlands are common in the floodplains. These floodplains have extensive distinct riparian vegetation and often include unique natural communities, such as floodplain forest, marsh, and shoreline communities. The channel bed undulates vertically, being composed of alternating riffles and pools or dune-ripple formations. Riffle-pool systems are dominated by gravels and sands, where dune-ripple systems are usually dominated by sands and silts. Stream flow is slow and flat with whitewater rarely present. Stream temperatures are typically cool to warm. Forest canopy shades the nearbank area of the channel but does not form a complete canopy over the channel. The aquatic food web in these channels is based on inputs of organic material from the adjacent vegetation (e.g., leaves, twigs, and branches) and transported from upstream, as well as instream aquatic vegetation. Large trees falling into the stream channel and transported from upstream provide important habitat features, especially since coarser streambed substrates are typically lacking in these systems. Woody debris provides cover and substrate for aquatic biota, as well as helping to maintain channel bed stability and enhancing habitat complexity with localized scour and aggradation of the channel bed. Numerous cool and warmwater fish species inhabit these streams, including bluntnose minnow, fallfish,

blacknose dace, creek chub, tessellated darter, and white sucker, as well as several mussel species. SGCN species uniquely associated with this habitat include American eel, sea lamprey (Connecticut River drainage only), Atlantic salmon (landlocked and anadromous), blackchin shiner, bridle shiner, blacknose shiner, redfin pickerel, stonecat, giant floater, cylindrical floater, elktoe, brook floater, wood turtle, river otter, mink, muskrat, bald eagle, osprey and some specific species of freshwater snails and Odonata.

Low Elevation Small Streams: These streams are small in size, but located in low gradient valleys (<2% slope) at low elevations (but above the Lake Champlain fall-line and 150 feet in elevation), and typically drain directly into a large waterbody (e.g., Lake Memphremagog, large tributaries of Lake Champlain). Valleys are unconfined, and floodplains are broad, relative to stream size, and flat. These floodplains have distinct riparian vegetation on the valley floor, and transition into upland forest communities on the valley side slopes. Adjacent wetlands are common in the floodplain. The channel bed undulates vertically, being composed of alternating riffles and pools or dune-ripple formations. Riffle-pool systems are dominated by gravels and sands, where dune-ripple systems are dominated by sands and silts. Stream flow is slow and flat. Stream temperatures are typically cool to warm. Streamside vegetation shades the channel, usually forming a closed canopy over the channel. The aquatic food web in these channels is based primarily on inputs of organic material from the adjacent vegetation (e.g., leaves, twigs, branches). Large trees falling into the stream channel provide important habitat features, especially since coarser streambed substrates are typically lacking in these systems. Woody debris provides cover and substrate for aquatic biota, as well as helping to maintain channel bed stability and enhancing habitat complexity with localized scour and aggradation of the channel bed. Typically cool and warmwater fish species inhabit these streams, such as blacknose dace and creek chub. SGCN species uniquely associated with this habitat include American eel, Atlantic salmon (landlocked), blackchin shiner, brassy minnow, bridle shiner, redfin pickerel, stonecat and some specific species of Odonata.

Landscape Fluvial Condition

Current Condition: In general, fluvial ecosystems in Vermont are most affected by conversion, alteration, and fragmentation. Typically steeper mountainous streams at high elevations, less suited for human development, have well forested riparian areas with cold, clean water and stable stream channels. Recreational activities and their associated development, such as ski resorts, and forestry are the land uses most common in these areas that may affect stream habitats. Mid and low elevation streams and rivers are more likely to be impacted by human land uses, including clearing of riparian vegetation, alteration of stream channels, and direct inputs of toxins, excess nutrients, and sediments. These impacts are related primarily to roads, residences, commercial development, and agriculture, the latter being especially extensive in the lower valleys of the Lake Champlain and Connecticut River tributaries.

The fragmentation of fluvial ecosystems is extensive in Vermont. A recent inventory of more than 200 culverts in the White River watershed showed more than half of the culverts inventoried were barriers to the upstream movement of all fish species present in the waterbody all of the time, and the other half of the culverts inventoried were barriers to some species and/or barriers some of the time (i.e. under certain stream flows when species

movement is likely to occur) (Vermont Fish and Wildlife 2004). In addition, most of Vermont's major rivers have large flood control and/or hydroelectric dams on them, with numerous smaller dams found throughout Vermont's smaller streams. Such structures influence local habitat conditions, restrict movement of aquatic species, and alter downstream flood and sediment transport processes. The Vermont Agency of Transportation is currently funding research regarding the extent of stream impediments and how to address issues such as culvert sizing and retrofits.

Some aquatic habitat degradation is due to lasting effects of historic land uses. During the last two centuries land use in Vermont has been dominated by extensive land clearing for forestry and agriculture, aggressive stream clearing of boulders and coarse woody debris for stream log driving and flood control, and by dam construction and railroad and road building. Such activities have resulted in the relocation and straightening of stream and river channels throughout Vermont, resulting in an overall decrease in available fluvial habitat. For example, a recent assessment of the upper White River watershed between Granville and Stockbridge shows that 93% (17.8 of 19.1 miles) of the length of the mainstem White River has been channelized in the past, 13 miles of which are still in channelized form (Vermont Department of Environmental Conservation 2004). In addition, the extensive removal of natural substrates, such as boulders and coarse woody debris, has reduced overall stream habitat complexity throughout the Northeast (Verry 2000). The hard armoring of channels combined with the construction of flood control dams means that many of Vermont's river channels have not regained their historic sinuosity. Furthermore, the slow regrowth of the Northeast's forests means that large woody debris contribution to stream and river channels has yet to reach historic levels (Verry 2000). Zadock Thompson, who served as Vermont's Assistant State Geologist and State Naturalist in the mid 1800's, offers first-hand insight on the impacts Vermont's intensive land use history has had on the streams and rivers of the state.

> "Before the country was cleared, the whole surface of the ground was deeply covered with leaves, limbs, and logs, and the channels of all the smaller streams were much obstructed by the same. The consequence was that, when the snows dissolved in the spring, or the rains fell in the summer, the waters were retained among the leaves, or retarded by the other obstructions, so as to pass off slowly, and the streams were kept up, nearly uniform as to the size during the whole year. But since the country has become settled, and the obstructions, which retarded the water, removed by freshets, when the snow melts or the rains fall, the waters run off from the surface of the ground quickly, the streams are raised suddenly, run rapidly, and soon subside. In consequence of the water being thus carried off more rapidly, the streams would be smaller than formerly during a considerable part of the year, even though the quantity of water be the same. It is a well known fact that the freshets in Vermont are more sudden and violent than when the country was new."
> **Zadock Thompson, Natural History of Vermont, 1853**

Desired Condition (SGCN Needs): Most of Vermont's aquatic species rely on streams and rivers that provide clean water, a diversity of in-channel habitat, and unobstructed movement upstream and downstream between habitats.

Characteristics of water quality vary in streams from clear and cold with little buffering capacity in most mountain streams to somewhat turbid and cool or warm with greater buffering capacity in the large valley rivers. Species found in the mountain headwater and mid-elevation streams are typically dependent on cold well-oxygenated waters. Some species

found in the headwater streams, such as brook trout, are fairly acid tolerant. Low-elevation rivers and streams typically support species with warmer water temperature requirements and tolerance to some turbidity and nutrient enrichment.

Whether in the mountain streams or large valley rivers, most aquatic SGCN require instream cover and/or substrates for protection and colonization. Most fish species seek cover for predator avoidance and to reduce metabolic (energy) demands. Mussels need firm substrates for colonization, as do most aquatic insect species. Substrates utilized may vary from rock to sand to instream aquatic vegetation, depending on the species, but all species can suffer from excessive fine sediments in the channel that can bury instream substrates. Loss of complexity and solid substrates for cover and colonization reduces overall habitat availability and quality. In addition, many species use instream substrates for reproduction. For example, brook trout deposit eggs in gravels on the channel bottom, whereas many shiner species utilize aquatic vegetation to spawn. Embedding of substrates, destabilization of substrates due to chronic channel instability, and direct removal of substrates all impact aquatic habitats and species. The mammal and bird species associated with streams and rivers, such as bald eagle, osprey, mink, river otter, muskrat, and water shrew, are also impacted when aquatic species are affected, as these species rely on aquatic species as prey. In addition, muskrat, otter, mink, and particularly water shrew, utilize undercut streambanks and other stable bank areas for denning. Chronic channel instability that results in substantial streambank erosion may reduce potential denning areas for these species.

Some of the SGCN uniquely associated with streams and rivers have extensive movement requirements, such as the Atlantic salmon and American eel, migrating from freshwater streams and rivers to the Atlantic Ocean and back again. Other species move shorter distances, but still require habitat connectivity to be able to access spawning, rearing, and seasonal habitats. There are also species, such as wood turtle and river otter, that move back and forth between the aquatic and nearby terrestrial habitats both daily and seasonally. Thus, it is important to maintain habitat connectivity both longitudinally along the river channel and adjacent riparian lands, as well as laterally between the aquatic habitat and the riparian habitat.

Ideally, Vermont's rivers and streams would provide an interconnected network of habitats in which species can move upstream and downstream as needed to fulfill seasonal and diurnal habitat needs. Instream structure would provide an abundance and diversity of habitat niches and be naturally maintained by physical stream processes over time (e.g., flooding, balanced sediment transport). Streams and rivers would be connected to the adjacent riparian habitats, which in turn function to protect and provide for fluvial habitat components, such as instream coarse woody debris and pollutant removal from surface runoff.

It is difficult to quantify the number of miles of intact fluvial and riparian habitat needed to conserve SGCN as the exact distribution of all SGCN associated with fluvial habitats is not known at this time.

Streams and Rivers provides habitat for 25 species and invertebrate groups of greatest conservation need.

Species of Greatest Conservation Need in Fluvial Habitat

High Priority

Bald eagle (Haliaeetus leucocephalus)
Fowlers toad (Bufo fowleri)
Wood turtle (Clemmys insculpata)
River/stream Odonata Group [dragonflies]
Elktoe (Alasmidonta marginata)
Giant floater
Cylindrical floater
Brook floater
Dwarf wedge mussels Group
Freshwater Snails Group
Mayflies/Stoneflies Group
American eel (Anguilla rostrata)
Atlantic salmon (anadromous) (Salmo salar)
Brassy minnow (Hybognathus hankinsoni)
Bridle shiner (Notropis bifrenatus)
Blackchin shiner (Notropis heterodon)
Blacknose shiner (Notropis heterolepis)
Stonecat (Noturus flavus)

Medium Priority

Osprey (Pandion haliaetus)
Northern river otter (Lutra canadensis)
Muskrat (Ondatra zibethicus)
Mink (Mustella vison)
Water shrew
Redfin pickerel (Esox americanus)
Brook trout (Salvelinus fontinalis)
Atlantic salmon (landlocked) (Salmo salar)

SGCN Notes: Lake sturgeon is addressed in the Lake Champlain tributaries summary. Plant SGCN not listed here: 16 species. The SGCN invertebrate groups listed here contain numerous species. For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/Info Need Category	Problem/Info Need Detail	Rank
Habitat Conversion	Channel straightening and maintenance of such that reduces overall stream/river miles, loss of floodplain connectivity, impoundment of river channels	High
Habitat Alteration	Floodplain and stream channel manipulation (e.g., riprap); degradation of water quality, loss of physical habitat structure, temperature alteration	High
Habitat Fragmentation	Interruption of movement to and from breeding, feeding, and seasonal habitats via alteration and conversion; roadways, and impassable dams and culverts	High
Sedimentation	Alteration of habitat (e.g., spawning areas); smothering of organisms	High
Pollution	Acid rain threatens higher elevation habitats, nutrient overloading is common in lower elevation areas, other toxins are suspected but data is unavailable to assess impacts	High
Pollution	Catastrophic spills: toxic chemicals (e.g., chlorine) and contaminants limit mid and lower elevation habitats, especially where roadways and development are in close proximity to stream channels	High
Invasion by Exotic Species	inter-species competition for habitat and food; predation on native species, loss of native riparian vegetation community from invasive competition.	High
Hydrologic Alteration	Stream flow regulation at dams, watershed development, and withdrawals alter hydrographs and instream flows	High
Inventory need	Minimal data is available on the distribution in Vermont of many fluvial-associated SGCN	Med

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Conduct inventories of known and potential SGCN sites		ANR, USFS, USFWS, TU	SWG, TU, EPA, NRCS
Provide technical assistance to anglers and other conservation groups on invasive exotic management and eradication	No new introductions of invasives exotic species that impact fluvial habitats	TNC (plants), angler groups, baitfish dealers	NRCS, LCBP
Provide technical assistance to private landowners and watershed organizations on riparian and fluvial habitat conservation	Increase in number of stream/river miles in "reference" condition, as per VTANR Stream Geomorphic Assessments	ANR, NRCS, FSA,	Clean & Clear, LCBP, LIP, CRP, WRP, EQIP
Provide financial incentives to private landowners for conservation and protection of SGCN and their riparian and fluvial habitat	Increase in number of stream/river miles and associated riparian areas that are conserved and/or restored	ANR, NRCS, USFWS, FSA	LIP, WHIP, USFWS, CRP, CREP, WRP
Provide technical assistance to town and regional planning organizations. Distribute *Conserving Vermont's Natural Heritage* (Austin et.al. 2004)	Increase in number of towns incorporating riparian and aquatic habitat conservation into planning and zoning; and increase in number of stream/river miles under regulated development that are in "reference" condition, as per VTANR Stream Geomorphic Assessments	ANR, ACCD, VLCT, AVCC, TNC, watershed organizations	ACCD planning grants, LCBP, SWG
Monitor, protect and restore water quality from excessive nutrient sediment loading, other pollutants.	Miles of SGCN habitat meeting water quality standards.	ANR, USFWS, NRCS, USFS, Lake & Watershed Associations	ANR. Clean & Clear (in L. Champlain Basin)
Support efforts to reduce the long range transport of acid rain pollutants to Vermont.	Reduction in acidity levels in monitored high elevation waterbodies	ANR, USFS, AG office, Legislature, Congress.	
Identify pollutant sources posing risks of catastrophic spills to SGCN populations and implement programs to minimize those risks		ANR, Agency of Agric., VTrans, wastewater facilities, town road managers	
Technical assistance to state and federal land management agencies to ensure consistency in program implementation and sensitivity to SGCN requirements	Increase in % or number of state and federal land management plans that provide for fluvial and riparian habitat conservation	ANR, USFS, USFWS, ACOE, VTrans	
Support efforts to manage flow regulation projects to minimize impacts on SGCN	Decrease in number of river miles with altered flow regimes	ANR, ACOE, VT Dam Task Force, USFWS, watershed orgs	LBCP, USFWS, ACOE, SWG
Provide technical assistance to VTrans, towns, and private landowners to identify and maintain (or restore) aquatic habitat connectivity	Increase in % or number of road crossings that do not impede aquatic organism movement	ANR, VTrans, Better Back Roads, USFWS, USFS, AVCC	SWG, USFWS, LCBP, VTrans

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the lead column

Plan or planning entity	Goal/Scope of plan	Lead
ANR State Lands Management Plans	Management practices for ANR-owned lands	FPR, VFWD
ANR Stream Geomorphic Assessments	Stream and riparian condition inventories	ANR
Opportunities for Action – LCBP	Aquatic resource conservation for the Lake Champlain Basin	LCBP
Strategic Plan for the Restoration of Atlantic Salmon to the Connecticut River.	"Protect, conserve, restore and enhance the Atlantic salmon population in the Connecticut River for the public benefit, including recreational fishing."	CRASC

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Vermont's Wildlife Action Plan

November 22, 2005

Chapter 5
Implementation, Monitoring & Review

Monitoring & Adaptive Management

This section of the Action Plan outlines plans to track the status of Species of Greatest Conservation Need (SGCN), evaluate and improve the effectiveness of conservation strategies and provide data to keep the Action Plan report up-to-date.

Adaptive Management

Elements five and six of the Eight Required Elements of a Action Plan outline Congressional expectations for monitoring and plan review in the Action Plan report. Specifically element five requires that states provide:

> Proposed plans for monitoring species [of Greatest Conservation Need] and their habitats, for monitoring the effectiveness of the conservation actions proposed in the 4th element [strategies], and for adapting these conservation actions to respond appropriately to new information or changing conditions.
>
> Element six requires that states provide:
> Descriptions of procedures to review the strategy at intervals not to exceed ten years.

Just as a doctor checks a patient's blood pressure at every visit, wildlife monitoring allows biologists to identify changes in the health of wildlife (e.g., population changes, the spread of disease, changes to the landscape). Wildlife biologists can also monitor the impact of strategies to determine effectiveness just as doctors assess the efficacy of treatments and compare competing medical practices. The goal is not simply to cure one patient but improve the understanding and standard of care for all patients.

Taken together elements five and six speak to the need for an adaptive management program to track changes in wildlife populations and hone the effectiveness of conservation strategies. Adaptive management is a formalized method for learning from experience (Fig 1) where design, management, and monitoring are integrated to test assumptions in order to adapt, learn and improve (Salafsky et. al. 2001). Instead of relying on a fixed conservation goal and an inflexible plan for achieving the goal, adaptive management allows for midcourse corrections.

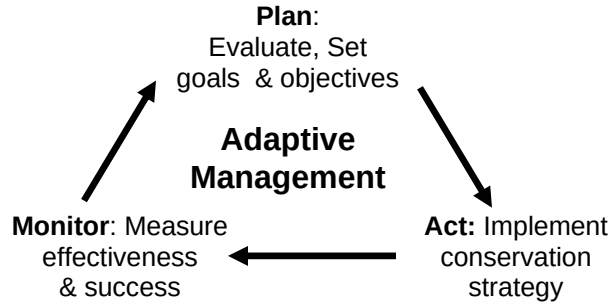

Fig 5-1 Basic steps in an adaptive management process (adapted from Noss & Cooperider 1994)

In the initial **planning** phase our Action Plan Species Teams and the Integration Team spent many hours evaluating data, identifying problems limiting SGCN and habitats. They

then developed hundreds of conservation strategies and research recommendations that the Vermont Fish & Wildlife Department (VFWD), Conservation Partners and others could begin to implement during an **action** phase. Measuring the effectiveness and success of the plans and actions occurs in the **monitoring** phase. The cycle begins anew with the fine-tuning of goals and objectives before action is renewed.

Monitoring is a linchpin in the adaptive management process. Monitoring is also a complex, demanding and never-ending task. With VFWD, sister departments at the Agency of Natural Resources, conservation partners, other local and federal agencies, academic institutions, non-governmental organizations and even individuals engaged in a broad range of wildlife and habitat monitoring projects, before any new monitoring programs are initiated a review of existing efforts and careful planning are required.

Current Survey and Monitoring of Vermont Wildlife

A list of current survey and monitoring projects that may provide relevant data for the conservation and management of SGCN is remarkably long. The Fish & Wildlife Department along with the Department of Environmental Conservation (DEC) and other conservation partners monitor state and federally designated threatened and endangered species, and some rare species and uncommon natural communities. VTrans in coordination with VFWD is recording road mortality data on the state highway system. Additionally data from wildlife surveys are regularly collected by VFWD's Nongame & Natural Heritage Program (NNHP). Many of these surveys, however, are not repeated enough to provide population trends, nor are they sufficient in extent to provide statewide estimates. In general baseline distribution and abundance estimates for SGCN has never been determined. Population trends, habitat availability or impacts of threats are similarly unknown. Nonetheless, any new monitoring efforts should build on these and other existing monitoring programs, as well as the expertise of the VFWD, conservation partners and others within Vermont, regionally and nationally.

The following is a cursory review of survey and monitoring efforts in Vermont that may benefit SGCN conservation and management. It is not meant to be comprehensive.

Birds: Birds are the most studied and best monitored group of wildlife in Vermont—and nationally. Key Vermont monitoring efforts include the Breeding Bird Atlas (Vermont Institute of Natural Science (VINS) & VFWD—sponsored by the State Wildlife Grants program (SWG)), the annual Breeding Bird Surveys (NABCI), and the Common Tern, the Important Bird Area and the Marshbird Monitoring programs (Audubon). The Vermont Institute of Natural Science has maintained bird data since 1974 with the eBird Online database. VINS also manages the Mountain Birdwatch, Forest Bird Monitoring Project, Loon Recovery Project, the Peregrine Falcon recovery program (with VFWD) and monitors of Bicknell's thrush on Hispaniola and of bobolink in Paraguay and Bolivia. A multi-party effort is underway to restore and monitor bald eagles in state. Other species-specific and guild-specific monitoring occurs for, osprey, American woodcock, turkey, waterfowl, and double crested cormorants. Regional and national monitoring efforts include the Breeding Bird Survey and Atlantic Coast Joint Venture.

Fish: Historically referred to as "vermin fishes" (Greeley 1930) and "trash fish," the species not prized by anglers have not been the focus of fisheries biologists either. More recently a variety of entities have been conducting surveys on a broader range of fish including some SGCN. *Fishes of Vermont* (Langdon et. al. in prep) is supported by DEC's 9,000 record fish distribution database. Non-native invasive species, such as alewife and zebra mussel, are also the subject regular surveys.

Invertebrates: Mussels may be best monitored of all Vermont invertebrates with semi-permanent survey stations in place. The SWG sponsored Vermont Butterfly Survey; a citizen science-based monitoring program coordinated by VINS is Vermont's first state-wide systematic inventory of invertebrate species. Some invertebrate monitoring occurs for pest species (FPR and Agency of Agriculture), as indicators of water quality (DEC) for several threatened and endangered invertebrates such as tiger beetles (3 species) and mollusks (10 species). DEC's water quality monitoring employs an index of integrity based on the composition of invertebrates in water bodies. Some taxa-wide surveys include moth surveys at Ethan Allen Firing Range (Griggs and Grehan 2000) and Mount Mansfield (Griggs and Grehan 2001). Nevertheless, most invertebrate taxa remain largely uninvestigated and unknown in Vermont. There remains a serious need for basic background survey work to document the presence and distribution of major orders of insects in Vermont, notably Odonata (dragonflies and damselflies).

Mammals: Deer, moose, black bear and furbearing species are closely monitored by VFWD. Keeping Track, Inc. has citizen monitoring teams in many sections of the state and region collecting long-term data on black bear, bobcat, moose, fisher, river otter, and mink. Threatened and Endangered species include American marten, and Canada lynx. Monitoring of several bats species in certain regions of the state has begun in the past three years funded by SWG. Most other mammals, particularly small mammals, have not been monitored historically and no baseline data is available. Numerous individual localized surveys have occurred in the past but on ongoing, repeatable monitoring have not taken place.

Reptiles & Amphibians: The Vermont Reptile and Amphibian Atlas (Middlebury College) is an ongoing citizen science research and monitoring project begun in 1995 to determine the distribution of reptiles and amphibians in Vermont. Additionally monitoring for some threatened and endangered reptiles and amphibians is conducted by VFWD, and DEC initiated Northern Leopard Frog surveys in 1996 in response to reports of malformed frogs in the Lake Champlain Basin.

Current Habitat and Vegetation Monitoring in Vermont

- Coordinated wildlife surveys (songbirds, reptiles, amphibians, and selected mammals—black bear, fisher, and bobcat) were conducted statewide in 2003-2004 by the Vermont Cooperative Fish and Wildlife Research Unit (VT Coop). These surveys provide a consistent statewide, on-the-ground baseline data for monitoring and results will inform predictive occurrence models for multiple taxa (T. Donovan, VT Coop), personal communication).

- The Ambient Biomonitoring Network program was established by DEC's Water Quality Division 1985 to: monitor long-term trends in water quality as revealed in changes over time to ambient fish and aquatic macroinvertebrate communities; to evaluate site-specific impacts of point and non-point discharges to aquatic biological communities, and to establish baseline data to assist in establishing Vermont-specific biological criteria for water quality classification attainment determinations in lakes, wetlands, rivers, and streams (DEC 2004b)

- The Long-Term Water Quality and Biological Monitoring Project for Lake Champlain began in 1992. A joint effort shared by DEC and the New York State Department of Environmental Conservation the n 1995, the primary purpose of the project is to detect long-term environmental change in the lake.

- The Vermont Wetlands Bioassessment Project is a coordinated effort between DEC and NNHP to document and understand biological and physical characteristics associated with vernal (seasonal) pools and northern white cedar swamps in the state (DEC 2004b).

- A joint Agency of Transportation-VFWD wildlife road crossing project is identifying significant wildlife travel corridors and road crossings to help reduce roadkill and improve future road design and placement.

- The Forest Inventory and Analysis (FIA) is a recurring inventory conducted by the US Forest Service's FIA Unit of the Northeastern Research Station in conjunction with the Vermont Department of Forests, Parks & Recreation. The inventory provides data for measuring changes and trends in the extent and condition of forest land, associated timber volumes, and rates of timber growth, mortality, and removal (Wharton et. al 2003). Though this information is developed primarily for timber management and does not track old-growth forests it does provide important information to wildlife managers.

- The National Resources Inventory program of the National Resource Conservation Service (NRCS) collects and distributes data on a state, regional and national level about the status, condition, and trends of soil, water, and related resources. The focus is primarily on agricultural lands with data includes available land-use types and land-use changes, erosion, and wetlands.

- The Gap Analysis Project (GAP) sponsored by the US Geological Survey (USGS) provides nationwide land cover data that can be used to identify lands important to wildlife and the extent to which habitat for native animal and plant species are being protected. A revised Vermont/New Hampshire GAP report is expected in 2007 (USGS 2005).

- The Vermont Monitoring Cooperative (VMC) coordinates numerous monitoring and survey operations in Vermont focusing primarily on forest health issues.

- The Nongame and Natural Heritage Program conducts ongoing natural community inventory identifies and maps natural community types statewide. A survey and

report on the distribution, ecology, classification of hardwood swamps was completed in 2004. NNHP also updates and maintains data on known and mapped significant natural communities, maps natural communities on state land and works with non-governmental organization partners to map or identify significant natural communities on NGO lands.

- Habitat Loss and fragmentation: the Vermont Forum on Sprawl can provide research, tools and training to track changes to habitat due to development. Also the NRCS State Office is creating a GIS layer urban and built-up lands by County. This GIS-based data may be helpful in efforts to assess habitat fragmentation

What Kind of Monitoring Is Needed to Successfully Implement the Wildlife Action Plan and Conserve SGCN?

In addition to monitoring the status, trends and problems impacting SGCN populations, an adaptive management program requires implementation, effectiveness and validation monitoring (Derr et. al 2005) to ensure that goals and objectives are achieved and SWG funds are spent wisely:

- **Implementation Monitoring:** Assessing the degree to which a conservation strategy was implemented (e.g., were trees planted in a riparian area?).
- **Effectiveness Monitoring:** Measuring the impact or effect of a conservation strategy (e.g., did planting trees in the riparian area stabilize the streambank?—the strategy's objective).
- **Validation Monitoring:** Checking the assumptions upon which the conservation strategy was based (e.g., did stabilizing the streambank actually reduce sedimentation of spawning beds downstream, producing more salmon fry? —the strategy's objective). Validation monitoring can help answer questions such as: Is the conservation strategy worth repeating or might another strategy produce results faster, more economically, or meet with better social acceptance?

The Fish & Wildlife Department already has implementation and financial monitoring protocols operating for State Wildlife Grants-funded projects. SWG project managers have 90 days from completion of a project to submit a draft report to the VFWD Division Director associated with each project. Division Directors review and edit the report and are responsible for final approval of all reports. Upon final approval reports are submitted to the US Fish & Wildlife Service Division of Federal Assistance for review.

SWG project managers review expenditure tracking reports report according to a regular schedule each year. Financial reporting of all in-kind match is required annually. Project managers are responsible for securing this information from third-parties organizations and contractors. The VFWD business office also tracks and documents third party match.

Though critically important, effectiveness and validation monitoring may not be practical or possible for each SWG funded conservation project (e.g., small scale, dispersed, technical support). Effectiveness may take years to determine (e.g., waiting for trees to grow to

sufficient height to shade a stream) and validation of a strategy's success may be difficult to tease out from other problems impacting a species or a site (e.g., the strategy did produce more salmon fry but the results were masked two unseasonably hot summers and an accidental chemical spill). SWG administrators and planners may want to focus conservation efforts on specific species and/or regions of the state (e.g., selected watersheds) for periods of time sufficient to ensure that the cumulative conservation efforts can be measured effectively. The demonstration projects can be rolled out to the elsewhere in the state after evaluation proves their utility.

Primary Challenges to the Implementation of a SGCN Monitoring Program

Pursuant to Congressional requirements Action Plan technical teams identified priority monitoring needs for every SGCN. Performance measures were also developed aid in implementation and effectiveness monitoring of Action Plan conservation strategies. However plans to implement a comprehensive monitoring program will first have to address four overarching issues:

1. Financial and staffing resources are insufficient to manage the current volume of wildlife survey and monitoring data developed by resource professionals.
2. Little data exists for most SGCN (lack of data was one criterion for selection as a Species of Greatest Conservation Need). Developing baseline distribution and abundance estimates is the first step in monitoring populations.
3. Despite SWG funds, financial resources are insufficient to support individual monitoring programs for 143 vertebrate and 188 invertebrate Species of Greatest Conservation Need.
4. Consistent protocols and systems for data collection and data sharing do not exist. Without the ability to collect and share data opportunities are lost and efforts can be duplicated.

To be successful, any Action Plan monitoring program will need to address these four challenges. It is hoped that the Action Plan and SWG funds will help direct future research and development efforts, facilitate the integration of existing monitoring projects across organizations and improve collaboration.

Adapting Conservation Actions in Response to New Information or Changing Conditions

White-tailed deer, the most closely watched animal in the state, underscores the need to adapt management to changing conditions and information. Vermont's deer management plan was crafted by many experts with seemingly limitless oversight and review. The recent finding of chronic wasting disease in the New York deer population, however, significantly changed the landscape for deer management in the region. New legislation, rules and procedures to protect the herd and the public were designed and implemented within weeks of confirmation of the initial findings. Action Plan monitoring and review procedures will be the primary tool to identify new information, changing conditions and the need for

adaptation. It will act at three scales—individual conservation projects, ongoing plan-wide adaptations (year-to-year), and 10-year plan review.

The iterative nature of adaptive management (plan→ implement→ monitor→ evaluate→ plan→…) builds opportunities to adapt directly into Action Plan project management activities. Project reporting, monitoring and the increased communication and coordination among conservation partners fostered by Action Plan implementation will feed into overall Action Plan management from year-to-year. All this information will be used to formally review and revise the Action Plan on a 10-year cycle (see also Action Plan Review later in this chapter).

Plans for Monitoring SGCN, Habitats and Conservation Actions

A statewide wildlife monitoring and adaptive management program is needed to measure progress toward desired outcomes for SGCN, their habitats, to evaluate and improve the effectiveness of conservation strategies, to adapt conservation actions to new information or changing conditions and to sustain the effectiveness of strategies in attaining desired outcomes. There was insufficient time to develop such a complex and important program prior to the October 1, 2005 deadline for Action Plan completion. In the coming months the Vermont Fish & Wildlife Department will initiate a collaborative process to develop and implement a statewide wildlife monitoring and adaptive management program to answer the following questions (adapted from USFS 2004, Schoonmaker and Luscombe 2005):

- What are the status and trends of SGCN, their habitats, and other important communities for which there are not specific anticipated outcomes (e.g., invasive species)?
- What are the areas of land and water within each biophysical region that will provide that provide the best opportunities for conservation actions for SGCN and habitats?
- Were planned conservation actions carried out?
- Are SGCN and habitats responding to the conservation actions as anticipated?
- How does new information compare with previous information or expectations?
- Who is implementing these actions?
- What are the costs of conservation actions?
- Are objectives consistently being achieved with outcomes as anticipated?
- How are stakeholders responding to conservation actions and Action Plan implementation?

Major guidelines for the development of this Action Plan monitoring program include:

Collaboration: Planning to develop and implement a Species of Greatest Conservation Need monitoring program should begin with collaboration. As with the design of conservation strategies in this report, successful monitoring of SGCN will require the help

and cooperation of many partners. Many current survey and monitoring efforts are conducted by interagency and inter-organizational efforts locally, regionally and nationally. These collaborations share expertise, make the best of limited resources, prevent redundancies of effort, increase the level of expertise of volunteers and improve program quality and effectiveness.

How much collaboration is needed? As many entities as possible should be brought together to develop consistent monitoring protocols and systems for data collection and data sharing, identifying indicators for species and habitats and goals and objectives for SGCN conservation.

The need for collaborative fund raising efforts cannot be overstated. Sufficient funds are imperative for monitoring to be effective. The State Wildlife Grants program currently is not sufficiently funded to finance the monitoring needs outlined here. Even if it was, state-side match is insufficient. A collaborative effort of agencies, conservation partners, local, state and federal elected officials, NGOs and private businesses and individuals is needed to develop adequate funding mechanisms at the state and federal levels.

Coordination: The coordination of monitoring programs, summarizing of results and sharing data with resources managers, researchers, local, state and national decision makers, educators, stakeholders and the general public will be essential to the success of a monitoring collaborative, to Action Plan efforts and to wildlife conservation in general. Solid coordination throughout the implementation phase will also make revisions of the Action Plan report straightforward and uncomplicated.

Baseline data: Distribution and abundance information for SGCN and their habitats are needed in order to establish meaningful baseline data. This data will be used to determine measurable goals and objectives that are the foundation of monitoring priorities.

Indicators: Monitoring every SGCN, their habitats, problems and the effects of conservation actions is too costly and time-consuming to ever complete. Relevant indicators that are measurable, precise, consistent, and sensitive are needed as coarse filters to make monitoring useful and manageable. Indicators should also be of appropriate scale, easily obtained and obvious in meaning so that results can be supported by a broad array of users.

Citizen Science: Successful monitoring projects such as VINS' Bird Atlas, Butterfly Survey and LoonWatch, the Vermont Reptile and Amphibian Atlas, Keeping Track Inc.'s big mammal monitoring, Audubon's Christmas Bird Counts, Marshbird Monitoring, and Great Backyard Bird Count and VFWD's Big Game Report Stations provide multiple benefits that should be considered in the development of new monitoring efforts. In addition to the direct benefits—improved wildlife knowledge—citizen-based monitoring also provides wildlife education through active field work on local projects, boosts awareness of and involvement in natural resource protection at the community level, and can be highly cost-effective.

Resources for Developing Vermont's Action Plan Monitoring Program

Baseline Wildlife Data and Predictive Models for Wildlife Distribution and Land-Use Change: A long-term study by the VT Coop will soon help determine the distribution of a diverse array of terrestrial species: predict how land use will change over time; and, predict how occurrence of biodiversity will change in response to land use change (T. Donovan, VT Coop, personal communication). In 2003-2004 coordinated wildlife assessments (songbirds, reptiles, amphibians, and selected mammals—black bear, fisher, and bobcat) were conducted statewide. Results will inform predictive occurrence models for multiple taxa. Importantly, these surveys provide the first statewide, on-the-ground baseline data for monitoring changes in biodiversity over time. Land use change will be modeled under multiple policy scenarios, including no change in current policies. The corresponding impact on biodiversity will be quantified for each policy scenario. Finally, spatial optimization methods will be used to identify land use patterns that are optimal for conserving an array of species, subject to socio-economic constraints. The result will be a decision-making tool that informs stakeholders of how projected land use change scenarios will likely affect different levels of biodiversity. The Unit intends to repeat these surveys on a 5-10 year cycle for long-term monitoring purposes.

Habitat-Based Monitoring for Assessing Conservation Strategies: *Habitat Monitoring: an Approach for Reporting Status and Trends for State Comprehensive Wildlife Conservation Strategies* (Schoonmaker and Luscombe 2005) was commissioned by Defenders of Wildlife expressly to help states develop their Action Plan monitoring programs. This report provides a framework to track and assess the effectiveness of conservation actions and to adapt proposed conservation actions as needed in response to new information and changing conditions. It includes guidance for developing conservation goals, building habitat baseline data, and detecting changes over time to measure outcomes. Species monitoring is not addressed in detail. The paper stresses the importance of building a constituency of involved stakeholders and ensuring that the development of a wildlife conservation strategy and monitoring program is a goal-driven process.

VMC as a Model for Coordination of Statewide SGCN Monitoring: The Vermont Monitoring Cooperative (VMC) (http://vmc.snr.uvm.edu) is a collaborative partnership that collects and pools information and data on Vermont's forested ecosystems. Participating cooperators from government, academic and private sectors, conduct research projects on a variety of topics including forest health, air quality and meteorology, wildlife and aquatic systems. The VMC makes the data and results from these projects available to other scientists, educators, resource managers and the general public through its online data library and card catalogue containing the data and metadata from more that 100 projects.

All-Bird Monitoring as a Model for Statewide SGCN Monitoring Programs: The science and reach of bird monitoring far exceeds monitoring programs for other taxa. The "All-Bird monitoring" programs coordinated by North American Bird Conservation Initiative (NABCII) (http://www.nabci-us.org/) should be the bases for bird monitoring in Vermont. Furthermore the development of monitoring protocols for other taxa can benefit from a review of these bird monitoring programs.

Reptile and Amphibian Monitoring: In addition to Vermont's Reptile and Amphibian Atlas, two other initiatives are developing monitoring protocols for reptiles and amphibians.

Partners in Amphibian and Reptile Conservation (PARC) (http://www.parcplace.org/) and Amphibian Research and Monitoring Initiative (ARMI) (http://armi.usgs.gov/). Both entities should be involved in the development of monitoring plans for Vermont.

Comprehensive Water Monitoring and Assessment Program: To ensure that states are responsible for implementing the Clean Water Act, the U.S. Environmental Protection Agency (EPA) requires that states develop a comprehensive water quality monitoring and assessment program to track environmental conditions and changes over time, to help set levels of protection in water quality standards, and to identify problem areas that are emerging or that need additional regulatory and non-regulatory actions to support water quality management decisions (EPA 2003)

Land Type Association Modeling/Mapping: In 2005 the Vermont Department of Forest, Parks and Recreation, The Nature Conservancy and the US Forest Service have started a project to define Land Type Associations (LTA) throughout the state. Land Type Associations describe landscapes of matrix communities (1,000's of acres) based on factors such as bedrock and surficial geology and soil types. The primary purpose of this project is to correlate LTA's w/ insect and disease outbreaks to aid forest management. Data from this project, particularly the baseline mapping data, can be helpful to wildlife and habitat monitoring.

The Montréal Process is an international working group formed in 1994 to develop and implement internationally agreed upon criteria and indicators for the conservation and sustainable management of temperate and boreal forests http://www.mpci.org/.

Data storage and data sharing: The volume of government (local, state, federal), NGO, and private sectors data available for plants, animals, ecosystems, climate, geology, hydrology, social and economic that could be used to conserve wildlife is simply huge. The management, storage and accessibility of monitoring data will be a significant issue for any coordinated monitoring efforts. Vermont's NNHP manages much of the current wildlife data in collected in Vermont but the program is already understaffed. Additional resources that may be of assistance in data storage and data sharing include:

The National Biological Information Infrastructure (NBII) (www.nbii.gov) is a broad, collaborative program led by the Center for Biological Informatics of the U.S. Geological Survey. The NBII links biological databases, information products, and analytical tools maintained by NBII partners and other contributors in government agencies, academic institutions, non-government organizations, and private industry. NBII facilitates also work on new standards, tools, and technologies that make it easier to find, integrate, and apply biological resources information.

NatureServe: (www.natureserve.org) represents an international network of biological inventories—known as natural heritage programs and conservation data centers—operating in all 50 U.S. states, Canada, Latin America and the Caribbean (NNHP is the Vermont affiliate to NatureServe). NatureServe collects and manages data on rare, threatened and endangered plants, animals, and ecosystems, establishes scientific standards for biological inventory and biodiversity data management, and develops data management tools.

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Action Plan: Implementation

Congressional intent for the Wildlife Action Plan project is to identify and address the needs of all wildlife species in the state that might require help in order to prevent their becoming threatened or endangered. The full import of the word "comprehensive" becomes overwhelmingly clear as numbers in this report are tallied. (1,349 problems identified, 593 conservation strategies (setting the stage for hundreds or thousands of potential conservation actions), for 143 vertebrate species, 188 invertebrates, 577 plants and more than 100 habitat/community/landscape categories). The next steps, conducting the recommended research, setting species and habitat goals and objectives, implementing strategies and designing and implementing the monitoring programs outlined in this report requires the continued help and support of all conservation partners—those that participated in the Action Plan development and new partners as well.

Congress has designated state Fish & Wildlife Departments as Action Plan and State Wildlife Grants (SWG) custodians because they are the entities mandated by state law to manage and protect wildlife. Custodial responsibilities include not only delivering the completed Action Plan by Oct 1, 2005 but also for regular review and updating of the Action Plan report and administrating SWG funds. To carry out these responsibilities the VFWD will assign sufficient staff and resources to this program to manage projects, coordinate efforts and monitor overall program operations.

The VFWD will take the lead in coordinating the implementation of the research and monitoring recommendations and conservation strategies described in this report. While the department may be responsible for implementing much of the research, monitoring and conservation strategies, it will be Conservation partners, however, that may be the more logical and appropriate leaders for other research and strategy implementation, due to their skills and expertise, staffing, history, location, available resources and constituencies.

The Action Plan will remain a work in progress for many years, an experiment in long-term multi-species conservation on a scale not experienced before. Much of the work in this document is ground breaking. Many of the species examined here have not received focused attention before. The next few cycles of implementation, review and updating of individual strategies and the Action Plan report overall will be the particularly important for working out kinks, testing methods, and improving aspects of the Action Plan.

Implementation and Participation

As a wildlife conservation plan for the entire state, the Action Plan includes some strategies that almost any individual or organization can implement. Any and all interested partners are encouraged to take part. Though many of these actions will not require the notification of VFWD, tracking the implementation and outcomes of each action is vital to the monitoring and adaptive management goals outlined elsewhere in this chapter. All participating partners are encouraged to consult with VFWD prior to taking action.

Impacts on other species, habitats and ecological processes and functions should always be considered when implementing conservation actions to benefit Species of Greatest

Conservation Need (SGCN). Implementation may also be subject to changing conditions and regulatory review (where required) and should be conducted in cooperation with land managers, land owners and key stakeholders. Large scale conservation efforts (e.g., broad scale monitoring) should be coordinated through VFWD, interagency workgroups and formal agreements where applicable.

Coordination and Collaboration

As noted throughout this report, coordination of efforts is vital to leveraging available resources to ensure maximum wildlife benefit. VFWD will take the lead in facilitating communications among Conservation Partners, including local, state and federal agencies, through email networks, SWG annual reporting and a yearly conservation partner meeting open to any and all interested parties.

Coordination between states (regionally and nationally) will be spearheaded by the International Association of Fish & Wildlife Agencies (IAFWA) and the US Fish & Wildlife Service. Plans are already underway to help states effectively implement their Action Plans, to facilitate projects spanning multiple states and to improve agency capacity to implement their Action Plans (IAFWA 2005).

Prioritizing Conservation Need

During the identification and assessment of SGCN our Action Plan technical teams began the process to prioritize conservation need through the following actions: SGCN were assigned either medium or high priority status (low priority species are deemed relatively secure for now, see Action Plan development, chapter 3 for ranking criteria), species conservation strategies, research and monitoring needs and habitat problems were ranked medium and high based on the combined expertise of each technical team.

We did not prioritize needs and strategies beyond this. The Action Plan is a conservation guide for the state—not only VFWD or the Agency of Natural Resources. It is meant to provide guidance to organizations, agencies and individuals who wish to conserve wildlife. The goals and missions of the many and varied partners involved in the project span a broad spectrum of wildlife interests, skills and reach (some are very local, others are state, regional and federal entities). It was clear that there would be no prioritization that would satisfy all partners and that conservation need is so great that there is room for everyone to select the species and habitats they find most important and implement the strategies they are most capable of working on.

When it comes to allocating SWG funds to specific projects, further prioritization is required. Prioritization will take into account the goal of the SWG program—to keep wildlife populations from declining to the point that they require protection under the federal Endangered Species Act (ESA)—and Congressional intent— that SWG funds benefit wildlife that have not historically been the primary beneficiaries of the Federal Aid in Wildlife Restoration Act, Federal Aid in Sport Fish Restoration Program or the federal ESA. Prioritization will also be based on the impact of problems to SGCN and habitats, the project's ability to affect positive change, other conservation and social impacts and the

availability of matching funds (see the draft process outlined below and Appendix J for the SWG Competitive Grants Proposal Evaluation form).

Conservation Opportunity Areas: The Action Plan monitoring program (discussed earlier in this chapter) will help identify areas of land and water within each biophysical region that provide the best prospects for conservation actions to benefit SGCN and their habitats. VFWD and partners can prioritize (though not limit) efforts on these "Conservation Opportunity Areas" in order to achieve a greater likelihood of success and to use limited conservation funds most efficiently.

Implementation Funds and Resources

Most of the conservation strategies in this report are eligible for State Wildlife Grants program funds, and there is the rub. Conservation need and opportunity far outstrips current financial resources. To strategically allocate funds to the species and habitats in greatest need *and* to those projects that are likely to show the most promising results, we have drafted a process for soliciting, evaluating and selecting projects to receive SWG funding. That process is described in the next section below.

Agencies, organizations and individuals seeking funding for Action Plan conservation projects through sources other than SWG are encouraged to reference the Action Plan in grant applications and seek letters of support from other Conservation Partners including the VFWD. Entities wishing to implement conservation strategies should consider calling on the VFWD and other Conservation Partners for their expertise, advice, training and needed equipment and where appropriate collaborations should be considered.

Allocating State Wildlife Grant Funds

Congress, through annual Interior Appropriations legislation has allocated funds to the State Wildlife Grants program yearly since 2001. Vermont's share of these appropriations has averaged approximately $600,000 each year. Interior appropriations bills are generally approved in the fall of each year. In the spring of the following year VFWD submits proposals for use of SWG funds to the US Fish & Wildlife Service Division of Federal Assistance (USFWS-FA), the entity responsible for administering and managing the SWG program nationwide. Funds for accepted proposals are made available later that year and will generally remain available several years thereafter. A portion of each year's SWG appropriation will be made available to Conservation Partners for Action Plan implementation through a grants program. All eligible entities may submit applications.

The following is an outline of the draft schedule and process for applying and selecting recipients of SWG grant funds. Full procedures and proposal guidelines will be ready in October 2005.

Timeline / Process (draft)

November: The VFWD determines the availability of funds for the coming year and the percentage of funds available for the SWG Small Grants program (this determination may be delayed if the federal budget is not approved on time, as is sometimes the case).

November/December: Meeting of Conservation Partners to discuss the past year's progress on Action Plan implementation and needs and opportunities for the coming year. Recommendations will be taken regarding the proportion of SWG funds to be allotted to conservation categories such as research, monitoring, habitat restoration, species recovery activities, etc. Final allocation will be determined by the VFWD Grants Committee (see below).

December: A request for proposals for use of SWG funds for Action Plan implementation will be announced by VFWD.

March Proposal submission deadline.

March-May Proposals will be reviewed as follows:

SWG Coordinator (VFWD staff): reviews proposals for completeness and eligibility. Complete proposals that meet the minimum eligibility standards are deemed accepted and are sent to the SWG Technical Committee.

SWG Technical Committee (VFWD staff and selected Conservation Partners): reviews & scores accepted proposals. Scoring will be based on draft criteria found here in Appendix J. The Technical Committee selects a slate of recommended proposals. All proposals are sent to the Grants Committee

Grants Committee (VFWD Division Directors and NNHP Coordinator): The Grants Committee selects finalists from both within and outside the Department based on proposal scoring, recommendations of Technical Committee, available funds and Department priorities.

VFWD Commissioner: receives finalists from Finalists are sent to the Commissioner for final approval.

References

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Action Plan Review

Element number six of the eight required elements for an Action Plan (see Chapter 1: Congressional Guidelines) requires that states provide "descriptions of procedures to review the strategy at intervals not to exceed ten years."

Vermont will update its Action Plan on a 10-year cycle. Ten years will allow for planning, and implementation of actions and for detectable responses for many SGCN. Vermont's adaptive management approach to Action Plan implementation, however, means that species and habitat monitoring, formal project reporting and financial tracking will be ongoing and will provide a constant flow of information during the intervening years. Managers, wildlife planners and biologists will use this data to hone strategies, fine tune operations and make mid-course corrections within each ten year cycle. Review activities will include:

- Twice yearly expenditure tracking for individual projects by SWG project managers.
- Annual financial reporting of all in-kind match for individual projects by SWG project managers.
- Full project reports due within 90 days of completion of Individual SWG projects by SWG project managers.
- Providing regular Federal Assistance reports to the US Fish & Wildlife Service Division of Federal Assistance.
- A biannual Action Plan meeting for Conservation Partners will be organized by VFWD to review the year's efforts, identify goals for the coming year and to share information about Vermont SGCN, successes, obstacles and needs related to wildlife conservation and Action Plan project implementation.
- A biannual report on the Action Plan to stakeholders, the general public and policy makers will review the past year's efforts and outline goals for the coming year.

Interstate Coordination and Information Sharing

With 49 other states and 6 territories all implementing their own Strategies in the coming months it is likely that there will be successful projects and programs that could benefit Vermont SGCN. There will undoubtedly be many regional and national efforts to share this information. Vermont should make it a priority to attend these meetings and perform a thorough review of methods and results from other states.

Ten Year Review

The process to review and update the Action Plan in 2015 should begin at least two years prior to the deadline. The current thinking is that the review process should mirror the original Action Plan development process. This will include full participation by Conservation Partners (including local, state and federal agencies) on teams and committees, analyses of the work completed to date, evaluation of monitoring data and the updating of each of the eight elements from the original congressional guidelines as follows:

1) Revise the list of SGCN and update information on the distribution and abundance of SGCN. Which species can be removed from the list, which should be added?

2) Update information on the location and condition of key habitats. Describe key habitats of any new SGCN.

3) Describe threats and problems impacting SGCN and their habitats. Update research needs.

4) Review the success of conservation actions implemented to date. Identify conservation actions to conserve SGCN and their habitats.

5) Review Action Plan monitoring efforts to date. Describe plans to monitor species, habitats and conservation actions for the future.

6) Update and describe the process for the next plan review.

7) Review coordination efforts to date. Update plans to coordinate with other plans and planning entities.

8) Revise and describe plans to include the public in the design and implementation of the next Action Plan report.

Vermont's
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Chapter 6
Glossary & Acronym Key

Chapter 6: Vermont Wildlife Action Plan Glossary & Acronym Key

This glossary contains definitions to many of the terms used in this document.

Actively managed: For wildlife this means that a management plan for the species or a suite of species exists. (E.g. an osprey plan, waterfowl plan, spruce grouse plan.)

Anthropogenic: Conditions that result from human activities. "Anthropo-" meaning human and "-genic" meaning produced from.

Comprehensive Wildlife Conservation Strategy (CWCS): This Wildlife Action Plan was developed under the working title of Comprehensive Wildlife Conservation Strategy (CWCS). Upon federal approval the name was changed to Wildlife Action Plan (Action Plan). The Action Plan/CWCS sets a plan of action for conserving Vermont's wildlife by addressing conservation issues, management needs, and priorities. It is intended to be used by anyone with an interest in wildlife conservation.

Conservation: Plans and actions that will help restore and/or sustain Vermont's wildlife populations, with a focus on Species of Greatest Conservation Need (SGCN), and utilizing the full array of traditional conservation tools such as management (.e.g. habitat manipulation, restoration (e.g. acquisition, fee-simple easements), landowner education and incentives.

Conservation Opportunity Areas: areas of land and water where the likelihood of successful conservation is strongest and the conservation needs of wildlife and their habitats would be best met.

Conservation Partners: The wildlife biologists, ecologists, sportsmen and other conservationists, non-governmental organizations, business leaders, colleges and universities and state and federal agencies representing more than 60 entities (table 1-1) that worked with the Vermont Fish & Wildlife Department to create Vermont's Comprehensive Wildlife Conservation Strategy. When implementation of the Action Plan begins, any and all individuals, organizations, agencies and other entities wishing to participate will be considered conservation partners.

Conservation Reserve Program (CRP): provides annual land rental payments up to 15 years and cost sharing assistance to install water quality enhancement practices on environmentally sensitive land.

Conservation Reserve Enhancement Program (CREP): State and Federal partnership allowing incentive payments to landowners who set aside environmentally sensitive land along streams or field boundaries.

Common Species: "Keeping Common Species Common" is a phrase Congress used to describe its goal for the SWG program and the Action Plan. Common in this situation refers to any species that is not on the federal Endangered Species List (Threaten or Endangered).

Contiguous Forest: An area of forested land with either no roads or low densities of class IV roads, and little or no human development (buildings, parking areas, lawns, gravel pits). Contiguous forest may have various age classes of forest cover and include other habitat types such as wetlands or grasslands that are part of the overall contiguous habitat complex.

Corridor: A route that permits the direct travel or spread of animals or plants from one area or region to another, either by the gradual spread of a species' population along the route or by the movement of individual animals, seeds, pollen, spores, or microbes.

Cultural Habitat: (sometimes referred to as anthropogenic habitat) communities and sites that are either created and/or maintained by human activities or are modified by human influence to such a degree

that the physical condition is substantially different from what existed prior to human influence (e.g. old mines, hayfields used by grassland birds, buildings and structures used by bats).

Data Gap: A clear data need identified in the Action Plan as important to the conservation of a species or habitat.

Ecosystem: A complex array of organisms, their natural environment, the interactions between them, and the ecological processes that sustain the system. Ecosystems can be defined at any scale, from rotting logs, to Lake Champlain, to the Green Mountains.

Endangered Species: A species in danger of becoming extinct that is protected by either the federal Endangered Species Act or the Vermont Endangered Species Act.

Endemic species Found only in a certain place. For the purposes of this document endemic refers to species found *only* in Vermont. There are no known endemic species in Vermont. The most likely possibilities are invertebrates.

Exotic Invasive & Pest Species: An invasive species is defined by the as a species that is 1) non-native (or alien) to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Environmental Quality Incentives Program (EQIP): provides cost sharing payments to participants who install enduring conservation practices to help control soil erosion and improve water quality.

Forest Cover Type: A descriptive classification of forestland based on present occupancy of an area by tree species (Society of American Foresters).

Game Species: Wildlife species that are subject to legal hunting, fishing or harvesting.

Habitat: A place where a plant or animal lives. A place where an organism lives. Habitat is generally thought of in terms of single species such as bear or calypso orchid habitat.

Herp: an abbreviation for herptile, which includes both amphibian and reptile species.

Herptile: amphibian and reptile species

Indicator species: A species, or community whose presence in an area indicates the presence of certain environmental conditions.

Indicators: Indicators are measures that track inputs, outputs, and outcomes by stating them in specific and observable terms. They are also used to monitor natural resource conditions and the threats that can degrade natural ecosystems (.e.g. the number lakes infested with Eurasian watermilfoil; the distribution of lakes infested with Eurasian watermilfoil # of boat checks conducted; % of boaters aware of exotic species laws)

Landscape: A heterogeneous area of land containing groups of natural communities and clusters of interacting ecosystems. These can be of widely varying scales, but normally include a range of elevations, bedrock, and soils.

Life-history traits: Examples include be species with low fecundity, that take a long time to reach sexual maturity, that take a long time between reproductive events (sturgeon, wood turtle)

Limiting factor: The factor that limits the growth, abundance, or distribution of a population of organisms or a habitat.

Metadata: Definitional information that provides information about or documentation of other data

Metapopulation: A small number of relatively isolated populations that may occasionally exchange individuals

Mosaic: A pattern of vegetation in which two or more different plant communities are interspersed in patches.

Natural Community: An interacting assemblage of plants and animals, their physical environment, and the natural processes that affect them.

Neotropical Migrants: Birds especially songbirds, that summer and breed in North America but migrate to the tropics for the winter. Neotropical refers to the region south of the Tropic of Cancer that includes southern Mexico, Central and South America, and the West Indies

Nongame Wildlife: Wildlife species that are not subject to legal hunting, fishing or harvesting.

Pathogen: Any disease producing microorganism or material

Problem: A force causing a negative impact at the species, population, habitat and landscape levels (e.g., habitat conversion, pollution, illegal pet trade). A problem can also be the lack of information or a data gap vital to the successful management of a species. Because this report addresses an extremely broad range of problems affecting species and their habitats, the term "problem" may not always be the most appropriate term: threat, stress, stressor, issue, concern and limiting factor may at times be more accurate.

Regulated Hunting/Fishing/Trapping: The harvest of wildlife under regulations stipulating setting of seasons, time frame of lawful harvest, open and closed zones, methods of take, bag limits, possession limits, and reporting or tagging of species.

Responsibility Species: Species for which Vermont has a long-term stewardship responsibility because they are not doing well regionally, even if populations are stable in Vermont. E.g. bobolink

SGCN: see Species of Greatest Conservation Need

Species of Greatest Conservation Need (SGCN): According to federal legislation and guidance from the USFWS on the development of Comprehensive Wildlife Conservation Strategies, "each State will determine these species in the context of developing its [Wildlife Conservation Strategy]. These species must be fauna, and not flora, and may include aquatic species and invertebrates. A State's list of "species of the greatest conservation need" may include currently listed Federal and State wildlife species and other species of concern. We anticipate that the composition of this list will change over time as the status and conservation need of species changes within the State." The term Species of Greatest Conservation Need is not a statutory designation similar to the terms "endangered" or "threatened" codified by federal and state Endangered Species Acts.

Take/Taking: "Take" and "Taking" mean pursuing, shooting, hunting, killing, capturing, trapping, disturbing, harrying, worrying, or wounding snaring and netting fish, birds and quadrupeds and all lesser acts including placing, setting, drawing or using any net or other device commonly used to take fish or wild animals, whether they result in taking or not. It includes every attempt to take and every act of assistance to another person in taking or attempting to take fish or wild animals.

Threatened Species: Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range that is protected by either the federal Endangered Species Act or the Vermont Endangered Species Act

Wildlife: According to State Wildlife Grants legislation, wildlife is any species of wild, free-ranging fauna including fish, and invertebrates and also fauna in captive breeding programs the object of which is to reintroduce individuals of a depleted indigenous species in a previously occupied range.

Wildlife Action Plan (Action Plan) The Action Plan sets a plan of action for conserving Vermont's wildlife by addressing conservation issues, management needs, and priorities. It is intended to be used by anyone with an interest in wildlife conservation. It was developed under the working title of Comprehensive Wildlife Conservation Strategy (CWCS).

Acronym Key

This key includes many of the acronyms used in this document. Please let the authors know if additional entries are warranted. A full list of the Conservation Partners collaborating on the development of this report can be found in Chapter 1: Introduction.

AFS: American Fisheries Society
AMP: Acceptable Management Practice
ANR: Vermont Agency of Natural Resources (comprised of VFWD, DEC, FPR)
AOT: Vermont Agency of Transportation
AVCC: Association of Vermont Conservation Commissions
BBS: Breeding Bird Survey
BCR: Bird Conservation Region
BMP: Best management practice
CBC: Christmas Bird Count
CITES: Convention on International Trade in Endangered Species of Flora and Fauna
CRASC: Connecticut River Atlantic Salmon Commission
CRJC: Connecticut River Joint Commission
CRP: Conservation Reserve Program (a program of FSA)
CWCS: Comprehensive Wildlife Conservation Strategy, the original name for the Wildlife Action Plan. The name change occurred when the CWCS received federal approval.
DEC: Vermont Department of Environmental Quality, also VDEC
DJ: Dingell-Johnson Act of 1950, Federal Aid in Sport Fish Restoration Act
EO: Element Occurrence
EQIP: Environmental Quality Incentives Program (a program of NRCS)
ESC: Endangered Species Committee
FIA: Forest Inventory Analysis
FIP: Forest Incentives Program (USFS)
FPR: Vermont Department of Forests, Parks & Recreation
FSA: Farm Service Agency (a USDA agency) (www.fsa.usda.gov/vt/)
FWD: Vermont Fish & Wildlife Department
GIS: Geographic Information Systems
GRP: Grassland Reserve Program
HAT: Hunters, Anglers & Trapper of Vermont
HAT: Hunters, Anglers & Trappers Assoc of Vermont
IAFWA: International Association of Fish and Wildlife Agencies
IBA: Important Bird Areas
LCBP: Lake Champlain Basin Program
LCC: Lake Champlain Committee
LCLT: Lake Champlain Land Trust
LIP: Landowner Incentive Program (a USFWS program, managed in Vermont by VFWD)
MBTA: Migratory Bird Treaty Act of 1940
NABCI: North American Bird Conservation Initiative
NASA: National Aeronautical and Space Administration
NEPCoP: New England Plant Conservation Program (http://www.newfs.org/)
NNHP: Nongame & Natural Heritage Program (of the Vermont Fish & Wildlife Department)

NRCS: Natural Resources Conservation Service (a USDA agency)
NRCS: U.S. Natural Resource Conservation Service (habitat programs include WHIP, EQIP, CRP)
NWI: National Wetlands Inventory
NWR: National Wildlife Refuge
NWTF: National Wild Turkey Federation
PARC: Partners in Amphibian and Reptile Conservation
PIF: Partners in Flight
PR: Pittman-Robertson Act of 1937, the Federal Aid to Wildlife Restoration Act
RGS: Ruffed Grouse Society
RPC: Regional Planning Commissions (see http://www.vapda.com/)
SAF: Society of American Foresters
SGCN: Species of Greatest Conservation Need
SWG: State Wildlife Grants
TNC: The Nature Conservancy
TU: Trout Unlimited
USACE: United States Army Corps of Engineers
USDA: United States Department of Agriculture
USEPA: United States Environmental Protection Agency
USFS: United States Forest Service
USFWS: United States Fish & Wildlife Service
USGS: United States Geological Service
VCGI: VDHCA: Vermont Department of Housing & Community Affairs
VFS: Vermont Forum on Sprawl
VFWD: Vermont Fish & Wildlife Department
VHCB: Vermont Housing & Community Board
VINS: Vermont Institute of Natural Sciences
VLCT: Vermont League of Cities & Towns
VLT: Vermont Land Trust
VLT: Vermont Land Trust
VNRC: Vermont Natural Resources Council
VT Coop: Vermont Cooperative Fish and Wildlife Research Unit (of the US Geological Service)
VTA: Vermont Trappers Association
VTFSC: Vermont Federation of Sportsmen's Clubs
VWA: Vermont Woodlands Association
VTrans: Vermont Agency of Transportation (also AOT)
WHIP: Wildlife Habitat Incentives Program (a program of NRCS)
WMA: Wildlife Management Area (managed by VFWD)
WRP: Wetland Reserve Program (NRCS)

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Appendices

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802-241-3700

www.vtfishandwildlife.com

Appendices: Vermont's Wildlife Action Plan 11/22/2005

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- A1-Birds
- A2-Fishes
- A3-Invertebrates
- A4-Mammals
- A5-Reptiles & Amphibians
- A6-Plant Species of Greatest Conservation Need list

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- Vernal Pools & Seeps Summary
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- Lake Champlain Tributaries Summary
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- Lake Champlain Summary
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C. Definitions of General Problem and Strategy Categories

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F. Sample Action Plan Media Coverage

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H. Secure Species: the initial species assessments during SGCN selection

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J. SWG Proposal Evaluation Form

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Appendix A1
Bird Species of Greatest Conservation Need

Index to Bird Species of Greatest Conservation Need

Common Name: **Common Loon**
Scientific Name: **Gavia immer**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: High Priority

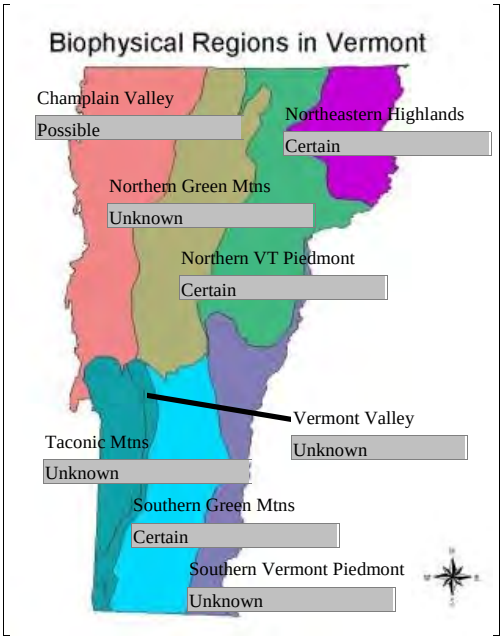
Global Rank: G5 **Global Trend:**
State Rank: S2B,S4N **State Trend:** Stable
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

Officially designated as Endangered in VT in 1978, statewide population has steadily rebounded from a low of 8 nesting pairs in 1983 and 1984 to 43 pairs in 2004. Increases due in large part to concerted management; population unlikely to remain secure without sustained management and monitoring for foreseeable future.

See: VT Loon Recovery Plan. Currently proposed for delisting from VT Endangered Species List

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☑
Outside US	☐

Distribution Summary:

Breeding concentrated in northeastern and north-central VT, with 5 pairs in south-central and southern VT. Breeding possible, but unconfirmed on Lake Champlain.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☑ General Literature ☑

Freshwater lakes > 10 ha in size, particularly those containing small islands and coves

Common Name: **Common Loon**
Scientific Name: **Gavia immer**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements: > 10 ha
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lacustrine
Aquatic: Lake Champlain
Aquatic: Man-Made Water Bodies

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Description of habitat problem(s): Lakeshore development and subsequent loss of shoreline habitat greatest single problem to breeding population. Recreational activities and direct human disturbance of nesting or nursery sites also a serious problem on more heavily used lakes.

Non-Habitat Problems:

Competition

Pollution

Trampling or Direct Impacts

Description of non-habitat problem(s): Mercury contamination has been shown to adversly affect loon reproduction and behavior in ME. Interference competition from extraterritorial loons has caused some territory and nest abandonments, as well as direct killing of chicks, ini recent years.

Common Name: **Common Loon**
Scientific Name: **Gavia immer**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Distribution and Abundance	Low	This is well known overall, due to sustained annual monitoring since 1978. Some smaller and more remote ponds need to be checked more regularly.
Research	Threats and Their Significance	Medium	1) Extent of mercury contamination needs to be better documented. Collaborative research on extent and possible effects of mercury contamination in VT loons should be continued. A sampling scheme in VT should be developed in conjunction with an overall regional effort to monitor mercury in loons and other aquatic wildlife. 2) Patterns of shoreline development and ownership of current and recent nest sites needs to be documented.
Monitoring	Population Change	High	Sustained monitoring is crucial to documenting population trends
Monitoring	Monitor Threats	Medium	Monitoring of all limiting factors goes hand-in-hand with population monitoring and is critical to evaluate long-term viability and management needs of statewide population. Sick, weak, and dead loons should be collected and sent to wildlife health facilities for determination of cause of death, including interference competition from other loons (trauma), lead, and other contaminants. Annual summaries of known causes of deaths should be completed and disseminated. Results should be evaluated for management applications.

Common Name: **Common Loon**
Scientific Name: **Gavia immer**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	High	Continue concerted public education effort targeting landowners and lake users [for what purpose?]. Volunteers should receive expanded training, toward long-term goal of having loon monitoring and management be largely volunteer-based.	Public presentations, informational signs at VFWD lake access areas, media articles, and informal meetings with lakeshore residents and recreationists are all crucial to increased public awareness. Platforms and sign buoys must be used as necessary.	VFWD, VINS	State Nongame Fund
Easements	High	Long-term protection of all current and recent (within past 5 years) loon nest sites should be secured through conservation easements and land acquisition.	Ownership of all current and recent nest sites should be documented. For those nest sites not currently protected, landowners should be contacted and protocols for securing protection should be developed.	VFWD, VINS, TNC, Lake Associations, power companies	TNC
Species Restoration	High	A post-listing monitoring and management plan should be developed and implemented.	Plan should ensure annual monitoring for at least 5 years after post-listing; annual management should be continued as necessary; after 5 years, future needs should be evaluated. Annual LoonWatch should be continued indefinitely.	VFWD, VINS	VFWD, USFWS

Bibliography:

Borden, S.E. and C.C. Rimmer. 1998. Vermont Loon Recovery Plan. Unpubl. report. Vermont Institute of Natural Science, Woodstock, VT and Vermont Fish and Wildlife Department, Waterbury, VT. 44 pp.

Hanson, E.W., C.C. Rimmer, and S. Parren. 2003. The 2003 breeding status of Common Loons in Vermont. Unpubl. report. Vermont Institute of Natural Science, Woodstock, VT and Vermont Fish and Wildlife Department, Waterbury, VT.

Common Name: **Pied-billed Grebe**
Scientific Name: **Podilymbus podiceps**
Species Group: **Bird**

Conservation Assessment:

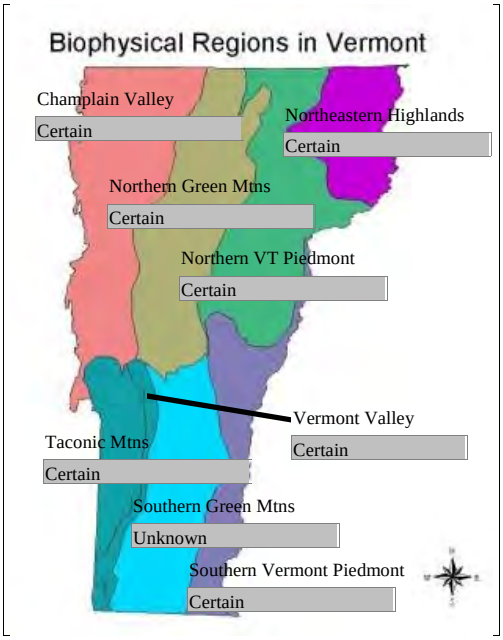
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S2B,S3N **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

A sporadic breeder in Vermont, but believed to have been much more common historically. Loss of suitable wetlands since European settlement may have greatly reduced population.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☑
Outside US	☑

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Lakes, ponds, marshes, swamps, and slow-moving streams and rivers.

Common Name: **Pied-billed Grebe**
Scientific Name: **Podilymbus podiceps**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Lower CT River
Floodplain Forests
Hardwood Swamps
Marshes and Sedge Meadows
Open Peatlands
Seeps and Pools
Shrub Swamps
Softwood Swamps
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Invasion by Exotic Species

Description of habitat problem(s): Conversion of Habitat - loss of wetlands due to draining, filling for development and agriculture.
Habitat Degradation - outdoor recreational activities disturb nesting.
Invasion by exotic species - common reed and purple loosestrife compete with native vegetation for nesting and feeding sites.

Non-Habitat Problems:

Harvest or Collection

Trampling or Direct Impacts

Description of non-habitat problem(s): Harvest or Collection - sometimes mistakenly shot as waterfowl.
Trampling or Direct Impacts - nests susceptible to damage by boating.

Common Name: **Pied-billed Grebe**
Scientific Name: **Podilymbus podiceps**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	More surveys needed to determine distribution and abundance.
Research	Threats and Their Significance	Medium	Impact of recreational activities at known nest sites.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	Medium	Protect nesting areas from destructive recreational activities through enforcement, signing, press releases, educational materials, television/radio commercials.	Presence/absence of nesting grebes, number of chicks surviving to fledgling stage.	Audubon Vermont, VINS, lake associations, angler groups, boating organizations.	NNHP Nongame funds, VINS, Audubon, VFWD, VT-FPR,USFWS
Publically-Owned Protected Areas	High	Protect large wetlands (>20 ac.) suitable as grebe nesting habitat, acquired in fee through purchase.	Number of acres conserved in fee.	USFWS,DU, TNC	Pittman-Robertson, DU, TNC, VHCB, VLT, Lake Champlain Land Trust
Policy & Regulations	High	Protect potential nesting habitat (large wetlands) through regulatory process.	Number of wetland acres protected from development.	VT-DEC	Pittman-Robertson, EPA

Bibliography:

The Atlas of Breeding Birds of Vermont. 1985. Laughlin, S.B. and D.P. Kibbe. University of New England Press. 456 p.

Muller, M.J. and R.W. Storer. 1999. Pied-billed Grebe (Podilymbus podiceps). In: The Birds of North America, No. 410 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Common Name: **American Bittern**
Scientific Name: **Botaurus lentiginosus**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: High Priority

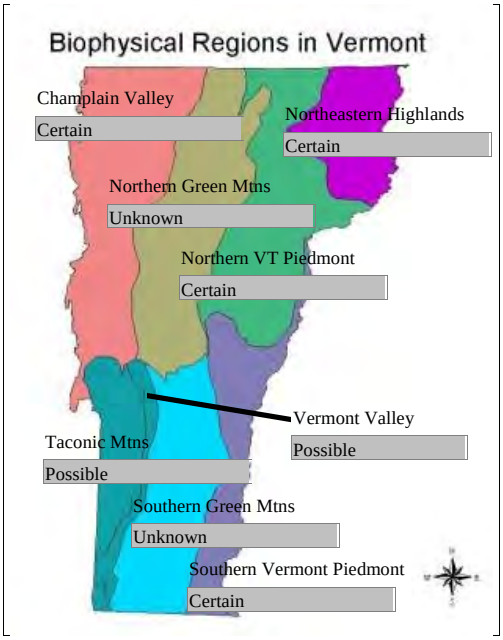
Global Rank: G4 **Global Trend:**
State Rank: S3B,S3N **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

The distribution and population status of this species of regional conservation concern are not well documented in VT. The Breeding Bird Survey indicates a 3.8% annual increase, but this is based on a small sample of routes and low abundance, so can not be considered reliable.

Listed as a Nongame Species of Management Concern by USFWS in 1982 and 1987, but populations are inadequately monitored overall, so actual conservation status not well known.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☑
Outside US	☑

Distribution Summary:

From first VT Breeding Bird Atlas, confirmed breeding in large wetland complexes in Champlain Valley, also in West Rutland Marsh, sites in lower Connecticut River Valley, and two sites in north-central VT. Probably breeds in other larger wetland complexes (e.g., Memphremagog) and scattered smaller wetlands throughout the state.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Primarily freshwater wetlands with tall, emergent vegetation. Inhabits wetlands of all sizes (0.1-1,000 ha), but more abundant on larger than smaller wetlands. Prefers impoundments and beaver-created wetlands to those of glacial origin.

Common Name: **American Bittern**
Scientific Name: **Botaurus lentiginosus**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	Unknown
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Grasslands and Hedgerows

Marshes and Sedge Meadows

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Invasion by Exotic Species

Description of habitat problem(s): Loss or degradation of wetland habitats the primary problem to this species throughout its range. Changes in wetland isolation and water stabilization may erode habitat quality. Invasion of Phragmites and purple loosestrife a further problem to native wetland vegetation.

Non-Habitat Problems:

Pollution

Description of non-habitat problem(s): Chemical contamination and human disturbance are identified problems.

Common Name: **American Bittern**
Scientific Name: **Botaurus lentiginosus**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Distribution and Abundance	Medium	1) More robust data are needed on the statewide distribution and abundance of this species in wetlands of different sizes and vegetative composition. 2) A standarized, coordinated statewide survey of this and other wetland birds is needed to establish baseline information on distribution and abundance. An extensive, single-season survey could be followed by annual monitoring at a core number of wetlands. A volunteer-based survey that uses standardized, repeatable protocols could collect presence/absence and relative abundance data at a large number of wetland sites statewide. A core number (12-15) of sites could be annually monitored for long-term trends
Research	Threats and Their Significance	Medium	
Monitoring	Population Change	High	A standardized monitoring program is needed for this and other wetland birds, Extensive sampling needs to coordinated periodically, while a core sample of wetlands should be monitored annually.
Monitoring	Habitat Change	Medium	Important to monitor habitat quality and changes that may be occurring, e.g. from invasive plants like Phragmites and purple loosestrife
Monitoring	Monitor Threats	Medium	

Common Name: **American Bittern**
Scientific Name: **Botaurus lentiginosus**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Invasive Species Control & Prevention	Medium	Assess whether wetland habitat quality is compromised by invasive species like Phragmites and purple loosestrife; implement control measures at selected sites to eliminate or minimize these species; evaluate success of measures for AMBI and other birds.	Correlate presence/absence and changes in relative abundance of AMBI and other wetland species, in relation to natural and manipulated changes in vegetation composition caused by increase or elimination of invasives	VFWD, USFWS, TNC	Wetland Reserve Program, NFWF, State Wildlife Grants
Policy & Regulations	Medium	Ensure that wetlands inhabited by this species are well-protected, including a representative sample of smaller wetlands. Ensure that further wetland loss or degradation in VT is minimized.	Conduct a spatially explicit inventory and evaluation of wetlands in VT, and assess local regulations for protecting them. Involve local conservation commissions in wetlands inventories and protection, also monitoring.	VFWD, USFWS, TNC, local conservation commissions	Wetland Reserve Program
Compatible Resource Use	Medium	Monitor wetland habitat quality (sedimentation rates, nutrient fluxes, water quality, chemical contamination) and correlate with changes in AMBI relative abundance or presence/absence.	Correlate habitat parameters with standardized AMBI survey data, and changes in both over time.	VFWD, USFWS, TNC, local conservation commissions	Wetland Reserve program, TNC

Bibliography:

Gibbs, J.P. and S.M. Melvin. 1992. American Bittern in Migratory nongame birds of management concern in the northeastern United States (K. Schneider and D. Pence, Eds.). U.S. Fish and Wildlife Service, Newton Corner, MA.
Gibbs, J.P., S.M. Melvin, and F.A. Reid. 1992. American Bittern in The Birds of North America, No. 18 (A. Poole, P. Stettenheim, and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, DC: The American Ornithologists' Union.

Common Name: **Least Bittern**
Scientific Name: **Ixobrychus exilis**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: High Priority

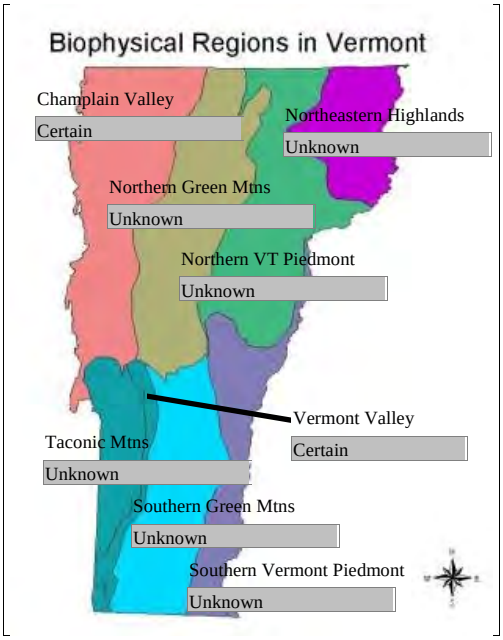
Global Rank: G5 **Global Trend:**
State Rank: S2B,S2N **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

No state BBS data. BBS routes are not well-sited for monitoring marsh species.

Status of species unknown in state; the species is regularly found in relatively few marshes in VT (Kibbe 1985).

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☑
Outside US	☑

Distribution Summary:

Data from Kibbe (1985).

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Freshwater and brackish marshes densely vegetated with emergent and aquatic vegetation, patches of open water and woody vegetation (Gibbs et al. 1992). Most abundant in Iowa marshes in years when open water and emergent vegetation were at a 1:1 ratio.

Common Name: **Least Bittern**
Scientific Name: **Ixobrychus exilis**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m): -1
Maximum Elevation (m): -1
Patch Size Requirements: > 1 ha
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Marshes and Sedge Meadows

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Invasion by Exotic Species

Description of habitat problem(s): Loss of wetlands will continue to limit the species. Invasion of wetlands by loosestrife and phragmites will degrade habitat quality. Agricultural and urban runoff could reduce water quality and prey populations.

Description of non-habitat problem(s):

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Medium	Information about the distribution of LEBI in VT is lacking. A state-wide (perhaps one-time) survey of all potential wetlands would also yield valuable information for other wetland-dependent species (SORA, VIRA, COME, PBGR, AMBI, BLTE). Marshbird monitoring programs are limited in their spatial extent in VT. An extensive initial survey would provide baseline data for a long-term monitoring program that would lay the foundation for a more representative marshbird monitoring program.
Monitoring	Population Change	High	Improving the standardization and spatial extent of marsh monitoring programs for wetland birds would greatly help our understanding of the species' distribution and population status.
Monitoring	Habitat Change	Medium	Most wetlands on which LEBI are found are protected, but more information about wetland loss and degradation would be useful as loss of wetlands will continue to limit LEBI. Although regulations currently in place will likely protect most nesting sites, some research indicates that LEBI is not area-sensitive (Gibbs and Melvin 1990) and may be found on wetlands <= 0.4 ha.

Common Name: **Least Bittern**
Scientific Name: **Ixobrychus exilis**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Invasive Species Control & Prevention	Medium	Prevent wetland invasions by Phragmites and Purple Loosestrife and remove these species where they have already invaded in order to maintain/improve habitat quality for LEBI.	Presence/absence of LEBI in relation to changes in vegetation composition.	NNHP, TNC, USFWS.	NFWF, Marsh bird monitoring groups, TNC, Wetland Reserve Program (NRCS).
Compatible Resource Use	Medium	Decrease sedimentation rates and nutrient influxes into marshes currently containing LEBI to maintain habitat quality.	Ideally, annual variation in abundance of LEBI could be correlated with changes in habitat quality. More realistically, survey results will need to be based on presence/absence in relation to changes in water quantity, quality and vegetation.	VFWD, TNC, USFWS.	NFWF, Marsh bird monitoring groups, TNC, Wetland Reserve Program (NRCS).

Bibliography:

Gibbs, J. P., and S. M. Melvin. 1990. An assessment of wading birds and other wetlands avifauna and their habitat in Maine. Final Report, Maine Dep. Inland Fish. Wildl., Bangor, Maine.

Gibbs, J. P., F. A. Reid, and S. M. Melvin. 1992. Least Bittern (Ixobrychus exilis). In The birds of North America, No. 17 (A. Poole and F. Gill, eds.). The birds of North America, Inc., Philadelphia, Pennsylvania, USA.

Kibbe, D. P. 1985. Least Bittern. Pages 36-37 in S. B. Laughlin and D. P. Kibbe, eds. The atlas of breeding birds of Vermont. University Presses of New England, Hanover, New Hampshire, USA.

Common Name: **Great Blue Heron**
Scientific Name: **Ardea herodias**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

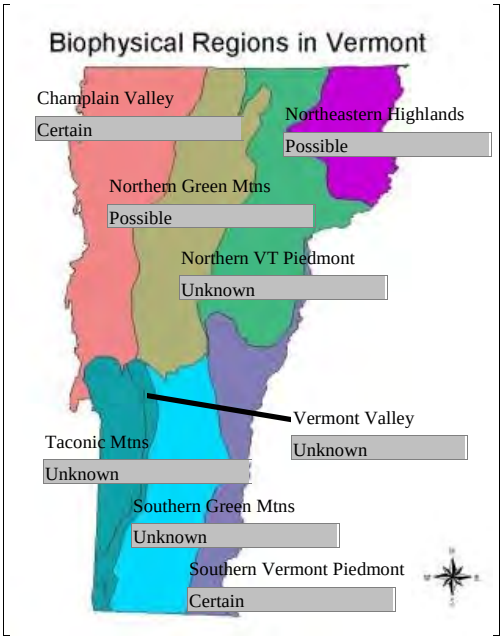
Global Rank: G5 **Global Trend:**
State Rank: S2S3B,S5N **State Trend:** Stable
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Population currently stable with numbers increasing at largest colony site, Missisquoi National Wildlife Refuge.

Largest breeding colony (350 pairs) currently located at Missisquoi National Wildlife Refuge, second largest at Porters Bay on Lake Champlain (~100 pairs). Smaller colonies located throughout the state. Missisquoi colony stable until 2000 when 600 pair colony failed due to disturbance early in the season. Has recovered to approx. 350 pairs.

Distribution:



Natural History Elements:

Home Range: N/A
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☑
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Widely distributed with the largest colonies located in Champlain Valley. Smaller colonies located throughout state.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☑ Regional Literature ☐ General Literature ☐

Colony nester, nesting in tall trees, usually in wooded swamps. Colony size ranges from a couple of pairs to more than 500 pairs. Inhabits marshes, swamps, streams and lakeshores.

Common Name: **Great Blue Heron**
Scientific Name: **Ardea herodias**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	Unknown
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Floodplain Forests
Hardwood Swamps
Seeps and Pools
Softwood Swamps

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Description of habitat problem(s): Loss or degradation of nesting habitat at colony sites, especially larger colony sites directly impacts population

Non-Habitat Problems:

Competition

Predation or Herbivory

Description of non-habitat problem(s): Disturbance of nesting colony early in the season has lead to abandonment of nesting colonies. Increasing numbers of nesting Double-crested Cormorants at large colony sites results in competition for nesting space and habitat degredation

Common Name: **Great Blue Heron**
Scientific Name: **Ardea herodias**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Determine specific habitat requirements for nesting locations.
Research	Basic Life History	Low	
Research	Distribution and Abundance	Medium	Document know nesting locations in the state, primarily smaller nesting colonies.
Research	Threats and Their Significance	High	Continue research efforts into competititon with cormorants in breeding colonies unknown. More research is needed to better understand dynamics between these 2 species and effects on heron breeding colonies. Determine impacts of Double-crested Cormorants on nesting habitat.
Research	Population Genetics	Low	
Monitoring	Population Change	High	Annually monitor known nesting colonies.
Monitoring	Habitat Change	High	Monitor habitat changes at colony sites especially degredation of nesting trees due to the presence of Double-crested Cormorants.
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	High	Monitor disturbance and nest site competition at colony sites.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use	Medium	Attempted predation by Bald Eagles is suspected of causing colony abandonment. Potential eagle nesting near colony sites could result in the loss of the colony	Maintain largest two colonies (Missisquoi and Porters Bay) in Vermont	USFWS,VT FWS, UVM, TNC	USFWS, SWG
Protected Area Management	High	Protect colony sites from human disturbance early in the nesting season to decrease chances of abandonment.	Increased education and awareness of individuals using the area (primarily boaters) through outreach efforts and signage.	USFWS, VTFWS, Audubon Vermont, TNC	USFWS, SWG
Habitat Restoration	High	Stop or reverse loss of vegetation used for nesting (trees) at Missisquoi NWR due to impacts of expanding Double-crested Cormorant colony. Suitable nesting structure needs to be maintained.	Maintenance of current nesting structure and identification of other suitable habitat at Missisquoi NWR	UFWS, UVM, Audubon	UFWS
Protected Area Management	High	Reduce competition at nesting locations by Double-crested Cormorants	Minimize impacts of cormorants on nesting herons by limiting the number nesting cormorants at the colony site	USFWS, VTFWS, UVM, TNC	USFWS, TNC

Common Name: **Great Blue Heron**
Scientific Name: **Ardea herodias**
Species Group: **Bird**

Bibliography:

Laughlin, S.B. and D. P. Kibbe, editors. 1985. The Atlas of Breeding Birds of Vermont. University Press of New England, Hanover, New Hampshire, USA.

Common Name: **Black-crowned Night-heron**
Scientific Name: **Nycticorax nycticorax**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

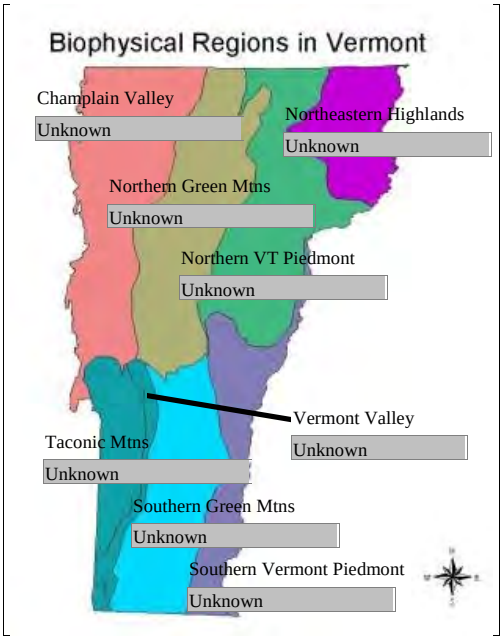
Global Rank: G5 **Global Trend:**
State Rank: S1B,S2N **State Trend:**
Extirpated in VT? **Regionally Rare?**

Assessment Narrative:

Currently no documented nesting in Vermont.

Black-crowned Night-herons have been documented nesting on Lake Champlain, Vermont with the largest colony (30-50 pairs) having been on Young Island in Lake Champlain. Competition fo nest sites and degredation of habitat by Double-crested Cormorants on Young Island resulted in the abandonment of that colony in the mid 1990's.

Distribution:



Natural History Elements:

Home Range:
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☑
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Has nested at 2 sites along Lake Champlain with the largest being Young Island on the northern part of the lake. Nesting has not been documented in the state since the mid 1990's.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☑ Regional Literature ☑ General Literature ☑

Prefers islands and wooded swamps for nesting locations. Feeds along shoreline and within marshes and swamps

Common Name: **Black-crowned Night-heron**
Scientific Name: **Nycticorax nycticorax**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Floodplain Forests
Hardwood Swamps
Marshes and Sedge Meadows
Shrub Swamps

Current Problems: (see Appendix C for definitions of problem categories)

Habitat Problems:

Habitat Alteration

Description of habitat problem(s): Degradation of habitat as a result of nesting Double-crested Cormorants

Non-Habitat Problems:

Competition

Description of non-habitat problem(s): Competition for nest sites with Double-crested Cormorants

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	Medium	Determine specific nesting habitat requirments
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	Currently there is no documented breeding of this species in Vermont although breeding suspected. Surveys for breeding pairs and colonies should be undertaken to better assess status in Vermont
Research	Threats and Their Significance	Medium	Determine limiting factors to potential breeding locations.
Monitoring	Population Change	High	Determine presence/absence of species in the state.
Monitoring	Habitat Change	Medium	
Monitoring	Monitor Threats	Medium	If nesting sites located determine and monitor potential limiting factors.

Common Name: **Black-crowned Night-heron**
Scientific Name: **Nycticorax nycticorax**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Protected Area Management	Medium	Rapid increase in cormorant population of Young Island has displaced BCNH. Efforts to reduce cormorant numbers and restore areas of the island for BCNH nesting may result in BCNH nesting here in the future.	BCNH nesting on Young Island	VTFWD, Wildlife Services	US government, USDA
Habitat Restoration	Medium	Restore nesting structure (trees and shrubs) on Young Island to enhance nesting opportunities.	BCNH nesting on Young Island	VTFW, UVM	USDA Wildlife Services, USFWS

Bibliography:

Laughlin, S. B. and D.P. Kibbe, editors. 1985. The Atlas of Breeding Birds of Vermont. University Press of New England, Hanover, New Hampshire, USA.

Common Name: **American Black Duck**
Scientific Name: **Anas rubripes**
Species Group: **Bird**

Conservation Assessment:

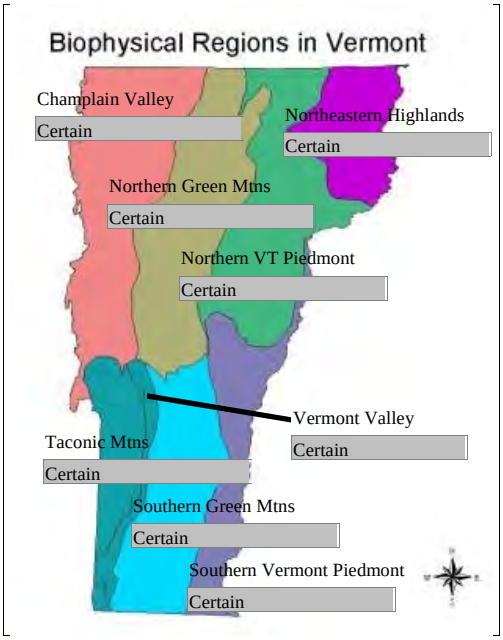
Final Assessment: High Priority

Global Rank: G5 **Global Trend:**
State Rank: S5B,S5N **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Population decline is readily apparent, but likely due to a number of factors including habitat loss, hybridization with mallard, and marine pollution that affects molluscs, an important winter food source.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☑
Within US	☑
Outside US	☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Uses a variety of wetland habitats along the coast, in woodlands, boreal forest, mixed conifer-hardwoods, wherever there is water nearby. Nests in dense shrub vegetation usually near water but sometimes up to a mile or more away. Preferred wintering habitat includes brackish marshes bordering bays, estuaries, and agricultural areas, but also found on inland lakes, reservoirs, and marshes wherever ice-free conditions exist.

Common Name: **American Black Duck**
Scientific Name: **Anas rubripes**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☑
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Lacustrine
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Lower CT River
Floodplain Forests
Hardwood Swamps
Marshes and Sedge Meadows
Open Peatlands
Shrub Swamps

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Description of habitat problem(s): Habitat conversion and degradation- conversion of wetlands to agriculture, and loss due to development including shoreline construction, ditching and other drainage methods; road building, alteration of wetland hydrology; invasive species such as purple loosestrife, common reed.

Description of non-habitat problem(s):

Common Name: **American Black Duck**
Scientific Name: **Anas rubripes**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	A breeding black duck survey is needed to determine where birds are breeding, by wetland or woodland type.
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	Distribution and abundance of breeding black ducks are not well known in Vermont.
Research	Threats and Their Significance	High	The main limiting factor includes the loss of shrub wetlands from agriculture and residential and commercial development, including alteration and degradation of habitats over time. This duck is more susceptible to human disturbances than other duck species due to its shy nature and tendency to abandon nests when disturbed.
Research	Population Genetics	Low	This species hybridizes with the mallard but it is not believed to be a long term threat.
Research	Taxonomy	Low	
Monitoring	Population Change	High	Regional trends show a declining population in the St. Lawrence River Valley and northern New England.
Monitoring	Habitat Change	High	Wetland inventories should be updated periodically and analyzed for changes in wetland abundance by wetland type (i.e. scrub-shrub wetlands as potential black duck nesting). habitat).
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	High	Same as Habitat change.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compliance & Enforcement	High	Better enforce state and federal wetland laws, including buffer zones.	Number of wetland acres and wetland buffer acres protected under state Conditional Use Determination regulatory process and federal Clean Water Act.	VT-DEC, EPA, US Army COE	EPA, Pittman-Robertson
Conservation Payments/Financial Incentives	High	Work with farmers and provide incentives for protection of wetlands from agricultural conversion.	Number of acres protected from conversion.	USFWS, USDA-NRCS, Ducks Unlimited	WHIP,LIP,EQIP,NAWCA, Pittman-Robertson, DU

Bibliography:

Bellrose, F.C. 1976. Ducks, Geese, and Swans of North America. Harrisburg,PA:Stackpole Books. 544 p.

Coulter, M.C. and W.R. Miller. 1968. Nesting biology of black ducks in northern New England. VT Fish and Game Dept. Bull., No. 68-2. Montpelier, VT.

Common Name: **Blue-winged Teal**
Scientific Name: **Anas discors**
Species Group: **Bird**

Conservation Assessment:

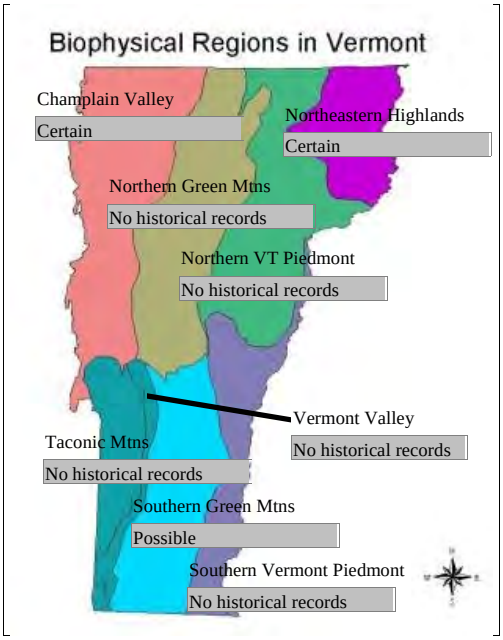
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S4B,S4N **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Populations are declining throughout BCR 13. Loss of wetland habitat due to development and agriculture. Changes in agricultural practices (i.e. early season mowing) may affect nesting productivity.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☑
Outside US	☑

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Prefers wetlands such as marshes, sloughs, ponds, lakes, and sluggish streams.

Common Name: **Blue-winged Teal**
Scientific Name: **Anas discors**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	Unknown
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Lake Champlain
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Lower CT River
Aquatic: Man-Made Water Bodies
Floodplain Forests
Grasslands and Hedgerows
Hardwood Swamps
Marshes and Sedge Meadows
Shrub Swamps
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Description of habitat problem(s): Conversion of wetlands to agriculture, wetland loss due to development
Habitat Degradation due to invasive plants such common reed, purple loosestrife.
Inadequate disturbance regime - early season mowing may disrupt nesting.

Description of non-habitat problem(s):

Common Name: **Blue-winged Teal**
Scientific Name: **Anas discors**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Low	
Research	Threats and Their Significance	High	Investigate delayed mowing on nesting productivity.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Research	Other Research	Low	
Monitoring	Population Change	Low	
Monitoring	Habitat Change	Low	
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	High	Monitor changes in wetland acres and grassland acres.
Monitoring	Other Monitoring Needs	Low	

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Policy & Regulations	Medium	Increase size of buffer zones to restrict development within sensitive wildlife habitat.			
Compliance & Enforcement	High	Better compliance and enforcement of state and federal wetland laws.	Number of wetland acres converted.	VT-DEC, USFWS, NRCS	Pittman-Robertson, EPA
Compatible Resource Use	High	Encourage delayed mowing in grasslands bordering wetland breeding areas for blue-winged teal.	Acres of grassland with delayed mowing.	NRCS,USFWS,DU	WHIP,LIP, Partners for Fish and Wildlife

Bibliography:

Bellrose, F.C. 1976. Ducks, Geese, and Swans of North America.

Common Name: **Osprey**
Scientific Name: **Pandion haliaetus**
Species Group: **Bird**

Conservation Assessment:

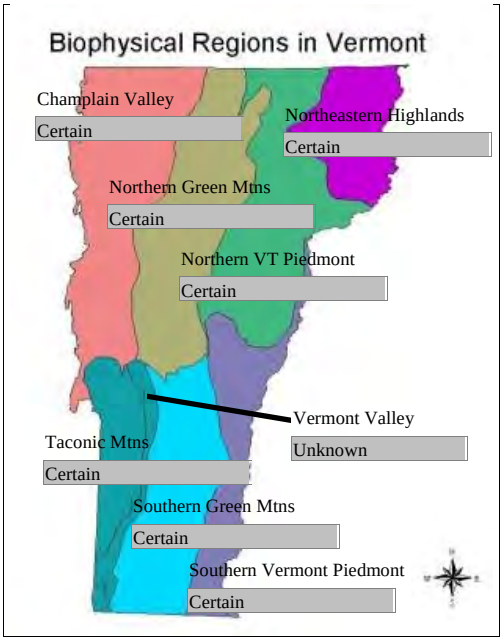
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S2B,S4N **State Trend:** Increasing
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Species was nearly extirpated in Vermont due to habitat loss and the presence of DDT in the food chain. Since DDT was banned in 1972 and efforts were made to re-colonize areas with artificial nesting platforms, the osprey has made a dramatic come-back. The bird is well established around Lake Champlain and is slowly expanding in other areas of the state.

Distribution:



Natural History Elements:

Home Range: <1000 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☑
Outside US	☑

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☐ General Literature ☐

Large ponds, lakes, and rivers generally greater than 10 hectares.

Common Name: **Osprey**
Scientific Name: **Pandion haliaetus**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	> 10 ha
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Lacustrine
Aquatic: Lake Champlain
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Lower CT River
Building or Structure
Cliffs and Talus
Floodplain Forests
Hardwood Swamps
Marshes and Sedge Meadows
Open Peatlands
Outcrops and Alpine
Seeps and Pools
Shrub Swamps
Softwood Swamps
Upland Shores
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Description of habitat problem(s): Loss of large trees bordering lakes, ponds, rivers, wetlands due to poorly planned logging and development. Degradation of habitat due to water pollution and negative impacts to fisheries. Placement of roads and trails along water courses limits nesting habitat and increases mortality.

Non-Habitat Problems:

Loss of Prey Base

Pollution

Reproductive Traits

Trampling or Direct Impacts

Description of non-habitat problem(s): Pollution - sensitive to PCBs, pesticides, and heavy metals.
Reproductive traits - does not reach breeding age until 4 or 5 years old. Relatively small clutches of 1-3 young.
Loss of prey base - susceptible to changes in fisheries communities.
Direct Impacts - susceptible to electrocution when nesting or foraging near power lines.

Common Name: **Osprey**
Scientific Name: **Pandion haliaetus**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Low	
Research	Threats and Their Significance	Medium	Presence and level of pollutants in aquatic environment.
Research	Population Genetics	Low	
Monitoring	Population Change	Medium	Continued population monitoring to insure population stability.
Monitoring	Habitat Change	Low	
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	Low	

Common Name: **Osprey**
Scientific Name: **Pandion haliaetus**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Easements	High	Conserve shoreline and waterfront through purchase of development rights.	Number of shoreline acres conserved.	LCLT, TNC, VLT, VHCB, USFWS	LCLT, TNC,VLT, VHCB, USFWS
Awareness Raising and Communications	High	Continue concerted public education effort targeting landowners and lake users. Volunteers should receive expanded training, toward long-term goal of having osprey monitoring and management be largely volunteer-based.	Public presentations, informational signs at VFWD lake access areas, media articles, and informal meetings with lakeshore residents and recreationists are all crucial to increased public awareness. Platforms and sign buoys must be used as necessary.	VFWD, VINS	State Nongame Fund
Publically-Owned Protected Areas	Medium	Acquisition of shoreline through fee purchase. Expansion of federal refuges, state parks, state wildlife management areas.	Acres protected in fee status.	USFWS-Missisquoi NWR, USFWS-Conte NWR, VT-FPR,VHCB, Vermont Land Trust, TNC, Ducks Unlimited, Lake Champlain Land Trust	Pittman-Robertson, state duck stamp funds, Legislature, USFWS, VHCB, TNC, DU, Vermont Land Trust, Lake Champlain Land Trust

Bibliography:

The Atlas of Breeding Birds of Vermont. 1985. Laughlin, S.B. and D.P. Kibbe, eds. University Press of New England. 456p.

Poole, Alan F. Ospreys: A Natural and Unnatural History. 1989. Cambridge University Press. 246p.

Common Name: **Bald Eagle**
Scientific Name: **Haliaeetus leucocephalus**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: High Priority

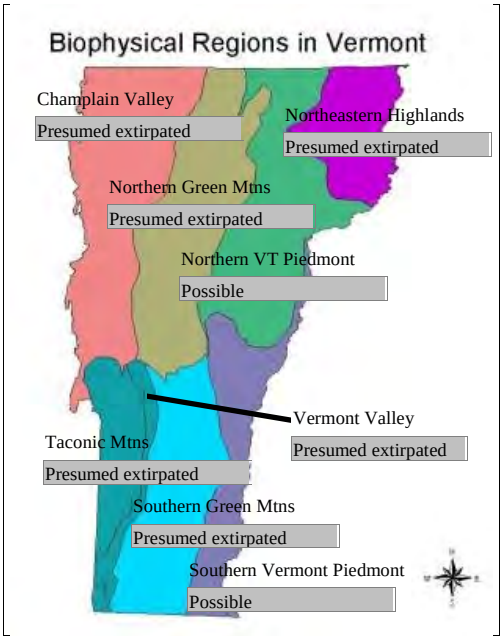
Global Rank: G4 **Global Trend:**
State Rank: SHB,S2N **State Trend:**
Extirpated in VT? Yes **Regionally Rare?** Yes

Assessment Narrative:

No known breeding in Vermont. Translocation project in process, beginning in 2004.

State and Federally listed as endangered. No known breeding pairs in Vermont. Breeds in all adjacent states.

Distribution:



Natural History Elements:

Home Range: <1000 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☑
Within US	☑
Outside US	☐

Distribution Summary:

No documented breeding records as of 2004, although a few unsubstantiated reports from the Connecticut River in Caledonia County in recent years. Only known historical breeding record in Champlain Valley.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Breeding: Lakes & rivers with large trees for nesting, perching and roosting. Prefers minimal human disturbance (USFWS 1999, DeGraaf & Yamasaki 2001).

Wintering: Large waterbodies with open water or good supply of carion (USFWS 1999).

Common Name: **Bald Eagle**
Scientific Name: **Haliaeetus leucocephalus**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	1
Maximum Elevation (m):	0
Patch Size Requirements:	> 100 ha
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lake Champlain

Aquatic: Large Lake Champlain Tribs Below Falls

Aquatic: Lower CT River

Aquatic: Man-Made Water Bodies

Floodplain Forests

Hardwood Swamps

Marshes and Sedge Meadows

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change

Conversion of Habitat

Habitat Alteration

Impacts of Roads or Trails

Description of habitat problem(s): Habitat loss and human disturbance considered significant problems to breeding eagles. Roads and/or trails near nest site can be detrimental if human activity is not restricted (Buehler 2000). Climate change has the potential to reduce food supply.

Non-Habitat Problems:

Disease

Loss of Prey Base

Pollution

Trampling or Direct Impacts

Description of non-habitat problem(s): Eagles are most vulnerable to toxic substances - lead, mercury, pesticides, and other toxic chemicals. Also vulnerable to collisions with vehicles and power lines and possibly to disease (USFWS 1999, Buehler 2000) (West Nile Virus effects are yet unknown).

Common Name: **Bald Eagle**
Scientific Name: **Haliaeetus leucocephalus**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Medium	Follow up on reports of nesting pairs until breeding pairs are known.
Research	Threats and Their Significance	Medium	Monitor potential effects of West Nile Virus
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Research	Other Research	High	Effects of chemical threats such as mercury not well-known in Vermont.
Monitoring	Population Change	High	Monitor population and productivity, once established.
Monitoring	Habitat Change	Medium	
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	High	

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Species Restoration	Low	Protect nesting habitat of naturally nesting pairs, as eagles begin breeding in VT monitor breeding population			
Awareness Raising and Communications		Educate the public [about?]			
Species Restoration	High	Fully implement VT Bald Eagle Recovery Plan			
Species Restoration	High	Continue USFWS/Senator Jeffords' sponsored translocation project until 2006	Number of fledglings successfully hacked into the wild. Number of natural nests initiated by hacked birds.	USFWS, NWF, VDWF	USFWS
Compatible Resource Use	Medium	Reduce impacts of contaminants such as lead, mercury and other toxic chemicals.	Number of necropsied eagles with/without toxic levels of contaminants	USFWS, Tufts University	VDFW, USFWS

Common Name: **Bald Eagle**
Scientific Name: **Haliaeetus leucocephalus**
Species Group: **Bird**

Bibliography:

Buehler, D. A. 2000. Bald eagle (Haliaeetus leucocephalus). In the Birds of North America, No. 506 (A. Poole & F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA. 40pp.

DeGraaf, R. M. & M. Yamasaki. 2001. New England wildlife: habitat, natural history, and distribution. University Press of New England, Hanover, NH. 482 pp.

Laughin, S. B., and D. P. Kibbe, eds. 1985. The atlas of breeding birds of Vermont. University Press of New England, Hanover, NH. 456 pp.

US Fish & Wildlife Service. 1983. Northern states bald eagle recovery plan. US Fish and Wildlife Service, Twin Cities, MN. 76 pp.

USFWS. 1999. Endangered and threatened wildlife and plant; proposed rule to remove the bald eagle in the lower 48 states from the list of endangered and threatened wildlife. Federal Register 64(128): 36454-36464.

Common Name: **Northern Harrier**
Scientific Name: **Circus cyaneus**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: High Priority

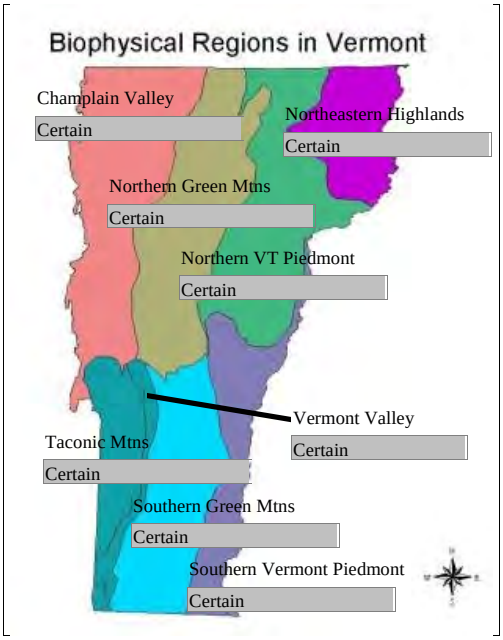
Global Rank: G5 **Global Trend:**
State Rank: S2B,S3S4N **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Detected on 5 BBS routes in VT (Sauer et al. 2004).

At risk of disappearing from the Northeast due to small breeding population size, there is suspected or documented decline of this species in some states, and declining trends in preferred early successional habitats. Population declines appear to be the result of habitat loss from reforestation, the filling of wetlands, and urban and industrial development in coastal areas. Recent trends in some states, however, are positive.

Distribution:



Natural History Elements:

Home Range: <1000 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☑
Outside US	☑

Distribution Summary:

Data from Ellison (1985).

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Open wetlands, marshy meadows, wet, lightly grazed pastures, old fields, marshes, upland prairies, mesic grasslands, drained marshlands, croplands, cold desert shrub-steppe, and riparian woodland. Densest populations typically associated with large tracts of undisturbed habitats dominated by thick vegetation (MacWhirter and Bildstein 1996).

Common Name: **Northern Harrier**
Scientific Name: **Circus cyaneus**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	2400
Patch Size Requirements:	Unknown
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☑
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Grasslands and Hedgerows

Marshes and Sedge Meadows

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Habitat Succession

Description of habitat problem(s): Major problem is likely early mowing of hayfields. Other problems include heavy grazing rotations in pastures, especially wet pastures and wetland drainage. Additionally, development hayfield abandonment (succession) and urban/suburban development are also problems.

Non-Habitat Problems:

Loss of Prey Base

Description of non-habitat problem(s): Early mowing decreases rodent populations.

Common Name: **Northern Harrier**
Scientific Name: **Circus cyaneus**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Wetlands are likely a safer nesting habitat for this species in VT. Proportion of birds nesting in wetlands versus hayfields would be helpful from a management standpoint.
Research	Basic Life History	Medium	Many studies on home range size, little on territory size. The disparity between the two (240 ha mean hr size versus 0.8 to 10 ha territory size) creates major variation in potential recommendations for habitat requirements for 500 pairs. Additionally, determining the causes of breeding failure and mortality are important.
Research	Distribution and Abundance	Low	
Research	Threats and Their Significance	Medium	Better information of timing of nesting in relation to hay harvest. Data from first breeding bird atlas suggests nestling dates are much later than necessary to fledge young prior to a Memorial Day cutting
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	Population would be relatively easy to monitor through roadside counts. Demographics would be more difficult to assess.
Monitoring	Habitat Change	Medium	It would be useful to know the proportion of grasslands lost to forest succession versus urban/suburban development.
Monitoring	Monitor Threats	High	Better information about the timing of hayfield cutting.

Common Name: **Northern Harrier**
Scientific Name: **Circus cyaneus**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	High	Develop an education and outreach program to provide information about grassland dependent species and management options to enhance their populations in Vermont.	Number of landowners reached. Number of cooperating landowners who are maintaining grasslands by periodic late-summer mowing. Periodically assess (5yrs) grassland acreage in Vermont, through GIS analysis of Landsat data.	UVM, NRCS.	NRCS, USDA.
Technical Assistance, Training, Learning Networks	High	Provide technical assistance to town and regional planning commissions to help conserve grassland habitats from development.	Number of town and regional planning commissions reached. # of cooperating landowners maintaining grasslands by periodic late-summer mowing. Periodically assess (5yrs) grassland acreage in Vermont, through GIS analysis of Landsat data.	UVM, NRCS.	USDA, NRCS.
Conservation Payments/Financial Incentives	High	Provide current use discounts for farmers who employ delayed mowing practices.	Number of cooperating farmers who are receiving use-tax discounts for delayed mowing. Additionally, estimates of foraging success rates of birds before and after hay harvest would help assess questions of abundance vs. availability of prey.	UVM, NRCS.	NRCS, USDA.
Habitat Restoration	High	Maintain grassland habitat in suitable locations through active management of woody vegetation within Grassland Bird Focus Areas.	Increase and maintain available habitat in suitable locations	VFWD, Audubon Vermont, NRCS, USFWS	US government
Protected Area Management	High	Maintain nesting habitat throughout breeding season by developing site specific conservation plans which include restricting mowing after July 15 on publicly owned lands (WMAs and state airports).	Maintain and increase current acreage under management on state lands	VFWD, NRCS, VTrans	VFWD

Common Name: **Northern Harrier**
Scientific Name: **Circus cyaneus**
Species Group: **Bird**

Bibliography:

Ellison, W. G. 1985. Northern Harrier. Pages 72-73 in S. B. Laughlin and D. P. Kibbe, eds. The atlas of breeding birds of Vermont. University Presses of New England, Hanover, New Hampshire, USA.

MacWhirter, R. B., and K. L. Bildstein. 1996. Northern Harrier (Circus cyaneus). In The birds of North America, No. 210 (A. Poole and F. Gill, eds.). The birds of North America, Inc., Philadelphia, Pennsylvania, USA.

Sauer, J. R., J. E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966-2003. Version 2004.1. USGS Patuxent Wildlife Research Center, Laurel, Maryland, USA.

Common Name: **Cooper's Hawk**
Scientific Name: **Accipiter cooperii**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

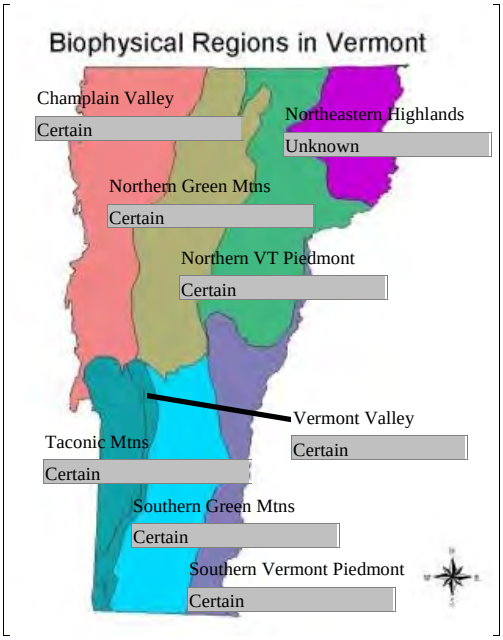
Global Rank: G5 **Global Trend:**
State Rank: S2S3B **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

BBS Eastern Region trend , 1966-2003 = +8.09 (p=0.0000), however VT trend = -7.77 (p=0.14).

"Populations have stabilized or are increasing in some parts of [the continental] range, but the species has not fully recovered from the drastic decline of the period 1940-1970+ throughout much of the eastern part of the range; reasons for this lack of recovery are unknown; potentially limited by the use of organochlorine biocides in Central America and locally by habitat loss."(natureserve.org).

Distribution:



Natural History Elements:

Home Range: > 1000 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☑
Within US	☑
Outside US	☑

Distribution Summary:

Distribution info from VT Breeding Bird Atlas - sightings reported in all biophysical regions except the Northeastern Highlands, but only 1 of 14 sightings was confirmed to be breeding (Laughlin & Kibbe 1985). Expert opinion is that Cooper's Hawks are now more common in VT than they were during the first atlas.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Breeding & wintering: Mature stands in coniferous, hardwood, or mixed forest in semi-open landscape, including small woodlands and suburban forests. Tolerant of fragmentation and human disturbance (DeGraaf & Yamasaki 2001).

Common Name: **Cooper's Hawk**
Scientific Name: **Accipiter cooperii**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	> 10 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Boreal Conifers
Early Succession Boreal Hardwoods
Early Succession Northern Hardwoods
Early Succession Pine and Hemlock
Early Succession Spruce-Fir
Early Succession Upland Oak
Grasslands and Hedgerows
Lawns, Gardens, and Row Crops
Northern Hardwood
Oak-Pine Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Unknown Habitat Threats

Description of habitat problem(s): Appears to be able to use a variety of habitats.

Non-Habitat Problems:

Pollution

Description of non-habitat problem(s): Significant declines in the 1940s- 1960s, due primarily to the use of DDT. Also declined prior to 1940s due to hunting (Laughlin & Kibbe 1985).

Common Name: **Cooper's Hawk**
Scientific Name: **Accipiter cooperii**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Medium	
Research	Threats and Their Significance	Medium	Determine limiting factors to nesting COHAs in VT
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	Monitor trends in VT population.
Monitoring	Habitat Change	Medium	
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	High	

Bibliography:

DeGraaf, R. M., and M. Yamasaki. 2001. New England wildlife: habitat, natural history, and distribution. University Press of New England, Hanover, NH. 482 pp.

Laughlin, S. B., and D. P. Kibbe. 1985. The atlas of breeding birds of Vermont. University Press of New England, Hanover, NH. 456 pp.

www.natureserve.org compreshensive report on the Cooper's Hawk. Accessed: March 31, 2005

Common Name: **Northern Goshawk**
Scientific Name: **Accipiter gentilis**
Species Group: **Bird**

Conservation Assessment:

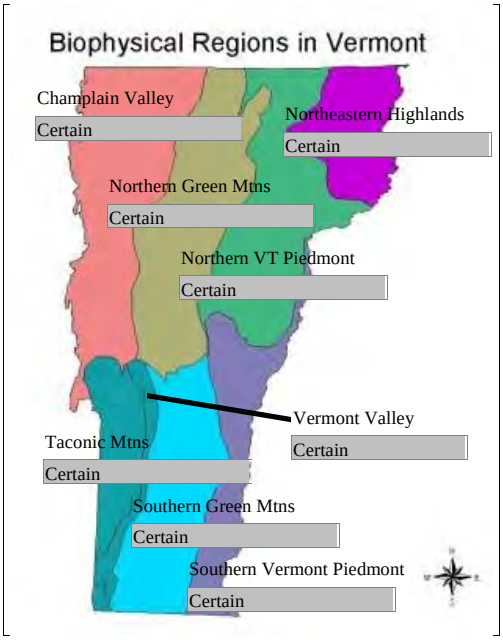
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S3S4B **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

Relatively abundant and widespread, Holarctic; population trends are difficult to determine; no hard evidence of a significant decline in recent decades, but probably declining in some areas primarily as a result of habitat alteration (natureserve.org). Formerly nested principally in Canada, but expanded breeding range south into northeastern North America beginning around 1950 (Laughlin & Kibbe 1985).

Distribution:



Natural History Elements:

Home Range: <1000 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☑
Within US	☐
Outside US	☐

Distribution Summary:

Distribution info from VT Breeding Bird Atlas (Laughlin & Kibbe 1985). NOGOs found in all regions of the state, with 7 confirmed breeding pairs in the central and southeastern part of the state, and 1 in the lower Champlain Valley. Most sightings were in areas of medium - high elevation, with all but 1 in the Champlain Valley in the hilly areas on the periphery of the region.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Breeding: Forest interior habitats prefers mature forests with large trees and open understories. Found in all elevations up to treeline (DeGraff & Yamasaki 2001). Nests usually in bottom of the canopy of a large hardwood tree in the East (Laughlin & Kibbe 1985). In Minnesota, 81% of 46 goshawks nests were in aspen trees, generally located in mature (>50 years) early successional upland hardwood stands (aspen and paper birch forest types) (Boal et al. 2001). Prey is primarily small to medium birds, but will also feed on small mammals. Preferred feeding habitats are openings in forests (DeGraaf & Yamasaki 2001).

Common Name: **Northern Goshawk**
Scientific Name: **Accipiter gentilis**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m): 30
Maximum Elevation (m): 760
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Boreal Conifers
Early Succession Boreal Hardwoods
Early Succession Northern Hardwoods
Early Succession Pine and Hemlock
Early Succession Spruce-Fir
Early Succession Upland Oak
Northern Hardwood
Oak-Pine Northern Hardwood
Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Fragmentation

Impacts of Roads or Trails

Description of habitat problem(s): Loss of interior mature forest caused decline when Europeans settled New England. Does not nest in small forest tracks bounded by roads (DeGraaf & Yamasaki 2001).

Non-Habitat Problems:

Pollution

Description of non-habitat problem(s): Highly sensitive to human presence (DeGraaf & Yamasaki 2001). Some sensitivity to pesticides/toxic checmicals.

Common Name: **Northern Goshawk**
Scientific Name: **Accipiter gentilis**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Basic Life History	Low	Estimate productivity of nesting pairs.
Research	Distribution and Abundance	Medium	Determine population status and trends in VT (locate nesting pairs).
Research	Threats and Their Significance	Medium	Need to determine significance of limiting factors to habitat in Vermont and whether active management/protection of this species is needed.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	Medium	Monitor trends in Vermont population
Monitoring	Habitat Change	Low	
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	Medium	Monitor limiting factors to VT population

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Publically-Owned Protected Areas	High	Manage a portion of Vermont public lands with long rotations or as no-cut reserves.	Number of productive nests on conserved public lands.	ANR, USFS, USFWS	SWG, P-R

Bibliography:

Boal, C. W., D. E. Anderson, and P. L. Kennedy. 2001. Home range and habitat use of northern goshawks (Accipiter gentilis) in Minnesota. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, MN. 48 pp.

DeGraaf, R. M., and M. Yamasaki. 2001. New England wildlife: habitat, natural history, and distribution. University Press of New England, Hanover, NH. 482 pp.

Laughlin, S. B., and D. P. Kibbe. 1985. The atlas of breeding birds of Vermont. University Press of New England, Hanover, NH. 456 pp.

www.natureserve.org comprehensive report on the Northern Goshawk. Accessed:March 31, 2005.

Common Name: **Red-shouldered Hawk**
Scientific Name: **Buteo lineatus**
Species Group: **Bird**

Conservation Assessment:

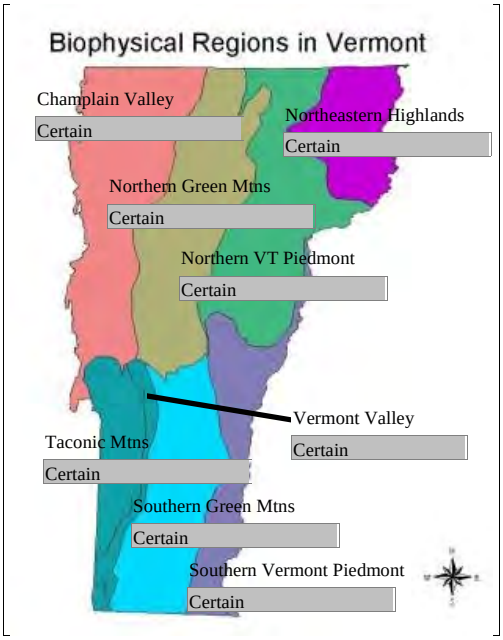
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S3S4B **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

BBS data shows increasing trend in the east, but current populations are thought to be far below historic levels (early 1900's).

Distribution:



Natural History Elements:

Home Range: <1000 ha
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☑
Within US	☑
Outside US	☐

Distribution Summary:

Distribution info from VT Breeding Bird Atlas (Laughlin & Kibbe 1985). Reported in all biophysical regions, with most confirmed breeding in south central and western parts of the state.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Mature forested wetlands near natural openings for foraging and upland forests adjacent to wetlands (DeGraaf & Yamasaki 2001).

Common Name: **Red-shouldered Hawk**
Scientific Name: **Buteo lineatus**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	> 10 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Floodplain Forests
Hardwood Swamps
Marshes and Sedge Meadows
Northern Hardwood
Oak-Pine Northern Hardwood
Open Peatlands
Seeps and Pools
Shrub Swamps
Softwood Swamps
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Description of habitat problem(s): Declines in early 1900s due to loss of wetland habitat (DeGraaf & Yamasaki 2001). Shown to be vulnerable to habitat conversion, including fragmentation (Laughlin & Kibbe).

Non-Habitat Problems:

Pollution

Description of non-habitat problem(s): RSHAs have been shown to accumulate pesticides such as PCBs (Laughlin & Kibbe).

Common Name: **Red-shouldered Hawk**
Scientific Name: **Buteo lineatus**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Medium	Determine population size and productivity in VT.
Research	Threats and Their Significance	Medium	Evaluate limiting factors to population in VT
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	Medium	Monitor population changes.
Monitoring	Habitat Change	Medium	Monitor loss of habitat
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	Medium	

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Species Restoration		Monitor and manage population so as to minimize problems.			
Habitat Restoration	Medium	Identify remaining blocks of contiguous forests w/mature components & encourage their conservation via easements or other financial incentives on private lands. Conserve these blocks on public lands via appropriate long-range management plan designations	Number and distribution of core forest blocks conserved on private and public lands	ANR, USFS, USFWS, VHCB, VLT, TNC	SWG, PR, VHCB

Bibliography:

1) DeGraaf, R. M., and M. Yamasaki. 2001. New England wildlife: habitat, natural history, and distribution. University Press of New England, Hanover, NH. 482 pp. 2) Laughlin, S. B., and D. P. Kibbe. 1985. The atlas of breeding birds of Vermont. University Press of New England, Hanover, NH. 456 pp.

Common Name: **American Kestrel**
Scientific Name: **Falco sparverius**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

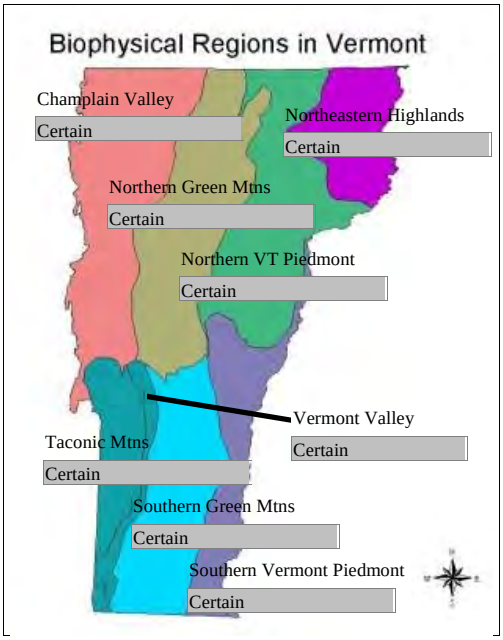
Global Rank: G5 **Global Trend:**
State Rank: S5B **State Trend:** Fluctuating
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Recent negative population trends in BBS data for VT (NS) and survey-wide (P < 0.01; Sauer et al. 2004). Concern about population in the Northeast as a whole.

Population secure globally, but fragmentation and succession are issues in the northeastern US.

Distribution:



Natural History Elements:

Home Range: < 100 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☑
Outside US	☑

Distribution Summary:

Based on William and Ellison (1985).

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Minimum area requirements appear to be ~25 ha grassland. Reports of home range size are variable. "Typical" densities are 0.11 to 1.74/100 ha (assuming peripatric home ranges, 57 to 909 ha). However, greater densities have been reported of 5.4 and 27.4/100 ha (3 -18 ha home range sizes; Smallwood and Bird 2002).

Common Name: **American Kestrel**
Scientific Name: **Falco sparverius**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	-1
Maximum Elevation (m):	4000
Patch Size Requirements:	> 10 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☑
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Grasslands and Hedgerows

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Fragmentation

Habitat Succession

Description of habitat problem(s): Loss of grassland habitat to forest succession and conversion of agricultural areas to urban/suburban development.

Non-Habitat Problems:

Trampling or Direct Impacts

Description of non-habitat problem(s): Automobile collisions.

Common Name: **American Kestrel**
Scientific Name: **Falco sparverius**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Research should focus on relative importance of grassland habitat and cavity availability. If cavity availability is limiting, species could benefit from an active nest box placement program.
Research	Basic Life History	Low	
Research	Distribution and Abundance	Medium	This species is relatively conspicuous and roadside counts could provide an excellent index of statewide population trends. Establishment of supplemental BBS-type routes to assess population trends of early successional species.
Research	Threats and Their Significance	Medium	Species is a useful model for environmental contaminants. May be a useful indicator species as they feed on herbivorous insects in agricultural habitats.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Research	Other Research	Low	
Monitoring	Population Change	Medium	Nest monitoring in MA cranberry bogs shows 4 consecutive years of population declines. Peterson (2003) suggests the species is "quietly slipping away in New England."
Monitoring	Habitat Change	Medium	It would be helpful to know whether development or forest succession is more important to habitat loss.
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	Medium	
Monitoring	Other Monitoring Needs	Low	

Common Name: **American Kestrel**
Scientific Name: **Falco sparverius**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Conservation Payments/Financial Incentives	Medium	Conserve grassland/shrubland habitats on private lands.	Number and total area of sites conserved.	USDA, USFWS, VHCB	FSA, SWG, VHCB
Technical Assistance, Training, Learning Networks	High	Educate agricultural community and general public about grassland birds and management options to protect habitat	Develop a grassland bird outreach program	VFWD, Audubon Vermont, VINS, UVM	SWG, VFWD
Habitat Restoration	High	Maintain grassland habitat in suitable locations through active management of woody vegetation within Grassland Bird Focus Areas.	Increase and maintain available habitat in suitable locations	VFWD, Audubon Vermont, NRCS, USFWS	US government
Easements	Medium	Appears to be somewhat area sensitive.	Creation of a large reserve (> 1000 ha) for early successional species (e.g., BOBO, UPSA, GRSP, HESP, NOHA, SEOW).	TNC, FWD, NRCS	NRCS, TNC, VT Housing and Conservation Board.
Technical Assistance, Training, Learning Networks		Develop a nest box program for interested landowners.	Nest box occupancy rates as reported by landowners.	NWF	WHIP

Bibliography:

DeGraaf, R. M., and M. Yamasaki. 2001. New England wildlife: habitat, natural history, and distribution. University of New England Press, Hanover, New Hampshire, USA, and London, UK.

Petersen, W. R. 2003. New England Region. North American Birds 57(4):465-469.

Sauer, J. R., J. E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966-2003. Version 2004.1. USGS Patuxent Wildlife Research Center, Laurel, Maryland, USA.

Smallwood, J. A., and D. M. Bird. 2002. American Kestrel (Falco sparverius). In The birds of North America, No. 602 (A. Poole and F. Gill, eds.). The birds of North America, Inc., Philadelphia, Pennsylvania, USA.

William, W. G., and W. G. Ellison. 1985. American Kestrel. Pages 86-87 in S. B. Laughlin and D. P. Kibbe, eds. The atlas of breeding birds of Vermont. University Presses of New England, Hanover, New Hampshire, USA.

Common Name: **Peregrine Falcon**
Scientific Name: **Falco peregrinus**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: High Priority

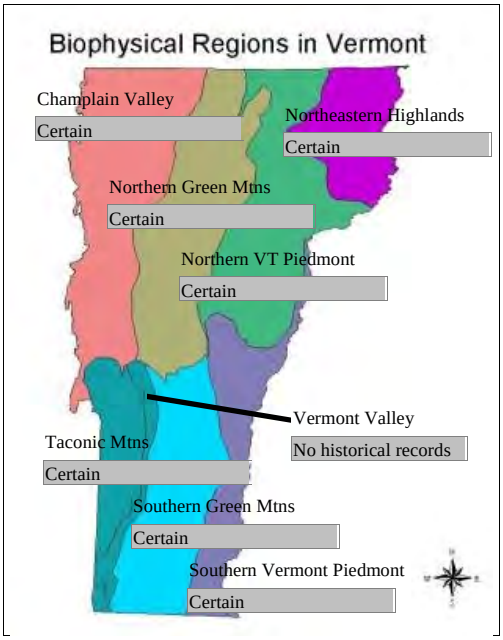
Global Rank: G4 **Global Trend:**
State Rank: S2B,S2N **State Trend:** Stable
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

Species proposed to be removed from the state endangered species list in 2003.

Species recently restored to more secure level and proposed for delisting. Delisting monitoring plan drafted by VDFW.

Distribution:



Natural History Elements:

Home Range: <1000 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☑
Within US	☑
Outside US	☐

Distribution Summary:

Nest sites known in all biophysical regions except the Vermont Valley and Southern Green Mountains. Historic nesting site(s) in the Southern Green Mountains (Laughlin & Kibbe 1985).

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☑ General Literature ☑

Open areas for hunting, adequate food supply and steep rocky cliffs for nesting (Ratcliffe, 1993).

Common Name: **Peregrine Falcon**
Scientific Name: **Falco peregrinus**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	> 100 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Lacustrine
Aquatic: Lake Champlain
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Lower CT River
Building or Structure
Cliffs and Talus
Grasslands and Hedgerows
Lawns, Gardens, and Row Crops
Mine
Upland Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Succession

Description of habitat problem(s): Inappropriate development, poorly planned forest management and habitat changes on or near a cliff during the breeding season may disturb nesting peregrines and cause them to abandon their nest site. Any development on or near a cliff may be enough to cause a pair to abandon that nest site (USFWS 1991, Fowle et al. 2000).

Non-Habitat Problems:

Loss of Prey Base

Pollution

Predation or Herbivory

Trampling or Direct Impacts

Description of non-habitat problem(s): Pesticides and other toxic chemicals have shown negative effects in the past, and some of these chemicals persist today (Fowle et al. 2000, USFWS, unpublished data). West Nile Virus may have an impact on the population in the future. Human disturbance on or near nesting cliffs is the greatest known problem to peregrines nesting in VT. Predation of young on the nest site has been an occasional problem in the past (Fowle et al. 2000).

Common Name: **Peregrine Falcon**
Scientific Name: **Falco peregrinus**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Medium	banding subset of population at some nesting cliffs
Research	Threats and Their Significance	Medium	Research potential effects of West Nile Virus and other toxic chemicals.
Research	Population Genetics	Low	
Monitoring	Population Change	High	Monitor breeding population and productivity annually and report monitoring results to the USFWS. Band young at subset of nest sites.
Monitoring	Habitat Change	Medium	Protect breeding habitat from human disturbance and development
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	High	Monitor human disturbance effects and protect nesting cliffs from disturbance.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use	High	Reduce/minimize human disturbance at nesting cliffs through access closures during the breeding season..			
Awareness Raising and Communications	Medium	Educate the public about the loss and recovery of the Peregrine falcon in Vermont.			
Species Restoration	Medium	Implement VT Peregrine Falcon Recovery Plan (Fowle et al 2000)			

Bibliography:

1) Ratcliffe, D. A. 1993. The peregrine falcon. Second edition. T. & A. D. Poyser, London. 454 pp. 2) Laughlin, S. B., and D. P. Kibbe, eds. 1985 The atlas of breeding birds of Vermont. University Press of New England, Hanover, NH. 456 pp. 3) Hickey, J. J. 1942. Eastern populations of the duck hawk. Auk 59:176-204. 4) US Fish and Wildlife Service. 1991. First update of peregrine falcon (Falco peregrinus) eastern population, revised recovery plan. Newton Corner, MA. 35 pp. 5) Fowle, M. R., S. G. Parren, S. D. Faccio, D.W. Blodgett, and J. C. Heintz. 2000. Vermont peregrine falcon recovery plan. National Wildlife Federation, unpublished document, Montpelier, VT. 43 pp.

Common Name: **Spruce Grouse**
Scientific Name: **Falcipennis canadensis**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: High Priority

Global Rank: G5 **Global Trend:**
State Rank: S1B **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

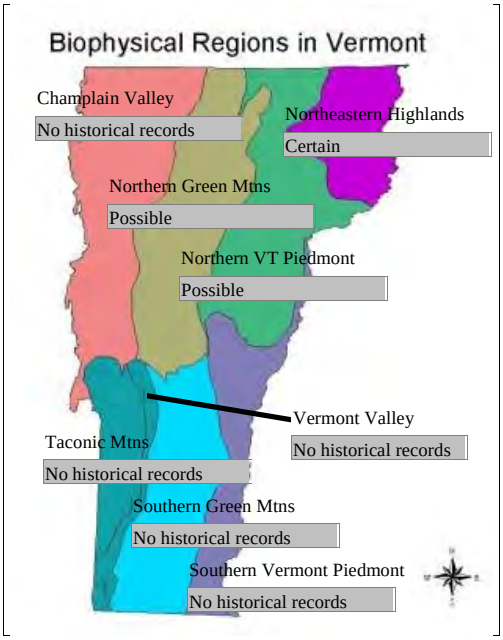
S1. State Endangered. No BBS data. Draft Recovery Plan for Vermont.

Spruce grouse (Falcipennis canadensis, formerly Dendragapus canadensis) inhabit the boreal forests of North America. Although considered common in Canada and in a few northern states, in Vermont the species is near the southern edge of its range. Historical accounts indicate the species was present in the northeastern counties of Orleans and Essex (Thompson 1853, Cutting 1884). Currently, breeding spruce grouse are restricted to a 62 km2 (25 mi2) area of spruce-fir forest in northern Essex County (Royar and Alexander 1987). This breeding habitat is principally owned by the U.S. Fish and Wildlife Service (Nulhegan Division of the Silvio Conte Refuge) and the State of Vermont, Department of Fish and Wildlife (Wenlock Wildlife Management Area).

It is believed that between 150 and 300 adult birds occur in this population, and periodic surveys since 1990 show a stable if not slightly increasing population. Although the future of this population would seem secure given the interest of the two public owners in conserving wildlife (assuming that vegetation management will continue to maintain and improve habitat and that disturbance from the potential increase in recreationists to this area can be controlled) a stochastic event such as a widespread fire or disease outbreak could prove disastrous.

Full recovery of spruce grouse in Vermont will require the establishment of 2 additional sub-populations, most likely on the State Lands located in the southern Essex County towns of Victory and Granby, and in the northern Essex County town of Norton.

Distribution:



Natural History Elements:

Home Range: < 100 ha
Migrant? Yes

Within watershed	☑
Within biophysical region	☑
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Spruce grouse (Falcipennis canadensis, formerly Dendragapus canadensis) inhabit the boreal forests of North America. Although considered common in Canada and in a few northern states, in Vermont the species is near the southern edge of its range. Historical accounts indicate the species was present in the northeastern counties of Orleans and Essex (Thompson 1853, Cutting 1884). Currently, breeding spruce grouse are restricted to a 62 km2 (25 mi2) area of spruce-fir forest in northern Essex

Common Name: **Spruce Grouse**
Scientific Name: **Falcipennis canadensis**
Species Group: **Bird**

County (Royar and Alexander 1987). This breeding habitat is principally owned by the U.S. Fish and Wildlife Service (Nulhegan Division of the Silvio Conte Refuge) and the State of Vermont, Department of Fish and Wildlife (Wenlock Wildlife Management Area).

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☑ General Literature ☑

The spruce grouse is a bird of the boreal forest. Highest grouse densities (40-80 adults in summer/100 ha) are found in young dense jack pine (Pinus banksiana) stands, where live branches occur from 4-8 meters (13-26 ft) above ground (Szuba and Bendell 1983; Keppie 1995). Jack pine forests do not occur in Vermont, however, spruce-fir forests of similar structure provide suitable habitat throughout much of the species range. Keppie (1987) documented breeding densities of 9.8 - 21.9 adults/100 ha (0.25-0.55/ac) in a New Brunswick spruce-fir pine forest. Spruce (Picea spp.) is preferred over fir (Abies balsamea) because it develops and maintains better vertical stratification. A shrub layer of Vaccinium spp. or regenerating spruce-fir in low densities enhances habitat for spruce grouse (Robinson 1969). Larch (Larix laricina) in the overstory may provide a preferred fall food resource. Forest openings are important to female spruce grouse and their broods, as they provide greater abundance of accessible food resources for chicks than the dense forest (Allan 1985).

General Habitat Preferences:

Minimum Elevation (m):	300
Maximum Elevation (m):	1000
Patch Size Requirements:	> 100 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Boreal Conifers

Early Succession Spruce-Fir

Open Peatlands

Softwood Swamps

Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Habitat Succession

Description of habitat problem(s): Two main causes of historic spruce grouse decline are habitat loss and human encroachment. As colonial settlements expanded from southern Vermont into northeastern Vermont forests, spruce fir forests were cleared and the relatively tame spruce grouse was undoubtedly taken for human consumption whenever the opportunity arose. As industrial timber companies were formed, vast

Common Name: **Spruce Grouse**
Scientific Name: **Falcipennis canadensis**
Species Group: **Bird**

areas of virgin spruce fir forest were cut, and 19th century loggers may have taken spruce grouse to supplement their daily fare. By 1980 spruce grouse apparently remained only in the Nulhegan Basin, which at the time was experiencing heavy cutting of its mostly mature forests. With the dawn of the new millennium, much of Essex County forests are publicly owned or subject to conservation easements held by the State and/or private conservation organizations. As a result,

Conservation and sustained forestry goals across much of Essex County forestland will likely maintain if not increase available spruce grouse habitat. Increasing human development, however, will no doubt continue to encroach on some peripheral habitats, and the forecast increases in outdoor recreationists to Essex County could disrupt breeding activities and/or increase susceptibility to predation or adverse weather conditions (especially if pets accompany their owners on excursions through grouse habitats).

Non-Habitat Problems:

Harvest or Collection

Predation or Herbivory

Description of non-habitat problem(s): Predation is likely the most common cause of spruce grouse mortality (Boag and Schroeder 1992) although no predator seems to depend on spruce grouse as a large part of its diet (Robinson 1980). A major predator of spruce grouse eggs is the red squirrel (Tamiasciurus hudsonicus) (Boag et al 1984, Naylor and Bendell 1987). Other potential predators in Vermont are the northern goshawk (Accipiter gentilis), barred owl (Strix varia), northern raven (Corvus corax), red fox (Vulpes vulpes), coyote (Canis latrans) , bobcat (Lynx rufus), black bear (Ursus americanus), striped skunk (Mephitis mephitis), fisher (Martes americana) and ermine (Mustela erminea). On Mount Desert Island, 7 of 19 radio transmitter-carrying adult females (37%) were predated between April and late August (Whitcomb et.al.1996). Predators identified were a Red-tailed Hawk (Buteo jamaicensis), red fox and an unidentified raptor. A study in Ontario of 67 spruce grouse nests found 55% were depredated by red squirrels, red fox, black bear and striped skunk (D'Eon 1997).

Another potential problem, especially in small patches that might hold dispersing grouse, is accidental shootings by ruffed grouse hunters. A grouse hunter, conditioned to shoot quickly at a flushing grouse, could easily mistake a flushed spruce grouse for a ruffed grouse. A few accidental shootings were documented during the 1980's in Ferdinand and Norton. The continuation of educational efforts aimed at grouse hunters in Essex County should help prevent this source of mortality from actually limiting the population.

Common Name: **Spruce Grouse**
Scientific Name: **Falcipennis canadensis**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Medium	Vermont's trienniel census within the Nulhegan Basin should be continued, and reported sighting from elsewhere during the breeding season should be investigated.
Research	Threats and Their Significance	Low	
Research	Population Genetics	Low	Genetic comparisons between Vermont birds and potential sources for reintroduction should occur.
Monitoring	Population Change	Medium	Vermont's trienniel census within the Nulhegan Basin should be continued, and reported sighting from elsewhere during the breeding season should be investigated.
Monitoring	Habitat Change	Medium	Extent of spruce-fir forests in Northeastern Vermont should be peridocally assessed (eg USFS Forest Survey).
Monitoring	Monitor Threats	Low	

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Species Restoration	High	Establish a 2nd sub-population in Victory Basin to reduce likelihood of serious impact to the overall population. Enhance genetic exchange with NH s grouse with establishment of another population within dispersal distance of the Connecticut River.	Number of sub-populations established and maintained.	ANR	SWG
Awareness Raising and Communications	Medium	Continue with educational campaign to reduce accidental harvest by ruffed grouse hunters.	Number of accidentally-shot spruce grouse	ANR, USFSW	SWG, PR
Habitat Restoration	Medium	Implement the habitat management guidelines as detailed in VFWD's Spruce Grouse Recovery Plan.	Number of public land management plans which incorporate Spruce Grouse habitat management.	ANR, USFWS	SWG, PR

Common Name: **Spruce Grouse**
Scientific Name: **Falcipennis canadensis**
Species Group: **Bird**

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Common Name: **Ruffed Grouse**
Scientific Name: **Bonasa umbellus**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

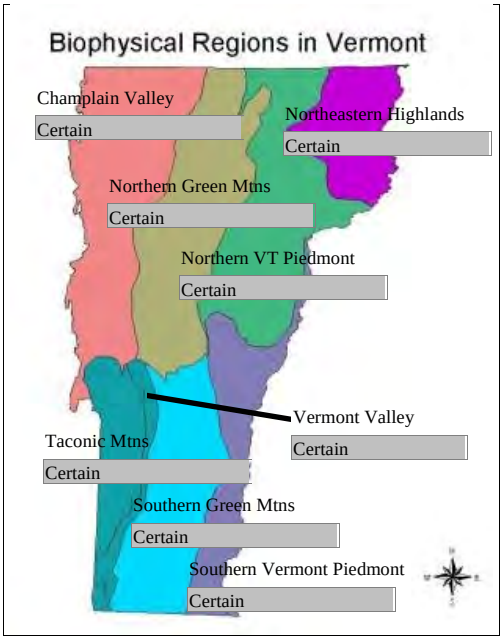
Global Rank: G5 **Global Trend:**
State Rank: S5B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

While no trend data is collected in Vermont, habitat declines and trends reported from other states (MA drumming survey, NH regional biologist information, ME hunter reports) indicate a general decline in ruffed grouse populations across New England. While the potential exists for some of these declines to be related to ruffed grouse "cycles", these cycles have been shown to be less prevalent in the NE than in midwest and northern/subarctic regions.

Early successional habitat components required by ruffed grouse are declining on both a statewide and regional basis. Losses of acceptable habitat continue due to conversion to non-forest use. On areas which remain forested, stand maturation due to reductions in active forest management have substantially reduced habitat quality. Conservation efforts should focus on implementing a comprehensive program of habitat improvements on both public land and private land.

Distribution:



Natural History Elements:

Home Range: < 100 ha
Migrant? Yes

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Distributed statewide where acceptable habitat components are present.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☑ General Literature ☑

Prefers mosaic of young and mid-aged hardwood and hardwood/conifer forests. Typically utilizes maturing forest habitats for nesting, sapling/pole stage hardwood forest habitats for breeding, and very young hardwood forest regeneration habitats for brood rearing. While
species can utilize and survive within edge and other suboptimal habitats, larger patch sizes of required habitat

Common Name: **Ruffed Grouse**
Scientific Name: **Bonasa umbellus**
Species Group: **Bird**

components adjacent to one another usually result in greater productivity and survival.

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	> 10 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☑
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Boreal Conifers
Early Succession Boreal Hardwoods
Early Succession Northern Hardwoods
Early Succession Other Types
Early Succession Pine and Hemlock
Early Succession Spruce-Fir
Early Succession Upland Oak
Floodplain Forests
Grasslands and Hedgerows
Hardwood Swamps
Marshes and Sedge Meadows
Northern Hardwood
Oak-Pine Northern Hardwood
Open Peatlands
Seeps and Pools
Shrub Swamps
Softwood Swamps
Spruce Fir Northern Hardwood
Upland Shores
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat
Habitat Fragmentation
Habitat Succession
Inadequate Disturbance Regime
Invasion by Exotic Species

Description of habitat problem(s):

- permanent loss of forest habitat to non-forest uses;
- regional forest maturation resulting in suboptimal brood survival due to lack of protective cover and resulting increased predation;
- fragmentation of dense regeneration habitats by mature forest resulting in substantially

Common Name: **Ruffed Grouse**
Scientific Name: **Bonasa umbellus**
Species Group: **Bird**

declining species productivity and significant mortality in localized, and sometimes large areas. Coupled with habitat loss to conversion of non-forest habitats, some ruffed grouse sub-populations have been extirpated in areas of former population abundance.

Non-Habitat Problems:

Parasites

Predation or Herbivory

Description of non-habitat problem(s): Herbivory by white-tailed deer can substantially limit necessary brood habitats in areas of high deer abundance, although this is essentially a manifestation of an ES habitat volume-related problem.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Information on optimal habitat component patch size in various landscapes and forest cover types would be helpful.
Research	Basic Life History	Low	
Research	Distribution and Abundance	Low	Institute a ruffed grouse drumming survey and small-game hunter survey to establish ruffed grouse breeding population trends and harvest levels.
Research	Threats and Their Significance	Medium	Information on mortality due to parasites or nest predation in northern hardwood forest would be helpful.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	Medium	Little monitoring has been done on either productivity or mortality. This has compromised efforts to adequately measure changes due to habitat loss and respond to these population changes with corrective actions.
Monitoring	Habitat Change	High	See above.

Common Name: **Ruffed Grouse**
Scientific Name: **Bonasa umbellus**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Species Restoration	High	Reverse VT ruffed grouse population trend delcine to support an annual average hunting harvest of 150,000 birds over 10 years through improvement of grouse breeding and rearing habitat Use CSWA habitat target of 82,000ha (Rosenberg 2004).	Population response to management, BBS surveys.	Ruffed Grouse Society, FWD	Pittman-Robertson, WHIP
Awareness Raising and Communications	Medium	Initiate public education campaigns to highlight the need for active, even age forest management on public and private lands to create and maintain seedling/sapling forest habitat complexes.	Number of media outlets reached, number of audiences reached, number of media products developed, number of participants in programs.		
Habitat Restoration	Medium	Determine appropriate old field habitat targets for state lands and restore and maintain old field habitats where needed to increase suitable ES songbird habitat.	Number of acres positively affected by management. Population response to management.	ANR, USFS, Audubon, Forest Products Association, VT Loggers Association	Pittman-Robertson, WHIP
Conservation Finance	Medium	Create a state-funded, private lands, early successional habitat improvement initiative. Fund for > $50,000/yr with revenues from state lands forest management.	Level of funds raised.	FWD	ANR, PR

Bibliography:

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Common Name: **Sora**
Scientific Name: **Porzana carolina**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

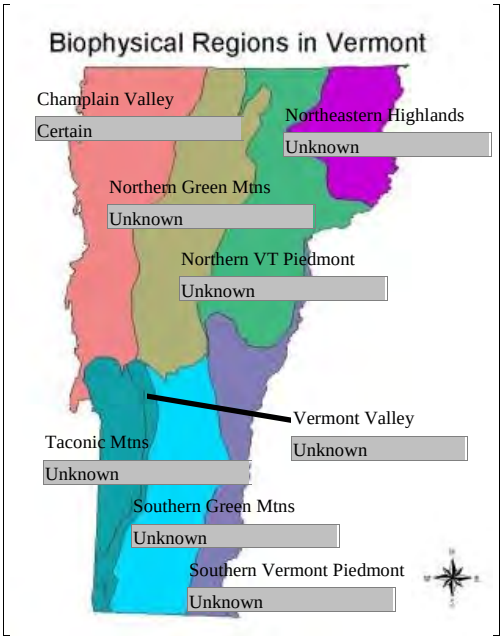
Global Rank: G5 **Global Trend:**
State Rank: S2S3B,S3N **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Current listed as species of special concern in Vermont.

Known as a breeder in the state but distribution and abundance unknown.

Distribution:



Natural History Elements:

Home Range:
Migrant? No

- **Within watershed** ☐
- **Within biophysical region** ☐
- **Within VT** ☐
- **Within Region** ☐
- **Within US** ☐
- **Outside US** ☐

Distribution Summary:

Has been located primarily in the Champlain Valley as well as Lake Memphremagog.

Common Name: **Sora**
Scientific Name: **Porzana carolina**
Species Group: **Bird**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Marshes and Sedge Meadows

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Unknown Habitat Threats

Description of habitat problem(s):

Description of non-habitat problem(s):

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	Medium	Determine habitat requirements specific to Vermont
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	Accurately determine distribution in Vermont through comprehensive presence/absence surveys of likely nesting locations.
Research	Threats and Their Significance	Medium	Determine potential limiting factors
Monitoring	Population Change	Medium	Monitor population changes at known location
Monitoring	Habitat Change	Medium	Monitor habitat changes at known nesting locations
Monitoring	Monitor Threats	Low	

Common Name: **Sora**
Scientific Name: **Porzana carolina**
Species Group: **Bird**

Bibliography:

Laughlin, S. B. and D.P. Kibbe, editors. The atlas of breeding birds of Vermont. University of New Enegland Press. Hanover, New Hampshire, USA.

Common Name: **Lesser Yellowlegs**
Scientific Name: **Tringa flavipes**
Species Group: **Bird**

Conservation Assessment:

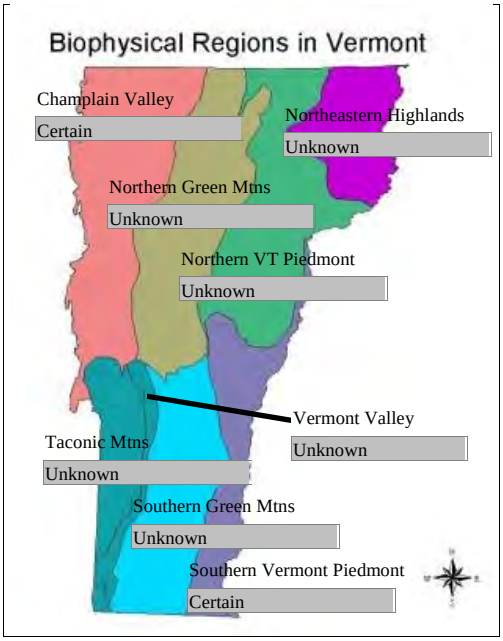
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S4S5N **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Unknown

Assessment Narrative:

This species population is believed to be stable. Impacts to breeding areas (Canadian tundra,muskeg) include commercial development, extraction of earth resources, and oil and gas development. Wetlands along migration routes in VT may be jeopardized by development also. Pollutants and un-regulated hunting may be concerns on wintering grounds (S. America).

Distribution:



Natural History Elements:

Home Range:
Migrant? Yes
Within watershed ☐
Within biophysical region ☐
Within VT ☐
Within Region ☐
Within US ☐
Outside US ☑

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Nesting habitat occurs in Arctic within the tundra-boreal forest ecotone or transition zone. Uses shallow wetlands, muskeg I areas with abundant aquatic invertebrates. Migratory habitats include lake shores, river banks, and wetlands near agricultural area and early successional forests and shrub patches.

Common Name: **Lesser Yellowlegs**
Scientific Name: **Tringa flavipes**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Lower CT River
Aquatic: Man-Made Water Bodies
Grasslands and Hedgerows
Marshes and Sedge Meadows
Open Peatlands
Shrub Swamps
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Description of habitat problem(s): Conversion of wetlands to agriculture and residential development along shorelines.

Description of non-habitat problem(s):

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Water level management to attract shorebirds. Timing and duration of drawdowns is critical to providing stopover areas along migration routes in VT.
Research	Distribution and Abundance	Medium	More shorebird surveys are needed around Lake Champlain and during drawdowns at state wildlife management areas.

Species Strategies *(see Appendix B for additional habitat, community & landscape conservation summaries.)*

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Policy & Regulations	Medium	Protect shorelines through ACT250 and other regulatory processes.	Number of shoreline acres or feet impacted by development.	Audubon Vermont, VT-DEC, USFWS	EPA, NNHP Nongame funds, Partners for Fish and Wildlife, WHIP

Bibliography:

Tibbitts, T.L. and W. Moskoff. 1999. Lesser Yellowlegs (Tringa flavipes). In: The Birds of North America, No. 427.

Common Name: **Upland Sandpiper**
Scientific Name: **Bartramia longicauda**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: High Priority

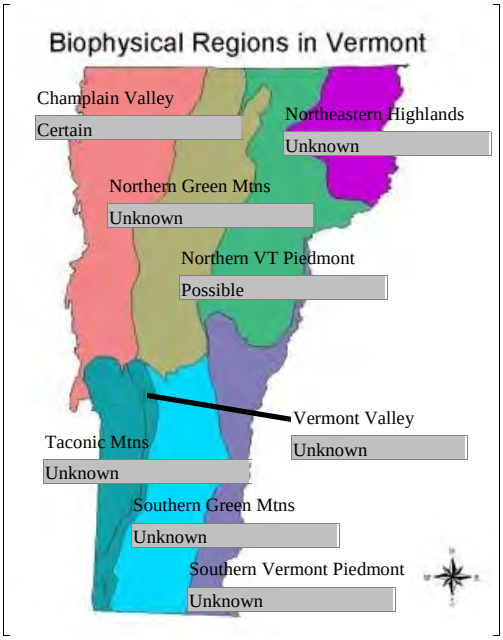
Global Rank: G5 **Global Trend:**
State Rank: S2S3B,S3N **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Currently listed as Endangered in Vermont and proposed for Endangered Status. Regional status is as follows: CT-S1, MA-S1, NH-S1, RI –S1, NY-S3, ME-S3 (see appendix I for codes)

Upland Sandpiper numbers have dropped sharply in Vermont since the early 1990's. Habitat loss due to direct loss and agricultural intensification implicated in this decline.

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Currently found in the Champlain Valley with highest concentrations in Addison and Alburg.

Known Watersheds

NA

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Upland Sandpiper, a migrant wintering in South America, prefers large grassland areas (50-100 acres) with a mosaic of grassland habitat types for nesting and brood rearing (pasture, hayfields, etc).

Common Name: **Upland Sandpiper**
Scientific Name: **Bartramia longicauda**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	> 100 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☑
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☑
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Grasslands and Hedgerows

Lawns, Gardens, and Row Crops

Other Cultural

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Fragmentation

Habitat Succession

Description of habitat problem(s): Loss of habitat due to direct loss of habitat, fragmentation of large agricultural grasslands and agricultural intensification (conversion to row crops, early haying regimes)

Non-Habitat Problems:

Trampling or Direct Impacts

Description of non-habitat problem(s): Destruction of nest site due to agricultural activities (haying)

Common Name: **Upland Sandpiper**
Scientific Name: **Bartramia longicauda**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Determine habitat requirements specific to Vermont
Research	Basic Life History	Low	
Research	Distribution and Abundance	Low	Conduct statewide Upland Sandpiper survey to accurately determine and location of breeding pairs statewide,
Research	Threats and Their Significance	Medium	Assess impacts of agricultural activities
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	Statewide census of Upland Sandpiper breeding population
Monitoring	Habitat Change	High	Assess habitat loss and impacts of agricultural intensification on available habitat
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	Medium	Determine potential limiting factors other than those related to habitat loss (i.e. predation)

Common Name: **Upland Sandpiper**
Scientific Name: **Bartramia longicauda**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration	High	Maintain grassland habitat in suitable locations through active management of woody vegetation within Grassland Bird Focus Areas.	Increase and maintain available habitat in suitable locations	VTFWD, Audubon Vermont, NRCS, USFWS	US government
Conservation Payments/Financial Incentives	High	Maintain nesting habitat during the breeding season by mowing after July 15th.	Increase habitat protection through enrollment in WHIP and GRP	VTDFW, Audubon Vermont , NCRS	US Government
Protected Area Management	High	Maintain nesting habitat throughout breeding season by developing site specific conservation plans which include restricting mowing after July 15 on publicly owned lands (WMAs and state airports).	Maintain and increase current acreage under management on state lands	VTFWD, NRCS, VTrans	VTFWD
Conservation Payments/Financial Incentives	High	Protect privately owned known nesting sites and suitable grassland habitat from development and agricultural intensification by creating Grassland Bird Focus Areas to concentrate management efforts (see the Vermont Grassland Bird Management Plan).	Development of Grassland Bird Focus Areas and increase protection of available habitat through enrollment in WHIP and GRP.	VTFWD, Audubon Vermont, NRCS, USFWS	US government
Technical Assistance, Training, Learning Networks	High	Educate agricultural community and general public about grassland birds and management options to protect habitat	Develop a grassland bird outreach program	VTFWD, Audubon Vermont, VINS, UVM	SWG, VTFWD
Conservation Payments/Financial Incentives	High	Maintain large tracts (>100 acres) of suitable grassland habitat for entire suite of grassland bird species	Increased protection of habitats through enrollment in WHIP and GRP	VTFWD, Audubon Vermont, NRCS	US Government

Bibliography:

Jones, A.L. and P.D. Vickery. 1997. Conserving grassland birds:managing large grasslands including conservation lands, airports, and landfills over 75 acres for grassland birds. Massachusetts Audubon Society, Lincoln, Mass. USA.

LaBarr, M. L. 2005. The Vermont Grassland Bird Management Plan. Unpublished report. Audubon Vermont, Huntington, VT.

Common Name: **American Woodcock**
Scientific Name: **Scolopax minor**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

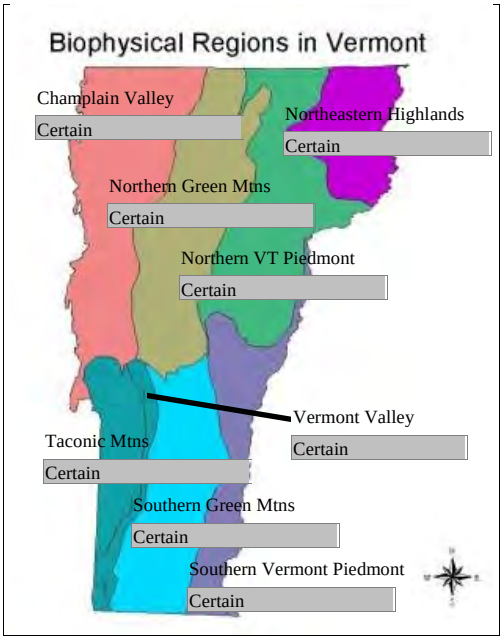
Global Rank: G5 **Global Trend:**
State Rank: S5B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

PIF Tier IIA -- high regional concern. Annual singing-ground survey trends for the Eastern Region and Vermont for the period 1968-
2004 = -2.1 (P<0.01) and -1.1%, respectively (Kelly 2004).

Rangewide declines in American woodcock have been tied to similar declines in habitat area and quality, and losses of these habitats appears to be accelerating. Existing, moist-soil early-successional hardwood habitat (especially alder and aspen-dominated sites), and open field components required by woodcock should be identified on both public and some conserved private land, and these habitats should be actively managed to prevent further losses or qualitative declines. Additional work should focus on identifying areas where active habitat management would re-establish quality regeneration and open field habitat components across all biophysical regions.

Distribution:



Natural History Elements:

Home Range: < 100 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☑
Outside US	☑

Distribution Summary:

American woodcock are present statewide where acceptable habitat exists. During migration, woodcock numbers increase and birds can often be found less optimal habitat. While distributed across all Vermont biophysical regions, the relative scarcity of critical habitat components w/in these polygons makes this distribution map somewhat a misleading gauge of habitat security.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☑ General Literature ☑

Prefers young hardwood, hardwood/conifer and alder forests proximate to open-field habitats in moist soil areas. Typically utilizes dense alder or aspen regeneration forest habitats for nesting, brood rearing and adult feeding, open field or forest openings > 1 ac. for breeding and roosting. While species can utilize and survive within moist soil forest edge and other suboptimal habitats, larger patch sizes of required habitat components

Common Name: **American Woodcock**
Scientific Name: **Scolopax minor**
Species Group: **Bird**

adjacent to one another usually result in greater productivity and survival.

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements: > 1 ha
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☑
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☑
Requires movement corridors: ☑
Prefers large expanses of forest habitat: ☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Boreal Hardwoods
Early Succession Northern Hardwoods
Early Succession Other Types
Early Succession Pine and Hemlock
Early Succession Upland Oak
Floodplain Forests
Grasslands and Hedgerows
Hardwood Swamps
Northern Hardwood
Oak-Pine Northern Hardwood
Open Peatlands
Outcrops and Alpine
Seeps and Pools
Shrub Swamps
Spruce Fir Northern Hardwood
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat
Habitat Alteration
Habitat Fragmentation
Habitat Succession
Inadequate Disturbance Regime

Description of habitat problem(s): Losses of moist-soil regeneration/successional habitats has been implicated in 30-yr population decline in both eastern and central flyways. Additional concerns regarding conversion to agriculture and non-forest cover of overwintering habitat in southern U.S. Fragmentation of both field habitats by reforestation and feeding/brood cover by succession has likely increased brood mortality during post-hatch brood movements to adequate rearing habitat.

Non-Habitat Problems:

Pollution
Predation or Herbivory

Common Name: **American Woodcock**
Scientific Name: **Scolopax minor**
Species Group: **Bird**

Description of non-habitat problem(s): Some anecdotal and emerging scientific data concerns regarding soil contaminants (primarily heavy metals) inducing adult mortality and compromising productivity.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Habitat/breeding success interelationship information would help to formulate range-wide recovery strategies.
Research	Basic Life History	Medium	AOU recommends studies to investigate large-scale population dymamics as related to habitat.
Research	Distribution and Abundance	Low	AOU recommends studies to investigate potential range expansions, however these likely would not be warranted in Vermont or established , central portions of range.
Research	Threats and Their Significance	Medium	As related to Habitat requirements, IAFWA has conducted work on habitat v. hunting mortality. Additional work could expand on this type of comparative mortality assessment, including such elements as soil contamination, losses by domestic predators and potential breeding losses due to various statutory restrictions on vegetation management in riparian and other "buffer" areas.
Monitoring	Population Change	High	Ongoing singing ground surveys should be enhanced and updated to consider historic habitat changes and other factors such as degree of development, etc.
Monitoring	Habitat Change	High	Habitat losses have largely been "tracked" by USFS Forest statistics in terms of age class/cover type composition. A more focused approach to estimation of historic, current and projected "woodcock habitat" across the region is certainly warranted,
Monitoring	Range Shifts	Medium	See above research needs re: distribution.

Common Name: **American Woodcock**
Scientific Name: **Scolopax minor**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	Medium	Initiate public education campaigns to highlight the need for active, even age forest management on public and private lands to create and maintain seedling/sapling forest habitat complexes.	Number of media outlets reached, number of audiences reached, number of media products developed, number of participants in programs.		
Species Restoration	High	Reverse declining woodcock breeding populations to BPOP of 3.0-3.2 males/singing ground route. Maintain population w/ breeding habitat enhancement and creation/maintenance of suitable migration/feeding habitat.Use CSWA habitat target (Rosenberg 2004)	Population response to management, BBS surveys.	Ruffed Grouse Society, FWD	Pittman-Robertson, WHIP
Habitat Restoration	Medium	Determine appropriate old field habitat targets for state lands and restore and maintain old field habitats where needed to increase suitable ES songbird habitat.	Number of acres positively affected by management. Population response to management.	ANR, USFS, Audubon, Forest Products Association, VT Loggers Association	Pittman-Robertson, WHIP
Conservation Finance	Medium	Create a state-funded, private lands, early successional habitat improvement initiative (modeled on NH's Small Landowner Grant program). Fund for > $50,000/yr with revenues from state lands forest management. This could offset landowner WHIP obligations.	Level of funds raised.	FWD	
Species Restoration	Medium	Continue and increase efforts at singing ground survey participation and observer recruitment.			
Habitat Restoration	Medium	Increase the size and number of well distributed roosting/display field habitats in proximity to feeding and brood habitat on public land.	Number and distribution of roosting/display fields		

Common Name: **American Woodcock**
Scientific Name: **Scolopax minor**
Species Group: **Bird**

Bibliography:

International Association of Fish and Wildlife Agencies (IAFAWA), 1999. The Report of the Woodcock Task Force to the Migratory Shore & Upland Game Bird Subcommittee, Migratory Wildlife Committee. Declines in American Woodcock Populations: Probable Cause and Management Recommendations. March, 1999.

Keppie, D.M. and R.M. Whiting, Jr. 1994. American Woodcock (Scolopax minor). In: The Birds of North America, No. 100 (A. Poole and F. Gill, Eds.) Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.

Kelley, J.R., Jr. 2004. American woodcock population status, 2004. U.S. Fish and Wildlife Service, Laurel, Maryland. 15pp.

Rosenberg, K. V. 2004. Partners in Flight continental priorities and objectives defined at the state and bird conservation region levels, Vermont. Cornell Lab of Ornithology, Ithaca, NY. 26 p.

Dessecker, D.R. and D.G. McAuley. 2001. Importance of early successional habitat for game birds. Wildlife Society Bulletin 29: 456-465.

Common Name: **Common Tern**
Scientific Name: **Sterna hirundo**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: High Priority

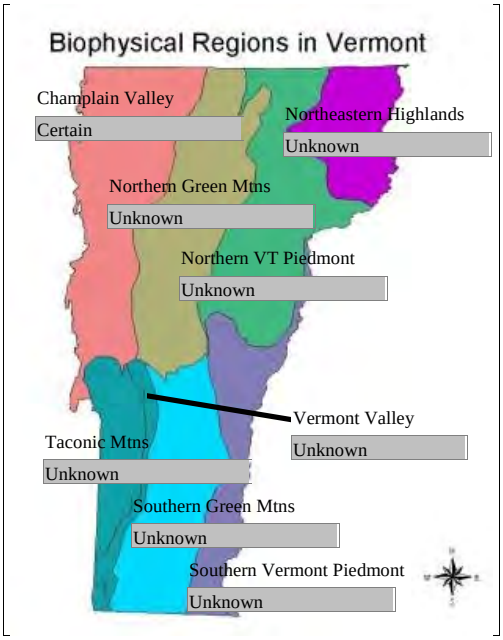
Global Rank: G5 **Global Trend:**
State Rank: S1S2B,S2N **State Trend:** Stable
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

VT state endangered since 1988

Common Tern populations in Vermont declined during the 1970's and 80's from about 300-400 breeding pairs to approx. 50 breeding pairs in 1988. Since then numbers have incresed steadily due to monitoring and mangement efforts and protection of nesting islands. Breeding numbers still remain below those recommended for down-listing to Threatened in Vermont and monitoring and management efforts will need to continue to avoid a population decline in the future.

Distribution:



Natural History Elements:

Home Range: <1 ha
Migrant? Yes

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Nests on 4-5 small islands in the NE arm of Lake Champlain. Can be observed throughout the northern part of the lake.

Known Watersheds

Lake Champlain Direct

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☐ General Literature ☐

Nests on isolated islands, beaches, dredge spoils and human made structures in areas with little to no vegetatior

Common Name: **Common Tern**
Scientific Name: **Sterna hirundo**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m): 94
Maximum Elevation (m): 110
Patch Size Requirements: None
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lake Champlain

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Description of habitat problem(s): Traditional nesting islands currently protected for species. No direct habitat problems documented although habitat degradation due to future use of nesting and roosting Double-crested Cormorants possible.

Non-Habitat Problems:

Competition

Predation or Herbivory

Trampling or Direct Impacts

Description of non-habitat problem(s): Predation by avian predators and ants, competition for nesting sites with Ring-billed gulls and Double-crested Cormorants and human disturbance are primary problems to this species.

Common Name: **Common Tern**
Scientific Name: **Sterna hirundo**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	Well documented.
Research	Basic Life History	Low	Well documented.
Research	Distribution and Abundance	Low	Well documented.
Research	Threats and Their Significance	Low	Well documented.
Research	Population Genetics	Low	Well documented.
Research	Other Research	Low	
Monitoring	Population Change	High	Annual monitoring needed to determine population size and reproductive success.
Monitoring	Habitat Change	Medium	Annual monitoring of impacts of Double-crested Cormorants and impacts on island vegetation.
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	High	Annual monitoring required to determine impacts of predation, nest-site competition, and human disturbance on breeding population

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Protected Area Management	High	Limit predation by owls and ants at nesting islands through active management (trapping owls, eradicating ants).	Sustained increase in reproductive success to 1 fledgling/pair	VTFWD, Audubon Vermont	Nongame Wildlife Fund, Private Foundations
Species Restoration	High	Prevent Double-crested Cormorants from nesting as nesting islands could be negatively impacted by Double-crested Cormorants resulting in alteration of current vegetative cover.	Number of islands free of double-crested cormorants.	VTFWD, Audubon Vermont, Lake Champlain Land Trust	Nongame Wildlife Fund, Private Foundations
Protected Area Management	High	Provide adequate nesting space by managing gull and cormorant populations as competition for nesting space on tern nesting islands by Ring-billed Gulls and Double-crested Cormorants may result in limited nesting space for terns.	breeding success, number of nests per island.	VTFWD, Audubon Vermont	Nongame Wildlife Fund, Private Foundations
Protected Area Management	High	Continue to restrict access to tern nesting islands during the breeding season.	No documented nest failure due to human disturbance	VTFWD, Audubon Vermont, VT State Police	Nongame Wildlife Fund, Private Foundations

Common Name: **Common Tern**
Scientific Name: **Sterna hirundo**
Species Group: **Bird**

Bibliography:

Mark LaBarr. 1996. The Vermont Common Tern Recovery Plan. Woodstock, VT. Vermont Institute of Natural Science. Unpublished

Common Name: **Black Tern**
Scientific Name: **Chlidonias niger**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: High Priority

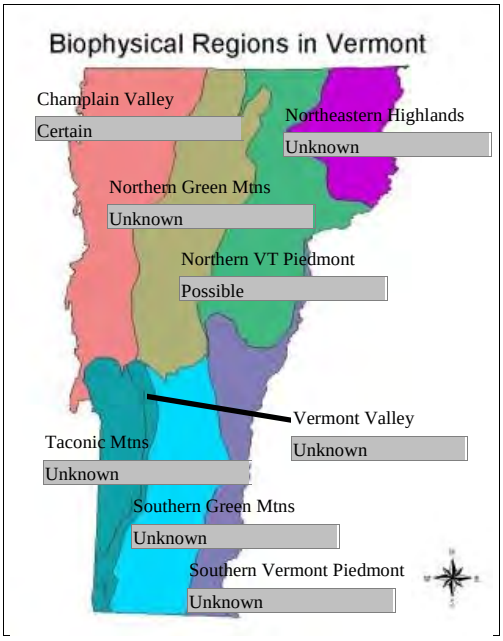
Global Rank: G4 **Global Trend:**
State Rank: S2B,S2N **State Trend:**
Extirpated in VT? **Regionally Rare?**

Assessment Narrative:

Relatively stable populations but restricted to one primary site at MNWR. Listed as Threatened in Vermont.

Black Tern populations have remained low but stable during the past decade. The number of nesting locations, however, has declined to just one, Missisquoi National Wildlife Refuge.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? Yes

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Black Terns are currently only found at one location, Missisquoi National Wildlife Refuge on northern Lake Champlain. Nesting occurred regularly in Lake Memphremagog South Bay throughout the 1990's.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☐ General Literature ☐

Nests in wetlands consisting of both emergent (cattails) and shrub (buttonbush) vegetation with adequate floating vegetation to build nests on.

Common Name: **Black Tern**
Scientific Name: **Chlidonias niger**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	94
Maximum Elevation (m):	0
Patch Size Requirements:	> 10 ha
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Marshes and Sedge Meadows

Shrub Swamps

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Unknown Habitat Threats

Description of habitat problem(s): Sufficient habitat seems available both at its known nesting site (MNWR) and at sites it has nested at in the past.

Non-Habitat Problems:

Unknown Non-Habitat Threatss

Description of non-habitat problem(s): Direct problems to this species have been difficult to determine, however Vermont is on the periphery of this species range and declines in the core of its range may be causing peripheral populations to decline at a faster rate.

Common Name: **Black Tern**
Scientific Name: **Chlidonias niger**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Determine if changes in habitat structure at nesting locations has resulted in abandonment of sites used in the past.
Research	Basic Life History	Low	Well documented
Research	Distribution and Abundance	Medium	Annually monitor current and past nesting locations
Research	Threats and Their Significance	High	Increased understanding of limiting factors to this species in Vermont
Research	Population Genetics	Medium	Relationship to core population
Research	Taxonomy	Low	
Research	Other Research	Low	
Monitoring	Population Change	High	Annually monitor breeding population at current and past nesting locations.
Monitoring	Habitat Change	Medium	Monitor changes in habitat structure, especially those due to invasive species.
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	Medium	Annually monitor known limiting factors
Monitoring	Other Monitoring Needs	Medium	Continue to manage protected wetlands to provide suitable habitat. Determine appropriate management actions (e.g. vegetation management, artificial nesting structures) that will enhance breeding success.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Species Restoration	High	Determine appropriate management strategies which will increase population size and the number of breeding locations.	Increase in population size and number of colony sites at different geographic locations.	VTFWD, Independent Contractors (Nat Shambaugh), Audubon Vermont	SWG

Bibliography:

Shambaugh, Nathanial. 2003. 2003 Black Tern Population Survey and Other Marshbird Monitoring Activities in Vermont

Common Name: **Black-billed Cuckoo**
Scientific Name: **Coccyzus erythropthalmus**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

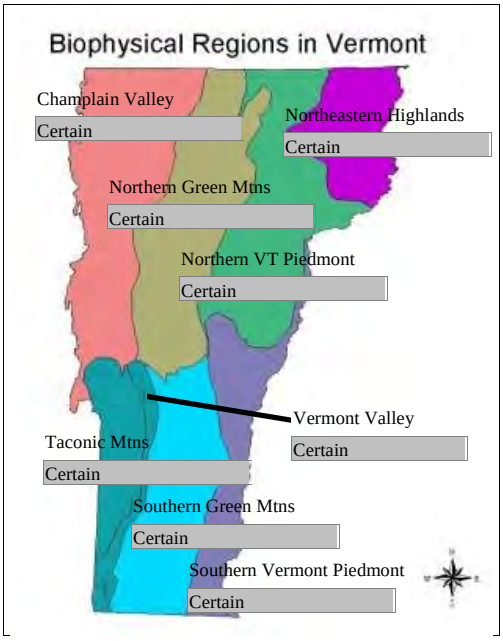
Global Rank: G5 **Global Trend:**
State Rank: S5B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Bird Conservation Regions 13 & 14 High Regional Concern. Not on Audubon's Watch or ABC's Green Lists.

BBS shows significant decline for Vermont (-11.35%, p = 0.0288) for 1966 - 2003. US routes show significant annual decreases, particulary from 1980 - 1998 (-4.7%. P < 0.01).

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

Distributed statewide, although less common in northeastern quarter of the state.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Brushy pastures, shrubby hedgerows at edges of fields, dry, open woods and groves (DeGraff and Rudis 1986). Prefers groves of trees, forest edges, and thickets; frequently associated with water. In NE. U.S.; usually found in edges and clearings of young deciduous-coniferous woods; abandoned farmland...brushy hillsides and pastures hawthorn thickets " (Hughes 2001).

Common Name: **Black-billed Cuckoo**
Scientific Name: **Coccyzus erythropthalmus**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	610
Patch Size Requirements:	> 1 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☑
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Boreal Hardwoods
Early Succession Northern Hardwoods
Early Succession Pine and Hemlock
Early Succession Spruce-Fir
Early Succession Upland Oak
Grasslands and Hedgerows
Lawns, Gardens, and Row Crops
Shrub Swamps

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Fragmentation

Habitat Succession

Description of habitat problem(s): "Declines in some regions could be due in part to reversion of abandoned farmland to forests that are unsuitable (Erskine 1992). Other problems responsible for declines could be modification of habitat on wintering grounds, hazards during migration, and pesticide use." (Hughes 2001).

Non-Habitat Problems:

Pollution

Description of non-habitat problem(s): Black-billed cuckoos may be highly vulnerable to pesticides used on insect outbreaks, perhaps especially on winter range in South America.

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	Medium	The nature of breeding range habitat changes relatively well understood, however the magnitude of these changes should be documented.
Research	Distribution and Abundance	Medium	Continued monitoring of changes in distribution and abundance should be tied to tracking changes in habitat (succession of abandoned farmland).
Monitoring	Population Change	Medium	Continued monitoring of changes in distribution and abundance should be tied to tracking changes in habitat (succession of abandoned farmland).
Monitoring	Habitat Change	Medium	The nature of breeding range habitat changes relatively well understood, however the magnitude of these changes should be documented.

Common Name: **Black-billed Cuckoo**
Scientific Name: **Coccyzus erythropthalmus**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Conservation Payments/Financial Incentives	Medium	Conservation of hedgerows could be incorporated into WHIP program goals.	Number of sites designated for hedgerow conservation and protection from development.	ANR, USFS, USFWS	SWG, PR,WHIP
Habitat Restoration	High	Early- successional habitat (shrubland) goals should be developed for public and private land to support 4,200 individuals (Rosenberg 2004).	Total area managed for ESH.	ANR, USFS, USFWS	SWG, PR,WHIP
Policy & Regulations	Medium	Better control use of pesticides harming this species and its food sources.	Number of regulations restricting use of harmful pesticides. Reduction in contaminates present in cuckoo habitat.	ANR, Vt. Dept of Agriculture, USDA	USDA, FDA

Bibliography:

Hughes, J. M. 2001. Black-billed cuckoo (Coccyzus erythropthalmus). In The Birds of North America, No. 587 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

DeGraff, R.M. and D.D. Rudis 1986. New England wildlife: habitat, natural history, and distribution. Gen. Tech. Rep. NE-108. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 491 p.

Rosenberg, K. V. 2004. Partners in Flight continental priorities and objectives defined at the state and bird conservation region levels, Vermont. Cornell Lab of Ornithology, Ithaca, NY. 26 p.

Common Name: **Barn Owl**
Scientific Name: **Tyto alba**
Species Group: **Bird**

Conservation Assessment:

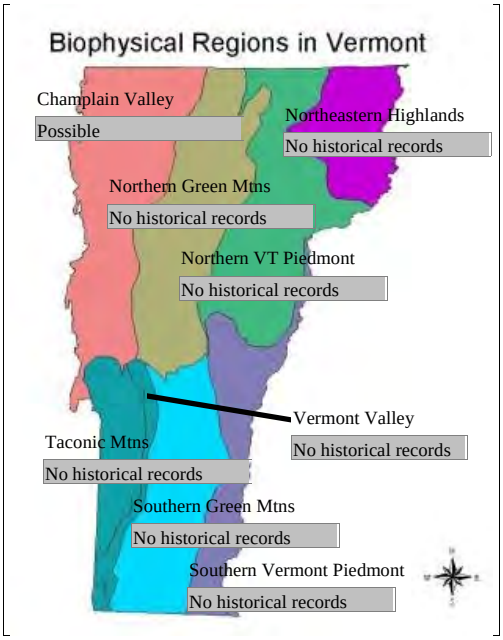
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S1B,S1N **State Trend:** Unknown
Extirpated in VT? Unknown **Regionally Rare?** No

Assessment Narrative:

"The Barn Owl is on the northern edge of its range in Vermont, and was not known to nest in the state until the [original] Atlas Project survey" (Laughlin and Kibbe 1985). No confirmed nesting records since 1983.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☑
Within US	☑
Outside US	☑

Distribution Summary:

Records from VT Breeding Bird Atlas show 4 confirmed nestings in the Champlain Valley from 1976-1981. Only one pair was still breeding in 1983 (Laughlin & Kibbe 1985). There have been no recent records of nesting barn owls.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Breeding: Semi-open low elevation habitats - agricultural areas, grasslands, pastures, etc., with old barn silos or abandoned structures for nest sites. Will nest in tree hollows, burrows, and nest boxes (DeGraaf & Yamasaki 2001).

Wintering: Needs protected roosting areas, as it is sensitive to extreme weather (Laughlin & Kibbe 1985).

Common Name: **Barn Owl**
Scientific Name: **Tyto alba**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	1
Maximum Elevation (m):	0
Patch Size Requirements:	Unknown
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☑
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☑
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Building or Structure

Grasslands and Hedgerows

Lawns, Gardens, and Row Crops

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Succession

Description of habitat problem(s): Succession/reforestation of farmlands and grasslands are believed to be the cause of regional declines (DeGraaf & Yamasaki 2001).

Description of non-habitat problem(s): Availability of food plays large role in breeding habits and productivity (DeGraaf & Yamasaki 2001).

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Medium	Determine status in Vermont including the identification of nesting pairs
Research	Threats and Their Significance	Low	
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	Medium	Monitor status in Vermont
Monitoring	Habitat Change	Low	
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	Low	
Monitoring	Other Monitoring Needs	Low	

Common Name: **Barn Owl**
Scientific Name: **Tyto alba**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Species Restoration	High	Erect nest boxes in habitats which formerly or are most likely to attract nesting owls.	Number of barn owls using nest boxes.	ANR, NWF, VINS, VA	SWG, PR
Habitat Restoration	High	Maintain grassland habitat in suitable locations through active management of woody vegetation within Grassland Bird Focus Areas.	Increase and maintain available habitat in suitable locations	VFWD, Audubon Vermont, NRCS, USFWS	US government
Conservation Payments/Financial Incentives	Medium	Conserve grassland/shrubland habitats on private lands.	Number and total area of sites conserved.	USDA, USFWS, VHCB	FSA, SWG, VHCB
Publically-Owned Protected Areas	Medium	Maintain large grassland/shrublands on public lands in the Champlain valley.	Number and total area of sites maintained.	ANR	SWG, PR
Technical Assistance, Training, Learning Networks	High	Educate agricultural community and general public about grassland birds and management options to protect habitat	Develop a grassland bird outreach program	VFWD, Audubon Vermont, VINS, UVM	SWG, VFWD

Bibliography:

1) DeGraaf, R. M., and M. Yamasaki. 2001. New England wildlife: habitat, natural history, and distribution. University Press of New England, Hanover, NH. 482 pp. 2) Laughlin, S. B., and D. P. Kibbe. 1985. The atlas of breeding birds of Vermont. University Press of New England, Hanover, NH. 456 pp.

Common Name: **Long-eared Owl**
Scientific Name: **Asio otus**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

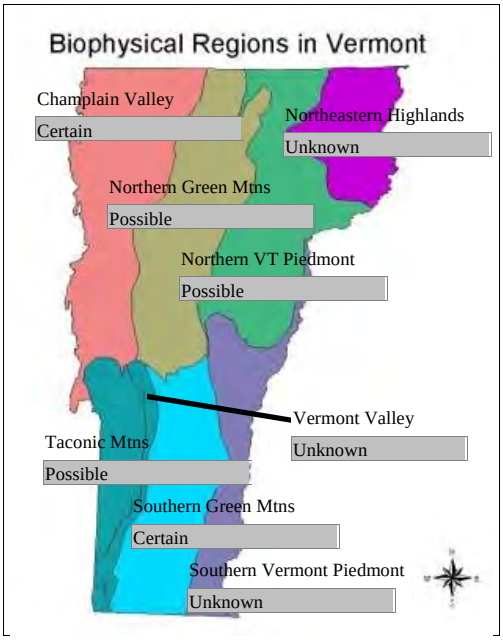
Global Rank: G5 **Global Trend:**
State Rank: S2B,S2N **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

Not adequately covered by standard population monitoring programs.

Status and distribution throughout the region are unknown. New monitorting techniques and extra effort are needed to inventory and monitor this species.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☑
Within US	☑
Outside US	☐

Distribution Summary:

Distribution info from VT Breeding Bird Atlas (Laughlin & Kibbe 1985). Fifteen adults were recorded from 1973-1983 in various parts of the state, including Northern Green Mts, Northern VT Piedmont, Southern Green Mts, and possibly the northern part of the Taconic Mts. There were three confirmed breeding locations - Sudbury, Waltham, and Brandon.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Breeding: Nests in dense coniferous or mixed forests adjacent to open land for foraging. Will also use thickets, forested wetlands and riparian areas, parks and orchards.

Wintering: Communal roosts in similar habitat to above (DeGraaf & Yamasaki 2001).

Common Name: **Long-eared Owl**
Scientific Name: **Asio otus**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	3300
Patch Size Requirements:	> 1 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Floodplain Forests
Grasslands and Hedgerows
Hardwood Swamps
Northern Hardwood
Oak-Pine Northern Hardwood
Seeps and Pools
Softwood Swamps
Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Unknown Habitat Threats

Description of habitat problem(s): Habitat-related problems unknown. Assume this species is somewhat vulnerable to deforestation and development, given its secretive status and need for seclusion.

Non-Habitat Problems:

Unknown Non-Habitat Threatss

Description of non-habitat problem(s):

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Distribution and Abundance	Medium	
Research	Threats and Their Significance	Medium	
Monitoring	Population Change	Medium	Monitor VT population trends and determine preferred habitat types.
Monitoring	Monitor Threats	Medium	

Common Name: **Long-eared Owl**
Scientific Name: **Asio otus**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	Medium	Initiate public education campaigns to highlight the need for active, even age forest management on public and private lands to create and maintain seedling/sapling forest habitat complexes.	Number of media outlets reached, number of audiences reached, number of media products developed, number of participants in programs.		
Habitat Restoration	High	Determine appropriate old field habitat targets for state lands and restore and maintain old field habitats where needed to increase suitable ES songbird habitat.	Number of acres positively affected by management. Population response to management.	ANR, USFS, Audubon, Forest Products Association, VT Loggers Association	Pittman-Robertson, WHIP
Conservation Finance	Medium	Create a state-funded, private lands, early successional habitat improvement initiative (modeled on NH's Small Landowner Grant program). Fund for > $50,000/yr with revenues from state lands forest management. This could offset landowner WHIP obligations.	Level of funds raised.	FWD	

Bibliography:

1) DeGraaf, R. M., and M. Yamasaki. 2001. New England wildlife: habitat, natural history, and distribution. University Press of New England, Hanover, NH. 482 pp. 2) Laughlin, S. B., and D. P. Kibbe. 1985. The atlas of breeding birds of Vermont. University Press of New England, Hanover, NH. 456 pp.

Common Name: **Short-eared Owl**
Scientific Name: **Asio flammeus**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

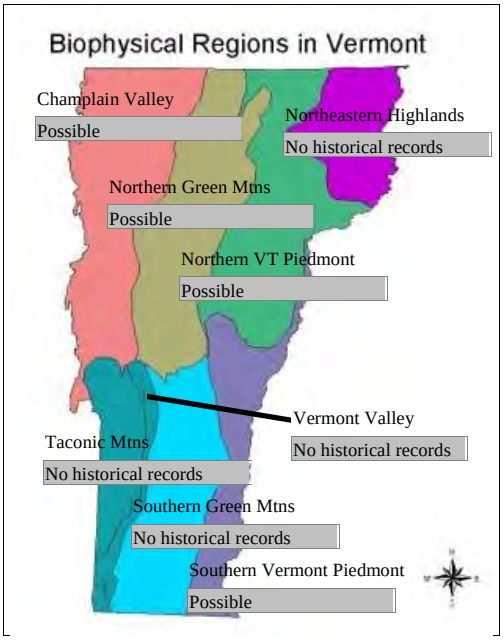
Global Rank: G5 **Global Trend:**
State Rank: S1B,S2N **State Trend:** Unknown
Extirpated in VT? Unknown **Regionally Rare?** Yes

Assessment Narrative:

Unknown breeding status in VT - regular winter sightings in Champlain Valley.

BBS data indicate significacant long-term overall decline, although trend unknown for many areas. Decline likely attributed to habitat conversion of marshes, grasslands, and low-use pastures.

Distribution:



Natural History Elements:

Home Range: <1000 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☑
Within US	☑
Outside US	☐

Distribution Summary:

Distribution info from VT Breeding Bird Atlas (Laughlin & Kibbe 1985). Two confirmed nestings found in Champlain Valley. Other sightings in Northern Green Mts, and Southern & Northern VT Piedmont - all single sightings. Significant wintering concentrations have been seen in the Champlain Valley.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Breeding: Open land (marshlands & grasslands preferred), but will also use agricultural land and other open habitat.

Wintering: same as above with little/no snow cover (DeGraaf & Yamasaki 2001).

Common Name: **Short-eared Owl**
Scientific Name: **Asio flammeus**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	30
Maximum Elevation (m):	0
Patch Size Requirements:	Unknown
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☑
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Grasslands and Hedgerows

Marshes and Sedge Meadows

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Succession

No Habitat Threats

Description of habitat problem(s): Loss of marshes and grasslands since 1930s has caused declines in population (DeGraaf & Yamasaki 2001).

Non-Habitat Problems:

Trampling or Direct Impacts

Description of non-habitat problem(s): Farming practices may impact nesting owls.

Common Name: **Short-eared Owl**
Scientific Name: **Asio flammeus**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Medium	Determine if there is a breeding population in VT
Research	Threats and Their Significance	Medium	
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	Medium	
Monitoring	Habitat Change	Medium	
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	Medium	

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Conservation Payments/Financial Incentives	High	Protect suitable grassland habitat from development and agricultural intensification by creating Grassland Bird Focus Areas to concentrate management efforts (see Vermont Grassland Bird Management Plan)	Development of Grassland bird focus Areas and increased protection of habitat through enrollment in WHIP and GRP	VTFWD, Audubon Vermont, NRCS	USDA
Protected Area Management	High	Maintain nesting habitat throughout breeding season by developing site specific conservation plans which include restricting mowing after July 15 on publicly owned lands (WMAs and state airports).	Maintain and increase current acreage under management on state lands	VFWD, NRCS, VTrans	VFWD
Habitat Restoration	High	Maintain grassland habitat in suitable locations through active management of woody vegetation within Grassland Bird Focus Areas.	Increase and maintain available habitat in suitable locations	VFWD, Audubon Vermont, NRCS, USFWS	US government
Technical Assistance, Training, Learning Networks	High	Educate agricultural community and general public about grassland birds and management options to protect habitat	Develop a grassland bird outreach program	VFWD, Audubon Vermont, VINS, UVM	SWG, VFWD

Common Name: **Short-eared Owl**
Scientific Name: **Asio flammeus**
Species Group: **Bird**

Bibliography:

DeGraaf, R. M., and M. Yamasaki. 2001. New England wildlife: habitat, natural history, and distribution. University Press of New England, Hanover, NH. 482 pp.

Laughlin, S. B., and D. P. Kibbe. 1985. The atlas of breeding birds of Vermont. University Press of New England, Hanover, NH. 456 pp.

Common Name: **Common Nighthawk**
Scientific Name: **Chordeiles minor**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: High Priority

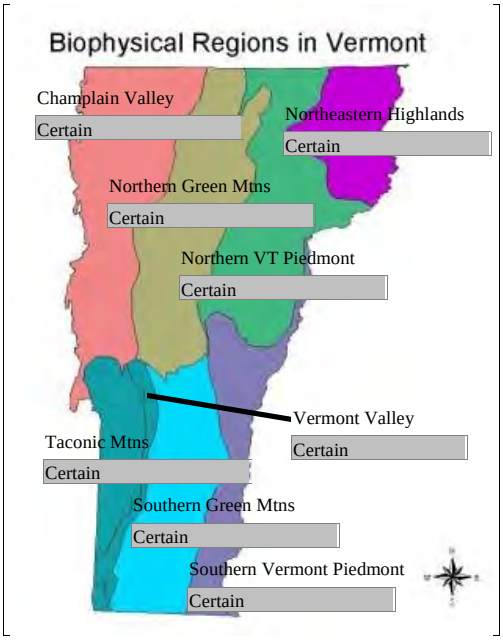
Global Rank: G5 **Global Trend:**
State Rank: S2S3B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

BBS trend for Eastern Region, 1996-2003 = -4.59% (p = 0.00000). Data set for Vermont too small for analysis.

Species declining due to lack of upland openings, clear-cuts and bare patches necessary for nesting. Additional evidence that non-selective pest control for mosquitoes has resulted in declining food resource availability (largely moths).

Distribution:



Natural History Elements:

Home Range: < 100 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Prefers nesting/breeding habitats including dunes, beaches, logged or clearcut areas, open forests, rock outcrops, gravel outwashes and gravel on flat roofed buildings. Utilizes virtually all open habitats, above water and open woodlands, including urban and suburban areas, during crepuscular feeding and migration.

Common Name: **Common Nighthawk**
Scientific Name: **Chordeiles minor**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	> 10 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☑
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☑
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Building or Structure
Early Succession Boreal Conifers
Early Succession Boreal Hardwoods
Early Succession Northern Hardwoods
Early Succession Pine and Hemlock
Early Succession Spruce-Fir
Early Succession Upland Oak
Floodplain Forests
Grasslands and Hedgerows
Hardwood Swamps
Marshes and Sedge Meadows
Northern Hardwood
Oak-Pine Northern Hardwood
Shrub Swamps
Softwood Swamps
Spruce Fir Northern Hardwood
Upland Shores
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat
Habitat Fragmentation
Habitat Succession
Inadequate Disturbance Regime
Unknown Habitat Threats

Description of habitat problem(s): Losses of upland openings, reductions of clearcut timber harvest, conversion of natural openings to non-suitable habitat (residential, etc.), conversion of flat, gravel-covered roofs to metal/rubberized coating/sheeting.

Non-Habitat Problems:

Loss of Prey Base
Predation or Herbivory
Unknown Non-Habitat Threatss

Description of non-habitat problem(s): 1) Reductions of preferred prey due to non-selective pesticide use.

Common Name: **Common Nighthawk**
Scientific Name: **Chordeiles minor**
Species Group: **Bird**

2) Losses due to vehicle collisions while roosting on gravel roads.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Factor accounting for decreased nesting on available gravel roofs and effects of deforestation; nest/roost site characteristics
Research	Basic Life History	Medium	Longevity of breeders, reproductive output; male fidelity.
Research	Threats and Their Significance	High	Population status as related to pesticide use.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration	Medium	Conduct complete vegetation removal on select areas of existing upland openings, and provide for even-age timber management on public lands to increase suitable common nighthawk nesting habitat.	Number of acres positively affected by management. Population response to management.	FWD, FPR, Audubon, Forest Products Association, VT Loggers Association	Pittman-Robertson, WHIP
Conservation Finance	Medium	Create a state-funded, private lands, early successional habitat improvement initiative. Fund for > $50,000/yr with revenues from state lands forest management. Allow the installation of gravel pads on flat roofed buildings as a conservation practice.	Level of funds raised.	FWD	P-R, ANR
Awareness Raising and Communications	Medium	Initiate public education campaigns to highlight the need for active, even-age forest management and the need for mineral soil outcrops (gravel, ledge) on public and private lands to create suitable habitat complexes.	Number of media outlets reached, number of audiences reached, number of media products developed, number of participants in programs.	ANR, USFS, USFWS	SWG, P-R
Habitat Restoration	High	Stabilize or reverse declining population trend for Common nighthawks to realize and maintain a survey value of ??? or between ??? and ??? Individuals (PIF has not set regional target populations).	Population response to management, BBS surveys.	Ruffed Grouse Society, Audubon, FWD	Pittman-Robertson, WHIP
Habitat Restoration	Medium	Identify and enlarge/enhance suitable lakeshore and riparian gravel depositions to create additional nesting habitat.	Number of sites identified and positively affected by management. Population response to management.	VA, VINS, NWF	SWG

Common Name: **Common Nighthawk**
Scientific Name: **Chordeiles minor**
Species Group: **Bird**

Bibliography:

Poulin,R.G., S.D. Grindal, and R.M. Brigham. 1996. Common Nighthawk (Chordeiles minor). In: The Birds of North America, No. 213 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Onithologists' Union, Washington, D.C.

Common Name: **Whip-poor-will**
Scientific Name: **Caprimulgus vociferus**
Species Group: **Bird**

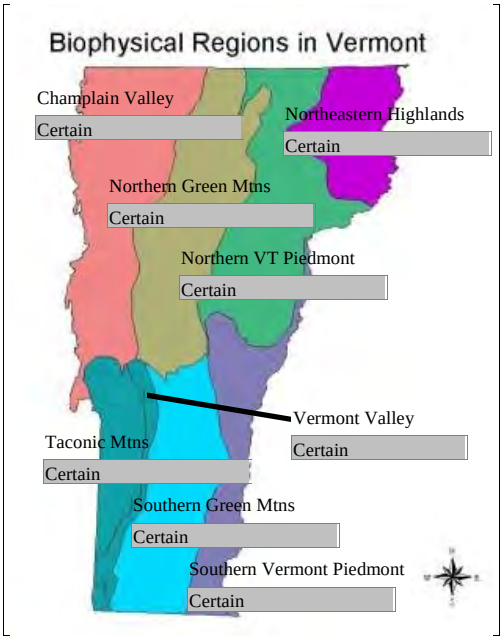
Conservation Assessment:

Final Assessment: High Priority

Global Rank: G5 **Global Trend:**
State Rank: S2B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☑
Within VT	☑
Within Region	☑
Within US	☑
Outside US	☑

Distribution Summary:

Statewide.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Dry open deciduous or open mixed forest with little or no underbrush or herbaceous layer on forest floor. In NY, prefers dry, low-elevation hardwood forests. Absent from heavily forested areas, and missing from many areas of dense, uninterrupted forest; however evidence suggests that small, isolated woodlots in agricultural areas provide poor habitat (Md. Data).

Common Name: **Whip-poor-will**
Scientific Name: **Caprimulgus vociferus**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 300
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☑
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☑
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Cliffs and Talus
Early Succession Boreal Hardwoods
Early Succession Northern Hardwoods
Early Succession Pine and Hemlock
Early Succession Upland Oak
Floodplain Forests
Grasslands and Hedgerows
Hardwood Swamps
Marshes and Sedge Meadows
Northern Hardwood
Oak-Pine Northern Hardwood
Open Peatlands
Outcrops and Alpine
Seeps and Pools
Shrub Swamps
Softwood Swamps
Spruce Fir Northern Hardwood
Upland Shores
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat
Habitat Alteration
Habitat Fragmentation
Habitat Succession
Impacts of Roads or Trails
Inadequate Disturbance Regime
Unknown Habitat Threats

Description of habitat problem(s): Habitat loss due to conversion, closure of forest openings and succession.

Non-Habitat Problems:

Loss of Prey Base

Common Name: **Whip-poor-will**
Scientific Name: **Caprimulgus vociferus**
Species Group: **Bird**

Pollution

Predation or Herbivory

Unknown Non-Habitat Threatss

Description of non-habitat problem(s): Evidence suggests non-specific pesticide/bio control for agricultural pests has reduced prey base.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	More research should be directed toward habitat use and requirements, since it appears that local populations utilize a diversity of forested habitat types throughout the Northeast, and that is a hopeful sign for its recovery and survival.
Research	Basic Life History	High	Reasons for population declines should be studied, including the effects of pesticide use for gypsy moth eradication. BT has been reported to be toxic to more than 40 species of lepidopterans, resulting in possible insect prey declines for this and other species of nightjars.
Research	Distribution and Abundance	High	There is a need to develop new region-wide standardized techniques and devote additional effort to inventorying and monitoring this species.
Research	Threats and Their Significance	High	Because the species flies low to the ground to forage along roads, its vulnerability to road mortality should be considered in plans to pave rural roads in species habitat. Roadside mortality studies should be encouraged, and the effects of grazing on this and other ground-nesting species of conservation concern need further study.
Monitoring	Population Change	High	More effort should be made to locate and report occurrence in August and September.

Common Name: **Whip-poor-will**
Scientific Name: **Caprimulgus vociferus**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration	Medium	Investigate and implement, where possible, understory prescribed burning to create open-forest habitat w/ little underbrush suitable for whip-poor-will nesting.	Number of sites identified and positively affected by management. Population response to management.		
Habitat Restoration	Medium	Determine appropriate old field habitat targets for state lands and restore and maintain old field habitats where needed to increase suitable ES songbird habitat.	Number of acres positively affected by management. Population response to management.	ANR, USFS, Audubon, Forest Products Association, VT Loggers Association	Pittman-Robertson, WHIP
Habitat Restoration	High	Stabilize or reverse declining population trend for whip-poor-wills to realize and maintain a population of 1,100 individuals. Use CSWA habitat target of 82,000ha (Rosenberg 2004).	Population response to management, BBS surveys.	Ruffed Grouse Society, Audubon, VFWD	Pittman-Robertson, WHIP
Awareness Raising and Communications	Medium	Initiate public education campaigns to highlight the need for active, even age forest management on public and private lands to create and maintain seedling/sapling forest habitat complexes.	Number of media outlets reached, number of audiences reached, number of media products developed, number of participants in programs.		
Conservation Finance	Medium	Create a state-funded, private lands, early successional habitat improvement initiative. Fund for > $50,000/yr with revenues from state lands forest management. Allow the installation of gravel pads on flat roofed buildings as a conservation practice.	Level of funds raised.	FWD	ANR, P-R

Bibliography:

Cink, C.L. 2002. Whip-poor-will (Caprimulgus vociferous). In A. Poole and F. Gill, editors, The Birds of North America, No. 620. Academy of Natural Sciences, Philadelphia, Pa., and American Ornithologists' Union, Washington, DC. 20 pp.

Laughlin, S. B., and D. P. Kibbe, editors. 1985. The Atlas of Breeding Birds of Vermont. University Press of New England, Hanover Vermont. 456 pp.

Rosenberg, K. V. 2004. Partners in Flight continental priorities and objectives defined at the state and bird conservation region levels, Vermont. Cornell Lab of Ornithology, Ithaca, NY. 26 p.

Common Name: **Chimney Swift**
Scientific Name: **Chaetura pelagica**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

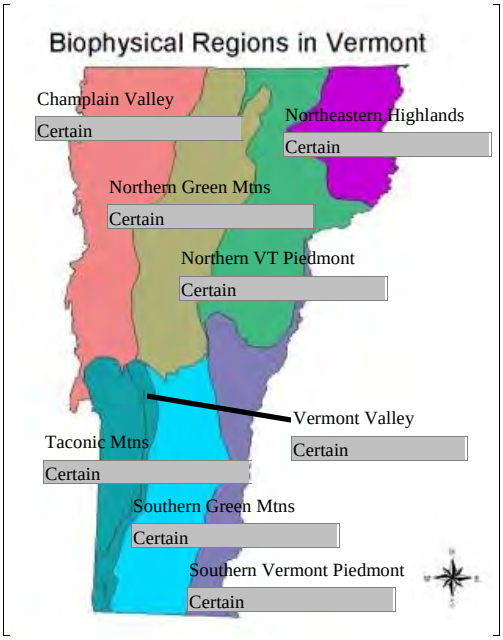
Global Rank: G5 **Global Trend:**
State Rank: S5B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Breeding Bird Survey data displays decreasing trend for northern Vermont and slight increase in population trend for southern Vt. Largest regional declines include the St. Lawrence River Plain and northern New England.

This species has declined in most states throughout its range. Once nested in old growth forests with scattered large hollow trees for roosting. Since settlement and industrialization, the species has shifted its habitat to mostly urban areas with large chimneys used for roosting snd nesting, and agricultural areas where barns and silos provide similar roosting and nesting habitat. Reductions in sizes of chimneys due to change from coal burning to oil and electricity use have now further reduced this species population.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Chimney swifts formerly nested and roosted in caves and large dead trees. As European settlement and development increased, the birds nested mainly in large, tall chimneys in urban and suburban areas. The conversion from heating with coal to oil and electricity in residential homes and industrial plants has reduced the size of chimneys making them less suitable as nest sites for chimney swifts. Some experts believe the birds may still nest in large snags in rural areas. Chimney swifts forage in a variety of habitats, but seem to prefer open areas over densely forested habitats.

Common Name: **Chimney Swift**
Scientific Name: **Chaetura pelagica**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	Unknown
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☑
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Man-Made Water Bodies

Building or Structure

Grasslands and Hedgerows

Lawns, Gardens, and Row Crops

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Description of habitat problem(s): Originally, loss of old growth habitat with large trees used for roosting and nesting. After habitat shift, loss of large chimneys in urban areas.

Non-Habitat Problems:

Unknown Non-Habitat Threatss

Description of non-habitat problem(s):

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	Medium	Snag requirements for nesting. Determine if artifical nest structures can reverse declining population.
Research	Distribution and Abundance	Medium	See habitat requirements.
Monitoring	Population Change	Medium	Continued monitoring needed to assess if declining trend in population is significant.
Monitoring	Habitat Change	Medium	Assess forest succession conditions throughout state and determine if chimney swifts are re-occupying original forest habitats.

Common Name: **Chimney Swift**
Scientific Name: **Chaetura pelagica**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration	Medium	Restoration of old growth habitats should be monitored to determine if chimney swifts are re-occupying these areas.	Presence/absence of chimney swifts on breeding bird surveys, bird atlas; location of roost or nest trees.	USFS,USFWS,VT-FPR, private landowners.	Pittman-Robertson, Nongame funding through NNHP
Habitat Restoration	High	Implement artificial nest structure program, especially on existing and new commercial buildings, to restore nesting opportunities for chimney swifts.	Number of artificial nest structures erected and utilized.	VDFW, VA, VINS, TWF, Vt. League of Cities and Towns, Vt. Builders Association.	SWG

Bibliography:

The Atlas of Breeding Birds of Vermont. 1985. S.B. Laughlin and D.P. Kibbe, eds. University Press of New England. 456 p.

Cink, C.L., and C.T. Collins. 2002. Chimney Swift (Chaetura pelagica). In: The Birds of North America, No. 646 (a. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Common Name: **Black-backed Woodpecker**
Scientific Name: **Picoides arcticus**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

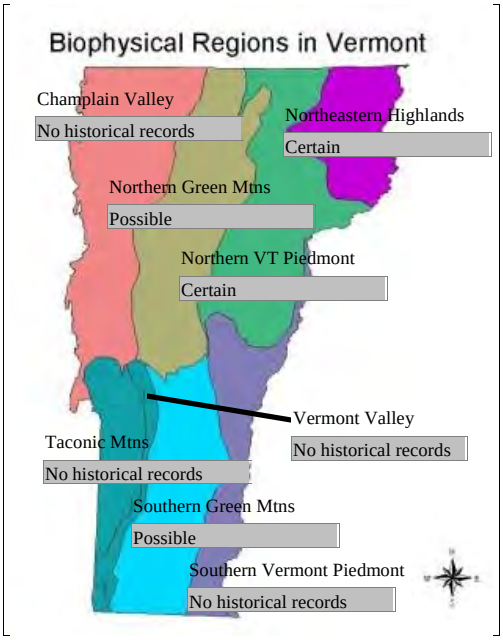
Global Rank: G5 **Global Trend:**
State Rank: S2B,S2N **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

Uncommon resident in northeastern Vermont. Thirty successful nesting pairs documented by Weinhagen (1998) in northeastern Vermont in 1996-97.

Black-backed woodpeckers in Vermont are habitat specialists that depend on mature/overmature spruce-fir-tamarack forests for nesting and foraging. Trends in amount of required habitat are unknown. Conversion of subtantial amount of potential habitat from intensively managed industrial forest land to public or private land w/easments over the past decade may lead to increased and/or stable amount of prefered habitats. Habitat losses may be caused by seasonal and/or permanent residential development, especially at shoreline sites, which may experience increase frequency in the coming decade in northeastern Vermont .

Distribution:



Natural History Elements:

Home Range: <1000 ha
Migrant? Yes

Within watershed	☑
Within biophysical region	☑
Within VT	☑
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Most nesting records concentrated in Northeast Highlands. Thirty successful nests were documented by Weinhagen (1998) in 1996-97.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☑ General Literature ☑

The Black-backed woodpecker inhabitants late successional spruce-fir forests.

Common Name: **Black-backed Woodpecker**
Scientific Name: **Picoides arcticus**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	300
Maximum Elevation (m):	1000
Patch Size Requirements:	> 100 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Open Peatlands

Softwood Swamps

Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Description of habitat problem(s): Black-backed woodpeckers in Vermont are habitat specialists that depend on mature/overmature spruce-fir-tamarack forests for nesting and foraging. Trends in amount of required habitat are unknown. Conversion of substantial amount of potential habitat from intensively managed industrial forest land to public or private land w/easements over the past decade may lead to increased and/or stable amount of preferred habitats. Habitat losses may be caused by seasonal and/or permanent residential development, however, especially at shoreline sites. Some predictions are that lakeshore development may experience increased frequency in the coming decade in northeastern Vermont .

Description of non-habitat problem(s):

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	Medium	Minimum and optimum patch size and degree of home range overlap should be determined. Effects of selective or shelterwood silvicultural practices on nesting success should be investigated.
Research	Distribution and Abundance	Medium	The second Vermont Breeding Bird Atlas should provide insight into current distribution.
Research	Threats and Their Significance	Medium	Known nest sites should be monitored periodically for limiting factors.
Monitoring	Population Change	Medium	Occupancy of known and potential nesting habitats should be periodically monitored.
Monitoring	Habitat Change	Medium	Known nest sites should be monitored periodically for limiting factors.

Common Name: **Black-backed Woodpecker**
Scientific Name: **Picoides arcticus**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration	Medium	Increase rotation age in some managed forests.	Number or sites and total area with increased rotation ages.	ANR	SWG,PR
Publically-Owned Protected Areas	Medium	Identify potential areas on public lands for designation as reserve or no-cut status (including some areas where wildfires and insect outbreaks would not be controlled).	Number of sites and total area of designated reserves.	ANR, UVM, TNC	SWG, PR
Protected Area Management	High	Area of suitable breeding habitat (mature spruce-fir patches > 100 ha) should be mapped. A subset of this data that is in reserve or no-cut status should be determined. Use research findings to inform whether additional acreage is necessary.	Number of sites inventoried. Number of these sites occupied by breeding black-backed woodpeckers.	ANR, UVM	SWG, PR

Bibliography:

Weinhagen, A. C. 1998. Nest-site selection by the Black-backed Woodpecker in northeastern Vermont. Master's thesis, Univ. of Vermont, Burlington.

Dixon, R.D. and V.A. Saab. 2000. Black-backed woodpecker (Picoides articus). In The birds of North America, No. 509. (A. Poole and F. Gill, eds). The Birds of North America. Inc. Philadelphia, PA.

Common Name: **Olive-sided Flycatcher**
Scientific Name: **Contopus cooperi**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

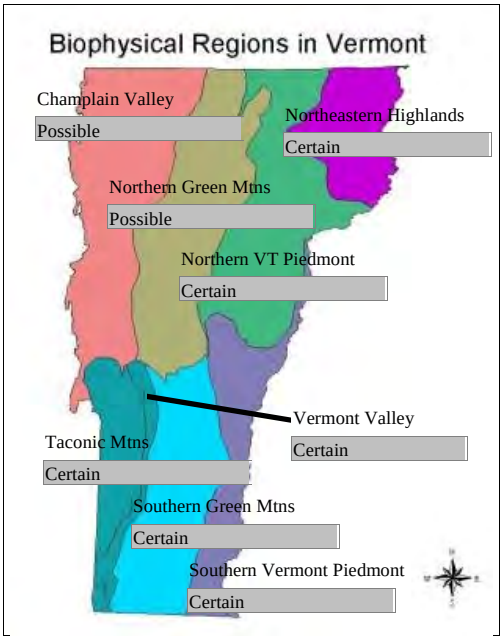
Global Rank: G4 **Global Trend:**
State Rank: S4B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Strong NS negative trends on VT BBS routes (Sauer et al. 2004).

Population declines throughout North America (Sauer et al. 2004). VT populations widespread but local (Fichtel 1985).

Distribution:



Natural History Elements:

Home Range: < 100 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

Based on Fichtel (1985).

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Montane and northern coniferous forests. Frequently associated with forest openings, forest edges near natural openings, or open to semi-open forest stands (Altman and Sallabanks 2000]).

Common Name: **Olive-sided Flycatcher**
Scientific Name: **Contopus cooperi**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	1
Maximum Elevation (m):	6500
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Other Cultural

Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Inadequate Disturbance Regime

Description of habitat problem(s): Species seems to require disturbances in coniferous forests. Beaver ponds, burns, clearcuts, or wind throws all appear to be appropriate. The species has a large territory size (10-20 ha), therefore there seems to be wide spacing between territories. Other problems are conversion to nonforest habitat, loss of wintering habitat, and decrease in prey species (summarized from Altman and Sallabanks 2000).

Description of non-habitat problem(s):

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	Medium	Range-wide, a better understanding of habitat associations is a research priority.
Research	Basic Life History	Low	
Research	Distribution and Abundance	Medium	Habitat-specific demographic data would be useful to understanding population ecology.
Research	Threats and Their Significance	High	The relative importance of breeding versus wintering habitat loss and degradation would help target effective conservation strategies.
Monitoring	Population Change	High	Distribution in Vermont and areas of high abundance to target habitat management activities.
Monitoring	Habitat Change	High	Determine effects of disturbance regimes on habitat quality.

Common Name: **Olive-sided Flycatcher**
Scientific Name: **Contopus cooperi**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration	Medium	Create more early successional habitat, particularly in the northeast kingdom of VT.	Number of acres positively affected by management. Population response to management.	ANR, USFWS	PR, SWG

Bibliography:

Altman, B., and R. Sallabanks. 2000. Olive-sided Flycatcher (Contopus cooperi). In The birds of North America, No. 502 (A. Poole and F. Gill, eds.). The birds of North America, Inc., Philadelphia, Pennsylvania, USA.

DeGraaf, R. M., and M. Yamasaki. 2001. New England wildlife: habitat, natural history, and distribution. University of New England Press, Hanover, New Hampshire, USA, and London, UK.

Fichtel, C. 1985. Olive-sided Flycatcher. Pages 170-171 in S. B. Laughlin and D. P. Kibbe, eds. The atlas of breeding birds of Vermont. University Presses of New England, Hanover, New Hampshire, USA.

Sauer, J. R., J. E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966-2003. Version 2004.1. USGS Patuxent Wildlife Research Center, Laurel, Maryland, USA.

Common Name: **Purple Martin**
Scientific Name: **Progne subis**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

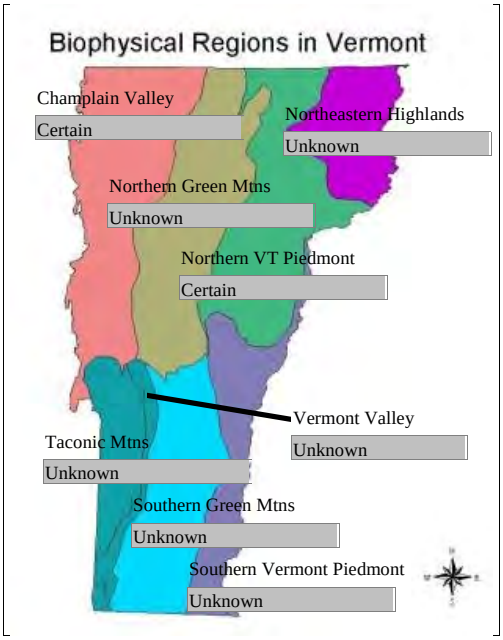
Global Rank: G5 **Global Trend:**
State Rank: S3S4B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Populations have shown a nation-wide decline, especially since 1980.

The purple martin once lived along riparian, lake shoreline, and swamp edges. It is now almost completely found inhabiting areas close to human settlement. It originally nested in tree cavities but almost all nesting now occurs in bird houses erected by humans, except in western U.S. where some natural nesting still occurs.

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Historically found along riparian areas, lake and pond shorelines, and edges of forest openings. Currently found almost exclusively around human settlements.

Common Name: **Purple Martin**
Scientific Name: **Progne subis**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Man-Made Water Bodies

Building or Structure

Grasslands and Hedgerows

Lawns, Gardens, and Row Crops

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Invasion by Exotic Species

No Habitat Threats

Description of habitat problem(s): Competes for nest sites with introduced house sparrow and European starling.

Non-Habitat Problems:

Competition

Description of non-habitat problem(s):
Competes with introduced house sparrow and European starling for nest sites. Inadequate number of nest boxes erected to attract martins and support population viability. Nest boxes may not be maintained adequately by owners.

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Medium	
Research	Threats and Their Significance	Medium	Determine if artifical nest boxes can attract martins to breed in suitable habitats where english house sparrows and starlings are not present or in low numbers.
Research	Population Genetics	Low	
Research	Taxonomy	Low	

Common Name: **Purple Martin**
Scientific Name: **Progne subis**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Species Restoration	High	Establish artificial nest box program on public and private lands.	Presence/absence of breeding martins, number of young fledged, number of nests abandoned due to house sparrows and starlings.	Audubon Vermont, VINS, Cornell Lab of Ornithology, USFWS, NRCS	NNHP Nongame funds, USFWS, Neotropical Bird Conservation Act grants, National Fish and Wildlife Foundation grants, USFWS,NRCS
Awareness Raising and Communications	Medium	Educate public about nest box program, nest box maintenance, and Purple Martin Society	Number of cooperating homeowners who erect martin boxes	VFWD, VA, VINS, NWF	SWG, PR

Bibliography:

The Atlas of Breeding Birds of Vermont. 1985. Laughlin, S.B. and D.P. Kibbe, eds. University of New England Press. 456p.

Brown, C.R. 1997. Purple Martin (Progne subis). In: The Birds of North America, No. 287 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

Common Name: **Gray Jay**
Scientific Name: **Perisoreus canadensis**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

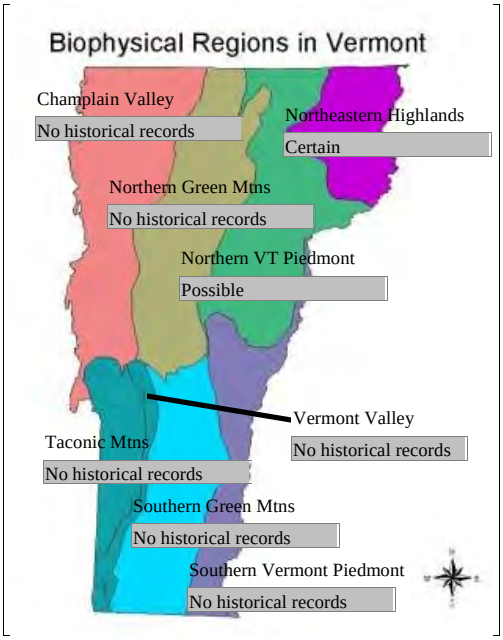
Global Rank: G5 **Global Trend:**
State Rank: S1S2B,S1S2N **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

PIF List (BCR 14 High Priority). Vt. SAG Species of Special Concern. S1S2B. No BBS data for VT.

BBS trend 1966-2002 increased (ns) both survey wide and in USFWS Region 5, but declined (ns) in New York. No BBS trend data for Vermont as the species is sparsely distributed in only one physiographic region. Increased softwood harvest in northeastern Vermont between 1978 to 1984 heightened concern for the gray jay's continued existence, and the SAG proposed it be listed as threatened, but the proposal was rejected. Public lands and conservation easements aquired over the last 2 decades in prime gray jay range, along with higher than expected densities found by Barnard in his ongoing field studies (begun in 1991) have reduced this concern.

Distribution:



Natural History Elements:

Home Range: < 100 ha
Migrant? No

Within watershed	☑
Within biophysical region	☑
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Distribution limited to largest boreal forest patches of northeastern Vermont. Strongholds include the Victory, Nulhegan and Coaticook River Basins. Also occurs at high elevation coniferous forest.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Coniferous forests and nearby deciduous or mixed woodlands.

Common Name: **Gray Jay**
Scientific Name: **Perisoreus canadensis**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	300
Maximum Elevation (m):	1000
Patch Size Requirements:	Unknown
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☑
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Boreal Conifers

Early Succession Spruce-Fir

Softwood Swamps

Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Habitat Fragmentation

Description of habitat problem(s): Gray jays utilize all seral stages of coniferous forests, readily occupy managed landscapes, and readily visit bird feeders or take handouts directly from humans. Conversion of coniferous forests in Vermont strongholds unlikely, however, smaller occupied patches (if they exist) could be degraded by residential or commercial development.

Non-Habitat Problems:

Harvest or Collection

Description of non-habitat problem(s): Accidental capture by trappers has been reported in Ontario. Succeptibility to land trap losses depends on types of baits used (Strickland and Ouellet 1993).

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	High	1) Investigate minimum patch size required for successful breeding and map all potential breeding habitat. 2) Determine total minimum area of suitable coniferous forest patches necessary to support 500 breeding pairs of gray jays in northeastern Vermont.
Monitoring	Population Change	Medium	Monitor population trends via surveys in targeted habitats and track the number of sites inventoried for breeding gray jays.
Monitoring	Habitat Change	Medium	

Common Name: **Gray Jay**
Scientific Name: **Perisoreus canadensis**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Technical Assistance, Training, Learning Networks	Low	Investigate the occurrence of gray jays accidentally caught in furbearer traps in Vermont and, if needed, educate trappers on baiting techniques to minimize losses.	Number of accidental losses.	ANR, VT Trappers Association	SWG, PR

Bibliography:

Stirckland, D. and H. Ouellet. 1993. Gray Jay. In The Birds of North America, No. 40 (A. Poole, P. Stettenheim, and F. Gill, Eds.). Philadelphia:The Academy of Natural Sciences; Washington, DC:The American Ornithologists' Union.

Common Name: **Sedge Wren**
Scientific Name: **Cistothorus platensis**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: High Priority

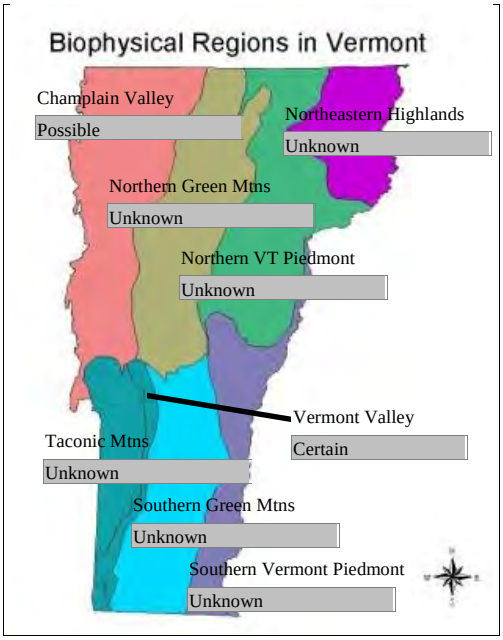
Global Rank: G5 **Global Trend:**
State Rank: S1B **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

Increasing long-term BBS population trend survey-wide (Sauer et al. 2004).

The sedge wren as a breeding species in the Northeast is considered to be in jeopardy. In nearly all the states where it occurs, it is state-listed as an endangered or threatened species. Populations have evidently undergone dramatic declines in the latter part of 20th century after a northern expansion in range which was probably due to the clearing of forests in the 1800s. The more recent shift in landscape from old fields and pasturelands to forests or development, and the draining, filling, and impounding of shallow wetland areas have reduced nesting habitat and continues at a rapid rate. Although habitat loss remains the major factor in population declines, it appears that sedge wren populations today remain well below the level that available habitats could support. Species rare and local in VT (Kibbe 1985). Breeding pairs that are present in one year are not necessarily present in subsequent years (Strong, personal observation).

Distribution:



Natural History Elements:

Home Range: <1 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☑
Outside US	☑

Distribution Summary:

Data from Kibbe (1985).

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Dense, tall growths of sedges and grasses in wet meadows, hayfields, retired croplands, upland margins of ponds and marshes, coastal marshes, and sphagnum bogs. Avoids short, sparse, or open vegetative cover, flooded areas, and wetlands dominated by cattails (Herkert et al. 2001).

Common Name: **Sedge Wren**
Scientific Name: **Cistothorus platensis**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	Unknown
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☑
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Grasslands and Hedgerows

Marshes and Sedge Meadows

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Succession

Description of habitat problem(s): Early haying of grasslands perhaps not as critical as SEWR in VT may be second nesting attempts of birds breeding further north earlier in summer. Consequently, drainage ditches in wet hayfields and meadows may reduce habitat availability. Succession of grassland habitats and conversion of agricultural habitats to urban/suburban developments problematic. Habitat conversion is likely not as severe a problem as for other grassland species, as SEWR requires wet meadow habitat and at least to some degree protected through regulatory measures.

Description of non-habitat problem(s):

Common Name: **Sedge Wren**
Scientific Name: **Cistothorus platensis**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Better understanding of habitat requirements, including preferred soil moisture regimes, vegetation height, density and composition, specific cover requirements for nesting, and minimum effective habitat area. The relationships between habitat use, the abundance of invertebrate prey and soil moisture, rainfall, wetland proximity, and grassland type also need to be defined. There is potential to evaluate through landsat imagery, although substantial ground-truthing would be necessary.
Research	Basic Life History	High	Determine where VT birds are coming from.
Research	Distribution and Abundance	High	Increased knowledge of the status of the population in Vermont. More surveys of potential suitable habitat is necessary to understand status in VT. Currently little information exists on the size and distribution of the population in Vermont. Addtionally, (breeding?) populations present in one year are not necessarily present in subsequent years making conservation recommendations problematic.
Monitoring	Population Change	High	Almost nothing known in VT.
Monitoring	Habitat Change	High	Potentially an easy habitat to manage. More information is necessary to better understand if there is a "population" to manage for.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Technical Assistance, Training, Learning Networks	High	Educate agricultural community and general public about grassland birds and management options to protect habitat	Develop a grassland bird outreach program	VFWD, Audubon Vermont, VINS, UVM	SWG, VFWD
Protected Area Management	High	Maintain nesting habitat throughout breeding season by developing site specific conservation plans which include restricting mowing after July 15 on publicly owned lands (WMAs and state airports).	Maintain and increase current acreage under management on state lands	VFWD, NRCS, VTrans	VFWD
Compatible Resource Use	Medium	Maintain consistency of timing of cutting for potential habitat, as early season mowing of potential habitat is a problem in dry springs.		UVM, NRCS.	NRCS (WHIP, GRP), USDA.
Habitat Restoration	Medium	Late season mowing of potential habitat would reduce problem of succession.	Long-term maintenance of wet meadow habitat.	UVM, NRCS.	NRCS (WHIP, GRP), USDA.

Common Name: **Sedge Wren**
Scientific Name: **Cistothorus platensis**
Species Group: **Bird**

Bibliography:

Heckert, J. R., D. E. Kroodsma, and J. P. Gibbs. 2001. Sedge Wren (Cistothorus platensis). In The birds of North America, No. 582 (A. Poole and F. Gill, eds.). The birds of North America, Inc., Philadelphia, Pennsylvania, USA.

Kibbe, D. P. 1985. Sedge Wren. Pages 228-229 in S. B. Laughlin and D. P. Kibbe, eds. The atlas of breeding birds of Vermont. University Presses of New England, Hanover, New Hampshire, USA.

Sauer, J. R., J. E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966-2003. Version 2004.1. USGS Patuxent Wildlife Research Center, Laurel, Maryland, USA.

Common Name: **Veery**
Scientific Name: **Catharus fuscescens**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

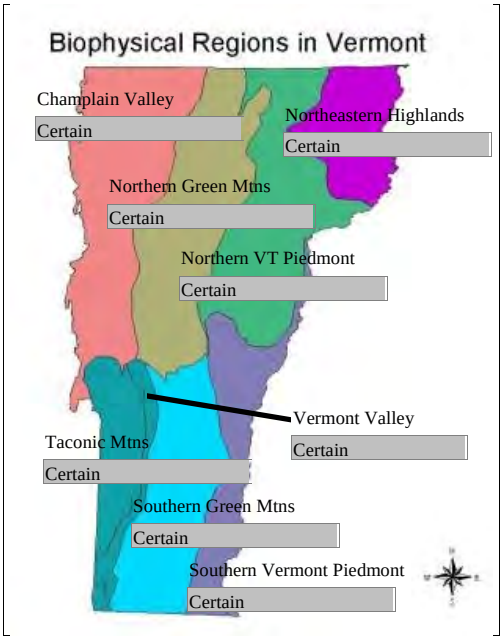
Global Rank: G5 **Global Trend:**
State Rank: S5B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Veery population in VT declined at an annual rate of -0.4%between 1966-2003, according to USGS Breeding Bird Survey data. This is slightly less than similar annual declines in NY (1.3%), NH (-1.6%, ME (-2.1%), and USFWS Region 5 (-1.1%). Continent wide, Veeries declined at a nonsignificant annual rate of -1.4% during this period.

A fairly common species in appropriate mesic, mid-successional hardwood forests. May not be adequately monitored in all habitat types that it occupies (e.g. floodplain forests). An important inhabitant of floodplain forests, should be considered a species to carefully watch for conservation.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

fairly common in all biophysical regions of VT

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☐ General Literature ☐

Damp, deciduous forests

Common Name: **Veery**
Scientific Name: **Catharus fuscescens**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Floodplain Forests
Hardwood Swamps
Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Fragmentation

Habitat Succession

Description of habitat problem(s): Succession or human disturbance that eliminates second-growth riparian or upland forests is detrimental. Fragmentation increases likelihood of nest predation by cowbirds and nest predation by edge specialists

Description of non-habitat problem(s):

Common Name: **Veery**
Scientific Name: **Catharus fuscescens**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Detailed information on habitat preferences in VT would help develop management strategies. Design and implement habitat specific studies to obtain population density and demographic data.
Research	Basic Life History	Medium	Information on demographics and breeding productivity would help understand population dynamics and conservation status
Research	Distribution and Abundance	Medium	Obtain and analyze rigorous population trend data from different forest habitat types, as a means to track populations and evaluate habitats most critical for to maintain or enhance Veery population viability.
Research	Threats and Their Significance	Medium	Investigate effects of human-induced fragmentation on demographics and breeding success through breeding studies in both core and fragmented forests; determine sensitivity of species to fragmentation and limiting factors (nest predators, cowbirds); use results to design conservation measures incorporating forestry and sustainable development
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	1) Important to continue annual monitoring and to ensure that floodplain forests are adequately covered. 2) Continue BBS and VINS Forest Bird Monitoring Program monitoring;
Monitoring	Habitat Change	Medium	1) Important to monitor health and persistence of floodplain forests, as these may contain highest densities of the species in VT. 2) Need iniformation on how forest succession has affected overall habitat suitability for Veery in VT
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	Medium	

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use	High	Develop and implement management strategies to conserve core habitats and enhance population stability; evaluate forestry practices that can enhance habitat suitability; inform landowners and communities about best management practices for Veeries.	Evaluate management strategies used in other parts of species' range and their applicability to VT; study species' response to specific forestry practices in VT and develop adaptive management; evaluate area sensitivity of VEER in different forest habitat	VFWD, VFPR, USFS, VINS	State Wildlife Grants, NFWF, USFWS

Common Name: **Veery**
Scientific Name: **Catharus fuscescens**
Species Group: **Bird**

Bibliography:

Moskoff, W. 1995. Veery (Catharus fuscescens). In The Birds of North America, No. 142 (A. Poole and F. Gill, eds.). The Birds of North America, Philadelphia, PA.

Common Name: **Bicknell's Thrush**
Scientific Name: **Catharus bicknelli**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: High Priority

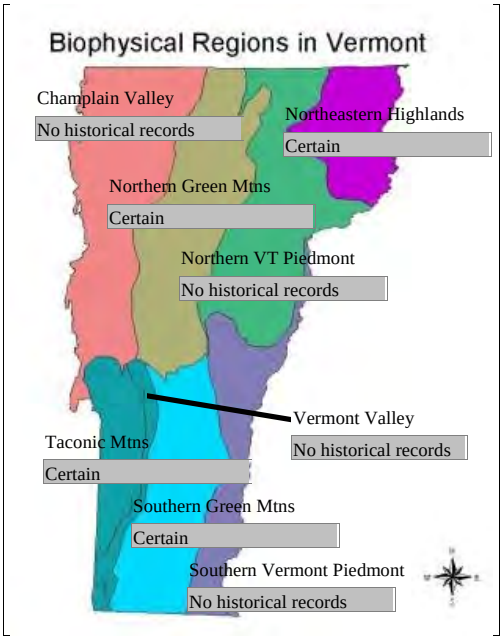
Global Rank: G4 **Global Trend:**
State Rank: S3B **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

Species extensively studied by VINS since 1992, but no baseline data before that, so population trends still poorly known. Recent data from Mountain Birdwatch project indicate that species experienced an annual regionwide decline of 9.1% from 2001-2004.

A habitat specialist whose overall population trends and abundance are not well known. Conservation limiting factors on both breeding and wintering grounds, combined with rarity and occupancy of naturally fragmented habitats, place the species at conservation risk. A high priority for attention in VT.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

Distributed throughout high elevation montane forests of VT

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☐ General Literature ☐

montane fir-dominated forest

Common Name: **Bicknell's Thrush**
Scientific Name: **Catharus bicknelli**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m): 850
Maximum Elevation (m): 1250
Patch Size Requirements: > 10 ha
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Boreal Conifers
Early Succession Spruce-Fir
Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change
Conversion of Habitat
Habitat Alteration
Habitat Fragmentation
Impacts of Roads or Trails

Description of habitat problem(s): The primary problems in Vermont and the Northeast (there are other, likely more significant problems on the species' Caribbean wintering grounds) are degradation and fragmentation of montane forests. Atmospheric pollution may be affecting forest health, and climate change could profoundly impact long-term viability of montane balsam fir forests. Immediate problems include loss and fragmentation of habitat from ski area development, communications tower development, and wind turbine development.

Non-Habitat Problems:

Pollution

Description of non-habitat problem(s): Mercury contamination may be a problem, as research has shown significantly higher atmospheric deposition rates in montane forests than in surrounding low elevation habitats. Recent research has indicated that Hg levels in adult BITH increase with age.

Common Name: **Bicknell's Thrush**
Scientific Name: **Catharus bicknelli**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	Habitat requirements are reasonably well known, though responses to human-created developments need study
Research	Basic Life History	Medium	Much basic life history is known, but some aspects of ecology and demography need further study
Research	Distribution and Abundance	Medium	Distribution is well-documented, but better information is needed on abundance and population ecology in different subhabitat types.
Research	Threats and Their Significance	Medium	1) Expand studies of mercury contamination in BITH and synergistic effects with other environmental stressors (such as calcium depletion); evaluate effects on reproductive success, behavior, survivorship. Design and implement expanded research program on multiple peaks (at least Stratton, Mansfield, and East Mt) 2) It is not known how developments affect local breeding populations
Research	Population Genetics	High	Knowledge of natal dispersal and migratory connectivity could help elucidate population structure and guide conservation planning
Research	Taxonomy	Low	Taxonomy, while still debatable to some, has been resolved and is not crucial to conservation
Research	Other Research	High	1) Conduct research that will enable robust predictions of breeding densities in different sub-habitat types, which can be extrapolated across VT and entire breeding range to derive population estimates. Design specific studies that will quantify BITH breeding densities, correlate density measures with GIS habitat data to estimate overall population numbers in different montane forest sub-habitat types. Use data to generate overall population estimates. 2) There are needs for additional research on the species' wintering grounds.
Monitoring	Population Change	High	Mountain Birdwatch is a critical, ongoing program to monitor population trends
Monitoring	Habitat Change	High	Mountain Birdwatch will collect habitat information with bird population data, as a means to evaluate local changes that may be occurring. Landscape level monitoring of montane forest habitats is essential.
Monitoring	Range Shifts	High	Ongoing monitoring through Mountain Birdwatch will help assess distributional changes, as will programs underway in Quebec and Canadian Maritime provinces, where the species also breeds.
Monitoring	Monitor Threats	High	Landscape level studies of the impacts of development on montane forest species will be the onnly means to document changes that occur. The current strategy of reacting to site-specific projects (e.g. East Mountain wind farm) is unlikely to provide rigorous information that can be applied across the species' range.
Monitoring	Other Monitoring Needs	High	Monitoring must be continued on the species' winter range.

Common Name: **Bicknell's Thrush**
Scientific Name: **Catharus bicknelli**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Technical Assistance, Training, Learning Networks	High	Identify the 15 core monitoring sites, ensure that funding is available to monitor them annually and indefinitely	Coordinate with VINS Mountain Birdwatch program to ensure annual coverage of sites	VINS, VFWD, GMC, USFS	State Wildlife Grant, USFWS, GMNF
Compatible Resource Use	High	Evaluate impacts of human development (ski area expansion/construction, wind power, telecommunications facility) on Bicknell's Thrush and montane forest habitat, and use results to guide future development	Evaluate published results of past studies, implement new studies as appropriate to investigate development impacts, develop and periodically revise as necessary guidelines to minimize and mitigate impacts, monitor post-construction response of BITH	ANR, USFS, TNC, VINS	State Wildlife Grants, GMNF, USFWS
Planning & Zoning	High	Develop a planning process whereby explicit mitigation and management guidelines are specified. Further develop a means to ensure that these are followed and monitored, both in short- and long-term.	Formalize as policy existing recommendations for ski areas and develop new recommendations as research findings warrant. Establish accountability by land owners/managers to adopt specified measures.	ANR, USFS, VINS	State Wildlife Grant, USFWS
Habitat Restoration	Medium	Implement experimental habitat manipulation measures to evaluate the possibility of creating suitable habitat for BITH through artificial disturbance	Conduct controlled habitat manipulations of montane forest to mimic natural disturbance events (e.g., fir waves, catastrophic storm events); carefully monitor BITH and vegetation responses over time	VFWD, VFPR, GMNF, VINS	State Wildlife Grant, GMNF, NFWF
Publically-Owned Protected Areas	High	Identify top 15 breeding sites (those with largest habitat blocks and/or largest known breeding concentrations), specify these as highest priority for long-term protection/conservation/monitoring. Ensure minimal or no further habitat loss at these sites.	Use GIS to identify 15 largest montane forest habitat patches, review current protected status of each, assess further needs for long-term protection, develop site-specific plans for each site.	VFWD, USFS, TNC, VINS	State Wildlife Grants, GMNF, USFWS

Common Name: **Bicknell's Thrush**
Scientific Name: **Catharus bicknelli**
Species Group: **Bird**

Bibliography:

Rimmer, C.C., K.P. McFarland, D.C. Evers, E.K. Miller, Y. Aubry, D. Busby, and R.J. Taylor. 2005. Mercury levels in Bicknell's Thrush and other insectivorous passerine birds in montane forests of northeastern North America. Ecotoxicology 14:223-240.

Lambert, J.D., K.P. McFarland, C.C. Rimmer, S.D. Faccio, and J.L. Atwood. 2005. A practical model of Bicknell's Thrush habitat in the Northeastern United States. Wilson Bulletin. In press.

Rimmer, C.C., K.P. McFarland, W.G. Ellison, and J.E. Goetz. 2001. Bicknell's Thrush (Catharus bicknelli). In The Birds of North America, No. 592 (A. Poole & F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Strong, A.M., C.C. Rimmer, and K.P. McFarland. 2004. Effect of prey biomass on the reproductive success and mating system of a polygynandrous songbird, the Bicknell's Thrush (Catharus bicknelli). Auk 121:446-451.

Goetz, J.E., K.P. McFarland, and C.C. Rimmer. 2003. Multiple paternity and multiple male feeders in Bicknell's Thrush. Auk 120:1044-1053.

Strong, A.M, C.C. Rimmer, K.P. McFarland, and K. Hagen. 2002. Effects of mountain resorts on wildlife. Vermont Law Review 26:689-716.

Rimmer, C.C. and K.P. McFarland. 2000. Migrant stopover and postfledging dispersal at a montane forest site in Vermont. Wilson Bull. 112:124-136.

Rimmer, C.C., J.L. Atwood, K.P. McFarland, and L.R. Nagy. 1996. Population density, vocal behavior and recommended survey methods for Bicknell's Thrush. Wilson Bull. 108:639-649.

Atwood, J.L., C.C. Rimmer, K.P. McFarland, S.H. Tsai, and L.R. Nagy. 1996. Distribution of Bicknell's Thrush in New England and New York. Wilson Bull. 108:650-661.

Common Name: **Wood Thrush**
Scientific Name: **Hylocichla mustelina**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

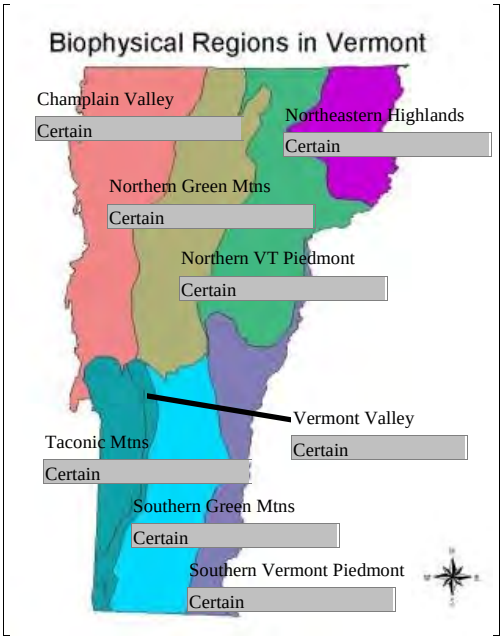
Global Rank: G5 **Global Trend:**
State Rank: S5B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Wood Thrush experienced a nonsignificant 2.1% annual decline in VT between 1966-2003, according to USGS Breeding Bird Survey data. The species is declining at similar rates in NH, ME, MA, and NY and throughout USFWS Region 5.

A common but declining breeding species of northern hardwoods forests, in many ways an "umbrella" species that merits focused conservation attention in VT. Its decline may be due in part to maturation of n. hardwoods forests, suggesting that targeted management might help stabilize or reverse declines. Factors on the species' Central American wintering grounds may also be involved in its declining populations.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

Distributed widely throughout state in n. hardwood forests

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☐ General Literature ☐

Upland, mesic northern hardwood forests

Common Name: **Wood Thrush**
Scientific Name: **Hylocichla mustelina**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m): 750
Maximum Elevation (m): 1000
Patch Size Requirements: > 10 ha
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Fragmentation

Description of habitat problem(s): Forest fragmentation may introduce nest predators and cowbirds that lower reproductive success, especially in smaller, isolated patches

Non-Habitat Problems:

Pollution

Description of non-habitat problem(s): Acidification of northern hardwoods forests and consequent calcium depletion may affect population ecology of this species

Common Name: **Wood Thrush**
Scientific Name: **Hylocichla mustelina**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Habitat-specific data needed in relation to assess area sensitivity in VT
Research	Basic Life History	Medium	age- and sex-specific survivorship and reproductive success in different forest subhabitats and patch sizes needed
Research	Distribution and Abundance	Medium	age- and sex-specific partitioning (relative abundance and density) in different forest subhabitats and patch sizes needed
Research	Threats and Their Significance	High	1) Need to understand relative importance of differing fragmentation effects on demography, productivity, and site persistence; also how species responds to different forestry practices. Conduct field studies in different forest types (successional stage, patch size and configuration, proximity to edge habitat), use results to guide conservation planning that incorporates forestry and sustainable development. 2) Investigate environmental stressors like mercury and calcium depletion in Wood Thrush, as a means to understand their synergistic role in avian population and forest health; use results to guide regulatory planning for Hg and acidic ion emissions. Conduct studies to measure levels of Hg and Ca in WOTH and in ecosystem food chain; correlate measures to WOTH demographics and reproductive success.
Monitoring	Population Change	High	Need continued, habitat-specific monitoring in core no. hardwoods habitats, both managed and unmanaged landscapes
Monitoring	Habitat Change	High	Need to document and understand impacts of landscape-level forestry practices and atmospheric pollution on species' population biology
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	Medium	

Common Name: **Wood Thrush**
Scientific Name: **Hylocichla mustelina**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Technical Assistance, Training, Learning Networks	Medium	Educate landowners, private foresters, local conservation and planning commissions about habitat conservation needs of Wood Thrush, as a means to guide sustainable land use practices and local regulations	Develop educational materials based on known information about Wood Thrush ecology, habitat needs and conservation in VT. Provide planning expertise to local planners, landowners, foresters.	VFWD, VFPR, USFS, TNC	Local planning grants(?), NFWF
Standards	High	Evaluate and refine current forestry practices as a means to promote optimal habitat suitability for this species, and to reverse population declines	Synthesize management studies from other parts of species' breeding range and evaluate applications to VT; conduct focused studies to assess species' response to differing forestry regimes	VFPR,VDFW, USFS, VT Assoc Loggers, private foresters, VWA, Coverts	NFWF, USFWS, State Wildlife Grants

Bibliography:

Roth, R.R., M.S. Johnson, and T.J. Underwood. 1006. Wood Thrush (Hylocichla mustelina). In The Birds of North America, No. 246 (A. Poole and F. Gill, eds.). The Birds of North America, Philadelphia, PA.

Common Name: **Brown Thrasher**
Scientific Name: **Toxostoma rufum**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

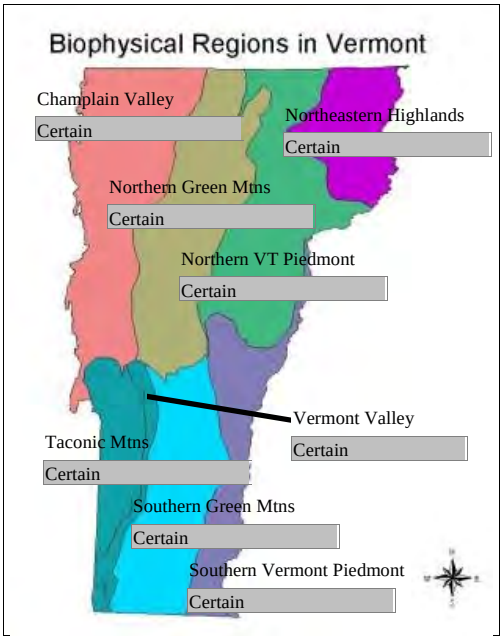
Global Rank: G5 **Global Trend:**
State Rank: S5B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

BBS trend 1966-2003 for VT was -1.37 (p = 0.25).

Species declining along with shrub dominiated and successional habitats throughout the East as forests mature and suitable habitat is converted to non-forest/non-habitat use.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☑
Outside US	☐

Distribution Summary:

Statewide

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Thicket/shrub complexes; hedgerows and early successional habitat w/ high stem densities coupled with low (10%-30%) canopy coverage.

Common Name: **Brown Thrasher**
Scientific Name: **Toxostoma rufum**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	520
Patch Size Requirements:	> 1 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☑
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Boreal Hardwoods
Early Succession Northern Hardwoods
Early Succession Other Types
Early Succession Pine and Hemlock
Early Succession Upland Oak
Grasslands and Hedgerows
Lawns, Gardens, and Row Crops
Shrub Swamps

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat
Habitat Alteration
Habitat Fragmentation
Habitat Succession
Impacts of Roads or Trails
Inadequate Disturbance Regime

Description of habitat problem(s): Losses of shrub dominated and early successional woody regeneration habitats due to conversion and forest maturation.

Non-Habitat Problems:

Pollution
Trampling or Direct Impacts

Description of non-habitat problem(s): Evidence exists that nest discovery/disturbance evokes high rate of abandonment; evidence exists that pesticide use in feeding areas resulted in substantial declines.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Effects of land management practices on nest site selection and productivity/mortality.
Research	Basic Life History	Medium	More comprehensive breeding ecology information.

Common Name: **Brown Thrasher**
Scientific Name: **Toxostoma rufum**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration	High	Stabilize or reverse declining population trend for Brown thrashers to realize and maintain a population of 5500 individuals. Use CSWA habitat target of 82,000ha (Rosenberg 2004).	BBS data	USFS, USFWS, VA, VINS	SWG, PR
Awareness Raising and Communications	Medium	Initiate public education campaigns to highlight the need for active, even age forest management on public and private lands to create and maintain seedling/sapling forest habitat complexes.	Number of media outlets reached, number of audiences reached, number of media products developed, number of participants in programs.	VINS, VA, USFWS	SWG
Habitat Restoration	High	Determine appropriate old field habitat targets for state lands and restore and maintain old field habitats where needed to increase suitable ES songbird habitat.	Number of acres positively affected by management. Population response to management.	FWD, FPR, USFS, Audubon, Forest Products Association, VT Loggers Association	Pittman-Robertson, WHIP
Conservation Finance	Medium	Create a state-funded, private lands, early successional habitat improvement initiative (modeled on NH's Small Landowner Grant program). Fund for > $50,000/yr with revenues from state lands forest management. This could offset landowner WHIP obligations.	Level of funds raised.	FWD	

Bibliography:

Cavitt, J. F. and C.A. Haas. 2000. Brown Thrasher (Toxostoma rufum). In The Birds of North America, No. 557 (A. Poole and F. Gill, eds.). The Birds of North America, Inc. Phila. Pa.

Rosenberg, K. V. 2004. Partners in Flight continental priorities and objectives defined at the state and bird conservation region levels, Vermont. Cornell Lab of Ornithology, Ithaca, NY. 26 p.

Common Name: **Blue-winged Warbler**
Scientific Name: **Vermivora pinus**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

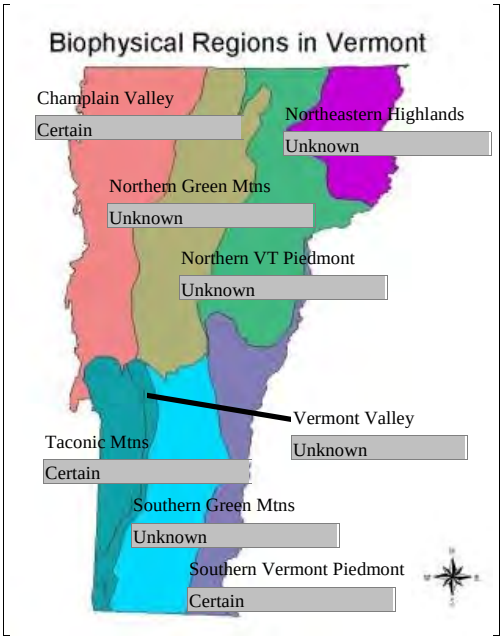
Global Rank: G5 **Global Trend:**
State Rank: S2S3B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Survey-wide, a non-significant (-0.6%) population decline. In Vermont, data are limited, but the species shows a large population increase, likely due to recent colonization of VT (Sauer et al. 2004).

RE: repsonsibility species: Rosenberg tier 1. Species will most likely be limited in VT as a result of forest succession and development.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

Data from Clark (1985). Likely occurs in other regions in migration.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

"Nests in brushy growth near the borders of swamps or streams, forest edges, abandoned fields and pastures, thickets, and second-growth woods. Prefers brushy old pastures and old fields with saplings < 3 m tall" (DeGraaf and Yamasaki 2001). Tends to use drier habitats than GWWA.

Common Name: **Blue-winged Warbler**
Scientific Name: **Vermivora pinus**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	360
Patch Size Requirements:	None
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Northern Hardwoods

Early Succession Pine and Hemlock

Grasslands and Hedgerows

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Succession

Description of habitat problem(s): Succession of old field to forest, loss of habitat to development, and fragmentation and BHCO parasitism major problems.

Description of non-habitat problem(s): Although hybridizes extensively with GWWA, introgressive hybridization appears to be asymetric with BWWA gene pool remaining largely "pure" (Gill et al. 2001). Competition between BWWA and GWWA appears to be leading to continual northward shift in the range of GWWA. Colonization of GWWA breeding sites by BWWA leads to extirpation of GWWA within 50 years.

Common Name: **Blue-winged Warbler**
Scientific Name: **Vermivora pinus**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	A better understanding of the characteristics of high quality habitat would be valuable.
Research	Distribution and Abundance	High	Likely more common in Vermont than BBA data suggest.
Research	Threats and Their Significance	Medium	Understanding effects of cowbirds, BWWA, development, and succession are necessary to manage and conserve the species in VT. More information is needed on the relative importance of parasitism, development, and succession to BWWA populations. Intensive BBS routes through suitable habitat and better information on the distribution of GWWA in VT.
Monitoring	Population Change	Medium	Knowing how long a patch remains suitable would be useful. Additionally, understanding BHCO parasitism would also be helpful.
Monitoring	Habitat Change	High	Quantifying the relative importance of succession and development is important.
Monitoring	Range Shifts	Medium	Is the species moving northward in VT?
Monitoring	Monitor Threats	Medium	Better information about current limiting factors to habitat (development versus habitat succession). Implement periodic assessment (5 year?) of grassland acreage in Vermont, likely through GIS analysis of Landsat data.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	Medium	Initiate public education campaigns to highlight the need for active, even age forest management on public and private lands to create and maintain seedling/sapling forest habitat complexes.	Number of media outlets reached, number of audiences reached, number of media products developed, number of participants in programs.		
Easements	High	VT should commit to at least one large (>1000 ha) management area dedicated to early successional species.	Acres of land purchase or conservation easements with dedicated management plan acquired.	UVM, NRCS, VFWD.	NRCS, USDA.
Habitat Restoration	High	Determine appropriate old field habitat targets for state lands and restore and maintain old field habitats where needed to increase suitable ES songbird habitat.	Number of acres positively affected by management. Population response to management.	ANR USFS, Audubon, Forest Products Association, VT Loggers Association	Pittman-Robertson, WHIP

Common Name: **Blue-winged Warbler**
Scientific Name: **Vermivora pinus**
Species Group: **Bird**

Bibliography:

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Gill, F. G., R. A. Canterbury, and J. L. Confer. 2001. Blue-winged Warbler (Vermivora pinus). In The Birds of North America, No. 584 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia, PA.

DeGraaf, R. M., and M. Yamasaki. 2001. New England wildlife: habitat, natural history, and distribution. University of New England Press, Hanover, New Hampshire, USA, and London, UK.

Sauer, J. R., J. E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966-2003. Version 2004.1. USGS Patuxent Wildlife Research Center, Laurel, Maryland, USA.

Common Name: **Golden-winged Warbler**
Scientific Name: **Vermivora chrysoptera**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: High Priority

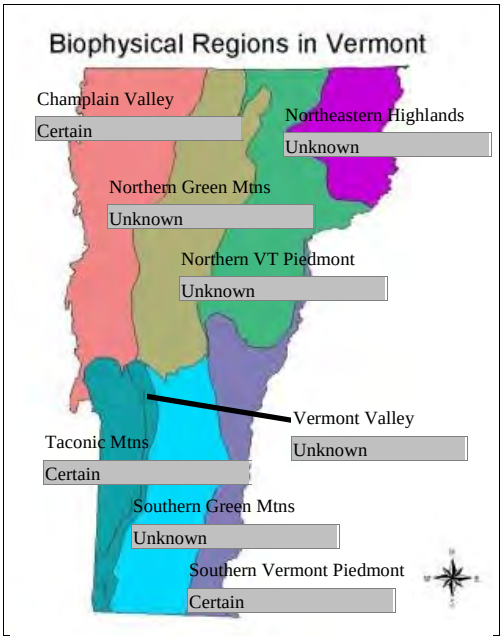
Global Rank: G4 **Global Trend:**
State Rank: S2S3B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

Significant long-term survey-wide decline (-2.4%). No data for Vermont

Responsibility species: Rosenberg tier 2. Forest succession will continue to limit this species, as will development of abandoned agricultural habitat.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

Data from Clark (1985). Species presumably occurs in other areas as migrant.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

"Early successional openings in deciduous forests that follow fire or logging, second-growth woods, especially gray birch stands, dense scrubby thickets and brush-bordered lowland areas. Also inhabits old fields or overgrown pastures with few trees and a dense understory of forbs, grasses, or ferns" (DeGraaf and Yamasaki 2001). Tends to use wetter habitats than BWWA.

Common Name: **Golden-winged Warbler**
Scientific Name: **Vermivora chrysoptera**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Grasslands and Hedgerows

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Succession

Description of habitat problem(s): Loss of habitat through development and succession. Habitat quality may decline with presence of BHCO and BWWA.

Non-Habitat Problems:

Genetics

Description of non-habitat problem(s): Hybridization with Blue-winged Warbler.

Common Name: **Golden-winged Warbler**
Scientific Name: **Vermivora chrysoptera**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	A better understanding of the characteristics of high quality habitat would be valuable.
Research	Distribution and Abundance	High	Likely more common in Vermont than BBA data suggest. However, because habitat is transitory and song is not necessary a good indicator of presence (because of hybridization), characterizing their distribution would be valuable (and difficult). Intensive BBS routes through suitable habitat and better information on the distribution of GWWA in VT is needed.
Research	Threats and Their Significance	High	Understanding effects of cowbirds, BWWA, development, and succession are necessary to manage and conserve the species in VT.
Research	Population Genetics	Medium	Quantifying the genetic "pureness" of the VT population would be valuable, especially understanding N-S variation. Hybridization may be a factor.
Monitoring	Population Change	High	Knowing how long a patch remains suitable would be useful. Additionally, understanding whether or not succession interacts with BWWA presence and BHCO parasitism would also be helpful.
Monitoring	Habitat Change	High	Quantifying the relative importance of succession and development is important.
Monitoring	Range Shifts	Medium	Is the species being pushed northward in VT as a result of hybridization and genetic swamping by BWWA?
Monitoring	Monitor Threats	Medium	Monitoring the effects of BWWA, development, succession, and BHCO would be useful. In particular Better information about current limiting factors to habitat (development versus succession). Periodic assessment (5 year?) of grassland acreage in Vermont, likely through GIS analysis of Landsat data.

Common Name: **Golden-winged Warbler**
Scientific Name: **Vermivora chrysoptera**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration	High	Stabilize or reverse declining population trend for blue-winged warbler to realize and maintain a survey value of ??? or between ??? and ??? Individuals.	Population response to management, BBS surveys.	VFWD, NRCS, TNC.	NRCS, TNC.
Invasive Species Control & Prevention	Medium	Ensure sufficient early successional habitat in wetter sites to maintain GWWA habitat that will discourage colonization by BWWA and prevent hybridization.	Stable population of GWWA in the presence of BWWA.	UVM, GMAS, VFWD.	NFWF.
Awareness Raising and Communications	Medium	Initiate public education campaigns to highlight the need for active, even age forest management on public and private lands to create and maintain seedling/sapling forest habitat complexes.	Number of media outlets reached, number of audiences reached, number of media products developed, number of participants in programs.		
Habitat Restoration	High	Establish at least one large (>1000 ha) management area dedicated to early successional species.	Land purchase or conservation easements and dedicated management plan.	VFWD, NRCS, TNC.	NRCS, TNC.

Bibliography:

Clark, D. B. 1985. Golden-winged Warbler. Pages 276-277 in S. B. Laughlin and D. P. Kibbe, eds. The atlas of breeding birds of Vermont. University Presses of New England, Hanover, New Hampshire, USA.

Confer, J. L. 1992. Golden-winged Warbler (Vermivora chrysoptera). In The Birds of North America, No. 20 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D. C.; The American Ornithologists' Union.

DeGraaf, R. M., and M. Yamasaki. 2001. New England wildlife: habitat, natural history, and distribution. University of New England Press, Hanover, New Hampshire, USA, and London, UK.

Sauer, J. R., J. E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966-2003. Version 2004.1. USGS Patuxent Wildlife Research Center, Laurel, Maryland, USA.

Common Name: **Chestnut-sided Warbler**
Scientific Name: **Dendroica pensylvanica**
Species Group: **Bird**

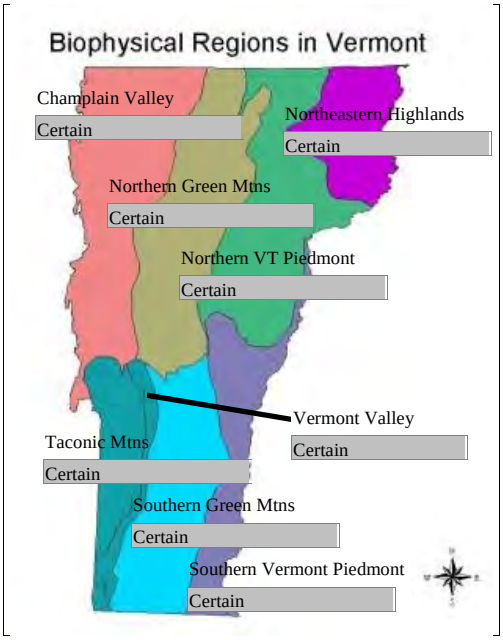
Conservation Assessment:

Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S5B **State Trend:** Stable
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Distribution:



Natural History Elements:

Home Range: <1 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Forested or shrubby habitats during migration. Highly specialized habitat for breeding, confined to early-successional deciduous forest ranging from wet to dry sites.

Common Name: **Chestnut-sided Warbler**
Scientific Name: **Dendroica pensylvanica**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☑
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Boreal Hardwoods
Early Succession Northern Hardwoods
Early Succession Pine and Hemlock
Early Succession Upland Oak
Grasslands and Hedgerows
Shrub Swamps

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat
Habitat Fragmentation
Habitat Succession
Inadequate Disturbance Regime

Description of habitat problem(s): Loss of successional habitats due to conversion to non-forested uses and suppression of natural disturbance (flood, fire), and reductions in active forest management.

Non-Habitat Problems:

Loss of Prey Base
Pollution

Description of non-habitat problem(s): Some indications that Lepidoptera larvae reductions due to pesticides and biological controls can decrease productivity.

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Basic Life History	Medium	Basic research on breeding activities is needed, particularly to determine trends in renesting and lifetime broods/reproductive success.

Common Name: **Chestnut-sided Warbler**
Scientific Name: **Dendroica pensylvanica**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Conservation Finance	Medium	Create a state-funded, private lands, early successional habitat improvement initiative (modeled on NH's Small Landowner Grant program). Fund for > $50,000/yr with revenues from state lands forest management. This could offset landowner WHIP obligations.	Level of funds raised.	FWD	SWG
Awareness Raising and Communications	Medium	Initiate public education campaigns to highlight the need for active, even age forest management on public and private lands to create and maintain seedling/sapling forest habitat complexes.	Number of media outlets reached, number of audiences reached, number of media products developed, number of participants in programs.	ANR, USFS, USFWS	SWG, P-R
Habitat Restoration	High	Stabilize or reverse declining population trend for Chestnut-sided warblers to realize and maintain a survey value of 14-15 per BBS route or between 120,000 to 180,000 individuals (Rosenberg 2004).	Population response to management, BBS surveys.	Audubon, VFWD	Pittman-Robertson, WHIP
Habitat Restoration	Medium	Determine appropriate old field habitat targets for state lands and restore and maintain old field habitats where needed to increase suitable ES songbird habitat.	Number of acres positively affected by management. Population response to management.	ANR, USFS, Audubon, Forest Products Association, VT Loggers Association	Pittman-Robertson, WHIP

Bibliography:

Richardson, M., and D.W. Brauning. 1995. Chestnut-sided warbler (Dendroica pensylvanica). In: Birds of North America, No. 190. (A. Poole and F. Gill, eds.) . The Academy of Natural Sciences, Philadelphia, and the American Ornithologists' Union, Washingto, D.C.

Rosenberg, K. V. 2004. Partners in Flight continental priorities and objectives defined at the state and bird conservation region levels, Vermont. Cornell Lab of Ornithology, Ithaca, NY. 26 p.

Common Name: **Black-throated Blue Warbler**
Scientific Name: **Dendroica caerulescens**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

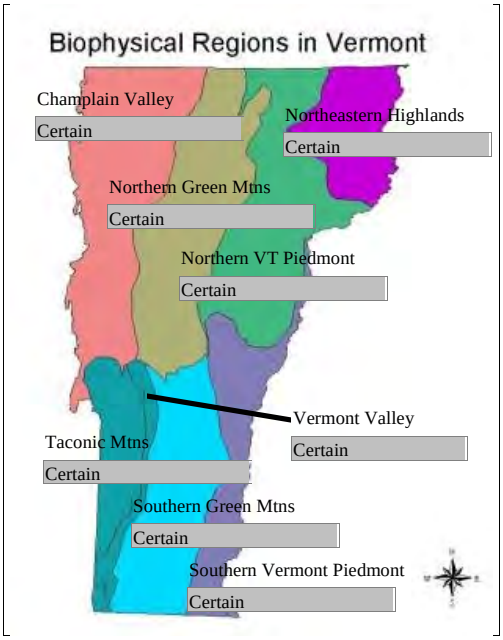
Global Rank: G5 **Global Trend:**
State Rank: S5B **State Trend:** Stable
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

BBS survey trends variable by time period. Survey-wide, non-significant positive long-term trend, but significant decrease (-3%) 1666-1979 and significant increase (2%) 1980-2003. Interestingly, VT trends are opposite. Recent and long-term trends non-significant, but a significant (5.7%) increase 1966-1979 (Sauer et al. 2004). PIF continental objective is stability (1.0) and the step-down target for Vermont is 57,000 breeding individuals.

Population likely secure. Primary breeding ground limiting factors result from consequences of fragmentation (by permanent land use changes) on reproductive success. Because winter range is restricted to the Caribbean, there is some concern over the effects of deforestation on these islands, particularly the Greater Antilles.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

From Kibbe (1985).

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☑ General Literature ☑

Large, continuous tracts of undisturbed deciduous or mixed deciduous/coniferous forests, often in hilly or mountainous terrain (Holmes 1994). " Uneven aged timber harvest methods such as selection or group cuts can effectively mimic the natural disturbance regime and seem to be compatible with Black-throated Blue Warbler conservation" (Burdett and Niemi 2003).

Common Name: **Black-throated Blue Warbler**
Scientific Name: **Dendroica caerulescens**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	300
Maximum Elevation (m):	1600
Patch Size Requirements:	> 100 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Description of habitat problem(s): Productivity and density decrease in forest fragments. Susceptible to parasitism by Brown-headed Cowbirds in these forests when located in predominately agricultural landscapes. Habitat conversion through development or habitat alteration from clearcutting can limit species. Conversely, as forest regenerates from abandonment of agricultural lands, additional habitat will become available through succession.

Description of non-habitat problem(s):

Common Name: **Black-throated Blue Warbler**
Scientific Name: **Dendroica caerulescens**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Distribution and Abundance	Medium	1) Compare changes in population trends across BBS routes in areas with different land use patterns. 2) More information is neede on distribution and overwinter survival in disturbed habitats on wintering grounds.
Research	Threats and Their Significance	High	Effects of fragmentation on breeding season productivity, particularly the effects of predation and cowbird parasitism should be further researched. Landscapes dominated by contigous forests have not consistently shown increased predation trends associated with relatively temporary disturbances, such as timber harvests; "It is critical to better comprehend the complex relationships that exist between nest predation, habitat fragmentation, and landscape context." (Burdett and Niemi 2003).
Monitoring	Population Change	Medium	A better assessment of population trends across a variety of landscape types is needed.
Monitoring	Habitat Change	High	1) Better information on land use change in Vermont would help concentrate development in areas that would be less likely to affect forest interior species. Trends in rate of forest loss and fragmentation across range should be investigated . 2) Continue to monitor populations at Hubbard Brook Experimental Forest (unfragmented), unevenaged-managed forests, and forest fragments in Vermont to better assess the effect of patch size and management on population trends using a source-sink framework.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use	Medium	Where timber resource extraction and/or other habitat management goals requiring timber cutting are desired, uneven aged management, using selection harvests, should be employed on a portion of public lands	Amount of public forests designated for unevenaged management.	ANR, USFS, USFWS	ANR, PR
Habitat Restoration	Medium	Identify contiguous forests blocks w/mature components & encourage their conservation via easements or other financial incentives on private lands. Conserve contiguous forest blocks on public lands via appropriate long-range management plan designations.	Number and distribution of core forest blocks conserved on private and public lands.		

Common Name: **Black-throated Blue Warbler**
Scientific Name: **Dendroica caerulescens**
Species Group: **Bird**

Bibliography:

Burdett, C.L. and G.J. Niemi. 2003. Conservation assessment for Black-throated Blue Warbler (Dendroica caerulescens) USDA Forest Service, Eastern Region. Natural Resources Research Institute, Univ. of Minnesota, Duluth, Minnesota, USA.

Kibbe, D. P.. 1985. Black-throated Blue Warbler. Pages 292-293 in S. B. Laughlin and D. P. Kibbe, eds. The atlas of breeding birds of Vermont. University Presses of New England, Hanover, New Hampshire, USA.

Holmes, R. T. 1994. Black-throated Blue Warber (Dendroica cerulescens). In The Birds of North America, No. 87 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D. C.; The American Ornithologists' Union.

Robbins, C. S., D. K. Dawson, and B. A. Dowell. 1989. Habitat area requirements of breeding forest birds of the Middle Atlantic States. Wildlife Mongraphs 103:1-34.

Sauer, J. R., J. E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966-2003. Version 2004.1. USGS Patuxent Wildlife Research Center, Laurel, Maryland, USA.

Common Name: **Prairie Warbler**
Scientific Name: **Dendroica discolor**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

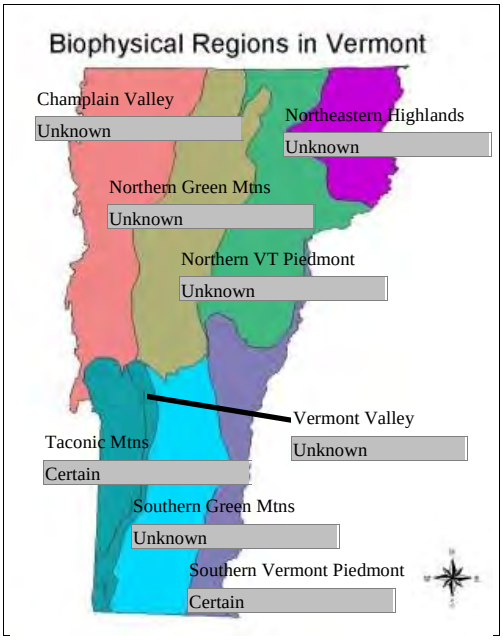
Global Rank: G5 **Global Trend:**
State Rank: S3B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

BBS trend for eastern region, 1966-2003 = -1.88 (p= 0.00001)

Very significant declines in the US per BBS data 1966 -1993; less significant decline 1984-1993. Distribution during first Vermont Bird Atlas was limited to the eastern foothills (Clark 1985).

Distribution:



Natural History Elements:

Home Range: <1 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

Rare breeded in southern Vermont.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Breeding habitat of early successional hardwood forest regeneration, old field, shrub/dune, upland shrub habitats; prefers open canopy (however uses closed canopy palustrine forest in Mid-Atlantic breeding areas). Utilizes Christmas tree farms and gravel pit/mine shrub habitats.

Common Name: **Prairie Warbler**
Scientific Name: **Dendroica discolor**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 1220
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☑
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Cliffs and Talus
Early Succession Boreal Conifers
Early Succession Boreal Hardwoods
Early Succession Northern Hardwoods
Early Succession Other Types
Early Succession Pine and Hemlock
Early Succession Spruce-Fir
Early Succession Upland Oak
Floodplain Forests
Grasslands and Hedgerows
Hardwood Swamps
Mine
Northern Hardwood
Oak-Pine Northern Hardwood
Outcrops and Alpine
Seeps and Pools
Softwood Swamps
Spruce Fir Northern Hardwood
Upland Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat
Habitat Alteration
Habitat Fragmentation
Habitat Succession
Inadequate Disturbance Regime

Description of habitat problem(s): Succession of old field habitats and forest maturation have caused habitat decline.

Non-Habitat Problems:

Parasites

Description of non-habitat problem(s): Parasitized by brown-headed cowbird.

Common Name: **Prairie Warbler**
Scientific Name: **Dendroica discolor**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration	Medium	Determine appropriate old field habitat targets for state lands and restore and maintain old field habitats where needed to increase suitable ES songbird habitat.	Number of acres positively affected by management. Population response to management.	ANR, USFS, Audubon, Forest Products Association, VT Loggers Association	Pittman-Robertson, WHIP
Conservation Finance	Medium	Create a state-funded, private lands, early successional habitat improvement initiative (modeled on NH's Small Landowner Grant program). Fund for > $50,000/yr with revenues from state lands forest management. This could offset landowner WHIP obligations.	Level of funds raised.	FWD	SWG
Awareness Raising and Communications	Medium	Initiate public education campaigns to highlight the need for active, even age forest management on public and private lands to create and maintain seedling/sapling forest habitat complexes.	Number of media outlets reached, number of audiences reached, number of media products developed, number of participants in programs.		
Species Habitat Restoration	High	Stabilize or reverse declining population trend for prairie warblers to realize and maintain a population of approximately >600 individuals. Use CSWA habitat target of 82,000ha (Rosenberg 2004).	Population response to management, BBS surveys.	Audubon, VFWD	Pittman-Robertson, WHIP

Bibliography:

Clark, D.B. 1985. Prairie Warbler in The Atlas of Breeding Birds of Vermont. S.B. Laughlin and D. P. Kibbe, eds. University Press of New England, Hanover N.H., USA and London, U.K.

Nolan, V. , Jr., E.D. Ketterson, and C.A. Buerkle. 1999. Prairie Warbler (Dendroica discolor). In The Birds of North America, No. 455 (A. Poole and F. Gill, eds.). The Birds ofNorth America, Inc. Phila. Pa.

Rosenberg, K. V. 2004. Partners in Flight continental priorities and objectives defined at the state and bird conservation region levels, Vermont. Cornell Lab of Ornithology, Ithaca, NY. 26 p.

Common Name: **Bay-breasted Warbler**
Scientific Name: **Dendroica castanea**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

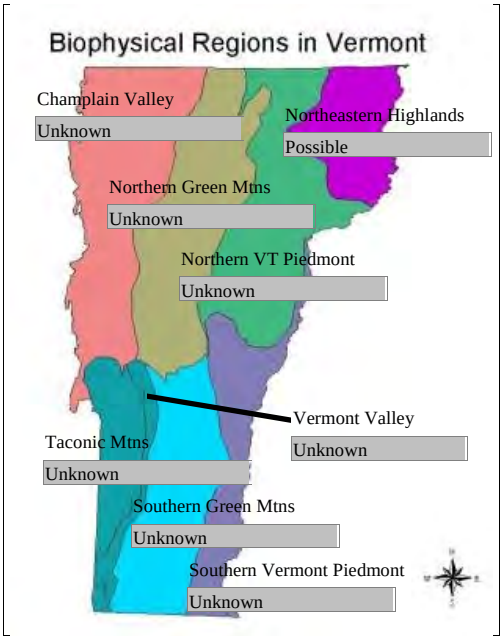
Global Rank: G5 **Global Trend:**
State Rank: S1B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Statewide status not well known due to inadequate monitoring

RE Life-history: Nomadic, RE: Stopover pts: probably no key points exist but data are limited

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

First breeding confirmation was near Sable Mountain, Granby (1980). Subsequently confirmed nesting at Wenlock Wildlife Management Area, Ferdinand (1987) and Brighton State Park, Brighton (1995).

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Mainly breeds in dense, boreal forests of mature spruce and fir; also inhabits old mixed-wood stands and prefers moist, swampy areas to dry, upland locations. (Mayasich and Niemi 2002). Dramactic increases reported in response to outbreaks of spruce budworm (Choristoneaura fumiferana).

Common Name: **Bay-breasted Warbler**
Scientific Name: **Dendroica castanea**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Boreal Conifers
Early Succession Spruce-Fir
Softwood Swamps
Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Fragmentation

Description of habitat problem(s): Loss and fragmentation of late successional, lowland spruce-fir forest; management practices that favor short-cutting cycles preventing establishment of late successional forests

Description of non-habitat problem(s): Possible impacts from aerial spraying for spruce budworm (declines following application of organophosphate insecticides documented in New Brunswick in 1970s)

Common Name: **Bay-breasted Warbler**
Scientific Name: **Dendroica castanea**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Specific habitat association in VT needs better documentation
Research	Basic Life History	Medium	
Research	Distribution and Abundance	High	Not well documented in VT. A targeted survey of this and other late successional, lowland boreal forest birds is needed. Virtually no information exists now.
Research	Threats and Their Significance	High	Need to understand landscape level limiting factors (primarily via timber harvesting) to persistence of late successional, lowland boreal forests and population biology of this species
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	Traditional monitoring methods (BBS, VT Forest Bird Monitoring Program) do not adequately cover this species. Need to document trends in VT via a targeted survey of lowland boreal forests
Monitoring	Habitat Change	High	Need to understand landscape level changes and limiting factors (primarily via poorly-planned timber harvesting) to persistence of late successional, lowland boreal forests. Quantify extent of current suitable breeding habitat.
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	Medium	

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Publically-Owned Protected Areas	Medium	Identify potential areas on public lands for designation as reserve or no-cut status (including some areas where wildfires and insect outbreaks would not be controlled).	Number of sites and total area of designated reserves.	ANR, USFS, USFWS, UVM, TNC	SWG, PR
Habitat Restoration	Medium	Apply increased rotation ages to some managed spruce-fir forests on public lands.	Number of sites and total area with increased rotation ages.	ANR, USFS, USFWS	SWG, PR, ANR
Species Restoration	Medium	Determine current management regimes, and ensure that overall management is compatible with goal of maintaining or increasing current population levels. No PIF target was set for VT as "Population numbers are unavailable at this time" (Rosenberg 2004).			

Common Name: **Bay-breasted Warbler**
Scientific Name: **Dendroica castanea**
Species Group: **Bird**

Bibliography:

Mayasich, J. M. and G. J. Niemi 2002. Conservation assessment for Bay-breasted warbler (Dendroica castenea). USDA Forest Service, Eastern Region, Milwaukee, WI.

Rosenberg, K. V. Partners In Flight continental priorities and objectives defined at the state and bird conservation region levels -- Vermont. Cornell Lab of Ornithology, Ithaca, NY.

Tumosa, J. and S. Lemieux. 2002. Bay-breasted warbler excerpts from USFS GMNF reviews. www.natureserve.org.

Williams, J.M. 1996. Bay-breasted Warbler. In The Birds of North America, No. 206 (A. Poole and F. Gill, eds.). The Birds of North America, Philadelphia, PA.

Common Name: **Blackpoll Warbler**
Scientific Name: **Dendroica striata**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

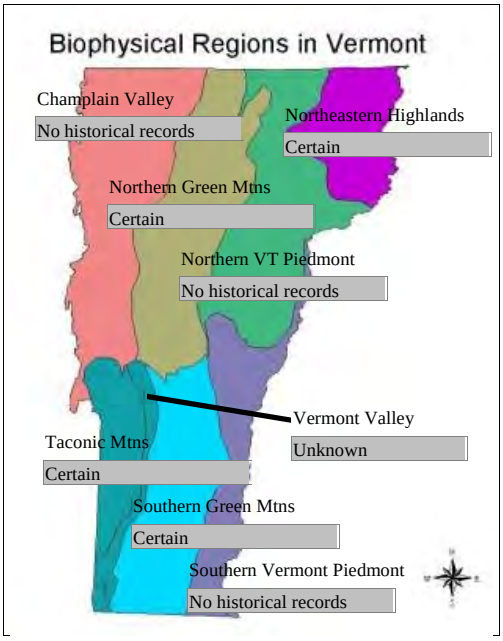
Global Rank: G5 **Global Trend:**
State Rank: S4S5B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

status poorly known, as traditional monitoring methods like BBS do not cover the species

BCR 14 High Priority; priority species for PIF Physiographic Areas 27 & 28 (mountaintop-conifer woodland and mature conifer (spruce-fir) forest habitat suites).

Distribution:



Natural History Elements:

Home Range: <1 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☑
Within Region	☑
Within US	☑
Outside US	☑

Distribution Summary:

From Laughlin and Kibbe 1985.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☐ General Literature ☐

montane fir-spruce forest, also transitional fir-spruce-birch forest

Common Name: **Blackpoll Warbler**
Scientific Name: **Dendroica striata**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m): 850
Maximum Elevation (m): 1250
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Spruce-Fir

Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Description of habitat problem(s): problems not well established, but potential problems include loss and fragmentation of montane forests from ski area, wind power and telecommunications development. Longer-term problem of atmospheric pollution and climate change.

Non-Habitat Problems:

Pollution

Description of non-habitat problem(s): Atmospheric pollution, including airborne mercury, could impact the species directly, as well as damage its habitat

Common Name: **Blackpoll Warbler**
Scientific Name: **Dendroica striata**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Habitat needs reasonably well known, although population structure in different subhabitat types (krummholz, regenerating chronically disturbed forests, taller stature and more open forests, transitional spruce-fir-birch forests) not well known.
Research	Basic Life History	High	Demographics and breeding success need more study, especially in different subhabitat types.
Research	Distribution and Abundance	Medium	Fairly well known, although relative abundance in different subhabitat types needs to be better quantified. Conduct research that will enable robust predictions of breeding densities in different sub-habitat types, which can be extrapolated across breeding range to derive population estimates.
Research	Threats and Their Significance	High	1) Species' susceptibility and response to habitat fragmentation and conversion from development (ski area, wind turbines, telecommunicatoins facilities) needs to be better understood. Evaluate impacts of human development (ski area expansion/construction, wind power, telecommunications facility) on Bicknell's Thrush and montane forest habitat, and use results to guide future development. 2) Impacts of atmospheric pollutants (e.g. mercury) and possible role of calcium depletion should be studied
Research	Population Genetics	Low	Genetic structure of breeding populations in Northeast, and relation to core breednig populations in Canada interesting, but probably not crucial for conservation
Research	Taxonomy	Low	Same as above
Monitoring	Population Change	High	Species poorly monitored by traditional methods like BBS. VINS Mountain Birdwatch program monitors adequately, but must be maintained for long-term. Very important to monitor this species as an avian indicator of montane forests. Continue long-term monitoring at a minimum of 15-20 sites in VT to document population trends.
Monitoring	Habitat Change	High	Important to document habitat changes in concert with population changes
Monitoring	Range Shifts	Medium	This should be covered by a regional monitoring program (i.e. Mountain Birdwatch)
Monitoring	Monitor Threats	Medium	Important to monitor limiting factors like development, atmospheric pollution, mercury burdens

Common Name: **Blackpoll Warbler**
Scientific Name: **Dendroica striata**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Planning & Zoning	Medium	Develop a planning process whereby explicit mitigation and management guidelines are specified. Further develop a means to ensure that these are followed, and results monitored, both in short- and long-term.			
Habitat Restoration	Medium	Identify 10-15 core breeding sites and ensure that a long-term protection plan exists for each.			

Bibliography:

Hunt, P.D. and B.C. Eliason. 1999. Blackpoll Warbler. In The Birds of North America, No. 431 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Laughlin, S. B. and D. P. Kibbe. 1985. The atlas of breeding birds in Vermont. University Press of New England, Hanover, N.H.

Common Name: **Cerulean Warbler**
Scientific Name: **Dendroica cerulea**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

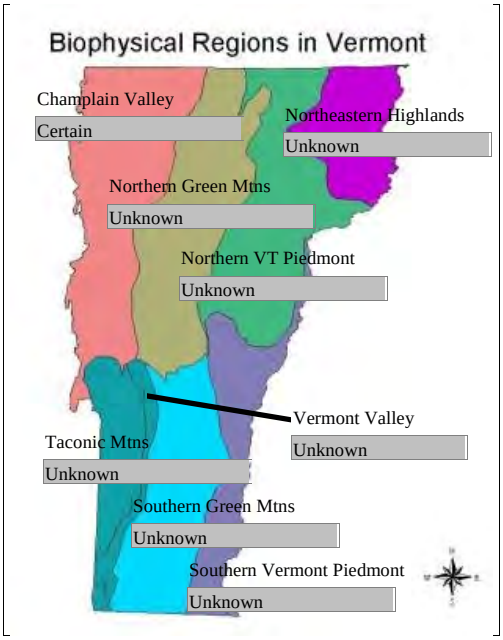
Global Rank: G4 **Global Trend:**
State Rank: S1B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

Strong significant long-term decline (-4.2%) based on survey-wide BBS data. No data from Vermont.

Historic population at the mouth of the Lamoille River appears to be extirpated. In 2002-2004, singing males have been located in Niquette Bay State Park, Highgate, and near Colchester Pond. More populations may be discovered as Vermont's forests continue to mature (and the second breeding bird atlas is completed), however declines throughout its range suggest that this species will never be common in Vermont. Preliminary survey data from the wintering range suggest that it can be found in a diversity of forest types in Columbia, Venezuela, Ecuador, and Peru (Hamel 2000).

Distribution:



Natural History Elements:

Home Range: <1 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

Data from Ellison (1985).

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

As summarized by Hamel (2000), this species requires a closed canopy, presence of scattered tall, old growth canopy trees, and distinct layering of foliage from ground cover to canopy. Area sensitivity varies by area with minimum patch size 20-30 ha in Ohio to 700 ha in Middle Atlantic States to 1,600 ha in the Mississippi Alluvial Valley, but breeding occurs in 10 ha patches in Ontario (summarized by Hamel 2000).

Common Name: **Cerulean Warbler**
Scientific Name: **Dendroica cerulea**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	-1
Patch Size Requirements:	> 100 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Floodplain Forests

Northern Hardwood

Oak-Pine Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Fragmentation

Description of habitat problem(s): Area sensitive in parts of its range, suggesting fragmentation a problem to population. Development or harvest of mature upland forests will decrease available habitat.

Description of non-habitat problem(s):

Common Name: **Cerulean Warbler**
Scientific Name: **Dendroica cerulea**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Species has been relatively well-studied on its breeding range, including recent studies from Ontario. However, better summaries of this information may lead to directed searches for new populations in Vermont. Better information about habitat requirements on the wintering grounds would be useful.
Research	Basic Life History	Medium	Also relatively well-studied, however more information about non-breeding social system, particularly as to whether or not they are an obligate flock follower.
Research	Distribution and Abundance	High	1) Directed surveys in Vermont are necessary to better understand their present status in the state. 2) Better information on distribution in Vermont will be critical to conserving the species and predicting future distribution. Intensively monitor (as least of population size) in areas where the species is present.
Research	Threats and Their Significance	Low	Presumably habitat quality in Vermont will increase as forests mature. However, some information on minimum patch size would help in understanding the effects of development.
Monitoring	Population Change	High	Population trends in Vermont will be difficult to assess without more information on distribution. But all known local populations should be carefully monitored.
Monitoring	Habitat Change	Low	As forest regenerates from abandonment of agricultural lands, habitat will become available through succession. Population response of CERW will be difficult to assess. Forest growth models might be useful in helping to predict future occurrences in the state.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Easements	Medium	Maintain of large forest tracts, particularly in Champlain Valley and Taconic regions.	Maintenance of large forest tracts, particularly in Champlain Valley and Taconic regions.	TNC, VFWD, Forest Legacy program	TNC

Bibliography:

Ellison, W.G. 1985. Cerulean Warbler. Pages 308-309 in S. B. Laughlin and D. P. Kibbe, eds. The atlas of breeding birds of Vermont. University Presses of New England, Hanover, New Hampshire, USA.

Hamel, P. B. 2000. Cerulean Warber (Dendroica cerulea). In The Birds of North America, No. 511 (A. Poole and F. Gill, Eds.). Philadelphia: The Birds of North American, Philadelphia, PA.

Sauer, J. R., J. E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966-2003. Version 2004.1. USGS Patuxent Wildlife Research Center, Laurel, Maryland, USA.

Common Name: **Canada Warbler**
Scientific Name: **Wilsonia canadensis**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: High Priority

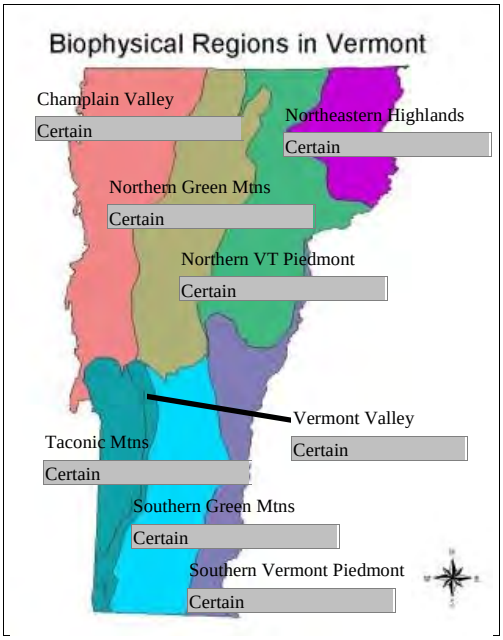
Global Rank: G5 **Global Trend:**
State Rank: S5B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

Declining throughout breeding range, causes not well-documented.

PIF Area 28 priority 1 species. BBS trend for VT, 1966-2003 = -2.71 (p = 0.13); for Multi-state Region 2 (ME, NH & VT) trend = -2.81 (p = 0.02).

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☑
Within Region	☑
Within US	☑
Outside US	☑

Distribution Summary:

Widespread in Vermont.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☑ General Literature ☑

A wide range of coniferous and deciduous forests at all elevations, but especially mid-slopes in Green Mountains. Uses both mature and regenerating forest (Conway 1999). Clearcuts and shelterwood cuts received more use than mature forest in northern New Hampshire (King and DeGraff, in press). First appear in clearcuts 5 years after harvest, become common after 15 years and remain abundant until the next cutting cycle (DeGraaf and Yamasaki 2001).

Common Name: **Canada Warbler**
Scientific Name: **Wilsonia canadensis**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m): 250
Maximum Elevation (m): 900
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Boreal Conifers
Early Succession Spruce-Fir
Northern Hardwood
Softwood Swamps
Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat
Habitat Alteration
Habitat Fragmentation
Habitat Succession

Description of habitat problem(s): Domestic problems may include forest succession and loss of forested wetlands (Conway 1999) and impingement of urban development on heavily forested landscapes (Miller 1999). Most significant problems may occur on South American wintering grounds (mid-slope of Andes Mts) (Faccio et al. 1997).

Description of non-habitat problem(s): Poorly known

Common Name: **Canada Warbler**
Scientific Name: **Wilsonia canadensis**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	These are reasonably well known overall, but important to understand ecological and demographic differences in core populations that inhabit in prime habitats vs. smaller, more peripheral populations in patchy, secondary habitats
Research	Basic Life History	High	nest success and productivity are poorly understood, as is age structure of populations in different habitat types. Need to understand demographics in secondary habitats (i.e. small patches) vs. those in core habitats
Research	Distribution and Abundance	Low	
Research	Threats and Their Significance	High	Need research on effects of forestry practices on populations in both prime and secondary habitats, e.g. whether the species can be effectively managed by mimicing canopy disturbance in northern hardwoods (ice storms, wind throw) without negatively impacting other breeding species. I.e., how well does the species do in managed forest landscapes?
Research	Population Genetics	Medium	
Research	Taxonomy	Low	
Monitoring	Population Change	High	Need to ensure a long-term monitoring program that adequately samples this species. BBS and VT Forest Bird Monitoring Program barely obtain large samples for robust population trend analysis.
Monitoring	Habitat Change	High	Important to know how species responds to both natural and human-caused habitat changes
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	Medium	

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration	Medium	Design and implement forest management strategies to enhance habitat suitability.	Area of potential habitat with long-range management plans which provide for beneficial forms of active forest management.	ANR, USFS, USFWS	SWG, P-R
Planning & Zoning	Medium	Conserve large tracts of core breeding habitats (mid-slope mixed forests, cedar swamps, red maple-conifer swamps).	Number of large forest tracts conserved via public ownership, easements, or town planning/zoning.	ANR, USFS, USFWS, Town and Regional Planning Commissions	SWG, PR

Common Name: **Canada Warbler**
Scientific Name: **Wilsonia canadensis**
Species Group: **Bird**

Bibliography:

Conway, C.J. 1999. Canada Warbler. In The Birds of North America, No. 421 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA

DeGraff, R. M. and Yamasaki, M. 2001. New England Wildlife: Habitat, Natural History, and Distribution. University Press of New England, Hanover, NH, USA and London, UK.

Faccio, S.D., C.C. Rimmer, and K.P. McFarland. 1997. Monitoring forest bird populations in Vermont: results of the Vermont forest bird monitoring program, 1989-1996. Report of the Vermont Institute of Natural Science, Woodstock, VT.

King, D. I. And R. M. DeGraff. In press. Bird species diversity and nesting success in mature, clearcut and shelterwood forest in northern New Hampshire, USA.

Miller, N.A. 1999. Landscape and habitat predictors of Canada Warbler (Wilsonia canadensis) and Northern waterthrush (Seiurus noveboracensis) occurrence in Rhode Island swamps. Masters thesis. University of Rhode Island, Kingston, R.I.

Common Name: **Rufous-sided Towhee**
Scientific Name: **Pipilo erythrophthalmus**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: High Priority

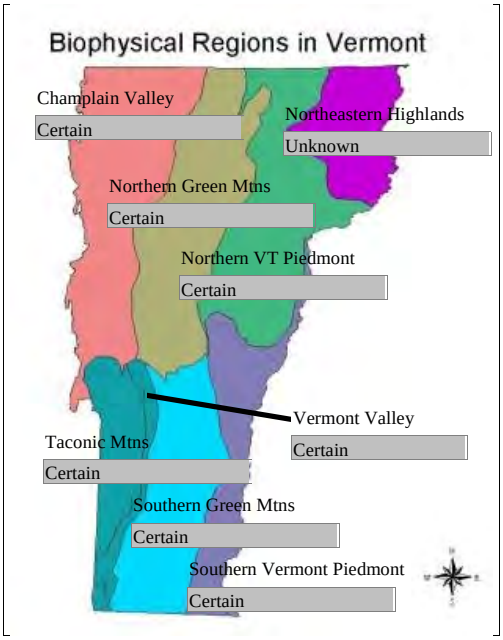
Global Rank: G5 **Global Trend:**
State Rank: S5B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

PIF moderate priority species for BCR 14. BBS trend in Physiographic Area 28 was -5.1%/year for 1966-1998 (significance = 0.09).

Species declining across region due to conversion of necessary early successional/shrub dominated habitats to either non-forest condition or via maturation of forest cover to an unsuitable forest age structure.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☑
Outside US	☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Early-successional/shrub/edge habitats, both mesic and xeric, characterized by dense shrub-small tree cover near ground and well-developed litter layer. Cover may be continuous or discontinuous patches interspersed w/in more open ground. Overstory trees may or may not be present, however open-canopied woodlands are favored over closed canopy coverage.

Common Name: **Rufous-sided Towhee**
Scientific Name: **Pipilo erythrophthalmus**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	> 1 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☑
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Boreal Hardwoods
Early Succession Northern Hardwoods
Early Succession Pine and Hemlock
Early Succession Upland Oak
Grasslands and Hedgerows
Shrub Swamps

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat
Habitat Alteration
Habitat Fragmentation
Habitat Succession
Inadequate Disturbance Regime

Description of habitat problem(s):

Description of non-habitat problem(s): Possible nest parasitism by cowbirds.

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Basic Life History	High	Studies on reproductive success and demography especially desireable in northeastern U.S. To acquire baseline data via marked birds.

Common Name: **Rufous-sided Towhee**
Scientific Name: **Pipilo erythrophthalmus**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Conservation Finance	Medium	Create a state-funded, private lands, early successional habitat improvement initiative (modeled on NH's Small Landowner Grant program). Fund for > $50,000/yr with revenues from state lands forest management. This could offset landowner WHIP obligations.	Level of funds raised.	FWD	SWG, P-R
Awareness Raising and Communications	Medium	Initiate public education campaigns to highlight the need for active, even age forest management on public and private lands to create and maintain seedling/sapling forest habitat complexes.	Number of media outlets reached, number of audiences reached, number of media products developed, number of participants in programs.	VINS, VA, USFS	SWG, P-R
Habitat Restoration	Medium	Determine appropriate old field habitat targets for state lands and restore and maintain old field habitats where needed to increase suitable ES songbird habitat.	Number of acres positively affected by management. Population response to management.	ANR, USFS, Audubon, Forest Products Association, VT Loggers Association	Pittman-Robertson, WHIP
Habitat Restoration	High	Stabilize or reverse declining population trend for Eastern towhees to realize and maintain a survey value of ??? or between ??? and ??? individuals PIF did not set regional target populations (Rosenberg 2004).	Population response to management, BBS surveys.	Ruffed Grouse Society, Audubon, VFWD	Pittman-Robertson, WHIP

Bibliography:

Greenlaw, J.S. 1996. Eastern Towhee (Pipilo errythrophthalmus). In: The Birds of North America, No. 262 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

Dettmers, R.D. and K. V. Rosenberg. 2000. Partners in Flight Landbird Conservation Plan: Physiographic Area 9: Southern New England. Version 1.0.

Hodgman, T.P. and K. V. Rosenberg. 2000. Partners in Flight Landbird Conservation Plan: Physiographic Area 27: Northern New England. Version 1.0.

Rosenberg, K. V. 2004. Partners in Flight continental priorities and objectives defined at the state and bird conservation region levels, Vermont. Cornell Lab of Ornithology, Ithaca, NY. 26 p.

Common Name: **Field Sparrow**
Scientific Name: **Spizella pusilla**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

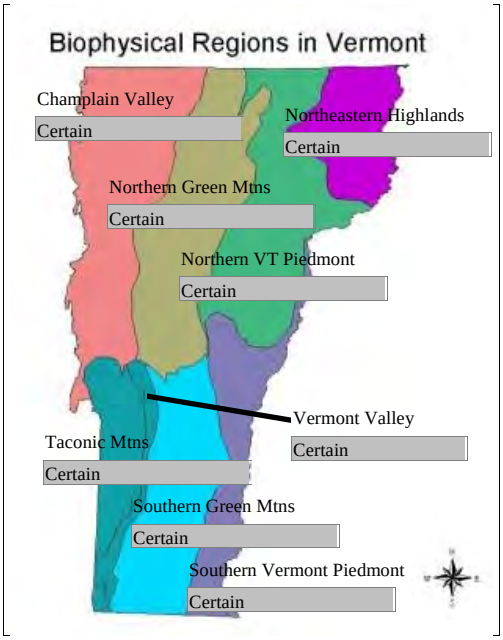
Global Rank: G5 **Global Trend:**
State Rank: S5B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Significant long-term population declines in VT and survey-wide based on BBS data (Sauer et al. 2004).

Will likely continue to decline in VT with succession of abandonned farmland to forest (see Carey et al. 2004).

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☑
Outside US	☐

Distribution Summary:

Data from Ellison (1985).

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Difficult to categorize in check boxes. Grasslands with scattered woody vegetation with elevated perches. Habitat declines as woody encroachment progresses. Can be found in orchards and Christmas tree farms (Carey et al. 1994).

Common Name: **Field Sparrow**
Scientific Name: **Spizella pusilla**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☑
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Grasslands and Hedgerows

Current Problems: (see Appendix C for definitions of problem categories)

Habitat Problems:

Conversion of Habitat

Habitat Succession

Description of habitat problem(s): Primary problems to the species are likely on breeding grounds; continued succession of old fields and conversion of agricultural habitat to urban/suburban development (Carey et al. 1994). Loss of wintering habitat could also be a problem.

Description of non-habitat problem(s):

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	High	1) General management practices are likely relatively straightforward. A better understanding of optimal stem densities and mowing rotations would help more specific management strategies. 2) Better information on habiat-specific demographics would enable a more thorough understanding of when and why habitat decreases in quality for FISP.
Research	Threats and Their Significance	Medium	1) Species could be heavily parasitized by cowbird. Nest predation is the major source of nest mortality (summarized in Carey et al. 1994). 2) Obtain better information about current limiting factors to habitat (development versus succession). Periodic assessment (5 year?) of grassland acreage in Vermont, likely through GIS analysis of Landsat data.
Monitoring	Population Change	High	Improved monitoring would elucidate population distribution and trends. A BBS-type survey route for early successional species could help monitor FISP, BWWA, GWWA, BRTH, PRAW, etc. More intensive demographic data would elucidate BHCO limiting factor.
Monitoring	Habitat Change	High	Succession of old field to forest will continue to limit populations in Vermont and should be monitored. Periodic assessment (5 year?) of grassland acreage in Vermont, likely through GIS analysis of Landsat data.

Common Name: **Field Sparrow**
Scientific Name: **Spizella pusilla**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Conservation Finance	Medium	Create a state-funded, private lands, early successional habitat improvement initiative (modeled on NH's Small Landowner Grant program). Fund for > $50,000/yr with revenues from state lands forest management. This could offset landowner WHIP obligations.	Level of funds raised.	FWD	
Habitat Restoration	High	Stabilize or reverse declining population trend for Field Sparrows to realize and maintain a survey value of ??? or 10,000 iIndividuals.	Population response to management, BBS surveys.	VFWD, NRCS, TNC.	NRCS, TNC.
Habitat Restoration	High	Stabilize or reverse declining population trend for Field Sparrows to realize and maintain a survey value of ??? or 10,000 iIndividuals.	Population response to management, BBS surveys.	VFWD, NRCS, TNC.	NRCS, TNC.
Awareness Raising and Communications	Medium	Initiate public education campaigns to highlight the need for active, even age forest management on public and private lands to create and maintain seedling/sapling forest habitat complexes.	Number of media outlets reached, number of audiences reached, number of media products developed, number of participants in programs.		
Habitat Restoration	High	Establish at least one large (>1000 ha) management area dedicated to early successional species.	Land purchase or conservation easements and dedicated management plan.	VFWD, NRCS, TNC.	NRCS, TNC.
Habitat Restoration	High	Determine appropriate old field habitat targets for state lands and restore and maintain old field habitats where needed to increase suitable ES songbird habitat.	Number of acres positively affected by management. Population response to management.	ANR, USFS, Audubon, Forest Products Association, VT Loggers Association	Pittman-Robertson, WHIP

Bibliography:

Carey, M., D. E. Burhans, and D. A. Nelson. 1994. Field Sparrow (Spizella pusilla). In The birds of North America, No. 103 (A. Poole and F. Gill, eds.). The birds of North America, Inc., Philadelphia, Pennsylvania, USA.

Ellison, W. G. 1985. Field Sparrow. Pages 340-341 in S. B. Laughlin and D. P. Kibbe, eds. The atlas of breeding birds of Vermont. University Presses of New England, Hanover, New Hampshire, USA.

Sauer, J. R., J. E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966-2003. Version 2004.1. USGS Patuxent Wildlife Research Center, Laurel, Maryland, USA.

Common Name: **Vesper Sparrow**
Scientific Name: **Pooecetes gramineus**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: High Priority

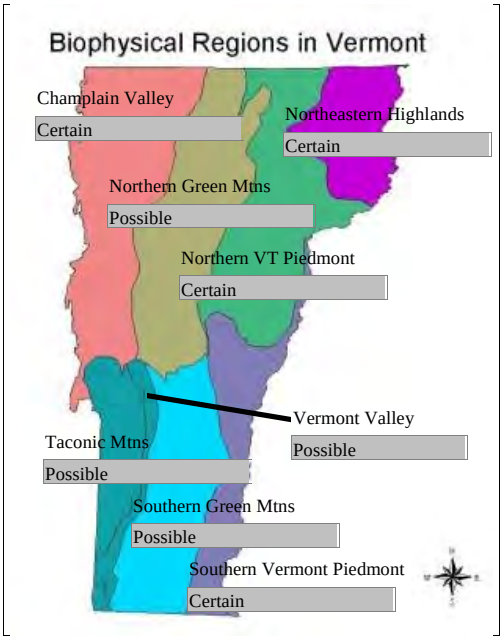
Global Rank: G5 **Global Trend:**
State Rank: S3B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

9.7% decline in VT, statistically significant despite being found on only 11 routes. Also long-term decline survey-wide (Sauer et al. 2004).

The generally small size of farming operations in VT seem as though they should create sufficient habitat to support a larger population in the state. The relative rarity of this species suggests that their habitat requirements may be somewhat more specialized than currently understood.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☑
Outside US	☑

Distribution Summary:

Data from Ellison (1985).

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Breeds in dry, open habitats with short, sparse, and patchy herbaceous vegetation; some bare ground; and low to moderate shrub or tall forb cover. In the East, suitable habitats include reclaimed surface mines, crop and haylands, weedy roadsides, natural meadows, and grasslands (Jones and Cornely 2002).

Common Name: **Vesper Sparrow**
Scientific Name: **Pooecetes gramineus**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	3000
Patch Size Requirements:	> 10 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Grasslands and Hedgerows
Lawns, Gardens, and Row Crops
Marshes and Sedge Meadows
Open Peatlands
Shrub Swamps
Wet Shores

Current Problems: (see Appendix C for definitions of problem categories)

Habitat Problems:

Conversion of Habitat

Habitat Succession

Description of habitat problem(s): Early hay harvest and more intensive management of other row crops substantially reduces nesting success. Conversion of agricultural habitats to urban/suburban development also a problem. Old field succession and farm abandonment also decreasing habitat availability. Area sensitive (Vickery et al. 1994).

Description of non-habitat problem(s):

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Better information about precise habitat requirements, in particular nest site selection would be helpful for management strategies.
Research	Basic Life History	Medium	If local, concentrated populations are located, more information about the species' demography would help conservation planning.
Research	Distribution and Abundance	High	Better information about population distribution in VT is necessary.
Research	Threats and Their Significance	Medium	
Research	Other Research	Medium	Completion of breeding bird atlas will provide some information, but more detailed ecological and demographic data will be of greater value.
Monitoring	Population Change	High	Population monitoring, particularly in response to changing agricultural and development practices.
Monitoring	Habitat Change	High	Understanding habitat-specific demographic parameters would help us assess management options.

Common Name: **Vesper Sparrow**
Scientific Name: **Pooecetes gramineus**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Technical Assistance, Training, Learning Networks	High	Educate agricultural community and general public about grassland birds and management options to protect habitat	Develop a grassland bird outreach program	VFWD, Audubon Vermont, VINS, UVM	SWG, VFWD
Market Forces	Medium	Enroll land into WHIP, GRP as well as FRPP programs to reduce the Impact of development on this species.		NRCS, VT Housing and Conservation Board.	NRCS, USDA.
Habitat Restoration	Medium	Prevent succession of grassland to forest.	Periodic assessment (5 year?) of grassland acreage in Vermont, likely through GIS analysis of Landsat data.	UVM, NRCS	NRCS, USDA.
Conservation Payments/Financial Incentives	Medium	Conserve grassland/shrubland habitats on private lands.	Number and total area of sites conserved.	USDA, USFWS, VHCB	FSA, SWG, VHCB

Bibliography:

DeGraaf, R. M., and M. Yamasaki. 2001. New England wildlife: habitat, natural history, and distribution. University of New England Press, Hanover, New Hampshire, USA, and London, UK.

Ellison, W. G. 1985. Vesper Sparrow. Pages 342-343 in S. B. Laughlin and D. P. Kibbe, eds. The atlas of breeding birds of Vermont. University Presses of New England, Hanover, New Hampshire, USA.

Jones, S. L., and J. E. Cornely. 2002. Vesper Sparrow (Pooecetes gramineus). In The birds of North America, No. 624 (A. Poole and F. Gill, eds.). The birds of North America, Inc., Philadelphia, Pennsylvania, USA.

Sauer, J. R., J. E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966-2003. Version 2004.1. USGS Patuxent Wildlife Research Center, Laurel, Maryland, USA.

Vickery, P. D., M. L. Hunter, Jr., and S. M. Melvin. 1994. Effects of habitat area on the distribution of grassland birds of Maine. Conservation Biology 8:1087-1097.

Common Name: **Grasshopper Sparrow**
Scientific Name: **Ammodramus savannarum**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: High Priority

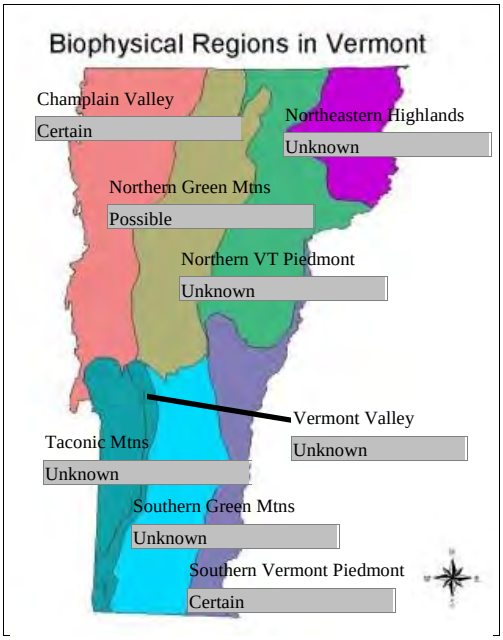
Global Rank: G5 **Global Trend:**
State Rank: S2B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

Currently listed as Threatened in Vermont

Species has declined throughout region due primarily to loss of grassland habitat and agricultural intensification (early mowing regimes).

Distribution:



Natural History Elements:

Home Range:
Migrant? No
Within watershed ☐
Within biophysical region ☐
Within VT ☐
Within Region ☐
Within US ☐
Outside US ☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☑ Regional Literature ☐ General Literature ☐

Grasslands, pastures, old fields and airports with minimal grass and litter cover and patches of bare ground.

Common Name: **Grasshopper Sparrow**
Scientific Name: **Ammodramus savannarum**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	> 10 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☑
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☑
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Grasslands and Hedgerows

Other Cultural

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Habitat Succession

Description of habitat problem(s): Direct loss of nesting habitat due to habitat conversion and agricultural intensification (mowing regimes)

Non-Habitat Problems:

Trampling or Direct Impacts

Description of non-habitat problem(s): Early and frequent mowing regimes directly impact nesting and reproductive success.
Insufficient information on statewide population size.

Common Name: **Grasshopper Sparrow**
Scientific Name: **Ammodramus savannarum**
Species Group: **Bird**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Determine habitat requirements specific to Vermont
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	Accutately determine population size and location of breeding pairs statewide.
Research	Threats and Their Significance	High	Determine impacts of habitat loss and agricultural practices on distribution and nesting success.
Research	Population Genetics	Low	
Monitoring	Population Change	High	Accurately determine population size and trend information throughout the state an particularly at know nesting locations (airports).
Monitoring	Habitat Change	High	Determine statewide changes in grassland habitats and agricultural practices. Identify habitat changes at known nesting locations (airports)
Monitoring	Monitor Threats	High	Monitor limiting factors at current nesting locations (airports) including habitat loss due to development of the site and mowing prcatices.

Common Name: **Grasshopper Sparrow**
Scientific Name: **Ammodramus savannarum**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Technical Assistance, Training, Learning Networks	High	Educate agricultural community and individuals with grasslands about grassland birds and management options.	Development of a grassland bird outreach program	VTFWD, Audubon Vermont, VINS, UVM	
Protected Area Management	High	Maintain nesting habitat throughout breeding season by developing site-specific conservation plans which include restricting field mowing until after July 15th on publicly owned lands (WMAs and state airports)	Maintain and increase current acreage under management on state lands	VTFWD, Audubon Vermont, NRCS, VTrans	VTFWD, VTrans
Conservation Payments/Financial Incentives	High	Maintain nesting habitat throughout breeding season by restricting field mowing until after July 15th	Increase protection of available habitat through enrollment in WHIP and GRP	VTFWD, Audubon Vermont, NRCS	
Habitat Restoration	High	Maintain grassland habitat in suitable locations through active management of woody vegetation within Grassland Bird Focus Areas.	Increase and maintain available habitat in suitable locations	VTFWD, private landowners	Unknown
Conservation Payments/Financial Incentives	High	Protect privately owned known nesting sites and suitable grassland habitat from development and agricultural intensification by creating Grassland Bird Focus Areas to concentrate management efforts (see the Vermont Grassland Bird Management Plan).	Development of Grassland Bird Focus Areas and increase protection of available habitat through enrollment in WHIP and GRP.	VTFWD, Audubon Vermont, NRCS, private landowners	US government
Conservation Payments/Financial Incentives	High	Maintain large tracts (> 100 acres) of suitable grassland habitat for entire suite of grassland bird species.	Increase protection of available habitat through enrollment in WHIP and GRP	VTFWD, Audubon Vermont, NRCS	

Bibliography:

Vickery, P.D. 1996 Grasshopper Sparrow. In A. Poole and F. Gill Editors. The birds of North America, no. 580 Academy of natural Sciences, Philadelphia PA, and American Ornithologists' Union, Washington, D.C., USA.

LaBarr, M. L. 2005. The Vermont Grassland Bird Management Plan. Unpublished report. Audubon Vermont, Huntington, VT.

Common Name: **Henslow's Sparrow**
Scientific Name: **Ammodramus henslowii**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

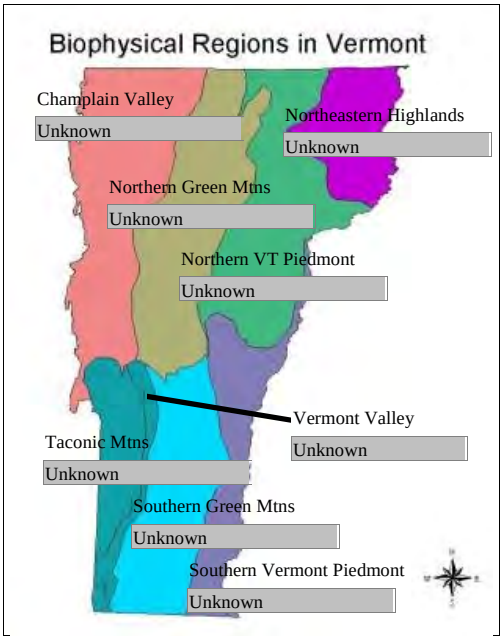
Global Rank: G4 **Global Trend:**
State Rank: S1B **State Trend:** Declining
Extirpated in VT? Yes **Regionally Rare?** Yes

Assessment Narrative:

Currently listed as endangered in Vermont

Listed as endangered in Vermont. Breeding by this species has not been documented in Vermont in the past 2 decades.

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Currently no breeding pairs in Vermont. Historical nesting records were from the southern half of the state.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Grassy and wet meadows, old fields with tall dense grassy vegetation with scattered woody vegetation

Common Name: **Henslow's Sparrow**
Scientific Name: **Ammodramus henslowii**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	> 10 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☑
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Grasslands and Hedgerows

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Succession

Description of habitat problem(s): Loss of appropriate habitat?

Description of non-habitat problem(s):

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Distribution and Abundance	High	Determine presence/absence of species in state.

Species Strategies ***(see Appendix B for additional habitat, community & landscape conservation summaries.)***

Strategy Type	*Strategy Priority*	*Strategy Description*	*Performance Measure*	*Potential Partners*	*Potential Funding Sources*
Habitat Restoration	High	Maintain diverse grassland habitat types with in GBFAs to include grasslands with some woody vegetation suitable to Henslow's Sparrow	Diverse grassland habitat types within GBFA	VTFWD, Audubon Vermont, NRCS	US Government, VTFWD
Technical Assistance, Training, Learning Networks	High	Educate agricultural community and general public about grassland birds and appropriate management options to protect them	Develop a grassland bird outreach program	VTFWD, Audubon Vermont, VINS, UVM	SWG, VTFWD
Protected Area Management	High	Protect suitable grassland habitat from development and agricultural intensification by creating Grassland Bird Focus Areas (GBFA) to protect entire suite of grassland bird species (see Vermont Grassland Bird Management Plan)	Development of GBFA and increased protection of habitat through enrollment in WHIP and GRP	VTFWD, Audubon Vermont, NRCS	SWG, VTDFW

Common Name: **Henslow's Sparrow**
Scientific Name: **Ammodramus henslowii**
Species Group: **Bird**

Bibliography:

Laughlin, S. B. and D. P. Kibbe, editors. The atlas of breeding birds of Vermont. University of New England Press. Hanover, New Hampshire, USA.

LaBarr, M. L. 2005. The Vermont Grassland Bird Management Plan. Unpublished report. Audubon Vermont, Huntington, VT.

Common Name: **Bobolink**
Scientific Name: **Dolichonyx oryzivorus**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

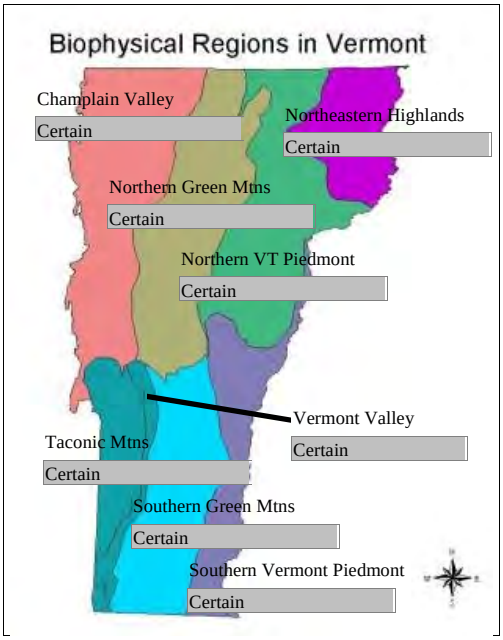
Global Rank: G5 **Global Trend:**
State Rank: S5B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Significant long-term population declines both in VT and survey-wide (Sauer et al. 2004) .

Much of VT grasslands are population sinks. As farms are abandoned management strategies to maintain grassland habitat are critical.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

Data from Ellison (1985).

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☑ General Literature ☑

Grasslands, primarily managed. Generally avoids alfalfa, row crops, and grass habitats with standing water during settlement period (late May).

Common Name: **Bobolink**
Scientific Name: **Dolichonyx oryzivorus**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	> 10 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☑
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Grasslands and Hedgerows

Marshes and Sedge Meadows

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Succession

Description of habitat problem(s): Greatest problems are the widespread early hay harvest (early June), continued decrease of agriculture and abandonment of agricultural land, and the conversion of agricultural habitat to urban/suburban development (Martin and Gavin 1995, Troy et al. in press).

Description of non-habitat problem(s):

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Basic Life History	Medium	1) Improve our understanding of Bobolink population structure to determine if female Bobolinks emigrate permanently after hayfield harvest, suggesting limited site fidelity and strongly panmictic population. 2) Determint whether females whose nesting attempt fails due to haying attempt to renest, and if so, where.
Monitoring	Population Change	High	Determine if the Champlain Valley is a source or sink for Bobolink.
Monitoring	Habitat Change	High	Better information is necessary regarding the timing of hay mowing in landscapes with various proportions of agriculture throughout VT.

Common Name: **Bobolink**
Scientific Name: **Dolichonyx oryzivorus**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration	High	As farms are abandoned management strategies to maintain grassland habitat are critical.	Periodic assessment (5 year?) of grassland acreage in Vermont, likely through GIS analysis of Landsat data.	UVM, NRCS.	NRCS, USDA.
Technical Assistance, Training, Learning Networks	High	Improve extension and outreach to landowners haying early in the nesting season without need for livestock forage (those primarily interested in reversing succession).	Number of acres enrolled in a late-mowing program, number of landowners contacted	UVM, NRCS	NRCS, USDA
Easements	High	Reduce the amount of grassland habitat being lost to development through strategic acquisition of grassland easements.	Periodic assessment (5 year?) of grassland acreage in Vermont, likely through GIS analysis of Landsat data.	UVM, NRCS.	NRCS, USDA.
Conservation Payments/Financial Incentives	High	Decrease nest losses due to early mowing regimes via conservation payments.	Increase in proportion and total area of grasslands in which hay cutting is delayed.	NRCS, UVM	NRCS (WHIP, GRP), USDA
Habitat Restoration	High	Establish a minimum of one large grassland reserve in the Champlain Valley (1000 ha) specifically for populations of bobolink and other grassland songbirds.	Continued assessment of the amount of grassland that is publicly owned or has conservation easements in the Champlain Valley.	TNC, NRCS.	TNC, NRCS
Technical Assistance, Training, Learning Networks	High	Improve extension and outreach to landowners haying early in the nesting season without need for livestock forage (those primarily interested in reversing succession).	Number of acres enrolled in a late-mowing program, number of landowners contacted	UVM, NRCS	NRCS, USDA

Bibliography:

Ellison, W. G. 1985. Bobolink. Pages 358-359 in S. B. Laughlin and D. P. Kibbe, eds. The atlas of breeding birds of Vermont. University Presses of New England, Hanover, New Hampshire, USA.

Martin, S. G., and T. A. Gavin. 1995. Bobolink (Dolichonyx oryzivorus). In The birds of North America, No. 176 (A. Poole and F. Gill, eds.). The birds of North America, Inc., Philadelphia, Pennsylvania, USA.

Sauer, J. R., J. E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966-2003. Version 2004.1. USGS Patuxent Wildlife Research Center, Laurel, Maryland, USA.

Common Name: **Eastern Meadowlark**
Scientific Name: **Sturnella magna**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

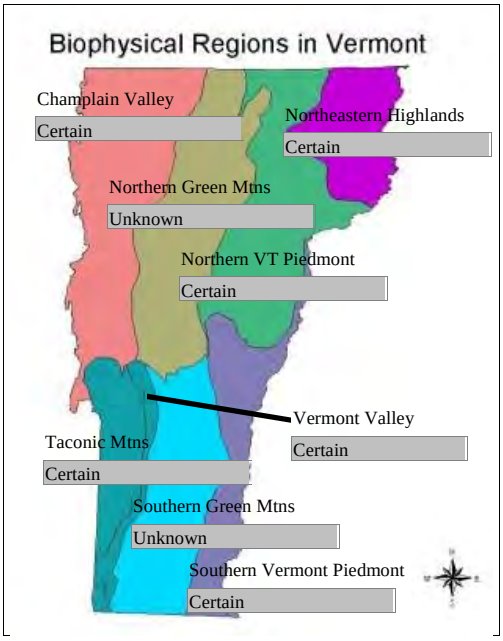
Global Rank: G5 **Global Trend:**
State Rank: S5B **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Populations declining throughout its range and in Vermont.

One of several grassland bird species whose population is declining throughout much of its range including Vermont. Loss and degredation (agricultural intensification) of grassland habitat suspected as primary reason.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☑
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Fairly well distributed throughout the state with concentrations in the Champlain Valley

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Meadows, old fields, hayfields with thick layer of dead grass

Common Name: **Eastern Meadowlark**
Scientific Name: **Sturnella magna**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	> 1 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☑
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Grasslands and Hedgerows

Other Cultural

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Habitat Succession

Description of habitat problem(s): Loss of habitat due to intensification of agricultural practices and development.

Non-Habitat Problems:

Trampling or Direct Impacts

Description of non-habitat problem(s): Early mowing regimes reduce nesting success. Sensitive to human disturbance.

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	Medium	Determine specific habitat requirements in Vermont
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	Determine distribution within Vermont and areas of highest concentration
Research	Threats and Their Significance	Medium	Determine limiting factors specific to this species
Monitoring	Population Change	High	Accurately determine current population trends for Vermont
Monitoring	Habitat Change	High	Assess changes in grassland habitat and management practices on those grasslands.
Monitoring	Monitor Threats	Medium	Monitor changes in agricultural pracatices which directly impact species

Common Name: **Eastern Meadowlark**
Scientific Name: **Sturnella magna**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Protected Area Management	High	Maintain nesting habitat throughout the breeding season by developing site specific conservation plans which include restricting mowing until after July 15 on publicly owned lands (WMAs, state airports).	Maintain and increase current acreage under management on state and federal lands	VFWD, Audubon Vermont, USFWS NRCS VTrans	SWG, USAD
Technical Assistance, Training, Learning Networks	High	Educate agricultural community and general public about grassland bird conservation and different management options and programs.	Develop a grassland bird outreach program	VTFWD, UVM, Audubon Vermont, VINS	SWG
Technical Assistance, Training, Learning Networks	High	Educate agricultural community and general public about grassland birds and management options to protect habitat	Develop a grassland bird outreach program	VFWD, Audubon Vermont, VINS, UVM	SWG, VFWD
Protected Area Management	High	Maintain nesting habitat throughout the breeding season by developing site specific conservation plans which include restricting mowing until after July 15 on publicly owned lands (WMAs, state airports).	Maintain and increase current acreage under management on state and federal lands	VTFWD, Audubon Vermont, USFWS NRCS VTrans	SWG, USAD
Habitat Restoration	High	Maintain grassland habitat in suitable locations through active management of woody vegetation in Grassland Bird Focus Areas	Increased and maintain suitable habitat	VTFWD, NRCS, private landowners	
Habitat Restoration	High	Maintain grassland habitat in suitable locations through active management of woody vegetation within Grassland Bird Focus Areas.	Increase and maintain available habitat in suitable locations	VFWD, Audubon Vermont, NRCS, USFWS	US government
Conservation Payments/Financial Incentives	High	Maintain nesting habitat by delaying mowing until after July 15th	Increased protection of habitat through enrollment in WHIP and GRP	VTFWD, Audubon Vermont, NRCS	
Conservation Payments/Financial Incentives	High	Protect suitable grassland habitat from development and agricultural intensification by creating Grassland Bird Focus Areas to concentrate management efforts (see Vermont Grassland Bird Management Plan)	Development of Grassland bird focus Areas and increased protection of habitat through enrollment in WHIP and GRP	VTFWD, Audubon Vermont, NRCS	USDA
Conservation Payments/Financial Incentives	High	Maintain large tracts (>100 acres) of suitable grassland habitat for entire suite of grassland bird species.	Increased enrollment in WHIP and GRP	VTFWD, Audubon Vermont, NRCS	SWG

Bibliography:

Puryear, K. 2004. Landscape-level Grassland Bird conservation in the southern Champlain Valley, Vermont. Masters Project. University of Vermont, Burlington Vermont, USA.

Common Name: **Rusty Blackbird**
Scientific Name: **Euphagus carolinus**
Species Group: **Bird**

Conservation Assessment:

Final Assessment: Medium Priority

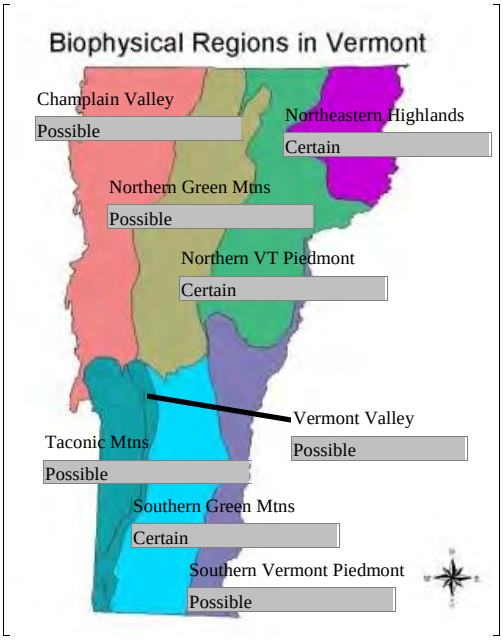
Global Rank: G5 **Global Trend:**
State Rank: S3B **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

Vermont SAG Species of Special Concern. Not on Audubon's Watch or ABC's Green Lists. BBS data showed a non-significant decrease for populations east of the Mississippi River during 1966-1991 but an increase during 1982-1991 (Avery 1995).

Ellison (1990) suggested no appreciable decline in Caledonia and Essex counties between 1982 - 1991. The recent recovery of beaver populations is believed to have increased available nesting habitat and benefited rusty blackbirds in the Adirondacks (Peterson 1988). "Wet forested habitat preferred by Rusty Blackbirds is relatively inaccessible and somewhat inhospitable, so breeding populations may be in no imminent danger, but more careful monitoring … is needed to confirm this." (Avery 1995).

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☑
Outside US	☐

Distribution Summary:

"Rusty Blackbirds are local and uncommon summer residents of the Northeast Highlands, the North Central region, and the Green Mountains." (Nichols 1985)

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Wooded swamps, tree-bordered marshes, beaver ponds, boreal bogs and stream borders with alder and willow thickets (DeGraff and Rudis 1986). "Disturbance can be favorable to this species; e.g., nests found in modest openings regenerating from clearcuts (Ellison 1990)" (Avery 1995).

Common Name: **Rusty Blackbird**
Scientific Name: **Euphagus carolinus**
Species Group: **Bird**

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Boreal Conifers
Early Succession Northern Hardwoods
Early Succession Spruce-Fir
Hardwood Swamps
Shrub Swamps
Softwood Swamps

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Description of habitat problem(s): Permanent residence and/or vacation home development on lakeshores/pondshores may reduce available habitat.

Non-Habitat Problems:

Harvest or Collection

Description of non-habitat problem(s): "Substantial mortality to local populations may occur when Rusty Blackbirds are in mixed-species winter roosts subjected to blackbird control in the s. U.S.(Stickley et al. 1986)" (Avery 1995).

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Basic Life History	Low	Some evidence of colonial nesting, however nesting by widely-separated individuals seems to prevails in Vermont. Factors governing how habitat might influence whether Rusty Blackbirds nest singly or colonially should be investigated (Avery 1995).
Research	Distribution and Abundance	Medium	More complete surveys of the distribution of breeding Rusty Blackbirds in Vermont are warranted to obtain a better estimate of it's true status.
Research	Threats and Their Significance	Low	
Monitoring	Population Change	Medium	
Monitoring	Habitat Change	Low	
Monitoring	Monitor Threats	Medium	Shoreline development in the Rusty Balckbird strongholds in Vermont should be monitored.

Common Name: **Rusty Blackbird**
Scientific Name: **Euphagus carolinus**
Species Group: **Bird**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Easements	Medium	Known nesting habitats should be monitored over time to track impacts from development. Easements should be considered to protect important breeding habitats from development. PIF Vermont target population is 226 breeding individuals.	Number of sites identified and conserved.	ANR, VINS, VA, VHCB	SWG, VHCB
Policy & Regulations	Low	Assist PIF with efforts to reduce mortality from pesticides used on wintering grounds.	Reduction in mortalities due to pesticides	PIF, USFWS	USFWS, USDA, SWG

Bibliography:

Avery, M. L. 1995. Rusty Blackbird (Euphagus carolinus). In The Birds of North Americas, No. 200 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologist's Union, Washington, D.C.

DeGraff, R.M. and D.D. Rudis 1986. New England wildlife: habitat, natural history, and distribution. Gen. Tech. Rep. NE-108. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 491 p.

Ellison, W.G. 1990. The status and habitat of the Rusty Blackbird in Caledonia and Essex counties. Vermont Fish Wildl. Dep., Waterbury, VT.

Nichols, W. D. 1985. Rusty Blackbird. Pp. 364-365 in The atlas of breeding birds of Vermont (S.B. Laughlin and D.P. Kibbe, eds.). Univ. Press of New England, Hanover, NH.

Vermont's Wildlife Action Plan November 22, 2005

Appendix A2 Fish Species of Greatest Conservation Need

Index to Fish Species of Greatest Conservation Need

Common Name: **Blueback Herring (CT River only)**
Scientific Name: **Alosa aestivalis (CT River only)**
Species Group: **Fish**

Conservation Assessment:

Final Assessment: Medium Priority

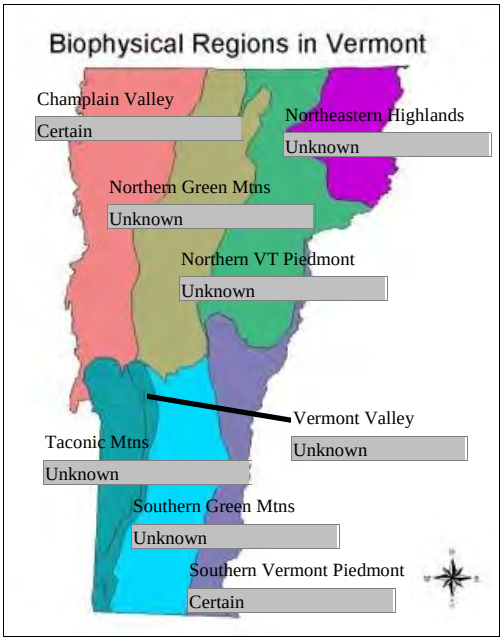
Global Rank: G5
State Rank: SU
Extirpated in VT? No

Global Trend:
State Trend: Declining
Regionally Rare? No

Assessment Narrative:

The blueback herring population in the Connecticut River has declined significantly over the past two decades to the extent that now it is rarely observed in the Vermont-New Hampshire section of the river. Population abundance as represented by annual fish passage counts at the Holyoke Dam fish lift in Massachusetts provides the best relative estimate of the species status in the Connecticut River basin. In the 12-year period, 1981-1992, annual herring passage averaged 433,000. In contrast, during the 1990s passage counts at Holyoke declined dramatically with an average of only 44,000 passed annually. Since then herring numbers have continued to drop with 1,939 fish counted in 2002 and only a couple hundred in 2004. Population estimates made at the Vernon Dam fish ladder, while always significantly lower than numbers counted further downstream have followed a similar declining trend with no blueback herring being recorded in some years. Three noteworthy blueback herring restoration/management plans exist for the conservation of this species: "1999 Review of the ASFMC Fishery Management Plan for Shad and River Herring (Alosa spp.)" developed by the Atlantic States Fisheries Management Council, the "Management Plan for Blueback Herring in the Connecticut River Basin (2003)" prepared by the Connecticut River Atlantic Salmon Commission, and the "Plan for the restoration of migratory fishes to the Ashuelot River basin, New Hampshire." These plans specify management goals and objectives for blueback herring restoration and conservation including target population levels, overfishing, habitat improvement, fish passage, and outmigrant survival. Blueback herring are not indigenous to Lake Champlain but got access to the lake via the likely route of the Hudson Barge Canal.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☑
Outside US	☐

Distribution Summary:

The blueback herring reaches its northern limit in Canadian waters and occurs along the eastern North American seaboard from Cape Breton, Nova Scotia south to northern Florida (Scott and Crossman 1973). Landlocked populations are also known to occur, including Lake Champlain. Anadromous blueback herring occur naturally in the Connecticut River basin, although their historic occurrence in the Vermont-New Hampshire section of the Connecticut River is uncertain but is believed to have been similar to American shad with the upstream limit to their distribution extending upstream to Bellows Falls, Vermont. Although blueback herring are also found in Lake Champlain, the

Common Name: **Blueback Herring (CT River only)**
Scientific Name: **Alosa aestivalis (CT River only)**
Species Group: **Fish**

species is not indigenous to that waterbody.

Known Watersheds

CT-Ashuelot River

CT-Bellows Falls Dam to Vernon Dam

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Blueback herring is an anadromous species spending portions of its life in both marine and freshwater environments. In freshwater, it migrates up rivers to spawn. Generally the upstream migration of blueback herring does not extend as far as for other clupeid species (e.g., alewife); spawning may occur in both brackish and fresh waters (Scott and Crossman 1973). Spawning occurs in a diversity of habitats, including large rivers, small streams, ponds and large lakes over a range of substrates, such as gravel, sand, detritus, and submersed vegetation and other structures. Swift flowing waters are used as spawning sites . Blueback herring spawn in rivers releasing their eggs into the water column whereupon the eggs settle and adhere to the substrate, including stones, gravel and sticks (Scott and Crossman 1973). Larval and juvenile blueback herring reside in the river during their first summer before outmigrating the following fall. Spawning success and survival of adults and juveniles are dependent on successful passage past manmade obstacles, such dams and hydroelectric generation plants.

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lower CT River

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Fragmentation

Description of habitat problem(s): Spawning success and survival of adults and juveniles are limited by the existence and development of dams and hydroelectric generation plants which may impede access to spawning and nursery habitats, as well as cause mortality to outmigrating fish. River flow reimes as manipulated by hydroelectric poer generation activities can affect blueback herring habitat.

Non-Habitat Problems:

Common Name: **Blueback Herring (CT River only)**
Scientific Name: **Alosa aestivalis (CT River only)**
Species Group: **Fish**

Predation or Herbivory

Description of non-habitat problem(s): Migrating adult and juvenile blueback herring are susceptable to predation, especially fish predators. Improvements in stock strength of striped bass and bluefish are believed to have increased predatory pressure on migrating clupeid populations, including blueback herring and American shad. Being an anadromous species, blueback herring are subjected to a wide variety of problems associated with extensive migrations and residency in both marine and freshwater environments. Outmigrating adult and juvenile herring may be exposed to turbine mortality at power dams resul;ting in high mortlaity.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Low	
Research	Threats and Their Significance	Medium	Turbine passage and mortality studies.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Research	Other Research	Low	Research is being conducted by other agencies to which Vermont is a cooperator.
Monitoring	Population Change	High	Monitor herring passage at Connecticut River fishpasses.
Monitoring	Habitat Change	Low	
Monitoring	Monitor Threats	Medium	

Common Name: **Blueback Herring (CT River only)**
Scientific Name: **Alosa aestivalis (CT River only)**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Species Restoration	High	Support and cooperate with the inter-agency program for the restoration of anadromous fishes to the Connecticut River basin (e.g., CRASC).	Implement Connecticut River Basin Management Plan for Blueback Herring. Percent of tasks implemented as prescribed in the plan.	CRASC, USFWS, USFS, NMFS, NHFGD, MaDFW, MaDMF, CtDEP	
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		CRASC, USFWS, CRJC, TNC, watershed associations	
Compatible Resource Use	High	Restore fish passage at dams to allow upstream migrants access to spawning and juvenile habitats and expedite outmigrants (post-spawned adults, juveniles) to sea. Operate and maintain existing fishways for peak passage performance.	Number of dams that provide suitable passage requirements for blueback herring.	CRASC, USFWS, VDEC, CRJC, ACE, power companies	ACE, power companies
Habitat Restoration	High	Reduce outmigration delay and turbine mortality at hydroelectric power stations.	Number of hydroelectric projects that have been evaluated for turbine mortality. Number of identified problem projects that provide alternative downstream fish passage or other mitigation.	CRASC, USFWS, VDEC, CRJC, ACE, power companies	ACE, power companies
Natural Processes Restoration	High	Improve flow regimes below hydroelectric generation and flood control projects.	Number of projects which operate under flow regimes that provide suitable habitat for blueback herring.	CRASC, USFWS, VDEC, FERC, CRJC, ACE, power companies	ACE, power companies

Common Name: **Atlantic Salmon (landlocked)**
Scientific Name: **Salmo salar (landlocked)**
Species Group: **Fish**

Conservation Assessment:

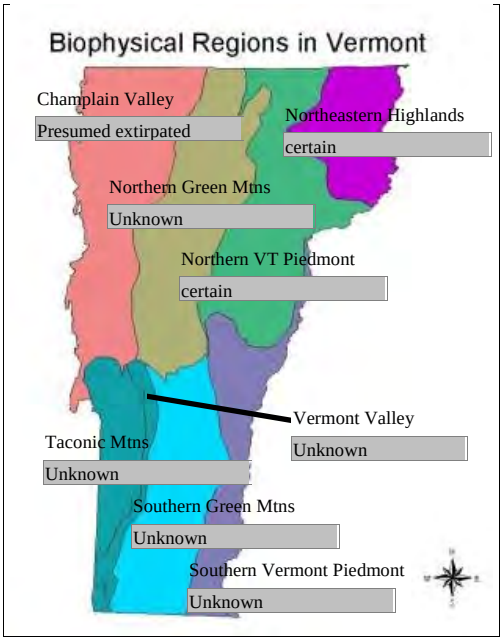
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S4 **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

The only landlocked salmon population in Vermont with some level of documented natural reproduction occurs in Lake Memphremagog and the Clyde River. Historically, landlocked salmon inhabited Lake Champlain. The Lake Champlain Fish and Wildlife Management Cooperative is currently engaged in a program to restore landlocked salmon to the Lake Champlain basin.

Distribution:



Natural History Elements:

Home Range:
Migrant? Yes

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Landlocked populations of Atlantic salmon occur principally in Newfoundland, Labrador and Quebec (Scott and Crossman 1973). Natural populations were also located in Maine and presumably in Vermont, i.e. lakes Champlain and Memphremagog. Scarola (1973) reports all landlocked salmon populations in New Hampshire are introduced. Landlocked populations have been stocked extensively to supplement natural populations, as well as to establish new fisheries. Even though salmon still occur in Lake Champlain, this is principally the result of a stocking program designed to restore a naturally reproducing population to the watershed, albeit there is little evidence of significant natural reproduction occurring there at this time. The Lake Memphremagog population does reproduce naturally with spawning occurring in the Clyde River.

Known Watersheds

Saint-Francois River

Common Name: **Atlantic Salmon (landlocked)**
Scientific Name: **Salmo salar (landlocked)**
Species Group: **Fish**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☑ General Literature ☑

The landlocked salmon is a fish of oligotrophic waters, that is deep, well oxygenated, relatively infertile lakes. As the spawning season sets in fish leave the depths of the lake to suitable spawning habitat located in shallow lake shore areas or to ascend tributary streams or use lake outlets (Scarola 1973). Habitat studies conducted in Lake Winnipesaukee, New Hampshire found the salmon have a preference for depths below the thermocline during the summer period (12-21 m) (Scarola 1973). Water temperatures at this time of year are in the mid 10s (C). Salmon can survive water temperatures into the 21s for brief periods of time but such temperatures are usually avoided if cooler water is available. Longer exposure to these temperatures can cause the fish physiological stress. Temperatures into the 27s can be lethal. Spawning habitat preferences are similar to those for anadromous Atlantic salmon.

General Habitat Preferences:

Minimum Elevation (m):	208
Maximum Elevation (m):	-1
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial

Aquatic: Lake Champlain

Aquatic: Large Lake Champlain Tribs Below Falls

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change

Habitat Alteration

Habitat Fragmentation

Invasion by Exotic Species

Sedimentation

Description of habitat problem(s): Salmon require cool streams for spawning and juvenile rearing. Many of the historical salmon streams in Vermont have barriers that impede their access to these habitats (e.g., Missisquoi, Lamoille, Winooski, Clyde rivers and Otter Creek). Dams and other impassable barriers, such as culverts, also fragment habitats that are needed to access spawning and rearing habitats but also for seasonal movements (e.g., summer feeding, temperature refugia, overwintering habitats). Water quality degradation, such as in mean annual temperatures, have occurred due to losses in mature riparian canopies, impacts from land use practices, urban stormwater runoff, and water retention in impoundments. Stream habitats have been degraded and habitat complexity decreased from channelization and removal and reduced recruitment of large woody debris to rivers. Habitat degradation from a variety of stressors has

Common Name: **Atlantic Salmon (landlocked)**
Scientific Name: **Salmo salar (landlocked)**
Species Group: **Fish**

reduced the quality of spawning and juvenile rearing habitats in Vermont streams. The appearance of alewife in Lake Champlain is of great concern due to their potential impact through competition with other pelagic planktivores, such as landlocked Atlantic salmon.

Non-Habitat Problems:

Competition

Genetics

Parasites

Description of non-habitat problem(s): The native stocks of landlocked salmon in Lake Champlain were extirpated by the mid 1800s. It is questionable whether past and current restoration efforts are using genetically appropriate strains for restoration given the habitat conditions present in the lake. Competition and displacement by introduced salmonids, such as rainbow trout, may impact juvenile rearing stages of salmon. Sea lamprey parasitism has been found to be a significant source of mortality affecting salmon restoration.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Low	
Research	Threats and Their Significance	Medium	Inter-specific non-native salmonid competition.
Research	Population Genetics	High	Evaluation of strains being stocked in Lake Champlain for restoration purposes.
Research	Taxonomy	Low	
Research	Other Research	High	Accelerate the development of Lake Champlain and Lake Memphremagog landlocked salmon strains which are more appropriate to the environmental conditions of those waters.
Monitoring	Population Change	High	
Monitoring	Habitat Change	Medium	
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	High	

Common Name: **Atlantic Salmon (landlocked)**
Scientific Name: **Salmo salar (landlocked)**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Species Restoration	High	Manage sea lamprey parasitism to achieve salmon restoration and fishery objectives.	Lamprey wounding targets as outlined in the EIS.	LCFWMC, NYDEC, VDEC	
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, TU, Echo Center, LCBP, lake and watershed associations	
Species Restoration	High	Develop landlocked Atlantic salmon forage base management and assessment plans.	Number of steps taken to advance the development of forage base management and assessment plans.	LCFWMC, USFWS, NYDEC	
Species Restoration	High	Reduce inter-specific competition between rainbow trout and landlocked salmon.	Percent of salmon survival targets met per the upcoming LCFWMC strategic plan.	LCFWMC, USFWS, NYDEC	
Invasive Species Control & Prevention	High	Implement measures to prevent the introduction or control the abundance of exotic species (e.g., alewife) which could limit landlocked Atlantic salmon populations in lakes Memphremagog and Champlain through competition.	Development and implementation management plans for the control of invasive aquatic organisms in lake trout waters.	LCFWMC, USFWS, VDEC, lake and watershed associations	
Habitat Restoration	High	Protect and restore lake, in-stream and riparian habitats via water quality, flows and temperature improvements; sediment reduction; streamside buffers; and maintenance of habitat structure (e.g., large woody debris, deep pools).	Number of acres of riparian habitat protected or restored. Number of miles of stream habitat protected or restored.	USFWS, NRCS TU, lake and watershed associations	
Compatible Resource Use	High	Restore fish passage at dams and culverts to allow upstream migrants access to spawning and juvenile habitats and expedite outmigrants (post-spawned adults, juveniles) to the lakes. Operate and maintain existing fishways for peak passage performance.	Number of dams and culverts with identified fish passage problems. Number of dams and culverts where fish passage has been restored either by removal or mitigation (e.g., retrofitting with fishways).	VTrans, USFWS, TU, hydroelectric power companies and other dam owners, town highway departments	

Common Name: **Atlantic Salmon (landlocked)**
Scientific Name: **Salmo salar (landlocked)**
Species Group: **Fish**

Habitat Restoration	Medium	Support efforts, such as the Climate Change Action Plan developed by the Conference of New England Governors, and local and regional initiatives, such as the Alliance for Climate Action, to reduce greenhouse gas emissions in the Northeast.	VDEC, EPA, USFWS, other Northeastern states and Canadian environmental agencies
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore landlocked Atlantic salmon critical habitats.	VDEC, RPCs, lake and watershed associations, town planning and conservation commissions

Bibliography:

Scott, W. B., and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184, Ottawa.

Sprankle, K. 1998. Plan for the restoration of migratory fishes to the Ashuelot River basin, New Hampshire. New Hampshire Fish and Game Department, Inland Fishheries Division, Concord.

Connecticut River Atlantic Salmon Commission. 2003. Management plan for blueback herring in the Connecticut River basin. U. S. Fish and Wildlife Service, Connecticut River Coordinator's Office, Sunderland, Massachusetts. Web site: http://www.fws.gov/r5crc/herring_plan.html.

Common Name: **Northern Brook Lamprey**
Scientific Name: **Ichthyomyzon fossor**
Species Group: **Fish**

Conservation Assessment:

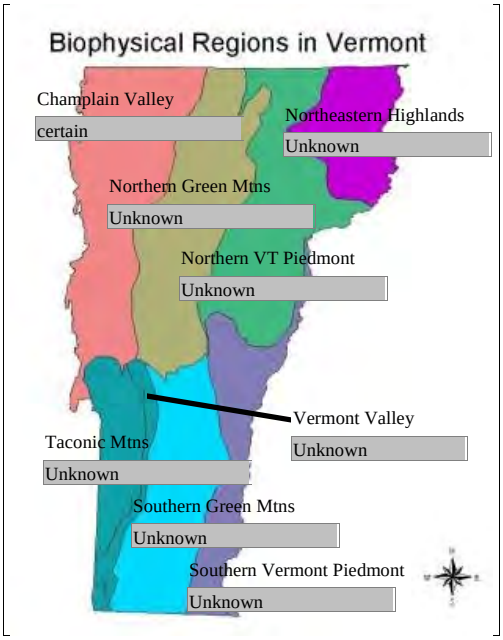
Final Assessment: High Priority

Global Rank: G4 **Global Trend:**
State Rank: S1 **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

In Vermont, the northern brook lamprey is a state listed endangered species; and, in Quebec, it is a species of special concern. Only one population is known to occur in the state encompassing two streams in the Lake Champlain biophysical region (Indian Brook and Malletts Creek). This population is at the eastern edge of its continental range. Plans for controlling sea lamprey in Lake Champlain do not appear to pose a limiting factor to northern brook lamprey at this time. The more serious limiting factor to the species is habitat loss and degradation. The Indian Brook-Malletts Creek watershed is located within a rapid development area, where point and non-point discharges to these waters are sources of sediments, pollutants and contaminants. Due to the small size of the population the potential for inbreeding depression is also a concern. Northern brook lamprey is a nonparasitic species.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Northern brook lamprey occur in the Mississippi and Great Lakes drainages from western New York, Quebec, Ontario, Michigan and eastern Wisconsin; from the north shore of Lake Superior to northern Indiana and Ohio (Scott and Crossman 1973). Only one northern brook lamprey population is known in Vermont. This population is limited to one watershed consisting of Indian Brook and Malletts Creek, both tributaries of Malletts Bay on Lake Champlain.

Known Watersheds

Lake Champlain Direct

Common Name: **Northern Brook Lamprey**
Scientific Name: **Ichthyomyzon fossor**
Species Group: **Fish**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Clear streams and small to moderate sized rivers (Scott and Crossman 1973; Smith 1985; Langdon et al, In press; Morman 1979). The non-parasitic northern brook lamprey spends its entire life in streams. No known populations reside on Lake Champlain's deltas, unlike sea lamprey and American brook lamprey. It has a 4 to 6 year life span and spends most of it buried in the substrate, where it grows to about 150mm, metamorphoses, and becomes sexually mature. Adults generally migrate upstream to spawn. Larval habitat includes lotic depositional and estuarine areas of streams with organic matter for feeding and fairly stable substrate in order to maintain burrow. Stream riffle areas with sand and pea gravel up to approximately 15 mm diameter are used for spawning (W. Bouffard, USFWS, personal communication). Spawning water depth is typically <450 mm deep (Scott and Crossman 1998).

General Habitat Preferences:

Minimum Elevation (m): 29
Maximum Elevation (m): 45
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial

Aquatic: Large Lake Champlain Tribs Below Falls

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Habitat Fragmentation

Sedimentation

Description of habitat problem(s): Culverts at road crossings may fragment habitat by creating barriers to the upstream migration of spawning adult northern brook lamprey. Sedimentation of stream bottoms reduces the quality of spawning habitat. The lower reaches of Malletts Creek and Indian Brook, which converge to form a large wetland complex, may reach the lethal temperature limit of 30.5 °C thereby limiting population distribution in those streams.

Non-Habitat Problems:

Competition

Genetics

Pollution

Description of non-habitat problem(s): Due to the small population size, distance from other regional

Common Name: **Northern Brook Lamprey**
Scientific Name: **Ichthyomyzon fossor**
Species Group: **Fish**

northern brook lamprey populations, and absence of gene flow between populations, there is a potential for inbreeding depression to occur naturally within Vermont's population. No diagnostic characteristics exist for differentiating between northern brook and silver lamprey accomocoetes. These two species were not readily distinguishable using mitochondrial sequence and mitochondrial restriction fragment length polymorphism analyses, raising the question whether they are different species or different ecomorphotypes (Mandrak et al. 2004). This presents difficulties in understanding current distributions and population trends for northern brook lamprey in the Lake Champlain basin. Competition for larval habitat with sea lamprey and silver lamprey could reduce survival and/or fitness of northern brook lamprey larvae. Small population sizes and extremely limited geographic distribution increase the vulnerability of the population to a potential pollution event. The Lake Champlain Fish and Wildlife Management Cooperative is currently involved in a sea lamprey control program that includes the use of lampricides to kill stream-resident sea lamprey larvae. These lampricides are toxic to all species of lamprey. Currently, sea lamprey are being controlled in streams with northern brook lamprey through the use of traps, eliminating the need for lampricides. The repeated use of lampricides has been shown to adversely affect populations of northern brook lamprey in Lake Superior tributaries (Schuldt and Goold 1980).

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Medium	Given difficulties in identifying northern brook lamprey from other Ichthyomyzon spp. and apparent low population densities, efforts to survey other streams having suitable habitat to locate potential new populations and better define current distribution are needed.
Research	Threats and Their Significance	High	Threats and their significance are poorly unserstood for this species.
Research	Population Genetics	High	Genetic similarities between the disjunct Vermont population and other nearest populations within the region have not been investigated. Investigate gene flow within and between northern brook lamprey populations in the Lake Champlain basin.
Research	Taxonomy	High	No diagnostic characteristics exist for differentiating between northern brook and silver lamprey accomocoetes. These two species were not readily distinguishable using mitochondrial sequence and mitochondrial restriction fragment length polymorphism analyses, raising the question whether they are different species or different ecomorphotypes.
Monitoring	Population Change	High	Current estimates are needed to ascertain status of known population.
Monitoring	Habitat Change	High	Habitat within species' limited distribution in state is not being monitored.
Monitoring	Monitor Threats	High	

Common Name: **Northern Brook Lamprey**
Scientific Name: **Ichthyomyzon fossor**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Invasive Species Control & Prevention	High	Manage potential non-target impacts of the Lake Champlain sea lamprey control program on northern brook lamprey.	Number of existing populations of northern brook lamprey protected and sustained.	LCFWMC, USFWS, VDEC	
Habitat Restoration	Medium	Maintain and restore aquatic organism passage at barriers (e.g., dams, culverts) to provide access to critical habitats.	Number of culverts and dams evaluated for passage. Number of barriers removed or mitigated.	VDEC, USFWS, VTrans, dam owners, town highway departments, town planning and conservation commissions	USFWS, LCBP
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore northern brook lamprey critical habitats.		VDEC, RPCs,watershed associations, town planning and conservation commissions	
Species Restoration	Medium	Assess, monitor and manage as appropriate the problem of sea lamprey competition with northern brook lamprey for spawning and juvenile habitats.	Number of northern brook lamprey populations assessed and monitored for threats.	LCFWMC, USFWS, UVM	LCBP, GLFC
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, Echo Center, LCBP, watershed associations	
Technical Assistance, Training, Learning Networks	High	Support research efforts in the Great Lakes for the development of taxonomic keys that will aid in differentiating between species of Ichthyomyzon.	Development of taxonomic key.	LCFWMC, USFWS, GLFC, USGS, University of Guelph	

Common Name: **Northern Brook Lamprey**
Scientific Name: **Ichthyomyzon fossor**
Species Group: **Fish**

Habitat Restoration	High	Protect and restore in-stream and riparian habitats via water quality improvements, flows, temperature, sediment reduction, streamside buffers, and maintenance of in-stream habitat structure (e.g., large woody debris).	Develop a northern brook lamprey stream habitat protection and management plan.	VDEC, USFWS, NRCS, waterhed associations	LCBP

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Common Name: **Silver Lamprey**
Scientific Name: **Ichthyomyzon unicuspis**
Species Group: **Fish**

Conservation Assessment:

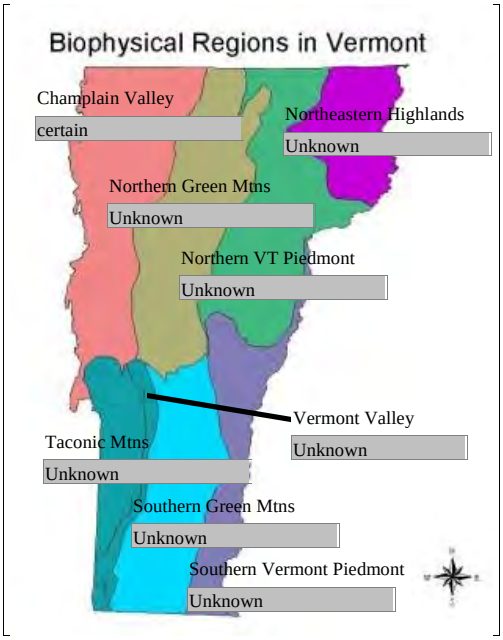
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S2? **State Trend:** Stable
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

The silver lamprey is a widely distributed and relatively common species in Lake Champlain and occurs in 11 Vermont tributaries. The Vermont population is on the eastern edge of its continental range. Habitat fragmentation resulting from the construction of passage barriers (e.g., road culverts) and habitat degradation, such as sedimentation, are limiting factors to the species. However, the treatment of its spawning and nursery habitats with lampricides for the control of sea lamprey in Lake Champlain may be a more formidable challenge facing the species' security in Vermont.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Silver lamprey are restricted to eastern North America, from the St. Lawrence River as far down as Montmagny, Quebec, west through the Great Lakes, through the upper Mississippi valley from Wisconsin, to eastern Manitoba; from Manitoba tributaries of Hudson Bay in the north to the Ohio River basin as far south as Kentucky (Scott and Crossman 1973). In Vermont, this species is at the eastern edge of its North American range. Vermont populations are limited to Lake Champlain and the lower reaches of several tributaries up to the fall line.

Known Watersheds

Lake Champlain Canal

Lake Champlain Direct

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☐ General Literature ☐

Generally occurs in large streams and lakes where host fish are present and can be parasitized. Larval habitat includes lotic depositional and estuarine areas of streams with organic matter for feeding and fairly stable

Common Name: **Silver Lamprey**
Scientific Name: **Ichthyomyzon unicuspis**
Species Group: **Fish**

substrate required to maintain burrows. Spawning occurs in riffle areas with sand and gravel up to approximately 30 mm diameter (W. Bouffard, U. S. Fish and Wildlife Service, personal communication). In Vermont, the silver lamprey spawns in the lower sections of several tributaries of Lake Champlain (Langdon et al. In press).

General Habitat Preferences:

Minimum Elevation (m): 29
Maximum Elevation (m): 45
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Lake Champlain
Aquatic: Large Lake Champlain Tribs Below Falls

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Habitat Fragmentation

Sedimentation

Description of habitat problem(s): Culverts and dams may constitute barriers to the upstream migration of spawning adults. Sedimentation of stream bottoms reduces the quality of spawning habitat.

Description of non-habitat problem(s): The Lake Champlain Fish and Wildlife Management Cooperative is currently involved in a sea lamprey control program that includes the use of lampricides to kill stream-resident larvae. These lampricides are toxic to all species of lamprey.

Common Name: **Silver Lamprey**
Scientific Name: **Ichthyomyzon unicuspis**
Species Group: **Fish**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Low	
Research	Threats and Their Significance	Low	
Research	Population Genetics	Low	
Research	Taxonomy	High	Current research suggests genetic similarity to northern brook lamprey. Resolution of the taxanomic question is needed.
Monitoring	Population Change	High	Population monitoring to determine current status and changes.
Monitoring	Habitat Change	Medium	Habitat assessment and monitoring to assess habitat change and identify limiting factors.
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	High	

Common Name: **Silver Lamprey**
Scientific Name: **Ichthyomyzon unicuspis**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Technical Assistance, Training, Learning Networks	Medium	Support research efforts in the Great Lakes for the development of taxonomic keys that will aid in differentiating between species of Ichthyomyzon.	Development of taxonomic key.	LCFWMC, USFWS, GLFC, USGS, University of Guelph	
Invasive Species Control & Prevention	High	Manage potentialnon-target impacts of the Lake Champlain sea lamprey control program on silver lamprey.	Number of existing silver lamprey populations protected and sustained.	LCFWMC, USFWS, VDEC	
Habitat Restoration	High	Protect and restore in-stream and riparian habitats via water quality, flow, and temperature improvements; sediment reduction; streamside buffers; and maintenance of in-stream habitat structure (e.g., large woody debris).	Number of existing silver lamprey populations protected and sustained..	USFWS, VDEC, VFWD, NRCS	LCBP
Habitat Restoration	High	Maintain and restore aquatic organism passage at barriers (dams, culverts, etc.) to provide access to critical habitats.	Number of culverts and dams evaluated for passage. Number of barriers removed or mitigated.	VDEC, USFWS, VTrans, dam owners, town highway departments, town planning and conservation commissions	
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore silver lamprey critical habitats.		VDEC, RPCs, watershed associations, town planning and conservation commissions	
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, Echo Center, LCBP, watershed associations	

Common Name: **Silver Lamprey**
Scientific Name: **Ichthyomyzon unicuspis**
Species Group: **Fish**

Bibliography:

Langdon, R. W., M. T. Ferguson, and K. M. Cox. In press. Fishes of Vermont. Vermont Department of Fish and Wildlife, Waterbury.

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Scott, W. B., and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulleting 184, Ottawa.

Common Name: **American Brook Lamprey**
Scientific Name: **Lampetra appendix**
Species Group: **Fish**

Conservation Assessment:

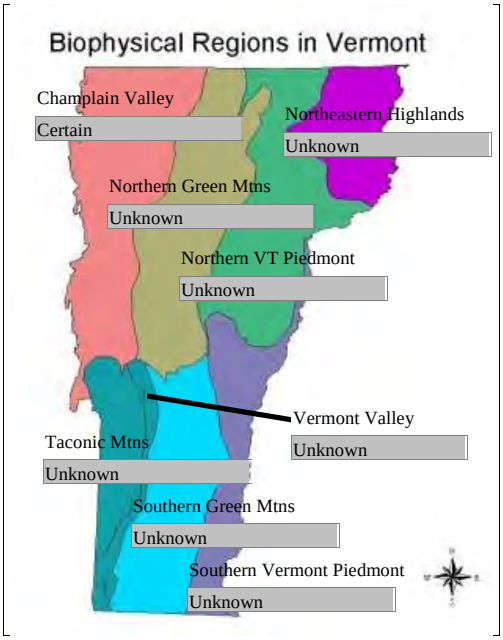
Final Assessment: High Priority

Global Rank: G4 **Global Trend:**
State Rank: S1 **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

In Vermont, the American brook lamprey is a state listed threatened species. Known populations in the state number four distributed among seven streams, all located within the Lake Champlain biophysical region (Missisquoi River, including Kelly, Hungerford and Youngman brooks; Trout Brook; and Winooski River, including Sunderland Brook). Some populations are limited by the use of lampricides to control sea lamprey in Lake Champlain and tributaries used for spawning. Other limiting factors to the species in Vermont are habitat fragmentation caused by the construction of fish passage barriers, such as road culverts, and the degradation of spawning habitat by sedimentation originating primarily from non-point land-based sources. American brook lamprey is a nonparasitic species.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

American brook lamprey is restricted to east-central North America: on the eastern seaboard from southeastern New Hampshire south to Maryland; and in the St. Lawrence River and tributaries from Montmagny southwest through the Great Lakes, west to southeastern Minnesota, south into the Mississippi River drainage to Tennessee and Missouri (Scarola 1973; Scott and Crossman 1973). In Vermont, it is known to occur in the Missisquoi River and tributaries, Hungerford and Kelly brooks; Winooski River. and its tributary, Sunderland Brook; Youngman Brook; and Trout Brook.

Known Watersheds

Lake Champlain Direct

Common Name: **American Brook Lamprey**
Scientific Name: **Lampetra appendix**
Species Group: **Fish**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☐ General Literature ☐

Clear, cool streams and small rivers characterized by a large proportion of groundwater inflow (Scott and Crossman 1973; Smith 1985; Langdon et al, in press; Morman 1979). The non-parasitic American brook lamprey spends its entire life in streams and infrequently migrates to lakes, except to reside on some Lake Champlain river deltas particularly in New York, i.e. Ausable and Salmon rivers (Langdon et al. in press). It has a 4 to 6 year life span and spends most of it buried in the substrate, where it grows to about 200mm, metamorphoses, and becomes sexually mature. Adults generally migrate upstream to spawn. American brook lamprey spawn the earliest and initiate spawning in the coolest water (~7ºC)(Hardisty and Potter 1971) compared to other species of lamprey in the Lake Champlain Basin. Larval habitat consists of lotic depositional, estuarine, and lentic areas of streams, with organic matter for feeding and fairly stable substrate in order to maintain burrow. Spawning occurs in riffle areas with sand and pea gravel up to approximately 20 mm diameter (Manion and Hanson 1980; W. Bouffard, USFWS, personal communication). Adults require certain physical factors for successful spawning such as suitable substrate (pea gravel), water velocities (0.3-0.5 m/s), and temperatures (mean 14ºC, range 6.7-20.6ºC) (Manion and Hanson 1980; Hardisty and Potter 1971; Morman 1979).

General Habitat Preferences:

Minimum Elevation (m):	29
Maximum Elevation (m):	45
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial

Aquatic: Large Lake Champlain Tribs Below Falls

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Habitat Fragmentation

Sedimentation

Description of habitat problem(s): Culverts at road crossings and dams may fragment habitat by creating barriers to upstream spawning migration of adult brook lamprey. Sedimentation of stream bottoms reduces the quality of spawning habitat.

Non-Habitat Problems:

Competition

Description of non-habitat problem(s): Competition for larval habitat with sea lamprey and silver lamprey

Common Name: **American Brook Lamprey**
Scientific Name: **Lampetra appendix**
Species Group: **Fish**

may reduce survival and/or fitness of American brook lamprey larvae (Scott and Crossman 1998). The Lake Champlain Fish and Wildlife Management Cooperative is currently involved in a sea lamprey control program that includes the use of lampricides to kill stream-resident larvae. These lampricides are toxic to all species of lamprey. In most streams where American brook lamprey and sea lamprey co-occur, traps are used to remove adult sea lamprey before they spawn, eliminating the need to use lampricides. The repeated use of lampricides has been shown to adversely affect populations of American brook lamprey in Lake Superior tributaries (Schuldt and Goold 1980).

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Low	
Research	Threats and Their Significance	High	
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	Population monitoring to determine current status and changes.
Monitoring	Habitat Change	High	Habitat assessment and monitoring to assess habitat change and identify limiting factors.
Monitoring	Monitor Threats	High	Monitor known limiting factors to populations and their habitats.

Common Name: **American Brook Lamprey**
Scientific Name: **Lampetra appendix**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Invasive Species Control & Prevention	High	Manage potential non-target impacts of the Lake Champlain sea lamprey control program on American brook lamprey.	Existing populations of American brook lamprey sustained.	LCFWMC, USFWS, VDEC	
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, Echo Center, LCBP, watershed associations	
Habitat Restoration	High	Protect and restore in-stream and riparian habitats via water quality, flow and temperature improvements; sediment reduction; streamside buffers; and maintenance of in-stream habitat structure (e.g., large woody debris).	Existing populations of American brook lamprey sustained.	VDEC, USFWS, NRCS, watershed associations	
Invasive Species Control & Prevention	Medium	Assess, monitor and manage as appropriate the problem of sea lamprey competition with American brook lamprey for spawning and juvenile habitats.	Number of American brook lamprey populations assessed and monitored for threats.	LCFWMC, USFWS, UVM	LCBP, GLFC
Habitat Restoration	High	Maintain and restore aquatic organism passage at barriers (e.g., dams, culverts, etc.) to provide American brook lamprey access to critical habitats.	Number of culverts and dams evaluated for passage. Number of barriers removed or mitigated.	VDEC, USFWS, VTrans, dam owners, town highway departments, town planning and conservation commissions	USFWS, LCBP
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore American brook lamprey critical habitats.	Number of known American brook lamprey populations protected.	VDEC, RPCs, watershed associations, town planning and conservation commissions	

Common Name: **American Brook Lamprey**
Scientific Name: **Lampetra appendix**
Species Group: **Fish**

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Vladykov, V.D. 1951. Fecundity of Quebec lampreys. Canadian Fish Culturist (10):1-14

Common Name: **Sea Lamprey (CT river only)**
Scientific Name: **Petromyzon marinus (CT river only)**
Species Group: **Fish**

Conservation Assessment:

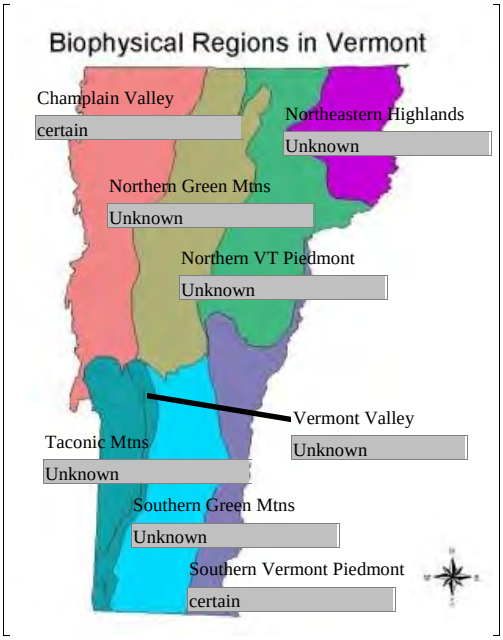
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S4S5 **State Trend:** Stable
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Sea lamprey of the Connecticut River basin were extirpated from Vermont about 200 years ago at about the same time anadromous Atlantic salmon and American shad were eliminated from the basin as a result of the construction of fish passage barriers and the degradation of spawning and nursery habitats. The retrofitting of dams on the river, including the Vernon dam in 1981, restored lamprey access to spawning waters. Currently, sea lamprey spawn in the Connecticut River main stem at least as far upstream as Wilder dam, as well as many of the tributaries along the way, such as the West, Williams, Black and White rivers. The most significant limiting factor to this species in the Connecticut River basin is fish passage obstruction. Continued operation and maintenance of existing fishways and the removal or mitigation of other barriers is necessary to assure this species security in Vermont. Another limiting factor to the species is sedimentation of its spawning habitats. At the present time the sea lamprey population in the Connecticut River basin appears to be path to recovery. Unlike the landlocked sea lamprey inhabiting Lake Champlain, the anadromous Connecticut River population does not feed in freshwater and, therefore, is not a threat to other Vermont fishes.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

Sea lamprey are common on both sides of the Atlantic Ocean; in the west, from southwestern Greenland and the Grand Banks, the Gulf of St. Lawrence, and as far up the St. Lawrence River and its tributaries as Sorel, Quebec, and south to northeastern Florida (Scott and Crossman 1973). Landlocked populations also exist, such as the one in Lake Champlain. Adult sea lamprey frequent the Connecticut River and many of its larger tributaries up to the first impassable barriers during the spawning season. Larval lamprey inhabit these waters wherever suitable habitat exist.

Known Watersheds

CT-Ashuelot River

CT-Bellows Falls Dam to Vernon Dam

CT-White River to Bellows Falls

Possible Watersheds

CT-Waits River to White River

Common Name: **Sea Lamprey (CT river only)**
Scientific Name: **Petromyzon marinus (CT river only)**
Species Group: **Fish**

White River

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☐ General Literature ☐

Anadromous populations of sea lamprey, as occurs in the Connecticut River basin, has a life cycle that depends on both marine and freshwater habitats. Adults migrate from the sea and ascend rivers and streams to spawn. Spawning occurs over substrate composed of a mixture of sand, gravel and rubble at water depth of 381-610 mm. Spawning activity starts when stream water temperature warms to 11.1-11.7 C and peaks at 14.4-15.6 C (Scott and Crossman 1973). Larvae take up residence by burrowing into rich organic stream bottoms and feed at the streambed surface by filtering out food organisms.

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Lake Champlain
Aquatic: Lower CT River

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Fragmentation

Sedimentation

Description of habitat problem(s): Excessive siltation degrades the quality of spawning habitat. Migration barriers (e.g., dams) fragment habitat and can prevent adults from gaining access to spawning areas.

Description of non-habitat problem(s):

Common Name: **Sea Lamprey (CT river only)**
Scientific Name: **Petromyzon marinus (CT river only)**
Species Group: **Fish**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Low	
Research	Threats and Their Significance	Low	
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	Medium	Monitoring adult sea lamprey runs at Connecticut River fishways is critical to detecting any changes in population status and trends.
Monitoring	Habitat Change	Low	
Monitoring	Monitor Threats	Medium	

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore sea lamprey critical habitats.		VDEC, CRJC, RPCs, watershed associations	
Habitat Restoration	High	Maintain and restore aquatic organism passage at barriers (e.g., dams , culverts) to provide access to critical habitats.	Number of culverts and dams evaluated for passage. Number of barriers removed or mitigated. Number of miles of restored habitat.	CRASC, USFWS, CRJC, VTrans, hydropower companies	ACE, VTrans, hydropower companies
Habitat Restoration	High	Protect and restore in-stream and riparian habitats via water quality, flow, and temperature improvements; sediment reduction; streamside buffers; and maintenance of in-stream habitat structure (e.g., large woody debris).	Increase suitable spawning and larval habitat for anadromous sea lamprey.	CRASC, USFWS, VDEC, NRCS, ACE, CRJC, watershed associations , town planning and conservation commissions	

Common Name: **Sea Lamprey (CT river only)**
Scientific Name: **Petromyzon marinus (CT river only)**
Species Group: **Fish**

Bibliography:

Scott, W. B., and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulleting 184, Ottawa.

Common Name: **Mottled Sculpin**
Scientific Name: **Cottus bairdi**
Species Group: **Fish**

Conservation Assessment:

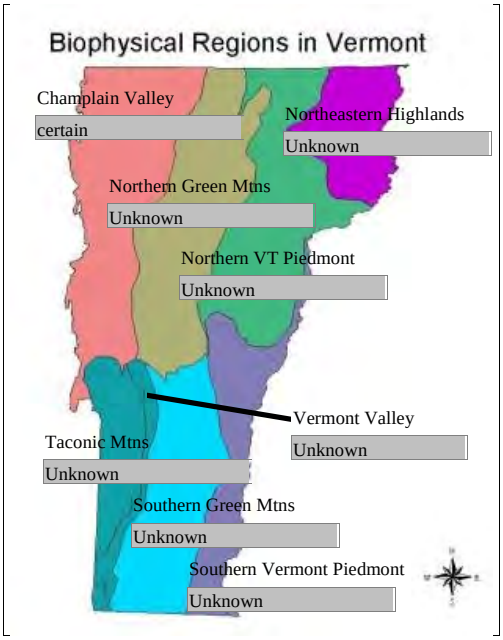
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S2 **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

In Vermont, the mottled sculpin has a very restricted distribution with only seven populations identified to date, all located in the northern Champlain Valley biophysical region. Even though the habitat of this species is generally described as cold or cool water, populations in Vermont are frequently found in warm water downstream of the principal fall line. This suggests Vermont populations may be at risk to habitat degradation, including warming temperature regimes, as well as increased sedimentation, pollutants and contaminants.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The mottled sculpin has a wide but discontinuous distribution in North America with the more eastern range encompassing northern Quebec and Labrador, and the drainages of the Great Lakes, Hudson and James bays. Western populations are largely limited to the Columbia River drainage (Scott and Crossman 1973). In Vermont, seven populations of mottled sculpin have been identified, all in tributaries to northern Lake Champlain (Allen Brook, Colchester; Bartlett Brook, South Burlington; Englesbee Brook, Burlington; Lamoille River, Milton; Mill River, Georgia; Stonebridge Brook, Milton; Trout Brook, Milton. It is also suspected to inhabit shoreline areas of Lake Champlain.

Known Watersheds

Lake Champlain Direct

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Mottled sculpin occur in cool streams, small rivers and in lakes. It prefers a bottom of gravel or rubble, rarely being found over sand. In streams it is a riffle dweller. In lakes it inhabits rocky shorelines. Although most reports label mottled sculpin as a cold or cool water species, Vermont specimens have been recorded in

Common Name: **Mottled Sculpin**
Scientific Name: **Cottus bairdi**
Species Group: **Fish**

warmer streams below the fall line (Langdon et al. In press). Mottled sculpin are found in areas with substrates composed of clean gravel and rubble/cobble. They are intolerant of habitat degradation (siltation and turbidity) and populations have been reduced in some parts of its range. Spawning takes place in cavities beneath rocks, ledges, or logs generally in May when water temperatures reaches 10 C (Smith 1985; Trautman 1981).

General Habitat Preferences:

Minimum Elevation (m):	29
Maximum Elevation (m):	45
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial

Aquatic: Large Lake Champlain Tribs Below Falls

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Sedimentation

Description of habitat problem(s): Mottled sculpin are intolerant of habitat degradation due to sedimentation, siltation and turbidity. This is believed to be one cause for the reduction or extirpation of populations in some parts of its range.

Non-Habitat Problems:

Unknown Non-Habitat Threatss

Description of non-habitat problem(s):

Common Name: **Mottled Sculpin**
Scientific Name: **Cottus bairdi**
Species Group: **Fish**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	Very little is known about the distribution and abundance
Research	Threats and Their Significance	Medium	Evaluate and monitor the impacts of sedimentation and strategies to reduce sedimentation
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	Monitoring population status needed.
Monitoring	Habitat Change	Medium	Monitor known habittat to ascertain current status and future changes.
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	Medium	Monitor the impacts of sedimentation

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, Echo Center, LCBP	
Habitat Restoration	High	Protect and restore stream and riparian habitats via water quality, flow and temperature improvements; sediment reduction; streamside buffers; and maintenance of habitat structure.		VDEC, USFWS, NRCS, RPCs, watershed associations, town conservation commissions	
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore mottled sculpin critical habitats	Number of identified mottled sculpin populations protected and/or restored.	VDEC, RPCs, watershed associations, town conservation commissions	

Common Name: **Mottled Sculpin**
Scientific Name: **Cottus bairdi**
Species Group: **Fish**

Bibliography:

Langdon, R. W., M. T. Ferguson, and K. M. Cox. Fishes of Vermont. Vermont Department of Fish and Wildlife, Waterbury.

Scott, W. B., and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184, Ottawa.

Smith, C. L. 1985. The inland fishes of New York State. New York State Department of Environmental Conservation, Albany.

Trautman, M. B. 1981. The fishes of Ohio with illustrated keys. Revised edition. Ohio State University Press, Columbus.

Common Name: **Lake Sturgeon**
Scientific Name: **Acipenser fulvescens**
Species Group: **Fish**

Conservation Assessment:

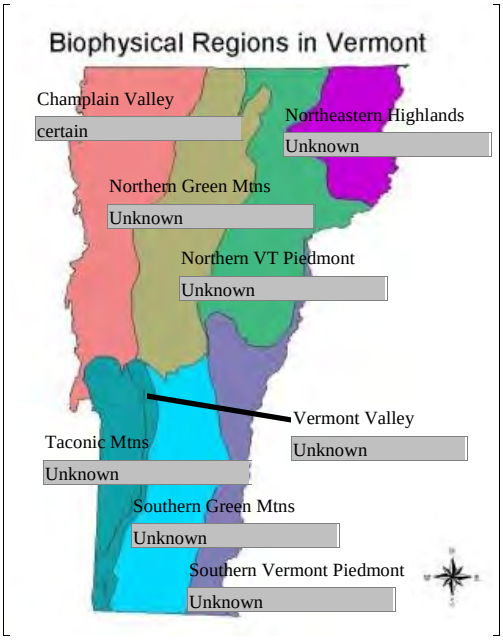
Final Assessment: High Priority

Global Rank: G3G4 **Global Trend:**
State Rank: S1 **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

In Vermont, the lake sturgeon is a state listed endangered species. The only population in the state occurs in Lake Champlain and in the low elevation reaches of the lake's largest tributaries (Missisquoi, Lamoille and Winooski rivers and Otter Creek). This population is at the eastern edge of its continental range. Lake sturgeon is limited by habitat loss and degradation as a result of construction of migration barriers eliminating access to historic spawning waters, sedimentation altering spawning habitat and egg survivial, and life history characteristics, such as age of maturation and spawning frequency, and low population size which presents the potential for inbreeding depression. Lake sturgeon were harvested commercially until 1967. Relatively little is known about the species in Vermont, such as abundance and age structure of the adult population, spawning, survivial from egg to adult life stages, and genetic characteristics of the population.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Lake sturgeon has a wide distribution occurring from the St. Lawrence River to Hudson Bay, west to the Saskatchewan River in Alberta, south through Lake Champlain, the Mississippi River to the Tennessee River in Alabama and in northern Mississippi; from lakes Winnipeg and Manitoba south through eastern North and South Dakota, northeaster Nebraska and Kansas to eastern Missouri and Arkansas (Scott and Crossman 1973). In Vermont, it inhabits only Lake Champlain and spawns in its larger tributaries (Missisquoi, Lamoille, Winooski rivers and Otter Creek). The Vermont population is on the eastern edge of the species North American range.

Known Watersheds

Lake Champlain Direct

Lamoille River

Mississquoi River

Common Name: **Lake Sturgeon**
Scientific Name: **Acipenser fulvescens**
Species Group: **Fish**

Otter Creek

Winooski River

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Lake sturgeon is a demersal species inhabiting lakes and large rivers, usually at 5-9 m depth, over mud, sand, and gravel (Page and Burr 1991). Sturgeon inhabiting Hudson bay and the Gulf of St Lawrence have occasionally been observed entering brackish water (Page and Burr 1991). Typical spawning sites are rocky and boulder filled areas at the outside bend of rivers.

General Habitat Preferences:

Minimum Elevation (m): 29
Maximum Elevation (m): 45
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lake Champlain

Aquatic: Large Lake Champlain Tribs Below Falls

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Habitat Fragmentation

Sedimentation

Description of habitat problem(s): Lake sturgeon eggs require clean river bottoms for survival and the species has declined in areas where siltation has been high. Dams fragment habitat and create barriers to upstream migrating fish during the spawning season.

Non-Habitat Problems:

Genetics

Harvest or Collection

Pollution

Reproductive Traits

Description of non-habitat problem(s): Lake sturgeon are long-lived. Maturity is attained at 14-20 years, and thereafter reproduction occurs approximately every four years. These life history characteristics make lake sturgeon extremely vulnerable to harvest and other disturbances. Lake sturgeon populations exhibit

Common Name: **Lake Sturgeon**
Scientific Name: **Acipenser fulvescens**
Species Group: **Fish**

long recovery times because of delayed maturation and the number of years between spawning events. Low population size could lead to inbreeding depression. Over-harvest by sport and commercial fishermen prior to closure of the Vermont fishery in 1967 may have contributed to the decline of the species in Lake Champlain.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	Little is known about the current distribution and abundance of lake sturgeon in Lake Champlain and spawning tributaries.
Research	Threats and Their Significance	High	
Research	Population Genetics	High	Data on the genetic characteristics of the Lake Champlain population is needed to determine whether inbreeding depression has occurred and how similar this population is to nearby populations in the St. Lawrence River and Great Lakes. Investigate the genetic profile of Lake Champlain sturgeon and Identify unique genetic markers for Lake Champlain population.
Research	Taxonomy	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	Medium	
Monitoring	Monitor Threats	High	

Common Name: **Lake Sturgeon**
Scientific Name: **Acipenser fulvescens**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, Echo Center, LCBP, watershed associations	
Invasive Species Control & Prevention	High	Manage potential non-target impact of the Lake Champlain sea lamprey control program on lake sturgeon.	Existing population of lake sturgeon is sustained and enhanced.	VDEC, LCFWMP, USFWS	
Compliance & Enforcement	High	Protect lake sturgeon from directed and incidental harvest by anglers through better public outreach and law enforcement.		USFWS	
Habitat Restoration	High	Maintain or restore aquatic organism passage at dams to provide lake sturgeon access to historic critical habitats.	Sturgeon passage through Swanton Dam on the Missisquoi River and Peterson Dam on the Lamoille River has been restored. Number of river-miles of habitat to which access has been restored.	VDEC, USFWS, VTrans, hydroelectric pwer companies,other dam owners	VTrans, dam owners
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore lake sturgeon critical habitats.		VDEC, RPCs, watershed associations, town planning and conservation commissions	
Habitat Restoration		Protect and restore lake and riverine habitats via water quality and temperature improvements; sediment reduction; and establishment of flow regimes supportive of the lake sturgeon habitat requirements.	Number of miles of sturgeon habitat that has been improved or restored (flows, substrate, etc.).	VDEC, USFWS, NRCS, LCFWMC, watershed associations	LCBP
Awareness Raising and Communications	High	Protect lake sturgeon from directed and incidental harvest by anglers through better public outreach		USFWS	

Common Name: **Lake Sturgeon**
Scientific Name: **Acipenser fulvescens**
Species Group: **Fish**

Bibliography:

Langdon, R. W., M. T. Ferguson, and K. M. Cox. In press. Fishes of Vermont. Vermont Department of Fish and Wildlife Waterbury.

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Page, L.M. and B.M. Burr, 1991. A field guide to freshwater fishes of North America north of Mexico.. Houghton Mifflin Company, Boston.

Scott, W. B., and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulleting 184, Ottawa.

Web sites:
http://www.dec.state.ny.us/website/dfwmr/wildlife/endspec/lakestur.html
http://www.fishbase.org
http://midwest.fws.gov/sturgeon/biology.htm
http://www.seagrant.wisc.edu/greatlakesfish/lakesturgeon.html

Common Name: **American Eel**
Scientific Name: **Anguilla rostrata**
Species Group: **Fish**

Conservation Assessment:

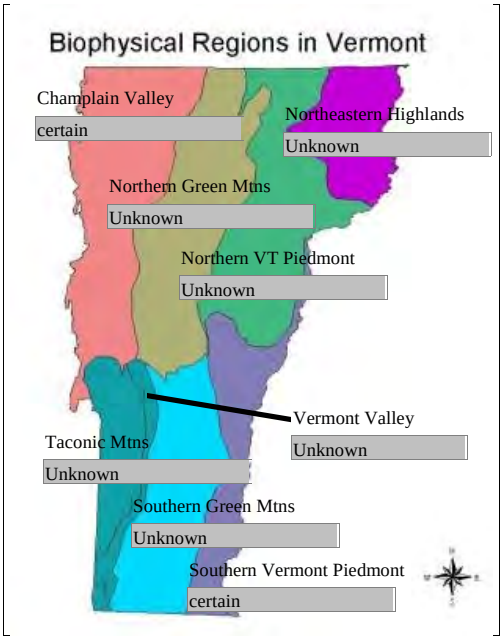
Final Assessment: High Priority

Global Rank: G5 **Global Trend:**
State Rank: S3 **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

American eel use to be an abundant species in both Connecticut and Lake Champlain drainages. As recently as the early 1980s, it was harvested commercially in Lake Champlain. For at least 150 years the Richelieu River, which flows out of Lake Champlain, supported a significant commercial eel fishery. Canadian fishery scientist estimated the average annual eel harvest between 1920 and 1980 was 35 metric tons; however, since 1981 landings have decreased from 72.9 tons to only 4.7 tons (Dumont et al. 2004). Today in Vermont, it is rarely encountered. The construction of large dams on rivers once ascended by eels have blocked juvenile fish access to critical rearing habitats. Dams used for hydropower generation have also been implicated in causing high levels of mortality as eels are subjected to turbine losses during their outmigration to sea. High commercial harvest of juvenile eels in coastal waters has further contributed to depressed U. S. stocks. Global limate change has also been identified as a potential limiting factor. The current status of American eel on a national level has given support to the species being recommended for federal endangered species designation. In 2000, the Atlantic States Marine Fisheries Commission adopted an "Interstate Fishery Management Plan for American eel."

Distribution:



Natural History Elements:

Home Range: N/A
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

The American eel occurs from Greenland throughout much of eastern Canada, south through most of eastern United States to the Gulf coast, along the eastern seaboard of Mexico to the Yucatan Peninsula, the West Indies and Bermuda to the Gulf of Mexico, Panama and the West Indies and Bermuda (Scott and Crossman 1973). Spawning grounds are in the Sargasso Sea. In Vermont, eel historically were found through much of Vermont (Lake Champlain and Connecticut River drainages).

Known Watersheds

CT-Ashuelot River

CT-Bellows Falls Dam to Vernon Dam

CT-Waits River to White River

Common Name: **American Eel**
Scientific Name: **Anguilla rostrata**
Species Group: **Fish**

Lake Champlain Direct

Lamoille River

Mississquoi River

Winooski River

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

American eel is a catadromous species and is reported to only spawn in the Sargasso Sea of the Atlantic Ocean. Larvae are carried by ocean currents to coastal areas where they transform into glass eels, then elvers and begin a long upstream migration to inland waters where they can live in excess of 20 years (as immature yellow eels) before returning to the sea to spawn (silver eels). The only life stages occurring in Vermont is the immature yellow phase and at the beginning of their downstream migrating the silver phase. Yellow-phase American eels have occurred in both the Connecticut River and Lake Champlain drainages of Vermont, where they can live in a wide variety of habitats including ponds, lakes, rivers and streams. They often occupy areas where they can find cover (rocks, snags, weeds) during daylight hours.

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	-1
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial

Aquatic: Lacustrine

Aquatic: Lake Champlain

Aquatic: Large Lake Champlain Tribs Below Falls

Aquatic: Lower CT River

Aquatic: Man-Made Water Bodies

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change

Habitat Fragmentation

Description of habitat problem(s): American eels migrate into Vermont from the Atlantic Ocean. Therefore, obstructions, such as dams, in the migration route can fragment habitat and limit access. Recent studies by Knights (2003) and Wirth and Bernatchez (2003) suggest that climate change may be affecting ocean temperatures and currents such that food and dispersal of eel larvae have been negatively impacted, thereby reducing survival and recruitment.

Non-Habitat Problems:

Harvest or Collection

Common Name: **American Eel**
Scientific Name: **Anguilla rostrata**
Species Group: **Fish**

Pollution

Description of non-habitat problem(s): For decades, eels from Lake Champlain have been harvested in Canada as they migrate out along the Richelieu and St. Lawrence rivers. This has also occurred elsewhere throughout the range of the species in North America. In addition, eels were harvested for commercial sale in Vermont waters of Lake Champlain by electrofishing for a few years in the 1980s. The commercial harvest of eels in Lake Champlain was made illegal in 2002. In-migrating glass eels and elvers have also been harvested in coastal areas and tributaries of North America for many years and shipped to Asia to supply aquacultural operations. Commercial exploitation has contributed to over-harvested eel stocks. Given the long length of time American eels can reside in freshwater and being piscivores pollution may contribute to bio-accumulation cf contaminants in their tissues. Being a catadromous species, American eel are subjected to a wide variety of problems associated with extensive migrations and residency in both marine and freshwater environments. During outmigration from freshwater rearing waters to saltwater silver eels can exposed to high mortality having to pass through turbines at hydroelectric power dams.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	Perform life history study of Lake Champlain eel population
Research	Distribution and Abundance	Medium	Contribution of eels in northern regions to overall stock is unknown.
Research	Threats and Their Significance	High	1) Pollution and contaminants:analyze tissue samples for contaminants. 2) Passage: determine passage efficiency of eelways on Richilieu R., assess impacts of turbine mortality on outmigrating eels, and investigate providing eelways at other critical dams within Vermont historic eel range 3) Support regional, national, and international efforts to understand recent declines in the global population of American eels, as well as anguillid eels elsewhere in the world.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	Monitor populations and maintain an eel database.
Monitoring	Habitat Change	Low	
Monitoring	Monitor Threats	High	

Common Name: **American Eel**
Scientific Name: **Anguilla rostrata**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration	High	Protect and restore lake and in-stream and riparian habitats via water quality, flow and temperature improvements; sediment reduction; streamside buffers; and maintenance of habitat structure.		USFWS, VDEC, NRCS, watershed associations	
Compatible Resource Use	High	Assess impacts of hydroelectric power generation (turbine mortality) on survival of outmigrating silver eels in the Lake Champlain and Connecticut River drainages; seek corrective measures to minimize losses.	Number of hydroelectric projects investigated or evaluated.	LCFWMC, CRASC, ASFMC, USFWS, VDEC, Canadian agencies, power companies	
Compatible Resource Use	High	Support efforts to reduce commercial fishing for American eels of all ages until stocks have met recovery objectives.		LCFWMC, CRASC, ASFMC, Canadian agencies	
Compatible Resource Use	High	Support efforts to enhance access of American eels to Vermont waters by eliminating or minimizing impacts of dams and other obstructions along the Richelieu, St. Lawrence, and Connecticut Rivers.	Number of dams where American eel passage has been restored. Number of river-miles of habitat to which access has been restored.	LCFWMC, CRASC, ASFMC, CRJC, ACE, Canadian agencies, VTrans, town highway departments, dam owners	
Habitat Restoration	Medium	Support efforts, such as the Climate Change Action Plan developed by the Conference of New England Governors, and local and regional initiatives, such as the Alliance for Climate Action, to reduce greenhouse gas emissions in the Northeast.		Northeastern states and Canadian provinces, EPA, USFWS, VDEC	
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore American eel critical habitats.		VDEC, RPCs, watershed associations, town planning and conservation commissions	

Common Name: **American Eel**
Scientific Name: **Anguilla rostrata**
Species Group: **Fish**

Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.	VDEC, USFWS, LCFWMC, CRASC, TNC, watershed associations

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Common Name: **American Shad**
Scientific Name: **Alosa sapidissima**
Species Group: **Fish**

Conservation Assessment:

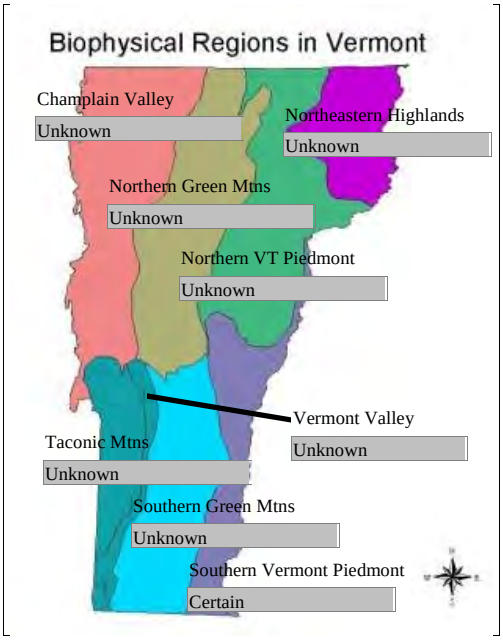
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S4 **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

American shad in the Connecticut River basin appears to be reasonably secure as long as access to spawning and nursery habitats is not obstructed by construction of new dams and fish passage facilities (e.g., fish ladders) at existing dams continue to be operated and maintained during critical times of the year. Other limiting factors to the species, such as harvest and predation, are factors that are exerting pressure on the population largely outside the upper Connecticut River basin. Size of annual adult spawning runs into the shared Vermont-New Hampshire section of the Connecticut River have declined since peak years of the early 1990s. This appears to be largely attributed to the inefficiency of fishways at dams on the river at Turners Falls, Massachusetts. Mortality of outmigrating adult and juvenile shad exposed to turbine passage at hydroelectric power dams continues to be a concern of fishery agencies.

Distribution:



Natural History Elements:

Home Range:
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

American shad inhabit waters along the Atlantic Coast from Newfoundland south to Florida; it has also been introduced to the Pacific Coast of North America (Scott and Crossman 1973). In Vermont, it is restricted to the Connecticut River from the Massachusetts line upstream to at least Bellows Falls dam. Low numbers in some years are passed above Bellows Falls via the fish ladder there. Shad have also been observed in the lower West River.

Known Watersheds

CT-Ashuelot River

CT-Bellows Falls Dam to Vernon Dam

CT-White River to Bellows Falls

Common Name: **American Shad**
Scientific Name: **Alosa sapidissima**
Species Group: **Fish**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☑ General Literature ☑

As an anadromous fish, the American shad divides its life between marine and freshwater environments. Adults ascend rivers and streams to spawn. Once the eggs hatch, larval and juvenile shad inhabit riverine habitats, including setbacks, through their first summer of life before outmigrating to the ocean in the fall. Maturity is attained at sea. Stier and Crance (1985) review the habitat requirements of American shad. Adults utilize well oxygenated (>=5 ppm), flowing water, although they do not appear to have specific preferences for spawning locations other than broad flats and shallow water. Spawning may occur over a variety of substrate types providing water velocity is sufficient enough to keep sedimentation minimal. Spawning generally occurs at water temperatures of 8-26 C with peak activity occurring within the range of 14-21 C. Temperatures for maximum egg hatch and survival is 15.5-26 C. Temperatures at or near 11 C are minimal for egg incubation, and temperatures in excess of 80.1 F are unsuitable. Juvenile shad are found at water temperatures of 10-31 C. Temperatures less than 10 C cannot be tolerated. Juvenile outmigration begins when the water temperature go below 15.5 C.

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lower CT River

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Fragmentation

Description of habitat problem(s): Spawning success and survival of adults and juveniles are limited by the existence and development of dams and power generation plants which may impede access to spawning and nursery habitats, as well as impose artificial flow regimes associated which in turn alter and degrade habitat for shad. Fishway design deficiencies at ladders on the Connecticut River at Turners Falls, Massachusetts are being examined as likely causes for the significant reduction in shad run abundance into Vermont and New Hampshire. This exacerbates the habitat fragmentation problem.

Non-Habitat Problems:

Harvest or Collection

Predation or Herbivory

Description of non-habitat problem(s): Migrating adult and juvenile shad are susceptable to predation,

Common Name: **American Shad**
Scientific Name: **Alosa sapidissima**
Species Group: **Fish**

especially fish predators. Improvements in stock strength of striped bass and bluefish are believed to have increased predatory pressure on migrating clupeid populations, including shad. Being an anadromous species, shad are subjected to a wide variety of problems associated with extensive migrations and residency in both marine and freshwater environments. Execessive commercial harvest off the Atlantic seaboard and within the estuaries represents a problem for shad stocks. Outmigrating adult and juvenile shad may be exposed to turbine mortality at power dams resulting in high mortlaity.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Low	
Research	Threats and Their Significance	High	Data are needed to design fish ladders for improved fish passage performance.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	Low	
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	High	

Common Name: **American Shad**
Scientific Name: **Alosa sapidissima**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		CRASC, USFWS, CRJC, TNC, watershed associations	
Compatible Resource Use	Medium	Assist other fishery agencies through the CRASC to manage commercial and sport harvest compatible with shad restoration goals.	Meet goals and objectives of Connecticut River Basin Management Plan for American Shad.	CRASC, USFWS, NMFS, ASFMC	
Natural Processes Restoration	High	Improve flow regimes below hydroelectric generation facilities (e.g., minimum flows).	Number of projects that operate with acceptable flow regimes.	CRASC, USFWS, VDEC, CRJC, ACE, power companies	ACE, power companies
Species Restoration	High	Support and cooperate with the inter-agency program for the restoration of anadromous fishes to the Connecticut River basin (e.g., CRASC).	Update and implement Connecticut River Basin Management Plan for American Shad. Percent of tasks implemented as prescribed in the plan.	CRASC, USFWS, USFS, NMFS, NHFGD, MaDFW, MaDMF, CtDEP	
Compatible Resource Use	High	Restore passage at dams to allow upstream migrants access to spawning and juvenile habitats and expedite outmigrants (post-spawned adults, juveniles) to sea. Operate and maintain existing fishways for peak passage performance.	Number of dams with identified fish passage problems. Number of dams where fish passage has been restored either by removal or mitigation (e.g., retrofitting with fishways).	CRASC, USFWS, USFS, CRJC, ACE, power companies, other dam owners	Dam owners

Bibliography:

Page, L. M., and B. M. Burr. 1991. A field guide to freshwater fishes of North America north of Mexico. Houghton Mifflin Company, Boston.

Scott, W. B., and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184, Ottawa.

Stier, D. J., and J. H. Crance. 1985. Habitat suitability index models and instream flow suitability curves: American shad. U. S. Fish and Wildlife Service Biological Report 82(10.88).

Common Name: **Mooneye**
Scientific Name: **Hiodon tergisus**
Species Group: **Fish**

Conservation Assessment:

Final Assessment: Medium Priority

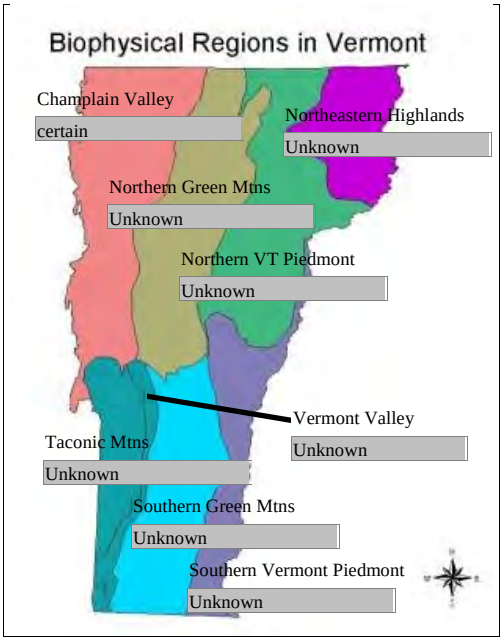
Global Rank: G5
State Rank: SU
Extirpated in VT? No

Global Trend:
State Trend: Unknown
Regionally Rare? Yes

Assessment Narrative:

Lake Champlain suports the only population of mooneye in Vermont. This population is on the eastern edge of of its continental range. Historic references to the species suggest this fish has never been abundant or common in the lake. Information on the biology and population status of mooneye in Lake Champlain is still generally lacking. It is reported to be sensitive to turbidity and sedimentation.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Mooneye is a North American species with a range extending from James Bay, Ottawa River to the Lake Champlain and St Lawrence watershed, southwest of the Appalachian Mountains through western New York and Pennsylvania to Arkansas and Oklahoma, north through eastern Kansas to North Dakota, southeastern Saskatchewan and southern Manitoba (Scott and Crossman 1973). In Vermont, it is a peripheral species at the eastern most extent of its range and has been recorded only from Lake Champlain, including the southern part of the lake, and near the mouths of the Missisquoi and Lamoille rivers and Otter Creek.

Known Watersheds

Lake Champlain Direct

Lamoille River

Mississquoi River

Otter Creek

Possible Watersheds

Winooski River

Common Name: **Mooneye**
Scientific Name: **Hiodon tergisus**
Species Group: **Fish**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Mooneye are found in shallow areas of large lakes and deep pools of clear rivers where the bottom is relatively free of silt (Langdon et al. In press). Although it is generally found in non-flowing waters, it may also occur in swift waters, such as below dams (Trautman 1957). Mooneye has rarely been taken with collection gear at depths greater than 10.7 m (Scott and Crossman 1973). The mooneye is a warm water species, preferring water temperatures in the range of 27.5-29.0 C, and migrate up rivers to spawn when the water temperatures reach 19.4 C (Langdon et al. In press).

General Habitat Preferences:

Minimum Elevation (m): 29
Maximum Elevation (m): 45
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lake Champlain

Aquatic: Large Lake Champlain Tribs Below Falls

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Fragmentation

Sedimentation

Description of habitat problem(s): Mooneye is not tolerant of silted habitats or turbidity (Scott and Crossman 1973).

Non-Habitat Problems:

Unknown Non-Habitat Threatss

Description of non-habitat problem(s):

Common Name: **Mooneye**
Scientific Name: **Hiodon tergisus**
Species Group: **Fish**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Assess habitat requirements and use by mooneye in Lake Champlain.
Research	Basic Life History	Medium	
Research	Distribution and Abundance	High	Very little is known about the distribution and abundance of mooneye in lake Champlain.
Research	Threats and Their Significance	Medium	
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	Monitoring population status needed.
Monitoring	Habitat Change	Low	
Monitoring	Monitor Threats	Medium	

Common Name: **Mooneye**
Scientific Name: **Hiodon tergisus**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, Echo Center, LCBP	
Habitat Restoration	Low	Maintain and restore aquatic organism passage at barriers to provide access to critical habitats.	Number of dams evaluated for passage. Number of barriers removed or mitigated.	LCFWMC, USFWS, VDEC, VTrans, town highway departments, hydroelectric power companies, other dam owners	Hydroelectric power companies, other dam owners
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore northern brook lamprey critical habitats.		VDEC, RPCs, watershed associations, town planning and conservation commissions	
Habitat Restoration	High	Protect and restore lake and in-stream riparian habitats via water quality, flow and water level, and temperature improvements; sediment reduction; streamside buffers; and maintenance of habitat structure.		LCFWMP, USFWS, VFWD, VDEC, lake and watershed associations, town planning and conservation commissions	

Bibliography:

Langdon, R. W, M. T. Ferguson, and K. M. Cox. In press. Fishes of Vermont. Vermont Department of Fish and Wildlife, Waterbury.

Scott, W. B., and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184, Ottawa.

Trautman, M. B. 1957. The fishes of Ohio. The Ohio University Press, Columbus.

Common Name: **Cisco or Lake Herring**
Scientific Name: **Coregonus artedi**
Species Group: **Fish**

Conservation Assessment:

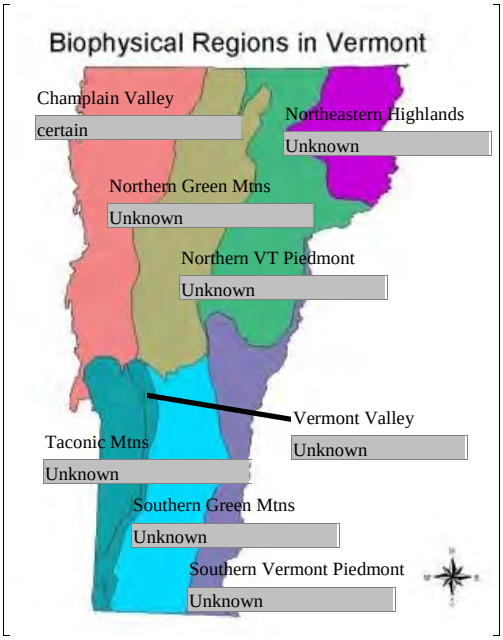
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S4 **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

In Vermont, cisco is limited to the deep, cold (oligotrophic) waters of Lake Champlain. It does not appear to be a particularly abundant species in the lake. Relatively little is known about the status of cisco in Lake Champlain, including its abundance and distribution. limiting factors to the species may be degradation of its habitat, such as alteration of the lake's thermal structure; potential competition with exotics (e.g., alewife) and parasitism by sea lamprey.

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

This species is the most widely distributed of the 14 species of the genus Coregonus occurring in North America. It is found from eastern Quebec to the Hudson Bay, through the Great Lakes system, Ontario, Manitoba, Saskatchewan and Alberta, north into the Northwest Territories, and in the Mackenzie River system north to Great Bear Lake (Scott and Crossman 1973). In Vermont, where it occurs on the eastern edge of its range, cisco are restricted to Lake Champlain.

Known Watersheds

Lake Champlain Direct

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

In Vermont, cisco inhabit the cold, deep areas of Lake Champlain. This is a schooling, open-water species inhabiting cool mid-lake areas during the summer, shifting to shallower waters inshore from fall to spring. It cannot tolerate water temperatures of over 26.1 C. Cisco spawn in late fall, just prior to ice formation, at depths of about .9-3 m, over gravel to rubble bottom (Langdon et al. In press).

Common Name: **Cisco or Lake Herring**
Scientific Name: **Coregonus artedi**
Species Group: **Fish**

General Habitat Preferences:

Minimum Elevation (m):	29
Maximum Elevation (m):	29
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lake Champlain

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change

Invasion by Exotic Species

Description of habitat problem(s): The appearance of alewife in Lake Champlain is of great concern due to their potential impact through competition with other pelagic planktivores, such as cisco. The species also require deep, cold water. If climate change has a significant impact on the thermal structure of Lake Champlain, this could affect the cisco population.

Non-Habitat Problems:

Competition

Loss of Prey Base

Parasites

Description of non-habitat problem(s): Sea lamprey have negatively impacted cisco in other bodies of water (Smith 1985, Bronte et al. 2003). As soft-scaled members of the salmon family, cisco are susceptible to parasitism/predation by sea lamprey. Lamprey predation was identified as a contributing factor to the decline of cisco in Lake Superior (Bronte et al. 2003), and 80% of cisco in Oneida Lake, NY that died off during high summer temperatures had lamprey scars (Smith 1985). So far there are no direct reports of lamprey impacts on cisco in Lake Champlain. Cisco are primarily pelagic (open-water) feeders on zooplankton, and therefore might compete with other species with similar feeding habits, such as smelt. The appearance of alewife in Lake Champlain could pose a problem to both of these native open-water planktivores.

Common Name: **Cisco or Lake Herring**
Scientific Name: **Coregonus artedi**
Species Group: **Fish**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	
Research	Basic Life History	Medium	
Research	Distribution and Abundance	High	Develop population indices through forage base monitoring in Lake Champlain.
Research	Threats and Their Significance	Medium	
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	Low	
Monitoring	Monitor Threats	Low	

Common Name: **Cisco or Lake Herring**
Scientific Name: **Coregonus artedi**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration	Medium	Support efforts, such as the Climate Change Action Plan developed by the Conference of New England Governors, and local and regional initiatives, such as the Alliance for Climate Action, to reduce greenhouse gas emissions in the Northeast.		Northeastern states and Canadian provinces, EPA, USFWS, VDEC	
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore cisco critical habitats.		VDEC, RPCs, watershed associations, town planning and conservation commissions	
Invasive Species Control & Prevention	High	Implement measures to prevent the introduction, or reduction in the abundance of exotic species (e.g., alewife) which could limit cisco in Lake Champlain through competition for food.	Development and implementation of a Lake Champlain management plan for the control of invasive aquatic organisms.	VDEC, LCFWMC, USFWS, NYDEC, Canadian agencies, LCBP, lake and watershed associations	LCBP
Habitat Restoration	High	Protect and restore lake and riparian habitats via water quality and temperature improvements, water level stabilization, sediment reduction, streamside buffers, and maintenance of lake habitat structure.		VDEC, USFWS, NRCS, watershed associations, town planning and conservation commissions	
Awareness Raising and Communications	Medium	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, Echo Center, LCBP	

Common Name: **Cisco or Lake Herring**
Scientific Name: **Coregonus artedi**
Species Group: **Fish**

Bibliography:

Bronte, C. R., M. P. Ebener, D. R. Schreiner, D. S. Vault, M. M. Petzoid, D. A. Jensen, C. Richards, and S. J. Lozano. 2003. Fish community change in lake Superior, 1970-2000. Canadian Journal of Fisheries and Aquatic Sciences 60:1552-1574.

Langdon, R. W., M. T. Ferguson, and K. M. Cox. In press. Fishes of Vermont. Vermont Department of Fish and Wildlife.

Scott, W. B., and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184, Ottawa.

Smith, C. L. 1985. The inland fishes of New York State. New York Department of Environmental Conservation, Albany.

Common Name: **Lake Whitefish**
Scientific Name: **Coregonus clupeaformis**
Species Group: **Fish**

Conservation Assessment:

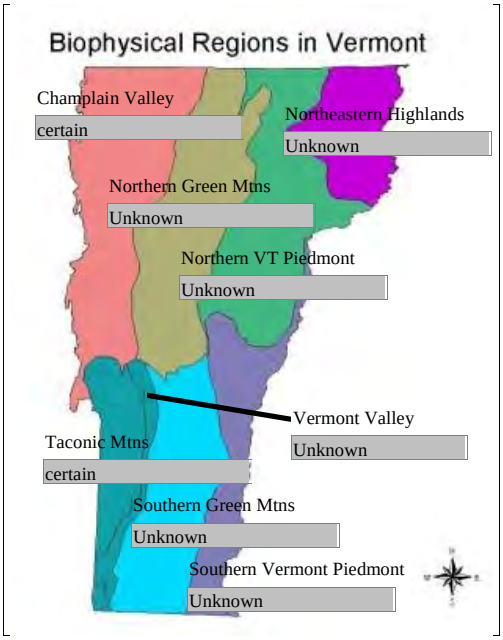
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S4? **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

In Vermont, lake whitefish are limited to the deep, cold (oligotrophic) waters of Lake Champlain. It does not appear to be a particularly abundant species in the lake. Relatively little is known about the status of lake whitefish in Lake Champlain, including its abundance and distribution. Limiting factors to the species are degradation of its habitat, such as alteration of the lake's thermal structure; potential competition with exotics (e.g., alewife) and parasitism by sea lamprey.

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Lake whitefish is a widely distributed North American species. Its range includes virtually all of Canada and Alaska, the Great Lakes, the St. Lawrence River including northern New York, Vermont, New Hampshire and Maine (Scott and Crossman 1973). In Vermont, it is confined to Lake Champlain. However, in 1878 lake whitefish were introduced into five other Vermont lakes, such as Lake Dunmore in Addison County and Lake St. Catherine in Rutland County, but none of these introductions were successful (Langdon et al. In press).

Known Watersheds

Lake Champlain Direct

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Lake whitefish inhabit cold lakes which are deep and clear. Lake whitefish spawn during November and December at water temperatures below 7.8 C; spawning occurs near the surface in water less than 7.6 m deep, and the adhesive eggs sink to the bottom onto a usually gravel or rubble and occasionally sand substrate (Langdon et al. In press).

Common Name: **Lake Whitefish**
Scientific Name: **Coregonus clupeaformis**
Species Group: **Fish**

General Habitat Preferences:

Minimum Elevation (m):	29
Maximum Elevation (m):	45
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lake Champlain

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change

Description of habitat problem(s): Lake whitefish also require deep, cold water. If climate change has a significant impact on the thermal structure of Lake Champlain, this could affect the population of lake whitefish.

Non-Habitat Problems:

Competition

Parasites

Description of non-habitat problem(s): The appearance of alewife in Lake Champlain is of great concern due to their potential impact through competition with other pelagic planktivores, such as lake whitefish. Sea lamprey have negatively impacted lake whitefish in Lake Superior (Bronte et al. 2003). As soft-scaled members of the salmon family, lake whitefish are susceptible to parasitism/predation by sea lamprey. Lamprey predation was identified as a contributing factor to the decline of lake whitefish in Lake Superior (Bronte et al. 2003), and whitefish populations rebounded after implementation of lamprey control.

Common Name: **Lake Whitefish**
Scientific Name: **Coregonus clupeaformis**
Species Group: **Fish**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	
Research	Basic Life History	Medium	
Research	Distribution and Abundance	High	Develop population indices through forage base monitoring in Lake Champlain.
Research	Threats and Their Significance	Medium	
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	Low	
Monitoring	Monitor Threats	Low	

Common Name: **Lake Whitefish**
Scientific Name: **Coregonus clupeaformis**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	Medium	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, Echo Center, LCBP	
Habitat Restoration	High	Protect and restore lake and riparian habitats via water quality and temperature improvements, water level stabilization, sediment reduction, streamside buffers, and maintenance of lake habitat structure.		VDEC, USFWS, NRCS, watershed associations, town planning and conservation commissions	
Habitat Restoration	Medium	Support efforts, such as the Climate Change Action Plan developed by the Conference of New England Governors, and local and regional initiatives, such as the Alliance for Climate Action, to reduce greenhouse gas emissions in the Northeast.		Northeastern states and Canadian provinces, EPA, USFWS, VDEC	
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore lake whitefish critical habitats.		VDEC, RPCs, lake and watershed associations, town planning and conservation commissions	
Invasive Species Control & Prevention	High	Implement measures to prevent the introduction or control the abundance of exotic species (e.g., alewife) which could limit lake whitefish population in Lake Champlain through competition.	Development and implementation of a Lake Champlain management plan for the control of invasive aquatic organisms.	LCFWMC, USFWS, VFWD, VDEC, Canadian agencies, lake and watershed associations	LCBP

Common Name: **Lake Whitefish**
Scientific Name: **Coregonus clupeaformis**
Species Group: **Fish**

Bibliography:

Bronte, C. R., M. P. Ebener, D. R. Schreiner, D. S. Vault, M. M. Petzoid, D. A. Jensen, C. Richards, and S. J. Lozano. 2003. Fish community change in lake Superior, 1970-2000. Canadian Journal of Fisheries and Aquatic Sciences 60:1552-1574.

Langdon, R. W., M. T. Ferguson, and K. M. Cox. In press. Fishes of Vermont. Vermont Department of Fish and Wildlife.

Scott, W. B., and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184, Ottawa.

Smith, C. L. 1985. The inland fishes of New York State. New York Department of Environmental Conservation, Albany.

Common Name: **Round Whitefish**
Scientific Name: **Prosopium cylindraceum**
Species Group: **Fish**

Conservation Assessment:

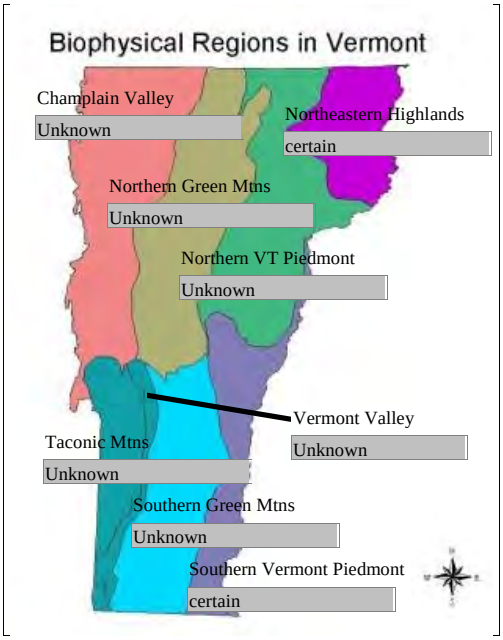
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S1 **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Unknown

Assessment Narrative:

Very little is known about its status in Vermont waters. Populations have been reported in lakes Seymour, Willoughby and Beaver Pond in Holland, and possibly Holland Pond. The New York State Department of Environmental Conservation plans to conduct research to verify and/or establish secure, abundant and self-sustaining populations of round whitefish in at least five Adirondack lakes. If necessary, remnant stocks of round whitefish will be enhanced through artificial propagation.

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

In Vermont, round whitefish is found in lakes Seymour, Willoughby and in Beaver Pond in Holland. A historic record of "lake whitefish" in Holland Pond (located near Beaver Pond in Holland) is believed actually to have been a round whitefish.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

The round whitefish is an inhabitant of cold, clear lakes and rivers. In rivers it occurs over rocky bottoms. In the Great Lakes it is commonly found inshore at depths of less than 36.6 m. It sometimes occurs in brackish waters. The round whitefish is a benthic insectivore, feeding on benthic invertebrates and occasionally fishes and fish eggs. Round whitefish require gravel for spawning. Since eggs incubate overwinter with no parental care, a silt-free spawning substrate probably is essential for successful recruitment as for other salmonids.

Common Name: **Round Whitefish**
Scientific Name: **Prosopium cylindraceum**
Species Group: **Fish**

General Habitat Preferences:

Minimum Elevation (m):	357
Maximum Elevation (m):	468
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lacustrine

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change

Habitat Alteration

Invasion by Exotic Species

Sedimentation

Description of habitat problem(s): This species was once common to many of New York's Adirondack lakes. Recent surveys have shown its distribution there significantly reduced. The New York DEC has speculated on the possible causes: "predation by invading yellow perch on whitefish eggs and fry; predation by smallmouth bass; competition with lake whitefish; over fishing; loss of spawning sites; siltation; and lake acidification". Given the current and past locations in Vermont, only the following causes are possible for Vermont lakes: predation by yellow perch on whitefish eggs and fry (in lakes Seymour and Willoughby); predation by smallmouth bass (Lake Seymour only); loss of spawning sites and siltation (lakes Seymour and Willoughby). Beaver Pond is a small remote pond with no human structures along the shore and only seasonal human use within the watershed. With a low alkalinity (about 4mg/l) lake acidification, however, exists as a potential problem to that population. pH values for beaver Pond have been observed to drop well below 6.0 during spring runoff. Since this species is a benthic insectivore it relies entirely on invertebrates on the bottom as a food source. Loss or reduction of this food through sedimentation would limit its existence. Sedimentation may also limit egg survival by reducing oxygen exchange with surrounding water. Eggs incubate for months unguarded and unmaintained making a low sedimentation rate necessary for egg survival. Loss of spawning sites through siltation is also a threat. Climate change could result in the warming of the coldwater thermal regime that round whitefish require.

Non-Habitat Problems:

Competition

Loss of Prey Base

Pollution

Predation or Herbivory

Description of non-habitat problem(s): Beaver Pond is a small remote pond with no human structures along the shore and only seasonal human use within the watershed. With a low alkalinity (about 4mg/l) lake

Common Name: **Round Whitefish**
Scientific Name: **Prosopium cylindraceum**
Species Group: **Fish**

acidification is a potential threat to that population. Acidification would first impact newly hatched eggs, since this stage is normally the most vulnerable to acidity. Multiple year class failures would result in reductions or possible extermination of the species. Predation on whitefish eggs and fry by yellow perch in lakes Seymour and Willoughby and by smallmouth bass in Lake Seymour is a threat to these populations. Lake whitefish may be a competitor with round whitefish.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	1) Assess current distribution and population status of round whitefish in waters where they are known to occur with particular attention to Holland and Beaver ponds. 2) Determine how much usable habitat is available in Holland and Beaver ponds.
Research	Threats and Their Significance	High	Identify potential limiting factors.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	Low	
Monitoring	Monitor Threats	High	

Common Name: **Round Whitefish**
Scientific Name: **Prosopium cylindraceum**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	Medium	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, lake and watershed associations	
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore round whitefish critical habitats.		VDEC, RPCs, lake and watershed assocaitions, town planning and conservation commissions	
Invasive Species Control & Prevention	High	Prevent the invasion of exotic species (e.g., yellow perch and bass) to Beaver Pond in Holland and monitor this waterbody for changes in the fish community.	Developed and implement a management plan for the monitoring and control of invasive aquatic organisms.	VDEC, lake and watershed associations, angling organizations	
Habitat Restoration	Medium	Support efforts, such as the Climate Change Action Plan developed by the Conference of New England Governors, and local and regional initiatives, such as the Alliance for Climate Action, to reduce greenhouse gas emissions in the Northeast.		Northeastern states and Canadian provinces, EPA, USFWS, VDEC	
Habitat Restoration	High	Protect and restore lake and riparian habitats via water quality and temperature improvements, water level stabilization, sediment reduction, streamside buffers, and maintenance of lake habitat structure.		VDEC, USFWS, NRCS, RPCs, lake and watershed associations, town planning and conservation commissions	

Common Name: **Round Whitefish**
Scientific Name: **Prosopium cylindraceum**
Species Group: **Fish**

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Scott, W. B. and E. J. Crossman. 1973. Freshwater Fishes of Canada. Bulletin 184, Fisheries Research Board of Canada, Ottawa.

Smith, C. L. 1985. The inland fishes of New York State. New York State Department of Environmental Conservation, Albany.

New York State Department of Environmental Conservation Website http://www.dec.state.ny.us/website/site/subject.html

Common Name: **Atlantic Salmon (anadromous)**
Scientific Name: **Salmo salar (anadromous)**
Species Group: **Fish**

Conservation Assessment:

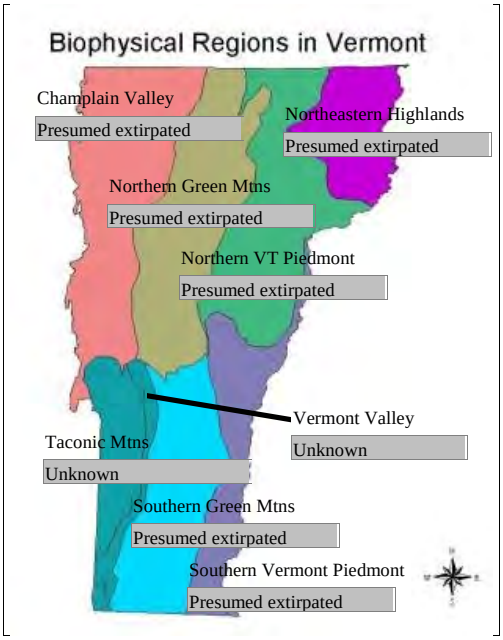
Final Assessment: High Priority

Global Rank: G5 **Global Trend:**
State Rank: S4 **State Trend:** Unknown
Extirpated in VT? Yes **Regionally Rare?** Yes

Assessment Narrative:

Self-sustaining populations of anadromous Atlantic salmon no longer exist in Vermont. The Connecticut River population is at this time wholly dependent on stocking cultured fry and smolts as part of the Connecticut River Basin Atlantic Salmon Restoration Plan developed by the Connecticut River Atlantic Salmon Commission. The species has also been considered for restoration to the Lake Champlain watershed (see bibliography); however, there is no consensus at this time of the historic presence of anadromous salmon in that basin. Current restoration efforts in Lake Champlain are directed at the landlocked form, although restoration of an anadromous population could be under future consideration.

Distribution:



Natural History Elements:

Home Range:
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

Anadromous Atlantic salmon historically were native to the Connecticut River Basin. In Vermont they ranged from the Massachusetts state line upstream to the Canadian border near Beechers Falls. Whether or not sea-run salmon were native to Lake Champlain is being debated and at this time cannot be substantiated. Further investigation is warranted. Juvenile salmon resulting from extensive stocking inhabit most of the larger watersheds of the Connecticut River Basin; occasionally adult salmon are also found in some of these waters. The stocking effort is part of a multi-state program with the goal to restore anadromous salmon to the basin.

Known Watersheds

CT-Ashuelot River
CT-Bellows Falls Dam to Vernon Dam
CT-Waits River to White River
CT-White River to Bellows Falls
Deerfield. MA-VT

Possible Watersheds

Lake Champlain Direct
Lamoille River
Mississquoi River
Winooski River

Common Name: **Atlantic Salmon (anadromous)**
Scientific Name: **Salmo salar (anadromous)**
Species Group: **Fish**

Passumpsic Vermont

Upper Connecticut

White River

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☑ General Literature ☑

The complex life cycle of the salmon requires spawning and rearing habitat in freshwater streams, migratory habitat in large rivers, coastal estuary environments where salmon smolts adapt from freshwater to saltwater life, and finally North Atlantic ocean environments where salmon spend most of their adult life. For spawning, salmon require streams with sufficient stretches of coarse, clean gravel for building nests and laying eggs. Gravel stretches are often 2-3 meters long and more than one meter wide. Water in spawning areas is swift with depths of 30-60 cm. Streams must have adequate cover, and food supply to sustain young salmon through the first two, sometimes three, years of life. Juvenile salmon utilize a variety of stream habitats depending on life stage and season. They feed on both aquatic and terrestrial invertebrates while using gravel, cobbles and boulders for protective cover. Adult salmon require pools as holding and resting habitat during migration prior to spawning. Salmon spawn in clean gravel areas of rivers or streams that provide a hydraulic head of water through the nest or redd. The optimum location is at the tail of a pool and the head of a riffle or upstream edge of a gravel bar where the water velocity is increasing (Peterson 1978). Redds average 25-50 cm deep and are quite large, about 4.0 m2 in size.

Upon emergence in May or June, salmon fry disperse and establish territories along stream margins and shallow riffles of gravel and cobble (Morantz 1987). Small parr, 4 to 7 cm in length, prefer riffle habitat with a gravel and cobble substrate. Studies by Rimmer et al (1983) indicated the use of pools by salmon parr increased with age and size. Large parr, exceeding 7 cm in length, prefer deeper riffle and run habitat with a cobble-boulder substrate in which particle size exceeds 6.4 cm (Bley 1987). As parr grow, their territories increase in area, forcing them to move to other locations or territories including pool habitat. Parr have been observed moving into ponds and lakes near fluvial streams and rivers as rearing habitat. Calkins (1989) summarized winter habitat requirements for salmon parr. Overall, parr generally stayed in their summer habitat during the autumn and moved into the substrate as the water temperature started to drop below 10 C. Cunjak (1988) documented salmon parr hiding beneath rocks in riffle and run habitats. Large parr and presmolts will use pools and lakes as over-winter habitat. Habitat connectivity is important not only for spawning adults but also for parr which have been found to shift between summer feeding territories and winter habitat (McCormick et al. 1998). It has been inferred that frozen substrate may increase salmon parr mortality in streams. Atlantic salmon smolts leave freshwater and the post-smolts migrate to feeding areas in the North Atlantic during late spring and summer (Hansen and Quinn 1998).

Adult Atlantic salmon require increased river flows and velocities to stimulate upstream migration. Optimum velocities for migration appear to be in the 67 to 128 cm/s range. Vertical barriers such as dams and waterfalls (head > 10 ft) pose significant problems for upstream migration. Adult salmon seek resting pools and large boulders as temporary refuge from swift currents during upstream spawning migration. Optimal holding pools are deep, well shaded pools with cool temperature provided by spring or seeps. Holding pools are characterized by a gravel substrate with large boulders. These pools also provide over-winter refuge for salmon after spawning in autumn.

Common Name: **Atlantic Salmon (anadromous)**
Scientific Name: **Salmo salar (anadromous)**
Species Group: **Fish**

General Habitat Preferences:

Minimum Elevation (m):	54
Maximum Elevation (m):	0
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial

Aquatic: Lower CT River

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Invasion by Exotic Species

Sedimentation

Description of habitat problem(s): Dams, culverts or other water diversions are serious problems to salmon. They can be barriers to both upstream migrating adults and downstream migration of smolts. Artificial flow regimes associated with hydrogeneration facilities can alter and degrade habitat for salmon. Removing stream buffers can result in habitat loss (loss of cover and increased water temperatures). Dredging or channelization of streams will result in loss and degradation of spawning and rearing habitat for salmon. Soil Erosion can increase stream sedimentation. Sedimentation adversely impacts salmon habitat through the deposition of fine sediment (particle size < .6 cm in diameter) into spawning gravel and cobble/boulder rearing areas. Non-native and exotic species primarily affect juvenile salmon including smolts through a number of factors such as increased predation, competition, and disease risk.

Non-Habitat Problems:

Disease

Genetics

Pollution

Predation or Herbivory

Unknown Non-Habitat Threatss

Description of non-habitat problem(s): Genetics considerations are an important factor for salmon restoration in Vermont. Since native salmon extirpated from the Connecticut River watershed, it is extremely important to maintain existing brood stock sources and breeding protocols to protect and enhance genetic diversity. Being an anadromous species, salmon are subjected to a wide variety of problems associated with extensive migrations and residency in both marine and freshwater environments. Upstream

Common Name: **Atlantic Salmon (anadromous)**
Scientific Name: **Salmo salar (anadromous)**
Species Group: **Fish**

migrating salmon are confronted by passage barriers, such as dams and culverts, and outmigrating fish are often subjected to mortality resulting from passage through power station turbines and/or extended residency times in power impoundments which may make fish physiologically unprepared for life in saltwater or expose smolts to greater freshwater predation pressures. Larger native and non-native fish such as striped bass, walleye, and smallmouth bass in the Connecticut River and possibly other estuary and marine species in Long Island Sound are significant predators of emigrating smolts.Salmon are highly susceptible to diseases primarily through contact with commercial aquaculture salmon in the marine or estuary environments, and fish culture operations in freshwater. Sea lice parasitism can also affect adult salmon. Acid deposition pollution appears to have adverse physiological effects on juvenile salmon especially emigrating smolts. In recent years, there have been more reports of declining salmon populations from many regions within its worldwide range. It is unknown whether this is a short-term downward trend or more of a long-term problem to the species. It is also believed that the water temperature oscillation in the Atlantic Ocean has been a factor in reducing adult salmon returns to home waters in many countries over the past decade.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Low	
Research	Threats and Their Significance	Medium	
Research	Population Genetics	Medium	
Research	Taxonomy	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	High	
Monitoring	Monitor Threats	High	

Common Name: **Atlantic Salmon (anadromous)**
Scientific Name: **Salmo salar (anadromous)**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use	High	Restore fish passage at dams and culverts to allow upstream migrants access to spawning and juvenile habitats and expedite outmigrants (spent adults, smolts, juveniles) to sea. Operate and maintain existing fishways for peak passage performance.	Number of dams and culverts with identified fish passage problems. Number of dams and culverts where fish passage has been restored either by removal or mitigation (e.g., retrofitting with fishways).	CRASC, USFWS, USFS, FERC, CRJC, ACE, VTrans, town highway departments, power companies, other dam owners	Power companies, ACE, other dam owners
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		CRASC, USFWS, TU, CRJC, TNC, watershed associations	
Habitat Restoration	Medium	Support efforts, such as the Climate Change Action Plan developed by the Conference of New England Governors, and local and regional initiatives, such as the Alliance for Climate Action, to reduce greenhouses gas emissions in the Northeast.		Northeastern states and Canadian provinces, EPA, CRASC, USFWS, VDEC	
Species Restoration	High	Support and cooperate with the inter-agency program for the restoration of anadromous fishes to the Connecticut River basin (i.e., CRASC).	Implement Connecticut River Basin Management Plan for Atlantic Salmon. Percent of tasks implemented as prescribed in the plan.	CRASC, USFWS, USFS, NMFS, NHFGD, MaDFW, MaDMF, CtDEP	
Species Restoration	High	Maintain existing anadromous salmon brood stock sources and breeding protocols to protect and enhance genetic diversity.	Number of acceptable brood stock sources (sea run, kelts, domestic) maintained.	CRASC, USFWS	

Common Name: **Atlantic Salmon (anadromous)**
Scientific Name: **Salmo salar (anadromous)**
Species Group: **Fish**

Habitat Restoration	High	Protect and restore in-stream and riparian habitats via water quality, flow and temperature improvement; sediment reduction; streamside buffers; and maintenance of in-stream habitat structure (e.g., large woody debris, deep pools).	Number of acres of riparian habitat protected or restored. Number of miles of stream habitat protected or restored.	CRASC, USFWS, USFS, CRJC, NRCS, TU, watershed associations, town planning and conservation commissions	
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore anadromous Atlantic salmon critical habitats.		VDEC, USFWS, CRASC, CRJC, TU, RPCs, town planning and conservation commissions	
Natural Processes Restoration	High	Improve flow regimes below hydroelectric and flood control dams on the Connecticut River and its tributaries.	Number of projects that operate with acceptable flow regimes.	CRASC, USFWS, VDEC, FERC, CRJC, ACE, power companies	ACE, power companies

Common Name: **Atlantic Salmon (anadromous)**
Scientific Name: **Salmo salar (anadromous)**
Species Group: **Fish**

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Common Name: **Atlantic Salmon (anadromous)**
Scientific Name: **Salmo salar (anadromous)**
Species Group: **Fish**

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Common Name: **Arctic Char or Sunapee Trout**
Scientific Name: **Salvelinus alpinus oquassa**
Species Group: **Fish**

Conservation Assessment:

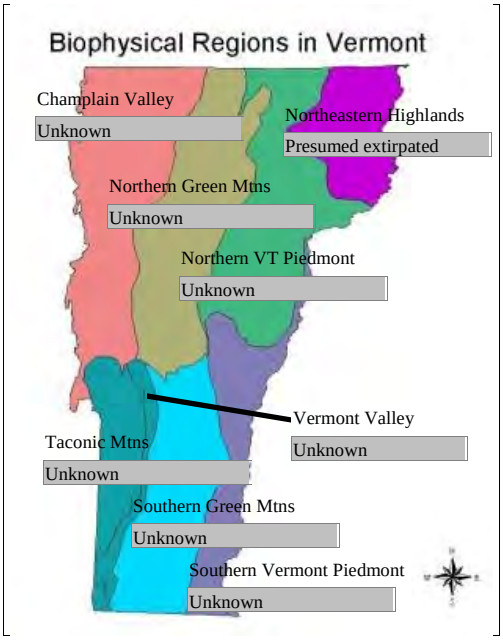
Final Assessment: High Priority

Global Rank: G5T2Q
Global Trend:
State Rank: SX
State Trend: Unknown
Extirpated in VT? Yes
Regionally Rare? Yes

Assessment Narrative:

The first documented report of arctic char from Vermont was of a fish collected by J. W. Titcomb in 1899 from Little Averill Lake. That fish was placed in the collection of the Smithsonian Institution (USNM 00061723), where it remains to this day. Since that collection and well into the early 1900s arctic char in the Averill lakes are mentioned anecdotally, including articles in some of the popular literature, suggesting that they were then quite common there. However, apart from that single archived specimen, the condition of which defies taxonomic confirmation, no other examples are know to exist in other collections nor have been reported in more recent years from the Averill lakes. Whether or not arctic char ever existed in the Vermont or actually were misidentified lake trout (saibling) is being actively debated. Nonetheless, whatever the outcome of the debate may be, for now the Vermont population is presumed to be extirpated.

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The species has a circumpolar distribution inhabiting inshore marine waters, lakes, and rivers of the northern hemisphere (Scott and Crossman 1973). In Vermont, arctic char have been reported only from Great and Little Averill Lakes in Essex County. Populations in Vermont are near the southern extent of the species North American range.

Known Watersheds

Saint-Francois River

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Arctic char inhabit inshore marine waters, lakes, and rivers (Scott and Crossman 1973). Both anadromous and freshwater (non-migratory) populations exist within its range; however, only the latter form may have occurred

Common Name: **Arctic Char or Sunapee Trout**
Scientific Name: **Salvelinus alpinus oquassa**
Species Group: **Fish**

in Vermont. Non-migratory fish remain in lakes and rivers where they frequent deep runs and pools of medium to large lakes, and rivers (www.fishbase.org). Habitat requirements of arctic char probably do not differ much from those of other related Salvelinus species, including brook trout and dolly varden. All require cold, well oxygenated water. Char spawn over gravel or rocky shoals in lakes, or in quiet pools in rivers, at depths of 1.0-4.5 m (Scott and Crossman 1973).

General Habitat Preferences:

Minimum Elevation (m): 513
Maximum Elevation (m): 530
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lacustrine

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change

Habitat Alteration

Habitat Fragmentation

Sedimentation

Description of habitat problem(s): These threats would apply to arctic char if it still occurred in Vermont. See reports for brook trout and lake trout.

Non-Habitat Problems:

Competition

Genetics

Pollution

Predation or Herbivory

Description of non-habitat problem(s): Arctic char are very sensitive to water pollution (www.fishbase.org). The population that once existed in the Averill lakes is suspected of having been eliminated following the introduction of lake trout and the resulting predation on arctic char.

Common Name: **Arctic Char or Sunapee Trout**
Scientific Name: **Salvelinus alpinus oquassa**
Species Group: **Fish**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Low	
Research	Threats and Their Significance	Low	
Research	Population Genetics	Medium	
Research	Taxonomy	High	Whether or not the fish collected from Little Averill Lake in 1899 was actually an arctic char or a misidentified lake trout (saibling) is being debated. That specimen is at the Smithsonian Institute (USNM 00061723) and was recently inspected but no firm taxonomic conclusion could be reached. There is a presumed variant of lake trout in Maidstone Lake (a.k.a. "lunge") may be contributing to the confusion and any doubts about the historic existance of arctic char in Vermont. Confirm historic records of arctic char in Vermont waters.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Research	High	Confirm if arctic char were ever historically present in Vermont waters.		UVM, MeDIFW	
Research	Medium	Conduct an extensive investigation of arctic char in Vermont, including historical records and expert opinions of the likelihood that a population once occurred in the Averill lakes.		VFWD, USFWS, TU, academic institutions, other NE state fishery agencies	
Research	Medium	Determine whether gentic testing can be done on Smithsonian Institution specimen. If so, compare genetic characteristics of Vermont specimen with confirmed arctic char from other populations within the Northeast.		VFWD, USFWS, TU, academic institutions, other NE state fishery agencies	

Common Name: **Arctic Char or Sunapee Trout**
Scientific Name: **Salvelinus alpinus oquassa**
Species Group: **Fish**

Bibliography:

Kendall, W. C. 1914. The fishes of New England. The salmon family. Part 1. The trout and chars. Memoirs of the Boston Society of natural History 8(1):46.

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Website: www.fishbase.org/Summary/SpeciesSummary.cfm?ID=247&genusname=Salvelinus...

Website: www.nmnh.si.edu/cgi-bin/wdb/fish/catalog/query/16651.

Common Name: **Brook Trout (naturally reproducing populations)**
Scientific Name: **Salvelinus fontinalis (naturally reproducing pops)**
Species Group: **Fish**

Conservation Assessment:

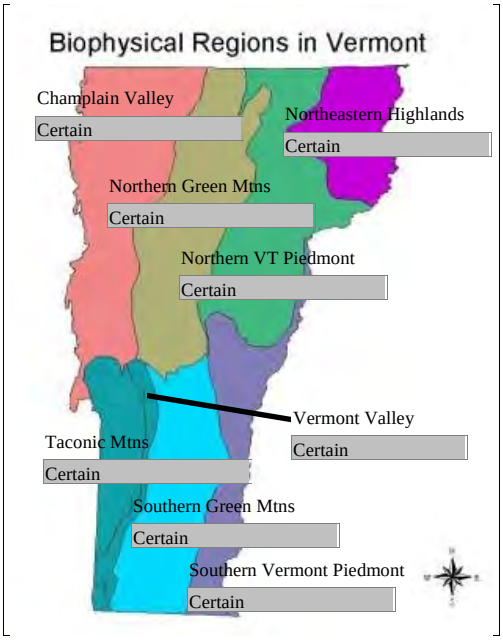
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S5 **State Trend:** Unknown
Extirpated in VT? Unknown **Regionally Rare?** Unknown

Assessment Narrative:

Brook trout is the most widely distributed and abundant salmonid species indigenous to Vermont. Today, wild, stocked and mixed populations occur throughout the state. Brook trout is sensitive to pollution and habitat degradation. Deforestation, water development and pollution, habitat degradation, and competition and/or predation from introduced fishes all have taken a toll on wild populations throughout its natural range. Beginning around the mid 1800s and continuing to the present time brook trout have been cultured in hatcheries and stocked to restore fishable populations to many waters throughout the state. Fish culture programs have relied upon brook trout strains from multiple sources most of which have originated from populations outside of Vermont. Strains may very well have been selected for characteristics other than their adaptability and survival in Vermont environments, but rather for their performance in hatcheries (e.g., survival and growth potential) and sport fishing qualities. The ability of hatchery trout to survive in Vermont waters beyond the first season after release has been evaluated with results indicating multi-season survival is generally poor. In many respects our established self-sustaining wild brook trout populations may have certain advantages over traditional hatchery strains in certain situations, such as greater adaptability to Vermont environments. In recent years other states within the natural range of the species have been investigating wild populations to identify heritage (native) brook trout strains. Research into the existance of heritage strains in Vermont has not been pursued. The extensive stocking of hatchery strains on top of wild populations throughout the state over the past 150 years raises doubts that any heritage strains can be identified with acceptable certainty. Therefore, the fallback position is conservation of all wild naturally reproducing brook trout populations in the state.

Distribution:



Natural History Elements:

Home Range:
Migrant? Yes

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The brook trout is native to most of eastern Canada from Newfoundland to west of Hudson Bay; south in the Atlantic, Great lakes and Mississippi River basins to Minnesota and through the Appalachian Mountains to Georgia (Page and Burr 1991). It has been introduced widely outside of its natural range. In Vermont, the species is distributed throughout the state where suitable habitat is available and competing species are absent or low in abundance.

Common Name: **Brook Trout (naturally reproducing populations)**
Scientific Name: **Salvelinus fontinalis (naturally reproducing pops)**
Species Group: **Fish**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Brook trout occur in headwater streams, small to medium rivers, and lakes and ponds where waters are clear, cool and well-oxygenated. Raleigh (1982) gives a comprehensive review of brook trout habitat requirements. Riverine brook trout habitat is characterized by being influenced by cold-springs, having silt-free rocky substrate in riffles and runs, well vegetated stream banks, abundant instream cover, and relatively stable stream flows, temperatures and stream banks. Lacustrine habitats are typically oligotrophic in character. The temperature range for brook trout is 0-24 C, with optimal temperatures for growth and survival in the range of 11-16 C. Warm water temperatures appears to be the single most critical factor influencing brook trout survival and production. Brook trout normally require high dissolved oxygen concentrations, optimally near saturation or >= 7 mg/L at temperatures <=15 C and >= 9 mg/L at temperatures >= 15 C. Instream and riparian cover is recognized as an important component of brook trout habitat. Brook trout tends to be more tolerant of low pH water than other salmonid species. Most spawning occurs in stream habitat, although brook trout may spawn directly in lakes and ponds where there are upwellings.

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial

Aquatic: Lacustrine

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change

Habitat Alteration

Habitat Fragmentation

Sedimentation

Description of habitat problem(s): Brook trout habitat has been degraded by alterations of natural stream channel morphology and flow regimes; water pollution; fragmentation (e.g., dams and culverts); reduction of riparian vegetation resulting in stream water temperature increases and loss of instream cover (e.g., large woody debris) Spawning habitat and trout egg and fry survival are negatively affected by sedimentation. Climate change could potentially degrade temperature regimes required by brook trout throughout its distribution.

Non-Habitat Problems:

Common Name: **Brook Trout (naturally reproducing populations)**
Scientific Name: **Salvelinus fontinalis (naturally reproducing pops)**
Species Group: **Fish**

Competition

Disease

Genetics

Pollution

Predation or Herbivory

Description of non-habitat problem(s): Brook trout compete poorly with introduced salmonids, such as brown and rainbow trout, as well as warmwater species (e.g., centrachids, percids and esocids). Additionally, these competitors may prey upon brook trout. Stocking of non-native brook trout strains on wild populations may result in inbreeding, loss of genetic characteristics necessary for species survival, and intra-specific competition. Stocking also puts heritage populations at risk of introducing disease causing pathogens, such as whirling disease.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Medium	Identify currently non-stocked wild brook trout populations to inform planning and management
Research	Threats and Their Significance	High	1) Evaluate the impact of culverts and other artificial obstructions on brook trout passage and distribution. 2) Identify and evaluate stream barriers as fish passage barriers to critical habitat and/or their value in isolating wild populations.
Research	Population Genetics	Medium	Nothing is known about the genetic characteristics of Vermont's wild populations and the possible existance of heritage strains.
Research	Taxonomy	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	High	
Monitoring	Monitor Threats	High	

Common Name: **Brook Trout (naturally reproducing populations)**
Scientific Name: **Salvelinus fontinalis (naturally reproducing pops)**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Research	Medium	Investigate the existance of heritage strains of brook trout in Vermont through genetic evaluation of wild populations and historical stocking of hatchery strains.	Number of wild naturally reproducing brook trout populations evaluated for possible heritage strains.	USFWS, USFS, TU, Eastern Brook Trout Initiative	
Habitat Restoration	High	Remove or mitigate fish passage barriers where removal does not pose a risk to the conservation and protection of identified heritage populations.	Number of barriers, such as dams and culverts, removed or rehabilitated to allow fish passage.	USFWS, USFS, VDEC, TU, Eastern Brook Trout Initiative, VTrans, town highway departments, town planning and conservation commissions	
Habitat Restoration	High	Protect and restore lake, in-stream and riparian habitats via water quality, flow and temperature improvements; sediment reduction; streamside buffers; and maintenance of habitat structure (e.g., large woody debris, deep pools).	Number of acres of riparian habitat protected or restored. Number of miles of stream habitat protected or restored.	USFWS, USFS, VDEC, NRCS, TU, Eastern Brook Trout Initiative, lake and watershed associations, town planning and conservation commissions	
Compatible Resource Use	Medium	Protect wild brook trout populations from the introduction of exotic nonindigenous fishes and other aquatic species that may outcompete brook trout or adversely alter or degrade brook trout habitat.		USFWS, USFS, TU, Eastern Brook Trout Initiative	
Habitat Restoration	Medium	Support efforts, such as the Climate Change Action Plan developed by the Conference of New England Governors, and local and regional initiatives, such as the Alliance for Climate Action, to reduce greenhouse gas emissions in the Northeast.		Northeastern states and Canadian provinces, EPA, USFWS, VDEC	

Common Name: **Brook Trout (naturally reproducing populations)**
Scientific Name: **Salvelinus fontinalis (naturally reproducing pops)**
Species Group: **Fish**

Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore brook trout critical habitats	VDEC, RPCs, TU, lake and watershed associations, town planning and conservation commissions

Bibliography:

Page, L. M., and B. M. Burr. 1991. A field guide to freshwater fishes of North America north of Mexico. Houghton Mifflin Company, Boston.

Raleigh, R. F. 1982. Habitat suitability index models: brook trout. U. S. Fish and Wildlife Service, FWS/OBS-82?10.24. 42 pp.

Common Name: **Lake Trout (naturally reproducing populations)**
Scientific Name: **Salvelinus namaycush (naturally reproducing pop)**
Species Group: **Fish**

Conservation Assessment:

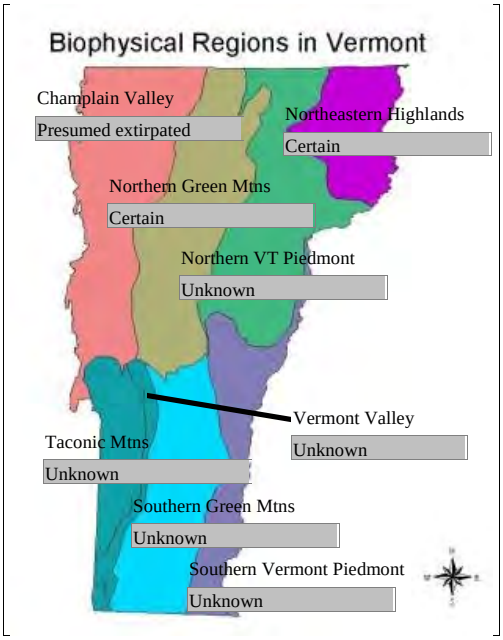
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S4 **State Trend:** Stable
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Even though a large number of lakes in Vermont are being managed for lake trout fisheries, with a few exceptions most of these waters do not support self-sustainig populations but depend on the stocking of hatchery-reared fish. Currently, six lakes are being managed for self-sustaining lake trout populations: Big and Little Averill ponds, Averill; Maidstone lake, Maidstone; Echo Lake, Charleston; Caspian Lake, Greensboro; and Crystal Lake, Barton. Restored naturally reproducing, self-sustaining lake trout populations within the species natural range in the state warrant special conservation attention.

Distribution:



Natural History Elements:

Home Range:
Migrant? Yes

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The natural occurrence of lake trout is limited to North America. Its natural range closely aligns with the limits of the Pleistocene glaciation. In Vermont, the species has been stocked extensively throughout the state; however, with perhaps very few exceptions these populations are not self-sustainable and are completely dependent on continued stocking for the populations to exist. The few self-sustaining populations in Vermont are all located in the Northeast Kingdom: Big and Little Averill ponds, Averill; Maid stone Lake, Maidenstone; Echo Lake, Charleston; Caspian Lake, Greensboro; and Crystal Lake, Barton (L. Gerardi, Vermont Fish and Wildlife Department, personal communication). Natural reproduction has been documented in Lake Champlain, but that population is not at the present time sustainable without stocking.

Known Watersheds

Saint-Francois River

Upper Connecticut

Common Name: **Lake Trout (naturally reproducing populations)**
Scientific Name: **Salvelinus namaycush (naturally reproducing pop)**
Species Group: **Fish**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☐ General Literature ☐

Lake trout is a species of oligotrophic lakes. In the southern part of their range the species inhabits deep, cold lakes whereas at more northern latitudes they are also found in shallow and deep waters. This species is intolerant of waters with low oxygen content, and prefers cold water, seeking areas with temperatures below 16 C (Langdon et al. In press). Lake trout spawn over rocky shoals and along wave-swept shorelines. Spawning in riverine habitat is rare. Lake trout can spawn in depths of water from .3-61 m over gravel that measures 3.8-10.2 cm in diameter, typically aggregating in the fall over clean substrate, with deep interstitial spaces (Langdon et al. In press). Lake trout prefer eating small crustaceans, insects, and fish. Young lake trout eat plankton, insects, and small aquatic invertebrates.

General Habitat Preferences:

Minimum Elevation (m):	288
Maximum Elevation (m):	530
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lacustrine

Aquatic: Lake Champlain

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change

Habitat Alteration

Habitat Fragmentation

Invasion by Exotic Species

Sedimentation

Description of habitat problem(s): Lake trout are susceptible to habitat degradation, such as lake eutrophication, hypolimnion oxygen depletion, spawning shoal sedimentation, lake level manipulations. Introduced species, such as alewives, are known to contribute to reproductive failure by disruption of thiamine metabolism in lake trout. Sea lamprey in Lake Champlain predate on lake trout and may be a significant factor in population declines there. Dams constructed at lake outlets raise lake levels that can erode shoreline soils, increasing sedimentation of spawning shoals and decreasing reproductive success. Water level fluctuations, associated with water storage for hydropower, may result in dewatered lake trout egg and embryos, also negatively impacting reproductive success.

Non-Habitat Problems:

Common Name: **Lake Trout (naturally reproducing populations)**
Scientific Name: **Salvelinus namaycush (naturally reproducing pop)**
Species Group: **Fish**

Genetics

Harvest or Collection

Parasites

Description of non-habitat problem(s): Lake Maidstone contains a population of lake trout (a.k.a. locally as lunge) that is morphologically distinct from lake trout in all other Vermont lakes. It is possible that this population is genetically distinct and represents a unique population that is native to Vermont. Because it is unknown whether this population is genetically distinct, no strategies exist to protect this population. Lake trout are highly valued by anglers due to the large size that this species can attain. Overfishing could result in the loss of self-sustaining, native lake trout populations (Ellrott and Marsden 2004).

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Low	
Research	Threats and Their Significance	Low	
Research	Population Genetics	High	Determine if Maidstone Lake lake trout are genetically distinct from other populations in Vermont.
Research	Taxonomy	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	High	
Monitoring	Monitor Threats	High	

Common Name: **Lake Trout (naturally reproducing populations)**
Scientific Name: **Salvelinus namaycush (naturally reproducing pop)**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration	High	Maintain or restore lake trout access to spawning inlets and/or outlets.		LCFWMC, USFWS, VDFW, VDEC	
Compatible Resource Use	High	Manage the harvest of lake trout in self-sustaining populations consistent with maintaining viable populations without the need for supplemental stocking, i.e. effectively manage populations to prevent over-harvest.	Number of unstocked, self-sustaining populations.		
Research	High	Determine if Maidstone Lake lake trout are genetically distinct from other populations in Vermont.		UVM, other academic institutions	
Invasive Species Control & Prevention	High	Implement measures to prevent the introduction, or reduction in the abundance of exotic species (e.g., alewife) which could limit lake trout populations in Lake Champlain and other waters.	Development and implementation management plans for the control of invasive aquatic organisms in lake trout waters.	LVFWMC, USFWS, VDEC, lake and watershed associations	
Habitat Restoration	High	Protect and restore lake and riparian habitats via water quality, water level and temperature improvements; sediment reduction; streamside buffers; and maintenance of habitat structure (e.g., spawning shoals).		USFWS, VDEC, lake and watershed associations	
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore lake trout critical habitats.		VDEC, RPCs, lake and watershed associations, town planning and conservation commissions	
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, Echo Center, LCBP	
Species Restoration	High	Develop lake trout forage base management and assessment plans.	Number of steps taken to advance the development of forage base management and assessment plans.	LCFWMC, USFWS, VDFW, NYDEC	

Common Name: **Lake Trout (naturally reproducing populations)**
Scientific Name: **Salvelinus namaycush (naturally reproducing pop)**
Species Group: **Fish**

Invasive Species Control & Prevention	High	Manage sea lamprey population in Lake Champlain to reduce the affect of lamprey on attaining lake trout restoration goals.	LCFWMC, USFWS
Habitat Restoration	Medium	Support efforts, such as the Climate Change Action Plan developed by the Conference of New England Governors, and local and regional initiatives, such as the Alliance for Climate Action, to reduce greenhouse gas emissions in the Northeast.	Northeastern states and Canadian provinces, EPA, USFWS, VDEC

Bibliography:

Ellrott, B. J., and J. E. Marsden. 2004. Lake trout reproduction in Lake Champlain. Transactions of the American Fisheries Society 133:252-264.

Langdon, R. W., M. T. Ferguson, and K. M. Cox. In press. Fishes of Vermont. Vermont Department of Fish and Wildlife, Waterbury.

Marcus, M. D., W. A. Hubert, and S. H. Anderson. 1984. Habitat suitability index models: lake trout (exclusive of the Great Lakes). U. S. Fish and Wildlife Service FWS/OBS-82/10.84. 12 pp.

Page, L. M., and B. M. Burr. 1991. A field guide to freshwater fishes of North America north of Mexico. Houghton Mifflin Company, Boston.

Common Name: **Redfin Pickerel**
Scientific Name: **Esox americanus**
Species Group: **Fish**

Conservation Assessment:

Final Assessment: Medium Priority

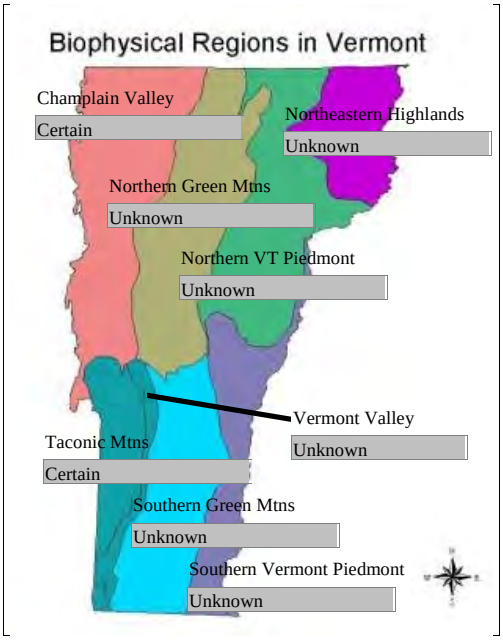
Global Rank: G5
State Rank: S4
Extirpated in VT? No

Global Trend:
State Trend: Unknown
Regionally Rare? No

Assessment Narrative:

In Vermont, the redfin pickerel has a limited distribution. Populations have been found in rivers and streams and associated wetlands primarily limited to the lower Champlain Valley. Very little is known about its biology and specific habitat requirements within the state. Redfin pickerel spawning habitat is vulnerable to alteration or degradation. The species is potentionally threateded by hybridization with other esocid species introduced to its waters.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? No

Within watershed ☐
Within biophysical region ☐
Within VT ☐
Within Region ☐
Within US ☐
Outside US ☐

Distribution Summary:

The redfin pickerel (Esox americanus americanus) is the subspecies restricted to eastern United States; the grass pickerel (E. a. vermiculatus) is the western subspecies. Redfin pickerel is a fish primarily associated with the eastern coastal plain. It is distributed from the St. Lawrence River (Lac St. Pierre) south through the Richelieu-Champlain-Hudson system into New York, east through southern Vermont and New Hampshire to Long Island and south along the coastal plain to Georgia (Scott and Crossman 1973). In Vermont, redfin pickerel appears to be limited to the Poultney-Castleton rivers drainage, South Fork of East Creek in Orwell, and Pond Brook in Monkton.

Known Watersheds

Lake Champlain Canal

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

The redfin pickerel occurs in weedy areas of lakes, ponds and slow rivers. The redfin is often found in tea-colored, acidic waters with pH values as low as 4.3. The redfin pickerel spawns during April and May when water temperatures reach 10 C (Langdon et al. In press). Adults congregate to spawn and adhesive eggs are

Common Name: **Redfin Pickerel**
Scientific Name: **Esox americanus**
Species Group: **Fish**

broadcast randomly in heavily vegetated, shallow areas along lakeshores or streambanks. Young redfins first consume zooplankton, snails and crustaceans, switching to fish as they grow older. Adults feed on fish and crayfish, but may supplement these food items with small crustaceans and insects (Jenkins and Burkhead 1993). This species may play a significant role in fish community structure because of its preference to predate on fish.

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial

Aquatic: Lacustrine

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Description of habitat problem(s): Loss or alteration (i.e. through flow alteration, dewatering, sedimentation) of vegetated, shallow areas along lakeshores or streambanks would pose a problem to the reproductive success of the species.

Non-Habitat Problems:

Genetics

Description of non-habitat problem(s): This species has a limited distribution in Vermont, located in 3 drainages. If any of these populations undergo a reduction in population size (i.e., population bottleneck), then it is possible that genetic variation will be lost, forfeiting the evolutionary potential of the species. Natural selection can only act in the presence of genetic variation, and, therefore, the higher the genetic variability in a population, the higher the likelihood for population persistence. If gene flow between the 3 populations is limited, then the genetic variability of each population could decrease over time. Also, redfin pickerel have been reported to hybridized with northern pike and chain pickerel (Jenkins, 1993), which poses further genetic concerns. The introduction of northern pike or chain pickerel to waters populated by redfin pickerel poses the risk of hybridization, as well as introduce inter-specific predation and competition for habitat and forage. Decreased genetic variation in redfin pickerel would hinder the ability of the populations to adapt to changing conditions over time.

Common Name: **Redfin Pickerel**
Scientific Name: **Esox americanus**
Species Group: **Fish**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	Identify number of redfin pickerel populations in Vermont and those which are not co-habitants with other esocid species.
Research	Threats and Their Significance	Low	
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	High	
Monitoring	Monitor Threats	High	The introduction of northern pike and chain pickerel to redfin pickerel waters limits the species by hybridization and should be monitored.

Common Name: **Redfin Pickerel**
Scientific Name: **Esox americanus**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, Echo Center, LCBP	
Habitat Restoration	High	Protect and restore in-stream and riparian habitats via water quality, flow and water level improvements; sediment reduction; streamside buffers; and maintenance of in-stream habitat structure (e.g., large woody debris, aquatic vegetation).	Existing number of redfin pickerel populations sustained. Number of stream-miles (acres of lake habitat) maintaining or restored to suitable flows or water levels.	VDEC, USFWS, NRCS, RPCs, lake and watershed associations, town planning and conservation commissions	
Species Restoration	High	Protect habitats currently supporting redfin pickerel populations from the introduction of other esocid species (e.g., chain pickerel, northern pike) which may compete for available habitat and/or potentially hybridize with redfin pickerel.	Number (percentage) of redfin pickerel waters remaining free of competing esocid species.	Angling organizations, watershed associations	
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore redfin pickerel critical habitats	Percent of habitat protected or restored.	VDEC, RPCs, lake and wateshed associations, town planning and conservation commissions	

Bibliography:

Jenkins, R. E., and N. M. Burkhead. 1993. Freshwater fishes of Virginia. American Fisheries Society, Bethesda, Maryland.

Langdon, R. W., M. T. Ferguson, and K. M. Cox. In press. Fishes of Vermont. Vermont Department of Fish and Wildlife, Waterbury.

Scott, W. B., and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184, Ottawa.

Common Name: **Muskellunge**
Scientific Name: **Esox masquinongy**
Species Group: **Fish**

Conservation Assessment:

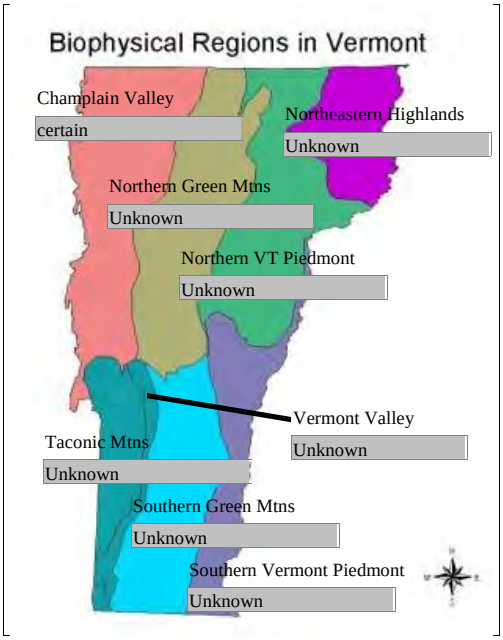
Final Assessment: High Priority

Global Rank: G5 **Global Trend:**
State Rank: S1 **State Trend:** Declining
Extirpated in VT? Unknown **Regionally Rare?** Unknown

Assessment Narrative:

In Vermont, currently there are only two recognized populations in the state. One population at least until recent years occurred in a stretch of the Missisquoi River between the Swanton and Highgate Falls dams. This is believed to be the only remaining native population in Vermont. The status of this population is much in doubt, although investigations continue and periodically there are reports of angler caught musky in this river section. The other population is in northern Lake Champlain, including the lower accessible reaches of the Missisquoi River below Swanton dam and possibly other large tributaries to the lake. Fish observed in the lake are of undetermined origin. Muskellunge of the Chautauqua strain are stocked by New York Department of Environmental Conservation into the Big Chazy River, a tributary to northern Lake Champlain. Similarly the Vermont Fish and Wildlife Department stocked musky into Otter Creek and the Lemon Fair River for a few years (1980-84) without evidence of successful population establishment. Whether or not fish now observed in the lower Missisquoi River are of wild, stocked or mixed origin is unknown at this time. In 2002, muskellunge was proposed for state endangered species designation; however, the recommendation was not adopted by the Secretary of the Agency of Natural Resources at that time.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

This species is restricted to eastern North America: south from Quebec through western Vermont (Lake Champlain), south and west of the Appalachian Mountains to Tennessee and north through Illinois into Wisconsin, Minnesota, western Ontario, and extreme southeastern Manitoba (Scott and Crossman 1973). It is currently believed that there are only two muskellunge populations remaining in Vermont. These populations are on the eastern edge of its native North American range. One population occurred in the reach of the Missisquoi River situated between the Swanton and Highgate falls dams, and the other is in northern Lake Champlain. Very little information (mostly anecdotal) is available for the status of these populations. Fish occurring above Swanton Dam have long been believed to be of the native heritage strain. Muskellunge in the lake could be native heritage strain, stocked fish from New York, or crosses between native

Common Name: **Muskellunge**
Scientific Name: **Esox masquinongy**
Species Group: **Fish**

and stocked fish.

Known Watersheds

Lake Champlain Direct

Mississquoi River

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

The muskellunge is a fish of warm, heavily vegetated lakes; stumpy, weedy bays; and slow, heavily vegetated rivers (Scott and Crossman 1973). In late winter and early spring (shortly after ice-out), they migrate into marshes to spawn in clear, shallow water having abundant aquatic and/or immersed terrestrial vegetation (Trautman 1957). The range of spawning temperatures is 9.4-15 C with an optimum temperature of 12.8 C. Eggs are distributed in shallow water (38-51 cm deep) with abundant vegetation (Scott and Crossman 1973). Adults return to deep water after spawning. After the eggs hatch, the fry remain in the shallow water but move out into deeper habitat as the water recedes from flooded areas. Optimum water temperature for muskellunge is 25.6 C, although temperatures up to 32.2 C can be withstood, and apparently low dissolved oxygen levels can be tolerated (Scott and Crossman 1973).

General Habitat Preferences:

Minimum Elevation (m):	29
Maximum Elevation (m):	45
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lake Champlain

Aquatic: Large Lake Champlain Tribs Below Falls

Marshes and Sedge Meadows

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Description of habitat problem(s): Habitat conversion, such as draining of wetlands and berming of floodplains for agriculture and land development, limit the species by eliminating critical spawning and nursery habitats. The construction of dams and other fish passage obstruction fragment muskellunge habitat and deny fish access to spawning areas (e.g., Swanton dam on the Missisquoi River). In the case of Swanton dam, any muskellunge still residing in the river upstream of the dam are isolated from the Lake Champlain population.

Common Name: **Muskellunge**
Scientific Name: **Esox masquinongy**
Species Group: **Fish**

Non-Habitat Problems:

Disease

Genetics

Harvest or Collection

Pollution

Predation or Herbivory

Description of non-habitat problem(s): The sizes of the native Lake Champlain and Missiquoi River muskellunge populations are unknown at this time. If adult numbers are extremely small, the loss of genetic variability may limit the native population. Additionally, stocking of Chautauqua strain muskellunge into the Big Chazy River, New York by NYDEP and the possibility for these fish to spawn with any native fish could alter genetic characteristics and introduce undesirable traits. In turn, the loss of genetic variation and/or introduction of deleterious traits could weaken the ability of the native population to survive or to be ultimately restored to its historic waters in Vermont. One disease of particular note is lymphosarcoma which was first detected in northern Lake Champlain northern pike in 2002 (T. Jones, Vermont Fish and Wildlife Department, personal communication). Wolf (1988) reports that of the two esocid species the muskellunge is more sensitive to this viral infection than northern pike. To date no muskellunge from Lake Champlain or the Missisquoi River have been tested for lymphosarcoma. Buchanan and Lebeau (2000) suggest several pollution sources to Lake Simcoe, Ontario, Canada as indirect impacts on muskellunge spawning and nursery habitats. Phosporus loading from natural sources, accelerated erosion and point sources. It has been reported that northern pike spawn earlier than muskellunge, such that pike fry are large enough to prey upon muskellunge fry.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	Conduct investigations into recruitment of muskellunge found in Lake Champlain and the Missisquoi River.
Research	Distribution and Abundance	High	Conduct investigations into the abundance and distribution of muskellunge found in Lake Champlain and the Missisquoi River.
Research	Threats and Their Significance	High	Investigate the significance of legalized pike shooting in Vermont as a threat to muskellunge.
Research	Population Genetics	High	Conduct investigations into the genetic characteristics of muskellunge found in Lake Champlain and the Missisquoi River.
Research	Taxonomy	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	High	
Monitoring	Monitor Threats	High	

Common Name: **Muskellunge**
Scientific Name: **Esox masquinongy**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Policy & Regulations	High	Pending further investigations into the current status of muskellunge in Vermont, propose species for state endangered status if results warrant.		Angling organizations	
Policy & Regulations	Medium	If legalized pike (muskellunge) shooting in Vermont found is found to be a significant problem, consider prohibiting or further restricting the activity.		Angling organizations	
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VFWD, USFWS, NRCS, TNC, Echo Center, LCBP, watershed associations	
Natural Processes Restoration	High	Maintain or restore flow regimes that are suitable to muskellunge habitat.	Number of hydroelectric power dams that have flow requirements that provide suitable habitat for muskellunge in their operating licenses. Number of miles of restored muskellunge habitat downstream from dams.	LCFWMC, USFWS, VDEC, hydroelectric power companies	
Compatible Resource Use	High	Maintain or restore connectivity between and within riverine and lake habitats by preventing the construction of fish passage barriers or the removal of existing dams.	Number of barriers removed. Number of miles of restored muskellunge habitat.	LCFWMC, USFWS, VDEC, ACE, VTrans, town highway departments, hydropower companies, other dam owners	

Common Name: **Muskellunge**
Scientific Name: **Esox masquinongy**
Species Group: **Fish**

Habitat Restoration	High	Protect and restore wetlands, floodplains and other habitats currently or historically used by muskellunge for spawning and juvenile habitat.	Numbers of acres of spawning and juvenile habitat restored.	VDEC, USFWS, NRCS, ACE, VDAFM, watereshed associations, town palanning and conservation commissions, farmers

Bibliography:

Buchanan, I., and B. Lebeau. 2000. Muskellunge restoration feasibility study, Lake Simcoe. Ontario Ministry of Natural Resources, Aurora, Ontario.

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Wolf, K. 1988. Fish viruses and viral diseases. Cornell University, Ithaca, New York.

Common Name: **Brassy Minnow**
Scientific Name: **Hybognathus hankinsoni**
Species Group: **Fish**

Conservation Assessment:

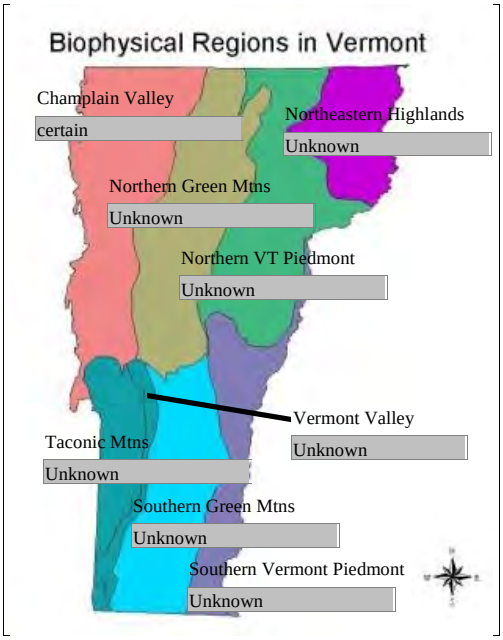
Final Assessment: High Priority

Global Rank: G5 **Global Trend:**
State Rank: S1 **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

The status and limiting factors to brassy minnow in Vermont are little known. Populations in the state have been identified in Little Otter Creek, Pond Brook (Colchester) and two Missisquoi River tributaries. One of the known populations in Vermont occurs in a low gradient stream which flows through lands under dairy use, such as streamside grazing and barnyard runoff. This suggests brassy minnow may be a tolerant species; however, this in itself does not explain the apparent limited distribution of the species within the Champlain Valley biophysical region. Vermont populations are on the eastern edge of the species North American range.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? No

Within watershed ☐
Within biophysical region ☐
Within VT ☐
Within Region ☐
Within US ☐
Outside US ☐

Distribution Summary:

This North American species ranges from the upper St. Lawrence River and Lake Champlain region west through southern Ontario and Michigan, west through the Arkansas and Missouri rivers to Colorado, Wyoming and Montana, north to Alberta, and in the Fraser and Peace rivers in British Columbia (Scott and Crossman 1973). In Vermont, it has only been found at few locations in the upper Missisquoi River watershed, Pond Brook in Colchester, and Little Otter Creek. Vermont populations are on the eastern edge of the species North American range.

Known Watersheds

Lake Champlain Direct

Mississquoi River

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

The brassy minnow is most commonly found in pools of cool, slow-flowing, tea-colored streams and small rivers. It may also occur in lakes and ponds but rarely in high numbers. The preferred bottom material is mud

Common Name: **Brassy Minnow**
Scientific Name: **Hybognathus hankinsoni**
Species Group: **Fish**

and organic debris but can also be found over sand and gravel. In Vermont, this species has been found over gravelly bottoms as well as mud and silt. Critical habitat for the brassy minnow is not clearly defined. The five Vermont occurrences (three drainages) are from low gradient streams. Since two of the five known records of occurrence in Vermont are from drainages that support high proportion of agricultural activities, it seems that this fish may not be particularly sensitive to impacts caused by barnyard runoff, intensive grazing or row crops. The literature reports the brassy minnow having a preference for slow boggy waters with soft bottoms; however, three out of the four Vermont occurrences are from non-bog (clear) streams with hard bottoms. They are considered to be a pool species and were found inhabiting pool habitats at all four sites in Vermont. In the Great Plains of the U.S. brassy minnows have been reported to withstand summertime water temperatures exceeding 90 F and dissolved oxygen levels less than 0.2 ppm when in isolated pools of small streams. It is not know whether Vermont populations are as hardy as their western counterparts. It is not a food specialist, being herbivorous to omnivorous. Adhesive eggs are laid on a variety of substrates including logs, rocks and plants.

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 200
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial

Current Problems: (see Appendix C for definitions of problem categories)

Habitat Problems:

Unknown Habitat Threats

Description of habitat problem(s): In Vermont, the brassy minnow is a rare but a generally tolerant species

Non-Habitat Problems:

Unknown Non-Habitat Threatss

Description of non-habitat problem(s):

Common Name: **Brassy Minnow**
Scientific Name: **Hybognathus hankinsoni**
Species Group: **Fish**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Little known about species habitat requirements. 1) Research brassy minnow habitat requirements, life history and limiting factors before identifying appropriate conservation strategies. 2) Support geomorphic assessments of streams with SGCN.
Research	Basic Life History	High	Little known about species life history. Research brassy minnow habitat requirements, life history and limiting factors before identifying appropriate conservation strategies.
Research	Distribution and Abundance	Medium	Knowledge about brassy minnow habitat, life history and limiting factors could provide insight into species apparent limited distribution and abundance in Vermont.
Research	Threats and Their Significance	High	Little known about limiting factors to species. Research brassy minnow habitat requirements, life history and limiting factors before identifying appropriate conservation strategies.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	Monitor known populations to ascertain current status and future changes.
Monitoring	Habitat Change	High	Monitor known habittat to ascertain current status and future changes.
Monitoring	Monitor Threats	Medium	

Common Name: **Brassy Minnow**
Scientific Name: **Hybognathus hankinsoni**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, LCBP, watershed associations	
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore brassy minnow critical habitats.		VDEC, RPCs, watershed associations, town planning and conservation commissions	
Habitat Restoration	High	Protect and restore in-stream and riparian habitats via water quality, flows, and temperature improvements; sediment reduction; streamside buffers; and maintenance of in-stream habitat structure (e.g., large woody debris).	Number of stream-miles fenced to restrict livestock access to streams and riparian areas. Number of off-stream watering sources developed for livestock.	USFWS, NRCS, VDEC, V, farmers	NRCS, USFWS, VDAFM, LCBP, watershed associations, farmers
Compatible Resource Use	High	Control runoff from agricultural activities into streams that support brassy minnow populations.	Number of streams that are brought into compliance with state water quality standards. Number of farms operating with manure pits and/or nutrient management plans.	USFWS, NRCS, VDEC, VDAFM, farmers	NRCS, USFWS, VAAFM, LCBP

Common Name: **Brassy Minnow**
Scientific Name: **Hybognathus hankinsoni**
Species Group: **Fish**

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Common Name: **Bridle Shiner**
Scientific Name: **Notropis bifrenatus**
Species Group: **Fish**

Conservation Assessment:

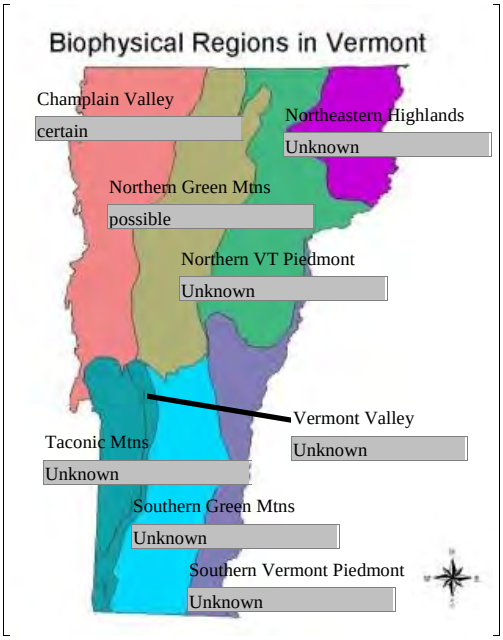
Final Assessment: High Priority

Global Rank: G5 **Global Trend:**
State Rank: S1? **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

No abundance trend data exists for Vermont populations; however, it is considered rare and/or a species in decline throughout much of its range, including Connecticut, Delaware, Maine, Maryland, Massachusetts, New York, North Carolina, Pennsylvania, Quebec, Rhode Island, South Carolina, and Virginia (Honeyfield and Ross 2004). Bridle shiner is reported to be extirpated from North and South Carolina, and disappearing from watersheds throughout most of its range (Sabo 2000). In Vermont, nine populations have been identified. With exception to the population reported to be in Lake Memphremagog, all populations are in the Lake Champlain watershed. Bridle shiner is a species sensitive to habitat degradation and alteration. Increased sedimentation and turbidity have been specifically identified as limiting factors. Reduction in aquatic plants either through water quality degradation or herbicide treatments also put the species at risk. Habitat lacking adequate refuge cover increase populations to predation.

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

This North American species occurs in the Atlantic drainage from southern Maine to Virginia, west through Lake Champlain to New York and the Lake Ontario basin (Scott and Crossman 1973). In Vermont, bridle shiner are found in Lake Champlain, several other locations within that watershed, and has been reported to occur in Lake Memphremagog.

Known Watersheds

Lake Champlain Canal

Lake Champlain Direct

Mississquoi River

Otter Creek

Possible Watersheds

Saint-Francois River

Common Name: **Bridle Shiner**
Scientific Name: **Notropis bifrenatus**
Species Group: **Fish**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

The bridle shiner is a species of quiet streams, lakes and ponds (Scott and Crossman 1973, Page and Burr 1991). Honeyfield and Ross (2004) describe its habitat as slow, warm backwater eddies of low gradient streams and ponds with dense vegetation and substrate of mud, sand or gravel. Spawning occurs in areas of calm water, at a depth of about two feet, and in openings within stands of dense emergent aquatic vegetation (Cornell web site). Holms et al. (1999) suggest bridle shiner require open water above aquatic plant stands to spawn. The species has a strong preference for clear water necessary for this daytime, sight-feeder to forage on prey organisms (Honeyfield and Ross 2004). It is tolerant of brackish water but is not acid tolerant (Holm et al. 1999).

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): -1
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial

Aquatic: Lacustrine

Aquatic: Lake Champlain

Aquatic: Large Lake Champlain Tribs Below Falls

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Habitat Fragmentation

Invasion by Exotic Species

Sedimentation

Description of habitat problem(s): Threats include stream channelization, erosion, point-source discharges, loss of riparian vegetation, and large-scale development all have been identified aspractices that have have been identified as practices that have increased turbidity and altered bridle shiner habitat where the species have become extirpated (Sabo 2000). Sedimentation and siltation are suspected as being major factors for the decline of bridle shiner in the Delaware River Basin (Honeyfield and Ross 2004). They also suggest the species may be vulnerable to highway construction activities which alter bridle shiner habitat including streamflow regimes, channel structure, water quality, and aquatic plant abundance. Being a sight-feeder turbid water conditions interfere with bridle shiner feeding and suppresses the growth of aquatic vegetation on which the fish is dependent for feeding, reproduction and cover (Holm et al. 1999). They also identify the spread of Eurasian milfoil as a potential problem to the species. This plant can alter the composition of the plant community by replacing native vegetation and invading the entire water column thereby eliminating clear water areas above the plants that are necessary for spawning (Sabo 2000).

Common Name: **Bridle Shiner**
Scientific Name: **Notropis bifrenatus**
Species Group: **Fish**

Non-Habitat Problems:

Genetics

Pollution

Predation or Herbivory

Description of non-habitat problem(s): Scott and Crossman (1973) state bridle shiner are an important forage species for pickerel as well as other piscivorus fishes (yellow perch, smallmouth bass, crappie) where these species co-exist. In some New England lakes and ponds, where significant reduction or removal of submersed aquatic plant stands has occurred, fish predators (e.g., bass) have decimated bridle shiner populations (Sabo 2000). Honeyfield and Ross (2004) state, that within the species range populations appear to be highly fragmented and declining with separation distances between known populations exceeding 200 km. They suggest this may have resulted in genetic divergence among populations, although this has not been investigated. This species is sensitive to sedimentation and chemical runoff from agricultural lands (Ontario's Biodiversity website). The bridle shiner is not tolerant of acidic water making it vulnerable to atmospheric deposition (Holm et al. 1999).

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	
Research	Basic Life History	Medium	
Research	Distribution and Abundance	High	Little quantitative data exists for Vermont populations; better distributional data is needed.
Research	Threats and Their Significance	High	
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	Monitoring program is recommended to assess changes in species abundance and distribution.
Monitoring	Habitat Change	High	Known populations, particularly those exposed to aquatic plant control activities, are in need of monitoring.
Monitoring	Monitor Threats	High	Known populations, particularly those exposed to aquatic plant control activities, are in need of monitoring.

Common Name: **Bridle Shiner**
Scientific Name: **Notropis bifrenatus**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Invasive Species Control & Prevention	High	Manage and/or control invasive aquatic vegetation taking into account bridle shiner habitat requirements.	Conduct investigations of the affects of aquatic plant control measures on populations. Number of aquatic vegetation control efforts executed which included measures to protect bridle shiner habitat.	VDEC, lake and watershed associations	
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, LCBP, lake and watershed associations	
Compatible Resource Use	Medium	Restrictions on bait fish harvest should be considered where bridle shiner populations are threatened with extirpation.	Number of at risk populations assessed and protected.	Commercial bait harvesters and dealers	
Habitat Restoration	High	Protect and restore lake, stream and riparian habitats via water quality and water level improvements; sediment reduction; shoreland buffers; and maintenance of habitat structure (e.g., large woody debris, aquatic vegetation).	Conduct investigations of the long term affects of aquatic plant control measures on bridle shiner populations. Number of known populations monitored for sustainability and habitat quality.	VDEC, NRCS, USFWS, academic institutions, lake and watershed associations	LCBP
Habitat Restoration	Medium	Maintain and restore aquatic organism passage at barriers (e.g., culverts) to provide access to critical habitats.	Number of culverts and dams evaluated for passage. Number of barriers removed or mitigated.	USFWS, VDEC, VTrans, town highway departments	
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore bridle shiner critical habitats.		VDEC, RPCs, lake and watershed associations, town planning and conservation commissions	

Common Name: **Bridle Shiner**
Scientific Name: **Notropis bifrenatus**
Species Group: **Fish**

Bibliography:

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Sabo, M. J. 2000. Threatened fishes of the world: Notropis bifrenatus (Cope, 1867) (Cyprinidae). Environmental Biology of Fishes 59:384.

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Common Name: **Blackchin Shiner**
Scientific Name: **Notropis heterodon**
Species Group: **Fish**

Conservation Assessment:

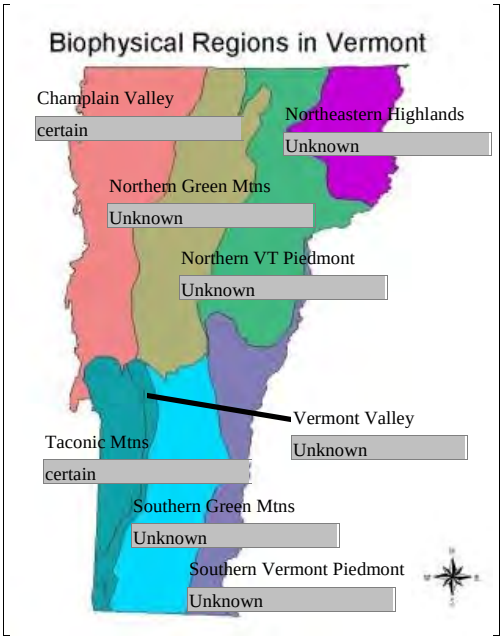
Final Assessment: High Priority

Global Rank: G5 **Global Trend:**
State Rank: S1 **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

The blackchin shiner has a very limited distribution in Vermont in that it is primarily restricted to the southern Lake Champlain watershed (5 identified populations) and a couple sites (2 populations) in the northern part of the watershed. Where it is found, the blackchin shiner does not occur in high abundance. This species is sensitive to habitat degradation and alteration. Increased sedimentation and turbidity have been specifically identified as limiting factors. Reduction in aquatic plants either through water quality degradation or herbicide treatments also put the species at risk. Habitat lacking adequate refuge cover increase populations to predation.

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

This North American species occurs only in the Great Lakes basin, the upper Mississippi River drainage, and downstream through the St. Lawrence River drainage into western Quebec (Scott and Crossman 1973). In Vermont, the species on the eastern edge of its distribution and if limited to a few locations within the Lake Champlain watershed.

Known Watersheds

Lake Champlain Canal

Lake Champlain Direct

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Trautman (1957) describes the blackchin shiner as a fish of glacial lakes and streams characterized by having very clear water, substrate of clean sand, gravel or organic debris, and the presence of dense beds of submersed vegetation. Scott and Crossman (1973) also note the species' preference for quiet pools in streams and weedy inshore areas of lakes. This shiner is also found in inlet and outlet streams of lakes (Becker 1983).

Common Name: **Blackchin Shiner**
Scientific Name: **Notropis heterodon**
Species Group: **Fish**

Scott and Crossman (1973) state "clear, clean, weedy waters are essential for the survival of the blackchin shiner," but little information has been reported on spawning site preference and behavior. This species is an indicator of good water quality.

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	200
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial

Aquatic: Lacustrine

Aquatic: Lake Champlain

Aquatic: Large Lake Champlain Tribs Below Falls

Aquatic: Man-Made Water Bodies

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Invasion by Exotic Species

Sedimentation

Description of habitat problem(s): The blackchin shiner is intolerant of silt. Trautman (1957) notes that it has disappeared from Ohio waters once they became turbid, silt covered the bottom, and the aquatic vegetation disappeared. The continuing expansion of the submersed exotic weed Eurasian milfoil in Vermont's lakes and ponds threatens blackchin shiner populations. Milfoil may displace native plant communities and alter the composition and fish habitat value of the aquatic plant community. Additionally the propensity for this invasive plant to establish dense beds impairing the use of some lakes for boating, swimming and fishing has resulted in the increased use of herbicides. Significant reduction in aquatic plant abundance could degrade habitat necessary for this species. One such herbicide in common use in Vermont is floridone (Sonar). The Michigan Environmental Science Board has concluded that this broad spectrum herbicide will not only control Eurasian milfoil but also significantly impact native aquatic plant species when applied at the labeled rate (Premo et al. 1999). Significant reduction in milfoil beds can subject blackchin shiner populations to increased predation pressure before native aquatic palnts become reestablished restoring cover habitat for the shiner.

Non-Habitat Problems:

Predation or Herbivory

Description of non-habitat problem(s): The blackchin shiner does not appear to be particularly abundant in any of the waters it is known to occur in Vermont. Aggressive aquatic plant control activities in these waters could significantly reduce this important refuge habitat and subject the shiner populations to increased predation.

Common Name: **Blackchin Shiner**
Scientific Name: **Notropis heterodon**
Species Group: **Fish**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	A greater understanding of the habitat requirements of this species is needed, especially the association with aquatic vegetation.
Research	Basic Life History	High	
Research	Distribution and Abundance	High	Little quantitative data exists for Vermont populations; better distributional data is needed.
Research	Threats and Their Significance	High	Impacts of aquatic plant control (e.g., herbicide and mechinical treatments) on blackchin habitat, biology, and aquatic community structure and function (e.g., species interactions, increased vulnerability to predation). Investigate and monitor these effects.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	Known populations, particularly those exposed to aquatic plant control activities, are in need of monitoring.
Monitoring	Habitat Change	High	Known populations, particularly those exposed to aquatic plant control activities, are in need of monitoring.
Monitoring	Monitor Threats	High	Known populations, particularly those exposed to aquatic plant control activities, are in need of monitoring.

Common Name: **Blackchin Shiner**
Scientific Name: **Notropis heterodon**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, LCBP, lake and watershed associations	
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore blackchin shiner critical habitats.		VDEC, RPCs, lake and watershed associations, town planning and conservation commissions	
Invasive Species Control & Prevention	High	Manage and/or control invasive aquatic vegetation taking into account habitat requirements of blackchin shiner.	Number of existing blackchin shiner populations protected and sustained.	VDEC, lake associations, town planning and conservation commissions	
Habitat Restoration	High	Protect and restore lake and riparian habitats via water quality and water level improvements; sediment reduction; shoreland buffers; and maintenance of in-water habitat structure (e.g., large woody debris, aquatic vegetation).	Number of existing blackchin shiner populations protected and sustained.	VDEC, USFWS, NRCS, lake and watershed associations	

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Trautman, M. B. 1957. The fishes of Ohio. The Ohio State University of Press, Columbus.

Cornell University web site: http://fish.dnr.cornell.edu/nyfish/Cyprinidae/blackchin shiner.html.

Common Name: **Blacknose Shiner**
Scientific Name: **Notropis heterolepis**
Species Group: **Fish**

Conservation Assessment:

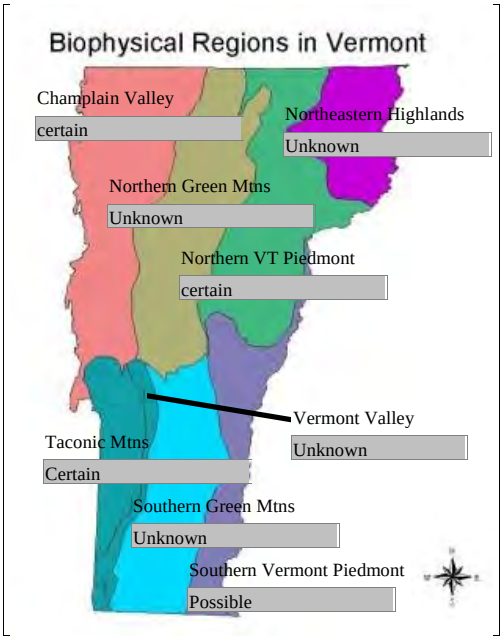
Final Assessment: High Priority

Global Rank: G4 **Global Trend:**
State Rank: S1 **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

The number of known blacknose shiner populations in Vermont is eight with all but one of these being in the Lake Champlain watershed. It has also been reported from Springfield Reservoir in Windsor County. Whether or not this single collection (one specimen) represents a population as removed as it is from other populations in the state is questionable. Blacknose shiner is a species sensitive to habitat degradation and alteration. Increased sedimentation and turbidity have been specifically identified as limiting factors. Reduction in aquatic plants either through water quality degradation or herbicide treatments also put the species at risk. Habitat lacking adequate refuge cover increase populations to predation.

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The blacknose shiner is a widely distributed species occurring from the Hudson Bay drainage to the New England states west to Iowa (Scott and Crossman 1973). In Vermont, it appear to be most frequently encountered in the Lake Champlain watershed, albeit there are a few occurrences from other locations within the state.

Known Watersheds

Lake Champlain Canal

Lake Champlain Direct

Mississquoi River

Winooski River

Possible Watersheds

CT-White River to Bellows Falls

Common Name: **Blacknose Shiner**
Scientific Name: **Notropis heterolepis**
Species Group: **Fish**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

The blacknose shiner is a species of clear, shallow water habitats in glacial lakes and small streams (Scott and Crossman 1973). Most recorded occurrences in Vermont (11 out of 13 records) have come from riverine habitats (R. Langdon, Vermont Department of Environmental Conservation, personal communication). The species does not appear to have any particular preference for substrate type, although Trautman (1957) states it has been found in waters with bottoms comprised of sand, gravel, muck, peat or organic debris. The presence of submersed vegetation is an important component of blacknose shiner habitat (Page and Burr 1991, Trautman 1957). Backlund (1995) reports the fish requires cool well-oxygenated water. This species is intolerant of sedimentation and turbid water (Backlund 1995, Eddy and Underhill 1974, Trautman 1957). This species is an important indicator of pristine, high quality waters (Backlund 1995). The biology and detailed habitat requirements of the blacknose shiner apparently have either been not thoroughly investigated or reported. Backlund (1995) states that the blacknose shiner is a host fish for the freshwater mussel cylindrical papershell Anodontoides ferussacianus, a state listed endangered species in Vermont.

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): -1
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial

Aquatic: Large Lake Champlain Tribs Below Falls

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Invasion by Exotic Species

Sedimentation

Description of habitat problem(s): Backlund (1995) states the blacknose shiner is intolerant of turbid, polluted waters and that in South Dakota it has disappeared from may streams due to sedimentation, loss of aquatic vegetation and food, water temperature increases, and lowered dissolved oxygen. Aquatic plant control also poses a problem to blacknose shiner populations. In Minnesota the removal of aquatic vegetation along lake shorelines and increase sedimentation and turbidity levels have reduced this species (Eddy and Underhill 1974).

Non-Habitat Problems:

Pollution

Predation or Herbivory

Common Name: **Blacknose Shiner**
Scientific Name: **Notropis heterolepis**
Species Group: **Fish**

Description of non-habitat problem(s): The blacknose shiner is reported to be intolerant of water pollution (Backlund 1995). Elimination of aquatic plant beds can expose this species to increased predation.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	A greater understanding of the habitat requirements of this species is needed, especially the association with aquatic vegetation.
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	Little quantitative data exists for Vermont populations; better distributional data is needed.
Research	Threats and Their Significance	High	Investigate and monitor the effects of aquatic vegetation control programs (e.g., Eurasian milfoil) on blacknose shiner populations.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	Known populations, particularly those exposed to aquatic plant control activities, are in need of monitoring.
Monitoring	Habitat Change	Medium	Known populations, particularly those exposed to aquatic plant control activities, are in need of monitoring.
Monitoring	Monitor Threats	High	Known populations, particularly those exposed to aquatic plant control activities, are in need of monitoring.

Common Name: **Blacknose Shiner**
Scientific Name: **Notropis heterolepis**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Invasive Species Control & Prevention	High	Manage and/or control invasive aquatic vegetation while taking into account the habitat requirements of blacknose shiner.	Number of existing blacknose shiner populations protected and sustained.	VDEC, lake and watershed associations, town planning and conservation commissions	
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, lake and watershed associations	
Habitat Restoration	High	Protect and restore lake and riparian habitats via water quality and water level improvements; sediment reduction; shoreland buffers; and maintenance of habitat structure (e.g., large woody debris, aquatic vegetation).	Number of existing blacknose shiner populations protected and sustained.	VDEC, lake and watershed associations, town planning and conservation commissions	
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore blacknose shiner critical habitats.		VDEC, lake and watershed associations, town planning and conservation commissions	

Common Name: **Blacknose Shiner**
Scientific Name: **Notropis heterolepis**
Species Group: **Fish**

Bibliography:

Backlund, D. 1995. The blacknose shiner. South Dakota Conservation Digest 62(2):18-19. Web site: http://www.sdgfp.info/WildlifeDiversity/Digest%20Articles/blacknose.htm.

Eddy, S., and J. C. Underhill. 1974. Northern fishes, with special reference to the upper Mississippi valley, 3rd edition. University of minnesota Press, Minneapolis.

Page, L. M., and B. M. Burr. 1991. A field guide to freshwatere fishes of North America north of Mexico. Houghton Mifflin Company, Boston.

Scott, W. B., and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries research board of Canada Bulletin 184, Ottawa.

Trautman, M. B. 1957. The fishes of Ohio. The Ohio State University of Press, Columbus.

Common Name: **Quillback**
Scientific Name: **Carpiodes cyprinus**
Species Group: **Fish**

Conservation Assessment:

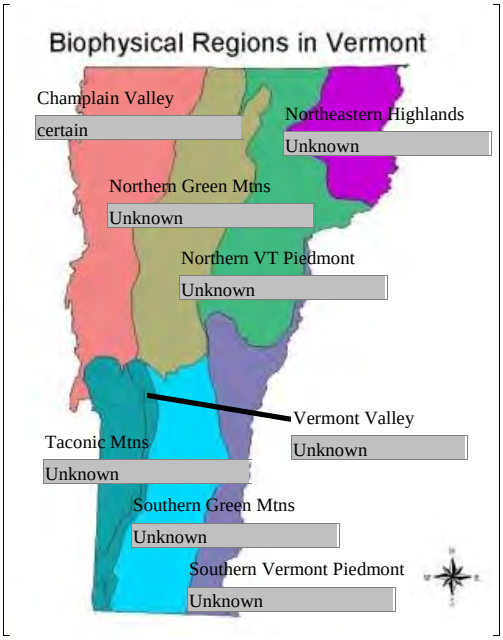
Final Assessment: High Priority

Global Rank: G5 **Global Trend:**
State Rank: S1 **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

In Vermont, the quillback is only know to occur in Lake Champlain and the lower reaches of a few of the lake's larger tributaries. It is rarely encountered and little is known of its abundance and habitat use within the lake. Historic accounts for this species in the suggest it has never been abundant there (Greeley 1930, VFGD 1963). Apparently little is known about this species biology, habitat requirements, and vulnerabilities which may shed light on reasons for its relative rarity in the state.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

This North American species occurs east from the St. Lawrence River south along the eastern seaboard to the Roanoke River in Virginia; west of the Appalachian Mountains through New York south to Alabama, west to Oklahoma, through eastern Kansas and the Dakotas, and west to central Alberta (Scott and Crossman 1973). In Vermont, quillback are limited to Lake Champlain and a few of the lake's larger tributaries as far upstream as the fall line (i.e., Missisquoi, Lamoille, Winooski rivers). The Vermont population is on the eastern edge of its North American range.

Known Watersheds

Lake Champlain Direct

Lamoille River

Mississquoi River

Winooski River

Common Name: **Quillback**
Scientific Name: **Carpiodes cyprinus**
Species Group: **Fish**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

The quillback is a demersal species inhabiting pools, backwaters and main channels of low gradient creeks to large rivers with substrate of sandy silt or sandy muck; they as well occur in lakes (Page and Burr 1991; Trautman 1957). Trautman (1957) also reported quillback inhabiting dredged ditches less than 3 m in width. During spawning season (April and May) quillback migrate to spawning areas, such as into streams and overflow areas at river bends or bays in lakes, where the eggs are randomly broadcast over sand or mud bottom substrate in quiet water (Scott and Crossman 1973). Quillback habitat ranges from clear lacustrine waters to turbid waters.

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	45
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lacustrine

Aquatic: Lake Champlain

Aquatic: Large Lake Champlain Tribs Below Falls

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Unknown Habitat Threats

Description of habitat problem(s): Very little is known about quillback biology (Scott and Crossman 1973), therefore it can be surmised that habitat problems are equally not well understood.

Non-Habitat Problems:

Reproductive Traits

Unknown Non-Habitat Threatss

Description of non-habitat problem(s): Life historty traits may be limiting but are unknown.

Common Name: **Quillback**
Scientific Name: **Carpiodes cyprinus**
Species Group: **Fish**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Identify habitat needs and availablility
Research	Basic Life History	High	Research life history traits.
Research	Distribution and Abundance	High	Better determine distribution and abundance.
Research	Threats and Their Significance	High	Identify factors limiting this species.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	Medium	
Monitoring	Monitor Threats	High	

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, Echo Center, LCBP	
Research	High	Research into quillback abundance and distribution in Lake Champlain; species habitat requirements and availability of habitat in the lake and its tributaries; life history; and threats is needed before conservation strategies can be developed.	Research projects implemented to address information needs.	Academic institutions	LCBP

Common Name: **Quillback**
Scientific Name: **Carpiodes cyprinus**
Species Group: **Fish**

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Web sites:
http://www.ben.umn.edu/research/fish/fishes/quillback.html.
http://www.dec.state.ny.us/website/dfwmr/fish/fishspecs/unu1text.htm1#quillback.
http://www.dnr.state.oh.us/wildlife/Fishing/aquanotes-fishid/quilback.htm.

Common Name: **Silver Redhorse**
Scientific Name: **Moxostoma anisurum**
Species Group: **Fish**

Conservation Assessment:

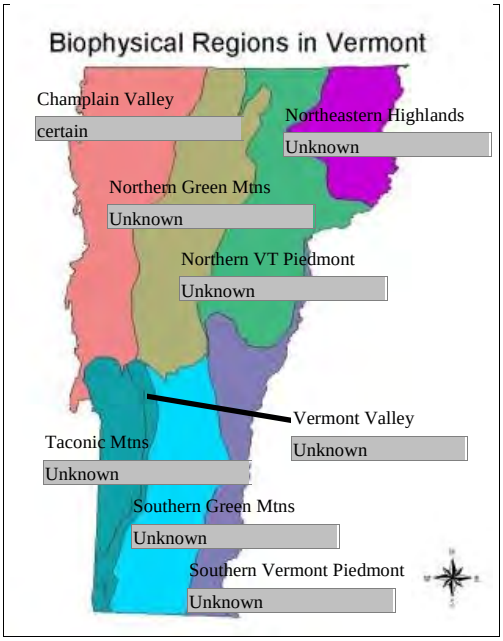
Final Assessment: High Priority

Global Rank: G5 **Global Trend:**
State Rank: SU **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Unknown

Assessment Narrative:

Vermont records indicate silver redhorse are found in Lake Champlain and the Poultney and Missisquoi rivers. Little is known about the species biology and habitat within these waters. Based on published accounts the species is vulnerable to habitat alteration, degradation and fragmentation. In Vermont, the species is on the eastern edge of its North American range.

Distribution:



Natural History Elements:

Home Range:
Migrant? Yes

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

A North American species which occurs east from the St. Lawrence River, south through central New York, southwest through the western half of the coastal states to northern Alabama, northwest through eastern Arkansas and Missouri, north through North Dakota, and into Saskatchewan and Alberta (Scott and Crossman 1973). In Vermont, the silver redhorse is on the eastern edge of its North American range and occurs only in Lake Champlain and up to the fall line in the Missisquoi and Poultney rivers.

Known Watersheds

Lake Champlain Direct

Mississquoi River

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

The silver redhorse is found in small to moderately-sized rivers and occasionally lakes. In rivers it prefers deep pools with some current (Meyer 1962). During their first year of life silver redhorses sometimes remain in small streams where they were hatched. This species avoids silty bottoms and may also be intolerant to general environmental degradation (Langdon et al. In press). Adult silver redhorse perform annual migrations to

Common Name: **Silver Redhorse**
Scientific Name: **Moxostoma anisurum**
Species Group: **Fish**

spawn. Seasonal movement patterns may prove important for successful spawning. Silver redhorse are early spawners and in their southern range breed from April through early May in water temperatures of 11-15 C. Spawning usually occurs in shallow riffles over gravel and cobble (Jenkins and Burkhead 1993). Silver redhorse feed on insect larvae, microcrustaceans, mollusks, algae, detritus, crayfishes, and the fry of shiners (Jenkins and Burkhead 1993).

General Habitat Preferences:

Minimum Elevation (m):	29
Maximum Elevation (m):	45
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lake Champlain

Aquatic: Large Lake Champlain Tribs Below Falls

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Habitat Fragmentation

Sedimentation

Description of habitat problem(s): Flow alteration, temperature alteration, or decreased habitat diversity (i.e. loss of deep pool habitat) will most likely have negative effects for different life stages of silver redhorse. Fragmentation of silver redhorse habitat may disrupt the seasonal movement patterns of this species. For example, these movement patterns may prove critical for successful reproduction, and therefore the completion of the species life cycle. Disruption to the spawning efforts of this species poses a problem to population viability (i.e. weak year classes over time compound negative influences and population declines). If the quantity or quality of silver redhorse habitat is limited in a system, then interconnected river reaches will prove necessary for this species to find and occupy optimal or suitable habitat. Loss of riparian vegetation, general construction activity, road maintenance activities (ditching, sanding), bridge and culvert construction, agriculture, timber harvest, dam failure, rapid drawdown of dam impoundments, streambank erosion, and shifts in channel form or location are sources of sediment for silver redhorse habitat. Controlling sediment input into streams may be crucial to prevent detrimental effects to silver redhorse, because sedimentation decreases the quality and quantity of optimal habitat (i.e. spawning, feeding) for this species. Sedimentation eliminates interstitial spaces which could be critical for egg deposition and development and for production of benthic organisms, such as aquatic insects, a source of food for silver redhorse. Sedimentation has been shown to cause loss or reduction in fish populations, and disrupt the feeding and reproductive activities of fishes (Berkman and Rabeni, 1987).

Non-Habitat Problems:

Pollution

Common Name: **Silver Redhorse**
Scientific Name: **Moxostoma anisurum**
Species Group: **Fish**

Description of non-habitat problem(s): Water pollution may indirectly influence silver redhorse through negative impacts to its prey base. Depletion of food items will negatively affect species growth and survival.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	Distribution, abundance and dynamics of greater redhorse populations in Vermont are poorly understood.
Research	Threats and Their Significance	Medium	
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	Medium	
Monitoring	Monitor Threats	Medium	Sediment and pollution

Common Name: **Silver Redhorse**
Scientific Name: **Moxostoma anisurum**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, Echo Center, LCBP, watershed associations	
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore silver redhorse critical habitats.		VDEC, RPCs, watershed associations, town planning and conservation commissions	
Habitat Restoration	High	Protect and restore in-stream and riparian habitats via water quality, flow and temperature improvements; sediment reduction; streamside buffers; and maintenance of in-stream habitat structure (e.g., large woody debris, deep pools).	Number of existing redhorse populations protected and sustained.	VDEC, USFWS, NRCS, watershed associations, hydroelectric power companies	
Habitat Restoration	High	Maintain or restore connectivity between and within riverine and lake habitats.	Number of projects where passage has been restored. Number of miles of restored silver redhorse habitat.	LCFWMC, USFWS, VDEC, VTrans, town highway departments, hydroelectric power companies, other dam owners	

Common Name: **Silver Redhorse**
Scientific Name: **Moxostoma anisurum**
Species Group: **Fish**

Natural Processes Restoration	High	Maintain or restore flow regimes that are suitable to silver redhorse.	Number of hydroelectric power dams that have flow requirements that provide suitable habitat for silver redhorse in their operating licenses. Number of miles of restored silver redhorse habitat downstream from dams.	LCFWMC, USFWS, VDEC, VFWD, FERC, towns, dam owners

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Jenkins, R. E., and N. M. Burkhead. 1993. Freshwater fishes of Virginia. American Fisheries Society, Bethesda, Maryland.

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Meyer, W. H. 1962. Life history of three species of redhorse (Moxostoma) in the Des Moines River, Iowa. Transactions of the American Fisheries Society 91(4):412-419.

Scott, W. B., and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184, Ottawa.

Common Name: **Shorthead Redhorse**
Scientific Name: **Moxostoma macrolepidotum**
Species Group: **Fish**

Conservation Assessment:

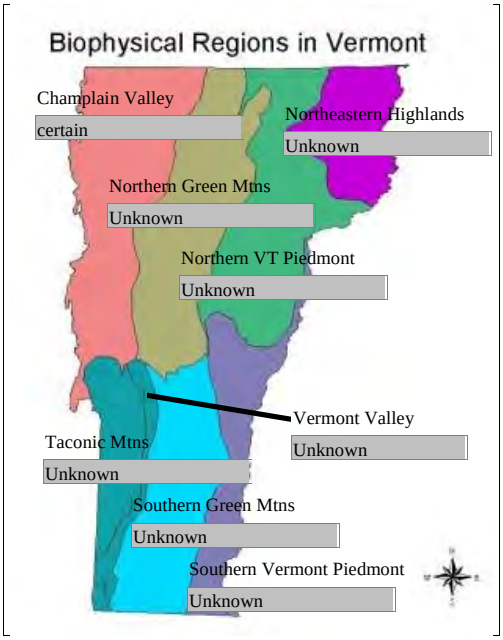
Final Assessment: Medium Priority

Global Rank: G5
Global Trend:
State Rank: SU
State Trend: Unknown
Extirpated in VT? No
Regionally Rare? Unknown

Assessment Narrative:

Vermont records indicate shorthead redhorse are found only in Lake Champlain and several of its larger tributaries. It is the more common of the three redhorse species occurring in the state. Virtually little is known about the species biology and habitat within these waters. Based on published accounts the species is vulnerable to habitat alteration, degradation and fragmentation. In Vermont, the species is on the eastern edge of its North American range.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The shorthead redhorse is the most widely distributed of the redhorse species in North America. It occurs from the upper St. Lawrence River, south into the Lake Champlain drainage to the coast in New York, east of the Appalachian Mountains to South Carolina, west through Pennsylvania and Ohio, southwest into Indiana and Arkansas, the Tennessee River drainage in Alabama, west to Texas, northwest through eastern Colorado and Montana, north to central Alberta, east to southern Hudson Bay and the east shore of James Bay (Scott and Crossman 1973). In Vermont, the species is on the eastern edge of its North American range and is confined to Lake Champlain and several large tributaries up to the fall line.

Known Watersheds

Lake Champlain Canal

Lake Champlain Direct

Common Name: **Shorthead Redhorse**
Scientific Name: **Moxostoma macrolepidotum**
Species Group: **Fish**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

This species prefers the clear water of small to large rivers and sometimes lakes. Most individuals have been observed holding or feeding in deep pools. It is found over clean sand, gravel, and cobble substrate, and is tolerant of water temperatures up to 37 C. It requires a silt-free habitat and is thought to be susceptible to many forms of water pollution (Langdon et al. In press). It is common to find this species living in the same areas as other redhorse species. In Vermont, the shorthead redhorse is restricted to the larger tributaries of Lake Champlain (Langdon et al. In press). The spawning period for shorthead redhorse occurs in spring from early April to early July, as influenced by local regional conditions (i.e. climate). Spawning water temperature is 11-21 C. Spawning occurs in slow and moderate runs and pools over large gravel (Jenkins and Burkhead 1993). Shorthead redhorse may perform spawning migrations to find optimal spawning habitat. Spawning groups of this species have been observed in streams where adults are normally not found except during breeding time (Jenkins and Burkhead 1993). Seasonal movement patterns may prove important for successful spawning. Shorthead redhorse is specialized to benthically feed on aquatic insects, small crustaceans, mollusks, algae, and detritus (Jenkins and Burkhead 1993). Highly silted or embedded substrate may preclude this species from consuming its preferred food items. Studies have shown that the principal, insect food items of redhorses are chironomids, ephemeropterans, and trichopterans (Meyer 1962).

General Habitat Preferences:

Minimum Elevation (m): 29
Maximum Elevation (m): 45
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lake Champlain

Aquatic: Large Lake Champlain Tribs Below Falls

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Habitat Fragmentation

Sedimentation

Description of habitat problem(s): Flow alteration, temperature alteration, or decreased habitat diversity (i.e. loss of deep pool habitat) will most likely pose negative effects for different life stages of shorthead redhorse. For instance, shallow, channel margin habitats that are indicative of slower velocities are important for young redhorses. Anthropogenic flow alteration has been shown to alter and limit this habitat, affecting juvenile life stages (Scheidegger and Bain, 1995). Fragmentation of shorthead redhorse habitat may disrupt the seasonal movement patterns of this species. For example, these movement patterns may

Common Name: **Shorthead Redhorse**
Scientific Name: **Moxostoma macrolepidotum**
Species Group: **Fish**

prove critical for successful reproduction, and therefore the completion of the species life cycle. Disruption to the spawning efforts of this species poses a problem to population viability (i.e. weak year classes over time compound negative influences and population declines). If the quantity or quality of shorthead redhorse habitat is limited in a system, then interconnected river reaches will prove necessary for this species to find and occupy optimal or suitable habitat. Loss of riparian vegetation, general construction activity, road maintenance activities (ditching, sanding), bridge and culvert construction, agriculture, timber harvest, dam failure, rapid drawdown of dam impoundments, streambank erosion, and shifts in channel form or location are sources of sediment for shorthead redhorse habitat. Controlling sediment input into streams may be crucial to prevent detrimental effects to shorthead redhorse, because sedimentation decreases the quality and quantity of optimal habitat (i.e. spawning, feeding) for this species. Sedimentation eliminates interstitial spaces which could be critical for egg deposition and development and for production of benthic organisms, such as aquatic insects, a source of food for shorthead redhorse. Sedimentation has been shown to cause loss or reduction in fish populations, and disrupt the feeding and reproductive activities of fishes (Berkman and Rabeni, 1987).

Non-Habitat Problems:

Pollution

Description of non-habitat problem(s): Water pollution may indirectly influence shorthead redhorse through negative impacts to its prey base. Depletion of food items will negatively affect species growth and survival.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	Distribution, abundance and dynamics of shorthead redhorse populations in Vermont are poorly understood.
Research	Threats and Their Significance	Low	
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	High	
Monitoring	Monitor Threats	High	Sedimentation and pollution

Common Name: **Shorthead Redhorse**
Scientific Name: **Moxostoma macrolepidotum**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Natural Processes Restoration	High	Maintain or restore flow regimes that are suitable to shorthead redhorse habitat.	Number of hydroelectric power dams that have flow requirements that provide suitable hab habitat for shorthead redhorse in their operating licenses. Number of miles of restored shorthead redhorse habitat downstream from dams.	LCFWMC, USFWS, VDEC, VFWD, FERC, towns, dam owners	
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore shorthead redhorse critical habitats.		VDEC, RPCs, watershed associations, town planning and conservation commissions	
Habitat Restoration	High	Maintain or restore connectivity between and within riverine and lake habitats.	Number of projects where passage has been restored. Number of miles of restored shorthead redhorse habitat.	LCFWMC, USFWS, VDEC, VTrans, town highway departments, hydroelectric power companies, other dam owners	
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, Echo Center, LCBP, watershed associations	

Common Name: **Shorthead Redhorse**
Scientific Name: **Moxostoma macrolepidotum**
Species Group: **Fish**

Habitat Restoration	High	Protect and restore in-stream and riparian habitats via water quality, flow and temperature improvements; sediment reduction; streamside buffers; and maintenance of in-stream habitat structure (e.g., large woody debris, deep pools).	Number of existing shorthead redhorse populations protected and sustained.	VDEC, USFWS, NRCS, watershed associations, hydroelectric power companies

Bibliography:

Berkman, H. E., and C. F. Rabeni. 1987. Effect of siltation on stream fish communities. Environmental Biology of Fishes 18(4):285-294.

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Scott, W. B., and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184, Ottawa.

Sheidegger, K. J., and M. B. Bain. 1995. Larval fish distribution and microhabitat use in free-flowing and regulated rivers. Copeia 1995(1):125-135.

Common Name: **Greater Redhorse**
Scientific Name: **Moxostoma valenciennesi**
Species Group: **Fish**

Conservation Assessment:

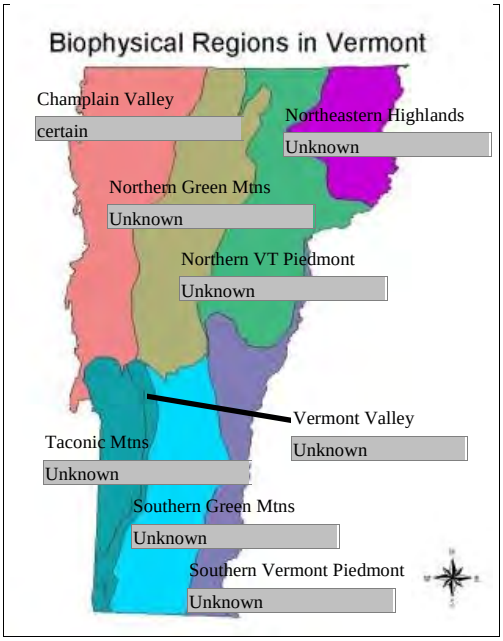
Final Assessment: High Priority

Global Rank: G4 **Global Trend:**
State Rank: SU **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

Vermont records indicate greater redhorse are found in northern Lake Champlain and the Missiquoi River. Virtually little is known about the species biology and habitat within these waters. Nonetheless, based on published accounts the species is vulnerable to habitat alteration, degradation and fragmentation. In Vermont, the species is on the eastern edge of its North American range.

Distribution:



Natural History Elements:

Home Range:
Migrant? Yes

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The greater redhorse is generally distributed in central and eastern North America primarily in the upper Mississippi and Great Lakes-St. Lawrence systems (Scott and Crossman 1979). This species has been recorded from northern Lake Champlain and the lower reach of the Missisquoi River (Langdon et al., In press). In Vermont, the species is on the eastern edge of its North American range.

Known Watersheds

Lake Champlain Direct

Mississquoi River

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

The greater redhorse inhabits medium to large rivers, large lakes and impoundments. It prefers coarse substrate, such as gravel, cobble, and boulders in clean water. In rivers, this species is frequently found in moderate to swift current in run or riffle habitat and may also be found in large river pools. Generally, it is not found in silty areas and is believed to be intolerant of silt and turbidity (Jenkins and Burkhead 1993). Spawning occurs in spring or summer in high velocity riffle habitat over gravel or cobble substrate that is silt free. Spawning has been found to occur in moderate stream velocities (3.8-116.9 cm/s) and at shallow depths

Common Name: **Greater Redhorse**
Scientific Name: **Moxostoma valenciennesi**
Species Group: **Fish**

(10-100 cm) (Healy 2002). Greater redhorse may perform annual migrations upstream to spawn and downstream after spawning. In an Ontario river, this species was observed dispersing up to 15 km downstream from its spawning habitat (Healy 2002). This species demonstrates important seasonal movement patterns. Different life stages have specific habitat preferences. Age-0 fish were found in shallow (20 cm), slow velocity pools (21 cm/s). Juvenile fish (greater than age-0 but not sexually mature) were found in slightly deeper pools (60-149 cm) and higher velocities (37 cm/s) (Healy 2002). The greater redhorse is a specialized benthic feeder such that highly silted or embedded substrate may preclude this species from consuming its preferred food items.

General Habitat Preferences:

Minimum Elevation (m): 29
Maximum Elevation (m): 45
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lake Champlain

Aquatic: Large Lake Champlain Tribs Below Falls

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Habitat Fragmentation

Sedimentation

Unknown Habitat Threats

Description of habitat problem(s): Flow alteration, temperature alteration, or low habitat diversity (i.e., loss of deep pool habitat, shallow riffles, or large woody debris due to human-induced change) will most likely pose negative effects for different life stages of greater redhorse. For instance, shallow channel margin habitats that are indicative of slower velocities are important for young redhorses. Flow alteration has been shown to alter and limit this habitat for juvenile life stages (Scheidegger and Bain 1995). Fragmentation of greater redhorse habitat may disrupt the seasonal movement patterns of this species. For example, these movement patterns may prove critical for successful reproduction, and therefore the completion of the species life cycle. Viability of greater redhorse populations most likely depends on optimal habitat availability (i.e., optimal or suitable depths, velocities, substrate, temperature, and flow regimes). Some evidence suggests that greater redhorse presence and abundance are correlated with longer contiguous river reaches (Healy 2002). If the quantity and quality of greater redhorse habitat is limited in a system, then interconnected river reaches will prove necessary for this species to find and occupy optimal or suitable habitat. Loss of riparian vegetation, general construction activities, road maintenance activities (ditching, sanding), bridge and culvert construction, agriculture, timber harvest, dam failure, rapid drawdown of dam impoundments, streambank erosion, and shifts in channel form or location are sources of sediment into greater redhorse habitat. Controlling sediment input into streams may be crucial to prevent detrimental effects to greater redhorse, because sedimentation decreases the quality and quantity of optimal

Common Name: **Greater Redhorse**
Scientific Name: **Moxostoma valenciennesi**
Species Group: **Fish**

habitat (i.e., spawning , feeding) for this species. Sedimentation eliminates interstitial spaces which could be critical for egg deposition and development and for production of benthic organisms, a primary food source for greater redhorse. Specialized benthic feeders, such as greater redhorse, represent a very ecologically vulnerable group to increased sedimentation, because they are unable to modify their feeding habits. Sedimentation has been shown to cause loss or reduction in fish populations, and disrupt the feeding and reproductive activities of fish (Berkman and Rabeni 1987). The greater redhorse seems to be rare over the majority of its range (Healy 2002). Determining the primary mechanism behind this trend is a challenge. Unknown habitat problems may exist.

Non-Habitat Problems:

Pollution

Description of non-habitat problem(s): The reproductive strategy of the greater redhorse is a crucial aspect to its conservation. It becomes sexually mature at a late age, is highly fecund, and spawns seasonally. Disruption to the spawning efforts of this species poses a problem to population viability (i.e., week year classes over time compound negative influences and population declines). Water pollution may indirectly influence greater redhorse through negative impacts on its prey base. Depletion of food items will negatively affect species growth and survivial.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	Distribution, abundance and dynamics of greater redhorse populations in Vermont are poorly understood.
Research	Threats and Their Significance	High	
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	High	
Monitoring	Monitor Threats	High	Sediment and pollution

Common Name: **Greater Redhorse**
Scientific Name: **Moxostoma valenciennesi**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration	High	Maintain or restore connectivity between and within riverine and lake habitats.	Number of projects where passage has been restored. Number of miles of restored greater redhorse habitat.	LCFWMC, USFWS, VDEC, VTrans, town highway departments, dam owners	
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, Echo Center, LCBP, watershed associations	
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore greater redhorse critical habitats.		VDEC, RPCs, watershed associations, town planning and conservation commissions	
Natural Processes Restoration	High	Restore and/or maintain flow regimes that are suitable to greater redhorse habitat.	Number of hydroelectric power dams that have flow requirements that provide suitable habitat for greater redhorse in their operating licenses. Number of miles of restored greater redhorse habitat downstream from dams.	LCFWMC, USFWS, VDEC, hydroelectric power companies, watershed associations	
Habitat Restoration	High	Protect and restore in-stream and riparian habitats via water quality, flow and temperature improvements; sediment reduction; streamside buffers; and maintenance of in-stream habitat structure (e.g., large woody debris, deep pools).	Existing populations of greater redhorse are sustained.	VDEC, USFWS, NRCS, watershed associations	

Common Name: **Greater Redhorse**
Scientific Name: **Moxostoma valenciennesi**
Species Group: **Fish**

Bibliography:

Berkman, H. E., and C. F. Rabeni. 1987. Effect of siltation on stream fish communities. Environmental Biology of Fishes 18(4):285-294.

Healy, B. 2002. Conservation assessment for the greater redhorse (Moxostoma valenciennesi). U. S. Department of Agriculture, Forest Service, Eastern Region.

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Scott, W. B., and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184, Ottawa.

Sheidegger, K. J., and M. B. Bain. 1995. Larval fish distribution and microhabitat use in free-flowing and regulated rivers. Copeia 1995(1):125-135.

Common Name: **Stonecat**
Scientific Name: **Noturus flavus**
Species Group: **Fish**

Conservation Assessment:

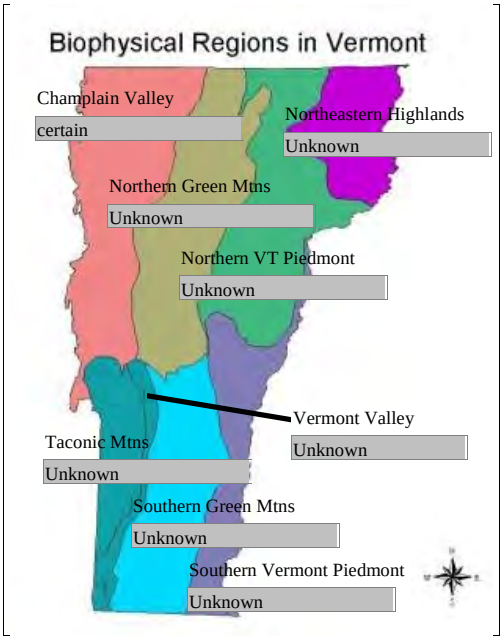
Final Assessment: High Priority

Global Rank: G5 **Global Trend:**
State Rank: S1 **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

The stonecat is a state listed endangered species in Vermont with two known populations in the state. One population occurs in a very short section of the river encompassing habitat immediately below and above the fall line. Population monitoring suggests the population has been declining due to unidentified causes. The other population was only recently discovered (October 2004) in Hungerford Brook, a tributary of the Missisquoi River. Little in currently known about the distribution and abundance of stonecat in that stream which warrants further investigation. Both populations is particularly vulnerable to habitat alteration and degradation. In Vermont, the species is on the eastern edge of its North American range.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

This is a North American species with a distribution described by Scott and Crossman (1973) as the St. Lawrence River and tributaries in Quebec, south in the Hudson, Allegheny and Mohawk systems in New York, west to the Appalachian Mountains, to western North Carolina and northern Alabama (Tennessee River), north through central Tennessee, west through northern Missouri, Kansas and northeastern Colorado, Wyoming to Alberta, east through North Dakota into Manitoba, southeast through the tip of Lake Superior to central Michigan, and into southern Ontario and Quebec (Scott and Crossman 1973). Only two populations of stonecat is known to occur in Vermont. One population is located within a relatively short reach of the LaPlatte River immediately above and below the fall line; and the second is in Hungerford Brook, a tributary of the Missisquoi River. In Vermont, the species is on the eastern edge of its North American range.

Known Watersheds

Lake Champlain Direct

Common Name: **Stonecat**
Scientific Name: **Noturus flavus**
Species Group: **Fish**

Mississquoi River

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☑ Regional Literature ☐ General Literature ☐

The stonecat prefers moderate currents of medium to large rocky-bottomed streams. It is absent, however, from high gradient streams with fast currents. It is also found in lakes near gravel shoals where the current is produced by wave action. The stonecat appears to require a current to prosper, since it has been eliminated from streams where flows have been slowed by the construction of dams. It appears to be intolerant to siltation and general habitat degradation. The stonecat is a state listed endangered species in Vermont with one known population in the state. This population is in a very short section of the river encompassing habitat immediately below and above the fall line. Population monitoring suggests the population has been declining due to unidentified causes. It appears from the literature and Vermont data from the LaPlatte River that this species requires moderate current and a low silt, coarse substrate. Stonecat prefer to use large cobble and boulders for hiding. The combination of habitat requirements of low silt, moderate current, and large substrate represent a somewhat restrictive combination within the Champlain Valley biophysical region.

General Habitat Preferences:

Minimum Elevation (m): 29
Maximum Elevation (m): 45
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial

Aquatic: Large Lake Champlain Tribs Below Falls

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Sedimentation

Description of habitat problem(s): It has been reported that this species is sensitive to siltation but the exact mechanism of impact is not known. It may be that siltation covers the developing eggs; however, this may not be a problem, since parents are cavity nesters, preparing the nest and providing care for the young. Or, siltation may embed coarse substrate materials eliminating cover habitat and nesting sites. Since in Vermont the stonecat is only found in the LaPlatte River and Hungerford Brook, a primary conservation consideration is the limiting of upstream land use activities that increase siltation in moderate gradient habitats.

Non-Habitat Problems:

Genetics

Common Name: **Stonecat**
Scientific Name: **Noturus flavus**
Species Group: **Fish**

Loss of Prey Base

Description of non-habitat problem(s): Stonecat is a benthic insectivore, specializing in aquatic insects. Excess sedimentation can impact aquatic insects populations and reduce this species' food base. This species would have difficulty shifting to non-benthic foods. Because stonecat has one of the most restricted distributions of any other fish species in Vermont, reductions in population size causing a bottleneck which could possibly result in a loss of genetic variation forfeiting the evolutionary potential of the species. Natural selection can only act in the presence of genetic variation, and therefore, the higher the genetic diversity in a population, the higher the likelihood for population persistence. If gene flow is limited to within one population of stonecat (estimated number probably much less than 100 individuals), the species is not prepared to adapt to environmental changes of time.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Comparative studies of habitat ocupied by the more abundant New York populations to LaPlatte River habitat.
Research	Basic Life History	High	
Research	Distribution and Abundance	Low	
Research	Threats and Their Significance	Low	
Research	Population Genetics	Medium	Investigate genetic characteristics of the LaPlatte River stonecat population and genetic similarity to populations in New York.
Research	Taxonomy	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	Medium	
Monitoring	Monitor Threats	High	

Common Name: **Stonecat**
Scientific Name: **Noturus flavus**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, Echo Center, LCBP, watershed associations	
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore stonecat critical habitats.		VDEC, RPCs, watershed associations, town planning and conservation commissions	
Invasive Species Control & Prevention	High	Manage potential non-target impacts of the Lake Champlain sea lamprey control program on stonecat populations.	Number of existing stonecat populations protected and sustained.	LCFWMC, USFWS, VDEC	
Habitat Restoration	High	Protect and restore in-stream and riparian habitats via water quality, flow and temperature improvements; sediment reduction; streamside buffers; and maintenance of in-stream habitat structure (e.g., unembedded coarse substrate).	Number of existing stonecat populations protected and sustained.	VDEC, LCFWMC, USFWS, watershed associations, town planning and conservation commissions	LCBP

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Walsh, S. J., and B. M. Burr. 1985. The biology of the stonecat, Noturus flavus (Siliforms: Ictaluridae) in central Illinois and Missouri streams and comparisons with Great lakes populations and congeners. Ohio Journal of Science 85:85-96.

Common Name: **Redbreast Sunfish**
Scientific Name: **Lepomis auritus**
Species Group: **Fish**

Conservation Assessment:

Final Assessment: Medium Priority

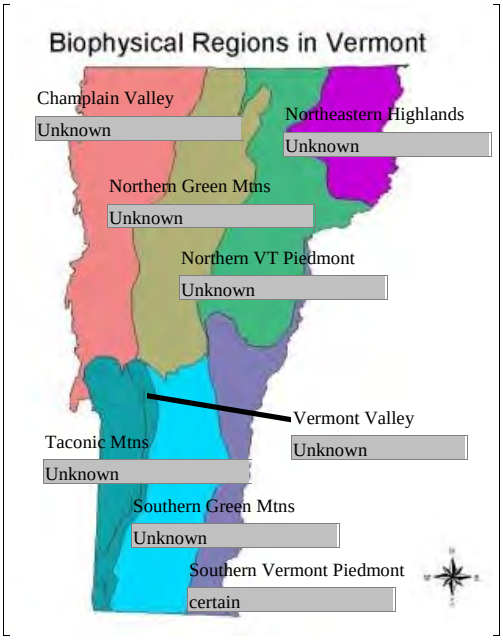
Global Rank: G5
State Rank: S4
Extirpated in VT? No

Global Trend:
State Trend: Unknown
Regionally Rare? No

Assessment Narrative:

At this time the redbreast sunfish is not listed as endangered or threatened in any New England state nor has it been federally listed. In Canada, it only occurs in New Brunswick (at the northern extreme of its distribution) and has been designated as a species at risk by the Committee on the Status of Endangered Wildlife. Very little is known about the limiting factors detrimental to this species in Vermont. Its spotty distribution in the state and that it is ecountered relatively infrequently even within the waters where it is known to occur warrants investigating the status of these populations, evaluation of its habitat, and identification of possible limiting factors.

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The redbreast sunfish occurs along the Atlantic Slope from New Brunswick to Florida. It is also found in Gulf Coast drainages in Georgia and Florida, north into Kentucky and Arkansas. In Vermont , redbreast sunfish are found in the Connecticut River and lakes Morey and Fairlee (Orange County) and the Black River (Windsor County). Historically, the species has been recorded from New York waters within the Lake Champlain drainage (e.g., Lake George and its outlet, the Mettawee River and Little Chazy River) (Greeley 1930); however, no records, past or present, are known from Lake Champlain.

Known Watersheds

CT-Ashuelot River

CT-Bellows Falls Dam to Vernon Dam

CT-Waits River to White River

CT-White River to Bellows Falls

Common Name: **Redbreast Sunfish**
Scientific Name: **Lepomis auritus**
Species Group: **Fish**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

This species inhabits the shores of lakes and ponds, and pools of clear streams with little current, but unlike other Vermont sunfishes it is more of a stream-adapted species. Aho and Terrell (1986) report cover, current velocity, and variables correlated with velocity (e.g., gradient, riffle/pool ratios) to be major factors determining the distribution and abundance of redbreast sunfish in riverine systems. Both juveniles and adults are usually found in shallow water near cover, although fish may occupy deeper habitats under warmwater summer conditions and during winter. Important cover include fallen trees, stumps and aquatic vegetation. These hard structures appear to be important habitat components for spawning site selection. Additionally, hard structures have been attributed to being the substrate producing more than 60% of the food organisms consumed by sunfish species, including redbreast sunfish. Scarola (1973) states redbreast sunfish can be found over gravelly bottoms with or without vegetation; however, unlike the pumpkinseed, it does not rely as much on there being aquatic vegetation present. Aho and Terrell (1986) quantify variables critical to habitat suitability models in both lotic and lentic environments for redbreast sunfish. Water temperatures regarded as suitable for growth and survival of adult and juvenile fish are assumed to be in the range of 15-35 C; for spawning and incubation the optimal range is assumed to be 21.1-27.2 C. Nests are generally constructed at depths less than 1.5 m. Water velocities at nest sites are less than 0.06 m/s with an average of 0.02 m/s. Based on available information for other sunfish species, 25-70% hard structure cover is estimated to be most productive for redbreast sunfish. This species appears to require a mixture of coarse sand and gravel substrate at spawning sites to be successful.

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Lacustrine
Aquatic: Lower CT River

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Description of habitat problem(s): Abundance of hard structures for cover are critical components of redbreast sunfish habitat. Removal of such cover or inadequate structure being recruited into lakes and streams (e.g., from forested riparian areas) may negatively affect the suitability of habitat for this species. It may be sensitive to acidity (i.e., long term pH values <4.0), but is tolerant of high temperatures (<35 C) (Aho and Terrell 1987). Rapid reductions in water level of more than 0.9 m during the spawning season may adversely affect embryo development and survival (Aho and Terrell 1987).

Common Name: **Redbreast Sunfish**
Scientific Name: **Lepomis auritus**
Species Group: **Fish**

Non-Habitat Problems:

Pollution

Description of non-habitat problem(s): Aho and Terrell (1987) identify several potential threats to this species. Low to moderate turbidity levels are suitable to this species; however, excessive levels may impact fish growth and abundance. Pesticide contamination of waters supporting redbreast sunfish has been a suspected cause for the observed decline of some populations.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	1) Determine its distribution in Vermont waters. It may be present in more streams of suitable habitat in the Connecticut Valley than is presently known. 2) The spatial extent of its presence in the Connecticut River and its larger tributaries should also be examined.
Research	Threats and Their Significance	Low	Evaluate and monitor pesticide levels in known populations of redbreast sunfish.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	Medium	Monitor known populations.
Monitoring	Habitat Change	Low	
Monitoring	Monitor Threats	Medium	

Common Name: **Redbreast Sunfish**
Scientific Name: **Lepomis auritus**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration	High	Protect and restore stream, lake and riparian habitats via water quality, flow and water level regime improvements; sediment reduction; streamside buffers; and maintenance of habitat structure.		VDEC, USFWS, NRCS, CRJC, RPCs, lake and watereshed associations, town planning commissions	
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, CRJC, TNC, lake and watershed associations	
Natural Processes Restoration	High	Protect natural riverine flow regimes or lake water levels from artificial regulation detrimental to redbreast sunfish habitat; restore habitat conditions where problems are identified.		VDEC, CRJC, RPCs, lake and watereshed associations, town planning and conservation commissions, hydroelectric power companies, other dam owners	Hydroelectric power companies, other dam owners
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore redbreast sunfish critical habitats		VDEC, RPCs, lake and watershed associations, town planning and conservation commissions	

Common Name: **Redbreast Sunfish**
Scientific Name: **Lepomis auritus**
Species Group: **Fish**

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Jenkins, R.E., and N.M. Burkhead. 1993 Freshwater fishes of Virginia. American Fisheries Society, Bethesda Maryland

Common Name: **Eastern Sand Darter**
Scientific Name: **Ammocrypta pellucida**
Species Group: **Fish**

Conservation Assessment:

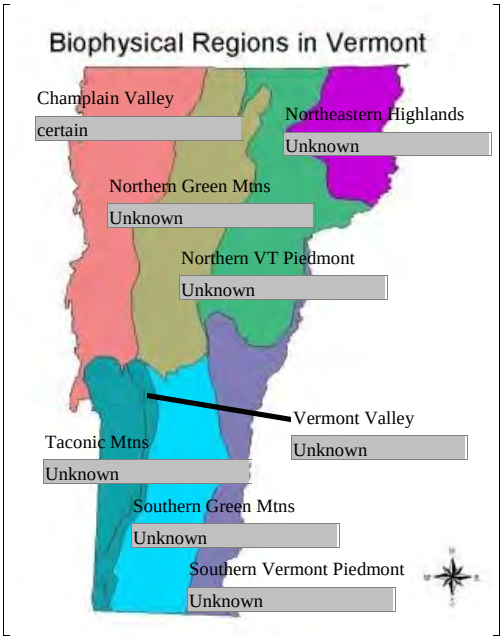
Final Assessment: High Priority

Global Rank: G3 **Global Trend:**
State Rank: S1 **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

In Vermont, the eastern sand darter is a state listed threatened species. All identified populations occur below the Lake Champlain fall line in the Missisquoi, Lamoille, Winooski and Poultney rivers. One exception is the recent collection of the species above the fall line on the Winooski River. Populations are at some risk due to the use of lampricides to control sea lamprey in Lake Champlain and tributaries. Other limiting factors are sedimentation of habitat, deteriorating water quality and flow regime alterations, such as associated with hydroelectric power generation facilities.

Distribution:



Natural History Elements:

Home Range: N/A
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Eastern sand darters range from the St. Lawrence River drainage, southern Quebec, Vermont and New York; through the Great lakes and Ohio River basins from western New York to eastern Illinois; and south to Kentucky (Page and Burr 1991). In Vermont, populations are known to occur below the fall line in the Missisquoi, Lamoille, Winooski, and Poultney rivers. There is one recent occurrence of the species being collected from above the fall line on the Winooski River. One individual has also been collected in Lake Champlain at the mouth of the Lamoille River in Malletts Bay. In Vermont, this species is on the eastern edge of its range.

Known Watersheds

Lake Champlain Canal

Lamoille River

Mississquoi River

Winooski River

Common Name: **Eastern Sand Darter**
Scientific Name: **Ammocrypta pellucida**
Species Group: **Fish**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

The eastern sand darter shows a strong preference for sandy areas of rivers and streams with slow to moderate currents, where it spends most of its time burrowed into the sand with only its eyes or head protruding. It has also been reported from sandy shoals in Lake Erie, but has not been reported in Lake Champlain, except for one individual at the mouth of the Lamoille River in Malletts Bay. The eastern sand darter requires medium to fine sand, so water velocity and sedimentation are important factors in habitat suitability. Habitat use and preference studies indicate that the fish use areas with a large percentage of sand particles 0.23 to 1 mm in size. It is quite sensitive to sedimentation and poor water quality.

General Habitat Preferences:

Minimum Elevation (m): 29
Maximum Elevation (m): 45
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Large Lake Champlain Tribs Below Falls

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Sedimentation

Description of habitat problem(s): The range of the eastern sand darter is believed to be shrinking due to the loss of clean sand habitat caused by increased siltation from soil erosion and agricultural activities. Hydroelectric power generation should be regulated to maintain suitable flows and habitat.

Description of non-habitat problem(s): The Lake Champlain Fish and Wildlife Management Cooperative is currently involved in a sea lamprey control program that includes the use of lampricides to kill stream resident lamprey larvae. Bioassay LCD levels on eastern sand darter have determined.

Common Name: **Eastern Sand Darter**
Scientific Name: **Ammocrypta pellucida**
Species Group: **Fish**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Determination of optimal microhabitat requirements (e.g., depth, velocity and substrate).
Research	Basic Life History	High	
Research	Distribution and Abundance	High	Increase sampling efforts in rivers with known populations, including sampling beyond known areas of occurrence.
Research	Threats and Their Significance	High	Effects of limiting factors (e.g., hydrogeneration) on habitat, and the long term effects of lampricide treatment on populations.
Research	Population Genetics	High	How closely are Vermont populations linked genetically to one another and to other populations located outside of the state.
Research	Taxonomy	Low	
Research	Other Research	Medium	Diet studies.
Monitoring	Population Change	High	
Monitoring	Habitat Change	Medium	
Monitoring	Monitor Threats	High	

Common Name: **Eastern Sand Darter**
Scientific Name: **Ammocrypta pellucida**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore eastern sand darter critical habitats.		VDEC, RPCs, watershed associations, town planning and conservation commissions	
Habitat Restoration	High	Protect and restore stream and riparian habitats via water quality and flow regime improvements; sediment reduction; streamside buffers; and maintenance of habitat structure.		VDEC, USFWS, NRCS, RPCs, TNC, watershed associations, town planning and conservation commissions	
Natural Processes Restoration	High	Restore and/ormaintain flow regimes that are suitable to eastern sand darter.	Number of hydroelectric power projects operating with flow regimes compatible with eastern sand darter habitat requirements.	VDEC, LCFWMC, USFWS, TNC, hydroelectric power companies	
Invasive Species Control & Prevention	High	Manage potential non-target impacts of the Lake Champlain sea lamprey control program on eastern sand darter.	Number of existing populations of eastern sand darter protected and/or sustained.	LCFWMC, USFWS, VDEC	
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, Echo Center, LCBP, watershed associations	

Common Name: **Eastern Sand Darter**
Scientific Name: **Ammocrypta pellucida**
Species Group: **Fish**

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Common Name: **Eastern Sand Darter**
Scientific Name: **Ammocrypta pellucida**
Species Group: **Fish**

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Common Name: **Channel Darter**
Scientific Name: **Percina copelandi**
Species Group: **Fish**

Conservation Assessment:

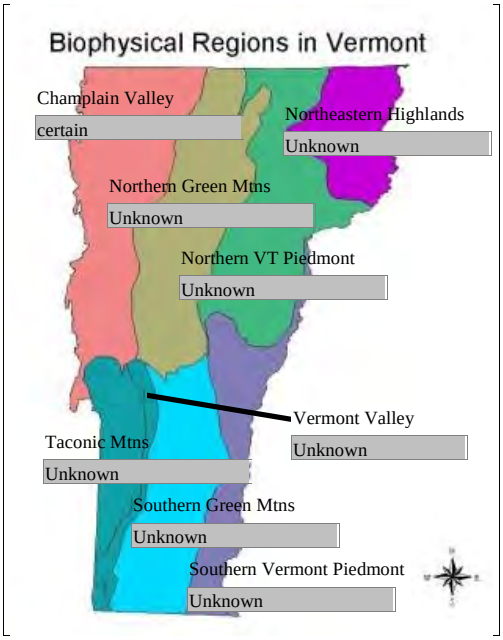
Final Assessment: High Priority

Global Rank: G4 **Global Trend:**
State Rank: S1 **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

In Vermont, the channel darter is a state listed endangered species. All identified populations occur below the Lake Champlain fall line in the Winooski, LaPlatte and Poultney rivers. Populations are at some risk due to the use of lampricides to control sea lamprey in Lake Champlain and tributaries. Other limiting factors are sedimentation of habitat and flow regime alterations, such as associated with hydroelectric power generation facilities.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

This is a wide ranging species but is highly localized in the St. Lawrence, Great Lakes and Mississippi River drainages from southern Quebec and Vermont, south to northern Louisiana; along the Gulf Slope in Mobile, Pascagoula and Pearl River drainages (Page and Burr 1991). In Vermont, the species is on the eastern edge of its range with populations known to occur below the fall line in the Winooski, LaPlatte and Poultney rivers. There is a historic record from Lake Champlain on the New York side (Greeley 1930); however, no occurrences have been made within the Vermont portion of the lake.

Known Watersheds

Lake Champlain Canal

Lake Champlain Direct

Winooski River

Common Name: **Channel Darter**
Scientific Name: **Percina copelandi**
Species Group: **Fish**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

The channel darter is a bottom dweller of gravelly or sandy shoals of warm lakes and rivers. In rivers, it is found in areas with coarse sand and gravel substrate. These areas have low to moderate current, but enough water velocity to prevent silt deposition. Channel darters are found in areas with substrates composed of gravel and sand. Preferred habitat is low in sediments and turbidity. Some studies of spawning in rivers and aquaria indicate that channel darters require swift currents (0.03-0.04 m/sec) presumably with gravel substrate.

General Habitat Preferences:

Minimum Elevation (m):	29
Maximum Elevation (m):	45
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Large Lake Champlain Tribs Below Falls

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Sedimentation

Description of habitat problem(s): Channel darters are limited by the loss of clean gravel substrate resulting from increased siltation and turbidity from soil erosion and agricultural activities. Alteration of river flow regimes from hydroelectric power generation may also degrade habitat quality.

Description of non-habitat problem(s): The Lake Champlain Fish and Wildlife Management Cooperative is currently involved in a sea lamprey control program that includes the use of lampricides to kill stream resident lamprey larvae.

Common Name: **Channel Darter**
Scientific Name: **Percina copelandi**
Species Group: **Fish**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	Increase sampling efforts in rivers with known populations, including sampling beyond known areas of occurrence.
Research	Threats and Their Significance	High	
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	High	
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	High	Monitor impacts of sea lamprey control in the Lake Champlain watershed on channel darter populations.

Common Name: **Channel Darter**
Scientific Name: **Percina copelandi**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, Echo Center, LCBP, watershed associations	
Habitat Restoration	High	Protect and restore stream and riparian habitats via water quality and flow regime improvements; sediment reduction; streamside buffers; and maintenance of habitat structure.		VDEC, USFWS, NRCS, RPCs, TNC, watershed associations, town planning and conservation commissions	
Invasive Species Control & Prevention	High	Manage potential non-target impacts of the Lake Champlain sea lamprey control program on channel darter.	Number of existing populations of channel darter protected and/or sustained.	LCFWMC, USFWS, VDEC	
Compatible Resource Use	High	Participate in existing regulatory processes (Act 250, stream alteration permitting, etc.) to protect and restore channel darter critical habitats		VDEC, RPCs, watershed associations, town planning and conservation commissions	
Natural Processes Restoration	High	Restore and/or maintain flow regimes suitable to channel darter below hydroelectric projects.	Number of hydroelectric power projects operating with flow regimes compatible with channel darter habitat requirements.	VDEC, LCFWMC, USFWS, TNC, hydroelectric power companies	

Bibliography:

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Page, L. M., and B. M. Burr. 1991. A guide to freshwater fishes of North America north of Mexico. Houghton Mifflin Company, Boston.

Common Name: **Sauger**
Scientific Name: **Sander canadense**
Species Group: **Fish**

Conservation Assessment:

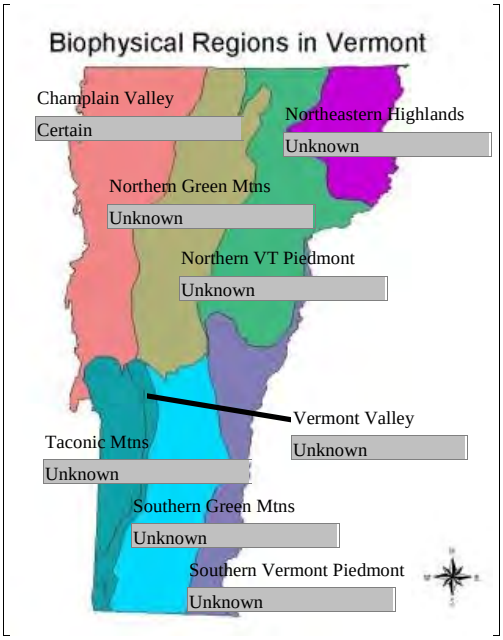
Final Assessment: High Priority

Global Rank: G5 **Global Trend:**
State Rank: S4S5 **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

In Vermont, sauger occur only in Lake Champlain, where generally they are believed to be more abundant in the southern portion of the lake than northern. Anderson (1978) reported sauger to be present in all sections of the lake except for the Main Lake. While similar to the walleye in appearance and biology, this species has attracted little attention in Vermont and, therefore, little is known about its population here. It has been reported to have been more frequently encountered in the past than at the present time based on general observations made during ice fishing creel surveys (C. Mackenzie, Vermont Department of Fish and Wildlife, personal communication). Sauger have declined in abundance and distribution across its North American range (Rawson and Scholl 1978; Hesse 1994; Pegg et al. 1977).

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The distribution of sauger in North America is from the St. Lawrence-Lake Champlain system south, west of the Appalachian Mountains to Tennessee River in Alabama, southwest to northern Louisiana, northwest through eastern Oklahoma to central Montana and central Alberta east below James Bay to Quebec (Scott and Crossman 1998). The distribution of sauger in Vermont is limited to Lake Champlain, where it may have been more numerous in the southern portion of the lake. Anderson (1978) reported sauger to be present in all sections of the lake except for the Main Lake.

Known Watersheds

Lake Champlain Canal

Common Name: **Sauger**
Scientific Name: **Sander canadense**
Species Group: **Fish**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Many of the general habitat requirements are similar between sauger and walleye; however, sauger habitat preferences are for large, shallow sections of lakes which are turbid with colloidal clay suspension, as well as large, turbid, slow flowing rivers (Anderson 1978; Scott and Crossman 1978). Scott and Crossman (1978) considered sauger "less adaptable" than walleye because of these preferences. Walleye and sauger may utilize the same shoals or gravel to rubble in large turbid lakes for spawning (Scott and Crossman 1978). Preferred spawning habitats are shallow shoreline and shoals of lakes and riffles in rivers, including areas immediately below dams providing there is rocky substrate and good water circulation from wave action and river currents (McMahon et al. 1984). Sauger have been found to be highly selective for spawning sites and in some parts of their range have been shown to be reliant on access to a few discrete areas in large tributaries (Nelson 1968; Gardner and Steward 1987; Penkal 1992; Jaeger 2004). Sauger fry must reach their initial feeding grounds (habitat type?) within 3-5 days before yolk-sac absorption or they will perish from lack of food (McMahon et al. 1984).

General Habitat Preferences:

Minimum Elevation (m):	29
Maximum Elevation (m):	45
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lake Champlain

Aquatic: Large Lake Champlain Tribs Below Falls

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Habitat Fragmentation

Invasion by Exotic Species

Description of habitat problem(s): Sauger are considered to be the most migratory percid and are heavily dependent throughout their life history on unimpeded access to a wide diversity of physical habitats (Collette 1977; Jaeger 2004). The historic spawning grounds of sauger in Lake Champlain are not well known. Undoubtedly, dams have decreased their accessibility to many of the historical spawning grounds in the basin. For example, recent lake sturgeon and walleye habitat assessments conducted on the Missisquoi River indicate most of the quality spawning habitat occurs above Swanton Dam (Madeline Lyttle, U. S. Fish and Wildlife Service, personal communication). Sauger also appear to be sensitive to changes in water quality. Sauger may be more dominant than walleye under very turbid water conditions where they co-occur; however, dominance may shift with changing water quality (Scott and Crossman 1998).

Common Name: **Sauger**
Scientific Name: **Sander canadense**
Species Group: **Fish**

Improvements in Lake Champlain water quality may explain the perceived reduction in sauger abundance, but this needs to be investigated.

Non-Habitat Problems:

Competition

Description of non-habitat problem(s): The suager population was once abundant in portions of Lake Champlain and were captured in considerable numbers as recently as the 1980s. Recent surveys of the South Bay, where sauger were formerly abundant, failed tp produce even in a single capture. Predation by native species, such as smallmouth bass (Johnson and Hale 1977) have been found to influence recruitment of walleye, a close relative to sauger, in natural systems (as referenced in Quist et al. 2003). Others have speculated that native piscivorous predators, such northern pike, smallmouth bass, lake trout, burbot and Atlantic salmon, can be a major source of mortality for age-0 walleye in Lake Champlain (Frater 2002). We would expect these interactions to be as important, if not more so, for sauger. For example, the introduction of black crappie in Black Lake (New York) was believed to have caused successive walleye year-class failures (Schiavone 1983). While black crappie are believed to be native to Lake Champlain, its cogener the white crappie is not. It too has been found to be a significant walleye fry predator in some systems (Quist et al. 2003). White crappie are known to occur in large numbers in areas where sauger were historically abundant, e.g. South Bay (David Nettles, U. S. Fish and Wildlife Service, personal communication). Another exotic in lake Champlain, the white perch, has been found to be an important predator of walleye eggs (Roseman et al. 1996; Schaeffer and Margraf 1987). White perch have become or are becoming one of the most dominant species in the fish assemblage in some areas of the lake, e.g. Missisquoi Bay (Pierre Bilodeau, Quebec Parks and Wildlife, personnel communication).

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	Determine the current population status of sauger in Lake Champlain (Vermont and New York sections), and identify critical spawning and juvenile habitats.
Research	Threats and Their Significance	High	1) Determine the effect of recent invasions of non-indigenous species (e.g., white crappie, white perch, zebra mussel) on sauger in lake Champlain. 2) Determine the effect, if any, changing water quality may have on the sauger population, such as decreasing lake turbidity.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	Low	
Monitoring	Monitor Threats	Medium	

Common Name: **Sauger**
Scientific Name: **Sander canadense**
Species Group: **Fish**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Research	High	Investigate the current status of the sauger population in Lake Champlain and its larger tributaries, as well as the current condition and availability of critical habitat for the species.	Number of surveys and investigations conducted.	LCFWMC, USFWS, NYDEC, UVM	
Awareness Raising and Communications	High	Enhance public understanding and public and professional partnerships to promote stewardship of aquatic habitat through outreach, education, and on-the-ground cooperative efforts.		VDEC, USFWS, NRCS, TNC, Echo Center, LCBP, watershed associations	

Common Name: **Sauger**
Scientific Name: **Sander canadense**
Species Group: **Fish**

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Vermont's Wildlife Action Plan

November 22, 2005

Appendix A3 Invertebrate Species Groups of Greatest Conservation Need

Index to Invertebrate Species Groups of Greatest Conservation Need

Common Name: **Bog/fen/swamp/marshy pond Odonates Group**
Scientific Name: **Bog/fen/swamp/marshy pond Odonates Group**
Species Group: **Invert**

Conservation Assessment:

Final Assessment: High Priority

Global Rank:
Global Trend:
State Rank:
State Trend: Unknown
Extirpated in VT? No
Regionally Rare? Yes

Assessment Narrative:

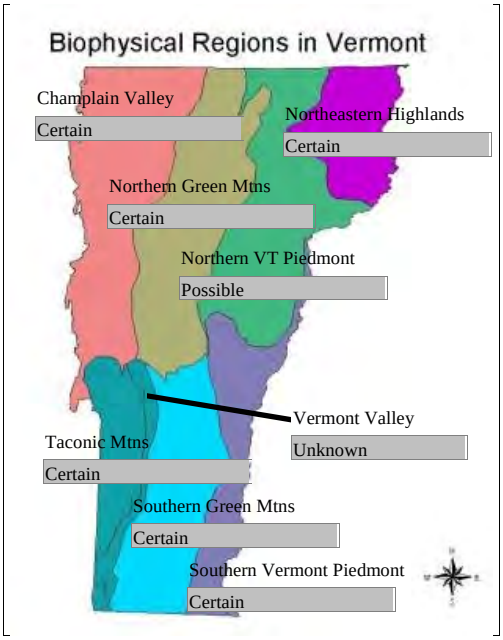
Individual species in this group are rare in Vermont; several are regionally or globally rare.

This group consists of several species, the habitat requirements of which vary within the general wetland category. Most species have not been assigned state status ranks, due to incomplete distribution and abundance information, but records for each are very limited. Habitats given for each species refer primarily to reproduction and nymphal requirements; adults of many species require various nearby terrestrial habitats as well. There is some taxonomic uncertainty in Vermont regarding Lestes disjunctus australis.

Southern Spreadwing (Lestes disjunctus australis) Still water habitats (ponds, swamps, backwaters, bogs, vernal pools)
Subarctic Bluet (Coenagrion interrogatum) Boggy sloughs
Citrine Forktail (Ischnura hastata) Marshy ponds, vernal pools, stream backwaters, seeps
Comet darner (Anax longipes) Vernal pools and semi-permanent ponds (no fish)
Mottled Darner (Aeshna clepsydra) Boggy/marshy edges of lakes
Zigzag Darner (Aeshna sitchensis) Boggy ponds, small bog pools, fen puddles
Subarctic Darner (Aeshna subarctica) Bog ponds, fens, swamps
Green-striped Darner (Aeshna verticalis) Marshy ponds and lakes, slow streams
Spatterdock Darner (Aeshna mutata) Vegetated ponds
Swamp Darner (Epiaeschna heros) Hardwood swamps
Harlequin Darner (Gomphaeschna furcillata) Bogs, boggy swamps,alder and cedar swamps
Cyrano Darner (Nasiaeschna pentacantha) Vegetated ponds
Petite Emerald (Dorocordulia lepida) Boggy ponds and lakes, marshes, cedar swamp streams
Ski-tailed Emerald (Somatochlora elongata) Marshy ponds, small shaded streams, beaver pond outlets
Forcipate Emerald (Somatochlora forcipata) Boggy rills, bogs, and small forested streams
Delicate Emerald (Somatochlora franklini) Bog pools, sping-fed bogs and pools
Kennedy's Emerald (Somatochlora kennedyi) Boggy streams; bogs, fens, and swamps often with flowing water.
Ebony Boghaunter (Williamsonia fletcheri) Boggy pools, forested fens
Painted skimmer (Libellula semifasciata) Marshy forested ponds, vernal pools, slow streams and bogs
Black Meadowhawk (Sympetrum danae) Marshy ponds, bogs, fens

Common Name: **Bog/fen/swamp/marshy pond Odonates Group**
Scientific Name: **Bog/fen/swamp/marshy pond Odonates Group**
Species Group: **Invert**

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

County distributions for bog/fen/swamp/marshy pond odonates:

Southern Spreadwing (Lestes disjunctus australis) ?
Subarctic Bluest (Coenagrion interrogatum) Essex
Citrine Fork tail (Ischnura hastata) Windham
Comet darner (Anax longipes) Windsor
Mottled Darner (Aeshna clepsydra) Rutland
Zigzag Darner (Aeshna sitchensis) Essex
Subarctic Darner (Aeshna subarctica) Essex
Green-striped Darner (Aeshna verticalis) Windham, Rutland, Addison, Washington, Chittenden
Spatterdock Darner (Aeshna mutata) Windham
Swamp Darner (Epiaeschna heros) Grand Isle
Harlequin Darner (Gomphaeshna furcillata) Rutland, Lamoille, Orleans, Essex
Cyrano Darner (Nasiaeschna pentacantha) Windham
Petite Emerald (Dorocordulia lepida) Caledonia, Essex
Ski-tailed Emerald (Somatochlora elongata) Bennington, Washington, Caledonia, Essex
Forcipate Emerald (Somatochlora forcipata) Rutland, Essex
Delicate Emerald (Somatochlora franklini) Caledonia, Essex
Kennedy's Emerald (Somatochlora kennedyi) Essex
Ebony Boghaunter (Williamsonia fletcheri) Washington
Painted skimmer (Libellula semifasciata) Windsor
Black Meadowhawk (Sympetrum danae) Washington, Essex

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

This group consists of several species, the habitat requirements of which vary within the general wetland category. Most species have not been assigned state status ranks, due to incomplete distribution and abundance information, but records for each are very limited. Habitats given for each species refer primarily to reproduction and nymphal requirements; adults of many species require various nearby terrestrial habitats as well. Some dragonflies are known to exhibit "hilltopping" behavior, in which they congregate on tops of hills,

Common Name: **Bog/fen/swamp/marshy pond Odonates Group**
Scientific Name: **Bog/fen/swamp/marshy pond Odonates Group**
Species Group: **Invert**

which may be fairly distant from egg-laying sites. This would increase the home range requirements for such species.

Southern Spreadwing (Lestes disjunctus australis) Still water habitats (ponds, swamps, backwaters, bogs, vernal pools)
Subarctic Bluet (Coenagrion interrogatum) Boggy sloughs
Citrine Forktail (Ischnura hastata) Marshy ponds, vernal pools, stream backwaters, seeps
Comet darner (Anax longipes) Vernal pools and semi-permanent ponds (no fish)
Mottled Darner (Aeshna clepsydra) Boggy/marshy edges of lakes
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Ebony Boghaunter (Williamsonia fletcheri) Boggy pools, forested fens
Painted skimmer (Libellula semifasciata) Marshy forested ponds, vernal pools, slow streams and bogs
Black Meadowhawk (Sympetrum danae) Marshy ponds, bogs, fens

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	Unknown
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Lacustrine
Hardwood Swamps
Marshes and Sedge Meadows
Open Peatlands
Seeps and Pools
Shrub Swamps
Softwood Swamps

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat
Habitat Alteration
Habitat Fragmentation
Sedimentation

Common Name: **Bog/fen/swamp/marshy pond Odonates Group**
Scientific Name: **Bog/fen/swamp/marshy pond Odonates Group**
Species Group: **Invert**

Description of habitat problem(s): Many of these wetlands are small, fragile, and could be easily degraded by disturbances within their watershed or groundwater source (e.g., development, clearcutting, hydrologic alterations). There is little specific information available citing negative impacts on these odonates. Several or all of these species utilize a combination of wetland and upland habitat to complete there life cycle; fragmentation of this complex could potential have a negative effect on these odonates.

Non-Habitat Problems:

Unknown Non-Habitat Threatss

Description of non-habitat problem(s):

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Define particular habitat requirements of each species within Vermont, utilizing current knowledge of researchers and field investigations.
Research	Distribution and Abundance	High	1) Obtain baseline distributional and abundance data for all species in group by conducting surveys throughout the state. Efforts should be focused on particular habitats required by each and, where appropriate, on regions of expected occurrence within the state (e.g., a northern peripheral species might be expected in the northern tier counties). Abundance information should be collected at sites of known occurrence. 2) Conduct inventories to detect and gather information on new SGCN odonate populations.
Research	Threats and Their Significance	Medium	Assess the vulnerability of nymphs of each species to wetland perturbations, such as siltation, temperature and water quality shifts, chemical pollution, and changes in vegetation. Investigate the upland habitat needs of the adults and the effects of such impacts as fragmentation and reduction.
Research	Taxonomy	Medium	There is some taxonomic uncertainty in Vermont regarding Lestes disjunctus australis.
Monitoring	Population Change	Medium	Population monitoring could be employed to track population trends at distinct locations. This would follow field surveys and assessments to identify populations judged to be large and viable. Focusing on such large populations would offer greater probability of detecting population shifts.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Easements	High	Acquisition/easement of high priority SGCN odonate wetland sites	Number of SGCN odonate sites protected	FWD, FPR, TNC, VLT, other land trusts	VHCB, SWG, LIP, WHIP, USFWS

Common Name: **Carabid Beetles Group**
Scientific Name: **Carabid Beetles Group**
Species Group: **Invert**

Conservation Assessment:

Final Assessment: Medium Priority

Global Rank:
Global Trend:
State Rank:
State Trend: Unknown
Extirpated in VT? Unknown
Regionally Rare? Unknown

Assessment Narrative:

This group contains a great number of species that are ranked as rare, but for which more information is needed before conservation strategies can be developed. Compilation of existing information as well as gathering new data is required.

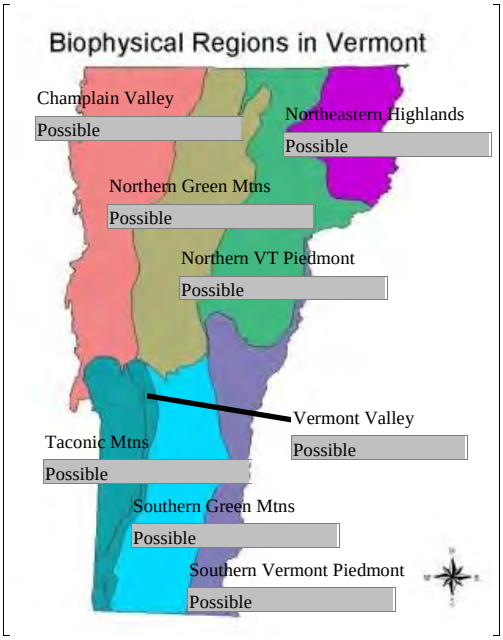
Little is known about the distribution, abundance, and status of the many rare species in this group. There is existing information which needs to be gathered and compiled. These beetles vary in their distribution and habitat requirements.
Species included:
Sphaeroderus nitidicollis brevoorti S2 G?T?
Agonum crenistriatum S2 G?
Agonum darlingtoni S2 G?
Agonum decorum S3 G?
Agonum moerens S3? G?
Agonum picicornoides S3 G?
Agonum punctiforme S2? G?
Agonum superioris S3? G?
Scaphinotus bilobus S2 G?
Pterostichus brevicornis S3 G?
Pterostichus castor S3 G?
Pterostichus lachrymosus S3 G?
Pterostichus pinguedineus S2 G?
Pterostichus punctatissimus S3 G?
Nebria suturalis S1 G?
Notiophilus nemoralis S3 G?
Bembidion rufotinctum S2 G?
Bembidion cordatum S1 G?
Bembidion grapei S2 G?
Bembidion muscicola S3 G?
Bembidion mutatum S2 G?
Bembidion quadratulum S2 G?
Bembidion robusticolle S1? G?
Bembidion rolandi S2 G?
Bembidion affine S3 G?
Acupalpus alternans S1? G?
Acupalpus rectangulus S2? G?
Diplocheila impressicollis S3 G?
Diplocheila striatopunctata S3 G?
Diplocheila assimilis S3 G?
Pseudamara arenaria S3 G?
Dyschirius brevispinus S2 G?
Dyschirius erythrocerus S2 G?
Dyschirius politus S2 G?
Elaphropus dolosus S2 G?
Elaphropus levipes S2 G?

Common Name: **Carabid Beetles Group**
Scientific Name: **Carabid Beetles Group**
Species Group: **Invert**

Elaphrus fuliginosus S2 G?
Geopinus incrassatus S2 G?
Harpalus fulvilabris S2 G?
Harpalus indigens S2 G?
Harpalus providens S2 G?
Lophoglossus scrutator S1 G?
Miscodera arctica S1 G?
Notiobia sayi S2 G?
Notiophilus aquaticus S2 G?
Notiophilus borealis S1 G?
Notiophilus novemstriatus S2 G?
Olisthopus micans S2 G?
Parastachys oblitus S2 G?
Parastachys rhodeanus S2 G?
Patrobus foveocollis S2 G?
Pentagonica picticornis S2 G?
Pericompsus ephippiatus S1 G?
Platynus cincticollis S1? G?
Platynus parmaginatus S2 G?
Platypatrobus lacustris S1 G?
Schizogenius ferrugineus S1 G?
Sericoda obsoleta S1 G?
Sericoda quadripuncata S1 G?
Tetragonoderus fasciatus S2 G?
Trichocellus cognatus S2 G?
Atranus pubescens S2 G?
Amara laevipennis S3 G?
Amara erratica S2 G?
Anchomenus picticornis S2 G?
Apristus latens S2 G?
Blethisa quadricollis S1 G?
Blethisa julii S2 G?
Blethisa multipuncata S3 G?
Carabus goryi S3 G?
Carabus maeander S3 G?
Dicaelus dilatus S1 G?
Dicaelus teter S2 G?

Common Name: **Carabid Beetles Group**
Scientific Name: **Carabid Beetles Group**
Species Group: **Invert**

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Information is needed to determine the probable extent of distribution of these species. Existing collection records and habitat information needs to be reviewed to assess the status of our current knowledge of these species.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Existing information needs review and new information must be collected to determine the habitat use and requirements of these beetles. Some are known to use specialized habitats and natural communities.

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change

Common Name: **Carabid Beetles Group**
Scientific Name: **Carabid Beetles Group**
Species Group: **Invert**

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Unknown Habitat Threats

Description of habitat problem(s): Habitat problems are not known for specific species, but would be most related to habitat loss and degradation. Being rare species, habitat fragmentation would lead to smaller, more vulnerable populations.

Non-Habitat Problems:

Genetics

Trampling or Direct Impacts

Unknown Non-Habitat Threatss

Description of non-habitat problem(s): The problems not related to habitat are not known for these beetle and need study. As rare species with often small populations, loss of metapopulation structure and function would be a problem. Some species are alpine, where heavy recreational use can result in trampling.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Gather information on habitats in which each SGCN carabid species reportedly occurs (literature research, consult researchers and hobbyists, etc.); this will be needed to refine distributional field surveys.
Research	Basic Life History	Medium	Life history information is needed for all species
Research	Distribution and Abundance	High	Conduct literature research and field surveys to gather baseline information on distribution of SGCN carabid species in Vermont.
Research	Threats and Their Significance	Medium	Research is needed on the vulnerability of species to various significant limiting factors to each habitat type.
Monitoring	Population Change	High	Revisit and survey sites with previous records of SGCN carabids to determine presence/absence; where present, determine abundance.

Common Name: **Crustaceans Group**
Scientific Name: **Crustaceans Group**
Species Group: **Invert**

Conservation Assessment:

Final Assessment: High Priority

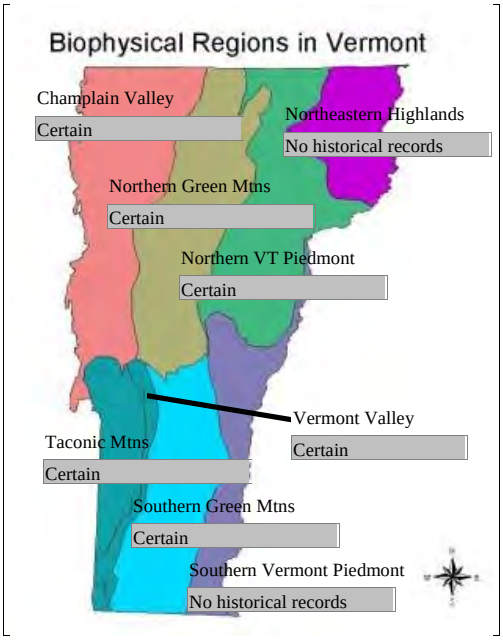
Global Rank:
Global Trend:
State Rank:
State Trend: Unknown
Extirpated in VT? No
Regionally Rare? Yes

Assessment Narrative:

Three species are included in this group. The cave amphipod is listed as endangered in Vermont. The other amphipod is known only from lakes Champlain and Memphremagog, where it is rarely recorded. The crayfish is found in small coldwater streams and is rare.

An amphipod (Diporeia hoyi) This deepwater species is rarely collected. It has been reported from Lake Champlain and Lake Memphremagog. It may occur in other deep lakes also. This species is cited as being very sensitive to pollution.
Taconic Cave amphipod (Stygobromus borealis) This state-endangered species is known from only a single cave in Vermont. The status of this population is not known. The cave is owned by a conservation organization, but limiting factors to this vulnerable population still exist.
Applacian Mountain crayfish (Cambarus bartonii) This rare crayfish is only found in small cold water streams and is limited by introduction of the rusty crayfish (Orconectes rusticus) and by development (stormwater sedimentation, acid rain)

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

An amphipod (Diporeia hoyi) This species is known in Vermont only from (1) deep water in Lake Champlain from Crown Pt. to Rouses Pt., including Inner Mallets Bay and Mississquoi Bay.; and (2) possibly Lake Memphremagog. It may also occur in other large lakes with similar deep water habitat. It was very rare in Lake Champlain 1992-1996 samples.
Taconic Cave amphipod (Stygobromus borealis) This amphipod is known in Vermont only from Dorset (Aeolus) Cave in Dorset. Is has also been reported from MA, and NY. It appears to be limited to subterranean drainage systems of karst terrain in the Taconic Mountains. Three single locations comprise the entire global distribution known for this species.
Appalachian Mountain crayfish (Cambarus bartonii) This crayfish is known from the Hudson drainage (Battenkill) and the Champlain Basin. It occurs both in the mountains and in small,

Common Name: **Crustaceans Group**
Scientific Name: **Crustaceans Group**
Species Group: **Invert**

valley streams.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

An amphipod (Diporeia hoyi) This is a deepwater species of large lakes, where is undergoes vertical migrations. It has been collected as deep as 900 feet in Lake Superior. It requires cold, deep water with a good oxygen supply. It is likely to be one of the first species to disappear when a lake is polluted.
Taconic Cave amphipod (Stygobromus borealis) In Vermont, this amphipod is found in a cave of marble bedrock with a deep (probably > 9 meters) pool of water with a silt and/or sand bottom. In MA, it was reported from a springhouse.
Applacian Mountain crayfish (Cambarus bartonii) This rare crayfish is only found in small cold water streams.

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Lacustrine
Aquatic: Lake Champlain
Subterranean

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Invasion by Exotic Species

Sedimentation

Description of habitat problem(s): D. hoyi is very pollution sensitive, needing clean, cold, well-oxygenated water. It is limited by shifts in food web dynamics caused by zebra mussels. The invasive quagga mussel is displacing D. hoyi in the Great Lakes and could cause similar effects if it reaches Lake Champlain. Long-term deposition of silt is likely altering the benthic habitat this amphipod uses.
S. borealis, due to the nature of its habitat, is vulnerable to such problems as pollution, nutrient shifts, and hydrologic alterations.
Cambarus bartonii is limited by introduction of the rusty crayfish (Orconectes rusticus) and by development (stormwater sedimentation, acid rain)

Non-Habitat Problems:

Pollution

Reproductive Traits

Common Name: **Crustaceans Group**
Scientific Name: **Crustaceans Group**
Species Group: **Invert**

Trampling or Direct Impacts

Description of non-habitat problem(s): D. hoyi is pollution sensitive. It is limited by shifts in food web dynamics caused by zebra mussel.
S. borealis is vulnerable to collection or other direct loss of individuals due to the small size and isolated nature of the population. The reproductive capability of this species is likely much more limited than that of surface-water inhabiting amphipods because of the limited food supply. This makes rebounding from population losses or poor reproductive years difficult.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	The habitat requirements for S. borealis needs to be studied and refined.
Research	Basic Life History	Medium	The life history of S. borealis is virtually unknown. Study is needed.
Research	Distribution and Abundance	High	1) The distribution and abundance of all three species has not been sufficiently investigated. Further survey work is needed to accurately determine the extent and status of these species in Vermont. 2) Conduct inventories to detect and gather information on new SGCN crustacean populations
Research	Threats and Their Significance	High	The potential impacts of recreational and other human uses of caves supporting S. borealis needs to be assessed. The potential for negative impacts due to manipulation or contamination of groundwater feeding these cave streams needs to be determined. The affects of fine sediments on the benthic habitat of D. hoyi should be studied. The effects of food web dynamics caused by zebra mussel colonization need to be studied with regard to D. hoyi.
Monitoring	Population Change	High	1) Known S. borealis population should be monitored; methods that do not impact individual amphipods will be required. 2) Monitor known SGCN crustacean populations.
Monitoring	Habitat Change	Medium	Water quality and volume in known S. borealis cave stream should be monitored.

Common Name: **Freshwater Mussels Group**
Scientific Name: **Freshwater Mussels Group**
Species Group: **Invert**

Conservation Assessment:

Final Assessment: High Priority

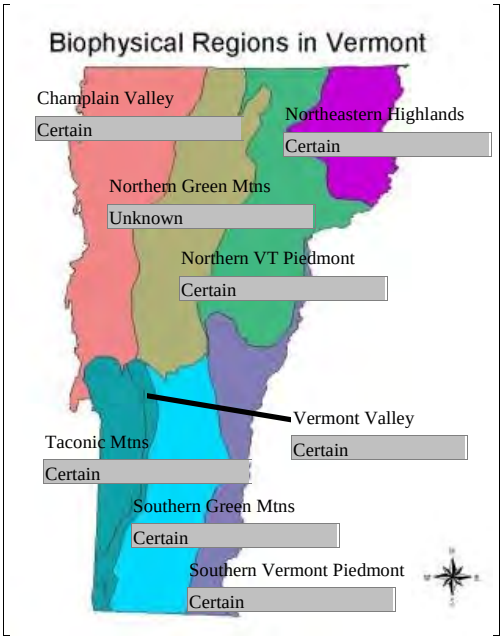
Global Rank:
Global Trend:
State Rank:
State Trend: Declining
Extirpated in VT? No
Regionally Rare? Yes

Assessment Narrative:

This group includes seven state-endangered and three state-threatened species. One is also federally endangered. Two of the three remaining species are each known from only a single short stretch of river. Freshwater mussels are recognized as one of the most highly endangered taxonomic groups in North America. Of the 297 native species in the U.S., over 70% are considered endangered, threatened, of special concern, or are resumed extinct. Of Vermont's 18 species, over half are listed as threatened or endangered.

Eastern pearlshell (Margaritifera margaritifera) State threatened
Dwarf wedgemussel (Alasmidonta heterodon) State and federal endangered
Brook floater (Alasmidonta varicosa) State threatened. Only one population, occupying only one river stretch.
Elktoe (Alasmidonta marginata) Very rare. Population first discovered in 2000. Occupies a single short river stretch.
Alewife floater (Anodonta implicata) Rare. Occupies a single river stretch.
Cylindrical papershell (Anodontoides ferussacianus) State endangered
Pocketbook (Lampsilis ovata) State endangered
Fluted-shell (Lasmigona costata) State endangered
Creek heelsplitter (Lasmigona compressa) Rare
Fragile papershell (Leptodea fragilis) State endangered
Black sandshell (Ligumia recta) State endangered. Probably most endangeredVermont mussel.
Pink heelsplitter (Potamilus alatus) State endangered
Giant floater (Pyganodon grandis) State threatened

Distribution:



Natural History Elements:

Home Range:
Migrant? No

- **Within watershed** ☐
- **Within biophysical region** ☐
- **Within VT** ☐
- **Within Region** ☐
- **Within US** ☐
- **Outside US** ☐

Distribution Summary:

Eastern pearlshell (Margaritifera margaritifera) Reported from the upper Winooski River and Lewis Creek systems of the Champlain basin, and the Passumpsic River, West River, and Nulhegan River systems of the Connecticut River basin. Dwarf wedgemussel (Alasmidonta heterodon) Connecticut River mainstem, and slightly upstream into some large tributaries. Historically found from Bloomfield to Brattleboro. More recently known from Hartland to Springfield, and from Guildhall to

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Lunenburg.
Brook floater (Alasmidonta varicosa) Known only from West River (Connecticut River tributary). One historic report from the Connecticut River mainstem at Norwich.
Elktoe (Alasmidonta marginata) Known only from a short stretch (~ 5 miles) of the Lamoille River in Fairfax and Georgia.
Alewife floater (Anodonta implicata) Occurs in Connecticut River from Bellows Falls to Massachusetts.
Cylindrical papershell (Anodontoides ferussacianus) Known from Missisquoi, Lamoille, and Poultney river systems, and also Stone Bridge Brook (Milton). May occur in other Lake Champlain rivers and the main lake itself. One historic report from the Clyde River.
Pocketbook (Lampsilis ovata) Champlain basin species: reported from Lake Champlain, Missisquoi River, Lamoille River, Winooski River, LaPlatte River, Lewis Creek, Otter Creek, and Poultney River. Only found below principal fall line.
Fluted-shell (Lasmigona costata) Champlain basin species: reported from Lamoille River, Winooski River, Otter Creek, Lewis Creek, and Poultney River. Shells have been taken in the Missisquoi River, but no live specimens have been observed. Observed above the principal fall line only in Otter Creek.
Creek heelsplitter (Lasmigona compressa) Reported from several small to large tributaries to Lake Champlain. Primarily a headwater to medium-sized creek species, but does occur in larger habitats (e.g., below fall line in Winooski River). One record is from outside the Champlain basin, the Coaticook River (Norton).
Fragile papershell (Leptodea fragilis) Lake Champlain basin only; reported from Lake Champlain, Missisquoi River, Lamoille River, Winooski River, Otter Creek, and Poultney River. Only found below principal fall line.
Black sandshell (Ligumia recta) Champlain basin species; reported from Missisquoi River, Otter Creek, Poultney River, and Hospital Creek, and shallow areas in Lake Champlain near the mouths of these rivers. Appears extirpated from Hospital Creek; most recent survey did not find it in Otter Creek. Only found below principal fall line.
Pink heelsplitter (Potamilus alatus) Champlain basin species; reported from Lake Champlain, Missisquoi River, Lamoille River, Winooski River, Otter Creek, Lewis Creek, Hospital Creek, and Poultney River. Only found below principal fall line.
Giant floater (Pyganodon grandis) Champlain basin species; reported in Lake Champlain, Missisquoi River, Lamoille River, Winooski River, Otter Creek, East Creek, and Poultney River. Reported from above the principal fall line only in Otter Creek and Lamoille River.

Known Watersheds

Possible Watersheds

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CT-Bellows Falls Dam to Vernon Dam
CT-Johns River to Waits River
CT-Waits River to White River
CT-White River to Bellows Falls
Lake Champlain Direct
Lamoille River
Mississquoi River
Otter Creek
Passumpsic Vermont
Upper Connecticut
Winooski River
Saint-Francois River

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☑ General Literature ☑

Eastern pearlshell (Margaritifera margaritifera) This is a coldwater species, found in streams that support trout populations. It inhabits firm sand substrates, often amidst gravel and cobbles, and occasionally tightly packed cobbles and gravel. Salmonids are the fish hosts.
Dwarf wedgemussel (Alasmidonta heterodon) A large river species, this mussel is found in stable mud, silty sand, sand, or gravel where the current is sufficient to keep the substrate free of surficial silt. Fish hosts may include the tessellated darter and slimy sculpin.
Elktoe (Alasmidonta marginata) This is a mussel of medium-sized rivers, where it occupies riffles or rapids on stable gravel or rocky bottoms. It burrows securely into the sand-filled spaces between stones.
Brook floater (Alasmidonta varicosa) This mussel occupies small rivers, where it is found in rocky or gravel substrates and in sandy shoals. It is usually found in or adjacent to rapids or riffles. Mussel beds usually support some submerged aquatic plants.
Pocketbook (Lampsilis ovata) This mobile mussel is found primarily in stretches of larger rivers from Lake Champlain to the first major waterfall. It also can be found in shallow areas of the main lake near deltas of these rivers. Mussels occupy firmly packed sand, sand and gravel, or silty sand.
Fluted-shell (Lasmigona costata) This mussel is found primarily in medium-sized creeks to larger rivers from Lake Champlain to the first major waterfall, but also occurs above this fall line in some streams. It inhabits a variety of substrates, including mud, sand, gravel, and aggregates of cobble, gravel, and sand.
Creek heelsplitter (Lasmigona compressa) This is a mussel of small creeks to small rivers, but occurs in small numbers in large river sections above Lake Champlain as well. It if found in gravel, sand, or mud.
Pink heelsplitter (Potamilus alatus) This mussel occurs in large rivers only between Lake Champlain and the first major waterfall. It also occupies areas of Lake Champlain adjacent to the deltas of these rivers. It is found in clay, clayey silt, sand, gravel and sand, or mixtures of cobble, sand, and silt. Pink heelsplitters usually bury themselves nearly completely into the substrate, their shape anchoring them securely in place.
Fragile papershell (Leptodea fragilis) This mussel occurs in large rivers only between Lake Champlain and the first major waterfall. It also occupies areas of Lake Champlain adjacent to the deltas of these rivers. It is found in sand, clayey silt, silty sand, or gravel and sand. Fragile papershells usually bury themselves nearly completely into the substrate, their shape anchoring them securely in place.
Black sandshell (Ligumia recta) This mussel occurs only in large rivers between Lake Champlain and the first

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major waterfall. Substrates include sand, sand and gravel, and mud.
Giant floater (Pyganodon grandis) A mobile species of large rivers and lakes, it is found in sand, sand and gravel, silty sand, and clay.
Cylindrical papershell (Anodontoides ferussacianus) These mussels are found in creeks and rivers, but likely occupy shallow lake habitat as well (Lake Champlain). Substrates include silt and silty sand in slow currents. It is found primarily below the first waterfall upstream of Lake Champlain, but is known from well above this barrier in the Lamoille River.
Alewife floater (Anodonta implicata) This is a riverine mussel in Vermont found in slow to fast waters. It occurs in a variety of substrates, including sand, sand and gravel, and silt.

Potential Fish hosts reported*:
Eastern pearlshell Rainbow trout, Atlantic salmon, brook trout
Dwarf wedgemussel tessellated darter, slimy sculpin
Elktoe white sucker, rock bass
Brook floater slimy sculpin, longnose dace, blacknose dace, golden shiner, pumpkinseed, yellow perch, tessellated darter
Pocketbook smallmouth bass, white crappie, largemouth bass, bluegill, sauger, yellow perch
Fluted-shell carp, spotfin shiner, longnose dace, slimy sculpin, black crappie, yellow perch
Creek heelsplitter slimy sculpin, black crappie, spotfin shiner, yellow perch
Pink heelsplitter freshwater drum
Fragile papershell freshwater drum
Black sandshell banded killifish, bluegill, redbreast sunfish, rock bass, white perch, white crappie, largemouth bass, sauger, yellow perch, walleye
Giant floater banded killifish, blackchin shiner, black crappie, blacknose dace, bluegill, bluntnose minnow, brook silverside, carp, brook stickleback, common shiner, creek chub, freshwater drum, gizzard shad, golden shiner, largemouth bass, longnose gar, pearl dace, pumpkinseed, rock bass, white crappie, white sucker, yellow bullhead, yellow perch
Cylindrical papershell spotfin shiner, black crappie; possibly sea lamprey and mottled sculpin
Alewife floater American shad, alewife
*Primarily from lab studies; this list does not indicate that fish hosts have been demonstrated in natural environment.

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Lake Champlain
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Lower CT River
Aquatic: Man-Made Water Bodies

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Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Invasion by Exotic Species

Sedimentation

Description of habitat problem(s): Zebra mussels are decimating Lake Champlain mussel populations, and are being found in the lower portions of some of the lake's tributaries.
Bridge construction and road-related river bank stabilization have been common direct impacts.
Dams have been responsible for large losses of habitat, particularly in the Connecticut River. Dams have also altered and degraded downstream habitats.

Non-Habitat Problems:

Genetics

Harvest or Collection

Pollution

Predation or Herbivory

Reproductive Traits

Trampling or Direct Impacts

Description of non-habitat problem(s): Loss of specific fish hosts can result in reduced/eliminated reproductive success.
Muskrats are mussel predators and can decimate local populations when their numbers are too high or when a mussel species is particularly vulnerable.
Black sandshell populations are extremely limited in number of individuals and age. Females are rarely found, if ever; juveniles are never found in Vermont. The low densities and skewed sex ratio are undoubtedly hampering reproductive success and may have genetic consequences.
Mussels have been shown to be sensitive to a variety of pesticides and other anthropogenic chemicals.
Use of mussels as bait by anglers has been problematic in some other states. This has not been investigated in Vermont.
Damage to/death of mussels due to trampling by stream users may occur regularly, but has not been investigated. Thin-shelled species are often found dead due to breakage.
Walleye sampling using large seines has resulted in large numbers (1000's) of mussels being dragged ashore at Sandy Point in Swanton in the past. These included some listed species. Many can be returned to the water, but some (particularly giant floaters) are fatally damaged.

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Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Define particular habitat requirements of each species within Vermont, utilizing current knowledge of researchers and field investigations.
Research	Basic Life History	High	Determine host fish requirements for each mussel species. This needs to be specific to Vermont populations.
Research	Distribution and Abundance	High	1) Obtain baseline information on distribution and abundance of each mussel species. This should include all existing information sources. 2) Conduct inventories of rivers and appropriate lake habitat to detect and gather information on new SGCN mussel populations.
Research	Threats and Their Significance	High	Assess limiting factors and their potential impacts to the aquatic habitats of each mussel species. Assessment should be on a watershed scale, including upland sources of potential limiting factor. Research is needed on how to protect native mussel populations that are being impacted by zebra mussels, and also those populations that are vulnerable to further zebra mussel colonization.
Research	Population Genetics	Medium	1) Certain species (e.g., black sandshell, elktoe) are highly isolated from nearest populations. Genetic comparisons with other populations will be needed before reintroduction options can be evaluated. 2) Determine genetic constraints that may be hampering the recovery of isolated SGCN mussel populations (particularly black sandshell and elktoe).
Research	Taxonomy	Medium	There is uncertainty about the species assignment of Lampsilis ovata. Vermont populations may be L. cardium, or more than one species could be here. This needs to be determined.
Research	Other Research	High	Investigate the potential benefits of dam removal to SGCN mussel populations
Monitoring	Population Change	Medium	Monitor known SGCN mussel populations. Population monitoring could be employed to track population trends at distinct locations. This would follow field surveys and assessments to identify populations judged to be large and viable. Focusing on such large populations would offer greater probability of detecting population shifts. Areas of habitat where species have disappeared need to be tracked.
Monitoring	Monitor Threats	High	Zebra mussel monitoring is needed in watersheds that support these native species. Occupied rivers and boating lakes that occur upstream need to be monitored. The effects of dams on downstream habitat needs to be monitored, including de-watering, temperature regime, and silt releases.

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Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration	High	Reduce the use of riprap in aquatic habitat as a method of bank stabilization	Annual number of stream feet impacted by new riprap projects	FWD, DEC, ANR, NRCS, FEMA, VTrans, FHWA	
Natural Processes Restoration	High	Work with regulators and dam operators/owners to reduce the impacts of dam operations on SGCN mussel populations. FERC re-licensing should require run-of-river flows.	Number of operating dams on SGCN mussel rivers that modify operations to run-of-river flows through FERC re-licensing or other negotiations.	FWD, DEC, FERC, dam operators/owners, USACOE, towns, VNRC	PR, Hydro funds
Invasive Species Control & Prevention	High	Prevent the introduction and spread of zebra mussels	Monitor sites of potential occurrence	LCBP, DEC, Municipalities, FWD, USFWS	VT Watershed Grants, LCBP
Species Restoration	High	Remove muskrats and potentially other predators where local mussel populations are vulnerable and are likely to be impacted by predation.	Continued surveillance to determine whether muskrats are absent from critical areas.	FWD, Wildlife Services (USDA), TNC, local trappers, USFWS	FWD, SWG, LIP, Endangered Species Section 6 (USFWS), PR
Alliance Development	High	Enhance coordination between government agencies and partners to ensure consistency in respective program implementation and increased sensitivity to SGCN mussel requirements and problem for SGCN mussels		ANR, USFWS, COE, FEMA, FHWA, NRCS, Wildlife Services, VTrans, others	PR (USFWS), LIP
Habitat Restoration	High	Protect and restore habitats on which SGCN mussels are dependent through pollution abatement, riparian buffers, flow regulation, etc.	Number of acres of riparian habitat protected and/or restored	LCLT, VLT, Watershed groups, USFWS, DEC, FWD	LIP, SWG, LCLT, VLT, NRCS
Easements	Medium	Acquire conservation easements for the protection of critical SGCN mussel habitats and maintenance or restoration of ecological functions	Number of riparian habitat acres acquired/enrolled	LCLT, VLT, FWD, ANR, TNC, NRCS	LCLT, VLT, TNC, SWG, LIP, NRCS

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Conservation Assessment:

Final Assessment: High Priority

Global Rank:
Global Trend:
State Rank:
State Trend: Declining
Extirpated in VT?
Regionally Rare? Yes

Assessment Narrative:

A diverse group of snails whose general status ranges from extirpated to declining to rare. Much work is needed to refine status assessment.

Fingered valvata (Valvata lewisi) Two locales recorded: a lake, a vernal pool. Possibly occurs elsewhere. Only found in low numbers throughout range.
Mossy valvata (Valvata sincera) Three records only; Lake Champlain valley only.
Squat duskysnail (Amnicola (Lyogyrus) grana) Four records, scattered in Vermont. An East Coast species.
Canadian duskysnail (Amnicola (Lyogyrus) walkeri) One site known.
Buffalo pebblesnail (Gillia altilis) Fourteen records known, most in Champlain valley. Atlantic drainage species.
Pupa duskysnail (Lyogyrus (Amnicola) pupoidea) Six records, all Lake Champlain. Hybridization with A. grana reported.
Boreal marstonia (Marstonia (Pyrgulopsis) decepta) Only known from Lake Champlain, where uncommon to rare. Uncommon in northern part of range; more common southward. Reported as abundant at some Massachusetts sites.
Liver elimia (Goniobasis livescens) Known only from northern Lake Champlain (9 sites). May become extirpated due to the exotic Bithnia tinticulata (snail). Still "uncommon" at this point, as opposed to "rare".
Sharp hornsnail (Pleurocera acuta) Reported from Vermont in literature, but there are no occurrence records at DEC.
Spindle lymnaea (Acella haldemani) Two locations known; limited and localized in distribution. Appears to be greatly reduced from historical range. Often only one location is reported for a lake, but it is easily overlooked. Rare. Reproduction may be a limiting factor.
Mammoth lymnaea (Bulimnea megastoma) Reported from Lake Champlain and its tributaries in 19th century literature; only a few sites were reported though. Was never abundant. May have been extirpated from NY by 1971. The species is probably extirated in Vermont as well. DEC has no records of occurrence.
Country fossaria (Fossaria rustica) Two sites known, both in Champlain valley. There may be some taxonomic issues with genus and species (e.g., it may be subspecies/variety of F. modicella).
Disco gyro (Gyraulus circumstriatus) Found recently in several vernal pools, also in some wetlands.
Star gyro (Gyraulus crista) Only known from 5 sites in Vermont. Holarctic (northern) distribution. Rare in NY.

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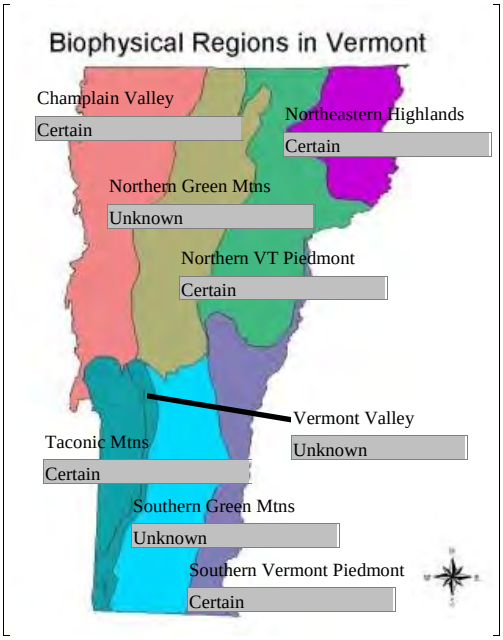
Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Fingered valvata (Valvata lewisi) Two locales recorded: Lake St. Catherine and a vernal pool in Winooski River floodplain (Colchester). Possibly occurs elsewhere. Probably not in Connecticut River basin.
Mossy valvata (Valvata sincera) Three records only; Lake Champlain only, including Dead Creek. St. Lawrence system only in NY (4 pops.)
Squat duskysnail (Amnicola (Lyogyrus) grana) Four records: Connecticut River, Lake Fairlee, and Lake St. Catherine. An East Coast species.
Canadian duskysnail (Amnicola (Lyogyrus) walkeri) Lake St. Catherine is only known site.
Buffalo pebblesnail (Gillia altilis) Fourteen records known, most in Champlain valley: Lake Champlain, Lamoille River, Missisquoi River. Connecticut River, Hinkum Pond (Sudbury), and Poultney River. Atlantic drainage species.
Pupa duskysnail (Lyogyrus (Amnicola) pupoidea) Six records, all Lake Champlain.
Boreal marstonia (Marstonia (Pyrgulopsis) decepta) Only known from Lake Champlain.
Liver elimia (Goniobasis livescens) Known only from northern Lake Champlain (9 sites). Found in many NY waterbodies.
Sharp hornsnail (Pleurocera acuta) Reported from Vermont in literature ("QE, VT, and northeastern NY"), but there are no occurrence records at DEC.
Spindle lymnaea (Acella haldemani) Two locations known: Beebe Pond and Otter Creek. Limited and localized in distribution. Historically in Lake Champlain, but there are no recent records from there. Appears to be greatly reduced from historical range. Often only one location is reported for a lake, but it is easily overlooked. Rare and sporadic in occurrence rangewide.
Mammoth lymnaea (Bulimnea megastoma) Reported from Lake Champlain and its tributaries in 19th century literature; only a few sites were reported though. Was never abundant. May have been

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extirpated from NY by 1971. The species is probably extirpated in Vermont as well. DEC has no records of occurrence.
Country fossaria (Fossaria rustica) Two sites known: Lewis Creek and Little Otter Creek.
Disco gyro (Gyraulus circumstriatus) Found recently in several vernal pools; also in wetlands of lakes St. Catherine and Bomoseen; Allen Brook (Williston); Arrowhead Mt. Reservoir.
Star gyro (Gyraulus crista) Only known from 5 sites in Vermont: Sunny Brook (Winooski River drainage in Randolph), East Branch of Passumpsic River, and Morehouse Brook (Winooski). Holarctic (northern) distribution.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Fingered valvata (Valvata lewisi) A pool/pond/lake species. Found particularly on sand, but also mud and aquatic vegetation down to 7 m.
Mossy valvata (Valvata sincera) Generally limited to oligotrophic and mesotrophic situations, but occasionally in eutrophic waters. Associated with submerged aquatic vegetation. In MA, however, it is reported as requiring deep lakes with a pH of 7.6 or greater, where it is often associated with rooted vegetation.
Squat duskysnail (Amnicola (Lyogyrus) grana) Found on organic debris and vegetation in standing waters of larger lakes and ponds, oxbows, and major rivers. Highly tolerant of acidic conditions, but limited tolerance to sodium (e.g., road salt).
Canadian duskysnail (Amnicola (Lyogyrus) walkeri) Found in sluggish streams and quiet ponds where dead plants accumulate. Occupies lentic waters, ranging from oligotrophic to marl ponds.
Buffalo pebblesnail (Gillia altilis) Large lakes and rivers. In Hudson River, it is found on mud and aquatic plants in the shallows.
Pupa duskysnail (Lyogyrus (Amnicola) pupoidea) Occurs in small to large ponds and large rivers. Found on organic debris and aquatic plants. Hybridization with A. grana reported.
Boreal marstonia (Marstonia (Pyrgulopsis) decepta) Found on stonewort (Chara) on soft and hard marly substrates.
Liver elimia (Goniobasis livescens) Grazes in shallow water on stones and gravel in lakes and clear rapid streams. In lakes, it burrows into the sand and feeds on algae and bacteria; this is not as good a food source as it is for other pulmonate snails.
Sharp hornsnail (Pleurocera acuta) Found in a variety of habitats. In lakes, found on boulders on exposed shores or in mud and sand. In rivers, found on stones in rapid current. Snails remain in shallow water up to 1 m deep, where they burrow under the sand and layers of decaying leaves and other organic matter.
Spindle lymnaea (Acella haldemani) Found on submerged logs, silt, sand, and mud; up to 2 m deep. Often is attached to leaves and stems of aquatic pondweed and other submerged vegetation. Reported to favor eutrophic lakes and ponds. Young don't travel far from where they hatched, leading to a clumped distribution.
Mammoth lymnaea (Bulimnea megastoma) Found in ponds, large and small lakes, and quiet embayment of rivers.
Country fossaria (Fossaria rustica) Occupies rivers and streams, lakes, ponds, and occasionally ditches and canals. Can be in damp mud flats and bodies of water with fluctuations in water level.
Disco gyro (Gyraulus circumstriatus) In Vermont, appears to be primarily a vernal pool species, but also found in lake-associated wetlands. Described as being found in quiet waters of lakes and ponds, intermittent streams, and temporary [intermittent] ponds. Found on mud to gravelly sands, often associated with dead and living plants. Intolerant of low pH waters. Also described as a species of temporary waters.

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Star gyro (Gyraulus crista) Found in dense aquatic vegetation, water-logged wood, and rotting terrestrial leaves (in water).

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Lacustrine
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Lower CT River
Floodplain Forests
Marshes and Sedge Meadows
Seeps and Pools
Shrub Swamps
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Invasion by Exotic Species

Sedimentation

Description of habitat problem(s): Acidification (acid rain) is a problem to several species.
Valvata sincera - lake drawdowns may be a problem to this species.
Gyraulus circumstriatus - intolerant of low pH waters; acid rain may be a problem.

Non-Habitat Problems:

Pollution

Reproductive Traits

Description of non-habitat problem(s): Some lake/pond species are vulnerable to chemical treatment of these waters to control algae, swimmers itch, etc.
Valvata lewisi - only found in very low densities throughout range; this may limit long-term viability of local populations.
Valvata sincera - low reproductive rate. Only a few eggs (4-12) produced per individual.
Amnicola grana - low tolerance to sodium (e.g., road salt). This may impact populations anywhere they are found (particularly in rivers).
Lyogyrus pupoidea - reported to hybridize with Amnicola grana. This could jeopardize both species where they co-occur.
Goniobasis livescens - Likely being impacted by the exotic Bithnia tinticulata (snail) in Lake Champlain. Region mollusc expert Dr. Doug Smith (Umass) believes it will become extirpated from the lake for this

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reason.
Acella haldemani - Apparently greatly reduced in distribution and abundance from historical range for unknown reasons. The young don't travel far from where the hatch, which creates limited abiliity to disperse and colonize/recolonize other habitat patches.
Bulimnea megastoma - may have been extirpated due to unknown causes.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Define particular habitat requirements of each species within Vermont, utilizing current knowledge of researchers and field investigations.
Research	Distribution and Abundance	High	1) Obtain baseline distributional and abundance data for all species in group by conducting surveys throughout the state. Abundance information should be collected at sites of known occurrence. 2) Conduct inventories to detect and gather information on new SGCN snail populations.
Research	Threats and Their Significance	High	Assess potential and existing impacts of limiting factors to habitat and individual species. Such limiting factors as habitat loss and degradation, exotic invasive snails, and use of pesticides should be examined.
Research	Taxonomy	Medium	Taxanomic questions regarding Fossaria rustica need to be resolved.
Monitoring	Population Change	Medium	1) Monitor known SGCN snail populations. 2) Population monitoring could be employed to track population trends at distinct locations. This would follow field surveys and assessments to identify populations judged to be large and viable. Focusing on such large populations would offer greater probability of detecting population shifts. Monitoring populations subjected to specific environmental perturbations should also be considered.
Monitoring	Monitor Threats	High	Number of waterbodies and areas chemically treated to control snails and algae needs to be tracked and used to assess the significance of this limiting factor to SGCN snails.

Common Name: **Freshwater Snails Group**
Scientific Name: **Freshwater Snails Group**
Species Group: **Invert**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Technical Assistance, Training, Learning Networks	High	Work to reduce the problem and impacts of acidification on aquatic habitat		DEC, other state regulators, state legislators, governor, congressmen	
Alliance Development	Medium	Enhance coordination between government agencies and partners to ensure consistency in respective program implementation and increased sensitivity to SGCN snail requirements and problem for SGCN snails		ANR, USFWS	
Compatible Resource Use	High	Reduce the use of algicides, molluscicides, and other pesticides in waters where it may impact SGCN snails	Sustained reduction in the number of annual requests for use of pesticides in SGCN waters	FWD, DEC, ANR, lake associations, private landowners	
Invasive Species Control & Prevention	High	Prevent the introduction and spread of invasive exotic species (particularly snails)		FWD, DEC, LCBP, USFWS	
Habitat Restoration	High	Protect and restore habitats on which SGCN snails are dependent through pollution abatement, riparian buffers, etc.	Number of acres of riparian and lakeshore natural vegetation protected and/or restored. Number of acres of lake habitat restored/protected	LCLT, VLT, Watershed groups, USFWS, DEC, FWD	LIP, SWG, LCLT, VLT, NRCS

Common Name: **Grassland Butterflies Group**
Scientific Name: **Grassland Butterflies Group**
Species Group: **Invert**

Conservation Assessment:

Final Assessment: High Priority

Global Rank:
Global Trend:
State Rank:
State Trend: Declining
Extirpated in VT?
Regionally Rare? Yes

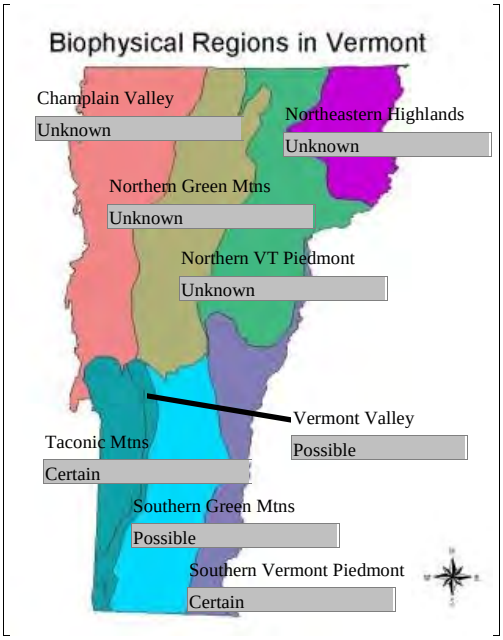
Assessment Narrative:

Regal fritillary is extirpated; other species are extremely rare in Vermont Persius duskywing has declined drastically in the Northeast, now being limited to a few small, fragmented populations.

This group consists of four species, the habitat requirements of which vary within the general grasslands category. Regal fritillary is extirpated in Vermont and almost all of the Northeast. The other species are very rare in Vermont. Habitats given for each species refer to required host plants.

Cobweb skipper (Hesperia metea) Grasslands, prairies, barrens, and old fields with little bluestem (Andropogon scoparius) and big bluestem (A. gerardi).
Persius duskywing (Erynnis persius) Open areas with lupine
Regal fritillary (Speyeria idalia) Tall-grass prairie and other open sites including damp meadows, marshes, wet fields, and mountain pastures.
Dusted Skipper (Atrytonopsis hianna) Grasslands, prairies, barrens, and old fields with little bluestem (Andropogon scoparius) and big bluestem (A. gerardi).

Distribution:



Natural History Elements:

Home Range:
Migrant? No

- **Within watershed** ☐
- **Within biophysical region** ☐
- **Within VT** ☐
- **Within Region** ☐
- **Within US** ☐
- **Outside US** ☐

Distribution Summary:

Town records:
Cobweb skipper Sunderland
Persius duskywing ?
Regal fritillary extirpated. Historic: Hartland, Pomfret
Dusted skipper Arlington, Dummerston

Common Name: **Grassland Butterflies Group**
Scientific Name: **Grassland Butterflies Group**
Species Group: **Invert**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

This group consists of four species, the habitat requirements of which vary within the general grasslands category. Regal fritillary is extirpated in Vermont and all of North America east of the Mississippi River except for one location in central PA. The other species are very rare in Vermont. Habitats given for each species refer to required host plants.

Cobweb skipper (Hesperia metea) Grasslands, prairies, barrens, and old fields with little bluestem and big bluestem
Persius duskywing (Erynnis persius) Open areas with wild lupine
Regal fritillary (Speyeria idalia) Tall-grass prairie and other open sites including damp meadows, marshes, wet fields, and mountain pastures.
Dusted Skipper (Atrytonopsis hianna) Grasslands, prairies, barrens, and old fields with little bluestem (Andropogon scoparius) and big bluestem (A. gerardi).

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☑
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Grasslands and Hedgerows

Oak-Pine Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Habitat Succession

Impacts of Roads or Trails

Inadequate Disturbance Regime

Description of habitat problem(s): Persius duskywing is extremely rare and requires wild lupine as larval food plant. It is therefore unlikely to be well established in Vermont unless this plant is reintroduced and the habitat managed for these species, or if an alternate larval food plant is discovered.

Non-Habitat Problems:

Common Name: **Grassland Butterflies Group**
Scientific Name: **Grassland Butterflies Group**
Species Group: **Invert**

Loss of Relationship with Other Species

Trampling or Direct Impacts

Description of non-habitat problem(s):

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Define particular habitat requirements of each species within Vermont, utilizing current knowledge of researchers and field investigations.
Research	Distribution and Abundance	High	1) Conduct inventories to detect and gather information on new SGCN butterfly populations. 2) Obtain baseline distributional and abundance data for all species in group by conducting surveys throughout the state. Efforts should be focused on particular habitats required by each and, where appropriate, on regions of expected occurrence within the state (e.g., a northern peripheral species might be expected in the northern tier counties). Abundance information should be collected at sites of known occurrence. Knowledge of host plant distribution is often helpful.
Research	Threats and Their Significance	High	Assess potential and existing impacts of limiting factors to habitat, host plants, and individual butterflies. Such limiting factors as habitat loss and degradation, exotic invasive plants, disease, and host plant loss should be examined.
Research	Population Genetics	Medium	Reintroduction of regal fritillary and persius duskywing would need to identify the source populations that are likely most similar to those originally occurring in Vermont.
Monitoring	Population Change	Medium	1) Monitor known SGCN butterfly populations. 2) Population monitoring could be employed to track population trends at distinct locations. This would follow field surveys and assessments to identify populations judged to be large and viable. Focusing on such large populations would offer greater probability of detecting population shifts.
Monitoring	Habitat Change	High	Grasslands are some of the habitats most vulnerable to loss due to development and intensive agriculture. Landscape level changes in this general habitat type should be monitored. Loss, restoration, and other changes to local habitat sites recognized as important to these species should be tracked.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Easements	High	Acquisition/easement of high priority SGCN butterfly grassland sites	Number of SGCN butterfly sites protected	FWD, VLT, other land trusts	VHCB, SWG, LIP, WHIP, USFWS

Common Name: **Hardwood Forest Butterflies Group**
Scientific Name: **Hardwood Forest Butterflies Group**
Species Group: **Invert**

Conservation Assessment:

Final Assessment: High Priority

Global Rank:
Global Trend:
State Rank:
State Trend: Unknown
Extirpated in VT? No
Regionally Rare? Yes

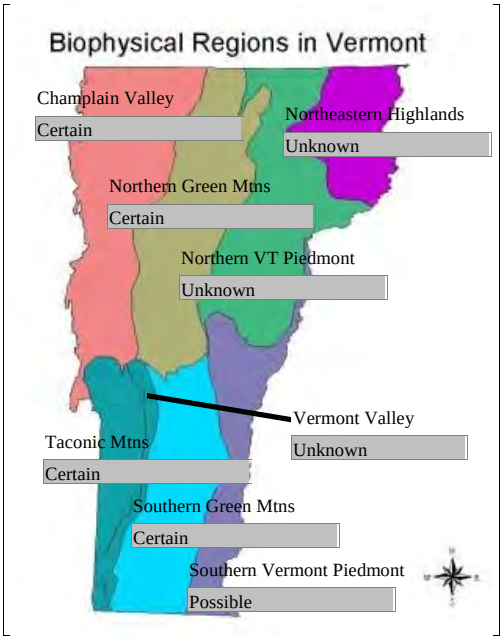
Assessment Narrative:

Individual species in this group are rare in Vermont; several are regionally or globally rare.

This group consists of several species, the habitat requirements of which vary within the general hardwood forest category. Most species have not been assigned state status ranks, due to incomplete distribution and abundance information, but records for each are very limited. Caterpillars depend on specific food plants, which are often themselves rare (e.g., hackberry, scrub oak).

West Virginia white (Pieris virginiensis) Rich hardwood forest with toothwort (larval host plant)
Early hairstreak (Erora laeta) American beech stands (larval host plant; feeds on nuts and leaves)
Hackberry emporer (Asterocampa celtis) Floodplain forest with hackberry stands (larval host plant)
Tawny emporer (Asterocampa clyton) Floodplain forest with hackberry stands (larval host plant)
Edwards' hairstreak (Satyrium edwardsii) Sand plain woodland/ pitch pine-oak-heath rocky hill and other similar habitat that contain either scrub or black oak stands (larval host plants)

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Town records:
West Virginia white Arlington, Shaftsbury, Underhill, Bradford, Sandgate, Woodford. Historic: Milton, Essex, Searsburg, Sandgate, Somerset, Fairfax
Early hairstreak Essex, East Montpelier, Pittsfield, Worcester. Historic: Granby, Guildhall, Rupert, Underhill, Marlboto, Stratton
Hackberry emperor Burlington, Salisbury, Windsor
Tawny empower Colchester, Orange, Richmond
Edwards' hairstreak Pownal

Common Name: **Hardwood Forest Butterflies Group**
Scientific Name: **Hardwood Forest Butterflies Group**
Species Group: **Invert**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

This group consists of several species, the habitat requirements of which vary within the general hardwood forest category. Most species have not been assigned state status ranks, due to incomplete distribution and abundance information, but records for each are very limited. Caterpillars require specific food plants, which are often themselves rare (e.g., hackberry, scrub oak).

West Virginia white (Pieris virginiensis) rich hardwood forest with toothwort (larval host plant)
Early hairstreak (Erora laeta) American beech stands (larval host plant)
Hackberry emporer (Asterocampa celtis) Floodplain forest with hackberry stands (larval host plant)
Tawny emporer (Asterocampa clyton) Floodplain forest with hackberry stands (larval host plant)
Edwards' hairstreak (Satyrium edwardsii) Sand plain woodland/ pitch pine-oak-heath rocky hill and other similar habitat that contain either scrub or black oak stands (larval host plants)

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Floodplain Forests

Northern Hardwood

Oak-Pine Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Invasion by Exotic Species

Description of habitat problem(s): Early hairstreak is limited by the loss of American beech stands due to beech bark disease. Caterpillars feed on the fruits of this tree, which are only produced by individuals 40 years old or more. Invasion of garlic mustard may limit the West Virginia White, as the adults will lay eggs on it. The plant is reported to be toxic to eggs/larvae.

Non-Habitat Problems:

Genetics

Loss of Relationship with Other Species

Common Name: **Hardwood Forest Butterflies Group**
Scientific Name: **Hardwood Forest Butterflies Group**
Species Group: **Invert**

Description of non-habitat problem(s): Asterocampa populations are far from closest known sites; these are not vagile species.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Define particular habitat requirements of each species within Vermont, utilizing current knowledge of researchers and field investigations.
Research	Basic Life History	Medium	It is possible that early hairstreak uses beaked hazelnut in Vermont, as well as American beech; but this is unknown.
Research	Distribution and Abundance	High	1) Conduct inventories to detect and gather information on new SGCN butterfly populations. 2) Obtain baseline distributional and abundance data for all species in group by conducting surveys throughout the state. Efforts should be focused on particular habitats required by each and, where appropriate, on regions of expected occurrence within the state (e.g., a northern peripheral species might be expected in the northern tier counties). Abundance information should be collected at sites of known occurrence. Knowledge of host plant distribution is often helpful.
Research	Threats and Their Significance	High	Assess potential and existing impacts of limiting factors to habitat, host plants, and individual butterflies. Such limiting factors as habitat loss and degradation, exotic invasive plants, disease, and host plant loss should be examined.
Monitoring	Population Change	Medium	1) Monitor known SGCN butterfly populations. 2) Population monitoring could be employed to track population trends at distinct locations. This would follow field surveys and assessments to identify populations judged to be large and viable. Focusing on such large populations would offer greater probability of detecting population shifts.
Monitoring	Habitat Change	High	Monitor change in available habitat for each species' specific requirements. Loss, restoration, and other changes to local habitat sites recognized as important to these species should be tracked.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Easements	High	Acquisition/easement of high priority SGCN butterfly hardwood forest sites	Number of SGCN butterfly sites protected	FWD, FPR, TNC, VLT, other land trusts	VHCB, SWG, LIP, WHIP, USFWS
Standards	High	Work with foresters to avoid significant impacts to SGCN butterfly populations and habitats during forest management activities	Number of SGCN butterfly locations indicated and protected in forest management plans (including mature beech stands)	FWD, FPR, USFS, private landowners	

Common Name: **Lakes/ponds Odonates Group**
Scientific Name: **Lakes/ponds Odonates Group**
Species Group: **Invert**

Conservation Assessment:

Final Assessment: High Priority

Global Rank:
Global Trend:
State Rank:
State Trend: Unknown
Extirpated in VT? No
Regionally Rare? Yes

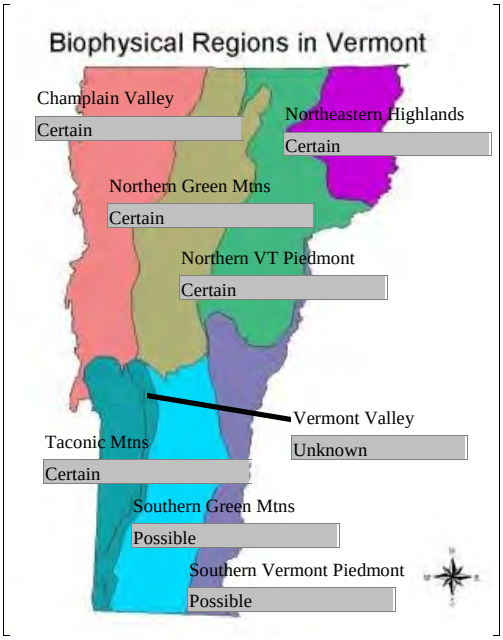
Assessment Narrative:

Individual species in this group are rare in Vermont; several are regionally or globally rare.

This group consists of several species, the habitat requirements of which vary within the general lakes/ponds category. Most species have not been assigned state status ranks, due to incomplete distribution and abundance information, but records for each are very limited. Habitats given for each species refer primarily to reproduction and nymphal requirements; adults of many species depend on various nearby terrestrial habitats as well. Some dragonflies are known to exhibit "hilltopping" behavior, in which they congregate on tops of hills, which may be fairly distant from egg-laying sites. This would increase the home range requirements for such species. Taxonomic uncertainty of Enallagma cyathigerum/E. vernale populations warrants investigation.

New England Bluet (Enallagma laterale) Vegetated ponds
Vernal Bluet (Enallagma vernale) Lakes, rivers, marshy ponds and lakes
Slender Bluet (Enallagma traviatum) Lakes and ponds with vegetation
Lilypad Forktail (Ischnura kellicotti) Ponds with lilypads
Ringed Emerald (Somatochlora albicincta) Cold ponds
Lake Emerald (Somatochlora cingulata) Shallow cold lakes, sluggish rivers and streams
White Corporal (Libellula exusta) Muck-bottomed lakes and ponds, slow streams; bog-bordered lakes and ponds

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? No

- **Within watershed** ☐
- **Within biophysical region** ☐
- **Within VT** ☐
- **Within Region** ☐
- **Within US** ☐
- **Outside US** ☐

Distribution Summary:

Members of species group vary in distribution. Most biophysical regions probably support one or more members.
County records for lakes/ponds odonates:
New England Bluet (Enallagma laterale) Windham
Vernal Bluest (Enallagma vernale) Windsor, Washington
Slender Bluest (Enallagma traviatum) Rutland
Lilypad Fork tail (Sichuan kellicotti) Rutland
Ringed Emerald (Somatochlora albicincta) Essex
Lake Emerald (Somatochlora cingulata) Caledonia, Essex

Common Name: **Lakes/ponds Odonates Group**
Scientific Name: **Lakes/ponds Odonates Group**
Species Group: **Invert**

White Corporal (Libellula exusta) Rutland, Addison

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

This group consists of several species, the habitat requirements of which vary within the general lakes/ponds category. Most species have not been assigned state status ranks, due to incomplete distribution and abundance information, but records for each are very limited. Habitats given for each species refer primarily to reproduction and nymphal requirements; adults of many species require various nearby terrestrial habitats as well. Some dragonflies are known to exhibit "hilltopping" behavior, in which they congregate on tops of hills, which may be fairly distant from egg-laying sites. This would increase the home range requirements for such species.

New England Bluet (Enallagma laterale) Vegetated ponds
Vernal Bluet (Enallagma vernale) Lakes, rivers, marshy ponds and lakes
Slender Bluet (Enallagma traviatum) Lakes and ponds with vegetation
Lilypad Forktail (Ischnura kellicotti) Ponds with lily pads
Ringed Emerald (Somatochlora albicincta) Cold ponds
Lake Emerald (Somatochlora cingulata) Cold ponds
White Corporal (Libellula exusta) Muck-bottomed lakes and ponds, slow streams; bog-bordered lakes and ponds

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Lacustrine
Aquatic: Man-Made Water Bodies
Marshes and Sedge Meadows
Open Peatlands

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat
Habitat Alteration
Sedimentation

Description of habitat problem(s):

Non-Habitat Problems:

Common Name: **Lakes/ponds Odonates Group**
Scientific Name: **Lakes/ponds Odonates Group**
Species Group: **Invert**

Pollution

Description of non-habitat problem(s):

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Define particular habitat requirements of each species within Vermont, utilizing current knowledge of researchers and field investigations.
Research	Distribution and Abundance	High	1) Monitor known SGCN odonate populations. 2) Obtain baseline distributional and abundance data for all species in group by conducting surveys throughout the state. Efforts should be focused on particular habitats required by each and, where appropriate, on regions of expected occurrence within the state (e.g., a northern peripheral species might be expected in the northern tier counties). Abundance information should be collected at sites of known occurrence.
Research	Threats and Their Significance	Medium	Assess the vulnerability of nymphs of each species to wetland perturbations, such as siltation, temperature and water quality shifts, chemical pollution, and changes in vegetation. Investigate the upland habitat needs of the adults and the effects of such impacts as fragmentation and reduction.
Research	Taxonomy	Medium	Taxonomic uncertainty of Enallagma cyathigerum/E. vernale populations warrants investigation.
Monitoring	Population Change	Medium	1) Conduct inventories to detect and gather information on new SGCN odonate populations. 2) Population monitoring could be employed to track population trends at distinct locations. This would follow field surveys and assessments to identify populations judged to be large and viable. Focusing on such large populations would offer greater probability of detecting population shifts.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Easements	High	Acquisition/easement of high priority SGCN odonate lake and pond sites	Number of SGCN odonate sites protected	FWD, VLT, other land trusts	VHCB, SWG, LIP, WHIP, USFWS

Common Name: **A slave-making ant**
Scientific Name: **Leptothorax n. sp.**
Species Group: **Invert**

Conservation Assessment:

Final Assessment: High Priority

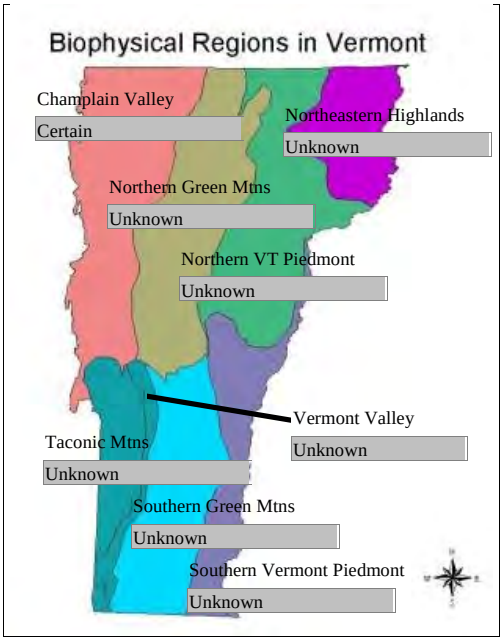
Global Rank:
Global Trend:
State Rank:
State Trend: Unknown
Extirpated in VT? Unknown
Regionally Rare? Yes

Assessment Narrative:

This is apparently a very rare species, only known from two sites globally. The sites are about 20 km apart.

This species is known from only two sites worldwide. At least one of these is in Vermont. This site is in a state park, which could provide some protection; however, the ant is not a conservation target for the park at this time. This species and its habitat are not currently afforded protected. This may be a species endemic to Vermont, depending on the location of the second site. More survey work is needed, however, to determine the extent of its range.
This slave-making ant was first collected at Niquette Bay State Park in 1986, but has not been found since then, despite 14 years of collecting effort at the park subsequent to the initial discovery. Information for the second site has not been pursued.

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The original site where this species was discovered in Niquette Bay State Park, Colchester. The second and only other reported site is described as being "about 20 km from our VT [NBSP] site."

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

This species utilizes a social "parasite" strategy, enslaving workers of other ant species to perform tasks of the nest. The slavemakers and their hosts live in preformed plant cavities such as hollow sticks and acorns in the litter and surface soil layers. The Vermont state park site is described in literature as second-growth temperate deciduous forest that has been protected from logging since the 1930's. The forest is dominated by oaks, while hemlock, birch, and pine contribute strongly to the canopy. The site is flat, possibly situated on a floodplain at

Common Name: **A slave-making ant**
Scientific Name: **Leptothorax n. sp.**
Species Group: **Invert**

about 30m elevation.
This slave-making ant lives in complex colonies that can occupy more than one physical location, termed polydomy. A colony represents a family unit and is typically fractionated into several "nests". There is differing information on whether these individual nests regroup in autumn or remain spatially stable. A nest, comprised of a local group of ants cohabiting a particular domicile, may or may not contain the colony's queen. Nests of a colony tend to be spatially clustered. Two host ant species were reported as being used by Leptothorax sp. at the Niquette Bay State Park site. A second and more abundant species of slave-making ant also inhabits this site and utilizes the same host species.

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Oak-Pine Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Description of habitat problem(s): Oaks are necessary, as they supply acorns used for habitation. Loss/reduction of oaks would impact habitat availability.

Non-Habitat Problems:

Competition

Loss of Relationship with Other Species

Pollution

Unknown Non-Habitat Threatss

Description of non-habitat problem(s): Any herbicide or insecticide use could negatively impact this ground-dwelling species.
Abundance has been declining at the state park for many species of ants, including the hosts of Leptothorax sp. This could result in loss of colony functions and could reduce survival.
The other slave-making ant known from this site is more abundant and utilizes the same host ant species and habitat. It does not appear to yet be impacted by declining host numbers. There may be significant competition for nesting cavities.
Low abundance of Leptothorax sp. makes this ant vulnerable to fluctuations in population density.

Common Name: **A slave-making ant**
Scientific Name: **Leptothorax n. sp.**
Species Group: **Invert**

Recolonization or rebound following large population drops may not be possible.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Distribution and Abundance	High	Use existing habitat description to help identify other sites in the state where this ant may exist. An intensive survey of these potential sites will be needed.
Research	Threats and Their Significance	High	Potential limiting factors to populations of this species need to be evaluated. This should particularly focus on factors at the state park site, such as use of chemicals, mowing, and removal of mature oak trees.
Research	Taxonomy	High	Species needs to be officially described.
Monitoring	Population Change	High	Original site where reported needs to be intensively surveyed to determine if this ant is still present and, if so, at what level of abundance.
Monitoring	Monitor Threats	High	limiting factors identified as significant at sites of occurrence need to be monitored.

Common Name: **Mayflies/Stoneflies/Caddisflies Group**
Scientific Name: **Mayflies/Stoneflies/Caddisflies Group**
Species Group: **Invert**

Conservation Assessment:

Final Assessment: High Priority

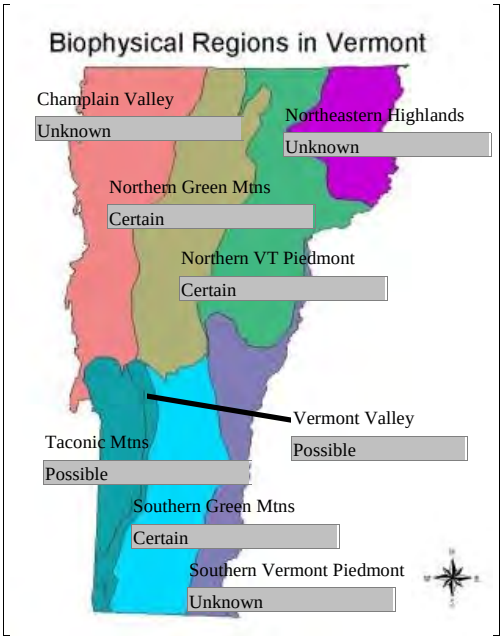
Global Rank:
Global Trend:
State Rank:
State Trend: Unknown
Extirpated in VT? No
Regionally Rare? Yes

Assessment Narrative:

This select group consists of only globally rare species (G1-G3). Very little information is available on Vermont populations, making status determination difficult.

A Mayfly (Ameletus browni) This is a globally rare species (G3/G4). Insufficient information is available to determine VT status.
Tomah Mayfly (Siphlonisca aerodromia) This is a globally rare species (G3G4). Although not yet recorded from VT, insufficient information is available to determine VT status.
Roaring Brook Mayfly (Epeorus frisoni) This is a globally rare species (G1). Known only recently from a single location in VT. To date, only four small stream populations are known worldwide.
A Mayfly (Eurylophella bicoloroides) This is a globally rare species (G3). Insufficient information is available to determine VT status.
A Mayfly (Baetisca rubescens) This is a globally rare species (G3/G4). Insufficient information is available to determine VT status.
A stonefly (Alloperla voinae) This is a globally rare species (G3) which is rarely collected. Insufficient information is available to determine VT status.
A caddisfly (Rhyacophila brunnea) This species is known from fewer than 10 sites in Vermont.

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Roaring Brook mayfly (Epeorus frisoni) Known in Vermont only from a Battenkill tributary near Dorset. Globally, known from a single historic site in NY and two small stream systems in ME.
Ameletus browni This species is not well documented, but has been reported from Bennington County.
Eurylophella bicoloroides This species is not well documented, but has been reported from Bennington County.
Tomah mayfly (Siphlonisca aerodromia) This mayfly has not yet been documented in VT. It is known only from a few sites in NY, ME, QE, and Labrador. Noted as one of the rarest mayflies in the world.
Baetisca rubescens Distribution of this species in VT is not

Common Name: **Mayflies/Stoneflies/Caddisflies Group**
Scientific Name: **Mayflies/Stoneflies/Caddisflies Group**
Species Group: **Invert**

known.
Alloperla voinae Distribution of this species in VT is not known. Otherwise known from NY to NS, south to MA.
Rhyacophila brunnea Known from Killington, Shrewsbury, Mendon, Orange, and Stowe.

Known Watersheds

Hudson-Hoosic Rivers

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Tomah mayfly (Siphlonisca aerodromia) This mayfly inhabits rivers with broad, seasonally flooded sedge-dominated floodplains.
Roaring Brook mayfly (Epeorus frisoni) This species inhabits small creeks. It has been reported from first and second order streams in NY and ME.
Ameletus browni Habitat is unknown for this species.
Eurlophella bicoloroides This is a stream/river species; the specific habitat is unknown.
Baetisca rubescens This is a stream/river species; the specific habitat is unknown.
Alloperla voinae Habitat is unknown for this species.
Rhyacophila brunnea This species inhabits small, high-elevation streams; these are acid-sensitive streams.

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial

Marshes and Sedge Meadows

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Sedimentation

Description of habitat problem(s):

Common Name: **Mayflies/Stoneflies/Caddisflies Group**
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Species Group: **Invert**

Non-Habitat Problems:

Pollution

Description of non-habitat problem(s): Several of these species are known globally from very few sites, which are often widely separated. Recolonization may not be possible if individual populations are lost.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Need to determine details of habitat requirements in order to refine distributional searches.
Research	Distribution and Abundance	High	1) 1) Conduct inventories to detect and gather information on SGCN stoneflies, mayflies, and caddisflies. 2) Need statewide surveys to provide basic understanding of distribution for all species.
Monitoring	Population Change	Medium	1) Monitor known SGCN stonefly/mayfly/caddisfly populations. 2) Populations should be monitored for presence/absence now; monitor for population changes after baseline abundance data is available.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration	High	Protect and restore habitats on which SGCN stoneflies, mayflies, and caddisflies are dependent through pollution abatement, riparian buffers, flow regulation, easements, etc.	Number of acres of riparian habitat protected and/or restored	FWD, USFS, Trout Unlimited, Watershed groups, Landowners, NRCS	LIP, SWG, WHIP, LCLT, VLT

Common Name: **Moths Group**
Scientific Name: **Moths Group**
Species Group: **Invert**

Conservation Assessment:

Final Assessment: High Priority

Global Rank:
Global Trend:
State Rank:
State Trend:
Extirpated in VT?
Regionally Rare? Yes

Assessment Narrative:

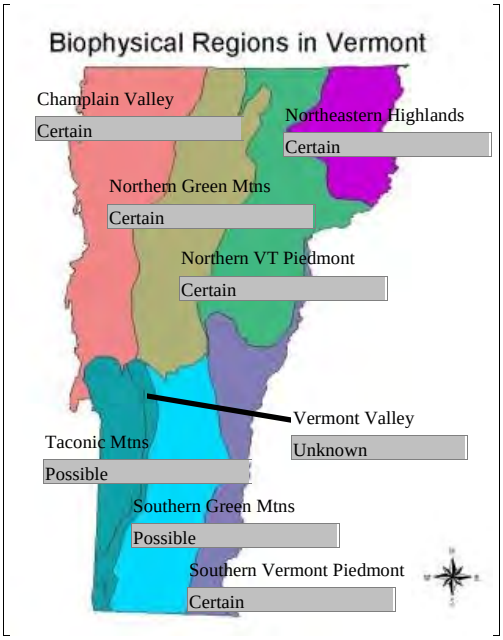
Numerous species of moths are considered rare, declining, or extirpated. Very little information is available on the distribution of these species, and there is even less known about their trends throughout the region. They are treated here together as a single group due to this dearth of information.

The following species:
Sthenopis thule A ghost moth Single specimen, South Hero in '92. LFP*: reported on willows, but not well known.
Itame ribearia Currant spanworm Collected Bakersfield, '91 (Franklin Co). LFP: currant, gooseberry. Formerly widespread, now rare through much of range due to eradication of currant in 1920's-'60's (alternate host of white pine blister rust).
Eacles imperialis pini Imperial moth One collected Grand Isle, '01; Chittenden Co. historically. White pine specialist; possibly also pitch pine. Found in coniferous forest. Declined drastically or disappeared from VT in '50's. Probable cause of decline was pesticide spraying and release of Compsilura concinnata for gypsy moth control. Use of BTK is also potential limiting factor if used wrong time of year (late June or later).
Hemileuca lucina New England buckmoth Restricted to New England; found in SE VT. Found in wet meadows and open fields. LFP: oak, Prunus serotina, willows, gray birch, Vaccinium; early instars on meadowsweet.
Sphinx drupiferarum Plum sphinx or Wild cherry spinx Reported from Franklin, Chittenden, Bennington, Orleans, and Lamoille counties. Populations declining in Eastern NA; uncommon to rare throughout range. Drastically reduced/extirpated over much of range, reportedly due to aerial (DDT) spraying. Found in wooded habitats and suburbs. LFP: cherry, plum, apple; also lilac and hackberry.
Sphinx eremitus Hermit sphinx Reported from Franklin, Windsor,and Grand Isle counties. Populations declining rangewide. LFP: Monarda, Mentha, Lycopis, Salvia.
Sphinx luscitiosa Clemens' sphinx Populations declining rangewide. Uncommon or rare throughout Northeast. LFP: willow, poplar, birch, apple, ash.
Lasionycta taigata A noctuid moth Reported from Essex Co. '75 (Moose Pond). A bog associate.
Lemmeria digitalis A noctuid moth Several collected in Chitenden Co., 1991-93.
Lithophane franclemonti Franclemont's lithophane Known from one Grand Isle specimen. LFP and habitat unknown.
Pachypolia atricornis An autumnal noctuid moth Reported from Chittenden Co. (Proctor Maple Research Forest). Very rarely collected throughout range. Found in mesic northern hardwoods with non-acidic soils.
Papaipema sp. 2 Ostrich fern borer moth Rare outside of VT. Responsibility species. Metapopulation structure is needed for long-term viability. Globally rare (G3G4).
Properigea sp. 1 (P. costa) A noctuidmoth Collected in Chittenden Co. Associated with shale, granite, or limestone barrens. Globally rare (G2G3).
Xestia fabulosa A noctuid moth Range not well-known. Recorded from VT, NH, and ON. (Previously in genus Anomogyna). LFP: Vaccinium sp.
Xestia homogena A noctuid moth Found in alpine habitat (high elevation; mountain peaks).
Zale submediana Gray spring zale Reported from Jericho Research Forest (Chittenden Co.) in '90. Very rare in VT; probably was previously common in sand plains. LFP: jack, pitch, red, and probably other hard pines.
Zanclognatha martha Pine barrens zanclognatha Reported from Jericho Research Forest (Chittenden Co.) in '90. Somewhat rare outside of NJ. Found in pitch pine/ scrub oak barrens in PA northward; Jericho population may have colonized pines from a remnant pine barren.

Common Name: **Moths Group**
Scientific Name: **Moths Group**
Species Group: **Invert**

* LFP is larval food plant.

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The following species:
Sthenopis thule A ghost moth Single specimen, South Hero in '92.
Itame ribearia Currant spanworm Collected Bakersfield, '91 (Franklin Co). Formerly widespread, now rare through much of range.
Eacles imperialis pini Imperial moth One collected Grand Isle, '01; Chittenden Co. historically. Declined drastically or disappeared from VT in '50's. Also known from northern NY and southern Canada.
Hemileuca lucina New England buckmoth Restricted to New England; found in SE VT.
Sphinx drupiferarum Plum sphinx or Wild cherry spinx Reported from Franklin, Chittenden, Bennington, Orleans, and Lamoille counties. Populations declining in Eastern NA; uncommon to rare throughout range. Drastically reduced/extirpated over much of range.
Sphinx eremitus Hermit sphinx Reported from Franklin, Windsor, and Grand Isle counties. Populations declining rangewide.
Sphinx luscitiosa Clemens' sphinx Populations declining rangewide. Uncommon or rare throughout Northeast.
Lasionycta taigata A noctuid moth Reported from Essex Co. '75 (Moose Pond).
Lemmeria digitalis A noctuid moth Several collected in Chittenden Co., 1991-93.
Lithophane franclemonti Franclemont's lithophane Known from one Grand Isle specimen.
Pachypolia atricornis An autumnal noctuid moth Reported from Chittenden Co. (Proctor Maple Research Forest). Very rarely collected throughout range.
Papaipema sp. 2 Ostrich fern borer moth Rare outside of VT. Responsibility species. Globally rare (G3G4).
Properigea sp. 1 (P. costa) A noctuidmoth Collected in Chittenden Co. Globally rare (G2G3).

Common Name: **Moths Group**
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Xestia fabulosa A noctuid moth Range not well-known. Recorded from VT, NH, and ON.
Xestia homogena A noctuid moth Found in alpine habitat (high elevation; mountain peaks).
Zale submediana Gray spring zale Reported from Jericho Research Forest (Chittenden Co.) in '90. Very rare in VT; probably was previously common in sand plains.
Zanclognatha martha Pine barrens zanclognatha Reported from Jericho Research Forest (Chittenden Co.) in '90. Somewhat rare outside of NJ.

* LFP is larval food plant.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

The following species:
Sthenopis thule A ghost moth Single specimen, South Hero in '92. LFP*: reported on willows, but not well known.
Itame ribearia Currant spanworm Collected Bakersfield, '91 (Franklin Co). LFP: currant, gooseberry. Forests, woodlands, wooded swamps. Formerly widespread, now rare through much of range due to eradication of currant in 1920's-'60's (alternate host of white pine blister rust).
Eacles imperialis pini Imperial moth One collected Grand Isle, '01; Chittenden Co. historically. White pine specialist; possibly also pitch pine. Found in coniferous forest. Declined drastically or disappeared from VT in 1950's. Probable cause of decline was pesticide spraying and release of Compsilura concinnata for gypsy moth control. Use of BTK is also potential problem if used wrong time of year (late June or later).
Hemileuca lucina New England buckmoth Restricted to New England; found in SE VT. Found in wet meadows and open fields. LFP: oak, Prunus serotina, willows, gray birch, Vaccinium; early instars on meadowsweet.
Sphinx drupiferarum Plum sphinx or Wild cherry spinx Reported from Franklin, Chittenden, Bennington, Orleans, and Lamoille counties. Populations declining in Eastern NA; uncommon to rare throughout range. Drastically reduced/extirpated over much of range, reportedly due to aerial (DDT) spraying. Found in wooded habitats and suburbs. LFP: cherry, plum, apple; also lilac and hackberry.
Sphinx eremitus Hermit sphinx Reported from Franklin, Windsor,and Grand Isle counties. Populations declining rangewide. LFP: Monarda, Mentha, Lycopis, Salvia.
Sphinx luscitiosa Clemens' sphinx Populations declining rangewide. Uncommon or rare throughout Northeast. LFP: willow, poplar, birch, apple, ash.
Lasionycta taigata A noctuid moth Reported from Essex Co. '75 (Moose Pond). A bog associate.
Lemmeria digitalis A noctuid moth Several collected in Chitenden Co., 1991-93.
Lithophane franclemonti Franclemont's lithophane Known from one Grand Isle specimen. LFP and habitat unknown.
Pachypolia atricornis An autumnal noctuid moth Reported from Chittenden Co. (Proctor Maple Research Forest). Very rarely collected throughout range. Found in mesic northern hardwoods with non-acidic soils.
Papaipema sp. 2 Ostrich fern borer moth Rare outside of VT. Responsibility species. Metapopulation structure is needed for long-term viability. Globally rare (G3G4).
Properigea sp. 1 (P. costa) A noctuidmoth Collected in Chittenden Co. Associated with shale, granite, or limestone barrens. Globally rare (G2G3).
Xestia fabulosa A noctuid moth Range not well-known. Recorded from VT, NH, and ON. LFP: Vaccinium sp.

Common Name: **Moths Group**
Scientific Name: **Moths Group**
Species Group: **Invert**

Xestia homogena A noctuid moth Found in alpine habitat (high elevation; mountain peaks).
Zale submediana Gray spring zale Reported from Jericho Research Forest (Chittenden Co.) in '90. Very rare in VT; probably was previously common in sand plains. LFP: jack, pitch, red, and probably other hard pines.
Zanclognatha martha Pine barrens zanclognatha Reported from Jericho Research Forest (Chittenden Co.) in '90. Somewhat rare outside of NJ. Found in pitch pine/ scrub oak barrens in PA northward; Jericho population may have colonized pines from a remnant pine barren.

* LFP is larval food plant.

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Floodplain Forests
Grasslands and Hedgerows
Northern Hardwood
Oak-Pine Northern Hardwood
Open Peatlands
Outcrops and Alpine

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change
Conversion of Habitat
Habitat Alteration
Habitat Fragmentation
Habitat Succession
Inadequate Disturbance Regime
Invasion by Exotic Species

Description of habitat problem(s): Sthenopis thule A ghost moth unknown problems
Itame ribearia Currant spanworm Formerly widespread, now rare through much of range due to eradication of currant in 1920's-'60's (alternate host of white pine blister rust).
Eacles imperialis pini Imperial moth Declined drastically or disappeared from VT in '50's. Probable cause of decline was pesticide spraying and release of Compsilura concinnata for gypsy moth control. Use of BTK is also potential problem if used wrong time of year (late June or later).
Hemileuca lucina New England buckmoth habitat loss, habitat succession
Lasionycta taigata A noctuid moth unknown problems
Lemmeria digitalis A noctuid moth unknown problems
Lithophane franclemonti Franclemont's lithophane unknown problems
Pachypolia atricornis An autumnal noctuid moth unknown problems
Papaipema sp. 2 Ostrich fern borer moth Metapopulation structure is needed for long-term viability (habitat

Common Name: **Moths Group**
Scientific Name: **Moths Group**
Species Group: **Invert**

loss, habitat fragmentation, invasion by exotic species)
Properigea sp. 1 (P. costa) A noctuid moth unknown problems
Xestia fabulosa A noctuid moth unknown problems
Xestia homogena A noctuid moth unknown problems
Zale submediana Gray spring zale habitat loss
Zanclognatha martha Pine barrens zanclognatha habitat loss

Non-Habitat Problems:

Parasites

Pollution

Reproductive Traits

Description of non-habitat problem(s): Eacles imperialis pini Imperial moth. Declined drastically or disappeared from VT in '50's. Probable cause of decline was pesticide spraying and release of Compsilura concinnata for gypsy moth control. Use of BTK is also potential problem if used wrong time of year (late June or later).
Sphinx drupiferarum Plum sphinx or Wild cherry spinx. Populations drastically reduced/ extirpated over much of range, reportedly due to aerial (DDT) spraying.
Sphinx eremitus Hermit sphinx. Populations declining rangewide; cause not reported, but likely similar to S. drupiferarum.
Sphinx luscitiosa Clemens' sphinx Populations declining rangewide; cause not reported, but likely similar to S. drupiferarum.
Papaipema sp. 2 Ostrich fern borer moth Metapopulation structure is needed for long-term viability.

Common Name: **Moths Group**
Scientific Name: **Moths Group**
Species Group: **Invert**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Define particular habitat requirements of each species within Vermont, utilizing current knowledge of researchers and field investigations.
Research	Basic Life History	High	Larval host plant requirements need to be studied and described or refined.
Research	Distribution and Abundance	High	1) Conduct inventories to detect and gather information on SGCN moth species. 2) Obtain baseline distributional and abundance data for all species in group by conducting surveys throughout the state. Efforts should be focused on particular habitats required by each and, where appropriate, on regions of expected occurrence within the state (e.g., a northern peripheral species might be expected in the northern tier counties). Abundance information should be collected at sites of known occurrence. Knowledge of host plant distribution is often helpful.
Research	Threats and Their Significance	High	Assess potential and existing impacts of limiting factors to habitat, host plants, and individual moths. Such limiting factors as habitat loss and degradation, exotic invasive plants, diseases, parasitoids, pest control, and host plant loss should be examined.
Research	Taxonomy	Medium	Taxonomic uncertainty of some species, such as Eacles imperialis pini, needs to be resolved.
Monitoring	Population Change	High	1) Monitor known SGCN moth populations. 2) Many of these species are declining regionally. These trends need to be monitored.
Monitoring	Habitat Change	Medium	Monitor change in available habitat for each species' specific requirements. Loss, restoration, and other changes to local habitat sites recognized as important to these species should be tracked.
Monitoring	Monitor Threats	Medium	Several species have been negatively impacted by gypsy moth control methods, including release of exotic parasitoids. Gypsy moth control needs to be tracked and considered in managing for SGCN moths. Exotic parasitoid populations and distributions need to be assessed also.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Easements	High	Acquisition/easement of high priority SGCN moth sites	Number of SGCN moth sites protected	FWD, FPR, VLT, other land trusts	VHCB, SWG, LIP, WHIP, USFWS
Standards	High	Work with those who manage forest pests to reduce/eliminate the use of pesticides and exotic invasive species where they may negatively impact SGCN moth species	Area of land where methods detrimental to SGCN moths has been eliminated through management planning	FWD, FPR, USFS, VT Entomological Society, towns, private landowners	

Common Name: **River/stream Odonates Group**
Scientific Name: **River/stream Odonates Group**
Species Group: **Invert**

Conservation Assessment:

Final Assessment: High Priority

Global Rank:
Global Trend:
State Rank:
State Trend: Unknown
Extirpated in VT? No
Regionally Rare? Yes

Assessment Narrative:

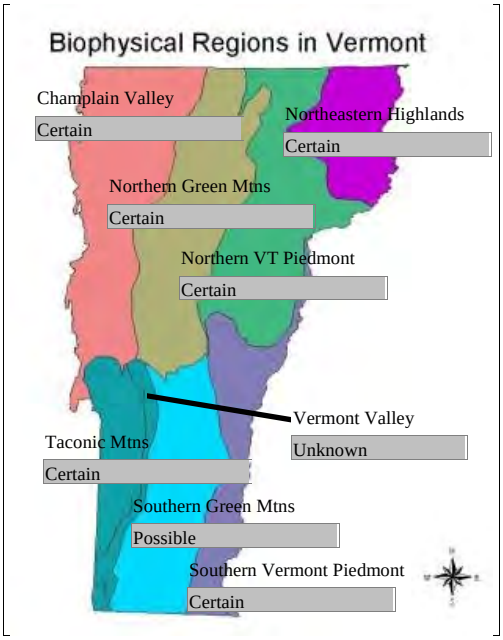
Individual species in this group are rare in Vermont; several are regionally or globally rare.

This group consists of several species, the habitat requirements of which vary within the general rivers/streams category. Most species have not been assigned state status ranks, due to incomplete distribution and abundance information, but records for each are very limited. Habitats given for each species refer primarily to reproduction and nymphal requirements; adults of many species depend on various nearby terrestrial habitats as well. Some dragonflies are known to exhibit "hilltopping" behavior, in which they congregate on tops of hills, which may be fairly distant from egg-laying sites. This would increase the home range requirements for such species.

American Rubyspot (Hetaerina americana) Streams and rivers with emergent vegetation
Blue-fronted Dancer (Argia apicalis) Small to large rivers with sand or mud; occasionally ponds and lakes
Rainbow Bluet (Enallagma antennatum) Slow streams
Spine-crowned Clubtail (Gomphus abbreviatus) Rivers
Rapids Clubtail (Gomphus quadricolor) Large streams and rivers
Skillet Clubtail (Gomphus ventricosus) Large rivers; mud or sand bottom
Cobra Clubtail (Gomphus vastus) Large rivers with mud bottom; sometimes large streams and lakes
Brook Snaketail (Ophiogomphus aspersus) Sandy streams
Riffle Snaketail (Ophiogomphus carolus) Rapid, rocky or sandy streams and rivers
Maine Snaketail (Ophiogomphus mainensis) Clear, rocky forested streams
Rusty Snaketail (Ophiogomphus rupinsulensis) Rapid large streams and rivers
Riverine Clubtail (Stylurus amnicola) Rivers
Zebra Clubtail (Stylurus scudderi) Rivers
Stygian Shadowdragon (Neurocordulia yamaskanensis) Large rivers and lakes; often rocky

Common Name: **River/stream Odonates Group**
Scientific Name: **River/stream Odonates Group**
Species Group: **Invert**

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

County records for river/stream odonates:
American Rubyspot (Hetaerina americana) Addison, Grand Isle
Blue-fronted Dancer (Argia apicalis) Rutland
Rainbow Bluet (Enallagma antennatum) Rutland
Spine-crowned Clubtail (Gomphus abbreviatus) Windham
Rapids Clubtail (Gomphus quadricolor) Rutland
Skillet Clubtail (Gomphus ventricosus) Windham
Cobra Clubtail (Gomphus vastus) Windham
Brook Snaketail (Ophiogomphus aspersus) Rutland, Orange, Grand Isle, Orleans, Essex
Riffle Snaketail (Ophiogomphus carolus) Windsor, Essex
Maine Snaketail (Ophiogomphus mainensis) Bennington, Rutland, Chittenden, Caledonia, Orleans, Essex
Rusty Snaketail (Ophiogomphus rupinsulensis) Windsor
Riverine Clubtail (Stylurus amnicola) Windham
Zebra Clubtail (Stylurus scudderi) Washington, Caledonia, Essex, Windsor
Stygian Shadowdragon (Neurocordulia yamaskanensis) Windham, Rutland

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

This group consists of several species, the habitat requirements of which vary within the general rivers/streams category. Most species have not been assigned state status ranks, due to incomplete distribution and abundance information, but records for each are very limited. Habitats given for each species refer primarily to reproduction and nymphal requirements; adults of many species require various nearby terrestrial habitats as well. Some dragonflies are known to exhibit "hilltopping" behavior, in which they congregate on tops of hills, which may be fairly distant from egg-laying sites. This would increase the home range requirements for such species.

American Rubspot (Hetaerina americana) streams and rivers with emergent vegetation
Blue-fronted Dancer (Argia apicalis) small to large rivers with sand or mud; occasionally ponds and lakes
Rainbow Bluet (Enallagma antennatum) slow streams

Common Name: **River/stream Odonates Group**
Scientific Name: **River/stream Odonates Group**
Species Group: **Invert**

Spine-crowned Clubtail (Gomphus abbreviatus) rivers
Rapids Clubtail (Gomphus quadricolor) large streams and rivers
Skillet Clubtail (Gomphus ventricosus) large rivers; mud or sand bottom
Cobra Clubtail (Gomphus vastus) large rivers with mud bottom; sometimes large streams and lakes
Brook Snaketail (Ophiogomphus aspersus) sandy streams
Riffle Snaketail (Ophiogomphus carolus) rapid, rocky or sandy streams and rivers
Maine Snaketail (Ophiogomphus mainensis) clear, rocky forested streams
Rusty Snaketail (Ophiogomphus rupinsulensis) rapid large streams and rivers
Riverine Clubtail (Stylurus amnicola) rivers
Zebra Clubtail (Stylurus scudderi) rivers
Stygian Shadowdragon (Neurocordulia yamaskanensis) large rivers and lakes; often rocky

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Lacustrine
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Lower CT River

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat
Habitat Alteration
Sedimentation

Description of habitat problem(s):

Non-Habitat Problems:

Pollution

Description of non-habitat problem(s):

Common Name: **River/stream Odonates Group**
Scientific Name: **River/stream Odonates Group**
Species Group: **Invert**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Define particular habitat requirements of each species within Vermont, utilizing current knowledge of researchers and field investigations.
Research	Distribution and Abundance	High	1) Conduct inventories to detect and gather information on new SGCN odonate populations. 2) Obtain baseline distributional and abundance data for all species in group by conducting surveys throughout the state. Efforts should be focused on particular habitats required by each and, where appropriate, on regions of expected occurrence within the state (e.g., a northern peripheral species might be expected in the northern tier counties). Abundance information should be collected at sites of known occurrence.
Research	Threats and Their Significance	Medium	Assess the vulnerability of nymphs of each species to wetland perturbations, such as siltation, temperature and water quality shifts, chemical pollution, and changes in vegetation. Investigate the upland habitat needs of the adults and the effects of such impacts as fragmentation and reduction.
Monitoring	Population Change	Medium	1) Monitor known SGCN odonate populations. 2) Population monitoring could be employed to track population trends at distinct locations. This would follow field surveys and assessments to identify populations judged to be large and viable. Focusing on such large populations would offer greater probability of detecting population shifts.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Easements	High	Acquisition/easement of high priority SGCN odonate riverine sites	Number of SGCN odonate sites protected	FWD, TNC, VLT, other land trusts, watershed groups	SWG, LIP, WHIP, USFWS

Common Name: **Seep/rivulet Odonates Group**
Scientific Name: **Seep/rivulet Odonates Group**
Species Group: **Invert**

Conservation Assessment:

Final Assessment: High Priority

Global Rank:
Global Trend:
State Rank:
State Trend: Unknown
Extirpated in VT? No
Regionally Rare? Yes

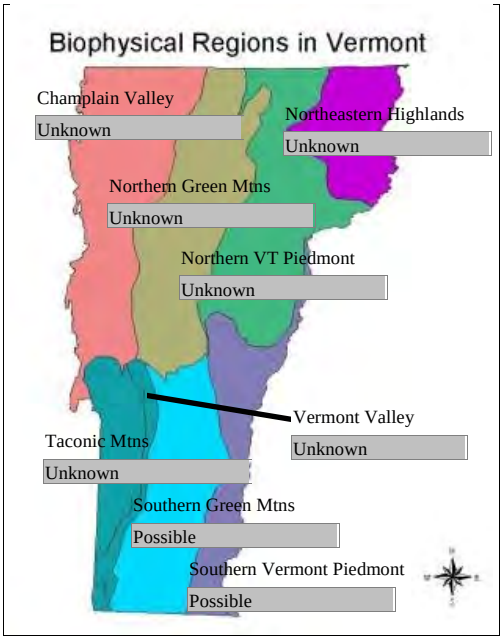
Assessment Narrative:

One species in this group: Gray petaltail (Tachopteryx thoreyi). Only a single, small population is known in Vermont. This is a rare species within the state, with specialized habitat requirements.

Current records for this species indicate that it is very rare. Greater effort is needed to located specific populations for conservation action. Habitat description refers primarily to reproduction and nymphal requirements; adults require adjacent, forested upland habitat as well. Some dragonflies are known to exhibit "hilltopping" behavior, in which they congregate on tops of hills, which may be fairly distant from egg-laying sites. This would increase the home range requirements for such species. Although placed in the wetland odonates group, the Citrine forktail (Ischnura hastata) will also use forested seeps.

Gray petaltail (Tachopteryx thoreyi) Forested hillside seeps

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Gray petaltail (Tachopteryx thoreyi) Reported only from Windham County.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Current records for this species indicate that it is very rare. Greater effort is needed to located specific populations for conservation action. Habitat description refers primarily to reproduction and nymphal requirements; adults require adjacent, forested upland habitat as well. Some dragonflies are known to exhibit "hilltopping" behavior, in which they congregate on tops of hills, which may be fairly distant from egg-laying

Common Name: **Seep/rivulet Odonates Group**
Scientific Name: **Seep/rivulet Odonates Group**
Species Group: **Invert**

sites. This would increase the home range requirements for such species. Although placed in the wetland odonates group, the Citrine forktail (Ischnura hastata) will also use forested seeps.

Gray petaltail (Tachopteryx thoreyi) Forested hillside seeps

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Seeps and Pools

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Impacts of Roads or Trails

Sedimentation

Description of habitat problem(s):

Non-Habitat Problems:

Pollution

Trampling or Direct Impacts

Description of non-habitat problem(s):

Common Name: **Seep/rivulet Odonates Group**
Scientific Name: **Seep/rivulet Odonates Group**
Species Group: **Invert**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Define particular habitat requirements within Vermont, utilizing current knowledge of researchers and field investigations.
Research	Distribution and Abundance	High	1) Conduct inventories to detect and gather information on new gray petaltail populations. 2) Obtain baseline distributional and abundance data by conducting surveys throughout the state. Efforts should be focused on particular habitats required. Abundance information should be collected at sites of known occurrence.
Research	Threats and Their Significance	Medium	Assess the vulnerability of nymphs to habitat perturbations, such as soil and forest floor disturbance, temperature and water quality shifts, chemical pollution, and changes in vegetation. Investigate the upland habitat needs of the adults and the effects of such impacts as fragmentation and reduction.
Monitoring	Population Change	Medium	1) Monitor known gray petaltail populations. 2) Population monitoring could be employed to track population trends at distinct locations. This would follow field surveys and assessments to identify populations judged to be large and viable. Focusing on such large populations would offer greater probability of detecting population shifts.
Monitoring	Habitat Change	Medium	Seeps and rivulets are generally not protected under federal regulation, and under state regulations only when part of a mapped wetland. Loss of this habitat due to development and other causes should be tracked.
Monitoring	Monitor Threats	Medium	Seeps and rivulets face many unregulated limiting factors. These need to be assessed the their effects monitored.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Easements	High	Acquisition/easement of high priority SGCN odonate seep/rivulet sites	Number of gray petaltail sites protected	FWD, FPR, TNC, VLT, other land trusts	VHCB, SWG, LIP, WHIP, USFWS
Standards	High	Work with foresters to avoid impacts to gray petaltail populations and habitats during forest management activities	Number of gray petaltail locations indicated and protected in forest management plans	FWD, FPR, USFS, private landowners	

Common Name: **Tiger Beetles Group**
Scientific Name: **Tiger Beetles Group**
Species Group: **Invert**

Conservation Assessment:

Final Assessment: High Priority

Global Rank:
Global Trend:
State Rank:
State Trend: Declining
Extirpated in VT?
Regionally Rare? Yes

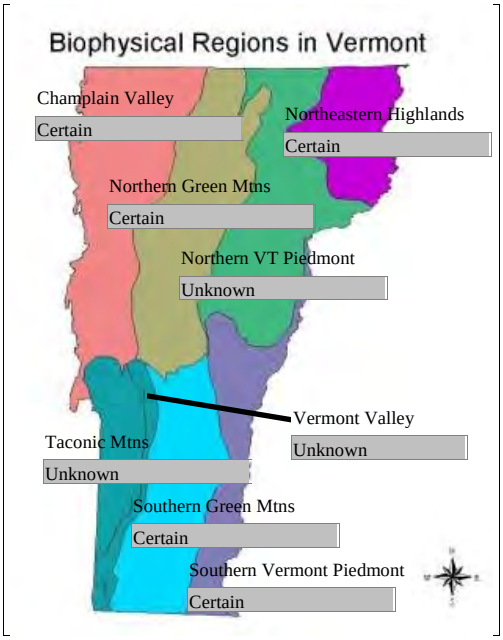
Assessment Narrative:

This group includes three state-threatened species, one of which is also federally threatened, and three rare species, two of which are known from only one or two collections. Two of these beetles are likely extirpated.

Boulder beach tiger beetle (Cicindela ancocisconensis) This rarely observed beetle is known from only single collections on two widely separated rivers. Return visits have not relocated this species. It is ranked S1 and is globally rare (G3).
Beach dune tiger beetle (Cicindela hirticollis) This state-threatened beetle's habitat and range has been greatly reduced in Vermont. It was formerly known from several sites along the northern Lake Champlain shores, but is now reduced to a single site. This habitat is fortunately protected by the Winooski Valley Park District.
Long-lip tiger beetle (Cicindela longilabris) Little is known about this species in Vermont. It is rarely collected, but more survey work is badly needed. It is ranked S2.
Cobblestone tiger beetle (Cicindela marginipennis) This state-threatened species has been studied in Vermont to a greater degree than other Cicindela species. Habitat losses along the Connecticut River and possibly other rivers have been significant due to impoundments.
Patterned green tiger beetle (Cicindela patruela) This is a very rare species throughout the Northeast and is known from a single Vermont collection made in 1870. It is also globally rare (G3). This species has probably gone the way of Vermont's sandplains; some habitat still remains that should be surveyed for this species and/or considered for reintroduction.
Puritan tiger beetle (Cicindela puritana) This federally threatened species is only known historically from a single Vermont site, although other historic sites were known along the New Hampshire side of the river. Impoundments along the Connecticut River likely caused the extirpation of this species. Other habitat losses may have also been a factor. Reintroduction could be considered if sufficient habitat improvements are made. Riverside recreational use has had a significant impact on populations at other New England sites.

Common Name: **Tiger Beetles Group**
Scientific Name: **Tiger Beetles Group**
Species Group: **Invert**

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

C. patruela Champlain valley. One historical site (Burlington).
C. ancocisconensis West River (Jamaica) and White River. Southern Green Mtns and possibly Southern Vermont Piedmont.
C. puritana Historically along lower portion of Connecticut River. Hartland, VT and nearby NH sites.
C. hirticollis Champlain valley. Along Lake Champlain shoreline. Current: Colchester; historical: 4 additional sites.
C. longilabris Northeast Highlands and near edge between Champlain Valley/ Northern Green Mtns.
C. marginipennis Lower Connecticut River, White River, West River, and single Winooski River. Southern Vermont Piedmont and Northern Green Mtns.

Known Watersheds

CT-Bellows Falls Dam to Vernon Dam

CT-White River to Bellows Falls

Lake Champlain Direct

White River

Winooski River

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Boulder beach tiger beetle (Cicindela ancocisconensis) Beetle is found along the margins of clear, clean permanent streams of mid-sized rivers with some degree of shading. The adults prefer sandy areas near the water, sometimes intermixed with cobbles, but always lacking vegetation. Larvae are found mostly in sandy-loam soil that is often some distance from the water's edge.
Beach dune tiger beetle (Cicindela hirticollis) This species is found on the sandy beaches formed at the mouths and shores along large rivers empting into the lake. Larvae burrow in moist sand in protected areas where there is little wave action.
Long-lip tiger beetle (Cicindela longilabris) This beetle is found near bogs on sand or fine gravel soil, and on

Common Name: **Tiger Beetles Group**
Scientific Name: **Tiger Beetles Group**
Species Group: **Invert**

bare rock ledges in the mountains. It is also found in sandy areas with mucky dark soil in or adjacent to coniferous forest. It occurs among jack pine, blueberries, and reindeer moss, often collected along abandoned or seldom-used sandy roads and other sandy gaps in coniferous forests. It has been reported from above tree line in the White Mountains, including the summit of Mt. Washington.
Cobblestone tiger beetle (Cicindela marginipennis) Species is in extremely restricted habitat, being found on cobble beaches of shores and islands of large rivers. Adults inhabit areas of cobble and sand where vegetation is very sparse. Larvae occupy burrows in the sand along the edges of cobblestones.
Patterned green tiger beetle (Cicindela patruela) This species occurs on sandy soil where jack pine, oak, blueberry, and sweet fern grow. Reported to occur along sandy roads and other coarse-grained sandy areas. Known elsewhere from pine-oak or other dry woodlands.
Puritan tiger beetle (Cicindela puritana) This species prefers wide sand deposits along big rivers or narrow beaches along rivers with clay banks.

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☑
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Oak-Pine Northern Hardwood
Open Peatlands
Other Cultural
Outcrops and Alpine
Spruce Fir Northern Hardwood
Upland Shores
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat
Habitat Alteration
Habitat Succession
Inadequate Disturbance Regime
Sedimentation

Description of habitat problem(s):

Non-Habitat Problems:

Genetics
Trampling or Direct Impacts

Description of non-habitat problem(s):

Common Name: **Tiger Beetles Group**
Scientific Name: **Tiger Beetles Group**
Species Group: **Invert**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Define particular habitat requirements of each species within Vermont, utilizing current knowledge of researchers and field investigations.
Research	Distribution and Abundance	High	1) Conduct inventories to detect and gather information on SGCN tiger beetles. 2) Obtain baseline distributional and abundance data for all species in group by conducting surveys throughout the state. Efforts should be focused on particular habitats required by each. Abundance information should be collected at sites of known occurrence.
Research	Threats and Their Significance	High	1) Assess potential and existing impacts of limiting factors to habitat. Such limiting factors as habitat loss and degradation, exotic invasive plants, incompatible recreation, and dams should be examined. 2) Investigate how rivershore tiger beetle populations are being affected by dams and actions that can be taken to restore or mimic natural processes that maintain habitat.
Monitoring	Population Change	High	1) Monitor known SGCN tiger beetle populations. 2) Population monitoring could be employed to track population trends at distinct locations. This would follow field surveys and assessments to identify populations judged to be large and viable. Focusing on such large populations would offer greater probability of detecting population shifts. Areas of habitat where species have disappeared need to be tracked.
Monitoring	Habitat Change	High	Monitor change in available habitat for each species' specific requirements. Loss, restoration, and other changes to local habitat sites recognized as important to these species should be tracked.
Monitoring	Monitor Threats	High	Recreational use of shoreline habitat needs to be monitored, as it can affect several species.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Easements	High	Acquisition/easement of high priority SGCN tiger beetle sites	Number of SGCN tiger beetle sites protected	FWD, FPR, USFS, NRCS, VLT, other land trusts	VHCB, SWG, GMNF, LIP, WHIP, USFWS
Compatible Resource Use	High	Work to restrict recreational vehicles from accessing riverbank and lakeshore SGCN tiger beetle habitat	Number of sites that have eliminated motorized access to SGCN tiger beetle habitat	FWD, NRCS, watershed groups, local landowners	
Compatible Resource Use	High	Work with land owners to direct recreational use away from critical rivershore tiger beetle habitat	Number of monitored sites where trampling of habitat is eliminated	FWD, watershed groups, local landowners	

Common Name: **Vernal pool Odonates Group**
Scientific Name: **Vernal pool Odonates Group**
Species Group: **Invert**

Conservation Assessment:

Final Assessment: High Priority

Global Rank:
Global Trend:
State Rank:
State Trend: Unknown
Extirpated in VT? No
Regionally Rare? Yes

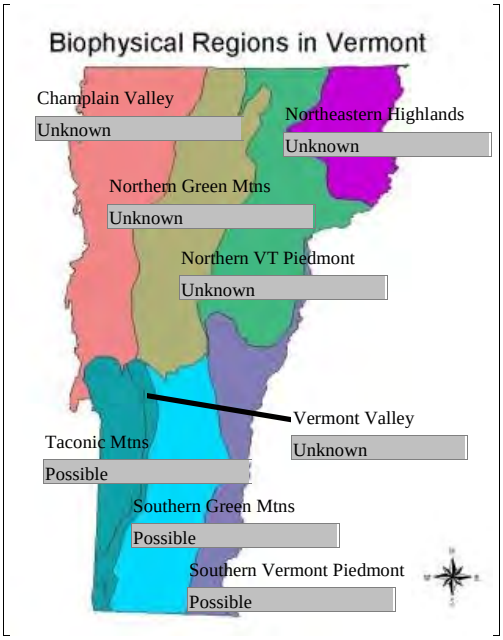
Assessment Narrative:

Individual species in this group are rare in Vermont; several are regionally or globally rare.

This group consists of two species, the habitat requirements of which vary. Species have not been assigned state status ranks, due to incomplete distribution and abundance information; records for each are very limited. Habitats given for each species refer primarily to reproduction and nymphal requirements; adults of many species require various nearby terrestrial habitats as well. Some dragonflies are known to exhibit "hilltopping" behavior, in which they congregate on tops of hills, which may be fairly distant from egg-laying sites. This would increase the home range requirements for such species. Although assigned to the wetland odonates group, the Southern spreadwing (Lestes disjunctus australis) and Citrine forktail (Ischnura hastata) will also utilize vernal pools for reproduction and early development.

Comet darner (Anax longipes) vernal pools and semi-permanent ponds (no fish)
Painted skimmer (Libellula semifasciata) Marshy forested ponds, vernal pools, slow streams and bogs

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

County records:

Comet darner (Anax longipes) Windsor
Painted skimmer (Libellula semifasciata) Windsor

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

This group consists of two species, the habitat requirements of which vary. Species have not been assigned state status ranks, due to incomplete distribution and abundance information; records for each are very limited.

Common Name: **Vernal pool Odonates Group**
Scientific Name: **Vernal pool Odonates Group**
Species Group: **Invert**

Habitats given for each species refer primarily to reproduction and nymphal requirements; adults of many species require various nearby terrestrial habitats as well. Some dragonflies are known to exhibit "hilltopping" behavior, in which they congregate on tops of hills, which may be fairly distant from egg-laying sites. This would increase the home range requirements for such species. Although assigned to the wetland odonates group, the Southern spreadwing (Lestes disjunctus australis) and Citrine forktail (Ischnura hastata) will also utilize vernal pools for reproduction and early development.

Comet darner (Anax longipes) vernal pools and semi-permanent ponds (no fish)
Painted skimmer (Libellula semifasciata) Marshy forested ponds, vernal pools, slow streams and bogs

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Open Peatlands
Seeps and Pools

Current Problems: (see Appendix C for definitions of problem categories)

Habitat Problems:

Conversion of Habitat
Habitat Alteration
Impacts of Roads or Trails
Sedimentation

Description of habitat problem(s):

Non-Habitat Problems:

Pollution
Trampling or Direct Impacts

Description of non-habitat problem(s):

Common Name: **Vernal pool Odonates Group**
Scientific Name: **Vernal pool Odonates Group**
Species Group: **Invert**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Define particular habitat requirements of each species within Vermont, utilizing current knowledge of researchers and field investigations.
Research	Distribution and Abundance	High	1) 1) Conduct inventories to detect and gather information on new SGCN odonate populations. 2) Obtain baseline distributional and abundance data for all species in group by conducting surveys throughout the state. Efforts should be focused on particular habitats required by each and, where appropriate, on regions of expected occurrence within the state (e.g., a northern peripheral species might be expected in the northern tier counties). Abundance information should be collected at sites of known occurrence.
Research	Threats and Their Significance	Medium	Assess the vulnerability of nymphs of each species to wetland perturbations, such as siltation, temperature and water quality shifts, chemical pollution, and changes in vegetation. Investigate the upland habitat needs of the adults and the effects of such impacts as fragmentation and reduction.
Monitoring	Population Change	Medium	1) Monitor known SGCN odonate populations. 2) Population monitoring could be employed to track population trends at distinct locations. This would follow field surveys and assessments to identify populations judged to be large and viable. Focusing on such large populations would offer greater probability of detecting population shifts.
Monitoring	Habitat Change	Medium	Isolated vernal pools are not protected under federal regulation, and under state regulations only when part of a mapped wetland. Loss of this habitat due to development and other causes should be tracked.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Standards	High	Work with foresters to avoid impacts to SGCN odonate populations and habitats during forest management activities	Number of SGCN locations indicated and protected in forest management plans	FWD, FPR, USFS, private landowners	
Easements	High	Acquisition/easement of high priority SGCN odonate vernal pool sites	Number of SGCN odonate sites protected	FWD, FPR, TNC, VLT, other land trusts	VHCB, SWG, LIP, WHIP, USFWS

Common Name: **Wetland Butterflies Group**
Scientific Name: **Wetland Butterflies Group**
Species Group: **Invert**

Conservation Assessment:

Final Assessment: High Priority

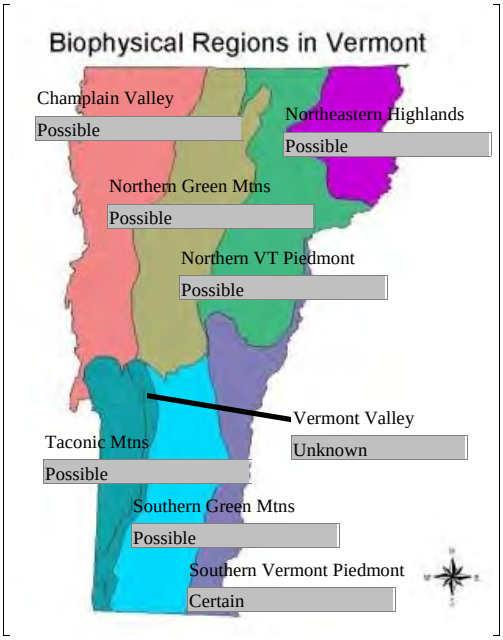
Global Rank: **Global Trend:**
State Rank: **State Trend:**
Extirpated in VT? **Regionally Rare?** Yes

Assessment Narrative:

This group consists of several species, the habitat requirements of which vary within the general wetland category. Most species have not been assigned state status ranks, due to incomplete distribution and abundance information, but records for each are very limited. Caterpillars require specific food plants, which are referenced below.

Bog copper (Lycaena epixanthe) Acid bogs with cranberry and other Ericaceae. Host plants are cranberries.
Jutta arctic (Oeneis jutta) Acid spruce bogs. Host plant is cottongrass (Eriophorum spissum)
Dion skipper (Euphyes dion) Various sedges including Scirpus cyperinus, Carex lacustris, and Carex hyalinolepis
Black dash (Euphyes conspicua) Host plant is Carex stricta
Two-spotted skipper (Euphys bimacula) Host plant is Carex trichocarpa
Mulberry wing (Poanes massasoit) Host plant is Carex stricta
Broad-winged skipper (Poanes viator) Host plant is Carex lacustris

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Town records:
Bog copper Franklin, Pownal, Woodbury. Historic: Swanton, Franklin, Wells, Ferdinand, Woodbury
Jutta arctic Ferdinand, Lewis
Dion skipper Bennington, Grande Isle, Pownal, Shaftsbury. Historic: Colchester, Danby
Two-spotted skipper Grand Isle
Black dash Bennington, Brattleboro, Guilford, Pownal, Shaftsbury
Mulberry wing Shaftsbury, Hubbardton, Dover, Bennington. Historic: Danby
Broad-winged skipper Bennington, Hubbardton, Grand Isle. Historic: Benson

Common Name: **Wetland Butterflies Group**
Scientific Name: **Wetland Butterflies Group**
Species Group: **Invert**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

This group consists of several species, the habitat requirements of which vary within the general hardwood forest category. Most species have not been assigned state status ranks, due to incomplete distribution and abundance information, but records for each are very limited. Caterpillars require specific food plants, which are referenced below.

Bog copper (Lycaena epixanthe) Acid bogs with cranberry and other Ericaceae. Host plants are cranberries.
Jutta arctic (Oeneis jutta) Acid spruce bogs. Host plant is cottongrass (Eriophorum spissum)
Dion skipper (Euphyes dion) Calcareous fens and other alkaline to neutral wetlands. Host plants are various sedges including Scirpus cyperinus, Carex lacustris, and Carex hyalinolepis.
Black dash (Euphyes conspicua) Wet meadows and marshes. Host plant is Carex stricta and possibly other Carex.
Two-spotted skipper (Euphys bimacula) Wet acid-soil areas such as bogs, acidic marshes, and meadows. Host plant is Carex trichocarpa.
Mulberry wing (Poanes massasoit) Wet meadows, open marshes, fens, or bogs. Host plant is Carex stricta, possibly other Carex.
Broad-winged skipper (Poanes viator) Marshes. Host plant is Carex lacustris.

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Marshes and Sedge Meadows

Open Peatlands

Shrub Swamps

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Habitat Succession

Description of habitat problem(s):

Non-Habitat Problems:

Common Name: **Wetland Butterflies Group**
Scientific Name: **Wetland Butterflies Group**
Species Group: **Invert**

Loss of Relationship with Other Species

Trampling or Direct Impacts

Description of non-habitat problem(s):

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Define particular habitat requirements of each species within Vermont, utilizing current knowledge of researchers and field investigations.
Research	Distribution and Abundance	High	1) Conduct inventories to detect and gather information on new SGCN butterfly populations. 2) Obtain baseline distributional and abundance data for all species in group by conducting surveys throughout the state. Efforts should be focused on particular habitats required by each and, where appropriate, on regions of expected occurrence within the state (e.g., a northern peripheral species might be expected in the northern tier counties). Abundance information should be collected at sites of known occurrence. Knowledge of host plant distribution is often helpful.
Research	Threats and Their Significance	High	Assess potential and existing impacts of limiting factors to habitat, host plants, and individual butterflies. Such limiting factors as habitat loss and degradation, exotic invasive plants, disease, and host plant loss should be examined.
Monitoring	Population Change	Medium	1) Monitor known SGCN butterfly populations. 2) Population monitoring could be employed to track population trends at distinct locations. This would follow field surveys and assessments to identify populations judged to be large and viable. Focusing on such large populations would offer greater probability of detecting population shifts.
Monitoring	Habitat Change	High	Monitor change in available habitat for each species' specific requirements. Loss, restoration, and other changes to local habitat sites recognized as important to these species should be tracked.
Monitoring	Monitor Threats	Medium	Monitor the spread (and control) of wetland invasive species that can impact the habitat and host plants of these butterfly species.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Easements	High	Acquisition/easement of high priority SGCN butterfly wetland sites	Number of SGCN butterfly sites protected	FWD, TNC, VLT, other land trusts	VHCB, SWG, LIP, WHIP, USFWS

Common Name: **Wetland Butterflies Group**
Scientific Name: **Wetland Butterflies Group**
Species Group: **Invert**

Bibliography:

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Vermont's Wildlife Action Plan

November 22, 2005

Appendix A4 Mammals Species of Greatest Conservation Need

Index to Mammals Species of Greatest Conservation Need

Common Name: **Northern bog lemming**
Scientific Name: **Synaptomys borealis**
Species Group: **Mammal**

Conservation Assessment:

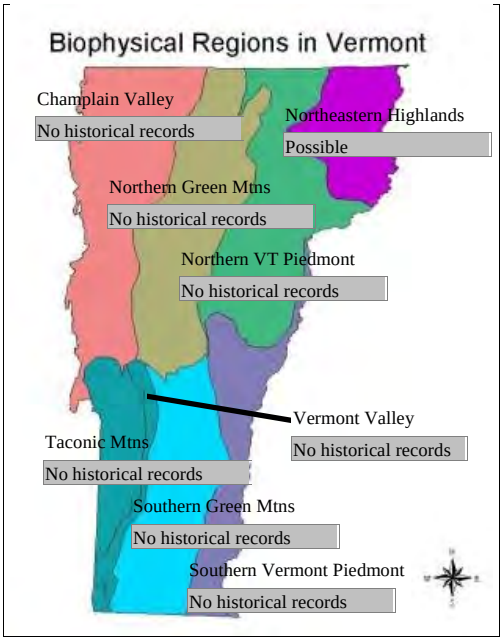
Final Assessment: High Priority

Global Rank: G4 **Global Trend:**
State Rank: SU **State Trend:** Unknown
Extirpated in VT? no **Regionally Rare?** N/A

Assessment Narrative:

There is no histoical or recent evidence that the Northern bog lemming was ever in Vermont, but Vermont is bracketed by a population in NY (1 specimen from Whiteface Mountain) and New Hampshire (Coos County, Mt Moosalacka 1996), Maine (3 specimens from Baxter State Park) and Quebec. Vermont appears to have viable habitat.

Distribution:



Natural History Elements:

Home Range: <1 ha
Migrant? No

Within watershed ☐
Within biophysical region ☐
Within VT ☐
Within Region ☐
Within US ☐
Outside US ☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

In the Adirondacks, Maine and New Hampshire the northern bog lemming is found in conifer forests often associated with sphagnum. They require moist loose soils with sphagnum (DeGraff and Yamasaki, 1986). Northern bog lemmings feed on the succulent parts of grasses as well as seeds and fungi and use burrows several inches below the ground (DeGraff and Yamasaki, 1986).

Common Name: **Northern bog lemming**
Scientific Name: **Synaptomys borealis**
Species Group: **Mammal**

General Habitat Preferences:

Minimum Elevation (m): 330
Maximum Elevation (m): 1375
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Open Peatlands
Outcrops and Alpine
Softwood Swamps
Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change

Conversion of Habitat

Impacts of Roads or Trails

Description of habitat problem(s): Habitat conversion that results in the elimination of peatlands is a problem to the n. bog lemming. Climate change that results in increasing temperatures, could result in could be an increase in the meadow mouse population which could compete with n. bog lemmings. Development of roads, trails and powerlines could also provide access for meadow mouse populations and result in increased competition with the n. bog lemming.

Non-Habitat Problems:

Competition

Description of non-habitat problem(s): Habitat changes that benefit the meadow mouse could result in increased competition that negatively affects the northern bog lemming.

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	High	Determine habitat requirements. Map appropriate habitat.
Research	Distribution and Abundance	High	Conduct baseline survey to determine presence or absence in Vermont.
Monitoring	Range Shifts	Medium	

Common Name: **Northern bog lemming**
Scientific Name: **Synaptomys borealis**
Species Group: **Mammal**

Bibliography:

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Saunders, D. Andrew. 1980. Adirondack Mammals. Adirondack Wildlife Program. State University of New Uyork (College of Environmental Science and Forestry, Syracuse), 216 pp.

Common Name: **Cinereus or Masked Shrew**
Scientific Name: **Sorex cinereus**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: Medium Priority

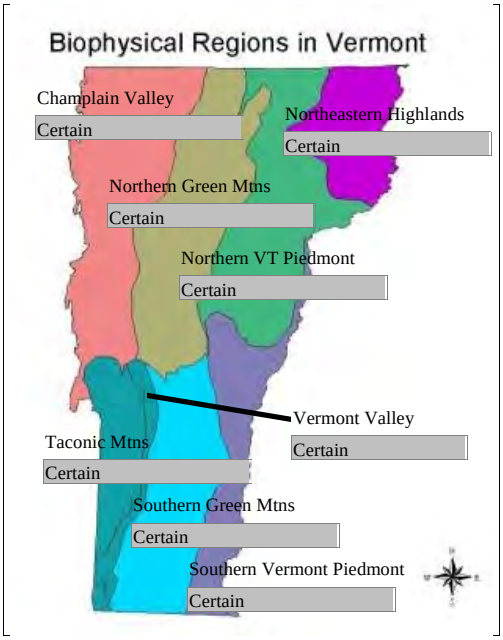
Global Rank: G5 **Global Trend:**
State Rank: S5 **State Trend:** Unknown
Extirpated in VT? NA **Regionally Rare?** no

Assessment Narrative:

S5 G5 State trend is unknown. May be the most common of the small shrews but still relatively rare at most locations. May be more common at higher elevations but the role of elevation is unclear. More common in old growth or late successional forests.

There is insufficient data on the status of this species. Considered rare though very broadly distributed.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Considered rare though broadly distributed.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Cool mesic deciduous and coniferous forests often at higher elevations. Sometimes found in mixed habitat types such as edges of bogs and other cool and wet sites (seeps). The masked shrew uses grasses, rocks, and logs or stumps for cover. They are primarily carnivorous and insectivorous consuming worms, spiders, snails, slugs, and small amounts of vegetable matter. Dampsness of site and depth of leaf litter, seems to be critical factors in determining habitat use.

down woody debris

Common Name: **Cinereus or Masked Shrew**
Scientific Name: **Sorex cinereus**
Species Group: **Mammal**

General Habitat Preferences:

Minimum Elevation (m): 200
Maximum Elevation (m): 4300
Patch Size Requirements: > 10 ha
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Lower CT River
Cliffs and Talus
Early Succession Boreal Conifers
Early Succession Boreal Hardwoods
Early Succession Northern Hardwoods
Early Succession Other Types
Early Succession Pine and Hemlock
Early Succession Spruce-Fir
Early Succession Upland Oak
Floodplain Forests
Grasslands and Hedgerows
Hardwood Swamps
Northern Hardwood
Oak-Pine Northern Hardwood
Open Peatlands
Outcrops and Alpine
Seeps and Pools
Shrub Swamps
Softwood Swamps
Spruce Fir Northern Hardwood
Upland Shores
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Unknown Habitat Threats

Description of habitat problem(s): Alterations to the habitat that dries out the site could negatively affect this shrew.

Non-Habitat Problems:

Competition

Loss of Prey Base

Common Name: **Cinereus or Masked Shrew**
Scientific Name: **Sorex cinereus**
Species Group: **Mammal**

Pollution

Trampling or Direct Impacts

Unknown Non-Habitat Threatss

Description of non-habitat problem(s): Competition from other shrews has been shown in the literature to put this shrew at risk
Loss of prey base may be caused by acid rain altering soil invertebrates.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Attempt to narrow down habitat requirements and determine criticle habitat needs of the masked shrew
Research	Distribution and Abundance	Medium	Determine distribution and abundance of the masked shrew. Maintain a data base of known locations.

Bibliography:

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Whitaker, J.O., Jr. 2004. Sorex cinereus. Mammalian Species, 743:1-9.

DeGraaf, Richard M. and Yamasaki, Mariko. New England Wildlife: Habitat, Natural History, and Distribution. University Press of New England, Hanover, NH, 2001.

Common Name: **Water Shrew**
Scientific Name: **Sorex palustris**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: High Priority

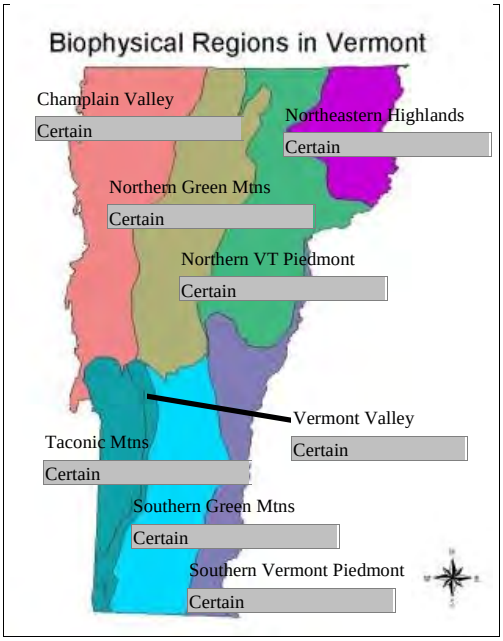
Global Rank: G5 **Global Trend:**
State Rank: S3 **State Trend:** unknown
Extirpated in VT? no **Regionally Rare?** yes

Assessment Narrative:

State trend: very limited data. Fifty five specimens taken since 1915 (pers com W. Kilpatrick) from 19 different localities.

Species is listed as a high priority because not a lot is known about it, and it has very specfic habitat needs. There is no evidence of a decline because there are so few records of it. Acid rain could be a significant problem.
We believe that at present there are limited localized at risk populations but the data too limited to determine status. There are taxonomic uncertainties: Is it actually more than one species? Potential limiting factors include flooding, water movement, ice movement, dams/flow regulation, clearcut w/o buffers, atmospheric deposition, loss of habitat, decline in hab quality , roads & trails, potential loss of prey base.

Distribution:



Natural History Elements:

Home Range: <1 ha
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

55 specimens have been taken in Vermont since 1915.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Found in undercut banks of streams and beaver dams. We assume that wooded buffers on streams are desirable. Wooded wetlands and streams are utilized over cattail wetlands. Mesic forests are important. Has been trapped on dry creekbeds but may prefer streams that flow year-round. DeGraaf (2001) suggests that coniferous forests are preferred over deciduous forests. Whitiker & Hamilton found this species on mud flats of sluggish backwaters. D. Andrew Saunders suggests that habitats adjacent to water, particularly fast cold

Common Name: **Water Shrew**
Scientific Name: **Sorex palustris**
Species Group: **Mammal**

streams may hold the largest populations.
Critical habitat appears to be undercut banks of streams and possibly beaver dams.

undercut stream banks and beaver seeps

General Habitat Preferences:

Minimum Elevation (m):	150
Maximum Elevation (m):	1300
Patch Size Requirements:	Unknown
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Floodplain Forests
Marshes and Sedge Meadows
Open Peatlands
Shrub Swamps
Spruce Fir Northern Hardwood
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Impacts of Roads or Trails

Inadequate Disturbance Regime

Description of habitat problem(s): Clear cutting adjacent to stream that results in the conversion of the forested buffer could cause warming, sloughing and habitat degradation that impacts survival and productivity.
Flooding (disturbance) may be important to keep the banks of streams undercut.
Lack of baseline data exists for distribution, abundance and basic life-history

Non-Habitat Problems:

Loss of Prey Base

Pollution

Description of non-habitat problem(s): Loss of prey base due to acid rain is a potential problem.

Common Name: **Water Shrew**
Scientific Name: **Sorex palustris**
Species Group: **Mammal**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Assess habitat at historical sites and sample for species.
Research	Basic Life History	High	Sample stomach contents to determine prey preferences.
Research	Distribution and Abundance	High	Develop baseline data on distribution and abundance
Research	Threats and Their Significance	High	Identify key limiting factors to this species.
Research	Population Genetics	High	Determine the extent of gene flow in the state.
Research	Taxonomy	High	Determine whether or not this is a single species.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration		Maintain prey base.	Identification of prey use, abundance and distribution	UVM, Middlebury, Johnson State College	SWG, LIP
Standards		Protect stream buffers sufficient to maintain a mesic environment.	Miles of riparian buffers intact and protected	NRCS, VLT, Coverts	WHIP, SWG, LIP

Bibliography:

DeGraff, R.M. and M. Yamasaki. 2001. New England Wildlife. Univ. Press of New England. Hanover. N.H.

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Whitaker, J.O., Jr. and William J. Hamilton.1998. Mammals of the Easten United States. Comstock Publishing, Ithaca.

Van Zyll de Jong, C.G. 1985. Handbook of Canadian Mammals. Volume 2. Bats. National Museums of Canada, Ottawa, Ontario, Canada. 212 pp.

Common Name: **Smoky Shrew**
Scientific Name: **Sorex fumeus**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: Medium Priority

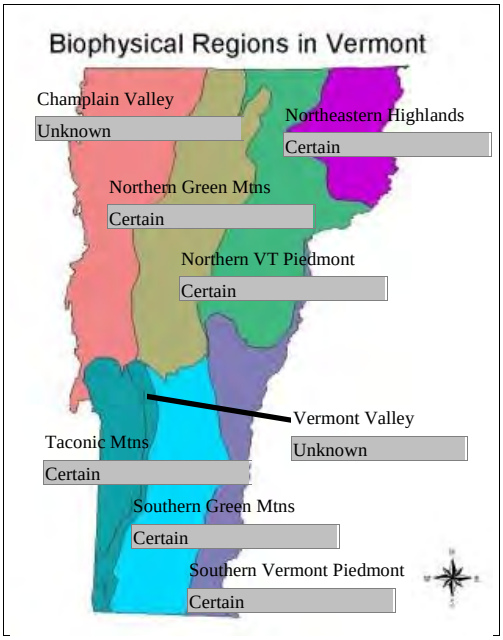
Global Rank: G5 **Global Trend:**
State Rank: S4 **State Trend:** unknown
Extirpated in VT? no **Regionally Rare?** no

Assessment Narrative:

S4 G5 More limited in numbers than the masked shrew and has more specific habitat requirements.

The status of this species is unknown and few records exist. Smoky shrew has more specific habtiat requirements (compared with other relatively abundant shrews).

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Certain everywhere but CV and VV where it is unknown

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Often occupies damp, boulder-strewn, upland woods (DeGraff and Yamasaki 2001). Found in cool mesic forests, often conifer, that are shady with deep, loose, leaf litter. Often occupies coniferous, higher elevation sites with damp, moss covered rocks. Requires dead and down logs for cover and foraging. Typically found along streams with moss covered banks (DeGraff and Yamasaki 2001). Diet is 80 % insectivorous but will also eat earthworms, spiders, snails, salamanders, small mammals, and birds. The dietary niche of the smoky shrew is broader than that of other shrews (Brannon 2000). Uses tunnels made by other animals for nesting as well as beneath stumps and rotten logs. Loose damp leaf litter may be critical to habitat use.

downed woody debris

Common Name: **Smoky Shrew**
Scientific Name: **Sorex fumeus**
Species Group: **Mammal**

General Habitat Preferences:

Minimum Elevation (m):	200
Maximum Elevation (m):	4300
Patch Size Requirements:	Unknown
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Cliffs and Talus
Early Succession Boreal Conifers
Early Succession Northern Hardwoods
Early Succession Spruce-Fir
Northern Hardwood
Oak-Pine Northern Hardwood
Open Peatlands
Outcrops and Alpine
Seeps and Pools
Softwood Swamps
Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Unknown Habitat Threats

Description of habitat problem(s): Conversion of habitat from forest to non forest may be a problem

Non-Habitat Problems:

Competition

Loss of Prey Base

Pollution

Description of non-habitat problem(s): Competition and predation from other shrews (Blarina brevicanda) may be a problem
Acid rain may reduce invertebrate prey base

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	Medium	Determine critical habitat needs in Vermont. Narrow the habitat requirements. Are there areas within available habitats where species are concentrated?
Research	Distribution and Abundance	Medium	Determine distribution and abundance in Vermont.

Common Name: **Smoky Shrew**
Scientific Name: **Sorex fumeus**
Species Group: **Mammal**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use		Identify and maintain rich mesic habitats	Number of habitats identified and maintained	Vermont Forest and Parks Dept., USFS, Coverts	SWG, LIP

Bibliography:

Brannon, M.P. 2000. Niche relationships of two syntopic species of shrews, Sorex fumeus and S. cinereus in the southern Appalachian Mountains. Journal of Mammalogy, 81:1053-1060.

DeGraaf, Richard M. and Yamasaki, Mariko. New England Wildlife: Habitat, Natural History, and Distribution. University Press of New England, Hanover, NH, 2001.

Godin, A.J. 1977. Wild Mammals of New England. Johns Hopkins University Press. Baltimore. MD. 303pp.

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Saunders, D.Andrew. 1980. Adirondack Mammals. Adirondack Wildlife Program, State University of New York (College of Environmental Science and forestry -Syracuse) 216 pp.

Whitaker, J.O. Jr. and W.J. Hamilton Jr. 1998. Mammals of the Eastern United States. 3rd edition. Cornell University Press. Ithaca. NY. 583 pp.

Common Name: **Long-tailed or Rock Shrew**
Scientific Name: **Sorex dispar**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: High Priority

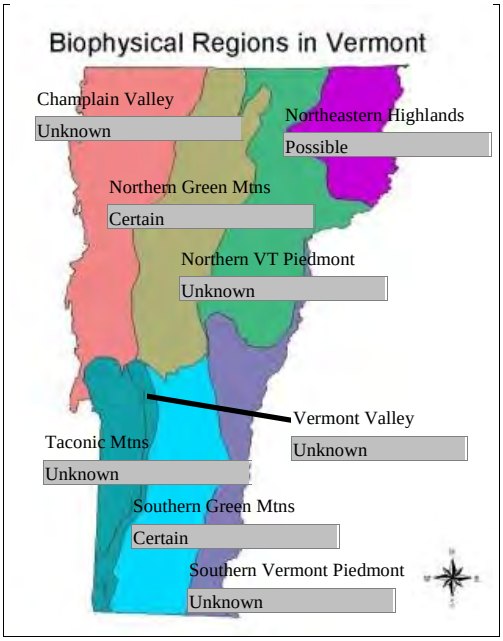
Global Rank: G4 **Global Trend:**
State Rank: S2 **State Trend:** unknown
Extirpated in VT? No **Regionally Rare?** yes

Assessment Narrative:

Sorex dispar is listed as an S2 species in Vermont. Total number of state occurrences is 17 (Tumosa 2001) but most of those were reported prior to 1940. Only 6 specimens have been taken since 1972 and there have been no known specimens since 1989. Currently listed as C-2 species by USFWS indicating that the species may be endangered or threatened but insufficient information is currently available to allow preparation of rules to list the species. (Chipman, 1994 in Tomosa 2001)

Limited localized at risk population with data too limited to determine status. One female was collected in stunted spruce/fir habitat in Stowe (Chipman 1994, VT Natural Heritage database). Three long-tailed shrews were captured at 3 sites in the Green Mountain biophysical region--2 on top of Mt. Manfield and one in a hardwood stand adjacent to a high elevation lake (Chipman 1994 in Tumosa 2001)

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Found in the Mendon-Wallingford area of the Southern Green Mountains

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Prefers cold, mesic forests, typically coniferous, near streams especially with undercut stream banks. The rock shrew often inhabits cool, mossy talus slopes and rocky moss covered boulders and logs. Moss-covered rocks and logs that provide shade and protective crevices or wooded talus slopes are also important. May also be found in deciduous and mixed forests. Rocky, loose talus, dead woody debris and open understories may be critical to the long-tailed shrew. May be associated with rock vole. They seem to spend most of their time in

Common Name: **Long-tailed or Rock Shrew**
Scientific Name: **Sorex dispar**
Species Group: **Mammal**

the labyrinth of spaces between rocks about a foot beneath the surface (Kirkland 1981).

undercuts of banks, presence of rock vole, Talus slopes

General Habitat Preferences:

Minimum Elevation (m): 150
Maximum Elevation (m): 1350
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Cliffs and Talus
Northern Hardwood
Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Description of habitat problem(s): Ski trails and associated structures could impact the habitat of the long-tailed shrew.
Conversion of habitat as a result of quarrying activities could also destroy critical rocky, talus habitat.

Non-Habitat Problems:

Loss of Prey Base

Pollution

Description of non-habitat problem(s): Change in prey base due to acid rain deposition at high elevations. Shrews feed on invertebrates and therefore may accumulate pesticides and heavy metals in body tissue (Tumosa 2001). Mining, mercury deposition, and the application of sewage sludge can all negatively affect long-tailed shrews due to a build up ot toxins in the body.

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Basic Life History	High	Determine home range and other life history needs.
Research	Distribution and Abundance	High	1) Determine distribution and abundance in a multi year monitoring effort. 2) Re-census historical habitats and survey in other likely habitats. 3) Map confirmed habitats.
Research	Population Genetics	High	Determine the isolation of existing populations and the need for the protection of movement corridors.
Monitoring	Population Change	Medium	Determine the status of the population.

Common Name: **Long-tailed or Rock Shrew**
Scientific Name: **Sorex dispar**
Species Group: **Mammal**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Standards	Medium	Ensure that ski trail development and maintainance follows best management practices.			
Habitat Restoration		Determine appropriate management strategies to improve and conserve habitat.	Number of Habitats identified and protected	TNC, University of Vermont, Middlebury College, Vt. Dept. of Forests and Parks	LIP, SWG
Privately-Owned Protected Areas		Minimize fragmentation (the permanent conversion of habitats as a result of development) between populations in core habitats	Number of travel corridors identified and protected.	TNC, VLT, Coverts, VHCB, Vt. Dept. of Forests and Parks	LIP, SWG, VHCB

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Common Name: **Pygmy Shrew**
Scientific Name: **Sorex hoyi**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: High Priority

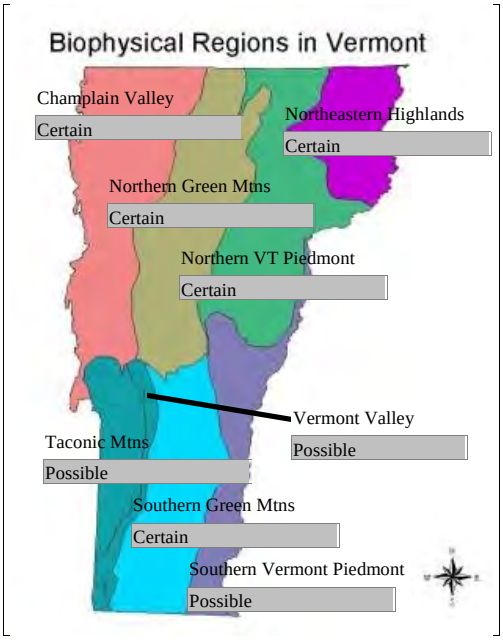
Global Rank: G5 **Global Trend:**
State Rank: S2 **State Trend:** Unknown
Extirpated in VT? no **Regionally Rare?** Unknown

Assessment Narrative:

Listed as an S2 species in Vermont.

Appears rare based on very few known records (<50) though this could be due to sampling error. The pygmy shrew is hard to catch and difficult to identify so it may be more abundant than records would suggest. Little is known about the historic population.

Distribution:



Natural History Elements:

Home Range: <1 ha
Migrant? No

Within watershed ☐
Within biophysical region ☐
Within VT ☐
Within Region ☐
Within US ☐
Outside US ☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Habitat requirements are relatively unknown. It is believed that mesic forests and fields are used but it has also been recorded in swamps and marshes. Critical habitat is often listed as boreal forests where wet and dry areas occur together. Disturbed sites and cultivated areas with leaf litter and downed logs may also be used. Believed to require moist leaf mold near water (DeGraff and Yamasaki, 2001). Usually found within 100yds of water. There is no evidence in the literature that it prefers any particular forest age class. It was found in 4 different age classes of cove hardwood stands in southern Appalachia (Ford et al. 1996 in Tumosa 2001).

bogs, mesic forest w/deep leaf litter, sandy & sandy loam well-drained soils (Miller, Caledonia Co)

Common Name: **Pygmy Shrew**
Scientific Name: **Sorex hoyi**
Species Group: **Mammal**

General Habitat Preferences:

Minimum Elevation (m): 30
Maximum Elevation (m): 1300
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Boreal Hardwoods
Grasslands and Hedgerows
Hardwood Swamps
Marshes and Sedge Meadows
Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Succession

Description of habitat problem(s): Habitat requirements aren't fully understood so problems are unknown.

Non-Habitat Problems:

Loss of Prey Base

Description of non-habitat problem(s): possibly loss of prey base due to habitat changes or conversion.

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	High	1) Identify and map critical habitat needs. 2) develop baseline data on habitat use
Research	Distribution and Abundance	High	develop baseline data on distribution and abundance

Common Name: **Pygmy Shrew**
Scientific Name: **Sorex hoyi**
Species Group: **Mammal**

Bibliography:

Osgood, F.L. 1938. The mammals of Vermont J. of Mammalogy. 19(4): 435-441.

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Common Name: **Hairy-tailed Mole**
Scientific Name: **Parascalops breweri**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: Medium Priority

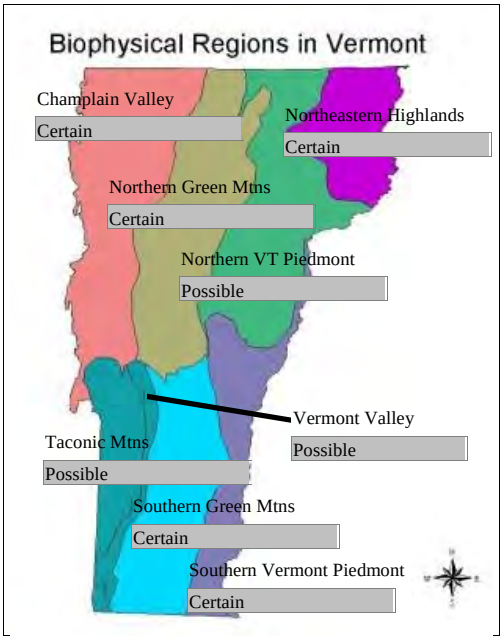
Global Rank: G5 **Global Trend:**
State Rank: S3S4 **State Trend:** unknown
Extirpated in VT? no **Regionally Rare?** no

Assessment Narrative:

Believed to be relatively common but population status and trends are unknown.

Little is known about this specie's status and habitat needs. Loss of habitat with sandy and sandy loam soils is a concern.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Found in all places with well-drained sandy loam soils (e.g. agricultural fields and older forests). Open deciduous woodlands with thick humus are preferred. Hairy tailed moles are also adapted to second growth stands, old fields, and hedgerows. They prefer well-drained, light, moist soil with well-mixed organic matter and minerals and avoid soils that are hard, dry, or with a large clay content.

sandy/sandy loam soils

Common Name: **Hairy-tailed Mole**
Scientific Name: **Parascalops breweri**
Species Group: **Mammal**

General Habitat Preferences:

Minimum Elevation (m): 30
Maximum Elevation (m): 700
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Grasslands and Hedgerows
Lawns, Gardens, and Row Crops
Northern Hardwood
Oak-Pine Northern Hardwood
Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Unknown Habitat Threats

Description of habitat problem(s): Conversion of required habitat to houses, roads or other development may be a problem.

Non-Habitat Problems:

Trampling or Direct Impacts

Description of non-habitat problem(s): Because of human/mole conflicts proximity to humans can result in decline. The application of pesticides/rodenticides may also cause a localized population decline, particularly in orchards. It is unknown how this species is doing in forested habitats.

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	Medium	Collect baseline data on critical habitat needs.
Research	Distribution and Abundance	Medium	Collect baseline data on distribution and abundance needs.

Common Name: **Hairy-tailed Mole**
Scientific Name: **Parascalops breweri**
Species Group: **Mammal**

Bibliography:

DeGraaf, Richard M. and Yamasaki, Mariko. New England Wildlife: Habitat, Natural History, and Distribution. University Press of New England, Hanover, NH, 2001.

Eadie, W.R. 1939. A contribution to the biology of Parascalops breweri. Journal of Mammalogy, 20: 150-173.

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Gorman, M. L., and R. D. Stone. 1990. The natural history of moles. Cornell Univ. Press

Hallett, J.G. 1978. Parascalops breweri. Mammalian Species, 98:1-4.

Common Name: **Little Brown Myotis**
Scientific Name: **Myotis lucifugus**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: Medium Priority

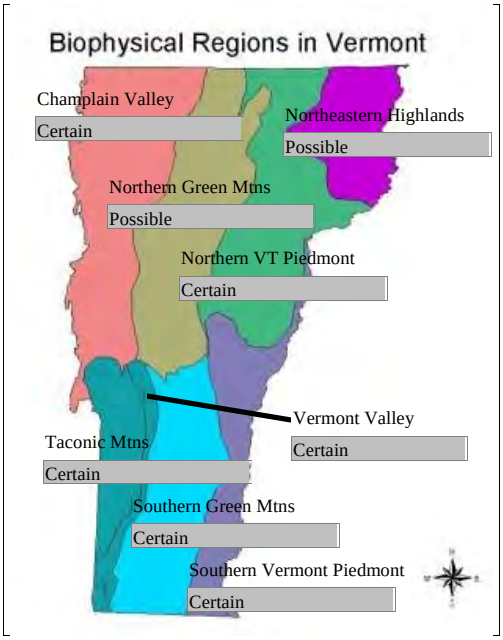
Global Rank: G5 **Global Trend:**
State Rank: S5 **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Presently considered to be relatively common but relies heavily on human dwellings as maternity sites. It is unclear as to what its native habitat is. Both maternity colony habitat and winter hibernacula are vulnerable and at risk. Every year bats lose hundreds of possible builing roosts as a results of exclusion or the actual removal of old barns and other structures. No attempts have been made to inventory maternity colonies in Vermont.

Although little brown bats are known to hibernate in slightly greater than 20 sites in Vermont, the vast majority of the population hibernate in a single cave. Little brown bats may also be impacted by the removal or killing of bats by pest control agents, as well as, recreational spelunking in hibernacula. Trend information is needed on this species.

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

The little brown bat prefers warmer and more humid areas where the temperature is constant. To prevent dehydration they awaken every ten to fourteen days to consume water. Little brown bats often hibernate in large clusters. This is thought to act as a buffer against water loss, enabling longer hibernation between arousals (Sanders 2004). During the summer it often inhabits attics where the temperature may average 100 degrees (Chenger 2004). Females may form nursery colonies of hundreds or even thousands of individuals. It is unclear where most of the males spend the summer months but it is assumed they are solitary. Colonies

Common Name: **Little Brown Myotis**
Scientific Name: **Myotis lucifugus**
Species Group: **Mammal**

usually exist close to water because little brown bats seem to prefer to forage over water. When foraging, the bats may repeat a set hunting pattern within a few miles of the roost (Chenger 2004). Little brown bats eat moths, wasps, gnats, crane flies, and beetles. Young are born in May, June, or early July. Average litter size is one. In winter little brown bats hibernate in caves with a constant temperature of 40 degrees F and a relative humidity of 80% (Banfield 1974: 42 in DeGraff and Yamasaki, 2001)

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lacustrine
Building or Structure
Marshes and Sedge Meadows
Mine
Northern Hardwood
Oak-Pine Northern Hardwood
Open Peatlands
Shrub Swamps
Spruce Fir Northern Hardwood
Subterranean
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Description of habitat problem(s): disturbance in hibernacula reduces fat reserves and negatively affects reproduction and survivability. In addition, every year big and little brown bats lose hundreds of possible building roosts due to exclusion or the actual destruction of buildings. Direct killing of bats is common due to human fears about rabies, bat bites and histoplasmosis.

Non-Habitat Problems:

Pollution

Description of non-habitat problem(s): Pesticides and environmental poisons have had negative impacts on, and increased the mortality rates of, bat populations. Bats store some lipophilic pesticides in brown adipose fat tissues. These stores are released as bats use their fat reserves during hibernation. Depending upon tissue levels of the pesticide, as well as the amount of fat used over a given time period, bats can be exposed to both chronic and acute poisoning which can result in death. At lower levels,chronic poisoning may raise a bat's metabolism, burning the limited fat resources more quickly and possibly causing them to starve to death. In addition, broad spectrum insecticides can deplete insect diversity and limit the food sources available for bats.

Common Name: **Little Brown Myotis**
Scientific Name: **Myotis lucifugus**
Species Group: **Mammal**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Distribution and Abundance	High	Develop a monitoring plan to determine distribution, abundance, and population trends

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Technical Assistance, Training, Learning Networks		Train wildlife control agents in proper bat exclusion techniques and develop Best Management Practices for exclusions.	Development of Best Management Practices and implementation of training	Wildlife Rehabilitators, NWCO's	USFWS
Habitat Restoration		Maintain at least 30 maternity sites and a minimum of 30,000 adult females	Number of maternity sites and bats protected	Coverts, Vermont Woodlands Magazine, NWF, UVM, Mammals subcommittee of ESA, Woodland Owners Association	SWG, LIP, USFWS
Habitat Restoration		Protect hibernacula containing 100 or more little brown bats	Number of hibernacula protected	Vermont Cavers Assoc., UVM, TNC, VLT, Coverts	USFWS, TNC, VLT, LIP

Common Name: **Little Brown Myotis**
Scientific Name: **Myotis lucifugus**
Species Group: **Mammal**

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Banfield, A.W.F. The mammals of Canada. Toronto, ON: University of Toronto Press; 1974. 438p. In R.M. Degraff and M. Yamasaki. 2001. New England wildlife: habitat, natural history, and distribution. University Press of New England, Hanover.

Chenger, J. 2003. Bat Inventory for Project Lands of the Upper Connecticut River Basin. Prepared for the U.S. Army Corp of Engineers New England District by Bat Conservation and Management, Inc. 102 pp

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Fenton, M.B., and R.M.R. Barclay, 1980. Myotis lucifugus. Mammalian species, 142:1-8.

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Van Zyll de Jong, C.G. 1985. Handbook of Canadian Mammals. Volume 2. Bats. National Museums of Canada, Ottawa, Ontario, Canada. 212 pp.

Common Name: **Indiana Bat**
Scientific Name: **Myotis sodalis**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: High Priority

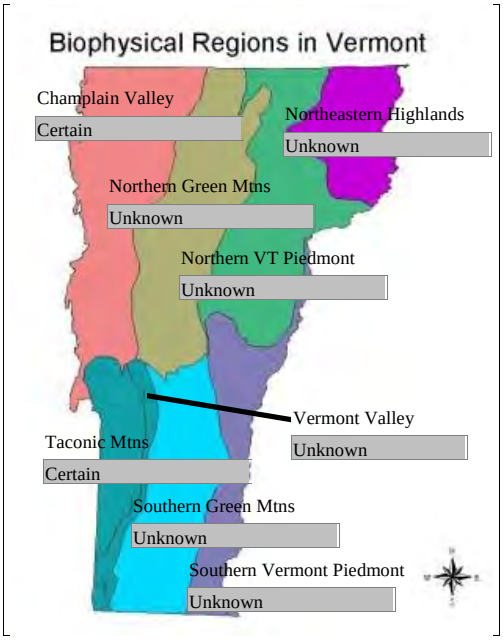
Global Rank: G2 **Global Trend:**
State Rank: S1 **State Trend:** Stable
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

Indiana bats are listed as endangered in Vermont. They have declined range wide by 60% since monitoring began in the 1960's. Historic numbers were estimated at 800,000 in the late 1960's and by 1997 the range wide population was down to 350,000 (USFWS, 1999 in Sanders, 2004). Recent surveys indicate that regionally the population may be rebounding and possibly increasing.

In Vermont in the1940-50s, Indiana bats were reported in the 1000s in hibenacula. In recent years a couple of hundred have been documented. For some reason this bat is declining nationally. It isn't known why, but could be related to disturbance in the hibernacula. Limited dispersal may be a problem for pregnant females. Vermont is the only New England state known to harbor maternity colonies. Radio collared Indiana bats roosting in the Champlain Valley came from hibernacula in New York (Sanders, 2004). Vermont also has three hibernacula currently used by Indiana bats: Brandon Silver Mine (159 bats in 2002), Littlw Skinner Hollow (297 bats in 2004), and Dorset Cave (16 bats in 2003). Historic hibernacula include the Plymouth Caves, Nickwacket Cave, and the Ely Copper Mine.

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Hibernacula: Brandon Silver Mine. Owned by TNC. Dorset Cave: Gated, owned by TNC. Skinner Hollow (private ownership. No protection for this property. Nickwackett gated, privately owned. Roost Trees/Maternity colonies: Champlain Valley

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Maternity roosts are in large diameter shaggy hardwoods with sloughing bark (maple, shagbark hickory, poplar). Indiana bats roost under loose or peeling bark or in crevices and require nearby water (within a few

Common Name: **Indiana Bat**
Scientific Name: **Myotis sodalis**
Species Group: **Mammal**

hundred meters) to forage over. Colonies typically select one or more primary roost tree that receives direct sunlight for most of the day. Additional alternate roost trees may be shaded or in the open. During the winter months Indiana bats hibernate and require caves with a specific microclimate. Cave conditions that include cool, stable temperatures are preferred. Roost sites that are below 10 degrees when they arrive and 3-6 degrees in mid-winter allow for population increases (Tuttle and Kennedy, 2002 in Tumosa, 2003). Relative humidity above 78% but below saturation is also important. It appears that there is fidelity to the hibernaculum. Indiana bats in Kentucky travel over 300 miles to maternity areas in Michigan (Kurta and Murray, 2000 in the Vermont bat conservation plan). They have also been documented flying over 20 miles in one hour during migration (Sanders and Chenger, 2001in the Vermont bat conservation plan). Indiana bats are insectivorous, eating mostly flies, moths, beetles, and caddis flies. Mosquitoes, midges, bees and other flying insects are also consumed (USFWS, 1999 in Tumosa, 2001). During the swarming period, the area within 0-2 miles of the hibernaculum is critical for foraging and night roosting; 2-5 miles is important, and 5-10 miles gets used but not as frequently. Connectivity between habitats may be important but is poorly understood.

specific shaggy trees (with sloughing bark) hickory, popular, etc are needed for roosting. shagbark hickory, caves

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Description of habitat problem(s): Disturbance of winter hibernacula is a significant problem to Indiana bats. These bats have been documented to lose 15-20% of their body weight during hibernation in an undisturbed hibernaculum (Johnson et al. 1997, in Sanders, 2004). Disturbance of hibernating bats causes them to awaken and forces them to use additional limited energy reserves (Sanders, 2004). Arousal can use up enough fat to sustain a bat for 10-30 days (Thomas et al. 1990, Thomas 1995). Changes in temperature and light, as well as, direct contact can cause a bat to awaken and deplete stored fat reserves. Alterations to cave mine openings can change the microclimate of a mine and affect bat survival. Loss of maternity roosts may also be a problem to survivability of young. Maternity roosts can house several hundred individual bats. Felling of a maternity roost tree can impact the survival of both adults and young. Development within close proximity of hibernacula, particularly along travel corridors could also be detrimental to survival. Destruction/development of summer habitats are likely to negatively affect bats if potential roost sites and foraging areas are altered (Tumosa 2003).

Common Name: **Indiana Bat**
Scientific Name: **Myotis sodalis**
Species Group: **Mammal**

Non-Habitat Problems:

Pollution

Description of non-habitat problem(s): Pesticides and environmental poisons have had negative impacts on, and increased the mortality rates of, bat populations. Bats store some lipophilic pesticides in brown adipose fat tissues. These stores are released as bats use their fat reserves during hibernation. Depending upon tissue levels of the pesticide, as well as the amount of fat used over a given time period, bats can be exposed to both chronic and acute poisoning which can result in death. At lower levels,chronic poisoning may raise a bat's metabolism, burning the limited fat resources more quickly and possibly causing them to starve to death. In addition, broad spectrum insecticides can deplete insect diversity and limit the food sources available for bats.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Develop baseline information on home range and habitat use to identify movement corridors.
Research	Basic Life History	High	Determine the summer range of bats that use VT hibernacula. Determine the proportion of VT bats that use NY hibernacula. 2) Assess the degree local recruitment to determine if are Vermont populations reproducing.
Research	Distribution and Abundance	High	Determine the site fidelity of Indiana bats in Vermont.
Research	Other Research	High	Learn more about the role of hibernacula in the region.
Monitoring	Population Change	High	Determine the level of survivorship and recruitment in Vermont populations as well as, the relationship to habitats in other states in the region.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Privately-Owned Protected Areas		Protect at least four USFWS Level I or II hibernacula in Vermont or New York	Number of hibernacula protected.	UVM, USFS, Cavers Organizations, TNC, NY DEC	SWG, LIP, USFWS, NYDEC
Protected Area Management	Medium	Maintain and protect all maternity roost trees that support over 150 adults. Conserve summer foraging habitat that supports 2500 adults.	Number of roost trees identified and protected. Acres of foraging habitat conserved.	UVM, Coverts, Cavers, TNC, NY DEC,	SWG, LIP, USFWS, NYDEC
Habitat Restoration	Medium	Determine the parameters of a viable roost tree and develop artificial roosts to provide additional roosting areas.	Number of roost sites being used by bats.	UVM, Coverts, Lewis Creek Association, Vt. Family Forests, NRCS	WHIP, LIP, SWG

Common Name: **Indiana Bat**
Scientific Name: **Myotis sodalis**
Species Group: **Mammal**

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Kiser, J.D., J. Beverly, and V. Brack, Jr., PhD. 2002. A survey of eastern forest bat communities in the Lake Champlanin Valley, with emphasis on the federally endangered Indiana bat (Myotis sodalis). Environmental solutions and Innovations, LLC. 70pp.

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Kurta, A., K.J. Williams, and R. Mies. 1996. Ecological, behavioral, and thermal observations of a peripheral population of Indiana bats (Myotis sodalis). Pp.102-117, in Bats and Forests symposium (R.M.R. Barclay and R.M. Brigham, eds.). Research Branch, British Columbia Ministry of Forests, Victoria British Columbia, CA Working Paper. 23:1-292.

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Tumosa, J. 2003. United States Forest Service Species Data Collection Form. 32pp.

Van Zyll de Jong, C.G. 1985. Handbook of Canadian Mammals. Volume 2. Bats. National Museums of Canada, Ottawa, Ontario, Canada. 212 pp.

Common Name: **Small-footed Bat**
Scientific Name: **Myotis leibii**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: High Priority

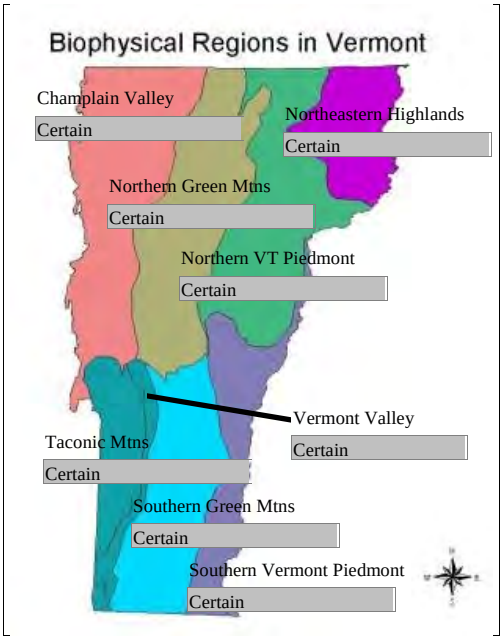
Global Rank: G3 **Global Trend:**
State Rank: S1 **State Trend:** unknown
Extirpated in VT? No **Regionally Rare?** yes

Assessment Narrative:

Status: S1, On the threatened list in Vermont. Regionally it seems to be at risk. The small-footed bat is listed as endangered in New Hampshire and a species of concern in Maine. It seems to be fairly widespread in SE Canada and the eastern U.S. but is found in very low numbers.

There is a general lack of information about this species. It may hibernate outside the major hibernacula in the state. It is found in small numbers in the major caves in Vermont. In 2004, 122 small-footed bats were counted in the Ely Copper Mine, a hibernaculum in Vermont. In 1991 Plymouth cave had a population of 16 (Tumosa 2003). Dorset cave had 2 individuals in 1992. Manchester had 1 individual in 1983 and the Vershire population seems to be highly variable but had 4 individuals in 2001. Danby in 1991 had 1 individual,; Brandon had 4 individuals in 1999; Corinth had 2 individuals in 1993; and Sudbury had 17 individuals in 1999 (Natureserve 2003 in Tumosa 2003). Three small-footed bats were caught in mist nets in 2003 at the Union Village Dam, North Hartland dam, and Townshend dam (a female, male, and female respectively) by a contractpr for the US Army Corp of Engineers (Chenger 2003). There are summer records of this bat from Monkton, E. Middlebury, Lincoln, and Brandon mine (Kilpatrick, pers., com). This bat may be particularly susceptible to disturbance.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☑
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Common Name: **Small-footed Bat**
Scientific Name: **Myotis leibii**
Species Group: **Mammal**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

In both winter and summer the small-footed bat is closely associated with rocky habitat such as caves, cliffs, talus piles, quarry faces, and rock outcrops. It hibernates in very cold sites, often in the entrance areas of caves and mines sometimes using small cracks or piles of breakdown on cave and mine floors. Hibernacula surveys probably undercount the species. They may also hibernate in talus piles and cliffs that have deep crevices; however, the extent of this behavior in Vermont is unknown. No maternity sites have been found in Vermont, however, in other states they use barns and buildings, cliffs and bridges, but are primarily found under exfoliating tree bark (Sanders 2004). Changer (2004) documented small-footed bats using crevices in rocks and large rip-rap on a man made dam face in New Hampshire. A radio-tansmittered small-footed bat was found to use power line corridors (Kilpatrick, pers com). Areas that promote an abundance of insects are crucial to small-footed bat survival (Tomosa, 2003). Beaver ponds with abundant snags may provide roosting and foraging sites.

outcrops

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☑
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Building or Structure
Cliffs and Talus
Mine
Other Cultural
Subterranean

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change

Conversion of Habitat

Habitat Alteration

Impacts of Roads or Trails

Description of habitat problem(s): These bats may be more susceptible to disturbance in the hibernacula. Disturbance of hibernating bats causes them to awaken and forces them to use additional limited energy reserves (Sanders, 2004). Arousal can use up enough fat to sustain a bat for 10-30 days (Thomas et al., 1990; Thomas, 1995; Martin et al, 1966). Changes in temperature and light, as well as, direct contact can cause a bat to awaken and deplete stored fat reserves. Alterations to cave mine openings can change the microclimate of a mine and affect bat survival. Loss of maternity roosts may also be a problem to survivability of young. Little is known about the summer habitat requirements of this bat but destruction/development of summer habitats are likely to negatively affect bats if potential roost sites and foraging areas are altered (Tumosa 2003).

Common Name: **Small-footed Bat**
Scientific Name: **Myotis leibii**
Species Group: **Mammal**

Warm winters and drought conditions are likely to increase bat body temperatures and corresponding metabolic demands which may influence survivability and reproduction.

Non-Habitat Problems:

Pollution

Unknown Non-Habitat Threatss

Description of non-habitat problem(s): Insecticides and pesticides have been implicated in the deline of several bat species (Belwood 1998 in Tumosa 2003). Environmental poisons have had negative impacts on, and increased the mortality rates of, bat populations. Bats store some lipophilic pesticides in brown adipose fat tissues. These stores are released as bats use their fat reserves during hibernation. Depending upon tissue levels of the pesticide, as well as the amount of fat used over a given time period, bats can be exposed to both chronic and acute poisoning which can result in death. At lower levels,chronic poisoning may raise a bat's metabolism, burning the limited fat resources more quickly and possibly causing them to starve to death. In addition, broad spectrum insecticides can deplete insect diversity and limit the food sources available for bats.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Determine summer habitat utilization from known hibernacula in NY and Vershire in a telemetry study
Research	Distribution and Abundance	High	1) estimate the statewide population by evaluating population densities in summer and winter habitat. 2) Document estimated populations of reproductive females.
Monitoring	Population Change	Medium	1) Monitor distribution and abundance to determine critical summer and winter habitats as well as population status. 2) Develop a monitoring plan to document the number of reproductive females.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Standards		Protect all VT hibernacula with 5 or more small-footed bats.	Number of hibernacula protected	TNC, VLT, Coverts	TNC, VLT, Forest Legacy, VHCB, USFWS, LIP

Common Name: **Small-footed Bat**
Scientific Name: **Myotis leibii**
Species Group: **Mammal**

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Common Name: **Northern Long-eared Bat**
Scientific Name: **Myotis septentrionalis**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: Medium Priority

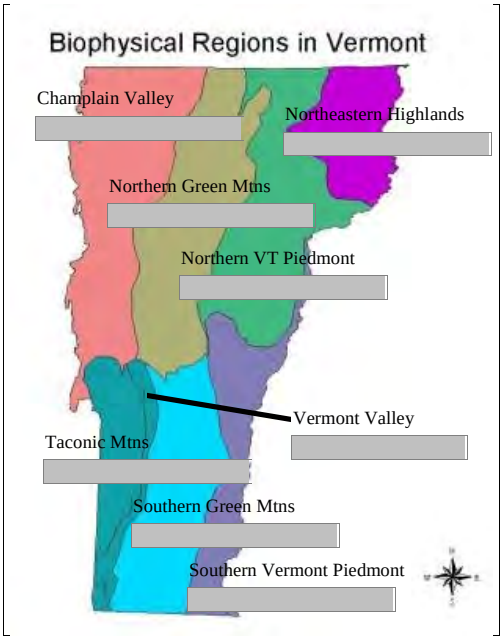
Global Rank: G4 **Global Trend:**
State Rank: S4S5 **State Trend:** unknown
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Until recently the northern long-eared bat was considered uncommon. Recent surveys however, refute that assessment. A study done in 1992 and 1993 found that of 1310 bats captured at fall swarming sites, 12% were long-eareds (Thomas, 1992 in Sanders 2004). A 1999 mist net survey by the USFS (Thomas, 1999) found that 35 of 126 bats captured were northern long-eared bats, 14 of which were either adult or juvinile females. In 2000 a similar survey on the Green Mountain National Forest (Reynolds 2000a, 2000b) resulted in 16 of the 25 bats being northern long-eared. Several other summer surveys have been conducted in recent years for the Green Mountain National Forest and other entities in Vermont (Kiser et al, 2001, 2002; Reynolds, 2000; Kilpatrick 2001; Decker and Kilpatrick, 2002, 2003; Beverly et al., 2002)

Loss of maternity roosts could be a concern. Little information exists regarding summer roosting needs. Recreational spelunking could also affect winter survivability. Information is needed on population trends and recruitment.

Distribution:



Natural History Elements:

Home Range:
Migrant? No
Within watershed ☐
Within biophysical region ☐
Within VT ☐
Within Region ☐
Within US ☐
Outside US ☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

N. long-eared bats hibernate in parts of caves and mines that are relatively cool and moist where the air is still. Hibernation may begin in August and may last for 8-9 months in northern latitudes. In the summer n. long-eared bats roost by day in buildings and under tree bark, shutters, bat houses and bridges. At night they use

Common Name: **Northern Long-eared Bat**
Scientific Name: **Myotis septentrionalis**
Species Group: **Mammal**

caves to roost. They tend to be more solitary than other bats (Chenger 2004). They are gleaners and Northern long-eared bats forage in forested hillsides rather than in stream associated woodlands and consume a variety of night flying insects. They are well suited to forest interior habitats.

roost sites

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	1600
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☑

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Description of habitat problem(s): Disturbance of hibernating bats causes them to awaken and forces them to use additional limited energy reserves (Sanders, 2004). Arousal can use up enough fat to sustain a bat for 10-30 days (Thomas et al. 1990, Thomas 1995). Changes in temperature and light, as well as, direct contact can cause a bat to awaken and deplete stored fat reserves. Alterations to cave mine openings can change the microclimate of a mine and affect bat survival. Loss of maternity roosts may also be a problem to survivability of young. Felling of a maternity roost tree can impact the survival of both adults and young. Development/roads within close proximity of hibernacula, particularly along travel corridors could also be detrimental to survival. Destruction/development of summer habitats are likely to negatively affect bats if potential roost sites and foraging areas are altered (Tumosa 2003).

Non-Habitat Problems:

Pollution

Description of non-habitat problem(s): Pesticides and environmental poisons have had negative impacts on, and increased the mortality rates of, bat populations. Bats store some lipophilic pesticides in brown adipose fat tissues. These stores are released as bats use their fat reserves during hibernation. Depending upon tissue levels of the pesticide, as well as the amount of fat used over a given time period, bats can be exposed to both chronic and acute poisoning which can result in death. At lower levels,chronic poisoning may raise a bat's metabolism, burning the limited fat resources more quickly and possibly causing them to starve to death. In addition, broad spectrum insecticides can deplete insect diversity and limit the food sources available for bats.

Common Name: **Northern Long-eared Bat**
Scientific Name: **Myotis septentrionalis**
Species Group: **Mammal**

Research and Monitoring Needs

Type	Need	Priority	Description
Monitoring	Population Change	Medium	Monitor species abundance and status

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Privately-Owned Protected Areas		Protect hibernacula containing 30 or more northern long-eared bats or having swarm capture rates of greater than 50 per night.	Number of hibernacula protected	UVM, Middlebury College, Vt. Cavers Assoc, VLT, TNC	SWG, LIP, TNC, USFWS

Common Name: **Northern Long-eared Bat**
Scientific Name: **Myotis septentrionalis**
Species Group: **Mammal**

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Common Name: **Northern Long-eared Bat**
Scientific Name: **Myotis septentrionalis**
Species Group: **Mammal**

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Common Name: **Silver-haired Bat**
Scientific Name: **Lasionycteris noctivagans**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: High Priority

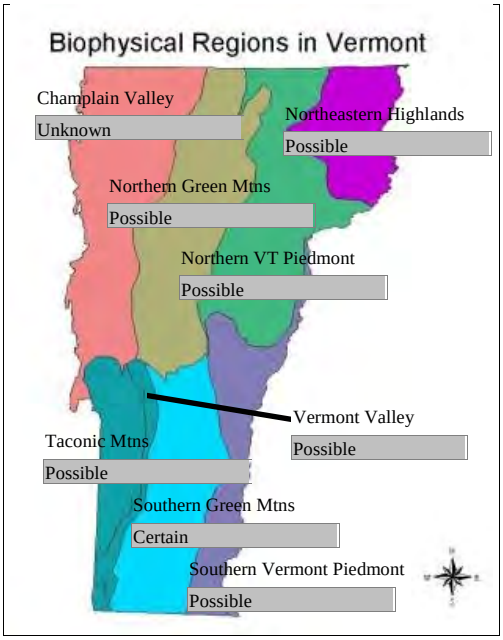
Global Rank: G5 **Global Trend:**
State Rank: S2 **State Trend:** Unknown
Extirpated in VT? no **Regionally Rare?** Yes

Assessment Narrative:

Status of this bat is unknown but presumed to be much lower than historical levels. Many factors could be influencing the decline. Silver-haired bats migrate along the eastern seaboard in winter and could encounter factors that affect its survival. In some parts of the country it is associated with late successional forests with a snag density of more than 21 snags/ hectare. Loss of forest habitat throughout the 1800's probably contributed to the decline of this bat in New England. Other factors such as pesticides, availability of prey, and loss of maternity roosts could also be influencing the status of this bat.

Once the most common bat in the region in the 1800s it has experienced a significant decline throughout the Northeast. Currently very rare. Two records in Vermont (Champlain Valley). This species is the shortest-lived (avg 2 years, maximum 12 years) and hence populaitons may be more sensitive to changes than other bat species. Perhaps this is a good indicator of bats in general.

Distribution:



Natural History Elements:

Home Range: < 100 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☑
Outside US	☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Silver-haired bats will range up to 5km from roost tree to forage areas. In summer, they roost under the bark of late- successional and old-growth boreal forests and perhaps along woodland edges. They forage in forest openings, including clear cuts, and over water and sometimes roost in buildings. In other parts of the country they are associated with late successional forests with snag densities of 21 snags /hectare. They form maternity

Common Name: **Silver-haired Bat**
Scientific Name: **Lasionycteris noctivagans**
Species Group: **Mammal**

colonies almost exclusively in tree cavities and will periodically switch roosts throughout the maternity season. Like big brown bats, the silver-haired bats feed on many insect pest species such as flies, midges, leafhoppers, moths mosquitoes, beetles, crane flies, lacewings caddis flies ants crickets, and spiders.

unknown

General Habitat Preferences:

Minimum Elevation (m):	20
Maximum Elevation (m):	2000
Patch Size Requirements:	Unknown
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Lacustrine
Aquatic: Lake Champlain
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Lower CT River
Early Succession Boreal Conifers
Early Succession Boreal Hardwoods
Early Succession Northern Hardwoods
Early Succession Other Types
Early Succession Pine and Hemlock
Early Succession Spruce-Fir
Early Succession Upland Oak
Grasslands and Hedgerows
Northern Hardwood
Oak-Pine Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Description of habitat problem(s): Conversion of forest habitat as a result of rural development that leads to loss of mature and older forests used as roosting habitat. Because silver-haired bats are migratory, they could be limited by wind and radio towers as well as powerlines. Predators include several kinds of birds including blue jays therefore increased suburbanization could increase loss to predation.

Non-Habitat Problems:

Disease

Loss of Prey Base

Pollution

Description of non-habitat problem(s): Pesticides and environmental poisons have had negative impacts on, and increased the mortality rates of, bat populations. Bats store some lipophilic pesticides in brown adipose fat tissues. These stores are released as bats use their fat reserves during hibernation. Depending upon tissue levels of the pesticide, as well as the amount of fat used over a given time period, bats can be

Common Name: **Silver-haired Bat**
Scientific Name: **Lasionycteris noctivagans**
Species Group: **Mammal**

exposed to both chronic and acute poisoning which can result in death. At lower levels,chronic poisoning may raise a bat's metabolism, burning the limited fat resources more quickly and possibly causing them to starve to death. In addition, broad spectrum insecticides can deplete insect diversity and limit the food sources available for bats. Silver-haired bats are also suceptible to a virulent strain of rabies.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Determine habitat requirements in Vermont.
Research	Basic Life History	Medium	Research the possibility of food competition and partitioning between red, hoary, silver-haired and eastern pipistrelle bats.
Research	Distribution and Abundance	Medium	Collect baseline data on distribution, abundance in Vermont.

Common Name: **Silver-haired Bat**
Scientific Name: **Lasionycteris noctivagans**
Species Group: **Mammal**

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Common Name: **Eastern Pipistrelle**
Scientific Name: **Pipistrellus subflavus**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: High Priority

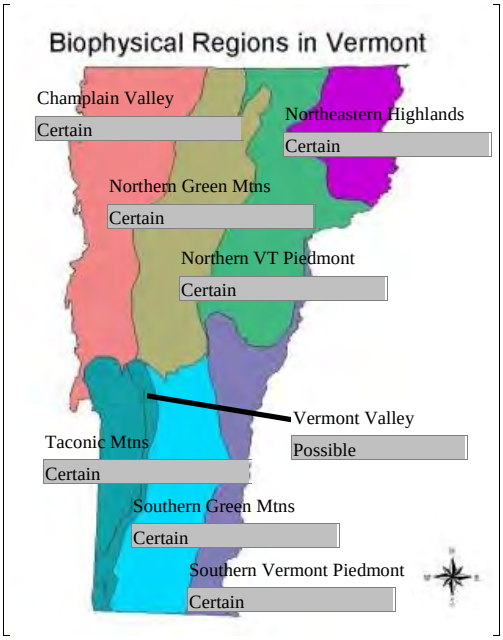
Global Rank: G5 **Global Trend:**
State Rank: S2S3 **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Unknown

Assessment Narrative:

One of the 6 species that overwinter in Vermont. The pipistrelle occur in small numbers in Vermont hibernacula and are only infrequently caught in mist net surveys. Its small size and multiple young (2 vs. 1 for most bats) makes it more vulnerable.

Little is known about this species, it appears uncommon but more data is needed. Approximately a dozen specimens have been found as a result of winter surveys and only one or two through summer surveys. May be at the northern edge of summer range.

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☑
Within US	☐
Outside US	☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

The pipistrelle forages over wetlands, riparian areas, and forest edges, ingesting ants, moths, small beetles, mosquitoes and other insects. Possibly uses trees for maternity roosts, although in Vermont, the Eastern pipistrelle has not been found with other tree roosting bats. In Indiana they are found in sugar maple and American elms, as well as tulip and sycamore trees. The pipistrelle is also found in the dead foliage of oaks. They hibernate in caves mines and rock crevices where humidity is high and temperatures are around 10 to 15 degrees centigrade.

unknown

Common Name: **Eastern Pipistrelle**
Scientific Name: **Pipistrellus subflavus**
Species Group: **Mammal**

General Habitat Preferences:

Minimum Elevation (m):	80
Maximum Elevation (m):	0
Patch Size Requirements:	Unknown
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Lacustrine
Aquatic: Lake Champlain
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Lower CT River
Building or Structure
Floodplain Forests
Hardwood Swamps
Mine
Subterranean
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Description of habitat problem(s): Hibernating bats are limited by degradation, destruction and disturbance of hibernacula (caves and mines). Bats disturbed within the hibernacula use significant stores of fat each time they are awakened. If awakened enough times, bats can deplete their fat reserves and not have enough energy resources to complete spring migration, survive post emergence periods of bad weather or initiate and successfully complete gestation. In some cases, awakening hibernating bats can directly lead to their death. Closure of mines or caves in winter, when bats are present, would lead to the destruction of the entire colony. Slight alterations in cave/mine microclimate as a result of modifications to the opening etc. could also negatively impact hibernating bats. Removal of trees which serve as bat roosts, especially those serving as maternity roosts can directly kill entire colonies of bats. Wind energy turbines located on ridge tops have been found to directly kill bats as well..

Non-Habitat Problems:

Pollution

Trampling or Direct Impacts

Description of non-habitat problem(s): Pesticides and environmental poisons have had negative impacts on, and increased the mortality rates of, bat populations. Bats store some lipophilic pesticides in brown adipose fat tissues. These stores are released as bats use their fat reserves during hibernation. Depending upon levels of the pesticide in the tissue, as well as, the amount of fat used over a given time period, bats can be exposed to both chronic and acute poisoning which can result in death. At lower levels,chronic poisoning may raise a bat's metabolism, burning the limited fat resources more quickly and possibly causing them to starve to death. In addition, broad spectrum insecticides can deplete insect diversity and limit the food sources available for bats.

Common Name: **Eastern Pipistrelle**
Scientific Name: **Pipistrellus subflavus**
Species Group: **Mammal**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Collect baseline data on habitat requirements.
Research	Basic Life History	Medium	Research possibility of food competition and partitioning between red, hoary, silver-haired and eastern pipistrelle bats.
Research	Distribution and Abundance	High	Collect baseline data on distribution and abundance

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Common Name: **Big Brown Bat**
Scientific Name: **Eptesicus fuscus**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: Medium Priority

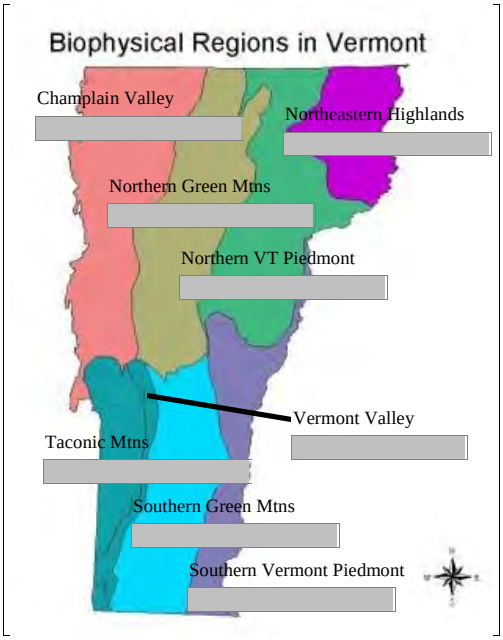
Global Rank: G5 **Global Trend:**
State Rank: S3S4 **State Trend:** unknown
Extirpated in VT? no **Regionally Rare?** no

Assessment Narrative:

Population is listed as S4--apparently secure, but could decline in future as a result of impacts to hibernacula (cold caves and buildings). In addition, loss of summer maternity roosts (buildings and the same trees as those used by the Indiana bat) could cause a decline in numbers over time.

Because big brown bat maternity sites are most often in human structures such as barns, sheds, houses, and churches, they are frequently in conflict with people. At best, they may be excluded from these structures, forcing a split into several smaller matenity sites. At worst, they may be extirminated by pest control agents. Little is really known about the status of this bat or its popuation trends. Big brown bats are among the first bats to give birth and often have 2 off-spring. Five Army Corp of Engineer (ACE) Vermont lakes were surveyed for bats the summer of 2003. Field inventories included mist netting, harp traps, and Ana Bat recordings between June 23 and July 14 and resampled July 25 and August 13. Ninety-nine males, 101 females and 16 unknown sex, big brown bats were captured with mist nets in the southern Connecticut River Valley (Chenger 2003).

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

In summer, big brown bats roost in the attics of churches, houses, and old abandoned structures and deciduous tree cavities. In winter they hibernate in very cold areas (cave entrances and cliff faces) often with temperatures very close to and sometimes below freezing. This is the only bat species in VT known to

Common Name: **Big Brown Bat**
Scientific Name: **Eptesicus fuscus**
Species Group: **Mammal**

hibernate in buildlings. These low temperatures allow them to drastically slow their metabolism (Sanders 2004). Right now, big brown bats hibernate in fewer than 20 sites in Vermont. Big brown bats consume beetles, ants, flies, mosquitoes, mayflies, stoneflies, and other insects. They emerge from their summer roost at dusk and fly a steady, nearly straight course to foraging areas (Chenger, 2004). There may be fidelity to the feeding grounds and some bats use the same grounds night after night. Little is known about where these bat winter.

unknown

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements:
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Description of habitat problem(s): Every year big and little brown bats lose hundreds of possible building roosts due to exclusion or the actual destruction of buildings. Direct killing of bats is common due to human fears about rabies, bat bites and histoplasmosis. In addition, alterations or impacts to winter hibernacula also limits the future of this bat.

Non-Habitat Problems:

Pollution

Description of non-habitat problem(s): Pesticides and environmental poisons have had negative impacts on, and increased the mortality rates of, bat populations. Bats store some lipophilic pesticides in brown adipose fat tissues. These stores are released as bats use their fat reserves during hibernation. Depending upon levels of the pesticide in the tissue, as well as, the amount of fat used over a given time period, bats can be exposed to both chronic and acute poisoning which can result in death. At low levels,chronic poisoning may raise a bat's metabolism, burning the limited fat resources more quickly and possibly causing them to starve to death. In addition, broad spectrum insecticides can deplete insect diversity and limit the food sources available for bats.

Common Name: **Big Brown Bat**
Scientific Name: **Eptesicus fuscus**
Species Group: **Mammal**

Research and Monitoring Needs

Type	Need	Priority	Description
Monitoring	Population Change	Medium	Monitor big brown bat populations to determine status, distribution, and trends.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration		Protect hibernacula that are found to contain 30 or more big brown bats	Number of hibernacula protected	Vermont Cavers Association, TNC, VLT, USFS, ACE, Coverts	SWG, LIP, USFWS
Habitat Restoration		Maintain at least 30 maternity sites and a minimum of 5,000 adult female individuals in Vermont	Number of maternity sites protected	NRCS, Coverts, USFWS, ACE, VLT, TNC	USFWS, NRCS, WHIP, LIP
Technical Assistance, Training, Learning Networks		Train Wildlife Control agents in proper bat exclusion and develop a modern set of guidelines/laws which advocate best management practices for exclusions	Development of Best Management Practices and implementation of training sessions	Wildlife Control Agents, Rehabilitators	SWG

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Common Name: **Eastern Red Bat**
Scientific Name: **Lasiurus borealis**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: High Priority

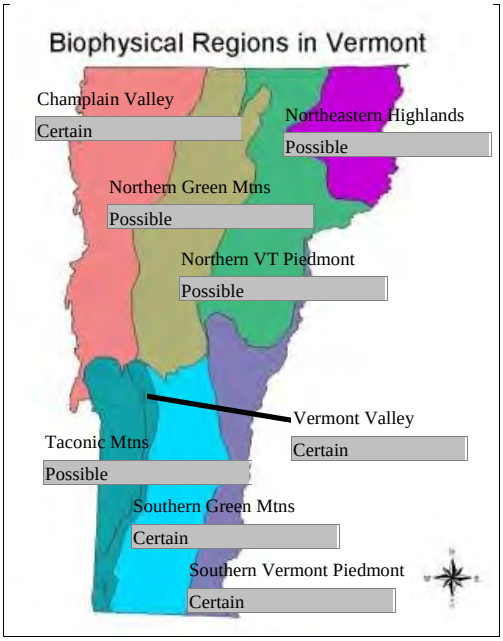
Global Rank: G5 **Global Trend:**
State Rank: S3S4 **State Trend:** unknown
Extirpated in VT? no **Regionally Rare?** Unknown

Assessment Narrative:

The red bat spends the winter in the southern U.S. or Mexico. They migrate back and forth along the eastern seaboard. A study in New York (Fisher 1896) reported red bats to be the second most common bat and reports from the late 1800's and early 1900's talk about "great flights of them during the whole day" (Mearns, 1898). This bat has a larger litter size than most other bats, ranging from one to five young.

Once one of the most abundant bats in many parts of their range, red bats appear to have declined dramatically over the last 100 years. Little is known about the Vermont population. Recent summer monitoring efforts (2003) in the upper Connecticut River Basin netted a total of 3 males and 1 female at Stoughton Pond in N. Springfield, Townshend Dam in Townshend, Townshend lake in Townshend, and Branch brook in Springfield respectively (Bat Conservation and Management, 2003).

Distribution:



Natural History Elements:

Home Range: < 100 ha
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☑
Outside US	☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

The eastern red bat is a solitary rooster which often hangs by one foot from branches in the foliage appearing as dead leaves in the crown of the tree. It prefers older forests with dense canopy foliage and open understory as well as hedgerows with elms and eastern red cedar stands. They are fast flyers that forage in open areas along hedgerows and field edges. The eastern red bats migrate south to Gulf states to hibernate. Tree bats such as the red, silver-haired, and hoary are the least studied of the bats and little is known about their status or

Common Name: **Eastern Red Bat**
Scientific Name: **Lasiurus borealis**
Species Group: **Mammal**

habitat needs in Vermont. Eastern red bats feed on moths, crickets, flies, mosquitoes, beetles, cicadas, and other insects.

red cedar

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	1300
Patch Size Requirements:	Unknown
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Lacustrine
Aquatic: Lake Champlain
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Lower CT River
Aquatic: Man-Made Water Bodies
Grasslands and Hedgerows
Northern Hardwood
Oak-Pine Northern Hardwood
Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Description of habitat problem(s): Problems include conversion/degradation of forest habitat, as well as, rural development leading to loss of mature forest. Loss of American elms, a major roost tree, may be a continuing factor in the decline of the red bat. Because red bats are migratory, they could be limited by wind and radio towers as well as powerlines. Predators include several kinds of birds including blue jays therefore increased suburbanization could increase loss to predation.

Non-Habitat Problems:

Loss of Prey Base

Pollution

Description of non-habitat problem(s): Being migratory they could be limited by wind and radio towers and powerlines
Pesticides and environmental poisons have had negative impacts on, and increased the mortality rates of, bat populations. Bats store some lipophilic pesticides in brown adipose fat tissues. These stores are released as bats use their fat reserves during hibernation. Depending upon tissue levels of the pesticide, as well as the amount of fat used over a given time period, bats can be exposed to both chronic and acute poisoning which can result in death. At lower levels,chronic poisoning may raise a bat's metabolism, burning the limited fat resources more quickly and possibly causing them to starve to death. In addition, broad spectrum insecticides can deplete insect diversity and limit the food sources available for bats.

Common Name: **Eastern Red Bat**
Scientific Name: **Lasiurus borealis**
Species Group: **Mammal**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Collect baseline data on habitat requirements
Research	Basic Life History	Medium	Research possibility of food competition and partitioning between red, hoary, silver-haired and eastern pipistrelle bats.
Research	Distribution and Abundance	High	Collect baseline data on distribution and abundance.
Monitoring	Monitor Threats	High	Research migratory patterns and impacts from power lines, wind towers, and road mortality

Common Name: **Eastern Red Bat**
Scientific Name: **Lasiurus borealis**
Species Group: **Mammal**

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Common Name: **Hoary Bat**
Scientific Name: **Lasiurus cinereus**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: High Priority

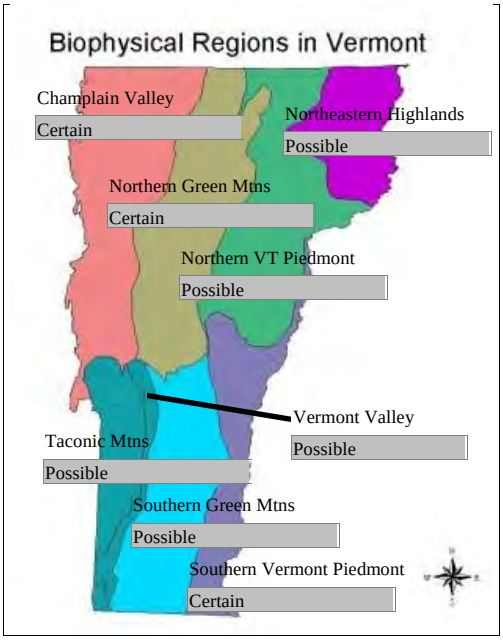
Global Rank: G5 **Global Trend:**
State Rank: S3 **State Trend:** unknown
Extirpated in VT? no **Regionally Rare?** no

Assessment Narrative:

Hoary bats are the largest bats of northeastern North America. They are ranked as S3 (uncommon).

Only five occurrences found in Vermont in the past 10 years. A specimen was netted in Addison County in 2002 (Decker & Kilpatrick 2002) and a hoary bat was detected by Anabat Bat Detector along the Lamoile River near Fairfax (Kilpatrick pers comm). The population has declined significantly since 1900. In 2001, one post reproductive female and one juvenile female hoary bat were captured by Environmental Solutions and Innovations during mist netting (ESI, 2001). The most recent report in Vermont was in 2003. Mist netting in the N. Springfield Lake/Stoughton Pond area yielded 45 bats the first sampling period and 53 bats in the second sampling period (Chenger 2003). One male hoary bat was captured as a result of the survey. In Connecticut 300 hours of mist netting yielded one hoary bat. Due to their solitary nature, we know the least about the 3 tree bat species in Vermont (red, hoary, and silver-haired).

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? Yes

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☑

Distribution Summary:

One historical record exists for Rutland, VT

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

In the summer, during the day, hoary bats may stay concealed in the foliage of trees, well-concealed but with an open understory, generally 10 to 17 feet above the ground and often on the edge of a clearing. They emerge after dark to feed and may make round trips of up to 24 miles to forage. They forage over wetlands, openings, lakes and edges. They are fast flyers. Northern populations make long seasonal migrations to and from warmer

Common Name: **Hoary Bat**
Scientific Name: **Lasiurus cinereus**
Species Group: **Mammal**

winter habitats in the southern United States or Mexico. The sexes are segregated throughout most of the summer range. Foods include moths, true bugs, mosquitoes, and other insects. Hoary bats have two young in mid-May through June or July. Females are solitary roosters and roost exclusively in trees. They may roost in the same tree in subsequent years.

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 1500
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☑
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☑
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Lacustrine
Aquatic: Lake Champlain
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Lower CT River
Aquatic: Man-Made Water Bodies
Grasslands and Hedgerows
Marshes and Sedge Meadows
Northern Hardwood
Oak-Pine Northern Hardwood
Open Peatlands
Shrub Swamps
Spruce Fir Northern Hardwood
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Description of habitat problem(s): Problems include conversion/degradation of forest habitat, as well as rural development leading to loss of mature forest. Because hoary bats are migratory, they could be impacted by wind and radio towers as well as powerlines. Predators include several kinds of birds including blue jays therefore increased suburbanization could increase loss to predation.

Non-Habitat Problems:

Loss of Prey Base

Pollution

Trampling or Direct Impacts

Description of non-habitat problem(s): Being migratory they could be impacted by wind and radio towers and powerlines
Pesticides and environmental poisons have had negative impacts on, and increased the mortality rates of, bat populations. Bats store some lipophilic pesticides in brown adipose fat tissues. These stores are released

Common Name: **Hoary Bat**
Scientific Name: **Lasiurus cinereus**
Species Group: **Mammal**

as bats use their fat reserves during hibernation. Depending upon tissue levels of the pesticide, as well as the amount of fat used over a given time period, bats can be exposed to both chronic and acute poisoning which can result in death. At lower levels,chronic poisoning may raise a bat's metabolism, burning the limited fat resources more quickly and possibly causing them to starve to death. In addition, broad spectrum insecticides can deplete insect diversity and limit the food sources available for bats.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Collect baseline data on habitat requirements.
Research	Basic Life History	Medium	Research the possibility of food competition and partitioning between red, hoary, silver-haired and eastern pipistrelle bats.
Research	Distribution and Abundance	High	Collect baseline data on distribution and abundance

Common Name: **Hoary Bat**
Scientific Name: **Lasiurus cinereus**
Species Group: **Mammal**

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Owen, S.F., M.A. Menzel, J.W. Edwards, W.M. Ford, J.M. Menzel, B.R. Chapman, P.B. Wood, and K.V. Miller. 2004. Bat activity inharvested and intact forest stands in the Allegheny Mountains. North. J. Appl. For. 21(3):154-159.

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Shump, K.A. and A.U. Shump.1982. Lasiurus cinereus. American Society of Mammalogists. Mammalian Species No. 185: 1-5.

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Common Name: **New England Cottontail**
Scientific Name: **Sylvilagus transitionalis**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: High Priority

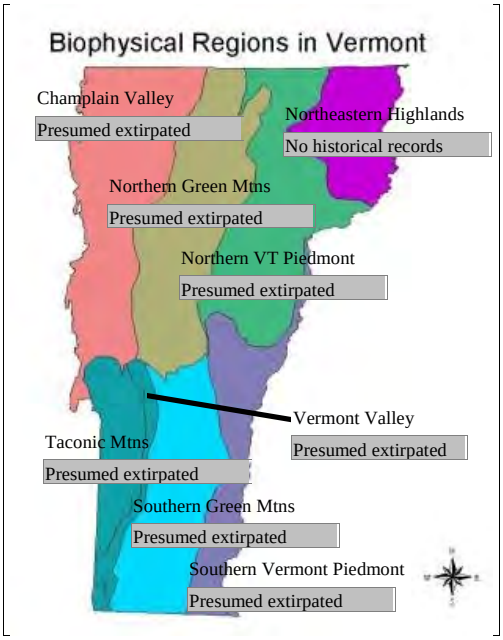
Global Rank: G4 **Global Trend:**
State Rank: SU **State Trend:** Unknown
Extirpated in VT? no **Regionally Rare?** yes

Assessment Narrative:

The New England cottontail is rare, possibly extirpated in Vermont.

S. transitionalis was abundant in Vermont in the 1940s. They were last documented in 1946. Widespread introductions of S. floridanus and habitat changes have resulted in apparent competition and possibly hybridization with eastern cottontails. Despite concerted trapping efforts in Vermont no evidence of S. transitionalis has been found since 1991.

Distribution:



Natural History Elements:

Home Range: <1 ha
Migrant? No

Within watershed ☐
Within biophysical region ☐
Within VT ☐
Within Region ☐
Within US ☐
Outside US ☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

New England cottontails are associated with many types of vegetation but are most often found in early successional old fields, 10-25 years post-disturbance with high stem density (9000-10,000 stems/hectare). It is critical that patches of dense hardwood and softwood shrubs, seedlings and saplings at least .5 meters tall and less than 7.5 meters in diameter be closely spaced to facilitate usage. Connectivity between patches is also important. Isolated patches are much less frequently used (Tumosa 2001). New England cottontails seldom venture far from dense cover and in winter will inhabit larger patches (greater than 10 ha) (DeGraff and Yamasaki, 2001). They cannot colonize areas already inhabitant by Eastern cottontail. Home ranges can be linear along riparian areas, roadsides etc.

10-25 yrs. Post disturbance

Common Name: **New England Cottontail**
Scientific Name: **Sylvilagus transitionalis**
Species Group: **Mammal**

General Habitat Preferences:

Minimum Elevation (m):	30
Maximum Elevation (m):	800
Patch Size Requirements:	> 10 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Boreal Hardwoods

Early Succession Pine and Hemlock

Grasslands and Hedgerows

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Habitat Succession

Invasion by Exotic Species

Description of habitat problem(s): Fragmentation and isolation of patches results in lower survival rates and skewed sex ratios and increases vulnerability to extirpation due to chance events (natureserve.org). Habitat patches less than 3 acres in size increases the risk of predation. Decline in patch size (less than 15-75 ha) and increase in juxtaposition (greater than 500m) reduces survivability of New England cottontails. Loss of 10-25 year post-disturbance habitat due to conversion, succession and fragmentation also negatively influences N.E. cottontail recovery. Competition from eastern cottontail is also a problem. The eastern cottontail will occupy a habitat first and exclude NE Cottontail

Non-Habitat Problems:

Competition

Description of non-habitat problem(s): Competition with eastern cottontail

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	Medium	Determine habitat requirements in Vermont.
Research	Distribution and Abundance	Medium	Continue to monitor for occurrence in likely Vermont habitats.
Research	Taxonomy	Medium	Genetically test trapped rabbits to determine distribution of floridanus vs. transitionalis
Monitoring	Monitor Threats	Medium	Monitor changes in early successional habitats in regards to size, age, and juxtapositon

Common Name: **New England Cottontail**
Scientific Name: **Sylvilagus transitionalis**
Species Group: **Mammal**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Ex-Situ Conservation		Identify regional refugia until habitat can be developed w/in a state. Maintain isolated populations until a long-term plan is developed.	Number of isolated populations conserved. Number of regional refugia conserved.	Other New England states, VLT, TNC, USFWS	LIP, SWG,

Bibliography:

Chapman, Joseph A., Kenneth L. Cramer, Nico J. Dppenaar, and Terence J. Robinson. 1992. Systematics and biogeographyu of the New England cottontail. SYLVILAGUS TRANSITIONALIS (Bangs, 1895), with the description of a new species from the Appalachian Mountains. Proc. Biol. Soc. Wash. 105 (4): 841-865.

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Litvaitis, John A., and B. Johnson, W. Jakubus, and K. Morris. 2003a. Distribution and Habitat features associated with remnant populations of New England cottontails in Maine. Can. J. Zool. L81: 877-887.

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Wilson, Don E. and Sue Ruff. 1999. The Smithsonian Book of North American Mammals. Smithsonian Institution Press, Washington and London.

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Www.natureserve.orgcomprehensive report on New England cottontail as of 4/27/01

Common Name: **Southern Flying Squirrel**
Scientific Name: **Glaucomys volans**
Species Group: **Mammal**

Conservation Assessment:

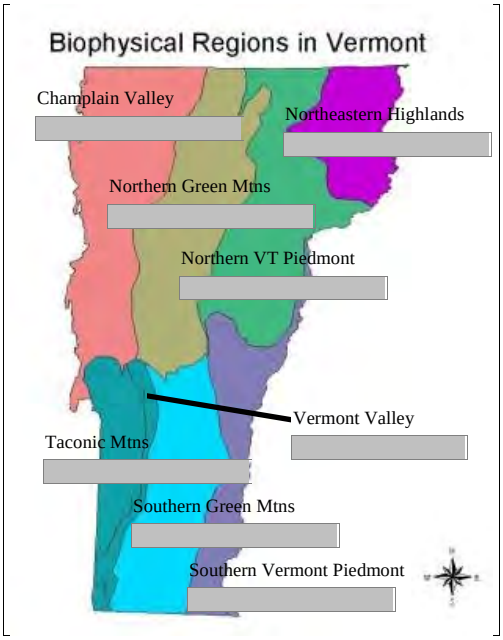
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S4 **State Trend:** stable
Extirpated in VT? no **Regionally Rare?** no

Assessment Narrative:

Species is listed as S4, apparently secure, but little is known about this species or population trends in the state.

Distribution:



Natural History Elements:

Home Range:
Migrant? No
Within watershed ☐
Within biophysical region ☐
Within VT ☐
Within Region ☐
Within US ☐
Outside US ☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

In eastern US usually found at lower elevations in decidious and mixed forests often near water (Godin 1977) . Each individual has several nest sites in mature forests with cavity trees (Degraff et all 1986).

Common Name: **Southern Flying Squirrel**
Scientific Name: **Glaucomys volans**
Species Group: **Mammal**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	1000
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Floodplain Forests
Northern Hardwood
Oak-Pine Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Description of habitat problem(s): Unknown

Description of non-habitat problem(s):

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Distribution and Abundance	Medium	Determine distribution and abundance population status

Bibliography:

DeGraff, R. M. and Rudis, D.D. 1986. New England wildlife: habitat, natural history, and distribution. Gen. Tech. Rep. NE-108. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 491 pp.

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Godin, A. J. 1977. Wild Mammals of New England. John Hopkins University Press, Baltimore, 304 pp.

Common Name: **Northern Flying Squirrel**
Scientific Name: **Glaucomys sabrinus**
Species Group: **Mammal**

Conservation Assessment:

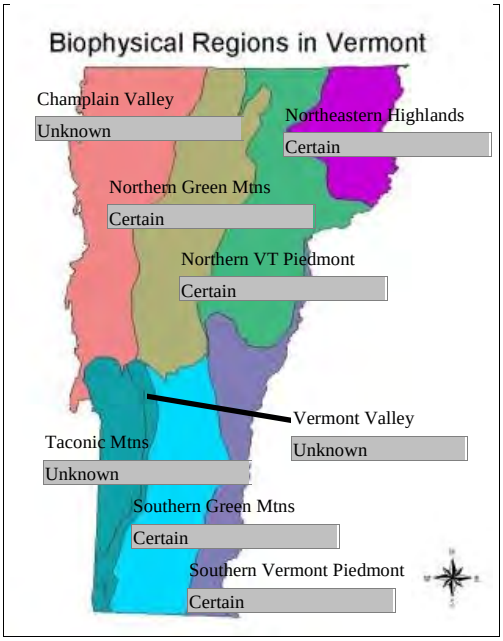
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S4 **State Trend:** stable
Extirpated in VT? no **Regionally Rare?** no

Assessment Narrative:

Species is listed as S4, apparantely secure, but little is known about its biology and population and threats within the state are not known. The dependance of this species on tree cavities for winter nest sites, reliance on specific fungi and lichens as dietary items during certain times of the year and potential lethal parasites carried by Southern flying squirrel could cause a decline in numbers over time.

Distribution:



Natural History Elements:

Home Range:
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Generally found in mature, hardwood dominated forests. Requires mature trees with cavities for winter den sites. Feeds on arboreal lichens in the winter (DeGraff et al, 1986).

Common Name: **Northern Flying Squirrel**
Scientific Name: **Glaucomys sabrinus**
Species Group: **Mammal**

General Habitat Preferences:

Minimum Elevation (m):	1000
Maximum Elevation (m):	1830
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Description of habitat problem(s): Loss of nest cavities

Description of non-habitat problem(s):

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Distribution and Abundance	Medium	Determine distribution and abundance and population status

Bibliography:

Degraff, R.M. and Rudis, D.D. 1986. New England wildlife: habitat, natural history, and distribution. Gen.Tech. Rep. NE-108. Broomall, PA: United States Department of Agriculture, Forest Service, Northeast Forest Experiment Station. 491 pp

Godin, A. J. 1977. Wild Mammals of New England. John Hopkins University Press, Baltimore, 304 pp.

Saunders, D. A. 1988. Adirondack Mammals. College of Environmental Science and Forestry, State University of New York, Syracuse, 216 pp.

Wells-Gosling, N., and L. R. Heaney. 1984. Glaucomys sabrinus. Mammalian Species, 220:1-8.

Common Name: **Rock Vole**
Scientific Name: **Microtus chrotorrhinus**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: High Priority

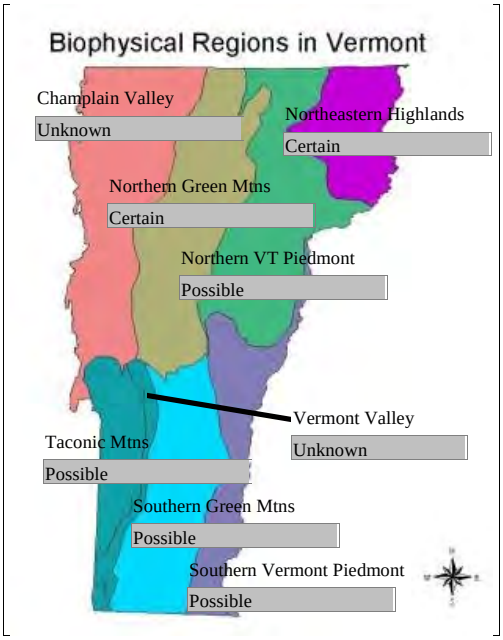
Global Rank: G4 **Global Trend:**
State Rank: S2 **State Trend:** unknown
Extirpated in VT? no **Regionally Rare?** yes

Assessment Narrative:

Ranked as S2 in Vermont and considered a species of special concern

Talus slopes are the species' refugal habitat. In some locations may be found in some early successional forest habitat (Kirkland 1977; Martell and Radvanyi 1977) (disappears 7 years after disturbance) and krumholtz. We don't know why the population fluctuates so much and there are relatively few known populations. There have been several historic records: 1937-1940: 20 specimens in Island Pond at 1400' elevation; 1953: 2 specimens in Brighton on the talus slopes of NW Bluff Mountain; 1954: one specimen near Smugglers cave on Mt. Mansfield; 1958-1959: 4 specimens from Nebraska Notch, Mt. Mansfield; 1966: 2 specimens (one male and one female collected in Nebraska Notch, Mt Mansfield State Forest at 1900 ft in Underhill; (Everett Marshall pers., com, Vt. Natural Heritage database). Current sites include: Whenlock WMA (Chipman, 1994); West Mountain WMA (Kilpatrick, 2001); East Mountain, East Haven (Kilpatrick, 2005), Eat Charleston (Kilpatrick, pers., com).

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? No

Within watershed ☐
Within biophysical region ☐
Within VT ☐
Within Region ☐
Within US ☐
Outside US ☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Occurs in disjunct populations that are not genetically differentiated so movement corridors may be important. This species is very habitat selective. They use moist talus habitats among mossy rocks and logs in spruce/ fir and northern hardwood forests, cedar swamps, and krummholz. May be naturally rare due to habitat

Common Name: **Rock Vole**
Scientific Name: **Microtus chrotorrhinus**
Species Group: **Mammal**

specificity. Rock vole has been reported in three-five year old clearcuts with slash however, not in Vermont. Critical habitat includes cool, moist talus and mossy rocks usually a stream or other surface water in the immediate vicinity.

General Habitat Preferences:

Minimum Elevation (m): 500
Maximum Elevation (m): 1300
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Cliffs and Talus
Softwood Swamps
Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Description of habitat problem(s): Mesic aspect of habitat is important so the loss of forest cover may dry out the site. Loss of connectivity may be a problem. Habitat is isolated and local populations may go extinct. Repopulation may require habitat corridors of coniferous forests that connect optimal habitats. Activities that destroy or degrade talus habitat would impact rock vole populations.

Non-Habitat Problems:

Competition

Description of non-habitat problem(s): Competition from meadow mouse as a result of habitat conversion, particularly near talus areas, could limit the rock vole. Metapopulation structuce is not clearly understood but local populations appear to go extinct and then are repopulated. In Massachusetts and West Virginia populations were negatively affected by high levels of deer over the long term (Healey and Brooks 1988).

Common Name: **Rock Vole**
Scientific Name: **Microtus chrotorrhinus**
Species Group: **Mammal**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Basic Life History	Medium	Telemeter to determine home range movements
Research	Distribution and Abundance	High	Determine distribution and abundance as well as corridor needs
Research	Population Genetics	Medium	Research genetics to determine changes in population structure and size.
Research	Other Research	High	Determine appropriate management strategies to improve and conserve habitat.
Monitoring	Population Change	Medium	In a multi year monitoring effort, re-census historical habitats and survey in other likely habitats and map confirmed habitats.
Monitoring	Monitor Threats	Medium	Monitor encroachment by medow mice.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use		Minimize permanent fragmentation between populations.			

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Healy, W.M. , Brooks, R.T. 1988. Small Mammal Abundance in Northern Hadwood Statnds in West Virginia. Journal of Wildlife Management. 52(3): 491-496.

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Kilpatrick, C.W. 2005. East Mountian Mammal Survey August 2004- December 2004. Final report May 15, 2005, Prpared for Kingdom Commons Group.

Kirkland, G. L., Jr. 1977. The rock vole, Microtus chrotorrhinus (Miller) (Mammalia: Rodentia) in West Virginia. Annals of Carnegie Museum, 46:45-53.

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Martell, A.M., and A. Radvanyi. 1977. Changes in small mammal populations after clear cutting of northern Ontario black spruce forest. Canadian Field Naturalist, 91:41-46.

Osgood, F. L., Jr. 1938. First Vermont record of the rock vole. Journal of Mammalogy, 19:108.

Tumosa, J. 2001. United States Forest Service speiceis data collection form for Microtus chrotorrhinus. 19 pp.

www.natureserve.org comprehensive report on rock vole.

Common Name: **Woodland Vole**
Scientific Name: **Microtus pinetorum**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: High Priority

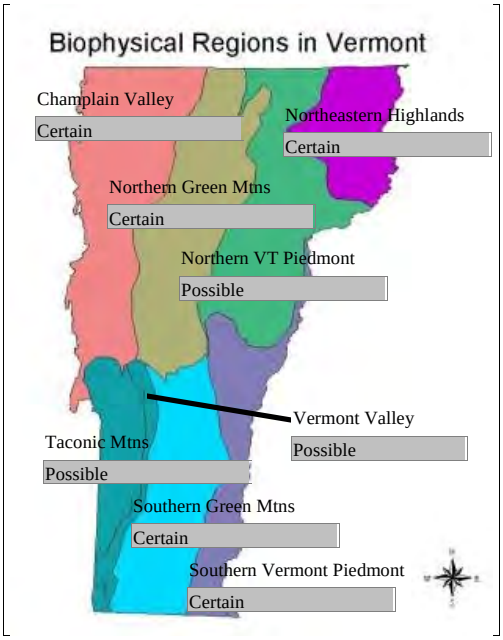
Global Rank: G5 **Global Trend:**
State Rank: S3 **State Trend:** unknown
Extirpated in VT? no **Regionally Rare?** no

Assessment Narrative:

status: Appears to be stable.

Often a pest that appears to do well in agricultural settings. However little is known about this species outside this setting or in its native habitat. Fewer than 50 specimens collected in the state. Known from very few localities including the flanks of Ide Mountain, West Lyndon Center (Miller, 1964); Island Pond (Miller, 1964); Sherburne (Osgood, 1936); and from Colchester and Duxbury (Kilpatrick, pers. com). Although often reported as an agriculrual pest, especially in apple orchards, much of the reported damage is the result of meadow voles (Microtus pennsylvanicus). Woodland voles are only known to occur in orchards in Putney, Mendon, and Bennigton (Kilpatrick, 1979).

Distribution:



Natural History Elements:

Home Range: Unknown
Migrant? No

Within watershed ☐
Within biophysical region ☐
Within VT ☐
Within Region ☐
Within US ☐
Outside US ☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Defining habitat characteristic is well-drained sandy loam soils. Found in all places with these soils (e.g. agricultural fields and older forests). Favors well-drained upland forests, grasslands, meadows, or orchards but can be found in marshes and swamps (DeGraff and Yamasaki, 2001). May require a ground cover of leaves or duff or grass. Forages primarily below ground digging tunnel systems 3 inches to 12 inches below ground. Nests are found under dead and down material, rocks, or in burrows. They are active throughout the year and eat tubers, roots and bulbs, seeds, nuts fruits, bark and leaves (DeGraff and Yamasaki, 2001). Can be a

Common Name: **Woodland Vole**
Scientific Name: **Microtus pinetorum**
Species Group: **Mammal**

problem in orchards.

none

General Habitat Preferences:

Minimum Elevation (m): 30
Maximum Elevation (m): 700
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☑
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☑
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Grasslands and Hedgerows
Lawns, Gardens, and Row Crops
Northern Hardwood
Oak-Pine Northern Hardwood
Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Unknown Habitat Threats

Description of habitat problem(s): Unknown

Non-Habitat Problems:

Pollution

Trampling or Direct Impacts

Description of non-habitat problem(s): Because of human/vole conflicts, the application of rodenticides may cause a decline of this species in orchards. The status of the wooland vole in forested habitats is unknown.

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	Medium	Develop baseline data on habitat requirements outside of agricultural areas.
Research	Distribution and Abundance	Medium	Develop baseline data on distribution and abundance outside of agricultural areas.

Common Name: **Woodland Vole**
Scientific Name: **Microtus pinetorum**
Species Group: **Mammal**

Bibliography:

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DeGraaf, R. M., and M. Yamasaki. 2001. New England Wildlife: Habitat, Natural History, and Distribution. University Press of New England, Hanover. 482 pp.

Hamilton, W.J. 1938. Life history notes on the northen pine mouse. Journal of Mammalogy, 19:163-170.

Kilpatrick, C.W. 1979. Habitat, climatological and management variables associated with vole populations in Vermont orchards, Unpublished Report. 27pp. For U.S. Fish and Wildlife Service.

Miller, D.H. 1964. Northern records of the pine mouse in Vermont. Journal of Mammalogy, 45:627-628.

Miller, D.H. and L.L. Getz. 1969. Life-history notes on Microtus pinetorum in central Connecticut. Journal of Mammalogy, 50: 777-784.

Osgood, F.L. 1936. Pine mice in Vermont. Jounal of Mammalogy. 17: 291-292.

Smolen, M.J. 1981. Microtus pinetorum. Mammalian species, 147: 1-7.

Common Name: **Muskrat**
Scientific Name: **Ondatra zibethicus**
Species Group: **Mammal**

Conservation Assessment:

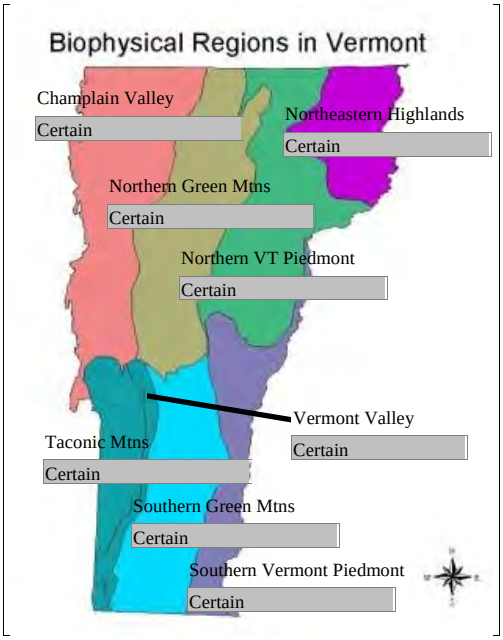
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S5 **State Trend:** declining
Extirpated in VT? no **Regionally Rare?** no

Assessment Narrative:

This species is on the decline nationally for unknown reasons.

Distribution:



Natural History Elements:

Home Range: linear-riparian
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Muskrat have flexible habitat requirements as long as there is permanent water and protection through burrows and vegetated lodges. Highest population densities exist where emergent vegetation is at a 1:1 ratio to open water

Common Name: **Muskrat**
Scientific Name: **Ondatra zibethicus**
Species Group: **Mammal**

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☑
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Lacustrine
Aquatic: Lake Champlain
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Lower CT River
Aquatic: Man-Made Water Bodies
Marshes and Sedge Meadows

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Invasion by Exotic Species

Unknown Habitat Threats

Description of habitat problem(s): Invasion by exotic species: plants such as purple loosestrife are replacing preferred forage vegetation
conversion of habitat: Extreme water fluctuations from dams and other flow control devices.
Unknown problem: The population of this species is the decline nationally. The cause(s) is unknown.

Non-Habitat Problems:

Disease

Description of non-habitat problem(s):

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Distribution and Abundance	Medium	More closely monitor distribution and abundance in Vermont
Research	Threats and Their Significance	High	Determine what factors may be influencing population ldensities, focusing in particular on pollution and mercury levels.

Common Name: **Muskrat**
Scientific Name: **Ondatra zibethicus**
Species Group: **Mammal**

Bibliography:

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Willner, G.R., G.A. Feldhammer, E.E. Zucker, and J.A. Champmand, 1980. Ondatra zibethicus. Mammalian Species, 141: 1-8.

Common Name: **Southern Bog Lemming**
Scientific Name: **Synaptomys cooperi**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: High Priority

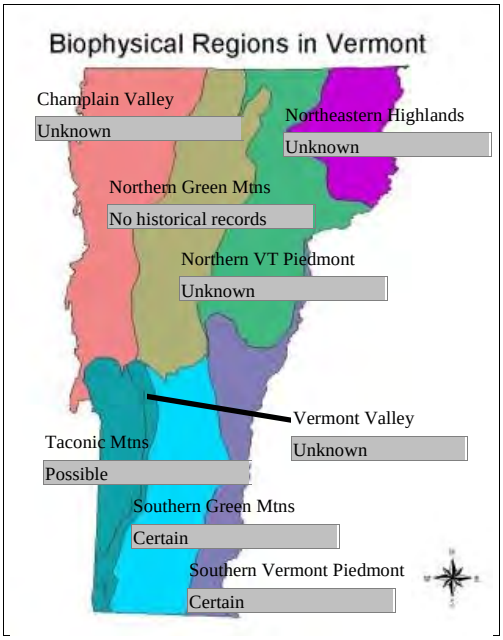
Global Rank: G5 **Global Trend:**
State Rank: S3 **State Trend:** Fluctuating
Extirpated in VT? no **Regionally Rare?** yes

Assessment Narrative:

Regionally rare from Quebec to Manitoba and south to Kansas, Arkansas, Virginia, and Maryland. Exists in scattered colonies. Status in Vermont is unknown.

Appears to be rare--fewer than 50 records in the state--with little historical data collected.

Distribution:



Natural History Elements:

Home Range: <1 ha
Migrant? No

Within watershed ☐
Within biophysical region ☐
Within VT ☐
Within Region ☐
Within US ☐
Outside US ☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Uses a variety of habitats from marshes and open meadows to moist deciduous and mixed forest. Common in orchards in Southern Appalachia but seems to prefer moist mixed deciduous forest with moist substrata such as sphagnum bog or a thick loose duff layer. Found in wet grasslands and hemlock/pine forest. Utilizes the burrow systems of hairy-tailed moles. The s. bog lemming will use clearcuts and other small forest openings with adequate ground cover (kirkland 1977b, in DeGraff 2001).

Common Name: **Southern Bog Lemming**
Scientific Name: **Synaptomys cooperi**
Species Group: **Mammal**

General Habitat Preferences:

Minimum Elevation (m): 140
Maximum Elevation (m): 1360
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Grasslands and Hedgerows
Marshes and Sedge Meadows
Northern Hardwood
Oak-Pine Northern Hardwood
Open Peatlands
Outcrops and Alpine
Softwood Swamps
Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change

Unknown Habitat Threats

Description of habitat problem(s): Little is known about the potential problems to this species

Non-Habitat Problems:

Competition

Description of non-habitat problem(s): Competition from microtus (meadow mouse) in sites where habitat has been altered

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	Medium	Determine baseline information
Research	Distribution and Abundance	High	Determine baseline information
Monitoring	Population Change	High	1) Begin low-level monitoring in appropriate habitats to determine distribution, abundance, and population status and trends. 2) Better understand distribution, abundance and changes in population.

Common Name: **Southern Bog Lemming**
Scientific Name: **Synaptomys cooperi**
Species Group: **Mammal**

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Common Name: **Wolf**
Scientific Name: **Canis sp?**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: Medium Priority

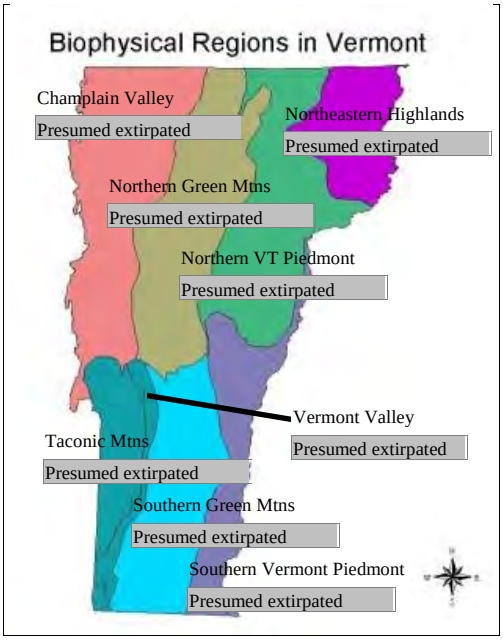
Global Rank: G4 **Global Trend:**
State Rank: SX **State Trend:** Unknown
Extirpated in VT? Yes **Regionally Rare?** Yes

Assessment Narrative:

Believed to be extirpated in Vermont and the rest of New England. Based on bounty records, wolves were historically common in Vermont but were eliminated from the state by the mid to late 1800's as the result of a $20.00 bounty and habitat changes.

The wolf is currently considered extirpated in the Northeast but a regional population exists in Canada with potential for migrants to arrive in Vermont within next 20 years (although the St. Lawrence river and adjacent agricultural/urban/suburban environments may pose a substantial barrier). However, habitat across the taxon's historic range has been reduced in quantity and quality and a majority of the historic populations have been extirpated. Recovery/reintroduction efforts are complicated by taxonomic uncertainty about the wolf or wolves that historically occupied the region, by public attitudes towards wolves, and by the potential interaction with the eastern coyote.

Distribution:



Natural History Elements:

Home Range: > 1000 ha
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Prefers core forest areas with limited human access, road densities of<1mi road per 1square mile of habitat. Prefers areas with <8 people per square kilometer (<3 mi2). Requires adequate amount of prey base (deer, moose, beaver). Estimates by Mladenoff and Sickley (1998) and Harrison and Chapin (1998) suggested that 20,000 mi2 to 25,000 mi2 of habitat remains in northern New England. Of that, Harrison and Chapin (1998)

Common Name: **Wolf**
Scientific Name: **Canis sp?**
Species Group: **Mammal**

suggest that only 950 mi2 is in Vermont. They based their estimates on road densities, human densities, and available forested habitat. Mladenoff and Sickley suggested that 20,000 mi2 of habitat could support 700 to 1439 wolves. Optimum habitat for the wolf depends in large part on the availability of prey (deer, moose, beaver) in predominantly forested areas with low human densities. In areas of high prey densities wolves may consume 1 deer/wolf/18-45 days (Mech 1974 in Tumosa 2003).

Regional corridors and habitat linkages are critical to maintaining wolves in potentially fragmented landscapes. Three key elements to wolf population and viability are large relatively undeveloped blocks of habitat, adequate prey, and freedom from excessive human exploitation (Fritts and Carbyn 1995; Fuller 1997; Haight et al. 1998 in Parson 2003).

undisturbed den sites

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements: > 1000 ha
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☑
Prefers large expanses of forest habitat: ☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Floodplain Forests
Northern Hardwood
Oak-Pine Northern Hardwood
Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Impacts of Roads or Trails

Description of habitat problem(s): Human activity associated with roads, vehicles, and houses seem to negatively influence use of an area by wolves. Conversion of forest habitat to non forest (development and agriculture) also negatively affects wolf densities. Wolves cannot survive without adequate prey, adequate protection, and adequate public support (Theberge et al, 1996 in Tumosa 2003). Connectivity with other wolf packs in the region is important to recovery of wolves in the northeast. Potential core habitat in southern Vermont is fragmented from core habitat in northeastern Vermont.

Non-Habitat Problems:

Competition

Genetics

Loss of Prey Base

Trampling or Direct Impacts

Description of non-habitat problem(s): Competition/hybidization with eastern coyote may impact the

Common Name: **Wolf**
Scientific Name: **Canis sp?**
Species Group: **Mammal**

success of wolf recovery. A better understanding of the ecological role of the eastern coyote is necessary. It could be argued that the eastern coyote is now the dominant, large canid predator in the Northeast. It is not clear how the existing coyote population would respond to the establishment of a wolf population and vise versa. In addition, recovery of wolves in the northeast would not be successful without public support. Any recovery effort would have to be preceeded by a public input porcess that evaluated public attitudes. Mech (1995 in Parsons 2003) suggests that increased human tolerance has led to wolves occupying areas of higher road densities in Minnesota. Inadequate levels of prey would significantly affect wolf densities and survivability.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Distribution and Abundance	Medium	Document and map the distribution of large wild canids
Research	Population Genetics	Medium	Determine the genetics of large wild canids in Vermont
Research	Taxonomy	High	Determine the species of wolf historically found in Vermont

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	Low	Determine public attitudes towards wolf recovery		NWF, Keeping Track, Federation of Sportsmen	USFWS, SWG
Planning & Zoning	Medium	Develop a statewide protocol to guide state and federal wildlife management actions in response to immigration of a wolf or wolves.	Adoption of guidelines by all partners	USFWS, USFS, NWF, VTFSC, Agency of Agriculture, NRCS, Far m Bureau, RPCs, Law Enforcement,	USFWS
Species Restoration		Monitor large canids to determine possible recolonization from Canadian population		NWF, Keeping Track	NWF, USFWS

Common Name: **Wolf**
Scientific Name: **Canis sp?**
Species Group: **Mammal**

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Fuller. 1997

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Common Name: **Common Gray Fox**
Scientific Name: **Urocyon cinereoargenteus**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: Medium Priority

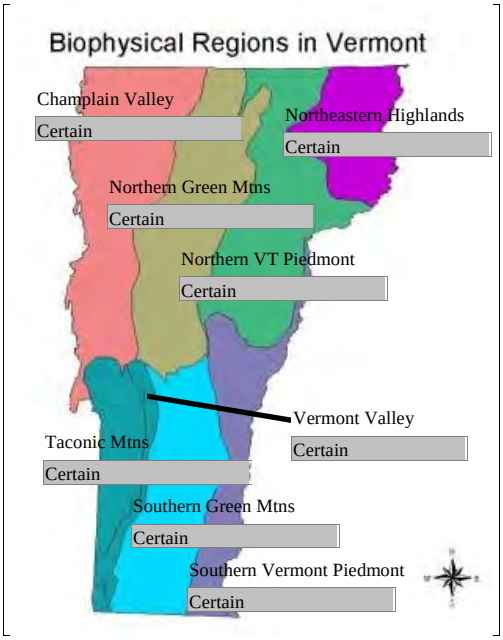
Global Rank: G5 **Global Trend:**
State Rank: S5 **State Trend:** Stable
Extirpated in VT? No **Regionally Rare?** no

Assessment Narrative:

Protected status classified as state furbearer

Information needed on competition from coyotes, red foxes and black bears and impacts from diseases.

Distribution:



Natural History Elements:

Home Range: <1000 ha
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Old field, deciduous forest, young dense stand of forest, most abundant with good interspersion of brushy field, woodlands and farm lands.

Common Name: **Common Gray Fox**
Scientific Name: **Urocyon cinereoargenteus**
Species Group: **Mammal**

General Habitat Preferences:

Minimum Elevation (m):	80
Maximum Elevation (m):	1000
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☑
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Boreal Conifers
Early Succession Boreal Hardwoods
Early Succession Northern Hardwoods
Early Succession Other Types
Early Succession Pine and Hemlock
Early Succession Spruce-Fir
Early Succession Upland Oak
Floodplain Forests
Grasslands and Hedgerows
Hardwood Swamps
Marshes and Sedge Meadows
Northern Hardwood
Oak-Pine Northern Hardwood
Open Peatlands
Seeps and Pools
Shrub Swamps
Softwood Swamps
Spruce Fir Northern Hardwood
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration
Habitat Succession
Unknown Habitat Threats

Description of habitat problem(s):

Non-Habitat Problems:

Competition
Disease
Loss of Prey Base

Description of non-habitat problem(s): Competition and mortality from coyotes, red fox and black bears. Impacts of disease (both rabies and distemper).

Common Name: **Common Gray Fox**
Scientific Name: **Urocyon cinereoargenteus**
Species Group: **Mammal**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Distribution and Abundance	Medium	Develop baseline distribution and abundance.
Research	Threats and Their Significance	Medium	Determine the effects of zoontic diseases (distemper and rabies), Gray foxes are also affected by competion from oyotes and may be excluded from some areas completely by competion (via mortality) from coyotes. Red fox competion may also limit gray fox populations.
Monitoring	Range Shifts	Medium	Determine possible range shifts and population changes due to competition with coyotes and changes in prey base.

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Cypher, B.L. 2003. Foxes, in G. A. Feldhammer, B.C Thompson and J.A Chapman eds. Wild Mammals of North Amercia. Biology, Management and Conservation. pp 511-546

Common Name: **Black Bear**
Scientific Name: **Ursus americanus**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: Medium Priority

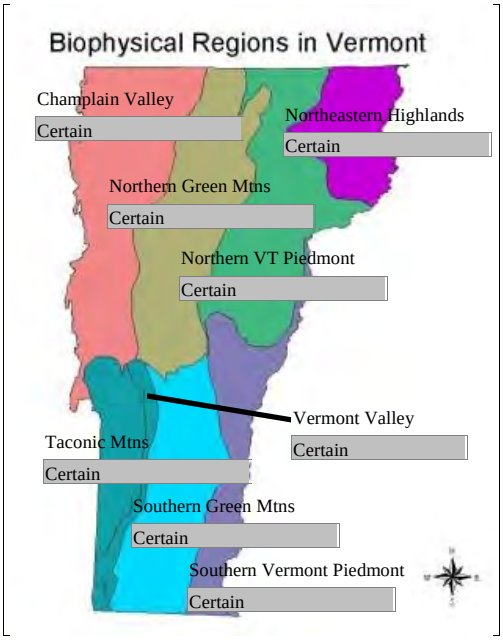
Global Rank: G5 **Global Trend:**
State Rank: S5 **State Trend:** Stable
Extirpated in VT? no **Regionally Rare?** no

Assessment Narrative:

Curently, the black bear population is stable and found through out Vermont. Certain habitat types are critical to the sustainablity of Vermont's black bear population.

Critical habitat (including mast stands, forested wetlands, and travel corridors) could be vulnerable due to habitat loss and conversion from development and fragmentation. Black bear depends on large exapanses of forested blocks with connectivity that could be lost due to development and fragmentation. It is already possible that Vermont has two distinct genetic populations due to fragmentation with the southern population below critical levels.

Distribution:



Natural History Elements:

Home Range: > 1000 ha
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Distribution is statewide. Higher densities are found along the Green Mountains and in the Northeast Highlands and Northern VT Piedmont.

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Eastern deciduous forest, mast producing hardwood forests, (beech, birch maple and oak hickory). Large blocks of forest with large stands of mast producing trees (.e.g. beech, oak and cherry). Uses forested wetlands, released apple orchards. Requires connectivity of habitat.

mast stands, wetlands, rich wet sites

Common Name: **Black Bear**
Scientific Name: **Ursus americanus**
Species Group: **Mammal**

General Habitat Preferences:

Minimum Elevation (m):	60
Maximum Elevation (m):	1300
Patch Size Requirements:	> 1000 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☑
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Boreal Conifers
Early Succession Boreal Hardwoods
Early Succession Northern Hardwoods
Early Succession Other Types
Early Succession Pine and Hemlock
Early Succession Spruce-Fir
Early Succession Upland Oak
Floodplain Forests
Grasslands and Hedgerows
Hardwood Swamps
Lawns, Gardens, and Row Crops
Marshes and Sedge Meadows
Northern Hardwood
Oak-Pine Northern Hardwood
Open Peatlands
Outcrops and Alpine
Seeps and Pools
Shrub Swamps
Softwood Swamps
Spruce Fir Northern Hardwood
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Fragmentation

Impacts of Roads or Trails

Description of habitat problem(s): Food is the most important resource for black bears. Nuts of American beech trees are an important primary fall food source in Northern New England. Nutritional plane of female bears and their reproductive rates would decline substantially if American beech trees diminish significantly in the forests of Vermont. Forest management practices, disease events and weather events may affect stands of mast producing trees.

Description of non-habitat problem(s):

Common Name: **Black Bear**
Scientific Name: **Ursus americanus**
Species Group: **Mammal**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Conduct comprehensive critical habitat inventory including location, and condition of mast stands and monitor changes through time. Develop a universal wildlife habitat management unit meaningful for basic life history requirements of black bears.
Research	Threats and Their Significance	Medium	Examine impacts and avoidance of commercial industrial wind energy generation in high elevation areas, and effects to denning behavior and sounds associated with operations of these industrial facilities.
Monitoring	Habitat Change	High	Examine long term effects of ice storm damage to high elevation beech stands, examine tree disease impacts on health and vigor of mast producing beech and oak stands. Examine trends in beech and oak stand health and distrbituion.
Monitoring	Monitor Threats	High	Examine highway development and improvements related to bear genetics statewide.
Monitoring	Other Monitoring Needs	Medium	Monitor other elements as identified in the statewide management plan for this species (e.g. sale of black bear parts, specific harvest parameters, monitor trends in large forest block patterns and connectivity).

Common Name: **Black Bear**
Scientific Name: **Ursus americanus**
Species Group: **Mammal**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Policy & Regulations	High	Maintain viable bear population through regulating harvest and managing bear habitat.			
Technical Assistance, Training, Learning Networks	Medium	Collaborate with Agency of Transportation regarding highway placement and passage of wildlife.			
Technical Assistance, Training, Learning Networks	High	Develop information for private land owners for managing critical habitat.			
Technical Assistance, Training, Learning Networks	Medium	Provide information to towns and regional planning commissions regarding habitat requirements.		Agency of Transportation	Federal Aid in Wildlife Restoration, Federal Highway Monies, State Wildlife Grants.
Compatible Resource Use	High	Conserve contiguous blocks of remote interior habitat and the linkages between them.			
Standards	High	Manage critical habitats on publicly owned land.			

Common Name: **Black Bear**
Scientific Name: **Ursus americanus**
Species Group: **Mammal**

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Common Name: **American Marten**
Scientific Name: **Martes americana**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: High Priority

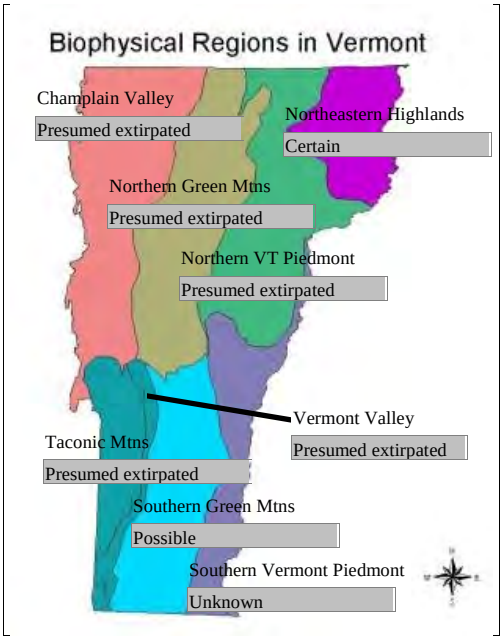
Global Rank: G5 **Global Trend:**
State Rank: S1? **State Trend:** Unknown
Extirpated in VT? Unknown **Regionally Rare?** no

Assessment Narrative:

The marten is presently listed as endangered in Vermont. Prior to European settlement, the species ranged from the Canadian border to Massachusetts and according to Thompson (1853) was very plentiful throughout most of the state. Marten populations declined in the late 1800's due to widespread habitat conversion and over harvest. Records since the turn of the century are scarce (DiStefano et al. 1990). The most recent documentation is from Hogback Mountain, Windham County in 1954. (Trombulak and Royar, 2000). A reintroduction effort was initiated by the U.S. Forest Service and the Vermont Fish and Wildlife Department in 1989, 1990, and 1991 in the southern portion of the Green Mountain National Forest (Wallingford, Stratton). One hundred and fifteen marten were released into Vermont, 11 from New York and 104 from Maine (K.Royar, pers com). The reintroduction effort appears to have been unsuccessful. Recently, animals and sign have been documented in the Northeast Kingdom (W.Staats, pers com).

Marten are presently extirpated or exist at very low levels in Vermont. They require deep fluffy snow and broad expanses of mature coniferous forest. They are likely to be impacted by global warming. Competition from fisher may also influence distribution.

Distribution:



Natural History Elements:

Home Range: > 1000 ha
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Common Name: **American Marten**
Scientific Name: **Martes americana**
Species Group: **Mammal**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Marten require large, unfragmented forests with sufficient dead and down wood to support rodent populations as a prey base and to allow marten to hunt below snow level (Bissonette et al., 1997). For every 9 square km of marten habitat, no more than 25% of the forest should be open. Deep fluffy snow is needed to out compete fisher. According to Chapin et al (1996), marten require late successional forests and select habitat at a landscape level scale. In addition, researchers documented that "forest fragmentation influenced spatial use of habitat by marten in an extensively clearcut industrial forest landscape" (Chapin et al., 1996) In managed landscapes efforts need to be made to maintain large blocks of intact late successional forest habitat. In this same study, female marten tolerated 20% of their home range in regenerating forest.

General Habitat Preferences:

Minimum Elevation (m):	300
Maximum Elevation (m):	1400
Patch Size Requirements:	> 1000 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Northern Hardwood

Softwood Swamps

Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change

Conversion of Habitat

Habitat Fragmentation

Description of habitat problem(s): Conversion of habitat and fragmentation could be a problem to marten. Optimum habitat must be at least 75% late successional forest. Some current silvicultural practices could reduce appropriate vertical and horizontal structure necessary for marten survival.

Climate changes that result in a warming trend could also reduce the potential for marten survival in Vermont. Warmer winters that result in less snow may promote fisher populations in areas that historically were limited to marten due to deep snow.

Non-Habitat Problems:

Competition

Predation or Herbivory

Description of non-habitat problem(s): It has been speculated that higher fisher densities may limit marten populations (Krohn,1995). Fisher pelt prices and corresponding trapper effort dropped drastically in the late

Common Name: **American Marten**
Scientific Name: **Martes americana**
Species Group: **Mammal**

1980's. Since then the fisher population has increased and expanded its range. Competition with, and predation by, fisher could negatively influence marten success in Vermont.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Perform a habitat suitability analysis that includies an assessment of snow characteristics, in the Northeast highlands. Determine if suitable habitat and conditions are available for reintroduction.
Research	Threats and Their Significance	High	Determine how fisher distribution affects the viability of marten populations and how snow depths affect this relationship?
Monitoring	Population Change	High	Develop and implement a monitoring plan to monitor the population to determine population trends.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Species Restoration	Medium	Investigate the possiblity of a marten reintroduction effort in the Northeast Kingdom	an assessment of the potential for success	Industrial Forest Landowners, VTA, VLT, TNC, UVM	VTA, SWG, UVM
Policy & Regulations	Medium	Support and cooperate with larger efforts to curb global climate change.			
Compatible Resource Use	High	Maintain unfragmented forest habitat.	Change in the number of large forest unfragmented blocks within the range of the marten.		

Bibliography:

Bissonette, J.A. , D.J. Harrison, , C.D. Hargis, T.G. Chapin. 1997. The influence of spatial scale and scale-sensitive properties on habitat selection by American marten. In wildlife and Lanscape Ecology, ed. J.A. Bisonette. New York, NY: Springer.

Krohn, W. B., K. D. Elowe, and R. B. Boone. 1995. Relations between fishers, snowfall, and martens. Forestry Chronical, 71:97-105.

Novak M., J.A. Baker, M.E. Obbard, and B. Malloch, eds. Wild furbearer management and conservation in North America. Ontario Trappers Assoc., North Bay.

Thompson, Zadock. 1853. Natural History of Vermont. Charles E. Tuttle. Rutland, Vermont. 286 pp.

Trombulak, S.C. and K. Royar. 2000. "Restoring the Wild: Species Recovery and Reintroduction," in Wilderness Comes Home: Rewildling the Northeast, edited by Christopher McGrory Klyza, Hanover, N.H. University Press of New England.

DiStefano, J.J., K. Royar, D. Pence, J.E. Denoncour. 1990. Marten Recovery Plan for Vermont. 19pp.

Chapin, T.G., D.J. Harrison, D.D. Katnik. 1996. Influence of Landscape Pattern, Forest Type, and Forest Structure on Use of Habitat by Marten in Maine. 78pp.

Common Name: **Long-tailed Weasel**
Scientific Name: **Mustela frenata**
Species Group: **Mammal**

Conservation Assessment:

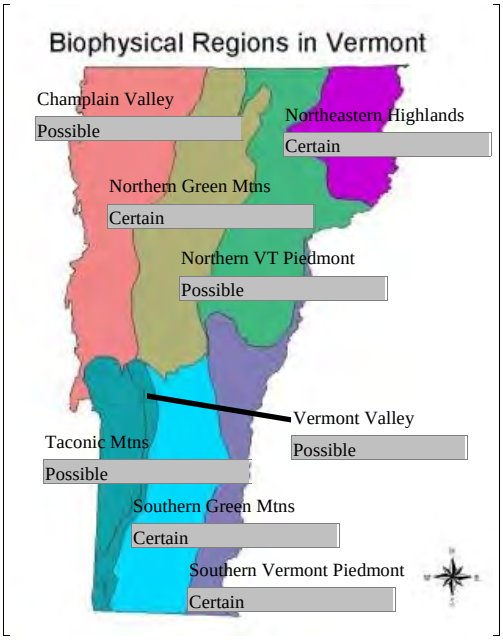
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S3S4 **State Trend:** unknown
Extirpated in VT? no **Regionally Rare?** no

Assessment Narrative:

Assumed to be common in Vermont but status is not monitored and little is known about abundance and distribution.

Distribution:



Natural History Elements:

Home Range: < 100 ha
Migrant? No

Within watershed ☐
Within biophysical region ☐
Within VT ☐
Within Region ☐
Within US ☐
Outside US ☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

The long-tailed weasel inhabits the broadest range of any of the weasels from low elevations to above treeline across the continent (Novak et al, 1987). They occupy a variety of habitats from forest and shrubs adjacent to stone walls to fields, wetlands and standing water. Where it overlaps with the short-tailed weasel, it may occupy more open habitats while the short-tailed weasel is more common in forested or wetland areas. Areas with high prey density are important. The long-tailed weasel feeds on small mammals such as mice, rabbits, voles and ground nesting birds. Water seems to be a critical factor. Hamilton (1933) reported that they can drink 25cc of water per day and therefore, it may be restricted to habitats in close proximity to standing water. The long-tailed weasel is more of a food generalist than the short-tailed weasel. On the average, long-tailed weasels will take 1.5 voles per day (Powell 1973 in Wild Furbearer Mgt 1987). The weasel uses excavated burrows or holes and/or crevices for den sites (DeGraff and Yamasaki, 2001).

Common Name: **Long-tailed Weasel**
Scientific Name: **Mustela frenata**
Species Group: **Mammal**

General Habitat Preferences:

Minimum Elevation (m): 0
Maximum Elevation (m): 0
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Man-Made Water Bodies
Early Succession Boreal Hardwoods
Early Succession Northern Hardwoods
Early Succession Upland Oak
Grasslands and Hedgerows
Marshes and Sedge Meadows
Northern Hardwood
Oak-Pine Northern Hardwood
Spruce Fir Northern Hardwood
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Succession

Description of habitat problem(s): problems are not well understood but conversion of habitat/habitat succession/habitat degradation could negatively affect weasel populations.

Non-Habitat Problems:

Predation or Herbivory

Description of non-habitat problem(s): Predation: cats and dogs, foxes, raptors and rattlesnakes Proximnity to humans: Increased predator control and potential for road kill may be a problem. Weasels could be affected directly and indirectly by pesticide use (effects on reproduction, habitat, and/or food supply).

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Distribution and Abundance	High	Determine abundance, distribution, and status of the Vermont population.

Common Name: **Long-tailed Weasel**
Scientific Name: **Mustela frenata**
Species Group: **Mammal**

Bibliography:

DeGraff, R.M.,and Yamasaki, M. 2001. New England Wildlife: Habitat, Natural History, and Distribution, Universithy Press of New England, Hanover and London.

Hamilton, W.J., Jr. 1933. The weasels of New York: their natural history and economic status, American Midland Naturalist, 14:289-344.

Novak, M., J.A. Baker, M.E. Obbard, and B.Malloch. Wildl Furbearer Management and Conservation in North America. Ontario Trappers Association. 1150pp.

Sheffield, S.R., and H.H. Thomas. 1997. Mustela frenata. Mammalian species, 570: 1-9

Simm, D.A. 1979. North American weasels: resource utilization and distribution. Canadian Journal of Zoology, 57:504-520.

Whitacker, J.O. and W.J. Hamilton, Jr. 1998. Mammals of the Eastern United States. Comstock Publishing, Ithaca, N.Y.

Common Name: **Mink**
Scientific Name: **Mustela vison**
Species Group: **Mammal**

Conservation Assessment:

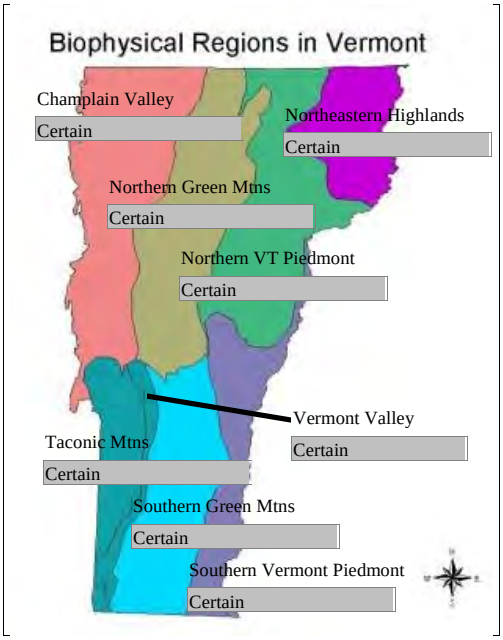
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S5 **State Trend:** Unknown
Extirpated in VT? no **Regionally Rare?** no

Assessment Narrative:

This status of this species is unknown. Concerns exists about pollution risk from PCBs, heavy metals and mercury which may influence reproduction and survival. A decrease in muskrat may influence prey availability. Distribution is found in all watersheds throughout the state.

Distribution:



Natural History Elements:

Home Range: linear-riparian
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☑ General Literature ☑

Requires a dependable source of food. Den sites include muskrat bank burrows, beaver dens, within 30 meters of water. Mink are adaptable to many different wetland habitats including beaver created wetlands, lakes, streams and ponds. Intact vegetation along the perimeter of streams, lakes and wetlands is an important habitat feature of otter habitat. Beaver bank dens and lodges are also used by mink. Beaver created wetlands provide critical foraging and denning habitat. Logjams resulting from fallen trees also provide shelter and foraging habitat. Mink also require clean water and an adequate prey base.

Common Name: **Mink**
Scientific Name: **Mustela vison**
Species Group: **Mammal**

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	Unknown
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Lacustrine
Aquatic: Lake Champlain
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Lower CT River
Floodplain Forests
Hardwood Swamps
Marshes and Sedge Meadows
Open Peatlands
Seeps and Pools
Shrub Swamps
Softwood Swamps
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Description of habitat problem(s): Habitat degradation: elimination/ degradation of riparian habitat
Conversion of habitat: shoreline development

Non-Habitat Problems:

Loss of Prey Base

Pollution

Description of non-habitat problem(s): Pollution: mercury and PCBs may be a problem. Mink is a bioindicator of pollution in aquatic systems.
Loss of prey base: suspected decline of muskrat and loss of additional prey species due to pollution may be a problem.

Common Name: **Mink**
Scientific Name: **Mustela vison**
Species Group: **Mammal**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Basic Life History	High	Determine if contaminent levels are affecting reproduction or mortality on mink. Determine population density estimates for this species.
Research	Threats and Their Significance	High	Determine baseline heavy metal and PCB elements in Mink in all Watersheds in Vermont.
Monitoring	Population Change	Medium	Monitor changes in population densitiies or mortality agents through time.

Bibliography:

Henny, C. J.,L.J.Blus, S.V. Gregory and C.J. Stfford. 1981. PCB's and organochlorine pesticides in wild mink and river otters from Oregon. Pages 1763-1780 in J.A.Chapman and D. Pursley, eds. Proc. Worldwide Furbearer Con., Frostburg, Md.

Loriviere, S. 1999. Mustela vison. Mammalian species, 608: 1-9.

Stevens, R.T., T. L Ashwood and J.M. Sleeman. 1997. Mercury in hair of muskrats (Ondatra zibethicus) and mink (Mustela vison) from the U.S. Department of Energy, Oak Ridge Reservation. Bulletin of Enviromental Contamination and Toxicology, 58:720-728.

Wobeser, G. N.O. Nielsen, and B. Schiefer. 1976. Mercury and mink. II. Experimental methyl mercury intoxication. Can. J. Comp. Med.40:34-45.

Wobeser, G. and M. Swift. 1976. Mercury poisoning in wild mink. J. Wildl. Dis. 12:335-340.

Wren, C.D., P.M. Stokes, and K.L. Fisher. 1986 Mercury levels in Ontario mink and otter relative to food levels and environmental acidification. Can. J. Zool. 64:2854-2859.

Common Name: **Northern River Otter**
Scientific Name: **Lutra canadensis**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: Medium Priority

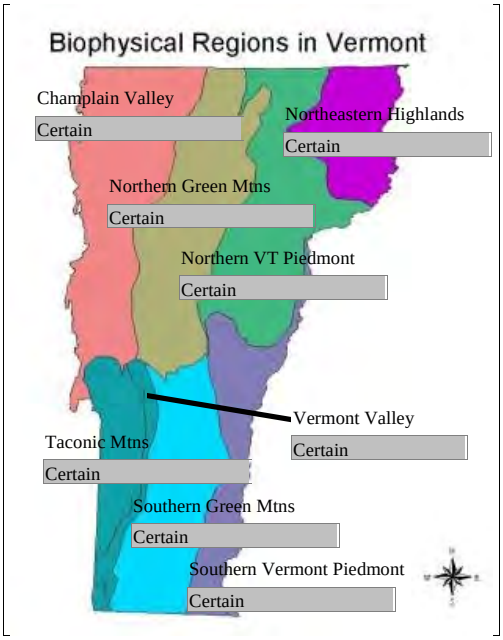
Global Rank: G5 **Global Trend:**
State Rank: S5 **State Trend:** stable
Extirpated in VT? no **Regionally Rare?** no

Assessment Narrative:

The otter population in Vermont is stable and distributed throughout the state

The river otters "pisciviorous diet and high trophic position make it a noteworthy indicator of pollution in aquatic systems" (Melquist and Dronkert 1987). Prey may also be succeptible to pollution and acid rain. Of 20 otter tested in 2001 for mercury in Vermont, two had levels higher than that recommended by the EPA (K.Royar, pers. com).

Distribution:



Natural History Elements:

Home Range: linear-riparian
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Otter are harvested in every watershed in Vermont.

Known Watersheds

CT-Ashuelot River

CT-Bellows Falls Dam to Vernon Dam

CT-Johns River to Waits River

CT-Waits River to White River

CT-White River to Bellows Falls

Deerfield. MA-VT

Hudson-Hoosic Rivers

Lake Champlain Canal

Common Name: **Northern River Otter**
Scientific Name: **Lutra canadensis**
Species Group: **Mammal**

Lake Champlain Direct

Lamoille River

Mississquoi River

Otter Creek

Passumpsic Vermont

Saint-Francois River

Upper Connecticut

White River

Winooski River

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Otter are adaptable to many different wetland habitats including beaver created wetlands, lakes, streams and ponds. Intact vegetation along the perimeter of streams, lakes and wetlands is an important habitat feature of otter habitat. Beaver bank dens and lodges are also used by otter. Beaver created wetlands provide critical foraging and denning habitat. Log jams resulting from fallen trees also provide shelter and foraging habitat. Otter also require healthy aquatic systems that provide an adequate prey base.

General Habitat Preferences:

Minimum Elevation (m):	80
Maximum Elevation (m):	1000
Patch Size Requirements:	
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial

Aquatic: Lake Champlain

Aquatic: Large Lake Champlain Tribs Below Falls

Aquatic: Lower CT River

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Description of habitat problem(s): Forested riparian buffers are key components of otter habitat. Loss and/or degradation could influence otter habitat selection and productivity. Historically, otter were limited by human encroachment, habitat destruction, and unregulated harvest. In Vermont, the extirpation of beaver, loss of habitat, and pollution resulted in a much reduced population throughout the 1800's and early 1900's. Otter populations have rebounded with the return of the beaver but increasing development pressure

Common Name: **Northern River Otter**
Scientific Name: **Lutra canadensis**
Species Group: **Mammal**

and pollutants such as mercury could negatively affect future population levels.

Non-Habitat Problems:

Loss of Prey Base

Pollution

Description of non-habitat problem(s): Contaminants such as PCB's, mercury, and other heavy metals can buildup in the tissue of otter and negatively affect reprduction and survival.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Distribution and Abundance	Medium	Monitor distribution and abundance
Research	Threats and Their Significance	High	Determine the impact of heavy metals and contaminants on otter populations in each watershed.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Species Restoration		Provide a suitable prey base.		Trout unlimited, DEC	TU, DEC, USFWS, SWG, LIP
Privately-Owned Protected Areas		Maintain riparian buffer strips along streams, rivers, lakes, ponds, and wetland habitats.	Number of linear miles of vegetated riparian buffers	Trout Unlimited, NRCS, USFWS, NWTF, DEC, Vt. F&P	SWG, LIP, USFWS
Policy & Regulations		Eliminate acid rain and the input of mercury into otter habitat.	Decrease acid, mercury, and heavy metal deposition into Vermont lakes, rivers, and streams	DEC, EPA,	DEC, EPA
Compliance & Enforcement		Enforce the Clean Water Act	Increase the number of bodies of water that meet class A designation	Trout Unlimited, NRCS, USFWS, USFS, Wild Turkey Federation, DEC, Vt. Forests & Parks	WHIP, LIP, SWG, EPA, NWTF

Common Name: **Northern River Otter**
Scientific Name: **Lutra canadensis**
Species Group: **Mammal**

Bibliography:

Lariviere S, Walton LR (1998) Lontra canadensis. Mammalian Species, 587, 1 -8.

Melquist, W.E. and A.E. Dronkert.1987. River Otter. In M. Novak, J.A. Baker, M.E. Obbard, and B. Malloch, eds. Wild furbearer management and Conservation in North America. Ontario Trappers Assoc., North Bay.

Parsons, D.R. 2003. Natural History Characteristics of Focal Species in the New Nexico Highlands Wildlands Network. Wildlands Project. 69 pp.

Common Name: **Lynx**
Scientific Name: **Lynx canadensis**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: High Priority

Global Rank: G5 **Global Trend:**
State Rank: SNA **State Trend:** Na
Extirpated in VT? yes **Regionally Rare?** no

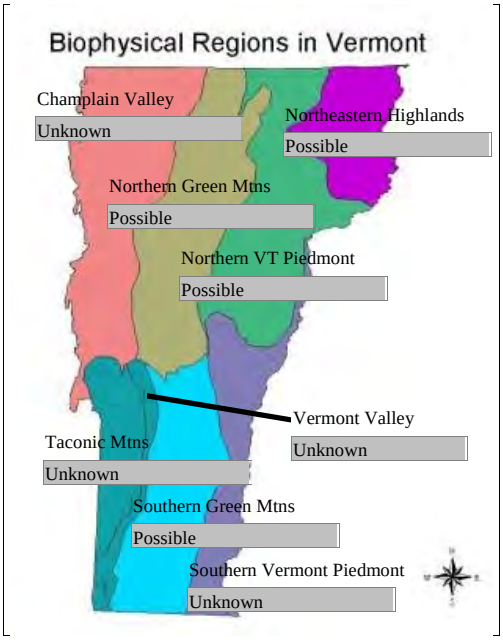
Assessment Narrative:

Presently listed as endangered in Vermont. Regionally, the only known viable population exists in northern Maine. Lynx are believed to be extirpated from New Hampshire, Vermont, and New York.. Vermont is at the southern edge of lynx range. Only 5 historical records exist in Vermont: a museum specimen in Royalton, Vermont; an animal killed in Windham, Vermont in1928 (Osgood, 1938); an animal taken in Ripton, Vermont in 1937 (Hamilton and Whittaker, 1979); and a lynx trapped in St. Albans, Vermont in 1968 (J. Hall, pers. Com.). In the late 1700's a bounty was paid on a lynx taken in Calais, Vermont (Vermont State Archives). There was a credible sighting in the Northeast Highlands (Yellow Bogs) in 2003 (K. Royar, pers.com).

Recovery of lynx is limited by global climate change and potential for hybridization with bobcats.The influence of competition from coyote, fisher, and bocat, which could potentially be exacerbated by global climate change, is not clearly understood (Ray et.al. 2002). In addition, maintaining connectivity between Vermont habitats and habitats in Canada, New Hampshire, and Maine is critical for the recovery of a resident population in Vermont.

At least 70 kittens have been produced by the northern Maine population in the last eight years. The areas to which they disperse is unclear.

Distribution:



Natural History Elements:

Home Range: > 1000 ha
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Killed in Windham 1928
Killed in St Albans 1968
Killed in Calais 1797
Sighting in Yellow Bogs 2003
Addision County 1937

Common Name: **Lynx**
Scientific Name: **Lynx canadensis**
Species Group: **Mammal**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Lynx are generally found in softwood and/or mixed forests in regions with deep snow. They prefer complexes of regenerating forest where snowshoe hare are likely to be abundant (Hoving 2001) such as areas of dense softwood in association with openings of 2-4 hectares (Novak 1987). Fuller (1999) and Homyack found that hare densities in Maine responded to habitat change in a logarithmic rather than a linear fashion: 12-15 year old regenerating clear-cuts had 280 times higher hare densities than early regenerating partially harvested stands (1.6/ha vs..01/ha); mature mixed forest stands had about seven times higher snowshoe hare densities than those that were partially harvested (Ray et.al. 2002). Critical habitat needs include snow depths greater than 268cm or 2.6 meters. Lynx are associated with areas with less than 27% deciduous forest (Hoving, 2001). Preliminary analysis suggests lynx denning requirements include volumes of downed woody debris equivalent to what has been found in 100 year old stands. In a Maine study equivalent attributes were found in 15 year old stands probably due to a spruce budworm outbreak in the 1970's. In addition, stem density was high and horizontal cover thick (Ray et.al. 2002).

General Habitat Preferences:

Minimum Elevation (m):	0
Maximum Elevation (m):	0
Patch Size Requirements:	> 1000 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☑
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Boreal Conifers

Early Succession Spruce-Fir

Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change

Habitat Fragmentation

Habitat Succession

Impacts of Roads or Trails

Description of habitat problem(s): Lynx could be limited by road densities, prey densities, climate factors (<268 cm snow) and lack of softwood (Hoving 2001). Past land use practices and poorly planned turn-of-the-century (19th) logging have resulted in a 75% loss of spruce-fir habitat on the Green Mountain National Forest (Ruediger et al, 2000). In addition, fragmentation of habitat corridors between Canada, New Hampshire, and Maine may limit lynx dispersal to Vermont.
Hoving (2001) suggests that snow depth can determine the distribution of lynx vs. bobcat. Climate change could influence future weather patterns/snowfall and therefore affect future distribution of lynx in the northeast.

Common Name: **Lynx**
Scientific Name: **Lynx canadensis**
Species Group: **Mammal**

Non-Habitat Problems:

Competition

Description of non-habitat problem(s): Competition from bobcat (Novak et al 1987), coyote, and fisher (Ray et.al. 2002) as well as, genetic isolation and hybridization with bobcats may limit recovery of lynx in Vermont.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Distribution and Abundance	Medium	Collect baseline data on lynx distribution and abundance
Research	Threats and Their Significance	High	Determine the relationship between lynx distribuition and abundance vs. habitat and prey base. Assess the dynamics betweeen habitat enhancement and the potential for an increase in competing species.
Monitoring	Population Change	Low	Conduct low level monitoring of occurrence.
Monitoring	Range Shifts	Low	If Lynx are found, monitor range expansion.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Species Restoration		Provide a suitable prey base of X hare/hectare.	# of acres of snowshoe hare habitat available within potential lynx range	Vt. Forest and Parks Dept, Industrial forest landowners, Coverts	WHIP, LIP, SWG, USFWS
Compatible Resource Use		Maintain connectivity of habitat between Maine, New Hampshire and Vermont.	# of acres of corridor habitat conserved	TNC, VLT, NHF&G, Conservation Fund, NWF, Keeping Track, Coverts	TNC, VLT, Conservation Fund, USFWS, Forest Legacy

Common Name: **Lynx**
Scientific Name: **Lynx canadensis**
Species Group: **Mammal**

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Common Name: **Bobcat**
Scientific Name: **Lynx rufus**
Species Group: **Mammal**

Conservation Assessment:

Final Assessment: Medium Priority

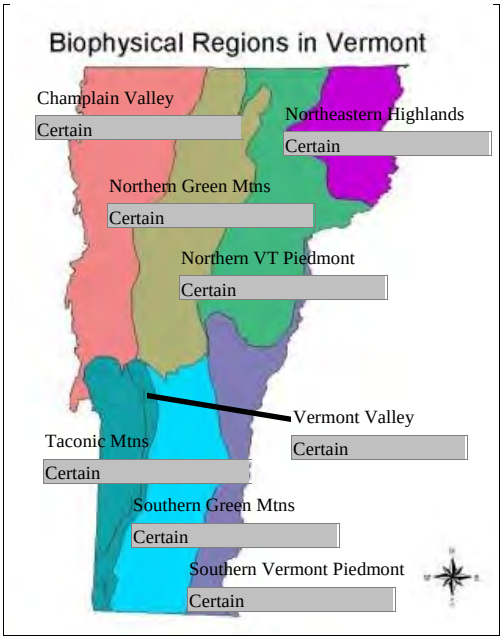
Global Rank: G5 **Global Trend:**
State Rank: S4 **State Trend:** Unknown
Extirpated in VT? no **Regionally Rare?** no

Assessment Narrative:

Apparently common and well distributed throughout Vermont although higher densities appear to exist in the Champlain Valley and the Taconics possibly due to higher prey densities and lower fisher densities. Population has declined since the middle of the 20th century due to land use changes that affect prey densities as well as competition from fisher and coyotes.

Critical habitat needs are unknown in Vermont. It is believed that bobcats depend on connected expanses of undeveloped habitat. The dynamics between bobcat, coyotes, fisher and landscape change are not clearly understood. Bobcats were bountied until 1971. Between 1955 and 1970 an average of 265 bobcats were taken per year as a result of the bounty (K.Royar, pers.com). It is believed that bobcat populations have declined since then primarily as a result of competition from coyotes and fisher and a decline in prey species as a result of habitat changes.

Distribution:



Natural History Elements:

Home Range: > 1000 ha
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Bobcats use a variety of habitat types including mixed woodlands, wetlands, agricultural/forest edges, and areas of dense undergrowth supporting high densities of prey species such as snowshoe hare, rabbits, and other small mammals and birds. Deer wintering areas may be important in winter for cover and as a source of prey (deer). Bobcats seem to be most successful in large tracts of undeveloped lands connected by vegetated

Common Name: **Bobcat**
Scientific Name: **Lynx rufus**
Species Group: **Mammal**

linkages. In Vermont, steep, rocky cliffs may be important as winter refugia and breeding habitat.

General Habitat Preferences:

Minimum Elevation (m):	80
Maximum Elevation (m):	1200
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Habitat Succession

Description of habitat problem(s): It is believed that bobcats in Vermont may require rocky ledges as winter and denning habitat. Direct loss of these areas, as well as, habitat fragmentation and conversion (to development) in habitats adjacent to these ledges, could affect bobcat survival. Disturbance from humans may influence habitat selection (McCord, 1974). Prey availability also affects bobcat distribution and survival.

Non-Habitat Problems:

Competition

Loss of Prey Base

Description of non-habitat problem(s): Bobcat numbers have declined since coyotes have become established in Vermont. Prey species have declined in some areas due to loss of early successional habitat.

Common Name: **Bobcat**
Scientific Name: **Lynx rufus**
Species Group: **Mammal**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Develop an understanding of bobcat habitat use and the influence of roadways on bobcat movement and survival Determine habitat use and relationships to roadways and ledge areas. Develop optimum/critical habitat needs including importance of ledge habitat, early sucessional habitats, and corridors.
Research	Distribution and Abundance	High	Determine the location of source and sink populations and identify the habitat parameters associcated with these populations.
Research	Threats and Their Significance	Medium	Determine effects of competition with coyotes.
Monitoring	Range Shifts	Medium	Assess possible range shifts and population changes due to competition with coyotes and changes in prey base.

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use		Identify important road crossings and provide for safer crossings and maintenance of connectivity between large blocks of habitat.	Number of crossings protected or conserved	Lewis Creek Association, Agency of Transportation, Town Road Crew, VLT, Conservation Commissions, Keeping Track	SWG, LIP, AOT
Species Restoration		Provide important prey base	Number of acres of rabbit and hare habitat and number of deer wintering areas protected	Coverts, USFS, Woodland Owners Association, Northern Woodland Magazine, USFS, Vt. Forest and Parks Dept, Ruffed Grouse Society	USFWS, Ruffed Grouse Society, WHIP
Species Restoration	Medium	Identify critical habitats and develop actions for protection	Number of critical habitats mapped and protected	Coverts, USFS, Woodland Owners Association, Northern Woodlands Magazine, VLT, UVM	UVM, VLT, USFS, USFWS

Common Name: **Bobcat**
Scientific Name: **Lynx rufus**
Species Group: **Mammal**

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Common Name: **Mountain Lion**
Scientific Name: **Felis concolor**
Species Group: **Mammal**

Conservation Assessment:

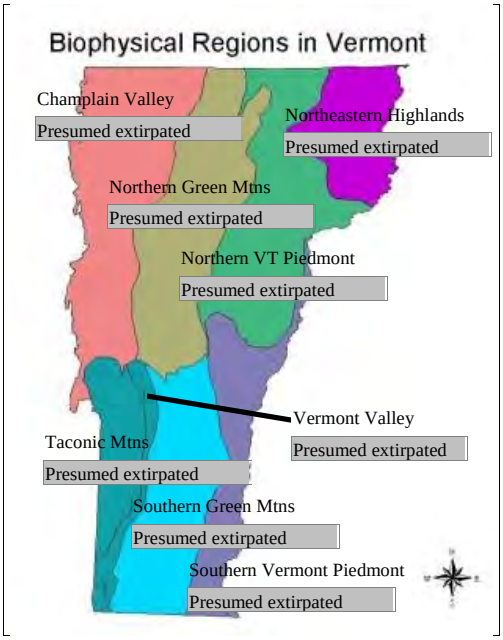
Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: SH **State Trend:** Na
Extirpated in VT? yes **Regionally Rare?** no

Assessment Narrative:

Believed to be extirpated in the East (except in southern Florida). Listed as endangered in Vermont. Anecdotal reports of field sightings are fairly frequent; however definitive, tangible evidence of the animal's presence in Vermont and the northeast is notably lacking.

Distribution:



Natural History Elements:

Home Range: <1000 ha
Migrant? No

Within watershed ☐
Within biophysical region ☐
Within VT ☐
Within Region ☐
Within US ☐
Outside US ☐

Distribution Summary:

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Cougars require remote, undisturbed, and un-fragmented habitat on a large scale and an adequate prey base to survive. Beier (1993), using simulated population dynamics, estimated that an area of 1,000 to 2,200 square kilometers (372 to 818 square miles, depending on the demographics of a particular population) was needed for a population of 15-20 adult cougars to have a very low risk (<98%) of extinction within 100 years. Smaller areas might suffice where adequated dispersal corridors allow movement among populations. Cougars typically avoid open areas and areas of human population (Kitchell 1999), often following watercourses in open areas to remain concealed by bank-side vegetation (Russell 1978). Specific dispersal barriers include roads and nighttime illumination (Beier 1993, 1995). Cougars are limited to areas with ungulate-size prey. Deer/ Elk wintering habitat is seasonally favored. (Lindzey 1987).

Common Name: **Mountain Lion**
Scientific Name: **Felis concolor**
Species Group: **Mammal**

General Habitat Preferences:

Minimum Elevation (m):	80
Maximum Elevation (m):	9250
Patch Size Requirements:	> 1000 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Cliffs and Talus

Northern Hardwood

Spruce Fir Northern Hardwood

Current Problems: (see Appendix C for definitions of problem categories)

Habitat Problems:

Conversion of Habitat

Habitat Fragmentation

Impacts of Roads or Trails

Description of habitat problem(s): Where they still exist, mountain lions presumably require access to large expanses of remote, rugged, forested terrain. Human development/disturbance and prey availability affects mountain lion distribution and survival.

Non-Habitat Problems:

Loss of Prey Base

Trampling or Direct Impacts

Description of non-habitat problem(s): Negative human attitudes towards mountain lions in regards to human safety and perceived impacts on deer populations limits successful establishment/ maintenance of lion populations in the East.

Research and Monitoring Needs

Type	Need	Priority	Description
Monitoring	Population Change	Medium	Continue current practice of low-level monitoring and documentation/mapping of mountain lion sightings. Consider active bait station monitoring to detect/confirm lion presence in Vermont. Attempt to collect material for genetic testing.

Common Name: **Mountain Lion**
Scientific Name: **Felis concolor**
Species Group: **Mammal**

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Vermont's Wildlife Action Plan

November 22, 2005

Appendix A5 Reptile & Amphibian Species of Greatest Conservation Need

Index to Reptile & Amphibian Species of Greatest Conservation Need

Vermont Department of Fish and Wildlife
Comprehensive Wildlife Conservation Strategy
Species Assessment Report

Common Name: **Jefferson Salamander**
Scientific Name: **Ambystoma jeffersonianum**
Species Group: **Herp**

Conservation Assessment:

Final Assessment: High Priority

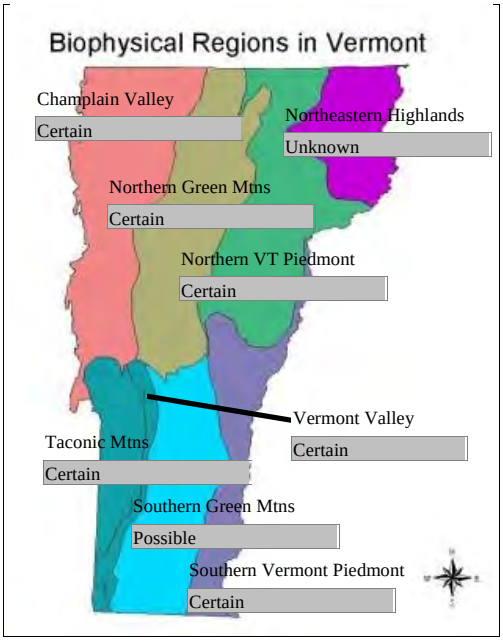
Global Rank: G4 **Global Trend:**
State Rank: S2 **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

Jefferson Salamander is rare in Vermont (S2, SC), and is considered a species of conservation concern within the region due to evidence of population declines, and the fact that a high proportion of the global population occurs within the Northeast (Terres 1999).

Jefferson Salander breeding habitat is limited almost exclusively to temporary woodland pools surrounded by relatively large stands of mature hardwoods. There is evidence that the species may be sensitive to forest fragmentation, and in southern New England some populations appear to have been outcompeted by its congener, the Blue-spotted Salamander (Klemens, personal communication). In addition, unisexual female hybrid populations exist that introduce uncertainties about the species' taxonomy, population biology, persistence, and long-term viability.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? No

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The distribution of this rare woodland species is widespread but scattered in Vermont.

Known Watersheds

CT-Bellows Falls Dam to Vernon Dam
CT-Waits River to White River
CT-White River to Bellows Falls
Hudson-Hoosic Rivers
Otter Creek
White River

Possible Watersheds

CT-Ashuelot River
CT-Johns River to Waits River
Deerfield. MA-VT
Passumpsic Vermont
Upper Connecticut

Common Name: **Jefferson Salamander**
Scientific Name: **Ambystoma jeffersonianum**
Species Group: **Herp**

Winooski River

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Requires well-shaded, relatively mature hardwood/hemlock forest stands with abundant course woody debris, leaf litter, and underground refugia (small mammal tunnels, rock crevices, etc) surrounding temporary woodland (vernal) pools (Faccio 2003). May also use semi-permanent pools. Most commonly found in ridgetop, mid-elevation Northern Hardwood forests in the foothills of the Green Mountains.

General Habitat Preferences:

Minimum Elevation (m):	40
Maximum Elevation (m):	750
Patch Size Requirements:	> 10 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Man-Made Water Bodies

Northern Hardwood

Oak-Pine Northern Hardwood

Seeps and Pools

Spruce Fir Northern Hardwood

Current Problems: (see Appendix C for definitions of problem categories)

Habitat Problems:

Climate Change

Habitat Alteration

Habitat Fragmentation

Impacts of Roads or Trails

Sedimentation

Description of habitat problem(s): Any habitat conversion, alteration, or fragmentation that disrupts species' ability to move between breeding and terrestrial sites, changes water/soil chemistry, temperature, pool hydroperiod, humidity, etc, may have negative effects. Road mortality can have major impacts on migrating adults and dispersing juveniles, especially when located between terrestrial and breeding habitats. Climate change that affects hydroperiod and/or water temperature of breeding pools could have significant impacts on productivity (Rowe and Dunson 1995).

Non-Habitat Problems:

Competition

Genetics

Pollution

Common Name: **Jefferson Salamander**
Scientific Name: **Ambystoma jeffersonianum**
Species Group: **Herp**

Trampling or Direct Impacts

Description of non-habitat problem(s): Unisexual, female hybrid populations reproduce via gynogenesis (requires sperm from diploid males which is not incorporated into the genome of embryos; Petranka 1998), resulting in female-biased sex ratios. Since hybrid females require males in the population for successful breeding, but do not produce males to replace those that have been lost, they may have the potential to dilute genetic variability of diploid populations. Competition from the Blue-spotted Salamander, which is more tolerant of disturbed habitats (Klemens 1993), may be a problem in areas where both species are found together (Champlain Valley?, southern NE). Loss of metapopulation structure due to fragmentation of suitable habitats by roads or other non-permeable development is problematic. Jefferson Salamander is more sensitive to acidification of breeding pools compared to other Ambystoma species (Petranka 1998).Complete egg mortality occurs in pools with low pH, and water with a pH <4.5 if often lethal to larvae. Also, widespread treatment of breeding pools to control West Nile Virus would likely have negative effects on amphibians. Long-lived amphibian with relatively fewer eggs that may not breed every year.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	1) Identify distribution and relative abundance of populations in Vermont. 2) Identify significant breeding sites. Large numbers (e.g., >25 egg masses) of breeders or evidence of use by any SGCN. 3) Map vernal pools statewide
Research	Threats and Their Significance	High	
Research	Population Genetics	Medium	Determine population genetics statewide and monitor populations for changes in sex ratios
Research	Taxonomy	Medium	
Monitoring	Population Change	High	
Monitoring	Habitat Change	High	
Monitoring	Range Shifts	Medium	
Monitoring	Monitor Threats	High	

Common Name: **Jefferson Salamander**
Scientific Name: **Ambystoma jeffersonianum**
Species Group: **Herp**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Standards		Timber harvest should be conducted on frozen ground and rutting of ground that could change hydrology of an area or intercept amphibians should be avoided.	Number of operations that did not disturb ground	landowners, FPR, USFS, consulting foresters	State Lands management, GMNF, WHIP, LIP, Current Use
Standards		Maintain 75% mature canopy cover beyond the 30-meter buffer in the terrestrial habitat	Sites with canopy cover	landowners, consulting foresters	State Lands management funds, WHIP, LIP, Current Use
Standards		Maintain 30-meter water quality buffer around entire perimeter of the pool. Timber harvesting, roads and any ground disturbing activities to be excluded within this buffer	Number of sites having water quality protected	landowners, consulting foresters	WHIP, LIP, Current Use
Compatible Resource Use		Maintain forested habitat matrix around temporary breeding pools	Number of pools with forest surrounding	landowners, consulting foresters	WHIP, LIP, Current Use
Technical Assistance, Training, Learning Networks		Identify significant road crossings and develop safe road crossings to address roadkill.	Number of sites reported	VTrans, Herp Atlas	VTrans, Federal Highway
Habitat Restoration		When existing road traffic is impacting migration of animals from terrestrial habitat to aquatic pool habitat, identify problem areas and redesign roads with crossing structures when roads are being upgraded.	Number of structures installed	VTrans	VTrans, Federal Highway
Habitat Restoration		When feasible restore deciduous or mixed forest surrounding breeding pool	Number of sites restored	landowners, consulting foresters	Current Use, WHIP, LIP
Awareness Raising and Communications		Help people understand the essential needs of all life stages, especially upland habitat in proximity to breeding pool.	Number of people exposed to conservation message	VFWD Outreach Division, media, Herp Atlas	marketing funds
Compatible Resource Use		Maintain breeding pools and needed terrestrial habitat (usually directly adjacent to pool perimeter out to 200m but could be the equivalent area along a portion of the perimeter while minimizing edge..	Pools with upland habitat.	landowners, consulting foresters	Current Use, WHIP, LIP
Compatible Resource Use		Maintain corridor connections between upland and pool habitat	Number of sites with upland connections	landowners, consulting foresters	Current Use, WHIP, LIP

Common Name: **Jefferson Salamander**
Scientific Name: **Ambystoma jeffersonianum**
Species Group: **Herp**

Habitat Restoration	If loss of important sites is likely due to development, consider creating or enhancing other pools that might allow some adults to transfer to the new site if they encounter it or develop a new breeding population from dispersal of colonizers.	Number of utilized pools.	VTrans, municipalities	VTrans, development conditions
Standards	maintain habitat mosaic and maintain connectivity between breeding pools. If two large sites are separated beyond the dispersal distance of a species it might be helpful to create or enhance pools that would link the two large sites.	Number of pools within habitat matrix	landowners, consulting foresters	State Lands management fund, WHIP, LIP, Current Use
Compatible Resource Use	Site all permanent roads more than 200 meters from a breeding pool, downslope of the pool if possible	Number of roads sited to minimize impacts to pools	VTrans, developers	VTrans, development conditions

Common Name: **Jefferson Salamander**
Scientific Name: **Ambystoma jeffersonianum**
Species Group: **Herp**

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Common Name: **Jefferson Salamander**
Scientific Name: **Ambystoma jeffersonianum**
Species Group: **Herp**

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Common Name: **Blue-spotted Salamander**
Scientific Name: **Ambystoma laterale**
Species Group: **Herp**

Conservation Assessment:

Final Assessment: Medium Priority

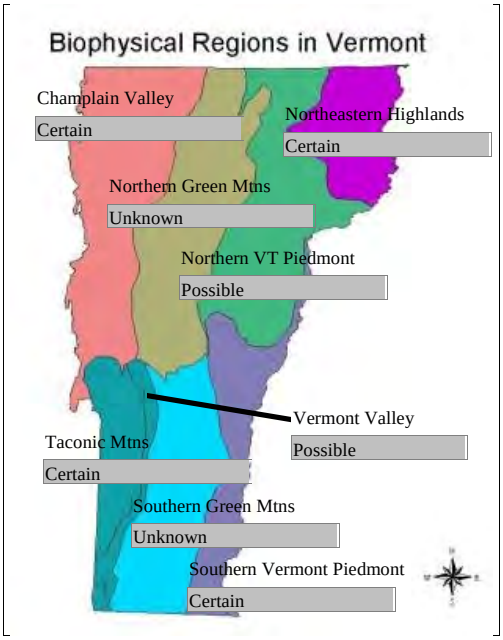
Global Rank: G5 **Global Trend:**
State Rank: S3 **State Trend:** Unknown
Extirpated in VT? **Regionally Rare?**

Assessment Narrative:

Blue-spotted Salamander is rare in Vermont (S3, SC), and is considered a species of conservation concern within the region due to its unknown population status, and taxonomic uncertainty (Terres 1999).

The blue-spotted salamander is dependent on habitat mosaics consisting of lowland forest adjacent to wetlands suitable for breeding. In addition, unisexual female hybrid populations exist that introduce uncertainties about the species' taxonomy, population biology, persistence, and long-term viability.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? No

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Well distributed in Vermont except for higher elevations so may be rare or absent form Green Mountains

Known Watersheds

CT-Bellows Falls Dam to Vernon Dam
Hudson-Hoosic Rivers
Lake Champlain Direct
Lamoille River
Mississquoi River
Otter Creek
Saint-Francois River
Upper Connecticut

Possible Watersheds

CT-Ashuelot River
CT-Johns River to Waits River
CT-Waits River to White River
CT-White River to Bellows Falls
Deerfield. MA-VT
Passumpsic Vermont
White River

Common Name: **Blue-spotted Salamander**
Scientific Name: **Ambystoma laterale**
Species Group: **Herp**

Winooski River

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Requires hardwood/mixed forest stands with abundant course woody debris, leaf litter, and underground refugia (small mammal tunnels, rock crevices, etc) surrounding a variety of wetland types, including red maple swamps, fens, marshes, temporary woodland (vernal) pools, etc. Most commonly found in bottomland forests adjacent to wetland with sufficient cover for breeding. More tolerant of disturbed habitats than Jefferson Salamander (Klemens 1993).

General Habitat Preferences:

Minimum Elevation (m):	30
Maximum Elevation (m):	350
Patch Size Requirements:	> 10 ha
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Man-Made Water Bodies
Hardwood Swamps
Marshes and Sedge Meadows
Northern Hardwood
Oak-Pine Northern Hardwood
Open Peatlands
Seeps and Pools
Shrub Swamps
Softwood Swamps
Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change
Conversion of Habitat
Habitat Alteration
Habitat Fragmentation
Impacts of Roads or Trails

Description of habitat problem(s): Any habitat conversion, alteration, or fragmentation that disrupts species' ability to move between breeding and terrestrial sites, changes water/soil chemistry, temperature, pool hydroperiod, humidity, etc, may have negative effects. Road mortality can have major impacts on migrating adults and dispersing juveniles, especially when located between terrestrial and breeding habitats. Climate change that affects hydroperiod and/or water temperature of breeding pools could have significant impacts on productivity (Rowe and Dunson 1995).

Non-Habitat Problems:

Common Name: **Blue-spotted Salamander**
Scientific Name: **Ambystoma laterale**
Species Group: **Herp**

Genetics

Pollution

Reproductive Traits

Trampling or Direct Impacts

Description of non-habitat problem(s): Unisexual, female hybrid populations reproduce via gynogenesis (requires sperm from diploid males which is not incorporated into the genome of embryos; Petranka 1998), resulting in female-biased sex ratios. Since hybrid females require males in the population for successful breeding, but do not produce males to replace those that have been lost, they may have the potential to dilute genetic variability of diploid populations. Loss of metapopulation structure leading to genetic isolation due to fragmentation of suitable habitats by roads or other non-permeable development is problematic. problems from acid precipitation that lowers pH of breeding pools may reduce productivity. Also, widespread treatment of breeding pools to control West Nile Virus would likely have negative effects on amphibians. Long-lived amphibian with relatively fewer eggs that may not breed every year.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	1) Identify distribution and relative abundance of populations in Vermont with focus on the Connecticut River Valley. 2) Identify significant breeding sites. Large numbers (e.g., >25 egg masses) of breeders or evidence of use by any SGCN herptile.
Research	Threats and Their Significance	High	
Research	Population Genetics	Medium	Determine population genetics statewide and monitor populations for changes in sex ratios.
Research	Taxonomy	Medium	
Monitoring	Population Change	High	
Monitoring	Habitat Change	High	
Monitoring	Range Shifts	Medium	
Monitoring	Monitor Threats	High	

Common Name: **Blue-spotted Salamander**
Scientific Name: **Ambystoma laterale**
Species Group: **Herp**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use	Medium	Site all permanent roads more than 200 meters from a breeding pool, downslope of the pool if possible	Number/ percentage of roads sited appropriately.	Developers, Act 250 Commissions	Planning grants, development costs
Compatible Resource Use		Maintain breeding pools and needed terrestrial habitat (usually directly adjacent to pool perimeter out to 200m but could be the equivalent area along a portion of the perimeter while minimizing edge).	Number of pools with adjacent upland habitat that is permeable for salamanders moving to and from pool.	Landowners	
Standards		Maintain 75% mature canopy cover beyond the 30-meter buffer in the terrestrial habitat	Number and percentage of habitats with adequate canopy	FPR, Consulting Foresters, USFS	
Standards		Timber harvest should be conducted on frozen or dry ground to avoid rutting of ground that could change hydrology of an area or intercept amphibians should be avoided.	Number of harvests conducted on frozen ground.	FPR, Consulting Foresters, USFS	timber sale
Habitat Restoration		When existing road traffic is impacting migration of animals from terrestrial habitat to aquatic pool habitat, identify problem areas and redesign roads with crossing structures when roads are being upgraded.	Number of structures installed.	VTrans, Federal Highway, municipalities	Federal Highway
Technical Assistance, Training, Learning Networks		Identify significant road crossings and develop safe road crossings to address roadkill.	Number of reported crossings	VTrans, town highway crews and conservation commissions, conservation organizations and volunteers.	Federal Highway
Compatible Resource Use		Maintain corridor connections between upland and pool habitat	Number of pools with secure travel paths to and from upland habitat. No net loss.	Consulting Foresters, USFS	Land Management Agency operating budgets
Habitat Restoration		When feasible restore deciduous or mixed forest surrounding breeding pool	Number of pools restored	Vermont Family Forest	Current Use

Common Name: **Blue-spotted Salamander**
Scientific Name: **Ambystoma laterale**
Species Group: **Herp**

Compatible Resource Use	Maintain permeable forested habitat matrix between and among breeding populations so that individuals can be exchanged among populations.	Number of linkages between populations	Herp Atlas, Conservation Organizations, Conservation Organizations, USFS	Current Use Program, LIP, WHIP
Awareness Raising and Communications	Help people understand the essential needs of all life stages, especially upland habitat in proximity to breeding pool.	Number of programs and individuals reached with message.	Herp Atlas, SWEEP, VFWD Outreach Division	Private Foundation grants
Standards	maintain habitat mosaic and maintain connectivity between breeding pools. If two large sites are separated beyond the dispersal distance of a species it might be helpful to create or enhance pools that would link the two large sites.	Connectivity among clusters of pools. No net loss of functional breeding pools	Wetlands Office	EPA
Habitat Restoration	If loss of important sites is likely due to development, consider creating or enhancing other pools that might allow some adults to transfer to the new site if they encounter it or develop a new breeding population from dispersal of colonizers.	Connectivity among clusters of pools. No net loss of functional breeding pools	Wetlands Office	EPA
Standards	Maintain 30-meter water quality buffer around entire perimeter of the pool. Timber harvesting, roads and any ground disturbing activities to be excluded within this buffer	Number of pools with protected buffers	Wetland Office	EPA
Technical Assistance, Training, Learning Networks	Identify significant road crossings and develop safe road crossings to address roadkill	Numbers of sites identified and addressed.	VTrans, Federal Highway Admin.	VTrans and Federal Highway

Common Name: **Blue-spotted Salamander**
Scientific Name: **Ambystoma laterale**
Species Group: **Herp**

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Common Name: **Blue-spotted Salamander**
Scientific Name: **Ambystoma laterale**
Species Group: **Herp**

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Common Name: **Spotted Salamander**
Scientific Name: **Ambystoma maculatum**
Species Group: **Herp**

Conservation Assessment:

Final Assessment: Medium Priority

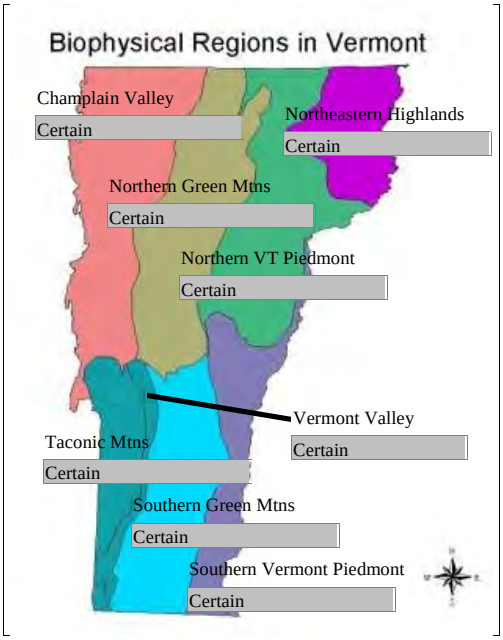
Global Rank: G5 **Global Trend:**
State Rank: S5 **State Trend:**
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Spotted salamander is found in pools adjacent to woodlands. It is widespread and abundant, but is killed in large numbers when it migrates across roads to and from it breeding pools, and is therefore a SGCN.

Conservation status could change over time with increased human pressure that impacts the species in Vermont. For now we consider it to be a medium priority species.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? Yes

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The Spotted Salamander is distributed widely in the state of Vermont, including the Green Mountains.

Known Watersheds

CT-Ashuelot River
CT-Bellows Falls Dam to Vernon Dam
CT-Johns River to Waits River
CT-Waits River to White River
CT-White River to Bellows Falls
Deerfield. MA-VT
Lake Champlain Canal
Lake Champlain Direct
Lamoille River

Possible Watersheds

Hudson-Hoosic Rivers

Common Name: **Spotted Salamander**
Scientific Name: **Ambystoma maculatum**
Species Group: **Herp**

Mississquoi River

Otter Creek

Passumpsic Vermont

Saint-Francois River

Upper Connecticut

White River

Winooski River

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☐ General Literature ☐

Spotted salamander breeds in pools that are imbedded in the forested landscape with movement corridors. This species needs both upland and pool habitat.

mixed or deciduous woodlands and adjacent pools

General Habitat Preferences:

Minimum Elevation (m): 30
Maximum Elevation (m): 3000
Patch Size Requirements: > 10 ha
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☑
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☑
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Man-Made Water Bodies

Floodplain Forests

Hardwood Swamps

Marshes and Sedge Meadows

Northern Hardwood

Oak-Pine Northern Hardwood

Open Peatlands

Seeps and Pools

Shrub Swamps

Softwood Swamps

Spruce Fir Northern Hardwood

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Impacts of Roads or Trails

Common Name: **Spotted Salamander**
Scientific Name: **Ambystoma maculatum**
Species Group: **Herp**

Description of habitat problem(s): Habitat problems for the Spotted Salamander include loss of upland or pool habitat, loss of movement between habitats, road mortality, if climate change results in less water

Non-Habitat Problems:

Reproductive Traits

Trampling or Direct Impacts

Description of non-habitat problem(s): Loss of connectivity to other populations and road mortalily, driving vehicles through breeding pools, disturbance of egg masses by humans, pets, and livestock are problems for for the Spotted Salamander. This is a long-lived amphibian producing relatively few eggs and it may not breed every year.

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	High	A complete inventory of vernal and other breeding sites statewide would be important for conservation of the Spotted Salamander and other pool breeding amphibians.
Research	Basic Life History	Medium	Need to determine travel distances to pools
Research	Distribution and Abundance	Medium	Identify significant breeding sites. Large numbers (e.g., >25 egg masses) of breeders or evidence of use by any SGCN.
Research	Threats and Their Significance	High	We need to identify and evaluate limiting factors.
Monitoring	Population Change	High	It is important to know population trends.
Monitoring	Habitat Change	High	It is important to understand the existing habitat base and track trends.
Monitoring	Monitor Threats	High	We should both monitor and manage limiting factors.

Common Name: **Spotted Salamander**
Scientific Name: **Ambystoma maculatum**
Species Group: **Herp**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Standards		Maintain 75% mature canopy cover beyond the 30-meter buffer in the terrestrial habitat	Number of sites where canopy cover is retained	landowners state and federal lands managers	state lands management funds, federal lands management, WHIP, LIP
Technical Assistance, Training, Learning Networks		Identify significant road crossings and develop safe road crossings to address roadkill.	Number of sites identified and crossings developed.	Herp Atlas, VTrans	VTrans, Federal Highway Admin.
Habitat Restoration		When feasible restore deciduous or mixed forest surrounding breeding pool	Number of sites with restored forest cover	landowners, consulting foresters, WHIP/LIP biologists	WHIP, LIP, Current Use
Standards		Maintain 30-meter water quality buffer around entire perimeter of the pool. Timber harvesting, roads and any ground disturbing activities to be excluded within this buffer	Number of sites where water quality is protected	DEC Water Quality/Wetlands Office, consulting foresters, WHIP/LIP biologists	WHIP, LIP
Standards		maintain habitat mosaic and maintain connectivity between breeding pools. If two large sites are separated beyond the dispersal distance of a species it might be helpful to create or enhance pools that would link the two large sites.	Number of areas linked.	FPR and VFWD lands managers, USFS, Federal Refuges, private landowners	State lands management funds, WHIP, Lip
Compatible Resource Use		Maintain corridor connections between upland and pool habitat	Number of sites with connections between pool and upland.	Landowners, consulting foresters, WHIP biologists	WHIP, LIP, Current Use
Habitat Restoration		When existing road traffic is impacting migration of animals from terrestrial habitat to aquatic pool habitat, identify problem areas and redesign roads with crossing structures when roads are being upgraded.	Number of structures installed	VTrans	VTrans, Federal Highway
Habitat Restoration		If loss of important sites is likely due to development, consider creating or enhancing other pools that might allow some adults to transfer to the new site if they encounter it or develop a new breeding population from dispersal of colonizers.	Number of sites enhanced.	VTrans	VTrans

Common Name: **Spotted Salamander**
Scientific Name: **Ambystoma maculatum**
Species Group: **Herp**

Compatible Resource Use	Maintain breeding pools and needed terrestrial habitat (usually directly adjacent to pool perimeter out to 200m but could be the equivalent area along a portion of the perimeter while minimizing edge.	Number of sites with both pools and upland habitat intact.	Landowners, consulting foresters, Herp Atlas	WHIP, LIP, Partners in Wildlife
Compatible Resource Use	Site all permanent roads more than 200 meters from a breeding pool, downslope of the pool if possible	Number of roads sited that minimize impacts.	VTrans, developers, municipalities	VTrans, conditional approval of subdivisions
Awareness Raising and Communications	Help people understand the essential needs of all life stages, especially upland habitat in proximity to breeding pool.	Number of people who are exposed to message	Herp Atlas, VINS, SAG-Herps	private grants
Standards	Timber harvest should be conducted on frozen ground and rutting of ground that could change hydrology of an area or intercept amphibians should be avoided.	Number of harvest operations that do not disturb ground.	Consulting foresters, FPR	Current Use

Common Name: **Spotted Salamander**
Scientific Name: **Ambystoma maculatum**
Species Group: **Herp**

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Common Name: **Spotted Salamander**
Scientific Name: **Ambystoma maculatum**
Species Group: **Herp**

Semlitsch, R.D. and J.R. Bodie. 2003. Biological criteria for buffer zones around wetlands and riparian hatibitats for amphibians and reptiles. Conservation Biology 17(5):1219-1228.

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Common Name: **Four-toed Salamander**
Scientific Name: **Hemidactylium scutatum**
Species Group: **Herp**

Conservation Assessment:

Final Assessment: Medium Priority

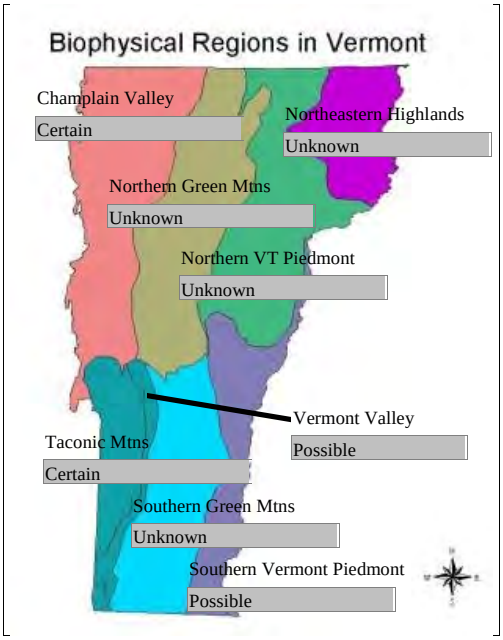
Global Rank: G5 **Global Trend:**
State Rank: S2 **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

The Four-toed Salamander is rare in Vermont (S2, SC) and the region.

Although the species is small and secretive, its distribution appears to be limited to low elevations of the Champlain Valley, Taconics, and probably the lower Connecticut River Valley. The species has specialized breeding requirements and is dependent on habitat mosaics consisting of lowland forest adjacent to suitable wetlands for breeding.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? No

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The distribution of the Four-toed salamander appears to be limited to low elevations of the Champlain Valley, Taconics, and probably the lower Connecticut River Valley.

Known Watersheds

Hudson-Hoosic Rivers
Lamoille River
Otter Creek
Winooski River

Possible Watersheds

CT-Ashuelot River
CT-Bellows Falls Dam to Vernon Dam
CT-White River to Bellows Falls
Deerfield. MA-VT
White River

Common Name: **Four-toed Salamander**
Scientific Name: **Hemidactylium scutatum**
Species Group: **Herp**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Requires relatively mature, moist hardwood/mixed forest stands with abundant course woody debris, leaf litter, and underground refugia (small mammal tunnels, rock crevices, etc) in close proximity to suitable breeding sites. Breeding sites include a variety of mossy wetlands, including red maple swamps, bogs, fens, temporary woodland (vernal) pools, etc. Most commonly found in bottomland forests adjacent to shallow, mossy wetlands with pools and sufficient cover for breeding.

General Habitat Preferences:

Minimum Elevation (m):	40
Maximum Elevation (m):	300
Patch Size Requirements:	> 10 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Hardwood Swamps
Marshes and Sedge Meadows
Northern Hardwood
Oak-Pine Northern Hardwood
Open Peatlands
Seeps and Pools
Shrub Swamps
Softwood Swamps
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change
Conversion of Habitat
Habitat Alteration
Habitat Fragmentation
Impacts of Roads or Trails

Description of habitat problem(s): The Four-toed Salamander has specialized breeding requirements that make it vulnerable to habitat disturbance. Any habitat conversion, alteration, or fragmentation that disrupts species' ability to move between breeding and terrestrial sites, changes water/soil chemistry, temperature, pool hydroperiod, humidity, etc, may have negative effects. Road mortality can negatively impact migrating adults and dispersing juveniles, especially when located between terrestrial and breeding habitats. Climate change that affects hydroperiod and/or water temperature of breeding pools could have significant impacts on productivity

Non-Habitat Problems:

Genetics
Pollution

Common Name: **Four-toed Salamander**
Scientific Name: **Hemidactylium scutatum**
Species Group: **Herp**

Trampling or Direct Impacts

Description of non-habitat problem(s): Loss of metapopulation structure leading to genetic isolation due to fragmentation of suitable habitats by roads or other non-permeable development is problematic. Widespread treatment of breeding pools to control West Nile Virus would likely have negative effects on many amphibians, including Four-toed Salamanders.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Gain better understanding of breeding habitat requirements in Vermont and upper elevational limits
Research	Basic Life History	Medium	
Research	Distribution and Abundance	High	1) Identify significant breeding sites. Large numbers (e.g., >25 egg masses) of breeders or evidence of use by any SGCN. 2) Determine distribution and relative abundance of species in southern Connecticut River Valley and Taconics.
Research	Threats and Their Significance	High	
Research	Population Genetics	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	High	
Monitoring	Range Shifts	Medium	
Monitoring	Monitor Threats	High	

Common Name: **Four-toed Salamander**
Scientific Name: **Hemidactylium scutatum**
Species Group: **Herp**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use		Site all permanent roads more than 200 meters from a breeding pool, downslope of the pool if possible	Number of roads sited so that pool impacts are minimized	VTrans, municipalities	VTrans, Federal Highway Admin
Habitat Restoration		When feasible restore deciduous or mixed forest surrounding breeding pool	Sites with restored forested habitat	Landowners	volunteer effort, WHIP, LIP
Compatible Resource Use		Maintain breeding pools and needed terrestrial habitat (usually directly adjacent to pool perimeter out to 200m but could be the equivalent area along a portion of the perimeter while minimizing edge..	Number of pools with needed upland habitat	landowners, consulting foresters	State Lands Management, Current Use, WHIP, LIP
Awareness Raising and Communications		Help people understand the essential needs of all life stages, especially upland habitat in proximity to breeding pool.	Number of people who receive message	Herp Atlas, VINS	private grant
Standards		Timber harvest should be conducted on frozen ground and rutting of ground that could change hydrology of an area or intercept amphibians should be avoided.	Number of operations that avoid ground alteration	FPR, Consulting Foresters	State Lands Management, Current Use
Standards		maintain habitat mosaic and maintain connectivity between breeding pools. If two large sites are separated beyond the dispersal distance of a species it might be helpful to create or enhance pools that would link the two large sites.	Number of sites enhanced	Landowners, consulting foresters	Current Use, WHIP, LIP
Technical Assistance, Training, Learning Networks		Identify significant road crossings and develop safe road crossings to address roadkill.	Number of structures installed	VTrans	VTrans
Compatible Resource Use		Maintain corridor connections between upland and pool habitat	Number of breeding sites with secure upland connection	Landowners, consulting foresters	volunteer compliance, Current Use, WHIP, LIP
Standards		Maintain 75% mature canopy cover beyond the 30-meter buffer in the terrestrial habitat	Number of pools with canopy cover retained	Consulting Foresters, private and public landowners	Current Use, WHIP, LIP
Standards		Maintain 30-meter water quality buffer around entire perimeter of the pool. Timber harvesting, roads and any ground disturbing activities to be excluded within this buffer	Number of pool sites managed for good water quality	Consulting Foresters, private and public landowners	Current Use, WHIP, LIP

Common Name: **Four-toed Salamander**
Scientific Name: **Hemidactylium scutatum**
Species Group: **Herp**

Compatible Resource Use	Maintain forested habitat matrix around breeding sites.	Number of pools within forested matrix	Landowners	Current Use, WHIP, LIP
Technical Assistance, Training, Learning Networks	Identify significant road crossings and develop safe road crossings to address roadkill.	Number of crossing identified and structures installed	VTrans	VTrans
Habitat Restoration	When existing road traffic is impacting migration of animals from terrestrial habitat to aquatic pool habitat, identify problem areas and redesign roads with crossing structures when roads are being upgraded.	Number of redesigns of roads	VTrans	VTrans, Federal Highway Admin.
Habitat Restoration	If loss of important sites is likely due to development, consider creating or enhancing other pools that might allow some adults to transfer to the new site if they encounter it or develop a new breeding population from dispersal of colonizers.	Number of utilized pools created	landowners, VTrans	VTrans, volunteer effort

Common Name: **Four-toed Salamander**
Scientific Name: **Hemidactylium scutatum**
Species Group: **Herp**

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Common Name: **Four-toed Salamander**
Scientific Name: **Hemidactylium scutatum**
Species Group: **Herp**

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Common Name: **Common Mudpuppy**
Scientific Name: **Necturus maculosus**
Species Group: **Herp**

Conservation Assessment:

Final Assessment: High Priority

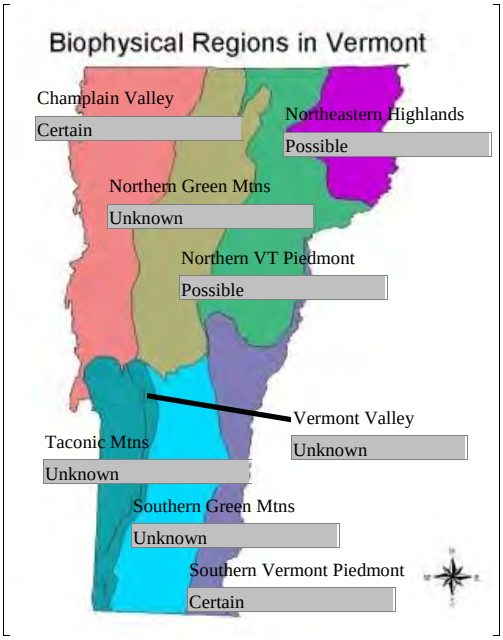
Global Rank: G5 **Global Trend:**
State Rank: S2 **State Trend:**
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

The Mudpuppy is native to Lake Champlain and the Burlington area is the source of the type specimen from the late 1700s. The Connecticut River population may be from an introduced source. Widespread lampricide applications in many Lake Champlain tributaries is a risk to Mudpuppies and losses have been documented, but not consistently. Surveying for Mudpuppies has proven to be difficult and our understanding of abundance, and even distribution, remains uncertain. A recommendation to list this species as threatened was not accepted by the Agency of Natural Resources.

This species appears to be restricted to the shoals and shallows of Lake Champlain and the lower reaches of tributaries to the lake. There is also a Connecticut River population that may not be native. Lampricide treatments in Lake Champlain (NY and VT) have killed wild mudpuppies. Specimens in some cage studies during treatments have survived and we do not fully understand why the effects have been so different between treatments. The USFWS has attempted to survey for Mudpuppies in and near Lake Champlain with little success.

Distribution:



Natural History Elements:

Home Range: <1 ha
Migrant? No

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Primarily Lake Champlain and lower reaches of tributaries and Connecticut River. One record from Missisquoi River tributary well above falls line in Town of Fairfield.

Known Watersheds

CT-Ashuelot River
CT-Bellows Falls Dam to Vernon Dam
CT-White River to Bellows Falls
Lake Champlain Direct

Possible Watersheds

CT-Johns River to Waits River
CT-Waits River to White River
Upper Connecticut

Common Name: **Common Mudpuppy**
Scientific Name: **Necturus maculosus**
Species Group: **Herp**

Mississquoi River

Winooski River

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

The mudpuppy inhabits the bottoms of lakes and rivers up to 30 m deep. It avoids swiftly moving water and seems to be somewhat sedentary moving up to 252 m in its aquatic environment. There is some evidence of short distance seasonal migrations from shallows to pools or river channels..

General Habitat Preferences:

Minimum Elevation (m): 25
Maximum Elevation (m): 60
Patch Size Requirements: Unknown
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial

Aquatic: Lacustrine

Aquatic: Large Lake Champlain Tribs Below Falls

Aquatic: Lower CT River

Aquatic: Man-Made Water Bodies

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Inadequate Disturbance Regime

Sedimentation

Description of habitat problem(s): The mudpuppy's aquatic habitat can be fragmented by dam barriers and this habitat can be degraded by loss of cover and sedimentation.

Non-Habitat Problems:

Disease

Pollution

Reproductive Traits

Trampling or Direct Impacts

Description of non-habitat problem(s): Direct mortality has been documented due to some TFM lampricide applications in NY and VT. The Mudpuppy produces <200 eggs, which are deposited

Common Name: **Common Mudpuppy**
Scientific Name: **Necturus maculosus**
Species Group: **Herp**

underwater to the underside of a rock or log. It does not reach reproductive maturity until about six years old. This is a long-lived species and survival of breeding adults is very important to the maintenance of populations. Some individuals are caught on hooks. A large botulism was reported in the Great Lakes in 2003.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	It would be helpful to understand how the mudpuppy is using our lake and river habitat and when. Gather data on egg-laying sites, instream shelter, and seasonal movement patterns.
Research	Basic Life History	Medium	Knowing if and when mudpuppies are entering or leaving our rivers would help us understand the potential impacts of TFM treatments
Research	Distribution and Abundance	High	1) Develop survey techniques to effectively sample mudpuppies. 2)The distribution of mudpuppies is not well known in VT and we do not have a good idea of population size or trend. Monitor the size and determine the sustainability of existing populations through age-class and genetic analysis.
Research	Threats and Their Significance	High	We need to better understand the impacts of TFM applications, fragmentation and changed river flows due to dams, and sedimentiaton.
Research	Population Genetics	Medium	It would be helpful to know if the Connecticut River mudpuppy is distinct from the Lake Champlain mudpuppy
Monitoring	Population Change	High	
Monitoring	Habitat Change	Medium	
Monitoring	Range Shifts	High	Range shift may need to be our index of population change because to date we have not been very successful sampling mudpuppies.
Monitoring	Monitor Threats	High	

Common Name: **Common Mudpuppy**
Scientific Name: **Necturus maculosus**
Species Group: **Herp**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications		Help Vermonters assign value to this species through educational programs, printed material, web site information, field trips, TV and video information	Number of programs and individuals reached with message.	, ECHO Center for Lake Champlain, Outreach Division	Corporate Sponsors, Lake Champlain Basin Program
Habitat Restoration		Consider removal of stream barriers that restrict upstream movement.	Number of miles of streams reopened	FERC, Trout Unlimited, VTrans, towns	Power Companies, VTrans, municipalities
Habitat Restoration		Maintain adequate stream flows to support mudpuppy populations.	Number of streams	DEC Water Quality Division, Power Generation companies, FERC	Power Generation companies
Awareness Raising and Communications		Encourage reports of sightings to the Vermont Nongame and Natural Heritage Program and the Vermont Reptile and Amphibian Atlas Project.	Numbers of reports received	Herp Atlas, volunteers	Nongame Wildlife Fund
Invasive Species Control & Prevention		Investigate and implement alternative lamprey control methods that have less impacts to mudpuppy populations.	Number of times alternative methods used.	TNC, USFWS, VFWD Fisheries Division	DJ, USFWS
Habitat Restoration		Prevent sedimentation that degrades mudpuppy habitat	Improvements in water quality. Number of miles of buffer strips established. Turbidity measures	DEC Water Quality, Dam operators, Dept. of Agriculture, VTrans, NRCS	Dam operators, Dept. of Agriculture, VTrans, WHIP, LIP
Planning & Zoning		Implement stream management in mudpuppy waters that promote better water quality .	Streams with improved water quality	USFWS, VFWD Fisheries Division, DEC Water Quality Division	DJ, USFWS

Common Name: **Common Mudpuppy**
Scientific Name: **Necturus maculosus**
Species Group: **Herp**

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Common Name: **Common Mudpuppy**
Scientific Name: **Necturus maculosus**
Species Group: **Herp**

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Common Name: **Fowler's Toad**
Scientific Name: **Bufo fowleri**
Species Group: **Herp**

Conservation Assessment:

Final Assessment: High Priority

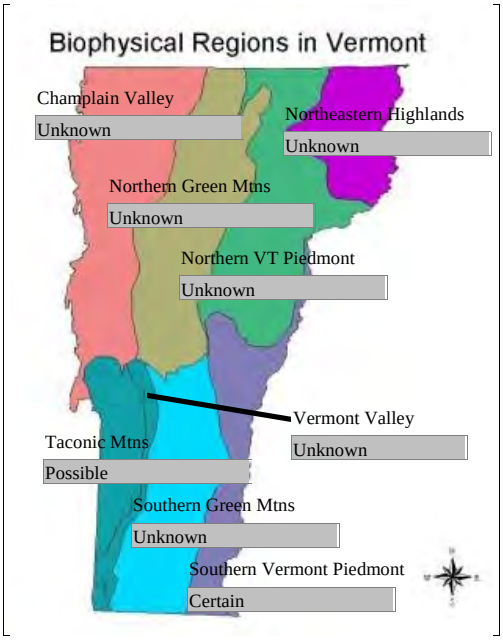
Global Rank: G5 **Global Trend:**
State Rank: S1 **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Unknown

Assessment Narrative:

The Fowler's Toad is rare in Vermont (S1, SC).

The Fowler's Toad has specialized habitat requirements and depends on habitat mosaics consisting of sandy shorelines and uplands adjacent to shallow breeding sites. Habitat loss due to succession is also a problem for this species.

Distribution:



Natural History Elements:

Home Range: <1 ha
Migrant? No

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The Fowler's Toad is primarily a species of the Atlantic Coastal Plain, its distribution in Vermont is limited to the lower Connecticut River valley, with populations documented at one site each in Vernon and White River Junction (Andrews 2001, Barker and Caduto 1984).

Known Watersheds

CT-Ashuelot River

CT-White River to Bellows Falls

Possible Watersheds

CT-Bellows Falls Dam to Vernon Dam

Deerfield. MA-VT

Hudson-Hoosic Rivers

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☑ Regional Literature ☑ General Literature ☑

Fowler's Toad primarily inhabits well-drained sites, particularly floodplain forests and sandy deciduous woodlands along shorelines and river valleys, but may also occupy also gardens, lawns, and fields.

Common Name: **Fowler's Toad**
Scientific Name: **Bufo fowleri**
Species Group: **Herp**

General Habitat Preferences:

Minimum Elevation (m):	35
Maximum Elevation (m):	150
Patch Size Requirements:	> 1 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lacustrine
Aquatic: Man-Made Water Bodies
Early Succession Northern Hardwoods
Early Succession Pine and Hemlock
Early Succession Upland Oak
Floodplain Forests
Grasslands and Hedgerows
Hardwood Swamps
Lawns, Gardens, and Row Crops
Marshes and Sedge Meadows
Northern Hardwood
Oak-Pine Northern Hardwood
Seeps and Pools
Shrub Swamps
Upland Shores
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change
Conversion of Habitat
Habitat Alteration
Habitat Fragmentation
Impacts of Roads or Trails

Description of habitat problem(s): The Fowler's Toad has specialized habitat requirements that make it vulnerable to disturbance. Any habitat conversion, alteration, or fragmentation that disrupts species' ability to move between breeding and terrestrial sites may have negative effects. Road mortality can negatively impact migrating adults and dispersing juveniles, especially when located between terrestrial and breeding habitats. Climate change that affects hydroperiod and/or water temperature of breeding pools could have significant impacts on productivity

Non-Habitat Problems:

Genetics
Pollution
Trampling or Direct Impacts

Common Name: **Fowler's Toad**
Scientific Name: **Bufo fowleri**
Species Group: **Herp**

Description of non-habitat problem(s): Known populations of this species occur in close proximity to humans, and in a region of the state that continues to see significant development pressure. Fragmentation of suitable habitats by roads or other non-permeable development may result in loss of metapopulation structure and leading to genetic isolation, especially considering the limited and localized populations of this species. Widespread treatment of breeding pools to control West Nile Virus would likely have negative effects on many amphibians, including Fowler's Toad.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Due to the likely spotty distribution of the rare Fowler's Toad in Vermont, it is important that we document and map habitat including connectivity of patches.
Research	Distribution and Abundance	High	1) There is a need to better document the distribution of the Fowler's Toad in Vermont, which will require dedicated searches during the calling period. 2) Continue to document species distribution in Connecticut River Valley with targeted searches of potential sites, and sites where previously reported.
Research	Threats and Their Significance	High	
Monitoring	Population Change	High	Monitor known population annually and attempt to determine population size and demographics.
Monitoring	Habitat Change	High	The habitat of the Fowler's Toad is likely vulnerable to human development and fragmentation of its habitat, including breeding pools.
Monitoring	Monitor Threats	High	

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Easements		Attempt to protect (through easement or purchase) currently known breeding site and adjacent terrestrial habitat.	Acreage protected by easement or purchase	VLT, local land trust, landowners	VHCB funds
Awareness Raising and Communications		Encourage reports of sightings to the Vermont Nongame and Natural Heritage Program and the Vermont Reptile and Amphibian Atlas Project	Number of reports received	Herp Atlas	Nongame Wildlife Fund, private grants

Common Name: **Fowler's Toad**
Scientific Name: **Bufo fowleri**
Species Group: **Herp**

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Common Name: **Western (Striped) Chorus Frog**
Scientific Name: **Pseudacris triseriata**
Species Group: **Herp**

Conservation Assessment:

Final Assessment: High Priority

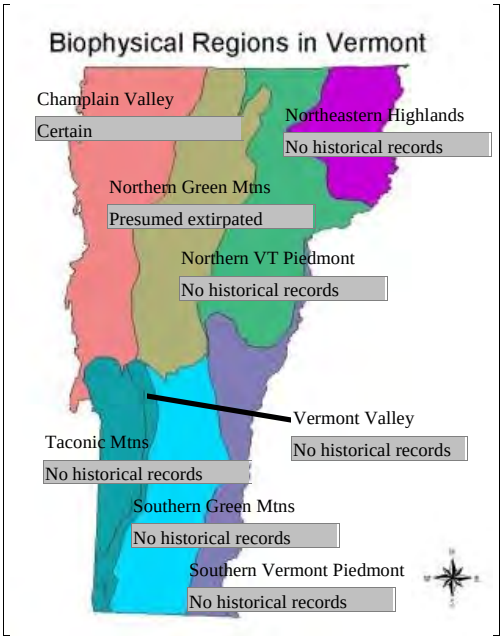
Global Rank: G5 **Global Trend:**
State Rank: S1 **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

This species was located in townships along northern Lake Champlain from Swanton/Alburg to Georgia in the 1970s. Today we struggle to find even a few individuals at a single location in Alburg. It is state-listed as endangered. We do not know where adults over winter and stay following the breeding season.

Habitat loss due to succession is also a problem for this species. Habitat loss from drainage of pools in agricultural fields. This species may be vulnerable to taking but isn't targeted directly by collectors. Species may also vulnerable to taking by mowing of agricultural fields. Habitat in Vermont seems to be flooded or ponded pasture with shrubs…not out in open with spring peepers. May be best to survey later in morning after peepers quiet down.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Known Watersheds

Lake Champlain Direct

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

sedge-shrub wetlands, shrub swamp, grassy wetlands, flooded swales. Where do adults over winter and stay post-breeding?

open-canopied shallow pools, wetlands w/ some standing water

Common Name: **Western (Striped) Chorus Frog**
Scientific Name: **Pseudacris triseriata**
Species Group: **Herp**

General Habitat Preferences:

Minimum Elevation (m):	100
Maximum Elevation (m):	150
Patch Size Requirements:	> 10 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Man-Made Water Bodies

Marshes and Sedge Meadows

Shrub Swamps

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Habitat Succession

Impacts of Roads or Trails

Description of habitat problem(s): Shallow wetland habitat appears to be limited and no strong population center known that would provide colonizers. Appears to be limited to NW Vermont. Known distribution retracted from northeastern shore of Lake Champlain (Canadian border to Georgia) to isolated site in Alburg. Also declines in Quebec and eastern Ontario.

Non-Habitat Problems:

Harvest or Collection

Pollution

Trampling or Direct Impacts

Description of non-habitat problem(s): Pesticides, herbicides, and runoff. May be inadvertantly collected when leopard frogs are collected by sweep net or drift fence.

Common Name: **Western (Striped) Chorus Frog**
Scientific Name: **Pseudacris triseriata**
Species Group: **Herp**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Determine habitat needs.
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	Thoroughly survey for this species in Vermont
Research	Threats and Their Significance	High	Determine the primary limiting factors for this species.
Research	Population Genetics	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	High	
Monitoring	Range Shifts	High	How Vermont fits in with regional population change
Monitoring	Monitor Threats	High	

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications		Encourage reports of sightings to the Vermont Nongame and Natural Heritage Program and the Vermont Reptile and Amphibian Atlas Project	Number of reports received	Herp Atlas	Nongame Wildlife Fund
Easements		Attempt to protect (through easement or purchase) currently known breeding sites and adjacent terrestrial habitat.	Acreage and number of sites conserved	Herp Atlas, Lake Champlain Land Trust, VLT	VHCB

Common Name: **Western (Striped) Chorus Frog**
Scientific Name: **Pseudacris triseriata**
Species Group: **Herp**

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Semlitsch, R.D. and J.R. Bodie. 2003. Biological criteria for buffer zones around wetlands and riparian hatibitats for amphibians and reptiles. Conservation Biology 17(5):1219-1228.

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Zug, G.R. 1993. Herpetology: an introductory biology of amphibians and reptiles. Academic Press, A Division of Harcourt Brace & Company, San Diego, California 527 pp

Common Name: **Spotted Turtle**
Scientific Name: **Clemmys guttata**
Species Group: **Herp**

Conservation Assessment:

Final Assessment: High Priority

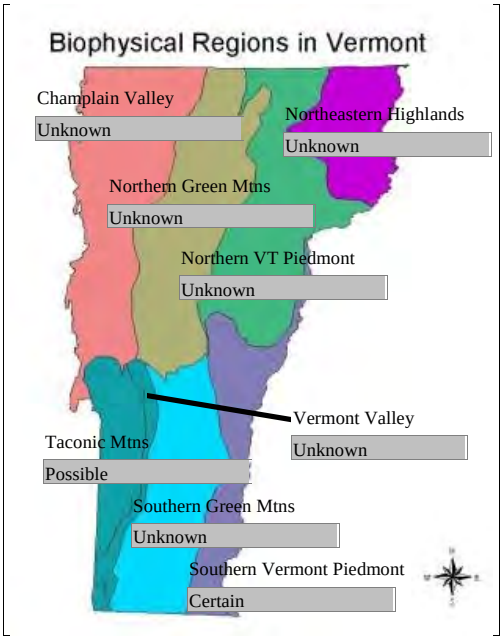
Global Rank: G5 **Global Trend:**
State Rank: S1 **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

The state-endangered Spotted Turtle has only a single known location in Vermont and is a species of regional conservation concern, therefore this species is a SGCN.

The single know Spotted Turtle site in Vermont is compromised by surrounding landuse and a RR that bisects the wetland limits safe passage of the turtles. We are currently monitoring limiting factors at this site, which is believed to have a very small population.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? Yes

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

One known population in SE Vermont. Possible in Shaftsbury/Arlington based on one female documented, but cannot rule out released/escaped captive

Known Watersheds

CT-Ashuelot River

Possible Watersheds

Hudson-Hoosic Rivers

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☐ General Literature ☐

The Spotted Turtle uses red maple swamps and other wetland habitats. In Massachusetts it has been documented to patch together woodland vernal pools in some localities and can also use ponds.

Common Name: **Spotted Turtle**
Scientific Name: **Clemmys guttata**
Species Group: **Herp**

General Habitat Preferences:

Minimum Elevation (m):	30
Maximum Elevation (m):	100
Patch Size Requirements:	> 10 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lacustrine
Aquatic: Man-Made Water Bodies
Hardwood Swamps
Marshes and Sedge Meadows
Northern Hardwood
Oak-Pine Northern Hardwood
Open Peatlands
Seeps and Pools
Shrub Swamps
Softwood Swamps
Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Climate Change
Conversion of Habitat
Habitat Alteration
Habitat Fragmentation
Impacts of Roads or Trails

Description of habitat problem(s): Habitat problems of the Spotted Turtle include loss of wetland overwintering and foraging habitat, loss of nesting areas, fragmentation isolating populations and separating needed seasonal habitats, as well as road mortality. Climate change could affect the Spotted Turtle if a change in water regime results

Non-Habitat Problems:

Genetics
Harvest or Collection
Predation or Herbivory
Reproductive Traits
Trampling or Direct Impacts

Description of non-habitat problem(s): The Spotted Turtles is vulnerable to collection, nest predation, road mortality, and population rescue is unlikely. If close to humans, risks increase

Common Name: **Spotted Turtle**
Scientific Name: **Clemmys guttata**
Species Group: **Herp**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	1) Given the rarity of this species, we really have to examine critical habitat (e.g., wintering sites). 2) Gather data on specific habitat requirements of Vermont populations: denning sites, egg-laying sites, foraging areas, overwintering areas and movement corridors.
Research	Distribution and Abundance	High	Pursue further surveys for spotted turtles in Vermont. Need to document all populations and their abundance, as well as the spatial relationship of populations.
Research	Threats and Their Significance	High	Need to identify and resolve potential limiting factors
Research	Population Genetics	Medium	We don't know if population genetics is a problem or not, but species is isolated in Vermont
Monitoring	Population Change	High	1) Track population size, age and sex distribution. 2) Monitor the size and determine the sustainability of existing populations through age-class or genetic analysis.
Monitoring	Habitat Change	High	It would be important to track changes in quality and quantity of habitat, as well as connectivity between habitats
Monitoring	Monitor Threats	High	We need to determine if we are making progress alleviating limiting factors.

Common Name: **Spotted Turtle**
Scientific Name: **Clemmys guttata**
Species Group: **Herp**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use		Control ATV and other off road usage in known habitat to avoid impacts	Frequency of ATV use	railroad, game wardens	operating funds
Compatible Resource Use		Continue to work with landowners and users of area to protect known habitat.	Number of cooperating landowners	local game warden, landowners, country forester	SWG, Nongame Wildlife Fund
Habitat Restoration		Create nesting sites and passages connecting wetland habitats.	Number of enhancements.	railroad, local warden	railroad, Nongame Wildlife Fund
Standards		Develop land management guidelines for owners and managers of appropriate habitat and make them readily available through multiple media, including print and the web	Number of landowners and managers who receive and use guidelines	landowners, consulting foresters, WHIP/LIP biologists	SWG, WHIP, LIP, Current Use
Awareness Raising and Communications		Encourage reports of sightings to the Vermont Nongame and Natural Heritage Program and the Vermont Reptile and Amphibian Atlas Project.	Number of reports received annually	Herp Atlas	Nongame Wildlife Fund
Species Restoration		Consider reintroduction or augmentation from closest healthy source. Maintaining and enhancing extant populations is always a priority and should be continued.	number of populations	Bonnyvale Environmental Center	SWG
Awareness Raising and Communications		Help Vermonters assign value to this species through educational programs, printed material, web site information, field trips, TV and video information.	Number of people exposed to message	VFWD Outreach division, Bonnyvale Environmental Center	marketing funds, private grants
Habitat Restoration		Work to maintain connectivity with populations to the south in Massachusetts	Number of potential connections to populations south of Vermont	Mass Fish and Wildlife, private landowners, VLT	VHCB
Species Restoration		Protect nests and adults by predator trapping.	number of raccoons harvested per year	Trappers Assoc., landowners	Trappers Assoc members
Easements		Conserve know habitat through fee simple purchase, development rights or easements, management agreements, and education of private landowners and managers regarding appropriate management.	acres of land conserved	VHCB	VHCB

Common Name: **Spotted Turtle**
Scientific Name: **Clemmys guttata**
Species Group: **Herp**

Compatible Resource Use	Review all roadway projects in appropriate habitat, check against known crossing areas VTRANS, VT F&W, HERP Atlas, survey appropriate habitat when unknown.	Number of projects reviewed with spotted turtle planning information	Herp Atlas, VTrans	VTrans
Awareness Raising and Communications	Encourage reports of road-killed specimens, road crossing, and road basking areas to VT F&W, VTRANS, and the Vermont Reptile and Amphibian Atlas Project	Number of reports	Herp Atlas Project, VTrans	VTrans, SWG

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Common Name: **Wood Turtle**
Scientific Name: **Clemmys insculpta**
Species Group: **Herp**

Conservation Assessment:

Final Assessment: High Priority

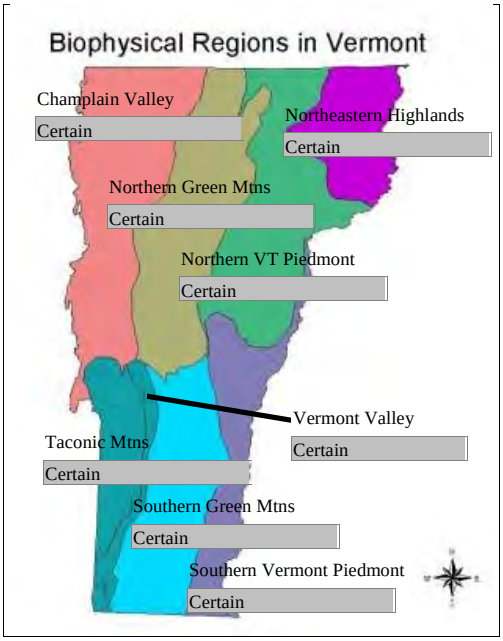
Global Rank: G4 **Global Trend:**
State Rank: S3 **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

The Wood Turtle is a species of regional conservation concern and possibly worthy of consideration as a federally listed species (NE Endangered Species and Wildlife Diversity Committee) and a species of special concern in Vermont. It is believed to still be widely distributed, but potentially declining throughout its range due to its long age to maturity and increasing loses of long-lived adults. It is still encountered over a wide region, which may be masking the conservation peril this species faces.

The Wood Turtle is found in upland habitat adjacent to streams, providing it is not heavily developed or intensively used for agriculture. It is vulnerable to mowing of agricultural fields and to road mortaility. Habitat loss due to succession is also a challenge for this species, but it seeks out and uses even small suitable patches withing woodlands. It is also at risk to collection.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The Wood Turtle is well distributed throughout Vermont, but not at very high elevations or apparently at the lowest levels of the Champlain Valley. A suitable medium gradient river or large creek is required.

Known Watersheds

CT-Ashuelot River
CT-Bellows Falls Dam to Vernon Dam
CT-Waits River to White River
CT-White River to Bellows Falls
Hudson-Hoosic Rivers
Lake Champlain Canal

Possible Watersheds

CT-Johns River to Waits River
CT-Waits River to White River
Passumpsic Vermont
Saint-Francois River
Upper Connecticut

Common Name: **Wood Turtle**
Scientific Name: **Clemmys insculpta**
Species Group: **Herp**

Lake Champlain Direct

Lamoille River

Mississquoi River

Otter Creek

White River

Winooski River

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☐ General Literature ☐

The Wood Turtle is found in a landscape of rolling hills. Upland habitat adjacent to streams needs to be permeable to Wood Turtle terrestrial wanderings. It uses shrub swamps, alder swamps, and can use human-altered landscapes if not too severe, but it must have a suitable home stream. Home range can be calculated as less than a hectare if long-distant movements for females to nest or for males to patrol a river or stream to breed females (1.5 km) is not included.

moderate gradient streams w/ refuge sites, sand gravel & rock streambeds. Areas for egg laying

General Habitat Preferences:

Minimum Elevation (m): 45
Maximum Elevation (m): 600
Patch Size Requirements: > 10 ha
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☑
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Fluvial
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Man-Made Water Bodies
Early Succession Northern Hardwoods
Early Succession Other Types
Early Succession Pine and Hemlock
Early Succession Upland Oak
Floodplain Forests
Grasslands and Hedgerows
Hardwood Swamps
Marshes and Sedge Meadows
Northern Hardwood
Oak-Pine Northern Hardwood
Open Peatlands
Seeps and Pools
Shrub Swamps
Softwood Swamps
Spruce Fir Northern Hardwood

Common Name: **Wood Turtle**
Scientific Name: **Clemmys insculpta**
Species Group: **Herp**

Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Habitat Succession

Description of habitat problem(s): Loss of upland habitat adjacent to Wood Turtle home stream is a real problem. It can tolerate a fair amount of succession providing some suitable patches remain. Although the Wood Turtle can use an agricultural landscape, too intensive a use such as row crops, is unsuitable. Habitat is being broken up by development and roads. Trails can bring more people into contact with Wood Turtles

Non-Habitat Problems:

Harvest or Collection

Predation or Herbivory

Trampling or Direct Impacts

Description of non-habitat problem(s): Wood turtles are susceptible to collection, egg predation, and road mortality, hence proximity to human habitatation is a risk.

Common Name: **Wood Turtle**
Scientific Name: **Clemmys insculpta**
Species Group: **Herp**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	1) Identification and protection of communal wintering and nesting sites is critical. 2(Gather data on specific habitat requirements of Vermont populations: denning sites, egg-laying sites, foraging areas, and movement corridors.
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	Identify distribution and relative abundance of populations in Vermont as good knowledge of current distribution and abundance is essential for good monitoring.
Research	Threats and Their Significance	High	It is important to have a solid understanding of limiting factors and how they impact populations of Wood Turtles.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	It is essential to monitor population change for this vulnerable species, consider doing so by monitoring the size and determine the sustainability of existing populations through age-class or genetic analysis.
Monitoring	Habitat Change	High	Since habitat loss/change affects the resilience of Wood Turtle populations, it is important to monitor habitat change.
Monitoring	Range Shifts	High	The Herp Atlas has provided a pretty good base line of Wood Turtle distribution by township. Failure to detect Wood Turtles in these same townships in the future will be cause for alarm.
Monitoring	Monitor Threats	High	Road mortality, collection, and nest success should be monitored

Common Name: **Wood Turtle**
Scientific Name: **Clemmys insculpta**
Species Group: **Herp**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use		Encourage holding off field mowing until October in wood turtle habitat or setting mowing bar at 6 inches or higher	number of areas adhering to mowing guidance	Corps of Engineers, WHIP/LIP biologists	Corps of Engineers, WHIP
Compatible Resource Use		Encourage land-use practices on private lands that continue to allow the wood turtle to maintain itself in Vermont.	Number of enrolled landowners	FPR, WHIP, LIP, USFWS, private landowners	Current Use Program, WHIP, LIP, Partners in Wildlife
Easements		Conserve known habitat through fee simple purchase, development rights or easements, management agreements, and education of private landowners and managers regarding appropriate management.	Number of sites protected	VLT, local land trust, towns	VHCB
Compatible Resource Use		Direct trail development away from streams to avoid impacts to wood turtle populations.	Number of trails sited in a way to avoid impacts	recreation planners, developers, regulators	private grants, SWG, Nongame Wildlife Fund, Technical Assistance
Habitat Restoration		Develop, implement, and monitor, road crossing structures and barriers for this species.	Effectiveness of crossing structures.	VTrans	VTrans, Federal Highway Admin
Easements		Use conservation easements to protect suitable habitat on privately owned land.	Number of sites protected	VLT, local land trusts	VHCB, private funds
Species Restoration		If populations limited, consider reintroduction or augmentation from closest healthy source. Maintaining and enhancing extant populations is always a priority and should be continued.	Number of reintroduced or augmented populations	Landowners, Corps of Engineers, SAG-Herps	SWG
Awareness Raising and Communications		Encourage reports of sightings to the Vermont Nongame and Natural Heritage Program and the Vermont Reptile and Amphibian Atlas Project	Number of reports	Herp Atlas Project	Nongame Wildlife Fund
Planning & Zoning		Include wood turtle habitat in town zoning to limit impacts from development	Number of towns considering wood turtle habitat in zoning	Conservation Commissions, League of Cities and Towns	SWG

Common Name: **Wood Turtle**
Scientific Name: **Clemmys insculpta**
Species Group: **Herp**

Standards	Develop land management guidelines for owners and managers of appropriate habitat and make them readily available through multiple media, including print and the web	Number of landowners and managers who receive and use guidelines	Herp Atlas, WHIP/LIP biologists	SWG, WHIP, LIP
Compatible Resource Use	Control ATV and other off road usage in known habitat to avoid impacts to wood turtles	Number of sites where ATV use is controlled	landowners, state and federal lands managers	state lands management funds, landowner decisions
Awareness Raising and Communications	Encourage reports of road-killed specimens, road crossing, and road basking areas to VT F&W, VTRANS, and the Vermont Reptile and Amphibian Atlas Project.	Number of reports	VTrans, Herp Atlas Project	VTrans
Compatible Resource Use	Site new roads 1000' away from wood turtle streams and avoid parallel roads.	Number of new roads sited away from streams	VTrans	VTrans
Publically-Owned Protected Areas	Protect suitable habitat on publicly owned land.	Number of sites on public land	ANR, TNC, USFS	state lands management funds, TNC, GMNF

Common Name: **Wood Turtle**
Scientific Name: **Clemmys insculpta**
Species Group: **Herp**

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Common Name: **Common Musk Turtle (Stinkpot)**
Scientific Name: **Sternotherus odoratus**
Species Group: **Herp**

Conservation Assessment:

Final Assessment: Medium Priority

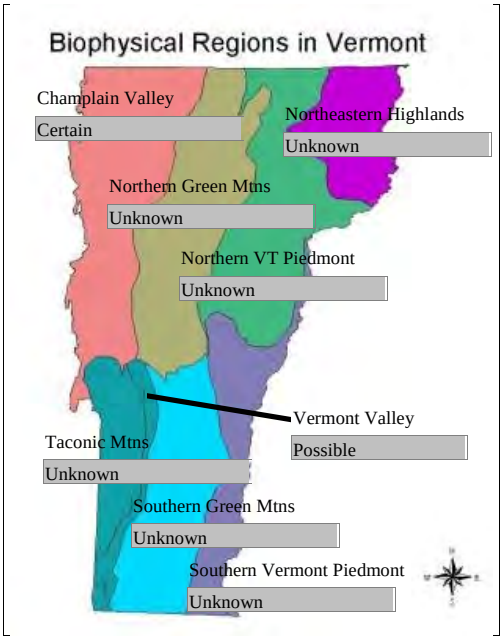
Global Rank: G5 **Global Trend:**
State Rank: S2 **State Trend:**
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

The musk turtle is only recorded from the Champlain Valley of Vermont in about ten townships. It is small with limited dispersal capabilities. Water chestnut control harvesting is a potential limiting factor to this species.

This species might be impacted by shoreline development that leads to loss of aquatic vegetation and suitable nesting sites (Harding 1997). In Vermont, ANR staff involved in water chestnut harvesting are aware of the potential to impact musk turtles that might be collected with the vegetation, and operate the harvester slowly and are on the lookout for turtles.

Distribution:



Natural History Elements:

Home Range: <1 ha
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Musk turtle reports are clustered in Colchester-Milton-Grand Isle, Ferrisburgh, and West Haven, Benson, Orwell, Castleton, Hubbarton, Sudbury

Known Watersheds

Lake Champlain Direct

Possible Watersheds

Lake Champlain Canal

Otter Creek

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Shallow permanent water of lakes and large ponds with aquatic vegetation, and large slow rivers.

Common Name: **Common Musk Turtle (Stinkpot)**
Scientific Name: **Sternotherus odoratus**
Species Group: **Herp**

General Habitat Preferences:

Minimum Elevation (m): 30
Maximum Elevation (m): 60
Patch Size Requirements: > 10 ha
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☐
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lacustrine
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Man-Made Water Bodies
Marshes and Sedge Meadows
Shrub Swamps

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Description of habitat problem(s): Development of shoreline that impacts nesting sites and aquatic vegetation

Non-Habitat Problems:

Trampling or Direct Impacts

Description of non-habitat problem(s): Mechanical harvesting of water chestnut. Literature suggests anglers sometimes persecute. Might be subject to some collection as pets but have little knowledge of this.

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	Medium	Gather data on specific habitat requirements of Vermont populations: nesting sites, foraging areas, over wintering sites.
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	Conduct statewide survey of musk turtle in Vermont. Identify distribution and relative abundance of populations in Vermont.
Research	Threats and Their Significance	Medium	Consider impacts of chestnut harvesting and shoreline development.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	Once baseline is established it would be helpful to monitor population over time.
Monitoring	Habitat Change	High	It would be good to detect habitat change while there is still time to act.
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	High	

Common Name: **Common Musk Turtle (Stinkpot)**
Scientific Name: **Sternotherus odoratus**
Species Group: **Herp**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Technical Assistance, Training, Learning Networks		Encourage observation and rescue of stinkpots removed from lakes by mechanical weed harvesting. Develop a training program to train weed harvesters how to do this.	Number of harvest operations that properly screen for turtles	DEC Water Chestnut Program, Municipalities that manage aquatic weeds, lake association	compliance not funding
Standards		Develop land and water management guidelines for owners and managers of appropriate habitat and make them readily available through multiple media, including print and the web	Number of owners and managers who receive information	ECHO Leahy Center for Lake Champlain	Lake Champlain Basin Program
Awareness Raising and Communications		Encourage reports of sightings to the Vermont Nongame and Natural Heritage Program and the Vermont Reptile and Amphibian Atlas Project	Number of reports received	Herp Atlas	Nongame Wildlife Fund

Common Name: **Common Musk Turtle (Stinkpot)**
Scientific Name: **Sternotherus odoratus**
Species Group: **Herp**

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Hunter, M.L., A. Calhoun, and M. McCullough (eds.). 1999. Maine amphibians and reptiles. The University of Maine Press, Orono, Maine 272 pp.

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Common Name: **Spiny Softshell (Turtle)**
Scientific Name: **Apalone spinifera**
Species Group: **Herp**

Conservation Assessment:

Final Assessment: High Priority

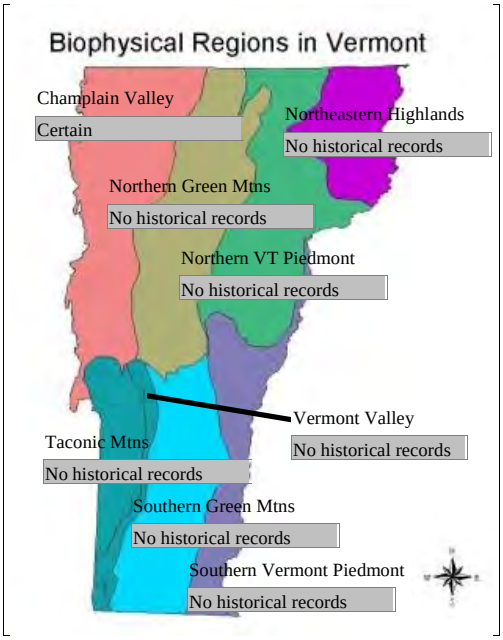
Global Rank: G5 **Global Trend:**
State Rank: S1 **State Trend:** Declining
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

The Spiny Softshell Turtle is restricted to Lake Champlain in VT and PQ, and is not found elsewhere in New England. It is not known from the NY side of Lake Champlain. All other historical locations in Quebec have been lost and the Winooski River population in Vermont has been lost. Shoreline development has limited nesting and basking areas for this species

The Softshell is a very strong swimmer, but it is restricted to habitats in or near Lake Champlain and is unlikely to gain immigrants from outside Lake Champlain. Habitat loss due to succession is also a problem for this species, but can be corrected with vegetative management and natural processess such as ice scour of nesting beaches. Increasing lake use is limiting this species directly by boat strikes and limiting habitat through lakeshore development, especially sea walls and riprap. Human disturbances limit basking and can chase nesting females away from nesting beaches. Egg predator populations are abnormally high due to lack of larger predators and trapping pressure, and are subsidized by humans in the form of increased food supplies (garbage, pet food, corn).

Distribution:



Natural History Elements:

Home Range: < 100 ha
Migrant? No

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The Softshell is currently restricted to Missisquoi Bay and surrounding areas of shore and lower reaches of rivers and creeks from Pike River to St. Alban's Bay and a smaller subpopulation is associated with the lower Lamoille River and surrounding lake.

Known Watersheds

Lake Champlain Direct

Common Name: **Spiny Softshell (Turtle)**
Scientific Name: **Apalone spinifera**
Species Group: **Herp**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☐ General Literature ☐

The Spiny Softshell Turtle is a highly aquatic species inhabiting lakes, larger rivers, and associated wetlands. It utilizes logs, shorelines, and even artificial structures for basking as long as they receive sufficient solar radiation and are relatively free of disturbance. Wetlands are used in the spring for foraging. Softshells bask aerially and in shallow water.

General Habitat Preferences:

Minimum Elevation (m):	28
Maximum Elevation (m):	32
Patch Size Requirements:	
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☐
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lacustrine

Aquatic: Lake Champlain

Aquatic: Large Lake Champlain Tribs Below Falls

Marshes and Sedge Meadows

Shrub Swamps

Upland Shores

Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Habitat Succession

Inadequate Disturbance Regime

Description of habitat problem(s): Shoreline development is the biggest habitat problem. Both nesting and basking substrate is lost. Natural processes that create and clear nesting areas along shoreline are now impaired. Dams can cut off upstream populations or even divide populations. Marinas or other deep water development can impact hibernacula.

Non-Habitat Problems:

Pollution

Predation or Herbivory

Trampling or Direct Impacts

Description of non-habitat problem(s): Softshell Turtles are subject to intense nest predation due to high levels of nest predators and concentrated nesting in a few locations. The nesting sites are impacted by human disturbance during nesting by shoreline and water recreation and nearby camps. Activity on nesting beaches can directly impact eggs and we have documented one case of equipment being driven over nests

Common Name: **Spiny Softshell (Turtle)**
Scientific Name: **Apalone spinifera**
Species Group: **Herp**

and causing damage. Human disturbance limits basking opportunities and duration. Polution may have played a role in the decline of the Winooski River population and there remains concern about contaminants in Lake Champlain and possible impacts from toxic blue-green algal booms.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	1) Determine feasibility of a Winooski River softshell population restoration. 2) Conduct habitat surveys and assessments that provide useful information about distribution, quality, and level of disturbance by humans.
Research	Basic Life History	Low	1) Continue to conduct studies that monitor individuals via radio-tagging in an effort to document habitat utilization and movements between those habitats among seasons and years. Movements of radio-tagged individuals will aid in our understanding of the extent of interchange between populations. 2) Develop emergence estimates based on the number of hatchlings produced from each nest, through either direct observation or the counting of eggshell fragments. 3) Nest success can be documented by monitoring nests and calculating the proportion of nests that successfully hatch young by the end of the nesting season.
Research	Distribution and Abundance	Medium	Have a pretty good handle on adults but not on juveniles. Document that recruitment of young into the breeding population is occurring.
Research	Threats and Their Significance	High	1) Assess recovered dead specimens for size, weight, length, age estimate, sex, and the cause of death determined. 2) Employ tracking boards and camera sets to determine what species are predating a nesting site. 3) Investigate sensitivity to environmental contaminants.
Research	Population Genetics	Medium	Investigate if Lake Champlain softshells are genetically distinct as there is interest in the uniqueness of Lake Champlain turtle population.
Research	Other Research	High	All individuals captured for research should be measured, age estimated, sexed, and possibly marked via pit tags which would provide long-term information
Monitoring	Population Change	High	Consider the use of genetic methods for investigating populations.
Monitoring	Habitat Change	High	
Monitoring	Range Shifts	High	
Monitoring	Monitor Threats	High	

Common Name: **Spiny Softshell (Turtle)**
Scientific Name: **Apalone spinifera**
Species Group: **Herp**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications		Develop and place brochures [what kind of brochures?] at fishing license agents, marinas, fishing derbies, and State parks and camping areas.	Brochures distributed	state parks, VFWD Outreach Div.	Marketing funds, Nongame Wildlife Fund
Awareness Raising and Communications		A softshell turtle reporting program that encourages the public to document softshell sightings should be part of the overall public outreach effort for this species.	Number of reports received	Herp Atlas project	Nongame Wildlife Fund
Species Restoration		Basking habitat could be created via floating platforms or permanent structures	Number of sites benefiting from basking structures	Normandeau Inc	VTrans bridge project
Market Forces		Develop an incentives program for diary farmers to halt the access and trampling of sandy shorelines by cows (i.e., provide farmers with large water tanks and electric fencing).	Number of sites were livestock trampling of shoreline controlled	NRCS, Farm Bureau	NRCS
Species Restoration		Employ mammalian predator trapping programs at nesting beaches that exhibit a relatively high concentration of nests to reduce the number of nests predated	Number of predators removed	USDA Wildlife Services	SWG
Species Restoration		Consider headstarting young if their survival in the nest is compromised	Number of young salvaged	ECHO Center for Lake Champlain, Ecomuseum (Montreal)	volunteer effort
Species Restoration		Removing debris and large rocks, provide sand-shale substrate, trim or remove shading brush, and dig out encroaching vegetation in old shale deposits at nesting beaches.	Area improved for nesting	volunteers, Audubon Vermont, UVM students	volunteer time
Alliance Development		Collaborate with other American and Canadian investigators, organizations, and agencies.	Number of interactions with partners	Société de la faune et des parcs du Québec, Société d'Histoire Naturelle de la Vallée du St-Laurent	
Species Restoration		Explore other deterrents such as fencing (chain link/floppy), electric wire, discouraging winter denning near nesting sites, night shooting, and night patrols with a trained dog to lessen predation	Number of sites where alternative methods employed	USDA Wildlife Services	SWG

Common Name: **Spiny Softshell (Turtle)**
Scientific Name: **Apalone spinifera**
Species Group: **Herp**

Awareness Raising and Communications	Incorporate softshells into existing Vermont Agency of Natural Resources fish and wildlife publications (i.e., law digest and fishing guide).	Number of times message is carried in ANR publications	VFWD outreach division and commissioner	marketing funds
Species Restoration	Consider recruiting volunteers to monitor potential nesting sites during the nesting season in an effort to identify previously undocumented nesting sites.	Number of trained volunteers and hours expended	Lake Champlain Land Trust, Audubon Vermont	volunteer effort
Awareness Raising and Communications	Develop and place signage along important habitat areas	Number of sites with signage	USDA Wildlife Service, State Parks staff	SWG, Nongame Wildlife Fund
Technical Assistance, Training, Learning Networks	Encourage softshell habitat landowners to become monitors and land stewards of that habitat for the purpose of softshell conservation.	Numbers of cooperating landowners	Lake Champlain Land Trust	Lake Champlain Land Trust, Nongame Wildlife Fund
Compliance & Enforcement	Protect nesting beaches from human disturbance during nesting season via on and offshore signage, law enforcement, and, if appropriate, visual screens.	Number of sites managed.	USDA Wildlife Service, game wardens	SWG
Compliance & Enforcement	Protect high-use basking areas from human disturbance via on and offshore signage and law enforcement.	Number of sites with signage and patrol	VFWD Outreach Div., game wardens	Nongame Wildlife Funds
Species Restoration	Trap nesting areas that exhibit a relatively high concentration of nests in an effort to reduce the number of predated nests.	Number of areas trapped	USDA Wildlife Services	SWG
Species Restoration	When feasible, nests will be protected via ½" x ½" hardware cloth or vinyl-coated wire mesh cages by state and federal biologists in an effort to reduce the number of depredated nests.	Number of successful nests protected	USDA Wildlife Services	SWG
Awareness Raising and Communications	Organize workshops at boat-ramps to educate anglers on turtle identification and fishing hook removal.	Number of workshops held and numbers of people who attend.	angler organizations, Lake Champlain Committee	LCI
Compliance & Enforcement	Identify areas that provide critical foraging habitat, particularly for juveniles, and protect vulnerable areas from human disturbance via on and offshore signage and law enforcement if the areas are reasonably small and identifiable.	Number of areas documented	The Nature Conservancy of Canada, Normandeau Associates	VTrans bridge monitoring
Compliance & Enforcement	Develop and maintain internal communications with law enforcement and biologists to build awareness and support for turtle protection	Number/frequency of exchanges of information.	Game wardens, fisheries biologists	SWG, Nongame Wildlife Fund

Common Name: **Spiny Softshell (Turtle)**
Scientific Name: **Apalone spinifera**
Species Group: **Herp**

Technical Assistance, Training, Learning Networks	Inform state biologists of potential problem for hibernacula (e.g., potential marina development) and take appropriate actions when a hibernaculum's physical characteristics and/or hibernating individuals are limited.	Number of actions taken to protect turtles and their habitat.	Act 250 coordinator, game warden, Missisquoi National Wildlife Refuge	
Habitat Restoration	When feasible, basking areas will be enhanced via natural (e.g., tree limbs and trunks) structures in an effort to increase basking surface area.	Number of basking areas	Missisquoi National Wildlife Refuge	refuge operating budget
Species Restoration	Protect known habitats from disturbance: nesting, wintering, basking, foraging.	Number of sites protected	Missisquoi National Wildlife Refuge, Société de la faune et des parcs du Québec, The Nature Conservancy of Canada, FPR, VFWD	Lake Champlain Management funds, Lake Champlain Basin Program funds, SWG
Species Restoration	Create nesting habitat in suitable areas close to water	Number of created nesting area	Corps of Engineers, Missisquoi National Wildlife Refuge	SWG
Compliance & Enforcement	Further develop program by which softshell sightings and/or harassment can be reported to Vermont's Nongame and Natural Heritage Program.	Number of reports received	Herp Atlas	Nongame Wildlife Fund
Policy & Regulations	Explore and implement legal protection to benefit the softshell turtle, including the establishment of a legal means of designating and protecting habitats critical for softshells, both on land and water	Number of legal tools provided	Game wardens	state general revenues
Publically-Owned Protected Areas	Pursue acquisition of those areas identified as important for maintaining and enhancing spiny softshell turtles.	Number of sites and acreage conserved	Lake Champlain Land Trust, Nature Conservancy of Canada	VHCB funds
Awareness Raising and Communications	Develop and distribute information to landowners of current and potential riverine and lakeside softshell habitat.	Numbers of landowners/camp owners contacted	Lake Champlain Land Trust	Lake Champlain Land Trust, Nongame Wildlife Fund

Common Name: **Spiny Softshell (Turtle)**
Scientific Name: **Apalone spinifera**
Species Group: **Herp**

Compliance & Enforcement	Monitor hibernacula when softshells have congregated (September – May) to ensure disturbance is minimal.	Frequency of monitoring	Société de la faune et des parcs du Québec	Québec grant
Awareness Raising and Communications	Recruit local volunteers for the purpose of monitoring nesting beaches and increasing the general public's awareness of Lake Champlain spiny softshells	Number of volunteers and effort expended	Audubon Vermont	Nongame Wildlife Fund, Audubon Vermont secured grants
Habitat Restoration	Improve water quality in Lake Champlain by reducing sources of existing pollution and prevent future pollution impacts.	Improvements in water quality	DEC, farmers, municipalities	Clean and Clear Program

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Andrews, J. 2001. The Vermont Reptile and Amphibian Atlas. http://cat.middlebury.edu/herpatlas/

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Klemens, M. (ed.) 2000. Turtle conservation. Smithsonian Institution Press. Washington 334 pp. (A current discussion of conservation challenges.)

Wells, D. and S. Parren 2004 (draft) Vermont Spiny Softshell Turtle Recovery Plan (draft)

Common Name: **Five-lined Skink**
Scientific Name: **Eumeces fasciatus**
Species Group: **Herp**

Conservation Assessment:

Final Assessment: High Priority

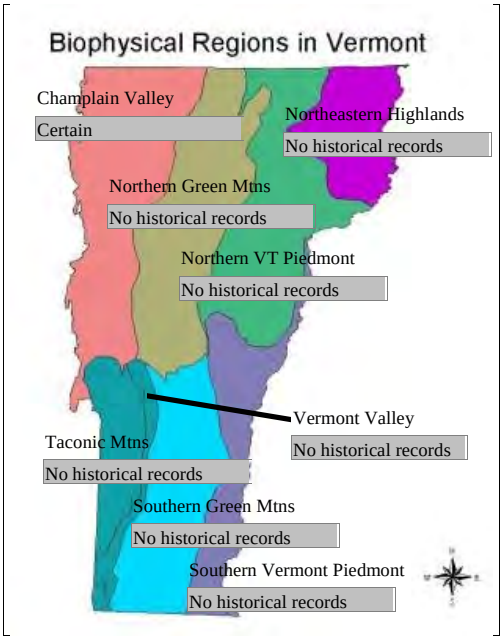
Global Rank: G5 **Global Trend:**
State Rank: S1 **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

The Five-lined Skink is an S1, state-endangered species, that is known from only three locations in West Haven, VT.

All Five-lined Skink sites in Vermont feature talus and exposed rock within a mile of Lake Champlain. Total records of individual sightings are fewer than 40. We have almost no data on their abundance and natural history in VT. We would benefit from data on distribution, behavior, seasonal movements, egg-laying sites, predators, food, population size, and microhabitat requirements.

Distribution:



Natural History Elements:

Home Range: <1 ha
Migrant? No

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The Five-lined Skink is known from three locations in West Haven, VT.

Known Watersheds

Lake Champlain Canal

Lake Champlain Direct

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

The Five-lined Skink is known currently only on talus slopes and nearby cliff faces, exposed rocky ridges, and rocky shorelines. The ridges are composed off a mixture of ledge, broken rock, and scattered juniper or hardwoods, All known sites have a south or southwestern exposure, low elevation, nearby water, and relatively warm climates for Vermont. Anecdotal historic reports mention the use of exposed faces of old buildings near

Common Name: **Five-lined Skink**
Scientific Name: **Eumeces fasciatus**
Species Group: **Herp**

the above habitat and old mining areas.

General Habitat Preferences:

Minimum Elevation (m):	30
Maximum Elevation (m):	300
Patch Size Requirements:	> 100 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Building or Structure

Cliffs and Talus

Oak-Pine Northern Hardwood

Other Cultural

Outcrops and Alpine

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Habitat Fragmentation

Habitat Succession

Impacts of Roads or Trails

Description of habitat problem(s): Five-lined Skinks need solar exposure, rock slides and fire may play a roll in keeping talus and ledges exposed. Development of lake-shore areas where the skink is found, removal of coarse woody debris, and introduction of cats could prove to eliminate local populations.

Skinks may move from denning sites on talus to feeding areas nearby. Short-distance seasonal movements seem likely. They do not seem to move across open field but rather short distances from talus to cliff, ridge, field edge, or lake-shore. Moderate traffic and wide roads could limit movements.

Future sources of coarse woody debris need to be maintained (old snags, large dead trees, etc.)

Non-Habitat Problems:

Genetics

Loss of Prey Base

Predation or Herbivory

Trampling or Direct Impacts

Description of non-habitat problem(s): Genetic isolation of populations could be a problem. Predation by cats or other introduced or subsidized predators could be a problem. Insecticide use could impact their prey base. When cold, lizards move slowly. Excessive trampling (intensive agricultural, residential, or recreational use could be a problem). Sites may have become isolated by large agricultural fields. Continuous sunny and rocky edge habitat seems to connect one large meta-population (Bald Mountain, Austin Hill, and adjacent rocky shorelines and talus slopes). The other known location (Dresden Narrows) may be isolated.

Common Name: **Five-lined Skink**
Scientific Name: **Eumeces fasciatus**
Species Group: **Herp**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	1) Gather data on specific habitat requirements of Vermont populations: denning sites, egg-laying sites, foraging areas, and movement corridors. 2) Identify critical habitat that includes basking sites.
Research	Basic Life History	Medium	
Research	Distribution and Abundance	High	1) Determine distribution and abundance in Vermont. 2) Survey anthropogenic sites such as old mines and talus piles in western Rutland County for this species. 3) Identify appropriate habitat in Western Rutland and Addison Counties from maps, photos, and aerial surveys, and ground survey and interview in likely areas for additional populations. 4) Survey all areas from which reports have originated in the last twenty years. 5) Learn population sizes, food requirements, egg-laying locations, annual range, and other important natural history information that can be used to better protect and/or enhance habitat.
Research	Threats and Their Significance	High	
Research	Population Genetics	Low	
Monitoring	Population Change	High	Monitor the size and determine the sustainability of existing populations through age-class or genetic analysis.
Monitoring	Habitat Change	High	
Monitoring	Range Shifts	Medium	
Monitoring	Monitor Threats	High	

Common Name: **Five-lined Skink**
Scientific Name: **Eumeces fasciatus**
Species Group: **Herp**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Technical Assistance, Training, Learning Networks		Train Rattlesnake and Ratsnake wardens and researchers to keep data on the sightings and habits of this species.	Number of cooperators who gather information on skinks	game wardens, volunteers	volunteer
Standards		Develop land management guidelines for owners and managers of appropriate habitat and make them readily available through multiple media, including print and the web.	Number of landowners and mangers who receive and use guidelines	VFWD district biologists, consulting foresters	SWG
Awareness Raising and Communications		Encourage reports of sightings to the Vermont Nongame and Natural Heritage Program and the Vermont Reptile and Amphibian Atlas Project.	Number of reports received	Vermont Reptile and Amphibian Atlas Project	private grant, Nongame Wildlife Fund
Awareness Raising and Communications		Help Vermonters assign value to this species through educational programs, printed material, web site information, field trips, TV and video information.	Number of people who receive message.	VFWD Outreach Division	marketing funds
Easements		Conserve known habitat through fee simple purchase, development rights or easements, management agreements and education of private landowners and managers regarding appropriate management.	Number of sites and acreage conserved.	TNC, VLT	VHCB funds
Awareness Raising and Communications		Encourage reports of sightings to the Vermont Nongame and Natural Heritage Program and the Vermont Reptile and Amphibian Atlas.	Number of reports received	Vermont Reptile and Amphibian Atlas Project	Private grants, Nongame Wildlife Fund
Species Restoration		Work to maintain connectivity with populations to the west in New York State and between the two known populations.	Quality and quantity of connecting habitat	New York DEC, TNC, VLT	VHCB funds
Habitat Restoration		Experiment with habitat enhancement such as creating small openings in heavily shaded areas along the top of cliffs and talus slopes, dropping logs onto the talus, maintaining coarse woody debris and scattered cover.	Number of sites with active management that have been monitored	TNC	TNC
Alliance Development		Continue to work cooperatively with important landowners such as the Nature Conservancy. Develop and maintain allies in local government and private citizens.	Number of joint meetings with partners	TNC, landowners	various
Compatible Resource Use		Manage ATV and other off road usage in known habitat to avoid impacts	Number of sites where ATV use is controlled	Landowners, TNC, Game Wardens	land management funds

Common Name: **Five-lined Skink**
Scientific Name: **Eumeces fasciatus**
Species Group: **Herp**

Awareness Raising and Communications	Encourage reports of road-killed specimens, road crossing, and road basking areas to VT F&W, VTRANS, and the Vermont Reptile and Amphibian Atlas Project.	Number of sites reported	VTrans, Herp Atlas, volunteers	VTrans
Species Restoration	If local populations are determined to be unsustainable, consider reintroduction or augmentation from closest healthy source. Maintaining and enhancing extant populations is always a priority and should be continued.	Number of extant sites	TNC, NYDEC	Private grant, SWG
Awareness Raising and Communications	Keep cats away from known habitat.	Number of areas fenced or otherwise protected	landowners, TNC	TNC

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Common Name: **Eastern Racer**
Scientific Name: **Coluber constrictor**
Species Group: **Herp**

Conservation Assessment:

Final Assessment: High Priority

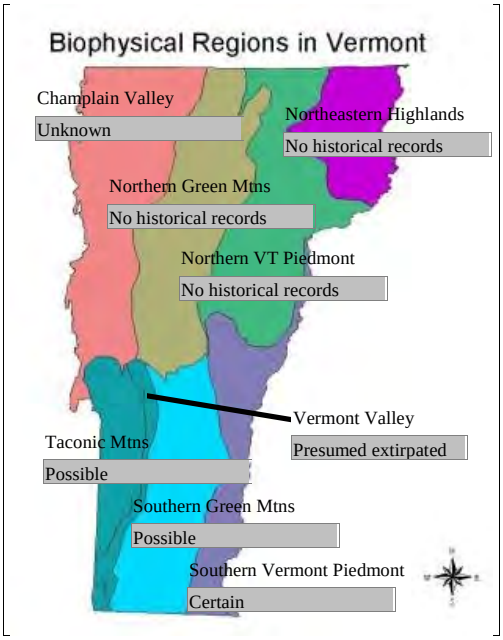
Global Rank: G5 **Global Trend:**
State Rank: S1 **State Trend:**
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

The Eastern Racer is currently known from only one site in Vermont. It had not been documented in Vermont since 1985 and had been feared extirpated until relocated in 2003. It is an S1 species proposed for state-threatened status.

Anecdotal historic reports in the southern Connecticut River Valley and on nearby ridges repeatedly speak of an Eastern Racer that was commonly seen twenty-five or more years ago, but it has not been seen in recent years. Habitat loss due to succession is likely negatively affecting this species.

Distribution:



Natural History Elements:

Home Range: > 1000 ha
Migrant? No

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The currently known distribution of the Eastern Racer is a small area of SE Vermont. Its distribution prior to 1985 was somewhat more widespread but still fairly localized in southern Vermont.

Known Watersheds

CT-Ashuelot River

Deerfield. MA-VT

Possible Watersheds

CT-Bellows Falls Dam to Vernon Dam

CT-White River to Bellows Falls

Hudson-Hoosic Rivers

Lake Champlain Canal

Lake Champlain Direct

Otter Creek

Common Name: **Eastern Racer**
Scientific Name: **Coluber constrictor**
Species Group: **Herp**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

The only known population of the Eastern Racer in Vermont uses early successional open ledge, grass, fern, and other herbaceous cover exclusively during the summer. It does move through short (30m) sections of woodlands between patches. It may move larger distances through woodlands to denning sites. It is known to den along ledges with talus slopes and exposed rock in other northern locations. One denning site in Vermont has been located.

General Habitat Preferences:

Minimum Elevation (m):	30
Maximum Elevation (m):	400
Patch Size Requirements:	> 1000 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Cliffs and Talus

Early Succession Upland Oak

Grasslands and Hedgerows

Outcrops and Alpine

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Habitat Succession

Impacts of Roads or Trails

Description of habitat problem(s): This species probably expanded in numbers as Vermont was cleared. Open pasture, fields mowed by hand or horse, or fields not mechanically baled probably provided expanded habitat. Loss of early successional habitat, increased row cropping, and increasing speed and mechanization of cutting and bailing are believed to have limited appropriate habitat.

Non-Habitat Problems:

Genetics

Reproductive Traits

Trampling or Direct Impacts

Description of non-habitat problem(s): Isolation of appropriate habitat patches may have led to genetic isolation. Increasing mechanization and speed of mowing and bailing causes direct mortality. Increasing road-building and traffic flow cause mortality and isolate populations. A mowed lawn does not support prey

Common Name: **Eastern Racer**
Scientific Name: **Coluber constrictor**
Species Group: **Herp**

base or provide adequate cover. Increasing ATV use in rural areas is a direct problem. Direct persecution from encounters with humans and possibly dogs needs to be addressed. This is a long-lived species. Survival of breeding adults is therefore very important to the maintenance of populations.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	While the general habitat requirements of the Eastern Racer are known from the literature, we do not have a full understanding of habitat utilization in Vermont, which is important for its conservation. Gather data on specific habitat requirements of Vermont populations: denning sites, egg-laying sites, foraging areas, and movement corridors.
Research	Distribution and Abundance	High	1) Survey all areas from which reports have originated in the last twenty years. 2) Survey for additional populations. Follow up on leads. Identify distribution and relative abundance of populations. Look for and examine any evidence of populations in Rutland and Bennington Counties. 3) Identify appropriate habitat in southeastern Vermont from maps, photos, aerial surveys, and ground survey and interviews in likely areas for additional populations.
Research	Threats and Their Significance	High	
Monitoring	Population Change	High	Monitor the size and determine the sustainability of existing populations through age-class or genetic analysis.
Monitoring	Habitat Change	High	
Monitoring	Monitor Threats	High	

Common Name: **Eastern Racer**
Scientific Name: **Coluber constrictor**
Species Group: **Herp**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration		Maintain and create early successional habitat in a way that is safe for this species. Create or enhance denning, basking, or egg-laying habitat if limited. Educate private landowners about maintaining habitat in a snake friendly manner.	Number of acres and specific sites maintained or enhanced.	VELCO, local landowners, VFWD district biologists, VTrans	VELCO operating funds, VFWD state lands management funds, VTrans funds
Alliance Development	Medium	Continue to work cooperatively with organizations and individuals in southeastern Vermont. Develop and maintain allies	Number of partners	Bonnyvale Environmental Center, local conservation commission, landowners, consulting foresters, VTrans, Herp Atlas	
Awareness Raising and Communications		Educate landowners in area about snakes in general and encourage coexistence with snakes. Inform them about the identification, natural history, and conservation problems and needs of this species.	Number of people who receive message	VFWD Outreach Division	marketing funds
Species Restoration		If local populations are determined to be unsustainable, consider reintroduction or augmentation from closest healthy source. Maintaining and enhancing extant populations is always a priority and should be continued.	Number of extant populations	Mass Fish and Wildlife	SWG
Planning & Zoning		Review all roadway projects in appropriate habitat, check against known crossing areas VTRANS, VT F&W, HERP Atlas, survey appropriate habitat when unknown.	Number of projects that utilize racer information	VTrans, Herp Atlas	Federal Highway funds
Awareness Raising and Communications	Medium	Encourage reports of sightings to the Vermont Nongame and Natural Heritage Program and the Vermont Reptile and Amphibian Atlas Project	Number of reports received	Herp Atlas	Nongame Wildlife Fund
Standards		Develop land management guidelines for owners and managers of appropriate habitat and make them readily available through multiple media, including print and the web	Number of managers and landowners who receive message.	Consulting foresters, VELCO, VTrans	SWG

Common Name: **Eastern Racer**
Scientific Name: **Coluber constrictor**
Species Group: **Herp**

Technical Assistance, Training, Learning Networks	Establish a web site with conservation information on this species and trained local contacts who can relocate snakes	Establishment of web site containing information on racer.	VFWD Outreach Division, VTrans, Bonnyvale Environmental Center, Herp Atlas	VTrans, VFWD marketing funds
Habitat Restoration	Develop, implement, and monitor, road crossing structures and barriers for this species	Number of structures installed.	VTrans	Federal Highway funds
Easements	Conserve know habitat through fee simple purchase, development rights or easements, management agreements, and education of private landowners and managers regarding appropriate management.	Number of areas conserved.	consulting foresters, landowners, Vermont Land Trust, local land trusts	VHCB funds
Species Restoration	Work to maintain connectivity with populations to the south in Massachusetts	Maintenance of connectivity	VTrans, VFWD, Mass Highway Dept.	Federal Highway funds
Awareness Raising and Communications	Encourage reports of road-killed specimens, road crossing, and road basking areas to VT F&W, VTRANS, and the Vermont Reptile and Amphibian Atlas Project.	Number of reports received	VTrans, Herp Atlas	Nongame Wildlife Fund
Awareness Raising and Communications	Help Vermonters assign value to this species through educational programs, printed material, web site information, field trips, TV and video information.	Number of people who received message	VFWD Outreach Division	Nongame Wildlife Fund
Compatible Resource Use	Manage ATV and other off road usage in know habitat to avoid impacts	Number of areas where ATV use is controlled	Landowners, VELCO, VTrans	VELCO, VTrans
Awareness Raising and Communications	Quickly and thoroughly, counter myths and misinformation appearing in the press that may limit this species	Number of press articles. Numbers of individuals who received message	Bonnyvale Environmental Center, Herp Atlas	Private funds and grants

Common Name: **Eastern Racer**
Scientific Name: **Coluber constrictor**
Species Group: **Herp**

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Common Name: **Eastern Rat Snake**
Scientific Name: **Elaphe obsoleta**
Species Group: **Herp**

Conservation Assessment:

Final Assessment: High Priority

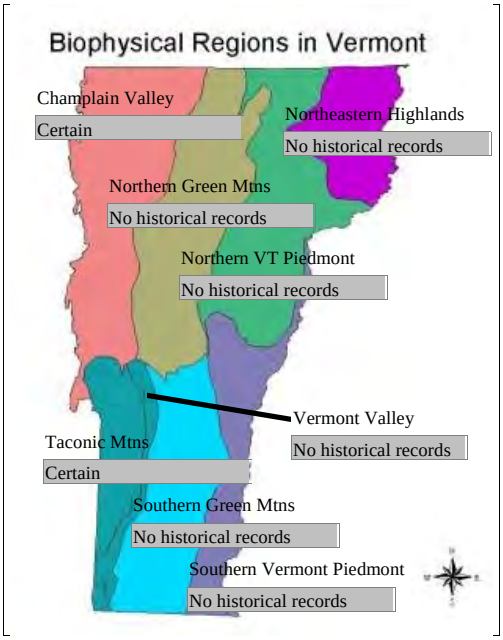
Global Rank: G5 **Global Trend:**
State Rank: S2 **State Trend:**
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

The Eastern Ratsnake is a S2 species that has been proposed for the status of state-threatened.

Development, habitat fragmentation, road mortality, and direct persecution limit both Ratsnake populations in Vermont.. The northern population appears to be entirely isolated. Anecdotal reports strongly suggest that both populations are declining.

Distribution:



Natural History Elements:

Home Range: < 100 ha
Migrant? No

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The Eastern Ratsnake is known from only two regions of VT. One meta-population can be found in western Rutland County and extending into southwestern Addison County. The second population is very localized on the border of Monkton, Bristol, and New Haven.

Known Watersheds

Lake Champlain Canal

Lake Champlain Direct

Otter Creek

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

This species dens in rocky talus slopes and possibly in rocky woodlands and along ledges at low elevation (<400m) with a southern or southwestern exposure. From these dens individuals travel to summer foraging areas that may be interior woodlands, edges, or wetland margins. Abandoned and low use buildings may be used.

Common Name: **Eastern Rat Snake**
Scientific Name: **Elaphe obsoleta**
Species Group: **Herp**

General Habitat Preferences:

Minimum Elevation (m):	30
Maximum Elevation (m):	400
Patch Size Requirements:	> 1000 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Building or Structure

Cliffs and Talus

Early Succession Upland Oak

Grasslands and Hedgerows

Hardwood Swamps

Oak-Pine Northern Hardwood

Other Cultural

Outcrops and Alpine

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Impacts of Roads or Trails

Description of habitat problem(s): Fragmentation of habitat by roads and ATV trails, development of low-elevation woodland fragments, and barriers to safe movement between denning and foraging areas all are problems.

Non-Habitat Problems:

Genetics

Reproductive Traits

Trampling or Direct Impacts

Description of non-habitat problem(s): Some populations appear to be completely isolated, others may become so. This is a long-lived species, consequently direct persecution from humans and increased road mortality of adult breeders can outpace production. Roads attract and hold cold snakes as basking areas. Increasing road density and traffic are a problems. Increased ATV use in and near woodland fragments is known to cause mortality to snakes basking in trails. This species appears to travel up to a couple miles from denning areas, consequently it requires large habitat mosaics that are easily fragmented.

Common Name: **Eastern Rat Snake**
Scientific Name: **Elaphe obsoleta**
Species Group: **Herp**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Determine food requirements, nesting locations, foraging areas, movement corridors, annual range, and other important natural history information that can be used to better protect and/or enhance habitat.
Research	Basic Life History	Medium	
Research	Distribution and Abundance	High	1) Identify distribution and relative abundance (population sizes) of populations in Vermont. 2) Survey all areas from which reports have originated in the last ten years.
Research	Threats and Their Significance	High	.
Research	Population Genetics	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	High	
Monitoring	Range Shifts	High	
Monitoring	Monitor Threats	High	

Common Name: **Eastern Rat Snake**
Scientific Name: **Elaphe obsoleta**
Species Group: **Herp**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use		Manage ATV and other off road usage in known habitat to avoid impacts	Number of sites where ATV use is controlled	Landowners, game wardens, TNC	
Alliance Development		Continue to work cooperatively with important landowners such as the Nature Conservancy. Develop and maintain allies in local government and private citizens.	No of joint meetings held with partners.	TNC, landowners, towns	Nongame Wildlife Fund
Technical Assistance, Training, Learning Networks		Work with VTrans crew and other land managers to raise awareness of conservation need and implement conservation actions that benefit snakes.	Number of crew members who receive training	VTrans	VTrans training funding
Habitat Restoration		Develop, implement, and monitor, road crossing structures and barriers for this species	Number of structures installed	VTrans, UVM, Middlebury College	SWG
Species Restoration		Work to maintain connectivity with populations to the west in New York State and between known populations	Quantity and quality of connective habitat.	New York DEC, Vermont Land Trust, Land Champlain Land Trust	VHCB
Standards		Review all roadway projects in appropriate habitat, check against known crossing areas VTRANS, VT F&W, HERP Atlas, survey appropriate habitat when unknown	Number of projects where ratsnake information was used for planning	VTrans, Herp Atlas	VTrans, Federal Highway funds
Compatible Resource Use		Identify important denning areas and movement corridors and minimize development, clearing, road building and increased traffic in these areas. Maintain low density human use in mosaics in known areas.	Number of specific sites identified. Number of sites with compatible land use.	TNC, landowners, land managers, VTrans, town governments	SWG, TNC, VTrans
Easements		Conserve known habitat through fee simple purchase, development rights or easements, management agreements and education of private landowners and managers regarding appropriate management.	Number of sites and acreage conserved	TNC, Vermont Land Trust	VHCB funding

Common Name: **Eastern Rat Snake**
Scientific Name: **Elaphe obsoleta**
Species Group: **Herp**

Awareness Raising and Communications	Medium	Encourage reports of road-killed specimens, road crossing, and road basking areas to VT F&W, VTRANS, and the Vermont Reptile and Amphibian Atlas Project.	Number of sites reported	VTrans, Vermont Reptile and Amphibian Atlas Project.	VTrans, Federal Highway
Awareness Raising and Communications		Educate landowners and residents within the snake's range to encourage coexistence with snakes.	Number of programs and number of people who receive message.	landowners, conservation commissions	private grant
Awareness Raising and Communications		Quickly and thoroughly, counter myths and misinformation appearing in the press that may limit this species.	Number of press responses carried by media.	SAG-Herps, Herp Atlas, VFWD Outreach Div	volunteer, marketing funds
Technical Assistance, Training, Learning Networks		Maintain and support the network of trained snake relocators for this species as well as Rattlesnakes. Put information about Ratsnakes and this service on the same web site as for rattlesnake.	Number of requests for assistance.	volunteers, Vermont Reptile and Amphibian Atlas Project, TNC	volunteer
Awareness Raising and Communications	Medium	Encourage reports of sightings to the Vermont Nongame and Natural Heritage Program and the Vermont Reptile and Amphibian Atlas Project.	Number of reports received	Vermont Reptile and Amphibian Atlas Project	Nongame Wildlife Fund, private grants
Standards		Develop land management guidelines for owners and managers of appropriate habitat and make them readily available through multiple media, including print and the web.	Numbers of landowners and managers who become aware and use guidelines	VFWD district biologists, consulting foresters	SWG
Awareness Raising and Communications		Help Vermonters assign value to this species through educational programs, printed material, web site information, field trips, TV and video information.	Number of people who receive information	VFWD Outreach Division	Marketing funds
Compliance & Enforcement		Patrol denning, birthing, and basking areas regularly during key time periods when denning sites overlap with Rattlesnakes	Number of sites patrolled, frequency of patrols, number of interactions with people at critical areas.	game wardens	VFWD

Common Name: **Eastern Rat Snake**
Scientific Name: **Elaphe obsoleta**
Species Group: **Herp**

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Zug, G.R. 1993. Herpetology: an introductory biology of amphibians and reptiles. Academic Press, A Division of Harcourt Brace & Company, San Diego, California 527 pp. (A standard text.)

Common Name: **Northern Water Snake**
Scientific Name: **Nerodia sipedon**
Species Group: **Herp**

Conservation Assessment:

Final Assessment: Medium Priority

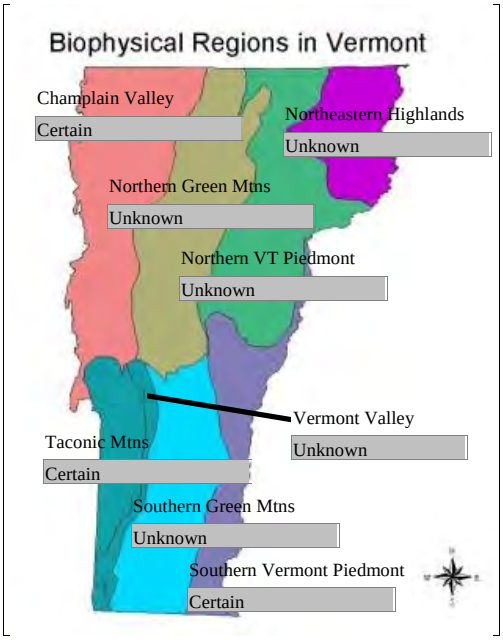
Global Rank: G5 **Global Trend:**
State Rank: S3 **State Trend:**
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

The Northern Water Snake is mainly a Champlain Valley species in Vermont, but also found in SE Vermont. This specie is relatively large and aggressive, so is sometimes killed by humans.

This species does suffer some road mortality and is purposefully killed by some. It is usually associated with large wetlands of the Champlain Valley. Shoreline development may increase negative impacts from humans. Literature suggests pollution may be a problem (Harding 1997; Hunter, Calhoun, McCollough 1999). In some locations, the Northern Water Snake can be found in large numbers (e.g., Bristol Pond)

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Watersnake is known from the Champlain Valley, Shaftsbury, and Vernon.

Known Watersheds

CT-Ashuelot River
Hudson-Hoosic Rivers
Lake Champlain Canal
Lake Champlain Direct
Mississquoi River
Otter Creek

Possible Watersheds

CT-Bellows Falls Dam to Vernon Dam
Lamoille River

Common Name: **Northern Water Snake**
Scientific Name: **Nerodia sipedon**
Species Group: **Herp**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Wetlands associated with permanent water bodies. Also used flooded meadows. Avoids deeply shaded areas (Hunter et al. 1999)

General Habitat Preferences:

Minimum Elevation (m):	30
Maximum Elevation (m):	120
Patch Size Requirements:	> 10 ha
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☐
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Lacustrine

Aquatic: Large Lake Champlain Tribs Below Falls

Aquatic: Man-Made Water Bodies

Marshes and Sedge Meadows

Shrub Swamps

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Description of habitat problem(s): Loss and conversion of wetlands and shoreline development

Non-Habitat Problems:

Pollution

Trampling or Direct Impacts

Description of non-habitat problem(s): Norther Water Snakes may be impacted by pollution of their aquatic habitat. They are sometimes persecuted by people and are run over when crossing roads.

Common Name: **Northern Water Snake**
Scientific Name: **Nerodia sipedon**
Species Group: **Herp**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	1) Identification of wintering sites would be important. 2) Gather data on specific habitat requirements of Vermont populations: denning sites, birthing sites, foraging areas, and movement corridors.
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	1) Need to develop a good baseline for this species. Identify distribution and relative abundance of populations in Vermont. 2) Target some surveys along the Connecticut River Valley
Research	Threats and Their Significance	High	1) It would be helpful to know the level of mortality due to human activity. 2) Investigate water quality and human impacts to snakes.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	Need to monitor population and distribution change in order to take action while there is still time.
Monitoring	Habitat Change	Medium	
Monitoring	Range Shifts	High	If distribution in Vermont where to change, it would be important to know.
Monitoring	Monitor Threats	High	It is important to monitor limiting factors to gauge impacts to the species.

Common Name: **Northern Water Snake**
Scientific Name: **Nerodia sipedon**
Species Group: **Herp**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use		Maintain or regain water quality in known use areas.	Maintenance or improvement in water quality	Wetlands managers, farmers, municipalities	Clean and Clear funding
Standards		Develop management guidelines for owners and managers of appropriate habitat and make them readily available through multiple media, including print and the web.	Numbers of landowners and managers who receive and use guidelines	Wetlands Managers, landowners	SWG
Compatible Resource Use		Manage ATV and other off road usage in known habitat to lessen impacts	Number of areas where ATV use is controlled	Missisquoi National Wildlife Refuge, landowners, state lands managers	Refuge management funds, State Lands management
Awareness Raising and Communications		Quickly and thoroughly, counter myths and misinformation appearing in the press that may limit this species	Number of media outlets that carry rebuttal of myths.	Herp Atlas, SAG-Herps, media, VFWD Outreach Division	Marketing funds, volunteer efforts
Species Restoration		Reexamine species status at regular intervals (no longer than every 10 years) to determine if listing is appropriate	Frequency of reviews.	SAG-Herps	volunteer effort
Policy & Regulations		Establish and maintain 100-foot buffers of natural vegetation along water bodies in known habitat	Number of sites with protected buffer habitat	landowners, wetland managers	state lands management funds, WHIP, LIP, Partners in Wildlife
Planning & Zoning		Review all roadway projects in appropriate habitat, check against known crossing areas VTRANS, VT F&W, HERP Atlas, survey appropriate habitat when unknown.	Number of projects that use water snake information for planning	VTrans	VTrans Federal Highway
Species Restoration		Protect denning areas.	Number of sites protected.	landowners, managers	LIP, WHIP
Habitat Restoration		Develop, implement, and monitor, road crossing structures and barriers for this species.	Number of structures installed	VTrans	VTrans, Federal Highway

Common Name: **Northern Water Snake**
Scientific Name: **Nerodia sipedon**
Species Group: **Herp**

Awareness Raising and Communications	Educate anglers regarding the conservation needs, habits of this species, and inform them of the protected status of this species.	Number of anglers exposed to message	VFWD Outreach Division, angler groups, refuge staff	Marketing funds
Awareness Raising and Communications	Put information about watersnakes on the web.	Number of sites with posting	Lake Champlain Committee, ECHO Leahy Center for Lake Champlain, Lake Champlain Basin Program	Lake Champlain Basin Program funds
Awareness Raising and Communications	Place informational posters at access areas where this species is known (Button Bay, Shelburne Pond, Bristol Pond, Vernon Pond).	Number of sites with signage	game wardens	Nongame Wildlife Fund
Awareness Raising and Communications	Encourage reports of sightings to the Vermont Nongame and Natural Heritage Program and the Vermont Reptile and Amphibian Atlas Project.	Number of reports received	Vermont Reptile and Amphibian Atlas Project	private grants, Nongame Wildlife Fund
Awareness Raising and Communications	Encourage reports of road-killed specimens, road crossing, and road basking areas to VT F&W, VTRANS, and the Vermont Reptile and Amphibian Atlas Project.	Number of sites reported	VTrans, Vermont Reptile and Amphibian Atlas Project	VTrans
Easements	Conserve known habitat through fee simple purchase, development rights or easements, management agreements and education of private landowners and managers regarding appropriate management	Number of sites and acreage conserved	VLT, Missisquoi National Wildlife Refuge	VHCB funds, refuge acquisition budget
Awareness Raising and Communications	Help Vermonters assign value to this species through educational programs, printed material, web site information, field trips, TV and video information.	Number of people exposed to message.	Herp Atlas, VFWD Outreach Division	marketing funds
Easements	Consider creation of basking, denning, and refuge areas (rock piles) near appropriate foraging habitat.	Number of sites created and used.	Wetland managers, refuge staff	state land management funds, refuge operating budget

Common Name: **Northern Water Snake**
Scientific Name: **Nerodia sipedon**
Species Group: **Herp**

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Zug, G.R. 1993. Herpetology: an introductory biology of amphibians and reptiles. Academic Press, A Division of Harcourt Brace & Company, San Diego, California 527 pp. (A standard text.)

Common Name: **Brown Snake**
Scientific Name: **Storeria dekayi**
Species Group: **Herp**

Conservation Assessment:

Final Assessment: Medium Priority

Global Rank: G5
State Rank: S4
Extirpated in VT? No

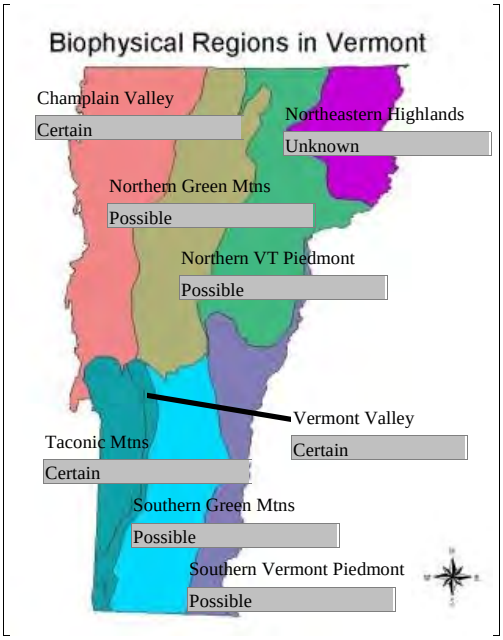
Global Trend:
State Trend: Unknown
Regionally Rare? No

Assessment Narrative:

The Dekay's Brownsnake is an S4 species in Vermont, but populations are small and highly localized.

The Brown Snake reaches its ecological limit across northern New England (Hunter et al. 1999), where it is less tolerant of disturbed sites and dependent upon habitat mosaics consisting of wetlands or riparian margins adjacent to upland forest overwintering sites.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? No

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

The Brown Snake is primarily found in the Champlain Valley, Taconics, and a few scattered records from the southern CT River Valley. It is widespread and more common in southern New England (Klemens 1993).

Known Watersheds

CT-Ashuelot River
CT-Bellows Falls Dam to Vernon Dam
CT-Waits River to White River
CT-White River to Bellows Falls
Deerfield. MA-VT
Lake Champlain Direct
Lamoille River
Otter Creek
Winooski River

Possible Watersheds

Hudson-Hoosic Rivers
Mississquoi River

Common Name: **Brown Snake**
Scientific Name: **Storeria dekayi**
Species Group: **Herp**

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Dekay's Brown Snake primarily occupies wet woods and fields, sedge meadows, seeps, and wetland or stream margins adjacent to upland forest. They are typically found under a variety of cover objects, including logs, stones, brush piles, leaf litter, etc.

General Habitat Preferences:

Minimum Elevation (m): 30
Maximum Elevation (m): 350
Patch Size Requirements: > 10 ha
Prefers large wetland complexes: ☐
Prefers large expanses of grassland habitat: ☐
Prefers habitat mosaics: ☑
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☑
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Man-Made Water Bodies
Early Succession Northern Hardwoods
Floodplain Forests
Grasslands and Hedgerows
Hardwood Swamps
Lawns, Gardens, and Row Crops
Marshes and Sedge Meadows
Northern Hardwood
Oak-Pine Northern Hardwood
Open Peatlands
Seeps and Pools
Shrub Swamps

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Impacts of Roads or Trails

Description of habitat problem(s): Any habitat conversion, alteration, or fragmentation that disrupts species' ability to move between foraging and overwintering sites may have negative effects. Road mortality can negatively impact migrating adults and dispersing juveniles, especially when located between hibernaculum and foraging habitats. In Vermont this species appears less tolerant of disturbed habitats than in southern New England near the core of its range.

Non-Habitat Problems:

Trampling or Direct Impacts

Description of non-habitat problem(s): This species often occurs in close proximity to humans, and its distribution is primarily in a region of the state that continues to see significant development pressure.

Common Name: **Brown Snake**
Scientific Name: **Storeria dekayi**
Species Group: **Herp**

Fragmentation of suitable habitats by roads or other non-permeable development may result in loss of metapopulation structure leading to genetic isolation and prevention of recolonization, especially considering the limited and localized populations of this species.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	1) Gather data on specific habitat requirements of Vermont populations: denning sites, birthing sites, foraging areas, and movement corridors. 2) Determine if and how habitat differs in Vermont compared to the core of the Brown Snake range.
Research	Distribution and Abundance	High	Determine species statewide distribution and relative abundance with emphasis in Taconics and southern CT River Valley.
Research	Threats and Their Significance	High	
Research	Other Research	Medium	Develop enhancement techniques for birthing and overwintering habitat.
Monitoring	Population Change	High	Monitor population sizes and distribution changes.
Monitoring	Habitat Change	High	
Monitoring	Range Shifts	High	Range distribution monitoring may be how we are able to track population change in Vermont (maintenance or loss of populations).
Monitoring	Monitor Threats	High	

Common Name: **Brown Snake**
Scientific Name: **Storeria dekayi**
Species Group: **Herp**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications		Encourage reports of sightings to the Vermont Nongame and Natural Heritage Program and the Vermont Reptile and Amphibian Atlas Project	Number of reports received. Geographic coverage of reports	Herp Atlas	Nongame Wildlife Fund
Compatible Resource Use		Review all roadway projects in appropriate habitat, check against known crossing areas VTRANS, VFWD, HERP Atlas, survey appropriate habitat when unknown	Number of sites where information on crossing areas utilized	VTrans, Herp Atlas	VTrans planning funds
Compatible Resource Use		Manage ATV and other off road usage in known habitat to lessen impacts	Number of brownsnake areas with restricted or managed ATV use	Land managers, private landowners.	
Awareness Raising and Communications		Encourage reports of road-killed specimens, road crossing, and road basking areas to VT F&W, VTRANS, and the Vermont Reptile and Amphibian Atlas Project.	Number of areas reported	VTrans, Herp Atlas	VTrans funds
Habitat Restoration		Maintain habitat mosaic and connectivity necessary for this species, particularly in Champlain Valley.	Number of intact habitats and connections	Consulting Foresters, landowners, conservation commissions	Current Use, LIP, WHIP
Standards		Develop land management guidelines for owners and managers of appropriate habitat and make them readily available through multiple media, including print and the web.			
Easements		Conserve known habitat through fee simple purchase, development rights or easements, management agreements and education of private landowners and managers regarding appropriate management.	Number of known sites conserved.	Consulting foresters, local conservation commissions	VHCB funds
Species Restoration	High	Reexamine species status at regular intervals (no longer than every 10 years) to determine if Endangered Species Act listing is appropriate	Frequency of review	SAG-Herps	donated time
Awareness Raising and Communications		Help Vermonters assign value to this species through educational programs, printed material, web site information, field trips, TV and video information.	Number of people exposed to message	VFWD Outreach Division	Marketing funds
Species Restoration		Develop, install, and monitor, road crossing structures and barriers for this species	Number of structures installed	VTrans	Federal Highway funds

Common Name: **Brown Snake**
Scientific Name: **Storeria dekayi**
Species Group: **Herp**

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Common Name: **Eastern Ribbon Snake**
Scientific Name: **Thamnophis sauritus**
Species Group: **Herp**

Conservation Assessment:

Final Assessment: Medium Priority

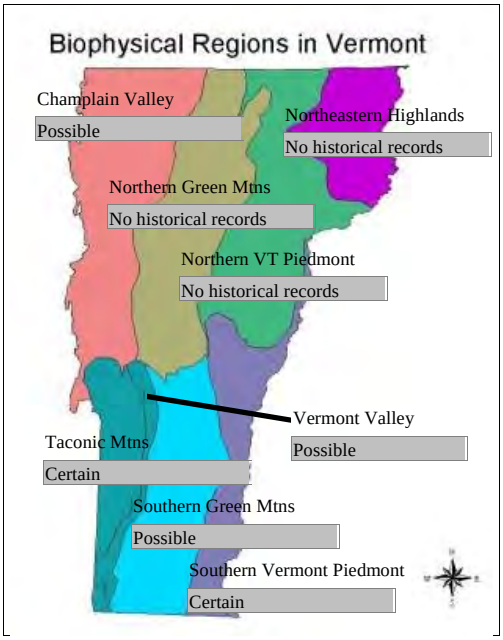
Global Rank: G5 **Global Trend:**
State Rank: S2 **State Trend:** Unknown
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

Eastern Ribbon Snake is an S2 species in Vermont and is considered a species of special concern in Vermont.

The Eastern Ribbon Snake is one of the rarest of snakes in Vermont based on the number of known current sites. It seems to depend on a combination of a relatively warm, undeveloped lowland site and wetlands.

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? No

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

It is currently documented from only six locations in Vermont: five in western Rutland County and one along the southern Connecticut River valley. A handful of historic records and sightings come from further north in the Lake Champlain basin and the Connecticut River Valley.

Known Watersheds

CT-Bellows Falls Dam to Vernon Dam
Lake Champlain Canal
Lake Champlain Direct

Possible Watersheds

CT-Ashuelot River
Hudson-Hoosic Rivers
Otter Creek
Winooski River

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

This species requires wetland edges with sunny exposed basking sites in warm, low-elevation, largely undeveloped, areas. The presence of nearby rocky woodlands and talus seems to increase the chances of finding this species.

Common Name: **Eastern Ribbon Snake**
Scientific Name: **Thamnophis sauritus**
Species Group: **Herp**

General Habitat Preferences:

Minimum Elevation (m):	30
Maximum Elevation (m):	400
Patch Size Requirements:	> 100 ha
Prefers large wetland complexes:	☑
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Aquatic: Man-Made Water Bodies

Cliffs and Talus

Grasslands and Hedgerows

Marshes and Sedge Meadows

Oak-Pine Northern Hardwood

Seeps and Pools

Shrub Swamps

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Habitat Alteration

Habitat Fragmentation

Impacts of Roads or Trails

Description of habitat problem(s): Conversion or drainage of wetlands, shoreline development, and fragmentation due to road density could all be problems.

Non-Habitat Problems:

Genetics

Loss of Prey Base

Trampling or Direct Impacts

Description of non-habitat problem(s): Some populations may be genetically isolated and others are becoming more so as a result of development. This species may be dependent on local amphibian populations that are known to vary annually. ATV use, increased traffic, cutting and bailing, and lawn mowing could all increase mortality significantly. It has not been located in moderately or heavily developed areas.

Common Name: **Eastern Ribbon Snake**
Scientific Name: **Thamnophis sauritus**
Species Group: **Herp**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	This species may use a wider variety of habitats in Vermont than is currently known. 1) Gather data on specific habitat requirements of Vermont populations: denning sites, birthing sites, foraging areas, overwintering sites and movement corridors.
Research	Distribution and Abundance	High	Identify distribution and relative abundance of populations in Vermont. Search for ribbon snakes in areas of open talus in the Champlain, Connecticut River valley, and other relatively warm valleys, especially if adjacent to wetland foraging areas.
Research	Threats and Their Significance	High	
Research	Other Research	Medium	Develop enhancement techniques to improve for birthing and overwintering habitat.
Monitoring	Population Change	High	Monitor population sizes and distribution changes.
Monitoring	Habitat Change	High	
Monitoring	Monitor Threats	High	

Common Name: **Eastern Ribbon Snake**
Scientific Name: **Thamnophis sauritus**
Species Group: **Herp**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications		Quickly and thoroughly, counter myths and misinformation appearing in the press that may limit this species	Number of response carried by media.	Media, SAG-Herps, Herp Atlas, VFWD Outreach Division	volunteer, marketing funds
Publically-Owned Protected Areas		Locate populations on public lands and manage some specifically for this species	Number of sites managed for ribbon snake	FPR, USFS, VFWD	State Lands Management funds, GMNF funds
Awareness Raising and Communications	Medium	Encourage reports of sightings to the Vermont Nongame and Natural Heritage Program and the Vermont Reptile and Amphibian Atlas Project	Number of reports received	Herp Atlas	Nongame Wildlife Fund, private grants
Awareness Raising and Communications		Encourage reports of road-killed specimens, road crossing, and road basking areas to VT F&W, VTRANS, and the Vermont Reptile and Amphibian Atlas Project.	Number of sites reported.	VTrans, volunteers	VTrans
Compatible Resource Use		Review all roadway projects in appropriate habitat, check against known crossing areas VTRANS, VFWD, HERP Atlas, survey appropriate habitat when unknown	Number of projects reviewed with planning information on snakes.	VTrans, Herp Atlas	VTrans
Compatible Resource Use		Manage ATV and other off road usage in known habitat to lessen impacts	Number of sites where ATV use is controlled	Land managers, landowners	
Easements		Conserve known habitat through fee simple purchase, development rights or easements, management agreements and education of private landowners and managers regarding appropriate management.	Number of sites conserved	Vermont Land Trust	VHCB funds
Awareness Raising and Communications		Help Vermonters assign value to this species through educational programs, printed material, web site information, field trips, TV and video information.	Number of people who receive message	VFWD Outreach Division	Marketing funds
Species Restoration	High	Reexamine species status at regular intervals (no longer than every 10 years) to determine if ESA listing is appropriate	Number of years since last review	SAG-Herps	volunteer
Standards		Develop land management guidelines for owners and managers of appropriate habitat and make them readily available through multiple media, including print and the web.	Number of landowners and managers who receive and use guidelines	VFWD district biologists, consulting foresters	SWG

Common Name: **Eastern Ribbon Snake**
Scientific Name: **Thamnophis sauritus**
Species Group: **Herp**

Habitat Restoration	Medium	Develop, implement, and monitor, road crossing structures and barriers for this species	Number of structures installed	VTrans	Federal Highway funds

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Common Name: **Smooth Green Snake**
Scientific Name: **Liochlorophis vernalis**
Species Group: **Herp**

Conservation Assessment:

Final Assessment: Medium Priority

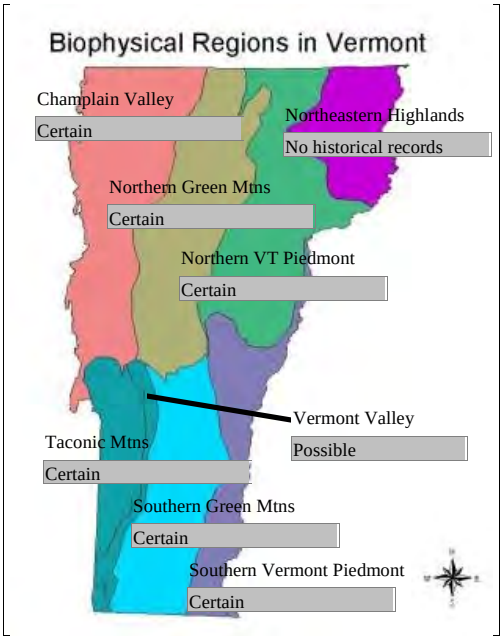
Global Rank: G5 **Global Trend:**
State Rank: S4 **State Trend:**
Extirpated in VT? No **Regionally Rare?** No

Assessment Narrative:

Few people encounter this species and it is thought to be found less frequently than in the past. Little is known about its distribution in Vermont. Conservation status is uncertain, but this species probably should be s3 and is being considered a medium priority species.

Habitat loss due to development is also a problem for this species, especially in the lowlands. In past large beaver meadows may have been connected. Mechanization of agriculture, lawn mowing, and roads all are likely impacts. In the southern Great Lakes Basin it is reported to be decreasing due to intensive conversion of its habitat to agricultural uses and pesticides (Harding 1997. The Amphibians and Reptiles of the Great Lakes Region)

Distribution:



Natural History Elements:

Home Range: < 10 ha
Migrant? No

Within watershed	☐
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Primarily mid-elevational, missing from NE VT

Known Watersheds

CT-Ashuelot River

CT-Bellows Falls Dam to Vernon Dam

CT-Johns River to Waits River

CT-Waits River to White River

Deerfield. MA-VT

Hudson-Hoosic Rivers

Common Name: **Smooth Green Snake**
Scientific Name: **Liochlorophis vernalis**
Species Group: **Herp**

Lake Champlain Canal

Lake Champlain Direct

Lamoille River

Mississquoi River

Otter Creek

White River

Winooski River

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Green snakes use sedge meadows, marsh borders, pastures, powerlines, shrub areas, and early successional habitat not mowed regularly.

dense annual vegetation

General Habitat Preferences:

Minimum Elevation (m): 30
Maximum Elevation (m): 700
Patch Size Requirements: > 10 ha
Prefers large wetland complexes: ☑
Prefers large expanses of grassland habitat: ☑
Prefers habitat mosaics: ☐
Prefers developed landscapes: ☐
Prefers actively managed woodland: ☐
Requires movement corridors: ☑
Prefers large expanses of forest habitat: ☐

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Early Succession Northern Hardwoods

Early Succession Other Types

Early Succession Upland Oak

Grasslands and Hedgerows

Marshes and Sedge Meadows

Open Peatlands

Shrub Swamps

Wet Shores

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Habitat Succession

Impacts of Roads or Trails

Description of habitat problem(s): mowing and pesticides limit this species, baling does impact snakes

Non-Habitat Problems:

Trampling or Direct Impacts

Common Name: **Smooth Green Snake**
Scientific Name: **Liochlorophis vernalis**
Species Group: **Herp**

Description of non-habitat problem(s): Mowing of habitat, road traffic, and pesticide use

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Gather data on specific habitat requirements of Vermont populations: denning sites, egg-laying sites, foraging areas, overwintering sites and movement corridors.
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	Identify distribution and relative abundance of populations in Vermont
Research	Threats and Their Significance	High	
Research	Population Genetics	Low	
Research	Other Research	Medium	Gather data from known habitat on how it is kept in early succession and apply this knowledge.
Monitoring	Population Change	High	Monitor population sizes and distribution changes.
Monitoring	Habitat Change	High	
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	High	

Common Name: **Smooth Green Snake**
Scientific Name: **Liochlorophis vernalis**
Species Group: **Herp**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use		Maintain connectivity between areas of appropriate early successional habitat	Number of acres linked through connectivity	landowners	WHIP, LIP, Current Use
Habitat Restoration		Develop, implement, and monitor, road crossing structures and barriers for this species.	Number of structures installed	VTrans	VTrans, Federal Highway
Awareness Raising and Communications		Encourage reports of sightings to the Vermont Nongame and Natural Heritage Program and the Vermont Reptile and Amphibian Atlas Project	Number of reports received	Vermont Reptile and Amphibian Atlas Project	private grant, Nongame Wildlife Fund
Easements		Conserve known habitat through fee simple purchase, development rights or easements, management agreements and education of private landowners and managers regarding appropriate management.	Number of sites and acreage conserved	VLT, local land trusts	VHCB funds
Compatible Resource Use		Manage ATV and other off road usage in known habitat to lessen impacts	Number of sites where ATV use is controlled	landowners, land managers	WHIP, LIP, state lands management funds
Standards		Develop land management guidelines for owners and managers of appropriate habitat and make them readily available through multiple media, including print and the web.			
Awareness Raising and Communications		Encourage reports of road-killed specimens, road crossing, and road basking areas to VT F&W, VTRANS, and the Vermont Reptile and Amphibian Atlas Project.	Number of reports received	VTrans	VTrans
Planning & Zoning		Review all roadway projects in appropriate habitat, check against known crossing areas VTRANS, VT F&W, HERP Atlas, survey appropriate habitat when unknown	Number of projects reviewed using green snake information	VTrans, Herp Atlas	VTrans, Federal Highway
Species Restoration		Reexamine species status at regular intervals (no longer than every 10 years) to determine if listing is appropriate	Frequency of reviews	SAG-Herps	volunteer effort
Awareness Raising and Communications		Help Vermonters assign value to this species through educational programs, printed material, web site information, field trips, TV and video information.	Number of people exposed to message.	Herp Atlas, VFWD Outreach Div	Marketing funds
Publically-Owned Protected Areas		Locate populations on public lands and manage some specifically for this species.	Number of sites managed for green snake.	district foresters and wildlife managers	state lands management funds

Common Name: **Smooth Green Snake**
Scientific Name: **Liochlorophis vernalis**
Species Group: **Herp**

Standards	Work with power companies, airports, horse farmers, and other landowners that provide large areas of early successional habitat to maintain it in a manner safe for this species.	Number of sites maintained in a safe manner.	Managers of powerlines, airport staff, landowners	VELCO, VTrans, WHIP, LIP

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Common Name: **Timber Rattlesnake**
Scientific Name: **Crotalus horridus**
Species Group: **Herp**

Conservation Assessment:

Final Assessment: High Priority

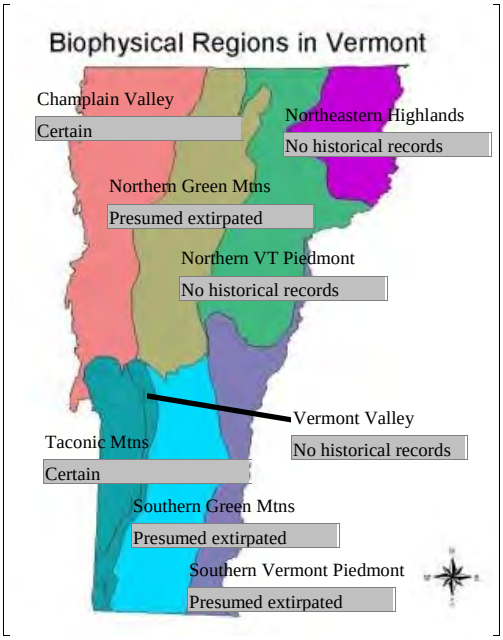
Global Rank: G4 **Global Trend:**
State Rank: S1 **State Trend:**
Extirpated in VT? No **Regionally Rare?** Yes

Assessment Narrative:

The Timber Rattlesnake is a state-endangered S1 species that was historically known from a much wider range in VT and the region.

It is currently documented from only two denning areas in Vermont. The species had a bounty on it until 1971. The bounty has been lifted but takings still occur. Its habit of denning communally at den sites which are now quite widely known make it unusually vulnerable to takings. This behavior also provides opportunities for geographically targeted protection. Since it is a venomous species, it is more widely feared and persecuted. As its name implies, it depends on warm low-elevation woodlands that are sparsely populated.

Distribution:



Natural History Elements:

Home Range: <1000 ha
Migrant? No

Within watershed	☑
Within biophysical region	☐
Within VT	☐
Within Region	☐
Within US	☐
Outside US	☐

Distribution Summary:

Extant populations of Timber Rattlesnake are restricted to areas near the southern portion of Lake Champlain in western Rutland County. Populations in other parts of the state have been lost.

Known Watersheds

Lake Champlain Canal

Lake Champlain Direct

Habitat Description:

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

The Timber Rattlesnake is currently documented only from western Rutland County. In this region it dens on south or southwest facing talus slopes which are near rocky ridges with exposed ledge and large undeveloped or sparsely developed areas of oak-hickory woods.

Common Name: **Timber Rattlesnake**
Scientific Name: **Crotalus horridus**
Species Group: **Herp**

General Habitat Preferences:

Minimum Elevation (m):	30
Maximum Elevation (m):	400
Patch Size Requirements:	> 1000 ha
Prefers large wetland complexes:	☐
Prefers large expanses of grassland habitat:	☐
Prefers habitat mosaics:	☑
Prefers developed landscapes:	☐
Prefers actively managed woodland:	☐
Requires movement corridors:	☑
Prefers large expanses of forest habitat:	☑

Vegetation Categories Used:

(see Appendix B for habitat, community & landscape organization and conservation summaries)

Cliffs and Talus

Grasslands and Hedgerows

Mine

Oak-Pine Northern Hardwood

Outcrops and Alpine

Subterranean

Current Problems: *(see Appendix C for definitions of problem categories)*

Habitat Problems:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Impacts of Roads or Trails

Description of habitat problem(s): The Timber Rattlesnake uses large contiguous woodland areas adjacent to their dens. Heavy agricultural or residential use, or conversion to open land are all problems. All remaining areas are adjacent to large sparsely-roaded woodlands. Heavy ATV use, increased traffic, or increased road-density are all problems. Lowland wooded patches are popular building sites and are becoming increasingly fragmented.

Non-Habitat Problems:

Genetics

Harvest or Collection

Reproductive Traits

Trampling or Direct Impacts

Description of non-habitat problem(s): One of the two known Timber Rattlesnake populations may be isolated from genetic exchange. Although venomous, this species is still illegally collected for various purposes and snakes that have been killed are regularly reported. Known traditional den sites and predictable patterns of behavior make the species very vulnerable to collection and persecution. Birthing sites also appear to be limited and traditional. This is a long-lived species that does not reproduce every year. Consequently, loss of breeding adults is more of a problem to the sustainability of the species. Heavy ATV use, increased traffic, and heavy recreational use along ridges during key time-periods is also a problem. Since this species is venomous, it is often feared and killed when found near residences.

Common Name: **Timber Rattlesnake**
Scientific Name: **Crotalus horridus**
Species Group: **Herp**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	1) Better determine range and habitat usage and protect critical areas. 2) Gather data on specific habitat requirements of Vermont populations: denning sites, egg-laying sites, foraging areas, movement corridors
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	1) Identify the distribution and relative abundance of populations in Vermont. 2) Identify appropriate denning habitat within 3 miles of reports from the last twenty years from maps, photos, and aerial surveys, and ground survey during appropriate seasons and weather conditions.
Research	Threats and Their Significance	High	
Research	Population Genetics	Low	
Monitoring	Population Change	High	Monitor the size and determine the sustainability of existing populations through age-class or genetic analysis.
Monitoring	Habitat Change	High	
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	High	

Common Name: **Timber Rattlesnake**
Scientific Name: **Crotalus horridus**
Species Group: **Herp**

Species Strategies

(see Appendix B for additional habitat, community & landscape conservation summaries.)

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications		Help Vermonters assign value to this species through educational programs, printed material, web site information, field trips, TV and video information	Number of people exposed to message	VFWD outreach division, Herp Atlas	marketing funds
Habitat Restoration		Develop, implement, and monitor, road crossing structures and barriers for this species	Number of structures installed	VTrans, consulting herpetologist	VTrans
Standards		Develop land management guidelines for owners and managers regarding appropriate management and make them readily available through multiple media, including print and the web.	Number of landowners and mangers who receive and use the guidelines	landowners and land managers, TNC, municipalities	SWG, TNC
Technical Assistance, Training, Learning Networks		Maintain and support the network of trained snake relocators. Put information about Rattlesnakes and this service on the web. Educate local landowners.	Number of times public receives technical assistance	volunteers, local warden, town officials, TNC, Vermont Reptile and Amphibian Atlas Project	volunteer effort, TNC
Species Restoration		Work to maintain connectivity with populations to the west in New York State and between the two known populations	Quantity and quality of landscape connections	New York DEC, TNC, VLT	VHCB
Awareness Raising and Communications		Quickly and thoroughly, counter myths and misinformation appearing in the press that may limit this species.	Number of press responses carried by media.	SAG-Herps, Herp Atlas, VFWD Outreach Div.	volunteer efforts, marketing funds
Awareness Raising and Communications	Medium	Patrolling of denning and birthing areas during critical times would protect all life stages and send an important message to the public.	Number of sites that are patrolled	Game Wardens	operating funds
Compatible Resource Use		Manage ATV and other off road usage in known habitat to avoid impacts, including foraging habitat.	Number of sites where ATV use is controlled	Landowners, land mangers, ATV user groups	land management funds/decisions
Awareness Raising and Communications		Encourage reports of sightings to the Vermont Nongame and Natural Heritage Program and the Vermont Reptile and Amphibian Atlas Project	Number of reports received	Vermont Reptile and Amphibian Atlas Project	Nongame Wildlife Fund

Common Name: **Timber Rattlesnake**
Scientific Name: **Crotalus horridus**
Species Group: **Herp**

Planning & Zoning		Review all roadway projects in appropriate habitat, check against known crossing areas VTRANS, VT F&W, HERP Atlas, survey appropriate habitat when unknown.	Number of projects reviewed using rattlesnake planning information	VTrans, Vermont Reptile and Amphibian Atlas Project, municipalities	VTrans,
Alliance Development		Continue to work cooperatively with important landowners such as the Nature Conservancy. Develop and maintain allies in local government and private citizens	Number of partner contacts made annually.	TNC, towns, landowners	
Species Restoration		If local populations are determined to be unsustainable, consider reintroduction or augmentation from closest healthy source. Maintaining and enhancing extant populations is always a priority and should be continued.	Number of successful reintroductions or augmentations	New York DEC	SWG
Technical Assistance, Training, Learning Networks	Medium	Work with District 3 VTrans crew and other land managers to raise awareness of conservation need and implement conservation actions that benefit snakes.	Number of VTrans and others managers cooperating.	VTrans	VTrans
Compatible Resource Use	High	Protect known denning areas and adjacent ledges and woodlands from incompatible development and heavy use during critical time periods. Protect foraging land from development.	Number of sites conserved	TNC, landowners, VLT	VHCB
Awareness Raising and Communications	Medium	Encourage reports of road-killed specimens, road crossing, and road basking areas to VT F&W, VTRANS, and the Vermont Reptile and Amphibian Atlas Project.	Number of sites reported	VTrans, Herp Atlas	VTrans, Nongame Wildlife Fund
Easements		Conserve known habitat through fee simple purchase, development rights or easements, management agreements, and education of private landowners and mangers regarding appropriate management.	Number of sites conserved	landowners, TNC, VLT	VHCB

Common Name: **Timber Rattlesnake**
Scientific Name: **Crotalus horridus**
Species Group: **Herp**

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Vermont's
Wildlife Action Plan

November 22, 2005

Appendix A6
Plant Species of Greatest Conservation Need

Vermont's Plant Species of Greatest Conservation Need

Plant Species of Greatest Conservation Need : 577 of approximately 2,000 vascular and non-vascular species. Vermont's plant SGCN list includes all species ranked S1 (critically imperiled) and S2 (imperiled) and a very few others that warrant concern. Those SGCN also on the New England Plant Conservation Program list of regionally rare plants will be ranked High Priority. All others were ranked medium priority. Plants are not eligible for State Wildlife Grant funds. We expect that community and landscape level conservation will provide secondary benefits including addressing the needs of many plant Species of Greatest Conservation Need.

Acalypha gracilens, Slender Copperleaf
Adiantum aleuticum, Aleutian Maidenhair-fern
Adiantum viridimontanum, Green Mountain Maidenhair-fern
Agastache nepetoides, Yellow Giant Hyssop
Agastache scrophulariifolia, Purple Giant Hyssop
Agrostis borealis, Boreal Bentgrass
Allium canadense, Wild Garlic
Allium schoenoprasum var. sibiricum, Siberian Chives
Amaranthus tuberculatus, Water Hemp
Ammophila champlainensis, Champlain Beach Grass
Anemone multifida, Early Thimbleweed
Anemonella thalictroides, Rue-anemone
Aplectrum hyemale, Putty-root
Arabis drummondii, Drummond's Rock-cress
Arabis lyrata, Lyre-leaved Rock-cress
Arabis missouriensis, Green Rock-cress
Arceuthobium pusillum, Dwarf Mistletoe
Arethusa bulbosa, Arethusa
Arisaema dracontium, Green Dragon
Aristida longespica, Spiked Grass
Artemisia campestris ssp. borealis, Boreal Wormwood
Artemisia campestris ssp. caudata, Beach Wormwort
Asclepias amplexicaulis, Blunt-leaved Milkweed
Asplenium montanum, Mountain Spleenwort
Asplenium trichomanes-ramosum, Green Spleenwort
Aster ptarmicoides, Snowy Aster
Aster sagittifolius, Arrow-leaved Aster
Aster vimineus, Small White Aster
Astragalus canadensis, Canadian Milk-vetch
Astragalus robbinsii var. jesupii, Jesup's Milk-vetch
Astragalus robbinsii var. minor, Blake's Milk-vetch
Aureolaria flava, Smooth False-foxglove
Aureolaria pedicularia, Feverweed
Aureolaria virginica, Downy False-foxglove
Bartonia virginica, Yellow Bartonia
Blephilia hirsuta, Hairy Wood-mint
Botrychium oneidense, Blunt-lobed Grapefern
Botrychium rugulosum, Rugulose Grape-fern
Braya humilis, Northern Rock-cress
Calamagrostis pickeringii, Pickering's Reed Bent-grass
Calamagrostis stricta ssp. inexpansa, Bentgrass
Calypso bulbosa, Fairy Slipper
Calystegia spithamaea, Low Bindweed
Cardamine bulbosa, Spring Cress
Carex aestivalis, Summer Sedge
Carex alopecoidea, Foxtail Sedge
Carex arcta, Contracted Sedge
Carex argyrantha, Hay Sedge
Carex atherodes
Carex atlantica, Eastern Sedge
Carex atlantica ssp. capillacea, Howe's Sedge
Carex atratiformis, Blackish Sedge
Carex bigelowii, Bigelow's Sedge
Carex buxbaumii, Buxbaum's Sedge
Carex capillaris, Capillary Sedge
Carex chordorrhiza, Creeping Sedge
Carex cumulata, Clustered Sedge
Carex davisii, Davis' Sedge
Carex emmonsii, Emmon's Sedge
Carex exilis, Bog Sedge
Carex foenea, Bronze Sedge
Carex garberi, Garber's Sedge
Carex haydenii, Hayden's Sedge
Carex houghtoniana, Houghton's Sedge
Carex livida, Pale Sedge
Carex lupuliformis, False Hop Sedge
Carex merritt-fernaldii, Sedge
Carex molesta, Troublesome Sedge
Carex muehlenbergii, Muehlenberg's Sedge
Carex oligocarpa, Few-fruited Sedge
Carex richardsonii, Richardson's Sedge
Carex schweinitzii, Schweinitz's Sedge
Carex scirpoidea, Scirpus-like Sedge
Carex siccata, Hay Sedge
Carex tenuiflora, Thin-flowered Sedge
Carex trichocarpa, Hairy Sedge
Carex vaginata, Sheathed Sedge
Carex wiegandii, Wiegand's Sedge
Carya glabra, Pignut Hickory
Cassia nictitans, Wild Sensitive Plant
Castilleja septentrionalis, Pale Painted-cup
Ceanothus herbaceus, Prairie Redroot
Cerastium nutans, Nodding Chickweed
Ceratophyllum echinatum, Prickly Hornwort
Chenopodium capitatum, Strawberry Blite
Chimaphila maculata, Spotted Wintergreen
Cirsium discolor, Field Thistle
Claytonia virginica, Virginia Spring Beauty
Collinsonia canadensis, Canada Horse-balm
Corallorhiza odontorhiza, Autumn Coral-root
Cornus florida, Flowering Dogwood
Corydalis aurea, Golden Corydalis
Corylus americana, American Hazelnut
Crataegus intricata, A Hawthorn
Crotalaria sagittalis, Rattlebox
Cynoglossum virginianum var. boreale, Northern Wild Comfrey
Cyperus diandrus, Low Cyperus
Cyperus houghtonii, Houghton's Cyperus
Cypripedium arietinum, Ram's Head Lady's-slipper
Descurainia pinnata, Tansy-mustard
Desmodium cuspidatum, Large-bracted Tick-trefoil
Desmodium rotundifolium, Prostrate Tick-trefoil
Diapensia lapponica, Diapensia
Diphasiastrum complanatum, A Clubmoss
Draba cana, Lanceolate Cress
Draba glabella, Smooth Draba
Dracocephalum parviflorum, American Dragonhead
Dryopteris filix-mas, Male Fern
Dryopteris fragrans, Fragrant Fern
Elatine minima, Small Water-wort
Eleocharis olivacea, Olive Spikerush
Eleocharis ovata, Ovate Spikerush
Eleocharis pauciflora, Few-flowered Spikerush
Eleocharis robbinsii, Robbins Spikerush
Elodea nuttallii, Nuttall Waterweed
Elymus villosus, Hairy Wild-rye
Empetrum nigrum, Black Crowberry
Equisetum palustre, Marsh Horsetail
Erigeron hyssopifolius, Hyssop-leaved Fleabane
Eriophorum gracile, Slender Cotton-grass
Eupatorium purpureum, Sweet Joe-pye Weed
Eupatorium sessilifolium, Sessile-leaved Boneset
Festuca saximontana, Sheep Fescue
Fimbristylis autumnalis, Autumn Fimbristylis
Galium labradoricum, Bog Bedstraw
Galium obtusum, Large Marsh-bedstraw
Gentiana andrewsii, Fringe-top Closed Gentian
Gentianella quinquefolia, Stiff Gentian
Geum laciniatum, Rough Avens
Geum vernum, Spring Avens
Glyceria acutiflora, Sharp Manna-grass
Glyceria septentrionalis, Eastern Manna-grass
Hackelia deflexa var. americana, Nodding Stickseed
Hedysarum alpinum, Apline Sweet-broom
Helenium autumnale, Sneezeweed
Helianthemum bicknellii, Plains Frostweed
Helianthus strumosus, Harsh Sunflower
Hierochloe alpina, Alpine Sweet-grass
Hippuris vulgaris, Mare's-tail
Hudsonia tomentosa, Beach Heather
Huperzia appalachiana, Mountain Fir Clubmoss
Huperzia selago, Northern Fir Clubmoss
Hybanthus concolor, Green Violet
Hydrastis canadensis, Golden-seal
Hydrophyllum canadense, Broad-leaved Waterleaf
Hypericum ascyron, Great St. John's-wort
Isoetes engelmannii, Engelmann's Quillwort
Isoetes macrospora, Lake Quillwort
Isoetes riparia, River-bank Quillwort
Isoetes tuckermanii, Tuckerman's Quillwort
Isotria verticillata, Large Whorled Pogonia
Juncus acuminatus, Tapering Rush
Juncus alpinus, Alpine Rush
Juncus gerardii, Black-grass Rush
Juncus greenei, Greene's Rush
Juncus marginatus, Grass Rush
Juncus militaris, Soldier Rush
Juncus secundus, Secund Rush
Juncus torreyi, Torrey's Rush
Juncus trifidus, Highland Rush
Juncus vaseyi, Vasey Rush
Juniperus horizontalis, Creeping Juniper
Lactuca hirsuta, Hairy Lettuce

Lathyrus maritimus, Beach Pea
Lathyrus ochroleucus, Pale Vetchling
Lathyrus palustris, Marsh Vetchling
Lechea mucronata, Hairy Pinweed
Lespedeza hirta, Hairy Bush-clover
Lespedeza violacea, Violet Bush-clover
Liparis liliifolia, Lily-leaved Twayblade
Listera auriculata, Auricled Twayblade
Listera australis, Southern Twayblade
Littorella americana, American Shore-grass
Lobelia siphilitica, Great Blue Lobelia
Lonicera hirsuta, Hairy Honeysuckle
Lonicera oblongifolia, Swamp Fly-honeysuckle
Ludwigia polycarpa, Many-fruited False-loosestrife
Lupinus perennis, Wild Lupine
Luzula parviflora, Small-flowered Rush
Luzula spicata, Spiked Wood-rush
Lycopus virginicus, Virginia Bugleweed
Lygodium palmatum, Climbing Fern
Lysimachia hybrida, Lance-leaved Loosestrife
Malaxis brachypoda, White Adder's Mouth
Malaxis unifolia, Green Adder's Mouth
Mimulus moschatus, Musk Flower
Minuartia groenlandica, Mountain Sandwort
Minuartia marcescens, Marcescent Sandwort
Minuartia rubella, Marble Sandwort
Moehringia macrophylla, Large-leaved Sandwort
Monarda punctata, Dotted Horsemint
Morus rubra, Red Mulberry
Muhlenbergia schreberi, Schreber's Muhly
Muhlenbergia uniflora, Fall Dropseed Muhly
Myosotis laxa, Smaller Forget-me-not
Myosotis verna, Spring Forget-me-not
Myriophyllum alterniflorum, Water Milfoil
Myriophyllum farwellii, Farwell's Water-milfoil
Myriophyllum humile, Low Water-milfoil
Myriophyllum verticillatum, Whorled Water-milfoil
Najas gracillima, Slender Naiad
Najas guadalupensis, Guadalupe Naiad
Neobeckia aquatica, Lake-cress
Nymphaea leibergii, Dwarf Water-lily
Nyssa sylvatica, Black Gum or Tupelo
Oenothera cruciata, Narrow Evening-primrose
Omalotheca sylvatica, Woodland Cudweed
Oryzopsis pungens, Slender Mountain-rice
Panax quinquefolius
Panicum flexile, Stiff Witch-grass
Panicum oligosanthes, Few-flowered Panic-grass
Panicum philadelphicum, Philadelphia Panic-grass
Panicum sphaerocarpon, Spherical Panic-grass
Panicum tuckermanii, Tuckerman's Panic-grass
Paronychia canadensis, Smooth Forked Chickweed
Paspalum ciliatifolium, Slender Paspalum
Peltandra virginica, Arrowleaf
Penstemon calycosus, Long-sepal Beardtongue
Petasites frigidus var. palmatus, Sweet Coltsfoot
Phegopteris hexagonoptera, Broad Beech-fern
Physostegia virginiana, Obedience
Pinguicula vulgaris, Butterwort
Platanthera blephariglottis, White-fringed Orchis
Platanthera flava, Tubercled Orchis
Platanthera hookeri, Hooker's Orchis
Poa fernaldiana, Wavy Bluegrass
Poa glauca, Glaucous Bluegrass
Poa nemoralis, Woods Bluegrass
Poa saltuensis ssp. languida, Drooping Bluegrass
Podophyllum peltatum, May-apple
Podostemum ceratophyllum, Riverweed
Polemonium vanbruntiae, Eastern Jacob's Ladder
Polygala polygama, Racemed Milkwort
Polygala senega, Seneca Snakeroot
Polygala verticillata, Whorled Milkwort
Polygonatum biflorum var. commutatum, Giant Solomon's Seal
Polygonum achoreum, Blue Knotweed
Polygonum douglasii, Douglas Knotweed
Polygonum erectum, Erect Knotweed
Polygonum tenue, Slender Knotweed
Polymnia canadensis, White-flowered Leafcup
Potamogeton bicupulatus, Snail-seed Pondweed
Potamogeton confervoides, Tuckerman's Pondweed
Potamogeton filiformis var. borealis, Slender Pondweed
Potamogeton hillii, Hill's Pondweed
Potamogeton ogdenii, Ogden's Pondweed
Potamogeton strictifolius, Straight-leaf Pondweed
Potamogeton vaseyi, Vasey's Pondweed
Potamogeton x haynesii
Potentilla pensylvanica var. bipinnatifida, Northern Cinquefoil
Prenanthes boottii, Boott's Rattlesnake-root
Prenanthes trifoliolata, Three-leaved Rattlesnake-root
Primula mistassinica, Bird's-eye Primrose
Proserpinaca palustris, Marsh Mermaid-weed
Prunus americana, Wild Plum
Prunus pumila var. cuneata, Sand Cherry
Prunus pumila var. depressa, Low Sand Cherry
Pterospora andromedea, Pinedrops
Pycnanthemum incanum, Hoary Mountain Mint
Pycnanthemum muticum, Blunt Mountainmint
Pyrola asarifolia, Bog Wintergreen
Pyrola minor, Lesser Pyrola
Quercus coccinea, Scarlet Oak
Quercus ilicifolia, Scrub Oak
Quercus prinoides, Dwarf Chinquapin Oak
Ranunculus allegheniensis, Allegheny Crowfoot
Ranunculus hispidus var. hispidus, Bristly Buttercup
Ranunculus longirostris, White Water-crowfoot
Ranunculus pensylvanicus, Bristly Crowfoot
Ranunculus sceleratus, Cursed Crowfoot
Ranunculus subrigidus, White-water Crowfoot
Rhexia virginica, Virginia Meadow-beauty
Rhododendron maximum, Great Laurel
Rhynchospora capillacea, Capillary Beak-rush
Rosa acicularis, Needle-spine Rose
Rosa nitida, Shining Rose
Salix pedicellaris, Bog Willow
Salix pellita, Satiny Willow
Salix planifolia, Tea-leaved Willow
Salix serissima, Autumn Willow
Salix uva-ursi, Bearberry Willow
Samolus parviflorus, Water Pimpernel
Sanguisorba canadensis, Canada Burnet
Sanicula canadensis, Short-styled Snakeroot
Saxifraga aizoides, Yellow Mountain Saxifrage
Saxifraga oppositifolia, Purple Mountain Saxifrage
Saxifraga paniculata, White Mountain-saxifrage
Scheuchzeria palustris ssp. americana, Pod-grass
Scirpus ancistrochaetus, Barbed-bristle Bulrush
Scirpus cespitosus, Deer-hair Sedge
Scirpus maritimus, Salt-marsh Bulrush
Scirpus polyphyllus, Many-leaved Sedge
Scirpus smithii, Smith's Bulrush
Scirpus verecundus, Bashful Bulrush
Scutellaria parvula, Small Skullcap
Sedum rosea, Roseroot
Sisyrinchium angustifolium, Narrow Blue-eyed Grass
Sisyrinchium atlanticum, Eastern Blue-eyed-grass
Solidago cutleri, Cutler's Goldenrod
Solidago odora, Sweet Goldenrod
Solidago ulmifolia, Elm-leaved Goldenrod
Sparganium androcladum, Branching Bur-reed
Sparganium fluctuans, Water Bur-reed
Sparganium natans, Lesser Bur-reed
Sphenopholis nitida, Shiny Wedgegrass
Sphenopholis obtusata, Blunt Sphenopholis
Spiranthes ochroleuca, Yellow Nodding Ladies'-tresses
Sporobolus asper, Rough Dropseed
Sporobolus neglectus, Small Dropseed
Stellaria alsine, Trailing Stitchwort
Taenidia integerrima, Yellow Pimpernel
Thelypteris simulata, Massachusetts Fern
Tillaea aquatica, Pygmyweed
Tofieldia glutinosa, Sticky False-asphodel
Triglochin maritima, Common Arrow-grass
Trillium cernuum, Nodding Trillium
Triphora trianthophora, Three-bird Orchid
Trisetum spicatum var. pilosiglume, Spiked Bristle Grass
Ulmus thomasii, Cork Elm
Utricularia inflata var. minor, Inflated Bladderwort
Utricularia resupinata, Northeastern Bladderwort
Uvularia perfoliata, Perfoliate Bellwort
Vaccinium boreale, Boreal Blueberry
Vaccinium cespitosum, Dwarf Bilberry
Vaccinium stamineum, Deerberry
Vaccinium uliginosum, Alpine Bilberry
Vaccinium vitis-idaea, Mountain Cranberry
Valeriana uliginosa, Marsh Valerian
Verbena bracteata, Large-bract Vervain
Veronica anagallis-aquatica, Brook Pimpernell
Veronica catenata, Water-speedwell
Veronicastrum virginicum, Culver's-root
Viburnum edule, Squashberry
Viola lanceolata, Lance-leaved Violet
Viola palmata, Early Blue Violet
Viola triloba, Three-lobed Violet
Vitis novae-angliae, New England Grape
Vulpia octoflora, Eight-flowered Fescue
Woodsia alpina, Alpine Woodsia
Woodsia glabella, Smooth Woodsia
Woodwardia virginica, Virginia Chain-fern
Xyris montana, Northern Yellow-eyed Grass
Zannichellia palustris, Horned Pondweed

Mosses

Amphidium lapponicum
Amphidium mougeotii
Anacamptodon splachnoides
Andreaea rothii
Anomobryum filiforme
Aphanorrhegma serratum
Astomum muhlenbergianum
Atrichum crispum
Atrichum tenellum
Aulacomnium androgynum
Barbula convoluta . var. convoluta
Blindia acuta
Brachythecium acuminatum
Brachythecium acutum
Brachythecium campestre
Brachythecium digastrum
Brachythecium erythrorrhizon
Brachythecium turgidum
Bryhnia graminicolor
Bryoandersonia illecebra
Bryohaplocladium microphyllum

Bryum gemmilucens
Bryum pallens
Buxbaumia aphylla
Buxbaumia minakatae
Calliergon obtusifolium
Calliergon richardsonii
Calliergon trifarium
Campylium polygamum
Campylium radicale
Cinclidium stygium
Cirriphyllum piliferum
Conardia compacta
Cynodontium alpestre
Cynodontium strumiferum
Cyrto-hypnum pygmaeum
Cyrtomnium hymenophylloides
Dichelyma capillaceum
Dichelyma falcatum
Dichelyma falcatum
Dichodontium pellucidum
Dicranella cerviculata
Dicranella rufescens
Dicranella schreberiana
Dicranodontium denudatum
Dicranum ontariense
Didymodon fallax var. fallax
Didymodon fallax var. reflexus
Didymodon tophaceus
Distichium capillaceum
Ditrichum lineare
Ditrichum pallidum
Ditrichum pusillum
Drummondia prorepens
Entodon brevisetus
Ephemerum cohaerens
Ephemerum spinulosum
Eurhynchium hians
Fissidens exilis
Fissidens subbasilaris
Fontinalis hypnoides var. duriaei
Forsstroemia trichomitria
Grimmia affinis
Grimmia pilifera
Grimmia trichophylla
Grimmia unicolor
Hamatocaulis vernicosus
Haplohymenium triste
Helodium blandowii
Herzogiella turfacea
Heterocladium dimorphum
Hygrohypnum closteri
Hygrohypnum duriusculum
Hygrohypnum duriusculum
Hygrohypnum molle
Hygrohypnum montanum
Hylocomiastrum pyrenaicum
Hypnum cupressiforme var filiforme
Hypnum cupressiforme var. resupinatum
Hypnum fertile
Hypnum recurvatum
Isopterygiopsis muelleriana
Isopterygiopsis pulchella
Leptodictyum humile
Leptodictyum humile
Leskea obscura
Limprichtia cossonii
Limprichtia revolvens
Meesia triquetra
Mnium ambiguum
Mnium thomsonii
Myurella julacea
Neckera complanata
Orthotrichum obtusifolium
Orthotrichum ohioense
Orthotrichum pumilum
Orthotrichum speciosum
Orthotrichum speciosum var. elegans
Orthotrichum stellatum
Oxystegus tenuirostris
Paludella squarrosa
Palustriella commutata
Philonotis marchica
Philonotis muehlenbergii
Philonotis yezoana
Physcomitrium immersum
Plagiobryum zieri
Plagiomnium drummondii
Plagiomnium rostratum
Platydictya confervoides
Platydictya jungermannioides
Platydictya subtile
Pleuridium subulatum
Pogonatum dentatum
Pohlia annotina
Pohlia bulbifera
Pohlia camptotrachela
Pohlia drummondii
Pohlia proligera
Polytrichum formosum
Polytrichum longisetum
Pottia davalliana
Pseudobryum cinclidioides
Pseudotaxiphyllum distichaceum
Pseudotaxiphyllum elegans
Ptychomitrium incurvum
Pylaisiella polyantha
Racomitrium canescens
Racomitrium fasciculare
Rhizomnium pseudopunctatum
Saelania glaucescens
Schistostega pennata
Schwetschkeopsis fabronia
Scorpidium scorpioides
Sematophyllum adnatum
Sematophyllum demissum
Sematophyllum marylandicum
Sphagnum andersonianum
Sphagnum atlanticum
Sphagnum austinii
Sphagnum bartlettianum
Sphagnum brevifolium
Sphagnum compactum
Sphagnum contortum
Sphagnum henryense
Sphagnum inundatum
Sphagnum isoviitae
Sphagnum majus
Sphagnum mcqueenii
Sphagnum nitidum
Sphagnum platyphyllum
Sphagnum quinquefarium
Sphagnum recurvum
Sphagnum riparium
Sphagnum torreyanum
Sphagnum viride
Splachnum ampullaceum
Taxiphyllum deplanatum
Thelia asprella
Timmia megapolitana
Tomenthypnum falcifolium
Tortella fragilis
Tortella inclinata
Tortula mucronifolia
Tortula ruralis
Trematodon ambiguus
Trichostomum crispulum
Warnstorfia exannulata

Liverworts
Anastrophyllum helleranum
Anastrophyllum michauxii
Anastrophyllum minutum
Anastrophyllum saxicolus
Aneura maxima
Athalamia hyalina
Barbilophozia hatcheri
Calypogeja integristipula
Calypogeja sphagnicola
Calypogeja suecica
Cephalozia connivens
Cephalozia leucantha
Cephalozia pleniceps
Cephaloziella arctica
Cephaloziella divaricata
Cephaloziella elachista
Cephaloziella massalongi
Cephaloziella rubella var. elegans
Cephaloziella rubella var. rubella
Cephaloziella stellulifera
Chandonanthus setiformis
Fossombronia foveolata
Frullania inflata
Frullania oakesiana
Frullania plana
Frullania squarrosa
Gymnocolea inflata
Gymnomitrion concinnatum
Harpanthus drummondii
Jungermannia caespiticia
Jungermannia evansii
Jungermannia gracillima
Jungermannia sphaerocarpa
Lophocolea cuspidata
Lophozia alpestris
Lophozia ascendens
Lophozia bicrenata
Lophozia collaris
Lophozia excisa
Lophozia heterocolpa
Lophozia kunzeana
Lophozia laxa
Lophozia longidens susbp. longidens
Lophozia sudetica
Marchantia alpestris
Marchantia aquatica
Metzgeria crassipilis
Mylia taylori
Nardia scalaris
Odontoschisma denudatum var. denudatum
Odontoschisma prostratum
Pellia megaspora
Phaeoceros laevis subsp. carolinianus
Porella pinnata
Radula obconica
Riccardia palmata
Riccia huebeneriana ssp. sullivantii
Scapania cuspiduligera
Scapania gymnostomophila
Scapania irrigua
Scapania lingulata var. lingulata
Scapania mucronata
Scapania umbrosa
Tritomaria quinquedentata var. quinquedent

Vermont's
Wildlife Action Plan

November 22, 2005

Appendix B
Habitat & Community Summaries

Note: Landscape Forest &
Landscape Aquatic Summaries are in Chapter 4

Introduction/SGCN Conservation at Multiple Scales

Vermont's list of Species of Greatest Conservation Need (SGCN) comprises 144 vertebrate species (including chestnut sided-warbler, lake sturgeon, and spotted salamanders) as well as 192 invertebrate species (including tawny emperor butterflies, cobblestone tiger beetles, and giant floater mussels). Developing individual conservation plans for each SGCN would have been exhausting and impractical. Moreover, attempts to implement the more than 300 plans would be impossible due to insufficient resources and the high overall cost, resulting from the inefficiency of implementing many uncoordinated plans (not to mention problems reminiscent of the Keystone Cops stemming from the hundreds of biologists in the field bumping into each other).

Fortunately an easier, cheaper, and more efficient approach to addressing the needs of our Species of Greatest Conservation Need exists. That method consists of designing and implementing conservation efforts at multiple scales. For example, wildlife managers have been creating edge habitat for decades (Smith 1980) where, for example, an early successional stage of forest borders later successional forest. They do this because research shows that this improves conditions for deer, rabbit, turkey, ruffed grouse and several other species. In this example management actions were targeted at the habitat level.

Similarly, research in the 1960's and 1970's indicated that pesticides such as DDT so weakened the eggs of loon, osprey, peregrine falcons and many other birds of prey that eggs were collapsing under the weight of expectant parents. Not only did this add to nationwide population crashes, it also impeded restoration efforts because the pesticides remained in the birds for years. Action taken at the state and federal level—the regulation of pesticides—eventually helped these species and loon, osprey, peregrine falcon were finally removed from the Vermont's endangered species list in April of 2005.

Following this approach, we began at the species level by assessing SGCN individually. Then SGCN were organized by taxonomic group and by habitat usage with habitats grouped by vegetation type. This resulted in conservation strategies at five levels (table 4-1). Some species will always require specific conservation attention, such as those that are very rare, those that are declining across their range, those that aggregate for breeding, and those that require large home ranges. Their needs are addressed at the Species Level. Other species' needs can be met by the long-term conservation of high quality habitats and communities used by these species (the Community Level). Still other species will require conservation at the scale of wildlife travel corridors and large forest blocks (the Landscape Level).

Table 4-1 Organization of Conservation Information in this Report

Level	Organization	Location in this document
1) Species	144 individual species summaries & 16 invertebrates group summaries	Appendix A
2) Taxon	5 group summaries (bird, fish, invertebrate, mammal and reptile & amphibian)	Chapter 4
3) Community & Cultural Habitat Groups	120 communities & cultural habitats grouped into 18 summaries	Appendix B
4) Landscapes	6 landscape summaries (4 forest, riparian & fluvial)	Chapter 4
5) State & Region	State-level conservation strategies and action themes	Chapter 1

Selection of Classification Systems

Though great strides have been made in developing vegetation classification systems that function at the site, landscape, region and national scales (Barnes 1979, Allen and Starr 1982, Forman and Godron 1986, Cleland et. al 1997, Grossman et. al 1998) they are incomplete. In particular, no system satisfactorily integrates aquatic and terrestrial communities and cultural habitats[1] used by wildlife. The efforts of every

[1] Cultural habitats are communities and sites that are either created and/or maintained by human activities or are modified by human influence to such a degree that the physical condition is substantially different from what existed prior to human influence (adapted from Reschke 1990)

state, however, in development of their Action Plan greatly improve our prospects and plans are underway for coordination and information sharing once states' Action Plan reports are approved (IAFWA 2005).

In lieu of a unified habitat classification system, Vermont's Action Plan technical teams utilized the best features of five peer-reviewed vegetation classification systems that can be crosswalked with those used in other states to support broader scale conservation efforts—regionally, nationally, and internationally. Forest Cover Types (Eyre 1980) and U.S Forest Service Forest Inventory & Analysis Types (USDA 2003) were used for early successional stage forests. Natural Communities (Thompson and Sorenson 2000) were the basis most terrestrial vegetation. "A Classification of the Aquatic Communities of Vermont" by Langdon et. al. (1998) was adapted for aquatic community designations and cultural habitats[1] were adapted from Reschke (1990). Landscape scale communities were adapted from Poiani et.al. (2000).

One hundred 120 aquatic and natural community types, cultural habitats and land cover types, capturing most of the habitat required by SGCN were selected from the five systems (table 4-2). Each was assigned to one of 22 categories. Because Lake Champlain and the Connecticut River harbor most of the fish diversity in Vermont, these two waterbodies were broken out from the taxonomy to provide for a more targeted assessment. Technical teams then developed assessment summaries for each that includes descriptions and general locations; current conditions; desired conditions based on the needs of associated SGCN; priority problems; conservation strategies to address problems (along with the identification of potential conservation partners and funding sources); and a listing of relevant plans and planning processes pertinent to a habitat type. (Appendix B)

In addition, three landscapes were selected (forest, riparian, and fluvial/stream) to address connectivity needs of many SGCN as well as the needs of wide-ranging SGCN. Assessment summaries were also completed for each landscape (see this chapter).

Successional Stages, Species of Greatest Conservation Need and the Action Plan

Plant succession produces cumulative change in the types of plant species occupying a given area through time. It is complicated by factors such as disturbance (large and small), local conditions, seed banks and soil legacies (Oliver 1981). A highly simplified timeline begins when land is cleared. Pioneer species typically return first followed by other species generally better adapted to the new and changing conditions created by the previous suite of species. Given sufficient time and appropriate conditions the area moves roughly through early, middle, and late successional stages—often referred to as mature or old growth. A disturbance, if sufficiently large, can re-set the clock anytime and succession begins again. The best known examples are forest succession but it occurs in virtually all vegetated areas. For example, lichen communities on granite mountaintops experience successional changes (Wessels 2002).

Succession can significantly impact habitat for Species of Greatest Conservation Need and other wildlife as in the edge habitat example noted earlier. Generally as succession moves from early to late stages some wildlife will lose out (e.g., spruce grouse, woodcock, cottontail rabbit) and others will benefit (e.g., marten, northern goshawk). Others still prefer a mix of successional stages in appropriate configurations (e.g., black bear, lynx).

Over the past two centuries the mix of successional stages available to Vermont's wildlife has changed dramatically in both distribution and abundance. Though precise estimates (current and historic) are unavailable, prior to 1800 a significant percentage of Vermont's forests were in late-successional stages (>150-300 years and older). One-hundred years later early-successional stages (1-15 years) dominated the state and today mid-successional forests (60-100 years) are most abundant. Wildlife populations have responded in turn. Vermont's SGCN list contains relatively few species requiring mid-successional forests and more that thrive in early and late-successional representations.

Because the loss of late-successional forests in the eastern US occurred prior to the advent of modern wildlife biology and the current scarcity of later-successional stages (particularly northern hardwood forest types) our understanding how wildlife utilized these stages is not as advanced as our knowledge of wildlife in early successional stages. Historic records and research in late-successional areas elsewhere indicate that the distribution and abundance of some wildlife species was much greater when late-successional forests were in greater abundance—even if these species can survive without them. Given the lack of this condition on the landscape it is advisable to increase its availability to wildlife.

The habitat, community and landscape summaries that follow here and in Appendix B address habitat the needs of Species of Greatest Conservation Need that use that vegetation type in one or more successional stages. Conservation strategies address the particular successional stage needs well those species that prefer a mosaic of successional stages.

Table 4-2: Landscape, Community, Habitat & Cover Type Categories

***** Categories marked with an asterisk "*" are considered major categories for the purposes of organizing this report (24 in all). Conservation summaries were developed addressing characteristics and location, current and desired condition, SGCN using this habitat category, priority problems impacting this category, conservation strategies to address the problems and a list of other plans and planning entities with significant interest in this area.

Landscapes (adapted from Poiani et.al. 2000)

*****Landscape Forests
- Large blocks of contiguous forest
- Statewide and regional wildlife corridors and linkages
- *Spruce-Fir Northern Hardwoods
- *Northern Hardwood Forests
- *Oak-Pine-Northern Hardwoods

(These three Northern Hardwood natural communities comprise the bulk of Vermont's landscape forests)

*****Landscape Level Aquatic & Shorelines (includes riparian areas)

*****Fluvial (Riverine) (adapted from Langdon et.al. 1998)
- Brook trout
- Brook trout-slimy sculpin
- Blacknose dace-slimy sculpin
- Blacknose dace-bluntnose minnow
- Blacknose dace creek chub
- Tessellated darter-fallfish
- Blacknose dace-slimy sculpin
- White sucker-tessellated darter

Aquatic Communities (adapted from Langdon et.al. 1998)

*****Lower Connecticut River (Atlantic salmon-American shad community)

*****Lower Lake Champlain Tributaries (Redhorse-lake sturgeon community)

*****Lacustrine (lakes and ponds)
- Dystrophic lakes
- Meso-eutrophic lakes
- Oligotrophic lakes
- High elevation acidic lakes

*****Lake Champlain

Cultural Habitats (adapted from Reschle 1990)

*****Building & structures

*Mine & gravel pits

*****Grassland & hedgerows
- Grasslands
- Hedgerow
- Old field/shrub
- Orchard

Successional Stages & Forest Cover Types (Eyre 1980, US Dept of Agriculture 2003)

Stages: Seedling/Sapling Sapling/Pole Timber, Pole Timber

Cover types

Boreal Conifers
- Balsam fir
- Black spruce
- White spruce

Boreal Hardwoods
- Aspen
- Pin cherry
- Paper birch

Spruce-Fir
- Red spruce
- Red spruce-balsam fir
- Paper birch-red spruce-balsam fir

Pine and Hemlock
- Eastern white pine

Note: *Habitat descriptions in the Individual Species Summaries (A1-A5) note specific stage & cover type needs for SGCN*

Landscape Forest Summaries (next section) incorporate stage and cover type as part of landscapes & natural communities

Table 4-2 continued: Terrestrial Natural Communities (Thompson & Sorenson 2000)

Open or Shrub Wetlands

*Open Peatlands
- Alpine peatland
- Dwarf shrub bog
- Black spruce woodland bog
- Pitch pine woodland bog
- Poor fen
- Rich fen
- Intermediate fen

*Marshes & Sedge Meadows
- Deep bulrush marsh
- Deep broadleaf marsh
- Shallow emergent marsh
- Sedge meadow
- Cattail marsh
- Wild rice marsh

*Wet Shores
- Calcareous riverside seep
- River cobble shore
- Lakeshore grassland
- Riverside sand or gravel shore
- Outwash plain pondshore
- River mud shore
- Rivershore grassland

*Shrub Swamps
- Buttonbush basin swamp
- Alder swamp
- Alluvial shrub swamp
- Sweet gale shoreline swamp
- Buttonbush swamp

Forested Wetlands

*Floodplain Forests
- Silver maple-ostrich fern riverine floodplain forest
- Lakeside floodplain forest
- Silver maple-sensitive fern riverine floodplain forest
- Sugar maple-ostrich fern riverine floodplain forest

*Hardwood Swamps
- Red maple-black ash swamp
- Red maple-northern white cedar swamp
- Calcareous red maple-tamarack swamp
- Red or silver maple-green ash swamp
- Red maple-black gum swamp
- Red maple-white pine-huckleberry swamp

*Softwood Swamps
- Northern white cedar swamp
- Spruce-fir-tamarack swamp
- Black spruce swamp
- Hemlock swamp

*Seeps & Vernal Pools
- Vernal pool
- Seep

Open Upland Communities

*Upland shores
- Riverside outcrop
- Lake sand beach
- Lake shale or cobble beach
- Erosional river bluff
- Sand dune

*Outcrops & Upland Meadows
- Alpine meadow
- Boreal outcrop
- Serpentine outcrop
- Temperate acidic outcrop
- Temperate calcareous outcrop

*Cliffs & Talus
- Boreal acidic cliff
- Boreal calcareous cliff
- Temperate acidic cliff
- Temperate calcareous cliff
- Open talus

Upland Forests & Woodlands

*Spruce-Fir Northern Hardwood Forest (included with landscape forest summary)
- Subalpine krummholz
- Montane spruce-fir forest
- Lowland spruce-fir forest
- Montane yellow birch-red spruce forest
- Boreal talus woodland
- Cold-air talus woodland
- Red spruce-northern hardwood forest

*Northern Hardwood Forest (included with landscape forest summary)
- Northern hardwood forest
- Rich northern hardwood forest
- White pine-northern hardwood forest
- Mesic red oak-northern hardwood forest
- Hemlock forest
- Hemlock-northern hardwood forest
- Northern hardwood talus woodland

*Oak-Pine-Northern Hardwood Forest (included with landscape forest summary)
- Limestone bluff cedar-pine forest
- Mesic maple-ash-hickory-oak forest
- Valley clayplain forest
- White pine-red oak-black oak forest
- Dry oak forest
- Pine-oak-heath sandplain forest
- Dry oak-hickory-hophornbeam forest
- Red cedar woodland
- Red pine forest or woodland
- Pitch pine-oak-heath rocky summit
- Dry oak woodland
- Transition hardwood talus woodland

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Floodplain Forest Summary

Characteristics and Location

Floodplain forests are usually dominated by silver maple or occasionally sugar maple, with abundant ostrich fern or sensitive fern. They are closely associated with river and lake floodplains and have exposed mineral soils of alluvial origin.

Natural communities of the Floodplain Forest include: Silver Maple-Ostrich Fern Riverine Floodplain Forest, Silver Maple-Sensitive Fern Riverine Floodplain Forest, Sugar Maple-Ostrich Fern Riverine Floodplain Forest and Lakeside Floodplain Forest.

Natural Communities of the Floodplain Forest:

Silver Maple-Ostrich Fern Riverine Floodplain Forest: This forest is found in the floodplains of moderate-gradient rivers. Silver maple and ostrich ferns are the dominant species and the soils are typically well drained sandy alluvium. Boxelder may be abundant in young forests.

Silver Maple-Sensitive Fern Riverine Floodplain Forest: These forests occur in the floodplains of large, low-gradient rivers. Silver maple is the dominant tree, but green ash and swamp white oak may be present. Sensitive fern and false nettle are characteristic. Soils are moist, typically mottled, silty alluvium.

Sugar Maple-Ostrich Fern Riverine Floodplain Forest: This uncommon floodplain forest type occurs along small to moderate sized high gradient rivers in areas of calcium-rich bedrock. Sugar maple, white ash, basswood, boxelder, and ostrich fern are common. There can be a diverse herbaceous layer. Soils are well drained sandy alluvium. Many examples of this community are uplands.

Lakeside Floodplain Forest: These forests occur primarily within the flooding zone of Lake Champlain. Silver maple and green ash are the dominant trees. Herbs include sensitive fern, false nettle, marsh fern, white grass, and Tuckerman's sedge. Surface organic layers are present in the moist silty soils and there are mottles near the surface.

Floodplain Forest Condition

Historical Perspective: Although there is little specific information on distribution and composition of floodplain forests prior to European settlement in the region (Siccama 1971), it is expected that they covered large areas and were likely continuous bands of forest extending unbroken for miles along all of our major rivers. Forests of towering silver maple and American elm likely covered many of the active floodplains, with more diverse forests of sugar maple, red oak, and other species on higher terraces of former floodplains. (Sorenson et al. 1998). Although their total numbers were relatively small, evidence suggests that the Abenaki people that lived in Vermont concentrated their villages and agriculture on and adjacent to the floodplains of the Connecticut River, other major rivers, and Lake Champlain (Klyza and Trombulak 1999).

Current Condition: High quality floodplain forests are now uncommon in Vermont because the vast majority of the floodplain forest in Vermont and the region has been converted to agricultural use. Floodplains have been prized as agricultural lands because of their high soil fertility associated with annual flooding and deposition and because of the absence of stones. As a result of their high value as agricultural lands, floodplain forests are now limited to fragments of their original size. The small percentage of riverine floodplains remaining in a forested condition is illustrated for Franklin County by a comparison made between the area of alluvial soils identified by the Natural Resources Conservation Service (USDA 1979)and the area of floodplain forests identified in a Vermont Fish and Wildlife Department floodplain forest inventory project (Sorenson et al. 1998). Although approximate, this comparison indicates that as little as 11% of the floodplains in Franklin County remain in a forested condition.

Significant changes to the flooding regimes of floodplain forests results from dam operation and the construction of roads, bridges, and culverts along rivers and in floodplains. Furthermore, the disturbed nature of many of the floodplain sites makes them vulnerable to invasive exotic plant species, such as goutweed (*Aegopodium podograria*), garlic mustard (*Alliaria petiolata*), dame's-rocket (*Hesperis matronalis*), honeysuckle (*Lonicera* spp.), and Japanese knotweed (*Polygonum cuspidatum*) (Sorenson et al. 1998).

Desired Condition (SGCN Needs): Floodplain forest is essential to those SGCN that require habitat mosaics of aquatic and riparian areas and upland forest. Several of the species associated with floodplain forests require a riparian mosaic that depends upon functioning floodplain wetlands (e.g., pied-billed grebe, Odonata, American black duck); many of which are most abundant in the floodplains of larger river systems. Other species such as the water shrew and spotted salamander use floodplain forest directly adjacent to the stream or river. Lastly, there are some species that require large (10-1000ha) contiguous blocks of forested habitat along stream and rivers—these range from the bald eagle to the mink to the wood turtle. In all, floodplain forest provides habitat for a total of 49 wildlife SGCN and 28 plant SGCN. Desired conditions include functional floodplain forests in healthy examples (mature, unfragmented) distributed across their range. High water quality is also an essential element of floodplain forest quality. Focus should be give to the largest examples.

Species of Greatest Conservation Need in Floodplain Forests

High Priority

American Black Duck (Anas rubripes)
Bald Eagle (Haliaeetus leucocephalus)
Canada Warbler (Wilsonia canadensis)
Fowler's Toad (Bufo fowleri)
Wood Turtle (Clemmys insculpata)
Bog/fen Odonata Group
Freshwater Snails
Hardwood Forest Butterflies
Lakes/ponds Odonata Group
Seep/rivulet Odonata Group
Vernal Pool Odonata Group
Eastern Pipistrelle (Pipistrellus subflavus)
Water Shrew (Sorex palustris)

Medium Priority

Blue-winged teal (Anas discors)
Great Blue Heron (Ardea herodias)
Long-eared Owl (Asio otus)
Red-shouldered Hawk (Buteo lineatus)
Veery (Catharus fuscescens)
Chimney Swift (Chaetura pelagica)
Cerulean Warbler (Dendroica cerulea)
Black-crowned Night-heron (Nycticorax nycticorax)
Osprey (Pandion haliaetus)
Pied-billed Grebe (Podilymbus podiceps)
Spotted Salamander (Ambystoma maculatum)
Brown Snake (Storeria dekayi)
Mink (Mustella vison)
Cinereus or Masked Shrew (Sorex cinereus)

SGCN Notes: Plant SGCN not listed here include 28 species. The SGCN invertebrate groups listed here contain numerous species Wolf and Black bear utilize floodplain forests but are addressed at the Landscape level. See that section for details. For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/Info Need/Categories	Problem/Info Need Detail	Rank
Habitat Conversion	Agriculture and development	High
Habitat Fragmentation	Wider ranging birds, mammals, and reptiles require unfragmented habitat mosaics of 10-1000 ha or more	High
Inadequate Disturbance Regime	Dams, drainage ditching, filling, and runoff that affect flooding, erosion, and deposition	High
Habitat Degradation	Altering forest conditions along streams and rivers	High
Distribution of successional stages	Loss of mid-story forest cover due to lack of disturbance or active management. (Veery)	Medium
Invasive Exotic Species	Loosestrife and common reed	High
Trampling or direct impacts	Human activity proximate to nesting birds	High
Inventory	Determine the location, distribution and condition of floodplain forests throughout their range.	Medium

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here.
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Locate floodplain forests and assess management practices for these forests.	Number of sites located and assessed	ANR,FSA, UVM,VA	SWG
Identify areas within the state with the largest matrix of floodplain forest for inclusion in conservation opportunity area.	Number of opportunity areas identified	ANR, UVM, NRCS	WRP, SWG
Consider protection of opportunity areas via acquisition of conservation easements, management leases and fee title acquisition	Number of sites conserved	ANR, VHCB, TNC, NRCS	VHCB, WRP, TNC
Manage exotic species on state owned sites and provide technical assistance to other landowners regarding control of exotics	Number of sites with control activities and/or invasive monitoring	ANR, NEPCoP, TNC, NRCS	WHIP, LIP, SWG
Technical assistance to private landowners, NGOs and government agencies to maintain and enhance floodplain forests for SGCN	Number of acres of floodplain forest managed for SGCN maintained, enhanced or restored. Number landowners incorporating SGCN into their land management.	NRCS, TNC, VFWD, FSA	WHIP, WRP, CREP, CRP, LIP, SWG

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Technical assistance to towns and regional planning organizations to maintain and enhance floodplain forests for SGCN. Distribute *Conserving Vermont's Natural Heritage* (Austin et.al. 2004)	Number of acres of floodplain forest managed for SGCN maintained, enhanced or restored. Number landowners incorporating SGCN into their land management, Number of towns including SGCN in their planning.	NRCS, TNC, VFWD	LIP, SWG, WRP, CREP
Financial incentives for private landowners to maintain and enhance floodplain forests for SGCN	Number of acres conserved/restored	VFWD, NRCS	LIP, WHIP, WRP
Conservation easements on higher quality sites with greatest number of SGCN or T&E listed SGCN	Number of acres conserved for SGCN	ANR, VLT, TNC	VHCB, VLT, LIP
Manage or remove dams to restore more natural flooding regimes	Number sites with adequate flooding regimes	ANR, CT River Watershed Council	ACOE

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the lead column

Plan or planning entity	Goal/Scope of plan	Lead
Floodplain Forests of Vermont	Natural Community Inventory	ANR
Draft VT Bat Conservation Plan	Bat conservation	ANR
Bald eagle recovery plan	Bald eagle recovery	NWF, ANR
Partners in Flight	Bird conservation plan	ANR, VT Audubon, USFWS
North American Waterfowl Plan	Waterfowl populations	USFWS, ANR, DU

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Hardwood Swamp Summary

Characteristics and Location

Hardwood dominated swamps are the most common swamp type in the state. They are especially common in the warmer regions of the state on flatter topography and so reach their largest size and greatest abundance in the Champlain Valley and are least frequent in the Northeast Highlands. While two of the seven types are widely distributed, two others are restricted to a few biophysical regions, and the remaining three occur primarily in only a single biophysical region.

Hardwood swamps provide a number of functions, including flood storage, water quality protection, and fish, wildlife, and endangered species habitat. Because of their more open, deciduous canopy, hardwood swamps have more significant understory development than do softwood dominated swamps. This feature, along with their characteristic hummock and hollow topography, creates a landscape mosaic that provides an abundance of microhabitats.

The hardwood swamp formation includes the seven following natural community types:

Red Maple-Black Ash Seepage Swamp: This is the most common hardwood swamp type in the state. It occurs in all biophysical regions as either small or large patches. Although they occur in various settings, this natural community type is closely associated with groundwater seepage and does not typically experience surface flooding of long duration. While red maple is typically the dominant tree, black ash is very characteristic of this community. There are also other tree species present and well developed shrub and herbaceous layers.

Red Maple-Sphagnum Acidic Basin Swamp: This is another common swamp type that is widely distributed throughout the state. Typically it occurs in poorly drained basins with deep organic soils. Groundwater seepage is absent and the permanently saturated soils tend to be quite acidic. Since they occur in basins, most of these basin swamps are small and typically have no inlet or outlet streams. Red maple is the dominant tree, often with a co-dominance of yellow birch and various softwoods. The shrub layer is well developed, but the herb layer is less diverse, often with dominance by cinnamon fern. Moss cover typically approaches 100%.

Red Maple-Northern White Cedar Swamp: This uncommon community type exists as large patches mostly in the western part of the state. This community is limited to areas of calcareous bedrock and is often associated with floodplains, especially in the Champlain Valley. Although it can also occur in isolated basins, it can form huge wetland complexes where it is associated with larger rivers. Red maple, white cedar, and black ash typically dominate the canopy. Both the shrub and herbaceous layer tend to be sparse depending upon the degree of shading and the abundance of water-filled hollows.

Calcareous Red Maple-Tamarack Swamp: This is a rare community type that is restricted to areas of calcareous groundwater seepage. It is mostly restricted to the Vermont Valley with only a few examples in other biophysical regions. It typically occupies small isolated basins, but may also occur as part of a large wetland complex. Red maple and tamarack

dominate the canopy that can range from nearly closed to very open. In the latter situation, especially, a diversity of shrubs, herbaceous, and bryophyte species flourish.

Red or Silver Maple-Green Ash Swamp: This uncommon natural community type is largely restricted to the Champlain and Vermont Valleys. It occurs as large patches mostly associated with Lake Champlain. This swamp type typically undergoes extensive spring flooding that often results in saturated soils throughout the growing season. Although silver maple typically dominates, red maple and green ash may be very abundant. Both the shrub and herbaceous layer are well developed.

Red Maple-Black Gum Swamp: This rare community type occurs as small patches. It is mostly restricted to the southeastern part of the state with a few outliers in other regions. It occurs in small basins that are isolated from surface waters and that contain deep, saturated organic soils. Red maple and black gum co-dominate, but hemlock, yellow birch, and red spruce are also common.

Red Maple-White Pine-Huckleberry Swamp: This is a very rare natural community type that is restricted to the Champlain Valley. All known examples occur near the center of much larger wetland complexes. The canopy is dominated by red maple and white pine, but the most striking feature is the dense cover of huckleberry below. Typically, cinnamon fern dominates the herbaceous layer.

Hardwood Swamps Condition

Current Condition: Although still relatively common in the state, hardwood swamps were formerly even more abundant. The primary activities resulting in loss of hardwood swamps were commercial and residential road development and road construction. Presently, agricultural conversion results in the greatest loss of swamps. Although protected by the Vermont Wetland Rules, many smaller examples are not mapped and therefore not protected under the regulations. Since many of these swamp types are most abundant in the lower, warmer regions of the state, they are subject to hydrologic impairment and incremental loss along the edges as the area around them is developed.

The primary problems to SGCN include agricultural conversion, invasion by exotics, altered hydrology, development and unrestricted logging.

Desired Condition: Forested wetlands provide habitat for a number of SGCN in the state. Hardwood dominated examples are especially diverse since they tend to be at lower elevations and in warmer areas of the state than coniferous swamps. A total of 36 SGCN animals and 43 plant SGCN rely on one or more of these natural communities to provide habitat. Several of the species associated with hardwood swamps also require a habitat mosaic that depends on functioning swamps. Desired conditions include functional hardwood swamps in healthy examples (mature, unfragmented) across the distribution of their range High water quality is also essential to habitat quality. Focus should be give to the largest examples.

Species of Greatest Conservation Need in Hardwood Swamps

High Priority

American Black Duck (Anas rubripes)
Canada Warbler (Wilsonia canadensis)
Fowler's Toad (Bufo fowleri)
Spotted Turtle (Clemmys guttata)
Wood Turtle (Clemmys insculpta)
Eastern Rat Snake (Elaphe obsoleta)
Bog/fen/swamp/marshy pond Odonata group
Eastern Pipistrelle (Pipistrellus subflavus)
Pygmy Shrew (Sorex hoyi)

Medium Priority

Blue-winged Teal (Anas discors)
Great Blue Heron (Ardea herodias)
Long-eared Owl (Asio otus)
Red-shouldered Hawk (Buteo lineatus)
Veery (Catharus fuscescens)
Chimney Swift (Chaetura pelagica)
Rusty Blackbird (Euphagus carolinus)
Black-crowned Night-heron (Nycticorax nycticorax)
Osprey (Pandion haliaetus)
Pied-billed Grebe (Podilymbus podiceps)
Blue-spotted Salamander (Ambystoma laterale)
Spotted Salamander (Ambystoma maculatum)
Four-toed Salamander (Hemidactylium scutatum)
Brown Snake (Storeria dekayi)
Cinereus or Masked Shrew (Sorex cinereus)
Black Bear (Ursus americanus)

SGCN Notes: Plant SGCN not listed here 43. The SGCN invertebrate group listed here contains numerous species. For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/Info Need/Category	Problem/Info Need Detail	Rank
Habitat Conversion	Agriculture, road building, development	High
Hydrologic alteration	Sedimentation, development in watershed, road building, dams	High
Invasion by Exotic Species	Non-native species can spread and degrade the habitat for wildlife and eliminate some plant species	Medium
Habitat Degradation	Selective removal of cedar or black gum, logging on non-frozen ground, heavy cutting	High
Habitat Fragmentation	Roads, agriculture, and development break swamps into smaller patches	High
Inventory	Statewide inventory has been completed, but not all sites have been evaluated	Low

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here.
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Provide information to State Wetlands Office & EPA	Number of sites added to database	DEC, EPA	SWG, EPA
Locate hardwood swamps and assess their management practices.	Number of sites located and assessed	ANR,FSA, UVM,VA	SWG
Identify areas within the state with the largest matrix of hardwood swamps for inclusion in conservation opportunity areas.	Number of opportunity areas identified	ANR, UVM	SWG
Consider protection of large hardwood swamps via acquisition of conservation easements, management leases and fee title acquisition	Number of sites conserved	ANR, VHCB, TNC	VHCB, TNC
Manage exotic species on state owned sites and provide technical assistance to other landowners regarding control of exotics	Number of sites with control activities and/or invasive monitoring. Number sites where invasive species are eliminated or controlled	NEPCoP, TNC, NRCS	LIP, SWG
Provide technical assistance to private landowners, NGOs and government organizations to plan and manage for SGCN in hardwood swamps.	Number of acres maintained, enhanced or restored. Number landowners incorporating SGCN into their land management.	NRCS, TNC, VFWD, FSA	LIP, SWG, CREP, WHIP, CRP
Provide technical assistance to towns and regional planning organizations to plan and manage for SGCN in hardwood swamps. Distribute *Conserving Vermont's Natural Heritage* (Austin et.al. 2004)	Number of acres maintained, enhanced or restored. Number landowners incorporating SGCN into their land management, Number of towns including SGCN in their planning.	NRCS, TNC, VFWD	LIP, SWG, CREP
Financial incentives for private landowners	Number of acres conserved/restored	VFWD, NRCS	LIP, WHIP, WRP
Conservation easements on higher quality sites with greatest number of SGCN or T&E listed SGCN	Number of acres conserved for SGCN	ANR, VLT, TNC	VHCB, VLT, LIP

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Plan or planning entity	Goal/Scope of plan	Lead
New England Plant Conservation Program – various Conservation Plans	Recovery of various plant species in New England	ANR
North American Waterfowl Plan	Waterfowl conservation and management	ANR
Black Bear Plan	Bear conservation and management in Vermont	ANR

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Softwood Swamps Summary

Characteristics and Location

Most softwood swamps in Vermont are situated at higher elevations in the cooler regions of the state. The one exception are hemlock swamps which behave more like hardwood swamps and are located in the lower, warmer portions of the state. Because of the dense shading in softwood swamps, the understory shrub and herbaceous layers are generally quite sparse. Conversely due to these same moist shady conditions, bryophyte cover tends to be quite abundant. All of the natural communities in this formation occur as small patches on the landscape with the exception of spruce-fir tamarack swamps which occur as large patch communities.

There are four types of natural community included within the softwood swamp group

Northern White Cedar Swamp: This is an uncommon natural community type that is associated with calcareous bedrock and groundwater seepage that makes the dissolved minerals available to the plants. Although it occurs in most of the state's biophysical regions, this community is more abundant in the northern half of the state since white cedar declines to the south. In addition to white cedar, balsam fir may be abundant, but the dense shading results in a sparse shrub and herb layers. Only bryophytes attain abundance in these swamps.

Spruce-Fir-Tamarack Swamp: This uncommon natural community is totally absent from the warmer parts of the state. They typically occupy basins that are isolated from surface water movement and have deep organic soils. The canopy is dominated by red or black spruce, fir, and tamarack in varying abundance. Generally more tamarack is indicative of more mineral rich conditions while more black spruce is indicative of deeper peat and less enriched conditions. Despite the deep shade, a number of tall shrubs persist here, especially mountain holly and wild raisin. Herbs are sparse whereas bryophytes proliferate in the cool, moist conditions.

Black Spruce Swamp: As the peaty soils become deeper and increasingly acidic and saturated, black spruce begins to replace the less tolerant red spruce. This community is restricted to only the coldest locations where they occupy basins that have gradually accumulated peat over the millennia. Black spruce dominates the canopy which is generally rather low and sparse. These swamps have low shrub and herbaceous diversity due more to the cold, wet, acidic conditions than shading. In openings, low shrubs characteristic of bogs may be common, but bryophytes are ubiquitous throughout the community.

Hemlock Swamp: This uncommon swamp is absent from the Northeast Highland and Northern Piedmont biophysical Regions. They typically occupy basins that receive some mineral enrichment either through groundwater seepage or surface water. Generally the hemlock is associated with varying amounts of yellow birch, red maple and black ash. The dense canopy allows for few shrubs or herbs to survive; instead the ground is covered by ferns and bryophytes.

Softwood Swamps Conditions

Current Conditions: Softwoods swamps have been less impacted than either hardwood swamps or floodplain forest communities due to their location in the colder regions of the state

and their generally saturated peat soils. As with the other two wetland types, softwood swamps also receive some protection from the Vermont Wetland Regulations. Nonetheless, they are still limited by habitat degradation and alteration, hydrologic impairment, and sedimentation from development on the fringes and in the watershed, road construction, and unrestricted logging. Exotic species, and herbivory, especially by moose, are also a concern. A potentially major problem for hemlock swamps is the presence in nearby Massachusetts of the hemlock wooly adelgid, an introduced insect that could devastate the Vermont's hemlocks.

Desired Conditions: The four natural communities in softwood swamp formation provide habitat for 26 SGCN animals. This includes a large number of birds, but also some turtles and salamanders. A total of 33 plant SGCN occur in softwood swamps; not surprisingly, the majority of which are bryophytes which thrive in the cool, moist, shady conditions. Only spruce-fir-tamarack swamps occur as large patches; however this community and northern white cedar swamps are often included within much larger wetland complexes. Three of the four community types exist as small patches, they are more easily protected; however protection would need to extend beyond the wetland boundary to include at least a portion of the watershed and should include connectivity to softwood swamps. In such situations protection would need to apply to the entire complex. Desired conditions include functional softwood swamps in healthy examples (mature, unfragmented) across the distribution of their range High water quality is also essential to habitat quality.

Species of Greatest Conservation Need in Softwood Swamps

High Priority

American Black Duck (Anas rubripes)
Spruce Grouse (Falcipennis canadensis)
Canada Warbler (Wilsonia canadensis)
Spotted Turtle (Clemmys guttata)
Wood Turtle (Clemmys insculpta)
Bog/fen/swamp/marshy pond Odonata
American Marten (Martes americana)
Rock Vole (Microtus chrotorrhinus)
Northern bog lemming (Synaptomys borealis)
Southern Bog Lemming (Synaptomys cooperi)

Medium Priority

Great Blue Heron (Ardea herodias)
Long-eared Owl (Asio otus)
Red-shouldered Hawk (Buteo lineatus)
Chimney Swift (Chaetura pelagica)
Rusty Blackbird (Euphagus carolinus)
Black-crowned Night-heron (Nycticorax nycticorax)
Osprey (Pandion haliaetus)
Gray Jay (Perisoreus canadensis)
Black-backed Woodpecker (Picoides arcticus)
Pied-billed Grebe (Podilymbus podiceps)
Blue-spotted Salamander (Ambystoma laterale)
Spotted Salamander (Ambystoma maculatum)
Four-toed Salamander (Hemidactylium scutatum)
Cinereus or Masked Shrew (Sorex cinereus)
Smoky Shrew (Sorex fumeus)
Black Bear (Ursus americanus)

SGCN Notes: Plant SGCN not listed here 33. The SGCN invertebrate group listed here contains numerous species. For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/Info Need/Category	Problem/Info Need Detail	Rank
Habitat Conversion	Development, road construction	High
Habitat Fragmentation	Roads and development fragment the habitat into smaller patches or from larger habitat mosaics for the wider-ranging species (e.g., wood turtle, American marten)	High
Hydrologic Alteration	Sedimentation, development in watershed, road building, dams	Medium
Invasion by Exotic Species	Non-native species (e.g., wooly adelgid) can spread and degrade the habitat for wildlife and eliminate some plant species	Medium
Habitat Degradation	Selective removal of cedar, logging on non-frozen ground, heavy cutting, lack of mature and overmature stands	High
Herbivory	Moose can eliminate regeneration in some community types	Medium
Inventory	Distribution, location and condition of these communities are not known. The ongoing statewide inventory needs to be completed to identify and protect the best examples	High

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here.
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Provide information to State Wetlands Office & EPA	Number of sites added to database	DEC, EPA	SWG, EPA
Locate softwood swamps and assess their management practices.	Number of sites located and assessed	ANR,FSA, UVM,VA	SWG
Identify areas within the state with the largest matrix of softwood swamps for inclusion in conservation opportunity areas.	Number of opportunity areas identified	ANR, UVM	SWG
Consider protection of large softwood swamps via acquisition of conservation easements, management leases and fee title acquisition	Number of sites conserved	ANR, VHCB, TNC	VHCB, TNC
Manage exotic species on state owned sites and provide technical assistance to other landowners regarding control of exotics	Number of sites with control activities and/or invasive monitoring. Number sites where invasive species are eliminated or controlled	ANR, NEPCoP, TNC, NRCS	LIP, SWG
Technical assistance and/or financial incentives to private landowners, NGOs and government organizations to maintain and enhance softwood swamps for SGCN,	Number landowners incorporating SGCN into their land management, Number of acres conserved/restored	NRCS, TNC, VFWD, FSA	LIP, SWG, WHIP, CREP, CRP, WRP
Technical assistance and/or financial incentives to towns and regional planning organizations to maintain and enhance softwood swamps for SGCN. Distribute *Conserving Vermont's Natural Heritage* (Austin et.al. 2004)	Number of towns considering SGCN in their planning for softwood swamps. Number of acres conserved/restored	NRCS, TNC, VFWD	LIP, SWG, WRP, WHIP, CRP, CREP
Conservation easements on higher quality sites with greatest number of SGCN or T&E listed SGCN	Number of acres conserved for SGCN	ANR, VLT, TNC, NRCS	VHCB, VLT, LIP, WRP

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Plan or planning entity	Goal/Scope of plan	Lead
New England Plant Conservation Program – various Conservation Plans	Recovery of various plant species in New England	ANR
Black bear plan	Bear population conservation and management	ANR
American Marten Recovery Plan	Recovery of American Marten in Vermont	ANR
North American Waterfowl Plan	Waterfowl conservation and management	ANR

References

Austin, J.M. C. Alexander, E. Marshall, F. Hammond, J. Shippee, E. Thompson. VT League of Cities and Towns. 2004. Conserving Vermont's Natural Heritage. A Guide to Community-Based Planning for the Conservation of Vermont's Fish, Wildlife and Biological Diversity. Vermont Fish & Wildlife Department and Agency of Natural Resources. Waterbury, VT. www.vtfishandwildlife.com/library.cfm?libbase_=Reports_and_Documents

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Vernal Pools & Seeps Summary

Vernal pools are small, open-water wetlands that are filled by rain and snowmelt in spring or fall and are typically dry during the summer months. Such a pool is usually contained within a small forested basin, has no permanent inlet or outlet, and does not support predaceous fish. Forested swamps may also contain vernal pools in small depressions. During particular wet growing seasons, temporary pools may persist without drying completely. Years of filling and drying result in a unique type of set of conditions that supports a variety of wildlife specialized to take advantage of these conditions. Vernal pools are often rich in unique insects, molluscs, and other invertebrates, as well as amphibians. When conditions are favorable, vernal pools are often used by mole salamanders and wood frogs for breeding.

Seeps occur on slopes or at the bases of slopes in upland forests. Groundwater discharge is evident at the seep margin. Scattered trees may be present but canopy closure is usually from the adjacent forest. Certain species are adapted to the living in these conditions, including some invertebrate and plant SGCN.

Vernal Pools & Seeps Condition

Current Condition: Vernal pools and the wildlife that that use them face many problems, including direct loss of pools, degradation of pool quality, and alteration of the surrounding upland habitat. Hikers, their pets, and recreational vehicles that enter vernal pool risk destroying amphibian eggs and larvae and invertebrate SGCN. In addition, recreational vehicles that enter vernal pools can destroy the soil structure that is so important to maintaining these pools and the species that depend on them. Alterations within the forested basin that surrounds a pool can have significant impacts on the pool's hydrology and its species. Reduction in the volume of water that fills the pool means that drying will occur sooner. Loss of the adjacent canopy trees increases the solar energy reaching the pool, causing water temperature to rise more rapidly and drying the pool earlier in the warm season that usual. Premature drying has a negative impact on the invertebrates and young amphibians that require a minimum length of time (up to 4 months or more) to complete critical life stages. Removal of too many mature trees and downed logs in the surrounding upland habitat can impair the forest floor used by pool-breeding salamanders and frogs. Ditches and vehicle ruts in the surrounding forest often intercept spring migrating adults, luring them to lay eggs in spots that can dry well before the young can leave the water. Road construction or increased road traffic that bisects the upland amphibian habitat surrounding a vernal pool often results in the death of many of these animals as the make their annual migrations between the terrestrial and aquatic environments. The recent arrival, of and public fervor over, West Nile Virus may result in vernal pools being targeted for mosquito control. This may include biological controls, chemical pesticides, and possibly draining.

Seeps face problems similar to those of vernal pools. Activities that alter the hydrology of a seep to even a minor degree can eliminate the characteristics required by some wildlife species. The ecological significance of seeps (and vernal pools) is often not recognized during development planning, with the result being direct loss of these features.

Desired Condition (SGCN Needs): Functional vernal pools are those examples that are intact, well-buffered and interconnected to ensure productivity and movement of species associated with vernal pools. Spotted salamanders, blue-spotted salamanders, Jefferson salamanders, and wood frogs all use vernal pools for breeding. They spend almost their entire lives in the surrounding upland forests, moving up to 300 meters or more from the pool. The adults return for a brief period in the spring to leave their eggs. Water depth must be great enough to cover the egg masses (generally 30cm or more) and provide continuous aquatic habitat until the young leave the pool (3-4 months, depending on the species and location). The terrestrial adults and juveniles can be found under cover material (logs, rocks, stumps) and in animal burrows in moist forest soils that have adequate leaf litter. Spotted turtles are seasonal users, foraging in vernal pools in the early spring. They require large wetland complexes and move between wetlands through the warm season. There are several insects, snails, fingernail clams, fairy shrimp, and other invertebrates that use vernal pools for their entire life cycle. During the dry months, these animals or their eggs remain on or under the soil surface, awaiting the return of water to the pool depression. Many other SGCN use vernal pools seasonally but do not require them.

Seeps are home to a few specialized SGCN as well as many more common species. The gray petaltail is a rare dragonfly that lays its eggs in forested seeps, where the nymphs remain and feed until reaching adulthood. Eastern Jacob's ladder is a threatened plant that is closely associated with seeps in Vermont.

Species of Greatest Conservation Need in Seeps and Vernal Pools

High Priority

Whip-poor-will (Caprimulgus vociferus)
American Woodcock (Scolopax minor)
Jefferson Salamander (Ambystoma jeffersonianum)
Fowler's Toad (Bufo fowleri)
Spotted Turtle (Clemmys guttata)
Wood Turtle (Clemmys insculpta)
Bog/fen/swamp/marshy pond Odonata Group
Freshwater Snails Group
Seep/rivulet Odonata Group
Vernal pool Odonata Group

Medium Priority

Great Blue Heron (Ardea herodias)
Long-eared Owl (Asio otus)
Ruffed Grouse (Bonasa umbellus)
Red-shouldered Hawk (Buteo lineatus)
Prairie Warbler (Dendroica discolor)
Osprey (Pandion haliaetus)
Pied-billed Grebe (Podilymbus podiceps)
Blue-spotted Salamander (Ambystoma laterale)
Spotted Salamander (Ambystoma maculatum)
Four-toed Salamander (Hemidactylium scutatum)
Brown Snake (Storeria dekayi)
Eastern Ribbon Snake (Thamnophis sauritus)
Cinereus or Masked Shrew (Sorex cinereus)
Smoky Shrew (Sorex fumeus)
Black Bear (Ursus americanus)

SGCN Notes: Six plant SGCN are found in seeps and vernal pools. The SGCN invertebrate groups listed here contain numerous species. See individual species assessment summaries in Appendix A for specific information about Species of Greatest Conservation Need listed here.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/Info Need/Category	Problem/Info Need Detail	Rank
1. Habitat Alteration	Thermal and hydrologic alterations that reduce the quality or usability of pools and seeps; modification of surrounding upland habitat needed to maintain dependent wildlife; creation of ditches and ruts that lure amphibians to unsuitable breeding habitat	High
2. Habitat Conversion	Direct loss of pool and seep habitat due to hydrologic manipulation, filling, draining, etc; loss of associated upland habitat due to development or conversion	Medium
3. Impact of roads and trails	Roads located too close to vernal pools kill amphibians as they attempt to migrate between the pools and upland habitat; loss of animals increases with traffic volume	Medium
4. Trampling or direct impacts	Destruction of and damage to amphibian eggs and invertebrate SGCN due to people and their pets entering vernal pools	medium
5. Incompatible recreation	Damage to habitat and loss of SGCN due to recreational vehicles entering vernal pools	High
6. Impacts of Roads and Trails	Trails leading to sensitive vernal pools bring recreational hikers and their pets	low
7. Pollution	Stormwater directed into pools carries sediments and contaminants that have a negative impact on this habitat and its aquatic populations	Medium
8.Disease	West Nile Virus control: Vernal pools may be annual targets of mosquito control, including the use of chemical and biological pesticides.	Medium
9. Inventory	Inventory needed for many SGCN, particularly those for which distributional and abundance information is greatly lacking	High
10. Monitoring	Monitor SGCN population trends to determine whether populations are able to persist; evaluate long-term effects of development near these habitats	High

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here.
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Monitor known SGCN populations and evaluate effects of development	Number of known SGCN sites monitored	ANR, EPA	SWG, EPA
Conduct statewide inventory of vernal pools and seeps important to SGCN	Number of completed inventories	ANR, EPA	SWG, EPA
Identify areas within the state with the largest examples of seep and vernal pools for inclusion in conservation opportunity area.	Number of opportunity areas identified	ANR, VHCB, TNC	SWG
Identify areas within the state with the largest matrix of floodplain forest for inclusion in conservation opportunity area.	Number of acres of habitat protected and/or restored	ANR, VINS, Landowners	LIP, SWG, EPA
Promote conservation easements where appropriate	Number of acres of habitat protected and/or restored	ANR	LIP
Manage access at sensitive sites	Number of selected sites with managed/restricted access in place	ANR, USFWS, Green Mt. Club	
Educate foresters, landowners, developers, and municipalities about the value of vernal pools and seeps and encourage behavior that conserves wildlife dependent on these features and the necessary surrounding habitat	Number of parties contacted	ANR, VFF, VINS, RPCs, towns	LIP, SWG, EPA
When appropriate, re-vegetate area surrounding pool or seep and restore hydrology	Number of sites restored; number of acres restored	ANR	LIP, EPA

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Develop and distribute forestry guidelines for the protection and management of vernal pools and seeps	Number of forest management activities meeting vernal pool guidelines	ANR, USFWS, SAF, VWA, NRCS,	USFWS, USFS, SWG, WHIP
Technical assistance to towns and regional planning organizations to maintain and enhance vernal pools for SGCN. Distribute *Conserving Vermont's Natural Heritage* (Austin et.al. 2004)	Number of towns considering vernal pools and seeps in their planning.	VFWD	SWG
Develop recreational management plans for state lands where vulnerable, sensitive vernal pools and seeps occur	Number of recreational management plans adopted for state lands identified as having vulnerable vernal pools and seeps	ANR, VOGA, VASA,	
Work with VTrans and Federal Highway Administration to encourage protection of vernal pool, seep, and associated upland habitat when designing future roads; encourage the use of well-designed animal passage structures or other methods to allow safe passage for animals across existing roads	Number of cooperative projects that have avoided potential wildlife conflicts or restored safe passage	VFWD, VTrans, FHWA	

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Plan or planning entity	Goal/Scope of plan	Lead
State Outdoor Recreation Plan (SCORP)	A comprehensive recreation plan for state lands	FPR

References

Austin, J.M. C. Alexander, E. Marshall, F. Hammond, J. Shippee, E. Thompson. VT League of Cities and Towns. 2004. Conserving Vermont's Natural Heritage. A Guide to Community-Based Planning for the Conservation of Vermont's Fish, Wildlife and Biological Diversity. Vermont Fish & Wildlife Department and Agency of Natural Resources. Waterbury, VT. www.vtfishandwildlife.com/library.cfm?libbase_=Reports_and_Documents

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Open Peatlands Summary

Characteristics and location

Open peatlands are wetlands that accumulate peat, a type of soil which consists of partially decomposed organic matter. These wetlands are permanently saturated with a stable water table at or near the soil surface, creating a nearly anaerobic soil environment. Seasonal flooding is generally lacking in these wetlands and mosses and liverworts are abundant. With the exceptions of Black Spruce Woodland Bogs and Pitch Pine Woodland Bogs, trees are generally absent or sparse due to the very low availability of dissolved oxygen and minerals in the soil. Bogs are a type of peatland with slightly raised surfaces that receive most of their water from precipitation, have acidic waters poor in minerals and nutrients, and are dominated by sphagnum mosses, heath shrubs, and in some areas black spruce. Fens, on the other hand, have slightly acidic to slightly basic mineral-rich waters from groundwater discharge and seepage, may be flat or gently sloping, and are dominated by sedges, grasses, and non-sphagnum mosses. Water in fens generally has higher oxygen concentrations than in bogs resulting in greater peat decomposition. There is a continuum, however, in the variations between bogs and fens.

Seven different natural community types are included in this group, all of which are considered rare:

Dwarf Shrub Bog: These are open, acid wetlands with few trees and are dominated by heath shrubs and sphagnum moss. Size ranges from one to 600 acres in isolated kettlehole basins and as inclusions in larger wetland complexes. They occur throughout Vermont but are more common in the cooler regions.

Black Spruce Woodland Bog: Stunted black spruce trees cover 25 to 60 percent of the ground over heath shrubs and sphagnum moss. Found in cold climate areas. These bogs are generally less than 50 acres in size in Vermont and are found in the cooler regions of Vermont, including the Southern Green Mountains.

Pitch Pine Woodland Bog: Pitch pine covers 25 to 60 percent of the ground over heath shrubs and sphagnum moss. This community is known only from Maquam Bog at the mouth of the Missisquoi River. Small patches of this community are scattered across this larger wetland matrix.

Alpine Peatland: This community has characteristics of both bog and poor fen, but is distinguished by its high elevation and the presence of particular plants. It is found only on the highest peaks of the Green Mountains, particularly Mount Mansfield. By their nature, these communities are limited in size to very small patches.

Poor Fen: These are open, acid peatlands dominated by sphagnum moss, sedges, and heath shrubs. There is some mineral enrichment of surface waters. Poor fens are scattered in all biophysical regions of Vermont.

Intermediate Fen: These open, slightly acid to neutral fens are dominated by tall sedges, non-sphagnum mosses, and a sparse to moderate cover of shrubs. Most examples are only several acres in size, with all known sites being less than 50 acres. These fens are found only in areas with calcium-rich bedrock, which may occur in all regions outside of the Green Mountains.

Rich Fen: These fens are similar to Intermediate Fen but typically have shallower sedge peat and more mineral-enriched surface waters. Sedges and non-sphagnum mosses dominate, and shrubs are present. All documented examples are 6 acres or less in size. Rich Fens are restricted to areas with calcium-rich bedrock in the Piedmont, Vermont Valley, and limited areas of the Taconic Mountains.

Open Peatlands Condition

Current Condition: Open peatlands occur in a variety of situations across the Vermont landscape, from small, hydrologically-isolated basins to components of large wetland matrices. The primary problems to SGCN in open peatlands include recreation, exotic species, hydrologic alterations, climate change, and habitat conversion and degradation. Peatlands are popular destinations for outdoor recreationalists interested in experiencing unique natural areas, an activity that can proved detrimental to these fragile communities and their associated SGCNs if not properly managed. Trampling of plants is a major concern especially near urban centers and at the more accessible sites. Nutrient enrichment of runoff waters due to agriculture can lead to invasion by exotic plants as well as replacement of rare plant species by more generalist species. The integrity of bogs and fens can be limited by significant changes in adjacent land use, such as development and clear-cutting, that result in increases in runoff and changes in water quality. Activities that alter the quality and quantity of water received from the groundwater recharge zone can be devastating to fen communities. Climate change is especially a concern with the Alpine Peatlands. Development of broadcasting facilities on mountain ridgelines also impacts this community type. Alteration of natural water level fluctuations in lakes, ponds, and streams associated with peatlands can also impact these wetlands. Prevention of natural disturbance regimes, including lightening-ignited fires, may limit the Pitch Pine Woodland Bog community.

Desired Condition (SGCN Needs): Many SGCN associated with this open peatlands, particularly some invertebrates and plants, are habitat specialists found only in these natural community types. Several SGCN dragonflies and damselflies require breeding and rearing habitat that is commonly described as bogs, fens, fen puddles, boggy ponds, boggy sloughs, and boggy streams. Many plants are found only in the wet, acid soils of bogs. Some vertebrates, such as bog lemmings (Synaptomys sp.) and spruce grouse are closely tied to bogs. Others, such as the blue-spotted salamander, four-toed salamander, spotted turtle, and water shrew, may rely on peatlands for habitat locally. Many of the other SGCN may utilize Open Peatlands but are not dependent on its specific characteristics (e.g., wood turtle, spruce grouse, and brown snake).

Species of Greatest Conservation Need in Open Peatlands

High Priority

American Black Duck (Anas rubripes)
Spruce Grouse (Falcipennis canadensis)
Vesper Sparrow (Pooecetes gramineus)
Spotted Turtle (Clemmys guttata)
Wood Turtle (Clemmys insculpta)
Bog/fen/swamp/marshy pond Odonata group
Lakes/ponds Odonata group
Moths group
Tiger Beetle group
Vernal pool Odonata group
Wetland Butterflies group
Hoary Bat (Lasiurus cinereus)
Water Shrew (Sorex palustris)
Northern bog lemming (Synaptomys borealis)
Southern Bog Lemming (Synaptomys cooperi)

Medium Priority

Blue-winged Teal (Anas discors)
Red-shouldered Hawk (Buteo lineatus)
Chimney Swift (Chaetura pelagica)
Osprey (Pandion haliaetus)
Black-backed Woodpecker (Picoides arcticus)
Pied-billed Grebe (Podilymbus podiceps)
Lesser Yellowlegs (Tringa flavipes)
Barn Owl (Tyto alba)
Blue-spotted Salamander (Ambystoma laterale)
Spotted Salamander (Ambystoma maculatum)
Four-toed Salamander (Hemidactylium scutatum)
Smooth Green Snake (Liochlorophis vernalis)
Brown Snake (Storeria dekayi)

SGCN Notes: Plant Species of Greatest Conservation Need not listed here: 62 species. The SGCN invertebrate groups listed here contain numerous species. For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem & Info Needs Category	Problem & Info Need Detail	Rank
1. Habitat Degradation	Significant land-use changes in adjacent areas can result in increases in runoff and changes in water quality (e.g. development, clear-cutting)	High
2. Habitat Conversion	Development of broadcasting facilities near alpine peatlands	Medium
3. Incompatible Recreation	Trampling of plants and soil in wetlands and on mountain tops	Medium
4. Hydrologic Alteration	Activities affecting the quantity and quality of ground water input and surface water runoff, or alter natural hydrologic regimes of associated water bodies	High
5. Impacts of Roads or Trails	Trails leading to sensitive peatlands bring recreational hikers	Medium
6. Pollution	Water quality is easily altered in peatlands and can bring about shifts in species composition (e.g., agriculture near rich fens)	High
7. Climate Change	Shifts in community composition in peatlands	Medium
8. Inadequate Disturbance Regime	Fire suppression inhibits pitch pine germination and results in shift in species composition	Medium
9. Statewide inventory of Open Peatland natural communities	Need to identify and locate best examples of these habitats that support the most SGCN	High

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here.
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Conduct statewide inventory of Open Peatland natural communities	Number of sites inventoried	VFWD, EPA	SWG, EPA
Manage access at sensitive sites	Number of selected sites with managed/restricted access in place	ANR USFWS, Green Mt. Club	
Manage for natural disturbance regime at Maquam Bay	Work with USFWS to develop and implement a fire plan to promote this natural process	VFWD, USFWS	USFWS
Technical assistance to private landowners to maintain and enhance open peatlands for SGCN.	Number landowners incorporating SGCN into their land management.	ANR, EPA, USFWS, Landowners	LIP
Technical assistance to town and regional planning organizations to manage open peatlands for SGCN. Distribute *Conserving Vermont's Natural Heritage* (Austin et.al. 2004)	Number of towns considering SGCN in their planning	ANR, EPA, Regional Planning Comm.	SWG, EPA, VT Watershed Grants

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Develop recreational management plans for state lands where vulnerable, sensitive open peatlands occur	Number of recreational management plans adopted for state lands identified as having vulnerable peatlands	ANR, VOGA, VASA	
Financial incentives for private landowners	Number of acres conserved	NRCS, VFWD, USFWS	NRCS, LIP, other USFWS grants
Acquisition/easement of high priority sites and their groundwater recharge areas	Number of acres acquired/enrolled	NRCS, VFWD, USFWS	NRCS, LIP, other USFWS grants
Increase enforcement of access restrictions at alpine peatlands	Number of hours of increased patrol	ANR, Green Mt. Club	
Increase cooperation/coordination among states and provinces and develop trans-jurisdictional actions to address issues such as climate change and acid rain		State of VT, other states, CA provinces, US and CA federal governments	

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Plan or planning entity	Goal/Scope of plan	Lead
State Outdoor Recreation Plan (SCORP)	A comprehensive recreation plan for state lands	FPR

References

Austin, J.M. C. Alexander, E. Marshall, F. Hammond, J. Shippee, E. Thompson. VT League of Cities and Towns. 2004. Conserving Vermont's Natural Heritage. A Guide to Community-Based Planning for the Conservation of Vermont's Fish, Wildlife and Biological Diversity. Vermont Fish & Wildlife Department and Agency of Natural Resources. Waterbury, VT. www.vtfishandwildlife.com/library.cfm?libbase_=Reports_and_Documents

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Thompson, E. H., and E. R. Sorenson. 2000. Wetland, woodland, wildland - A guide to the natural communities of Vermont. University Press of New England, Hanover and London, 456 pp.

Marshes and Sedge Meadows Summary

Marshes and Sedge Meadows provide some of the largest natural openings to be found in Vermont. These natural communities and the streams and ponds with which they are associated provide critical habitat for many species of wildlife. Often called emergent marshes, these open wetlands have less than 25 percent shrub or tree cover, and in many cases woody plants are absent. Hydrology is the single most important factor controlling these wetlands.

Six different natural community types are included in this community type:

Shallow Emergent Marsh: This is a common and variable marsh type with mineral or shallow organic soils that are moist to saturated and only seasonally inundated. Several grasses, bulrushes, and Joe-pye weed may be abundant. This community is commonly associated with old beaver impoundments. This is a widespread natural community found throughout Vermont.

Sedge Meadow: These wetlands are permanently saturated and seasonally flooded. Soils are typically shallow organic muck, although mineral soils may be present in some wetlands. Tussock sedge or other sedges are dominant plants here. This common community is found throughout Vermont, most often along stream and pond margins and in beaver meadows.

Cattail Marsh: Common cattail or narrow-leaved cattail dominates these marshes. The muck or mineral soils are typically inundated with shallow standing water throughout the year, although the substrate may be exposed in dry years. Cattail Marshes range in size from less than an acre to over 500 acres along the shores of Lake Champlain. These common wetlands occur throughout the state but are most common at lower elevations.

Deep Broadleaf Marsh: Water depth in these marshes is typically over one foot deep for most of the year, although some may have only saturated soils in dry summers. Soils are organic. Common plants include pickerelweed, broad-leaved arrowhead, and giant bur-reed. This common community type is found throughout Vermont on the sheltered margins of lakes and ponds, on the slow-moving backwaters of larger rivers, and in isolated basins. The largest examples occur in lowland areas.

Wild Rice Marsh: These uncommon marshes are dominated by wild rice, with an organic soil substrate that is inundated with one to two feet of water throughout the summer. Wild Rice Marshes are found in wave-sheltered coves and on river deltas of Lake Memphremagog and Lake Champlain, and in the slow-moving backwaters of our larger rivers (Connecticut River and lower Champlain tributaries).

Deep Bulrush Marsh: These are marshes of open water along the shores of lakes and ponds. Water depths can range from one to six feet. Soft-stem bulrush and hard-stem bulrush dominate most of these marshes, although marsh spikerush and other bulrushes may be abundant. These common wetlands occur in open water along the shores of lakes and ponds and can be found throughout the state.

Marshes & Sedge Meadows Condition

Current Condition: These natural community types are not considered rare, but do provide critical habitat to many wildlife species, including SGCN. Sedge Meadows are often successional stages that would lead to forested wetlands if left undisturbed. Although they may occur in isolated basins, Marshes and Sedge Meadows are most commonly associated with water bodies

(lakes, ponds, rivers) and other wetlands and, therefore, are subject to the same problems (e.g., pollution) as these associated communities. Many marshes, particularly Shallow Emergent Marshes, are small and not protected under Vermont Wetland Rules. Additional protection is needed for such wetlands important to SGCN through regulation and/or education. Invasive exotic species are a major problem for some of these community types. Common reed and purple loosestrife can easily become established in Shallow Emergent Marshes, and water chestnut can crowd out native species in Deep Broadleaf Marshes. Alteration of the natural hydrologic regime by dam operation or creation of impoundments can significantly impact deeper water communities. Greater inventory information is needed for all these natural community types as well as further study on the identification and significance of particular problems.

Desired Condition (SGCN Needs): Marshes and Sedge Meadows support a host of wildlife species. A variety of SGCN are marsh specialists. Among others, these include many plants, dragonflies, damselflies, butterflies, and birds. Several dragonflies and damselflies require breeding and rearing habitat that is commonly described as marshy ponds, marshy edges of lakes, and marshes. Black terns, least bitterns, and soras spend the nesting season raising their young within marshes. Some other SGCN, such as spotted salamanders, northern water snakes, and mink are commonly associated with these wetland types and may rely on them locally, but do not specifically require marshes to complete their life cycles. Pygmy shrews, smooth green snakes, and chimney swifts are examples of more casual users that may be found foraging in marshes and sedge meadows.

Species of Greatest Conservation Need in Marshes and Sedge Meadows

High Priority

American Black Duck (Anas rubripes)
Black Tern (Chlidonias niger)
Northern Harrier (Circus cyaneus)
Sedge Wren (Cistothorus platensis)
Least Bittern (Ixobrychus exilis)
Vesper Sparrow (Pooecetes gramineus)
Muskellunge (Esox masquinongy)
Spiny Softshell (Turtle) (Apalone spinifera)
Fowler's Toad (Bufo fowleri)
Spotted Turtle (Clemmys guttata)
Wood Turtle (Clemmys insculpta)
Western Chorus Frog (Pseudacris triseriata)
Bog/fen/swamp/marshy pond Odonata group
Freshwater Snails group
Lakes/ponds Odonata group
Mayflies/Stoneflies group
Wetland Butterflies group
Hoary Bat (Lasiurus cinereus)
Pygmy Shrew (Sorex hoyi)
Water Shrew (Sorex palustris)

Medium Priority

Blue-winged Teal (Anas discors)
Short-eared Owl (Asio flammeus)
Red-shouldered Hawk (Buteo lineatus)
Chimney Swift (Chaetura pelagica)
Bobolink (Dolichonyx oryzivorus)
Osprey (Pandion haliaetus)
Pied-billed Grebe (Podilymbus podiceps)
Sora (Porzana carolina)
Lesser Yellowlegs (Tringa flavipes)
Barn Owl (Tyto alba)
Blue-spotted Salamander (Ambystoma laterale)
Spotted Salamander (Ambystoma maculatum)
Four-toed Salamander (Hemidactylium scutatum)
Smooth Green Snake (Liochlorophis vernalis)
Northern Water Snake (Nerodia sipedon)
Common Musk Turtle (Sternotherus odoratus)
Brown Snake (Storeria dekayi)
Eastern Ribbon Snake (Thamnophis sauritus)
Long-tailed Weasel (Mustela frenata)
Mink (Mustela vison)
Muskrat (Ondatra zibethicus)
Southern Bog Lemming (Synaptomys cooperi)

SGCN Notes: Plant Species of Greatest Conservation Need not listed here: 24 species. The SGCN invertebrate groups listed here contain numerous species. For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problems/Info Need Categories	Problem & Info Need Detail	Rank
1. Habitat Conversion	Loss or fragmentation, particularly in small, unmapped (NWI) wetlands; ditching and plowing for agricultural use	High
2. Habitat Degradation	Cattle grazing	Medium
3. Hydrologic Alteration	Manipulation of the natural hydrologic regimes of associated water bodies through dam operation or impoundment can drastically impact deep water marshes in particular	High
4. Exotic Invasive Species	Crowding out of native plants and wildlife habitat by purple loosestrife, common reed, water chestnut, etc.	High
5. Pollution	Pollutants entering wetlands from runoff and tributaries can impact species and can bring about shifts in community composition	High
6. Statewide inventory of Marshes and Sedge Meadows	Inventory is needed for all natural community types, as well as further study on the identification and significance of particular problems	High

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here.
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Conduct statewide inventory of Marshes and Sedge Meadows	Number of sites inventoried. The number of high quality examples identified containing SGCN	VFWD, EPA	SWG, EPA
Protect wetlands not on NWI maps through alternative regulations (e.g., Act 250)	Number of acres conserved	ANR, Regional Planning Comm, ACOE	
Provide technical assistance and/or financial incentives to private landowners, towns and RPC's to maintain and enhance mash and sedge meadows for SGCN. Distribute *Conserving Vermont's Natural Heritage* (Austin et.al. 2004)	Number landowners incorporating SGCN into their land management, Number of towns including SGCN in their planning. Number of acres conserved	ANR, EPA, NRCS, TNC, RPC's, towns, VLCT, private landowners	NRCS, LIP, SWG, EPA, LCBP, VT Watershed Grants
Financial incentives for private landowners	Number of acres conserved	NRCS, VFWD, USFWS	NRCS, LIP, other USFWS grants
Acquisition/easement of high priority sites	Number of acres acquired/enrolled	NRCS, VFWD, USFWS	NRCS, LIP, other USFWS grants, Land trusts

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Use existing/new regulations to prevent damage of SGCN-important lake/pond-side and river-side wetlands caused by dam operation	Number of acres conserved	ANR, COE, Hydro operators, FERC	
Prevent loss of SGCN-important lake/pond-side and river-side wetlands caused by new impoundments	Number of acres conserved	ANR, COE, Hydro operators, FERC	

References

Austin, J.M. C. Alexander, E. Marshall, F. Hammond, J. Shippee, E. Thompson. VT League of Cities and Towns. 2004. Conserving Vermont's Natural Heritage. A Guide to Community-Based Planning for the Conservation of Vermont's Fish, Wildlife and Biological Diversity. Vermont Fish & Wildlife Department and Agency of Natural Resources. Waterbury, VT. www.vtfishandwildlife.com/library.cfm?libbase_=Reports_and_Documents

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Wet Shores Summary

Characteristics and Distribution

All of the natural communities contained within the upland shore formation occur as small patches scattered irregularly over the landscape. Four of the natural communities are widely distributed while the three rarest types are restricted to one or more biophysical regions. All the community types in this formation are non-forested and maintained in this early successional state by a combination of flooding, ice scour, and erosional processes. This makes wetland shores perhaps our most dynamic and changeable group of natural communities.

The wet shores formation includes the seven following natural community types:
Outwash plain pondshore: This is among the rarest natural communities in the state and is found only in the Southern Vermont Piedmont Biophysical Region. It occurs only on sloping shorelines that are seasonally exposed due to fluctuating water levels. The vegetation is characterized by sedge, rush, and herbaceous species, many of them annuals.

River mud shore: This is a common natural community type that occurs in all eight biophysical regions. It is restricted to slow moving rivers whose shorelines are exposed during times of low flow. This community type tends to be sparsely vegetated, primarily by annuals since the shore is often exposed late in the growing season.

River sand or gravel shore: This is a common natural community type that occurs in all eight biophysical regions. It is restricted to the swifter rivers where moving water creates sand and gravel deposits. Because of their dynamic nature they are sparsely vegetated, mostly by grasses and herbs but often with a woody component consisting of willows and cottonwood.

River cobble shore: This common natural community is widely distributed across the state along high-energy waterways. Due to their dynamic nature, this community is sparsely vegetated, mostly by grass and sedge species, but often with a woody component of willows and cottonwood.

Calcareous riverside seep: This is a rare natural community type that is known mostly from the Connecticut Valley. They are restricted to areas where calcareous groundwater seeps on to exposed bedrock on rivershores. The natural processes of flooding and ice scour serve to keep the community open while the limy seepage sustains a unique flora that includes many rare species of sedges, herbs, and bryophytes.

Rivershore grassland: This is a widely distributed natural community that occurs in more sheltered, and hence more stable, portions of our larger rivers. Since the natural river processes needed to maintain their open condition occur less frequently, this community tends to have more of a woody component of shrubs and low trees mixed in with the more abundant grasses.

Lakeshore grassland: This rare natural community type is restricted to the shores of Lake Champlain and Lake Memphremagog where it occurs on gently sloping shorelines that are kept open by waves, flooding, and ice. They tend to be very narrow in width, but may extend for considerable distances along the shore. The community is dominated by grasses, sedges, and forbs with a varying amount of woody species depending upon the frequency and intensity of the natural disturbance.

Wet Shores Condition

Current Condition: All of the natural communities within the wet shore formation are dependent upon the natural processes of flooding, wave action, and ice scour. As such, they all occur as small patches that are restricted to areas where these processes are focused. Since they are maintained in an open state, all of these natural community types provide a specialized habitat for animals and plants. Spiny softshell, spotted, and wood turtles, Fowler's toad, and tiger beetles all depend on one or more of these communities. Outwash plain pondshore and calcareous riverside seeps provide the unique habitat for plants and contain a disproportionate number of rare or Threatened species.

The primary problems to SGCN in this formation include hydrologic alteration, recreation, exotic species, and habitat conversion and degradation. Since all seven community types are dependent upon periodic disturbance by water, ice or wind, anything that prevents these natural processes from occurring would jeopardize the integrity and continued existence of the SGCN they harbor. These community types also support heavy recreational use, and trampling of vegetation is a major concern especially near urban centers and at the more accessible sites. The continual natural disturbance at these sites also provides excellent opportunity for invasive plants to become established, and recreational use adds to this potential. The river cobble shore and the two grassland types are especially subject to habitat conversion or degradation to create marinas, docks, and bathing beaches.

Desired Conditions: Although all the natural communities comprising the wet shore formation occur as small patches on the landscape, they all provide critical habitat to a number of SGCN that utilize both the aquatic and terrestrial environment or require unforested areas for basking, nesting, or foraging. A total of 22 animal and 31 plant SGCN are known to utilize the wet shore communities. To protect these sites we recommend the following activities:

Species of Greatest Conservation Need in Wet Shores

High Priority

American Black Duck (Anas rubripes)
Vesper Sparrow (Pooecetes gramineus)
Spiny Softshell (Turtle) (Apalone spinifera)
Fowler's Toad (Bufo fowleri)
Spotted Turtle (Clemmys guttata)
Wood Turtle (Clemmys insculpta)
Freshwater Snails group
Tiger Beetles group
Cobblestone Tiger Beetle (Cicindela marginipennis)
Hoary Bat (Lasiurus cinereus)
Eastern Pipistrelle (Pipistrellus subflavus)
Water Shrew (Sorex palustris)

Medium Priority

Blue-winged Teal (Anas discors)
Red-shouldered Hawk (Buteo lineatus)
Chimney Swift (Chaetura pelagica)
Osprey (Pandion haliaetus)
Pied-billed Grebe (Podilymbus podiceps)
Lesser Yellowlegs (Tringa flavipes)
Barn Owl (Tyto alba)
Smooth Green Snake (Liochlorophis vernalis)
Long-tailed Weasel (Mustela frenata)

SGCN Notes: Plant SGCN not listed here 31. The SGCN invertebrate groups listed here contain numerous species. For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/Info Need Categories	Problem/Info Need Detail	Rank
Habitat Conversion	Construction of marinas, docks, bathing beaches, and other activities that remove shoreline vegetation	High
Hydrologic Alteration	Communities dependent upon wind, wave, and ice action	High
Incompatible Recreation	Intense use of shore disturbs wildlife, tramples rare plants, and introduces exotic species.	High
Invasion by Exotic Species	Non-native species can spread and degrade the habitat for wildlife and eliminate some plant species	Medium
Habitat Fragmentation	Roads and development fragment habitat along wet shores for species such as the wood turtle and smooth green snake	High
Inventory	Distribution, location, and condition of this habitat are not known: A statewide inventory is needed to identify and locate the best examples of these habitats that support the most SGCN	High

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here.
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Conduct statewide inventory of upland shores	Number of sites inventoried. The number of high quality examples identified containing SGCN	FPR	SWG
Provide technical assistance to private landowners to prevent or mitigate hydrologic and recreational impacts to wet shores.	Number landowners incorporating SGCN into their land management	NRCS, TNC, VFWD	LIP, SWG
Manage exotic species on state owned sites and provide technical assistance to landowners regarding control of exotics	Number of sites with control activities and/or invasive monitoring. Number of acres conserved.	ANR, NRCS, TNC, EPA	LIP
Technical assistance to town & regional planning organizations to help maintain and/or enhance SGCN habitat, and to maintain natural processes and hydrologic conditions. Distribute *Conserving Vermont's Natural Heritage* (Austin et.al. 2004)	Number of towns/RPC's including SGCN in their planning	VFWD	VFWD
Conservation easements on higher quality sites with greatest number of SGCN or T&E listed SGCN	Number of acres conserved for SGCN	ANR, VLT, TNC	VHCB, VLT, LIP
Work with state and municipal managers to reduce and focus recreational impacts		ANR, VOGA	VFWD,

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the lead column

Plan or planning entity	Goal/Scope of plan	Lead
New England Plant Conservation Program – various Conservation Plans	Recovery of various plant species in New England	ANR
State Outdoor Recreation Plan	A comprehensive recreation plan for state lands	FPR

References

Austin, J.M. C. Alexander, E. Marshall, F. Hammond, J. Shippee, E. Thompson. VT League of Cities and Towns. 2004. Conserving Vermont's Natural Heritage. A Guide to Community-Based Planning for the Conservation of Vermont's Fish, Wildlife and Biological Diversity. Vermont Fish & Wildlife Department and Agency of Natural Resources. Waterbury, VT. www.vtfishandwildlife.com/library.cfm?libbase_=Reports_and_Documents

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Shrub Swamps Summary

Characteristics and Distribution

All of Vermont's shrub dominated natural communities are wetlands, and most are thought to be retained in this early successional state by periodic flooding. Some of the community types, however, are likely to be more transitional and will eventually become forested. These transitional types are believed to have arisen following some type of disturbance either natural, such as a catastrophic flood or beaver activity, or artificially from past agricultural use. If beaver activity and natural flooding are allowed to continue, examples of this community should continue to replace themselves on the landscape.

Of the four natural community types included within this formation two occur as small patches while the remaining two occupy larger areas on the landscape. Only one of the communities, buttonbush swamp, is thought to be rare in the state and restricted in its distribution to four of the state's eight biophysical regions. The other three communities are distributed throughout the state.

The shrub swamp formation includes the following four natural community types:
Alluvial Shrub Swamp: This common natural community type is found on alluvial soils in the floodplains of small rivers. This is a high energy, dynamic environment that receives regular flooding and ice scour. As the stream channel naturally wanders across the floodplain, the community also migrates. Senescent channels succeed to floodplain forest while alluvial shrub swamps thrives in newly established channels. While speckled alder is the dominant species here, black willow and boxelder can be very abundant under certain conditions. Ostrich fern typically dominates the ground layer although some grasses, herbs, and vines can also be common in more sheltered areas.

Alder Swamp: This is a very common, widely distributed community type that occurs in a variety of settings including lakes and pond margins, backwater floodplains of rivers and streams, beaver flowerages, and poorly drained basins. Depending upon the frequency and duration of flooding, some examples may become more forested over time while others may remain shrub dominated. While speckled alder is the dominant shrub, shrubby willows, dogwoods, and young red maple may be locally abundant. Sedges and grasses along with sensitive fern and Joe pye weed typically dominate the ground layer.

Sweet Gale Shoreline Swamp: This relatively common natural community occupies shorelines of ponds and slow moving streams. This swamp typically occurs as a narrow floating mat, but the shrubs may also be rooted directly into the peaty shore. Sweet gale dominates this community, but speckled alder and meadow-sweet are usually also abundant. Leatherleaf may be co-dominant in more acidic, boggy conditions. Various sedge species typically dominate the ground layer.

Buttonbush Swamp: This relatively rare natural community occurs in two different settings: on the edges of larger lakes and ponds and in poorly drained, isolated depressions where water is retained through much of the growing season. Because of the permanently saturated conditions, this community typically occurs on deep, organic soils. While in some examples buttonbush may grow so dense that nearly all other vegetation is excluded, in other

situations leatherleaf and meadow-sweet may be common. Depending upon the shrub density and degree of flooding, various herbs and grasses may become established.

Shrub Swamps Condition

Current Condition: Shrub swamps are very common wetland types and occur in a variety of situations that are either too wet or too frequently disturbed to allow woody vegetation to become established. Although some examples are becoming forested, new examples continually arise due to natural disturbance. As long as the natural processes of flooding, ice scour, and beaver activity continue unabated, shrub swamps will remain common in our landscape.

The primary problems to the communities and SGCN in this formation include habitat alteration and fragmentation, suppression of the natural disturbance regime, hydrologic alteration, and invasive exotic species.

Desired Condition: Providing habitat for 30 SGCN makes shrub swamps among the more valuable community types for wildlife of concern is state. Especially notable is the high number of amphibians included in this total. There are few plant SGCN associated with shrub swamps, however; they provide habitat for only six vascular plants and three bryophytes. Many types of shrub swamps are commonly associated with larger wetland complexes along river and streams. Maintaining the natural flooding regimes and other natural processes including beaver activity of these shrub swamps and associated forested swamps and marshes is critical to their long-term function. Maintaining upland buffers for shrub swamps are especially important for amphibian SGCN as well as for other species.

Species of Greatest Conservation Need in Shrub Swamps

High Priority

American Woodcock (Scolopax minor)
American Black Duck (Anas rubripes)
Black Tern (Chlidonias niger)
Vesper Sparrow (Pooecetes gramineus)
Spiny Softshell (Turtle) (Apalone spinifera)
Fowler's Toad (Bufo fowleri)
Spotted Turtle (Clemmys guttata)
Wood Turtle (Clemmys insculpta)
Western (Striped) Chorus Frog (Pseudacris triseriata)
Bog/fen/swamp/marshy pond Odonata group
Freshwater Snails group
Wetland Butterflies group
Hoary Bat (Lasiurus cinereus)
Water Shrew (Sorex palustris)

Medium Priority

Blue-winged Teal (Anas discors)
Red-shouldered Hawk (Buteo lineatus)
Chimney Swift (Chaetura pelagica)
Black-billed Cuckoo (Coccyzus erythropthalmus)
Rusty Blackbird (Euphagus carolinus)
Osprey (Pandion haliaetus)
Pied-billed Grebe (Podilymbus podiceps)
Lesser Yellowlegs (Tringa flavipes)
Barn Owl (Tyto alba)
Blue-spotted Salamander (Ambystoma laterale)
Spotted Salamander (Ambystoma maculatum)
Four-toed Salamander (Hemidactylium scutatum)
Smooth Green Snake (Liochlorophis vernalis)
Northern Water Snake (Nerodia sipedon)
Common Musk Turtle (Stinkpot) (Sternotherus odoratus)
Brown Snake (Storeria dekayi)
Eastern Ribbon Snake (Thamnophis sauritus)

SGCN Notes: Plant SGCN not listed here: 9. The SGCN invertebrate groups listed here contain numerous species. For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/Info Need Category	Problem/Info Need Detail	Rank
Habitat Conversion	Development, road construction, docks, marinas	High
Habitat Fragmentation	Agriculture, roads	High
Hydrologic Alteration	Sedimentation, development in watershed, road building, dams, artificial lake fluctuations	High
Distribution of successional stages	Woodcock are negatively affected by maturing alder stands and adjacent openings.	High
Invasion by Exotic Species	Non-native species can spread and degrade the habitat for wildlife and eliminate some plant species	Medium
Inadequate Disturbance Regime	Suppression of natural processes such as eliminating beaver activity, limiting flooding, etc	High
Inventory	Distribution, location and condition of these communities are not known. A statewide inventory needs to be conducted to identify and protect the best examples	High

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here.
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Conduct a statewide inventory of shrub swamp natural communities	The number of high quality examples identified containing SGCN		
Provide information to State Wetlands Office & EPA	Number of sites discussed	DEC, EPA	SWG, EPA
Provide technical assistance and/or financial assistance in maintaining natural processes and hydrologic conditions to landowners, especially to municipal and private owners concerned with beaver activity.	Number landowners incorporating SGCN into their land management, Number of towns considering SGCN in their planning	NRCS, TNC, VFWD, RPC, VLCT	NRCS programs, LIP
Acquisition and conservation easements on higher quality sites with greatest number of SGCN or T&E listed SGCN	Number of acres conserved for SGCN	ANR, VLT, TNC	VHCB, VLT, LIP
Manage exotic species on state lands & provide technical assistance to other landowners regarding control of exotics	Number of sites with control activities and/or invasive monitoring	ANR, NEPCoP, TNC, NRCS	LIP, SWG

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the lead column

Plan or planning entity	Goal/Scope of plan	Lead
New England Plant Conservation Program – various Conservation Plans	Recovery of various plant species in New England	ANR
Partners in Flight Plan	Bird conservation	ANR, Audubon

References

Thompson, E. H., and E. R. Sorenson. 2000. Wetland, Woodland, Wildland—A guide to the natural communities of Vermont. University Press of New England, Hanover and London.

Upland Shores Summary

Characteristics and Distribution

All of the natural communities contained within the upland shore formation occur as small patches scattered irregularly over the landscape. Both the riparian associated natural communities occur in all eight biophysical regions of the state. In contrast, the three lakeshore natural communities are more restricted with both lake or shale cobble beach and sand dunes occurring in a single biophysical region and lake sand beach in three regions. Since all the upland shores are naturally kept open, all five natural community types provide specialized habitat for animals and plants. Riverside outcrops and sand dunes in particular provide habitat for some plants that occur nowhere else in the state. Generally SGCN have the best potential for persisting at sites with the most intact natural processes. These same sites likely provide the best and most abundant habitat for SGCN.

The upland shores formation includes the five following natural community types:
Riverside outcrop: This relatively common natural community occurs throughout the state wherever bedrock is exposed along waterways. They are dependent upon natural hydrologic processes that typically keep the sites open via either flooding or ice scour. This community type is sparsely vegetated, primarily by herbaceous species with only a few shrubs and vines able to withstand the regular disturbance regime.

Erosional river bluff: This is a rare natural community type with a statewide distribution that is restricted to steep banks where soil is actively eroding. Both the nature of the soils and the intensity of the erosional action greatly influences the vegetative cover of these communities, but rarely are woody species frequent.

Lake or shale cobble beach: This uncommon natural community can occur on any large lake in the state, but the only significant examples occur on Lake Champlain. Due to the constant wave action and seasonal flooding and ice scour, they tend to be sparsely vegetated. Although the vegetation is mostly herbaceous, willows, cottonwood, silver maple, and ash can become established at their upper reaches.

Lake sand beach: This is a rare natural community with the most extensive examples on the shore of Lake Champlain, and only scattered examples occurring in other regions of the state. Their formation and sustenance depends upon a regular source of material this is subsequently transported and deposited by waves and/or wind. Due to the constant wind and wave action and seasonal flooding and ice scour, this community is largely kept open. Typically herbs, grasses, and low sedges dominate although willows, cottonwood, box elder, and ash often becomes established at their higher reaches.

Sand dune: This extremely rare natural community is restricted to the present and previous shoreline of Lake Champlain where they are situated on the leeward side of sand beaches. They are dependent upon a continual supply of depositional sand and will be adversely affected by anything that inhibits this process. Because of the shifting nature of the substrate and the dry windy conditions, they are sparsely vegetated mostly by grasses, low sedges, and viney herbs. Cottonwoods, aspen, and gray birch eventually become established and make the dune system more stable.

Upland Shores Condition

Current Condition: All five community types within this formation are dependent upon continual disturbance by water, ice and wind and therefore occur in close proximity to lakes and rivers. They all reach their best development on the shores of Lake Champlain or other larger lakes and rivers in the state. Because they are desirable places to be, recreational use has impacted a number of our upland shores. The three lake associated shores are especially subject to habitat conversion or degradation to create marinas, docks, and bathing beaches. Trampling of plants is a major concern especially near urban centers and at the more accessible sites. The continual natural disturbance at these sites provides excellent opportunity for invasive plants to become established.

Desired Condition: Functional upland shores are primarily undeveloped sites where natural processes operate and human disturbance of SGCN is limited. Although all of the upland shores occur as small patches on the landscape, they provide a very specialized habitat that is utilized by a few SGCN and that may not be available elsewhere. Eight SGCN animals and one suite of species (tiger beetles) utilize upland shores. In addition, 33 SGCN plants are dependent upon this formation. To protect the natural communities contained within this formation we would do the following:

Species of Greatest Conservation Need in Upland Shores

High Priority

Peregrine Falcon (Falco peregrinus)
Common Tern (Sterna hirundo)
Spiny Softshell (Turtle) (Apalone spinifera)
Fowler's Toad (Bufo fowleri)
Tiger Beetles group

Medium Priority

Blue-winged Teal (Anas discors)
Chimney Swift (Chaetura pelagica)
Osprey (Pandion haliaetus)
Cinereus or Masked Shrew (Sorex cinereus)

SGCN Notes: Plant SGCN not listed here 31. The SGCN invertebrate group listed here contains numerous species. For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/Info Need Category	Problem/Info Need Detail	Rank
Habitat Conversion	Construction of marinas, docks, bathing beaches, retaining walls, rip-rap	Medium
Hydrologic Alteration	Communities dependent upon wind, wave, and ice action and supply of substrate	Medium
Incompatible Recreation	Intense use of beaches tramples rare plants, degrades dunes and introduces exotic species.	Medium
Invasion by Exotic Species	Non-native species can spread and degrade the habitat for wildlife and eliminate some plant species	Medium
Inventory	Distribution, location, and condition of this habitat are not known. A statewide inventory is needed to identify and locate the best examples of these habitats that support the most SGCN	High

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here.
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Conduct a statewide inventory of upland shore natural communities to identify the best sites and those with SGCN	Number of sites inventoried. Number of sites with SGCN identified	FPR	SWG
Technical assistance to private landowners to prevent or mitigate hydrologic alteration and recreational impacts and to conserve SGCN	Number landowners implementing conservation practices for SGCN	NRCS, TNC, VFWD	LIP, SWG
Technical assistance to town and regional planning organizations to prevent or mitigate hydrologic alteration and recreational impacts and to conserve SGCN. Distribute *Conserving Vermont's Natural Heritage* (Austin et.al. 2004)	Number of towns/organizations planning for SGCN conservation	VFWD	VFWD
Conservation easements on higher quality sites with greatest number of SGCN or T&E listed SGCN	Number of acres conserved for SGCN	ANR, VLT, TNC	VHCB, VLT, LIP
Work with state and municipal managers to reduce recreational impacts on these sites and to focus recreational impacts elsewhere.	Number of sites where recreational impacts are managed successfully.	ANR, VOGA	VFWD
Manage exotic species on state owned sites and provide technical assistance to private landowners to control exotics	Number of sites with control activities and/or invasive monitoring	ANR, NRCS	LIP

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the lead column

Plan or planning entity	Goal/Scope of plan	Lead
New England Plant Conservation Program – various Conservation Plans	Recovery of various plant species in New England	ANR
State Outdoor Recreation Plan (SCORP)	A comprehensive recreation plan for state lands	FPR

References

Austin, J.M. C. Alexander, E. Marshall, F. Hammond, J. Shippee, E. Thompson. VT League of Cities and Towns. 2004. Conserving Vermont's Natural Heritage. A Guide to Community-Based Planning for the Conservation of Vermont's Fish, Wildlife and Biological Diversity. Vermont Fish & Wildlife Department and Agency of Natural Resources. Waterbury, VT. www.vtfishandwildlife.com/library.cfm?libbase_=Reports_and_Documents

Thompson, E. H., and E. R. Sorenson. 2000. Wetland, Woodland, Wildland - A guide to the natural communities of Vermont. University Press of New England, Hanover and London, 456 pp.

Outcrops & Upland Meadows Summary

Characteristics and Distribution

Outcrops and upland meadows are naturally unforested as a result of a number of factors: little or no soil, high winds, cold temperatures, and drought. Many of these factors are inter-related and work together in combination to limit tree growth. Outcrops and upland meadow are generally restricted to ridgetops and ledges where bedrock is exposed or close to the surface, and thus all the natural community types occur as small patches. They are often flat or gently sloping, but by definition, have slopes less than 60 degrees.

The outcrop and upland meadow formation includes the five following natural community types:

Alpine Meadows: This very rare natural community is restricted to the highest elevations in the state where the harsh growing conditions severely restrict vegetative growth. There are only a few known examples, all restricted to the Northern Green Mountains Biophysical Region. Low herbaceous vegetation, primarily grasses and sedges, dominate although stunted fir and black spruce and various heath shrubs occur in more sheltered locations.

Boreal Outcrop: This relatively common natural community occurs at mid to high elevations and is distributed widely in the cooler areas of the state. It occurs in the Northern and Southern Green Mountains, Northern Piedmont, Northeastern Highlands, and Taconics Biophysical Regions. They are sparsely vegetated by scattered low trees, including fir, red spruce, yellow birch, red maple, heath shrubs, and grasses. In some examples, however, mosses and lichens can be abundant and even dominate.

Serpentine Outcrop: One of the rarest natural communities in the state, serpentine outcrops are restricted to the Northern and Southern Green Mountains where this rock type is exposed. Serpentine rocks and the soils derived from them are very low in most plant nutrients, instead containing high amounts of heavy metals that can reach levels that are toxic to plants. The result is a sparse flora, but also one that has adapted to these extremely harsh conditions.

Temperate Acidic Outcrop: This is a relatively common natural community that is absent from only the higher elevations and colder regions of the state. Trees, especially paper and gray birch, white and pitch pine, and red maple are frequent here although they are stunted and slow growing. Beneath then typically grow low heath shrubs, grasses, and various herbs. Mosses and lichens can also be very abundant.

Temperate Calcareous Outcrop: This is an uncommon natural community that is restricted to the warmer regions of the state; generally the Champlain and Connecticut River Valleys, the Taconics and the Vermont Valley. The community is limited to areas with calcareous bedrock and thus support a characteristic flora of lime-loving plants. Despite their exposure and resulting doughtiness, the availability of nutrients makes these outcrops more diverse than their more acidic counterparts.

Outcrops & Upland Meadows Condition

Current Condition: All of the natural communities contained within the outcrop and upland meadow formation are the result of specific conditions, and as such, they occur as small patches and are scattered irregularly over the landscape. Only temperate acidic outcrops occur in all eight biophysical regions of the state. In contrast, alpine meadows are restricted to a single biophysical region and serpentine outcrops to two regions. Since they all are open communities within a generally forested matrix, all five natural community types provide a specialized habitat for animals and plants. They are important basking sites for reptiles, and alpine meadows, serpentine outcrops, and temperate acidic outcrops in particular provide habitat for many plants that occur nowhere else in the state.

The primary problems to SGCN in this category include recreation, exotic species, climate change, and habitat conversion and degradation. Since all five community types provide vistas, they are often a destination for hikes, skiers, and climbers. Trampling of plants is a major concern especially near urban centers and at the more accessible sites. Invasion by exotic plants, especially at the lower elevation temperate outcrops and all communities with major trail access, is increasingly a concern. Alpine meadows are affected by ski area development while both serpentine and temperate calcareous outcrops continue to be limited by mining operations. Climate change is especially a concern with the colder alpine meadows and boreal outcrops.

Desired Condition: Outcrops and upland meadows are very specialized natural communities in Vermont since they are relatively permanent openings within a forested landscape. As such they provide specific habitat requirements for a small number of SGCN, especially some species of snakes which utilize these openings as basking sites. Although they provide significant habitat for only nine SGCN and two suites of species (moths and tiger beetles), these openings are utilized by many additional wildlife species. The number of SGCN plants (95) that rely on this formation speaks to its importance in the state despite the small area that it covers. To protect these sites we would do the following:

SGCN in Outcrops & Upland Meadows

High Priority

Eastern Racer (Coluber constrictor)
Timber Rattlesnake (Crotalus horridus)
Eastern Rat Snake (Elaphe obsoleta)
Moths group
Tiger Beetles group
Northern bog lemming (Synaptomys borealis)
Southern Bog Lemming (Synaptomys cooperi)

Medium Priority

Chimney Swift (Chaetura pelagica)
Osprey (Pandion haliaetus)
Cinereus or Masked Shrew (Sorex cinereus)
Smoky Shrew (Sorex fumeux

SGCN Notes: Plant SGCN not listed here: 95. The SGCN invertebrate groups listed here contain numerous species. For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/Info Need Category	Problem/Info Need Detail	Rank
Habitat Conversion	Quarrying activity, development, and ski area development	Medium
Climate Change	Species generally have no higher elevations to move to	High
Incompatible Recreation	Rock climbing, hiking disturbs wildlife, tramples rare plants, and introduces exotic species.	High
Invasion by Exotic Species	Non-native species can spread and degrade the habitat for wildlife and eliminate some plant species	Medium
Habitat Fragmentation	Some species require large expanses of forestland surrounding their denning sites	High
Inventory	Distribution, location, and condition of this habitat are not known. A statewide inventory is needed to identify and locate the best examples of these habitats that support the most SGCN	High

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here.
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Conduct a statewide inventory of outcrop and meadow natural communities to identify the best sites and those with SGCN	The number of high quality examples identified containing SGCN	FPR	SWG
Provide technical & financial assistance to private, municipal and federal landowners to control invasive species and to minimize the impact of recreation on SGCN	Number landowners managing for SGCN. Number of acres conserved	NRCS, TNC, VFWD	LIP, SWG
Technical assistance to town and regional planning organizations to maintain and enhance outcrops and upland meadows for SGCN. Distribute *Conserving Vermont's Natural Heritage* (Austin et.al. 2004)	Number of towns including SGCN in their planning	VFWD	VFWD
Develop conservation easements on higher quality sites with greatest number of SGCN or T&E listed SGCN	Number of acres conserved for SGCN	ANR, VLT, TNC	VHCB, VLT, LIP
Work with hiking and rock/ice climbing groups to avoid sensitive sites. Limit hiker use and new trails on high quality state-owned sites		ANR,	VFWD,

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the lead column

Plan or planning entity	Goal/Scope of plan	Lead
New England Plant Conservation Program – various Conservation Plans	Recovery of various plant species in New England	ANR
State Outdoor Recreation Plan	A comprehensive recreation plan for state lands	FPR

References

Austin, J.M. C. Alexander, E. Marshall, F. Hammond, J. Shippee, E. Thompson. VT League of Cities and Towns. 2004. Conserving Vermont's Natural Heritage. A Guide to Community-Based Planning for the Conservation of Vermont's Fish, Wildlife and Biological Diversity. Vermont Fish & Wildlife Department and Agency of Natural Resources. Waterbury, VT. www.vtfishandwildlife.com/library.cfm?libbase_=Reports_and_Documents

Thompson, E. H., and E. R. Sorenson. 2000. Wetland, Woodland, Wildland - A guide to the natural communities of Vermont. University Press of New England, Hanover and London.

Cliff & Talus Summary

Characteristics and location

Cliffs are areas of exposed bedrock, with slopes greater than 60 degrees. Examples range from very small and shaded by surrounding forests to extensive sites greater than one hundred acres. Vermont's cliffs are divided on the basis of their climatic affinities and their bedrock. Climate is the factor separating boreal cliff types from temperate cliff types. The boreal types are found in the cooler regions of the state, the Northeast Highlands and the Green Mountains, though a few are found in generally warmer regions, in especially cool situations such as at high elevations or in cold valleys. The temperate types are found either at middle to low elevations or in the warmer regions of the state. Bedrock is the factor separating acidic cliff communities from calcareous cliff communities. Granites, some quartzites, and sandstones are typically acidic, whereas limestones, dolomites, calcareous schists, and some quartzites are calcareous. [Thompson and Sorenson 2000]

Talus slopes are areas of rockfall below cliffs and are characterized by an accumulation of many rocks broken off a cliff face through physical forces including freezing and thawing.

Types of Cliff and Talus Communities:

Boreal Acidic Cliff: These are high elevation cliffs, generally above 2,000 feet, found on acidic bedrock such as granite, gneiss, quartzite, or non-calcareous schist. Vegetation is usually red spruce, balsam fir, American mountain-ash, bush-honeysuckle, three-toothed cinquefoil, and hairgrass. Eastern Hemlock is absent from these cliffs. Found primarily in the cooler regions of the state, the Northeast Highlands and the Green Mountains.

Boreal Calcareous Cliff: These are high elevation cliffs, mostly above 2,000 feet, where calcareous bedrock (usually calcareous schist, but occasionally limestone or marble) combined with seepage creates conditions that favor certain calciphilic plants, some of which are quite rare statewide.

Temperate Acidic Cliff: These are lower elevation cliffs, generally below 2,000 feet, found on acidic bedrock. Characteristic vegetation includes eastern hemlock, white pine, red maple, paper birch, harebell, and heart-leaved aster. Found primarily either at middle to low elevations or in the warmer regions of the state.

Temperate Calcareous Cliff: These are low elevation cliffs in warmer areas on limestone, marble, dolomite, or calcareous quartzite. They may be moist or dry, depending on the situation, but usually do not have abundant seepage. Some characteristic species are northern white cedar, purple clematis, smooth cliff-brake, purple-stemmed cliff brake, harebell, and herb robert. Found primarily either at middle to low elevations or in the warmer regions of the state.

Open Talus: This broadly defined community type includes all areas of open rockfall. These rockfall areas usually occur below cliffs, and can be comprised of granite, quartzite, gneiss, shale, or less commonly limestone or marble.

Cliff & Talus Condition

Current Condition: Generally, cliffs and talus communitiess are not directly vulnerable to habitat degradation simply because they tend to be inaccessible and limited in timber or development potential. Recreational activities and intensive quarrying may be the greatest impacts to these communities where such activities occur.

Desired Condition (SGCN Needs): Cliffs and talus are often host to habitat specialists, many of which are plants directly linked to the natural community type. In general, the larger the site, the greater the likelihood that numerous SGCN plant species will exist and that they will persist. Many of the animal species associated with this community types; however, do require accessible, unfragmented habitat mosaics. Several of the animal species require the cliff and talus for nesting or hibernation, but range as far as 1000 ha from the site. Three of the species (eastern racer, rock vole, and five-lined skink) specifically benefit from active management for early successional features or small openings around the sites in order to provide solar radiation. The eastern racer is found on only one site in Vermont. The five cliff and talus community types provides the habitat for 100 SGCN.

Species of Greatest Conservation Need in Cliffs & Talus

High Priority

Peregrine Falcon (Falco peregrinus)
Eastern Racer (Coluber constrictor)
Timber Rattlesnake (Crotalus horridus)
Eastern Rat Snake (Elaphe obsoleta)
Five-lined Skink (Eumeces fasciatus)
Rock Vole (Microtus chrotorrhinus)
Small-footed Bat (Myotis leibii)
Long-tailed or Rock Shrew (Sorex dispar)

Medium Priority

Eastern Ribbon Snake (Thamnophis sauritus)

SGCN Notes: Plant SGCN not listed here 88 species. For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/Info Need Category	Problem/Info Need Detail	Rank
Habitat Conversion	Quarrying activity and poorly designed ski trails	High
Habitat Fragmentation	Wider ranging reptiles require unfragmented habitat mosaics of 1000 ha or more	High
Climate Change	Species generally have no higher elevations to move to	High
Incompatible Recreation	Rock climbing disturbs falcons and tramples rare plants	High
Distribution of successional stages	Active management for early successional openings (eastern racer), young forest (rock vole), and forest openings for solar radiation (five-lined skink).	Medium
Pollution	Acid rain threatens higher elevation habitats	Medium
Research & Inventory needs	Distribution, location, and condition of this community type are not known.	High

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here.
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Conduct statewide inventory of cliff and talus and identify and locate the best examples of these community types that support the most SGCN	Number of sites inventoried	FPR	SWG
Provide technical assistance and/or financial assistance private landowners to maintain and enhance cliff and talus for SGCN.	Number landowners incorporating SGCN into their land management,	NRCS, TNC, FWD	LIP, SWG
Technical assistance to town and regional planning organizations for conservation practices that maintain and/or enhance habitat for SGCN. Distribute *Conserving Vermont's Natural Heritage* (Austin et.al. 2004)	Number of towns/RPCs considering SGCN in their planning	VFWD	VFWD
Conservation easements on higher quality sites with greatest number of SGCN or T&E listed SGCN	Number of acres conserved for SGCN	ANR, VLT, TNC	VHCB, VLT, LIP
Work with hiking and rock/ice climbing groups to avoid sensitive sites	Number of sensitive sites with programs implemented to limit encroachment	ANR, GMC, VOGA	VFWD, Access Fund

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the lead column

Plan or planning entity	Goal/Scope of plan	Lead
Peregrine falcon plan	Remove peregrine from ESA list	ANR
Draft VT Bat Conservation Plan		ANR
ANR Land Conservation Plan	ANR land acquisition	ANR
VT Recreation Plan (SCORP)	Recreation priorities throughout the state	ANR, GMC, VOGA

References

Austin, J.M. C. Alexander, E. Marshall, F. Hammond, J. Shippee, E. Thompson. VT League of Cities and Towns. 2004. Conserving Vermont's Natural Heritage. A Guide to Community-Based Planning for the Conservation of Vermont's Fish, Wildlife and Biological Diversity. Vermont Fish & Wildlife Department and Agency of Natural Resources. Waterbury, VT. www.vtfishandwildlife.com/library.cfm?libbase_=Reports_and_Documents

Thompson, E. H., and E. R. Sorenson. 2000. Wetland, woodland, wildland - A guide to the natural communities of Vermont. University Press of New England, Hanover and London.

Lake Champlain Tributaries Summary

These waters include the lower-most portions of tributaries that empty into Lake Champlain. On many rivers and streams this is defined at its upstream end by the first major waterfall or cascade, called the principal fall line. On streams which do not have this abrupt elevation change, the upstream limit for is roughly 150 feet above sea level. The SGCN supported in these waters are numerous, with many found nowhere else in the state but in here and Lake Champlain. There are several factors accounting for the unique aquatic assemblages found here, including: glacial history and ancient routes of colonization from the west and south; the barrier to upstream migration presented by the principal fall line; and the generally warmer temperatures and finer substrates found here compared to those in higher elevation areas of Vermont. Unique species include many fishes and freshwater mussels, the common mudpuppy, and the spiny softshell. Key features include riffles, runs, and long pools with a variety of dominant substrate types. Small gravel, sand, and finer substrates are more dominant in the lowest reaches of these streams and rivers. Woody debris is prevalent, especially in deep holes in pool sections.

Lake Champlain Tributaries Condition

Current Condition: Some of the most heavily human-populated areas of the state occur adjacent to river sections included in this community type. While the larger volumes of water carried by the large rivers in Lake Champlain tributaries do afford a greater diluting potential than found in smaller rivers and streams, these Champlain tributaries are located in an area of the state where the intensity and frequency of insult to the aquatic habitat from human use is expected to be greater. For example, stormwater runoff reaching the lower Winooski River from developed lands is much greater than in most other Vermont fluvial communities. Stormwater runoff from developed lands increases the amount of sediments, nutrients, and contaminants that reach rivers instead of being trapped by the soil and vegetation. Floodplains function, in part, to absorb runoff and deliver it slowly to rivers through the soil. Paving of land sends water more directly to streams and rivers, in essence bypassing the floodplain. This creates a scouring effect on riverine habitat, due to the more extreme fluctuations in velocity of stormwater runoff.

Pollutants enter these rivers from various non-point sources as well. Agricultural lands located adjacent to rivers within these watersheds can contribute excessive amounts of silt, nutrients, and pesticides to the systems when adequate riparian buffers are not maintained. In such instances, excessive sediments can cover coarser river-bottom substrates needed by many SGCN, as well as covering some of these species themselves. Also, salt from roadways makes its way into rivers, degrading the water quality. These and other sources of non-point pollution are likely the greatest contributors of contaminants to these systems. These pollutants comes not only from adjacent lands, but from the entire watershed.

Accidental contaminant spills are rare, but can have immediate and devastating effects on the aquatic environment and the SGCN that live there. Chemicals, manure, industrial waste, and other potential contaminants stored in areas where they could reach these rivers or their tributaries if released are significant problems. Bridges and riverside roads and railways also present long stretches where accidental spills into rivers and streams can occur. A catastrophic contaminant spill could (and has) easily wipe out entire SGCN populations. As with other sources of pollution, this problem comes from the watershed upstream as well as adjacent lands.

Direct loss of habitat occurs when fill material is placed on the river bottom. Examples of this include riprapping to stop toe erosion along streambanks, placement of piers or causeways to accommodate bridges, and construction of boating access facilities. Direct mortality of freshwater mussels, which live on the river bottom, is sometimes the result of these activities within lower Champlain rivers. The replacement of natural substrates with large stone provides reduced or unsuitable habitat for recolonization by bottom-dwelling animals. The construction of buildings and roads adjacent to rivers creates a hazard for the structures, increasing the potential that bank stabilization will be pursued.

Two dams on major rivers within the Lake Champlain tributaries have cut off migration for fishes and mussels, and have resulted in the loss of spawning habitat for some species. Impoundments created by these structures have altered the natural habitat from riverine to more lake-like water bodies. "De-watering" of the aquatic habitat that sometimes occurs due to atypical "hydro-peaking" dam operations leaves many benthic SGCN, particularly mussels, out of the water and exposed to the elements and predators. This can occur upstream or downstream of these structures. Existing dams located on fall lines may significantly alter the natural physicochemical regime of waters flowing downstream. The altered hydrologic regimes found below dams degrades the quality of habitat here for SGCN.

Zebra mussels that have devastated the Lake Champlain freshwater mussel community are a problem for rivers in this Lake Champlain tributaries. Adult zebra mussels have been found in the lower reaches of Otter Creek, Little Otter Creek, Lewis Creek, LaPlatte River and the Winooski River in past years. They are also present in Lake Bomoseen, whose outlet stream feeds into the Poultney River.

Desired Condition (SGCN Needs): These waters, along with Lake Champlain, support the greatest diversity of aquatic species found in the state. The larger rivers support the highest number of SGCN. Species include both year-round residents and those that use the rivers and streams primarily for spawning, development of young, or feeding. Minnows, freshwater mussels and snails, benthic fishes, and mammals are among those that utilize the Lake Champlain tributaries year-round, and often require a variety of habitats. Lake sturgeon, mooneye, greater redhorse, and possibly common mudpuppy are among those that depend on these rivers seasonally for reproduction. Others, such as map turtle, spiny softshell, northern watersnake, wood turtle, and bats use these waters for foraging, winter shelter, or other seasonal purposes.

Gravel/cobble substrates that are free of loose silt are required by many of the riverine species that spawn here. Eggs in contact with excessive silt are not able to adequately absorb oxygen for development. The eastern sand darter requires silt-free sand for this purpose. Substrates also need to be stable in order to support many SGCN, particular benthic organisms like freshwater mussels, darters, hibernating spiny softshells, and nesting mudpuppies. This is often affected by stream hydrodynamics; that is, streams that are hydrodynamically imbalanced can have substrates that shift frequently and do not provide a firm footing or shelter for aquatic organisms that occur there. Small invertebrates are less abundant in silted-in or unstable stream bottoms, thus providing a reduced food source for their predators. Woody debris is an important habitat component in lower Lake Champlain tributaries, especially for aquatic insects. Historically, people removed trees and branches that fell into streams. Unfortunately, this removed the structure and habitat needed for many invertebrates and their predators, as well as basking habitat for turtles.

Two aquatic SGCN, the American eel and the Atlantic salmon, were historically able to ascend the fall line from downstream. The American eel did so to reach smaller waters upstream where the young eels would grow for several years before migrating back out to sea to spawn. Landlocked Atlantic salmon jumped the falls to reach the clean, coarse gravel substrates located upstream where they would spawn their eggs. With the construction of dams at or below the falls on all the major Lake Champlain rivers, much of the habitat needed for these two species was made unavailable to them. Reconnection of these fishes with this habitat would likely be beneficial to their long-term survival.

River otter and mink are susceptible to heavy metals and PCB's.

Species of Greatest Conservation Need in Lake Champlain Tributaries

High Priority

Peregrine Falcon (Falco peregrinus)
Bald Eagle (Haliaeetus leucocephalus)
Lake Sturgeon (Acipenser fulvescens)
Eastern Sand Darter (Ammocrypta pellucida)
American Eel (Anguilla rostrata)
Quillback (Carpiodes cyprinus)
Muskellunge (Esox masquinongy)
American Brook Lamprey (Lampetra appendix)
Northern Brook Lamprey (Ichthyomyzon fossor)
Silver Redhorse (Moxostoma anisurum)
Greater Redhorse (Moxostoma valenciennesi)
Bridle Shiner (Notropis bifrenatus)
Blackchin Shiner (Notropis heterodon)
Blacknose Shiner (Notropis heterolepis)
Stonecat (Noturus flavus)
Channel Darter (Percina copelandi)
Sauger (Sander canadense)
Spiny Softshell (Turtle) (Apalone spinifera)
Common Mudpuppy (Necturus maculosus)
River/stream Odonata group
Wood Turtle (Clemmys insculpta)
Silver-haired Bat (Lasionycteris noctivagans)
Eastern Red Bat (Lasiurus borealis)
Hoary Bat (Lasiurus cinereus)
Eastern Pipistrelle (Pipistrellus subflavus)
Freshwater Mussels Group
Freshwater Snails Group

Medium Priority

Blue-winged Teal (Anas discors)
Osprey (Pandion haliaetus)
Pied-billed Grebe (Podilymbus podiceps)
Lesser Yellowlegs (Tringa flavipes)
Mottled Sculpin (Cottus bairdi)
Mooneye (Hiodon tergisus)
Silver Lamprey (Ichthyomyzon unicuspis)
Shorthead Redhorse (Moxostoma macrolepidotum)
Atlantic Salmon (landlocked) (Salmo salar)
Northern Water Snake (Nerodia sipedon)
Common Musk Turtle (Sternotherus odoratus)
Northern River Otter (Lutra canadensis)
Mink (Mustela vison)
Muskrat (Ondatra zibethicus)
Cinereus or Masked Shrew (Sorex cinereus)

SGCN Note: The SGCN invertebrate groups listed here contain numerous species. Sea lamprey is not a Species of Greatest Conservation Need in the Lake Champlain Basin. For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/Info Need Category	Problem/Info Need Detail	Rank
Habitat Alteration	Input of sediments and nutrients from surface and stormwater runoff, and from small tributaries; caused by human land use nearby	High
Habitat Conversion	Loss of benthic habitat due to riprapping, bridge construction, boat access construction, etc. Loss of riverine environment due to impoundment.	High
Hydrologic Alteration	Changes in hydrologic and physicochemical regime due to dams and stormwater runoff. Direct loss of SGCN due to dewatering.	High
Habitat Fragmentation	Migration barriers created by dams	High
Pollution	Vulnerability to Catastrophic Spills: Bordering roadways, bridge crossings, adjacent industry, and manure pits are examples of high risk points of entry for large-scale contaminant spills	High
Invasion by exotic species	Zebra mussels are currently high risk threat to SGCN; other exotics may also be displacing native SGCN	High
Sedimentation	Alteration of habitat (e.g., spawning areas); fine sediments can embed of substrate and smother invertebrates, incubating eggs and the young of many fish species.	High
Pollution	Water quality degradation due to contaminants from agricultural fields, stormwater runoff, other point and non-point sources	High
Inventory	Inventory needed for many SGCN, particularly those for which distributional and abundance information is greatly lacking	High
Monitor	Detect SGCN population trends to help guide conservation actions and to track the effectiveness of current management	High

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here.
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Monitor known SGCN populations	Number of known SGCN sites monitored	USFWS, ANR, TNC, Universities, EPA	SWG, VFWD, VT Watershed Grants, EPA
Conduct inventories of rivers to detect and gather information on new SGCN populations	Number of sites/rivers with completed inventories	USFWS, ANR, TNC, Universities, EPA	SWG, VFWD, VT Watershed Grants, EPA
Protect and restore habitats on which SGCN are dependent through pollution abatement, riparian buffers, flow regulation.	Number of acres of riparian habitat protected and/or restored	LCLT, VLT, Watershed groups, USFWS, ANR, Army Corps, EPA	EPA, LIP, SWG, LCLT, VLT, NRCS, EPA, Clean & Clear
Restore migration corridors for SGCN by removal of artificial barriers or construction of effective fish passage facilities at dams	Number of artificial SGCN migration barriers removed or provided with passageways Number of adult fish passed migrating to upstream spawning habitat (e.g., lake sturgeon, greater redhorse)	Hydro operators, FERC, ANR, Municipalities, VNRC	USFWS, NRCS
Provide for the safe and expeditious out-migration of SGCN from upstream of dams	Number of artificial SGCN migration barriers removed or provided with out-migration passageways	Hydro operators, FERC, ANR, Municipalities, VNRC	ANR, Army Corp

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Prevent the introduction and spread of invasive exotic species, particularly zebra mussels	Number of sites with control activities and/or invasive monitoring. Number sites where invasive species are eliminated or controlled	LCBP, ANR Municipalities, USFWS, EPA	VT Watershed Grants, LCBP, Clean & Clear
Provide technical outreach and financial assistance to private landowners, watershed groups and other partners to maintain or enhance habitat and tributary functions for SGCN.	Number of actions implemented to maintain or enhance tributary function for SGCN.	USDA, USFWS, EPA, NRCS, VFWD, TNC, LCBP, RPC's. Municipalities, Watershed groups	EPA, USFWS, WHIP, CRP, CREP, VT Watershed Grants, LCBP, LIP, SWG, Clean & Clear
Provide technical outreach towns and regional planning commissions to maintain or enhance Lake Champlain tributary habitat and tributary functions for SGCN. Distribute *Conserving Vermont's Natural Heritage* (Austin et.al. 2004)	Number of actions implemented to maintain or enhance tributary function for SGCN.	USDA, USFWS, EPA, NRCS, VFWD, TNC, LCBP, RPC's. Municipalities, Watershed groups	EPA, USFWS, WHIP, VT Watershed Grants, LCBP, LIP, SWG, Clean & Clear
Acquire conservation easements for the protection of critical SGCN habitats and maintenance or restoration of ecological functions	Number of riparian habitat acres acquired/enrolled	LCLT, VLT, ANR, TNC, NRCS	LCLT, VLT, EPA, TNC, SWG, LIP, NRCS
Enhance coordination between government agencies and partners to ensure consistency in respective program implementation and increased sensitivity to SGCN requirements and problems to SGCN		ANR, USFWS, COE, FEMA, FHWA, NRCS, Wildlife Services, VTrans	WHIP, EQUIP, USFWS, LIP, EPA, Clean & Clear

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the lead column

Plan or planning entity	Goal/Scope of plan	Lead
Lake Champlain Basin Aquatic Nuisance Species Management Plan (2000).	Management and prevention of invasive exotic species in the basin	VTDEC, NYDEC
DEC Water Quality Division	Water quality and stream protection and restoration programs	DEC
Quebec Ministère de l'Environnement	Shared watershed for Missisquoi River	Quebec Ministère de l'Environnement
Conserving Lake Champlain's Biological Diversity 6/102005	Strategic plan focused on conserving Lake Champlain's biological diversity	TNC
Various watershed planning efforts	Watershed protection and restoration; river and lake restoration and protection	VTDEC; local/regional watershed groups

References

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Lower Connecticut River Summary

Characteristics and Location

The Lower Connecticut River encompasses approximately 130 miles of the main stem from the Massachusetts state line upstream to its confluence with the Wells River and occurs almost exclusively within the Southern Vermont Piedmont biophysical region. Additionally, this summary includes the lower sections of its Vermont tributaries that are directly influenced by or have physical and/or biological similarity to the Connecticut River. The presence of a readily identifiable geological feature, such as a fall line, is not evident on all tributaries. Where the fall line is apparent, typically within a short distance from the tributary mouth (e.g., as on the Williams, Black, Ottauquechee, Waits and Wells rivers), this feature delineates the upstream extent of the Lower Connecticut River. On other tributaries (e.g., the West and White rivers), artificial structures (e.g., the lowermost dam) are used to define the upstream limit. Rivers and streams located within the Connecticut River basin but upstream of the habitat boundary are covered under the Fluvial (Stream) Summary. To a limited degree the historic distribution of several anadromous fish species native to the Connecticut River basin, namely sea-run Atlantic salmon, American shad and sea lamprey, as well as current management goals for the restoration of these fishes to the basin also define the bounds of the Lower Connecticut River.

Lower Connecticut River Condition

Current Condition: Prior to European settlement and subsequent industrial development of the Connecticut River basin, rivers and streams were free-flowing systems subject to natural flow regimes and processes. Waters ran free of pollutants, and the landscape, including riparian lands, was predominantly forested. These conditions provided habitat for both aquatic and terrestrial plant and wildlife assemblages native to the Lower Connecticut River. However, over the past 200 plus years, the river and its tributaries have been altered extensively fragmenting historic migration routes, changing natural habitats and ecological functions, as well as the current composition of the plant and wildlife communities.

Dams constructed for waterpower and flood control have greatly altered river and streams throughout the Connecticut River basin. Historic migration corridors used by Atlantic salmon, American shad, blueback herring, sea lamprey and American eel to gain access to critical spawning and nursery habitats have been obstructed. Long sections of the main stem and tributaries have been transformed from free-flowing waters to impoundments; and natural flow regimes are now regulated in ways that are not compatible with the habitat requirements of many aquatic species, including SGCN. Impoundments and artificial flow regimes have significantly influenced sediment transport and deposition, which in turn have altered the character, quantity and quality of various habitat types found throughout the Lower Connecticut River. Waters above and below dams are managed in ways, which result in fluctuating impoundment levels and tail water discharges. Frequently, flows released from dams are not adequate in volume or fluctuate in magnitude and duration so as to create habitat conditions unsuitable for SGCN. While water management within impoundments and free-flowing river segments may benefit habitat for a few SGCN (e.g., expose mudflats and shorelines used by feeding lesser yellowlegs during migration), fluctuating water levels can be detrimental to strictly aquatic SGCN (e.g., redbreast sunfish, common mudpuppy).

The extensive conversion of the Connecticut River from a free-flowing system to one dominated by impoundments has created habitats suitable to a variety of aquatic exotic plants and animals. Shorelines and wetlands associated with these impoundments have been invaded by phragmites, Eurasian milfoil and purple loosestrife, which have established dominant stands degrading nesting habitats needed by waterfowl, songbirds and muskrats. In recent years water chestnut was discovered in North Springfield Reservoir, which is on the Black River, a tributary of the Connecticut River. It has also been found in sections of the river in Massachusetts and Connecticut. This invasive exotic aquatic plant has been a significant environmental problem on Lake Champlain demanding large expenditure of funds and labor to keep it under control. Several fish species not indigenous to the Connecticut River, including predatory largemouth bass, northern pike, bluegill, crappie and rock bass, were introduced during the 1800s and early 1900s and have benefited from habitat formed within the impoundments. These species have altered the composition of the natural fish community of the river and have influenced ecological relationships at all trophic levels. At the present time, zebra mussels have not been found in the Connecticut River.

Prior to the federal Clean Water Act (amended in 1977) and subsequent implementation of water pollution abatement programs, a 1951 government report described the Connecticut River as the "best landscaped sewer in New England" (CRJC 1997). Over the past three decades water quality in the river and its tributaries has vastly improved habitats for aquatic SGCN. Nonetheless these waters continue to receive point and non-point source pollution (sediments, nutrients, toxic chemicals), which remain problems to aquatic habitats and the ability of the environment to support healthy, sustainable populations of SGCN, such as eagles, ospreys, fishes, freshwater mussels, and other aquatic invertebrates. Healthy aquatic systems are important to maintaining food webs not only for aquatic SGCN but also terrestrial species (eagles, ospreys, bats, otter, mink).

Development and logging along the river and tributaries has had a significant impact on riparian areas functions and benefits to SGCN. The loss of naturally vegetated (forested) riparian areas have lead to increased inputs of sediment and other pollutants to streams, increased water temperatures, channel instability, and loss of in-stream habitat structure created by the recruitment of large wood. Removal of living and dead trees (snags) from riparian lands has reduced sites for eagle and osprey nesting, roosting and perching.

Unique to the Lower Connecticut River is the existence of the Vermont Yankee Nuclear Power Station, which uses the river as a source of reactor cooling water and by state permit is allowed to discharges waste heat within specified thermal limits to the river. Excessive heat discharged to the river can potentially limit the temperature regime of the river within vicinity of the power plant to the detriment of aquatic SGCN intolerant of warm water. On a larger scale is the effect of climate change on aquatic habitats critical to certain SGCN (e.g., Atlantic salmon, American eel).

Desired Conditions (SGCN Needs): Eventual restoration and maintenance of sustainable populations of migratory native fishes to the Connecticut River basin is dependent on eliminating or mitigating artificial barriers which currently do not allow fish access to critical habitats, whether freshwater spawning and nursery areas or seawater (e.g. Atlantic salmon, American shad, sea lamprey, American eel). Dam removal would open river migration corridors, as well as restore natural flow regimes, sediment transport and other fluvial

processes essential to creating and maintaining instream aquatic habitat. Where dam removal is not feasible, fish passage should be restored by retrofitting structures with fish ladders, lifts or similar devices. Existing fishways demand continued operation and maintenance to assure their effectiveness. New dam construction should be avoided. Establishing flow regimes below dams and water level management within impoundments that mimic natural systems would benefit many of the aquatic SGCN.

The reduction of sediment inputs to the Lower Connecticut River from land development and chronic streambank erosion is important to maintaining SGCN populations, many of which depend on habitats consisting of coarse river bottom substrates (i.e., gravels and cobbles) that are not embedded by finer substrates. Riparian vegetation contributes to the reduction of these fine sediment inputs to surface waters by obstructing and slowing down overland runoff, while also reinforcing streambanks against the erosional forces of running water. Riparian areas also provide several habitat functions for species that inhabit them. Mature trees in the riparian zone provide necessary nesting sites for eagles and ospreys. These trees eventually may be recruited to the river channel, creating instream habitat such as refuge cover required by common mudpuppy and redbreast sunfish.

The potential for new non-indigenous invasive organisms (e.g., zebra mussel, Asiatic clam, hydrilla) becoming established in the Connecticut River is a persistent problem for the native biota and habitats.

Species of Greatest Conservation Need in Lower Connecticut River

High Priority

Peregrine Falcon (Falco peregrinus)
Bald Eagle (Haliaeetus leucocephalus)
American Eel (Anguilla rostrata)
Anadromous Atlantic Salmon (Salmo salar)
Common Mudpuppy (Necturus maculosus)
Freshwater mussels group
River/stream Odonata group
Silver-haired Bat (Lasionycteris noctivagans)
Eastern Red Bat (Lasiurus borealis)
Hoary Bat (Lasiurus cinereus)
Eastern Pipistrelle (Pipistrellus subflavus)

Medium Priority

Blue-winged Teal (Anas discors)
Osprey (Pandion haliaetus)
Pied-billed Grebe (Podilymbus podiceps)
Lesser Yellowlegs (Tringa flavipes)
Blueback Herring (Alosa aestivalis)
American Shad (Alosa sapidissima)
Redbreast Sunfish (Lepomis auritus)
Sea Lamprey (Petromyzon marinus)
Northern River Otter (Lutra canadensis)
Mink (Mustela vison)
Muskrat (Ondatra zibethicus)
Cinereus or Masked Shrew (Sorex cinereus)

SGCN Note: The SGCN invertebrate groups listed here contain numerous species. For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/Info Need Category	Problem/Info Need Detail	Rank
1. Habitat conversion	Loss of riparian and in-stream habitats from land and water development projects and activities, including impoundments.	High
2. Habitat alteration	Alteration and degradation of riparian and in-stream habitats from land and water development projects, including streambank rip rapping.	High
3. Hydrologic alteration	Replacement of natural flow cycles and processes with regulated flow regimes (e.g., inadequate minimum flows, fluctuating flows) rendering riverine habitats unsuitable to certain SGCN.	High
3. Sedimentation	Habitat degradation resulting from land development and uses; dams disrupting natural sediment transport; flushing sediments from impoundments; excessive bank erosion from inadequate riparian vegetation.	High
4. Habitat fragmentation	Interruption of migration corridors to and from breeding/spawning/wintering habitats via alteration and conversion of home range; construction of dams and culverts.	High
6. Invasion by exotic species	Displacement or restructuring of native aquatic plant and animal communities by invasive organisms impacting habitat and community structure and processes.	Med
7. Pollution	Nutrient overloading and other pollutants.	High
8. Pollution	Vulnerability to catastrophic spills: Bordering roadways, bridge crossings, adjacent industry and urban centers pose high risk points of entry for large-scale contaminant spills.	High
10. Monitoring	Population and habitat monitoring: Improved data on known SGCN populations is needed to track changes in species abundance and habitat quantity and quality as may be affected by natural processes and anthropogenic factors; habitats with potential for having existing SGCN populations or SGCN restoration potential should be investigated.	High

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here.
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Monitor, protect and restore riparian and in-stream habitats limited or impacted by development.	Number of SGCN sites (habitats) monitored; acres/miles of undisturbed habitats protected; acres/miles of disturbed habitats restored.	ANR, USFWS, NRCS, CRJC, TNC, Power Companies	EPA
Monitor, protect and restore river and stream water quality from excessive nutrient and sediment loading and other pollutants.	Miles of SGCN habitat meeting water quality standards.	ANR, USFWS, NRCS, CRJC, TNC	EPA
Monitor, protect and restore migration and travel corridors limited or impacted by dams, culverts and roads.	Number of identified artificial migration barriers removed or mitigated; miles of critical habitat restored by removal of barriers.	ANR, CRASC, USFWS, CRJC, VTrans, , Utilities	EPA, USACE
Monitor the Connecticut River and its tributaries for invasive species; prevent the introduction or spread of invasive species; implement control measures which take into account SGCN and their habitat requirements.	Number of SGCN habitats monitored for invasive species; number of SGCN habitats with plans in place designed to control invasive species and restore or enhance SGCN.	ANR, USFWS, CRJC, VY, TNC	WHIP, EQUIP, LIP, USFWS Conte Grants, EPA
Support policies and programs designed to reduce climate change.	Number of climate change policies and programs established or supported.	ANR, EPA, Other NE States	EPA
Conduct inventories to detect and gather information on new SGCN populations and their habitats.	Number of potential SGCN habitats surveyed.	ANR, USFWS, TNC, USGS, EPA	EPA

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Provide technical outreach and financial assistance to private landowners, towns, watershed and lake associations, regional planning commissions, and other partners to increase their awareness of problems to SGCN.	Number of actions implemented to maintain or enhance river function for SGCN.	ANR, USFWS, NRCS, CRJC, TNC	Farm Bill, Conte Grants, LIP EPA
Distribute *Conserving Vermont's Natural Heritage* (Austin et.al. 2004) to town and Regional Planning Commissions.	Number of towns and RPC considering SGCN in their planning. Number of actions implemented to maintain or enhance river function for SGCN.	AVCC	SWG, VFWD
Acquire conservation easements for the protection of SGCN sites and maintenance or restoration of their ecological functions.	Number of SGCN habitats acquired or enrolled in land conservation easement programs.	ANR, USFWS, TNC	EPA
Enhance coordination between government agencies/partners to ensure consistency in respective program implementation and increase sensitivity to problems and requirements for SGCN.	Number of agencies and private conservation organization, which recognize and address problems to SGCN.	ANR, USFWS, USFS, NRCS, USACE, VTrans, CRJC, TNC	EPA

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the lead column

Plan or planning entity	Goal/Scope of plan	Lead
Connecticut River Corridor Plan	"That plants, migratory birds, anadromous fish, and other native birds, fish, and wildlife continue to find the Connecticut River corridor and watershed hospitable to their unique needs for clean water and connected, protected open lands and forests;"	CRJC
A Plan to Restore the Aquatic Ecosystem in the Connecticut River Watershed	"Restore aquatic ecosystem so as to recover and support migratory and native fish populations and promote natural reproduction in the Connecticut River and its tributaries."	NRCS
Strategic Plan for the Restoration of Atlantic Salmon to the Connecticut River.	"Protect, conserve, restore and enhance the Atlantic salmon population in the Connecticut River for the public benefit, including recreational fishing."	CRASC
A Management for American Shad in the Connecticut River Basin.	"Restore and maintain a spawning shad population to its historic range in the Connecticut River Basin and to…"	CRASC
Management Plan for Blueback Herring in the Connecticut River Basin.	"Restore and maintain a spawning blueback herring population within its historic range in the Connecticut River basin."	CRASC
Management Plan for Sea Lamprey in the Connecticut River Basin (draft).	"CRASC should seek to conserve a spawning sea lamprey population within its historic range in the Connecticut River basin for both public and ecological benefits."	CRASC
Plan for the Restoration of Migratory Fishes to the Ashuelot River Basin, New Hampshire.	"Protect, conserve, restore, and enhance the migratory fish populations in the Ashuelot River system for both public and ecological benefits."	NHFG

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Austin, J.M. C. Alexander, E. Marshall, F. Hammond, J. Shippee, E. Thompson. VT League of Cities and Towns. 2004. Conserving Vermont's Natural Heritage. A Guide to Community-Based Planning for the Conservation of Vermont's Fish, Wildlife and Biological Diversity. Vermont Fish & Wildlife Department and Agency of Natural Resources. Waterbury, VT. www.vtfishandwildlife.com/library.cfm?libbase_=Reports_and_Documents

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Lake Champlain Summary

Lake Champlain includes the main body of the lake and its bays and river deltas. These waters are shared with New York and Quebec. At about 120 miles in length and a maximum depth over 400 feet, this is Vermont's largest waterbody. Aquatic habitats found here are many and extensive. Among these are expansive sand-bottomed shallows, shale/cobble littoral shorelines and bays, and deep limnetic environments. Other natural communities, such as large tributaries, emergent marshes, and floodplain forests, are integral to Lake Champlain and provide a critical habitat component for many SGCN found here. This is, in general, an oligo-mesotrophic lake, with nutrient levels in different parts of the lake dependent on local soil and bedrock types, as well as the type and extent of human land use within the surrounding watershed. This lake supports the highest lacustrine diversity of any of our lakes, which is due mainly to its large size and connections (current and historical) with the Great Lakes-St. Lawrence River and the Hudson River.

Lake Champlain Condition

Current Condition: The most outstanding concerns facing this large system are water quality and habitat degradation, and invasive exotic species. The lake is within the largest watershed in Vermont and is fed by many large tributaries that drain extensive agricultural and developed lands. A significant portion of the excessive nutrients, contaminants, and fine sediments that enter streams and rivers eventually reach Lake Champlain. Water and benthic habitat quality are affected, particularly in delta areas and along the shoreline, but also within the open and deeper waters over time. SGCN that are sensitive to contaminants and those that depend on consolidated (firmly-packed) substrates may be impacted by these changes to their habitat. Development along Lake Champlain's shoreline and within smaller watersheds immediate to the lake is ever-increasing, and with it the amount of contaminants entering directly into the lake. Excessive nutrients that reach the lake from various land uses within the watershed can cause eutrophication, reducing water quality and altering food webs. Zebra mussels have had a dramatic and devastating impact on the biotic community of Lake Champlain, including populations of many SGCN. These exotic pests foul the shells of native freshwater mussels, decreasing their ability to move about and obtain food and oxygen, resulting in a slow death. Populations of native mussels have been eliminated from large areas, a scenario that has repeated itself throughout most of the lake. The only areas where native mussels have not been seriously impacted by zebra mussels are Mallets Bay, the Inland Sea, and Missisquoi Bay. Water chestnut is an invasive that has impacted aquatic communities in the lake by forming huge, dense masses that cover the water surface and crowd out species. The exotic snail *Bithynia tentaculata* now dominates much of the shale/cobble habitat in Lake Champlain, likely reducing native snail populations and altering the food web. Among other invasive exotics that loom on the horizon for Lake Champlain are round goby, alewife, quagga mussel, and rusty crayfish. Additional problems to Lake Champlain include habitat conversion and vulnerability to catastrophic contaminant spills.

Desired Condition (SGCN Needs): These waters, along with Lake Champlain tributaries, support the greatest diversity of aquatic species found in the state. SGCN supported by Lake Champlain include mid- to deep-water species like cisco and lake whitefish that require cold, well-oxygenated waters. Shallow-water species such as mooneye and sauger utilize upper portions of the lake where temperatures are often much warmer. Near-shore and benthic species like bridle shiner, pink heelsplitter, giant floater, and spiny softshell are often found in bays or in the shallows of deltas.

The lake offers a variety of habitats that provide for the many needs of aquatic species, such as refuge, food, thermal protection, and spawning substrate. The great majority of freshwater mussel species remain buried in the substrate most of their lives, where they grow, feed, produce offspring, and seek refuge from the elements. Lake sturgeon feed on lake-bottom invertebrates, only entering rivers for brief periods to spawn. Different fishes can be found occupying different strata of the lake where they find the temperatures and oxygen levels they prefer. Degradation of water quality through nutrient input, thermal shifts, or other changes can cause significant alterations in food webs and habitat availability. Similarly, excessive fine sediments entering the lake from the shoreline and tributaries blankets and degrades the benthic substrate used by many SGCN. Improvement and protection of Lake Champlain's water quality, including reduction of nutrient and fine sediment inputs, is paramount to ensure that the SGCN populations found here remain viable. Control of exotic species, including preventing new species from invading, is also of great importance to the survival of these native species.

Many SGCN utilizing Lake Champlain depend on closely associated aquatic, wetland, and terrestrial habitats to complete their life cycles. Many fish, such as lake sturgeon, greater redhorse, and mooneye are found in the lake most of the year, but spawn over rocky substrates in Champlain tributaries. Osprey feed in the lake but need nearby suitable nesting trees or structures to raise their young. Spiny softshells occupy the lake much of the year for basking, feeding, and over-wintering, but require adjacent beaches of sand or gravel/cobble for egg-laying. Bats feed on emerging aquatic insects over the lake, while utilizing upland roosting and nursery sites. Muskrats river otter and mink find a rich aquatic food source within Lake Champlain and its associated wetlands, but must den above the waterline. Maintaining these connections to critical wetland, aquatic, and terrestrial habitat is key to ensuring the continuation of these SGCN in the lake.

Species of Greatest Conservation Need in Lake Champlain

High Priority

Peregrine Falcon (Falco peregrinus)
Bald Eagle (Haliaeetus leucocephalus)
American Brook Lamprey (Lampetra appendix)
Lake Sturgeon (Acipenser fulvescens)
American Eel (Anguilla rostrata)
Muskellunge (Esox masquinongy)
Silver Redhorse (Moxostoma anisurum)
Greater Redhorse (Moxostoma valenciennesi)
Quillback (Carpiodes cyprinus)
Sauger (Sander canadense)
Blackchin Shiner (Notropis heterodon)
Bridle Shiner (Notropis bifrenatus)
Crustaceans Group
Freshwater Mussels Group
Freshwater Snails group
Spiny Softshell (Apalone spinifera)
Silver-haired Bat (Lasionycteris noctivagans)
Eastern Red Bat (Lasiurus borealis)
Hoary Bat (Lasiurus cinereus)
Eastern Pipistrelle (Pipistrellus subflavus)

Medium Priority

Osprey (Pandion haliaetus)
Cisco or Lake Herring (Coregonus artedi)
Lake Whitefish (Coregonus clupeaformis)
Mooneye (Hiodon tergisus)
Silver Lamprey (Ichthyomyzon unicuspis)
Shorthead Redhorse (Moxostoma macrolepidotum)
Atlantic Salmon (landlocked) (Salmo salar)
Lake Trout (naturally reproducing populations) (Salvelinus namaycush)
Mink (Mustela vison)
Muskrat (Ondatra zibethicus)
Northern River Otter (Lutra canadensis)

SGCN Note: SGCN plants not listed here 7 species. The SGCN invertebrate groups listed here contain numerous species. Sea lamprey is not a Species of Greatest Conservation Need

in the Lake Champlain Basin. For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/Info Need Category	Problem/Info Need Detail	Rank
1. Habitat Alteration	excessive sediments and nutrients from surface runoff and tributaries; caused by human land use nearby	High
2. Habitat Conversion	benthic habitat due to riprapping, bridge construction, boat access construction, etc.	High
3. Pollution	bility to Catastrophic Spills: Bordering roadways, bridge crossings, adjacent industry, and manure pits are examples of high risk points of entry for large-scale contaminant spills	High
4. Invasion by exotic species	Zebra mussels and water chestnut are currently impacting SGCN; other exotics may also be displacing native SGCN	High
5. Pollution	Water quality degradation due to contaminants from agricultural fields, stormwater runoff, other point and non-point sources	High
6. Inventory	Inventory needed for many SGCN, particularly those for which distributional and abundance information is greatly lacking	High
7. Monitor	Detect SGCN population trends to help guide conservation actions and to track the effectiveness of current management	High

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here.
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Monitor known SGCN populations	Number of known SGCN sites monitored	USFWS, ANR, TNC, Universities	SWG, VFWD, VT Watershed Grants
Conduct inventories to detect and gather information on new SGCN populations	Number of completed species or species-group inventories	USFWS, ANR, TNC, Universities	SWG, VFWD, VT Watershed Grants
Protect and restore habitats on which SGCN are dependent through pollution abatement, riparian buffers, etc.	Number of acres of riparian and lakeshore natural vegetation protected and/or restored Number of acres of lake habitat restored/protected	LCLT, VLT, Watershed groups, USFWS, ANR, EPA	LIP, SWG, LCLT, VLT, NRCS, EPA, Clean & Clear
Restore migration corridors for SGCN by removal of artificial barriers to spawning habitat or construction of effective fish passage facilities at dams	Number of artificial SGCN migration barriers removed or provided with passageways Number of adult SGCN fish passed migrating to upstream spawning habitat (e.g., lake sturgeon, greater redhorse)	USFWS, Hydro operators, FERC, ANR, Municipalities, VNRC, EPA	NRCS, USFWS, Clean & Clear, EPA
Implement an invasive species monitoring program to prevent the introduction and spread of invasive exotic species. Manage, mitigate, and/or eliminate invasive species that are detected.	Estimated percent of invasive exotic species controlled per year. Number of sites with control activities and/or invasive monitoring	LCBP, ANR, Municipalities, USFWS, EPA	USFWS, VT Watershed Grants, LCBP, EPA, Clean & Clear

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Provide technical outreach and financial assistance to private landowners, watershed groups, and other partners to maintain and enhance Lake Champlain for SGCN.	Number of actions implemented to maintain or enhance lake suitability for SGCN	EPA, VFWD, TNC, LCBP, VLCT, Watershed groups,	VT Watershed Grants, LCBP, LIP, EPA, Clean & Clear
Provide technical outreach to towns and regional planning commissions o maintain and enhance Lake Champlain for SGCN. Distribute *Conserving Vermont's Natural Heritage* (Austin et.al. 2004)	Number of towns considering SGCN in their planning. Number of actions implemented to maintain or enhance lake suitability for SGCN	EPA, AVCC, LCBP, RPC's Municipalities,	EPA, SWG
Acquire conservation easements for the protection of SGCN sites and maintenance or restoration of ecological functions	Number of riparian habitat acres acquired/enrolled	LCLT, VLT, ANR, TNC, NRCS, EPA	LCLT, VLT, TNC, SWG, LIP, NRCS, EPA, Clean & Clear
Enhance coordination between government agencies and partners to ensure consistency in respective program implementation and increased sensitivity to SGCN requirements and problems to SGCN	Number of programs that incorporate SGCN conservation.	ANR, USFWS, COE, FEMA, FHWA, NRCS, Wildlife Services, VTrans	USFWS, LIP, EPA, Clean & Clear

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the lead column

Plan or planning entity	Goal/Scope of plan	Lead
Lake Champlain Basin Aquatic Nuisance Species Management Plan (2002).	Management and prevention of invasive exotic species in the basin	VTDEC, NYDEC
VTDEC Water Quality Division	Lake protection and restoration programs	VTDEC
NYDEC	Lake protection and restoration programs	NYDEC
Quebec Ministère de l'Environnement	Protection of Québec's ecosystems and biodiversity; prevention, reduction or elimination of water contamination	Quebec Ministère de l'Environnement
Vermont Osprey Recovery Plan	Recovery and management of osprey within VT	VFWD
Conserving Lake Champlain's Biological Diversity 6/102005	Strategic plan focused on conserving Lake Champlain's biological diversity	TNC
Various watershed planning efforts	Watershed protection and restoration; river and lake restoration and protection	VTDEC; local/regional watershed groups

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Lacustrine Summary (excluding Lake Champlain)

Characteristics and Location

Lacustrine areas include natural lakes and ponds throughout Vermont, which can be classified on the basis of their productivity and associated physio-chemical characteristics. Lake types discussed here include oligotrophic lakes, mesotrophic lakes, eutrophic lakes, high elevation acidic lakes, and dystrophic lakes. Lake Champlain, representing oligotrophic, mesotrophic and eutrophic habitat types, is not included in this summary due to its large size and unique species assemblages (see Lake Champlain Summary). The following descriptions of Vermont lake types are based in part on parameters provided by the Vermont Department of Environmental Conservation, Water Quality Division, Lakes and Ponds Section.

Types of Lacustrine Communities:

Oligotrophic Lakes: These lakes are typically deep with clear, cold water; low in dissolved nutrients, such as phosphorus and nitrogen; and experience seasonal periods of temperature and oxygen stratification and de-stratification (mixing). Biochemical parameters generally characterizing this lake type are: (1) total phosphorus concentration in the summer photic zone, <10 μg/L; total nitrogen concentration, <0.35 mg/L; average summer chlorophyll-a concentration, ≤3.5 μg/L; and average summer secchi disc depth, ≥5.5 m. Another general feature of oligotrophic lakes is the lack of an extensive littoral zone. Littoral plants are scarce and plankton density is low. Several SGCN uniquely associated with this lacustrine waters are landlocked Atlantic salmon, lake trout, and round whitefish. In Vermont, lakes of this type are predominantly located in the Northeast Highlands biophysical region.

Mesotrophic Lakes: Lakes of this type are intermediary between oligotrophic (nutrient poor) and eutrophic (nutrient rich) systems. Mesotrophic lakes are shallower than oligotrophic lakes, have a well-established littoral zone supporting aquatic vegetation, and are moderately rich in dissolved nutrients. Consequently, primary productivity and plankton densities are greater than in oligotrophic systems but less than in eutrophic waters**.** Biochemical parameters generally characterizing this lake type are: (1) total phosphorus concentration in the summer photic zone, 10 to 24 μg/L; total nitrogen concentration, 0.35 to <0.65 mg/L; average summer chlorophyll-a concentration, >3.5 to 7.0 μg/L; and average summer secchi disc depth, 3.0 to 5.5 m. Several SGCN uniquely associated with meso-eutrophic lakes are bridle shiner, blackchin shiner, redfin pickerel, redbreast sunfish, common musk turtle, and northern water snake. Lakes of this type are distributed throughout Vermont; however, those supporting one or more populations of SGCN tend to be represented in greater frequency in the Champlain Valley and Connecticut River biophysical regions.

Eutrophic Lakes: Lakes of this type are generally characterized as nutrient mature systems. They are richer in dissolved nutrients and generally shallower than oligotrophic and mesotrophic lakes with extensive littoral areas supporting prolific growths of aquatic vegetation. Primary productivity and plankton densities are greater than in mesotrophic lakes. Eutrophic lakes that thermally stratify are likely to experience oxygen depletion below the thermocline during summer and/or winter stratification periods. Oxygen depletion during winter can occur when ice cover prohibits atmospheric exchange of oxygen resulting in "winter-kill" conditions. Biochemical parameters generally characterizing this lake type are: (1) total phosphorus concentration in the summer photic zone, >24 μg/L; total nitrogen concentration, >0.65 mg/L;

average summer chlorophyll-a concentration, ≥7.0 µg/L; and average summer secchi disc depth, 0 to 3.0 m. SGCN associated with eutrophic lakes are similar to mesotrophic lakes with decreasing occurrence in lakes of more advanced eutrophication. Though advanced eutrophication may make unsuitable habitat for purely aquatic SGCN, the productivity of these waters may be important to terrestrial and semi-aquatic species (e.g., bald eagle, osprey, bats and northern water snake) due to the abundance of food organisms these waters are capable of producing. Lakes of this type are distributed throughout Vermont but are more likely to be at low elevations and in disturbed landscapes.

High Elevation Acidic Lakes: These are clear-water lakes generally located at elevations over 1500 feet with neutralizing capacity (ANC) less than 25 mg/L and more typically within the range of 0 to 5 mg/L. Lakes of this type are vulnerable to and in some cases are known to be adversely affected by acid deposition. These lakes are usually small and shallow, with rocky or gravelly bottoms, and little accumulated organic material. Dissolved nutrient concentrations and primary production are generally low. Relatively few SGCN are associated with high elevation acidic lakes. One possible associate is brook trout. In Vermont lakes of this type are generally distributed within the Northern and Southern Green Mountain biophysical regions.

Dystrophic Lakes: Lakes of this type are usually associated with bogs. These are characterized by brown stained water (color >50 Pt Co) and are high in nutrients and humic materials. Dystrophic lakes are often acidic and may be anoxic or nearly so in the deeper waters. Relatively few SGCN are associated with dystrophic lakes with the possible exception of brook trout. Although examples of dystrophic lakes may be found statewide, generally they are more abundant in the Northern Green Mountains, Southern Green Mountains and Northeast Highlands biophysical regions.

Lacustrine Condition

Current Condition: The lacustrine (lake) waters represented in this summary have notably different physio-chemical characteristics, therefore problems and changes to their water quality and chemistry may affect each lake type and species assemblages in different ways. Most oligotrophic and mesotrophic lakes in Vermont have experienced abundant lakeshore development, both historically and currently, such as seasonal and permanent residences, marinas and docks, and public and private beaches. In many instances these developments have altered natural lakeshore and littoral habitats through the addition of fill materials (e.g., sand, bottom barriers), removal of large woody debris, and removal of native aquatic vegetation for beach construction and maintenance, resulting in the direct loss of habitats for SGCN. Additionally, development has increased stormwater runoff to lakes and has elevated the input of pollutants, including sediments, nutrients, and toxic chemicals. Nutrient loading can accelerate the eutrophication process causing excessive growth of phytoplankton and other aquatic vegetation, reduced water clarity, and increased biological oxygen demand. Such water quality and habitat changes may be detrimental to certain SGCN associated with specific lakes. Many SGCN species are heavily dependent on healthy aquatic systems for food sources, such as abundant fish and/or invertebrate populations utilized by eagles, osprey, mink, river otter, muskrat and bats.

Development of shorelands may alter habitat required by terrestrial SGCN that are associated with lacustrine areas, such as bald eagle, osprey and mink. As an example, the

reduction of mature trees by clearing within the riparian area may eliminate eagle and osprey nesting sites and reduce recruitment of woody debris into the littoral zone.

The invasion of lacustrine waters by habitat-altering exotic species and the subsequent control of these exotics may have degraded habitat for some aquatic SGCN. For example, the establishment of Eurasian milfoil in several mesotrophic lakes where blackchin shiners are known to occur has likely displaced native aquatic plant communities on which this fish species is dependent for spawning and refuge. While milfoil control activities, such as herbicide treatment, are conducted to restore lake conditions conducive to water-based recreational pursuits (boating, swimming, sport fishing), the result is loss of vegetative cover now provided by milfoil stands, increased predation on shiners by other resident fishes (e.g., bass, sunfish, pike), as well as the loss of spawning habitat. These pressures on blackchin shiner populations continue until littoral areas are adequately revegetated with native plant species, a process that may take many years.

The deliberate and accidental introduction of plant and animal species to Vermont's lakes and ponds over the past 200 years has greatly changed natural communities and their ecological functions. Many fish species, including those native to the state as well as ones brought from outside, have been established in waters where they did not naturally occur. For example, largemouth bass, bluegill and northern pike, all native in Vermont to Lake Champlain only, now have transplanted populations in habitats nearly statewide. Rainbow and brown trout originated from the western United States and Europe, respectively, and now are established in many lakes within the state. The distribution of these species was expanded beyond their natural range for the primary purpose of increasing sport fishing opportunities; however, in the past little consideration was given to the negative effects these species have on native ecosystems. More recently, 1997, the exotic alewife was discovered in Lake St. Catherine where previously the species did not exist. This was the first recorded occurrence of alewife in the state. The impacts this species has on native fish communities are well documented, including: (1) out-competing other planktivores for food and causing shifts in zooplankton species composition and size structure; (2) preying on the eggs and larvae of native fishes; and (3) causing significant mortality syndrome in salmon and trout fry (Good 2001). The trans-state movement and introduction of exotic species into natural habitats has become an environmental problem of national scale. Past species introductions changed the current character of many Vermont lacustrine areas, and the problem is a persistent problem for maintaining lakes and ponds in a desired condition well into the future.

Currently dystrophic and high elevation acidic lakes are somewhat less limited by direct development pressures that other lake types are experiencing. On the other hand, these lakes are particularly vulnerable to habitat alteration through the effects of acid deposition.

Desired Condition (SGCN Needs): Lacustrine areas directly and indirectly support a host of species, including aquatic invertebrates (insects, crustaceans, mollusks), fishes, reptiles, amphibians, mammals, birds and plants.

Obligate SGCN associated with oligotrophic lakes (e.g., landlocked Atlantic salmon, lake trout, arctic char, round whitefish) require deep, clear, well-oxygenated water for their survival. Potential increases in lake water temperatures due to climate change represent a problem for these oligotrophic lakes and the associated cold-water SGCN.

In contrast, species associated with mesotrophic and eutrophic lakes are more dependent on the high productivity of these lake systems to produce needed food sources and habitat complexity, such as well-established littoral communities for feeding, reproduction and refuge cover.

A number of SGCN, notably the reptiles and amphibians, have home ranges that encompass both lacustrine and terrestrial areas at particular times of the year. For example, spotted and musk turtles, which reside most of the year in lakes and ponds, leave these waters briefly for upland areas to lay eggs. Similarly, lake residing brook trout may seasonally ascend tributary streams to spawn. In contrast, Fowler's toads travel from their usual terrestrial haunts to aquatic habitats to deposit eggs along the shoreline. Forested riparian zones provide nesting and feeding perches for bald eagle and osprey. Mature trees that eventually die and are recruited into the littoral area contribute to forming refuge and basking habitats. Maintenance of water quality conditions characteristic of specific lake types is a requirement of SGCN associated and dependent on those habitats.

The desired condition for all lacustrine communities would include: 1) the existence of intact riparian conditions; 2) the existence of minimally disturbed littoral zones; 3) evolutionary (e.g trophic) processes occurring at rates not accelerated by disturbance; 4) pollutant levels (e.g sediment and toxics, including acid deposition) below concentrations that would adversely affect SGCN; 5) absence of exotic species that adversely affect SGCN; 6) unimpeded access by SGCN to habitats required for the maintenance of life cycle functions; and 7) unaltered hydrological and temperature regimes.

Species of Greatest Conservation Need in Lacustrine Communities (excluding Lake Champlain)

High Priority

Peregrine Falcon (Falco peregrinus)
Bald Eagle (Haliaeetus leucocephalus)
American eel (Anguilla rostrata)
Bridle Shiner (Notropis bifrenatus)
Blackchin Shiner (Notropis heterodon)
Arctic Char (Salvelinus alpinus oquassa)
Fowler's Toad (Bufo fowleri)
Common Mudpuppy (Necturus maculosus)
Bog/fen/swamp/marshy pond Odonates
Crustaceans group
Freshwater Snails Group
Lakes/ponds Odonates Group
River/stream Odonates Group
Silver-haired Bat (Lasionycteris noctivagans)
Eastern Red Bat (Lasiurus borealis)
Hoary Bat (Lasiurus cinereus)
Eastern Pipistrelle (Pipistrellus subflavus)

Medium Priority

Osprey (Pandion haliaetus)
Redfin Pickerel (Esox americanus)
Redbreast Sunfish (Lepomis auritus)
Round Whitefish (Prosopium cylindraceum)
Atlantic salmon-landlocked (Salmo salar)
Brook Trout-naturally reproducing populations (Salvelinus fontinalis
Lake Trout-naturally reproducing populations (Salvelinus namaycush)
Northern Water Snake (Nerodia sipedon)
Common Musk Turtle or Stinkpot (Sternotherus odoratus)
Mink (Mustela vison)
Muskrat (Ondatra zibethicus)

SGCN Note: Plant SGCN not listed here 25 species. The SGCN invertebrate groups listed here contain numerous species. For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/Info Need Category	Problem/Info Need Detail	Rank
1. Habitat Conversion	Loss of riparian, shoreline and littoral habitats from land and water development projects and activities.	High
2. Habitat Alteration	Alteration and degradation of riparian, shoreline and littoral habitats from development, invasive species, and aquatic vegetation control; water level regulation; loss and inadequate recruitment of large woody debris.	High
3. Sedimentation	Alteration and degradation of habitat (e.g., spawning areas); smothering of organisms.	High
4. Habitat Fragmentation	Interruption of migration and travel corridors to and from breeding/spawning/wintering habitats via alteration and conversion home range; construction of roads, dams and culverts.	High
6. Invasion by Exotic Species	Alteration and conversion of native littoral plant communities; inter-species competition for habitat and food; predation on native species; impacts resulting from invasive species control programs and activities.	High
7. Climate change	Alteration of water and temperature regimes.	High
8. Pollution	Nutrient and sediment overloading, acid deposition and other pollutants.	High
9. Pollution	Nutrient input to lakes accelerates the eutrophication process altering normal trophic succession.	High
10. Monitoring	Population and habitat monitoring: Improved data on known SGCN populations is needed to track changes in species abundance and habitat quantity and quality as may be affected by natural processes and anthropogenic factors; habitats with potential for having existing SGCN populations or SGCN restoration potential should be investigated.	High

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Monitor, protect and restore riparian, shoreline and littoral habitats limited or impacted by development.	Number of SGCN sites (habitats) monitored; acres of undisturbed habitats protected; acres of disturbed habitats restored.	ANR, USFWS, NRCS, USFS, Lake and Watershed Associations	USFWS, EPA, Clean & Clear, ANR
Monitor, protect and restore lake and pond water quality from excessive nutrient and sediment loading, other pollutants, and acid deposition.	Acres of SGCN habitat meeting water quality standards.	ANR, USFWS, NRCS, USFS, Lake and Watershed Associations	ANR. Clean & Clear (in Lake Champlain Basin)
Monitor, protect and restore migration and travel corridors limited or impacted by roads, dams, culverts, etc.	Number of identified artificial migration barriers removed or mitigated; number of migration corridors protected.	ANR, USFWS, NRCS, USFS, VTrans	USFWS, EPA
Monitor, protect and maintain known softshell turtle nesting sites; restore and protect additional nest sites.	Number of nest sites monitored, managed and protected; nest sites restored.	ANR, USDA, Wildlife Services, EPA	USFWS, EPA
Monitor lakes and ponds for invasive species; implement programs to prevent the introduction or spread of invasive species; implement control measures which take into account SGCN and their habitat requirements.	Numbers of SGCN habitats monitored for invasive species; number of SGCN habitats with plans in place designed to control invasive species and restore or enhance SGCN; incorporation of SGCN.	ANR, Lake and Watershed Associations	

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Support policies and programs designed to reduce climate change.	Number of climate change policies and programs established or supported.	ANR, EPA, Other NE States	
Conduct inventories to detect and gather information on new SGCN populations and their habitats.	Number of potential SGCN habitats surveyed.	ANR, USFWS, USFS, EPA, USGS	USFWS
Provide technical outreach and financial assistance to private landowners, towns, watershed and lake associations, regional planning commissions, and other partners to increase their awareness of problems to SGCN.	Number of actions implemented to maintain or enhance lake function for SGCN.	ANR, USFWS, NRCS, TNC	USFWS
Acquire conservation easements for the protection of SGCN sites and maintenance or restoration of their ecological functions.	Number of SGCN habitats acquired or enrolled in land conservation easement programs.	ANR, TNC, USFS	USFWS
Enhance coordination between government agencies/partners to ensure consistency in respective program implementation and increase sensitivity to SGCN requirements and problems to SGCN.	Number of agencies and private conservation organization, which recognize and address problems to SGCN.	ANR, USFWS, USFS, NRCS, VTrans, TNC, Lake and Watershed Associations	

Coordination with other plans

Plan or planning entity	Goal/Scope of plan	Lead
DEC Water Quality Division	Lake protection and restoration programs	DEC

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Grassland & Hedgerow Summary

Characteristics and location

Grasslands are landscapes dominated by grasses, sedges and forbs with little to no tree or shrub cover. Most of the larger examples of this community type are the result of current or past agricultural practices. Grassland habitats are also commonly maintained at airports, fairgrounds, landfills and industrial complexes. Smaller grasslands are found in fallow beaver flowages, seasonally flooded areas adjacent to rivers, and sandplain communities, and are covered under separate summaries.

Hedgerows are linear patches of trees or shrubs, often lining field borders or roadsides. Hedgerows enable some species to more fully utilize adjacent grassland communities (for perching, nesting, sheltering or escaping predators), while other species may occupy annual or seasonal home ranges solely within hedgerows. Hedgerows also often serve as travel or dispersal corridors connecting disjunct habitat patches.

Types of Grassland & Hedgerow Communities:

Hayfields, pastures, old fields, power line and RR right-of-ways, mowed interstate medians, airports, industrial complexes.

Treed and/or brushy hedgerows lining field edges and roads.

Grassland & Hedgerow Condition

Historical Perspective: Grasslands in Vermont are primarily a result of land clearing for agriculture since European settlement of the area. It has been estimated that early successional forest (1-15 year age class) occupied from 1.1-3.0% of the regional presettlement landscape in areas of northern hardwood forest and 2.4-7.1% of the regional landscape in areas of spruce-northern hardwood forest (Lorimer and White 2003).

Current Condition: Most of Vermont's grasslands occur in the Champlain Valley and to a lesser extent the Connecticut River Valley and the area around Lake Memphremagog. There are also numerous grasslands of various types and sizes scattered across the rest of the state. Most grasslands are associated with current or past agricultural practices. There are, however, grasslands that are the result of other human activities and are maintained for specific purposes. These include grasslands associated with airports (commercial and private), landfills, fairgrounds, military reservations and industrial complexes (e.g., IBM, Husky, etc.). Most of Vermont's grasslands are in private ownership, although the state and federal governments own and manage some of these areas. The counties with the highest percentages of land in agriculture and open land are Addison (35.5%), Franklin (29.5%), Grand Isle (25%) and Orleans (22%, primarily in the area surrounding Lake Memphremagog) (U.S. Department of Agriculture. 1997).

Although agriculture practices create and maintain valuable grasslands, recent intensification of these practices has had negative impacts on their quality and availability. Small diversified farming which provided a range of suitable habitat types has given way to larger, more intensively managed farms as a result of improved agricultural techniques. Advances in equipment, fertilizers and extensive use of potent pesticides and herbicides have resulted in greater management of hayfields (early and frequent cutting which disrupts nesting activity), conversion of hayfields to row crops or legumes, and intensive grazing (LaBarr et al. 2004).

Urban and suburban development has also resulted in a loss of grasslands. This loss comes in two forms, the direct loss of grasslands as structures and lawns replace fields, and fragmentation of large grassland areas into smaller parcels rendering them insufficient for use by some breeding grassland bird (e.g., Upland Sandpiper). In Vermont, the urban and suburban growth of Chittenden county is expanding into Franklin and Grand Isle counties to the north and Addison county to the south. As a result there is increasing pressure to develop agricultural lands important to grassland species (LaBarr et al. 2004).

Other factors contributing to loss of quality grasslands include incompatible management of grasslands in non-agricultural settings (i.e., airports). Although airport construction and management has provided suitable habitat for grassland species, mowing regimes, many of which are required by the Federal Aviation Administration (FAA) often disturb nesting activity. Also, a lack of airport expansion planning (new hangers, airplane parking, etc.) which takes into account grassland species has lead to the loss of important grassland habitat at these sites (LaBarr et al. 2004).

More is known about the effects of current conditions on grassland bird species than other SGCN taxa that use grasslands and/or hedgerows. Grassland bird species as a whole have declined steadily throughout their range. Reported results from the U.S. Fish and Wildlife Service Breeding Bird Survey show that declines of grassland birds have been consistently steeper and more widespread than any other assemblage of birds (Askins 1993, Sauer et al. 2001). In Vermont, Upland Sandpiper populations have declined precipitously (Peterson 1999) and Grasshopper Sparrows are considered rare and uncommon (Ellison 1985, Record of Vermont Birds). Both Sedge Wren and Henslow's Sparrow populations have declined to where they may no longer be breeding in the state. Other obligate grassland species, although relatively abundant (i.e., Bobolink and Eastern Meadowlark) have also show significant declines in recent years (LaBarr et al. 2004).

Desired Condition (SGCN Needs): A variety of grasslands and hedgerows are needed to conserve the suite of species dependant on these habitat types. For example, Bobolinks utilize large expanses of grassland or fallow hay fields with little or no alfalfa, high litter cover and scattered broad-leafed forbs for nest-site cover (Martin and Gavin 1995). Northern Harrier habitat includes marshy meadows, wet, lightly grazed pastures, old fields, mesic grasslands, and drained marshlands. Densest populations are typically associated with large tracts of undisturbed habitats dominated by thick vegetation (MacWhirter and Bildstein 1996). Upland Sandpipers prefer large grassland areas (20-40 ha) with a mosaic of grassland types as areas of short grass are used for feeding while areas of taller grass (10-30 cm) are used for nesting. All three of these aforementioned species benefit from grasslands that are not subjected to early (before July 15) mowing. American Kestrels nest in cavities or nest boxes in most open areas (< 30% canopy cover; Smallwood and Bird 2002). Gray Fox, New England Cottontail, Eastern Rat Snake, Smooth Green Snake and Brown Snake all utilize hedgerows for foraging, denning or nesting, and/or as movement corridors.

Species of Greatest Conservation Need in Grasslands & Hedgerows

High Priority

Grasshopper Sparrow (Ammodramus savannarum)
Upland Sandpiper (Bartramia longicauda)
Northern Harrier (Circus cyaneus)
Sedge Wren (Cistothorus platensis)
Peregrine Falcon (Falco peregrinus)
Vesper Sparrow (Pooecetes gramineus)
Fowler's Toad (Bufo fowleri)
Wood Turtle (Clemmys insculpta)
Eastern Racer (Coluber constrictor)
Timber Rattlesnake (Crotalus horridus)
Eastern Rat Snake (Elaphe obsoleta)
Grassland Butterflies Group
Moths Group
Eastern Red Bat (Lasiurus borealis)
Hoary Bat (Lasiurus cinereus)
Woodland Vole (Microtus pinetorum)
Pygmy Shrew (Sorex hoyi)
New England Cottontail (Sylvilagus transitionalis)
Southern Bog Lemming (Synaptomys cooperi)

Medium Priority

Cooper's Hawk (Accipiter cooperii)
Henslow's Sparrow (Ammodramus henslowii)
Blue-winged Teal (Anas discors)
Short-eared Owl (Asio flammeus)
Long-eared Owl (Asio otus)
Chimney Swift (Chaetura pelagica)
Black-billed Cuckoo (Coccyzus erythropthalmus)
Bobolink (Dolichonyx oryzivorus)
American Kestrel (Falco sparverius)
Purple Martin (Progne subis)
Field Sparrow (Spizella pusilla)
Eastern Meadowlark (Sturnella magna)
Lesser Yellowlegs (Tringa flavipes)
Barn Owl (Tyto alba)
Blue-winged Warbler (Vermivora pinus)
Smooth Green Snake (Liochlorophis vernalis)
Brown Snake (Storeria dekayi)
Eastern Ribbon Snake (Thamnophis sauritus)
Long-tailed Weasel (Mustela frenata)
Hairy-tailed Mole (Parascalops breweri)
Common Gray Fox (Urocyon cinereoargenteus)

SGCN Notes: Plant SGCN not listed here: 23. The SGCN invertebrate groups listed here contain numerous species. For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/Info Need/Category	Problem/Info Need Detail	Rank
1. Habitat Degradation	Widespread early hay harvest (early June) and heavy grazing rotations in pastures.	High
2. Habitat Conversion	conversion of agricultural habitat to urban/suburban development	High
3. Distribution of successional stages	Abandonment and forest succession of former agricultural land.	High
4. Habitat Degradation	Removal of hedgerows to accommodate larger tractors and farm machinery.	High
5. Habitat Fragmentation	Fragmentation of habitat by roads and trails and increase use of roads and tails by motor vehicles, including ATV's, and mountain bicycles.	High
6. Inventory	Distribution and condition of this habitat are not well known. Better information is necessary regarding the timing of hay mowing in landscapes with various proportions of agriculture throughout VT.	Medium
7. Inventory	Better information is needed on the distribution of SGCN within grasslands habitats and the relative values of the various types and sizes of these habitats to the SGCN.	Medium

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here.
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Locate grassland and assess management practices on those grasslands.	Number of sites located and assessed	ANR,FSA, UVM,VA	SWG
Identify areas within the state with the largest matrix of grasslands for inclusion in grassland bird opportunity areas.	Number of opportunity areas identified	ANR, UVM	SWG
Ensure protection of opportunity areas via acquisition of conservation easements, management leases and fee title acquisition	Number of sites conserved	ANR, VHCB, TNC	VHCB, TNC
Develop education and outreach program to provide information about grassland/hedgerow dependant species and management options to enhance their populations in Vermont.	Number of maintained or enhanced sites on private land	ANR, FSA, VFB	SWG, WHIP, LIP, GRP, VDA
Promote conservation easements or incentives to landowners managing grasslands/hedgerows for SGCN.	Number of maintained or enhanced sites on private land	ANR, FSA, VFB	SWG, WHIP, LIP, GRP, VDA
Develop conservation plans at state airports where SGCN are regularly found.	Number of sites with conservation agreements	ANR, VTRANS, FAA	SWG, VTRANS
Continue to work with Vermont National Guard staff at Camp Johnson to manage grasslands to benefit grassland species.	Number of SGCN conserved at Camp Johnson	VNG, ANR	SWG
Maintain and manage grasslands and hedgerows on state and federal lands (wildlife management areas, state parks, National Wildlife Refuges, GMNF)	Number of sites reclaimed and/or managed	ANR, USFWS, USFS	SWG, PR
Manage power line ROW, road margins and related lands known or suspected to support SGCN that depend on grasslands and enhance surrounding habitat by creating and maintaining open habitat.	Number of sites reclaimed and/or managed	ANR, VETCO, GMP	SWG, VETCO, GMP
Support current efforts and develop new efforts to study distribution, productivity, and survivorship of grassland bird species in Vermont.	Number of hypothesis tested	ANR, UVM, VA, VINS	SWG, PR
Develop safe road crossings to limit road kill of snakes and turtles which use grassland habitats	Number of safe crossings developed	ANR, Towns, VTRANS,	SWG, PR, VTRANS

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the lead column

Plan or planning entity	Goal/Scope of plan	Lead
VT Grassland Bird Management Plan	Maintain and enhance grassland bird populations	VFW, WHIP
Partners in Flight	Regional Bird conservation	VFW, VA, USFWS,PIF,NABSCI
VTRANS Transportation Plans	Manage airports	VFW, VTRANS

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Mines and Quarries Summary

Characteristics and location

Mines may provide many or all of the habitat qualities of natural caves and can even provide better habitat in some instances. Similarly, quarries may mimic natural cliffs, outcrops, and talus slopes. These human-created cultural habitats, due to the history of Vermont are found statewide and may augment the natural habitats available to wildlife.

Types of Mines and Quarries:

Mines in Vermont include gold, silver, iron asbestos, and talc mines.
Quarries in Vermont include marble, granite, and slate quarries
In some cases gravel pits and road cuts may provide habitat

Mines & Quarries Condition

Current Condition: Mines and quarries occur throughout the state. Some are long abandoned, some more recent, and others currently used to lesser or greater extents. The sites vary in their structural stability and some are very dangerous (large sections of the Elizabeth Mine have collapsed) Bats are known to use some mine sites as hibernacula. Peregrine falcons may nest or roost on the walls of some rock cuts. Mine vents and other vertical rock structure may provide nesting habitat for swifts. Small-footed bats might seek shelter in between and under large rock talus created by mining or quarrying operations. In some instances the sites are toxic due to leaching of mine tailings. Some sites have the entrances blocked, become dumping areas, or recreational vehicle parks.

Desired Condition (SGCN Needs): Some mines and quarry site provide conditions that certain species select. A mine that has appropriate temperatures and humidity may provide good wintering habitat for bats. Like caves, if the conditions change or if disturbances occur, the site may no longer be suitable habitat and can even cause the death of bats using the mine. Some rattlesnake reports historically have been from slate quarries in proximity to existing or historical den sites. Quarries could provide foraging and basking habitat as well as escape cover. Rock piles with abundant spaces that extend below the frost line could even provide denning sites. Sites providing necessary habitat for SGCN are important and should be conserved.

Species of Greatest Conservation Need using Mines and Quarries

High Priority

Chimney Swift (Chaetura pelagica)
Peregrine Falcon (Falco peregrinus)
Timber Rattlesnake (Crotalus horridus)
Indiana Bat (Myotis sodalis)
Small-footed Bat (Myotis leibii)
Eastern Pipistrelle (Pipistrellus subflavus)

Medium Priority

Big Brown Bat
Little Brown Bat
Northern Long-eared Bat

SGCN Note: For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/Info Need Category	Problem/Info Need Detail	Rank
Habitat Conversion	Closure of mine entrances and filling of quarries.	High
Habitat Alteration	Modification of mine entrances or interiors that either exclude wildlife or create unsuitable conditions	High
Habitat Conversion	External surface changes to drainage patterns or tree cover that render the mine or quarry unsuitable for wildlife use.	High
Pollution	Poisonous gasses that can infiltrate a mine or runoff that contaminate a site	High
Trampling or Direct Impacts	Direct persecution [of wildlife using mines or quarries	High
Habitat conversion	Reopening an abandoned mine or cave for extraction of mineral resources	High
Incompatible recreation	Recreational use of mines or caves used by wildlife.	High
Inventory	Distribution, location, and condition of this habitat are not fully known .A statewide inventory would add to our knowledge of sites that support the most SGCN	Med

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here.
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Conduct statewide inventory of mines and quarries important to SGCN.	Number of sites surveyed that have SGCN that are dependent on mines and quarries	VFWD, Town Conservation Commissions, AVCC	SWG, LIP, Section 6
Identify those mines or quarries important to SGCN and at risk of loss, then take actions to conserve them with priority given to structures with most vulnerable species, largest concentration of a SGCN, or the greatest number of SGCN present.	Number of protected occurrences of each SGCN using mines and quarries.	VFWD, Town Conservation Commissions, AVCC	SWG, LIP, Section 6
Raise awareness and acceptance of the need to provide cultural habitat for some SGCN that depend on mines and quarries and modify recreational and other activities.	Number of audiences reached.	Environmental Educators	
Promote conservation easements or agreements for important sites for SGCN	Number sites having conservation agreements	ANR, BCI	VHCB, VLT, LIP
Consider direct purchase of a mine or quarry if that is the most effective manner to manage for SGCN	Number of conserved SGCN that are dependent on mines and quarries	VFWD, Town Conservation Commissions, AVCC	SWG, LIP, Section 6
Provide technical assistance and economic incentives for property owners to manage mines and quarries for SGCN while protecting the health and safety of humans.	Maintained or enhanced condition of SGCN using a mine or quarry (numbers of individuals, reproductive success, survival rate)	VFWD	LIP

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Work with landowners to provide fencing and/or appropriately designed gates that exclude human intrusion and reduce liability to landowner, while maintaining SGCN using a mine or quarries	Maintained or enhanced condition of SGCN using a mine or quarry (numbers of individuals, reproductive success, survival rate)	VFWD	LIP
Educate users of mine and quarry sites and encourage avoidance of important sites when SGCN are vulnerable (e.g., bats fall through spring).	Increased understanding and acceptance of mine/quarry conservation by the public	VFWD, BCI, School programs, media	Marketing? Section 6
Encourage use of alternative sites that do not harbor SGCN	Increased understanding and acceptance of mine/quarry conservation by the public	VFWD, BCI, School programs, media	Marketing? Section 6

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the lead column

Plan or planning entity	Goal/Scope of plan	Lead
Peregrine falcon federal monitoring plan and state recovery plan	Remove peregrine from state list and prevent need to re-list	ANR/NWF
Draft VT Bat Conservation Plan	Conservation of all bats, especially those currently listed in Vermont	ANR/VFWD
Rattlesnake plan being drafted	Maintain and enhance rattlesnake populations in VT and move them toward recovery	ANR/VFWD, Jim Andrews

References

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Subterranean Summary

Characteristics and Location

Subterranean areas area are defined as below-surface natural features (mines are addressed under Cultural Habitats) that consist of both aquatic and terrestrial conditions. Because these areas are below ground, there is limited human access to locate and inventory these sites. Consequently, there is little information on their abundance, distribution, and condition.

Some of the best information on subterranean areas comes from the caving community. Members of the Vermont Cavers Association have particular interest in locating, exploring, and even surveying these areas. Some of the earlier documentation of Vermont caves is from John Scott (1959) and, more recently, Peter Quick (1994).

Most of Vermont's caves are relatively small, ranging from less than 100 feet underground to several hundred feet. Some caves contain passages that may continue far beyond what has been accessed. Most Vermont caves are solutional, meaning they have been formed through erosion from moving water.

While caves are found throughout Vermont, most of the known caves are located in southern Vermont, particularly the Taconics and Southern Green Mountains regions. These areas also are known to have the geologic features most associated with underwater springs and streams that would provide subterranean aquatic habitats.

Subterranean Condition

Current Condition: Due to the geologic nature of the habitat type, caves remain in much of their original structure. Many of the more accessible caves do exhibit signs of graffiti and evidence of the destruction or removal of cave formations such as stalagmites and stalactites. Historic accounts of some caves document the loss of beautiful formations by visitors. Currently, 3 caves are gated and locked to control human visitation.

Subterranean areas provide a very consistent environment of temperature, relative humidity, and air flow. While these variables are likely important to the overall condition, there is very limited information on these variables. Changes in structure and hydrology could greatly affect these habitat provided by subterranean areas.

There are 6 species of bats known to hibernate in Vermont caves. Bats are one of the better studied wildlife species associated with subterranean areas, and have been surveyed in caves going back into the 1930s (Trombulak et al. 2001). Trend data from hibernacula surveys does provide for some evaluation of the value of specific caves to particular bat species and populations. Recent surveys indicate that caves may hold as few as less than 10 bats to as many as over 23,000. Interest and understanding in the invertebrate community associated with caves is just beginning.

Little is known about the condition of the subterranean aquatic habitats.

The primary activities resulting in the loss or degradation of subterranean areas involve either human disturbance to either the cave structure (thereby affecting temperature, humidity, or air flow) or the species using the area and pollutants to the aquatic elements of the subterranean areas.

Desired Condition: Subterranean areas provide habitat for a small number of SGCN in the state. However, subterranean areas provide a critical habitat component for the survival of these species. Subterranean areas should remain intact, with limited human alteration or influence from above-ground pollutants. Many of the SGCN associated with subterranean areas use the sites for denning or hibernation, but also spend a disproportionate amount of the year in the surrounding area (e.g., fall swarming for bats or breeding and birthing for rattlesnakes).

A total of 8 SGCN are associated with subterranean area.

Species of Greatest Conservation Need in Subterranean Landscapes

High Priority

Indiana Bat (Myotis sodalis)
Eastern Pipistrelle (Pipistrellus subflavus)
Small-footed Bat (Myotis leibii)
Timber Rattlesnake (Crotalus horridus)

Medium Priority

Chimney Swift (Chaetura pelagica)
Big Brown Bat (Eptesicus fuscus)
Little Brown Bat (Myotis lucifugus)
Northern Long-eared Bat (Myotis septentrionalis)

SGCN Note: For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/Info Need Category	Problem/Info Need Detail	Rank
Hydrologic alteration	Sedimentation, development in watershed, road building	Medium
Habitat Conversion	Roads, development, and agriculture remove SGCN habitat surrounding subterranean sites	High
Habitat Degradation	Alteration of cave structure, thereby influencing temperature, humidity, or air flow	High
Incompatible recreation	Disturbance to hibernating bats or denned rattlesnakes	Medium
Pollution	Aquatic pollutants	Medium
Inventory	Statewide inventory has been completed, but not all sites have been evaluated	Low

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here.
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Gate subterranean sites experiencing risk from unlimited human visitation	Number of sites gated	USFWS, TNC, VCA	SWG, USFWS
Conservation easements on higher quality sites with greatest number of SGCN or T&E listed SGCN	Number of acres conserved for SGCN	ANR, VLT, TNC, NCC	VHCB, VLT, LIP
Provide technical assistance and/or financial incentives to private landowners, towns and RPC's to maintain and enhance Subterranean habitat for SGCN. Distribute *Conserving Vermont's Natural Heritage* (Austin et.al. 2004)	Number landowners incorporating SGCN into their land management, Number of towns including SGCN in their planning. Number of acres conserved	NRCS, TNC, FWD, RPC, VLCT, USFWS	NRCS programs, USFWS

Coordination with other plans

See Chapter 6 for definitions of acronyms used in the lead column

Plan or planning entity	Goal/Scope of plan	Lead
Draft Bat Conservation and Recovery Plan	Conservation and recovery of Vermont bat species	ANR
Cave Management Plans	Management plans for specific caves in Vermont	ANR, VCA, NCC

References

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Buildings & Other Structures Summary

Characteristics and location

Buildings and structures may provide habitat for wildlife, generally in the form of shelter, when they provide appropriate conditions (i.e., temperature and humidity) and are relatively secure from disturbance. Sometimes the structures provide habitat for prey species (mice) that attract the foraging SGCN (snakes). In other cases the structures may simply become an extension of the natural landscape, such basking and foraging sites for skinks. Structures used by wildlife are located throughout Vermont, but are not always known or appreciated as habitat for wildlife.

Types of Buildings and Other Structures Providing Habitat for SGCN:

Barns and other outbuildings
Abandoned or little used buildings
House attics
Bridges
Dam sites
Power poles and other vertical structures (possibly)
Towers or tall buildings that mimic cliffs

Condition of Buildings & Other Structures

Current Condition: Buildings and other structures may be used by wildlife under a variety of circumstances. Bats may roost in abandoned building attics, the attics of occupied dwellings, or in outbuildings or covered bridges. Peregrine falcons may nest on ledges of tall buildings, tower, or bridges although we don't have any currently nesting in such locations at present. Small-footed bats might seek shelter in between and under large rock talus used to armor dams. Osprey may nest on power poles near water and chimney swifts may build their nests inside chimneys.

Desired Condition (SGCN Needs): Some buildings and other structures provide conditions that certain species select. If the site is relatively undisturbed and secure over time, large number of some species may come to depend on the site (e.g., large bat maternity colony). Change the light regime or air circulation, and the conditions may no longer be as suitable. In some cases the surrounding area, or even the specific geographic location, may determine if a structure is used by a SGCN. Only barns located near existing skink populations will be used by that species and a power pole used by osprey for nesting has to be within flying distance of fishable waters.

Species of Greatest Conservation Need Using Buildings & Other Structures

High Priority

Chimney Swift (Chaetura pelagica)
Peregrine Falcon (Falco peregrinus)
Purple Martin (Progne subis) ??? uses boxes and gourds provided for them
Eastern Rat Snake (Elaphe obsoleta)
Five-lined Skink (Eumeces fasciatus)
Indiana bat (Myotis soldalis)
Small-footed Bat (Myotis leibii)
Eastern Pipistrelle (Pipistrellus subflavus)

Medium Priority

Big Brown Bat
Little Brown Bat
Northern Long-eared Bat
Osprey (Pandion haliaetus)
Barn Owl (Tyto alba)

SGCN Note: For more information about a specific Species of Greatest Conservation Need see that species' assessment summary in Appendix A.

Problems & Information Needs

See Appendix C for definitions of problem and strategy categories used here

Problem/Info Need Category	Problem/Info Need Detail	Rank
Inventory	Distribution, location, and condition of this habitat are not known. A statewide inventory is needed to identify and locate the best examples of these habitats that support the most SGCN	Medium
Habitat Conversion	Loss of old buildings that provide shelter for wildlife	High
Habitat Conversion	Modification of structures that exclude wildlife or create unsuitable conditions	High
Habitat Conversion	Changes to structures that may trap or kill animals (including deliberate exclusions)	High
Pollution	Use of chemicals that may poison or kill wildlife	High
Trampling or Direct Impacts	Direct persecution of wildlife using structures	High

Priority Conservation Strategies

See Appendix C for definitions of problem and strategy categories used here.
See Chapter 6 for definitions of acronyms used in the Partners and Funding Source columns

Strategy	Performance Measure	Potential Partners	Potential Funding Sources
Conduct statewide inventory of buildings and structures important to SGCN.	Number of conserved sites with SGCN that are dependent on buildings and other structures	VFWD, Town Conservation Commissions, AVCC	SWG, LIP, Section 6
Identify those buildings or other structures important to SGCN and at risk of loss, then take actions to conserve or replace.	Number of protected occurrences of each SGCN using buildings and other structures.	VFWD, Town Conservation Commissions, AVCC	SWG, LIP, Section 6
Promote conservation easements or agreements for important sites for SGCN	Number sites having conservation agreements	ANR, BCI	VHCB, VLT, LIP
Consider direct purchase of a structure if that is the most effective manner to manage for SGCN (e.g., PA bat maternity colony in old church).	Number of conserved SGCN that are dependent on buildings and other structures	VFWD, Town Conservation Commissions, AVCC	SWG, LIP, Section 6
Provide appropriately designed structures in suitable locations to replace buildings and structures no longer available to SGCN. In some cases these need to be provided in conjunction with an exclusion	Number of protected occurrences of each SGCN using buildings and other structures.	VFWD, Town Conservation Commissions	SWG, LIP, Section 6
Provide technical assistance and economic incentives for property owners to manage their structures for SGCN while protecting the health and safety of humans.	Maintained or enhanced condition of SGCN using a building or structure (numbers of individuals, reproductive success, survival rate)	VFWD Wildlife Services	LIP

Vermont's Wildlife Action Plan

November 22, 2005

Appendix C Definitions for the Problem & Strategy Categories found in the Wildlife Action Plan

Habitat-Related Problem Categories

Climate Change: Long-term changes linked to global warming and other climate issues that can lead to major changes in habitat availability (e.g., high elevation habitats), vegetative composition and location (e.g., the movement up in elevation or north in latitude, invasion by exotic pests) as well as climate variability (e.g., change in snow depth, rainfall and/or natural disturbances).

Habitat Alteration/Degradation: A lessening of the quality of a habitat by human action stopping short of complete conversion (examples include: the reduction of mast production from a forest stand, the riprapping a streambank, and significant land use changes adjacent to a habitat such as replacing a forest stands on the edge of a wetland with a housing development. In the last case, the development would be a conversion of the forest stand and, if not designed properly, could also degrade the wetland). Habitat Conversion, Habitat Fragmentation, Hydrologic Alteration, Sedimentation, Pollution and Inadequate Distribution Of Successional Stages are closely related categories.

Habitat Conversion: The complete transformation or loss of a habitat by human action (examples include: filling a wetland to create a grassy field, converting a forest into a parking lot, or damming a stream to create a reservoir). Habitat Alteration/Degradation, Habitat Fragmentation, Hydrologic Alteration, and Inadequate Distribution of Successional Stages are closely related categories.

Habitat Fragmentation: The breaking up of habitats into smaller, non-contiguous patches as a result of habitat conversion (e.g., housing, commercial development, roads, utility lines). Fragmentation can: 1) render important habitats inaccessible (such as isolating a den site from a feeding site), 2) breakdown of the metapopulation structure of a species (for example grassland butterflies, spotted salamander, and tiger beetles); and, 3) degrade remaining habitat patches through edge effects that favor edge-tolerant species such as raccoons and crows, as well as invasive exotic species that can out-compete native and rare species. The result of habitat fragmentation is often increased predation, increased mortality, reduced mobility and changes in habitat micro-climates. Habitat Alteration/Degradation, Hydrologic Alteration and The Impacts off Roads and Trails are closely related categories.

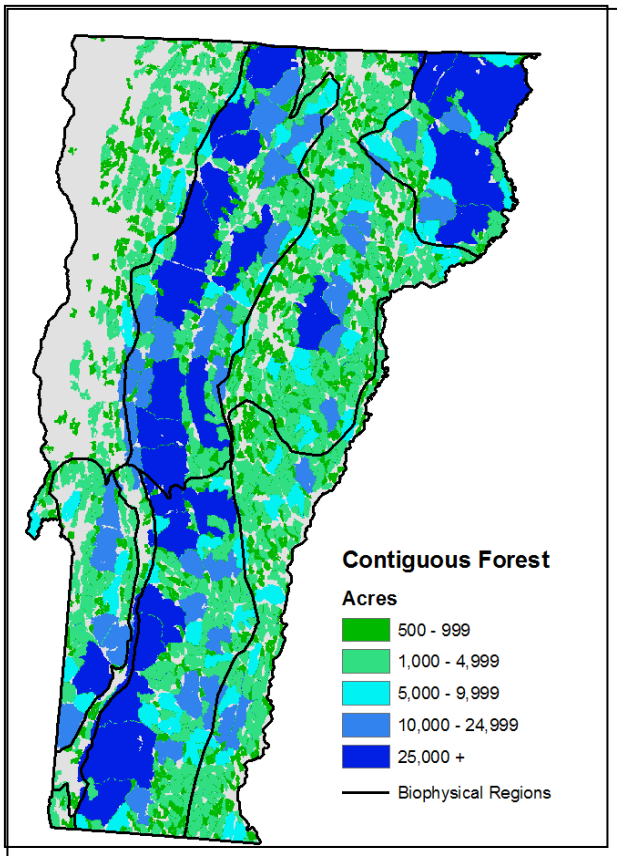
"But Vermont is 78% forested. How could habitat conversion, alteration or fragmentation be a problem?"

First, many Species of Greatest Conservation Need require non-forested habitat. This plan is concerned about loss and fragmentation to non-forested habitat too.

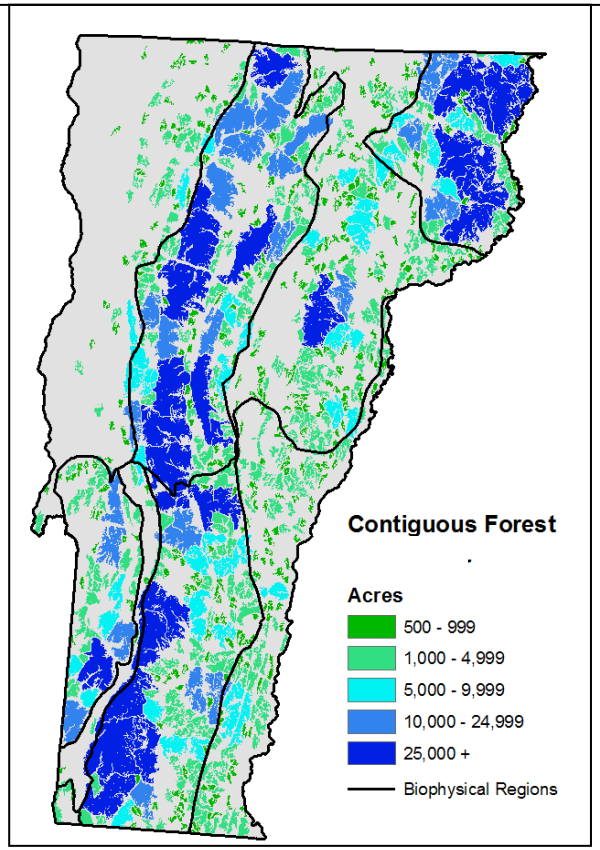
And, second, Though Vermont's forests look intact from the sky, if you peer below the canopy it's clear that 78% forested does not mean 78% unfragmented.

See figure 1 for details.

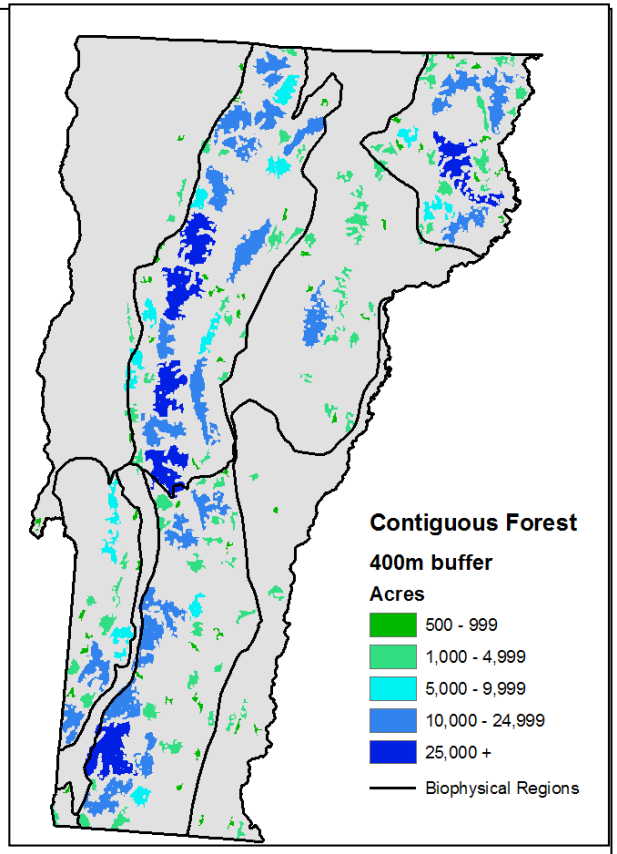
Hydrologic Alteration: Changes in the flow, periodicity or quality of a surface or subsurface water system (examples include a dam on a river preventing historic fluctuations in water level and mining activities causing a perennial seep to run dry). Dams can also increase water temperature. If warm water was identified as a problem then that problem would be placed in the pollution category. Hydrologic Alteration is a subset of Habitat Alteration but is a significant enough problem to warrant a separate category.



1-A. Forest blocks bordering developed lands



1-B. Forest blocks at least 100m from edge of developed lands



1-C. Forest blocks at least 400m from edge of developed lands

Fig 1: Vermont Contiguous Forest Blocks

Why be concerned about wildlife if Vermont is 78% forested? As these maps indicate, though forest cover is significant (map 1-A) in many cases forests are fragmented into smaller parcels with few large blocks far from development (maps 1-B, 1-C). While some wildlife species thrive in smaller parcels, large contiguous blocks provide more suitable habitat (and reduce potential conflict with humans) for Lynx, American marten, Mountain lion, Black bear, River otter, Northern goshawk, Red shouldered hawk and others. As the number and size of blocks decrease, it becomes more difficult for these species to persist.

Contiguous Forest Block refers to an area of forested land either without roads or with low densities of class IV roads, and little or no human development (buildings, parking areas, lawns, gravel pits). Contiguous forest may have various age classes of forest cover and include other habitat types such as wetlands or grasslands that are part of the overall contiguous habitat complex.

Maps depict forested habitat in blocks of at least 500 acres. Blocks include actively and passively managed forest. Source data are 1992-1993.

Impacts of Roads and Trails: Transportation corridors that bring people, disturbance, and exotics to a habitat or directly impact a Species of Greatest Conservation Need (examples include: road kill, bird species whose mating calls are drowned out by the noise of road traffic, a road corridor that speeds the spread of an exotic invasive species, poorly planned ORV or hiking trails that cause wildlife to abandon a den site). Habitat Fragmentation, habitat Alteration/Degradation and Impact of Roads & Trails are closely related categories.

Inadequate Distribution of Successional Stages: The lack of either late, mid or early successional habitat in appropriate size and/or juxtaposition (examples include ruffed grouse and woodcock which prefers early successional forest stands, American marten which prefers late-successional stands and lynx which depends on a mix of stages).

Inadequate Disturbance Regime: A disturbance regime is re-occurring process that disrupts a habitat, ecosystem, populations, and/or substrate causing significant change to a system (Picket and White). Many species have adapted to these disturbances and depend upon them to maintain habitats (examples include: the loss of beaver created wetlands, and a dam preventing the yearly flooding of floodplain forests that brings nutrients to the site and creates opening for early successional vegetation).

Invasion by Exotic Species: The introduction and spread of nuisance exotic and native species (plants and animals). These species may lead to the elimination of populations, threats to long-term stability or extirpation by out-competing a native species, displacing its food source or altering a key process or function of a habitat. Note that this category includes both exotic species and invasive native species such as cowbirds and sea lamprey. Exotic disease and parasites are addressed separately in the disease category.

Parcelization: The separation of a large parcel of land into multiple smaller parcels. Parcelization is a significant driver of habitat fragmentation (and is often driven itself by tax policy). Parcelization can make it difficult to deliver management programs or present access issues which could impede actions benefiting SGCN even when fragmentation is not a problem (e.g., when a single 800-acre parcel is broken into many smaller lots some of the new landowners may choose to post their land while others may close logging roads).

Sedimentation: Excessive inputs (in frequency and/or abundance) of solid material (inorganic or organic solid fragments) that are carried and deposited by wind, water, or ice to a water body. These materials have a negative impact on Species of Greatest Conservation Need through their physical presence (example: soils washing into a stream from a construction site and smothering fish eggs and other aquatic species that live in the spaces between rocks and gravel in a streambed). Sedimentation was broken out from the habitat alteration/degradation category because of its significant impact on aquatic species. Note: a problem that exerted a negative chemical impact on wildlife (e.g., road salt), would be listed in the Pollution category.

Non-Habitat-Related Problem Categories

Competition Where two or more species are in competition of the same limited resource (e.g., space, food, nutrients) there will be a decrease of survival, growth rate

and/or reproduction of competing individuals (for example: fisher, bobcat and coyote have overlapping habitat needs and preference for prey).

Disease: Any disease causing agent such as, fungi, bacteria and viruses (examples include: rabies, West Nile disease, whirling disease, chronic wasting disease, hemlock wooly adelgid, and sudden oak death). Diseases are often transmitted by parasites, a related problem.

Genetics: A reduction of survival or fecundity of a species due to inbreeding depression (the mating of close relatives) usually due to small and isolated populations, and outbreeding depression (the mating of different locally adapted populations). Examples include lake sturgeon and timber rattlesnake for whom inbreeding depression and genetic drift may be distinct possibilities due to small and isolated populations. Outbreeding depression can be a problem for native baitfish whose locally adapted genes may be swamped out by the accidental release of relatives taken from other waters in the state or elsewhere.

Harvest or Collection: The legal or illegal taking of biological resources (such as hunting, trapping, collecting, fishing) for commercial, recreation, subsistence, research, or management purposes (examples include: the accidental taking of spruce grouse or American marten by a hunter or trapper, illegal collection of wood turtles for sale in the pet trade, and the harvesting of eels).

Incompatible Recreation: Recreational activities (outside of established transport corridors) that directly impacts SGCN or their habitats (examples include: bird watchers that get too close to nesting common loons can cause the loons to abandon their nest, and off-road vehicles operated outside of approved areas can run through vernal pools degrading the pool and crushing spawning amphibians and their eggs) Because of the scale of impact, the construction of a golf course or ski area would be listed in Habitat Conversion or Habitat Alteration categories respectively. Incompatible Recreation is also closely related to Impacts of Roads & Trails.

Loss of Food Base or Prey Base: The disappearance of a food source important to a species' survival (examples include: lynx which feeds primarily on snowshoe hare and the whippoorwill whose primary diet of flying insects has been decreased).

Loss of Relationship with Other Species: A species whose existence depends upon another for a process, function or product (examples include the larvae of many mussel species will attach to fish and depend on these fish for dispersal). Many insects, including butterflies and moths, have specific relationships with host plants that serve as its sole food. In some cases the host plant also conveys a chemical protection to the insect.) This category differs from the Loss of Prey Base category in that there are no alternatives (e.g., lynx and whippoorwill can take other prey, monarch butterflies won't persist without milkweed to feed on and to provide chemical protection from predators).

Parasitism: A relationship between two species in which one benefits (the parasite) and the other (the host) is harmed, (Smith 1980) although not directly killed (examples include: ticks, sea lamprey parasitizing lake whitefish and lake trout). Parasites may

transmit diseases to the host therefore disease is a closely related problem. Examples include ticks transmitting Lyme disease and mosquitoes transmitting West Nile virus.

Pollution: The introduction of exotic materials (other than sediments) from point and non-point sources. This includes: chemicals and toxins such as industrial chemicals in the air, land, and water; excess nutrients from farm and municipal sewage plants; garbage and other solid waste; radioactive materials; road salt; excessive noise; excessive heat; and light pollution that disturbs animals and disrupts migration patterns. Note: Sediments were broken out from this category because of its significant impact on some water bodies. Greenhouse gasses such as carbon dioxide and methane would be covered in the Climate Change category.

Predation or Herbivory: Species or habitats negatively impacted by wildlife species that eat them (examples include: raccoons and skunks that eat wood turtle and spiny softshell turtle eggs and moose over-browsing vegetation and preventing the regeneration of a forest stand. This category differs from Competition in that competition is two or more species vying for the same specific resource, whereas predation is one species eating another.

Reproductive Traits Species whose specific reproductive strategies make it vulnerable, such as species producing very few offspring because they take a long time to reach sexual maturity and/or take a long time between reproductive events (examples include: lake sturgeon and wood turtle).

Trampling & Direct Impacts: Non-recreational, and sometimes inadvertent, negative impacts to a species (examples include the crushing of wildlife by agricultural equipment operating in a farm field, vehicles operating off-road**,** the killing of rattlesnakes or bats out of antipathy for the species, increased nest abandonment by brown thrashers due to the proximity of people). Impacts to a habitat would be assigned to the Habitat Degradation/Alteration and perhaps Habitat Conversion. Incompatible Recreation and Impacts of Roads & Trails are closely related categories.

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Appendix C: Definitions for Strategy Categories Used in the Wildlife Action Plan

Element number four of the eight congressionally required elements of a Wildlife Action Plan requires that states describe "conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions."

We identified strategies to address the problems impacting each of Species of Greatest Conservation Need (SGCN) and habitats in the Action Plan. Strategies identified in the Action Plan are based on the best science available today as well as our strategic assessment of needs and priorities of all wildlife species. In the coming years, as monitoring data on SGCN and conservation actions becomes available, as priorities change, or new problems or opportunities arise, strategies may need to be revisited. Not every strategy in this report will be eligible for State Wildlife Grant funding. Furthermore, it may not be suitable, or feasible, for the VT Fish & Wildlife Department to implement some of the strategies in this report, however, some conservation partners may find them fitting and practical.

Strategies are described in the Action Plan in short narratives in each species summary and in each habitat summary. Strategies are intentionally broad, directional, and nonspecific so as not to constrain our selection of actions for implementing them. For example, a strategy such as "provide technical assistance to landowners to maintain or improve riparian habitat for Species of Greatest Conservation Need" allows for different approaches to providing that assistance and leaves the door open to a variety of providers to implement. Where strategy implementation is to be funded by the State Wildlife Grant program the approach should be consistent with the Department's mission and strategic plan, and precise procedures will be detailed in operational plans once the Action Plan is finalized.

Vermont's Wildlife Action Plan was designed to be a strategy for the state, not just the Fish & Wildlife Department. While the department may be responsible for implementing many of the strategies in this report, it will be Conservation partners, however, that may be the more logical and appropriate leaders for others, due to their skills and expertise, staffing, history, location, available resources and constituencies.

Each of the strategies identified in the Action Plan were assigned to one of 27 categories in six major classes. The categories were adapted from the Proposed Taxonomy of Conservation Actions (Salafsky 2005). The taxonomy was developed as a means to standardize terminology (not practices) among conservation practitioners worldwide. Many states have used these same categories to organize the strategies and actions in their Action Plan.

It should be noted that the categories are used solely for the purpose of organizing and grouping strategies developed by Action Plan teams and committees. It was not our goal to create strategies for every category. A few categories were not applicable to the species or habitats in Vermont whereas others were deemed not as effective. The categories with the greatest number of associated strategies were sections 4a, research; and 4c technical assistance.

Land/Water Protection

a) **Creating Publicly-Owned Protected Areas**: Setting up or expanding public parks, forests and other protected areas where wildlife conservation is a primary management objective (examples include: wildlife management areas, state forests, municipal lands)

b) **Creating Privately-Owned Protected Areas:** Setting up or expanding private reserves and other protected areas where wildlife conservation is a primary management objective (examples include: private lands managed by non-profit conservation or hunting groups)

c) **Easements**: Setting up protection of some specific aspect of a resource on public or private lands (examples include: development rights, wild & scenic river designation)

2) Land/Water/Species Management

a) **Protected Area Management:** Generally managing protected areas where wildlife conservation is a primary management objective (examples include: site design, training park staff, managing water levels).

b) **Compatible Resource Use**: Promoting use of resource lands (where wildlife management is not a primary objective) to be compatible with conservation (examples include: promoting sustainable logging, grazing, fishing, hunting, farming, aquaculture, energy development, transportation infrastructure).

c) **Invasive Species Control & Prevention**: Dealing with invasive and/or alien plants, animals, and pathogens (examples include: developing boat wash stations, pulling noxious weeds from a habitat).

d) **Habitat Restoration**: Enhancing degraded or restoring missing habitats (examples include: clayplain forest restoration and riparian tree plantings). If a strategy specifically targets one or two species we consider it a species restoration strategy. If it specifically targets three or more species we consider it a habitat restoration strategy.

e) **Natural Processes Restoration**: Enhancing or restoring natural ecosystem functions (examples include: prescribed burns, dam removal and restoration of historic flow regimes, fish ladders).

f) **Species Restoration**: Enhancing or restoring specific plant and animal populations (examples include: translocating spruce grouse from Canada to Vermont, and erecting artificial nesting boxes/platforms for bluebirds and osprey.) If a strategy specifically targets one or two species we consider it a species restoration strategy. If it specifically targets three or more species we consider it a habitat restoration strategy.

g) **Ex-Situ Conservation**: Protecting wildlife out of its native habitats (examples include: captive breeding of bald eagles and creating regional refugia for New England cottontail rabbit).

3) Law & Policy

a) **Legislation**: Making, changing, influencing, or providing input into formal legislation at all levels: international, national, state/provincial, local (examples include: lobbying to make the State Wildlife Grant program permanent, addressing greenhouse gas emissions).

b) **Policy & Regulations:** Making, changing, influencing, or providing input into policies and regulations affecting the implementation of laws at all levels: international, national, state/provincial, local (examples include: providing data to policy makers, development of wildlife harvest regulations).
c) **Planning & Zoning**: Developing, changing, influencing, or providing input into plans governing natural resource use and allocation (examples include: municipal zoning, public or private management plans for ecoregions, sites, habitats, or species, commenting on zoning plans, developing a town ordinance).
d) **Standards**: Setting, changing, influencing, or providing input into voluntary standards that govern practices (examples include: best management practices for forestry, habitat guidelines for state lands).
e) **Compliance & Enforcement**: Monitoring and enforcing compliance with laws, policies & regulations, plans, and standards (examples include: water quality standard monitoring, enforcement of ATV regulations).

4) Research, Education & Awareness

a) **Research:** Conducting and disseminating research to improve knowledge about conservation issues (examples include: conducting inventories for SGCN, developing habitat maps, demonstration projects for sustainable forestry)
b) **Technical Assistance, Training, Workshops:** Enhancing knowledge, skills and information exchange for practitioners, landowners, stakeholders, and other relevant individuals in structured settings outside of degree programs (examples include: providing technical assistance to landowners, monitoring workshops, conferences, learning networks)
c) **Lifelong Learning:** Enhancing knowledge and skills of practitioners, stakeholders, and other relevant individuals through non-structured means (examples include: writing a how-to manual for landowners or towns and communities, stakeholder education on proper ORV use)
d) **Awareness Raising and Communications:** Raising conservation awareness and providing information through various media (examples include: websites, newsletters, puppet shows, etc.)

5) Economic & Other Incentives

a) **Linked Enterprises**: Developing enterprises that directly depend on natural resources as a means of influencing behaviors, attitudes, and beliefs (examples include: ecotourism, sustainable forest product harvesting).
b) **Substitution**: Promoting products and services that substitute for environmentally damaging ones (examples include: floodplain restoration in place of dams and bank reinforcement and promoting recycling and use of recycled materials)
c) **Financial Incentives & Market Forces**: Using market mechanisms to influence behaviors, attitudes, and beliefs (examples include: forestry certification, positive incentives, negative incentives, forest banking, valuation of ecosystem services such as flood control)

d) **Conservation Payments**: Using direct or indirect payments to influence or reinforce behaviors, attitudes, and beliefs (examples include: landowner payment programs).
e) **Non-Monetary Values**: Using non-market forces to change behaviors, attitudes, and beliefs (examples include: landowner/land manager recognition awards).

6) Capacity Building

a) **Institutional Development:** Creating or providing non-financial support & capacity building for non-profits, government agencies, and for-profits (examples include: creating new local land trusts)
b) **Alliance Development**: Forming and facilitating partnerships, alliances, and networks of organizations (examples include: Action Plan Conservation Partners, Vermont Monitoring Cooperative, Vermont Sportsmen's Federation).
c) **Conservation Finance**: Raising and providing funds for conservation work (examples include: State Wildlife Grants small grants program, private foundations, debt-for-nature swaps).

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Vermont's
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Appendix D
CWCS Team and Committee Charters

Conservation Partners Charter for the Comprehensive Wildlife Conservation Strategy

revised 4/28/2004

Public Participation Goal: The Department of Fish and Wildlife (FWD) wishes to create a Comprehensive Wildlife Conservation Strategy (CWCS) for the state of Vermont—one that meets the needs of all fish and wildlife as well as participating partners and the FWD. Therefore, FWD will collaborate with the CWCS Conservation Partners in each aspect of their charge.

Promise to the Public: The Vermont Fish and Wildlife Department will look to the Conservation Partners committee for direct advice and innovation in formulating solutions. We will strive to create a CWCS that Partners can be a part of and we will look to Conservation Partners to help implement the CWCS upon its completion.

Committee Charge

The Comprehensive Wildlife Conservation Strategy Conservation Partners committee is established to provide advice to FWD in the development and implementation of the Comprehensive Wildlife Conservation Strategy for the state of Vermont. The committee will:

- Review federal guidelines and sideboards for developing a CWCS.
- Review CWCS drafts and final report
- Nominate experts for staffing of technical teams.
- Review the interim draft CWCS report and provide constructive and timely feedback to the Steering Committee.
- Review final draft CWCS report and provide constructive and timely feedback to the Steering Committee.
- Help implement the Comprehensive Wildlife Conservation Strategy upon completion.

Responsibilities

In order to achieve their mission the CWCS Conservation Partners will:

- Meet as needed to develop an understanding CWCS development issues (approximately 3-4 meetings/year).
- Complete assigned tasks and projects by dates specified on the CWCS timeline
- Work together to represent their organizations' views and respect other organizations' views and opinions.
- Provide staff and experts from their organizations to participate as appropriate on the technical teams.
- Serve as a liaison to their respective organizations to keep members informed of CWCS progress.

Committee Members

Members may include representatives of local, state and federal agencies, NGOs, landowners, utilities, wildlife related businesses and others.

Steering Committee Charter for the Comprehensive Wildlife Conservation Strategy

revised 4/28/2004

Committee Charge

The CWCS Steering Committee meets regularly with the CWCS Coordinator for briefing, guidance, and review of planning efforts. The committee provides leadership and organizational commitment to ensure success of the CWCS, as well as expertise in conservation biology and wildlife management. It champions the CWCS process and ensures that sufficient resources are allocated to the effort. Tasks may include but are not limited to:

- Review of federal guidelines and sideboards for developing a CWCS.
- Review of charters for CWCS teams and committees, as developed by the CWCS Coordinator.
- Introducing the planning effort and team charges to the other committees and teams at initial meetings and to Fish and Wildlife Department staff.
- Suggesting criteria that might be used for identifying species of greatest conservation need.
- Recommending tools and data sets that technical teams will use and providing guidance in the consistent use of the data.
- Suggesting criteria to assist in prioritizing conservation actions.
- Reviewing public involvement materials and drafts of the CWCS as necessary.

Responsibilities

The CWCS Steering Committee:

- Has statutory responsibility for completion of the CWCS and management of State Wildlife Grant funds.
- Encourages meaningful participation and buy-in among partners and the Fish and Wildlife Department staff during CWCS development.
- Appoints members to Species Teams and Integration Team.

Committee Members

Ron Regan FWD Operation Director, Tom Decker FWD Wildlife Director, Eric Palmer FWD Fisheries Director, Scott Darling FWD District Biologist, Steve Parren FWD Nongame and Natural Heritage Program Coordinator, Tom Wiggins FWD Fish Culture Program Chief/Department Planner, Jon Kart CWCS Coordinator.

Conservation Strategy Review Team Charter for the Comprehensive Wildlife Conservation Strategy *revised 4/28/2004*

Public Participation Goal: The Department of Fish and Wildlife (FWD) wishes to create a Comprehensive Wildlife Conservation Strategy (CWCS) for the state of Vermont—one that meets the needs of all fish and wildlife as well as participating partners and the FWD. Therefore, FWD will collaborate with the Conservation Strategy Review Team in each aspect of their charge.

Promise to the Public: The Vermont Fish and Wildlife Department will look to the CWCS Conservation Strategy Review Team for direct advice and innovation in formulating solutions.

Committee Charge
The CWCS Conservation Strategy Review Team is established to provide advice to FWD and Conservation Partners in the development of a comprehensive wildlife conservation strategy for the state of Vermont. The team will:

- Review federal guidelines and sideboards for developing a CWCS.
- Review existing wildlife and conservation plans.

Responsibilities
In order to achieve their mission the CWCS Conservation Strategy Review Team will:

- Complete assigned tasks and projects by dates specified on CWCS timeline
- Review limiting factors and draft strategies developed by the Integration Team.
- Develop additional strategies as needed and prioritize strategies.
- Work together, to bring the team's knowledge and expertise of species, habitats/natural communities and conservation strategies to the development of a statewide Comprehensive Wildlife Conservation Strategy.

Committee Members
Conservation Partners as well as designees from the environmental education and wildlife law enforcement communities.

Integration Team Charter for the Comprehensive Wildlife Conservation Strategy

revised 4/28/2004

Public Participation Goal: The Department of Fish and Wildlife (FWD) wishes to create a Comprehensive Wildlife Conservation Strategy (CWCS) for the state of Vermont—one that meets the needs of all fish and wildlife as well as participating partners and the FWD. Therefore, FWD will collaborate with the Integration Team in each aspect of their charge.

Promise to the Public: The Vermont Fish and Wildlife Department will look to the CWCS Integration Team for direct advice and innovation in formulating solutions.

Committee Charge

The CWCS Integration Team is established to provide advice to FWD and Conservation Partners in the development of a comprehensive wildlife conservation strategy for the state of Vermont. The team will:

- Review federal guidelines and sideboards for developing a CWCS.
- Review existing wildlife and conservation plans.
- Analyze criteria for the identification of "species of greatest conservation need" used by CWCS development teams in others states and in conservation biology literature.
- Advise Species Teams where needed to ensure consistent analysis and application of recommended procedures across taxonomic groups.

Responsibilities

In order to achieve their mission the CWCS Integration Team will:

- Complete assigned tasks and projects by dates specified on CWCS timeline
- Develop criteria for identifying species of greatest conservation need.
- Monitor the progress of Species Teams to ensure deadlines are met.
- Coordinate work and facilitate communication between Species Teams.
- Analyze reports of the Species Teams and identify gaps in existing information.
- Addresses special habitat and natural community needs.
- Synthesizes reports of the Species Teams and strategies developed by the Conservation Strategy Review.
- Consult with the Conservation Strategy Review Teams
- Work together, to bring the team's knowledge and expertise of species, habitats/natural communities and conservation strategies to the development of a statewide Comprehensive Wildlife Conservation Strategy.

Committee Members

Facilitators of the Species Teams and additional Fish and Wildlife Department staff, Conservation Partner staff and other experts as assigned by the Steering Committee.

Species Team Charter for the Comprehensive Wildlife Conservation Strategy

revised 4/28/2004

Public Participation Goal: The Department of Fish and Wildlife (FWD) wishes to create a Comprehensive Wildlife Conservation Strategy (CWCS) for the state of Vermont—one that meets the needs of all fish and wildlife as well as participating partners and the FWD. Therefore, FWD will collaborate with the Species Teams in each aspect of their charge.

Promise to the Public: The Vermont Fish and Wildlife Department will look to the Species Teams for advice and innovation in formulating solutions.

Team Charge

The Species Teams of the Comprehensive Wildlife Conservation Strategy are established to provide expertise on various wildlife species. The teams will:

- Review federal guidelines and sideboards for developing a CWCS.
- Review existing wildlife and conservation plans pertinent to the team's work.
- Apply the criteria provided by the Integration Team to create a list "species of greatest conservation need."
- Identify locations and conditions of habitats and natural communities of listed species of greatest conservation need.
- Identify limiting factors to the listed species of greatest conservation need and their habitats.
- Recommend draft strategies for managing species of greatest conservation need
- Develop plans to monitor identified species and effectiveness of conservation strategies.
- Address comments submitted by the Conservation Partners and FWD staff during the interim review and incorporate where appropriate into the Species Team's report to the Integration Team.

Responsibilities

In order to achieve their mission the CWCS Species Team will:

- Meet on a schedule as needed by the team.
- Complete assigned tasks and projects by dates specified on CWCS timeline
- Work together, to bring their knowledge and expertise of species and habitats/natural communities for the development of a statewide CWCS.
- Identify gaps in existing information.

Team Members

Members should have demonstrable training and experience in a taxonomic specialty sufficient to allow them to critically analyze life history requirements, limiting factors to population persistence, and needed conservation actions. Teams include 1) Birds, 2) Fish, 3) Invertebrates, 4) Mammals, 5) Plants, 6) Reptiles & Amphibians.

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Appendix E
Sample Conservation Partner Correspondence

VERMONT FISH & WILDLIFE DEPARTMENT

103 South Main Street, 10 South
Waterbury, VT 05671-0501

(p) 802-241-3652
(f) 802-241-3295
jon.kart@anr.state.vt.us

February 23, 2004

Subject: Comprehensive Wildlife Conservation Strategy

Dear Conservation Partner,

I'm writing to encourage you and/or your organization to get involved in the development of Vermont's Comprehensive Wildlife Conservation Strategy (CWCS). The CWCS is a new statewide (and national) effort, funded by the federal State Wildlife Grants program, to identify species of greatest conservation need and their habitats and to define actions that will conserve them. Two key elements set the CWCS apart from other planning efforts: 1) it will be an all species strategy; and 2) it will be a strategy for Vermont, not just for the Fish and Wildlife Department. On March 24, 2004 we'll hold the first meeting of CWCS Conservation Partners. We'd like you or someone from your organization to attend.

The State Wildlife Grants program (SWG) was created by Congress in 2001 to support fish and wildlife conservation for under-funded species. The Vermont Fish and Wildlife Department has since become eligible for more than $2.5 million in federal conservation dollars—with millions more available in the in the future. SWG requires that we develop a statewide Comprehensive Wildlife Conservation Strategy by Oct 1, 2005.

The Comprehensive Wildlife Conservation Strategy is not just another plan. Congress has charged State Fish and Wildlife Departments with developing statewide all-species conservation strategies. The actions defined by Vermont's CWCS will be eligible for hundreds of thousands of dollars of federal funds annually for implementation. Furthermore, Conservation Strategies are being produced by every state, the territories and the District of Columbia. Together, the strategies will provide a collective "plan" for safeguarding our wildlife legacy—efficiently and cost-effectively.

How will the CWCS be developed? The CWCS will grow out of a joint effort of many conservation partners. Congress charged State Fish and Wildlife Departments with leading the CWCS development but Congress also made it clear that it expects the help, advice and expertise of other state and federal agencies, conservation organizations and the general public.

Why you're needed. A strategy is only as good as its components. We need your expertise, your ideas, your priorities and your solutions. To be effective, the strategy must be shaped by the people who know Vermont, and who understand the issues, the challenges and the threats to wildlife.

What's in it for you? The Conservation Strategy will help create a vision for the future direction of wildlife conservation and will likely influence future funding. By participating,

you will expand and strengthen networks and coalitions for conserving our wildlife resources. By working collectively for our common conservation interests we will insure a health future for wildlife in Vermont.

What will Vermont's Comprehensive Wildlife Conservation Strategy look like?
Congress has left much of the development of the CWCS up to us, though there are a number of required elements including the identification of species of greatest conservation need and their habitats, the identification of threats and the development of actions to conserve these species. The Conservation Strategy should also consider the full array of Vermont's wildlife and habitats—taking advantage of good work already done in Vermont and filling in missing gaps.

In order to develop a plan by 2005, we've created an approach that employs several interactive teams, including:

- *Conservation Partners:* an advisory committee that will assist the development of the Conservation Strategy.
- *Species Advisory Team* a technical team that will develop criteria for selecting species of greatest conservation need and synthesize and develop overarching conservation solutions.
- *Species Teams* a technical team that will identify species in need, their habitats, threats and conservation actions.

I am contacting you because of your commitment to Vermont's wildlife. Please consider becoming a Conservation Partner in the creation of our state's Comprehensive Wildlife Conservation Strategy, a commitment that will run through October 2005.

I encourage you to get involved in this important project for the future of Vermont's wildlife. **If you or another member of your organization is interested in participating as a Conservation Partner please contact Jon Kart at 802-241-3652 or jon.kart@anr.state.vt.us by March 10, 2004**. If you or your organization is unable to participate as a Conservation Partner, we will try to provide other meaningful ways for your involvement in the planning process and welcome a chance to talk with you about potential roles.

Please feel free to contact me, or Jon Kart, with any questions, comments, or ideas for the development of a statewide Comprehensive Wildlife Conservation Strategy. I look forward to working with you.

Sincerely,

Wayne A. Laroche
Commissioner

Enclosures:
Meeting agenda and directions to the meeting
Meeting registration form

Conservation Partners Meeting for the Comprehensive Wildlife Conservation Strategy

March 24th, 2004 • Lake Morey Resort • Fairlee, VT

Meeting Agenda

9:30 Registration and coffee

10:00 Welcome, Commissioner Wayne Laroche

10:15 Review of the Day, Fisheries Director Eric Palmer

10:20 History of Wildlife Funding in Vermont, Wildlife Director Tom Decker

10:40 Wildlife Conservation Opportunities, Operations Director Ron Regan

11:00 The Comprehensive Wildlife Conservation Strategy process, CWCS Coordinator Jon Kart

11:30 Questions & Answers

Noon Lunch (provided)

1:00 Reconvene

1:05 Breakout sessions to refine the Comprehensive Wildlife Conservation Strategy process

2:30 Where do we go from here?

3:00 Adjourn

Directions to Lake Morey Resort, Fairlee, VT

Lake Morey Resort 800-423-1211

From the North: Take I-91 south to Exit 15. Turn right off Exit 15. Then take the first immediate right followed by the first left. Lake Morey Resort will be on your right (it is less than a minute from the exit).

From the South: Take I-91 north to Exit 15. Turn left off Exit 15. Then take the first immediate right followed by the first left. Lake Morey Resort will be on your right (it is less than a minute from the exit).

From the West:

Interstate Directions: Take I-89 South to White River Junction to I-91 North to Exit 15. Turn left off Exit 15. Then take the first immediate right followed by the first left. Lake Morey Resort will be on your right (it is less than a minute from the exit).

Back road Directions: (faster if you are coming from Montpelier or points West of Montpelier.) Take I-89 to Exit 7. Take Rt. 62 East to Rt. 302 East to Rt. 25 East to Bradford, VT. In Bradford take I-91 South one exit to Exit 15. Turn right off Exit 15. Then take the first immediate right followed by the first left. Lake Morey Resort will be on your right (it is less than a minute from the exit).

Conservation Partners Meeting Registration
Comprehensive Wildlife Conservation Strategy

March 24th, 2004 • Lake Morey Resort • Fairlee, VT

Please join us at the initial meeting of Conservation Partners in the development of Vermont's Comprehensive Wildlife Conservation Strategy. We need to move forward developing the Conservation Strategy, so please let us you of your interest by returning this form by March 10, 2004.

Register with Jon Kart, CWCS Coordinator by March 10th, 2003

Registration procedures

1) Fill out the form below and…
2) Submit your registration by telephone, email, fax or US mail.
   -Call: Jon Kart 802-241-3652
   -Email: jon.kart@anr.state.vt.us
   -Fax: 802-241-3295
   -US Mail: Jon Kart CWCS Coordinator, Vermont Fish and Wildlife Department, 103 South Main Street, 10 South, Waterbury, VT 05676

_____
Name

_____
Organization

_____ _____ ____ _____
Mailing Address City State Zip

_____ _____
Telephone Email

☐ I will attend the Conservation Partner meeting on March 24th, 2004

☐ I cannot attend the meeting but I am interested in serving as a Conservation Partners.

☐ I am unable to serve on the Conservation Partners Team.
   ☐ Please send me updates on the Comprehensive Wildlife Conservation Strategy.
   ☐ I do not wish to receive future information on this topic.

For more information contact

Jon Kart, CWCS Coordinator
Vermont Fish and Wildlife Department
103 South Main Street, 10 South
Waterbury, VT 05676

(p) 802-241-3652 (f) 802-241-3295
jon.kart@anr.state.vt.us

VERMONT FISH & WILDLIFE DEPARTMENT

103 South Main Street, 10 South
Waterbury, VT 05671-0501

(p) 802-241-3652
(f) 802-241-3295
jon.kart@anr.state.vt.us

May 6th, 2004

Comprehensive Wildlife Conservation Strategy Update

Dear CWCS Conservation Partner,

As promised at our meeting at Lake Morey on March 24th, I'm writing with an update on progress made on Vermont's Comprehensive Wildlife Conservation Strategy. The past few weeks have been busy as the Steering Committee, Species Team leaders and I have worked with the feedback we received from you to improve the CWCS process. I believe that we've done a good job of it and, we will soon be ready to set loose the Species Teams to do their jobs. However, before that happens I wanted to send you this CWCS update that includes:

1) A responsiveness summary addressing the comments, questions and feedback we've received so far from Conservation Partners and others interested in conserving Vermont's wildlife. In general we have sought to balance the desire for greater input, more frequent updates and opportunities for information sharing with your requests not to be deluged with email and regular mail.

2) Changes and improvements made to the CWCS process. Based on your suggestions we've made a couple of changes to the process originally outlined at the Lake Morey meeting on 3/24/04. In particular we've added a new Conservation Strategies Review team to the array of CWCS committees and teams. This is in direct response to requests by Conservation Partners for added participation in the development of conservation strategies. We've also change the name of the Conservation Science Team to Integration Team to better reflect the role that this team will play.

3) Appointments to the CWCS technical teams and updated list of Conservation Partners

4) Technical Team Meetings and Meeting Policies for technical team meetings.

5) Next steps in the development of Vermont's Comprehensive Wildlife Conservation Strategy.

Please review the documents on the following pages and let me know if you have any further comments or suggestions.

1. Responsiveness Summary to feedback and comments received during and after the CWCS meeting at Lake Morey Resort, Fairlee, VT on March 24, 2004.

Dear Conservation Partner,

Many, many excellent, thought-provoking comments and suggestions were received at the Comprehensive Wildlife Conservation Strategy meeting at Lake Morey on March 24th. We have done our best to incorporate your recommended improvements/amendments to the CWCS process. Below you'll find an edited and condensed list of the comments (similar comments were grouped to reduce redundancy) along with Fish and Wildlife Department (FWD) actions and responses. Comments are listed in bold text below. If a number in parentheses follows a comment it signifies the number of times a similar response was received. Responses follow each comment in plain text.

Project Scope

Taking a species by species approach to conservation won't work. There are too many species and not enough is known about most of them. An approach focusing on habitats/natural communities and threats to them will be more effective. (9)

The Fish and Wildlife Department chose to develop the Comprehensive Wildlife Conservation Strategy using a species by species format so that the product will be more understandable to the lay audience. However, we realize that 1) in many cases the needs of multiple species overlap; and, 2) that we have species of wildlife in Vermont that are poorly documented or understood. In both of these cases, management for habitats/natural communities is the prudent and most cost-effective way to address the needs of many species. The Integration Team will likely employ habitat/natural community conservation measures when it begins synthesizing the work of the six species teams. Furthermore the Conservation Strategy Review Team (a new team, see the Process & Teams section below) will likely take a similar approach.

In assessing threats look at common threats across species (also strategies).

Each of the six species teams (birds, fish, invertebrates, mammals, plants, and reptiles and amphibians) will likely do this for wildlife within their charge. The Integration Team and Conservation Strategy Review Team will do the same for all species across all taxa as they look for overarching solutions to conservation threats.

Will new species be addressed? Will species be reintroduced?

Species that have not historically been found in Vermont will likely not be addressed as part of Vermont's CWCS (except where they pose threats to native species). Regarding reintroductions: federal guidelines for CWCS development and implementation define wildlife as "any species of wild, free-ranging fauna including fish, and also fauna in captive breeding programs the object of which is to reintroduce individuals of a depleted indigenous species in a previously occupied range." Therefore species reintroduction is permissible.

We don't know if Vermont's Comprehensive Wildlife Conservation Strategy will ultimately include a recommendation or recommendations for species reintroductions, but discussions about the efficacy of reintroduction of extirpated wildlife should certainly take place amongst the technical teams.

Define the end goal (products) for the CWCS early in order to establish direction for the process. (5)

Congress' requirement that state Comprehensive Wildlife Conservation Strategies must address the broad range of wildlife and wildlife-related issues (keep common species common) *and* place appropriate priority on "species of greatest conservation need" (focus on wildlife that have not benefited from wildlife and sportfish restoration funding) is a tall order. Our goal is to develop a CWCS that will: 1) identify species, habitats, threats and strategies; and, 2) serve as a blueprint that all interested agencies and organizations can use to proactively conserve Vermont's wildlife.

What is the Fish and Wildlife Department's commitment (time and money)? (3)

The Vermont Fish and Wildlife Department is fully committed to the development and implementation of the Comprehensive Wildlife Conservation Strategy. We've hired one full-time staff person as project coordinator (Jon Kart), seven FWD staffers are leading technical teams with six other staffers serving as technical team members. Additional FWD staff will assist in CWCS development and implementation on project-by-project bases (examples include public outreach and data development). Finally, senior level staff serves as the CWCS Steering Committee ensuring department-wide support.

Coordinate with other states so we can learn what they are doing, and so that we can work together on larger regional issues rather than just looking within our own borders. Also: Rely on the Vermont Biodiversity Project and other resources. (2)

Interstate coordination is the seventh of eight Congressional requirements for all Conservation Strategies: Coordinate the development, implementation, review, and revision of the CWCS with Federal, State, and local agencies and Indian tribes. One of the many great things about this CWCS process is that all 50 states along with a number of territories and Native American tribes are developing their Conservation Strategies at the same time. Interstate meetings and communication are being facilitated by the US Fish and Wildlife Service and the International Association of Fish and Wildlife Agencies.

The work Vermont Biodiversity Project and other planning efforts will certainly be reviewed in the development of Vermont's CWCS. We do not want to reinvent wheels. If good science and planning information exists, we hope to use it wisely.

What happens after October 2005?

The implementation phase begins. We hope that most, if not all of our Conservation Partners will join the Fish and Wildlife Department in implementing strategies outlined in the Comprehensive Wildlife Conservation Strategy.

Process & Teams

The organization chart needs to be shortened condensed– too much too soon. (3)

The mix of teams and committees proposed to tackle the CWCS mirrors the complexity of the task at hand. Collecting and analyzing scientific data and developing strategies and policies are difficult in themselves. Maximizing the participation of a broad array of partners—without overtaxing them—makes CWCS development doubly challenging. We believe that the process outlined in this document is as streamlined as we can get and still involve as many voices as possible.

The CWCS process needs to integrate policy early on instead of just focusing on biology and ignoring broader policy issues. Species teams should not be only taxonomists and biologists. Bring in others for strategy development. (4) Species "threats and strategies" should be separate team "boxes" that conservation partners are involved with (i.e., a "strategies" team).

The initial three steps in development of a Comprehensive Wildlife Conservation Strategy are primarily biological: 1) Identify wildlife distribution and abundance; 2) Identify the location and assess the condition of key habitats and community types; and, 3) Identify key threats and research needs. Inserting policy issues at this stage would be premature. Once these steps have been accomplished then we can begin identifying conservation strategies and other policy issues.

We have added an additional team to the equation (see the top of the right column of the attached organizational chart). The Conservation Strategy Review Team (CSR) to the process. The CSR will receive a draft list of threats, goals and strategies facing wildlife from the Integration Team. They will review the draft and provide feedback to the Integration Team about the efficacy of the strategies. The CSR can develop additional strategies where they see fit.

What are the criteria for placing people on a species team?

Species team members should have training and experience in a taxonomic specialty sufficient to allow them to critically analyze life history requirements, threats to population persistence, and needed conservation actions. The Steering Committee sifted through the list of technical team nominees looking for people with technical expertise for as a broad a suite of species as possible. We tried to not select people with a single species focus in order to get the broadest coverage of wildlife expertise on a team while keeping the team size small (to maximize effectiveness). We expect that technical team members will participate to share their expertise, not to represent their organization's or agency's position.

Work partners and volunteers more in the process and plan.

We've done our best to include a broad array of partners on the various technical teams while keeping in mind advice from several Conservation Partners that as teams get larger their effectiveness wanes. We've tried to keep the size of our Species Teams to five-seven people. We do welcome additional organizations and agencies to participate as Conservation Partners. If you know of additional entities that should be involved in the CWCS, please have them contact Jon Kart, CWCS Coordinator at 802-241-3652 or jon.kart@anr.state.vt.us.

Somewhere in the process there must be a place to resolve conflicts on products. (2)

The Integration Team will address conflicts that develop within and among the Species Teams and the Conservation Strategies Review Team. If conflicts cannot be settled by the Integration Team then they will be addressed by the CWCS Steering Committee and, if needed, the Commissioner of the Fish and Wildlife Department.

Open the Steering Committee to others than Fish and Wildlife employees. (3) The steering committee should solicit partners' guidance on pending issues before a final decision is made.

State Fish and Wildlife departments have been given statutory responsibility by Congress for completion of Comprehensive Wildlife Conservation Strategies and for management of State Wildlife Grant funds. For efficiency and accountability we believe that the Steering Committee should remain Fish and Wildlife Department directors only. The

role of the Steering Committee is to provide coordination and continuity during the development of the CWCS. For those that want additional input and oversight during the development of the CWCS we've created the Conservation Strategy Review Team (see above).

Communications with Conservation Partners and the Public

Use a web-based process to allow immediate updates and input. (4) The interested public should have a conduit for submitting comments.

We are currently working on improvements to the Fish and Wildlife Department's website to allow for the posting of timely updates and meeting schedules and to announce important dates and decision-making points. This site should include interactive opportunities to allow Conservation Partners and the general public to ask questions and post comments directly to the site. Partners and the general public could then respond directly to the list of species of greatest conservation need, alert us to what they deem to be key threats to wildlife, etc. We will also explore opportunities to use interactive television to make our meetings more accessible to partners and the general public.

Alert the public more frequently, not just for the final review. (3) Could conservation partners be used for public outreach?

A public outreach effort has already begun. Almost 3,000 copies of *Fish & Wildlife Conservation News* have been distributed across the state. This new newsletter highlights projects currently funded by State Wildlife Grants and introduces readers to the CWCS. The next issue will be out in fall 2004. A media plan is in development. We want to encourage print, radio and TV outlets to spotlight CWCS efforts and projects currently funded by the State Wildlife Grants. We hope that Conservation Partners will inform their members and the general public about the CWCS too. A sample story for organization's newsletters will be drafted and distributed to all Conservation Partners. To get additional information or to provide feedback the public will be directed to the website mentioned above.

Supply partners with the list of reference materials used by the species teams.

Technical teams will cite all references used in the development of their reports. Where possible, lists of reference materials expected to be used during future team meetings will be posted for Conservation Partner review. Please note that the timeline for completing this project is a short one and it may not be possible to provide much if any advance notice of specific topics of future meeting and/or lists of reference materials to be used. Partners could also supply teams with relevant reference materials.

Time needs to be built in process so that the advisory group can be brought up to a common level (maybe use web-based application to get information out). (2) Prefer regular check-in/update opportunities for Conservation Partners that won't limit the ability of teams to get work done.

Unfortunately, time is in short supply, both for completing the CWCS by the Congressionally mandated deadline of October 1, 2005 and for many of you busy with your own projects and organizational responsibilities—as many Conservation Partners have told us. We will do our best to provide Conservation Partners with the information they need to stay informed and knowledgeable. We will explore web-based opportunities for disseminating and sharing information. We will also explore opportunities for using interactive television. This latter idea may prove more useful to the technical teams.

We can arrange to have regular, brief, targeted updates posted to the VT Fish & Wildlife Department's website. An email update of CWCS progress can also be sent out regularly.

Outreach

Where are representatives from Forest, Parks and Recreation and other departments?

The Lake Morey meeting was aimed at executive directors of agencies and organizations to introduce the CWCS to the state. Forest, Parks and Recreation was fully represented by Operations Director Ed Leary. Since that meeting we've met with additional FPR directors and with directors of other agencies to identify key individuals within the department who should be taking the lead for their agencies.

All landowners need to be involved and at an earlier level (include Farm Bureau) (2) Outreach to private landowner may be a role for some of the Conservation Partner organizations.

The Vermont Grange and several consulting foresters/landowner representatives were at the Lake Morey meeting. The Farm Bureau is a CWCS Conservation Partner but unfortunately could not attend the meeting in Lake Morey.

If one or more Conservation Partners would like to play a role in outreach to private landowners, please contact Jon Kart CWCS Coordinator at 802-241-3652, jon.kart@anr.state.vt.us

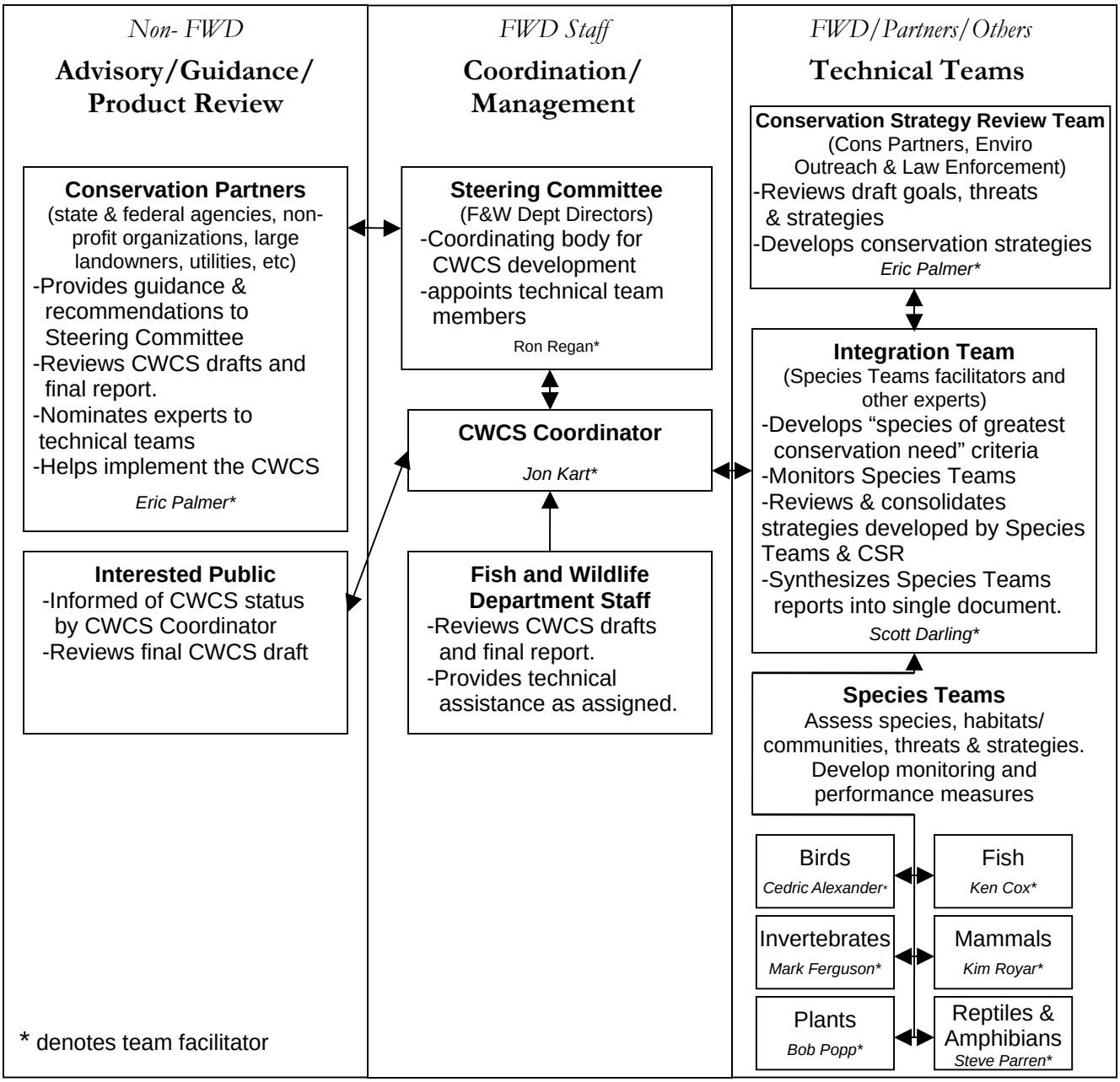
Academics need more involvement, particularly at species level.

Several have been added to technical teams.

Committed youth (e.g. selected high school students) should be involved at partner level.

If one or more Conservation Partners would like to take the lead in identifying and educating interested youth, please contact Jon Kart CWCS Coordinator at 802-241-3652, jon.kart@anr.state.vt.us

2) VT Comprehensive Wildlife Conservation Strategy Roles & Workflow



Approximate timeline

Develop CWCS process	Provide advice on CWCS process	Identify "species of greatest conservation need"	Identify habitats and threats. Develop conservation strategies	Strategy review & development	Interim review	Synthesize Species Teams' reports, prioritize strategies.	Draft CWCS. Develop monitoring protocols, performance measures.	Public review	Finalize CWCS, submit to USFWS
Steering Comm.	*Conserv Partners*	*Species Teams*	*Species Teams*	*CSR*	*Conserv Partners-FWD Staff*	*Integration Team*	*Integration Team -CWCS Coordinator*	*Gen Public*	*CWCS Coord*

Jan 2004 July 2005

Roles of the Comprehensive Wildlife Conservation Strategy Teams and Committees

Conservation Partners (state & federal agencies, non-profit organizations, large landowners, utilities, State legislators, academics, and others**)**

- Provides guidance and recommendations to the Steering Committee.
- Reviews interim and final CWCS drafts.
- Nominates experts for participation on technical teams.
- Helps implement the CWCS upon its completion.

Steering Committee (Fish and Wildlife Department Directors, Nongame and Natural Heritage Program Coordinator, FWD Planner)

- Executive body for the CWCS development and implementation with statutory responsibility for completion of the CWCS and management of State Wildlife Grant funds.
- Provides leadership and organizational commitment to ensure success of the CWCS.
- Encourages meaningful participation and buy-in among partners.
- Appoints members to technical teams.

CWCS Coordinator (Fish and Wildlife Department staff)

- Manages the project.
- Supports activities of the technical teams.
- Manages outreach and communications.

Conservation Strategy Review (CSR) (Conservation Partners as well as designees from the environmental education and wildlife law enforcement communities)

- Reviews threats and draft strategies suggested by the Species Teams.
- Develops additional strategies as needed.

Integration Team (Species Team facilitators plus additional Fish & Wildlife staff and non-staff experts).

- Develops criteria for designating species of greatest conservation need.
- Keeps Species Teams on schedule.
- Synthesizes reports of the Species Teams and strategies developed by the Conservation Strategy Review
- Identifies gaps in information and addresses special habitat and natural community needs.
- Prioritizes strategies and solutions to conservation challenges.

Species Teams (Fish and Wildlife staff, partners, and other experts as needed) Species teams: 1) Birds, 2) Fish, 3) Mammals, 4) Reptiles & Amphibians, 5) Invertebrates, 6) Plants

- Develop and refine lists of species of greatest conservation need.
- Assess species distribution and abundance, identify habitats/natural communities, threats & strategies.
- Develop monitoring and performance measures.
- Recommend draft strategies for managing species of greatest conservation need.
- Address comments made by Conservation Partners during interim review.

Interested Conservation Public

- Will be kept informed of the status of the CWCS by the CWCS Coordinator. Methods of communication may include brochures, newsletters, website, public meetings, media outlets.
- Will be asked to provide comments on the final draft.

3) Appointments to the CWCS Technical Teams as of 5/4/04

Birds
*Cedric Alexander
Eric Derlath USFWS
Patrick Doran, Wildlands Project
Margaret Fowle, NWF
John Gobeille, VFWD
Paul Karczmarczyk, RGS invited
Mark Labarr, Audubon
Chris Rimmer, VINS
Allan Strong, UVM

Fish
*Ken Cox
Doug Facey, St. Michaels College
Anne Hunter, VFWD
Rich Langdon, VDEC
John Lepore, VTrans
Craig Martin, USFWS
Donna Parrish, VT Coop
Steve Roy, USFS

Reptiles & Amphibians
*Steve Parren
Jim Andrews, Middlebury College
Steve Faccio, VINS
Chris Slesar, VTrans

Invertebrates
*Mark Ferguson
Steve Fiske VDEC
Trish Hanson, VFPR
Bryan Pfeiffer, VT Bird Tours
Kent McFarland

Mammals
*****Kim Royar
Pat Bartlett, Consulting Foresters Assoc VT
Tom Decker, VFWD
Bill Kilpatrick, UVM
John Sease, USFS
Peter Smith, Green Mtn College
Charles Wood, UVM retired

Plants
*****Bob Popp
Dorothy Allard, Scientific Advisory Group on Flora
Errol Briggs, VT Grange
Anne Bove, VDEC
Mary Beth Deller, USFS
Brett Engstrom, Scientific Advisory Group on Flora
Diana Frederick, VFPR
Marc Lapin, ESC Scientific Advisory Group on Flora
Annie Reed, ESC Scientific Advisory Group on Flora
Susan Warren, VDEC
Mike Winslow, Lake Champlain Committee

Integration Team
*Scott Darling
Christa Alexander, VFWD
John Austin, VFWD
Farley Brown, VT Coverts
Doug Burnham, VDEC
Dave Capen, UVM
Kathy Daly, Wildlands Project
Therese Donovan, VT Coop
Paul Fredrick, VFPR
Clay Grove, USFS
Liz Thompson, UVM
Keith Weaver, USFWS

Cedric Alexander (ad hoc)
Ken Cox (ad hoc)
Mark Ferguson (ad hoc)
Steve Parren (ad hoc)
Bob Popp (ad hoc)
Kim Royar (ad hoc)

Conservation Strategy Review Team
*Eric Palmer

Conservation
Rob Borowske, F&W Board
Gina Campoli, VTrans
Clint Gray, VFSC invited
David Kelley, Ski Areas Assoc
Warren King, Audubon
Sherb Lang, HAT
Leo Laferriere, SAF
Virginia Rasch, AVCC
John Roe, TNC
Dave Tilton, USFWS
Jim Wood, NCE&F

Education
Sally Laughlin, ESC
Ginger Anderson, VFPR
Mark Scott, VFWD

Law Enforcement
Bob Rooks, VFWD
Mark Sweeny, USFWS
Federal agent TBA

* *denotes team facilitator*

Conservation Partners of the Comprehensive Wildlife Conservation Strategy

as of 4/26/04

American Chestnut Foundation
Association of VT Conservation Commissions
Audubon Vermont
Burlington Electric Department
Center for Woodlands Education
Connecticut River Watershed Council
The Conservation Fund
Consulting Foresters Association of VT
Ducks Unlimited
Echo
Endangered Species Committee
Fairbanks Museum & Planetarium
Forest Watch
Green Mountain National Forest
Hunters, Anglers & Trappers Assoc of VT
Keeping Track, Inc
Lake Champlain Committee
Lake Champlain International, Inc.
Lake Champlain Land Trust
Lake Champlain Walleye Association
Gale Lawrence
Lewis Creek Association
Marsh-Billings-Rockefeller NHP
National Wild Turkey Federation
National Wildlife Federation
Natural Resources Conservation Service
Nature Conservancy
New Haven River Anglers Association
North Country Environmental & Forestry
Ruffed Grouse Society
Ryegate Power Station
Sam Shultis
Sierra Club
Society of American Foresters
Smugglers Notch Resort
Sportsmen Inc
US Fish & Wildlife Service, Lake Champlain Fish & Wildlife Resources Complex
US Fish & Wildlife Service, Missisquoi NWR
US Fish & Wildlife Service, Nulhegan Basin Division
UVM School of Natural Resources
VT Agency of Transportation
VT Association of Snow Travelers
VT ATV Sportsman's Association, Inc
VT Bird Tours
VT Cooperative Fish & Wildlife Research Unit
VT Coverts
VT Department of Environmental Conservation
VT Department of Forests, Parks & Recreation
VT Farm Bureau
VT Federation of Sportsmen's Clubs
VT Fish & Wildlife Board
VT Forest Products Association
VT Institute of Natural Sciences
VT Land Trust
VT Loggers Association
VT Natural Resources Council
VT Outdoor Guides Association
VT Ski Area Association
VT State Grange
VT Trappers Association
VT Woodlands Association
Wildlands Project

Representative Steve Adams
Office of Congressman Sanders
Office of Senator Jeffords
Office of Senator Leahy

4) CWCS Technical Team Meetings and Meeting Policies

The Integration team and the six species teams will begin meeting in May (the Conservation Strategy Review team will start in September). These meeting will be open to the public. Once the teams develop their meeting schedules I will contact you again via email to inform you of the schedules. When our CWCS website is running we will post the schedules there.

The eight technical teams (Conservation Strategy Review Team, Integration Team and the six Species Teams) are charged with developing much of the science and strategies for Vermont's Comprehensive Wildlife Conservation Strategy. Time is short and these are huge responsibilities. To help these teams work effectively the following meeting polices have been developed. Team members and meeting guests are urged to respect them.

- Team members are expected to share their expertise in wildlife conservation, not to represent their organization's or agency's position.

- Team appointments are for individuals, not organizations—no proxies for meeting representation will be allowed. To ensure continuity and team efficiency from meeting to meeting the same organization representative must come to each meeting.

- Team meetings are working meetings with full agendas and members need to focus on their time-sensitive responsibilities. Non-team members are welcome to attend primarily as observers. Non-members may provide timely and appropriate information. However, little time can be devoted to review or to help non-members get "up-to-speed." A few minutes will be reserved at the beginning and end of each meeting to take comments and answer questions.

- To encourage free and open discussions and information sharing during meetings, team members and guests need to recognize that all documents and information produced and developed by a team, and discussions had within and among teams, are to be considered drafts, or for discussion purposes only, until officially approved by a team. If information is shared outside the team, all recipients should be made aware of the preliminary nature of the information.

If warranted, additional policies and meeting guidelines may be adopted.

5) Next Steps

The Integration team and the six species teams will begin meeting in May (the Conservation Strategy Review team will start in September). Once the teams develop their meeting schedules I will contact Conservation Partners again via email with the meeting schedules and will post schedules to a VT-CWCS as soon as possible. You are welcome to attend meetings. Please note, however, that these will be working meetings with full agendas. Guidelines for meeting formats and protocols can be found in the previous section of this letter.

The first step for the Integration Team will be to define criteria for the designation of "species of greatest conservation need." Once this occurs, the six species teams will begin developing their lists of species of greatest conservation need. If you are interested in the criteria for designating of "species of greatest conservation need" let me know and I will email it to you. When the lists of species of greatest conservation need are developed by the species teams I will collect them and send them to you for review.

Once the species teams have generated their lists of species of greatest conservation need they will further assess the abundance and distribution of these species, and identify habitats for the species of greatest conservation need. It is possible that this may result in adjustments to the species lists.

While this is taking place I will be working on the CWCS outreach plan to inform the general public about Vermont's Comprehensive Wildlife Conservation Strategy.

The Conservation Strategy Review team will meet in September for two or three meetings to review a draft list of goals, threats and strategies developed by the species teams and to develop additional strategies as needed.

Though much work lies ahead of us, I'd like to thank you for your help so far. Your feedback and suggestions have improved the process we will use to complete this project. Your help on technical teams and as Conservation Partners providing guidance and oversight during the coming months will ensure that we do our utmost to conserve Vermont's wildlife. Please feel free to contact me with any additional comments or suggestions. We remain open to making the process more effective and responsive.

Thanks for your time.

Sincerely,

Jon Kart
CWCS Coordinator
103 South Main Street, 10 South
Waterbury, VT 05671-0501
(p) 802-241-3652
(f) 802-241-3295
jon.kart@anr.state.vt.us

VERMONT FISH & WILDLIFE DEPARTMENT

103 South Main Street, 10 South
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(f) 802-241-3295
jon.kart@anr.state.vt.us

September 4, 2004

Comprehensive Wildlife Conservation Strategy Update#2

Hello,

It's been a busy and productive summer for the teams developing Vermont's Comprehensive Wildlife Conservation Strategy and I want to take a moment to provide you with a progress report. I'd also like to inform you that after a lot of work, a VT-CWCS website is finally up and running. This website will make it easier for you to access background information on the CWCS, track the progress of the project and team meeting schedules.

The address is http://www.vtfishandwildlife.com/swg_home.cfm

I encourage you to alert members of your respective organizations and other friends of wildlife and interested parties to the existence of this site.

Progress Report by team/committee:
The Conservation Partners has not met since it first got together at the Lake Morey Inn in March 2004. A summary and recommendations that came from that meeting was part of the Conservation Partners Update #1 which was sent to you in May. If you did not receive that update please let me know and I will send it to you.

The Conservation Partners will not meet again until a draft of the CWCS is ready for your review. We originally projected that date to be this November, but a thorough reality check informs us that a draft won't be ready till late February. We value your time and we want to give you something substantive to work with. An updated schedule follows at the end of this note.

Most of the work on the CWCS during the last three months has been done by the six Species Teams (Bird, Fish, Invertebrate, Mammal, Plant, and Reptile & Amphibian). They have the huge task of conducting the basic species assessments--pouring over distribution data and discussing meta-population and viability reports. Their short term goal is to develop a list of Species of Greatest Conservation Need. A *draft* list should be complete by mid-September. When it is ready I will post it to the website and send you a reminder.

Once that list is complete, the Species Teams will focus on identifying key habitats for the Species of Greatest Conservation Need, conducting threat and opportunity assessments and developing conservation strategies.

That work should be completed by Nov 1st.Then the Integration Team takes over and will join together the work of the six Species Teams. Over the last couple of months the Integration Team has met to provide guidance to the Species Teams and to develop a database and integration plan that will be used to collect and analyze data developed by the Species Teams.

A draft Comprehensive Wildlife Conservation Strategy will be prepared for the Conservation Strategy Review team (CSR) to review at their initial meeting in early December and subsequent meeting in early January. The CSR will review the document and strategies and make recommendations to add/change strategies, gather public input on the strategies, and works with the Integration Team to finalize the strategies.

The CWCS development schedule follows below.

CWCS Timeline

2004

Sept Species Teams complete drafts of Species of Greatest Conservation Need (SGCN) lists.

Sept Fish & Wildlife Dept. Commissioner and Integration Team review draft SGCN list

Sept Draft SGCN list is then distributed to Conservation Partners and Conservation Strategy Review team

Nov Species Teams complete their draft reports (reports go to the Integration Team)

Dec Integration Team completes their review of the Species Teams reports and completes a draft of the CWCS (this is sent to the Conservation Strategy Review team (CSR)).

Dec Conservation Strategy Review team meets to review the draft CWCS and begins work on strategies assessment/development

2005

Jan Conservation Strategy Review team reconvenes to complete its report

Jan Integration Team reviews the CSR report, drafts a responsiveness summary and incorporates CSR recommendations into the CWCS

Jan Draft CWCS to Fish & Wildlife Dept. Commissioner and Steering Committee

Feb	Draft & comments back from the Commissioner and Steering Committee
Feb	Draft of CWCS is sent to Conservation Partners for review
Mar	Conservation Partners meet to discuss and review the draft CWCS
Apr	Steering Committee completes and distributes a responsiveness summary based on Conservation Partner feedback.
May	Public review of the draft CWCS begins
May	Public review ends
July	CWCS completed

VERMONT FISH & WILDLIFE DEPARTMENT

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jon.kart@anr.state.vt.us

January 9, 2005

Comprehensive Wildlife Conservation Strategy Update#3

Dear Conservation Partner,

Happy New Year. I'm writing with an update about Vermont's Comprehensive Wildlife Conservation Strategy (CWCS) as well as to share some good news about the State Wildlife Grants program with you.

The teams developing the CWCS have made great progress since the last update. The CWCS Species Teams (Birds, Fish, Invertebrates, Mammals, Plants and Reptiles & Amphibians) have just about completed full assessments of our Species of Greatest Conservation Need (SGCN). This includes identifying known distribution and abundance, habitat descriptions, threats and limiting factors, research and inventory needs and conservation strategies for each SGCN.

Our CWCS Integration Team is quickly piecing together the myriad species, habitat and landscape components into a recognizable plan. They have had to integrate information on more than 250 wildlife species and 400 plants into the 25 habitat types that will form the backbone of our report. In addition the Conservation Strategy Review team held its first organizational meeting and will soon begin prioritizing threats and reviewing strategies.

Our pace has been fast and furious. As we hurtle towards our July 2005 deadline I doubt the pace will slow. We've had to make a little more room in our timeline for both the Integration Team and Conservation Strategy Review team to complete their tasks. This will ensure that the draft CWCS that we bring to you will be complete. We now anticipate a Conservation Partner Review meeting in early May to review the draft document and a public review in June. I will contact you with specific dates as soon as possible.

For those of you who just can't wait to see what a comprehensive strategy looks like, I recommend that you check out North Carolina's version. NC is a few months ahead of Vermont (and most other states) and has posted several sections of their CWCS on the web for the public review. You can find it at http://www.ncwildlife.org/pg07_WildlifeSpeciesCon/pg7c1_3.htm. Vermont's CWCS will be organized similarly.

CWCS in the News: Our CWCS has received a good deal of media attention recently. This includes a Free-Press editorial (1/2/05), a Times-Argus article (12/30/04) (links below). The Associated Press evidently picked up the story too. Please let me know if you saw/heard a story elsewhere as I'm trying to keep track of them.

Burlington Free Press: Editorial 1/2/05:
http://www.burlingtonfreepress.com/bfpnews/editorial/sunday/1000h.htm

Times-Argus: Article 1/30/04:
http://www.timesargus.com/apps/pbcs.dll/article?AID=/20041230/NEWS/412300377/1002

CWCS Outreach to members and constituents: If your organization or agency has a newsletter or website, please consider including a notice about this project and upcoming public review opportunities in your next issue. A sample article follows at the end of this message, please feel free to adapt it as needed. I would also be happy to give a presentation about the CWCS at one of your meetings.

From the Department of Good News: Though most programs in the recently passed federal budget received significant budget cuts, the State Wildlife Grants program (SWG) actually grew to $69 million from $67.5 million the previous year. SWG provides funding to States to prevent wildlife species from becoming endangered. Vermont will receive more than $600,000 in SWG funds to continue our work conserving Vermont's wildlife and to start implementing the CWCS. This is certainly good news. It also underscores the strong bi-partisan support that wildlife conservation and the State Wildlife Grants have in Congress and with the current Administration.

If you have questions about this update or anything else related to the Comprehensive Wildlife Conservation Strategy please contact me anytime at 802-241-3652 or jon.kart@anr.state.vt.us. You can also find information at the VT CWCS website: http://www.vtfishandwildlife.com/swg_home.cfm. I encourage you to alert members of your respective organizations and other friends of wildlife and interested parties to the existence of this site.

Thank you for your help.

Sincerely, Jon

Jon Kart
CWCS Coordinator

---The following is a sample article about the CWCS. Please free to adapt it to best fit your agency's or organization's newsletter or website---

Vermont's Wildlife Get a Check-Up

An unprecedented evaluation of Vermont wildlife is underway. _____ [your organization] the Vermont Fish & Wildlife Department and biologists, ecologists, sportsmen and conservationists representing more than 60 agencies and organizations have teamed-up to give Vermont's wildlife a check-up.

From to black bear to golden-winged warbler, silver redhorse to blue-spotted salamander, experts are gauging the health of wildlife populations and developing prescriptions for healthy wildlife futures.

Next fall, when the work is complete, Vermont will have its first Comprehensive Wildlife Conservation Strategy (CWCS). "The CWCS will be a strategic vision for conserving the state's wildlife, one that all conservation-minded agencies and organizations can get behind," according to Jon Kart, CWCS Coordinator for the VT Fish & Wildlife Dept.

Development of the CWCS is driven by the federal State Wildlife Grants program (SWG). Preventing wildlife from becoming endangered is SWG's goal. Vermont has received more than $2.5 million from SWG since the program's inception in 2001. "In these tight budgets times, the State Wildlife Grants program allows us to reach out and better conserve and manage more wildlife than ever before" said Wayne Laroche, Commissioner of the Fish & Wildlife Dept.

Vermont is home to 42 species of reptiles and amphibians, 58 mammals, 94 fish, 235 birds, more than 2,000 plants and many, many more insects, mollusks and other invertebrates. Assessing the status of each of these species is a huge task requiring an effort of unmatched cooperation.

Step one in developing the CWCS was identifying Vermont's Species of Greatest Conservation Need. These species were selected based on criteria such as species rarity, vulnerability to habitat fragmentation or loss, and threat by exotic plants or animals. Then teams assessed habitat quality and identified significant threats to the species. Now conservation strategies are being developed for species and their habitats.

A review draft of the CWCS and public comment period will available during the spring of 2005. Wildlife enthusiasts, landowners, businesses and the general public are encouraged to track and take part in CWCS development. More information can be found on the Vermont CWCS website: www.vtfishandwidlife/swg_home.cfm.

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February 24, 2005

Comprehensive Wildlife Conservation Strategy Update#4

Dear Conservation Partner,

I'm writing with a short CWCS Conservation Partner Update and an offer to talk to your board or membership about the Comprehensive Wildlife Conservation Strategy.

The Comprehensive Wildlife Conservation Strategy is taking shape quickly as our Species Teams and Integration Team piece together reports on our Species of Greatest Conservation Need and their habitats. In addition, our Conservation Strategy Review team met for the third time last week. We received great comments and ideas on how to improve the CWCS and we're doing our best to incorporate those suggestions now.

We expect to have a draft ready for you to review in late April. Based on your feedback we will then prepare a public review draft. We will then hold public meetings on the CWCS in June.

In preparation for these events I'd like to offer to give a presentation on the CWCS to your organization's board or general membership. Please let me know at your earliest convenience if you are interested and specific date(s) that your group meets. Also, if you are looking for material for your newsletter or website, please consider adapting the sample article that follows below.

Thanks for your interest.

Sincerely, Jon

---The following is a sample article about the CWCS. Please free to adapt it to best fit your agency's or organization's newsletter or website---

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An unprecedented evaluation of Vermont wildlife is underway. _____ [your organization] the Vermont Fish & Wildlife Department and biologists, ecologists, sportsmen and conservationists representing more than 60 agencies and organizations have teamed-up to give Vermont's wildlife a check-up.

From to black bear to golden-winged warbler, silver redhorse to blue-spotted salamander, experts are gauging the health of wildlife populations and developing prescriptions for healthy wildlife futures.

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A review draft of the CWCS and public comment period will available during the spring of 2005. Wildlife enthusiasts, landowners, businesses and the general public are encouraged to track and take part in CWCS development. More information can be found on the Vermont CWCS website: www.vtfishandwidlife/swg_home.cfm.

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April 29, 2005

Comprehensive Wildlife Conservation Strategy Update #5

Dear CWCS Conservation Partner,

I'm writing with a short CWCS Conservation Partner Update.

When I last wrote to you (Feb 2005, Update #4) about the development of Vermont's Comprehensive Wildlife Conservation Strategy (CWCS) I stated that we hoped to have a draft of the CWCS ready for you to review in late April. We'll, it is now April 29 and the draft is not yet ready. The reason for the delay is that, recognizing the scope and importance of the CWCS, our agency secretary has requested additional time for our three Agency of Natural Resources commissioners to complete their review of a rough draft of the document.

The commissioners will complete their review by June 1st. We will then address comments from our commissioners and will prepare draft for you to review in mid-June. Based on your feedback we will then prepare a public review draft and have it ready for distribution by mid to late-July. The federal deadline for submission to the US Fish & Wildlife Service is October 1.

In preparation for these events I'd like to offer to give a presentation on the CWCS to your organization's board and/or general membership. A number of groups have taken us up on this offer already. These briefings have been great opportunities for information exchange and idea sharing. Please let me know at your earliest convenience if you are interested and specific date(s) that your group meets.

Thanks for your interest. Feel free to contact me if you have any questions, concerns or comments.

Sincerely, Jon Kart

Go to www.vtfishandwidlife/swg_home.cfm for more information about Vermont's CWCS.

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May 16, 2005

CWCS Update #6—Partner Meeting and Report Release

Dear CWCS Conservation Partner,

I'm writing to inform you of a meeting to be held Friday June 24 to present and discuss the draft Comprehensive Wildlife Conservation Strategy (CWCS) report. The meeting will run from 9am-noon and will be held in the Old Dorm Lounge at Vermont Technical College in Randolph, VT (directions below).

The draft CWCS report will be available to you at least one week prior to the meeting when we post it to the CWCS website (www.vtfishandwildlife.com/SWG_home.cfm). I will alert you when it is ready. Comments on the draft will be welcome at least through July 18.

I will send more details about the meeting as they develop. The agenda is as follows:
9-9:30 Registration, coffee
9:30-9:40 Welcome - Commissioner Laroche
9:40-9:55 the Future of Wildlife Conservation
9:55-10:25 Vermont's CWCS report (process and recommendations)
10:25-10:35 Break
10:35-noon Questions & Comments

In addition, I again offer to give a presentation on the CWCS to your organization's board and/or general membership. These briefings have been great opportunities for information exchange and idea sharing. Please let me know at your earliest convenience if you are interested and specific date(s) that your group meets.

Thank you for your interest. Feel free to contact me if you have any questions, concerns or comments.

Sincerely, Jon Kart

Directions to the Vermont Technical College:
- Take I-89 to exit 4.
- From the Exit 4 ramp, turn onto Rt. 66 heading uphill away from McDonalds. Proceed 3/4 mile to intersection at top of hill. -Drive straight through the intersection to access campus from main entrance.
- Look for signs to the Old Dorm Lounge

Go to www.vtfishandwidlife/swg_home.cfm for more information about Vermont's CWCS.

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jon.kart@anr.state.vt.us

June 20, 2005

CWCS Update #7—Partner Meeting and Report Release

Dear CWCS Conservation Partner,

On behalf of the many Conservation Partners and Vermont Fish & Wildlife Dept staff that have been working on Vermont's Comprehensive Wildlife Conservation Strategy (CWCS), I am pleased to announce that the Conservation Partner draft of the CWCS is now available at our CWCS website http://www.vtfishandwildlife.com/swg_cwcs_report.cfm. There you can view and download report chapters (recommended) or the entire report as a single file (NOT recommended, it's a BIG file, as a comprehensive report should be). You will find a handy online comment form there too. We would appreciate your reviewing the document and providing a feedback.

The comment period is open until July 18. Comments received before the end of this month can be incorporated into the public draft that comes out in early July.

Completing a CWCS is a requirement of the federal State Wildlife Grants program that provides funds to states to keep wildlife from becoming endangered—every state and territory in the U.S. completing one. The deadline for submission is October 1,, 2005 and the CWCS teams and committees have been racing to complete the report before that date.

Please keep in mind that you are reviewing a draft document. It is not complete and will not be complete without your help. In order to meet federal deadlines for completion and submission to the US Fish & Wildlife Service, this version will undergo additional format changes. The final document will have a professional design and layout.

To make your comments most useful please provide specific feedback; give suggestions for improvement in clarity or accuracy of content; or, propose key recommendations that are missing or should be elaborated on. Doing so is much more helpful to the authors than general observations or criticisms. Specific comments about the text should include chapter, page and line numbers (e.g. "chapter 3, page 12 lines 23-24 are confusing."). Please consider addressing the following questions:

"Potential Partners" and "Potential Funding Sources": Each species and habitat strategy in this document includes fields to list both "potential partners" and "potential funding sources." The omission of any logical entities from these fields is strictly due to a lack of time. Please help us by suggesting partners and funding sources.

Don't forget: the CWCS Conservation Partner Review Meeting at Vermont Technical College is this Friday June 24. It will run from 9:30am-12:00pm. The agenda and driving directions are posted below. Please, take a moment now to let me know whether you or are coming or not and the number of people from your agency or organization will join you.

Conservation Partner Meeting Friday 6/24/05
Old Dorm Lounge at Vermont Technical College, Randolph, VT
Agenda
9-9:30 Registration, coffee
9:30-9:40 Welcome - Commissioner Laroche
9:40-9:55 the Future of Wildlife Conservation
9:55-10:25 Vermont's CWCS report (process and recommendations)
10:25-10:35 Break
10:35-noon Questions & Comments

Directions to the Vermont Technical College:
-Take I-89 to exit 4.
-From the Exit 4 ramp, turn onto Rt. 66 heading uphill away from McDonalds. Proceed 3/4 mile to intersection at top of hill. -Drive straight through the intersection to access campus from main entrance.
-Look for signs to the Old Dorm Lounge

Public Meetings: CWCS Public Meetings are scheduled for July 12 (Montpelier) and July 14 (Manchester) and will run from 7:00pm to 8:30pm. I urge you to join us there and to encourage your members to attend. You are welcome to set up a display or bring literature about your organization to the public meetings. Just let me know ahead of time so we can arrange for space. If you can't attend but want to provide me with materials to display, please mail a packet to me at the address below or give it to me at the meeting next week.

Thank you and happy reading.

Sincerely, Jon

Hey! My email address changed on 6/6/05.
It's now --> jon.kart@state.vt.us
Please update your address book. Thank you.

Jon Kart
CWCS Coordinator
Vermont Fish and Wildlife Department
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Vermont's
Wildlife Action Plan

November 22, 2005

Appendix F
Sample Media Coverage

Burlington Free Press
www.burlingtonfreepress.com

Wildlife checkup

Vermont is part of a major national project to find out what is needed to keep America's wildlife healthy.

This complex and important endeavor, with a deadline of October 2005, has biologists, sportsmen, ecologists, conservationists, and wildlife experts working together to develop a comprehensive blueprint for effective conservation programs across the United States.

Led by the Vermont Fish and Wildlife Department, the Vermont team is supported by a significant federal contribution, the State Wildlife Grants program, which has a goal of preventing wildlife from becoming endangered. Vermont has received more than $2.5 million in grants since the program began in 2001, but many of the participants have volunteered countless hours to be part of this pioneering wildlife inventory.

Next fall, when the work has been completed and the public has had a chance to review draft findings, Vermont will have its first "comprehensive wildlife conservation strategy," a long-range vision for conserving the state's wildlife, from the lowly woodland vole to the catamount.

This effort is in refreshing contrast to recent federal initiatives that have seriously undermined entrenched environmental policies such as the Clean Air Act. It is the kind of positive and innovative work that enthuses scientific experts as well as the average Vermonter who respects and admires the state's wildlife.

Very little is known about many of the species being studied, says Jon Kart, coordinator of Vermont's wildlife checkup. But even the smallest insect can play an important role in the ecosystem. Plants are also being studied to provide the most complete picture possible.

Six teams of experts looked at species that have declining populations, are potentially threatened or are virtual unknowns to scientists. The goal is to identify "species of greatest conservation need" and to identify habitats, key threats, the research needed to increase knowledge about them and strategies to conserve the species. A broad-based review team from 60 agencies and organizations will distill the information and provide a "reality check" before recommendations are made for the public to review in the spring.

A preliminary look at the list of species with the greatest conservation need in Vermont suggests there are about 130 vertebrates, including birds, mammals, amphibians and reptiles, 120 invertebrates, and about 400 plants that need special attention.

The list includes bobcat, bald eagle, common nighthawk, salmon, lynx, martin, a number of bats, barn owl and even mountain lion, or catamount. Kart says

catamounts have existed in Vermont, but there have been no documented findings of them in some time.

"If we can get to the species before it becomes threatened, we have many more options to conserve them and it is much cheaper," Kart said in an interview Thursday.

Vermonters take conservation seriously, not only because they have an affinity for the natural environment they grow up in, but because they benefit from it economically. About $386 million is spent on wildlife-based recreation in Vermont every year, according to a 2001 survey by the U.S. Fish and Wildlife Service.

Once the conservation strategy is complete, stable federal funding will be needed to follow up on the recommendations. Vermont's congressional delegation has been supportive and must continue to press for this allocation. The state will also be asked to contribute, possibly through investing in conservation programs or providing technical and financial assistance to the landowners who own about 85 percent of Vermont's land. These property owners might have the will, but not the money or expertise to preserve their natural areas.

It will require a partnership and an investment. A healthier future for America's wildlife is worth it.
Join the discussion

Go to www.vtfishandwildlife.com and click on Wildlife Programs for more information.

Respond to this opinion item or letter in a Letter to the Editor

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Monday
January 03, 2005

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MORE TOP NEWS

State compiling wildlife inventory

December 30, 2004

By Sky Barsch Times Argus Staff

WATERBURY – In an effort to avoid emergency recovery programs, Vermont wildlife specialists are using federal funds to survey and plan for the protection of creatures that might otherwise be headed for the endangered species list.

Vermont's Fish and Wildlife Department, with the help of federal funding and more than 60 agencies and organizations, is compiling an inventory and plan for the state's animals most in need of conservation, according to Jon Kart, comprehensive wildlife conservation strategy coordinator for the department. The list, called the Comprehensive Wildlife Conservation Strategy, will include what experts believe are the best management practices for more than 200 animals, from lynxes and silver-haired bats to southern bog lemmings and American bitterns. The study looks at plants as well.

The goal is to list the mammals, fish, reptiles, amphibians, birds, invertebrates and insects that are rare or whose populations are declining, and to identify and implement conservation methods before the creatures become so rare that restoring populations is expensive and potentially not possible.

The program is funded by the State Wildlife Grants program, a federal source that aims to survey and protect animals that aren't on the endangered species list and those that aren't typically hunted or fished, according to Kart

"It's so much cheaper to help something when it's in good shape than to provide triage," Kart said. "That's probably the main reason Congress was interested in enacting this legislation."

Vermont has been eligible for a total of $2.5 mil-lion since the program's inception in 2001, and that money has gone to numerous habitat restoration and conservation programs, Kart said, including studying and restoring Bicknell's thrush, osprey and tiger beetles, as examples.

The state is required to complete a Comprehensive Wildlife Conservation Strategy in order to receive the grant funding and must provide a match with state funds, donations and funding from other organizations.

Though the strategy inventory is a requirement of the federal program, Kart indicated the chance to complete the inventory as an exciting opportunity rather than a burden.

"This is the first time this has ever been done. No state has done anything like this. It's all on uncertain territory. We're trying to do this with wildlife we know very little about. It's an incredible exploration," he said.

So far, teams of biologists, ecologists, conservationists and sportsmen and women have identified about 130 vertebrates, including mammals, birds and fish, and more than 120 invertebrates, including insects and mussels, as in greatest need of help. These include martens, shrews, voles, eastern darters, Atlantic salmon, spotted turtles, Western chorus frogs and different species of mayflies.

Champlain Business Journal

"They've all been identified," Kort said of the animals in need of conservation. "We go from peregrine falcons, which we know a lot about, to little (woodland) voles, a rodent we only have historically maybe 50 records of them. There's only 50 of those and we don't know, are they very rare in the state? Or are they everywhere and people just didn't look?"

Kart said the Comprehensive Wildlife Conservation Strategy has many benefits. With such a large number of wildlife experts putting their heads together, Kart hopes that the inventory will allow all individuals and organizations who are interested in conservation to be on the same page. Experts are trying to figure out what conditions are adversely affecting Vermont's wildlife. Threats may include a lack of contiguous forest, competing exotic species, or an uncontrolled harvesting by people.

The Conservation Strategy also aims to provide a science-based foundation for understanding the issues involved in addressing wildlife needs, allow conservation actions to be more proactive and less reactive, allow conservation actions of agencies, landowners, interest groups, conservation organizations and others to be coordinated so that they are more cost-effective and produce cumulative benefits and allow existing programs that provide incentives or technical assistance to private landowners for voluntary actions to conserve natural resources on private lands to be used more effectively, among others.

The final strategy, subject to public comment and federal approval, will likely be an electronic document the public will be able to access, Kart said. That way, an individual who is interested in property improvement for wildlife habitat could access the document and get the most comprehensive data available on land management practices.

Vermont is not alone in this mission. The 49 other states and several territories are participating in the conservation program as well, Kart said. Federal money is awarded based on a formula that takes into account a state's size as well as its population.

Kart said he is in frequent contact with those working on the same project in other states, to see what sort of management plans can be implemented regionally.

Field work will continue in the spring, and a draft of the Comprehensive Wildlife Conservation Strategy is due out sometime next year.

Contact Sky Barsch at sky.barsch@timesargus.com or 223-3335.

News

Study focuses on health of Vermont's wildlife

Steve Zind

Listen

COLCHESTER, VT (2004-12-31)

(Host) The Vermont Fish and Wildlife Department is involved in a nationwide effort to take stock of country's wildlife. Officials say when the work is completed it will be the first time that all of the state's animals, plants and insects have been surveyed.

VPR's Steve Zind reports.

(Zind) Biologists, sportsmen and conservationists have spent a lot of time studying Vermont's game animals and endangered species. But Jon Kart of the state Fish and Wildlife Department says most of the state's wildlife doesn't fall into those categories.

(Kart) "The other 95 percent of the wildlife in the state has been virtually ignored due to lack of funds, due to lack of biologists to work on them and manage them and care for them. Finally, just a few years ago, Congress came up with the state wildlife grant program and this program provides money for that other 95 percent."

(Zind) The federal government is requiring states to devise what's called a Comprehensive Wildlife Conservation Strategy. Kart heads up Vermont's effort. He's been working with representatives from more than 60 groups to gather information about everything from crawfish to black bears.

The idea is to alert officials to species that are in trouble before they reach a critical point. Kart says the study is designed to find out which species are healthy and which are in decline, and to identify threats to species and strategies to conserve them. He says it's clear that for many species declining habitat is clearly an issue.

(Kart) "In the Champlain Valley we have a fraction of the clay-plain forest we once had. And the number of species that might live there, well we're just starting to figure out because there's maybe 10 percent left. I guess the main piece is, we're finding key habitats that need attention."

(Zind) Kart says the biggest surprise so far is how little we know about many species. He says once every state has completed its survey, scientists, policymakers and the public will for the first time have a big picture idea of the health of the nation's wildlife.

(Kart) "And really be able to show what do we need to do to preserve wildlife in America. And that's going to be a great moment."

Editor's Choice

Marketplace: The Next Four Years

Today's Editorial Cartoon

(Zind) Kart says a draft of Vermont Comprehensive Wildlife Strategy should be complete by spring when the state will hold public hearings on the plan. But the work will be ongoing because Kart says there's still much to learn about Vermont's wildlife.

For Vermont Public Radio, I'm Steve Zind.

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campaigning harder than ever against sex and violence on TV, but it doesn't seem to change what people watch. The paradox of the culture war, Monday on NPR's *Morning Edition*.

All Things Considered

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Vermont's
Wildlife Action Plan

November 22, 2005

Appendix G
Sample Newsletters

FISH & WILDLIFE
CONSERVATION NEWS

WINTER 2004

A publication of the Vermont Fish & Wildlife Department
Agency of Natural Resources

Inside:

Conserving Vermont's fish, wildlife, and plants and their habitats for the people of Vermont.

VERMONT
FISH & WILDLIFE DEPARTMENT
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Commissioner's Greeting

In recent years, state fish and wildlife agencies, all across the country, have been the beneficiaries of new federal dollars for conservation through a program called State Wildlife Grants. One of the requirements of accepting these new dollars is that each state agency must complete a Comprehensive Wildlife Conservation Strategy by October 1, 2005. This newsletter, which we anticipate publishing twice per year, will be one tool to assist with communicating about the progress of developing the Strategy.

These new dollars offer a historic opportunity to fund *new* research, inventory, and management actions for species of greatest conservation need, as mandated by the funding legislation. This is consistent with the Vermont Fish & Wildlife Department's broad mission and provides much needed sustainable funding. In this first issue of the newsletter, we highlight some of the exciting new initiatives being funded with the help of State Wildlife Grant dollars.

Sincerely,

Wayne A. Laroche

Wayne A. Laroche

Vermont is home to a vast array of fish and wildlife species, including mammals, reptiles, amphibians, birds, fish, and insects. Many of these species are not traditionally harvested through regulated hunting, fishing or trapping programs. These species account for more than 95 percent of the fish and wildlife in Vermont. Some of these species are declining or considered at risk. Over 200 species are endangered, threatened or rare.

For several years, the States have asked the U.S. Congress to provide adequate, reliable annual funding to help reverse the decline and prevent species from becoming endangered. Congress responded by providing one-time state funding in the form of the Wildlife Conservation and Restoration Program (WCRP) in 2001. Congress then provided additional funding for the next three years through the State Wildlife Grants (SWG) Program.

With this new influx of monies, the Vermont Fish & Wildlife Department will begin laying the groundwork for proactively managing our species of greatest conservation concern. Over the next four years, between $2 and $2.3 million will be invested to support a variety of projects that will fill important knowledge gaps involving species of conservation concern, measure public opinion on

fish and wildlife conservation issues, and significantly contribute to the development of Vermont's Comprehensive Wildlife Conservation Strategy.

By developing a Comprehensive Wildlife Conservation Strategy for Vermont, the department has the opportunity to incorporate the management of all species into existing programs, build valuable partnerships, and identify conservation threats and opportunities that will affect our wildlife management efforts. We hope this will help secure long-term funding for the important job of conserving Vermont's fish and wildlife heritage. In the following pages you will learn about some of the projects we are initiating to fulfill our mission to conserve Vermont's fish and wildlife, their habitats, and natural communities for the people of Vermont.

Fish and Wildlife Species and Habitat Inventories

Several projects funded through the State Wildlife Grant program will provide information on species abundance and distribution as well as the location and condition of suitable habitats. We will use the information gathered to determine the status of populations, identify the threats to sustaining these populations, and prioritize effective conservation strategies. The following are some highlights of those projects.

The **Montane Spruce-Fir Forest** natural community will be inventoried. The Montane Spruce-Fir Forest is a dominant natural community above 2,500 feet elevation in Vermont. This forest and associated subalpine and alpine communities provide important wildlife habitat for many species, including Bicknell's thrush, a bird of special concern in Vermont.

This project will identify most of the state's examples of Montane Spruce-Fir Forest. The ecological integrity and habitat value of each example will be evaluated through aerial flights, maps and site visits. A newly developed ranking system will be used to evaluate the ecological significance of each example.

Although this community is not under threat of typical residential sprawl, it may be threatened by acidic precipitation and development associated with ski areas and ridgeline wind towers. Therefore, the information gathered will improve the department's ability to work with the public and landowners to make sound decisions on land and habitat conservation and management planning.

A recovery plan for Vermont's endangered **spruce grouse** population will be developed. This species is restricted to 25 square miles of Lowland Spruce-Fir Forest in northern Essex County.

Mount Mansfield's Montane Spruce-Fir Forest

Although the population appears to be stable if not slightly increasing, there is only one isolated population. Reintroducing and re-establishing a second subpopulation of spruce

spruce grouse

grouse to a former portion of their range in Vermont could help secure the long-term viability of the population.

The department will capture and release a minimum of 60 spruce grouse (40 percent adults and 60 percent juveniles) in Victory Basin. The captured spruce grouse will originate from Quebec, Ontario, New Brunswick, or Maine. Genetic investigations will help determine which source, if any, would be the most appropriate. Following the release of the birds, we will conduct annual surveys to monitor and determine the project's success. A number of the released birds also will be radio-tagged. This will enable us to monitor bird location throughout year and provide information on survival, home range size and dispersal movements.

The **lake sturgeon**, once abundant in Lake Champlain, is now listed as endangered. A survey program was initiated in 1998 to determine if sturgeon are still present, and to gather data on relative abundance, age and size structure of any remaining population. The survey targeted historic spawning sites in the Winooski and Lamoille Rivers.

The results of this sampling effort were positive, sturgeon still exist in Lake Champlain. However, sampling indicated the need to expand our

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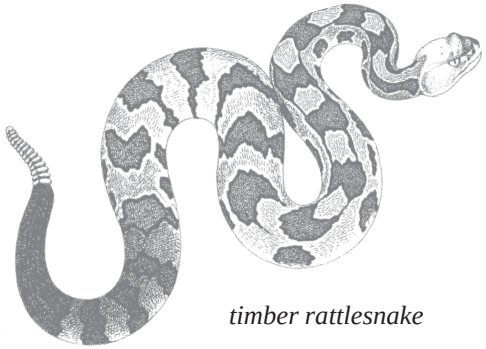
survey to include other historic spawning sites and other tributaries to the lake.

With the new State Wildlife Grant funding, we plan to expand department efforts to attempt sturgeon egg collection in Otter Creek as well as continue egg sampling on the Lamoille and Winooski Rivers. Biologists also will attempt to collect drifting sturgeon larvae.

Results from this project will improve our information on the population size, reproductive success, and the age and size structure of the lake sturgeon found in Lake Champlain. This information will be vital for developing restoration strategies for the recovery of Lake Champlain's sturgeon.

The **timber rattlesnake** and **eastern ratsnake** both have restricted distributions in Vermont, and their continued existence in this state is a conservation concern.

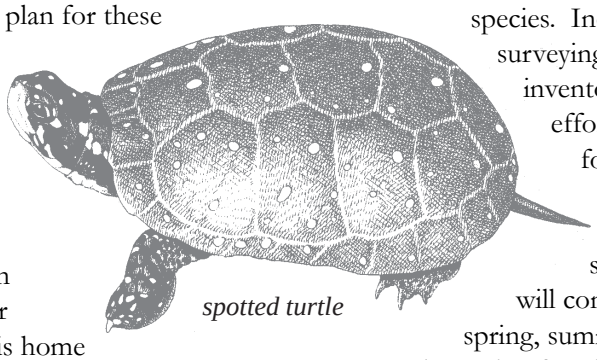


timber rattlesnake

The rattlesnake is listed as endangered and the ratsnake is at risk and proposed for threatened status. Traffic, mowing and intentional killing are all sources of mortality. In addition, visitation to sensitive sites, such as denning areas, is believed to negatively impact the rattlesnakes.

With State Wildlife Grant funding we will build on past efforts to monitor and inventory rattlesnakes in Vermont. Although the rattlesnake and ratsnake have different life histories, their habitat use and geographic distributions overlap. Therefore, conservation efforts on behalf of the endangered rattlesnake will also benefit the ratsnake.

Through department inventory work we will gain better understanding of species distribution, population health, and how these species use the landscape throughout the year. We will reach out to local citizenry living close to rattlesnake habitat to encourage conservation and gather information about the snakes and threats to their survival. This information also will enable us to develop a recovery plan for these snake species.



spotted turtle

Inventorying and documenting the current distribution of **turtle species** of conservation risk in Vermont is another project. Vermont is home to seven species of turtles that are of a conservation concern. The spotted turtle is state-endangered with only one documented population. The spiny softshell turtle is state-threatened and is found in only two areas of Lake Champlain. The wood turtle, although still widespread, is at risk from a variety of threats, as are the remaining four turtle species. Population isolation, habitat loss, boat and car traffic, nest predators, and the pet trade threaten the survival of Vermont's turtle species.

The department will monitor selected turtle species (spotted, spiny softshell, and wood turtles) to gain knowledge of their life history and habitat needs. Using a variety of techniques biologists will gather information on populations, necessary habitats, distribution, and threats. This information will help in maintaining and enhancing vulnerable turtle populations. The department also plans to draft recovery plans for spiny softshell and spotted turtles.

Currently the department is in the process of developing a **statewide bat conservation and recovery plan**. Vermont is inhabited by nine species of bats, six of which are known to hibernate in the state and eight of which are thought to raise young here. Of these nine, only one is ranked as demonstrably secure. The remaining bat species are ranked as uncommon, very rare, federally endangered or state threatened.

While developing the plan, it became evident we needed more information on the current status of several bat species. Increased surveying and inventorying efforts will focus on the highest priority species. We will conduct spring, summer and fall surveys to determine female Indiana bat distribution in Vermont. We will survey for the small footed bats, eastern pipistrelle, and Vermont's migratory bat species–red, hoary and silver-haired bats. Inventories will include known and potential winter hibernating sites (hibernacula). We will document big brown and little brown maternity sites (sites used by bats for having and rearing young). We also will compile existing records of bat surveys to develop a comprehensive bat species inventory by town, region and other attributes.

This distribution and habitat use information will help in developing sound management and conservation

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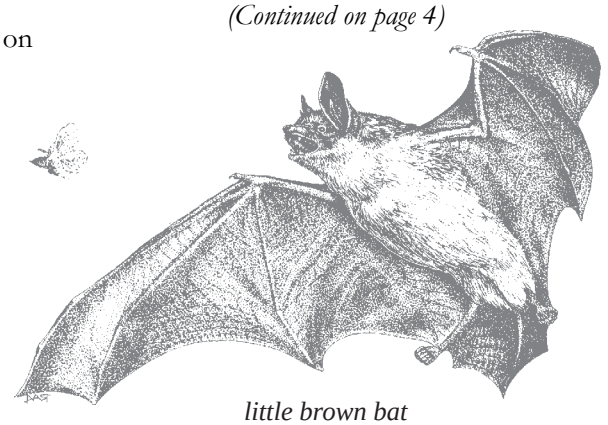

little brown bat

elktoe mussel

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strategies. These strategies may include: forest management activities that conserve habitats used by Indiana bats for feeding and rearing their young; strategies to maintain man-made structures, such as barns and bridges, for roosting habitat; and pest control procedures that minimize bat mortality.

In Vermont, ten of our eighteen **fresh water mussel species** are on the state's endangered and threatened species list and several others are considered rare. Funds provided through the State Wildlife Grant program will finance inventory and monitoring efforts on rivers around the state to determine the status of selected freshwater mussel species.

The mussel species targeted for investigation include state or federally listed species, or species of special concern that need more information to determine their current status. These include the dwarf wedgemussel, brook floater, elktoe, and a group of mussels species that occur within portions of Lake Champlain and its major tributaries below the river's first major waterfall. Seven species in this group are listed as state threatened or endangered.

Information collected from these inventory and monitoring efforts will be used to develop conservation priorities and strategies to achieve mussel recovery goals. Ongoing survey and monitoring efforts will aid in tracking population trends statewide, help refine recovery strategies, and determine whether recovery goals have been met.

Two citizen-based inventory projects receive funding through the State Wildlife Grant program. They are the **Vermont Butterfly Atlas** and the **Vermont Breeding Bird Atlas**. The benefits of these "citizen science" projects are many. The projects engage a large number of Vermonters in collecting and reporting species and habitat information. Not only do these volunteers collect information important for conservation, but they also make these extensive inventorying efforts possible, due to the scope of these projects.

monarch butterfly

The Vermont Butterfly Atlas is a five-year project to gather data on butterfly distribution and abundance statewide. The project focuses on a group of approximately 118 species. The resulting information will be used to set priorities and develop strategies for invertebrate species of conservation concern.

The first year of this five-year project, funded under the Wildlife Conservation and Restoration Program, has already produced promising results. Over 120 participants have been registered with the project with well over 2,000 hours volunteered. Of the potential 118 species of butterflies known to Vermont, at least 98 were cataloged.

The Vermont Breeding Bird Atlas is a comprehensive statewide mapping project. It is directed by the Vermont Institute of Natural Science and financially supported by the Vermont Fish & Wildlife Department's State Wildlife Grant program. In the spring and summer of 2003, over 300 volunteers took to Vermont's countryside to begin a five-year project to gather information about birds breeding in Vermont. The atlas is providing needed information on some of Vermont's rarest birds, a comparative look at the distribution of all wild birds, and some abundance data. This information will enable the bird conservation community to detect changes in bird distribution and number, identify areas of concern, and aid in conservation planning.

The State Wildlife Grant funds also are providing support for work to evaluate **aquatic habitats**. Temperature is a significant factor in determining a stream's fish community. This project will test the effectiveness of using stream temperature data to address the issues of land use, the need for adequate riverbank vegetation (riparian zones) and the benefits of dam removal.

Using the Mad River as a test site, this project will analyze temperature data to provide a variety of information. Some of this information includes: measuring the effect of shading by

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Rod Wentworth, VFWD Aquatic Scientist ,retrieves a temperature data logger from the Mad River.

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determining water temperature differences between the forested upper river and the open agricultural section downstream; demonstrating the effects of the Moretown dam on downstream temperatures; using a temperature model to explore "what if" scenarios for temperature changes that would result from establishing a certain type of riparian zone over a certain length of river; and assessing the usefulness of temperature modeling for future applications and conservation planning.

Data from the Mad River will be used to explore applications that can be used statewide. And, it will add support to our habitat restoration efforts by providing actual numbers to demonstrate the relationship between land use and stream temperature.

Another project involves revising and updating the current **ranking system for natural communities**. In Vermont, natural communities are recognized as one of the primary tools for describing and mapping state lands. They also are a tool used for making land-management decisions regarding wildlife habitat, rare species and recreation values.

The rarity of natural communities is ranked based on how frequently they occur and the total area the community type occupies. The quality of natural communities also is ranked based on an assessment of the size, the current condition of the natural community, and the condition of the surrounding landscape. The new ranking specifications will weight these three quality factors and will be based on a review of current scientific literature. This new system will "fine-tune" the current system by improving objectivity in the ranking process.

This new system will provide an accurate, objective, reliable, and practical tool for evaluating and ranking the ecological significance of natural communities. State agencies and private landowners will benefit from this new system when making conservation and management planning decisions.

Conservation Planning Assistance

The State Wildlife Grant program also supports projects focused on providing conservation planning assistance to government, local and regional land use planning, and conservation organizations. The conversion of the department's existing database for tracking rare species and significant communities to the new **GIS-based Biotics data system** is one example.

The department's database system tracks and maps critical wildlife habitat like deer wintering yards.

The Vermont Fish & Wildlife Department maintains a database that includes 6,000 occurrences of rare species and significant communities. Other databases include information about deer yards, bear habitat, wildlife road crossings, and other information. The new Biotic database system will track and map this information more efficiently and be more user-friendly. Converting to this database system will increase the availability of up-to-date information to biologists, planners and the general public. It will improve customer service and provide better information for conservation planning and technical assistance to government, conservation organizations and interested citizens.

The new State Wildlife Grant inventorying and monitoring projects will generate a great deal of new data vital for conservation planning, species management and regulatory review. Some of these projects will add more than 100 new or updated occurrence records to our Biotics database. In addition, other ongoing projects and outside sources also generate data for inclusion in our database.

To maintain a current database and to improve assistance to local, state and region wide projects and plans, we hope to use State Wildlife Grant funding to add several specialists to our staff. These specialists will create and update GIS coverages for rare animals, critical wildlife habitats and natural communities for conservation planning, and provide technical information on rare species, significant natural communities and critical habitats from the department's database to government and non-government planners, researchers and landowners.

The State Wildlife Grant funds also will provide the financial support to employ a wildlife biologist to assist in **town and regional conservation planning**. This person will be responsible for assisting interested groups in applying the processes and information presented in a conservation planning manual recently developed by the department.

This guidance manual, funded through the Wildlife Conservation and Restoration Program, was written to help town planning commissions and conservation commissions develop land use plans that recognize the

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conservation needs of fish and wildlife resources. The biologist will work directly with interested towns, regional planning commissions and other interested conservation organizations, and assist them in using the manual. The position will provide a centralized expert for people involved in planning to contact for help and ensures that the assistance provided is consistent and based on contemporary science and information.

This position and program will foster a greater appreciation and understanding of fish, wildlife and biological processes within Vermont communities. It also will enhance the department's abilities to further fish and wildlife conservation on private lands throughout Vermont.

Fish and Wildlife Research

Two projects funded by the State Wildlife Grant program are research projects. One research project will investigate the population dynamics of the **Indiana bat** in the Champlain Valley. This State Wildlife Grant is partially funding the second phase of Indiana bat research at the University of Vermont (UVM) Cooperative Fish and Wildlife Unit. The research will increase our understanding of maternity colony characteristics and activities as well as habitat needs.

This project will identify and characterize maternity and alternate roost trees; document the use of roost trees over the years; determine how many individuals are using the identified trees; and analyze landscape characteristics of maternity roost sites. The research also will identify habitat characteristics associated with Indiana bat roosting and feeding activities. The information collected will help in refining our Indiana bat conservation planning efforts and programs.

double-crested cormorants

The other research project, also being conducted at UVM, involves determining the influence of egg-oiling on the population dynamics of **double-crested cormorants**. In 1999, the department began applying corn oil to cormorant eggs on Young Island to manage population size. Although the oiling nearly eliminated all cormorant reproduction on Young Island in 1999 and 2000, the overall impact on the size and distribution of the cormorant population on Lake Champlain was unclear. Patterns of dispersal suggest egg oiling causes cormorants to abandon the Young Island colony and move to alternate locations.

Indiana bat

Current models for predicting cormorant population growth assume no movement between the colonies. However, research suggest a model that incorporates movement between colonies is needed to accurately predict and assess changes in the overall cormorant population size and distribution in response to oiling practices.

This State Wildlife Grant project will develop a population growth model for cormorants on Lake Champlain that includes movement of cormorants among colonies. This model, know as a metapopulation model, will predict growth of individual cormorant colonies given specific demographic rates (rates of birth, death, birds joining and birds leaving a colony) for each colony. It also will predict the growth and persistence of the Lake Champlain population. The model will allow managers to develop a cormorant management plan based on predicted growth of each colony on Lake Champlain in response to different management scenarios.

What's Next?

Although the State Wildlife Grants program funding is short-term, the projects it is funding will greatly enhance our knowledge and understanding of those species of concern. It will help establish a means to proactively manage these species through the development of a Vermont Comprehensive Wildlife Conservation Strategy.

This Strategy will outline the status, threats, and conservation strategies needed to maintain Vermont's native fish and wildlife species. It also will serve as a roadmap for Vermont's fish and wildlife conservation community to work toward achieving its many goals and interests in a comprehensive approach that ultimately conserves all fish and wildlife species. In the months to come, we will use this newsletter to report on the progress of the different projects as well as the Strategy's development.

FISH & WILDLIFE

CONSERVATION NEWS

FALL 2004

A publication of the Vermont Fish & Wildlife Department
Agency of Natural Resources

Inside:

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American Toad / photo by Chris Slesar

Vermont's Wildlife Get a Check-Up

An unprecedented evaluation of Vermont wildlife is underway. Spearheaded by the Vermont Fish & Wildlife Department, biologists, ecologists, conservationists and sportsmen representing more than 60 agencies and organizations have teamed-up to give Vermont's wildlife a check-up.

From black bear to yellow-bellied sapsucker, red mulberry plant to blue-spotted salamander, and silver redhorse sucker to pink heelsplitter mussel, experts are assessing the health of wildlife populations and developing prescriptions for healthy wildlife futures.

Next fall, when their work is complete, Vermont will have its first Comprehensive Wildlife Conservation Strategy (CWCS). It will be a strategic vision for conserving the state's wildlife, one that all conservation-minded agencies and organizations can get behind.

Development of CWCS is driven by the State Wildlife Grants program (SWG), a federal funding program to prevent wildlife from becoming endangered. Since SWG's inception in 2001, Vermont has received more than $2.5 million in conservation dollars. To remain eligible for State Wildlife Grants states must complete a CWCS by October 2005.

Vermont is home to 42 species of reptiles and amphibians, 63 mammals, 94 fish, 235 birds, more than 2,000 plants and many, many more insects, mollusks and other invertebrates. Assessing the status of each of these species is a huge task requiring an effort of unmatched cooperation.

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Good News for Vermont's Wildlife:

State Wildlife Grants and The Comprehensive Wildlife Conservation Strategy

State Wildlife Grants (SWG) provides federal dollars to every state and territory to support conservation aimed at preventing wildlife from becoming endangered. To make the best use of the State Wildlife Grants program, Congress charged Vermont and all other states with developing a statewide Comprehensive Wildlife Conservation Strategy (CWCS) by October 2005. This newsletter highlights the development of the CWCS and the essential conservation efforts supported by State Wildlife Grants dollars.

Why is SWG essential to wildlife conservation in Vermont? State fish and wildlife agencies have a great record of success restoring and conserving wildlife. Hunter and angler license fees and taxes on hunting and fishing equipment have funded the bulk of this work. As a result, much of the conservation efforts have focused on game species. There has always been a serious lack of funding for those species that are not hunted or fished. SWG funds will help Vermont and other states address the needs of those species for which limited funding has been available. In many cases, SWG funded conservation projects represent the first time a species or habitat has been examined or surveyed by professionals in Vermont.

Creating Vermont's Comprehensive Wildlife Conservation Strategy

The Comprehensive Wildlife Conservation Strategy (CWCS) is an exciting opportunity to shape the future of Vermont's fish and wildlife conservation. Congress charged state fish and wildlife departments with leading the CWCS development, but Congress expects the states to solicit help, advice and expertise from other state and federal agencies, conservation and sportsmen's organizations and the general public. To this end, six technical and three coordination teams were created to ensure comprehensive scientific input into the CWCS.

What will the Comprehensive Wildlife Conservation Strategy look like? The primary purpose is to target species of greatest conservation need. However, the plan will address the full array of wildlife and habitats—taking advantage of good work already done and filling in knowledge gaps. Congress left much of the design of the CWCS up to each state, but Congress does require eight elements be included in every Strategy. Those elements are:

1. Status Check: Identify the distribution and abundance of wildlife species.
2. Habitat Check: Assess locations and condition of habitats that are vital to conserving species.
3. Key Threats: Describe problems that may harm species and priority research needs.
4. Conservation Actions: Identify prescriptions and priorities for conserving wildlife species and habitats.
5. Monitoring: Identify steps for keeping an eye on species, habitats and conservation actions.
6. Review: Assess the CWCS at intervals not to exceed 10 years.
7. Coordination: Involvement of federal, state, local agencies and Indian tribes that manage lands or programs affecting wildlife.
8. Public Participation: An essential element of developing and carrying out plans.

You can find periodic updates and background materials on the development of the Comprehensive Wildlife Conservation Strategy at the department's CWCS website www.vtfishandwildlife.com/swg_home.cfm. A draft of the CWCS will be posted on the website in April 2005, and public meetings will be held after that. If you want additional information, or if you have comments or suggestions, contact CWCS Coordinator Jon Kart at jon.kart@anr.state.vt.us or 802-241-3652.

American marten / USFWS

Here Kitty Kitty

by Jon Kart

Anyone who's ever looked for a home knows how difficult it can be to find the right place. Choices are rarely simple. Would you accept a smaller living room if the view was great? What if the house were close to work? How close do shopping or schools need to be? How much privacy do you want? Clearly, finding the right place is a blend of many factors.

We're not alone. Many wildlife species face the same questions. Though some species are quite easy to satisfy—you can find squirrels in almost any forest, woodlot or suburban yard—others are more discriminating.

The bobcat is in the latter category. Although bobcats are found throughout Vermont, it is an elusive animal with special habitat needs that aren't fully understood.

It is believed a combination of steep rocky ledges, wetlands, and large undeveloped tracts of land connected by corridors are important to the future of bobcats in Vermont. However, no one is sure how bobcat reproduction and survival are impacted by the loss or degradation of these habitats. As development pressure increases in Vermont, bobcat habitat might be lost or fragmented.

Wildlife biologists will tackle this home design puzzle using funding from the State Wildlife Grants program. University of Vermont Cooperative Extension Unit, in cooperation with the Vermont Fish & Wildlife Department, will evaluate how ledge habitat, landscape fragmentation, road densities, and increasing human densities affect bobcat habitat use, bobcat birth rates, and bobcat survivability.

Ten to twenty bobcats in northwestern Vermont will be fitted with radio collars. The high-tech collars will record time, date, level of activity, and temperature every five hours. Biologists will be able to track the bobcats' movements over a two-year period. The movements will be mapped along with habitat information collected from on-the-ground surveys and remote-sensing geographic information systems (GIS) data.

The end product will be a picture of how bobcats move through their territories and should reveal the requirements of healthy bobcat communities. This will allow land and wildlife managers to identify and manage important bobcat habitat, ensuring bobcats will be around in Vermont for future generations to enjoy.

The State Wildlife Grants (SWG) program plays a vital role in efforts to conserve Vermont's wildlife. In many cases SWG-funded projects represent the first time species and habitats have been examined, studied or surveyed by experts. Since 2001, SWG has funded more than 40 programs in Vermont including conservation research and recovery planning, terrestrial and aquatic habitat assessments, and the inventory and monitoring of rare and uncommon species. Here is a list of current and ongoing SWG-funded projects.

- Bobcat habitat use and habitat assessment.
- Improving road/stream crossing structures to aid fish and other aquatic organisms.
- Statewide all-bird inventory (atlas).
- Statewide butterfly inventory (atlas).
- Lake Champlain deepwater forage fish inventory.
- Inventory for rare and uncommon non-game fish such as sculpin, stonecat, several species of redhorse, shiner and darter.
- Comprehensive inventories of State Wildlife Management Areas for amphibians, reptiles, invertebrates, non-game fish, birds, and mammals.
- Inventory and recovery planning for several species of rare tiger beetles.
- Public workshops to reduce the spread of invasive non-native fish sold as bait fish.
- Lake sturgeon inventory and recovery planning.
- Muskellunge inventory and recovery planning.
- Stream temperature and habitat improvement.
- Bicknell Thrush inventory and habitat assessment.
- Research on the Black-throated blue warbler.
- DNA-based fish health research.

Robert Savannah - USFWS

Pipe Dreams

by Christa Alexander

Imagine you are a brook trout. You pride yourself with being a strong swimmer and a pretty good leaper. You can scale steep brooks and shimmy through log jams. But for the life of you, you can't leap three feet up into that culvert and swim 150 feet through ripping stream flow to reach that primo spawning habitat upstream. You can sense it's there—you can almost smell it. But it's beyond reach.

Such is the case for many fish and other aquatic organisms throughout Vermont's waters. There are countless barriers, such as culverts and dams that prevent wildlife from moving up and down Vermont's streams and rivers. Culverts in particular pose a daunting challenge, as there are literally thousands of them in Vermont's landscape with the potential of more being installed every day as Vermont continues to develop.

Poorly designed or installed culverts can lead to:

- direct loss of aquatic habitat
- loss of resident aquatic populations, including fish, salamanders, mussels, and other stream-dwelling animals
- loss of access to critical spawning, rearing, feeding or refuge habitat, especially for Vermont's trout species, walleye, fallfish, smelt, and other fish known to move seasonally
- altered aquatic community structure
- altered genetic composition of aquatic populations

Though Vermont road owners have legal obligations to design and install stream-crossing structures that do not hinder the movement of aquatic organisms, thousands of these structures are deficient. This is partly due to lack of sufficient understanding of aquatic organism passage needs, both in the academic and management realms. There have been many recent gains, however, elsewhere in North America in understanding the needs of aquatic organism passage at culverts. Bringing this knowledge and expertise to Vermont to better design, install and maintain stream crossing structures is essential to restoring aquatic habitat connectivity and aquatic organism movement in Vermont's rivers and streams.

Barriers, such as culverts, can prevent wildlife from moving up and down Vermont's streams and rivers.

With funding from the Wildlife Conservation and Restoration Program (the precursor to State Wildlife Grants program), and in partnership with the Vermont Agency of Transportation, the Vermont Fish & Wildlife Department is developing technical criteria and guidelines for installation and management of stream crossing structures. The department also will provide technical training and assistance to road managers, regulators, fisheries biologists and others. The goal of the project is to improve aquatic organism passage at road crossings over streams and enhance habitat connectivity in Vermont's waters.

Nature presents its own challenges for wildlife movement up and down Vermont's streams and rivers.

An Ear To The Water

by Jon Kart

The Hydro-Acoustic Project isn't the name of a band. However it will keep Bernie Pientka out late at night listening attentively. Bernie is a fisheries biologist with Vermont Fish & Wildlife Department (VFWD) and in this case he'll listen for fish—not Phish.

Bernie is interested in the forage fish community of Lake Champlain. Forage fish play a key role supporting much of the lake's food web. Most food webs resemble pyramids, with lots of species at the bottom eaten by fewer species at the top. However, rainbow smelt is the single dominant species of the deep-water fish community in Lake Champlain. If the smelt population were to decline, due to disease, pollution, the arrival of an invasive species or some other reason, much of the rest of the pyramid of larger fish could crash. In other words, this little three-ounce, iridescent fish with a pale green back and purple, blue and pink sides plays a pivotal role in the lake's ecosystem.

Clearly, keeping tabs on the smelt population is important, but counting fish in the sixth largest lake in the U.S. is no easy task. So, with financial

Continued on page 6

Wildlife Get a Check-Up

Continued from page 1

The Vermont Fish & Wildlife Department has teamed up with local, state and federal agencies and non-profit organizations who help conduct the assessments and provide oversight. Our Conservation Partners are listed on the right.

Six species teams spent several months identifying Vermont's "species of greatest conservation need" using criteria such as species rarity, vulnerability to habitat fragmentation or loss, and threat by exotic plants or animals. The list is available on the Vermont CWCS website: www.vtfishandwildlife.com/swg_home.cfm.

The species teams are Bird, Fish, Invertebrate, Mammal, Plant, and Reptile and Amphibian. Now, these teams are assessing habitat and identifying significant threats to the species. They also will develop conservation strategies to conserve these species and their habitats.

An integration team will then combine the work of the six species teams into an integrated strategy and develop monitoring plans to track wildlife progress and measure the effectiveness of the conservation strategies.

A conservation strategy review team will review the CWCS. They will make additional strategy recommendations, help gather public input, and work with the integration team to finalize the Comprehensive Wildlife Conservation Strategy.

A draft of the CWCS will be available for review and a public comment period will occur during the spring of 2005. Wildlife enthusiasts, landowners, businesses and the general public are encouraged to track and take part in CWCS development. More information can be found on the Vermont CWCS website: www.vtfishandwildlife.com/swg_home.cfm.

Conservation Partners in Vermont's Comprehensive Wildlife Conservation Strategy

The development of Vermont's Comprehensive Wildlife Conservation Strategy is a project for all Vermonters. The Vermont Fish & Wildlife Department is working with dozens of organizations representing diverse interests who have joined forces to help wildlife, including:

- American Chestnut Foundation
- Association of VT Conservation Commissions
- Audubon Vermont
- Burlington Electric Department
- Center for Woodlands Education
- Chittenden County Regional Planning Commission
- Connecticut River Watershed Council
- The Conservation Fund
- Consulting Foresters Association of Vermont
- Ducks Unlimited
- ECHO
- Endangered Species Committee
- Fairbanks Museum & Planetarium
- Forest Watch
- Green Mountain National Forest
- Hunters, Anglers & Trappers Association of Vermont
- Keeping Track, Inc.
- Lake Champlain Committee
- Lake Champlain International, Inc.
- Lake Champlain Land Trust
- Lake Champlain Walleye Association
- Lewis Creek Association
- Marsh-Billings-Rockefeller NHP
- National Wild Turkey Federation
- National Wildlife Federation
- Natural Resources Conservation Service
- Nature Conservancy
- New Haven River Anglers Association
- North Country Environmental & Forestry
- Ruffed Grouse Society
- Ryegate Power Station
- Sierra Club
- Society of American Foresters
- Smugglers Notch Resort
- Sportsmen Inc.
- US Fish & Wildlife Service, Lake Champlain Fish & Wildlife Resources Complex
- US Fish & Wildlife Service, Missisquoi NWR
- US Fish & Wildlife Service, Nulhegan Basin Division
- UVM School of Natural Resources
- UVM Botany Department
- VT Agency of Transportation
- VT Association of Snow Travelers
- VT ATV Sportsman's Association, Inc.
- VT Bird Tours
- VT Cooperative Fish & Wildlife Research Unit
- VT Coverts
- VT Department of Environmental Conservation
- VT Department of Forests, Parks & Recreation
- VT Farm Bureau
- VT Federation of Sportsmen's Clubs. Inc.
- VT Fish & Wildlife Board
- VT Forest Products Association
- VT Institute of Natural Sciences
- VT Land Trust
- VT Loggers Association
- VT Natural Resources Council
- VT Outdoor Guides Association
- VT Ski Area Association
- VT State Grange
- VT Trappers Association
- VT Woodlands Association
- Wildlands Project
- Representative Steve Adams
- Office of Congressman Sanders
- Office of Senator Jeffords
- Office of Senator Leahy

Vermont Fish & Wildlife Department
Vermont Agency of Natural Resources
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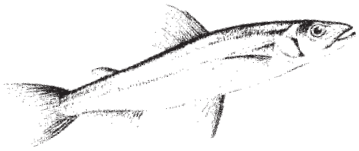
Waterbury, VT 05671-0501

An Ear To The Water

Continued from page 4

support from State Wildlife Grants, Bernie, Dave Gibson (VFWD), Nick Staats (USFWS), Donna Parrish (VT Cooperative Fish and Wildlife Research Unit) and Lars Rudstam (Cornell University) are designing a lakewide hydro-acoustic survey to track the abundance and distribution of smelt and other forage fish in the lake.

Based on a similar method used in the Great Lakes, sonar (sound waves) is used to "photograph" the fish. Some are then netted to determine the species and their age.



Rainbow smelt

Biologists can then estimate the number and age of fish in the lake. Surveys are conducted at night when the fish are more uniformly distributed, using the department's 32-foot research vessel.

Tracking changes in abundance of the forage fish community more accurately adds to our understanding of the entire Lake Champlain ecosystem. Data collected will aid biologists in evaluating and responding to changes to the ecosystem, such as the impacts of new invasive species, helping to maintain a balance in a lake so important to wildlife and people.

PLEASE DONATE TO THE NONGAME WILDLIFE FUND.

The State Wildlife Grants program makes your tax-deductible gift go ***much*** further.

For every dollar we receive for the Nongame Wildlife Fund, we can spend four dollars on protecting and enhancing Vermont's nongame wildlife and natural communities.

You can contribute to the Nongame Wildlife Fund on your Vermont income tax form, on hunting and fishing license applications, by purchasing a Conservation License Plate, or by direct donations to the Nongame Wildlife Fund, Vermont Fish & Wildlife Dept., 103 S. Main St., Waterbury, VT 05671-0501.

FISH & WILDLIFE
CONSERVATION NEWS

SPRING 2005

A publication of the Vermont Fish & Wildlife Department
Agency of Natural Resources

Inside:

Conserving Vermont's fish, wildlife, and plants and their habitats for the people of Vermont.

VERMONT
FISH & WILDLIFE DEPARTMENT
www.vtfishandwildlife.com
(802) 241-3700

Recovery success! Thanks to long-term management efforts, Osprey, Peregrine Falcon and Common Loon are off Vermont's Threatened and Endangered Species List.

Good News and Bright Futures

by Jon Kart, CWCS Coordinator

This is a classic story of hard work and cooperation. It's certainly one to celebrate.

Ospreys, common loons and peregrine falcons--each exciting and fascinating birds--were removed from the State's Endangered Species List in April 2005. This it the first time *any* endangered species in Vermont has recovered sufficiently to warrant delisting. In the words of John Hall, veteran FWD staffer, "No one thought the recovery programs would be so successful so quickly."

It wasn't always this way.

Osprey, loon and peregrine falcon, each evolved over eons to take advantage of their particular niche. But by the mid to late 1900s challenges overwhelmed them.

Among the worst, poorly designed development shredded habitats, pollutants such as lead caused mortality, and eggs were so weakened from pesticides that shells collapsed under the weight of expectant parents. Populations plummeted. Peregrine falcons were gone from Vermont by the mid-1900s. Osprey nesting ceased in the early 1970s. By 1983 only eight breeding pairs of common loons remained in Vermont.

Something had to be done. And it was.

All three species benefited from the

Continued on page 5

Nine Great Reasons to Support the CWCS

by Jon Kart, CWCS Coordinator

The Comprehensive Wildlife Conservation Strategy (CWCS) is the largest wildlife conservation planning project ever in Vermont and the nation. Intensive development efforts have been under way since January 2004. With just a few short months until completion, two feelings well up as I review what we've accomplished so far: exhaustion and excitement. I'll spare you the first, but I will share nine exciting reasons to support Vermont's CWCS.

1. This is an historic effort: this kind of comprehensive endeavor has never been done before in Vermont. Every state and territory in the nation is also developing a CWCS.
2. The goal is to prevent wildlife populations from declining and being listed on the Threatened and Endangered Species List. Keeping common species common means more wildlife to enjoy and fewer regulatory requirements.
3. This is a rigorous review process to determine conservation priorities for species that have previously received little attention.
4. The CWCS asks: What species and habitats are most at risk? What are the risks and threat factors? Most importantly, what are the appropriate actions needed to improve or keep populations from declining? Strategic action is the name of the game. The CWCS will be packed with action recommendations such as: Providing technical assistance to anglers, landowners and/or communities to better manage habitat; creating safer passage over or under roads where they intersect wildlife corridors; and, providing financial incentives for private landowners to protect key habitats.
5. The Vermont Fish & Wildlife Department is working with a broad cross section of Vermonters to create the CWCS. From wildlife experts to sportsmen to other conservationists to industry leaders and state and federal agencies, more than 60 entities have signed on as CWCS Conservation Partners.
6. This effort has emerged through the work of a broad national bipartisan wildlife conservation coalition called Teaming with Wildlife. The Teaming with Wildlife coalition includes more than 3,000 organizations.
7. The CWCS is not just a planning exercise—the strategies in it will guide the existing State Wildlife Grants program (SWG). Vermont has received almost $3 million in SWG funds since its inception is 2001 and more is expected for implementation.
8. The task of conserving declining wildlife is challenging, but we know success is possible from our history with wildlife conservation successes such as the wild turkey, white-tailed deer, beaver, moose, wood duck, Canada goose, fisher, osprey, common loon, and peregrine falcon.
9. The Comprehensive Wildlife Conservation Strategy and the State Wildlife Grants mark the start of a new era in wildlife conservation, one where we hope to keep common species common.

Your input is needed too. For more information and meeting dates go to the Fish & Wildlife website: ***www.vtfishandwildlife.com*** *and click on Comprehensive Wildlife Strategy under the Wildlife Programs drop-down menu.*

One of the goals of the Comprehensive Wildlife Conservation Strategy is to keep common species--like this red eft--common, so there is more wildlife to enjoy.

Private Landowners are the Key to Vermont Wildlife Conservation

by Jon Kart, CWCS Coordinator

Tree and shrub planting is one way private landowners can improve wildlife habitat under the Wildlife Habitat Incentive Program.

Some of Vermont's best wildlife biologists, fisheries biologists, ecologists, botanists, foresters, planners, water quality specialists, hunters, trappers, anglers, and conservationists spent much of the past year developing our Comprehensive Wildlife Conservation Strategy (CWCS). From the black sandshell (mussel) to golden-winged warbler, silver redhorse to blue-spotted salamander, these experts are gauging the health of wildlife populations and developing prescriptions for healthy wildlife futures.

When asked about the big picture, how to prevent extinctions and keep common species common, most will tell you "private landowners are the key to wildlife conservation in Vermont." With 87 percent of the state in private ownership and economic conditions driving the sale and subdivision of much of the state's forest and farmlands, it's an astute and challenging reply.

The Fish & Wildlife Department has long worked to address this challenge, but now two federal programs are providing the needed funding to move efforts in new directions. These are the State Wildlife Grants program (SWG), and the Wildlife Habitat Incentives Program (WHIP). SWG funds will be used to implement the CWCS. Expect the CWCS to include many cooperative strategies such as: providing technical assistance to landowners, towns and communities to help them better manage wildlife habitat; financial incentives for habitat management; education programs concerning habitat and species requirements; and strategies for protecting critical habitat resources.

A test program will begin this spring cosponsored by Vermont Fish & Wildlife and Vermont Coverts, a nonprofit group dedicated to encouraging the maintenance and improvement of wildlife habitat on private forestlands. Coverts will serve as a liaison to private landowners and assist the department in providing habitat management and technical assistance for conservation of species of greatest conservation need.

The WHIP program, administered by the USDA Natural Resources Conservation Service (NRCS), helps landowners create and enhance wildlife habitat on their property. NRCS and the department are partners in the implementation of the WHIP program. "We'll help develop habitat plans and recommend ways to carry out management practices that create, restore and enhance fish and wildlife habitat," explained Mary Beth Adler, one of the department's new habitat specialists. "WHIP provides financial assistance in the form of cost share payments to enhance habitat on eligible land and also provides participants with technical assistance and educational materials for wildlife habitat needs. Our goal is to foster a positive public attitude towards wildlife, wildlife habitat and land stewardship."

Wildlife may face new challenges in the coming years. But the Vermont Fish & Wildlife, NRCS, Coverts, and its other partners are gearing up to meet them.

For more information about WHIP, contact Dave Adams 879- 2330 (Essex), Mary Beth Adler 885-8836 (Springfield) or Fred Schroeder 786-3879 (Rutland) or see the department's Habitat Highlights newsletter available on line at www.vtfishandwildlife.com.

SPEAK UP!

Public Meetings for Vermont's Comprehensive Wildlife Conservation Strategy

July 12: Montpelier High School, Montpelier. 7-8:30p.m.

July 14: Burr and Burton Academy, 57 Seminary Ave. Manchester. 7-8:30p.m.

Public meetings will include information packets, a presentation on the CWCS, and a question and answer session. Copies of the CWCS will be available through our website beginning approximately July 6th. Comments and questions can also be submitted electronically at: **www.vtfishandwildlife.com/SWG_home.cfm**

CSI:VT Fish Lab

by Jon Kart, CWCS Coordinator

Hurrying to a dependable Vermont trout stream, two anglers can't wait to start their spring day. Wading to their favorite location, one of the anglers notices several small trout struggling to swim. Investigating further they notice that the fish start to swim erratically, whirling about. Soon the fish tire, lying on their sides, gasping rapidly. The anglers are concerned; they have never seen trout like this before.

Smooth as glass, the picturesque lake is a haven for many fish species. A lone bass fisherman notices hundreds of dead carp floating on the surface. Taking a closer look, he notices red sores on the carp.

The two scenarios above are hypothetical but could become a troublesome reality in Vermont. In both cases, anglers would likely report their findings to the Vermont Fish & Wildlife Department or the Vermont Department of Environmental Conservation. Both are responsible for investigating fish kills in the state.

Vermont Fish & Wildlife Department fish health biologists, Thomas Jones or Barbara Johnston, would respond to the scene, collecting potential evidence to establish a cause. Each scenario is an example of a disease that is of major concern to the department: Whirling Disease, a parasite, and Spring Viremia of Carp, a virus.

In 2002, Whirling Disease was first discovered in brook trout and brown trout from Vermont's Batten Kill River. For official confirmation of this disease in the Batten Kill River, samples were sent out-of-state.

Spring Viremia of Carp is a new

Continued on page 5

Conservation Partners in Vermont's Comprehensive Wildlife Conservation Strategy

The Vermont Fish & Wildlife Department is working with dozens of organizations representing diverse interests who have joined forces to help wildlife, including:

- American Chestnut Foundation
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- Audubon Vermont
- Burlington Electric Department
- Center for Woodlands Education
- Chittenden County Regional Planning Commission
- Connecticut River Watershed Council
- The Conservation Fund
- Consulting Foresters Association of Vermont
- Ducks Unlimited
- ECHO
- Endangered Species Committee
- Fairbanks Museum & Planetarium
- Forest Watch
- Green Mountain National Forest
- Hunters, Anglers & Trappers Association of Vermont
- Keeping Track, Inc.
- Lake Champlain Committee
- Lake Champlain International, Inc.
- Lake Champlain Land Trust
- Lake Champlain Walleye Association
- Lewis Creek Association
- Marsh-Billings-Rockefeller NHP
- National Wild Turkey Federation
- National Wildlife Federation
- Natural Resources Conservation Service
- Nature Conservancy
- New Haven River Anglers Association
- North Country Environmental & Forestry
- Ruffed Grouse Society
- Ryegate Power Station
- Sierra Club
- Smugglers Notch Resort
- Society of American Foresters
- Sportsmen Inc.
- Trout Unlimited
- US Fish & Wildlife Service, Missisquoi NWR
- US Fish & Wildlife Service, Lake Champlain Fish & Wildlife Resources Complex
- US Fish & Wildlife Service, Nulhegan Basin Division
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- VT Regional Planning Commissions
- VT Ski Area Association
- VT State Grange
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- Wildlands Project
- Representative Steve Adams
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- Office of Senator Jeffords
- Office of Senator Leahy

Good News

Continued from page 1

regulation of pesticides, habitat protection and active management under department-led programs. Partnerships with the Vermont Institute of Natural Science (VINS), National Wildlife Federation, Vermont electric utilities and private landowners, and the support of the general public were vital to these successes.

In the case of peregrines, a hacking (captive breeding) program was established. For osprey, electric utility companies helped erect nesting platforms. The loon benefited from water level stabilization during breeding season to avoid inundating nests, installation of artificial floating nests and public education. Careful monitoring of all three species was essential to assess and improve recovery efforts.

Populations of each of these birds have grown sufficiently for them to be removed from the Endangered Species List. That doesn't mean they'll be ignored from here out. Monitoring and management plans for each species will be ongoing. And, in the event that populations again decline, steps will be taken to prevent the need for re-listing.

Lessons learned: Practice Smarter Wildlife Conservation

Everyone working on these recovery projects could tell you that had we started earlier, recovery would have been much easier and cheaper. Unfortunately funding was limited. Thanks to our Congressional representatives, we now have a State Wildlife Grants program (SWG). Created in 2001, SWG provides money to every state to prevent species from becoming endangered (see related articles in this newsletter). In Vermont, SWG has funded more than 40 conservation projects to date.

"Recovering an endangered species is a milestone that every wildlife enthusiast can be proud of."
- Craig McLaughlin -

"Recovering an endangered species is a milestone that every wildlife enthusiast can be proud of. Recovering three is a great achievement to celebrate," said Craig McLaughlin, Wildlife Director for the Vermont Fish & Wildlife Department.

One of the best gifts we can give the peregrine, osprey and loon is to show that we've learned from the past. That we won't wait until another species practically disappears before taking action. With the help of the SWG program we will keep more common species common.

CSI:VT Fish Lab

Continued from page 4

disease to the United States. It was first discovered in 2002 on a North Carolina carp farm. Since then, it has been discovered in fish from a major carp kill in Cedar Lake, Wisconsin. Because of the severity of this disease, it is listed as one of the top five deadly viruses found in fish worldwide.

It takes two to three weeks for test results to return from out of state labs. This is a long, long time when diseases such as these are expected. Now, thanks to funding from the State Wildlife Grants program, the Vermont Fish & Wildlife fish health laboratory will acquire state-of-the art genetic testing equipment

Continued on page 6

Good News for Vermont's Wildlife:

State Wildlife Grants and The Comprehensive Wildlife Conservation Strategy

State Wildlife Grants (SWG) provide federal dollars to every state and territory to support conservation aimed at preventing wildlife from becoming endangered. To make the best use of the State Wildlife Grants program, Congress charged Vermont and all other states with developing a statewide Comprehensive Wildlife Conservation Strategy (CWCS) by October 2005. This newsletter highlights the development of the CWCS and the essential conservation efforts supported by State Wildlife Grants dollars.

Why is SWG essential to wildlife conservation in Vermont? State fish and wildlife agencies have a great record of success restoring and conserving wildlife. Hunter and angler license fees and taxes on hunting and fishing equipment have funded the bulk of this work. As a result, much of the conservation efforts have focused on game species. There has always been a serious lack of funding for those species that are not hunted or fished. SWG funds will help Vermont and other states address the needs of those species for which limited funding has been available. In many cases, SWG funded conservation projects represent the first time a species or habitat has been examined or surveyed by professionals in Vermont.

Vermont Fish & Wildlife Department
Vermont Agency of Natural Resources
103 South Main Street, 10 South
Waterbury, VT 05671-0501

Don't Miss The CWCS Public Meetings.
July 12 - Montpelier
July 14 - Manchester
See page 3 for details.

CSI:VT Fish Lab

Continued from page 5

that is required to confirm many fish diseases.

The new testing procedure is called Polymerase Chain Reaction. "The PCR test is a fabulous invention," said Jones. "One of the test components is produced from bacteria called *Thermus aquaticus*. This bacterium was first discovered in a hot spring in Wyoming's Yellowstone National Park." The PCR test is being used around the world with many applications, including but not limited to human diseases, evolutionary studies, genetic research, and criminology investigations.

Now it's being used to help detect, prevent and control serious fish diseases, enabling biologists to more effectively conserve and manage fish. Both Johnston and Jones are excited about obtaining this new technology provided by the State Wildlife Grant initiative.

The State Wildlife Grants (SWG) program plays a vital role in efforts to conserve Vermont's wildlife. Since 2001, SWG has funded more than 40 programs in Vermont including conservation research and recovery planning, terrestrial and aquatic habitat assessments, and the inventory and monitoring of rare and uncommon species.

Here is a list of current and ongoing SWG-funded projects.

- Bobcat habitat use and habitat assessment.
- Improving road/stream crossing structures to aid fish and other aquatic organisms.
- Statewide all-bird inventory (atlas).
- Statewide butterfly inventory (atlas).
- Lake Champlain deepwater forage fish inventory.
- Inventory for rare and uncommon non-game fish such as sculpin, stonecat, several species of redhorse, shiner and darter.
- Comprehensive inventories of State Wildlife Management Areas for amphibians, reptiles, invertebrates, non-game fish, birds, and mammals.
- Inventory and recovery planning for several species of rare tiger beetles.
- Public workshops to reduce the spread of invasive non-native fish sold as bait fish.
- Lake sturgeon inventory and recovery planning.
- Muskellunge inventory and recovery planning.
- Stream temperature and habitat improvement.
- Bicknell's thrush inventory and habitat assessment.
- Research on the black-throated blue warbler.
- DNA-based fish health research.

Vermont's
Wildlife Action Plan

November 22, 2005

Appendix-H
Secure Species: Assessment Forms for Species Not Selected as SGCN

Secure Species Summary

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Group	Species	Secure?	At Risk Due To:							Uncertainties:		Other Considerations:								
			Habitat Loss or Change	*Habitat Fragmentation*	*Life History Limitations*	*Taking Threats*	*Deadly Human Contact*	*Limited Local Populations*	*Threatened by Exotics*	*Uncertain Status*	*Uncertain Taxonomy*	*Keystone Species*	*Responsibility Species*	*Endemic Species*	*Specialized Habitat*	*Limited Dispersal*	*Key VT Migration Stop*	*Selected by Experts*	*Actively Managed*	*Relationship to Core Range*
Herp	Desmognathus fuscus (Nothern Dusky Salamander)	Yes	Y	Y	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	central
Herp	Eurycea bislineata (Northern Two-lined Salamander)	Yes	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	central
Herp	Gyrinophilus porphyriticus (Spring Salamander)	Yes	Y	Y	N	N	N	N	N	N	N	N	Y	N	Y	Y	N	N	N	central
Herp	Plethodon cinereus (Northern Redback Salamander)	Yes	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	central
Herp	Notophthalmus viridescens (Eastern Newt)	Yes	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	central
Herp	Bufo americanus (American Toad)	Yes	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	central
Herp	Hyla versicolor (Gray Treefrog)	Yes	Y	Y	N	N	Y	N	N	N	N	N	N	N	N	Y	N	N	N	central
Herp	Pseudacris crucifer (Spring Peeper)	Yes	Y	Y	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	central
Herp	Rana catesbeiana (Bullfrog)	Yes	Y	N	N	Y	Y	N	N	N	N	N	N	N	N	Y	N	N	N	central
Herp	Rana clamitans (Green Frog)	Yes	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	Central
Herp	Rana palustris (Pickerel Frog)	Yes	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	central
Herp	Rana pipiens (Northern Leopard Frog)	Yes	N	N	N	Y	Y	N	N	N	N	N	N	N	N	Y	N	N	N	cenral
Herp	Rana septentrionalis (Mink Frog)	Yes	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	peripheral
Herp	Rana sylvatica (Wood Frog)	Yes	Y	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	central
Herp	Chelydra serpentina (Common Snapping Turtle)	Yes	N	N	N	Y	Y	N	N	N	N	N	N	N	N	Y	N	N	N	central
Herp	Chrysemys picta (Painted Turtle)	Yes	N	N	N	N	Y	N	N	N	N	N	N	N	N	Y	N	N	N	central

NOTE: Y = Yes, N = No, and U = Unknown

Group	Species	Secure?	At Risk Due To:							Uncertainties:		Other Considerations:								
			Habitat Loss or Change	*Habitat Fragmentation*	*Life History Limitations*	*Taking Threats*	*Deadly Human Contact*	*Limited Local Populations*	*Threatened by Exotics*	*Uncertain Status*	*Uncertain Taxonomy*	*Keystone Species*	*Responsibility Species*	*Endemic Species*	*Specialized Habitat*	*Limited Dispersal*	*Key VT Migration Stop*	*Selected by Experts*	*Actively Managed*	*Relationship to Core Range*
Herp	Graptemys geographica (Common Map Turtle)	Yes	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	peripheral
Herp	Diadophis punctatus (Ringneck Snake)	Yes	N	N	Y	N	Y	N	N	N	N	N	N	N	N	Y	N	N	N	central
Herp	Lampropeltis triangulum (Milk Snake)	Yes	N	N	N	N	Y	N	N	N	N	N	N	N	N	Y	N	N	N	central
Herp	Storeria occipitomaculata (Redbelly Snake)	Yes	N	N	N	N	Y	N	N	N	N	N	N	N	N	Y	N	N	N	central
Herp	Thamnophis sirtalis (Common Garter Snake)	Yes	N	N	N	N	Y	N	N	N	N	N	N	N	N	Y	N	N	N	Central
Bird	Ardea alba (Great Egret)										N	N		N						
Bird	Egretta thula (Snowy Egret)	no	Y		Y	N	N	Y	N	N	N	N		N	Y	N	N		N	peripheral
Bird	Bubulcus ibis (Cattle Egret)	no	Y		Y	N	Y	U	N	N	N	N	N	N	Y	N	N		N	peripheral
Bird	Chen caerulescens (Snow Goose)					N					N	N		N		N	N			
Bird	Branta canadensis (Canada Goose)										N	N		N						
Bird	Aix sponsa (Wood Duck)					N					N	N		N		N	N			
Bird	Anas platyrhynchos (Mallard)										N	N		N						
Bird	Anas acuta (Northern Pintail)										N	N		N						
Bird	Anas strepera (Gadwall)										N	N		N						
Bird	Anas americana (American Wigeon)										N	N		N						
Bird	Aythya collaris (Ring-necked Duck)	Unknown	U		N	Y	N	U	N	Y	N	N	N	N	N	N	N	N	N	Peripheral
Bird	Melanitta nigra (Black Scoter)	Unknown	U		N	Y	Y	N	Y	Y	N	N	U	N	Y	N	Y		Y	Central
Bird	Mergus serrator (Red-breasted Merganser)					N					N	N		N		N	N			
Bird	Accipiter striatus (Sharp-shinned Hawk)										N	N		N						
Bird	Falco columbarius (Merlin)										N	N		N						
Bird	Rallus limicola (Virginia Rail)	unknown	Y		N	N	N	N	N	Y	N	N	N	N	N	N	N		N	core
Bird	Gallinula chloropus (Common Moorhen)					N					N	N		N		N	N			

Group	Species	Secure?	At Risk Due To:							Uncertainties:		Other Considerations:								
			Habitat Loss or Change	Habitat Fragmentation	Life History Limitations	Taking Threats	Deadly Human Contact	Limited Local Populations	Threatened by Exotics	Uncertain Status	Uncertain Taxonomy	Keystone Species	Responsibility Species	Endemic Species	Specialized Habitat	Limited Dispersal	Key VT Migration Stop	Selected by Experts	Actively Managed	Relationship to Core Range
Bird	Charadrius vociferus (Killdeer)	yes	Y		Y	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	Central
Bird	Gallinago delicata (Wilson's Snipe)	Yes	Y		N	Y	N	N	Y	Y	N	N	M	N	N	N	N		Y	Central
Bird	Larus philadelphia (Bonaparte's Gull)	Yes	U		N	N	Y	N	Y	Y	N	N	M	N	Y	N	Y		N	Central
Bird	Larus argentatus (Herring Gull)	yes	N		Y	N	N	N	N	N	N	N	N	N	Y	N	N		N	core
Bird	Larus marinus (Great Black-backed Gull)	yes	N		N	N	N	N	N	N	N	N	N	N	N	N	N		N	unknown
Bird	Coccyzus americanus (Yellow-billed Cuckoo)										N	N		N					N	
Bird	Aegolius acadicus (Northern Saw-whet Owl)	Yes								N	N									
Bird	Melanerpes erythrocephalus (Red-headed Woodpecker)										N	N		N					N	
Bird	Sphyrapicus varius (Yellow-bellied Sapsucker)	Yes	N		N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Central
Bird	Colaptes auratus (Northern Flicker)	Yes	Y		N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Central
Bird	Contopus virens (Eastern Wood-pewee)	Unknown	U	U	N	N	N	N	N	Y	N	N	U	N	N	N	N	N	N	Central
Bird	Empidonax flaviventris (Yellow-bellied Flycatcher)	Unknown	Y		N	N	N	N	N	Y	N	N	U	N	N	N	N		N	Peripheral
Bird	Empidonax alnorum (Alder Flycatcher)																			
Bird	Empidonax minimus (Least Flycatcher)	Unknown	Y		N	N	N	N	N	Y	N	N	U	N	N	N	N		N	Central
Bird	Sayornis phoebe (Eastern Phoebe)										N	N		N			N		N	
Bird	Eremophila alpestris (Horned Lark)	Unknown	Y	U	N	N	N	N	N	Y	N	N	N	N		N	N		N	Central
Bird	Stelgidopteryx serripennis (Northern Rough-winged Swallow)										N	N		N		N	N			
Bird	Riparia riparia (Bank Swallow)										N	N		N		N	N			
Bird	Hirundo rustica (Barn Swallow)										N	N		N		N	N			

Group	Species	Secure?	At Risk Due To:							Uncertainties:		Other Considerations:								
			Habitat Loss or Change	Habitat Fragmentation	Life History Limitations	Taking Threats	Deadly Human Contact	Limited Local Populations	Threatened by Exotics	Uncertain Status	Uncertain Taxonomy	Keystone Species	Responsibility Species	Endemic Species	Specialized Habitat	Limited Dispersal	Key VT Migration Stop	Selected by Experts	Actively Managed	Relationship to Core Range
Bird	Poecile hudsonica (Boreal Chickadee)	No	Y		N	N	N	N	N	Y	N	N	U	N	N	U	N		N	Peripheral
Bird	Thryothorus ludovicianus (Carolina Wren)				N	N	N	Y	U		N	N	N	N	Y	N	N	N	N	Peripheral
Bird	Cistothorus palustris (Marsh Wren)	Yes	Y	N	N	N	N	Y	Y	Y	N	N	M	N	Y	N	N		N	Peripheral
Bird	Sialia sialis (Eastern Bluebird)	Yes	Y	Y	Y	N	N	N	Y	N	N	N	N	N	N	N	N	Y	N	peripheral
Bird	Bombycilla garrulus (Bohemian Waxwing)	Unknown	U		Y	N	Y	N	Y	Y	N	N	U	N	N	N	N		N	Peripheral
Bird	Lanius ludovicianus migrans (Migrant Loggerhead Shrike)	No	Y	U	N	N	N	N	N	N	Y	N	N	N	U	N	N		N	Peripheral
Bird	Vireo solitarius (Blue-headed)		Y	Y	N	N	N	N	N	Y	N	N	U	N	N	N	N	N	N	Central
Bird	Vireo gilvus (Warbling Vireo)		N	N	N	N	N	N	N			N	U	N	N	N	N		N	Central
Bird	Vireo philadelphicus (Philadelphia Vireo)		Y	U	N	N	N	N	N			N	N	N	N	N	N		N	Peripheral
Bird	Vermivora peregrina (Tennessee Warbler)	Yes	Y		N	N	N	N	N	Y	N	N	U	N	N	N	N		N	Peripheral
Bird	Parula americana (Northern Parula)		U		N	N	N	N	N	Y	N	N	Y	N	U		N		N	Central
Bird	Dendroica tigrina (Cape May Warbler)	Unknown	Y		Y	N	N	N	N	Y	N	N	N	N	Y	N	N		N	Peripheral
Bird	Dendroica virens (Black-throated Green Warbler)	Yes	N		N	N	N	N	N	N	N	N	Y	N	N	N	N		N	Central
Bird	Dendroica fusca (Blackburnian Warbler)	Yes	Y	Y	N	N	N	N	N	Y	N	N	U	N	N	N	N	N	N	Central
Bird	Dendroica palmarum (Palm Warbler)	Unknown	N		N	N	N	N	N	Y	N	N	N	N	Y	N	N		N	Peripheral
Bird	Mniotilta varia (Black-and-white Warbler)	Unknown	Y	Y	N	N	N	N	N	Y	N	N	U	N	N	N	N		N	Central
Bird	Setophaga ruticilla (American Redstart)	Unknown	Y	Y	N	N	N	N	N	Y	N	N	M	N	N	N	N		N	Central
Bird	Seiurus noveboracensis (Northern Waterthrush)	Yes	Y	Y	N	N	N	N	N	Y	N	N	U	N	N	N	N		N	Central
Bird	Seiurus motacilla (Louisiana Waterthrush)	Unknown	N	Y	N	N	N	N	N	Y	N	N	U	N	Y	N	N		N	Peripheral

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Bird	Wilsonia pusilla (Wilson's Warbler)	Unknown	N		N	N	N	N	N	Y	N	N	N	N	N	N	N		N	Peripheral
Bird	Piranga olivacea (Scarlet Tanager)					N		N				N		N			N		N	
Bird	Pheucticus ludovicianus (Rose-breasted Grosbeak)					N		N				N		N			N		N	
Bird	Passerculus sandwichensis (Savannah Sparrow)	unknown	Y	Y	N	N	Y	N	N	Y	N	N		N	N	N	N		N	core
Bird	Icterus spurius (Orchard Oriole)	No	N		N	N	N	U	Y	Y	N	N	N	N	N	N	N	Y	N	Peripheral
Bird	Icterus galbula (Baltimore Oriole)	Yes	U		N	N	N	N	N	Y	N	N	N	N	N	N	N		N	unknown
Bird	Carpodacus purpureus (Purple Finch)	Unknown	N		N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	Central
Bird	Loxia curvirostra (Red Crossbill)																			
Bird	Loxia leucoptera (White-winged Crossbill)																			
Fish	Cottus cognatus (Slimy Sculpin)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Central
Fish	Lepisosteus osseus (Longnose Gar)	No	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral
Fish	Amia calva (Bowfin)	No	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral
Fish	Dorosoma cepedianum (Gizzard Shad)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N		Peripheral
Fish	Oncorhynchus mykiss (Rainbow Trout)																			
Fish	Salmo trutta (Brown Trout)																			
Fish	Osmerus mordax (Rainbow Smelt)	Yes	Y		N	Y	N	N	Y	N	N		N	N	N	N		N		Central
Fish	Umbra limi (Central Mudminnow)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral
Fish	Esox lucius (Northern Pike)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	Y	Peripheral
Fish	Esox niger (Chain Pickerel)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Central
Fish	Carassius auratus (Goldfish)																			

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Fish	Couesius plumbeus (Lake Chub)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Central
Fish	Cyprinus carpio (Common Carp)																			
Fish	Exoglossum maxillingua (Cutlips Minnow)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral
Fish	Hybognathus regius (Eastern Silvery Minnow)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Central
Fish	Notemigonus crysoleucas (Golden Shiner)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Central
Fish	Notropis atherinoides (Emerald Shiner)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral
Fish	Notropis hudsonius (Spottail Shiner)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Central
Fish	Notropis rubellus (Rosyface Shiner)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral
Fish	Notropis stramineus (Sand Shiner)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral
Fish	Notropis volucellus (Mimic Shiner)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral
Fish	Phoxinus eos (Northern Redbelly Dace)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Central
Fish	Phoxinus neogaeus (Finescale Dace)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral
Fish	Pimephales notatus (Bluntnose Minnow)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral
Fish	Pimephales promelas (Fathead Minnow)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral
Fish	Rhinichthys atratulus (Blacknose Dace)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Central
Fish	Rhinichthys cataractae (Longnose Dace)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Central
Fish	Scardinius erythrophthalmus (Rudd)																			
Fish	Semotilus atromaculatus (Creek Chub)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Central
Fish	Semotilus corporalis (Fallfish)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Central
Fish	Cyprinella spiloptera (Spotfin Shiner)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral

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Fish	Luxilus cornutus (Common Shiner)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Central
Fish	Margariscus margarita (Pearl Dace)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral
Fish	Catostomus catostomus (Longnose Sucker)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Central
Fish	Catostomus commersoni (White Sucker)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Central
Fish	Moxostoma carinatum (River Redhorse)																			
Fish	Moxostoma hubbsi (Copper Redhorse)																			
Fish	Ictalurus punctatus (Channel Catfish)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral
Fish	Ameiurus natalis (Yellow Bullhead)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral
Fish	Ameiurus nebulosus (Brown Bullhead)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Central
Fish	Percopsis omiscomaycus (Trout-perch)																			
Fish	Lota lota (Burbot)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Central
Fish	Fundulus diaphanus (Banded Killifish)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Central
Fish	Labidesthes sicculus (Brook Silverside)																			
Fish	Culaea inconstans (Brook Stickleback)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral
Fish	Morone americana (White Perch)																			
Fish	Morone saxatilis (Striped Bass)																			
Fish	Ambloplites rupestris (Rock Bass)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral
Fish	Lepomis gibbosus (Pumpkinseed)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Central
Fish	Lepomis macrochirus (Bluegill)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral
Fish	Lepomis microlophus (Redear Sunfish)																			

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Fish	Micropterus dolomieu (Smallmouth Bass)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	Y	Peripheral
Fish	Micropterus salmoides (Largemouth Bass)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	Y	Peripheral
Fish	Pomoxis annularis (White Crappie)																			
Fish	Pomoxis nigromaculatus (Black Crappie)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	Y	Peripheral
Fish	Etheostoma exile (Iowa Darter)																			
Fish	Etheostoma flabellare (Fantail Darter)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral
Fish	Etheostoma olmstedi (Tessellated Darter)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Central
Fish	Perca flavescens (Yellow Perch)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	Y	Central
Fish	Percina caprodes (Logperch)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral
Fish	Sander vitreum (Walleye)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	Y	Peripheral
Fish	Aplodinotus grunniens (Freshwater Drum)	Yes	N		N	N	N	N	N	N	N		N	N	N	N		N	N	Peripheral
Mammal	Didelphis virginiana (Virginia Opossum)	yes	N		Y	N	N	N	N	N	N	N	N	N	N	N	N		Y	peripheral
Mammal	Blarina brevicauda (Northern Short-tailed Shrew)	yes	N		N	N	N	N	N	N	M	N	U	N	N	N	N		N	no
Mammal	Condylura cristata (Star-nosed Mole)	yes	N		N	N	N	N	U	N	N	N	N	N	N	N	N		N	no
Mammal	Sylvilagus floridanus (Eastern Cottontail)	yes	N		N	N	N	N	N	Y	N	N	N	N	N	N	N		Y	no
Mammal	Lepus americanus (Snowshoe Hare)	yes	Y		N	N	N	N	U	U	N	N	N	N	N	N	N		Y	central
Mammal	Tamias striatus (Eastern Chipmunk)	yes	N		N	N	N	N	N	N	N	N	N	N	N	N	N		N	central
Mammal	Marmota monax (Woodchuck)	yes	Y		N	N	N	N	N	N	N	N	N	N	N	N	N		N	central
Mammal	Sciurus carolinensis (Eastern Gray Squirrel)	yes	N		N	N	N	N	N	N	N	N	N	N	N	N	N		Y	central
Mammal	Tamiasciurus hudsonicus (Red Squirrel)	yes	N		N	N	N	N	N	N	N	N	N	N	N	N	N		N	central

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Mammal	Castor canadensis (American Beaver)	yes	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N		Y	central
Mammal	Peromyscus maniculatus (Deer Mouse)	yes	N		N	N	N	N	N	N	N	N	N	N	N	N	N		N	central
Mammal	Peromyscus leucopus (White-footed Mouse)	yes	N		N	N	N	N	N	N	N	N	N	N	N	N	N		N	central
Mammal	Clethrionomys gapperi (Southern Red-backed Vole)	yes	N		N	N	N	N	N	Y	N	N	N	N	N	N	N		N	central
Mammal	Microtus pennsylvanicus (Meadow Vole)	yes	N		N	N	N	N	N	N	N	N	N	N	N	N	N		N	central
Mammal	Rattus norvegicus (Norway Rat)																			
Mammal	Zapus hudsonius (Meadow Jumping Mouse)	yes	N		N	N	N	N	N	N	N	N	N	N	N	N	N		N	central
Mammal	Napaeozapus insignis (Woodland Jumping Mouse)	yes	N		N	N	N	N	N	N	N	N	N	N	N	N	N		N	central
Mammal	Erethizon dorsatum (Common Porcupine)	yes	N		N	N	N	N	N	N	N	N	N	N	N	N	N		N	central
Mammal	Canis latrans (Coyote)	yes	N		N	N	N	N	N	N	Y	N	N	N	N	N	N		Y	central
Mammal	Vulpes vulpes (Red Fox)	yes	N		N	N	N	N	N	N	Y	N	N	N	N	N	N		Y	central
Mammal	Procyon lotor (Common Raccoon)	yes	N		N	N	N	N	N	N	N	N	N	N	N	N	N		Y	central
Mammal	Martes pennanti (Fisher)	yes	N		N	N	N	N	N	N	N		N	N	N	N	N		Y	central
Mammal	Mustela erminea (Ermine)	yes	N		N	N	N	N	N	N	N	N	N	N	N	N	N		Y	central
Mammal	Gulo gulo (Wolverine)	no	Y		N	N	N	N	N	N	N	N	N	N	N	N	N		N	peripheral
Mammal	Mephitis mephitis (Striped Skunk)	yes	N		N	N	N	N	N	N	N	N	N	N	N	N	N		Y	central
Mammal	Cervus elaphus (Wapiti or Elk)	NA	N		N	N	N	N	U	N	Y	N	N	N	N	N	N		N	central
Mammal	Alces alces (Moose)	na	N		N	N	N	N	N	N	N	N	N	N	N	N	N		N	
Mammal	Rangifer tarandus (Caribou)	yes	N		N	N	N	N	N	N	N	N	N	N	N	N	N		Y	periferal

Vermont's
Wildlife Action Plan

November 22, 2005

Appendix I
Explanation of Legal Status and Information Ranks used by the Nongame & Natural Heritage Program, Vermont Fish & Wildlife Department

Appendix I: Explanation of Legal Status and Information Ranks
Nongame & Natural Heritage Program
Vermont Fish & Wildlife Department

Legal Status

State Status per the Vermont Endangered Species Law (10 V.S.A. Chap. 123)

E: Endangered: in immediate danger of becoming extirpated in the state

T: Threatened: with high possibility of becoming endangered in the near future

Information Categories only; not established by this law

SC: Special Concern: rare; status should be watched

PE: Proposed for endangered

PT: Proposed for threatened

Federal Status As per the Federal Endangered Species Act (P.L. 93-205)

LE: Listed endangered

LT: Listed threatened

Natural Heritage Ranking: Informational categories only; not established by law. Developed by the Science Division of The Nature Conservancy.

State Ranks of Plants, Animals, and Natural Communities

State ranks are assigned by the Nongame & Natural Heritage Program based on the best available information. Ranks are reviewed annually. For bird species the ranks refer to breeding status only.

S1: Very rare, generally 1 to 5 occurrences believed to be extant and/or some factor(s) making it especially vulnerable to extirpation from the state

S2: Rare, generally 6 to 20 occurrences believed to be extant and/or some factor(s) making it vulnerable to extirpation in the state

S3: Uncommon, believed to be more than 20 occurrences and/or there is some threat to it in the state

S4: Apparently secure in state, often with more than 100 occurrences

S5: Demonstrably secure in state

SA: Accidental in state

SE: An exotic established in state

SH: Known from historical records only

SR: Reported from the state, but without persuasive documentation

SRF: Reported in error but this error persisted in the literature

SP: Possible in the state but no reported or documented records

SSYN: No longer considered a taxon in the state.

SZ: Not of practical conservation concern because there are no definable occurrences

SX: Extirpated from the state

SU: Status uncertain

?: Denotes provisional rank

Breeding Status (primarily birds) only for species which have distinct breeding and or non-breeding populations

B: Breeding status e.g. S1B is a very rare breeder

N: Nonbreeding status e.g. S1N is a very rare nonbreeder; and SZN is a migrant that occurs in an irregular, transitory, and/or dispersed manner

Global Ranks of Plants, Animal, and Natural Communities

Global Ranks are assigned by the international network of Natural Heritage Data Centers. The ranks are tracked by The Nature Conservancy and by The Natural Heritage Programs. They reflect the rarity and endangerment of species worldwide.

G1: Critically imperiled globally (on the order of 1-5 occurrences worldwide)

G2: Endangered globally (ca. 6-20 occurrences worldwide)

G3: Threatened globally: rare and/or local

G4: Apparently secure globally, though perhaps locally rare

G5: Demonstrably secure globally

T: Subrank for subspecies and varieties; 1-5 ranking similar to G ranks

Q: Questionable taxonomic assignment

?: Denotes provisional rank

NE: Exotic established in nation

GU: Status uncertain

For further information contact
Vermont Nongame and Natural Heritage Program,
Fish and Wildlife Department
Waterbury, VT 05671-0501

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Appendix: J
State Wildlife Grants
Competitive Grant Program Proposal
Evaluation Form

State Wildlife Grants
Competitive Grant Program
Proposal Evaluation Form

Draft 6/1/05

Project Title:_____

Submitted by:_____

Cooperators (if any)_____

Date submitted:_____

Estimated Project Cost (total) $_____ Requested from SWG: $_____

Match amount $_____Source of match: _____

Staff* $_____

Equipment $_____

Outreach materials $_____

Training $_____

Other $_____

*FWD personnel only: include indirect costs here too.

Will funds be used to fill a temporary position or any other type of special or special hires (if yes please describe)?

_____

Reviewed by:_____

Date: _____

Score_____

Questions/recommendations:_____

_____

_____

project title_____

Which Species of Greatest Conservation Need and/or habitat(s) will the project benefit?

Which Limiting Factor(s) to SGCN(s) and/or habitats will this project address?

How will this project remove or reduce the impact of the limiting factor?

Reviewers: Use the following criteria to evaluate each SWG proposal.
Scoring Proposals
Write in and circle the appropriate score for each criterion.
Maximum possible score: 260 Points

1. State Wildlife Grants Appropriateness — Max 40 points

1.1 Will this project help conserve species or species groups of greatest conservation need or their habitats?

(not appropriate) 0 5 10 15 20 (very appropriate)

If '0' (not appropriate) do not continue ranking this proposal.

1.2 Is other federal funding (e.g. Pittman-Robertson, Dingell-Johnson, Endangered Species Act, Clean Water Act) available in place of SWG funds?

(Yes) 0 5 10 15 20 (No)

2. Matching Funds — Max 10 points

2.1 Has the appropriate match (25% for planning or 50% for implementation) requirement been met (score 5) or exceeded (score >5)? Does the project leverage significant additional funding? If no met (score 0).

(match not met) 0 5 10 (match exceeded)

If '0' (match not met) do not continue ranking this proposal.

3. State Wildlife Grants Intent — Max 40 points

3.1 Does this project demonstrate the principle behind SWG, which is that fish and wildlife agencies are taking on non-traditional responsibilities, and/or responding to non-traditional audiences, and therefore need non-traditional funding sources?

(no new direction) 0 5 10 15 20 (new direction demonstrated)

3.2 Does this project fill a specific unmet conservation need identified in the Comprehensive Wildlife Conservation Strategy?

(ignores priority projects) 0 5 10 (fills priority project need)

3.3 Does the project provide important conservation information or address the unmet needs of species/species groups of greatest conservation concern and their habitats?

(ignores priority projects) 0 5 10 (fills priority project need)

4. Conservation Impact — Max 105 points

4.1 Does the project involve a conservation issue that must be dealt with as soon as possible?

(not timely) 1 5 10 (very timely)

4.2 Will the project stop or reverse a decline in a population, or provide data vital to stopping or reversing a decline?

(won't stop/reverse decline) 1 5 10 (will stop/reverse decline)

4.3 Does the project address species of greatest conservation need (SGCN)?

(No SGCN addressed) 0 5 10 (high priority SGCN)

4.4 Does the project benefit multiple Species of Greatest Conservation Need (SGCN)?

(one SGCN) 1 5 10 15 20 (multiple SGCN)

1 species=1pts, 2-10=10pts, 11-20=20pts

4.5 Does the project link existing protected areas or is it adjacent to existing protected areas (i.e. does it reduce fragmentation)?

(no link) 1 5 10 (links protected areas)

4.6 In addition to its focus on wildlife, does the project provide significant benefit to plant SGCN and other imperiled plant species?

(no plant SGCN benefit) 1 2 3 4 5 (plant SGCN benefit)

4.7 Does the project benefit rare habitats?

(no rare habitats benefit) 1 5 10 (rare habitats benefit)

score by S-rank and….

4.8 Will the project contribute a long term benefit to the public or to species with greatest unmet conservation needs? Does the project appear to have the potential for "life" after SWG funding ends? Is there a plan/process to "market" the project as a model or demonstration area once completed and/or will the information gathered contribute to long term conservation goals?

(no long term relevance) 1 5 10 (long term relevance)

4.9 Will the data from this project be demonstrably useful for updating Vermont's Comprehensive Wildlife Conservation Strategy?

(No) 1 5 10 (Yes)

project title_____

5. Social Impact — Max 30 points

5.1 Does the proposal bring traditional and/or nontraditional partners to the table? Does the project involve state and/or local decision-makers? Is there multi-partner involvement (federal, state, and local governments or agencies, businesses, private landowners, NGO's, research institutions, citizens, etc)?

(partners not significant) 1 2 3 4 5 (partners significant)

5.2 Will the project be useful to other agencies and organizations? Can it serve as a model process or demonstration site?

(not useful as model) 1 2 3 4 5 (very useful)

5.3 Does the project have an educational component that will lead to increased appreciation, understanding, support, stewardship, of wildlife?

(no education component) 1 2 3 4 5 (strong education component)

5.4 Does the project have potential for widespread or statewide public/media appeal?

(low appeal) 1 2 3 4 5 (high appeal)

5.5 Does the project encourage public involvement in its implementation or use? Is it open for public use and enjoyment (where appropriate) and/or engage the full range of conservation interests (public and private sectors, traditional and non-traditional constituencies, etc)?

(low public benefit) 1 2 3 4 5 (high public benefit)

5.6 Does the project demonstrate multiple benefits? (Conservation and/or recreation and/or education; benefit terrestrial and aquatic species; consumptive and non-consumptive users, etc)

(narrow benefit) 1 2 3 4 5 (multiple benefits)

6. Other Factors — Max 35 points

6.1 What is the overall feasibility of the project?

(infeasible as proposed) 1 5 10 (very feasible)

6.2 Project timeliness: is the project ready or near-ready to implement? Will there be significant deliverables within the first fiscal year?

(long start up required) 1 5 10 (project ready to go)

6.3 Are project activities focused on achieving the stated goals and objectives? Does the project have clearly stated objectives, well designed procedures and realistically attainable results? (For research & inventory projects: Are sample sizes adequate? Is data analysis and utilization, and methods for sharing results included?)

(activities not focused) 1 5 10 (activities focused)

6.4 What is the capability of project personnel for completing the project (the applicant's history with previous projects can be used to assess this criterion)?

(Potential for success low) 1 2 3 4 5 (Potential for success high)

Vermont's Wildlife Action Plan

November 22, 2005

Appendix K
Exotic Invasive & Pest Species

Introduction to Invasive Exotic and Pest Species

Invasive exotic and pest species are one of the most frequently noted problems impacting Vermont's Species of Greatest Conservation Need (SGCN) and their habitats. Invasive species can literally overwhelm native species and their habitats forcing the natives out. Invasive plants such as Japanese knotweed, phragmites, and purple loosestrife can change soil composition, change water tables and disrupt insect cycles. They often lack food value that wildlife depend upon compared with the plants they've replaced. Some invasive animals prey heavily upon natives while others such as the alewife and zebra mussel out-compete natives for food and nutrients with significant impacts reverberating up and down food chains.

The problem of invasives isn't simply a local one. Each year the United States loses 1.7 million acres to the spread of these invasives and estimates of the total costs of invasive species in the United States amounts to more than $130 billion annually (Pimentel et al. 1999). About 42% of the species on the federal Threatened or Endangered species lists are at risk primarily because of non-indigenous species (Wilcove et al. 1998).

Some non-natives species are considered invasives or pests. Some are deemed beneficial (e.g. apple trees) while others are considered neutral (e.g. Queen Anne's lace and goldfish). An invasive species is defined by the National Invasive Species Council (Executive Order 13112); http://www.invasivespecies.gov/) as a species that is:

1) Non-native (or alien) to the ecosystem under consideration; and,
2) Whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

The national strategy to address invasive species encompasses four elements (US Forest Service 2004)

1) Prevention
2) Early detection and rapid response
3) Control and management
4) Rehabilitation and restoration

Strategies to address impacts from invasive exotic and pest species are noted here in each species conservation summary (Appendix A) and in the habitat, community, and landscape summaries (Appendix B). However, the world of invasive exotic control and eradication is a rapidly evolving one. This section of the CWCS report provides lists of invasive species maintained by state agencies and along with key resources that readers should check for more up-to-date information and expert assistance.

Vermont's Invasive Species

The three lists of invasive species currently maintained by the state were developed for different reasons and with different publics in mind. Combined they identify the most significant invasives in the state. They are:

1) Invasive Species Watch List for Vermont. 2/18/ 2005. Department of Environmental Conservation. Waterbury, VT. www.anr.state.vt.us/dec/waterq/wqdhome.htm

2) Non-native Plant and Animal Species in Aquatic and Wetland Habitats in Vermont. 5/2004. Vermont Department of Environmental Conservation, Waterbury, VT. www.anr.state.vt.us/dec/waterq/lakes/docs/ans/lp_ans-list.pdf

3) Quarantine #3: Noxious Weeds. 4/22/2002 Vermont Agency of Agriculture. Montpelier, VT. www.vermontagriculture.com/noxiousweeds.PDF

Additional Resources

The Vermont Fish & Wildlife Department's *Baitfish of Vermont* is a 38-page guidebook was produced to help baitfish dealers and anglers identify the species of baitfish that are legal to use for fishing in Vermont.

Stop Aquatic Hitchhikers! SAH is a public awareness campaign dealing with the national aquatic invasive species issue. http://www.protectyourwaters.net

References

Pimentel D., L. Lach, R. Zuniga, and D. Morrison. 1999. Environmental and Economic Costs Associated With Non-Indigenous Species In The United States College of Agriculture and Life Sciences, Cornell University. Ithaca, NY

US Forest Service. October 2004. National Strategy and Implementation Plan for Invasive Species Management. US Department of Agriculture. Washington DC. www.fs.fed.us/foresthealth/ publications/Invasive_Species.pdf

Wilcove D.S., D. Rothstein, J. Bubow, A. Phillips, and E. Losos. 1998. Quantifying Threats to Imperiled Species in The United States. BioScience 48(8): 607-615.

Invasive Species Watch List for Vermont

Vermont Invasive Exotic Plant Committee
February 18, 2005

Introduction

This is a list of non-native plants that have some potential to become invasive in Vermont based on their behavior in northeastern states. Since not enough is known about the distribution or abundance of these species in Vermont, or their potential to become invasive in Vermont, we hope this list encourages people to observe, assess and report where these species occur and how rapidly they may be spreading.

About one-third of the plant species found in Vermont are not native to our state. Many of these introductions are beneficial and economically important (e.g. red clover, our state flower) and many others are neutral in their impact (e.g. mullein or Queen Anne's lace.) A small percentage of the non-native plants, about 8%, have the potential to create environmental and economic harm due to their ability to grow rapidly, profusely and widely. It is these non-native invasive plant species that the Vermont Invasive Exotic Plant Committee is monitoring.

Definition

An invasive species is defined by the National Invasive Species Council as a species that is

1) non-native (or alien) to the ecosystem under consideration **and**
2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health. (Executive Order 13112; http://www.invasivespecies.gov/)

Invasive species can be plants, animals, and other organisms (e.g., microbes). Human actions are the **primary** means of invasive species introductions.

Watch List versus the Noxious Weed Quarantine

This Watch List is different from the Noxious Weed Quarantine Rule created in 2002 by the Vermont Agency of Agriculture, Food and Markets. The Watch List is intended for public information and as a way to enlist volunteers to monitor potentially harmful plants in Vermont. The Watch List has no regulatory force.

The Noxious Weed Quarantine Rule has the force of law. It was created to regulate the importation, movement, sale, possession, cultivation and/or distribution of 32 invasive plants. For more information about the Noxious Weed Quarantine Rule see www.state.vt.us/agric/invasive.htm. The rule plus additional information is also posted at www.uvm.edu/mastergardener/. Click the yellow circle at the bottom for Invasive Plant Info.

Purpose of the Watch List

The purpose of this Watch List is to alert and inform people about some plants that may become invasive in Vermont. We've included species known to be invasive elsewhere but their status in Vermont is uncertain. The listed plants are primarily those that may spread into Vermont's natural habitats; this list does not include plants that may be pests of agricultural lands or disturbed habitats such as roadsides. Some of these plants are not yet here as far as we know. Others are here but no one knows how extensively they occur or whether they are spreading. We hope that by making this list public, people will be motivated to help track the occurrence, distribution and rate of spread of the listed plants throughout Vermont.

Criteria

For inclusion on the Watch List, a plant must meet at least #1 and #2, and either #3 or #4.

1. The taxon[1] is nonindigenous[2] to northeastern North America.
2. The taxon may negatively affect native species or natural communities.
3. In Vermont, the taxon has the potential, based on its biology and its colonization history in the northeast or elsewhere, for rapid and widespread dispersal and establishment over spatial gaps away from the site of introduction.
4. The taxon is acknowledged to be invasive in northeastern North America but its Vermont status is unknown or unclear. This may result from lack of field experience with the taxon or from difficulty in taxonomic determination.

Invasive Species Impacts

Invasive non-native species are the second greatest worldwide threat to native species and ecosystems after direct habitat destruction[3]. In the United States invasive non-native plants spread on public lands at the rate of 4,600 acres per day, or one-tenth the size of an average Vermont town.[4] Invasive non-native plants can displace native species, disrupt ecosystem relationships, degrade wildlife habitat, impede recreation and cause economic damage to forests, agricultural crops and other managed lands. Invasive species cost the American public an estimated $138 billion each year[5] and negatively impact about 42% of the plant and animal species listed by the Federal government as threatened or endangered[6].

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[1] A taxon can be a species, a subspecies or variety

[2] Indigenous means native to an area.

[3] Randall, J. 1996. Weed Control for the Preservation of Biological Diversity. Weed Technology 10: 370-383.

[4] Westbrooks, R. 1998. Pulling Together: National Strategy for Invasive Plant Management. Federal Interagency Committee for Management of Noxious and Exotic Weeds.

[5] Pimental, D., L. Lach, R. Zuniga, D. Morrison. 2000. Environmental and Economic Costs Associated with Non-Indigenous Species in the United States. BioScience 50:53-65.

[6] Wilcove, D.S., D. Rothstein, J. Bubow, A. Phillips, E. Losos. 1998. Quantifying Threats to Imperiled Species in the United States. BioScience 48(8):607-615.

List of Watch Species in Vermont

Scientific Name	Common Name
Acer ginnala Maxim.	Amur maple
Acer platanoides L.	Norway maple
Alnus glutinosa (L.) Gaertner	European black alder
Amorpha fruticosa L.	False indigo
Ampelopsis brevipedunculata (Maxim.) Trautv.	Porcelainberry
Anthriscus sylvestris (L.) Hoffm.	Wild chervil
Berberis thunbergii DC.	Japanese barberry
Berberis vulgaris L.	Common barberry
Callitriche stagnalis Scop.	Pond water-starwort
Cardamine impatiens L.	Narrowleaf bittercress
Centaurea maculosa L. Syn.: *Centaurea biebersteinii* DC	Spotted knapweed
Elaeagnus angustifolia L.	Russian olive
Elaeagnus umbellata Thunb.	Autumn olive
Euonymus alata (Thunb.) Sieb.	Winged euonymus
Euphorbia cyparissias L.	Cypress spurge
Glyceria maxima (Hartman) Holmberg	Reed mannagrass
Hesperis matronalis L.	Dame's rocket
Iris pseudacorus L.	Yellow iris
Ligustrum obtusifolium Sieb. & Zucc.	Border privet
Lonicera xylosteum L.	Dwarf honeysuckle
Lysimachia vulgaris L.	Garden Loosestrife
Marsilea quadrifolia L.	European waterclover
Microstegium vimineum (Trin.) A. Camus	Japanese stilt grass
Najas minor Allioni	Brittle waternymph
Paulownia tomentosa (Thunb.) Sieb & Zucc. Ex Ste.	Princess tree
Phalaris arundinacea L.	Reed canary grass
Polygonum perfoliatum L.	Mile-a-minute vine
Polygonum sachalinense F. Schmidt ex Maxim. Syn: *Fallopia sachalinensis* (F. Schmidt ex Maxim.) Dcne.	Giant knotweed
Populus alba L.	White poplar
Robinia pseudoacacia L.	Black locust
Rorripa nasturtium-aquaticum (L.) Hayek Syn: *Nasturtium officinale* Ait. f.	Watercress
Rosa multiflora Thunb. ex Murr.	Multiflora rose

What You Can Do

We encourage you to identify, observe, map or measure, and report on the status of any of these plants you find in your vicinity. By making this Watch List public, we hope that people will pay more attention to the plants around them, help in the effort to collect data and watch these species for signs of invasiveness. A more comprehensive list of plant species that can become invasive throughout New England is on the website of the Invasive Plant Atlas of New England (IPANE) at http://invasives.eeb.uconn.edu/ipane/.

Please send us, the Vermont Invasive Exotic Plant Committee, information on these plants and consider becoming a volunteer for IPANE (see box on the following page.)

To report invasive non-native terrestrial plants

Kathy Decker, Vermont Department of Forests, Parks and Recreation
802-751-0117
kathy.decker@anr.state.vt.us

To report invasive non-native aquatic plants

Ann Bove, Vermont Department of Environmental Conservation
802-241-3782
ann.bove@anr.state.vt.us

For identification help, see these websites

http://invasives.eeb.uconn.edu/ipane/
http://tncweeds.ucdavis.edu/

About VTIEPC

The Vermont Invasive Exotic Plant Committee is comprised of representatives from state and federal government, non-profit organizations, private industry, and concerned individuals. The Committee meets semi-annually to assemble and disseminate information about invasive exotic plants. The goal of the Committee is to "provide coordination and guidance on invasive exotic plant issues so as to protect natural communities, native species, agricultural and forestry interests, and human use and enjoyment of Vermont's natural resources."

About IPANE

The Invasive Plant Atlas of New England's (IPANE) mission is to create a comprehensive web-accessible database of invasive and potentially invasive plants in New England that will be continually updated by a network of professionals and trained volunteers. The database will facilitate education and research that will lead to a greater understanding of invasive plant ecology and support informed conservation management. An important focus of the project is the early detection of, and rapid response to, new invasions. To learn how to volunteer go to http://invasives.eeb.uconn.edu/ipane/.

Non-native Plant and Animal Species in Aquatic and Wetland Habitats in Vermont

Updated May 2004

	Elements of the VTDEC's Aquatic Nuisance Control Program				
	Control Research Technology	Environmental Monitoring	Control and Spread Prevention	Admin. of Grants and Permits	Public Info and Education
Category One: Non-native aquatic or wetland species with a demonstrated ability to be highly invasive on a localized or widespread scale. These species are currently having economic and/or ecological impacts in Vermont.					
flowering rush (*Butomus umbellatus*)		√			√
yellow flag iris (*Iris pseudacorus*)		√			√
Japanese knotweed (*Fallopia japonica*)					√
purple loosestrife (*Lythrum salicaria*)	√	√	√	√	√
Eurasian watermilfoil (*Myriophyllum spicatum*)	√	√	√	√	√
common reed (*Phragmites australis*)					√
water chestnut (*Trapa natans*)	√	√	√	√	√
zebra mussel (*Dreissena polymorpha*)	√	√	√	√	√
Category Two: Non-native aquatic or wetland species considered having the potential to be invasive on a localized or widespread scale.					
European frogbit (*Hydrocharis morsus-ranae*)		√			√
slender-leaved naiad (*Najas minor*)		√			√
yellow floating heart (*Nymphoides peltata*)		√			√
curly leaf pondweed (*Potamogeton crispus*)		√			√
great water cress (*Rorippa amphibia*)					√
alewife (*Alosa pseudoharengus*)					F&W
faucet snail (*Bithynia tentaculata*)		√			√
Chinese mystery snail (*Cipangopaludina chinensis*)		√			√
mute swan (*Cygnus olor*)			F&W		F&W
common carp (*Cyprinus carpio*)					
gizzard shad (*Dorosoma cepedianum*)					
white perch (*Morone americana*)					
rusty crayfish (*Orconectes rusticus*)		√			√
European rudd (*Scardinius erythrophthalmus*)					

Non-native Plant and Animal Species in Aquatic and Wetland Habitats in Vermont

Updated May 2004

		Elements of the VTDEC's Aquatic Nuisance Control Program				
		Control Research Technology	Environmental Monitoring	Control and Spread Prevention	Admin. of Grants and Permits	Public Info and Education
Category Three: Non-native aquatic or wetlands species not known to be present in Vermont, but with the potential to become invasive if/when they arrive. Known regional location follows scientific name.						
fanwort (*Cabomba caroliniana*)	CT, MA, NH, NJ, NY, PA, RI	√	√			√
Brazilian elodea (*Egeria densa*)	CT, MA, NH, NJ, NY, PA	√	√			√
East Indian hygrophila (*Hygrophila polysperma*)	FL	√	√			√
hydrilla (*Hydrilla verticillata*)	CT, MA, ME, NJ, PA	√	√			√
giant salvinia (*Salvinia molesta, auriculata, biloba or herzogii*)	NC	√	√			√
parrot's feather (*Myriophyllum aquaticum*)	CT, NJ, NY, MA, PA	√	√			√
variable-leaved watermilfoil (*Myriophyllum heterophyllum*)	CT, MA, ME, NH, NY, RI	√	√			√
spiny water flea (*Bythotrephes cederstroemi*)	NY					√
asiatic clam (*Corbicula fluminea*)	NY, MA					
quagga mussel (*Dreissena bugensis*)	NY, Quebec	√	√			√
Eurasian ruffe (*Gymnocephalus cernuus*)	Lakes Superior & Huron					√
round goby (*Neogobius melanostomus*)	NY					√
tubenose goby (*Proterothinus marmoratus*)	NY					
tench (*Tinca tinca*)	NY		F&W			F&W

√ = VT Department of Environmental Conservation F&W = VT Department of Fish & Wildlife

For specific information on the species or programs listed above contact:
VT Department of Environmental Conservation at
802-241-3777 or www.vtwaterquality.org
or
VT Department of Fish & Wildlife at
802-241-3700 or www.anr.state.vt.us/fw/fwhome

Quarantine #3 Noxious Weeds

Vermont Department of Agriculture, Food & Markets
April 22, 2002

Vermont noxious weed quarantine was created in order to regulate the importation, movement, sale, possession, cultivation and/or distribution of certain invasive plants. These plants either pose a threat the Vermont environment or are already negatively impacting waterways and natural areas in the state. Many of these plants are becoming such a problem that there is no alternate prevention method. This rule will also prevent plants not yet found in Vermont from being introduced, and will protect the state from the many environmental, agricultural, recreational, and/or economical problems associated with their presence.

For questions and comments related to Vermont's Noxious Weed Quarantine Rule go to www.vermontagriculture.com/noxiousweeds.PDF, or contact:

VT Department of Agriculture, Food & Markets
Plant Industry Division
116 State St., Drawer 20
Montpelier, VT 05620-2901
802-828-2431
www.state.vt.us/agric/

Designated Noxious Weeds

(A) Class A Noxious Weeds.

(1) All weeds listed in 7 C.F.R. 360.200 as amended, which is hereby incorporated by reference including subsequent amendments and editions.
(2) *Cabomba caroliniana* (fanwort)
(3) *Egeria densa* (Brazalian elodea)
(4) *Hydrilla verticillata* (hydrilla)
(5) *Hygrophila polysperma* (Roxb.) T. Anderson (E. Indian hygrophila)
(6) *Myriophyllum aquaticum* (Vell.) Verdc. (Parrot feather)
(7) *Myriophyllum heterophyllum* (variable-leaved milfoil)
(8) *Salvinia auriculata* (giant salvinia)
(9) *Salvinia biloba* (giant salvinia)
(10) *Salvinia herzogii* (giant salvinia)
(11) *Salvinia molesta* (giant salvinia)
(12) *Vincetoxicum hirundinaria* Medikus. (pale swallow-wort)

(B) Class B Noxious Weeds.

(1) *Aegopodium podagraria* L. (goutweed)
(2) *Ailanthus altissima* (tree-of-heaven)
(3) *Alliaria petiolata* (*A. officinalis*) (garlic mustard)
(4) *Butomus umbellatus* (flowering rush)
(5) *Celastrus orbiculatus* Thunb. (Oriental bittersweet)
(6) *Fallopia japonica* (Polygonum cuspidatum) (Japanese knotweed)
(7) *Hydrocharis morsus-ranae* L. (frogbit)
(8) *Lonicera x bella* (Bell honeysuckle)
(9) *Lonicera japonica* (Japanese honeysuckle
(10) *Lonicera maackii* (Amur honeysuckle)
(11) *Lonicera morrowii* (Morrow honeysuckle)
(12) *Lonicera tatarica* (Tartarian honeysuckle)
(13) *Lythrum salicaria* (purple loosestrife)
(14) *Myriophyllum spicatum* (Eurasian watermilfoil)
(15) *Nymphoides peltata* (Gmel.) (yellow floating heart)
(16) *Phragmites australis* (common reed)
(17) *Potamogeton crispus* L. (curly leaf pondweed)
(18) *Rhamnus cathartica* (common buckthorn)
(19) *Rhamnus frangula* (glossy buckthorn)
(20) *Trapa natans* L. (water chestnut)
(21) *Vincetoxicum nigrum* L. (black swallow-wort

Vermont's
Wildlife Action Plan

November 22, 2005

Appendix L
Plans & Planning Processes
Impacting Vermont Wildlife

L. Plans & Planning Processes Impacting Vermont Wildlife

The Comprehensive Wildlife Conservation Strategy has not tried to reinvent wheels in its attempt conserve Vermont's wildlife. Rather it strives to connect existing programs with wildlife in need and with the people and organizations wishing to help. Conservation strategies found in this report list potential funding sources and potential partners to help readers connect with others interested in similar efforts. However, this is only the tip of the proverbial iceberg when it comes to plans and planning process that can impact Vermont's wildlife. The following list can further orient and direct (though hopefully not overwhelm) interested parties. The list is clearly incomplete as there are too many local plans as well as numerous organizations spearheading public/private collaborations to mention here.

Plan/Planning Process/Team	Goal/purpose	Lead Agency or NGO	Website
Riparian Buffer Guidance, and Riparian Buffers and Corridors Technical Papers 1/20/2005	Helps in the development of recommendations and designs for Act 250-regulated projects that incorporate appropriate buffer zone widths for protecting riparian functions	ANR	www.anr.state.vt.us/dec/dec.htm
Alpine Natural Community	Species Recovery Plan	VFWD	http://www.vtfishandwildlife.com/
American Marten	Species Recovery Plan	VFWD	http://www.vtfishandwildlife.com/
American Shad Workgroup		USFWS	http://www.fws.gov/r5crc/who/crasc.html
ANR Hydro		ANR	http://www.anr.state.vt.us/
ANR Land Conservation Plan		ANR	http://www.anr.state.vt.us/
Atlantic Coast Joint Venture Plan	To significantly expand upon goals/objectives identified in the North American Waterfowl Management Plan	USFWS	http://northeast.fws.gov/migratorybirds/acjv.htm
Baitfish/Exotics - Aquatic Nuisance	To reduce the impact of invasive exotic and nuisance baitfish in VT, and avoid additional introductions.	VFWD	http://www.vtfishandwildlife.com/
Bald eagle	Species Recovery Plan	VFWD	http://www.vtfishandwildlife.com/
Basin Plans (many similar plans)	Integrates topics of special local importance with topics of special state importance, contains management recommendations on these topics and updates previously developed water quality plans.	DEC/WQD	http://www.anr.state.vt.us/dec/dec.htm
Bass Team		VFWD	http://www.vtfishandwildlife.com/
Bat Plan	Species Recovery Plan	VFWD	http://www.vtfishandwildlife.com/

Plan/Planning Process/Team	Goal/purpose	Lead Agency or NGO	Website
Bats in Eastern Woodlands	Woodland bat conservation	Bat Conservation International	http://www.batcon.org
Batten Kill River		VFWD	http://www.vtfishandwildlife.com/
Bear Managemnt Plan		VFWD	http://www.vtfishandwildlife.com/
Best Management Practices for Resolving Human-Beaver Conflicts in Vermont		VFWD, VDEC	http://www.vtfishandwildlife.com/library//Factsheets/Fish_and_Wildlife/Best_Management_Practices_for_Human-Beaver_Conflicts.pdf
Bird Conservation Region 13--Lower Great Lakes/Saint Lawrence Plain	Cooperative habitat conservation for migratory birds in the lower Great Lakes region of the United States and Canada	NABCI	http://www.nabci-us.org/bcrs.html
Bird Conservation Region 14--Atlantic Northern Forest	A partnership of state, international and federal agencies, non-government organizations, academic institutions, private industries, and individuals	NABCI	http://www.nabci-us.org/bcrs.html
Blueback Herring: Management Plan for Blueback Herring in the Connecticut River Basin (2003)		Connecticut River Atlantic Salmon Commission	http://www.fws.gov/r5crc/who/crasc.html
Bridge & Culvert Committee		VFWD	http://www.vtfishandwildlife.com/
Camel's Hump Long Range Management Plan		FPR	http://www.vtfpr.org/
Carry Bay Flow Study		VFWD	http://www.vtfishandwildlife.com/
Circumferential Highway Project	Highway project in Chittenden County	VTRANS	http://www.aot.state.vt.us/eis/default.htm
Chittenden County Uplands Project	A partnership to conserve the rural back country of eastern Chittenden County in accordance with the wishes of area communities	Jericho-Underhill Land Trust	http://www.jult.org/
Clayplain Forest	Species Recovery Plan	VFWD	http://www.vtfishandwildlife.com/
Clean and Clear Action Plan	meet water quality standards	DEC	http://www.anr.state.vt.us/dec/dec.htm
Climate Change Action Plan		Conference of New England Governors and Eastern	http://www.negc.org/

Plan/Planning Process/Team	Goal/purpose	Lead Agency or NGO	Website
		Canadian Premiers	
Cobblestone and Beach dune tiger beetle plan	Species Recovery Plan (draft)	VFWD	http://www.vtfishandwildlife.com/
Common Tern	Species Recovery Plan	Audubon Vermont	http://www.vt.audubon.org
Connecticut River Atlantic Salmon Commission Genetics		USFWS	http://www.fws.gov/r5crc/who/crasc.html
Connecticut River Atlantic Salmon Commission Salmon Studies		USFWS	http://www.fws.gov/r5crc/who/crasc.html
Connecticut River Atlantic Salmon Commission Tech Committee		USFWS	http://www.fws.gov/r5crc/who/crasc.html
Conservation2001	SWG	VFWD	http://www.vtfishandwildlife.com/
Conti Refuge		USFWS	http://www.fws.gov/r5soc/
Current Use Guidelines		FPR	http://www.vtfpr.org/
Deer Plan		VFWD	http://www.vtfishandwildlife.com/
District Lands Stewardship Team(s)		FPR	http://www.vtfpr.org/
Eastern Brook Trout Initiative	Conservation of Native Brook Trout	TU	http://www.vermonttu.org/
Eastern sand darter and Channel darter plan	Species Recovery Plan (draft)	VFWD	http://www.vtfishandwildlife.com/
Ecoregional Plan		TNC	http://www.nature.org/wherewework/northamerica/states/vermont/
Fish Contaminants Team		VFWD	http://www.vtfishandwildlife.com/
Fish Culture Computer Team		VFWD	http://www.vtfishandwildlife.com/
Fish Culture Public Outreach		VFWD	http://www.vtfishandwildlife.com/
Fish Culture Safety Team		VFWD	http://www.vtfishandwildlife.com/
Fish Outreach Team		VFWD	http://www.vtfishandwildlife.com/
Fish Scientific Advisory Group	Advises the ANR Endangered Species Committee	VFWD	http://www.vtfishandwildlife.com/
Fisheries: Review of the ASFMC Fishery Management Plan for Shad and River Herring (Alosa spp.) (1999)		Atlantic States Fisheries Management Council	http://www.asmfc.org/

Plan/Planning Process/Team	Goal/purpose	Lead Agency or NGO	Website
Fisheries: Plan for the Restoration of Migratory Fishes to the Ashuelot River basin, New Hampshire.		Connecticut River Atlantic Salmon Commission	http://www.fws.gov/r5crc/who/crasc.html
Forest Land Enhancement Program Priority Plan (FLEP)		FPR	http://www.vtfpr.org/
Forest Legacy Plan		Interagency	
Freshwater mussels	Species Recovery Plan (draft)	VFWD	http://www.vtfishandwildlife.com/
Geomorphology Group		VFWD	http://www.vtfishandwildlife.com/
Governors Task Force on ATVs		ANR	http://www.anr.state.vt.us/
Grassland Birds	Species Recovery Plan (draft)	VFWD	http://www.vtfishandwildlife.com/
Green Mountain National Forest Plan		USFS	http://www.fs.fed.us/r9/gmfl/green_mountain/index.htm
Habitat Team		VFWD	http://www.vtfishandwildlife.com/
Important Bird Areas Program	Effort to identify and conserve sites deemed most critical to birds	Audubon Vermont	http://www.vt.audubon.org
Instream Flow		VFWD	http://www.vtfishandwildlife.com/
International Association of Fish & Willdife Agencies		VFWD	http://www.vtfishandwildlife.com/
Lake Bomoseen Long Range Management Plan		FPR	http://www.vtfpr.org/
Lake Champlain Basin Program		LCBP	www.lcbp.org/
Lake Champlain Management Cooperative - Fish Tech Comm		USFWS	
Lake Trout Team		VFWD	http://www.vtfishandwildlife.com/
Loon Plan	Species Recovery Plan	VFWD	http://www.vtfishandwildlife.com/
Missisquoi NWR		USFWS	http://refuges.fws.gov/profiles/index.cfm?id=53520
Moose Plan		VFWD	http://www.vtfishandwildlife.com/
Mt Mansfield Long Range Management Plan		FPR	http://www.vtfpr.org/
Muskellunge		VFWD	http://www.vtfishandwildlife.com/
Municipal Plans		VT cities and towns	

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New England Fish Health Committee	fish health plans and guidelines		http://www.vtfishandwildlife.com/
New England Plant Conservation plans in VT		New England Plant Conservation Program	http://www.newfs.org/
Non-game plan		VFWD	http://www.vtfishandwildlife.com/
North American Bird Conservation Initiative	To deliver the full spectrum of bird conservation through regionally based, biologically driven, landscape-oriented partnerships.	USFWS	http://www.nabci-us.org
North Hero Long Range Management Plan		FPR	http://www.vtfpr.org/
Northern Forest Council Plan		Interagency	http://www.northernforestlands.org/northernforestland.htm
Osprey	Species Recovery Plan	VFWD	http://www.vtfishandwildlife.com/
Peregrine Falcon	Species Recovery Plan	VFWD	http://www.vtfishandwildlife.com/
PIF North American Landbird Conservation Plan, March 2003, Draft	Provides an overview of the highest priority landbirds in North America. A government agencies, private organizations, individuals, academic communities, and industry cooperative partnership.	USFWS	www.partnersinflight.org/cplan.htm
Rattlesnake	Species Recovery Plan (in progress)	VFWD, TNC	http://www.vtfishandwildlife.com/, http://nature.org/wherewework/northamerica/states/vermont/
Reciprocal License		VFWD	http://www.vtfishandwildlife.com/
Regional Planning Commission Plans & reports		VT Assoc of Planning & Development Agencies	http://www.vapda.com/
Regulation Review (Fish)		VFWD	http://www.vtfishandwildlife.com/
Riparian Propagation		VFWD	http://www.vtfishandwildlife.com/
Sea Lamprey		VFWD	http://www.vtfishandwildlife.com/
Sea Lamprey Alternatives		VFWD	http://www.vtfishandwildlife.com/

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Sea-run Atlantic salmon Conn. R. basin	Fisheries Plans	USFWS	http://www.fws.gov/r5crc/who/crasc.html
SONAR Review Team		VFWD	http://www.vtfishandwildlife.com/
Spiny softshell turtle	Species Recovery Plan (draft)	VFWD	http://www.vtfishandwildlife.com/
Spotted turtle	Species Recovery Plan (draft)	VFWD	http://www.vtfishandwildlife.com/
Spruce Grouse	Species Recovery Plan (draft)	VFWD	http://www.vtfishandwildlife.com/
State Lands Management Plans		FPR	http://www.vtfpr.org/
Statewide Outdoor Recreation Plan (SCORP)		FPR	http://www.vtfpr.org/
Stream Habitat Alteration Team		VFWD	http://www.vtfishandwildlife.com/
Sturgeon		VFWD	http://www.vtfishandwildlife.com/
The North American Waterbird Conservation Plan	Provides a continental framework and guide for conserving waterbirds	USFWS	http://www.nacwcp.org/
Total Maximum Daily Loads (TMDL)	Assessment of stormwater impaired waters	DEC	http://www.anr.state.vt.us/dec/dec.htm
Town Plans		Towns	
Trout	Fisheries Plans	VFWD	http://www.vtfishandwildlife.com/
Trout Team		VFWD	http://www.vtfishandwildlife.com/
US Army Corps Dam Operations		US Army Corps	
US Atlantic Salmon Assessment Committee		USFWS	http://www.fws.gov/r5crc/ascomreports.htm
Vermont Fish & Wildlife Dept Strategic Plan		VFWD	http://www.vtfishandwildlife.com/
Victory Bog Long Range Management Plan		FPR	http://www.vtfpr.org/
VT Accepted Management Practices		FPR	http://www.vtfpr.org/
VT Biodiversity Project		UVM	http://www.uvm.edu/~envnr/sal/vbp/
VT Dam Taskforce			http://www.vtfishandwildlife.com/
VT Fish Health Testing		VFWD	http://www.vtfishandwildlife.com/
VT Forest Resource Council Plan		FPR	http://www.vtfpr.org/
VT Land Acquisitions Plan		FPR	http://www.vtfpr.org/
VT Monitoring Cooperative		Interagency	http://vmc.snr.uvm.edu/

Plan/Planning Process/Team	Goal/purpose	Lead Agency or NGO	Website
VT Pesticide Advisory Council		VT Agency of Agriculture	http://www.vermontagriculture.com/VPAC.htm
VT Recreation Plan (SCORP)		FPR	http://www.vtfpr.org/
VT Transportation Plan		VTrans	http://www.anr.state.vt.us/
VT Yankee			
Walleye	Fisheries Plans	VFWD	http://www.vtfishandwildlife.com/
Watershed Plans		DEC	http://www.anr.state.vt.us/dec/dec.htm
West Mountain Long Range Management Plan		FPR	http://www.vtfpr.org/
Wild turkey plan		VFWD	http://www.vtfishandwildlife.com/
Green River Reservoir management plan		FPR	http://www.vtfpr.org/
Willoughby Forest Management plan		FPR	http://www.vtfpr.org/

Energy/Global Warming/Air Quality

2005 Final draft of the Vermont Comprehensive Energy and Electric Plan, the Department of Public Service

2005 First Biennial Report to the Governor of the Vermont Climate Neutral Working Group, the Departments of Environmental Conservation, Public Service and Buildings and General Services.

2005 New England's Rising Global Warming Emissions and How to Reverse the Tend, New England Climate Coalition

2004 Wind Energy and other Renewable Energy Development on ANR Lands, ANR Policy

2000 The Climate Action Plan, Burlington Climate Protection Task Force

1998 Vermont Comprehensive Energy Plan and Greenhouse Gas Action Plan, the Department of Public Service

1993 State of Vermont Air Quality Implementation Plan, DEC

Transportation

2004 Metropolitan Transportation Plan (for Chittenden County), Chittenden County Metropolitan Planning Organization

2002 Vermont Long Range Transportation Plan, VTrans

Water Quality

Completed basin plans, DEC

Impaired waters plans, DEC