Viral Hemorrhagic Septicemia and Baitfish Use and Movement in Vermont

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August 29, 2007

Background

Viral hemorrhagic septicemia (VHS) is a viral fish disease that is considered to be one of the most serious diseases of salmonids in freshwater environments in Europe. Outbreaks of the VHS virus can result in severe fish mortality events in commercial aquaculture practices as well as in wild populations, and can often have serious socio-economic consequences. For these reasons, VHS is listed as a reportable disease by the World Organization for Animal Health.

There have been four unique genetic isolates of VHS identified; three from Europe and one from North America. Each isolate appears to have unique pathogenic effects on different species of fish. The North American VHS isolate was first identified in the United States in 1988 in spawning salmon in the Pacific Northwest. VHS is now prevalent in both wild and hatchery raised salmon in the Pacific Northwest as well as wild Pacific herring and Pacific cod populations off the coast of Alaska, Canada, and Washington State. In the Atlantic Ocean, the virus has been found in Atlantic herring and Greenland halibut.

Fish infected with VHS may exhibit minor external hemorrhaging in the form of red pin-point spots or larger patches, particularly around the head. However, some infected fish may not exhibit any external signs at all. Internally, organs often display multiple hemorrhages, particularly in the liver, spleen, intestines and swim bladder. Sick fish often appear lethargic, swim in circles, or lie motionless just below the water surface. Although not all infected fish develop the disease, they can be carriers and have the ability to spread the disease to other fish.

Until recently VHS was known only as a marine pathogen in North American waters. However, in 2005, it was confirmed in freshwater for the first time in the Great Lakes following die-offs of freshwater drum and round goby in the Bay of Quinte, Lake Ontario. It has been determined that this VHS strain is most similar to that previously isolated from the Atlantic coast of North America, but has been categorized as a unique strain of the virus (Type IVb). It is possible this is a mutated form of the Atlantic Ocean isolate.

Subsequent to the 2005 confirmation in Lake Ontario, VHS was identified from an archived sample of Lake St. Clair muskellunge taken in 2003 following a mass mortality event there. In 2006, the VHS virus was confirmed in a wide variety of fish species in new locations within Lake Ontario, as well as Lake Erie, the Niagara River and the St. Lawrence River. In early 2007, VHS was confirmed in Lake Huron from whitefish samples taken in 2006, and in May 2007 VHS was confirmed in the Michigan and Wisconsin waters of Lake Michigan in smallmouth bass and brown trout. In less than four years, the virus has spread through four of the five Great Lakes. Lake Superior is the only Great Lake that has not yet tested positive. Confirming state biologists' expectations that the disease would quickly spread from Great Lakes, the disease has also begun to show up in inland waters. Following a fish kill of adult walleye in August 2006, the New York Department of Environmental Conservation tested for and confirmed the presence of VHS in Lake Conesus, the western most Finger Lake. In May 2007, New York DEC staff investigated a fish kill of rock bass and smallmouth bass in one of the eastern Finger Lakes - Skaneateles Lake, and these fish also tested positive for VHS. Neither of these lakes have direct water connections to the Great Lakes. On April 30, 2007, Michigan Department of Natural Resources officials responded to a large die-off of black crappie, bluegill and muskellunge in 175-acre Budd Lake. Test results received at the end of May confirmed the presence of the VHS virus in the dead fish. As in the New York cases, Budd Lake is not connected to any Great Lake, the closest of which is Lake Huron, 45 miles east. The Wisconsin Department of Natural Resources responded

to a fish kill of hundreds of freshwater drum in Little Lake Butte des Morts and Lake Winnebago in April 2007, and in May test results confirmed the cause as being viral hemorrhagic septicemia.

Since 2005, a number of large-scale die-offs have occurred in the Great Lakes and in several inland lakes involving a wide range of fish species, many of which are ecologically, recreationally and economically important in the region. These include muskellunge, northern pike, walleye, smallmouth bass, white bass, freshwater drum, yellow perch, bluegill, rock bass and black crappie. A number of other fish species have been identified as carriers of the virus, although no mortalities have been observed. These include Chinook salmon, silver redhorse, shorthead redhorse, burbot, spottail shiners, and emerald shiners. A total of 37 species are currently known to carry VHS.

The VHS virus is readily transmissible to fish of all ages, and survivors of infection can become lifelong carriers. The virus is shed from infected fish in urine, feces, and reproductive fluids and transmission can occur through the water or by direct contact. In a hatchery or fish holding facility, mechanical transfer of the VHS virus on the surfaces of both animate and inanimate objects presents a substantial hazard. The virus has been isolated from feral fish in waters receiving hatchery effluent, and can persist in water without a host for several days. It has also been documented that the virus cannot be killed by freezing infected fish.

Baitfish Movement and VHS

The movement and use of baitfish has been recognized as one of the most significant potential vectors for the introduction and/or spread of the VHS virus to new waters. A number of key baitfish species have been identified as capable of carrying the VHS virus. For example, emerald shiners from the Niagara River and from Barcelona Bay, NY on Lake Erie, have tested positive for VHS, and it is therefore reasonable to assume that emerald shiners harvested from other parts of the lower Great Lakes may also carry VHS.

Wild baitfish are routinely collected from both the U.S. and Canadian waters of the Great Lakes and exported for use as bait for sport fisheries around the country, including Vermont. Additionally, some aquaculture producers collect baitfish broodstock from the Great Lakes to produce commercial baitfish in aquaculture facilities and for subsequent export. The destinations and numbers of baitfish moved are not well documented.

Since there is no current vaccination or cure for VHS, preventing contact between the virus and potential hosts is the most effective method for controlling this disease. To this end, five states (New York, Michigan, Pennsylvania, Vermont and Wisconsin) and one province (Ontario) have implemented new regulations pertaining to VHS and the use and movement of baitfish. Shortly after VHS was confirmed in various locations around the Great Lakes, several of the aforementioned government agencies took immediate action by implementing emergency interim measures to stop the movement of potentially infected baitfish into new waters and prevent the spread of VHS. Each of these agencies is continuing to develop more comprehensive, permanent baitfish regulations.

Due to concerns about spreading the VHS virus inland, the New York Department of Environmental Conservation released an emergency interim rule in November 2006 that banned the commercial harvest and sale of baitfish from Lake Ontario, the St. Lawrence River and their tributaries. In late March 2007, NYDEC

released a draft set of revised state-wide rules to permanently replace the interim rules. The revised regulations, which went far beyond the scope of the emgercency rules, were formally adopted June 6, 2007. The regulations implement a "certified bait" program and poses tight restrictions on the possession, sale, transfer, taking and release of baitfish. The new rules require personally harvested baitfish, live or dead, be used only in the waters where taken, and prohibit the overland transport of personally harvested baitfish by motorized vehicle. Commercially harvested "uncertified" baitfish, live or frozen, can only be possessed, sold, and offered for sale on the same body of water from which it was caught and cannot be transported overland by a motorized vehicle unless under a permit issued by NYDEC. Disease-tested (certified) baitfish sold for retail may be transported overland and used as bait provided that the angler has been issued a sales receipt that states the bait is certified and includes the vendor name, sale date, species, and quantity of fish sold. Receipts are valid for 7 days, after which bait is no longer valid for transport or use and must be properly discarded. If a commercial baitfish vendor holds uncertified and certified lots of baitfish at the same location, or lots are mixed together, all baitfish at that location are considered uncertified. The regulation also outlines strict certification requirements which commerical bait dealers must adhere to in order to be authorized to sell baitfish for transport and use around the state.

On January 1, 2007, the Pennsylvania Fish & Boat Commission implemented emergency measures regarding VHS. Stating that the action was necessary and appropriate for the protection, preservation and management of fish, the PA F&B Commission placed a temporary 1-year ban on the transport of all live fish, including baitfish, from Lake Erie and its tributary waters inland. The intent of this emergency measure is to reduce the potential spread of exotic fish species and fish diseases (VHS) found in the Great Lakes to the state's inland waters. Through 2007, the PA F&B Commission will work towards developing and adopting a more comprehensive, permanent regulation by the end of the year to address the more immediate VHS issue as well as the larger issue of exotics, diseases, and fish movement.

On January 8, 2007, the Ontario Ministry of Natural Resources established interim regulations on the transfer of live baitfish to help control the spread of VHS. Ontario's approach was to divide the province into zones: an infected zone, a buffer zone and a virus-free zone. The interim regulations prohibit the commercial harvest of live baitfish in the infected zone. Furthermore, the movement of live baitfish from the infected zone to the buffer zone or the virus-free zone, and from the buffer zone to the virus-free zone, is prohibited both at the commercial and personal levels. The Ontario Ministry of Natural Resources, the Ontario Ministry of Agriculture, Food and Rural Affairs, the Federal Department of Fisheries and Oceans and the Canadian Food Inspection Agency are working together on a more comprehensive approach that will result in the implementation of permanent regulations in the spring of 2007 to address live fish movement within Ontario. Some of the proposed changes specific to baitfish include expanding the VHS positive zone to include Lake Huron & Georgian Bay, redefining the VHS positive zone boundary to include barriers to fish migration on tributaries and road networks, removing the interim buffer zone, re-instating commercial baitfish harvest within the VHS positive zone but restricting sale and use to within the infected zone only, and implementing a sale receipt system for anglers, similar to what New York has implemented. A permanent regulation is expected in early summer 2007.

In January 2007, the Michigan Department of Natural Resources began the process of drafting new regulations in response to VHS by creating a VHS Positive Management Area (PMA), a VHS Surveillance Management Area (SMA), and a VHS Free Management Area (FMA). The PMA encompassed all known infected waters in the state including Lake Huron, the St. Clair River, Lake St. Clair, the Detroit River and

Lake Erie, while the SMA at the time included the St. Marys River from the Soo Locks to Lake Huron and all of Lake Michigan. The PMA and SMA areas have now expanded following the recent spread of the VHS virus, while the FMA has been reduced. On June 7, 2007 the Michigan DNR released Fish Disease Control Order FO-245, which implemented strict regulations designed to slow the spread of VHS. These new regulations only apply to a "Prohibited Species List" of fish specified in the new rule. All forms of the species listed (live, frozen, or dead, including roe and cut portions of fish) are included. Key provisions in the new regulations are separated into personal baitfish use and commercial baitfish sale. For personal use of baitfish, anglers will be required to be in possession of a receipt from the baitshop where bait was purchased. The receipt, valid for 7 days, will indicate where the bait can be used, or if it is certified VHS-free, which can be used anywhere in the state. If baitfish purchased from a shop is uncertified or collected by anglers themselves, then its use will also be restricted. Baitfish collected from the PMA can only be used on VHS positive waters, baitfish from the SMA can be used in VHS surveillance or positive waters, and baitfish from VHS-free waters can be used anywhere in the state. Only those baitfish species and fish eggs on the Prohibited Species List can be used as bait. Anglers are also prohibited from releasing bait when done fishing. Unused baitfish must be disposed of on land. The new Michigan regulations also prohibits the release of live fish in waters other than those where they were taken. Further more, the regulations stipulate that anglers must empty all water from live wells and bilge areas of boats when leaving a body of water. For the commercial baitfish industry, Michigan now has a two-stage certification process that includes both the holding facilities and the actual baitfish. The certification process is not required, but is an avenue by which the baitfish industry can provide certified disease-free bait to the angling public that is permitted for use anywhere in the state. Uncertified bait is restricted to where it can be used. Michigans new regulations require both wholesale and retail baitfish dealers to indicate on customer receipts where the baitfish were collected taken, the lot or transaction code, and what disease management area it can be used. Receipts must be kept for one year.

In February 2007, the Vermont Fish & Wildlife Department implemented a new regulation restricting the importation of all fish species, including baitfish, into the state. The regulation requires that an importation permit be obtained from the Department prior to importing any fish for the purposes of releasing them to waters of the state. It also stipulates that imported fish must originate from an approved, inspected hatchery source. Wild caught fish may also be imported with a permit provided the source is also approved by the Department.

In early June 2007, the Wisconsin Department of Natural Resources released new emergency regulations aimed at containing the spread of the VHS virus. The regulation requires boaters to drain water from their craft immediately after leaving Lake Michigan, Green Bay, Lake Superior, the Mississippi River, Lake Winnebago, the Fox River from Lake Winnebago to Green Bay, and any tributary up to the first barrier impassable to fish. The rules also prohibit the movement of live fish, including baitfish, from any of the above state waters or any future water classified as VHS-positive. Finally, the regulations implement a new commercial baitfish permitting system. Bait dealers will be required to obtain a wild harvest permit from the WI DNR in order to harvest minnows, crayfish or frogs for use as bait from any Wisconsin waters. Bait dealers will also be required to maintain daily records all bait harvest activites. Records must include the water body of origin, and details of collection sites with the waters, the species harvested, the date of harvest, the quantity or volume harvested, and the disposition of the bait. At this time, Wisconsin has not proposed an inspection or baitfish certification process similar to New York or Michigan. The Wisconsin Natural

Resources Board plans on holding public hearings on these emergency regulations in August, after which they or a version of them will be adopted as permanent regulations.

Vermont's Baitfish Industry and VHS

There is little doubt left amongst fisheries professionals in the Great Lakes region that Viral Hemorrhagic Septicemia poses a very real threat to sport and recreational fisheries and the economies that rely on them. Moreover, the transport and use of baitfish is widely accepted as one of the key potential vectors that may spread the VHS virus from the infected Great Lakes to other waters, and it is understood that this mechanism must be addressed if the spread of VHS is to be controlled. Fisheries professional in New York, Michigan and Wisconsin all have agreed that the most likely source of spread of VHS from the Great Lakes to the four inland waters now infected was either by baitfish movement or overland watercraft movement carrying infected water.

As discussed above, a number of states and one Canadian province have implemented or will soon implement regulations, interim or permanent, to restrict both the commercial and personal use of baitfish. The challenge faced by all is to implement reasonable and realistic restrictions that act to conserve the biological and economic value of fish populations while at the same time recognize the effect these restrictions may have on those in the industry that depend on baitfish for their livelihood and the anglers that purchase and use baitfish.

Lake Champlain is the most probable location where VHS would first be detected in Vermont. In January 2007, the New York DEC released a document assessing the risk of VHS becoming established in Lake Champlain. Their assessment concluded that it is highly likely, since the lake is connected to two VHS-positive waterbodies via the Champlain/Erie Canals and the Richelieu River/Chambly Canal, as well as other potential vectors such as baitfish use, overland fish movement, and boat traffic. The Michigan DNR has begun to similarly assess the potential for VHS to be introduced from the infected Great Lakes to their state's inland waters. Evaluations of Michigan's inland waterbodies include reviewing criteria such as 1) the existence of public launches, 2) zebra mussel presence prior to 1995, and 3) Master Angler awards by waterbody where live baitfish is indicated as the technique. Lake Champlain, of course, has a large number of public access areas. Additionally, zebra mussels were first documented in the lake in 1993. Since it is expected that the VHS virus and zebra mussel veligers are spread via similar vectors, primarily through water connections and overload transport of watercraft and bait, it is reasonable to expect that Lake Champlain will eventually become infected. The question at hand then is not whether Lake Champlain will get VHS, but rather how quickly it will arrive. Once it does arrive in Lake Champlain, it can reasonably be expected to then spread to Vermont's inland lakes and other New England states to the east and south.

Although testing for VHS in 2006 and 2007 in a variety of Lake Champlain fish species came up negative, it is possible that the virus already exists in the lake but has not yet been detected. It is known that for a short time, emerald shiners were imported into Vermont from the Niagara River, an area now known to be infected with VHS. Information from Michigan indicates that it may take three to four years for titer levels to increase to a detectable level in fish populations following initial introduction of the virus to a waterbody. VHS testing has begun and will continue in Lake Champlain through 2007, focusing on the north and south

ends of the lake, near the canal entrances to the lake, and will target fish species known to be susceptible to VHS, including emerald shiners.

Although fisheries biologists predict that VHS will eventually become established in Lake Champlain, it has not yet been detected, and consequently there is an opportunity to proactively protect Vermont's inland waters from VHS through an amendment to existing baitfish regulations. Next to imported wild baitfish, now controlled through the new Fish Importation regulation, Lake Champlain is the largest source of wild-harvested baitfish used throughout Vermont. The implementation of amended regulations governing the harvest, sale, movement, and use of baitfish from Lake Champlain before VHS is detected would act to prevent the future spread of the virus to inland waters. Outreach and education efforts would be necessary as well, but such measures alone would not prevent the spread of VHS inland.

New York DEC's risk analysis of the potential for the VHS virus to infect Lake Champlain included an assessment of the lake's risk to inland waters should the virus become established. They concluded that, assuming good compliance, the statewide baitfish regulations proposed in March 2007 would control the potential spread of VHS from Champlain to inland waters. These regulations included restricting personal collection and use of baitfish to waters where collected, and required disease testing for commercially harvested bait prior to transport and sale.

Existing baitfish regulations in Vermont do not protect inland waters should Lake Champlain become infected. It is acknowledged that implementing similar regulations to those implemented by other states and provinces will apply unwelcome pressure on Vermont's baitfish industry as well as some anglers. Individual bait shops may be required to pay for expensive disease testing on wild-harvested bait, or import more costly farmed-raised, disease-free bait. Some shops may be forced to close. Others will pass on increased operating costs to the consumer, resulting in more expensive baitfish in the future. This may in turn negatively impact fishing license sales. However, the effect of not taking the appropriate measures needed to respond to this threat would invite a potentially significant impact on Vermont's sportfisheries, and in turn, license sales.

Recommendations

Considering the information provided and discussed above, it is recommended that the Vermont Department of Fish & Wildlife take immediate steps to further regulate baitfish use in the state to proactively protect Vermont's inland waters and fish populations from infection. Recommendations include: (1) prohibiting the personal harvest and use of wild baitfish, (2) prohibiting commercial harvest and sale of wild baitfish, (3) requiring commercially sold baitfish be from an approved hatchery source, (4) requiring a receipt of sale be provided to and possessed by anglers when purchasing bait, (5) prohibiting anglers from from leaving waters with live baitfish in their possession, (6) requiring anglers and boaters to drain all water from boats, trailers, bilges, livewells, baitbuckets, and boating and fishing equipment.

It is recommended that the Aquatic Nuisance Species Team of the VT Fish & Wildlife Department begin working on the specifics of such a proposal and present it to the Commissioner for adoption as an Emergency Regulation in the fall of 2007. Following that, the regulation should be prepared for the Fish & Wildlife Board for consideration and potential adoption in 2008.

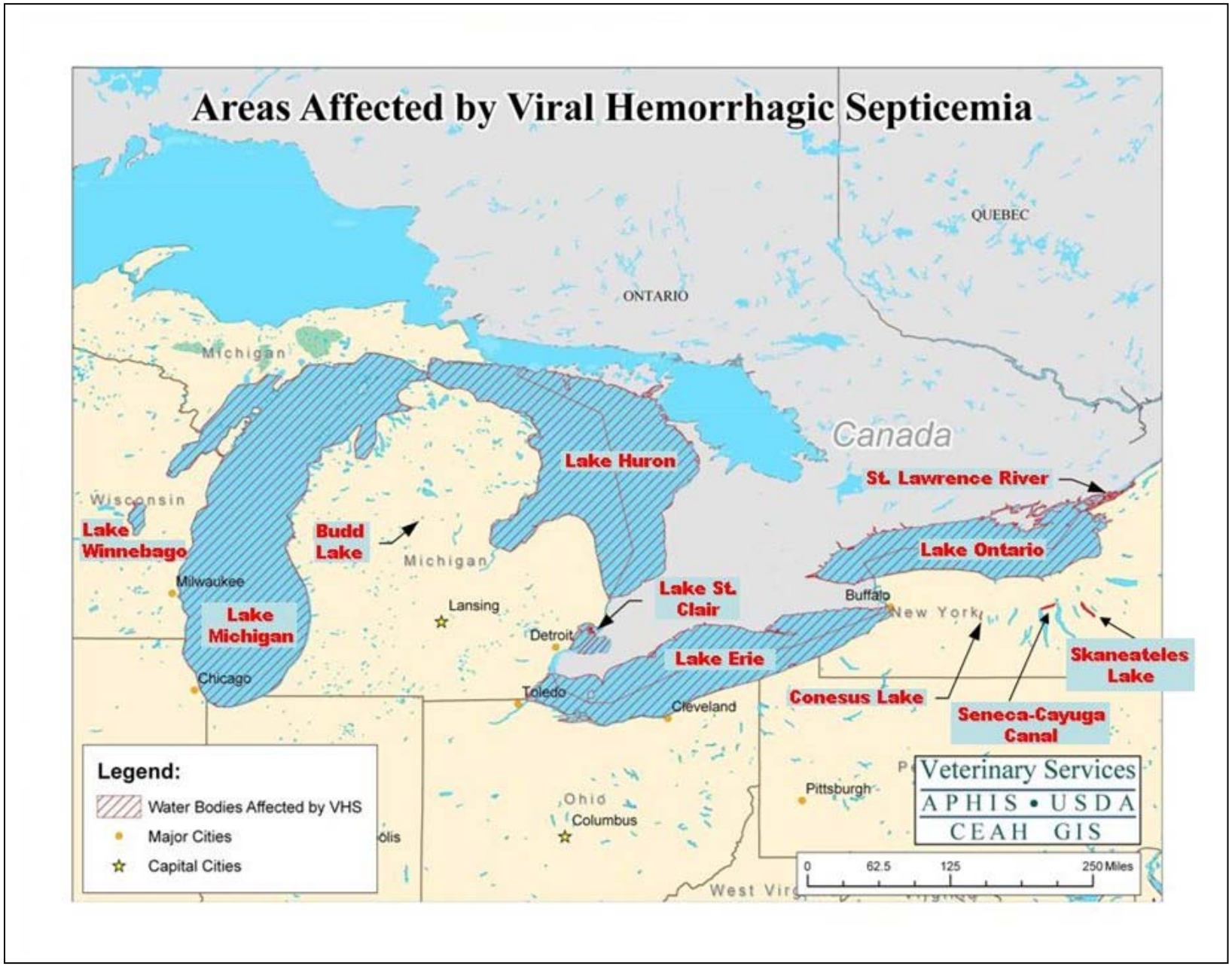

Figure 1. Waters testing positive for Viral Hemorrhagic Septicemia as of August, 2007. This includes at least 6 inland waters not connected to the Great Lakes in New York, Michigan and Wisconsin.