National Park Service
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Lake Superior Basin National Parks

Grand Portage Band of Lake Superior Chippewa
Natural Resources Management

Emergency Prevention and Response Plan For Viral Hemorrhagic Septicemia

National Park System Units and the Grand Portage Indian Reservation within the Lake Superior Basin

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Emergency
Prevention and Response Plan
For
Viral Hemorrhagic Septicemia
Approvals and Concurrence

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Note: Emergency issues and actions are highlighted (shaded) throughout this plan.

Executive Summary

Emergency Prevention and Response Plan
for Viral Hemorrhagic Septicemia
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What is VHSv?

Viral Hemorrhagic Septicemia (VHSv)[1] is a deadly fish virus that has been recently detected in lower Great Lakes' freshwater fish. It has not yet been found in Lake Superior. VHSv can infect a wide range of fish species and has been the cause of large fish kills in other parts of the Great Lakes. Great Lakes fish have no exposure history to VHSv and, therefore, are especially susceptible to the disease. In fact, according to the Wisconsin Department of Natural Resources, there has not been a virus in the past that has affected so many fish species from so many fish families in the Great Lakes. (Wisconsin DNR, 2007). VHSv does not pose a threat to human health.

What resources are at risk?

All waters within the Lake Superior basin are at immediate risk for VHSv introduction, including those of Isle Royale National Park, Pictured Rocks National Lakeshore, Apostle Islands National Lakeshore, and the Grand Portage Band of Lake Superior Chippewa Reservation, which contains the Grand Portage National Monument within its reservation boundaries. These parks contain some of the most productive fisheries in the basin and may include (at Isle Royale) unique morphotypes of lake trout (Goodier 1981, Burnham-Curtis 1996, Moore and Bronte 2001).

VHSv can cause massive fish kills, catastrophically reducing important recreational opportunities, subsistence and commercial fish stocks; potentially destroying the morphotypes of lake trout at Isle Royale; and creating unpleasant conditions such as windrows of dead fish.

What is the focus of this Plan?

This plan is focused on (1) preventing contamination of the waters of the four units of the National Park System located in the Lake Superior basin and the Grand Portage Indian Reservation, (2) detecting the introduction of VHSv and (3) responding to VHSv detection and outbreaks. The plan will assist park and tribal managers, staff and cooperators in assessing the risk of VHSv introduction and, subsequently, planning and implementing the appropriate levels of prevention and monitoring actions for their area based upon that risk. The plan also provides a framework for response. Implementation of this plan will require close coordination with tribes; federal, state and provincial agencies and other organizations as they implement their own plans around the basin.

[1] Viral Hemorrhagic Septicemia (VHS) is the disease in fish caused by the Viral Hemorrhagic Septicemia virus (VHSv).

What happens if we do nothing?

There is the potential for catastrophic loss of species important for recreational, subsistence and commercial fishing opportunities, as well as potential impacts to prey species that could affect higher levels of the food web within Lake Superior. Any loss of stocks from the Apostle Islands area and Isle Royale could cause a loss of genetic material and valuable information that would compromise ongoing efforts to restore lake trout populations in the other Great Lakes. There is also a potential for loss of Isle Royale coaster brook trout populations from which eggs and milt are collected to create brood stock in hatcheries that enhance the overall sustainability of coaster brook trout populations and lake-wide restoration efforts. The plan identifies emergency response actions that are essential to implement prior to the beginning of the spring spawning, recreational fishing, and shipping seasons on Lake Superior in order to fulfill the resource protection mandates of the National Park Service and the Grand Portage Band.

What are the major elements of this plan?

This plan includes an analysis of the risks posed by the various pathways, or vectors, for transmission of the virus; a listing of known measures to prevent or contain the virus; an overall plan for the prevention of or response to the virus in the four National Park System units and the Grand Portage Indian Reservation and recommendations for enhancing cooperation with tribes, agencies and other organizations.

Emergency recommendations for the parks and the Grand Portage Band include an outreach campaign; boat decontamination; restrictions on the use of bait; and insuring that agency operations and practices do not spread the virus, including agency-controlled vessel ballast water. All of these actions will be implemented in close coordination and collaboration with the respective tribal and state regulatory agencies. Longer-term, non-emergency recommendations include research; enforcement of laws and regulations; collaborating with the US Coast Guard and the states and commenting on the development of their ballast water regulations; engaging with other stakeholders on aquatic invasive species prevention measures and the harmonization of regulations amongst agencies; conducting pre-infection fisheries assessments; and working with other stakeholders to conduct a detailed risk assessment.

What Are the Next Steps?

The National Park Service will request that the states impose emergency regulatory action to protect park fisheries resources. Should that not be possible in the emergency timeframe, the NPS and the Grand Portage Band will collaborate with the states but will act within their authorities. Consultation and collaboration will be essential elements of all efforts to prevent and respond to VHSv. As knowledge and technologies improve, actions will be evaluated and refined. We will only succeed at preventing VHSv in Lake Superior by recognizing that tribal, federal, state, and private interests must work in concert, and as rapidly as possible.

Introduction

Background

Concerns over aquatic invasive species (AIS) have been growing since the sea lamprey invasion of the Great Lakes in the early to mid-twentieth century. Recently, a growing concern has emerged for aquatic invaders that cannot be seen with the naked eye, such as viruses, bacteria, and parasites. Although pathogens and parasites have received less attention to date, they are formally recognized as aquatic invasive species in the most recent amendment of the Nonindigenous Aquatic Nuisance Prevention and Control Act (16 USC 4702), and are clearly addressed in the mandate of the intergovernmental Aquatic Nuisance Species Task Force (ANS Task Force, *Strategic Plan 2007 – 2012).*

The Viral Hemorrhagic Septicemia virus (VHSv) has been identified in all of the Great Lakes, except Lake Superior, with a significant number of large-scale fish mortality events. The pathogenic effects of this microbe are clearly evidenced by massive die-offs among VHSv-infected Great Lakes fish, including muskellunge, freshwater drum, yellow perch, gizzard shad, white bass, and round gobies.

VHSv, a viral fish disease, caused mortality in rainbow trout and turbot aquaculture operations in Europe, and in Pacific herring and pilchard populations along the Pacific Coast of North America. This virus has a number of identified isolates (unique genetic types) grouped in four types: three from Europe and one from North America. The isolate recently found in Great Lakes fish is most similar to the VHS strain previously isolated from the Atlantic Coast in eastern North America (Winton, et al, 2008).

VHSv is transmitted between fish by ingestion of a diseased fish or by contact with urine, feces and sexual fluids of infected fish; however, the concentration of the virus in fluids must be high to be virulent. Reservoirs of the virus can include clinically ill and carrier fish that do not show signs of infection. The virus can be found on the surface of the salmonid eggs during spawning of infected female brood stock and is capable of vertical (egg-associated) transmission between generations. It is also likely to enter the body through the gills, wounds, or ingestion of infected prey, although direct oral transmission is unlikely. Fish infected with VHSv may exhibit bulging of the eyes, hemorrhaging in the skin, including large red patches, and hemorrhaging in internal organs. The ultimate cause of death is usually internal organ failure. Although virulent to fish populations, VHSv is not a human pathogen and does not pose risks to human health.

It is estimated that VHSv arrived in the Great Lakes around 2002. It is not known how the virus was initially introduced to the Great Lake-St. Lawrence River system; however, genetic evidence suggests that it originated from the Atlantic coast of North America, possible via transport in ballast water or infected migratory fishes (Elsayad, et al., 2006). That paper states:

> "The historic absence of VHSV in past health surveys and the recovery of identical isolates of VHSV from large numbers of dying fish in several of the Great Lakes

> suggest that the virus may have been recently introduced into the Great Lakes through one of several potential sources including ballast water or by anadromous or catadromous species that can enter the Great Lakes via the St. Lawrence river."

The large scale of the fish kills (typical of a new virus infecting a native fish community) and the low genetic diversity found in Great Lakes VHSv isolates to date suggest that this aquatic invader is a new arrival to the Great Lakes, likely within the past 5 to 10 years (Winton, et al., 2008). VHS-infected fish have been documented in Lake Huron (Cheboygan and Alpena. MI areas), Lake St. Clair, Lake Erie (all basins), Niagara River, Lake Ontario (Rochester, NY area), Lake Michigan (Green Bay, WI area), and the St. Lawrence River (Thousand Islands, Que. area). Based on the APHIS list, vulnerable coolwater species are muskellunge, northern pike, walleye, yellow perch, white bass, bluegill, black crappie, smallmouth bass, rock bass, freshwater drum, gizzard shad, round gobies, silver redhorse, shorthead redhorse, emerald shiners, and spottail shiners. Coldwater species on the APHIS list are Chinook salmon, lake whitefish and burbot.

It is important to recognize that our knowledge of VHSv is evolving and fish species that are not on the APHIS list may be vulnerable to the disease. McAllister (1990) includes the following discussion of fish known to be susceptible to VHS including several species that are present in Lake Superior but not included on the APHIS list:

> "In Europe, epizootics of VHS occur primarily in rainbow trout, Oncorhynchus mykiss; browntrout, Salmo trutta; and to a lesser extent in northern pike, Esox lucius (Jorgensen 1980; Meier and Jorgensen 1980). Natural infections have also occurred in grayling, Thymallus thymallus, and whitefish Coregonus sp. (Wizigmann et al. 1980; Ahne and Thomsen 1985; Meier et al. 1986). Outbreaks of VHS have been suspected in pollan,Coregonus avaretus,and lake trout, Salvelinus namaycush. In the United States, natural infections have been diagnosed in chinook salmon, O. tshawytscha; coho salmon, O. kisutch; and steelhead (searun rainbow trout). Fish shown by experimental challenge to be susceptible to VHS virus infection are Atlantic salmon, Salmo salar; brook trout, alvelinus fontinalis; golden trout, O. aguabonita; rainbow trout x coho salmon hybrids; giebel, Carassius auratus gibelio; sea bass, Dicentrarchus labrax; and turbot, Scophthalmus maximus (de Kinkelin and Castric 1982; Castric and de Kinkelin 1984; Wolf 1988). Fish shown by experimental challenges to be refractory to VHS virus infection are common carp, Cyprinus carpio; chub, Leuciscus cephalus; Eurasian perch, Perca fluviatilis; roach, L. rutilus; and tench, Tinca tinca."

Once introduced into a wild fish community, VHSv is impossible to eliminate and difficult to control. This contagious disease can cause large-scale mortalities of fish of commercial and recreational value and still others of ecological importance. These fish are potential carriers throughout the Great Lakes and inland waters. Human-induced movement vectors are being evaluated to reduce the potential spread of this pathogen.

Various entities, the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS), committees of the Great Lakes Fishery Commission and state and federal agencies have developed and adopted management measures to contain and slow the spread of this pathogen within jurisdictional borders and the Great Lakes basin. These include actions such as greatly increasing VHS surveillance, restricting bait fish movement, and initiating a moratorium on the hatchery production of selected high risk fish species

such as walleye. Other measures being taken to control this pathogen are strict regulation of interstate fish movements between and from infected regions by state departments of agriculture and APHIS. (Whelan, 2007).

The Grand Portage Band of Lake Superior Chippewa is a full partner in this plan, but is clearly a separate and sovereign governmental unit with authorities that are similar to the states on both reservation lands and treaty-ceded waters (see the Authorities and Policies section of this plan for details). The Grand Portage Indian Reservation (GPIR) described in this document includes the Grand Portage Zone waters of Lake Superior and extends beyond the boundaries of the Grand Portage National Monument. The Band regulates fish and wildlife harvesting and gathering by their members, including gear, bait, and seasons on the reservation. The Band, like other Indian tribes, has substantial commercial fisheries in Great Lakes waters and has treaty rights for inland waters. The Band also has the clear authority, capability and equipment to conduct scientific assessments.

The Grand Portage tribal government oversees biological staff in the development of regulations and management actions. Compliance is ensured by enforcement staff. The Grand Portage Band also belongs to The 1854 Treaty Authority, an intertribal organization that protects the off-reservation treaty rights specified in the 1842 and 1854 treaties with the United States of America.

Purpose and Scope of the Plan

Purpose: The purpose of this plan is to protect the resources of the four Lake Superior National Park System units identified above and the Grand Portage Indian Reservation (GPIR) by preventing the introduction of the VHS virus and effectively responding to it if the virus is detected. This plan serves as the guiding document for park and tribal managers to provide for the prevention, early detection, and rapid response to VHS viral infections in Lake Superior. Emergency and long-term actions are identified.

Scope. While this plan applies to the waters and resources of the units of the National Park System and the Grand Portage Indian Reservation, the plan recognizes that close coordination and cooperation with tribes, other agencies, and other organizations is essential for success.

Objectives and Strategies.

The following are the overall objectives and strategies for preventing, detecting and responding to VHSv:

1. Prevent the introduction and spread of VHSv in NPS and Grand Portage Indian Reservation waters to the greatest degree possible.

   Strategies:

   - Complete a situation analysis by analyzing the risks posed by each known vector.

- Identify and implement the appropriate emergency and long-term measures for parks and the GPIR to take, within existing authority, to mitigate the risks posed by each vector.
- Seek the cooperation of tribes, agencies and other organizations to take appropriate actions, within the scope of their authority, to mitigate the risk to parks.
- Build consensus and coordinate activities with cooperating federal, tribal, state, and local agencies; partners, and others as needed.
- Conduct an outreach campaign.

2. Detect introductions of VHSv in and near park and Grand Portage Indian Reservation waters.

   Strategies:
   - Complete a situation analysis that identifies risks.
   - Determine and implement the monitoring and detection measures needed to detect the presence of VHS in or near parks based on the identified risks.
   - Coordinate activities with allied federal, tribal, state, and local agencies; partners, and others as needed.

3. Respond to and minimize the spread and impact of VHSv.

   Strategies:
   - Maintain robust communications with and closely coordinate activities with allied federal, tribal, state, and local agencies; partners and others.
   - Provide an overall response plan that can be implemented, if needed, including components that ensure robust coordination and cooperation with tribes, other agencies, and other organizations.

4. Provide timely and accurate information to employees, management, stakeholders, and the public.

   Strategies:
   - Develop and implement a comprehensive VHSv communications strategy in coordination with allied federal, tribal, state and local agencies; partners and others.
   - Establish and maintain an easily updated web page that exhibits VHSv information or links to other web pages that include appropriate information.

5. Provide for the safety of personnel and the public.

   Strategies:
   - Review safety procedures for treatment in places when treatment options will be used.

- Perform a risk assessment for all planned activities, using existing Job Hazard Analyses (JHA) when available, and develop JHAs when they are not available.
- Communicate and enforce the mitigations found in the JHAs as well as standard safety practices.

6. Keep costs commensurate with the values at risk.

   Strategies:

- Evaluate all proposed actions to determine if they will achieve the desired results, to ensure that critical resources and facilities are appropriately protected, and to ensure the actions provide the greatest benefit for the cost.
- Coordinate actions with cooperating agencies and organizations; share costs or resources when appropriate.
- Develop and implement cost containment measures.
- Implement accurate cost estimating and tracking programs.
- Properly document and justify expenditures.

Planning Assumptions

Assumptions. These planning assumptions are based on the best information available at the time this plan was prepared:

- Knowledge of this strain of VHSv and its effects, particularly in freshwater fish, is incomplete and emerging. As knowledge expands, additional or revised measures may become available.
- Introduction of the VHS virus is likely to disrupt and degrade natural fish systems and related human activities, and will likely have adverse economic impacts on commercial and subsistence fishing and the recreational industry.
- Multiple potential vectors will facilitate the spread of VHSv.
- Tribes, agencies, and organizations have identified a variety of management practices for the prevention, detection, and response to VHSv.
- There is no single authority with jurisdiction over all aspects of the VHSv prevention issue in the Lake Superior basin, or even the U.S. waters of the basin. In fact, there is no single authority over any vector that may spread VHSv.
- The National Park Service and the Grand Portage Band of Chippewa have jurisdiction over a very small percentage of the waters in the Lake Superior basin, and over only a small fraction of the activities that may contribute to the introduction and spread of VHSv. The NPS and the Grand Portage Band nonetheless have an affirmative legal responsibility to fully act, within the authority they do possess, to protect national park system and Grand Portage Band resources.
- Working to achieve the goal of preventing the spread of VHSv into any of the waters under NPS and Grand Portage Band jurisdiction within these four parks and reservation waters will require a sophisticated and sensitive application of both NPS and tribal authorities, and close collaboration with other federal, state, and local agencies, and organizations.

- The risk of VHS in park and reservation waters is sufficient for the National Park Service and the Grand Portage Band to take reasonable emergency management measures now and to ask cooperators to consider measures now despite incomplete knowledge about the virus.

Scope of the VHSv Problem. The potential for human-mediated spread of VHSv into the waters of the Lake Superior basin and in other waters of the mid-west is substantial. It is important to undertake preventive measures as soon as possible. (personal communication, Gael Kurath, U.S. Geological Survey Western Fisheries Research Center, 2008). Each entity/jurisdiction will have different priorities based on their basic mission; many of these will overlap, some may be in conflict. Based on these priorities, agency response actions will vary.

Environmental Compliance Considerations. The National Environmental Policy Act (NEPA) provides policies and planning mechanisms to protect and mitigate park resources from damage. Affected parks will abide by all applicable requirements under NEPA for actions related to VHSv prevention and control.

Emergency authorities will be utilized for rapid response as necessary. Some of the emergency actions may involve changes to existing regulations or the promulgation of new regulations. These actions fall within National Park Service NEPA Categorical Exclusion A.8.[2]

Aquatic Invasive Species and the Great Lakes

This plan has been prepared in the context of a number of reports and recommendations regarding aquatic invasive species (AIS). Various agencies and organizations have worked diligently over a number of years to develop recommendations for prevention and management of these species. These recommendations come from:

- Intentional Introductions Policy Review – Report to Congress (Department of the Interior), May 3, 1994.
- U.S. Congress, Office of Technology Assessment, *Harmful Non-Indigenous Species in the United States*, OTA-F-S65, Washington, D.C. (U.S. Government Printing Office, September, 1993). Known as the OTA report.
- The Great Lakes Regional Collaboration Strategy, December, 2005, produced pursuant to Executive Order 13340, Establishment of Great Lakes Interagency

[2] Categorical Exclusion A.8 reads as follows:
Modifications or revisions to existing regulations, or the promulgation of new regulations for NPS-administered areas, provided the modifications, revisions, or new regulations do not:
(a) increase public use to the extent of compromising the nature and character of the area or cause physical damage to it.
(b) introduce non-compatible uses that might compromise the nature and characteristics of the area or cause physical damage to it.
(c) conflict with adjacent ownerships or land uses.
(d) cause a nuisance to adjacent owners or occupants.
Source: http://www1.nrintra.nps.gov/EQD/DO12Site/03_CatEx/034_CEs_record.htm

Task Force and Promotion of a Regional Collaboration of National Significance for the Great Lakes.

The recommendations of the Great Lakes Regional Collaboration Strategy build upon the Intentional Introductions Policy Review and the OTA report and apply directly to the AIS response in the Great Lakes. Some of these recommendations applicable to VHSv management in NPS units include:

1. Ship and barge-mediated introductions and spread of AIS in the Great Lakes should be eliminated, through the immediate promulgation of environmentally protective standards for ballast water, and the implementation of effective ship-board treatments and management measures.

2. Federal, state and/or local governments must enact measures that ensure that the region's canals and waterways are not a vector for AIS.

3. Federal and state governments must take immediate steps to prevent the introduction and spread of AIS through trade and the potential release of live organisms.

4. Establish a Great Lakes Aquatic Invasive Integrated Management Program to implement rapid response, control and management programs and assess the effectiveness of those programs.

5. Federal, state and tribal agencies, academic institutions and organizations should receive adequate support to conduct and evaluate cost-effective AIS vector-specific outreach and education programs. These programs should focus on behavior change and the responsibility of resource users.

Situation Analysis

Overall Situation

In May 2005, the Ontario Ministry of Natural Resources (OMNR) reported a significant mortality of freshwater drum in the Bay of Quinte (Lake Ontario). The cause of the mortality was determined to be VHSv. Prior to 2005, VHSv in North America was only known to be present in marine fishes along the Pacific and Atlantic coasts.

Following this initial report of VHSv by OMNR, a virus that had previously (2003) been isolated from a muskellunge caught in Lake St. Claire and archived at Michigan State University was confirmed to be VHSv by biologists at the U.S. Geologic Survey Western Fisheries Research Center in Seattle, WA. This indicated that VHSv was present in the Great Lakes basin as early as 2003 and may have arrived earlier.

During the spring and summer of 2006, significant fish mortality events were observed in Lake Erie, Lake Ontario, Lake St Claire, the St. Lawrence River, and Conesus Lake (Finger Lakes Region, New York). Species reported in these mortality events included freshwater drum, gizzard shad, muskellunge, round goby, walleye, and yellow perch. In January 2007, the Michigan DNR reported that VHSv had been detected in lake whitefish, walleye, and Chinook salmon in northern Lake Huron.

In the spring of 2007, fish kills were reported from several inland lakes in the Great Lakes basin, including Budd Lake (numerous species) in Michigan, Skaneateles Lake (rock bass, smallmouth bass, lake trout) in New York, and Lake Winnebago (freshwater drum) and Little Lake Butte des Morts (freshwater drum) in Wisconsin. Additional VHSv isolates were also made from brown trout, lake whitefish, and smallmouth bass collected in the Wisconsin waters of Lake Michigan. Figure 1 (page 14) shows the known distribution of VHS in the Great Lakes basin.

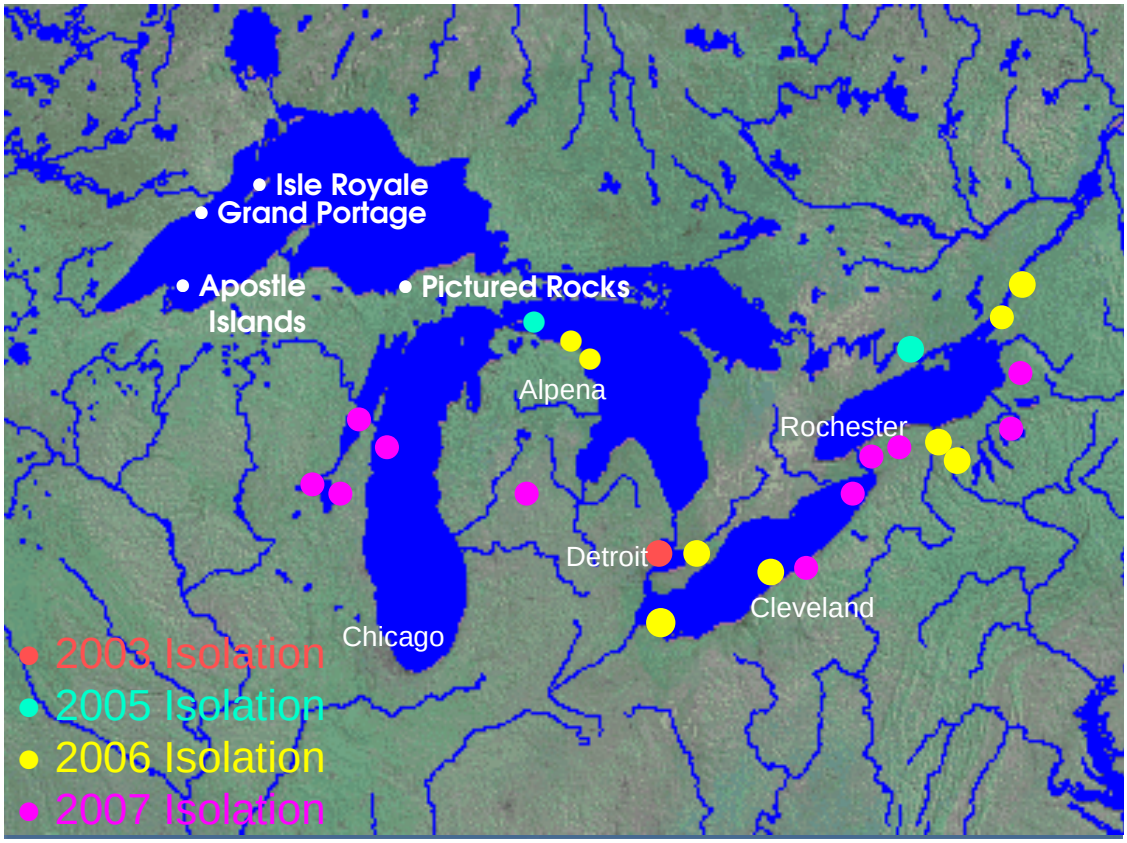
The strains of VHSv in North America are genetically different from the three genotypes of VHSv present in Europe (Gagne, et al., 2007; Winton, et al., 2008). The Great Lakes strain is most similar to isolates from the Atlantic coast of Canada, suggesting a marine origin. All of the isolates of VHSv in the Great Lakes have shown extremely low genetic diversity, suggesting that the virus is a recent introduction.

VHSv can remain stable in water over periods of weeks or month, depending on the temperature of the water. Note that the cooler the water, the greater the length of the virus' stability. (Table 1 on page 14.).

Table 1. VHSv stability in water. Adapted from Kurath, 2008.

VHSv Stability in Water	Time to complete inactivation at different temperatures, starting with 10e& pfu/ml of virus in different water types.	
Temp °C	**Seawater**	**Freshwater**
4	2 weeks	-2 months
10	1-2 weeks	-1 month
15	1 week	2 weeks
20	1 day	2 weeks
25	(not done)	1-2 weeks
30	(not done)	1 week

Figure 1. Known occurrences of VHS in the Great Lakes as of late 2007. Adapted from Kurath, 2008.



Park and Tribal Resources at Risk

The most recent (November 2007) APHIS prohibited species list contains 28 species that have been affected in the Great Lakes Basin (Table 2). These species have been documented to be carriers of, or susceptible to, VHSv in the wild. Some species on the list have been involved in large scale mortality events, while others have been documented through monitoring efforts as being infected by VHSv, but showing no clinical symptoms. Species that may have been reported as succumbing to VHS, such as lake trout in New York state, are not on the APHIS list because of the testing

(Preliminary Chain Reaction or PCR) that was conducted to verify VHSv in the affected fish. Table 2 below lists all fish species occurring in the four National Park units and those species on the APHIS list.

Table 2. Fish species listed by APHIS as having been affected by VHSv, including non-native species (November 8, 2007).

Black crappie	Bluegill
Bluntnose minnow	Brown bullhead
Brown trout	Burbot
Channel catfish	Chinook salmon
Emerald shiner	Freshwater drum
Gizzard shad	Lake whitefish
Largemouth bass	Muskellunge
Shorthead redhorse	Northern Pike
Pumpkinseed	Rainbow trout
Rock bass	Round goby
Silver redhorse	Smallmouth bass
Spottail shiner	Trout-Perch
Walleye	White bass
White perch	Yellow perch

Current Actions Underway

Surveillance. Great Lakes fisheries agencies have greatly expanded VHSv surveillance, and have been aided in part through funding from APHIS. Over 300 lots (a group of fish, typically 60-120 individuals of one species from a particular location and sampling event) were examined in 2007. A similar number of lots will likely be examined by Great Lakes fisheries agencies in 2008. Efforts will also be made in 2008 to involve other agencies such as the U.S. Geologic Survey (USGS) and the U.S. Environmental Protection Agency (EPA), in the surveillance program.

Outreach. All fisheries agencies within the Lake Superior Basin have developed extensive websites with VHSv information aimed at anglers and the recreating public. Both the USGS and APHIS are developing national websites and information summaries on VHSv. The USGS recently released an update of their information paper and APHIS intends to continue a public information and outreach campaign in fiscal year 2008.

Great Lakes Sea Grant offices have developed targeted outreach efforts that include "Don't Dump Bait" campaign and a "Hazard Analysis and Critical Control Point" (HAACP) program for the bait industry (Gunderson and Kinnunen, 2001, 2002, 2004). Training in HACCP planning has been conducted for the bait and aquaculture industry in the Great Lakes region. The U.S. Fish and Wildlife Service (USFWS) has a similar campaign to "Stop Aquatic Hitchhikers". All of the outreach materials on aquatic invasive species (AIS) prepared or distributed by the state and federal agencies, including those that have authority over fisheries and water quality issues, have direct applicability to controlling the spread of VHSv.

The North Central Regional Aquaculture Center (Michigan State University, East Lansing, MI and Iowa State University, Ames, IA) is developing an outreach program for private aquaculturists concerning biosecurity and VHSv. Other outreach efforts for aquaculture include a biosecurity workshop by the Ontario Ministry of Natural Resources and a VHSv and biosecurity workshop that was conducted by the Wisconsin Department of Agriculture.

Egg Disinfection Experiments. Great Lakes Fish Health Committee (a committee of the Great Lakes Fisheries Commission) member agencies have conducted experiments to determine the best methods for disinfecting cool-water fish eggs. Additional experiments are planned to determine the effect of declumping agents, including research with experimentally infected eggs.

The North Central Regional Aquaculture Center is in the process of approving work that examines egg disinfection techniques for a few key cool-water aquaculture species. Similar work is being considered in Ohio.

Research. Two new research projects have been recently funded or in the process of being funded. The Great Lakes Fishery Trust[3] is funding researchers from USGS, Michigan State University and Cornell University to examine the susceptibility of a number of important Great Lakes sports-fish to VHSv, including lake trout and Pacific salmon, and will develop new and faster detection techniques.

Biosecurity Measures. All of the members of the Great Lakes Fish Health Committee have greatly enhanced biosecurity measures at their hatcheries. This includes greatly increased brood stock testing, deployment of foot baths and unique nets to each raceway, new disinfection stations for hatchery trucks and equipment, disinfection policies for survey equipment, and new policies for testing fish to be transferred between waters.

The USFWS has required the development and implementation of Hazard Analysis and Critical Control Points (HACCP) plans at all of its field stations. In addition, The North Central Regional Aquaculture Center is in the process of approving a project on biosecurity and HACCP programs directed at different types of aquaculture production systems within the North Central Region of the U.S. See the References and Resources section for details about HACCP plans.

[3] The Great Lakes Fisheries Trust is an innovative funding source created in April 1996 as part of the settlement with Consumers Energy and the Detroit Edison Company for fish losses caused by the operation of the Ludington Pumped Storage Plant

Vector Analysis

Vectors. A number of vectors, or pathways, have the potential to spread VHSv into and around the Lake Superior basin. This section identifies those vectors, describes generally accepted measures to thwart or impede the vector and an analysis of the risk to tribal and park waters posed by the vectors.

These potential vectors include: aquaculture, ballast water, commercial and subsistence fishing, movement/migration of fish and wildlife, National Park Service and Grand Portage Indian Reservation operations and agency-controlled activities and water-based recreational activities.

Aquaculture

Description. Aquaculture practices primarily pose a risk to infection through stocking of infected fish.

Level of risk. The level of risk posed by this vector is relatively low because of awareness and health certification programs in hatcheries. In addition, stocking in NPS units and Grand Portage is only allowed for restoration purposes. Currently, stocking occurs only in Grand Portage waters; however, stocking of fish outside of park boundaries has the potential to cause problems.

Prevention measures. The most generally accepted prevention measure is to require batch certification of stocked fish.

Ballast Water

Description. Ballast water is a significant vector for the introduction and potential spread of AIS into the Great Lakes basin. It is estimated that over 70% of the non-native species introductions in the Great Lakes are attributable to ballast water (Holeck, et al., 2004). Intra-lake transfer of AIS through ships' ballast water has also been of concern among the lakes (Hensler and Jude 2007). The following conclusion and recommendations come from the Water Quality Board of the International Joint Commission:

- "The discharge of ballast water from vessels coming from outside the U.S. and Canadian Exclusive Economic Zone, however, has been identified as the single most important source for alien invasive species entering the Great Lakes basin."
- "Until acceptable long-term treatment technologies are developed for treating ballast water to achieve the bi-national discharge standards, the Commission should recommend that the Parties give serious consideration to chemical treatment of ballast water as a short-term, emergency measure for all vessels entering the Great Lakes from outside the Exclusive Economic Zone. To

facilitate the short-term, emergency use of chemical treatment, the Commission should recommend that the Parties, in cooperation with shippers and other relevant stakeholders, undertake appropriate testing and evaluation activities to determine the efficacy of alternative chemicals, including effective biocide chemical dosages, relative costs, onboard handling requirements and vessel safety, and potential environmental impacts of treated ballast water discharges. The Parties should develop and apply a uniform protocol for evaluating the results from the testing and evaluation program for application throughout the Great Lakes basin."

While jurisdiction for ballast water regulation of commercial vessels currently falls under the authority of the U.S. Coast Guard, the National Park Service (NPS) controls the treatment and discharge of ballast water onboard vessels operated by the NPS and has the authority to regulate discharges from vessels that are in park waters to protect park resources. Various types of ballasted vessels operate in Great Lakes waters, including park waters. These include ferry boats (both privately and NPS owned), cruise ships and private yachts. During the fall of 2007 the National Park Service vessel *Ranger III* (which transits to Isle Royale), treated its ballast on all runs with chlorine and neutralized the chlorine using vitamin C to meet applicable clean water standards. The Park is currently pursuing a more permanent treatment system for the ship and collaborating with researchers to find emergency treatment options for small to freighter sized ships.

While the number and frequency of ballasted ship traffic is low in parks other than Isle Royale National Park, some traffic does occur in those locations. Discharge of ballast in or near any of the parks' waters from commercial vessels is likely very rare, but there is a possibility that it could occur. The highest likelihood for a discharge would be in Isle Royale. Some ships in transit to Thunder Bay pass through Isle Royale waters and may need to begin discharging ballast several hours before arriving at port. These vessels may be relatively close to park waters when discharge begins.

Risk Factors. The following are considered to be risk factors for ballast: volume of ballast discharged to Lake Superior ports, species composition in ballast uptake areas and past epizootic outbreaks or documented VHSv at areas of ballast uptake

Volume of Discharge. A relatively small number of ports in Lake Superior receive the majority of ballast discharge from vessels coming from the lower Great Lakes. Ports such as Duluth-Superior and Thunder Bay, therefore, would have a higher risk of receiving ballast water with VHSv than other areas.

Species Composition. Hensler and Jude (2007) surmise that diel movement of larval goby influences their susceptibility to be taken up in ballast water at the time of the day when they are nearer the surface water and affects the rate of spread of this species through intra-lake movement of ballast water. Since round gobies are highly susceptible to VHSv, this increases potential spread of VHSv through intra-lake ballast transfers when ballast is taken on at ports where gobies exist. Time of year (i.e., when larvae are

not likely to be present) and time of day of ballast discharge will play a role in reducing this risk.

Past epizootic outbreaks or documented VHSv at areas of ballast uptake. Several areas within the upper Great Lakes have had mortality events within the past two to three years. Movement of ballast from these areas, especially if fish or larvae are present in ballast water, would increase risk of transporting VHSv to Lake Superior.

Potential Prevention Measures. The following are accepted measures to prevent this vector from spreading VHSv:

- Preventing entry of infected fish or fish larvae into ballast tanks by screening intake flows.
- Routine disinfection of ballast water.
- Exchange of ballast water outside of identified 'at risk' ports (although some reviewers of this plan thought that this action may increase the spread of VHSv in the other Great Lakes if VHSv contaminated ballast water were to be dropped on large populations of fish).

An estimation of the effectiveness of these measures, conducted under various conditions and frequencies, is shown in table 4 below.

Table 3. Estimated effectiveness of potential prevention measures.

Frequency	Activity	Targets	Relative cost	Risk reduction (1=low,5=high)
Continuous	Screening (small)	Fish and larvae	Very high	3
	Screening (large)	Fish	High	2
	Ballast exchange	Fish, larvae, and water	Low	3
	Disinfect	Everything	Moderate	5
Seasonal (spring & fall)	Ballast exchange	Fish, larvae, and water	Low	2
	Disinfect	Everything	Moderate	4
Trigger of VSH detection (epizootic event)	Ballast exchange	Fish, larvae, and water	Low	1
	Disinfect	Everything	Moderate	3

Commercial and Subsistence Fishing

Description. This vector includes fish waste, gear and features of vessels.

Fish waste**.** The two prevailing methods for processing fish captured in commercial and subsistence fisheries are on-vessel or on-land. On-vessel fish processing poses a risk of spreading infection across the surface waters of Lake Superior, because some commercial fishermen dispose of fish offal overboard.

Gear**.** Gill nets are set at various locations throughout Lake Superior. They are typically checked every other day and the catches may be processed aboard vessels or on land. Trap Nets are set for periods of up to one week or longer and are typically maintained in the same location over relatively long periods of time. Catch may be processed on the boat or on shore.

Vessel**.** Body fluids from harvested fish transported in fish boxes leak into the bilge and are discharged from the bilge into the lake onsite or during transit and in port.

Level of Risk. The following describe the level of risk.

Fish waste**.** The risk of spreading the disease through disposal of fish waste is potentially high. Waste disposed of at the fishing location could perpetuate the disease within the target species or sympatric species. Waste disposed in transit or in port poses the risk of introducing the virus to additional populations and species.

Gear**.** In general the risk of spreading VHSv through gear is lower than the risk of spreading VHSv through fish waste. There is some level of risk associated with moving nets from contaminated to uncontaminated waters. Risk is lowest when fishing gear is used within a limited area of Lake Superior and highest when gear is used both in VHSv positive waters and within Lake Superior.

Vessel**.** There is a moderate risk of perpetuating or facilitating the spread of VHSv through the discharge into the lake of bilge water contaminated with fish body fluids because of the dilution factor when the bilge water is released.

Potential Prevention Measures. The following are accepted measures to prevent this vector from spreading VHSv:

- Prevent in-lake disposal of fish waste at locations other than where fish were harvested. Consideration should be given to processing harvested fish on-shore and disposing of waste through rendering, appropriately managed landfills or other approved methods.
- Recommend disinfection by drying or dilute bleach solution when moving distances between Lake Superior management zones.
- Recommend separate fishing gear among separate Great Lakes water bodies.

- Prevent the discharge of bilge water or disinfect bilge water by bleach solution during transit, in accordance with state and federal environmental regulations.[4]

Movement/Migration of Fish and Wildlife

Description. Fish migration in Lake Superior includes both inter-lake (between lakes) and intra-lake (within Lake Superior) migration.

Inter-lake migration of a VHSv-positive fish into Lake Superior could occur through the St. Mary's River or via waterways connecting Lake Superior with Hudson Bay. Currently, the Soo Locks and associated hydro facilities on the St. Mary's River provide a partial barrier to fish movement into Lake Superior from the other lakes. Fish can migrate past dams through a passage structure (such as a lock) or over the dam. While it is possible for fish to migrate through the locks, locks themselves are not conducive to fish passage and are not traditionally considered fish passage structures.

If VHSv were to be introduced into Lake Superior, intra-lake fish migration, often channeled by counterclockwise lake currents (personal communication with Dr. Sarah Green, Michigan Technological University, 2007), may contribute to the spread of the virus to other locations within the lake. The risk of spreading VHSv within the lake would depend on which species were to become infected. Schooling species that migrate throughout the lake (e.g., ciscoe, short-jaw cisco, smelt, etc.) would pose the greatest risk. Non-schooling species (e.g., lake trout, brook trout, etc.), or non-migratory species such (e.g., smallmouth bass, etc.), would pose the least risk.

Migratory birds pose a very low risk of spreading the virus into Lake Superior, or around Lake Superior (if an infection were to occur). Birds could serve as a vector of VHSv by carrying an infected fish from one location to another. It is very unlikely that a bird would carry an infected fish over a great distance, however, and avian body temperatures typically are above 39 °C - well above the temperature at which VHSv is deactivated. The digestive processes of avian species would also readily destroy the virus.

[4] The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) regulates the production, sale, distribution and use of products intended to prevent, destroy, repel, or mitigate pests, such as the VHS virus. Therefore, any product used to control VHS is required by FIFRA to be registered as a pesticide with U.S. EPA prior to its use in this country. Alternatively, under emergency conditions, the U.S. EPA can permit unregistered products to be used under a Section 18 exemption. Thus, an EPA registered pesticide, or an unregistered product permitted under Section 18, must be used. In addition, there are state requirements for certification of persons applying pesticides on property they do not personally own. These requirements would pertain to personnel applying pesticides to agency vessels. In most states, the Departments of Agriculture implement and enforce the training and certification of applicators. For state contact information, please see http://aapco.ceris.purdue.edu/htm/control.htm .

Level of Risk and Potential Prevention/Containment Measures. Table 4 on page 23 below shows an estimation of the level of risk of this vector, along with generally accepted prevention/ containment measures and research recommendations.

Table 4. Risks; measures for prevention, monitoring, detection and response; and recommendations for research related to natural fish movement and migration.

Description of Vector	Level of Risk	Prevention Measures	Monitoring & Detection Measures	Response Measures	Research & Other Recommendations
Intra-Lake Superior (Basin) Natural Fish Movement and Migration	High if VHSv is in Lake Superior, otherwise virtually no risk	Review removal plans for low-head dams on tributaries, and consider retaining them for their potential role in preventing VHS introduction to inland waters.	Continue monitoring and surveillance of wild fish for presence of VHSv; create a central hotline or website for reporting suspected VHSv outbreaks.	Be prepared for removal of fish on banks / shores	Determine whether or not highly migratory fish (including sea lamprey) are potential VHSv carriers or hosts.
Inter-Great Lakes Natural Fish Movement and Migration (Ste. Mary's River and Soo Locks; connecting waterways from Hudson Bay)	Low	Consider modifications to the Soo Locks or management of connecting waterways from Hudson Bay.	Continue monitoring and surveillance of wild fish for presence of VHSv; create a central hotline or website for reporting suspected VHS outbreaks.	Be prepared for removal of fish on banks / shores	
Bird Movement and Migration	Very Low			If VHSv outbreak occurs, minimize bird contact with fish carcasses.	Demonstrate that virus cannot survive passage through birds.

NPS and Reservation Operations and Agency Controlled Activities

Description. National Park Service (NPS) and Grand Portage Indian Reservation (GPIR) operations include a wide range of activities that could spread VHSv, including the operation of vessels (such as the ballasted Ranger III). NPS and GPIR also control the activities of other agencies and organizations that may affect VHSv transport and prevention, such as permitted research and management activities, special events in or near NPS waters (kayak symposia, boat rallies, sailing regattas, and fishing competitions), concessionaire operations (including docks, ferries), non-NPS and non-GPIR fisheries research and management activities, operation of vessels, deployment of buoys and navigation markers, marina operations, and dredging activities.

Risk. Relative risks associated with these activities will vary, largely depending on the status of VHSv in Lake Superior and the degree to which fish are involved. Prior to VHSv detection in Lake Superior, many agency activities will pose a relatively low risk of introducing VHSv. The highest risk activities will be those that involve transfer of fish or gametes from other waters into Lake Superior (i.e., for stocking or rehabilitation efforts), or movement of vessels or gear into Lake Superior from outside the basin (i.e., special events).

Preventative Measures: Several considerations for VHSv prevention and response may be applied broadly across NPS and GPIR activities.

- NPS, GPIR, and other agencies should review their existing operations, particularly those that involve activity in both VHSv infected waters and Lake Superior or those that involve fish contact or transfer. Where appropriate, agencies should develop or revise Hazard Analysis Critical Control Point (HACCP) plans to facilitate prevention.
- Agency staff and non-NPS researchers should be trained to observe VHSv signs and symptoms, to share this information with visitors, and to rapidly report any VHSv introductions.
- Agency-controlled vessels should use clean municipal or disinfected ballast water in their operations.
- Outreach campaign actions should be developed with other agencies and entities to encourage VHSv prevention measures.
- In the event of VHSv detection in Lake Superior, closures, suspension, or rescheduling of high-risk agency activities should be considered.

Table 5, starting on page 25, shows an estimation of the level of risk of this vector, along with generally accepted prevention/containment measures and research recommendations.

Table 5. National Park Service and Reservation matrix of agency and partner activities that may affect VHSv transport or introduction, with associated level of risk, prevention, monitoring, detection, and response measures, and recommendations for research and other needs.

Description of Vector	Level of Risk	Prevention Measures	Monitoring & Detection Measures	Response Measures	Research & Other Recommendations
Field Operations (including law enforcement, maintenance, resource management, interpretation and ferry operations)	Low (pre-VHSv in Lake Superior) Medium-High (post-VHS in Lake Superior; particularly if involves fish contact)	Emphasize communication within and beyond NPS; use water body-specific gear; disinfect gear; disinfect ballast on ballasted vessels.	Watch for disease signs and kills; initiate visitor contacts to communicate VHSv information.	Ramp up enforcement and outreach; consider fishing closures in infected waters; consider suspending or rescheduling operations during VHS outbreaks.	
Permitted Research and Management Activities	Low (pre-VHSv in Lake Superior) Medium-High (post-VHS in Lake Superior; particularly if involves fish contact)	Include VHSv prevention provisions in research permits; use water body-specific gear; disinfect gear.	Watch for disease signs and kills; report detections.	Consider suspending or rescheduling operations during VHSv outbreaks. Schedule activities/work to avoid periods when VHSv concentration is high (temperature/spawning run considerations).	
Concessionaires and Contractors	Low (pre-VHSv in Lake Superior) Medium (post-VHSv in Lake Superior)	Emphasize communication; include VHSv prevention conditions in permits or contracts.			
Special Events (e.g., kayak symposium, boat rallies, sailing	Medium to High (depending on the home waters and	Emphasize communication; include VHS	Survey participants to evaluate boat cleaning and	Increase surveillance in areas with such events.	

Description of Vector	Level of Risk	Prevention Measures	Monitoring & Detection Measures	Response Measures	Research & Other Recommendations
regattas, fishing competitions)	prevention measures taken by participants)	prevention conditions in special use permits.	prevention measures taken.		
Non-NPS Fisheries Research & Management Activities	Low-Medium (most activities, pre-VHSv in Lake Superior) High (fish stocking and transfer activities, regardless of VHSv status in Lake Superior)	Consider formal interagency agreements to prevent VHSv transfer; use water body-specific gear; disinfect gear; regularly deployed check gear; ensure adequate fish health inspection prior to stocking; disinfect fertilized eggs; consider modifying timing of stocking activities to avoid VHS outbreaks; review VHS risks posed by lamprey control activities.	Regularly check fish condition in field; watch for disease signs, and kills; report detections; ensure adequate fish health inspection prior to stocking.	Consider suspending or rescheduling activities during outbreaks (possibly excepting activities for which the benefit to threatened or endangered species is greater than the risk posed by VHSv); schedule activities/ work to avoid periods when VHSv concentration is high (temperature/spawning run considerations).	Determine whether or not sea lamprey may serve as a VHSv carrier.
Agency Vessel Operations (including ballast and gear; including research, law enforcement, interpretation, transport, and other vessels)	Medium-High (if lake-to-lake transport involved)	Use water body-specific gear; disinfect gear; consider ballast treatment or use of clean ballast in agency vessels.	Watch for disease signs, kills, and report detections.	Enforce existing rules regarding ballast water discharge in NPS waters; encourage ballast treatment for non-NPS waters as well.	

Description of Vector	Level of Risk	Prevention Measures	Monitoring & Detection Measures	Response Measures	Research & Other Recommendations
Buoy & Navigation Marker Placement	Low	Avoid transferring buoys or navigational markers from VHSv-infected waters into Lake Superior.			
Marina Operations	Medium	Encourage marina operators to share invasive species information and include VHSv prevention conditions in slip rental agreements.			
Dredging Operations	Low (pre-VHSv in Lake Superior) Medium (following VHSv detection)	Ensure boats and equipment are disinfected after use in VHSv infected waters, before use in Lake Superior.		Restrict dredging operations during times when fish are most susceptible to infection.	Conduct research on VHS viability in sediment and susceptibility of benthic organisms to VHSv.

Water Based Recreation Activities

Description. VHSv may be spread from one water body to the next by a variety of water-based recreational activities. Of particular concern are activities involving the movement of fish, watercraft and equipment with potential to be in contact with the virus and/or contaminated water.

Level of Risk: The following activities are considered to be high to low risk, depending upon their association with infected fish and contaminated water.

High Risk
- Bait, live or dead, as used in angling including open water, ice and shore fishing
- Recreational bait harvesting
- Recreational boats with water-holding capacity with particular concern for live-wells, bilges, coolers, and bait containers

Moderate Risk
- Recreational boats without water holding capacity if anchors may pick up VHSv in contaminated sediments
- Smelt seining or netting
- SCUBA diving or snorkeling, including fish spearing
- Aircraft operation on water
- Personal watercraft with water, such as jet skis

Low to No Risk
- Artificial Bait
- Swimming
- Waterfowl hunting using watercraft without water
- Personal watercraft without water, such as kayaks, canoes, windsurfers

Potential Prevention Measures. The following are generally accepted prevention measures to prevent spreading VHSv:

General Guidelines. Follow the guidelines for nationally-accepted prevention steps for aquatic invasive species, such as:
- Inspect and remove aquatic plants, animals, and mud from your boat, trailer and equipment.
- Drain all water from your motor, livewell, bilge, transform wells, etc.
- Dispose of unused bait in the secure trash. Never release live bait into a waterbody, or transfer aquatic animals or water from one waterbody to another.
- Wash your boat and equipment with hot (>104º F) and/or high pressure water, particularly if moored for more than one day, or…
- Dry your boat and equipment thoroughly for 5 days or…

- Disinfect your vessel or equipment using a chlorine solution, in accordance with federal and state environmental requirements (see the footnote on page 21).

Specific Guidelines for VHSv. Table 6 shows the prevention guidelines specific to VHSv. The Wisconsin Department of Natural Resources has excellent guidelines for boat and gear disinfection (see the References and Resources section). Additional information can be found at http://dnr.wi.gov/fish/pages/vhs.html and http://www.michigan.gov/dnr/0,1607,7-153-10364_10950_46202---,00.html.

Table 6. Prevention guidelines specific to VHSv for water based recreation activities.

Activity or Gear	Guidelines
Fish bait (dead or alive)	o Jurisdictions may prohibit the use of live or dead bait in NPS waters. o If bait is allowed for use in designated areas, bait use and disposal must be regulated a. Pursuant to state regulations or b. Pursuant to following biosecurity practices: • Use only bait Certified Disease Free • Use bait fish that have been harvested locally and certified disease free. • Use roe (fish eggs) as bait only when fishing in the same waterbody where roe was collected. Roe should either be certified, or follow state bait regulations per park. • Do not discard roe or bait fish or fish parts in waterbodies. Place unused bait in the garbage. Fish part disposal in trash for some Isle Royale boaters will be difficult because they'll be camping near dock areas at remote parts of the island. • Do not move live or dead fish between waters . • When cleaning/gutting fish, ensure that the waste products do not contact waterways. Dispose of fish internal organs, skin, scales, heads and tails in the garbage, in an upland location or buried. • Empty bait fish containers, live wells and bilges away from water, in an area where the water will be absorbed into the ground
Boats, trailers and live wells (focus areas that come in contact with fish)	o Remove organic material from boats, trailers, and live wells. Drain water from live wells, bilges and pumps. The outside and inside of the boat, trailer, live wells, bilges, and pumps should be sprayed with the disinfection solution and left wet for the appropriate contact time. The inside of the live wells, bilges and pumps should be made to contact the solution for the appropriate contact time as well. Run pumps so they take in some of the disinfection solution and make sure that the solution comes in contact with all parts of the pump and hose. The boat, trailer, bilges, live well, and pumps should be rinsed with clean water or water from the next waterbody after the appropriate contact time. Every effort should be made to keep

	the disinfection solution and rinse water out of waterbodies. (See the footnote on page 21).
Motors	o For outboard motors, rig up a short (6-foot) piece of garden hose to lower unit muffs. A pail of the disinfectant can be set in the back of the boat and gravity fed to the lower unit to run the disinfectant through the motor.
Nets and other gear	a. Organic debris should be removed prior to disinfection. Nets could be sprayed with a garden hose to remove debris. Nets should be placed in the disinfection solution for the appropriate contact time for the solution being used. After rinsing nets, they can be used immediately, or hung to dry. b. Options for disinfecting personal protective and other gear include the following. i. Option one: The gear can be sprayed with the disinfection solution and a wet surface maintained for the appropriate contact time. The gear should be rinsed with clean water or water from the next waterbody before it is used again. ii. Option two: Fill a tub with disinfection solution and place all equipment in the tub for the appropriate contact time (see Table 1 for time). The gear should be rinsed with clean water or water from the next waterbody before it is used again. iii. Option three: Use a completely new set of gear for each waterbody during the work day and disinfect all gear at the end of the day using option one or two.
Water that has been in contact with fish	o Avoid discharging such water into any natural body of water. o Disinfect water by bleach solution, in accordance with state and federal environmental regulations, and/or prevent discharge (see the footnote on page 21).

Assessment of Risks to Tribal and Park Resources by Vector

Relative Risks Outside of Jurisdictional Waters. Table 7, starting on page 31, shows the relative risk (associated with vectors) to waters outside of Tribal and Park jurisdictions.

Relative Risks Within Jurisdictional Waters. Table 8, starting on page 32, shows the relative risk (associated with vectors) to waters within Tribal and Park jurisdictions associated with the vectors.

Table 7. Relative risk from VHSv vectors outside NPS and GPIR jurisdictional boundaries (Risk factors: Low, Medium or High; Overall Risk score: HHH=H+, HHM=H, HHL=H-, MMH=M+, MMM=M, MHL=M, MML=M-, LLH=L+, LLM=L, LLL=L-).

Human Activities						
Vector	**Risk Factors**			**Risk Score**	**Current Risk to Park Units**	**Prevention Actions**
	Volume of Activity *1	**Transport Potential *2**	**Propagule Pressure *3**			
Ballast water	High	High	Med	HHM	H	Cooperate with regulatory authorities to promote effective ballast water regulation for Lake Superior
Bait	High	High	Med	HHM	H	Support improved certification protocols and regulation as necessary.
Recreational boating and fishing	High	Med	Med	HMM	M+	Support effective regulations (drain and dry or disinfection) and enforcement.
Stocking	Med	High	Low	MHL	M	Support continued evaluation and improvement of certification protocols.
Agency operations	Med	Med	Low	MML	M-	Lead by example (HACCP plans etc). Encourage practices that minimize risk by other management agencies.
Commercial and Subsistence Fishing	Med	Med	Low	MML	M-	Cooperate with appropriate regulatory agencies to promote practices that reduce risk of transmission

Natural Processes						
Vector	**Risk Factors**			**Risk Score**	**Current Risk to Park Units**	**Prevention Actions**
	Volume of Activity *1	**Transport Potential *2**	**Propagule Pressure *3**			
Wild fish Movements (from lower Great Lakes)	Low	High	Med	LHM	M	Support studies of fish movement from lower Great Lakes to Lake Superior and measures to reduce movement as appropriate
Wild fish Movements (w/in Lake Superior)	Med	High	Low	MHL	M	Cooperate with other agencies to implement sampling and testing within NPS waters.
Migratory Birds	High	Low	Low	HLL	L+	None

*1 Volume of the identified activity – A qualitative indicator of the current level of activity within Lake Superior.
*2 Transport potential – A qualitative indicator of potential for an activity to transport and introduce VHS. The potential that the activity will transport infected fish, fish parts and infested water, i.e. increased activity will raise the potential to transport infected fish, fish parts, and water.
*3 A qualitative indicator of the concentration of organisms per unit volume of water based on the current situation (i.e. absence of virus from Lake Superior and current state management practices with respect to hatchery and bait fish certification).

Table 8. Relative risk associated with VHS vectors within NPS and GPIR jurisdictional boundaries (Risk factors: Low, Medium or High; Overall Risk score: HHH=H+, HHM=H, HHL=H-, MMH=M+, MMM=M, MHL=M, MML=M-, LLH=L+, LLM=L, LLL=L-).

Human Activities								
Vector	**Risk Factors**			**Risk Score**	**Current Risk to NPS Units**	**Risk Reduction Feasible on NPS Units?**	**Prevention Actions**	**Risk of VHS introduction with Prevention Actions**
	Volume of Activity *1	**Transport Potential *2**	**Propagule Pressure *3**					
Bait	High	High	Med	HHM	H	Yes	Prohibit use of bait that can transmit VHS in NPS waters	Low
Recreational boating and fishing	High	Med	Med	HMM	M+	Yes	Require draining and drying of boats, prior to entry into NPS waters.	Low
Agency operations	High	Med	Low	HML	M	Yes	Develop and adopt HACCP Plans Biosecurity practices Conditions on research and other permits Conditions on concessions and commercial services	Low
Ballast water with Fish	Low	High	Med	LHM	M	Yes	To keep risk at low, continue prohibition on untreated ballast water exchange within ISRO waters and expand to include all Lake Superior National Parks if USCG regulation is not timely.	Low
Commercial and subsistence Fishing	Med	Med	Low	MML	M-	Yes	Outreach to commercial and subsistence fishermen. Recommend sampling and best management practices	Low
Stocking	Low	High	Low	LHL	L+	Yes	Require batch certification of all stocked fish	Low

Natural Processes								
Vector	**Risk Factors**			**Risk Score**	**Current Risk to NPS Units**	**Prevention Actions Feasible on NPS Units**	**Potential Prevention Actions**	**Risk of VHS introduction with Prevention Actions**
	Volume of Activity *1	**Transport Potential *2**	**Propagule Pressure *3**					
Wild fish movements (into and within NPS units)	Med	High	Low	MHL	M	No	Work with other agencies to implement sampling and testing within NPS waters.	Med
Migratory Birds	High	Low	Low	HLL	L+	No	None	Low

*1 Volume of the identified activity – A qualitative indicator of the current level of activity within NPS boundaries.
*2 Transport potential – A qualitative indicator of potential for an activity to transport and introduce VHS. The potential that the activity will transport infected fish, fish parts and infested water, i.e. increased activity will raise the potential to transport infected fish, fish parts, and water.
*3 A qualitative indicator of the concentration of organisms per unit volume of water based on the current situation (i.e. absence of virus from Lake Superior and current state management practices).

Rationale for the Determination of Risk. VHSv vectors were identified and prioritized based on assessments of the overall risk that they will introduce the disease to fish population in NPS waters. For the purposes of this exercise the level or risk was considered to be influenced by three elements: 1) Volume of activity; 2) transport potential; and 3) propagule pressure. Risk associated with each element was identified as high, medium or low (H, M or L, respectively) based on the professional judgment of the participating subject matter experts. Overall risk was determined by the composite of the rankings for the individual elements. Overall risk scores were considered to be high (H+, H, H-), medium (M+, M, M-) or low (L+, L, L-), depending on the composite score. It is important to recognize that this approach is ordinal and rankings do not correspond to quantitative measures of risk.

Volume of activity is essentially an estimate of the frequency of occurrence for events that have the potential to introduce the VHS virus. For example, in the case of recreational boating, it is proportional to the number of recreational boats entering NPS waters. For wild fish it is some measure of abundance and the rate at which fish move across an NPS boundary.

Transport potential is an estimate of the suitability of a vector to maintain the VHS virus in a viable condition over the period of time it is transported from one location to another. As an example, the virus can remain viable indefinitely inside an infected fish; therefore the transport potential for fish is high. Likewise, the transport potential for ballast water is high if it includes fish that were entrained with the water; for ships that prevent the entrainment of fish through the use of screens, risk associated with ballast water would be lower. In contrast, transport potential for recreational boats is considered medium because the length of time that the virus can remain viable is shorter for water transported within a boats plumbing system than it is for fish. However, if a recreational boat were transporting fish in its live well transport potential would be considered high.

Propagule pressure is an estimate of the density of the VHS virus associated with a particular vector. As with transport potential, risk from propagule pressure is highest for live fish that can serve as a host for the virus. However, because the VHS has not yet been detected for fish from Lake Superior, risk associated with propagule pressure is currently considered low for wild fish. On the other hand, risk from propagule pressure is considered to be medium for ballast water and bait because both vectors have the potential to transport fish that have come from VHS infected waters outside the Lake Superior basin.

Authorities and Policies

Introduction. The prevention and control of the spread of VHSv will require a multi-jurisdictional approach. This section is a summary of Tribal, National Park Service, other federal and state authorities, both general and specific to fishing regulations in Lake Superior and inland waters.

Tribal Authorities

General Authorities of Lake Superior Ojibwe tribes[1]. Tribal authority predates the creation of the United States. Tribal authority extends from those rights and powers that they have not voluntarily relinquished or that Congress had not abridged. As a general rule, the right to tribal self-government remains intact unless tribal powers have been modified by treaty or by Congressional action.

Tribal rights to Lake Superior fish are codified in treaties between tribes and the federal government. Three treaties negotiated in 1837, 1842, and 1854, stipulate the rights of Ojibwe in the United States to fish in Lake Superior (see the specific language related to fish on page 35). In these three cases, the treaties predate statehood in each respective state: Michigan, Wisconsin, and Minnesota. Some Lake Superior Ojibwe tribes with fishing rights are legally called Bands, such as the Fond du Lac and Grand Portage Bands of the Minnesota Chippewa Tribe. In the case of Lake Superior fish, each "Band" has the same legal role as a "tribe." And in some instances, Bands have collectively created intertribal organizations to advise and help them manage fish and game related matters, such as the 1854 Treaty Authority for the Grand Portage and Bois Fort Bands and the Great Lakes Indian Fish and Wildlife Commission for Bands in Wisconsin and parts of the Upper Peninsula of Michigan. However, the legal "rights" to fish is retained by the federally recognized tribe or Band unless formally delegated to the intertribal organization. A suite of Court decisions has articulated how the three treaties apply today.

Each Tribal Nation or Band is legally, politically, socially and culturally unique[5]:

- Tribal governments are established in accordance with each Tribal Nation's own laws and traditions, as well as within the framework of how Tribal Nations have been brought into the U.S. Constitution.

[5] Most of the following material is derived from a paper given by James Zorn of the Great Lakes Indian Fish and Wildlife Commission entitled "Great Lakes Regional Collaboration - Tribal Nations Issues and Perspectives," dated April 26, 2005, with permission. The tribal briefing paper is found on the GLRC website at http://www.glrc.us/documents/strategy/GLRC-Tribal-Briefing-Paper.pdf.

- The powers of tribal governments generally are set forth in tribal Constitutions or similar organic documents, but also might be determined in accordance with a Tribal Nation's customs and traditions.

Tribal "on-reservation" rights and authority may extend outside of reservation boundaries. For example, many reservations are located on the shores of Lake Superior precisely to secure access to the Lake for fishing and other purposes. In addition to reservation-based rights and interests, many Great Lakes Tribal Nations retain treaty-guaranteed off-reservation hunting, fishing and gathering rights that extend to large parts of the Great Lakes basin. These are commonly referred to as ceded territory treaty rights because they pertain to areas that Tribal Nations ceded (or sold) to the United States in various treaties.

The government-to-government relationship implicit in federal treaty making and in the federal trust responsibility toward Tribal Nations and individual tribal members has been expanded over time to include the full gamut of federal policy implementation by all federal agencies. Federal agencies have "Indian trust responsibilities" specific to their jurisdictional sphere to insure those tribal rights are protected.

Specific Authority for the Grand Portage Band of Minnesota Chippewa Tribe. The Grand Portage Band retains the fishing related rights agreed upon in the 1854 Treaty negotiated between the United States government and several Chippewa Bands. Article 11 of the 1854 Treaty states:

> "Article 11. All annuity payments to the Chippewa of Lake Superior, shall hereafter be made at L'Anse, La Pointe, Grand Portage, and on the St. Louis River; and the Indians shall not be required to remove from the homes hereby set apart from them. And such of them as reside in the territory hereby ceded, shall have the right to hunt and fish therein, until otherwise ordered by the President."

The 1854 Treaty provisions are still in effect. For reservation-based matters (on the Grand Portage Reservation), unless Congress has otherwise provided, the state of Minnesota does not have the authority to regulate tribal members exercising reservation-based hunting or fishing rights. Fishing rights off the reservation are more complicated. The Grand Portage Reservation Tribal Council is concerned about how state or federal agency actions could impact the quantity or quality of the Lake Superior fish and tribal members ability to harvest Lake Superior fish.

National Park Service Authorities and Policy

National Park Service Authorities Relevant to VHSv in the Lake Superior Basin. To effectively prevent the introduction of VHSv into the lakes and streams under NPS jurisdiction in these four national parks will require significant collaboration and cooperation among a number of other Federal and State agencies and local organizations.

While the NPS has clear legal responsibility and authority to protect park resources, including significant authority to manage fish, wildlife and public use within these parks, it does not possess the authority to independently design or implement a comprehensive protection plan for the whole basin, which is necessary to effectively protect these parks from VHSv. Use and implementation of NPS authorities alone will not be sufficient.

Achieving the goal of preventing the spread of VHSv into any of the waters under NPS jurisdiction within these four parks will require a sophisticated and sensitive application of both NPS authority and close collaboration with other federal, state and local agencies; industries, organizations and the public.

It is a clearly established legal principle[6] that pursuant to the Supremacy Clause and the Property Clause of the U.S. Constitution, the federal government in areas subject to the jurisdiction of the United States has the authority to regulate activities within the federal area when it is determined necessary to protect fish and wildlife. While consultation with respective States is often required by park-specific enabling legislation, the NPS continues to be legally responsible for the protection and management of fish and wildlife within the federal area. The NPS has defined the federal area in its regulations at 36 CFR 1.2 as including all federally owned lands and waters, and other waters within the boundaries of the National Park System that are subject to the jurisdiction of the Unites States, without regard to the ownership of submerged lands.

General Legal Authorities of the National Park Service. The National Park Service has broad statutory authority under Title 16 of the United States Code, Section 1 *et seq.* (National Park Service Organic Act of 1916, as amended) to "…regulate the use of the Federal areas known as national parks, monuments, and reservations…by such means and measures as conform to the fundamental purposes of the said parks…which purpose is to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment for future generations" (16 U.S.C. Section 1). In addition, the NPS Organic Act directs the Secretary of the Interior, acting through the NPS, to "make and publish such rules and regulations as he may deem necessary or proper for the use and management of the parks, monuments, and reservations under the jurisdiction of the National Park Service" (16 U.S.C. Section 3).

In 1970, Congress amended the NPS Organic Act to clarify its intentions as to the overall mission of the NPS. Through the General Authorities Act of 1970 (16 U.S.C. Sections 1a-1 - 1a-8), Congress emphasized that all areas administered by the NPS are part of one National Park System and directed the NPS to manage all areas under its administration consistent with the Organic Act of 1916.

In the 1978 "Redwood Amendment" to the Organic Act, Congress reasserted the high standard of protection defined in the original Organic Act by stating "Congress further reaffirms, declares, and directs that the promotion and regulation of the various areas of

[6] Affirmed numerous times by U.S. Courts, e.g. Missouri v. Holland (1920); New Mexico v. Udall (1969); Kleppe v. New Mexico (1976); United States v. Brown (1977); Wyoming v. Norton (2002).

the National Park System, … shall be consistent with and founded in the purpose established by Section 1 of this Title, to the common benefit of all people of the United States." Congress further reinforced the Secretary's duty to safeguard units of the National Park System, as follows:

> The authorization of activities shall be construed and the protection, management, and administration of these areas shall be conducted in light of the high public value and integrity of the National Park System and shall not be exercised in derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress.

The Senate committee report stated that under the Redwood amendment, "The Secretary has an absolute duty, which is not to be compromised, to fulfill the mandate of the 1916 Act to take whatever actions and seek whatever relief as will safeguard the units of the national park system."

16 U.S.C. Section 1c defines the National Park System as "…any areas of land and water now or hereafter administered by the Secretary of the Interior through the National Park Service for park, monument, historic, parkway, recreational, or other purposes."

The Park System Resources Protection Act, 16 U.S.C Section 19jj-2(b)(1), directs the Secretary to "undertake all necessary actions to prevent or minimize the destruction, loss of, or injury to park system resources, or to minimize the imminent risk of such destruction, loss, or injury."

Title 36 of the Code of Federal Regulations provides the NPS with broad legal authority to manage all public and recreational use on federally owned lands within parks, including the promulgation of regulations that would be more restrictive than those allowed under normal State regulations or generally allowed in other NPS units.

In addition, these regulations allow for specific closures and public use limits:

> *"36 CFR § 1.5 (Closures and Public Use Limits)*
> (a) Consistent with applicable legislation and Federal administrative policies, and based upon a determination that such action is necessary for the maintenance of public health and safety, protection of environmental or scenic values, protection of natural or cultural resources, aid to scientific research, implementation of management responsibilities, equitable allocation and use of facilities, or the avoidance of conflict among visitor use activities, the superintendent may:
>
> (1) Establish, for all or a portion of a park area, a reasonable schedule of visiting hours, impose public use limits, or close all or a portion of a park area to all public use or to a specific use or activity.
>
> (2) Designate areas for a specific use or activity, or impose conditions or restrictions on a use or activity.

(3) Terminate a restriction, limit, closure, designation, condition, or visiting hour restriction imposed under paragraph (a)(1) or (2) of this section."

National Park Service Management Policies. In addition to the above statutory authority, the Superintendents are guided by established NPS policy as found in the *NPS Management Policies* (2006) and related documents. As stated in the Management Policies, the primary responsibility of the NPS is to protect and preserve our national natural and cultural resources while providing for the enjoyment of these resources by visitor and other users, as long as such use does not impair park resources or values, including the opportunity to enjoy those resources or values.

Management Policies elaborates on the meaning of "preserve" in the context of biological resources in national parks, explaining that the NPS is to preserve, and where necessary, restore native biota and natural systems, and to do so, wherever possible, in the context of cooperative conservation with other responsible entities whose interests lie beyond park boundaries:

4.4.1 General Principles for Managing Biological Resources

The National Park Service will maintain as parts of the natural ecosystems of parks all plants and animals native to park ecosystems. The term "plants and animals" refers to all five of the commonly recognized kingdoms of living things and includes such groups as flowering plants, ferns, mosses, lichens, algae, fungi, bacteria, mammals, birds, reptiles, amphibians, fishes, insects, worms, crustaceans, and microscopic plants or animals. The Service will successfully maintain native plants and animals by

- preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur;
- restoring native plant and animal populations in parks when they have been extirpated by past human-caused actions; and
- minimizing human impacts on native plants, animals, populations, communities, and ecosystems, and the processes that sustain them.

4.4.1.1 Plant and Animal Population Management Principles

In addition to maintaining all native plant and animal species and their habitats inside parks, the Service will work with other land managers to encourage the conservation of the populations and habitats of these species outside parks whenever possible. To meet its commitments for maintaining native species in parks, the Service will cooperate with states, tribal governments, the U.S. Fish and Wildlife Service, NOAA Fisheries, and other countries, as appropriate, to

- participate in local and regional scientific and planning efforts, identify ranges of populations of native plants and animals, and develop cooperative strategies for maintaining or restoring these populations in the parks;

- suggest mutually beneficial harvest regulations for lands and waters outside the parks for populations that extend across park boundaries, such as resident deer or fishes …;
- prevent the introduction of exotic species into units of the national park system, and remove, when possible, or otherwise contain individuals or populations of these species that have already become established in parks.

In order to achieve the resource protection mandates of the National Park Service, each park Superintendent is directed to analyze overall park use and determine if any particular use is appropriate – and act accordingly. The following excerpts from Chapters 1 and 8 of Management Policies make the obligations on park superintendents to act quite clear:

> *1.4.3 The NPS Obligation to Conserve and Provide for Enjoyment of Park Resources and Values*
> Congress, recognizing that the enjoyment by future generations of the national parks can be ensured only if the superb quality of park resources and values is left unimpaired, has provided that when there is a conflict between conserving resources and values and providing for enjoyment of them, conservation is to be predominant. This is how courts have consistently interpreted the Organic Act.
>
> *1.4.3.1 Park Purposes and Legislatively Authorized Uses*
> In the administration of authorized uses, park managers have the discretionary authority to allow and manage the use, provided that the use will not cause impairment or unacceptable impacts.
>
> *1.5 Appropriate Use of the Parks*
> When proposed park uses and the protection of park resources and values come into conflict, the protection of resources and values must be predominant.
>
> *8.2 Visitor Use*
> If and when a superintendent has a reasonable basis for believing that an ongoing or proposed public use would cause unacceptable impacts to park resources or values, the superintendent must make adjustments to the way the activity is conducted to eliminate the unacceptable impacts. If the adjustments do not succeed in eliminating the unacceptable impacts, the superintendent may (1) temporarily or permanently close a specific area, or (2) place limitations on the use, or (3) prohibit the use.

Park Enabling Legislation. No specific language exists in Isle Royale's enabling legislation authorizing consumptive use other than what would normally be permitted in national park units (see Table 9). When the state of Michigan conveyed title to the NPS subsequent to the establishment of the park, however, it saved to itself authority to regulate fishing in the waters of Lake Superior. While this was acknowledged by the federal government and has never been challenged, some unresolved issues remain as to the ultimate authority over fishing in the lake. Unquestionably, however, the NPS does

have authority over the fish and therefore has responsibility to protect the fish from impairment or other harm. The park has found that working cooperatively with the State of Michigan on fishing regulation and seeking State regulatory changes when the NPS believes they are needed has been a successful strategy in light of the legal ambiguity.

The enabling legislation for both Apostle Islands and Pictured Rocks specifically requires close coordination of fishing regulations with their respective states (see Table 9). Language is explicit allowing the NPS to deviate from state fishing law at APIS under certain conditions, while the law is silent on the subject at PIRO. The enabling legislation of Grand Portage authorizes use of the monument by members of the Minnesota Chippewa Tribe, and allows the NPS to regulate this use if necessary.

Table 9. Park enabling legislation specific to fishing at the four national park units bordering Lake Superior (emphasis added).

Apostle Islands National Lakeshore (APIS) **16 USC 460w**	**Isle Royale National Park (ISRO)** **16 USC 408**	**Grand Portage National Monument (GRPO)** **16 USC 450oo**	**Pictured Rocks National Lakeshore (PIRO)** **16 USC 460s**
The Secretary shall permit hunting, fishing, and trapping on lands and waters under his jurisdiction within the boundaries of the lakeshore in accordance with the appropriate laws of Wisconsin and the United States to the extent applicable, except that he may designate zones where, and establish periods when, no hunting, trapping, or fishing shall be permitted for reasons of public safety, administration, fish or wildlife management, or public use and enjoyment. Except in emergencies, any regulations prescribing any such restrictions shall be put into effect only after consultation with the appropriate State agency responsible for hunting, trapping, and fishing activities.	The Secretary of the Interior shall make and publish such general rules and regulations as he may deem necessary and proper for the … preservation from injury and spoliation of all … natural curiosities, or wonderful objects within said park, and for the protection of the animals and birds in the park from capture or destruction, and to prevent their being frightened or driven from the said park; and he shall make rules and regulations governing the taking of fish from the waters in the said park. **From the Federal Register Dec. 14, 1955:** ... the Legislature of the State of Michigan, by Act No. 281,	Recognized members of the Minnesota Chippewa Tribe shall not be denied the privilege of traversing the area included within the Grand Portage National Monument for the purposes of … fishing: *Provided*, That in order to preserve and interpret the historic features and attractions within the monument, the Secretary may prescribe reasonable regulations under which the monument may be traversed.	In administering the lakeshore the Secretary shall permit hunting and fishing on lands and waters under his jurisdiction in accordance with the applicable laws of the United States and of Michigan. The Secretary, after consultation with the Michigan Department of Conservation, may designate zones and establish periods where and when no hunting shall be permitted for reasons of public safety, administration, or public use and enjoyment. The Secretary shall, after consultation with such department, issue regulations, consistent with this section, as he may determine necessary to carry out the purposes of this section.

	Michigan Public Acts of 1949, amended the act of February 27, 1939, among other things, to cede to the United States exclusive jurisdiction over the submerged lands within four and one-half miles of the shore line of Isle Royale and immediate surrounding islands, and, further, to convey title to such submerged lands to the United States. The act saved to the State, however, among other things, all oil and mineral rights in and to the submerged lands, and further saved that fishing in said waters shall be subject to and conducted according to applicable State laws.		

Federal Regulations

General Regulations (36 CFR § 2.3 Fishing). The following regulations apply to all NPS areas except as modified by Special Regulations (see next section), that is, these apply in their entirety to ISRO but the 3 other parks have special regulations.

(a) Except in designated areas or as provided in this section, fishing shall be in accordance with the laws and regulations of the State within whose exterior boundaries a park area or portion thereof is located. Nonconflicting State laws are adopted as a part of these regulations.
(b) Except in emergencies or in areas under the exclusive jurisdiction of the United States, the superintendent shall consult with appropriate State agencies before invoking the authority of § 1.5 for the purpose of restricting or closing park areas to the taking of fish.
(c) The following are prohibited (emphasis added):

(1) Fishing in fresh waters in any manner other than by hook and line, with the rod or line being closely attended.

(2) Possessing or using as bait for fishing in fresh waters, live or dead minnows or other bait fish, amphibians, nonpreserved fish eggs or fish roe, except in designated waters. Waters which may be so designated shall be limited to those

where non-native species are already established, scientific data indicate that the introduction of additional numbers or types of non-native species would not impact populations of native species adversely, and park management plans do not call for elimination of non-native species.

(3) Chumming or placing preserved or fresh fish eggs, fish roe, food, fish parts, chemicals, or other foreign substances in fresh waters for the purpose of feeding or attracting fish in order that they may be taken.

Special Regulations. Federal Register Volume 49, Number 84, page 18448-9 (April 30, 1984) indicates that the purpose of the general regulation above (2.3) is "to ensure that … resources are not adversely affected by the introduction of non-native species. Where such regulations are found to be unnecessary in order to accomplish Service management objectives, relief can be granted through the use of special regulations." It goes on to say that for the parks that have special fishing regulations (including the three below, Table 10), the NPS "has determined that allowing recreational fishing in accordance with all methods permitted by the State would be advantageous to visitor use and not incompatible with park resources. These situations include cases where non-native species have become well established and it is impractical to consider eradication in favor of native species."

The explanation elaborated further:

> "The regulations provide, however, that superintendents may, through the designation process, restrict these fishing methods. Such restrictions might be applied to specific locations within a park area or might deal with a fishing method which is found to be incompatible with management objectives for the park area. The National Park Service intends that Superintendents will implement restrictions on methods of taking of fish on a determination that such taking:
>
> (1) Is consistent with the purpose for which the area was established; and
>
> (2) Will not be detrimental to other park wildlife or the reproduction potential of the species to be taken; and
>
> (3) Will not have an adverse effect on the ecosystem."

The intent of the federal regulations is that sport fishing shall be permitted within the parks in accordance with federal and state law wherever appropriate. At APIS, NPS may enact closures under its enabling legislation, as well as by authority of the special regulation (locations or time periods), which must be done only after consultation with the states (except in case of emergency, when no consultation is required). At PIRO, this legislative authority exists for hunting closures but the law is silent on fishing closures. The PIRO special regulation permitting designation of circumstances where state fishing law should not apply, however, resolves the ambiguity on this topic left by the omission of such explicit authority in the PIRO enabling legislation.

Consultation with the states, which is required except as noted above, does not mean that the states have to agree or promulgate their own action to enact the closure.

§ 2.3 says federal and state fishing laws and regulations apply to the extent applicable. Since nonconflicting state laws and regulations are automatically adopted, conflicting state laws are assumed to be those that are not "to the extent applicable" at ISRO, in the absence of special regulations.

The special regulations for APIS, GRPO, and PIRO contain identical language (Table 10), saying that fishing is authorized according to applicable state law (and presumably state regulation) unless otherwise designated. In these cases, it can be assumed that the definition of "applicable" is not limited to the non-conflicting state laws. The Federal Register clearly indicates that the Superintendents are authorized to designate the circumstances under which NPS will not conform to state fishing law. This is in marked contrast to CFR 2.18, which explicitly requires snowmobile routes to be designated through special regulation. NPS will consult with the Department of the Interior Solicitor regarding whether or not any "designations" would have to be promulgated through additional special regulations.

Table 10. Special regulations specific to fishing at three national park units.

Apostle Islands National Lakeshore **36 CFR § 7.82**	**Grand Portage National Monument** **36 CFR § 7.59**	**Pictured Rocks National Lakeshore** **36 CFR § 7.32(b)**
Fishing. Unless otherwise designated, fishing in a manner authorized under applicable State law is allowed.	*Fishing.* Unless otherwise designated, fishing in a manner authorized under applicable State law is allowed.	*Fishing.* Unless otherwise designated, fishing in a manner authorized under applicable State law is allowed.

Superintendents' Compendia. Apostle Islands and Pictured Rocks have long deferred to the states to make whatever rules are needed to protect and manage recreational fishing. The two parks have used their Superintendent's Compendia language to reiterate the meaning of their special regulations. Despite the absence of a special regulation for ISRO, because of the state's assertion of retained jurisdiction over Lake Superior fishery management, that park treats Lake Superior and inland waters differently: inland waters are recognized as having the full protection of 36 CFR 2.3; there is considerable deference to state regulation of recreational fishing on Lake Superior waters.

Clearly, the combination of the law and CFR sections reserves the right to the NPS to deviate from state law and regulation under some circumstances. Equally clearly, the protection of native species from VHSv and other aquatic invasive species fit well within the criteria of the special regulations provisions for additional NPS control over fishing.

All four parks, either explicitly through their compendia (APIS, PIRO) or implicitly through their special regulation (GRPO), or acknowledgement of the state's retained authority over fishing (ISRO), permit the use of live or dead fish bait in Lake Superior waters within the parks. While this appears counter to the intent of 36 CFR § 2.3, it is consistent, in the case of the three parks with the special regulations, with the intent of each park's special regulation, at least as the situation in these parks was understood in

1984. VHS and other aquatic invasive species, however, have changed the NPS' understanding of the condition and threat to its resources since that time.

Table 11. Superintendents' compendia specific to fishing in the four national park units bordering Lake Superior.

Apostle Islands National Lakeshore	**Isle Royale National Park**	**Grand Portage National Monument**	**Pictured Rocks National Lakeshore**
2.3 FISHING A. 36 CFR 2.3(a): Fishing Activities. Fishing is permitted in accordance with regulations of the State of Wisconsin as directed by 36 CFR 7.82. B. 36 CFR 2.3(d)(2): Bait. The use of non-native bait is permitted in accordance with applicable State regulations.	**2.3 FISHING** (d)(2) - Possessing or using as bait for fishing in inland waters, live or dead minnows or other bait fish, amphibians, non-preserved fish eggs, or fish roe is prohibited. Possession or use of insects and invertebrates (e.g., leeches, worms, and clams) is prohibited.	*No specific language related to fishing*	**2.3 FISHING** 1. Under the authority of 36 CFR 2.3(d)(2): All waters within the Pictured Rocks National Lakeshore boundary, owned in fee by the NPS, are open to use or possession of live or dead minnows or other bait fish, amphibians, non-preserved fish eggs, or fish roe for bait in accordance with laws and regulations of the State of Michigan as directed by 36 CFR 7.32(b).

Collaborating Agencies

No one agency has overall authority over the issues related to VHSv. Numerous tribal, federal and state agencies, as well as a host of organizations, have jurisdiction or interests in one or more of the issues. It is clear that all entities will need to collaborate and coordinate to properly manage VHSv issues in Lake Superior. A list of jurisdictions and authorities can be found in the Reference and Resources section.

Actions to Protect Tribal and National Park Resources

The following actions have been prescribed to protect Tribal and Park resources from the potential adverse effects of VHSv, in accordance with the authorities and policies of each. Because these vary, some actions are outlined for the National Park Service only.

Most of these actions will require collaboration, coordination and cooperation with numerous other agencies and organizations. As a result, some of these actions may be modified as that process unfolds.

The following prevention actions are planned:

Emergency Prevention Actions

1. Conduct a coordinated **outreach** campaign to encourage compliance with laws and regulations and promote behaviors that prevent and contain VHSv **(**both NPS and GPIR).

Prevention Action 1 Work Plan		
Task	**Assigned to**	**Due Date**
a. From the attached Communications Strategy, develop a plan to provide information to the public, staff, cooperators and other stakeholders.		
b. Determine and obtain funding for the campaign.		
c. Train involved staff in the purposes and content of the campaign.		
d. Implement the campaign.		

2. Encourage (and require, to the degree practicable) the **decontamination of boats** and all associated equipment prior to entering NPS and GPIR waters **(**both NPS and GPIR).

Prevention Action 2 Work Plan		
Task	**Assigned to**	**Due Date**
a. Develop an information handout and web link with the appropriate information about procedures to decontaminate boats and gear.		
b. Train public and tribal contact staff in the proper decontamination of boats and gear.		
c. As a part of the outreach campaign, notify the public of the desired decontamination procedures.		
d. Develop specifications for, and then seek and obtain funding for any equipment or capital improvements needed in the parks and GPIR to decontaminate agency boats and equipment.		

3. Request that Michigan, Wisconsin, Minnesota and the Grand Portage Band of Lake Superior Chippewa Indians take emergency action to immediately prohibit, in waters either within these four national parks or waters that flow into these parks, the use of any type of **bait** that is known or suspected to be a carrier of VHS, or any other aquatic

nuisance species[7] or is in and of itself an aquatic nuisance or non-native species. Work with the states and tribe to develop actions that will protect waters, which may include emergency restriction of certain activities that spread VHS. If states or the Band decline to take action, the NPS will exercise its authority to enact such an emergency activity restriction for the waters within its jurisdiction.

Prevention Action 3 Work Plan		
Task	**Assigned to**	**Due Date**
a. Notify and consult with the regional and other agency officials as appropriate.		
b. Consult with the states, each park's affiliated tribes, and the associated intertribal organizations.		
c. Prepare formal requests for the involved states, tribe and associated intertribal organizations.		
d. Coordinate with and provide technical assistance, if requested, on parallel actions by additional tribes.		
e. Assist the states and tribe(s) in implementing and publicizing such emergency closures.		
f. Prepare coordinated language and justification for each park's Superintendent's Compendium and the Band's Policies to be used if needed. Consult as needed with higher offices and the solicitor.		
g. Promulgate and publicly announce changes in each unit's rules, if needed.		
h. Consult with and inform user groups and other interested parties, including other federal, tribal, state, and local partners, of the changes.		
i. Assess the need for new special federal regulations and begin that process, if needed.		

4. Seek formal U.S. Coast Guard clarification that ballast water discharge or uptake exchange is already prohibited in NPS waters; if this cannot be done prior to the 2008 spawning season, use NPS and GPIR authorities to prohibit the discharge or uptake of untreated **ballast water** in NPS and GPIR waters (both NPS and GPIR).[8] [9]

Prevention Action 4 Work Plan		
Task	**Assigned to**	**Due Date**
a. Notify and consult with regional and other agency officials as appropriate.		

[7] The term "aquatic nuisance species" is to be interpreted comprehensively, in keeping with 16 USC 4702 and the intergovernmental Aquatic Nuisance Species Task Force's definition and, thus, includes pathogens and parasites.

[8] NPS has been told by USCG personnel that the existing USCG regulation 33 CFR 151.2035(a)(1) can and should be applied to all NPS waters, although the rule language is more general:

Sec. 151.2035 What are the required ballast water management practices for my vessel?

(a) Masters, owners, operators, or persons-in-charge of all vessels equipped with ballast water tanks that operate in the waters of the U.S. must:

(1) Avoid the discharge or uptake of ballast water in areas within or that may directly affect marine sanctuaries, marine preserves, marine parks, or coral reefs.

[9] Treatment options must control pathogens that could adversely impact visitors or resources, including VHSv.

b. Consult with the three states, each park's affiliated tribes, and the Great Lakes Indian Fish and Wildlife Commission.		
c. Notify and consult with the Michigan, Wisconsin, and Minnesota Congressional delegations		
d. Request the US Coast Guard clarify in the Federal Register and through Notices to Mariners that the existing regulation already prohibits the discharge or uptake of ballast water within or that may directly affect national park units; alternatively, seek immediate change to regulatory language to make the prohibition explicit and allow for discharge of water treated to disinfection standards for VHS.		
e. Review, with the USCG, that enforcement protocols for the above are in place and will be implemented.		
f. If/when the above actions are accomplished, withdraw the emergency Isle Royale ballast water restriction promulgated in September 2007.		
g. Prepare coordinated language and justification for each park's Superintendent's Compendium and the Band's Policies to be used if needed. Consult as needed with higher offices and solicitors.		
h. Promulgate and publicly announce changes in each unit's rules, if needed.		
i. Consult with and inform user groups and other interested parties, including other federal, tribal, state, and local partners, of the changes.		
j. Assess the need for new special federal regulations and begin that process, if needed.		
k. Coordinate with and provide technical assistance, if requested, on parallel actions by additional tribes.		
l. Publish the notice of closure to ballast in the Mariners Notice (including latitude and longitude boundary descriptions of all four Lake Superior national parks and the GPIR)		
m. Monitor compliance in each park and GPIR by accessing interlake and saltwater vessel ballast records.		

5. Ensure that agency operations, including vessels, and agency-controlled activities employ **best practices** for prevention and containment of VHSv **(**both NPS and GPIR).

Prevention Action 5 Work Plan		
Task	**Assigned to**	**Due Date**
a. Review all operations to identify critical points where VHSv may be spread (see table 6).		
b. Develop or revise Hazard Analysis Critical Control Point (HACCP) plans to prevent VHSv spread.		
d. Develop standard language outlining VHSv prevention practices required by contractors, researchers, cooperators and others controlled by the agency.		
e. Require VHSv prevention practices when issuing permits, contracts and other instruments.		

Non-Emergency Prevention Actions

6. Determine and then require the proper disposal of **fish waste and bait (**both NPS and GPIR).

Prevention Action 6 Work Plan		
Task	**Assigned to**	**Due Date**
a. Conduct research to determine the proper methods of disposal of fish waste and bait, addressing both VHSv risks and other environmental protection requirements.		
b. Prepare a logical waste disposal policy outlining the needed procedures.		
c. Consult with the involved states, each park's affiliated tribes, and the associated intertribal organizations.		
d. Consult with user groups and other interested parties, including other federal, tribal, state, and local partners.		
e. Seek and obtain funding for any capital improvements needed in the parks and GPIR; e.g., fish cleaning stations.		
f. Prepare coordinated language and justification for each park's Superintendent's Compendium and the Band's Policies to be used if needed. Consult as needed with higher offices and solicitors.		
g. Promulgate and publicly announce changes in each unit's rules, if needed.		
h. Consult with and inform user groups and other interested parties, including other federal, tribal, state, and local partners, of the changes.		
i. Assess the need for new special federal regulations and begin that process, if needed.		

7. Emphasize **enforcement** of laws and regulations designed to prevent and contain VHSv **(**both NPS and GPIR).

Prevention Action 7 Work Plan		
Task	**Assigned to**	**Due Date**
a. Train public and tribal contact staff and law enforcement personnel in (1) the dangers of VHSv, (2) the pertinent laws and regulations and (3) the need to vigilantly enforce these laws.		
b. As a part of the outreach campaign, notify the public that pertinent laws and regulations will be diligently enforced.		
c. Meet with prosecutors and others to explain the importance of enforcing these laws.		
d. Enforce laws and regulations during scheduled patrols. .		
e. Conduct special operations, as needed, to enforce laws and regulations during critical time periods..		

8. Comment on U.S. Coast Guard and states' **regulation development** for ballast water and recommend that all federal ships with ballast should have a ballast management plan **(**both NPS and GPIR).

Prevention Action 8 Work Plan		
Task	**Assigned to**	**Due Date**
a. Share the results of the planning effort that resulted in this plan with the USCG and the shipping industry.		
b. Review all notices and Federal Register entries regarding USCG rule-making.		
c. Participate in both formal and informal meetings with the USCG.		
d. Develop formal comments regarding USCG rule-making and have them approved by the respective agency or tribal leadership, with review by solicitors as needed.		
e. Submit formal comments by the required deadlines.		

9. Engage with public and private maritime interests to promote successful implementation of VHSv and AIS prevention measures for **ballast water (**both NPS and GPIR).

Prevention Action 9 Work Plan		
Task	**Assigned to**	**Due Date**
a. Identify relevant interests.		
b. Designate key staff to act as leads for each entity.		
c. Participate in both formal and informal meetings with each entity to clarify NPS and GPIR mandates for resource protection and resources at risk.		

10. **Begin dialog** with cooperating entities: Great Lakes Fisheries Commission, the Great Lakes Fish Health Committee, the Great Lakes Indian Fish and Wildlife Commission, the Great Lakes Regional Collaboration and the Great Lakes Panel on Aquatic Nuisance Species **(**both NPS and GPIR).

Prevention Action 10 Work Plan		
Task	**Assigned to**	**Due Date**
a. Designate key staff to act as leads for each entity.		
b. Participate in both formal and informal meetings with each entity to clarify NPS and GPIR mandates for resource protection.		
c. Request that the Great Lakes Fish Health Committee identify and prioritize gaps in the VHSv surveillance on a basin-wide basis.		
d. Request that the Great Lakes Working Group convene and determine the authorities and procedures for employing an incident management team in the event of a VHSv outbreak, recommending that the Great Lakes Fish Health Committee have a lead role.		

11. Encourage tribal, state and provincial partners to **harmonize regulations** concerning ballast, bait, fish health certification, disinfection options and other requirements **(**both NPS and GPIR).

Prevention Action 11 Work Plan		
Task	**Assigned to**	**Due Date**
a. Work with the Great Lakes Commission and the Great Lakes ANS Panel to review existing and new regulations and determine where there are opportunities for harmonization.		
b. Participate in both formal and informal meetings with each entity or groups of entities to negotiate regulation harmonization.		
c. Take appropriate actions to revise NPS and GPIR regulations and rules.		
d. Work with other entities to assist them in revising regulations and rules.		

12. **Track VHSv related research**, communicate findings with staff and modify actions as needed **(**both NPS and GPIR).

Prevention Action 12 Work Plan		
Task	**Assigned to**	**Due Date**
a. Review research results on a periodic basis.		
b. Conduct briefings with staff to apprise them of research developments.		
c. Modify planned actions, if needed, in accordance with pertinent research results.		

13. Identify and prioritize **VHSv related research needs (**both NPS and GPIR).

Prevention Action 13 Work Plan		
Task	**Assigned to**	**Due Date**
a. Develop a work group to review current research and identify gaps.		
b. Prioritize research needs.		
c. Prepare proposals to conduct the research and submit to the appropriate funding source.		

14. Complete **pre-VHSv assessments** of fisheries conditions for NPS and GPIR waters **(**both NPS and GPIR).

Prevention Action 14 Work Plan		
Task	**Assigned to**	**Due Date**
a. Prepare a pre-VHSv assessment plan.		
b. Implement the pre-VHSv plan.		

15. Encourage the Smithsonian[12], the U.S. Coast Guard and the U.S. Fish and Wildlife Service to conduct a **detailed risk assessment** of the VHSv threat **(**both NPS and GPIR).

Prevention Action 15 Work Plan		
Task	**Assigned to**	**Due Date**
a. Designate key staff to act as leads for each agency.		
b. Participate in both formal and informal meetings with each agency to clarify NPS and GPIR mandates for resource protection and interest in the assessment.		
c. Request that the agencies determine and map the numbers of ships and transit routes as well as currently known infected harbors.		

16. **Encourage and, if applicable and possible, support research** in the following areas:

a. Increased surveillance and detection efforts at priority locations within and near NPS and GPIR boundaries.
b. Modification of human behavior to minimize risk of human-assisted spread.
c. Prediction of the locations at highest risk for introduction of VHS
d. Development of containment protocols in the event of infestation and/or fish kill
e. Identification and increased protection of vulnerable rare species
f. Identification of risks to shortjaw cisco, coaster brook trout, and lake trout stocks with low abundance.
g. Identification of the susceptibility of other aquatic fauna to infection:
    i. Determine if sea lamprey can be carriers of VHSv.
    ii. Determine VHSv viability in sediment serving as a potential pathway for infection of benthic organisms
    iii. Investigate relationships of VHSv infected fish species on non-host species, including other fish as well as mussels, leeches and other benthic organisms.
h. Increasing research into ballast water treatment methods, including shore-based testing of viable treatment options for VHSv.

Prevention Action 16 Work Plan		
Task	**Assigned to**	**Due Date**
a. Determine entities interested in, or engaging in any of these research topics..		
b. Develop a support plan with the entity whenever appropriate.		

Monitoring and Detection Actions

[12] The Smithsonian Environmental Research Center operates the Marine Invasions Research Laboratory. They have completed research on the effectiveness of ballast water exchange in reducing aquatic nonindigenous species introductions in the Great Lakes.

Introduction. The goal of detection and monitoring is to determine whether VHSv is present in a water body as soon as possible after an introduction occurs. Early detection is important for containment and control.

Monitoring and Detection. There are a variety of agencies and organizations responsible for monitoring aquatic animal health issues within the Lake Superior basin. The GPIR and parks will have to determine those agencies and organizations conducting monitoring near them and collaborate with those agencies to develop a monitoring program for tribal and park waters.

Federal, state, and tribal agencies are currently conducting surveillance to detect VHS in Lake Superior. Examples include the USFWS-National Wild Fish Health Survey, surveillance efforts by the Michigan, Minnesota and Wisconsin natural resource agencies, and Chippewa Ottawa Resource Authority.

1. Review existing surveillance operations, and consider expanding to include Park waters and resources (both NPS and GPIR).

Monitoring Action 1 Work Plan		
Task	**Assigned to**	**Due Date**
a. Identify existing surveillance operations in and around GPIR and NPS waters and determine their sufficiency.		
b. Work with surveillance system operators to expand surveillance in and near GPIR and NPS waters as needed.		

2. Conduct or support sampling of commercially caught species in GPIR and NPS waters.

Monitoring Action 2 Work Plan		
Task	**Assigned to**	**Due Date**
a. Survey agencies and determine if commercially caught species are sampled in or near GPIR and NPS waters.		
b. Work with surveillance system operators to expand surveillance in and near GPIR and NPS waters as needed.		

3. Direct field staff to watch for disease signs and kills, and to initiate visitor contacts to broaden the pool of potential observers.

Monitoring Action 3 Work Plan		
Task	**Assigned to**	**Due Date**
a. Train staff in the signs of disease and kills.		
b. Develop and implement plans for staff to conduct this work.		

Assessment. Following a reported detection, a scientific assessment will be initiated in preparation for emergency response. Depending on the circumstances surrounding the detection (i.e., a routine wild fish monitoring detection vs. a large scale fish kill), it may be appropriate to implement certain emergency response measures prior to completing a

full scientific assessment. Prior to any detection, a team of VHSv experts should be established to serve on a scientific assessment committee if detection occurs.

The scientific assessment should be conducted in the following manner:

1. **Confirm** detection through:
    a. Increased targeted sampling at detection site
    b. Use of two detection methods; rapid detection (PCR) and the certified, accepted method of cell culture
2. **Notify** federal, tribal, state, provincial and local governmental representatives and other appropriate stakeholders of the detection and its status. Use the Great Lakes Regional Collaboration's AIS Rapid Response Communication Protocol in communicating news of the detection among Collaboration stakeholders.
3. **Characterize** the nature of the initial detection to determine:
    a. The threat of movement from the location of detection to parks, including likely vectors.
    b. The scope of the detection (i.e., detected in isolated live fish versus detected via fish mortality); if due to mortality, move immediately to emergency response while proceeding with the following measures.
4. **Determine the potential extent** of the infection through increased surveillance, including:
    a. Targeted sampling of similar habitats and fish species in Lake Superior;
    b. Determination of vulnerable species present in detection area;
    c. Sampling of water bodies adjacent to detection site.
5. **Characterize affected area,** including:
    a. Bathymetry/substrate
    b. Circulation patterns
    c. Conductivity/nutrient status
    d. Temperature
    e. Status of existing biological community
        i. Stable/perturbed ecosystem
        ii. Community composition
        iii. Threatened species
        iv. Societal uses (e.g. anglers, other recreation)

Response Actions

Response Levels	
Level	**Actions**
Level 1: VHSv has not been detected within Lake Superior.	Complete a coordinated response plan for use in the event of an outbreak in GPIR or NPS waters.
Level 2: VHSv has been detected within Lake Superior, but outside parks.	--Review the coordinated response plan. --Implement outreach and rules to prevent introduction of VHSv from another location within Lake Superior.
Level 3: VHSv has been detected	--Conduct a situation analysis, determine the incident complexity

within a park	and order resources (including an incident management team) as the situation warrants. --Closely coordinate activities with other agencies (consider unified command). --Develop and issue interagency communications and inform the public of VHSv detection and an overview of response plan. --Implement approaches (e.g., HACCP) to ensure that VHSv is not spread by management activities. --Pickup and properly dispose of fish killed. --Implement quarantine orders, bait restrictions, and other rules. --Evaluate needs for rehabilitation of affected resources. --Throughout all activities, ensure safety of participants, and compliance with laws, and policies.

Coordinated Response Pre-plan. Table 13 shows the components of the Coordinated Response Pre-plan that each park and the reservation should prepare before any outbreak incident occurs.

Table 12. Components of the Coordinated Response Pre-plan.

Components	Details
Define the potential geographic scope.	Assess the geographic, administrative, and political area potentially affected in order to establish a multi-jurisdiction response and establish effective coordination. Affected areas may define the geographic scope of the infestation and coordinate a response based on: • Hydrologic basins (HUC units) • Political boundaries (Federal, state, county, municipal, tribal) • Collateral enforcement jurisdictions • Administrative and legal authority of Federal, state, and local water storage projects and conveyance structures • Location/Use of Federal, state fish hatcheries (water source connectivity and stocking destinations) • Federal and state Congressional districts • Local and regional visitor use patterns
Identify interagency partners	Within the determined geographic scope, identify management federal, state, or other agencies with management authority for water, fish, boats, or shorelines in the water basin (e.g. a reservoir, a river reach, or combination). These are hereafter referred to as partner agencies in this document. For example, the agencies involved could include State, Federal, Tribal and local governments, nongovernmental organizations, and Canadian counterparts.
Pre-plan incident response with interagency partners using ICS.	During pre-planning the interagency partners should try to agree on response objectives that will be used in the event of detection. This information will be very useful in preparing the delegation of authority for Incident Commander and/or Incident Management Team and will be critical to focusing the response to maximize efficiency and effectiveness.
Develop fish kill collection procedures	Classify shorelines as to physical description and ecological considerations for access, preferred collection method, and

	logistical needs. Assess special ecological protection needs for fragile shoreline vegetation, or special features that could be damaged during large-scale removal operations. Develop a procedure for protecting those resources during a fish kill collection event.
Determine appropriate fish disposal methods and locations	Review park-based versus off-site alternatives, identify non-park disposal sites ahead of time, and determine whether park equipment and vessels or contractors would transport carcasses. Identify what necessary modifications to park equipment, or what emergency contracting specifications would apply.
Outline the steps required in responding to an incident	See the incident response steps listed below.

Incident Response Steps. If an incident or event is projected to be more complex than the local staff/local agencies can manage, then the park must consider ordering a type 2 or type 1 incident management team. Follow these steps:

STEP 1: Take initial response actions in accordance with local plans and procedures.

A. Respond to the incident in accordance with local plans and procedures, with close regard to the safety of incident personnel and the public. If possible, take the appropriate initial steps to protect human life, prevent or minimize damage to resources and prevent or minimize damage to property.

Initial actions may be reactive/defensive in nature and may include such things as:

- instituting an emergency evacuation
- terminating non-essential services
- containing suspect materials with movement control zones
- establishing surveillance or other forms of monitoring
- installing protective barriers
- establish decontamination or treatment stations as needed

There are a host of other actions that can be considered. The overall goal is, to the extent safely possible, to stabilize the situation or minimize the negative impacts of the incident.

STEP 2: Conduct a situation analysis, including incident complexity.

A. Rapidly gather as many facts about the incident as possible using a situation analysis or a checklist. Consider the incident's potential and forecasted effects. Ask yourself, what *could* happen, as well as what is likely to happen, in the next two weeks? The next month? Consider the appropriateness of managing the incident under a Unified Command.

B. Use the Incident Complexity Guide (see appendix in the Reference section) to determine the actual or potential complexity of the incident. Using the facts gathered

during the situation analysis, review the various factors shown on the Guide. Decide which of the characteristics of each factor (listed under the "type" columns) best describes your incident.

No single incident is likely to have all of its characteristics fit neatly under just "type" column. Rather, you determine the complexity type based upon the preponderance of factor characteristics identified. See the detailed instructions found on page 2 of the Guide.

Your Regional Emergency Coordinator or designee can assist you in conducting these analyses. S/he can help you ensure that all of the significant situation issues have been identified and can help you determine the incident's complexity level. If there are multiple, simultaneous incidents occurring or if the incident is likely to draw national attention, you may also want to collaborate with the WASO Emergency Services Branch Chief.

If regional or WASO funding may be involved, then you must consult your Regional Emergency Services Coordinator and the WASO Branch Chief, Emergency Services.

STEP 3: Order incident resources, including an Incident Management Team.

A. Use local and nearby mutual aid resources first, then turn to out-of-area resources.

B. To order out-of-area resources, first determine if the incident a homeland security incident/event or another kind of incident/event. Order incident resources, including an Incident Management Team, using the procedures appropriate for that kind of incident/event:

Kind of Incident	***Order System***	***Order Route***
Homeland Security related	Emergency Incident Coordination Center (EICC) at Shenandoah. Do not use the interagency system.*****	Order by contacting EICC directly (540-999-3411).
Other incidents and events	Check with EICC to determine IMT and specialized resource ordering procedures. Other resources will be ordered through the Interagency coordination system (check with your local dispatch center to determine if ROSS should be used).	Contact EICC for IMT and specialized resource ordering (540-999-3411). Order other resources through the local or zone dispatch/ coordination center.

STEP 4: Prepare for the incoming Incident Management Team.

A. Before the Incident Management Team arrives, a Delegation of Authority should be prepared and signed at the appropriate level. This delegation, which is very much like a performance contract, should outline what is expected from the Incident Commander and the team. It should include:

- a description of the results expected from the team, listed as goals, desired outcomes, specific targets or other strategic method.
- a list of other considerations, including financial constraints.
- an identification of park staff assigned to assist the team.
- any exceptions or matters specifically not delegated to the team.
- any special requirements.
- any requirements for rehabilitation of park or incident facilities.

B. Plan two briefings for the incoming incident management team. One should be conducted by the Superintendent, or acting, and should focus on the desired results and strategic issues. The second briefing should be conducted by the initial action (or current) Incident Commander, focusing on the situation, objectives, strategy, tactics, logistics and other issues specific to the incident.

(1.) *Agency Administrator (Superintendent, Regional Director or Director) Briefing*

It is desirable for the Superintendent to brief the Incident Management Team's command and general staff, although the Superintendent may brief only the Incident Commander in special circumstances. The Superintendent's briefing should include:

- a general review of the situation.
- a general review of the actions taken so far.
- safety concerns.
- a review of the Delegation of Authority to the Incident Commander.
- management considerations and priorities, especially as the incident may affect the Park's operations and future plans.
- legal constraints.
- resource and visitor issues.
- political considerations.
- financial considerations.
- other agencies involved.

(2.) *Current Incident Commander*

The briefing by the current Incident Commander should include these key elements:

Situation

☐	incident map	☐	subject/resources/etc.
☐	weather (current/predicted)	☐	time of incident start
☐	topography	☐	point of origin/PLS/etc.

Resources

☐	aircraft use/availability	☐	transportation needs

☐	boat use/availability	☐	resources ordered
☐	resources available	☐	resources assigned
☐	rental agreements		

Actions Taken

☐	review of existing plan	☐	copy of plan or briefing form
☐	current strategies	☐	tactics
☐	operations	☐	costs to date
☐	communications plan	☐	medical plan

General

☐	hazards	☐	safety issues
☐	identity of Agency Reps	☐	photo/map availability
☐	helispot/helibase locations	☐	water availability
☐	infrared requests	☐	duplicating facilities
☐	weather data sources	☐	ICP and incident facilities
☐	access routes	☐	Communications issues/internet access
☐	security problems		
☐	sanitation facilities	☐	feeding facilities
☐	claims/injuries	☐	traffic plan
		☐	payroll/time functions

C. Attempt to accomplish the following tasks before the arrival of the team:

- Determine an incident command post/base location sufficient for the needs of the team.
- Order support equipment, supplies and basic support organization for the incident (if this is an emergency, you may want to contact the incoming team as they travel to get these orders into the system).
- Secure an ample supply of maps and have the local Geographic information System (GIS) ready to provide information.
- Schedule the times and locations for briefings.

D. Prepare ICS form 201, Incident Briefing, with all of the pertinent information available.

E. Determine the recommendations for the status of personnel being replaced by the team (will they be released from incident? assigned to positions within the team? assigned to trainee positions? reassigned to operations?).

F. Determine who will serve as the Agency Advisor, giving advice to the Incident Commander and making decisions on behalf of the Agency Administrator.

G. Prepare an Incident Action Plan (IAP) for the first operational period that will be managed by the team.

STEP 5: Brief the incoming Incident Management Team.

A. Conduct the "Agency Administrator" (Superintendent, Regional Director or Director) briefing. Note that upon arrival the incoming Incident Commander may wish to negotiate

portions of the delegation based upon her/his experience, resource availability and other factors.

B. Conduct the initial action/current Incident Commander briefing.

STEP 6: Coordinate with the Incident Management Team to properly manage the incident.

A. Meet regularly with the Incident Commander and incident staff as conditions and circumstances allow.

B. Ensure that the park (hosting agency) finance staff becomes engaged with the incident finance staff early in the incident.

C. Plan the for the transition of management of the incident either to another Incident Management Team (in the case of an extended incident) or back to the park. Incidents with significant resource or facility damage may transition to a contracting and project management organization. Incident Management Teams may prepare a formal transition plan for some incidents, depending on the status of the incident. In all cases, teams shall keep the Park in the long-term planning process.

STEP 7: Close out with the Incident Management Team.

Conduct a close-out meeting with the Incident Management Team. The meeting will generally include:

- A review of incident operations and safety.
- A review of the Delegation of Authority and the actual accomplishments.
- A review of the status of the other functional areas (planning, logistics, finance, information).
- A review of the transition plan.
- A general evaluation of the team and park's performance (most significant incidents should have a separate After Action Review (AAR), conducted at a later date).
- Identification of any immediate lessons learned.
- A list of pending actions that still need to be completed.
- A list of other actions.
- A "Return of Delegation" or transfer of command document.

Long Term Rehabilitation

Rehabilitation Plan Concept. In some situations, fish kills resulting from VHSv infections may result in the loss of biodiversity and impact on populations of significance. In these cases, the reservation or park should consider completing and implementing a rehabilitation plan, similar to Burned Area Emergency Rehabilitation plans done following a wildfire.

Objectives. The objectives of these plans may include:

- Mitigate and/or restore areas infested by VHS to acceptable levels as determined by technical feasibility and stakeholder values and desired functions. An open forum process that is mediated may be necessary to accomplish this task.
- Repair or improve waters unlikely to recover naturally from severe virus damage by emulating historic or pre – VHS ecosystem structure, function, diversity, and dynamics according to park enabling legislation or other park plans.
- Restore or establish healthy, stable ecosystems, even if these ecosystems cannot fully emulate historic or pre- VHS conditions as specified in approved land management plans.
- Maintain monitoring program for future viral infections following rehabilitation.

Potential Tasks. These may include:

1. Identifying rehabilitation priorities based on desired pre-VHSv ecosystem conditions by compiling data and information from representative sites that account for the full range of biodiversity across regional ecosystems.
2. Establish effective partnerships for restoration projects
3. Select species to take priority in rehabilitation efforts, including those species from rare NPS stocks, species of high ecological value, such as endangered species. In so doing, ensure genetic integrity within park or closely related stocks.
4. Choose sites for restoration projects and identify strategies to restore habitat of those sites to desired level of functionality
5. Implement rehabilitation strategies
6. Measure effectiveness of rehabilitation strategies
7. Maintain monitoring program targeted for future VHS infections.

Communications Strategy

Objectives:

1. Provide information to the public to gain their support and assistance in preventing or slowing VHS infestation in NPS units on Lake Superior.

2. Provide information and tools to park employees and partners on their role in VHS prevention and response to an infestation.

3. Facilitate communication of consistent message between agencies and partners.

4. Provide linkage to information already available.

Key Messages:

VHSv is most quickly spread primarily through human activity.

VHSv can cause significant fish morality, but is not a human pathogen.

VHSv outbreak will negatively impact visitor experiences:

- floating dead fish (visual, odor)
- bacterial outbreaks may impact water quality and become a public health issue (beaches closures)
- unpredictable change in fish populations will impact fishery

People can help prevent the introduction of spread of VHSv. The following guidelines may prevent or slow spread of VHS into Lake Superior and inland waters of NP units:

- Drain all water from boats, PWCs, motors, bilges, live wells, and fishing equipment (including bait buckets and coolers) before leaving water body or shoreline.
- Do not move fish, fish eggs, or fish parts (alive or dead, including unused bait minnows) between waters.
- Do not release live fish into wild waters, i.e. unused bait minnows, exotic ornamental fish.
- Clean and disinfect recreational equipment

Encourage visitors to report mortality events:

- Report sightings of individual fish with these signs …..
  - Bulging eyes
  - Signs of bleeding around the eyes, bases of fins, sides and head
  - Distended (fluid-filled) belly
- Report large numbers of dead or dying fish immediately to park staff**.**

Visit following links for existing prevention campaign outreach materials.

http://seagrant.wisc.edu/fisheries/Default.aspx?tabid=1586
http://www.seagrant.umn.edu/fisheries/vhs_virus_facts
www.dnr.state.mn.us/
www.dnr.state.mi.us/
http://www.michigan.gov/dnr/0,1607,7-153-10364_10950_46202-172530--,00.html
www.dnr.state.wi.us/
http://dnr.wi.gov/fish/vhs/vhs_rules.html
www.mnr.gov.on.ca/mnr/fishing
http://www.mnr.gov.on.ca/MNR/csb/news/2007/jan8bg_07.html
http://www.glerl.noaa.gov/res/Programs/ncrais/docs/factsheets/novirhabdovirus.html
http://www.aphis.usda.gov/publications/animal_health/content/printable_version/fs_vhs_q_and_a.pdf
http://www.aphis.usda.gov/animal_health/animal_dis_spec/aquaculture/downloads/vhs_fed_order_amended.pdf
www.ProtectYourWaters.net
www.wisconsinaquaculture.com
http://www.wisconsinaquaculture.com/View_WAANews.cfm?NewsID=86
www.wildlifeforever.org

Campaign Information: "Invaders Among us" Invasive Species Threat Campaign contact Nick Schmal U.S. Forest Service Eastern Regional Project Officer. nschmal@fs.fed.us

For French translation: Ontario Ministry of Natural Resources
www.mnr.gov.on.ca/mnr/fishing

PSA Cards are available through state DNRs and other organizations – see above links

Internal Audiences:
NPS leadership and management: Administration, Midwest Region staff, Superintendents, Department of the Interior officials; Grand Portage tribal officials

Park staff: law enforcement, interpreters, entrance station staff, maintenance staff, resource management, volunteers (not limited to just these groups).

Partners: tribes, concessionaires, contractors, researchers, CUA permittees, cooperating associations, state, provincial and federal agencies with jurisdiction for Lake Superior and inland waters.

External Audiences:
Park Visitors
Media
Elected officials: local, state and federal
Canadian government – Parks Canada, other federal agencies, provincial agencies and First Nations
Gateway communities
Businesses, especially those that interact with park businesses
Boating organizations
State tourism organizations
State Universities
Special Interest Groups
Non-profit organizations
Special Event Participants and Coordinators

Methods of Communication

AUDIENCE	METHOD	RESPONSIBLE PARTY
NPS leadership, GPIR leadership and DOI officials	• Briefing papers/white paper • Meetings • Telephone calls • News Releases • InsideNPS • Email	• park management
NPS employees of Lake Superior Parks, Other NPS employees, Other GPIR employees	• all employee meetings • fact sheet handout • employee newsletter • bulletin board postings	• park management • park management • designated staff person

	• park intranet sites • training • park web pages • Inside NPS • Employee VHS "tool" kit (large zip lock bag, gloves, golf pencil, PSA watch card, tag to write info on)	• designated staff person • park webmaster • park management
Partners: GPIR and other tribes Cooperating assns Concessionaires CUA permittees State and federal agencies (USDA-USFS, USDA-APHIS, USFWS, USGS, State DNR, State AG) Friends' organizations National Parks of Lake Superior Foundation Researchers Contractors Great Lakes Regional Working Group	• meetings • email • linking to websites • telephone calls • news releases • permit requirements • public notice postings	• Park management • Park management • Park webmaster • Park management • Design. staff person • Design. staff person • Design. staff person
Park Visitors - provide info in multiple languages where feasible (French, Ojibwe, Hmong, Spanish, etc.)	• Park newspaper • Internet – park site and links • Flyers/handouts • Bulletin board postings (restrooms, trailheads, launch ramps, picnic areas) • Off-site postings • Attachments to permits • PSAs • News releases • Personal contacts (Protection, Maint, Resource, Interp and VIPs) • TIS (where applic) • Handouts and postings at outside marinas or entry points • Public meetings on new reg promulgation • Billboards	• Responsible staff person in park • Responsible staff person • Partner designee Partner designee • Partner designee • Responsible staff person

	• TV spots • Interpretive programs • Threat Campaign • Good behavior incentive awards (pins, stickers, etc,)	▪ Partner with Wildlife Forever and Forest Service Campaign
Media	• Press Release • PSA • News Conference • Interview	• Public Information Officer/Public Affairs Specialist • Park Management
Elected officials: local, state and federal	• Meetings • Briefing papers • Telephone • Park Visits	• Park Management for all
Canadian govt agencies -Parks Canada - First Nation entities	• Meetings • Briefing papers • Telephone • Park Visits	• Park Management for all
State Universities Science Partners Non-profit organizations	• Meetings • Briefing papers • Telephone • Park Visits	• Park Management for all
Gateway communities Businesses (bait shops, where fishing licenses sold, etc.) Boating organizations State tourism organizations	• Public Meetings • News Releases • Fact Sheets • Telephone • Bulk Mailings • Speaking engagements	• PIO/PAO • Park Management
Special Interest Groups	• Fact Sheets • Telephone • Speaking Engagements • Briefing Statements • Press Release • Park Visit	• PIO/PAO • Park Management

Monitoring Methods:
Monitor coverage of VHS in newspapers, TV, radio, web blogs, etc.
Feedback from employees, visitors, local residents, officials, organizations, etc. via phone calls, emails, hits on web site, etc.

Suggested Actions:

Spring 2008 – Initiate aggressive VHS prevention outreach campaign via signage, park publications, attachments to special permits/reservations/fishing license sales, local news media (TV and radio), etc. Target visitor base locations that are not local. Develop a 30 second video PSA to be placed in multiple locations (regional).

Develop common prevention information (signage, handouts, etc.) for the four Lake Superior parks and the Grand Portage Indian Reservation..
- APIS can fabricate signs at cost.

Prepare key messages and plan for appropriate outreach methods in the event of VHS detection.

Summer 2008 – Continue aggressive campaign using full range of outreach methods as operations begin for the season.

Employee Tool Kit Components and Tag Template:

1. large zip-lock bag
2. gloves
3. pencil
4. fish tag
5. instructions

Park Name
Fish Information Tag:

Date and Time:_____
Location (Water body name and specific location): _____
Reporter Name:_____
Name of Person Finding Fish: _____
Contact Info: _____
Number of fish found: _____
Was fish dead or alive: _____
Did other fish in area appear to be stressed or dying? _____

Appendices in Reference Section:

VHS Fact Sheet
VHS Prevention Info Template

Evaluation and Measuring Success

The following are measures of effectives based on objectives:

Objective 1: Prevent the introduction and spread of VHS in NPS and GPIR waters.

- Number of infested waters within NPS and GPIR jurisdiction.
- HACCP plans for park activities are developed and implemented by agency personnel.
- Other prevention actions have been initiated and are underway.

Objective 2: Detect VHS infestations

- Monitoring sites within park and GPIR waters are being maintained by state and/or other agencies for VHSv based the risk analysis of vectors
- Coordinated detection activities are being conducted with federal, state, local agencies, tribal authorities, local business.

Objective 3: Respond to and minimize the impacts of VHS

- Rapid response plan based on ICS has been developed for implementation in advance of a VHSv outbreak.

Objective 4: Provide timely and accurate information to employees, management, stakeholders, and the public

- Comprehensive communications strategy developed and implemented within jurisdictions targeting all appropriate audiences.
- Outreach efforts maximized as measured by numbers of public contacts, handouts distributed, number of website visits VHS information is accessible to park visitors through NPS outreach strategies.

Objective 5: Safety

- Job Hazard Analysis developed for known hazards
- Reportable injuries or accidents minimized as related to VHSv prevention, detection, and response and rehabilitation

Objective 6: Financial

- Cooperative agreements, friends organizations, Lake Superior National Parks Foundation and related partnerships have been developed to leverage funds to support implementation of aforementioned plan objectives.
- Implement cost containment, justification, and documentation measures.

Location-specific Considerations

The following are considerations for specific locations, based upon their legislation or unique characteristics.

Apostle Islands National Lakeshore

Risks and Issues Specific to the Park. The federal boundary and jurisdiction of Apostle Islands National Lakeshore extends ¼ mile into Lake Superior from all 22 park land units. There is no central entrance station or point which all visitors pass. The vast majority of park boaters launch boats outside NPS jurisdiction rather than at an NPS boat ramp, making communication with visitors very challenging.

The State of Wisconsin has created two fish refuges where no is allowed:[13] Gull Island Refuge (1976) and Devils Island Refuge (1981). Gull Island Shoal is one of the few places where a remnant lake trout spawning population survived the lamprey invasion. Although there have been past stocking efforts in these areas, natural reproduction was responsible for the majority of recruitment at the Gull Island Shoal between 1964 and 1992, indicating the importance of these refuges and populations in the long term recovery of lake trout stocks in western Lake Superior (Schram et al 1995). Portions of these refuges lie within the waters of the national lakeshore.

Commercial fishing occurs within park waters. Regulation of this fishery is split between the Wisconsin DNR and tribal authorities.

Very little bait fishing occurs within park waters; it is believed to be primarily an activity of winter ice anglers.

The concessioner that is under contract to Apostle Islands National Lakeshore to operate within park waters has the sole right to bring more than 6 paying visitors into the park at a time. Any commercial or tour vessel carrying fewer than 6 passengers would require a commercial use authorization (CUA) or special use permit (SUP) from the NPS. The park concessioner's vessels are not ballasted and it is unlikely small vessels requiring CUAs or SUPs would be large enough to be ballasted.

Therefore, any ballasted passenger vessel, such as a cruise line, may not bring visitors into the park and would not be eligible for a permit from the NPS. If such a vessel were to visit the area, it would need to utilize the services of the park's concessioner or one of the businesses if they wish to provide a means by which their clientele can visit islands within the park.

[13] Guide to Wisconsin Hook and Line Fishing Regulations 2007-2008, Wisconsin Department of Natural Resources, page 62.

Unique among the four parks, Apostle Islands has the in-house capability of producing high-quality metal signs, and is therefore willing to produce identical signs (at cost) needed by all four parks and the Grand Portage tribe to fulfill this Plan's communication strategy.

Coordination with Other Agencies Specific to the Park. The park's enabling legislation requires consultation with the state prior to the NPS taking any action to change fishing rules, though it does not require consensus. Park management should work closely with the State and tribal authorities to achieve the mutual objective of keeping park (and Lake Superior basin) waters VHSv-free.

Apostle Islands National Lakeshore staff have an obligation to consult with tribes on issues that might affect reserved rights relating to the Treaty of 1842 between the United States and the Chippewa. Any actions that restrict the activities of fishermen within the ceded territory must be discussed with the tribes to ensure there is not a disproportionate impact on tribal members exercising treaty rights.

Coordination with the Great Lakes Indian Fish and Wildlife Commission, the Red Cliff Band, and the Bad River Band is essential to assure the park and the tribes are working in concert on VHSv prevention, containment, and response.

The two fish refuges provide an added impetus for the NPS and the state to work in concert on fisheries protection.

Grand Portage Indian Reservation and Grand Portage Natl. Monument

Integrated resources. The Grand Portage Indian Reservation and the Grand Portage National Monument (GRPO) share a unique relationship, whereby the entirety of the National Park unit lies within reservation boundaries. Because the federally recognized Indian reservation is a sovereign nation, references to state authorities in fish related regulations do not specifically apply to the Grand Portage National Monument. Instead, the authority for natural resources management within the reservation is the Grand Portage Band. The primary recreational fishing resource, the Grand Portage Creek, winds throughout "Band" and NPS jurisdictions. Similarly, the Band and the NPS share ownership of Lake Superior shoreline within Grand Portage Bay. The intertwining of these two resources and two jurisdictions means effective management must be consistent to be effective. Coordination between the Band and GRPO on many activities is necessary for effective management.

Fish as cultural as well as natural resource. The Grand Portage Band, like other tribal peoples living along Lake Superior, were and are maritime people. They have lived along the lake shore for hundreds of years and frequently harvest fish from its waters. Fishing and consuming fish are traditional activities for Grand Portage people. It is part of who they are. Fish are highly esteemed and thus any source that might disrupt those activities and food is a cultural as well as natural resource threat. GRPO recognizes this

cultural value of fish and interprets this relationship to visitors. Thus, VHSv prevention is a shared issue of concern between the Band and GRPO. Some background on the importance of fish to the Band is shown in the examples below.

A building block of Ojibwe society were clans, sometimes called totems. Each person was a clan member, descending through their father's side (much like last names today). One of the principal clans at Grand Portage was/is the Awause (or fish) clan. Members of the Awause or fish clan are known to have fished in Grand Portage and Isle Royale waters. (Personal communication between Gilbert Caribou and Tim Cochrane, July 19, 2000, Grand Portage). Other Ojibwe fish clans included: whitefish, sturgeon, sucker, catfish, and pike clans. A number of these fish species appear to be threatened by VHSv.

Historically Grand Portage Band members have fished Grand Portage Creek a number of ways. Band members actively "smelted" or dip netted Grand Portage Creek from roughly 1962 or 1963 to 1977 or 1978, or almost a fifteen year period. Mirroring smelt fishing elsewhere along the North Shore, Band members would dip net smelt from creek waters. (Personal communication between Melvin Gagnon and Tim Cochrane, January 8, 2008, Grand Portage, Minnesota). Band members have also fished the Creek with rod and reel and, in earlier times, with a fish weir. Pond nets were used in Grand Portage Bay and gill nets continue to be used today.

Grand Portage Band elder Ernie Olson, like many other men, fished commercially in Lake Superior waters. He mentioned catching siskiwits along with lean trout as a young adult fisherman in the 1930s. They were used as a fine lubricant and a base for paint. Ernie, like many other men, have a range of knowledge about lake Superior fish. For example, he noted that the smaller siskiwits (about a pound) were okay eating. Larger than that the fat layers would make them less palatable. They were caught in very deep water during the summer months. Ernie mentioned that there was a practical depth that siskiwit fishing could go before mechanical net lifters. Because of the hard work and time involved they were not likely caught in deep water, but Ojibwe waited until they came up in relatively shallow water for spawning. (Personal communication between Ernie Olson and Tim Cochrane, April 25, 2006, Grand Portage and Grand Portage Chippewa: Stories and Experiences of Grand Portage Band Members, Grand Portage, Minnesota: Grand Portage Tribal Council, 2000).

Knowledge and appreciation of fish was not confined to men or those taking part in commercial activities. Women also knew much about fish. Grand Portage elder Ellen Olson mentioned that "old timers" liked siskiwits. They dried them, they salted them, they extracted the oil from them. They used it like bear grease for quite a number of purposes. And being rendered, it was sometimes put in a cold cache in the ground to preserve it. It would congeal. They would also hang the siskowits over a smudge fire by impaling a wooden stick just under the fish's gills. Dozens and more would be dried this way. Then were transferred to barrels and hauled to a central location from Isle Royale to Grand Portage. (Personal communication between Mrs. Ellen Olson and Tim Cochrane, February 17, 2006, Grand Portage).

As maritime peoples, Grand Portage Ojibwe traveled great distances to harvest preferred fish. Mrs. Ellen Olson's grandfather and great grandfather fished in Isle Royale waters and lived on the Island during the summer months for a number of years. They would go to Isle Royale – to hunt woodland caribou, harvest passenger pigeon, and fish for siskiwit and lean trout. They would leave the Island in the fall to harvest wild rice at Whitefish Lake in Ontario. (Personal communication between Mrs. Ellen Olson and Tim Cochrane, April 10, 2003, Grand Portage).

Treaty Rights. Both the 1842 and 1854 Treaties signed by the U.S. Government and the Grand Portage Band recognize the rights of the Band to Lake Superior fish and the enduring responsibilities of the U.S. Government for trust resources such as Lake Superior fish.

Issues Specific to Grand Portage National Monument. Issues specific to the national monument are related to coaster brook trout restoration activities and to sport fishing. The National Monument is one of the few park units where fish restoration actively occurs. Coaster brook trout restoration activities are undertaken by the Grand Portage Natural Resources Department in a partnership with the U.S. Fish and Wildlife Service National Fish Hatchery program. All fish that are stocked are certified disease-free. The Grand Portage Natural Resources Department has recently completed construction of the Grand Portage Native Fish Hatchery and has begun operation of the facility. The hatchery treats water as it enters the facility and testing will be conducted for disease-free certification. The band is committed to batch certification for fish stocked into Grand Portage Creek waters. The Band and GRPO must work together to protect Grand Portage Creek.

Sport fishing activities are presently regulated by the Grand Portage Natural Resources Management Department. To enable effective VHSv prevention in Grand Portage National Monument waters of Grand Portage Creek, joint management between the band and the Monument is required. The regulations that must be considered include the use of fish-based bait during the steelhead fishing season in early spring. Typically anglers harvest spawn from a locally caught fish and use that spawn as bait for future fishing trips. This practice will need to be evaluated for risk and addressed appropriately.

There are two commercial marinas on the GPIR, both operated by the Grand Portage Band and both located within Grand Portage Bay. Most of the small boat traffic from Minnesota to Isle Royale leaves from these marinas. Small boats are also launched from docks and beaches throughout the reservation shoreline. Other access points to the lake are controlled by the GPIR.

Apostle Islands has the in-house capability of producing high-quality metal signs, and is willing to produce identical signs (at cost) needed by all four parks and the Grand Portage tribe to fulfill this Plan's communication strategy.

Isle Royale National Park

Background (excerpted from ISRO Water Resources Management Plan, 2006)

Isle Royale National Park (ISRO) is a unique and remote island park located in the northwestern portion of Lake Superior in the Great Lakes Basin. Although it is closer to the Canadian shoreline, the park is under the political jurisdiction of the United States in the state of Michigan, and represents the northern-most point in Michigan. This wilderness archipelago is 45 miles long and 9 miles wide at its widest point. The park is approximately 13 miles from Ontario, 18 miles from Minnesota on the USA mainland, and about 70 miles northwest of Houghton, Michigan in Michigan's Keweenaw Peninsula. Park waters extend 4.5 miles into Lake Superior. Total land area is 209 square miles (133,781 acres). About 80 percent of ISRO is under water, with aquatic habitats ranging from shallow, warm-water lakes, streams, and rivers, found internally on the park's islands, to cold deep-water areas in Lake Superior. The park consists of one large island ("the island") surrounded by about 400 smaller islands.

Situated in the northwest corner of Lake Superior, ISRO is intersected by several commercial shipping lanes. Ship traffic out of Thunder Bay, Ontario destined for the lower lakes passes between Blake Point, the most northeastern point of the main island, and Passage Island, the largest easterly island in the archipelago. Traffic from the western port of Duluth, Minnesota for Thunder Bay, passes Rock of Ages Reef on the western corner of the island. Weather conditions can be severe at this latitude during winter months of the year. In all, 10 major shipwrecks have been located and identified around the perimeter of Isle Royale.

As ISRO is completely within Michigan waters, discharge from any vessels navigating in proximity to the island is regulated under Michigan Act 451, Part 95, and "Watercraft Pollution Control." Strictly prohibited is "any litter, sewage, oil, or other liquid or solid materials that render the water unsightly, noxious, or otherwise unwholesome so as to be detrimental to the public health or welfare, or to the enjoyment of the water for recreational purposes." The law applies both to recreational watercraft, and to commercial vessels including domestic cargo carriers, foreign flag ships and passenger ships.

Direct access to the island by non-U.S. registered vessels is regulated, in the case of passenger vessels, by the Passenger Services Act, 46 U.S.C. App. 289, which reserves the right to transport passengers from one U.S. port to another on U.S.-built, U.S. crewed and U.S. flagged vessels. Non-U.S. flag vessel access is also regulated by U.S. Customs, 19 C.F.R., Part 4, as in any other U.S. port. Other than the ferries that service ISRO, there are no commercial navigation routes calling directly at the island. Occasionally, however, Isle Royale provides protection from harsh weather on Lake Superior for cargo vessels plying the heavily used shipping lanes between the head of Lake Superior and the Soo Locks. There are no U.S. Coast Guard rules or regulations dictating navigation routing in the open waters of the Great Lakes; the decision to reroute a vessel into the proximity of

Isle Royale in heavy weather rests solely with the ship's master. Typically a vessel will seek refuge off the north shore of the island in the face of strong southeasterly or southwesterly winds, and conversely off the south when winds are northwesterly. Such rerouting is rare, occurring only a few times a season and under only the most extreme conditions. Cargo carriers seeking the lee of Isle Royale are physically able to hug the island relatively closely (no closer than 0.6 miles), as there is deep water, up to 195 ft (60 m), and no shoaling throughout the area.

ISRO's inland lakes and streams are not accessible by motor vessels. There are a limited number of established portages for kayakers and canoers to some of the inland lakes closest to the Lake Superior shorelines on the main island. Fishing in the inland lakes and streams is regulated by the park, and anglers usually fish from shore or canoe. Inland fishing regulations include a prohibition on using natural bait ("artificial lures only") in inland lakes and streams. The park also has had a spiny water flea awareness program in place since 2005, which includes a request to visitors to change their reel line before moving from Lake Superior to inland lakes to fish.

Isle Royale's inland streams are plentiful but generally small and/or intermittent. The largest and most rapid streams on Isle Royale include Washington and Grace Creeks flowing to the west, Big Siskiwit, Little Siskiwit and Siskiwit Rivers entering Siskiwit Bay, and Tobin Creek draining into Tobin Harbor. While streams on Isle Royale flow predictably toward Lake Superior through narrow valleys, apparent flow alterations occasionally occur as a result of Lake Superior seiche (resonant oscillations in an enclosed body of water) events. Such events back lake water up into streams and affect the usually unidirectional transfer of nutrients, energy and organic matter between streams and Lake Superior. In addition, anadromous species such as rainbow trout and coaster brook trout travel between Lake Superior and the island's streams. While current USFWS surveys show no presence of larval sea lamprey (due to successful eradication efforts), the park has had historic populations of sea lamprey breeding in inland tributaries such as Washington Creek.

There are an estimated 202 lakes and ponds on the island, ranging from small shallow ponds covering a fraction of a hectare to the large and deep Siskiwit Lake. Most lakes (162) are larger than 1 acre (0.4 ha), 118 lakes are larger than 2 acres (0.8 ha), and 56 lakes exceed 5 acres (2 ha). 43 lakes are named on the current topographic map, and fishes have been reported from 39 lakes. Of the named lakes, 20 were qualitatively characterized as eutrophic, ten as dystrophic, and four as oligotrophic. Lake surface areas are variable on Isle Royale, ranging from the 3.2-acres (1.3 ha) Epidote Lake to the 4040-acre (1,635 ha) Siskiwit Lake. Larger lakes tend to have larger watersheds, and most of the lakes are shallow and elongate. About half the inland lakes contain one or more islands. In terms of thermal regime, Isle Royale lakes fit into roughly three classes: cold polymictic (unstratified), discontinuous polymictic (sporadically stratified) or dimictic (stably stratified during summer, with mixing before and after) (Kallemeyn 2000). The two most widespread fish species in the park's inland lakes are yellow perch and northern pike. A 1995-1997 survey of 32 inland lakes determined that species richness ranged from 2-15, with the majority of surveyed lakes containing 5 or fewer species, and the

lakes showing relatively little change in species composition since a 1929 island survey (Kallemeyn 2000.) Island lakes also contain healthy native mussel populations, and large freshwater sponge colonies.

Prevention Measures

- Isle Royale will need to identify a long-term ballast disinfection method for its ballasted vessel, the Ranger III.
- Develop pre-loading procedures for boats onto RIII in Houghton to check live wells, bilges, etc. Install interim wash station (prior to installation of permanent station in HQ construction plan)
- Review existing contract language and park procedures for RIII and other large vessel dry-docking.
- Data are lacking to characterize baseline conditions for the park's rare or unique fish populations. Additional data on the park's distinct stocks of lake trout, including genetic information and seasonal use of specific habitats by specific strains. Small populations of potentially genetically distinct fish stocks, such as northern pike occurring in selected bays, should also be assessed.
- Inland lakes research: genetic analysis of inland lake fish species is necessary, focused on coregonids and other species focused on during 1995-1997 survey of inland lakes by Kallemeyn.
- Island streams connecting inland lakes to Lake Superior, where coaster brook trout spawn, should be identified and included in a prevention/protection strategy. (Evaluate effectiveness/practicability of potential protection measures such as isolating a spawning population in the event of a fall VHSv outbreak at the park?)
- Contact agency, private organizations that conduct research and educational tours through the Great Lakes and establish cooperative prevention practices (includes EPA's Lake Guardian, Milwaukee & Duluth teaching vessels.) Develop standard language for research permit conditions, and Special Use Permits.
- Evaluate the potential use of the centralized permit system (when implemented) as a means to regulate the importation of bait into the park.
- Revise Fish Management Plan to include VHS information.
- Evaluate effectiveness, practicability, and impacts of preventive inoculation for coaster brook trout populations in Tobin Harbor and Siskiwit Bay. Implement if evaluation indicates.

Communication/Coordination with Agencies and Organizations

- Utilize Isle Royale Natural History Association and Isle Royale Institute to disseminate information to park visitors, teachers groups, potential research partners (message focus varies based on target audience.)
- Work with the Isle Royale Boaters Association newsletters and meetings to quickly disseminate information.
- Use Isle Royale Institute to assist in identifying grant opportunities for research and baseline inventory work.

- Review current park research proposals and determine if additional proposals need to be developed. Develop proposals for submission to all available fund sources.
- Develop interdivisional fact sheet prior to 2008 field season for distribution to staff. Include in orientation training.
- Track ongoing VHS research, especially with respect to mollusks (in the case of virus outbreaks, what will the role of filter feeders be; what will impacts be on mussels that rely on fish such as yellow perch for a part of their life cycle?)

Park-Specific Risks/Challenges/Considerations

- Enforcing new bait rules across park waters because of the extent of park Lake Superior waters (4.5 miles offshore).
- Changing/adjusting current fish gut disposal methods that prevent wolf habituation (disposal of fish parts offshore). Considerations include: disposal in wilderness; weekly or monthly removal of trash to the mainland via LCM.
- Isle Royale's coaster brook trout populations at Tobin Harbor and Siskiwit Bay are source populations for USFWS hatcheries, and restoration efforts on the North Shore.
- The lack of information on the role of or impacts to aquatic taxa such as mollusks and freshwater sponges related to VHS is problematic because the park contains large numbers of both native mussels and sponge colonies.

Park Incident Response Plan

- Use Net Environmental Benefit Analysis (EPA risk assessment tool) as reference to characterize different shorelines and develop fish collection methods based on physical characteristics (i.e. sand vs. rocky), access issues, and shoreline habitat considerations that may need protection during removal actions.

Pictured Rocks National Lakeshore

Park Boundary. The boundary of Pictured Rocks National Lakeshore (PIRO) extends a ¼ mile from the shore into Lake Superior along approximately 43 miles of park shoreline. PIRO has jurisdiction over these Lake Superior waters, inland waters in the shoreline zone, and lands the park owns in fee simple. Boat launches at Grand Marais and Munising, Michigan, allow relatively quick access to Lake Superior waters within this boundary. Small watercraft can launch from Sand Point, near park headquarters, directly onto Lake Superior within park waters. Commercial fishing, subsistence fishing by tribal members, recreational fishing, and recreational ice fishing may occur within the ¼ mile area of Lake Superior under the PIRO's jurisdiction. Boats that carry ballast (e.g., special cruise boat) are a very unusual occurrence within the park boundary.

PIRO's legislated Inland Buffer Zone (IBZ) is unique in the National Park Service (US Congress 1966). The IBZ was established by the park's enabling legislation, in part, to protect the watersheds that flow through the shoreline (federally owned) zone. The park

boundary encompasses the IBZ, and ownership of the IBZ is a mix of state, corporate (logging), and private entities.

In addition to Lake Superior, fifteen named inland lakes and seven major watersheds exist within the entire park boundary. The larger streams (e.g., Miners River, Hurricane River) head outside PIRO's boundary. Numerous small, unnamed, first order streams flow directly to Lake Superior through the park, particularly in the western portion.

Three of the large inland lakes (Beaver/Little Beaver Lakes and Grand Sable Lake) have boat launches and, thus, easy access. The remainder are accessed by hiking or portaging a canoe or kayak and therefore, have fewer boaters and anglers.

Most streams have natural barriers (waterfalls) between the headwaters and the mouths of the streams. These waterfalls form a natural impediment to upstream transport of fish infected with VHSv. However, downstream transport of infected fish could occur. **Prevention of the introduction of VHSv into inland lakes and streams is of particular importance, and the park has greater control over the vectors to the inland waters than to Lake Superior.**

Prioritization of VHSv vectors at Pictured Rocks National Lakeshore. Through outreach and law enforcement, PIRO has the opportunity to diminish the likelihood that the vectors of live/dead bait, agency operations, and recreational boating and fishing will introduce VHSv into PIRO waters. These priorities are based upon the following factors:

1. There is no central entrance station or point that all visitors pass.

2. Volume of the identified activity. The likelihood that increased activity will introduce infected water, fish or fish parts, i.e., increased fishing with bait will increase the likelihood of introduction of water, fish or fish parts with VHSv.

3. Transport potential. The potential that the activity will transport infected fish, fish parts and infested water, i.e., increased activity will raise the potential to transport infected fish, fish parts, and water.

4. Concentration of VHS viral particles (propagules) per unit volume of water or within the body of an infected fish. The potential for further infection increases as the concentration of virus increases.

Recommendations

Outreach

Informational outreach and educational programs are essential to the success of the VHSv prevention plan at PIRO, because the most likely vectors are the result of human activities: fishing and boating. The park can make best use of its outreach effort by taking advantage of materials and signage (e.g, *Stop Aquatic Hitchhikers*) that already

exist. Most importantly, working with partners to broadcast the information as broadly as possible is extremely important. These partnerships will strengthen the regional effort and reduce the risk of VHSv and its introduction in the park as well.

Coordination with other institutions and organizations

While the federally owned lands and waters are under the authority of the National Park Service, it is essential for park management to work closely with the State of Michigan, both because of the agencies' cooperative relationship and the State's authority over the waters of the IBZ.

In addition, communication with other agencies, tribes, and organizations are essential in coordinating the effort on several fronts: legislation/regulation, outreach, implementation of best practices to prevent the spread of VHSv, emergency response, research, and rehabilitation. Particular emphasis should be placed on coordination with the following institutions:

- Sault Band of Lake Superior Chippewa
- Bay Mills Tribe of Chippewa
- U.S. Fish and Wildlife Service, Ashland Fish and Wildlife Conservation Office (Ashland, WI), Fish Health Lab (LaCrosse, WI), and Seney National Wildlife Refuge (Germfask, MI)
- U.S. Geologic Survey, Lake Superior Biological Station (Ashland, WI)
- Hiawatha National Forest (Munising, MI)
- U.S. Environmental Protection Agency, (Chicago, IL and Duluth, MN) (chemical treatment of gear)
- U.S. Coast Guard (Sault Ste. Marie, MI)
- Michigan DNR – Fishery Division, State Forest campgrounds (i.e., Kingston Lake), State Parks
- Canadian national and provincial parks
- PIRO concessionaires (e.g., kayak outfitter, Pictured Rocks Cruises)
- The Nature Conservancy (Marquette, MI)
- Lake Superior National Parks Foundation (Houghton, MI)
- Eastern National Forests Interpretive Association and Hiawatha Interpretive Association
- City of Munising and Village of Grand Marais, MI
- Marinas
- Commercial fishermen
- Bait shops and businesses selling fishing and boating gear
- Neenah Paper Co. (coal delivery by boat, assume ballast intake)
- PIRO Volunteers In Park
- Various universities

Legislation/Regulations

The following legislation and/or regulations are recommended:

- The strongest action that PIRO can take to prevent the introduction and/or spread of VHSv is to prohibit the use of live and/or dead bait within the park boundary.
- PIRO can work with the State of Michigan to promulgate a regulation that prohibits the transport of all water craft before water has been drained from all parts of the vessel, coolers, and the motor and the vessel and thoroughly dried.

Park internal operations

The following actions within Pictured Rocks National Lakeshore are recommended:

- Revise/edit HACCP plans for any activity conducted by park staff and volunteers that relates to working in natural bodies of water and stress the importance feedback and of reporting non-compliance
- As a condition of a concession permit for a company that works in water, include the requirement that the concessionaire follow the park's HACCP plan for aquatic exotic species
- As a condition of a research permit for aquatic studies, include the requirement that the concessionaire follow the park's HACPP plan for aquatic exotic species
- Create VHSv factsheet for all park staff. Include a unit on VHSv prevention in seasonal training and at least annually for permanent employees
- Schedule activities in streams to avoid spring and fall fish spawning migrations. (During spawning fish are stressed and in close proximity, making them more susceptible to VHSv)
- Emphasize enforcement of fishing and bait regulations in shoreline zone
- Purchase and label separate gear for separate lakes and streams, especially for those with the easiest access

Safety Considerations

Many of the actions identified in this plan involve potentially high risk job duties. It is critical for managers to carefully evaluate resource values versus safety risk when implementing these activities. Most, if not all, of the potentially high risk duties have required training and certifications. Nothing in this plan minimizes or replaces safety protocols or standard operating procedures.

Risk assessment and Job Hazard Analysis should be performed for each work element in your program with particular attention to the high risk tasks or conditions. These high risk duties may include (but are not limited to):

- General Boat operations
- Sample collection
- Driving
- Towing boat trailers
- Loading boat trailers
- Decontamination of personnel and equipment
- Field work where personal protective equipment (PPE) is used or where heat stress may become a factor
- Disinfectant applications
- Effluent disposal

All field work conducted in conjunction with this plan should be reviewed by a safety professional. No work should take place unless appropriate safety controls and considerations are in place. Employees should have proper training, be well rested, and be alerted to hazards prior to undertaking work.

NPS and GPIR Financial Considerations

National Park System units and the GPIR may be limited by the availability of immediate and available funding needed for prevention, monitoring, and response. Although the Lake Superior parks and the Grand Portage Tribe have dedicated monies to create prevention, detection, and response plans for the Superior parks, park sites likely will not have funding necessary for the scope of this issue. The NPS and GPIR must determine need and funding sources for prevention, detection, and response.

NPS sites should coordinate efforts to pursue funding options for program development, training and implementation. Organizations and industries that have a vested interest in successful early detection and rapid response systems should be identified in order participate in the development of funding sources or to partner in response.

a. Funding Analysis: Consider, and possibly study, the following types of funding sources:
    - Temporary funding sources: Park managers should talk to their regional office for needed immediate contingency funding after local park funding options are exhausted. Parks need to identify this problem as a very high priority for funding within their park budgets. The Midwest Regional Office may have to reprioritize OFS requests if or when the problem emerges.

    - Natural Resources service wide funding may be available but may have limited application. Monies as part of the service wide comprehensive call, National Resources Preservation Program (NRPP) for Biological Resources and for Resource Protection, and High Priority Watershed Projects, (funded annually through the Natural Resources Program Center (NRPC)) should also be considered. Visit the internal NPS webpage, www1.nrintra.nps.gov, for further guidance.

    - A permanent funding source (or sources) maintained solely for rapid response actions. Short-term and long-term funding needs should be anticipated and submitted early to NPS funding sources.

    - National Parks of Lake Superior Foundation (the non-profit fund-raising organization for the Lake Superior parks) may be able to provide funding for public education and prevention components.

    - Fee Demonstration Funding: Fee Demo monies may be available at individual park sites to address the public education and prevention components.

- Private/public partnerships for these efforts in the form of equipment, supplies, personnel or funding: NPS sites should explore these partnerships, interagency Memorandums of Understanding (MOU), reimbursable accounts and other cooperative agreements with federal agencies, state entities, local governments, park concessionaires, and park partners. Possible VHSv infestation will have great impact that will be felt far beyond park boundaries. Parks should outreach to these partners to explore shared solutions, response, and funding. The US Boat Foundation may have grant monies for education and prevention. NOAA and US Fish and Wildlife Service may be other options.

    1. APHIS funding for surveillance is not directly applicable to the NPS. However, the monies could be applied indirectly to NPS sites with cooperation from the states. NPS could identify locations desired for surveillance and, with a cooperative agreement with the states, USGS, and others, complete collection or provide state personnel access to NPS jurisdiction waters for collection. The states would complete this surveillance/ testing with APHIS funds. This would additionally encourage partnership and sharing of data.

    2. NOAA has grants available for projects to develop, test, and demonstrate technologies that treat ships' ballast water in order to reduce the threat of introduction of aquatic invasive species to U.S. waters through the discharge of ballast water. This seems that the NPS would only be able to seek this funding for ballast in its own ships/ water. For further guidance, visit http://www.seagrant.noaa.gov/funding/rfp.html#bwtreatment

    3. NPS should follow the National Aquatic Invasive Species Act (NAISA). If passed, NAISA " contains provisions to: regulate ballast discharge from commercial vessels; prevent invasive species introductions from other pathways; support state management plans; screen live aquatic organisms entering the United States for the first time commercially; authorize rapid response funds; create education and outreach programs; conduct research on invasion pathways, and prevention and control technologies; authorize funds for state and regional grants; and strengthen specific prevention efforts in the Great Lakes." This was introduced by the Senate. Related bills were introduced by the House of Representatives. For more information and updates, visit http://www.ucsusa.org/invasive_species/the-national-aquatic-invasive-species-act.html

- One-time grants for specific planning or research projects related to rapid response. Parks should explore existing CESU agreements.

b. Cost Analysis: Parks will need to maintain and track costs for the prevention, monitoring, and response portions of this plan and be able to adequately justify expenditures.

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References and Resources

This section contains the following references:

- Glossary and Acronyms
- VHSv Fact Sheet
- VHSv Facts for the Public
- VHSv Prevention Information Template
- Jurisdiction and Authorities
- Wisconsin Boat and Gear Disinfection Protocol
- Information on HACCP Plans
- Information for Collaboration on Ballast Water
- Great Lakes Organizations
- Roles, Responsibilities and Authorities for Aquatic Fish Health
- Fish Species Occurring in Park and Reservation Waters
- Incident Complexity Guide
- Guidelines For Responding to Fish Kills
- Literature Cited

Glossary and Acronyms

AIS – Aquatic Invasive Species

ANS – Aquatic Nuisance Species

APIS – Apostle Island National Lakeshore

APHIS – Animal and Plant Health Inspection Service

BRD – Biological Resource Division

CESU – Cooperative Ecosystem Studies Unit

CFR – Code of Federal Regulations

CUA – Commercial Use Authorization

DNR – Department of Natural Resources

GIS – Geographic Information System

GLFHC – Great Lakes Fish Habitat Conservation Committee

GPIR – Grand Portage Indian Reservation

GRPO – Grand Portage National Monument

HACCP - Hazard Analysis Critical Control Point

HUC – Hydrologic Unit Code

IBP - Incidental Business Permit

IC – Incident Commander

ICS – Incident Command System

IRI – Isle Royale Institute

JHA – Job Hazard Analysis

MI DEQ – Michigan Department of Environmental Quality

MN DNR – Minnesota Department of Natural Resources

MOU – Memorandum of Understanding

MWRO – NPS Midwest Regional Office

NAISA – National Aquatic Species Act

NEPA – National Environmental Protection Act

NOAA – National Oceanic and Atmospheric Administration

NPDES - National Pollutant Discharge Elimination System

NPS – National Park Service

NRPC – Natural Resource Program Center

NRPP – Natural Resource Protection Program

OIE – Organization International de Epizooties (World Organization of Animal Health)

OMNR – Ontario Ministry of Natural Resources

PIRO – Pictured Rocks National Lakeshore

USC – United States Code

USCG – United States Coast Guard

USDA – United States Department of Agriculture

USEPA – United States Environmental Protection Agency

USFWS – United States Fish and Wildlife Service

VOYA – Voyageurs National Park

VHS –Viral Hemorrhagic Septicemia

VHSv –Viral Hemorrhagic Septicemia virus

WASO – Washington Office of the Natural Park Service

WI DNR – Wisconsin Department of Natural Resources

WRD – Water Resource Division

Glossary

Epizootic Definition – A fish die off resulting from a disease outbreak that is outside of typical seasonal or daily mortalities. Typically, non-typical site or area mortalities above 1000 fish for forage species and above 100 fish for predator species could be considered epizootic events.

VHS – Disease cause by the VHS virus

VHSv – the virus itself

USGS
science for a changing world

Detection of Viral Hemorrhagic Septicemia Virus

Viral hemorrhagic septicemia virus (VHSV) is considered to be one of the most important viral pathogens of finfish and is listed as reportable by many nations and international organizations (Office International des Epizooties 2006). Prior to 1988, VHSV was thought to be limited to Europe (Wolf 1988; Smail 1999). Subsequently, it was shown that the virus is endemic among many marine and anadromous fish species in both the Pacific and Atlantic Oceans (Meyers and Winton 1995; Skall et al. 2005). Genetic analysis reveals that isolates of VHSV can be divided into four genotypes that generally correlate with geographic location with the North American isolates generally falling into VHSV Genotype IV (Snow et al. 2004). In 2005-2006, reports from the Great Lakes region indicated that wild fish had experienced disease or, in some cases, very large die-offs from VHSV (Elsayed et al. 2006, Lumsden et al. 2007). The new strain from the Great Lakes, now identified as VHSV Genotype IVb, appears most closely related to isolates of VHSV from mortalities that occurred during 2000-2004 in rivers and near-shore areas of New Brunswick and Nova Scotia, Canada (Gagne et al. 2007). The type IVb isolate found in the Great Lakes region is the only strain outside of Europe that has been associated with significant mortality in freshwater species.

Cell culture and molecular assays are used for the detection and identification of fish viruses.

As of mid-2007, VHSV strain IVb has been isolated from fish in Lake Michigan, Lake Huron, Lake St. Clair, Lake Erie, Lake Ontario, the Saint Lawrence River, inland lakes in New York, Michigan and Wisconsin as well as the coastal areas of eastern Canada. The new strain has an exceptionally broad host range and has been isolated from over 25 species of finfish to date. Significant mortality has been reported in muskellunge, freshwater drum, yellow perch, round goby, emerald shiners and gizzard shad.

Fisheries managers throughout the US and Canada are concerned about the further spread of this highly virulent virus among populations of native freshwater fish and the introduction of VHSV into the private aquaculture industry could lead to trade restrictions as well as direct losses from disease. As a result, agencies in the US and Canada have placed restrictions on the movement of fish or fish products that could represent a risk for the spread of VHSV to regions outside of the currently known geographic range. These restrictions include requirements for viral examinations by standard methods. The purpose of this information sheet is to review some important factors for the isolation of VHSV Genotype IVb using cell culture assays and its identification by the polymerase chain reaction (PCR) assay.

muskellunge

freshwater drum

yellow perch

emerald shiner

U.S. Department of the Interior
U.S. Geological Survey

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USGS FS 2007-3055
July 12, 2007

Cell culture for initial isolation:

Both the Manual of Diagnostic Tests for Aquatic Animals (OIE 2006) and the Suggested Procedures for the Detection and Identification of Certain Finfish and Shellfish Pathogens (American Fisheries Society 2005 - in revision) specify cell culture assays for determination of virus-free status. While European strains of VHSV grow well on the cell lines recommended by the OIE (e.g. RTG-2 and BF-2), isolates of the North American genotype are more efficiently isolated using the EPC, FHM or BF-2 lines (Table 1). These latter cell lines, available from the American Type Culture Collection, are acceptable to the OIE and specified in the revised version of the AFS "Bluebook".

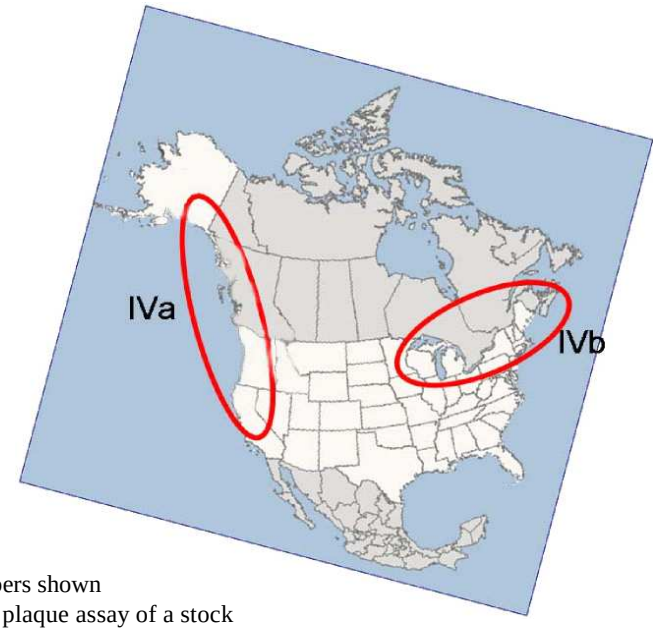


Table 1. Relative plating efficiency for various isolates of VHSV on selected cell lines. The numbers shown represent the $_{log10}$ of the virus titer determined by plaque assay of a stock suspension of each virus isolate on each of the lines. The VHSV strains are: F1 (Denmark); 23-75 (France); KRRV (Japan); Makah (WA), muskellunge (MI) and mummichog (NB). The genotype of each isolate is shown in parentheses. n.d. = not done.

	F1 (Ia)	23-75 (Ia)	KRRV (IVa)	Makah (IVa)	muskellunge (IVb)	mummichog (IVb)
EPC-ATCC	6.5	6.8	5.6	8.6	7.3	7.0
EPC-Newport	6.3	7.0	5.2	8.6	7.5	7.3
FHM-J	6.3	6.9	5.4	8.5	7.4	7.4
FHM-Lamar	6.5	n.d.	5.5	8.7	7.5	7.2
CHSE-214	7.0	5.4	5.1	8.1	5.5	6.2
RTG-2	7.2	n.d.	<3.7	5.1	3.3	3.7
BF-2	7.9	6.7	7.4	8.3	7.4	7.0

Incubation temperature affects the growth of all fish viruses and strains of VHSV are best isolated at incubation temperatures between 15-18°C as recommended by the Manual of Diagnostic Tests for Aquatic Animals (OIE 2006) and the Suggested Procedures for the Detection and Identification of Certain Finfish and Shellfish Pathogens (American Fisheries Society 2005). As shown in Table 2, the Genotype IVb isolate of VHSV from the Great Lakes grew best at 15°C. Plating efficiency began to decline at 20°C, and the isolate did not grow at 25°C.

Table 2. Plaque assay titers for a North American Genotype IVb isolate of VHSV from muskellunge plated on three cell lines and incubated at selected temperatures. The numbers shown represent the log_{10} of the virus titer detected by each of the lines.

Cells	10°C	15°C	20°C	25°C
EPC-ATCC	7.04	7.06	6.26	<3.40
BF-2	6.85	7.22	6.98	<3.40
FHM-J	7.00	7.34	6.99	<3.40

More so than for other fish viruses, the pH of the cell culture medium is particularly important for the successful isolation of VHS V. Table 3 shows the effect of selected pH levels on the ability of three cell lines to detect the Genotype IVb isolate of VHSV from the Great Lakes. It is obvious from the data that the pH of the culture medium should remain at or above pH 7.4 during the assay.

Polymerase chain reaction for confirmation:

The polymerase chain reaction assay has largely replaced the serum neutralization assay as a confirmatory test for VHSV. For the PCR assay to be broadly useful, it is important that the primers be located in regions of the virus genome that are conserved among all the strains of the virus that might be encountered. Following discovery of the Great Lakes strain of VHSV, sequence analysis of the new isolates showed that the primers recommended by the American Fisheries Society Fish Health Section Bluebook for PCR identification of VHSV were not optimal. The revised version of the VHS section of the Bluebook (available at no charge on-line at http://web.fisheries.org/units/fhs/VHS_inspection.html) contains new PCR primer sequences that are identical to those currently specified by the OIE Manual of Diagnostic Tests for Aquatic Animals. In addition, the revised VHS section of the Bluebook now recommends use of an extraction procedure for preparation of viral RNA from cell culture fluids rather than a simple heat treatment. These changes have resulted in the VHS sections of the Bluebook and OIE Manual becoming essentially equivalent.

Sites of VHSV IVb isolation in the Great Lakes as of summer 200 7.

Table 3. Plaque assay titers for a North American Genotype IVb isolate of VHSV from muskellunge plated on three cell lines and incubated at selected pH levels. The numbers shown represent the $_{log10}$ of the virus titer detected by each of the lines.

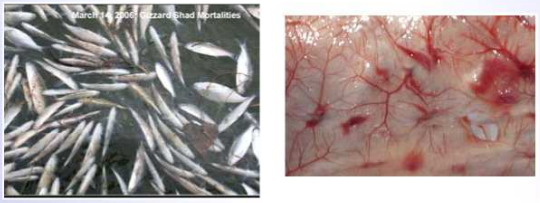
Cells	pH 6.6	pH 7.0	pH 7.4	pH 7.8	pH 8.2
EPC-ATCC	<3.40	3.40	7.04	7.13	6.94
BF-2	<3.40	<3.40	7.26	6.92	7.15
FHM-J	<3.40	<3.40	7.25	7.25	7.38

VHSV Disease Outbreaks in North America

West Coast: VHSV genotype IVa causes significant mortality in wild marine forage fish such as herring and sardines. These fish are critical to Pacific ecosystems.

Photos courtesy of Garth Traxler.

Great Lakes: As of mid-2007, VHSV strain IVb has been isolated from fish in Lake Michigan, Lake Huron, Lake St. Clair, Lake Erie, Lake Ontario, the Saint Lawrence River, inland lakes in New York, Michigan andWisconsin as well as the coastal areas of eastern Canada. Significant mortality has been reported in muskellunge, freshwater drum, goby, burbot, yellow perch, gizzard shad, and smallmouth bass. It has been isolated from several other species including chinook salmon.



Hemorrhagic disease in gizzard shad. Photos courtesy of Mohammed Faisal.

References:

American Fisheries Society. 2005. Suggested Procedures for the Detection and Identification of Certain Finfish and Shellfish Pathogens. American Fisheries Society, Bethesda, MD. This publication is currently in revision. For the new section on VHSV go to: http://web.fisheries.org/units/fhs/ VHS_inspection.html

Elsayed, E., M. Faisal, M. Thomas, G. Whelan, W. Batts and J. Winton. 2006. Isolation of viral hemorrhagic septicemia virus from muskellunge, *Esox masquinongy* (Mitchill), in Lake St. Clair, Michigan, USA reveals a new sub-lineage of the North American genotype. Journal of Fish Diseases 29:611-619.

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Meyers, T.R. and J.R. Winton. 1995. Viral hemorrhagic septicemia virus in North America. Annual Review of Fish Diseases 5:3-24.

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Skall, H. F., N. J. Olesen, and S. Mellergaard. 2005. Viral hemorrhagic septicaemia virus in marine fish and its implications for fish farming – a review. Journal of Fish Diseases 28:509-529.

Smail, D. A. 1999. Viral haemorrhagic septicaemia. Pages 123-147 *in* P. T. K. Woo, and D. W. Bruno, editors. Fish Diseases and Disorders, Volume 3: Viral, Bacterial and Fungal Infections. CAB International, New York, New York.

Infectious disease is increasingly recognized as an important feature of aquatic ecosystems; however, the impact of disease on populations of wild fish has been difficult to study. While many of the viral, bacterial, protozoan and fungal pathogens of fish that were initially discovered in captive animals are actually endemic among wild populations, the introduction of exotic pathogens into aquatic systems can lead to explosive mortality and may be especially threatening to native stocks. At the WFRC, field and laboratory investigations, aided by the tools of molecular biology, have begun to provide information on the ecology of infectious diseases affecting natural populations of fish in freshwater and marine ecosystems.

Further Reading:

A complete list of WFRC publications may be found at: http://wfrc.usgs.gov/pubs/pubs.htm

Snow, M., N. Bain, J. Black, V. Taupin, C. O. Cunningham, J. A. King, H. F. Skall, and R. S. Raynard. 2004. Genetic population structure of marine viral haemorrhagic septicaemia virus (VHSV). Diseases of Aquatic Organisms 61:11-21.

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Wolf, K. 1988. Viral hemorrhagic septicemia. Pages 217-248 *in* Fish Viruses and Fish Viral Diseases. Cornell University Press, Ithaca, NY.

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[end of fact sheet]

VHSv Facts for the Public

This reference was developed to provide the public with information about VHSv in a FAQ format.

What is Viral Hemorrhagic Septicemia (VHS) and where did it come from?

- VHS is an infectious fish disease. It is a virus.
- VHS found within the Great Lakes is closely related to the VHS strain detected within Atlantic and eastern Gulf of St. Lawrence waters.

Is VHS currently found in Lake Superior?

- Not detected to date.

How might an outbreak of this virus affect my visit?

- A fish kill caused by VHS will change the nature of your visit. There will be an odor associated with large numbers of dead fish either floating in the water or washing up on beaches. This will be the case until the dead fish are removed. A large fish kill will also affect your visual experience in the park.
- For anglers- there will be unpredictable changes in fish populations that may impact fisheries.
- Bacterial outbreaks originating from decaying fish could impact water quality and become a public health issue. Beaches could be closed.

Is VHS dangerous for people handling or consuming fish?

- VHS has no impact on human health.

What fish are affected by VHS in the Great Lakes to date?

Black crappie
Bluegill
Bluntnose minnow
Brown bullhead
Brown trout
Burbot
Channel catfish
Chinook salmon
Emerald shiner
Freshwater drum
Gizzard shad
Lake whitefish
Largemouth bass
Muskellunge
Shorthead redhorse
Northern Pike
Pumpkinseed
Rainbow trout
Rock bass
Round goby
Silver redhorse
Smallmouth bass
Spottail shiner
Trout-Perch
Walleye
White bass
White perch
Yellow perch

What does a fish infected with VHS look like?

- Signs of bleeding around the eyes, bases of fins, sides and head.
- Bulging eyes.
- Distended (fluid-filled) belly.

Note that although these symptoms may be present in fish that are infected with VHS, they are not diagnostic. Similar symptoms may be indicative of other common fish diseases and conditions.

How is VHS spread?

One known method of spreading VHS from one body of water to another is by moving fish through importation, stocking or the use of bait. Other potential ways of spreading the virus are through natural fish movements, recreational boating/angling, bird assistance, and ballast water discharge.

Does Lake Superior's water quality and fish health need you?

- Absolutely!
- VHS most commonly is spread with assistance in some way from humans. Therefore human behavior is essential. You CAN help!

How can you help?

- Drain all water from your boat, motor, bilge, live wells, trailer, containers, bait buckets, coolers and fishing equipment before leaving the lake or shoreline.
- Clean and disinfect all recreational equipment with a household bleach/water solution. Chlorine bleach is known to kill VHSv.* All disinfection must be in accordance with federal and state law (see footnote on page 21).
- Do not move live or dead fish (including unused minnows), fish eggs, or fish parts between waters. All fish must be dead before leaving the landing or shoreline. Ice your catch and discard your minnows in secure trash. Frozen bait can still spread VHSv.
- Do not use minnows unless they were purchased from a certified bait dealer.
- Do not release live fish into wild waters, i.e. unused bait minnows, exotic ornamental fish.
- Remove all visible plants, animals and mud from your boat and trailer before leaving shoreline.

*A consumer's first choice is to find an EPA-approved product although none are known at this time.

What are the National Park Service and the Grand Portage Indian Reservation doing to control the spread of VHS?

In January of 2008, four national park units around Lake Superior joined to formulate an action plan to address VHS in Lake Superior.

What should I do if I find a sick or dying fish?

Each park to provide specific info here.

Where can I get more information?

[Each location to provide specific info here.]

VHSv Prevention Information Template

VHS Prevention Information for Park Employees and Visitors

Viral hemorrhagic septicemia (VHS) is a deadly fish virus that was first detected in the lower Great Lakes in 2003. It has been confirmed in various locations in Lakes Huron, Michigan, Erie and Ontario, and in the connecting waterways. It has also been documented in some inland waters in New York, Wisconsin and Michigan. It has not yet been found in Lake Superior.

VHS can infect a large range of fish species and has been the cause of large fish kills. It is transmitted between fish through urine, feces and reproductive fluids released into the water, and by eating infected fish. VHS is not a threat to people who handle or eat infected fish, but it is a threat to more than 25 freshwater fish species in the Great Lakes, which include popular sport fish such as muskies, walleye, lake whitefish and freshwater drum.

The presence of VHS must be confirmed by lab tests, but some of the signs shown by an infected fish are bulging eyes, bloated abdomens, bleeding, and unusual behavior. If you see a fish that has these signs, or observe a fish kill, notify a park ranger as soon as possible.

The National Park Service, in cooperation with its partners and other agencies, has developed a planning guide to assist park managers in making decisions to protect park resources that would be impacted if and when this disease enters the Lake Superior ecosystem. More detailed information is available at park visitor centers or on line at [each location to provide specific info here.]

Jurisdiction and Authorities

Jurisdiction and Authorities Regarding VHSv in Lake Superior. This section lists agencies organized by their relationship to vectors and resources within the Lake Superior basin and is not presumed to be fully comprehensive. For a more complete listing of activities and authorities by agency please review the Great Lakes Organizations section and "Roles Responsibilities and Authorities for Aquatic Fish Habitat."

I. Jurisdiction over water quality, including the addition of any chemicals within the Lake Superior basin

a) All waters under the Clean Water Act
EPA

b) Waters within their legally defined boundaries:
Wisconsin- Water Quality Division, DNR
Michigan-DEQ
Minnesota-PCA
National Park Service- each park

II. Ownership and management of the fish within Lake Superior

1854 Authority
Bad River Band of Lake Superior Chippewa
Chippewa-Ottawa Treaty Fishery Management Authority
Fond du Lac Band of Lake Superior Chippewa
Grand Portage Band of Lake Superior Chippewa
Great Lakes Indian Fish and Wildlife Commission
Keweenaw Bay Indian Community
Michigan Department of Natural Resources
Minnesota Department of Natural Resources
Ontario Ministry of Natural Resources
Red Cliff Band of Lake Superior Chippewa
U.S. Fish and Wildlife Service
U.S. National Park Service
Wisconsin Department of Natural Resources

III. Agency with regulatory authority over the addition of nuisance species into the waters

States- Have authority under the 10th Amendment to create laws to protect the health, safety, and welfare of citizens; however state laws pertaining to commercial shipping are preempted by federal law under the Commerce Clause, Supremacy Clause, and Foreign Affairs Clause (under legal challenge).

APHIS- Executive Order 13112 and its National Invasive Species Management Plan
NPS within their borders: 36 CFR, 16 USC

IV. Jurisdiction over significant VHS vectors

a) Recreational boating and fishing (water recreational vector)

1) Boaters

USCG within navigable waters
States within their boundaries
NPS within their boundaries

2) Anglers

States within their boundaries (DNR's)
Federal agencies within their jurisdictions if fisheries objective are different from states
Tribal authority for tribal members

b) Aquaculture and commercial fishing vector

APHIS
States DNRs
Agency mission & purpose within their boundaries (NPS)

c) Ballast (maritime recreational vector)

States in the absence of federal regulation (currently under legal challenge)
EPA (currently under legal challenge)
USCG- narrowly defined CFR: 33 CFR Section 151; Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990; National Invasive Species Act of 1996
Isle Royale National Park, 33 CFR 1.5 (a)(2) Emergency Restriction prohibiting the discharge of untreated ballast water within park waters

d) Additional vectors

Agency commerce vector
Organisms in trade vector
Illegal activities vector
Canals and diversions vector
Tourism vector

V. Jurisdiction over chemicals that can be used

EPA
States

VI. Management of supportive facilities/infrastructure/communication pathways that can affect other vectors- Please list facility and applicable legislation

USDOT

Wisconsin Boat and Gear Disinfection Protocol

BOAT AND GEAR DISINFECTION PROTOCOL FOR FH STATEWIDE - 2007

Additional Information Available at:
http://dnr.wi.gov/fish/pages/vhs.html

ALL WATERS

Boat transfer guidelines have been widely distributed to the public through a variety of publications and pamphlets, signs, etc. The guidelines consist of a nationally-accepted set of prevention steps. It is also important that DNR staff follow the same guidelines to set a good example for the boating public, to insure that we are not contributing to the spread of aquatic invasives through our work activities, and because it's the law. The public is being asked to take the following steps before transferring boats or equipment from one waterbody to another:

- **Inspect** and **remove** aquatic plants, animals, and mud from your boat, trailer and equipment.
- **Drain** all water from your motor, livewell, bilge, transom wells, etc.
- **Dispose** of unwanted bait in the trash. Never release live bait into a waterbody, or transfer aquatic animals or water from one waterbody to another.
- **Wash** your boat and equipment with hot (>104° F) and/or high pressure water, particularly if moored for more than one day, OR
- **Dry** your boat and equipment thoroughly for 5 days.

Since we are not able to guarantee that any waters are free of aquatic invasive species, we ask the public to take the first 3 prevention steps *every time* they move their boat and equipment. We also strongly suggest that they take steps 4 and/or 5 whenever possible, particularly if they are leaving a known infested waterbody or if their boat has been moored for more than a day.

Since DNR FH staff regularly move equipment between waters, it is important that we always follow the same guidance - take the first 3 steps, and wash or dry boats and equipment whenever possible on all waters.

WATERS WITH SPECIFIC KNOWN EXOTICS AND ENDEMIC PATHOGENS

Additional disinfection measures are required on waters with the following known exotic species: zebra mussels, fishhook or spiny water fleas, spring viremia of carp virus (SVCv), largemouth bass virus (LMBv), viral hemorrhagic septicemia virus (VHSv) and Heterosporis. They must also be used on waters with known presence of the endemic disease Lymphosarcoma. **These additional measures must be taken prior to moving to another waterbody. They are not needed daily when sampling only on the affected**

waterbody. (See Table 1 for approved disinfectants/properties/safety and Table 2 for mixing concentrations)

ALTERNATIVE FOR HETEROSPORIS: The only time UNDISINFECTED gear could be moved between water bodies is AFTER 5 CONSECUTIVE DAYS OF COMPLETE DRYNESS (This does not include the days to initially dry it out). Dessication has been shown to kill Heterosporis spores under lab conditions.

Nets
Organic debris should be removed prior to disinfection. Power washing is not required, but nets could be sprayed with a garden hose to remove debris. Nets should be placed in the disinfection solution for the appropriate contact time for the solution being used (see Table 1 for times). After rinsing, the nets can be used immediately, or hung to dry.

Personal protective gear, including rain gear, gloves, boots/waders
Scrub personal protective gear with the disinfection solution. After scrubbing, the gear should be kept wet with the disinfection solution for the appropriate contact time (see Table 1 for times). Rinse with clean water or water from the next waterbody. Every effort should be make to keep the disinfection solution and rinse water out of surface waters.

Dip nets, measuring boards and other sampling gear
Remove any organic material from sampling gear. There are several options for disinfecting smaller gear:

- Option one: The gear can be sprayed with the disinfection solution and a wet surface maintained for the appropriate contact time (see Table 1 for time). The gear should be rinsed with clean water or water from the next waterbody before it is used again.

- Option two: Fill a tub with disinfection solution and place all equipment in the tub for the appropriate contact time (see Table 1 for time). The gear should be rinsed with clean water or water from the next waterbody before it is used again.

- Option three: Use a completely new set of gear for each waterbody during the work day and disinfect all gear at the end of the day using option one or two. Every effort should be make to keep the disinfection solution and rinse water out of surface waters.

Boats, trailers, and live wells
Remove organic material from boats, trailers, and live wells. Drain water from live wells, bilges and pumps. The outside and inside of the boat, trailer, live wells, bilges, and pumps should be sprayed with the disinfection solution and left wet for the appropriate contact time (see Table 1). The inside of the live wells, bilges and pumps should be made to contact the solution for the appropriate contact time as well. Run pumps so they take in some of the disinfection solution and make sure that the solution comes in contact with all parts of the pump and hose. The boat, trailer, bilges, live well, and pumps should be

rinsed with clean water or water from the next waterbody after the appropriate contact time. Every effort should be make to keep the disinfection solution and rinse water out of surface waters.

Motors
For outboard motors, rig up a short (6-foot) piece of garden hose to lower unit muffs. A pail of the disinfectant can be set in the back of the boat and gravity fed to the lower unit to run the disinfectant through the motor. Allow solution to remain in motor for the appropriate contact time (see Table 1). The hose will need to be primed to start the gravity flow because the lower unit does not create enough suction to prime the hose. A non-corrosive (Virkon - S or Peroxigard/Accel) should be used to protect the impeller.

In cases where boats and gear return to state hatcheries, disinfection should be done in a location away from ponds and water supplies to prevent disinfectant or untreated water from entering those areas.

General Practices

- Organize your sampling so the work in infested waters is always done last.
- If a high percentage of your work is done in waters infested with invasive species, consider dedicating certain gear to be used only in those waters.
- Depending on the type of work you are doing, it may be possible to work with lake volunteers and use their boats to collect samples. That way only your gear needs to be disinfected.
- Keep a log that indicates what equipment is disinfected, the date, the disinfection method, and the initials of the person doing the disinfection.

Table 1. Disinfectants, target species and proper use. When mixing any of these chemicals, wear eye protection and gloves and also a dust mask if it is a powder.

Reason to Treat	Chemical	Conc.	Contact Time	Safety precautions
Zebra Mussels Zooplankton	Vinegar Glacial Acetic Acid[1]	100% 6%	20 min 20 min	Wear eye protection, rain gear, gloves if spraying. Stay upwind of the spray. Is corrosive to metal. Is toxic to fish at these concentrations so rinse well after disinfection.
Zebra Mussels Zooplankton	Salt	1%	24 hrs	Due to the long contact time, salt may only be used as a bath solution (not sprayed)
SVCv LMBv	Iodophor	250 ppm	10 min	Wear eye protection, rain gear, and gloves if spraying. Stay upwind of the spray. Will stain surfaces brown. Will break down in sunlight and when in contact with organic material. Is corrosive to metal and rubber. Is toxic to fish at these concentrations so rinse well after disinfection or neutralize with sodium thiosulfate*.
VHSv	Iodophor	100	10 min	
SVCv LMBv VHSv	Virkon S	1:100	20-30 min	This is a disinfectant in the peroxygen (hydrogen peroxide) family. It is a powder. It is 99.9% biodegradable and breaks down to water and oxygen. It is not corrosive at the working dilution. Wear eye protection, rain gear and gloves if spraying. Stay upwind of spray.
SVCv LMBv VHSv	Peroxigard/ Accel	1:16	5 min	This is a disinfectant in the peroxygen family. It is a liquid. It is not corrosive at the working dilution. No rinsing is required. Wear eye protection, rain gear and gloves if spraying. Stay upwind of spray.
SVCv LMBv VHSv Lymphosarcoma Zebra Mussels Zooplankton	Chlorine	200 ppm	10 min	Wear eye protection, rain gear, gloves if spraying. Stay upwind of the spray. Will break down in sunlight and when in contact with organic material. Is corrosive to metal and rubber. Is toxic to fish at these concentrations so rinse well after disinfection or neutralize with sodium thiosulfate*.

SVCv **VHSv**	True steam cleaning			True steam cleaning (212 °F) will inactivate rhabdoviruses within seconds. This may be an option when chemical disinfection is difficult.
Heterosporis	Chlorine	2200 ppm	5 min	Wear eye protection, rain gear, gloves if spraying. Stay upwind of the spray. Will break down in sunlight and when in contact with organic material. Is corrosive to metal and rubber. Is toxic to fish at these concentrations so rinse well after disinfection or neutralize with sodium thiosulfate*.

[1] Glacial Acetic Acid is a very viscous, concentrated acid. Be sure to wear protective gear and rinse all measuring and mixing equipment well. Remember to always add acid to water (not water to acid).

* - For neutralizing chlorine or iodine, spray sodium thiosulfate in an 800 ppm solution (3 grams per gallon of water) on all surfaces after the disinfection period is over. Rinse with water from the next lake to remove any remaining sodium thiosulfate.

Table 2. Volume of disinfectant needed to make 1, 2, 5, 20 and 100 gallons of solution.

Chemical	1 gallon	2 gallons	5 gallons	20 gallons	100 gallons
200 ppm Chlorine- bleach 5.25%	15 ml	30 ml	75 ml	300 ml	1.5 L
200 ppm Chlorine- 70% HTH granular	1.2 grams	2.4 grams	6 grams	24 grams	120 grams
2200 ppm Chlorine - Bleach 5.25%	5 oz	1 1/4 cups	3 cups	12 cups	60 cups
100% Vinegar	1 gal	2 gal	5 gal	20 gal	100 gal
6% Glacial Acetic Acid	1 cup	2 cups	5 cups	5 quarts	6 gallons
1% Salt	1/8 cup	1/4 cup	2/3 cup	2 2/3 cups	13 1/3 cups
250 ppm 1% Iodophor Solution	95 ml	190 ml	475 ml	1.9 L	9.5 L
100 ppm 1% Iodophor solution	38 ml	76 ml	190 ml	760 ml	3.8 L
Virkon S 1:100	38 grams	76 grams	190 grams	760 grams	3.8 kg
Peroxigard 1:16	8 oz	16 oz	40 oz	5 qt	6.25 gal
True steam cleaning (212 °F)	A few seconds				

Conversion: 8 oz = 1 cup

Sources of disinfectants

Chlorine- household bleach (5.25 % chlorine) can be purchased from a grocery or convenience store. HTH is granular chlorine (70% calcium hypochlorite) and can be purchased from a pool supply company.

Sodium Thiosulfate- is commonly used to neutralize chlorine and iodine. It should be available at a pool supply company or from a chemical supply company.

Glacial Acetic Acid – is a viscous concentrated acetic acid (vinegar). It should be available from a chemical supply company or from Fisher Scientific. The phone number for Fisher is 1-800 766 7000 and the catalog number for 2.5 liters of acetic acid, glacial, is A490-212. You can use your Pcard when ordering from Fisher.

Iodophor- a 1 % solution (Argentyne or Betadine) is available from Argent, an aquaculture supplier. The phone is 1-800- 426-6258. It may also be available from drug stores as a 1% surgical prep or scrub solution. The scrub solution can be used as a disinfectant for gear and hard surfaces, but should not be used to disinfect fish eggs because it may contain a detergent that is detrimental to eggs. Western Chemical sells Ovadine which is also a 1% iodine solution used to disinfect fish eggs or gear. Their phone is 1 800 283 5292.

Virkon-S – is available in 10 pound pails from Holt Products in Madison. They are the distributor for Wisconsin. Ten pounds of chemical will make up 128 gallons of disinfectant.

Holt Products
613 Atlas Avenue
Madison, WI 53704
608.223.3232

Virkon Aquatic is available from Western Chemical. It is the same formulation, but without the perfume and dye, and the label addresses specific fish pathogens. Their phone is 1 800 283 5292.

Peroxigard/Accel – still have not been registered for use in the United States (they are manufactured in Canada).

Final prepared by Steve AveLallemant, Sue Marcquenski, 03-19-2007

Information regarding Michigan VHS prevention activities can be found at http://www.michigan.gov/dnr/0,1607,7-153-10364_10950_46202---,00.html.

Information on HACCP Plans

Information about Hazard Analysis and Critical Control Points, or HACCP plans, can be found at http://www.haccp.nrm.org . The website includes basic information, sample plans and a plan development wizard.

Contact Michigan or Minnesota Sea Grant for training needs in AIS-HACCP and plan development.

Information for Collaboration on Ballast Water

The National Park Service remains concerned about the timely progress on critical issues that may affect park resources. Determining the specific risk level of ballast water as a vector for VHSv is difficult, but a general description of ballast as a potential vector is relatively simple, regardless of the actual level of risk. Other vectors such as movement of bait and recreational boating have been addressed by state and federal agencies and actions to reduce those risks have been widely implemented. This document builds upon the actions already taken by other agencies to minimize those vectors, and to apply specific guidance to NPS units in Lake Superior. Discussions of the risk of ballast are ongoing however, and there has not been consensus on the threat level of ballast by the wider audience of all concerned. Therefore, we feel it is worth examining in more detail some potential ballast management actions that may help to reduce overall risk. Ballast exchange with VHSv could potentially kill or infect several species of fish in Lake Superior and NPS jurisdictional waters. Although ballast exchange within or near park boundaries is low and infrequent, if it occurs during times of high stress such as spawning or periods when fish are concentrated, it has the potential for devastating results.

There are five primary types of non-NPS ballasted vessels that may transit within or near park boundaries, boundaries. They are listed in the general descending order of volume of discharge: domestic and ocean going bulk freighters, certain classes of research and federal vessels, barges, cruise ships, and various types of recreational boats. It should be noted that the volumes may vary between these categories.

This appendix documents the process that was used to form the opinions related to VHSv risk reduction via ballast exchange, screening treatment, and proposed management opportunities for collaboration that can contribute to risk reductions. The recommended actions are listed in the main planning document.

Need for Change

One of the vectors for AIS in the Great Lakes, including VHSv, is ballast water from commercial vessels. 73% of the invasive species established in the Great Lakes since the completion of the St. Lawrence Seaway are attributed to ballast discharge from transatlantic ships (Holeck et al, 2004.) Lake Superior has the first ports of call for 52% of ballasted ships, and receives the majority of the de-ballasting by “no ballast” ships, even though its ports are often not the first port of call for those vessels (Lovell and Stone, 2005.) Both ballasted vessels and “no ballast” vessels (those that deliver cargo, then take on ballast at Great Lakes ports) pose the threat of discharging AIS. “No ballast” vessels represent 90% of the inbound Great Lakes traffic, and as they exchange cargo for ballast and vice versa in various Great Lakes ports, they can discharge live and resting stages of AIS that are in residual ballast water and in the tank sediments that are suspended during ballast exchange or release (Lovell and Stone, 2005.) This includes the AIS that may have traveled from transatlantic ports as well as AIS that are picked up in Great Lakes ports and released in previously uncontaminated

ports in the lakes. “No ballast” vessels on average contain 50 metric tons of residual sediment and 10 metric tons of residual water (Holeck et al, 2004.) The average number of saltwater-going vessels entering the St. Lawrence Seaway over the past ten years is greater than 500 ships per year (cite Izaak Walton League report). A rough estimate of discharge into Duluth Harbor alone could be over 8 billion of gallons per year. (estimated based on ship capacity and will vary from year to year).

The number of ballasted ships entering Lake Superior has been difficult to determine; ports list the data in such a way that it is difficult to determine whether ten ships entered 10 times a season or 100 different ships entered one time each. The number of all ships, tugs and barges entering Lake Superior via the Sault Locks in 2006 was over 2,200 vessels (Panik, "Vessel" 2008). For vessel ballast citations, the following data was generated from U.S. Army Corp of Engineers (USACE) data (Panik, "ballasted" 2008). For Oceangoing vessels 188 transited in-ballast into Lake Superior. Their total number of passages into Lake Superior was 233 with 179 passages transiting to/from Thunder Bay.

The U.S. and Canadian fleet of inter-lake carriers consists of 140 ships in 2006 (Cangalosi report). For American Flag Lakers there were 975 in-ballast transits into Lake Superior. There were a total of 1327 number of passages into Lake Superior with only one of the passages headed to/from Thunder Bay. The rest were headed for US ports of call. Numbers are hard to find, but it is estimated that the 13 thousand foot ships that move into and out of the Superior basin probably contribute to 30% of the ballast exchange within the basin (Wiley personal communication).

For Canadian Flag Lakers 476 in-ballast transits occurred into Lake Superior out of a total traffic of 645 passages into Lake Superior. Thunder Bay received the highest number of visits receiving 589 passages to/from the port. Passenger vessels both American and Canadian were small in number totaling only 8 passages from the Lower Lakes.

Anecdotal information suggests the majority of the Lake Superior basin traffic is repeat visits on repeat runs. If this information is validated it would imply that if effective prevention measures could be adopted and the risk of VHSv spread could be greatly reduced. For example if only a small number of ships are leaving contaminated ports and heading to Lake Superior it would reduce the impact on the industry to treat. A more thorough evaluation of risk reduction is needed. Until ballast records by ship by transit within the Great Lakes becomes available to agencies it will be difficult to provide better estimates. The most recent information from the National Ballast Center is from 2004. Economists from Grand Valley State University estimate the cost of existing invasive species ranges from $200 million to $5 billion per year, and that the economic benefit of oceangoing commerce in the Great Lakes is approximately $55 million annually (Izaak Walton League 2007).

The risk of VHSv introduction to park fisheries is obviously highest if ballast is discharged in park waters. However, ballast water that is exchanged in Lake Superior

ports, has a higher potential of transmitting VHSv throughout Lake Superior than an introduction of VHSv at a park or reservation, because of volume and frequency of ballast exchange. In addition, counter-clockwise currents and boats that travel from port to port within Lake Superior could move infected fish around the lake.

The primary routes and home ports of ships are summarized in Figures 1 & 2.

Fig. 1 . Generalized trade pattern of overseas-flagged transoceanic vessels transporting steel in and grain out of the Great Lakes-St. Lawrence Seaway system

(From Cangelosi and Mays, 2006.)

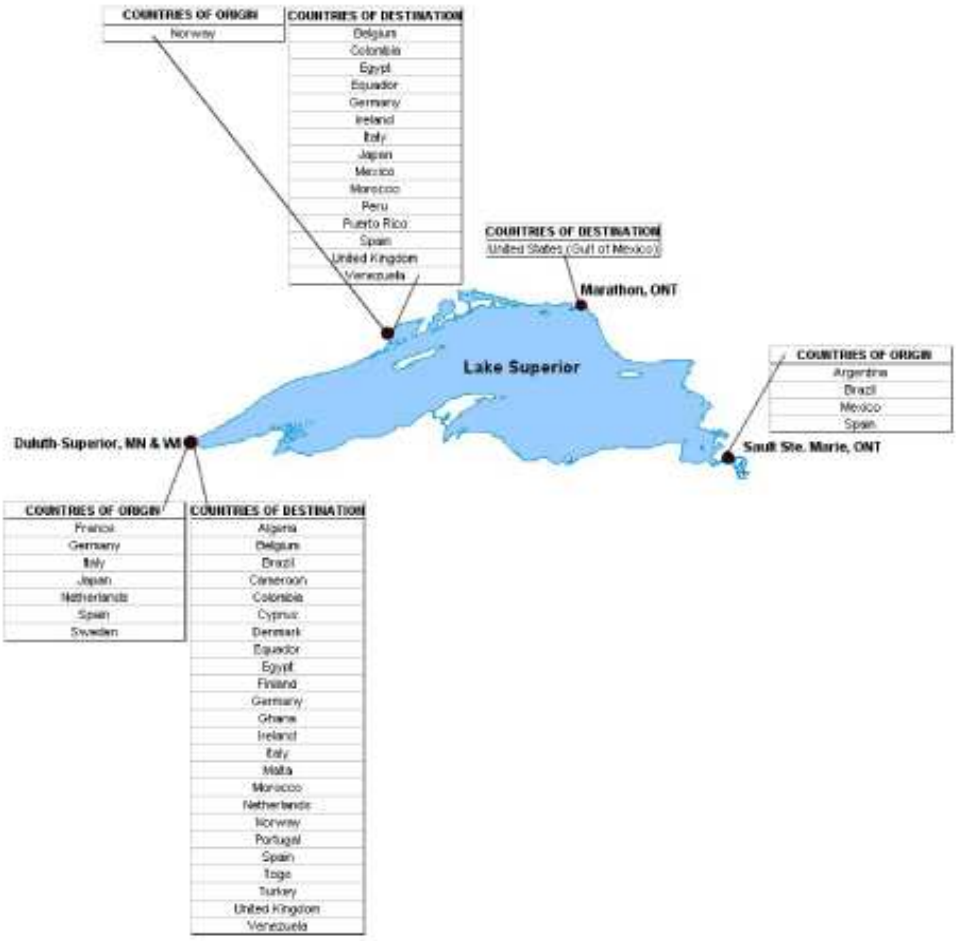

Fig. 2 Countries of origin and destination for cargoes transported to and from ports in Lake Superior in 2002

(From Cangelosi and Mays, 2006.)

Lake Superior Currents

Natural distribution via currents may occur in the following manner. The prevailing water circulation in the western arm of Lake Superior is a counter-clockwise flow, although winds can drive surface water in other directions (Beletsky, et al., 1999). Thus, water discharged in Thunder Bay can be carried along shore to the south west, passing between Isle Royale National Park and the Minnesota shoreline. Water from Duluth Harbor is transported to the east towards the Apostle Islands and then to the north east along the Keweenaw Peninsula. Flow from the western arm into Eastern Lake Superior occurs primarily through the Keweenaw Current, which carries large volumes of water around the tip of the peninsula. With the virus' ability to remain viable in cold waters, currents can play a role in distribution though dilution should help reduce risk overall.

Ballast is primarily discharged during approach and in the ports of Thunder Bay, Duluth, and Sault Ste Marie during the loading of cargo. Many ships adjust their ballast on their

way out of port and sometimes during transit. Grand Portage National Monument and the Grand Portage Indian Reservation could be at risk within a few days from VHSv infected fish from ballast discharged at Thunder Bay. Infected ballast discharged in Duluth could infect fish that could reach Apostle Islands National Lakeshore, and possibly southern Isle Royale National Park. Of the four parks, Pictured Rocks is expected to be the most protected from current-driven contamination, but not surface/wind-driven contamination. Infected ballast deposits at Sault Saint Marie or at the Soo Locks are unlikely to move into Lake Superior since flow at that point is downstream towards Ste. Mary's River and Lake Huron. However, some risk from ships discharging ballast into Lake Superior as they leave the locks and move into Lake Superior exists. Isle Royale National Park has a shipping lane through park waters and freighters transit within miles of the shorelines of all four parks and Grand Portage Indian Reservation.

Current Industry and Agency Actions

PPD Technologies, a marine engineering firm commissioned by Transport Canada to review shore side treatment facilities, also sought unorthodox solutions for ballast water treatment in March 2006. They evaluated a shore station delivery system that boasted an environmentally sustainable, biochemical solution using modular delivery systems. Recommendations for treatment also stressed economic and practical feasibility. One criteria was that the access to the ships ballast tanks should "be easy to use, poured/pushed/pumped through a small vent or sounding pipe opening on the deck in order to minimize ship retrofit costs" (PPD Technologies Inc, 2006).

The new Green Marine initiative is a proactive effort by the shipping industry to address many environmental issues. This effort includes members of industry, the St. Lawrence Canadian Department of Fisheries and Great Lakes marine transportation industry to reduce environmental impacts through voluntary actions. More information on this program is available at the Green Marine website http://www.green-marine.org/.

Keeping problematic debris out of intakes via screening has been modified to include keeping fish out of the tanks by better screening and screen inspections. Exchange of ballast water during salt water crossings and in specific exchange zones started as a voluntary practice that became mandatory as part of an effort to reduce the transportation of exotics. Policy changes or emergency treatment standards that build incremental steps to meet or exceed International Maritime Organization (IMO) standards need to be developed now in order to prepare for the future and protect natural resources in the interim.

The shipping industry is to be commended for voluntary actions regarding screening and ballast management. The Canadian shipping company FedNav is an industry leader in testing treatment options. Few treatment options have focused on their efficacy on viruses. The World Organization for Animal Health, known internationally as OIE, includes VHS in its list of notifiable diseases, thus highlighting the urgency of addressing all potential vectors for this pathogen. NPS supports and encourages industries that increase their efforts to reduce the risks of non-native species introductions.

In May 2007 the shipping federation of Canada distributed a brochure to encourage members to comply with the exchange practices for preventing disease transference from Hamilton, Ontario, Harbor on Lake Ontario.Erie.

Isle Royale National Park operates the *Ranger III*, a vessel with the capacity for 125 tons of ballast in 10 tanks. The *Ranger III*, which transits between Houghton, MI and Isle Royale National Park, treated its ballast on all trips during the fall of 2007 with chlorine to avoid any accidental introduction of VHSv, and neutralized the chlorine to clean water standards. The Park is currently pursuing a more permanent treatment system for the ship and collaborating with researchers to find emergency treatment options for small to bulk-freight sized ships.

While the park devised its own methods used on the *Ranger III* independently, the first stage of the emergency treatment of the tanks was a simple dosing system through tank vents. This technique has been used elsewhere to reduce the risk of transmission of cholera and AIS. (Mearns, et al., 1999; Argentina, Lloyd's Register, 2006).

Planning Session

During the preparation of this plan, NPS management convened an interactive conference call among the subject matter experts so that they could hear mutual concerns while building a ranking of the biological efficacy of strategies for ballast water treatment. The group presented the following preliminary analysis to promote further discussion under U.S. Coast Guard (USCG) leadership to encourage a timely decision on these technologies, and the implementation of actions to reduce the risk of transmitting VHSv to Lake Superior fish and park and reservation resources.

The group of subject matter experts convened on the first day of the planning effort included:

Convening in Chicago-
Sarah Green, Michigan Tech University
Linda Drees, NPS, Exotic Species Branch
Gary Whelan, Michigan Dept. Natural Resources
Jay Glase, NPS Water Resources Division
Gael Kurath, USGS Seattle
Phyllis Green, Isle Royale NP

Participating via phone (not all participants were able to participate for the full call)-
Bill Hanrahan, NPS, Captain *Ranger III*
Tim Cummins, Commander, USCG
Roger Eberhardt, Michigan Dept. Environmental Quality
Kim Klotins, Canadian Food Inspection Agency
Susan Sylvester, Wisconsin Dept. Natural Resources
Jim Winton, USGS Seattle

The agenda of this group was to:

(1) Discuss the pros and cons of fresh water exchanges in US waters from a biological standpoint to reduce the risk of transmitting VHSv to fish in the Lake Superior basin and, thus, to Park resources. To identify concerns related to when and how less risky exchanges could occur.

(2) Review biological concerns relative to screening.

(3) Evaluate relative risk reduction for VHSv of current actions being undertaken or considered: exchange, screening, and treatment.

Figure 1. A freighter in the Portage canal demonstrates the difference in size and scope of ballasted vessels. The vessel in the foreground is Isle Royale National Park's *Ranger III*.

Summary of Group Discussion

The group talked about the spread of disease through free-floating virus, live fish, fish larvae, and dead fish (whole or in parts). They agreed that while dilution helps reduce risk for free floating virus, chemical treatment to kill it is best. Gary Whalen estimated that wild movement of this disease could take decades to reach Lake Superior emphasizing the importance but relatively low risk of moving VHSv into Lake Superior by this vector. Via ballast could move it within days when the wrong combination of

virulent water or infected fish are discharged on top of uninfected, high concentrations of fish under stress. Preventing the movement of infected live or dead fish via ballast water will significantly reduce risk. The virus will not replicate in dead fish, thus if fish are present in ballast water, killing the fish and the virus within the tissue chemically would also reduce risk. However, eliminating the virus in fish tissue would be difficult.

The effectiveness and cost of each intervention depends, in part, on the frequency that it is employed. Treatment can be continuously employed, used seasonally when risk of infection it highest, or instigated when an infectious event is identified. Continuous chemical treatment would be the most effective treatment. Treating only during identified epizootic events may be too late to prevent transport of the virus since the disease may be present for weeks before it is detected in a population.

Ballast water and bait were both determined to be higher risk vectors than recreational activities (non-angling/fishing recreation). The risk of bait as a vector has been at least somewhat reduced because of the efforts of the States and APHIS to regulate bait transfers and the educational efforts begun in each state. Therefore, the group was asked to discuss options that would provide effective reductions in the risk of ballast similar to the those done for bait. The interventions for ballast were discussed from the biological viewpoint and technical feasibility will have to be further evaluated. Biological concerns for the viability of exchange as a means of risk reduction include: (1) being able to avoid moving contaminated water to vulnerable parts of the Great Lakes and (2) having the ability to identify clean or low risk areas to take on or release ballast. This would include the identification of low density fish zones in the lower lakes where dilution would reduce the risk of transport to Lake Superior and not unduly spread the disease in concentrations or concentrated zones of fish to other locations in the lower lakes. Avoidance of commercial fishing areas as locations for exchange would be critical.

The group ranked screens as the least risk-reducing method of the three intervention methods, unless the mesh were sufficient to prevent fish larvae and fry from passing through the ballast water,. Pumps still move “packets” of water through the pumps themselves, so the sizes of the water packets will determine what fish will make it through the pump alive or intact. The team concluded that exchange would reduce risk better than screening but not as well as treatment.

The biology team raised follow-up questions:

- Can exchange zones be developed for the lower lakes and reduce the spread rate to Superior?
- Can high risk ports be identified quickly?

Members of the team would be willing to discuss frequency and timing of exchange if the USCG proceeds with a more thorough review.

In addition, the following pros and cons were developed:

1. Screening ballast inflows

Pros

Specifically targets fish vectors.
Continuous use, once installed.
Improvements might come from power companies' screening technology.

Cons

Requires installation of new equipment.
Implementation would be slow, if adequate screening were not in place.
Will not remove virus from water or small particle sources (e.g. larvae, fish feces, eggs).
May require diving to monitor condition of screens.
Difficult to verify compliance.

Summary

Screening will result in low to moderate risk reduction, depending on size of mesh. Cost of implementation and maintenance may be high.

2. Ballast exchange with off-shore lake water. The experts discussed a scenario in which a ship picked up water in Green Bay where the virus is present and discussed whether an exchange prior to entering Lake Superior would reduce risk. Their conclusion was that exchange would reduce risk better than screening, but not as well as treatment. Mapping low fish density zones would be critical.

Pros

Targets both fish and water.
Low cost.
Can be employed continuously or initiated as needed.
Rapid implementation.

Cons

Difficult to verify compliance.
Has potential to infect fish outside initial site (minimized by mapping zones of low fish density for discharge).
May transport unwanted port species to the off-shore zone.

Summary

Will result in a moderate risk reduction. How effective it would be within Lake Superior waters after the basin is contaminated would need further assessment. The group only explored lower lake exchanges. The value of this risk reduction would

have to be assessed it in the context of safety issues for the ships and concentration of the virus in the waters where ballast is taken in.

3. Disinfection of ballast water:

Pros

Targets both fish and water.
Targets other known or unknown invasive species.
Two identified chemicals can be used to kill VHS at low dosages.
Ranger III has demonstrated efficacy for small ballasted ships for Chlorine and a neutralizing agent to treat at level to kill VHS and meet clean water standards.
The cost of one chemical, chlorine, is low
Treatment through air vents or access ports could be low cost.
Verification of compliance is straightforward (chemical analysis for disinfection.
Also works on sediment.

Cons

Environmental regulatory issues exist with use of chemicals.
Possible formation of undesirable chemicals
May not kill the virus deep within a fish (but if it kills the fish, dead fish are less risk)
Biological material in the tank other than fish that uses up the active substance has to be accounted for.
No national standards have been established for either long term or emergency treatment for ballast tank disinfectant.
Chemicals need to be vetted for corrosive issues at the proposed dosage level
Efficacy of chemical mixing if the delivery system is through air vents or access ports has not been rigorously tested.
Chemicals (active substances) should be approved through the EPA FIFRA process.

Summary

As a result of the subject matter experts' input, the VHSv planning team supports the efforts of maintaining screening as an intervention in the absence of treatment and applauds the Canadian action to initiate exchange. The team concurred that disinfection offers the highest risk reduction of the three options. Ideally, disinfection can decrease VHSv levels if done seasonally during high risk times. Disinfection only during an epizootic event is less effective due to the risk of transmission prior to detection. If the technical difficulties of delivery, efficacy, and neutralization for tank disinfection can be resolved, this would be the highest order of risk reduction. Implementation of either of these options should not reduce the emphasis on finding a solution for all other non-native invasive species, and require that all ships meet or exceed IMO standards, provided the options include the ability to kill targeted virus.

The following table was developed by this group and included in the ballast vector discussion of this plan.

Table 1. Estimated effectiveness of potential prevention measures (based on group discussion).

When	Activity	Targets	Relative cost	Risk reduction (1=low,5+high)
Continuous	Screening (small)	Fish and larvae	Very high	3
	Screening (large)	Fish	High	2
	Ballast exchange	Fish, larvae, and water	Low	3
	Disinfect	Everything	Moderate	5
Seasonal (spring & fall)	Ballast exchange	Fish, larvae, and water	Low	2
	Disinfect	Everything	Moderate	4
Trigger on VSH detection (epizootic event)	Ballast exchange	Fish, larvae, and water	Low	1
	Disinfect	Everything	Moderate	3

Results

The results of this discussion led to recommendations that were incorporated in the "Actions to Protect Tribal and Park Resources" section of this plan. Details regarding those recommendations are included below.

General Recommendations for the short term (*i.e*., weeks) versus long term (prior to significant vector activity increases on March 15):

Short term: The results in this planning document should be shared with the USCG to vet with industry and fully review safety concerns and interest in further voluntary industry compliance in the absence of emergency regulation. Involvement with EPA, USFWS and APHIS would be sought to determine if further action is warranted.

Short term: NPS, USFWS, USCG, states and appropriate Lake Commissions work jointly to map and develop the numbers of ships and transit routes and currently known infected harbors to provide a more thorough risk assessment. The mapping should include all known VHS-contaminated or active ports and characterize the number and types of ships using them and headed for Lake Superior. The information will serve as a basis for determining the potential effectiveness of targeted ballast exchange zones, prioritizing surveillance and prioritizing emergency actions.

Short term: Before ballast exchange is promoted, data about low fish densities from the Great Lakes Fishery Commission should be factored into developing identified exchange zones, similar to the salt water designated exchange zones.

Short Term: High risk ports should have higher levels of surveillance by federal, tribal, and/or state fish and wildlife agencies. Agencies will reduce risk by being prepared to implement agreed upon emergency actions to reduce the spread of VHSv. The Grand Portage Indian Tribe, APHIS, Great Lakes Fisheries Commission, Ontario and the NPS should design a coordinated approach to the monitoring strategy that incorporates state, interstate and provincial needs.

Short term: The Midwest Federal Regional Working group should review all emergency authorities to determine if one or more agencies and tribes acting together can take emergency actions to control or limit the spread. Use of an interagency Incident Management Team should be explored.

Short term: When the results of the tests on active substances that kill VHS, (chlorine and iodine) are completed with the Great Ships initiative, Isle Royale National Park and the NPS Midwest Region should continue to work with researchers to test the interim emergency treatment options, including delivery systems and chemical options for small ships and freighter at a shore station and ship deployment level. These options should be shared with the USCG, states, tribes, and provinces to determine the technical feasibility and regulatory authority to implement. If the USCG does not have emergency authority to act relative to ballast exchange, NPS should support any future legislative action granting them that authority.

Long term: Support an interagency and intertribal dialog on how to fund treatments by the U.S. and Canadian governments as part of emergency response or incentives or directives to industry to implement the treatments.

Long term: All federal ships with ballast should develop a ballast management plan or ballast tank access portals developed in order to be able disinfect their ships regardless of current exemptions. Disinfection should always occur when moving from a virus contaminated zone to a virus free zone. Risk reduction evaluation should be undertaken when moving within a basin with known VHS to uncontaminated areas.

Long term: After the responsible agency or agencies are determined, the NPS should work with Port Authorities and responsible agencies in the same manner as, and in coordination with, the Department of Fisheries and Oceans to mandate ballast exchange as a minimum measure for each ship leaving a port where a VHSv outbreak has occurred.

Citations

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Great Lakes Organizations

Introduction. The Great Lakes encompass a wide array of governmental and non-governmental interests, spanning eight U.S. States and two Canadian provinces and including municipalities as well as state and Federal agencies. These overlapping interests as well as historic layers of legislation addressing specific aspects of Great Lakes issues have resulted in a number of different organizations that can be hard to distinguish. The following is a primer on some of the major groups, and is not presumed to be comprehensive. Most information below was adapted from information found on the web sites of each organization or agency. It was compiled by the National Park Service Midwest Region in 2007 as a reference aid for NPS staff in the Great Lakes.

U.S. Environmental Protection Agency – Great Lakes National Program Office
www.epa.gov/glnpo

Located in Chicago, Illinois, GLNPO has a staff of 46 and a budget of almost $15 million. GLNPO brings together Federal, state, tribal, local, and industry partners in an integrated, ecosystem approach to protect, maintain, and restore the chemical, biological, and physical integrity of the Great Lakes. The program monitors Lake ecosystem indicators; manages and provides public access to Great Lakes data; helps communities address contaminated sediments in their harbors; supports local protection and restoration of important habitats; promotes pollution prevention through activities and projects such as the Canada-U.S. Binational Toxics Strategy; and provides assistance for community-based Remedial Action Plans for Areas of Concern and for Lakewide Management Plans. Each year, GLNPO uses its funding to assist Great Lakes partners in these areas through grants, interagency agreements, and contracts.

The Boundary Waters Treaty of 1909 and the 1987 Great Lakes Water Quality Agreement (GLWQA) with Canada provide the basis for our international efforts to manage this shared resource. Additional responsibilities are defined in Section 118 of the Clean Water Act, Section 112 of the Clean Air Act Amendments, and the Great Lakes Critical Programs Act of 1990.

Great Lakes Regional Collaboration **www.glrc.us**

Executive Order 13340, signed May 18, 2004, established a Great Lakes Interagency Task Force and promoted the formation of the Regional Collaboration for the Great Lakes. The EO applies to the Great Lakes drainage basin. The Interagency Task Force consists of the Cabinet officers of ten federal Departments or their designees, and is chaired by the Administrator of the EPA. The EO also directed that a Regional Working Group (RWG) be established, which consists of the regional directors or their designees of each federal agency represented on the Task Force, including NPS. Phyllis Ellin is the NPS representative. The RWG meets weekly, and its purpose is to coordinate and make recommendations on how to implement the policies, strategies, projects and priorities of the Task Force. The Task Force convened a Regional Collaboration that included states, municipalities, tribes and NGOs, and which produced a Great Lakes Regional

Collaboration Strategy in December 2005. The RWG's primary task at this time is to work toward implementation of the federal elements of the Strategy. Two subcommittees formed to do this so far are focusing on the federal role in wetlands restoration and aquatic invasive species rapid response.

MNRG Great Lakes Terrestrial Invasive Species Committee
www.mnrg.gov/committees/gltisc/index.htm

This committee was formed by the Midwest Natural Resources Group, a voluntary group of senior federal managers in the Midwest, to complement the Great Lakes Regional Collaboration Strategy, whose invasive species focus was on aquatic invasives only.

International Joint Commission (IJC) www.ijc.org

This independent bi-national organization was established by the Boundary Waters Treaty of 1909. Its purpose is to help prevent and resolve disputes relating to the use and quality of boundary waters and to advise Canada and the United States on related questions.

The Commission has six members. Three are appointed by the President of the United States, with the advice and approval of the Senate, and three are appointed by the Governor in Council of Canada, on the advice of the Prime Minister. The Commissioners must follow the Treaty as they try to prevent or resolve disputes. They must act impartially, in reviewing problems and deciding on issues, rather than representing the views of their respective governments.

In 1972 Canada and the United States signed the first Great Lakes Water Quality Agreement. The two countries agreed to work to control pollution in these waters and to clean up waste waters from industries and communities. In 1978, they signed a new agreement, in which they added a commitment to work together to rid the Great Lakes of "persistent toxic substances." These substances remain in the environment for a long time and can poison food sources for animals and people. In 1987 the governments signed a Protocol promising to report on progress and calling on the Commission to review "Remedial Action Plans" in what are described as 43 "Areas of Concern." The Plans are prepared by governments and communities and contain strategies to clean up problem areas and promote sustainable development in the Great Lakes region. The Protocol also calls on the Commission to review "Lakewide Management Plans" that propose actions to improve the quality of the water in Lakes Superior, Huron, Michigan, Erie and Ontario.

Great Lakes Fishery Commission www.glfc.org

The Great Lakes Fishery Commission was established in 1955 by the Canadian/U.S. Convention on Great Lakes Fisheries. The commission coordinates fisheries research, controls the invasive sea lamprey, and facilitates cooperative fishery management among the state, provincial, tribal, and federal management agencies.

The commission consists of four Canadian commissioners appointed by the Privy Council and four American commissioners (plus one alternate) appointed by the President. The commissioners are supported by a secretariat, located in Ann Arbor, Michigan. Funding for the commission is provided by the governments of Canada and the United States. The commission also has trust funds in both countries to accept private donations.

USGS Great Lakes Science Center www.glsc.usgs.gov/default.php

The Science Center has headquarters in Ann Arbor, MI and field stations in Cortland, New York (Tunison Laboratory of Aquatic Sciences); Millersburg, Michigan (Hammond Bay Biological Station); Munising, Michigan; and Porter, Indiana (Lake Michigan Ecological Station at INDU). A mid-lake vessel base is located at Cheboygan, Michigan. Combined field stations and vessel bases are located at Ashland, Wisconsin (Lake Superior Biological Station); Oswego, New York (Lake Ontario Biological Station); and Sandusky, Ohio (Lake Erie Biological Station).

The Center's activities include fish holding and rearing facilities, health of aquatic biota, genetic analyses, habitat studies library and information services, database and information management, fish population analysis, trophic interactions, exotic and native mollusks, and research support.

NOAA: Great Lakes Environmental Research Laboratory www.glerl.noaa.gov

The NOAA Great Lakes Environmental Research Laboratory, located in Ann Arbor, Michigan, is one of seven NOAA research laboratories. GLERL research provides information and services to support decisions that affect the environment, recreation, public health and safety, and the economy of the Great Lakes and coastal marine environments.

Binational Executive Committee (BEC)

The BEC is composed of senior-level representatives of Canadian and U.S. federal, state, provincial, and tribal agencies who are accountable for delivering major programs and activities that respond to the terms of the Great Lakes Water Quality Agreement. Several NGOs have been given observer status as well. NPS is an affiliate, not a primary member agency.

BEC aims to meet twice a year or as required to:

- set priorities and strategic direction for binational programming in the basin;
- coordinate binational programs and activities;
- respond to new and emerging issues on the Great Lakes including tasking existing or creating new working groups to undertake designated activities;
- evaluate progress under the Great Lakes Water Quality Agreement; and,

- provide advice, comment or other input for the preparation of various binational reports and presentations.

U.S. Policy Committee

This group represents the U.S. side of the BEC. It is an alliance of Federal, State, Tribal, and local agencies. It consists of senior level policy makers to guide policy directions and coordination of Great Lakes environmental management and protection programs. EPA's Great Lakes National Program Office serves as Secretariat to the USPC, which meets twice a year. The primary federal members are EPA, the U.S. Army Corps of Engineers, USDA/NRCS, U.S. Fish & Wildlife Service, USGS, NOAA – GLERL, the U.S. Coast Guard, and the State Department. Each State environmental agency is also represented, as are Great Lakes Tribes. NPS is an affiliate member. Other affiliates are the Nuclear Regulatory Commission, the Agency for Toxic Substance and Disease Registry, the U.S. Forest Service, the Great Lakes Fishery Commission. NGOs may request observer status.

Illinois – Indiana Sea Grant www.iisgcp.org

Illinois-Indiana Sea Grant (IISG) is one of 32 programs constituting the National Sea Grant network. The network is dedicated to an approach that uses research, education and outreach to promote the wise use of our nation's coastal, ocean, and Great Lakes resources for a sustainable economy and environment. IISG serves clients along 104 miles of heavily urbanized and industrialized shoreline in Illinois and Indiana. IISG is jointly sponsored by University of Illinois and Purdue University. The program promotes and embraces partnerships with universities throughout the bi-state area. IISG focuses its resources on local topics, which also address priorities outlined in the National Oceanic and Atmospheric Administration (NOAA) and National Sea Grant Program Strategic Plans. Over the next five years, IISG will address local and regional needs and opportunities in four thematic areas: Habitats and Ecosystems, Water for Our Future, Coastal Cities, and Nourishing Healthy Communities. Research grants using NOAA funds are available. Two Sea Grant staff are located in EPA's GLNPO office in Chicago.

Minnesota Sea Grant www.seagrant.umn.edu

Through scientific research and public education programs, Minnesota Sea Grant works to enhance Minnesota's coastal environment and economy. The program involves universities, federal and state agencies, the public and industry in a partnership to understand the complex nature of the multidisciplinary problems facing us, and then help in the development of the infrastructure necessary for innovative solutions. It is part of a network linked by the National Sea Grant Program, which supports 30 similar programs in coastal states throughout the United States and Puerto Rico. It receives funding through the National Oceanic and Atmospheric Administration and the University of Minnesota. The program participates in many partnerships on local, regional, and national levels.

University of Wisconsin Sea Grant http://www.seagrant.wisc.edu

This statewide program of basic and applied research, education, and outreach and technology transfer is dedicated to the stewardship and sustainable use of the nation's Great Lakes and ocean resources. Sea Grant support enables University of Wisconsin researchers to investigate issues critical to the wise use and protection of the Great Lakes to the benefit of everyone who manages, uses, or simply enjoys these fabulous freshwater seas. Headquartered at the University of Wisconsin-Madison, the institute is housed in the Graduate School Aquatic Sciences Center. Wisconsin Sea Grant is part of a national network of 30 university-based programs funded through the National Sea Grant College Program, National Oceanic & Atmospheric Administration, U.S. Department of Commerce, and through matching contributions from participating states and the private sector.

Michigan Sea Grant http://www.miseagrant.umich.edu

Michigan Sea Grant is a joint program of University of Michigan and Michigan State University. It is part of the National Sea Grant College Program, a network of 30 university-based programs in coastal states across the country. Michigan Sea Grant currently funds research projects and educational activities related to the program's strategic plan. Federal funds are matched with funds from state, tribal, business, and other sources to carry out scientific and educational programs. The five strategic emphasis of the strategic plan are: Aquatic Invasive Species, Coastal Communities and Economies, Fisheries, Coastal Aquatic Habitat, and Marine and Aquatic Science Literacy.

Great Lakes Panel on Aquatic Nuisance Species www.glc.org/ans/panel.html

A binational body comprised of representatives from government (state, provincial, federal, tribal), business and industry, universities, citizen environmental groups and the larger user community, that provides guidance on ANS research initiatives, policy development and information/education programs. Staffed by the Great Lakes Commission.

Great Lakes Commission www.glc.org

The Commission was established by joint legislative action of the Great Lakes states in 1955 (the Great Lakes Basin Compact) and granted congressional consent in 1968. A Declaration of Partnership established associate membership for the Canadian provinces in 1999.

Each jurisdiction appoints a delegation of three to five members comprised of senior agency officials, legislators and/or appointees of the governor or premier. Federal agencies, tribes, commissions, etc. are Observers.

The Commission is a bi-national public agency dedicated to the use, management and protection of the water, land and other natural resources of the Great Lakes-St. Lawrence system. The Commission is funded by dues from its members. The Commission also manages the Great Lakes Information Network (GLIN): www.great-lakes.net

Council of Great Lakes Governors www.cglg.org

The Council of Great Lakes Governors is a non-partisan partnership of the Governors of the eight Great Lakes States - Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin. In 1983, the region's Governors joined forces to create the Council and tackle the severe environmental and economic challenges then facing the citizens of their States. In more recent years, the Premiers of Ontario and Québec have joined with the Governors in advancing the high performance economy of the Great Lakes region.

Great Lakes and St. Lawrence Cities Initiative www.glslcities.org

This group is a bi-national coalition of mayors and other local officials that works actively with federal, state, and provincial governments to advance the protection and restoration of the Great Lakes. GLSLCI is an independent 501(c)(3) headquartered in Chicago. It enables mayors and other local officials to be active participants in Great Lakes issues relating to governance, economics, and science.

International Association for Great Lakes Research (IAGLR) www.iaglr.org

IAGLR is a scientific organization made up of researchers studying the Laurentian Great Lakes and other large lakes of the world, as well as those with an interest in such research. They promote all aspects of large lakes research and communicate research findings through publications and meetings.

To support these objectives, IAGLR holds an Annual Conference, attended by hundreds of Great Lakes researchers; publishes the Journal of Great Lakes Research, an interdisciplinary scientific journal with four issues per year; and gives out several Awards and Scholarships to recognize excellence in Great Lakes research.

Lake Forums – (Public Participation)

Lake Superior Binational Forum	www.superiorforum.info
Lake Michigan Forum	www.lkmichiganforum.org
Lake Erie Forum	erieforum.org

Great Lakes United **www.glu.org**

Great Lakes United is a bi-national coalition of private interests from a wide range of backgrounds that serves as an advocacy organization on Great Lakes issues.

Healing Our Waters - Great Lakes Coalition **www.healingourwaters.org**

This coalition was formed in 2004 with the support of the Wege Foundation. A meeting of more than 70 leading environmentalists, ecologists, scientists and academicians convened and developed a report to outline a plan for restoring and protecting the Great Lakes. The current co-chairs of the coalition are the President and CEO of the Alliance for the Great Lakes, the Diretor of the Great Lakes Natural Resource Center, and the President of the National Parks Conservation Association.

Alliance for the Great Lakes **www.greatlakes.org**

The Alliance (formerly the Lake Michigan Federation) works to conserve and restore the Great Lakes through policy, education and local efforts. It works with the region's residents, and with teachers, scientists, economists, legal specialists, government representatives, communities and individuals. Their programs focus on water quality, water conservation, habitat recovery, land use, clean energy, and education and outreach. Governed by about 20 volunteers from around the region, the Alliance also coordinates a network of community-based organizations from around the region, which gather annually to craft basin-wide solutions with a local emphasis.

Great Lakes Natural Resource Center **www.nwf.org/greatlakes**

Based in Ann Arbor, Michigan, this regional center of the National Wildlife Federation works to protect the Great Lakes for the wildlife and humans that depend on this invaluable resource. The issues they focus on are: Global Warming, Great Lakes Restoration, Great Lakes Water Resources, Lake Superior, Great Lakes Water Quality, Backyard Wildlife Habitats, and Wolves.

Roles, Responsibilities and Authorities for Aquatic Fish Health

Introduction

The National Aquaculture Act of 1980 (Public Law 96-362, 94 Stat. 1198, 16 U.S. Code (U.S.C.) 2801, et seq.) defines aquaculture as "the propagation and rearing of aquatic animals in controlled or selected environments," and includes species of "finfish, mollusk, crustacean, or other aquatic invertebrate, amphibian, reptile, or aquatic plant." In addition to covering a wide range of animals, aquatic animal health issues cross multiple jurisdictional boundaries, and there are multiple roles for various stakeholders, from private aquaculturists to State, Tribal and Federal agencies.

For the NAAHP to be successful, it is vital that all stakeholders understand their respective roles and responsibilities in the area of aquatic animal health. For example, for the NAAHP to facilitate safe and uninterrupted commerce, stakeholders need to be aware of requirements for movement across jurisdictional boundaries as well as the appropriate agencies and contacts involved in that movement. For those stakeholders with legal responsibilities, it is imperative that aquatic animal health activities fit within the scope of their legal authorities. Therefore, the goal of this chapter is to define the current roles, responsibilities, and, where appropriate, the legal authorities of private industry, State, tribal and Federal governments in administering national aquatic animal health programs in the United States.

Current Roles, Responsibilities, and Legal Authorities

Industry

Roles and responsibilities: The NAAHP recommends how aquatic animal health should be managed in the United States. The primary role of industry should be to actively participate in the development and review of the NAAHP; industry representatives will continue to be invited to stakeholder meetings and their contributions are critical.

Once the NAAHP is developed, it is the responsibility of industry to be an active team member in its implementation. More detail on how industry will participate in implementing the NAAHP can be found in chapter 10.

States and Territories

Legal authorities: States and U.S. territories have authority over aquatic animal health issues within their borders and within their coastal zones to the boundary of the exclusive economic zone, which is the area defined as the marine waters from 3 to 200 miles off the coasts of the United States and its territories, as specified in the Magnuson-Stevens Act. Animal health regulations may be administered by one or more agencies in each State. The regulating State agencies are typically the departments of agriculture, fish and wildlife, and/or natural resources. Individuals responsible for administering and

enforcing State aquatic animal health regulations may have a diverse background to include fishery biologists, fish pathologists, veterinarians, ecologists, and others.

States are responsible for licensing and enforcing the take of wild fishery resources within their jurisdictional boundaries. While States have regulatory authority over controlling introduction of animals across their borders from other States or countries, these existing regulations might not be in harmony with other States or with existing Federal regulations or new regulations proposed in the NAAHP. It is critical that States participate in the development of the NAAHP to ensure harmony between Federal and State regulations.

Roles and responsibilities: Animal health programs vary from State to State, with some being very complex while others rely on Federal agencies for their services. Many States have integrated aquatic animal health programs that include health protection regulations, field health services, extension specialists, and diagnostic and inspection laboratories for testing for diseases and pathogens. Some of these State laboratories are operated by the State agency with regulatory authority. Others are operated within aquatic animal health departments of academic institutions. Many of these laboratories are recognized and approved by Federal agencies.

Federally recognized Native American Tribes

Legal authorities: Federally recognized Native American treaty tribes (Tribes) have legal authority within their respective areas to manage fishery resources, including aquaculture and aquatic animal health. While Tribes have regulatory authority over controlling introduction of animals into their borders from other States or countries, these existing regulations might not be in harmony with existing State and Federal regulations or new regulations proposed in the NAAHP. It is critical that Tribes participate in the development of this plan to ensure harmony between Federal, State, and tribal regulations.

Roles and responsibilities: Animal health programs vary among Tribes, with some being very complex while others rely on Federal agencies for their services. Many Tribes or groups of Tribes have integrated aquatic animal health programs that include health protection regulations, field health specialists, and diagnostic and inspection laboratories for testing for diseases and pathogens. These laboratories are recognized and may be approved by Federal agencies.

Federal agencies

A brief description of the current legal authorities of the Federal agencies involved in aquatic animal health follows.

Joint Subcommittee on Aquaculture

Legal authorities, roles, and responsibilities: The JSA is one of the subcommittees of the Committee on Science of the Executive Office and serves as the Federal interagency coordinating body for increasing the effectiveness and productivity of aquaculture research, technology transfer, and coordination and communication between Federal agencies involved in aquaculture. The JSA was established as part of the National Aquaculture Act of 1980. While the JSA has no defined regulatory authority over animal health, it provides an important forum to discuss issues and plans such as the NAAHP. The National Aquatic Animal Health Task Force is one of the many technical groups under the JSA and is charged with developing a national aquatic animal health management plan.

Animal and Plant Health Inspection Service

Legal authorities: APHIS is the lead agency for preventing, controlling, and eliminating animal diseases and for providing Federal oversight to health programs in livestock. Authority of USDA for aquatic animals is found in Subtitle C, Animal Health Protection Act (AHPA), Sec. 1021-1038. The Act gives the Secretary of Agriculture regulatory authority over all aquatic animal pests and diseases that have the potential to affect livestock (farmed aquatic animals).

In regard to private commercial aquaculture, the Secretary of Agriculture has authority to regulate imports, exports, and interstate commerce of all animals should they pose a risk to other livestock. The Secretary has the authority to hold, seize, treat, or prohibit and restrict the movement of any farm-raised animals should the Secretary deem necessary.

The Virus-Serum-Toxin Act of 1913, as amended in 1985, gives the USDA the authority to regulate veterinary biologics. The Act requires that both products and facilities be licensed, and that products distributed in the United States are not worthless, dangerous, contaminated, or harmful. APHIS is the Federal agency responsible for licensing domestic manufacturers of veterinary biological materials (biologics), such as vaccines, and issues permits allowing biologics from other countries to be imported into the United States. The interstate and international movement of pathogens, organisms, and vectors for research or for the production of biologics are regulated by APHIS.

APHIS, in coordination with other Federal, State, and private entities, is the U.S. agency responsible for reporting the occurrence of certain notifiable aquatic animal pathogens to the World Organization for Animal Health (OIE) in Paris, France. This reporting occurs through the Deputy Administrator for APHIS in Charge of Veterinary Services, also known as the Chief Veterinary Officer (CVO).

National Marine Fisheries Service (NOAA Fisheries)

Legal authorities: Several laws give NOAA Fisheries responsibility and authority over activities affecting aquatic animal health. The Magnuson-Stevens Fishery Conservation

and Management (Magnuson-Stevens Act, 16 U.S.C. 1801), requires the agency to "take immediate action to conserve and manage the fishery resources found off the coasts of the United States, and the anadromous (migrating) species and Continental Shelf fishery resources of the United States.

Under the Endangered Species Act, 16 U.S.C. 1531, NOAA Fisheries and FWS are identified as the lead agencies with the responsibility of protecting and conserving endangered or threatened species.

In addition, the Atlantic Coastal Fisheries Management Act of 1993, 16 U.S.C. 71, requires that the Secretary of Commerce, in cooperation with the Secretary of the Interior, develop and implement a program to support the Atlantic States Marine Fisheries Commission in interstate fishery management consistent with the Magnuson-Stevens Act.

Under the Lacey Act Amendments of 1981, 16 U.S.C. 3371-3378, the Secretaries of Commerce and Interior must jointly promulgate regulations for the marking and labeling of containers or packages containing fish or wildlife in transport, import, and export.

The Fish and Wildlife Act of 1956 and associated provisions, 16 U.S.C. 742a-753d, 742e-742j, 742k, 744-748, 750-753, 753a-753b, 754, 758-758d, 760a-760g authorizes NOAA Fisheries to conduct investigations and prepare and disseminate information regarding fish and their habitats to provide for the proposed development of fish resources.

The Fish and Wildlife Coordination Act (16 U.S.C. 661-666c) provides authority for Commerce and DOI to conduct cooperative programs with NOAA Fisheries and other agencies. The National Aquaculture Act, 16 U.S.C. 2801-2810, directs the Secretaries of Commerce, Interior, and Agriculture to develop, periodically review and revise, and implement an aquaculture program. It also directs the Secretaries to undertake a continuing assessment of aquaculture in the United States.

The Saltonstall-Kennedy Act, 15 U.S.C. 713c-3, requires the Secretary of Commerce to make grants from a fund established under this section to persons carrying out research and development projects addressed to any aspect of United States fisheries.

Fish and Wildlife Service (FWS)

Legal authorities: FWS has regulatory authority over two areas of aquatic animal health. The first is the Endangered Species Act (16 U.S.C 1531 *et seq.).* The second is 50 CFR Part 16.13, known as "Title 50," whose primary purpose of Title 50 is to protect wild and cultured fish in the United States from viruses that may be imported with live or dead salmonids or their products. This regulation requires live or dead uneviscerated fish of the Salmonidae family and their live fertilized eggs or gametes to be tested and found free of certain viral pathogens before import into the United States. The Title 50 inspector must issue a signed statement attesting that these commodities have been tested

and found free of the listed pathogens. Additionally, the importation into the United States of live salmonid fish requires the written permission of the Director of FWS, who maintains a list of approved Title 50 inspectors.

The Fish and Wildlife Act of 1956 (16 U.S.C. 742f) requires the Department of the Interior (DOI) to take steps "required for the development, advancement, management, conservation, and protection of fishery resources." In addition, the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), the Wildlife Coordination Act (16 U.S.C. 661-666c), and the Anadromous Fish Conservation Act (16 U.S.C. 757a – 757g) each authorize DOI to enter into cooperative agreements with stakeholders to protect and conserve fishery resources. The Lacey Act (18 U.S.C. 42) prohibits the possession or importation of any animal or plant deemed to be injurious to human beings, wildlife, or wildlife resources, or to the interests of agriculture, horticulture, forestry, or to wildlife or the wildlife resources of the United States. DOI is charged with enforcement of this Act.

Environmental Protection Agency

Legal authority: The authority of the Environmental Protection Agency (EPA) is found in 33 U.S.C. 1251, also known as the Clean Water Act. This law gives EPA the authority to require a National Pollutant Discharge Elimination System (NPDES) permit for aquaculture operations in the United States. EPA is in the process of updating its rules for discharge permits for aquaculture operations. Areas that the new rules (and some existing NPDES permits for near-shore aquaculture operations) will cover include the discharge of drugs and chemicals used to treat aquatic animals, the disposal of mortality, and potentially the discharge of pathogens from an aquaculture site. EPA also regulates the administration of some pesticides.

Health and Human Services - Food and Drug Administration

Legal authority: The primary authority of the Food and Drug Administration (FDA) lies in the Food, Drug and Cosmetic Act, 21 U.S.C. 301 *et seq.* This act gives FDA the responsibility for ensuring that all food is safe and wholesome to eat. In regard to this plan, the approval of drugs for use on aquatic animals falls under the regulatory purview of FDA. In this context, the word "drug" means any compound that alters or affects the health or physiological state of an animal, but does not include biologics under the authority of USDA.

State Department and U.S. Trade Representative

The State Department and the U.S. Trade Representative (USTR) negotiate treaties and agreements with foreign countries.

2.2.5 National and international advisory bodies

The contributions of national and international animal health-related organizations are crucial in developing the NAAHP. Several are profiled here. Other more specialized organizations also provided valuable expertise on aquatic animal issues.

OIE: The OIE is the international advisory group that recommends processes and procedures by which animal health is managed and coordinated in all countries of the world (though not every country is a member of the OIE). Pathogen and disease data on all animals are maintained by the OIE and shared with member countries. The Aquatic Animal Health Standards Commission of the OIE is responsible for authoring the OIE Aquatic Animal Health Code and the OIE Diagnostic Manual for Aquatic Animals.

American Fisheries Society, Fish Health Section (AFS/FHS): The Fish Health Section, founded in 1972, is charged with promoting the health of aquatic animal resources in the United States. The section has established an accreditation program to recognize professionals in the field of aquatic animal health. The section publishes a procedures manual known as the "Blue Book" for the diagnosis and testing of certain aquatic animal diseases and pathogens which includes a segment specific for inspections. The newest edition contains a section specifically addressing standardized procedures for hatchery health inspection and was co-produced and published with the FWS.

American Veterinary Medical Association (AVMA): The AVMA represents the interests of veterinarians who practice aquatic animal medicine in the United States. Policies on aquatic animal issues are developed in the AVMA's Aquatic Veterinary Medicine Committee (AVMC, previously the Aquaculture and Seafood Advisory Committee). Draft policies are forwarded from AVMC to the AVMA Executive Board for review and approval, as the AVMC functions only in an advisory capacity.

The United States Animal Health Association (USAHA): USAHA is a forum for communication and coordination among State and Federal governments, universities, industry, and other concerned groups on issues such as animal health and disease control, animal welfare, food safety, and public health. It is a clearinghouse for new information and methods that may be incorporated into laws, regulations, policy, and programs. USAHA develops solutions based on science, new information and methods, public policy, risk/benefit analysis, and the ability to develop a consensus for changing laws, regulations, policies, and programs.

The Association of Fish and Wildlife Agencies (AFWA): The AFWA is the collective voice of North America's fish and wildlife agencies at every level of government. The Association promotes sound management and conservation, and speaks with a unified voice on important fish and wildlife issues. The Association also provides management and technical assistance to both new and current fish and wildlife leaders.

State Agencies

The regulating State agencies are typically the departments of agriculture, fish and wildlife, and/or natural resources. Individuals responsible for administering and

enforcing State aquatic animal health regulations may have a diverse background to include fishery biologists, fish pathologists, veterinarians, ecologists, and others.

States are generally responsible for licensing and enforcing the take of wild fishery resources within their jurisdictional boundaries. While States have regulatory authority over controlling introduction of animals across their borders from other States or countries, these existing regulations may not harmonize with other States or with existing Federal regulations or new regulations.

Parks in the Great Lakes have adopted state fishing therefore, the following list of contacts and sites for regulations are provided.

Michigan

Private aquaculture

Michigan Department of Agriculture
Assistant State Veterinarian
Nancy Frank FrankN@michigan.gov
(517) 373-1077

All other aquaculture including aquatic animals to be stocked or otherwise released, and wild aquatic animal health issues

Michigan Department of Natural Resources
Kelley Smith SMITHK@michigan.gov
517-373-3375

Site for listing of laws and departments for Michigan:
http://invasivespeciesinfo.gov/laws/mi.shtml

Minnesota

All aquaculture and wild aquatic animal health issues

Minnesota Department of Natural Resources
Ron Payer Ron.Payer@dnr.state.mn.us
(651) 259-5229

Site for listing of laws and departments for Minnesota
http://invasivespeciesinfo.gov/laws/mn.shtml

Wisconsin

All aquaculture and wild aquatic animal health issues

Wisconsin Department of Agriculture, T & CP

Myron Kebus Myron.Kebus@datcp.state.wi.us
(608) 224-4876

Site for listing of laws and departments for Wisconsin
http://invasivespeciesinfo.gov/laws/wi.shtml

Fish Species Occurring in Park and Reservation Waters

Fish species occurring in the Apostle Islands National Lakeshore, Grand Portage National Monument, the Grand Portage Indian Reservation, Isle Royale National Park, and Pictured Rocks National Lakeshore (X = presence has been documented; L = presence not documented but presence is likely; U = reported but unconfirmed; E=encroaching). Bold font and shading indicate species identified by APHIS as susceptible to VHSv.

Fish Species	*Apostle Islands National Lakeshore*[1]	*Grand Portage National Monument*[1]	*Grand Portage Indian Reservation*[2]	*Isle Royale National Park*[1] *(Inland Lakes & Tributaries)*	*Isle Royale National Park*[1] *(Lake Superior & Tributaries)*	*Pictured Rocks National Lakeshore*[1]
Alewife	X	U			X	X
American brook lamprey						X
Atlantic salmon					X	
Black bullhead	X					X
Black crappie						**U**
Blackchin shiner				X	X	X
Blacknose shiner	X	X	X	X	X	X
Blacknose dace	X	L	X	X		X
Bloater	X		X		X	L
Bluegill						**X**
Bluntnose minnow		**X**	**X**		**X**	**X**
Brassy minnow					L	X
Brook stickleback	X	X	X	X	X	X
Brook Trout	X	X	X	X	X	X
Brown bullhead						**X**
Brown trout	**X**		**X**		**X**	**X**
Burbot	**X**	**X**	**X**	**X**	**X**	**X**
Central mudminnow		X	X			X
Channel catfish						
Cisco (lake herring)	X	X	X	X	X	X
Chinook salmon	**X**		**X**		**X**	**X**
Coho salmon	X	X	X		L	X
Common shiner	X	X	X			X
Creek chub	X	X	X	X	X	X
Deepwater sculpin	X		X		X	
Emerald shiner	**X**			**X**	**X**	**X**
Fathead minnow		X	X	X	X	X
Finescale dace		L		X	X	X
Freshwater drum						
Gizzard shad						
Golden shiner				X	X	X
Green sunfish						X
Iowa darter		L		X	X	X
Johnny darter	X	X	X	L	L	X
Kiyi	X		X		X	X
Lake chub	X	X	X	X	X	X
Lake sturgeon	X		X		X	L

Fish Species	*Apostle Islands National Lakeshore*[1]	*Grand Portage National Monument*[1]	*Grand Portage Indian Reservation*[2]	*Isle Royale National Park*[1] *(Inland Lakes & Tributaries)*	*Isle Royale National Park*[1] *(Lake Superior & Tributaries)*	*Pictured Rocks National Lakeshore*[1]
Lake trout		X	X	X	X	
Lake whitefish	**X**	**X**	**X**	**X**	**X**	**X**
Largemouth bass						**X**
Logperch	L	X	X	X	X	X
Longnose dace	X	X	X		X	X
Longnose sucker	X	X	X		X	X
Mimic shiner				X	X	L
Mottled sculpin	L	X	X	X	X	X
Muskellunge					**X**	
Ninespine stickleback	X		X	X	X	X
Northern brook lamprey				L	L	X
Northern Pike	**X**		**X**	**X**	**X**	**X**
N.redbelly dace		X	X	X	X	X
Pearl dace		L		X		X
Pink salmon		U	X	X		X
Pumpkinseed			**X**	**X**		**X**
Pygmy whitefish	X				X	L
Rainbow smelt	X	X	X		X	X
Rainbow trout	**X**	**X**	**X**	**X**	**X**	**X**
Rock bass	**L**		**X**		**L**	**X**
Round goby				**E**		**X**
Round whitefish	X	X	X		X	X
Ruffe	X			E		U
Sand shiner						X
Sea lamprey	X		X		X	X
Shorthead redhorse			**X**	**L**		**L**
Shortjaw cisco	X		X		X	L
Silver lamprey					L	
Silver redhorse			**X**			**L**
Slimy sculpin	X	X	X	X	X	X
Smallmouth bass	**X**		**X**			**X**
Splake	X					X
Spoonhead sculpin	X		X	X	X	L
Spottail shiner	**X**	**X**	**X**	**X**	**X**	**X**
Threespine stickleback	X	E	X			X
Trout-Perch	**X**	**X**	**X**	**X**	**X**	**X**
Walleye	**X**	**X**	**X**	**X**		**X**
White sucker	X	X	X	X	X	X
Yellow bullhead						L
Yellow perch	**X**	**X**	**X**	**X**	**X**	**X**

1: NPSpecies - The National Park Service Biodiversity Database. Secure online version. https://science1.nature.nps.gov/npspecies/web/main/start (accessed February 17, 2008).
[Note: The NPSpecies database reflects information compiled from available reports, publications, and unpublished data. Species records are provisional and subject to change as new information becomes available.]

2: Grand Portage Natural Resources Management

Incident Complexity Guide

This two page guide begins on page 137.

NATIONAL PARK SERVICE • Incident Management Program ● INCIDENT COMPLEXITY GUIDE

FACTOR	TYPE 3	TYPE 2	TYPE 1
Incident objectives	•objectives cannot be met by the initial response	•objectives cannot be met by a type 3 incident organization	•objectives cannot be met by a type 2 incident organization
Resources	•mostly local resources •small to moderate number •used to working together •variety of resources not of issue •local resources qualified and experienced at the extended response level	•moderate number •many resources arrived pre-organized •moderate variety of different kinds of resources •some ordering difficulties •lack of qualified incident personnel	•large number •large number of single resources that need to be organized •there may be span of control issues to be resolved •wide variety of different kinds of resources •serious/severe ordering difficulties
Political sensitivity/ visibility and consequences	•local significance	•high local/regional significance	•national/ international significance
Variety of activities involved in incident	•encompasses a small to moderate variety of activities •activities are generally standard for local operations	•encompasses a moderate variety of activities	•encompasses a wide variety of activities
Costs/source of money	•uses well established funding mechanisms	•WASO budget office may be involved •possibility of needing supplemental appropriation •home unit has inadequate incident funding capability	•WASO budget office is involved •there is a probability of needing supplemental appropriation
Number of agencies and organizations involved	•small to moderate number	•moderate number	•large number
Scope of agreements and contracts	•agreements and contracts are in place and useable, or are not needed •incident operations are well within local capabilities	•some or most agreements and contracts exists and are useable •a small number may need to be written	•large number of agreements and contracts need to be developed and implemented •very large contracts may need to be developed (Level IV Warrant)
Logistic difficulties	•within local capabilities or can be easily solved	•problems can be resolved through normal procedures and channels •incident activities may be dispersed over a wide geographic area	•special interventions with outside organizations may be needed to solve logistics problems •logistics may need to be branched
Safety complexity	•most identified risks can be mitigated by standard procedures	• most identified risks can be mitigated by standard procedures	•significant research may be needed to identify risks or appropriate mitigations •large number of assistant safety officers required
Media interest / complexity	•low to moderate local or regional significance	•high local/regional significance •most information is straight forward	•national / international significance •potential for highly sensitive information or circumstances
Size of area involved	•incident facilities and operational work sites are relatively close together	•moderate number of scattered incident facilities and or operational work sites.	•large number of widely scattered incident facilities and operational work sites.
Duration/impacts to unit operations	•short duration or •disruption to normal operations is minimal or of short duration	•normal operations/unit activities may be disrupted for a prolonged period of time	•local unit cannot resume normal operations because of the duration and/or severity of the incident
Air operations	•the local agency is prepared to properly manage the air resources needed to manage the incident	•the local agency is not prepared to manage the air resources needed	• the local agency is not prepared to manage the air resources needed •aviation complexity may require OAS or FAA intervention to resolve issues

NATIONAL PARK SERVICE • Incident Management Program

INCIDENT COMPLEXITY GUIDE, Instructions and Definitions

INSTRUCTIONS FOR USING THIS GUIDE

1. Gather as many facts about the incident as possible, using the "factors" column to help identify the information needed.

2. Contact your regional emergency coordinator and discuss the situation with her or him. Include type 2 or type 1 incident commanders in the decision process, as appropriate.

3. Looking at the typical characteristics of each factor, decide which of the characteristics listed under the "type" columns best describes your incident. Remember, usually no one incident will have all of the factors fall under just one of the "type" columns.

4. Determine the complexity based upon the column under which the preponderance of factor characteristics fall. For example, if most of the characteristics are best described by the type 2 column, then the incident is probably of type 2 complexity. But, also consider mitigating as well as aggravating circumstances. For example, an analysis of agency participation in the 2002 Olympics in Salt Lake City seemed to have a number of type 1 characteristics, such as international significance and world-wide media attention. However, further inspection of these factors showed that they were NOT an agency responsibility and should not force the incident to type 1. Conversely, the President's three week vacation in Grand Teton National Park meant high-level political involvement with significant media attention over an extended period, driving an otherwise type 2 incident to type1.

5. Order incident resources, including an Incident Management Team, if needed, accordingly. Remember, one of the benefits of the Incident Command System is that if you were wrong, or if the situation changes, you can always transition to a more complex or lower complex management structure as needed.

INFORMATION REGARDING INCIDENT TYPES

Type 5 incidents are relatively simple incidents that are usually handled by one resource. Examples:

- motor vehicle accident with no injuries investigated by a single police officer
- small grass fire extinguished by a single engine.

Type 4 incidents are those normally encountered by an agency or jurisdiction and are normally managed by the initial responding resources. Examples:

- multi-vehicle accident with injuries, handled by multiple resources.
- single-alarm working building fire.

Type 3 incidents are incidents that may require more resources in addition to those that initially responded and/or the timeframes for managing the incident are extended. (Some large parks may maintain organized type 3 Incident Management Teams.) Examples:

- lost person search extending over several operational periods.
- one-day dignitary visit.
- multiple alarm structural fire.

Type 2 incidents are incidents of significant complexity exhibiting characteristics shown by the factors listed on the reverse side of this sheet. These incidents are usually managed by regionally organized type 2 Incident Management Teams. Examples:

- impacts from moderate to large disaster, such as a hurricane, flood, tornado or earthquake.
- large special event or ceremony.

Type 1 incidents are the most complex incidents, often involving multiple kinds of activities, a large area of operation or significant political involvement. These incidents are usually managed by a nationally organized type 1 Incident Management Team. Examples:

- impacts from a large disaster, such as a hurricane, flood, tornado or earthquake.
- large special event or ceremony with national or international significance.

Guidelines For Responding To Fish Kills

Guidelines for responding to fish kills with a potential VHS etiology. Adapted from Puzach 2006. Refer to that document for more detailed information.

Complete fish kill report (see form on following pages)

Conduct site visit

1. Collect fish sample (see guidelines on following page for details)
2. Complete site report (see forms on following pages)
3. Complete chain of custody card (see form on following pages)

Mail or deliver sample to:

Becky Lasee
LaCrosse Fish Health Center
555 Lester Avenue, Suite 100
Onalaska, WI 54650-8522
V. 608.783.8444
F. 608.783.8450

Pre -disease confirmation

1. Conduct fish clean up where fish easily accessible near inlets or shore.
2. Dispose of fish of fish in appropriate location
3. Institute biosecurity practices (require boat and equipment cleaning).
4. Continue monitoring fish kill.

Post-disease confirmation

1. Continue site monitoring.
2. Continue use of biosecurity practices
3. Conduct fish cleanup as needed.

Guidelines for fish sample collection

- If possible call the local FWS diagnostic laboratory prior to collecting and submitting samples. The FWS can give precise directions on sample collection and delivery

- Collect a minimum of ten fish

- Live fish:
  - Fish that are sick and exhibiting obvious signs of disease are preferred.
  - If possible transport live fish directly to the laboratory in a water-filled bucket or cooler.
  - If it is not possible to transport fish directly to the lab, consult with commercial shippers on rules governing shipping
  - Live fish should be double-bagged with air and water and packed inside an insulated box.
- Dead fish
  - If it is necessary to collect dead fish, specimens should be as fresh as possible. Ideally the specimens should have clear eyes, red gills and exhibit no signs of decomposition
  - Dead fish can be preserved with ice but the ice should not come in direct contact with the fish. Contact with ice can be prevented by placing fish in plastic bags or by wrapping the ice

FISH KILL NOTIFICATION

STATE: _____

DATE OF KILL: _____

DATE REPORTED: _____ TIME REPORTED: _____

NAME OF REPORTER: _____

ADDRESS: _____ PHONE: _____

ORGANIZATION: _____

WATER(s) INVOLVED: _____ COUNTY: _____

SPECIFIC LOCATION OF KILL (bridge, highway or state road, industry, landmark, mountain, park,etc.): _____

_____

_____

Township: _____ Range: _____ Section: _____ 1/4 Section: _____

SUSPECTED REASON FOR FISH KILL: _____

_____

LOCATION OF SOURCE: _____

NAME OF ALLEGED POLLUTER: _____

ADDRESS: _____ PHONE: _____

SPECIES INVOLVED: _____

NUMBER: _____ FISH STILL DYING? _____

PERSONS AND AGENCIES NOTIFIED:

	NAME	TIME	PHONE
1.			
2.			
3.			

ADDITIONAL COMMENTS: _____

_____

_____

REPORT RECEIVED BY

_____

FIGURE 1.1. Example of an initial notification form.

from Southwick and Loftus 2003

Appendix B - NWFHS Submission Forms

Form 1 is a simplified version for submission of laboratory samples only.
Form 2 includes additional environmental data for the collection site.

National Wild Fish Health Survey - Submission Form 1

Submitter:	Collection Date: Collection Time:	
Location: State: County:	GIS Coordinates: deg. min. sec. Latitude: Longitude:	
Site Description -Name of Water Body :		
Capture Method/Procedure:		
Type of samples: Whole fish Tissue(s) Slant(s) Head(s) (circle all that apply) Pooled tissue(s) GI	Number of Samples - Fish:	Species:
Remarks:		
Submitter Signature:	Date:	
Lab Use Only		
Lab I D:	Date Received:	
Remarks:	Time: Received By: Case Tracking Number:	
Case Coordinator/inspector/pathologist Signature:	Date Finished:	

from Puzach 2006

National Wild Fish Health Survey - SUBMISSION FORM 2

Information in bold is mandatory **Case #**_____

Submitter: (partnership)

Collection Date: Collection Time:

Water body: Reach

County:

State: Ecoregion:

GIS Coordinates:

Latitude: _____Deg _____Min _____Sec
Longitude: _____Deg _____Min _____Sec
map: T. _____ R. _____ S. _____
HUC _____1/4 of the _____1/4 of the _____1'4

Capture Method:

boat e-fish weir bp e-fish hook other:

Site Description or Common Name:

Type of Sample: (circle one)
Random Selective

Ambient temp: _____ C
Water temp: _____ C
Flow: _____cfs
Conductivity: _____ uS/cm
Turbidity: _____ ntu
pH: _____
D.O. _____ mg/L

Map elevation:
Rosgen stream type:
Stream order:
Total reach length:
Gen wetted area:
Stream gradient:
Streambank condition:
left:
right:

Longitudinal Habitat distribution:
riffle:
run:
glide:
pool:

Additional Information/Comments: (including activities that affect reach. Circle all that apply)

Agriculture Wilderness Roads
Forestry Grazing Recreation
Mining Beaver Complex Urbanization

Submitter Signature and Date:

Number of Samples submitted: _____ fish
(details on back)
Ship Date:

LAB USE ONLY

Received by: (if different from submitter) **Date:** **Time:**

Tests Performed: (Circle any Positives) Corroborative Testing:

Bacteriology Y N Asal Yruck Etar Eict Fcol Fpsy _____ Y N

Virology Y N IHNV IPNV OMV VHS WSIV LMBV _____ Y N

Parasitology Y N AT Csha Mcer _____ Y N

ELISA Y N Rsal # positive pools _____ # pools confirmed _____

Other: _____

Date of Completion:

Proper Agency Notification:
Contact Person:
Date:
Signature:

(Revised 5/2001 - Page 1 of 2)

from Puzach 2006

National Wild Fish Health Survey - SUBMISSION FORM 2 - PAGE 2

Case Number:

	Genus / spp	Age A/J	Size (mm)		Sex	Whole Fish # of fish	Samp #	Fish per Pool	Pooled Specimens					ELISA # of samples	LAB USE	
			Min	Max					Heads	Guts	Viral	Cultures	media	Kidneys	Rec	Init
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
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(Revised 5/2001 - Page 2 of 2)

Note: Copying and reformatting this page in landscape orientation will provide more space in the boxes for entering data.

from Puzach 2006

Appendix 3.B - Chain of Custody Form

U.S. Fish & Wildlife Service
Wild Fish Health Survey
Chain of Custody Record

Source of Samples____
Case History Number (to be filled in by receiving lab)____________________

FROM: (print name, agency) TO: (print name, agency)	RELEASE SIGNATURE: RECEIPT SIGNATURE:	RELEASE DATE: RECEIPT DATE:	DELIVERED VIA: ☐ U.S. Mail ☐ Fed Ex ☐ UPS ☐ In person ☐ Other:
FROM: (print name, agency) TO: (print name, agency)	RELEASE SIGNATURE: RECEIPT SIGNATURE:	RELEASE DATE: RECEIPT DATE:	DELIVERED VIA: ☐ U.S. Mail ☐ Fed Ex ☐ UPS ☐ In person ☐ Other:
FROM: (print name, agency) TO: (print name, agency)	RELEASE SIGNATURE: RECEIPT SIGNATURE:	RELEASE DATE: RECEIPT DATE:	DELIVERED VIA: ☐ U.S. Mail ☐ Fed Ex ☐ UPS ☐ In person ☐ Other:

☐ **Continuation of Chain-of-Custody on Further Sheets**

from Puzach 2006

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