

Standard Operating Procedure #5: Decontamination of Equipment to Remove Exotic Species

Version 1.3 (2021)

In Water Quality Monitoring Protocol for Inland Lakes: Great Lakes Inventory and Monitoring Network

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Revision History Log

The following table lists all edits and amendments to this document since the original publication date. Information entered in the log must be complete and concise. Users of this standard operating procedure will promptly notify the project manager and/or the Great Lakes Network (GLKN) data manager about recommended and required changes. The project manager must review and incorporate all changes, complete the revision history log, and change the date and version number on the title page and in the header of the document file. For complete instructions, please refer to Revising the Protocol, SOP #13.

Previous Version #	Revision Date	Author (with title and affiliation)	Location in Document and Concise Description of Revision	Reason for Change	New Version #
1.0	3/1/2010	Richard Damstra, Joan Elias GLKN Aquatic Ecologists	Minor clarifications throughout; section 5.2.2, Procedures for Decontamination updated such that a single procedure is outlined regardless of remoteness of site; Appendix B, HACCP updated to include VHS and zebra mussels	To clarify protocol and bring field procedures and protocol into agreement, based on staff field experience.	1.1
1.1	5/1/2015	David VanderMeulen, GLKN	Updated the NPS contact author and fixed a few grammatical errors	To update contact author since Version 1.1 was published in 2010	1.2
1.2	3/2021	Alexander Egan, Aquatic Ecologist, GLKN	Minor text changes.	To clarify and update SOP based on changes that have occurred since Version 1.2 was published in 2015	1.3
Add rows as needed for each change or set of changes tied to an updated version number					

Acknowledgements

I wish to thank Jeff Gunderson and Doug Jensen, of the Minnesota Sea Grant Program, Phil Moy, of the Wisconsin Sea Grant Program, and Mike Klepinger, of the Michigan Sea Grant Program, for their willingness to discuss exotic species issues in national parks and for providing information on the Hazard Analysis Critical Control Point (HACCP) method. Valena Hofman, National Park Service, Great Lakes Inventory and Monitoring Network prepared the HACCP plan.

5.0 Introduction

Aquatic invasive species (AIS) are an issue of increasing concern nationwide. In the Great Lakes, for example, approximately 140 exotic species have invaded since the late 1800s (Great Lakes Information Network 2005) and have had enormous ecosystem effects (e.g., Dermott and Kerec 1997, Barnhisel and Kerfoot 2004, Hoff 2004, Great Lakes Commission 2005). Some of these species have invaded inland water bodies, where disruptions to native species are also documented (e.g., Jack and Thorp 2000, Indrisi et al. 2001, Compton and Kerfoot 2004). Zebra mussels (*Dreissena polymorpha*) now occur in several lakes at Sleeping Bear Dunes National Lakeshore, and the spiny waterflea (*Bythotrephes* spp.) has been found in Grand Sable Lake, Pictured Rocks National Lakeshore. Invasive plants associated with waterbodies, such as hybrid cattails (*Typha glauca* x *Typha angustifolia*), are found at many network parks, including Isle Royale. When the parks and Great Lakes Network conduct routine water quality monitoring, it is important to ensure these aquatic exotics or other emerging threats are not transferred from contaminated water bodies to uncontaminated water bodies.

As we conduct water quality monitoring on inland lakes, we are concerned with the limited suite of AIS that can adhere to, or passively catch on, sampling equipment (including waders, boats and trailers). In this standard operating procedure (SOP) we will focus on aquatic plants, zooplankton, and mussels.

At each park, we will use the Hazard Analysis Critical Control Point (HACCP) method (Gunderson and Kinuunen 2004) to identify water bodies at risk and locations where control of AIS is imperative. It is critical to integrate this SOP with monitoring for the occurrence of AIS in inland lakes.

5.1 Equipment and Supplies

The sampling equipment used in monitoring inland lakes is detailed in SOP #6. We designed the decontamination process to be simple, straight-forward, and consistent with NPS wilderness considerations. Specifically, no toxic chemicals are required for decontamination.

The supplies and equipment required for decontamination of sampling equipment between lakes consists of:

- tap water
- hose and sprayer nozzle
- large pot
- portable propane burner (sold as a turkey deep fryer) or other means of heating water in a large pot (Figure 1)
- thermometer for measuring temperature of heated water
- scrub brushes



Figure 1. An example of a propane burner and pot used to heat water to 140° F (60° C) for decontaminating non-electronic equipment. Any large pot and heat source is acceptable, however a thermometer should be used to verify that sufficient temperatures have been achieved.

5.2 Decontamination Procedures

5.2.1 Aquatic Invasive Species Procedure Plan and Hazard Analysis Worksheet

The aquatic invasive species hazard analysis and critical control point (HACCP) worksheet is used in describing the sampling project, including types of gear, methods of transportation, steps involved in the procedure; and analyzing the potential risk of AIS transport from one water body to another, or one section of a stream to another section. Details on completing the worksheet are described in the AIS-HACCP manual (Gunderson and Kinuunen 2004), and are included in Appendix A. The example worksheet included in Appendix B is for Isle Royale National Park. The network has modified the worksheet slightly to suit our needs. Worksheets will be completed for each park unit, and will be reviewed, and if necessary updated, annually prior to the sampling season. Worksheets will also be updated in the following circumstances:

- change in sampling equipment or techniques
- addition of a new water body or to the sampling regime
- change in the order of sampling water bodies
- detection of a new AIS in a water body
- change in scientific knowledge regarding life history, potential hazard, or control of an AIS.

5.2.2 Procedures for Decontamination

Many AIS, especially plants can be controlled by simply being vigilant and periodically examining equipment, clothing, and boots and removing materials suspected to be an AIS species (cattail “fluff” or other seeds, viable plant materials, animal “hitchhikers” such as spiny water flea or other invertebrates stuck on equipment).

When the hazard analysis worksheet identifies a significant AIS risk and adequate drying or freezing of equipment is not feasible (five days in the sun for boats and trailers, 10 days for other equipment, or two days of freezing; Gunderson and Kinuunen 2004), the procedures below will be followed. The decontamination procedure assumes tap water is available.

Basic guidelines:

- Be vigilant about periodically checking equipment, clothing, and boots during portages and especially upon arrival and departure from sampling sites. Look for signs of AIS, especially plant materials.
- When possible, avoid using equipment on both infested and uninfested waters. Designate a set of equipment for both types of waters.
- Always begin sampling with sites not known to harbor exotic species; sample sites known or suspected to contain exotic species last.
- Thoroughly clean or disinfect all equipment between uses in all inland waters.
- When possible, allow sampling equipment, to dry for 10 days after sampling a water body known to be infested with AIS.

- Due to emerging science on the transport of AIS in felt soles of wading boots, lug soles constructed of a non-porous material, such as rubber, should be utilized for ease of decontamination (Gates 2007, Bothwell et al. 2009).

Step-by-Step Procedure:

When finished at a sampling site and before sampling the next site:

- Remove or rinse mud, plant material, invertebrates, and other visible organic material from boots, nets, and all sampling equipment with a hose and high pressure nozzle.
- Non-electronic gear, such as lines, tapes, dipnets, wading boots, should be exposed to water heated to 140°F (60°C) and held at this temperature for at least 1 minute. Portable turkey fryers are ideal for this, although a large pot on a stove will work. Rags and brushes used in decontamination procedures should be heat treated as well. Electronic equipment such as flow meters, depth probes, temperature probes, data collection sondes, and associated cables should be rinsed with copious amounts of tap water and cleaned with brushes and/or clean rags.
- Pay particular attention to lines, cracks, and crevices in equipment, and rinse well.
- Visually inspect all gear to verify that all equipment and gear has been cleaned and rinsed.
- Take measures to allow equipment to dry out as completely as possible.

5.3 Documentation

The original AIS-HACCP worksheet and all updates will be maintained at each park and copies will be kept at the network office. Documents used to complete each worksheet will also be kept on file at the parks and at the network. Examples of such supporting documentation include information used in analyzing the hazards of contamination and determining adequate prevention of AIS spread, and the most current geographic range of AIS.

5.4 Literature Cited

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Appendix A. Instructions for completing a Hazard Analysis and Critical Control Point Plan.

The following instructions for completing HACCP Procedure Form, Potential Hazards Worksheet, Hazard Analysis Worksheet, and Plan are taken directly from the AIS-HACCP manual (Gunderson and Kinuunen 2004). Not all steps will apply to the Great Lakes Inventory and Monitoring Network's protocol for decontamination of water quality monitoring field equipment and gear.

Preliminary Steps

1: Document general information.

Record the name and address of your facility or agency in the spaces provided on the first page of the Hazard Analysis Worksheet and the AIS-HACCP Plan Form (Appendix 9).

2: Describe the cultured or wild harvested fish (if applicable).

Identify the market name or Latin name (species) of the fish. Examples:

- Fathead minnows (*Pimephales promelas*)
- Golden shiners (*Notemigonus crysoleucas*)
- White sucker (*Catostomus commersoni*)
- Walleye (*Sander vitreus*)

Fully describe the product. Examples:

- Fathead minnows graded on 16 grader
- Golden shiners graded on 21 grader
- White suckers ungraded
- Rosy red minnows from Arkansas, held in ponds until distribution
- White suckers graded on a 23 grader
- Walleye fingerlings 5–8 inches
- Yellow perch fingerlings 2.5–3 inches

For management, research, and enforcement activities:

- Completely describe research or management activities
- Describe all equipment and gear that will be used
- Identify when and how activities will be conducted

Record this information in the spaces provided on the first page of the Hazard Analysis Worksheet and the AIS-HACCP Plan Form.

3: Describe the harvest, production, management, research, or enforcement activity.

Identify how the product or the samples are collected, stored, and distributed. Identify whether any special shipping or handling methods are used. Examples:

- Wild harvested with seines, held in tanks, graded, then trucked to retail stores
- Pond-raised, seined, then held in different ponds over the winter, trucked to retail stores
- Pond-raised, trapped from ponds, then transferred directly to lakes for stocking
- Anglers on three lakes are checked for violations each day for a given period of time
- Electroshocking and seining are conducted on 10 lakes to assess year class strength

Record this information in the spaces provided on the first page of the Hazard Analysis Worksheet and the AIS-HACCP Plan Form.

4: Identify the intended use and customer (if applicable).

Identify how the product will be used. Examples:

- Live fishing bait
- Feeder fish (feeding pond or aquarium fish)
- Stocking into public waters
- Stocking into private waters
- Stocking into aquaculture production facility (indoor or outdoor)
- Scale and stomach samples will be brought back to the office for analysis
- Fish will be brought back for captive brood stock

Identify your intended customer or user of the product. Examples:

- General public
- A wholesaler
- A retail store
- Fish farmer
- State agency

Record this information in the spaces provided on the first page of the Hazard Analysis Worksheet and the AIS-HACCP Plan Form.

5: Develop a flow diagram.

The purpose of the flow diagram is to provide a clear, simple description of the steps involved in producing your fishery products or conducting your management, research, and enforcement activities. The flow diagram should cover all of the steps in the process that your firm or agency performs. The flow diagram should be verified on-site for accuracy. Examples of flow diagrams can be found in appendices 3–8.

Hazard Analysis Worksheet

6: Set up the Hazard Analysis Worksheet.

Record each of the steps from the flow diagram in column 1 of the Hazard Analysis Worksheet.

7: Identify the potential AIS-related hazards.

Record the AIS-related hazards for each step. Use your own expertise and that of others to identify AIS hazards related to your fish production, or management, research, or enforcement practices. Check with appropriate agencies to determine if the waters in which you conduct activities are infested with invasive species.

Even if you think you have effective hazard controls in place, record the hazard. For example, your equipment might be free of AIS plant material because of the: 1) absence of AIS in the area of harvest or sampling in an infested water body; or 2) existence of inadvertent hazard controls (procedures you typically use in the course of your activities that may remove AIS).

8: Complete the Hazard Analysis Worksheet.

Completing the Hazard Analysis Worksheet requires understanding potential hazards, determining if each potential hazard is significant, and identifying critical control points for each significant hazard associated with your product or activities.

AIS –HACCP Plan Form

9: Complete the AIS-HACCP Plan Form.

Copy the Critical Control Points from column 6 of the Hazard Analysis Worksheet to column 1 of the AIS-HACCP Plan Form. Enter the associated hazard(s) from column 2 of the worksheet to column 2 of the plan form. If you did not identify significant hazards and CCPs, you do not need to complete an AIS-HACCP plan.

Complete the AIS-HACCP Plan Form by designing techniques, methods, and treatments to deal with each significant hazard in column 2. For each significant hazard:

- set critical limits
- establish monitoring procedures
- establish corrective action procedures
- establish a record keeping system
- establish verification procedures

After you completed these steps for each hazard, the AIS-HACCP plan form is finished.

To signify that the AIS-HACCP plan has been accepted for implementation, the responsible individual on-site or a higher-level official should sign and date the first page of the plan form.

Appendix B. Aquatic Invasive Species Hazard Analysis and Critical Control Point Plan for water quality monitoring of inland lakes at Isle Royale National Park (version 1.1).

Prepared by Valena Hofman, Great Lakes Network Office

March 25, 2009

Revision History Log

The following table lists all edits and amendments to this document since the original publication date.

Previous Version #	Revision Date	Author (with title and affiliation)	Location in Document and Concise Description of Revision	Reason for Change	New Version #
1.0	02/25/2010	Richard Damstra Aquatic Ecologist, GLKN	Added zebra mussel (<i>Dreissena polymorpha</i>) to all sections concerned with AIS invertebrates; added Viral Hemorrhagic Septicemia virus (VHSV) to sections on AIS pathogens	Zebra mussel documented in Lake Superior waters at ISRO in September 2009; Viral Hemorrhagic Septicemia virus (VHSV) documented in Lake Superior in 2009.	1.1

AIS-HACCP PLAN

Aquatic Invasive Species-Hazard Analysis and Critical Control Point

Procedure Form**Procedure Description**

Park info:	Park name: <i>Isle Royale National Park (ISRO)</i>	
	Address: <i>800 Lakeshore Drive East, Houghton, MI 49931</i>	
(if applicable):	Fish species: <i>NA</i>	
Management, research, or monitoring activity:	Activity: <i>Water Quality (WQ) Monitoring of Inland Lakes by the Great Lakes Network Office (GLKN)</i>	
Method of transportation, distribution, and storage of boats, gear, etc.	Methods: <i>Travel on Lake Superior waters with NPS boats to transport personnel, sampling equipment, and canoe to trailheads/portages to inland lakes. Sampling equipment and canoe are carried to inland lakes; sample site is accessed via canoe which is stabilized at site with anchor bags and lines. Profiles of water temperature, dissolved oxygen, specific conductance, and pH are collected with multi-probe sonde; field and water conditions are recorded; secchi depth is measured. Water is collected with an integrated sampler for lab analyses. Sometimes more than one lake is sampled per day.</i>	
Procedure Flow List the steps involved in the management, research, or monitoring activity.	(1) <i>NPS staff operates NPS boat around Isle Royale to transport personnel, equipment and canoe to shore or dock to access inland lakes. At times the boat is anchored out or a drop-off & pick-up is required and the canoe is used on Lake Superior to paddle to shore.</i> (2) <i>Equipment and canoe are portaged to inland sampling lake, on and off trail. At times additional lakes need to be paddled across to access sample lakes.</i> (3) <i>Equipment and canoe are portaged to inland sampling lake, on and off trail. At times additional lakes need to be paddled across to access sample lakes.</i> (4) <i>Sampling equipment, canoe and water samples are portaged to Lake Superior and the NPS boat. At times the canoe is used to paddle from shore to the NPS boat.</i> (5) Optional: <i>If sampling is not done and an additional lake is to be sampled at this time, return to step 1 AND a new set of sampling equipment is obtained and/or used equipment is decontaminated prior to reuse. OR If sampling is done for the day, proceed to step 6.</i> (6) <i>NPS motorboat is used to return to park headquarters or campsite.</i> (7) <i>At the end of each sampling trip (single or multi-day), water samples are processed back at the park lab. Some samples may be processed in the field.</i> (8) <i>At the end of each sampling trip (single or multi-day), all equipment coming in contact with any lake water is decontaminated; methods vary with type of equipment and use.</i>	
Upon completion of the AIS-HACCP plan, sign here to accept plan for implementation.	Name:	
	Signature:	Date:

AIS-HACCP PLAN

Aquatic Invasive Species-Hazard Analysis and Critical Control Point

Potential Hazards Worksheet**Potential AIS Hazards**

List all relevant species

AIS Fish and Other Vertebrates Examples: round goby, ruffe, carp, etc.	<i>Sea lamprey (Petromyzon marinus) and three-spine stickleback (Gasterosteus aculeatus) present in Lake Superior waters at Isle Royale. No known AIS fish and other vertebrates in inland lakes.</i>
AIS Invertebrates Examples: zebra mussel, spiny water flea, rusty crayfish, etc.	<i>Spiny water flea (Bythotrephes longimanus) present in Lake Superior waters at Isle Royale. Zebra mussel (Dreissena polymorpha) present at Washington Harbor and Mott Island docks. No known AIS invertebrates in inland lakes.</i>
AIS Plants Examples: curly pondweed, Eurasian water-milfoil, etc.	<i>Narrow-leaved and hybrid cattail (Typha angustifolia and T. x glauca) found along Lake Superior shoreline and numerous inland lakes, streams, and wetlands.</i>
AIS Pathogens Examples: whirling disease, <i>Heterosporis</i> , etc.	<i>Viral Hemorrhagic Septicemia virus (VHSV) detected in Lake Superior; not known in inland lakes.</i>

Next Step:

After identifying the potential hazards, complete a hazard analysis form.

AIS-HACCP PLAN

Aquatic Invasive Species-Hazard Analysis and Critical Control Point

Hazard Analysis Worksheet

(1) Activity	(2) Hazards	(3) Significance	(4) Justification	(5) Control	(6) CCP
Activity step from flow diagram, page 1	Potential AIS hazards introduced or controlled at this step (from potential hazards worksheet)	Are AIS hazards significant? (Yes/No)	Justify your decisions for column 3.	What control measures will be applied to prevent the significant hazards?	Is this step a critical control point? (Yes/No)
Work Flow Step (1): NPS staff operates NPS boat around Isle Royale to transport personnel, equipment, and canoe to beach or dock access to inland lakes. At times the boat is anchored out or a drop-off & pick-up is required and the canoe is used to paddle to shore.	Fish/Other Vertebrates <i>Sea lamprey</i> (<i>Petromyzon marinus</i>) and <i>three-spine stickleback</i> (<i>Gasterosteus aculeatus</i>)	No	<i>Sea lamprey and three-spine stickleback present in Lake Superior waters. Boat and equipment used will not capture either.</i>		No
	Invertebrate <i>Spiny water flea</i> (<i>Bythotrephes longimanus</i>) and <i>Zebra mussel</i> (<i>Dreissena polymorpha</i>)	Yes	<i>Spiny water flea and zebra mussel documented in Lake Superior waters; no documentation of presence in the inland lakes. Canoe may be used on Lake Superior.</i>	<i>If in contact with Lake Superior waters, wipe down paddles, entire hull of canoe, and any sampling equipment with a cloth and inspect for invertebrates.</i>	Yes
	Plant <i>Cattail species</i> (<i>Typha x glauca</i> & <i>Typha angustifolia</i>)	Yes	<i>Invasive cattail species documented along shorelines of Lake Superior and numerous inland lakes.</i>	<i>Hazard controlled simultaneous with invertebrate hazard control (above).</i>	No
	Pathogens <i>Viral Hemorrhagic Septicemia virus</i> (VHSv)	No	<i>VHSv documented in Lake Superior.</i>	<i>Hazard controlled simultaneous with invertebrate hazard control (above).</i>	No
Work Flow Step (2): Equipment and canoe are portaged to inland sampling lake, on and off trail. At times additional lakes need to be paddled across to access sample lakes.	Fish/Other Vertebrates N/A	No	<i>No AIS fish/vertebrates documented on inland lakes.</i>		No
	Invertebrate N/A	No	<i>No documentation of spiny water flea or zebra mussel in the inland lakes.</i>	<i>Routine precautionary wiping with a cloth and inspection of canoe and paddles if used on additional inland lakes.</i>	No
	Plant <i>Cattail species</i> (<i>Typha x glauca</i> & <i>Typha angustifolia</i>)	Yes	<i>Invasive cattail species are documented along shorelines of numerous inland lakes, streams, and wetlands.</i>	<i>Periodically inspect for and remove any viable cattail plant material from canoe, equipment, clothes, and shoes.</i>	Yes

AIS-HACCP PLANAquatic Invasive Species-Hazard Analysis and Critical Control Point**Hazard Analysis Worksheet (continued)**

(1)	(2)	(3)	(4)	(5)	(6)
Activity	Hazards	Significance	Justification	Control	CCP
Activity step from flow diagram, page 1	Potential AIS hazards introduced or controlled at this step (from potential hazards worksheet)	Are AIS hazards significant? (Yes/No)	Justify your decisions for column 3.	What control measures will be applied to prevent the significant hazards?	Is this step a critical control point? (Yes/No)
	Pathogens N/A	No	No AIS Pathogens documented on inland lakes.		No
Work Flow Step (3): Once at sample lake, canoe is used to access WQ sample site; anchor bags (filled with rocks from the sample lake) and lines secure boat at site. WQ parameters are measured with a multi-probe sonde, clarity measured with a secchi disc and field notes are recorded; water sample is collected with an integrated sampler for lab analysis.	Fish/Other Vertebrates N/A	No	No AIS fish/ vertebrates in inland lakes.		No
	Invertebrate N/A	No	No documentation of spiny water flea or zebra mussel in the inland lakes.		No
	Plant Cattail species (Typha x glauca & Typha angustifolia)	No	Potential to increase spread of invasive cattails, but overall, minimal hazard to lakes with existing cattail populations.	Avoid cattails and viable cattail plant material as a precautionary measure.	No
	Pathogens N/A	No	No AIS Pathogens documented on inland lakes.		No
Work Flow Step (4): Sampling equipment, canoe and water samples are portaged to Lake Superior and the NPS boat. At times the canoe is used to paddle from shore to the NPS boat.	Fish/Other Vertebrates Sea lamprey (Petromyzon marinus) and three-spine stickleback (Gasterosteus aculeatus)	No	No AIS fish/ vertebrates in the inland lakes. Equipment and canoe will not catch or transport fish or vertebrates on Lake Superior.		No
	Invertebrate Spiny water flea (Bythotrephes longimanus) and zebra mussel (Dreissena polymorpha)	No	No documentation of spiny water flea or zebra mussel in the inland lakes. Spiny water flea and zebra mussel documented in Lake Superior waters; at times canoe may be paddled on Lake Superior waters to access NPS boat.	If canoe, paddles, and any equipment contact Lake Superior waters, these hazards must be addressed in step 5 (optional), if sampling an additional lake, or in step 8.	No (see steps 5 or 8)

AIS-HACCP PLANAquatic Invasive Species-Hazard Analysis and Critical Control PointHazard Analysis Worksheet (continued)

(1)	(2)	(3)	(4)	(5)	(6)
Activity	Hazards	Significance	Justification	Control	CCP
Activity step from flow diagram, page 1	Potential AIS hazards introduced or controlled at this step (from potential hazards worksheet)	Are AIS hazards significant? (Yes/No)	Justify your decisions for column 3.	What control measures will be applied to prevent the significant hazards?	Is this step a critical control point? (Yes/No)
	Plant <i>Cattail species</i> (Typha x glauca & Typha angustifolia)	Yes	<i>Invasive cattail species are documented along shorelines of numerous inland lakes, streams, and wetlands, and Lake Superior shorelines. Unintentional transport could spread populations.</i>	<i>Periodically inspect for and remove any viable cattail plant material from canoe, equipment, clothes, and shoes.</i>	Yes
	Pathogens <i>Viral Hemorrhagic Septicemia virus</i> (VHSV)	No	<i>VHSV documented in Lake Superior.</i>	<i>If canoe or paddles contact Lake Superior waters, these hazards must be addressed in step 5 (optional), if sampling an additional lake, or in step 8.</i>	No
Work Flow Step 5 (optional): <i>If sampling is not done for the day and an additional lake is to be sampled at this time, return to step 1 AND a new set of sampling equipment is obtained and/or used equipment is decontaminated prior to reuse.</i> OR <i>If sampling is done for the day, proceed to step (6).</i>	Fish/Other Vertebrates <i>Sea lamprey (Petromyzon marinus) and three-spine stickleback (Gasterosteus aculeatus)</i>	No	<i>Equipment used and decontamination procedures will not capture any fish or vertebrates.</i>		No
	Invertebrate <i>Spiny water flea (Bythotrephes longimanus) and zebra mussel (Dreissena polymorpha)</i>	Yes	<i>Routine decontamination prevents potential hazards.</i> <i>Canoe, paddles, and equipment may be contaminated if canoe was paddled from shore to NPS boat in previous step.</i>	<i>Standard sampling protocol: For next sample lake, obtain a new set of sampling equipment (i.e., lines, anchor bags, I-tube) or decontaminate (wipe, rinse and inspect) used equipment (i.e., probe, canoe, paddles, secchi disc) before use in second lake.</i> <i>If canoe and paddles are to be used on Lake Superior to access next sample lake, decontamination of these items can wait until returning to step 1.</i>	Yes
	Plant <i>Cattail species</i> (Typha x glauca & Typha angustifolia)	No	<i>Routine decontamination addresses potential hazards.</i>	<i>The above precautionary control measures address this low potential hazard.</i>	No

AIS-HACCP PLANAquatic Invasive Species-Hazard Analysis and Critical Control Point**Hazard Analysis Worksheet (continued)**

(1)	(2)	(3)	(4)	(5)	(6)
Activity	Hazards	Significance	Justification	Control	CCP
Activity step from flow diagram, page 1	Potential AIS hazards introduced or controlled at this step (from potential hazards worksheet)	Are AIS hazards significant? (Yes/No)	Justify your decisions for column 3.	What control measures will be applied to prevent the significant hazards?	Is this step a critical control point? (Yes/No)
	Pathogens <i>None known</i>	No	<i>No AIS pathogens present.</i>		No
Work Flow Step (6): <i>NPS motorboat is used to return to headquarters or campsite</i>	Fish/Other Vertebrates <i>Sea lamprey (Petromyzon marinus) and three-spine stickleback (Gasterosteus aculeatus)</i>	No	<i>Sea lamprey and three-spine stickleback present in Lake Superior waters. NPS boat does not leave Lake Superior waters and is not a transport vector.</i>		No
	Invertebrate <i>Spiny water flea (Bythotrephes longimanus) and zebra mussel (Dreissena polymorpha)</i>	No	<i>Spiny water flea and zebra mussel documented in Lake Superior waters; NPS boat does not leave Lake Superior waters and is not a transport vector.</i>		No
	Plant <i>Cattail species (Typha x glauca & Typha angustifolia)</i>	No	<i>Cattail species documented along shorelines of Lake Superior; NPS boat does not leave Lake Superior waters and is a low-risk transport vector.</i>		No
	Pathogens <i>Viral Hemorrhagic Septicemia virus (VHSV)</i>	No	<i>VHSV documented in Lake Superior.</i>		No
Work Flow Step (7): <i>Water samples are processed back at the park lab at the end of each sampling trip (single or multi-day). Some samples may be processed in the field.</i>	Fish/Other Vertebrates <i>N/A</i>	No	<i>No AIS fish/ vertebrates in sample water. Equipment used will not capture any fish.</i>		No

AIS-HACCP PLANAquatic Invasive Species-Hazard Analysis and Critical Control PointHazard Analysis Worksheet (continued)

(1)	(2)	(3)	(4)	(5)	(6)
Activity	Hazards	Significance	Justification	Control	CCP
Activity step from flow diagram, page 1	Potential AIS hazards introduced or controlled at this step (from potential hazards worksheet)	Are AIS hazards significant? (Yes/No)	Justify your decisions for column 3.	What control measures will be applied to prevent the significant hazards?	Is this step a critical control point? (Yes/No)
	Invertebrate N/A	No	No documentation of AIS invertebrates in the inland lakes/ sample water.		No
	Plant Cattail species (Typha x glauca & Typha angustifolia)	No	Equipment used and processing procedure will not capture AIS plants.		No
	Pathogens N/A	No	No AIS pathogens in inland lakes/ sample water.		No
Work Flow Step (8): At the end of each sampling trip (single or multi-day) all equipment coming in contact with Lake Superior or inland lake water is decontaminated; method depending on type of equipment and use.	Fish/Other Vertebrates Sea lamprey (Petromyzon marinus) and three-spine stickleback (Gasterosteus aculeatus)	No	No AIS fish/ vertebrates present in inland lakes. Equipment used will not transport nor capture any fish.		No
	Invertebrate Spiny water flea (Bythotrephes longimanus) and zebra mussel (Dreissena polymorpha)	Yes	Potential spiny water flea and zebra mussel contamination during NPS boat ride and canoe use on Lake Superior.	Routine equipment decontamination procedures, using combination of heat, physical removal and desiccation, prevents hazards. All sampling equipment, canoe, and paddles are decontaminated.	Yes
	Plant Cattail species (Typha x glauca & Typha angustifolia)	Yes	Potential AIS plant contamination during canoe use on Lake Superior.	Hazards controlled simultaneously with decontamination procedures listed above.	No
	Pathogens Viral Hemorrhagic Septicemia virus (VHSV)	No	VHSV documented in Lake Superior.	Hazards controlled simultaneously with decontamination procedures listed above.	No

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Aquatic Invasive Species-Hazard Analysis and Critical Control Point

AIS-HACCP Plan Form

Critical Control Point Each row answered "yes" in column 6 of Hazard Analysis Form	(1) Work Flow Step (1): NPS staff operates NPS boat around Isle Royale to transport personnel, equipment, and canoe to beach or dock access to inland lakes. At times the boat is anchored out or a drop-off & pick-up is required and the canoe is used to paddle to shore.	(1) Work Flow Step (2): Equipment and canoe are portaged to inland sampling lake, on and off trail. At times additional lakes need to be paddled across to access sample lakes.
Significant Hazards as determined in column 3 of Hazard Analysis Form	(2) Spiny water flea (<i>Bythotrephes longimanus</i>) and zebra mussel (<i>Dreissena polymorpha</i>) documented in Lake Superior waters. Potential introduction of spiny water flea and zebra mussel veligers on WQ sampling equipment if canoeing on Lake Superior and during NPS boat transport (i.e., water in boat, bow spray).	(2) Cattail species (<i>Typha x glauca</i> & <i>Typha angustifolia</i>) documented along Lake Superior shoreline and shorelines of numerous inland lake, streams, and wetlands.
Limits for Each Control Measure	(3) If using canoe on Lake Superior waters, or if canoe was splashed during transport, wipe down paddles and entire hull of canoe with a cloth and inspect for invertebrates.	(3) Periodically inspect for and remove any viable cattail plant material from canoe, equipment, clothes and shoes; particularly after passing cattail populations and/or wetlands, shorelines or paddling across additional lakes. If at the source of cattail hazard, leave vegetation there, otherwise pack out and throw away in trash.
Monitoring Describe what is being monitored	(4) Canoe, paddles, and equipment being monitored for presence of spiny water flea, zebra mussel veligers, and Lake Superior water contamination.	(4) Presence of viable cattail plant material on equipment (including canoe and paddles), clothing, and boots/shoes. Ensure that boat and all equipment is free of dirt, mud, and viable plant parts. Viable cattail plant material includes, fruiting parts, "fluff", and roots/ tubers/ rhizomes. It does not include leaves, or stalks.
Explain how the monitoring will take place	(5) Visual inspection of equipment, canoe and paddles upon reaching shore after paddling on Lake Superior or after a NPS boat ride in which equipment is wet with Lake Superior water (i.e., due to wave spray).	(5) Visual inspection of equipment, clothing, and boots/shoes.
Frequency of monitoring	(6) Each time, before equipment is used in a lake, after equipment, canoe and paddles are exposed to Lake Superior waters.	(6) Ongoing during the portage, especially after passing cattail populations, wetlands, shorelines or after paddling across additional lakes while accessing the sample lake.
Person or position responsible for monitoring	(7) Water quality monitoring staff.	(7) Water quality monitoring staff.
Corrective Actions Actions taken when limits of control measures are not met	(8) Cease operation and re-wipe equipment with a new clean cloth to dislodge invertebrates, rinse with non-Lake Superior water (tap or inland lake water sample), or obtain a new set of decontaminated equipment.	(8) Clean equipment again with physical removal and rinsing with tap water, if needed, and inspect again.
Verification Method of verification	(9) Personal communication among crew. Review record.	(9) Personal communication among crew. Review record.
Records List what is recorded at each critical control point	(10) Check sampling equipment, canoe and paddles for Lake Superior water contamination, check for viable cattail vegetation. Record Y/N to presence of spiny water flea, zebra mussel and cattail vegetation; document actions taken if Y and final result on record (i.e., wiped and inspected, free of invertebrates).	(10) Check sampling equipment, canoe/paddles, clothing, and boots/shoes for viable cattail plant material. Record Y/N to presence of cattail vegetation; document actions taken if Y and final result on record (i.e., removed cattail fluff from backpack, backpack clean).

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Aquatic Invasive Species-Hazard Analysis and Critical Control Point AIS-HACCP Plan Form (continued)

Critical Control Point Each row answered "yes" in column 6 of Hazard Analysis Form	(1) Work Flow Step (4): Sampling equipment, canoe and water samples are portaged to Lake Superior and the NPS boat. At times the canoe is used to paddle from shore to the NPS boat.	(1) Work Flow Step (5 optional): If sampling is not done for the day and an additional lake is to be sampled at this time, return to step 1 AND a new set of sampling equipment is obtained and/or used equipment is decontaminated prior to reuse. NOTE: If sampling is done for the day, proceed to step 6; this critical control point does not apply.
Significant Hazards as determined in column 3 of Hazard Analysis Form	(2) Spiny water flea (<i>Bythotrephes longimanus</i>) and zebra mussel (<i>Dreissena polymorpha</i>) documented in Lake Superior waters. Potential introduction of spiny water flea on WQ sampling equipment if canoeing on Lake Superior.	(2) Spiny water flea (<i>Bythotrephes longimanus</i>) and zebra mussel (<i>Dreissena polymorpha</i>) documented in Lake Superior waters. Potential introduction of spiny water flea and zebra mussel veligers on WQ sampling equipment if canoeing on Lake Superior.
Limits for Each Control Measure	(3) If using canoe on Lake Superior waters, or if canoe was splashed during transport, wipe down paddles and entire hull of canoe with a cloth and inspect for invertebrates.	(3) If canoe was used to paddle on Lake Superior from shore to NPS boat, the canoe, paddles, and equipment may be contaminated with invertebrates. If sampling is not done for the day and an additional lake is to be sampled at this time, obtain a new set of sampling equipment (i.e., lines, anchor bags, I-tube) or decontaminate (wipe, rinse and inspect) used equipment (i.e., probe, canoe, paddles, secchi disc) before use in second lake. If canoe and paddles are to be used on Lake Superior to access next sample lake, decontamination of these items can wait (they will be addressed again in step 1, after being re-used). NOTE: If sampling is done for the day, this critical control point does not apply.
Monitoring Describe what is being monitored Explain how the monitoring will take place	(4) Canoe, paddles, and equipment being monitored for presence of spiny water flea, zebra mussel veligers, and Lake Superior water contamination. (5) Visual inspection of equipment, canoe and paddles upon reaching shore after paddling on Lake Superior or after a NPS boat ride in which equipment is wet with Lake Superior water (i.e., due to wave spray).	(4) Canoe, paddles, and equipment being monitored for presence of spiny water flea, zebra mussel veligers, and Lake Superior water contamination. (5) Visual inspection of equipment, canoe, and paddles upon reaching NPS boat after paddling on Lake Superior from shore.
Frequency of monitoring	(6) Each time, before equipment is used in a lake, after equipment, canoe and paddles are exposed to Lake Superior waters.	(6) Upon reaching the NPS boat or at the latest, prior to portaging to next sample lake.
Person or position responsible for monitoring	(7) Water quality monitoring staff.	(7) Water quality monitoring staff.
Corrective Actions Actions taken when limits of control measures are not met	(8) Cease operation and re-wipe equipment with a new clean cloth to dislodge invertebrates, rinse with non-Lake Superior water (tap or inland sample lake water), or obtain a new set of decontaminated equipment.	(8) Cease operation and repeat decontamination procedures as required based on type of equipment and use; obtain new, decontaminated set of sampling equipment prior to accessing sample lake.
Verification Method of verification	(9) Personal communication among crew. Review record.	(9) Personal communication among crew. Review record.

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Aquatic Invasive Species-Hazard Analysis and Critical Control Point AIS-HACCP Plan Form (continued)

Records List what is recorded at each critical control point	(10) Check sampling equipment, canoe/paddles, clothing, and boots/shoes for viable cattail plant material. Record Y/N to presence of cattail vegetation; document actions taken if Y and final result on record (i.e., removed cattail fluff from backpack, backpack clean).	(10) Document if only lake or second (other) lake sampled today; record Y/N that all equipment for second (other) lake has either been decontaminated and/or is a new clean set prior to sampling.
Critical Control Point Each row answered "yes" in column 6 of Hazard Analysis Form	(1) Work Flow Step (8): At the end of each sampling trip (single or multi-day) all equipment coming in contact with Lake Superior or inland lake water is decontaminated; method depending on type of equipment and use.	(1)
Significant Hazards as determined in column 3 of Hazard Analysis Form	(2) Bythotrephes longimanus and Dreissena polymorpha documented in Lake Superior waters. Potential introduction of invertebrates on WQ sampling equipment if canoeing on Lake Superior and during NPS boat transport (i.e., water in boat, bow spray).	(2)
Limits for Each Control Measure	(3) Routine decontamination procedures for all sampling equipment coming into contact with any lake water. Methods as of 2008: - soft equipment and some hard equipment (anchor bags, lines, and secchi disc) are soaked in hot water (140°F) for 1 minute. - hard equipment (multi-probe, secchi disc, I-tube, paddles) are wiped down, rinsed with tap water and visually inspected OR - all equipment is allowed to dry thoroughly and remain dry for at least 5 days.	(3)
Monitoring Describe what is being monitored	(4) Water quality sampling equipment, everything that comes in contact with any lake (large or inland sample).	(4)
Explain how the monitoring will take place	(5) Visual inspection during and post routine decontamination.	(5)
Frequency of monitoring	(6) At least once at end of decontamination.	(6)
Person or position responsible for monitoring	(7) Water quality monitoring staff.	(7)
Corrective Actions Actions taken when limits of control measures are not met	(8) If dirty used equipment or presence of invertebrates is found; cease operation and repeat decontamination procedures as specified; change method if necessary. Re-inspect to ensure equipment is clean.	(8)
Verification Method of verification	(9) Personal communication among crew. Review record.	(9)

AIS-HACCP PLAN

Aquatic Invasive Species-Hazard Analysis and Critical Control Point AIS-HACCP Plan Form (continued)

Records	(10) <i>Record the equipment receiving decontamination and the method(s) used. Check for and mark Y/N for presence of invertebrates and/or cattail, and action taken if Y.</i>	(10)
List what is recorded at each critical control point		

This form accommodates two Critical Control points. Attach additional pages of this form as necessary.

Final Step:

Once the HACCP plan is completed, attach it to the signed procedure form with the hazard analysis worksheets.