



**Michigan Department of Environmental Quality  
Michigan Department of Natural Resources  
Michigan Department of Agriculture and Rural Development  
POLICY AND PROCEDURE**

Original Effective Date: December 9, 2014	Subject: Invasive Species Decontamination for Field Operations in Michigan	
	Revised Date:	Number: QOL-2-2014
		Page 1 of 5

*A Quality of Life (QOL) Policy and Procedure cannot establish regulatory requirements for parties outside of the QOL. This document provides direction to QOL staff regarding the implementation of rules and laws administered by the QOL. It is merely explanatory; does not affect the rights of, or procedures and practices available to, the public; and does not have the force and effect of law.*

**POLICY:**

The Michigan Department of Environmental Quality (MDEQ), Michigan Department of Natural Resources (MDNR), and Michigan Department of Agriculture and Rural Development (MDARD) will aim to perform basic decontamination steps for field equipment in order to minimize the risk of invasive species transfer between work locations. Each division/office within each QOL department will develop decontamination steps that are practical and reasonable to perform by field staff to accomplish the goal of limiting the spread of invasive species.

**INTRODUCTION:**

Preventing new introductions and limiting the dispersal of established invasive species is the most cost-effective approach to management. The purpose of this policy and procedure is to assist employees of the MDEQ, MDNR, and MDARD in minimizing the risk of transferring invasive species while performing job activities in the field.

While this is a QOL policy and procedure, this document can be used by other departments (e.g., the Michigan Department of Transportation).

A decontamination guidance document, Invasive Species Decontamination for Field Operations in Michigan, is attached for staff conducting field activities including, but not limited to, research, management, monitoring, inspections, and site surveys that may result in contact with invasive species. Many types of field activities are conducted by State of Michigan employees. The attached guidance document provides the basic decontamination steps every employee should take to minimize the risk of invasive species transfer, as well as options specific to types of equipment used by QOL staff. Selection of specific decontamination methods is dependent on the type of work and the situation (e.g., time between site visits, risk level, or emergency response). Specific decontamination methods may be developed by a division/office for routine work or for special projects. In addition to preventing the dispersal of invasive species, decontamination methods are becoming increasingly important with the use of sensitive invasive species detection techniques, like environmental DNA (eDNA) sampling, to prevent false positives.

Michigan Department of Environmental Quality  
Michigan Department of Natural Resources  
Michigan Department of Agriculture and Rural Development  
POLICY AND PROCEDURE

Number: QOL-2-2014

Subject: Invasive Species Decontamination for Field  
Operations in Michigan

Page 2 of 5

This policy and procedure and attached guidance document do not preclude any decontamination policies or procedures currently being followed by any of the QOL departments.

**AUTHORITY:**

Michigan's Aquatic Invasive Species (AIS) and Terrestrial Invasive Species (TIS) Core Teams are composed of representatives from each of the state agencies with environmental or natural resource responsibilities. In general, the MDEQ, MDNR, and MDARD share responsibility for invasive species policy, legislation, regulation, education, monitoring, assessment, management, and control.

Relevant sections of Michigan Laws include:

Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).

Part 413, Transgenic and Nonnative Organisms, of the NREPA:

**324.41303 Possession of live prohibited or restricted organism; prohibition; exceptions; notification of location where found.**

Sec. 41303. (1) Subject to subsection (2), a person shall not knowingly possess a live organism if the organism is a prohibited species or restricted species ....

**324.41305 Introduction of prohibited or restricted species, or genetically engineered or nonnative aquatic plant, bird, crustacean, fish, mammal, or mollusk; exceptions.**

Sec. 41305. A person shall not introduce a prohibited species, a restricted species, or a genetically engineered or nonnative aquatic plant, bird, crustacean, fish, mammal, or mollusk unless the introduction is authorized ....

**324.41325 Boat, boating equipment, or boat trailer with aquatic plant attached; placement in state waters prohibited; order to remove aquatic plants; notice; posting; violation as civil infraction; penalty; definitions.**

Sec. 41325. (1) A person shall not place a boat, boating equipment, or boat trailer in the waters of this state if the boat, boating equipment, or boat trailer has an aquatic plant attached.

Michigan Department of Environmental Quality  
Michigan Department of Natural Resources  
Michigan Department of Agriculture and Rural Development  
POLICY AND PROCEDURE

Subject: Invasive Species Decontamination for Field  
Operations in Michigan

Number: QOL-2-2014

Page 3 of 5

MDNR, Fisheries Division, Fisheries Order 245, Fish Disease Control:

General Statewide Provisions. 16. A person who trailers a boat over land shall drain all water from the live well(s) and the bilge of their boat upon leaving any body of water.

**PROCEDURE:**

Selection of specific decontamination methods is dependent on the type of work and the situation (e.g., time between site visits, risk level, or emergency response). Specific decontamination methods may be selected by a division/office for routine work or for special projects. Staff should be aware of their work environment, the level of risk of transporting invasive species, and how their actions may contribute to the dispersal of invasive species; and based on this information, select and implement appropriate decontamination methods.

There are a variety of ways boats, vehicles, and field equipment can be decontaminated. Divisions/offices within each QOL department will develop their own tailored decontamination requirements; however, field crews will need to use best professional judgment when assessing risk. Field crews can tailor decontamination methods to be site-specific based on risk (as long as they are within their own division/office's decontamination requirements). Not every decontamination method will apply to all types of fieldwork; therefore, field crews should assess their level of risk in spreading invasive species.

Responsibilities for implementing this policy and procedure are as follows:

AIS and TIS Core Teams:

- Provide divisions/offices within each QOL department an invasive species decontamination guidance document (see attached). The AIS and TIS Core Teams will review and make revisions if needed, as appropriate, to the attached guidance document annually.

Divisions/Offices:

- Identify decontamination methods appropriate for type of work being completed or special projects that are reflective of the guidance document provided to the divisions/offices by the AIS and TIS Core Teams.
- Provide staff with the required tools and supplies to perform decontamination activities.
- Provide staff with training as to why, how, when, and where decontamination activities need to be conducted.

Michigan Department of Environmental Quality  
Michigan Department of Natural Resources  
Michigan Department of Agriculture and Rural Development  
POLICY AND PROCEDURE

Number: QOL-2-2014

Subject: Invasive Species Decontamination for Field  
Operations in Michigan

Page 4 of 5

- Ensure staff performs decontamination activities as required by their division/office.
- Summarize and communicate to the AIS and TIS Core Teams the decontamination methods being used and recommended modifications to the guidance document.

Staff:

- Each employee is responsible for performing decontamination activities as required by their division/office.

**SAFETY PRECAUTIONS:**

When using chemicals for disinfection, certain safety protocols should always be followed. Read the Material Safety Data Sheet or Safety Data Sheet and product labels for chemicals being used (e.g., Virkon®, bleach, and Formula 409) and follow instructions to avoid inhalation and eye/skin irritation problems. Wear chemical splash goggles, gloves, and an apron to prevent contact with eyes or skin. Spray downwind.

When decontaminating equipment (e.g., the underside of mowers), field crew safety must always be a priority. Use best professional judgment and consider safety in every decontamination step.

**SPECIAL CIRCUMSTANCES:**

*Emergency Situations*

There may be some cases, especially in the MDNR's Law Enforcement Division and Forest Resources Division (fire), when field staff is required to respond to an emergency situation. In these cases, safety/rescue/containment is the priority, not equipment decontamination. Situations requiring quick response times because of environmental or human health threats, like pollution emergencies, may require different levels of decontamination methods. The responding agency is responsible for determining priorities and risks to the environment, public health and safety, and staff safety.

*Birds and Mammals*

Diseases of birds and mammals can be as important as the birds and mammals themselves. When handling birds or mammals, attention needs to be given to protecting human health and the health of other animals; it is as important to stop the spread of the diseases as it is to stop the spread of the invasive animals (see attached guidance document for additional information).

Michigan Department of Environmental Quality  
Michigan Department of Natural Resources  
Michigan Department of Agriculture and Rural Development  
POLICY AND PROCEDURE

Number: QOL-2-2014

Subject: Invasive Species Decontamination for Field  
Operations in Michigan

Page 5 of 5

**REVIEW:**

This policy and procedure will be reviewed one year following the effective date and every five years thereafter, as a minimum. The attached guidance document will be reviewed annually.

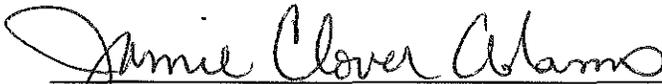
Approved:



Dan Wyant, Director  
Michigan Department of Environmental Quality



Keith Creagh, Director  
Michigan Department of Natural Resources



Jamie Clover Adams, Director  
Michigan Department of Agriculture and Rural Development

Attachment

# INVASIVE SPECIES DECONTAMINATION FOR FIELD OPERATIONS IN MICHIGAN

## A GUIDANCE DOCUMENT FOR THE MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY, MICHIGAN DEPARTMENT OF NATURAL RESOURCES, AND MICHIGAN DEPARTMENT OF AGRICULTURE AND RURAL DEVELOPMENT

NOVEMBER 2014

The Michigan Department of Environmental Quality (MDEQ), Michigan Department of Natural Resources (MDNR), and Michigan Department of Agriculture and Rural Development (MDARD) will aim to perform basic decontamination steps for field equipment in order to minimize the risk of invasive species transfer between work locations. Each division/office in each department will develop decontamination steps that are practical and reasonable to perform by field staff to accomplish the goal of limiting the spread of invasive species.

### **INTRODUCTION:**

Preventing new introductions and limiting the dispersal of established invasive species is the most cost-effective approach to management. The purpose of this document is to assist employees of the MDEQ, MDNR, and MDARD in minimizing the risk of transferring invasive species while performing job activities in the field.

While this is a Quality of Life (QOL) guidance document, this can be used by other departments (e.g., the Michigan Department of Transportation [MDOT]).

Guidance on various decontamination methods are presented here for staff conducting field activities, including, but not limited to, research, management, monitoring, inspections, inventory, site surveys, construction, treatments to land and water resources, and other field activity that may result in contact with invasive species. The definition of "site" may be dependent on scale and type of work or project specific (i.e., statewide vs. smaller regions). Further clarification on the definition of site will be provided by each division/office. Many types of field activities are conducted by State of Michigan employees. This document provides the basic decontamination steps to minimize the risk of invasive species transfer, as well as options specific to types of equipment used by QOL staff. Selection of specific decontamination methods is dependent on the type of work and the situation (e.g., time between site visits, risk level, or emergency response). Specific training and implementation guidance regarding decontamination methods will be developed by all divisions/offices for routine work or for special projects. In addition to preventing the dispersal of invasive species, decontamination methods are becoming increasingly important with the use of sensitive invasive species detection techniques, like environmental DNA (eDNA) sampling, to prevent false positives.

This document does not preclude any decontamination policies or procedures currently being followed by any of the QOL departments.

### **ACKNOWLEDGEMENTS:**

This document was produced by the State of Michigan's Aquatic Invasive Species (AIS) Core Team and the Terrestrial Invasive Species (TIS) Core Team. The Core Teams considered

various scientific studies on decontamination practices and other states' decontamination protocols, namely, California, Nebraska, New York, Pennsylvania, Washington, and Wisconsin.

**AUTHORITY:**

Michigan's AIS and TIS Core Teams are composed of representatives from each of the state agencies with environmental or natural resource responsibilities: MDEQ's Water Resources Division and Office of the Great Lakes; MDNR's Fisheries Division, Wildlife Division, Parks and Recreation Division, Forest Resources Division, Law Enforcement Division, and Marketing and Outreach Division; MDARD's Pesticide and Plant Pest Management Division, Animal Industry Division, and Environmental Stewardship Division; and MDOT's Environmental Services Section. In general, the MDEQ, MDNR, and MDARD share responsibility for AIS policy, legislation, regulation, education, monitoring, assessment, management, and control.

Relevant sections of Michigan Laws include:

Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA)

Part 413, Transgenic and Nonnative Organisms, of the NREPA:

**324.41303 Possession of live prohibited or restricted organism; prohibition; exceptions; notification of location where found.**

Sec. 41303. (1) Subject to subsection (2), a person shall not knowingly possess a live organism if the organism is a prohibited species or restricted species ....

**324.41305 Introduction of prohibited or restricted species, or genetically engineered or nonnative aquatic plant, bird, crustacean, fish, mammal, or mollusk; exceptions.**

Sec. 41305. A person shall not introduce a prohibited species, a restricted species, or a genetically engineered or nonnative aquatic plant, bird, crustacean, fish, mammal, or mollusk unless the introduction is authorized ....

**324.41325 Boat, boating equipment, or boat trailer with aquatic plant attached; placement in state waters prohibited; order to remove aquatic plants; notice; posting; violation as civil infraction; penalty; definitions.**

Sec. 41325. (1) A person shall not place a boat, boating equipment, or boat trailer in the waters of this state if the boat, boating equipment, or boat trailer has an aquatic plant attached.

MDNR, Fisheries Division, Fisheries Order 245, Fish Disease Control:

General Statewide Provisions. 16. A person who trailers a boat over land shall drain all water from the live well(s) and the bilge of their boat upon leaving any body of water.

## PROCEDURAL GUIDANCE:

Selection of specific decontamination methods is dependent on the type of work and the situation (e.g., time between site visits, risk level, or emergency response). Specific decontamination methods may be selected by a division/office for routine work or for special projects. Staff should be aware of their work environment, the level of risk of transporting invasive species, and how their actions may contribute to the dispersal of invasive species; and based on this information, select and implement appropriate decontamination methods.

## EXPLANATION OF SELECTED METHODS:

Visual inspection and removal of plants, insects, and debris: Inspecting and removing vegetation by hand picking can reduce the amount of plants on boats and trailers by 88% (Rothlisberger *et al.*, 2010). This method is effective on TIS as well. Pull vegetation; brush, sweep, or remove mud and seeds; and inspect areas that can hold seeds. Remove vegetation and mud before leaving a site and leave materials on site or, if further decontamination is prudent at another location (e.g., power washing at the field crew's workshop), dispose of materials in a trash receptacle (LeDoux and Martin, 2013).

Flushing or high pressure washer: Pressure washing or rinsing removes AIS but does not necessarily kill them (Aquatic Nuisance Species Task Force, 2013). Pressure washing will remove most TIS; however, to prevent the spread of TIS, power washing should be limited to the actual site location (as defined by the division/office), if possible. Using a wash station or car wash is more effective if the facility has an underbody blast feature. Washing with a hose and high pressure nozzle will work well, but getting to the underbody of the vehicle may be more difficult.

Hot water pressure washer: Hot water can be an effective tool used to kill many AIS and TIS, including viruses and diseases. Specifically, hot water sprays have been shown to cause 100% mortality of zebra and quagga mussels when sprayed for 10 seconds and 5 seconds, respectively, at 140°F/60°C (Morse, 2009; and Comeau *et al.*, 2011). Hot water pressure washers may not be locally available and some commercial hot water car washes cannot reach the recommended 140°F/60°C. A feasible alternative for some equipment and situations is to use a household steamer in conjunction with an additional decontamination method. Household steamers are typically available at grocery or housewares stores.

## Chemical Treatments:

Bleach: Chlorine bleach (e.g., Clorox® Regular Bleach [sodium hypochlorite] or equivalent products) 5.25% (EPA Reg. No. 5813-1) is commercially labeled for use as a disinfectant. Bleach is a widely used biocide and disinfectant agent, but it is corrosive to metal and rubber. Always refer to the manufacturer's directions for additional guidance.

- Recommended bleach solution is ½ cup (4 fluid ounces) bleach to 5 gallons of water or 120 milliliters (mL) bleach to 19 liters of water.
- Apply by spraying or use a sponge so surface is thoroughly exposed to the bleach solution. Contact time should be at least 10 minutes. Some gear types may require rinsing with tap water after decontamination with bleach.

- Chlorine bleach degrades over time and effectiveness as a disinfecting agent is diminished. After opening the original bottle of bleach, it may only be used for a maximum of two months. Write the date the container was opened on the original container. Bleach is best stored out of heat and sun.
- Use diluted bleach within a 24-hour period postdilution because chlorine dissipates rapidly. The words “Bleach Solution” and the date and time of dilution must be written on the container holding the diluted bleach.
- Dispose of unused bleach and diluted bleach solution in the sanitary sewer.

Field staff may elect to rinse equipment with sodium thiosulfate after using bleach for decontamination to neutralize chlorine and reduce potential damage to equipment.

Sodium thiosulfate: Sodium thiosulfate, Pentahydrate (CAS Reg. No. 10102-17-7), also known as thiosulfuric acid, is used for a variety of purposes that include: analytical chemistry, photography film processing, medical uses (e.g., treatment of arsenic poisoning), and removal of excess bleach in the textile industry. It is also commonly used in aquaculture to neutralize chlorine (which is harmful to fish and invertebrates). The U.S. Environmental Protection Agency has reviewed toxicity and exposure data and determined sodium thiosulfate pentahydrate to be a safe product. As a result, there is an existing tolerance exemption (Title 40 of the Code of Federal Regulations, Section 180.910). Always refer to the manufacturer’s directions for additional guidance.

- Recommended thiosulfate solution is 3 grams per gallon of water.
- Apply by spraying or use a sponge so surface is thoroughly exposed to the sodium thiosulfate solution. Contact time should be at least 10 minutes. Rinse with tap water after soak time is complete.
- Store crystals in a tightly sealed container and in a cool, dry area. Write the date the container was opened on the original container. Degradability of solution is not established.
- Dispose of small amounts of unused sodium thiosulfate solution in the sanitary sewer in a safe manner and in accordance with local/national regulations.

Bleach can be purchased from any grocery store. Sodium thiosulfate can be purchased at a pool supply company. While bleach is effective in killing most invasive species, it will not dissolve the shells of zebra/quagga veligers. Therefore, it is imperative to use 100% vinegar to dissolve the shells from sampling nets and gear that are used for zebra/quagga mussel sampling. Bleach will not kill New Zealand mudsnails (Hosea and Finlayson, 2005). **Caution should be taken to not mix chlorine bleach with other chemicals (e.g., vinegar). After using bleach, rinse well with water and then apply additional chemicals. Sodium thiosulfate should not be mixed with sodium nitrite, mercury, or iodine.**

Virkon Aquatic®: Virkon Aquatic is a contact disinfectant in the hydrogen peroxide family. It is a powder and 99.9% biodegradable. It breaks down to water and oxygen and is not corrosive at the working dilution. Note: Virkon Aquatic is labeled for use only as a bactericide and viricide. Do not depend on its use against other invasive species, including invertebrates, plants, and vertebrate species. However, a recent study showed a 15-20 minute bath immersion of 20 grams per liter (g/L) Virkon Aquatic was effective in killing 99% of New Zealand mudsnails (Stockton and Moffitt, 2013). Always refer to the manufacturer’s directions for additional guidance.

- Prepare Virkon Aquatic by mixing 20 g/L of water.
- Apply straight to clean surface by spraying or use a sponge so surface is thoroughly exposed to the Virkon Aquatic solution. Contact time should be at least 20 minutes.
- Use Virkon Aquatic within 7 days postmixing because the product degrades. The word “Virkon” and the date of mixing must be written on the container holding the solution.
- Dispose of unused Virkon Aquatic in the sanitary sewer.

Formula 409: A 10-minute submersion treatment of 100% Formula 409 causes 100% mortality in New Zealand mudsnails (Schisler *et al.*, 2008). Formula 409 is a popular household disinfectant and can be purchased at any grocery store. Contact appropriate supervisor for purchase information. The active ingredient in Formula 409 is Alkyl C12-16 Dimethylbenzyl Ammonium Chloride. Always refer to the manufacturer’s directions for additional guidance. To date, New Zealand mudsnails have not been detected in inland waters in Michigan. If New Zealand mudsnails are detected in Michigan inland waters, additional guidance will be developed.

Vinegar: White distilled vinegar can be purchased at any grocery store. Vinegar dissolves zebra/quagga veliger shells and should be used on nets or gear that are used to collect samples for zebra/quagga mussel analysis (e.g., eDNA or veliger samples) after sampling to prevent false positive detections in uninfected lakes. There have been no peer reviewed studies investigating vinegar as a disinfectant for invasive species. Store in a cool, dry area away from incompatible materials (e.g., bleach). Always refer to the manufacturer’s directions for additional guidance.

- Use white distilled vinegar without dilution.
- Apply by spraying or use a sponge so surface is thoroughly exposed to the vinegar. Contact time should be at least 10 minutes.
- Shelf life is indefinite if stored properly.
- Small amounts of unused vinegar may be disposed of in the sanitary sewer.

Salt solution: Table salt (sodium chloride; e.g., Morton® table salt or a similar product) is an effective decontamination method for certain species and gear. Zebra and quagga mussel veligers are killed when gear is submersed in a salt solution (½ cup salt per gallon of water) for 30 minutes (Kilgour and Kepple, 1993).

## **SAFETY PRECAUTIONS:**

When using chemicals for disinfection, certain safety protocols should always be followed. Read the Material Safety Data Sheet or Safety Data Sheet and product labels for chemicals being used (e.g., Virkon Aquatic, bleach, and Formula 409) and follow instructions to avoid inhalation and eye/skin irritation problems. Wear chemical splash goggles, gloves, and apron to prevent contact with eyes or skin. Spray downwind.

When decontaminating equipment (e.g., the underside of mowers), field crew safety must always be a priority. Use best professional judgment and consider safety in every decontamination step.

## **EQUIPMENT LIST:**

Depending on the type of decontamination method chosen by the division/office, items that may be needed include:

- Boot brush
- Screwdriver, hoof pick
- 5 gallon buckets
- Sponges
- Spray bottles (e.g., hand-held sprayers used for applying pesticides)
- Thermometer
- Boat/car wash station
- Adhesive rollers
- Household steamer
- Broom (small and/or long handle)
- Shovel
- Vacuum
- Pressure washer
- Air compressor
- Chemicals - bleach, vinegar, salt, Virkon Aquatic, and Formula 409
- Personal protective equipment (e.g., chemical splash goggles, gloves, and apron)

## **GENERAL FIELD PRECAUTIONS:**

Ways to Minimize Risk of Spread:

1. Know your management area and level of risk whenever possible (Cal-IPC, 2011). Visit areas without invasive species first, followed by infested areas (lowest risk to highest risk).
2. In aquatic environments, consider using waders or boots that are one-piece, rubber, and nonfelt soled. The more complicated a wader set is, the easier it is for invasive species to hitch a ride (i.e., multipiece waders with fabric, detachable boots, and felt soles).
3. Inspect gear and equipment as you work between sites, especially boots and nets. Pull or brush away vegetation, insects, dirt, mud, seeds, egg masses, etc., that may hold invasive species.
4. If possible, conduct activities when the risk of spreading the invasive species is minimal/nonexistent (i.e., avoid traveling in infected sites when the propagules of the invasive species are present). Propagules are any part of an organism that can independently grow without the parent (Brooks and Lusk, 2008).
5. Direct on-site foot traffic to avoid infested/infected areas, if possible.

#### Basic Steps to Decontamination:

1. Inspect and remove plants, animals, and mud from your boat, trailer, vehicle, equipment, and gear (DiVittorio *et al.*, 2012). Dispose of unwanted plants and animals in a responsible manner. If possible, scrub all equipment to free it of sediment or debris. Rinse with tap water when possible. If possible, decontaminate at the site location.
2. Drain all water from your boat and boat related equipment, including motor, live well, bilge, transom wells, and any other equipment and gear used.
3. Drying is the most effective way to minimize risk for many aquatic species; however, a busy fieldwork season typically does not allow the 5-7 days needed for a total drying of equipment. Disinfecting all equipment will be the typical decontamination method for most staff to prevent the spread of AIS.
4. Utilize high pressure washes, hot water washes, or chemical disinfecting, as appropriate, following visits to areas known to be infected by invasive species of concern.

#### **SPECIAL CIRCUMSTANCES:**

##### *Emergency Situations*

There may be some cases, especially in the MDNR's Law Enforcement Division and Forest Resources Division (fire), when field staff is required to respond to an emergency situation. In these cases, safety/rescue/containment is the priority, not equipment decontamination. Situations requiring quick response times because of environmental or human health threats, like pollution emergencies, may require different levels of decontamination methods. The responding agency is responsible for determining priorities and risks to the environment, public health and safety, and staff safety.

##### *Birds and Mammals*

Diseases of birds and mammals can be as important as the birds and mammals themselves. When handling birds or mammals, attention needs to be given to protecting human health and the health of other animals; it is as important to stop the spread of the diseases as it is to stop the spread of the invasive animals.

When dealing with birds or mammals, note that:

- Personal biosecurity is important as there are diseases that can be transmitted between people and animals (zoonotic diseases).
- Diseases can be spread by fomites (objects such as boots, truck tires, unwashed hands, etc.) and through the air. For example, driving a truck containing feral swine infected with pseudorabies virus down the road could allow the disease to be spread to farms along the route of travel.
- Disinfectant choices for birds and mammals are different than choices for aquatic species.
  - Flushing and pressure spraying without disinfectant can spread disease.
  - Using compressed air to clean vehicles could spread disease.

- Bleach, Virkon® S, and TB-Cide are usually acceptable disinfectants.
- Virkon Aquatic, Formula 409, vinegar, and salt solution are not acceptable disinfectants for birds and mammals.
- If you have questions about personal biosecurity or about decontamination or disinfection pertaining to birds and mammals, contact the MDNR's Wildlife Division or the MDARD's Animal Industry Division.

## **LEVELS OF RISK:**

There are a variety of ways boats, vehicles, and field equipment can be decontaminated as noted above. Divisions/offices within each department will develop their own tailored decontamination requirements; however, field crews will need to use best professional judgment when assessing risk. Field crews can tailor decontamination methods to be site-specific based on risk (as long as they are within their own division/office's decontamination recommendations). Not every decontamination method will apply to all types of fieldwork; therefore, field crews should assess their level of risk in spreading invasive species. For example, a field crew obtaining water samples from a dock will have a different level of risk than a crew wading in a bed of aquatic plants at multiple locations. A crew working on land that has an invasive plant that spreads only by seed from the current year will have a high risk situation if doing work during the seed dispersal period, but will have a low risk situation if working in the winter or during a period in which the plant has not yet produced seed. Staff needs to be aware of changes in risk level according to season and weather and adjust decontamination methods accordingly. Once the level of risk is determined, the field crew should adhere to recommended decontamination methods.

\*If there are multiple levels of risk identified (e.g., low and medium), the field crew should take the highest level of precaution (e.g., medium).

The following work conditions should be considered to assist staff in determining risk:

### **LOW:**

- In contact with one water body or field site in a week.
- Frequenting an area near a water body but not entering the water body.
- No documented invasive species in the area and none observed during field operation.
- In contact with more than one field site/week but invasive species known or observed in each area have no risk of spreading at the time of the visit(s) (propagules are not present).

### **MEDIUM:**

- In contact with multiple water bodies or field sites in a week.
- In contact with any invasive species infested water body or field site and risk of spread is present (propagules are present).

### **HIGH:**

- In contact with multiple water bodies or field sites in a single day and the risk of spread is present (propagules present) in one or more sites.
- In contact with both pristine/isolated locations and invasive species infested water bodies or field sites in a given field trip and propagules present in one, or more, locations.

- In direct contact with water bodies in multiple watersheds.
- Visiting rare and imperiled communities or known habitat for threatened and endangered species. For a list of species, visit the MDNR's Web site: [http://www.michigan.gov/dnr/0,4570,7-153-10370\\_12141\\_12168---,00.html](http://www.michigan.gov/dnr/0,4570,7-153-10370_12141_12168---,00.html).
- High risk could be one visit to one infected site depending on the organism and its virulence.

## **PROCEDURAL GUIDANCE FOR DECONTAMINATION BASED ON LEVEL OF RISK (REFER TO TABLE 1 FOR RISK SUMMARY)**

### **I. Boats, Trailers, and Motors**

#### Low Risk: Basic Decontamination Steps (Figure 1):

1. Clean, Drain, Rinse, and Dry:
  - a. Clean by hand picking or scrubbing attached sediment, plants, or debris from boats, motors, and trailers before leaving access area.
  - b. Drain water from bilges, pumps, and live wells at the ramp before leaving. Dispel water from motor by turning over engine.
  - c. Rinse all surface areas with potable water, if possible.
  - d. Dry thoroughly before using in a different body of water, if possible.

#### Medium Risk: Perform all steps in the Low Risk Category first and then perform one or more (as appropriate), of the following additional and equally viable options:

1. Disinfect
  - a. Clean all surfaces, live wells, and bilges with one of the following:
    - i. Bleach solution ( $\frac{1}{2}$  cup [4 fluid ounces] bleach to 5 gallons of water or 120 mL bleach to 19 liters of water). Apply by spraying or use a sponge so surface is thoroughly exposed to the bleach solution. Contact time should be at least 10 minutes.
    - ii. Virkon Aquatic (20 grams of Virkon powder to 1 liter of water). Spray solution so surface is thoroughly exposed to disinfectant. Leave the solution on for 20 minutes.

When using either bleach or Virkon Aquatic, make sure the boat is away from the water body to reduce the chance of the disinfection solution going into surface waters.
  - b. Rinse with clean water.

2. Heat

- a. Use a hot water pressure washer with exposure time of a minimum of 10 seconds at 140°F/60°C to kill most AIS.

High Risk: Perform steps in the Low and Medium Risk Categories first and then perform the following additional step:

1. Motor flush – flush engine cooling system with fresh tap water at 140°F/60°C for a minimum of 5 minutes and an exiting temperature of 120°F/49°C or at ambient temperature for 10 minutes.

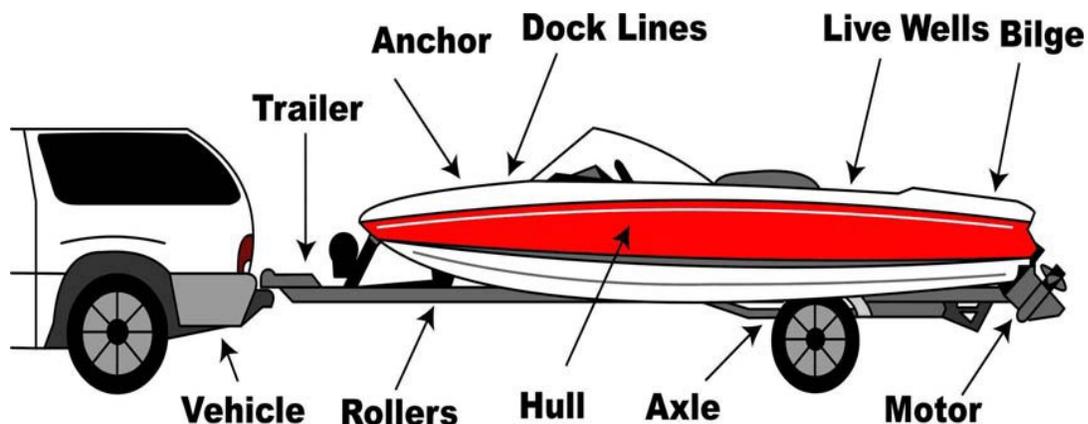


Figure 1: Key areas on boats and trailers to inspect for plants, animals, muds, and water. Diagram from California Department of Fish and Wildlife.

## II. Water Body Sampling Gear

Examples of sampling gear: nets (e.g., fyke, trap, gill, hoop, or dip) and other equipment that has direct contact with the water from the water body sampled.

Low Risk: Basic Disinfection Steps:

1. Clean, Rinse, and Dry:
  - a. Clean by hand picking or scrubbing attached sediment, plants, or debris from sampling nets and other equipment.
  - b. Rinse all surface areas with potable water, if possible.
  - c. Dry thoroughly ( $\geq 2$  days, if possible), preferably in the sun, before using gear in a different body of water.

Medium Risk: Perform all steps in the Low Risk Category first and then perform one or more (as appropriate), of the following additional and equally viable options:

1. Disinfect:

- a. Soak nets and equipment with one of the following after leaving the site:
  - i. Bleach solution ( $\frac{1}{2}$  cup [4 fluid ounces] bleach to 5 gallons of water or 120 mL bleach to 19 liters of water). Thoroughly spray or soak equipment. Contact time should be at least 10 minutes. Rinse with clean water. When sampling for veligers (zebra or quagga mussel larvae), be sure to use a vinegar spray or soak (100%) for 20 minutes. This will prevent false positives at the next sampling location.
  - ii. Virkon Aquatic. Soak for 20 minutes. Spray solution so surface is thoroughly exposed to disinfectant.

2. Heat and Dry:

- a. Expose equipment for 10 seconds at 140°F/60°C with pressurized hot water.
- b. Dry thoroughly ( $\geq 5$  days), preferably in the sun, before using gear in a different body of water.

High Risk: Perform steps in the Low and Medium Risk Categories first and then perform the following additional step:

1. Use alternative gear that has not been deployed in infested waters within the past 5 days.

### **III. Waders, Boots, and Other Field Equipment**

Low Risk: Basic Disinfection Steps:

1. Clean, Rinse, and Dry:

- a. Cleaning Options:
  - i. By hand: Before leaving a site, remove all sediment, plants, or debris from boots, waders, clothing, shovels, knives, and other field gear.
  - ii. Brushing: Use a boot brush or pick to remove clods of dirt from boot or wader treads. If there is a nap to clothing material, brushing with the nap will remove plant material and seeds rather than embed it further.
  - iii. Adhesive roller: Use an adhesive roller over all fabric clothing and footwear to remove small or embedded seed and plant material. Bag used adhesive sheets and dispose of in trash.
- b. Rinse all surface areas with potable water, if possible.
- c. Dry thoroughly ( $\geq 2$  days, if possible), preferably in the sun, before using gear in a different water body.

Medium Risk: Perform all steps in the Low Risk Category first and then perform one of the following additional and equally viable options:

1. Launder clothing and footwear options:
  - a. Wash and dry clothing (including field vest, etc.) before using in a different water body and field site, if possible.
  - b. Wash footwear in sink or boot wash station in field offices before using in a different water body or field site.
2. Disinfect:
  - a. Clean or soak other equipment such as shovels, knives, augers, etc., with one of the following options:
    - i. Bleach solution ( $\frac{1}{2}$  cup [4 fluid ounces] bleach to 5 gallons of water or 120 mL bleach to 19 liters of water). Apply by spraying or use a sponge so surface is thoroughly exposed to the bleach solution. Contact time should be at least 10 minutes.
    - ii. Virkon Aquatic. Soak for 20 minutes. Spray solution so surface is thoroughly exposed to disinfectant.
    - iii. Formula 409. Spray 100% Formula 409 with a contact time of 10 minutes.
  - b. Rinse with clean water.

High Risk: Perform steps in the Low and Medium Risk Categories first and then perform the following additional steps:

1. Heat and Dry:
  - a. Heat Options:
    - i. Household steamer: Expose waders, boots, or clothing to steam for 1 minute.
    - ii. Pressurized hot water: Expose other equipment such as shovels, knives, augers, etc., for 10 seconds at 140°F/60°C.
  - b. Dry thoroughly ( $\geq 5$  days), preferably in the sun, before using gear in a different water body.

#### **IV. Sensitive Equipment**

Examples of sensitive equipment: sondes, hydrolabs, and dataloggers.

Low, Medium, and High Risk: Always perform the following steps:

1. Sensitive equipment should be cleaned and sanitized every time it has been exposed to water and other substrates that harbor invasive species.

2. Dataloggers and similar equipment should be thoroughly rinsed after every exposure to suspect infested water or land areas using potable water or other similar purified water.
3. Aquatic equipment should always be thoroughly cleaned when moving from one water body to another using a mild soap and water solution and the maintenance brush or similar cleaning device provided with the equipment.
4. Always consult the operating manual for the equipment to determine the manufacturer's recommendation for cleaning.

## **V. Vehicles**

Vehicles that stay on roads have a low risk of spreading invasive species. Whenever possible, park on a paved lot or in an area mowed or maintained with little or no vegetation to minimize contact with plant materials, soils, and water. This will reduce the likelihood of invasive species hitching a ride on your vehicle.

Examples of vehicles: passenger cars and trucks, and recreational vehicles such as all-terrain vehicles (ATV) and snowmobiles.

### Low Risk: Basic Decontamination Steps

1. Clean:
  - a. Overall, before leaving each site visually inspect interior and exterior of the vehicle and remove plants, animals, and mud.
  - b. Interior of vehicles.
    - i. Use rubber/plastic floor mats if possible. Carpet-type mats are harder to clean.
  - c. Exterior of vehicles.
    - i. Knock off all large clods of dirt.

### Medium Risk: Perform steps in the Low Risk Category first and then perform the following additional steps:

1. Clean:
  - a. Interior of vehicles.
    - i. Sweeping, vacuuming, or using compressed air (on-site only).
  - b. Exterior of vehicles.
    - i. Scrape or brush soil and debris from exterior surfaces.

High Risk: Perform steps in the Low and Medium Risk Categories first and then perform one of the following additional steps:

1. Clean with water using a high pressure washer.
2. Take vehicle through car wash with undercarriage flush.

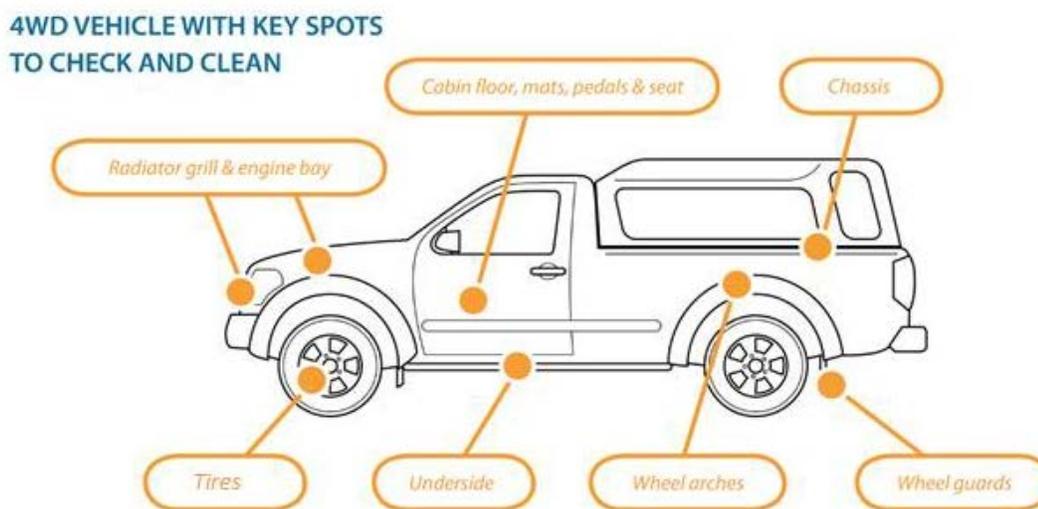


Figure 2: Vehicle with key spots to check and clean. Diagram courtesy of Ontario Invasive Plant Council (Halloran *et al.*, 2013).

## VI. Heavy Equipment

Examples of heavy equipment: off-road, rubber-tired, and tracked equipment, including excavators, dozers, graders, skidders, log trucks, dump trucks, loaders, feller bunchers, timber processors, mowers, and other equipment such as farm implements, construction mats, and marshmasters\*. Heavy equipment that stays on roads has a low risk of spreading invasive species. Whenever possible, park on a paved lot or in an area mowed or maintained with little or no vegetation to minimize contact with plant materials, soils, and water. This will reduce the likelihood of invasive species hitching a ride on your vehicle.

\*When decontaminating a marshmaster, the instructions in the "Boats, Trailers, and Motors" section are often applicable in addition to the heavy equipment instructions.

Low Risk: Basic Decontamination Steps:

1. Clean:
  - a. Interior of vehicles.
    - i. Sweeping, vacuuming, or using compressed air.
    - ii. Use rubber/plastic floor mats if possible. Carpet-type mats are harder to clean.

- b. Exterior of vehicles.
  - i. Knock off all large clods of dirt.
  - ii. Scrape or brush soil and debris from exterior surfaces.
    - 1. An additional option is to use a leaf blower to remove vegetative debris.

Medium/High Risk: Perform all steps in the Low Risk Category first and then perform the following additional steps:

1. If using both compressed air and water, clean areas with compressed air (such as radiators and grills and on-site only) prior to using water.
2. Clean with water using a high pressure washer.
3. Equipment with the ability to run fans in reverse should use this feature to clean air intakes. Reversing the fan direction and blowing loose material out of equipment before leaving a location can reduce the likelihood of moving invasive species to another site.
4. If vehicle is in direct contact with a known infestation of invasive species of significant concern, use a hot water pressure washer with undercarriage flush, if available.

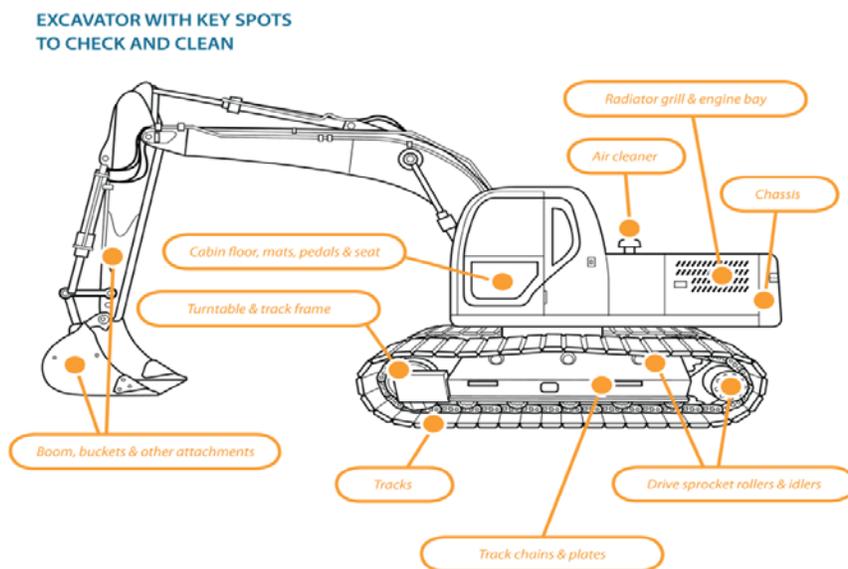


Figure 3: Key spots to check and clean for large equipment. Diagram courtesy of Ontario Invasive Plant Council (Halloran *et al.*, 2013).

## VII. Portable Pumps

Examples of pumping equipment: portable pumps and suction hoses or any equipment that draws water from a water body, such as that used in water level management and fire operations.

Avoid moving water from one water body to another. Any equipment that draws water from one water body should not be drained into another water body without careful consideration of the likelihood of moving invasive species and their impacts.

Low Risk: Basic Decontamination Steps:

1. Clean:
  - a. Scrape or brush soil and debris from exterior surfaces.

Medium/High Risk: Perform all steps in the Low Risk Category first and then perform the following additional steps:

1. Flush:
  - a. Large portable pumps and suction hoses should be flushed and run with clean water between uses.
2. Disinfect:
  - a. Small portable pumps can be flushed by pouring disinfectant solution into priming hole, running solution through the suction hoses, and sitting for 20 minutes.  
Solution can consist of:
    - i. Virkon Aquatic (20 g/L).
    - ii. Bleach solution (½ cup [or 4 fluid ounces] bleach to 5 gallons of water or 120 mL bleach to 19 liters of water). Rinse with clean water.

## **VIII. Diving Equipment**

Examples of diving equipment: wet suit, dry suit, mask, snorkel, fins, buoyancy compensator, and weight belt.

Low Risk: Basic Decontamination Steps

1. Clean, drain, rinse, and dry:
  - a. Clean off by hand any attached sediment, plants, animals, or debris from wet suit, dry suit, mask, snorkel, fins, buoyancy compensator, regulator, tank, weight belt, and other gear.
  - b. Drain tank, regulator, buoyancy compensator, and other equipment that may hold water.
  - c. Rinse all gear with clean water.
  - d. Dry thoroughly (>2 days, if possible) before going into another water body.

Medium and High Risk: Perform all steps in the Low Risk Category first and then perform one of the following additional and equally viable options:

1. Wash gear with the following options:
  - a. Soak wet suit, mask, snorkel, and fins in a salt solution (½ cup salt per gallon of water) for 30 minutes. Rinse thoroughly with clean water.
  - b. Hot water (>120°F/49°C) bath for 30 minutes for wet suits, masks, snorkels, and fins.
2. Dry thoroughly (>5 days, if possible) before using in another water body.

Table 1: Summary of decontamination options to help minimize the transfer of invasive species. Perform all steps in the lower risk categories first, then perform the decontamination steps in the higher risk categories (e.g., High Risk: Perform steps in the Low and Medium Risk Categories first).

Equipment	Low	Medium Options (pick one). Rinse after all.	High
Boats, trailers, and motors	Inspect, clean, drain, rinse, and dry	<ul style="list-style-type: none"> <li>Bleach: ½ cup [4 oz] bleach to 5 gallons of water or 120 mL bleach to 19 liters of water</li> <li>Virkon Aquatic for 20 minutes (20 g/L)</li> <li>Hot water pressure: 140°F/60°C for 10 second contact time</li> </ul>	Motor flush: 140°F for 5 minutes and an exiting temperature 120°F/49°C OR ambient temperature for 10 minutes
Sampling gear (e.g., nets and other equipment that have direct contact with water)	Inspect, clean, rinse, and dry	<ul style="list-style-type: none"> <li>Bleach: ½ cup [4 oz] bleach to 5 gallons of water or 120 mL bleach to 19 liters of water</li> <li>Then use 100% vinegar for 20 minutes to dissolve any veliger shells</li> <li>Virkon Aquatic for 20 minutes (20 g/L)</li> <li>Hot water pressure: 140°F/60°C for 10 second contact time; dry ≥5 days in sun</li> </ul>	Use alternative gear that has not been deployed in infested water within the past 5 days
Waders, boots, and other field equipment	Inspect, clean, rinse, and dry	<ul style="list-style-type: none"> <li>Launder clothing and footwear</li> <li>Disinfect other equipment</li> <li>Bleach: ½ cup [4 oz] bleach to 5 gallons of water or 120 mL bleach to 19 liters of water</li> <li>Virkon Aquatic for 20 minutes (20 g/L)</li> <li>Formula 409 for 10 minutes for New Zealand mudsnails</li> </ul>	Heat and dry: household steamer or pressure wash; dry ≥5 days
Sensitive equipment (e.g., sondes, hydrolabs, and dataloggers)	Inspect, clean, and sanitize every time it has been exposed to water; follow manufacturer's directions		
Vehicles	Inspect and clean interior and exterior	<ul style="list-style-type: none"> <li>Clean with water using pressure washer</li> <li>Take vehicle through carwash with undercarriage flush</li> </ul>	
Heavy equipment (e.g., mowers, dozers, loaders, and dump trucks)	Inspect and clean interior and exterior	<ul style="list-style-type: none"> <li>Compressed air, then high pressure washer, rinse, and dry; run fans in reverse if possible to clean air intakes</li> </ul>	
Portable pumps (any equipment that draws water from a water body)	Inspect and clean exterior surfaces	<ul style="list-style-type: none"> <li>Flush, clean, rinse, and dry</li> <li>For small portable pumps, flush with either Virkon Aquatic (20 g/L) for 20 minutes or with a bleach solution (½ cup [4 oz] bleach to 5 gallons of water or 120 mL bleach to 19 liters of water for 20 minutes</li> </ul>	
Diving equipment (e.g., wet suit, snorkel, fins, and buoyancy compensator)	Inspect, clean, drain, rinse, and dry	<ul style="list-style-type: none"> <li>Salt solution: ½ cup salt per gallon of water for 30 minutes</li> <li>Hot water: &gt;120°F/49°C for 30 minutes</li> </ul> <p>After treatment, completely dry if possible</p>	

## Literature Sources

Brooks, M. and M. Lusk. 2008. Fire Management and Invasive Plants: a Handbook. United States Fish and Wildlife Service, Arlington Virginia, 27 pages.

Cal-IPC. 2011. BMP Manual. Cal-IPC Publication 2011-02. California Invasive Plant Council, Berkeley, CA. Available: <http://www.cal-ipc.org>.

Comeau, S, S. Rainville, W. Baldwin, E. Austin, S. Gerstenberger, C. Cross, and W. H. Wong. 2011. Susceptibility of quagga mussels (*Dreissena rostriformis bugensis*) to hot-water sprays as a means of watercraft decontamination. *Biofouling*, 27:3, 267-274.

DiVittorio, J., M. Grodowitz, and J. Snow. 2012. Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species. U.S. Department of the Interior, Bureau of Reclamation, Technical Memorandum No. 86-68220-07-05.

Halloran, Joe, Hayley Anderson, and Danielle Tassie. 2013. Clean Equipment Protocol for Industry. Peterborough Stewardship Council and Ontario Invasive Plant Council. Peterborough, ON.

Hosea R.C. and B. Finlayson. 2005. Controlling the spread of New Zealand mud snails on wading gear. California Department of Fish and Game, Pesticide Investigations Unit. Administrative Report 2005-02. May 16, 2005.

Kilgour, B.W., and R. Kepple. 1993. Effects of salinity on the survival of zebra mussel veliger larvae. Third International Zebra Mussel Conference, Toronto, Canada.

LeDoux, Chris B. and Danielle K. Martin. 2013. Proposed BMPs for Invasive Plant Mitigation during Timber Harvesting Operations. Gen. Tech. Rep. NRS-118. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 12 pages.

Morse, J.T. 2009. Assessing the effects of application time and temperature on the efficacy of hot-water sprays to mitigate fouling by *Dreissena polymorpha* (zebra mussels Pallas). *Biofouling*, 25:7 605-610.

Rothlisberger, J.D., W.L. Chadderton, J. McNulty, and D.M. Lodge. 2010. Aquatic invasive species transport via trailered boats: What is being moved, who is moving it, and what can be done. *Fisheries*. Volume 35, No. 3, 121-132.

Stockton, K.A. and C.M. Moffitt. 2013. Disinfection of three wading boot surfaces infested with New Zealand mudsnails, *North American Journal of Fisheries Management*, 33:3, 529-538.

Schisler, G.J., N.K.M. Vieira, and P.G. Walker. 2008. Application of household disinfectants to control New Zealand Mudsnails. *North American Journal of Fisheries Management* 28:1172-1176.

## State and Federal Decontamination Protocols

A New York Boaters Guide to Cleaning, Drying and Disinfecting Boating Equipment: Procedures To Prevent the Spread of Aquatic Invasive Species While Boating:  
[http://www.dec.ny.gov/docs/fish\\_marine\\_pdf/boatdisinfect.pdf](http://www.dec.ny.gov/docs/fish_marine_pdf/boatdisinfect.pdf)

Aquatic Nuisance Species Task Force. 2013. Voluntary guidelines to prevent the introduction and spread of aquatic invasive species: Recreational activities:  
[http://www.anstaskforce.gov/Documents/AIS\\_Recreation\\_Guidelines\\_Final\\_8\\_29-3.pdf](http://www.anstaskforce.gov/Documents/AIS_Recreation_Guidelines_Final_8_29-3.pdf)

California Department of Fish and Wildlife Aquatic Invasive Species Decontamination Protocol 2013:  
<https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333>

Commonwealth of Pennsylvania: Pennsylvania Fish and Boat Commission. Biosecurity Measures for Commission Operations, Facilities, and Equipment 2009: [http://fishandboat.com/ais/pfbc\\_biosecurity.pdf](http://fishandboat.com/ais/pfbc_biosecurity.pdf)

Washington Department of Fish and Wildlife. Invasive Species Management Protocols. Version 2, November 2012: <http://wdfw.wa.gov/publications/01490/wdfw01490.pdf>

Wisconsin Department of Natural Resources: Boat and Gear Disinfection Protocol:  
[http://dnr.wi.gov/topic/fishing/documents/vhs/disinfection\\_protocols.pdf](http://dnr.wi.gov/topic/fishing/documents/vhs/disinfection_protocols.pdf)