

Wisconsin DNR Boat, Gear, & Equipment Decontamination & Disinfection Manual Code

Maureen Ferry
Aquatic Invasive Species Monitoring Coordinator

Webinar April 21, 2021

WISCONSIN
DEPT. OF NATURAL RESOURCES

Prevention

**PREVENT THE SPREAD OF
INVASIVE SPECIES
IT'S THE LAW**

PENALTIES MAY EXCEED \$2000

Before *launching* and before *leaving* **YOU MUST:**

- ✓ **INSPECT** boats, trailers, and equipment.
- ✓ **REMOVE** all attached aquatic plants and animals.
- ✓ **DRAIN** all water from boats, vehicles, and equipment.
- ✓ **NEVER MOVE** plants or live fish away from a waterbody.*

 **STOP AQUATIC HITCHHIKERS!**
Prevent the spread of invasive species, it's the law

 *Limited exceptions apply. Visit WWW.DNR.WI.GOV and search for "BAIT LAWS."



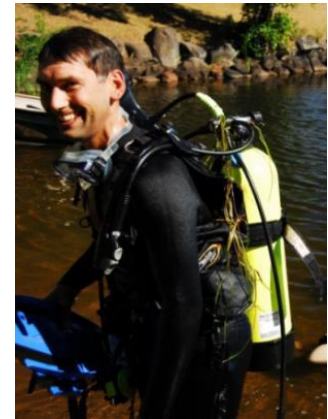
**STOP AQUATIC
HITCHHIKERS!™**

Prevent the transport of nuisance species.
Clean all recreational equipment.
www.ProtectYourWaters.net

Prevention



However...





Manual Code

- Prepared in 2007; updated in 2016
- Inspect & remove, drain, dispose
- **DISINFECT** by either:
 - Dry 5 days
 - Hot water
 - Chlorine
 - Virkon

Manual Code

- Revision needed
 - New species
 - Research gaps





Revisions in 2016

- Definitions
- Upstream crossing barrier
- Added $\geq 140^{\circ}\text{F}$ hot water
- Increased concentration
- Rinse water from clean source
- Updated safety
- **Condition of grants & permits**



Manual Code

- Therefore, Counties or Associations that receive DNR funding or permits must follow Manual Code (MC) and also make any subcontractors working under DNR funding or permits disinfect per MC when moving between waters.

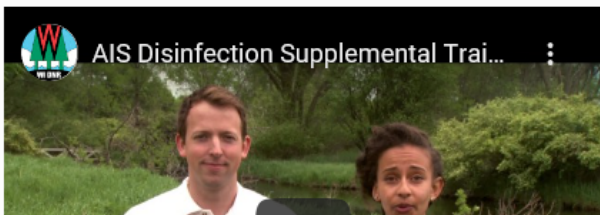


BOAT, GEAR AND EQUIPMENT DECONTAMINATION AND DISINFECTION MANUAL CODE 9183.1

BEST MANAGEMENT PRACTICES

The general public are required to follow decontamination steps identified in s. [NR 40.02\(44\)](#) and [NR 40.07](#) to prevent the spread of invasive species. This webpage outlines best management practices (BMPs) for the boat, gear and equipment. Decontamination and disinfection manual code, which requires all Wisconsin Department of Natural Resources employees, agents, and permittees that transport equipment between waters to take additional prevention steps. If you are unsure if you are required to follow this guidance, please review the [Common Questions and Answers \[PDF\]](#). If you still have questions, contact the person that issued your contract or permit or the DNR [invasive species team](#).

1. [Manual Code #9183.1 \[PDF\]](#)
2. [Full BMPs for boat, gear and equipment decontamination \[PDF\]](#)
3. Check for species present in the work area using one of the following tools:
 - [Lakes and aquatic invasive species mapping tool](#)
 - [Lakes, Rivers and Wetlands with Aquatic Invasives](#)
4. Select the best [disinfection method for species present](#)



Invasive Species

[Learn More](#)

[Report an Invasive](#)

[Prevent the Spread](#)

[Control Measures](#)

[Rules and Regulations](#)

[Wisconsin Invasive Species Council](#)

[AIS Efforts](#)

[Publications](#)

For more information, contact:

[DNR invasive species staff](#)



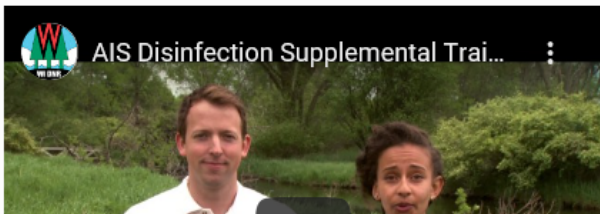
BOAT, GEAR AND EQUIPMENT DECONTAMINATION AND DISINFECTION MANUAL

BEST MANAGEMENT PRACTICES

LET'S CHECK IT OUT!

The general public are required to follow decontamination steps identified in s. [NR 40.02\(44\)](#) and [NR 40.07](#) to prevent the spread of invasive species. This webpage outlines best management practices (BMPs) for the boat, gear and equipment. Decontamination and disinfection manual code, which requires all Wisconsin Department of Natural Resources employees, agents, and permittees that transport equipment between waters to take additional prevention steps. If you are unsure if you are required to follow this guidance, please review the [Common Questions and Answers \[PDF\]](#). If you still have questions, contact the person that issued your contract or permit or the DNR [invasive species team](#).

1. [Manual Code #9183.1 \[PDF\]](#)
2. [Full BMPs for boat, gear and equipment decontamination \[PDF\]](#)
3. Check for species present in the work area using one of the following tools:
 - [Lakes and aquatic invasive species mapping tool](#)
 - [Lakes, Rivers and Wetlands with Aquatic Invasives](#)
4. Select the best [disinfection method for species present](#)



Invasive Species
Learn More
Report an Invasive
Prevent the Spread
Control Measures
Rules and Regulations
Wisconsin Invasive Species Council
AIS Efforts
Publications

For more information, contact:

[DNR invasive species staff](#)



BOAT, GEAR AND EQUIPMENT DECONTAMINATION AND

Invasive Species

1. [Manual Code #9183.1 \[PDF\]](#)
2. [Full BMPs for boat, gear and equipment decontamination \[PDF\]](#)
3. [Check](#) for species present in work area using one of the following tools:
 - [Lakes and aquatic invasive species mapping tool](#)
 - [Lakes, Rivers and Wetlands with Aquatic Invasives](#)
4. Select best [disinfection method for species present](#)

1. [Manual Code #9183.1 \[PDF\]](#)
2. [Full BMPs for boat, gear and equipment decontamination \[PDF\]](#)
3. Check for species present in the work area using one of the following tools:
 - [Lakes and aquatic invasive species mapping tool](#)
 - [Lakes, Rivers and Wetlands with Aquatic Invasives](#)
4. Select the best [disinfection method for species present](#)

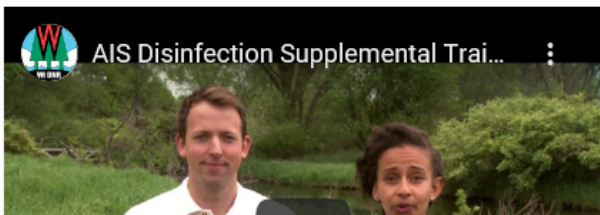
Council

AIS Efforts

Publications

For more information, contact:

[DNR invasive species staff](#)





dnr.wi.gov search "disinfection"

BOAT, GEAR AND EQUIPMENT DECONTAMINATION AND

Invasive Species

1. [Manual Code #9183.1 \[PDF\]](#)
2. [Full BMPs for boat, gear and equipment decontamination \[PDF\]](#)
3. [Check](#) for species present in work area using one of the following tools:
 - [Lakes and aquatic invasive species mapping tool](#)
 - [Lakes, Rivers and Wetlands with Aquatic Invasives](#)
4. Select best [disinfection method for species present](#)

1. [Manual Code #9183.1 \[PDF\]](#)
2. [Full BMPs for boat, gear and equipment decontamination \[PDF\]](#)
3. Check for species present in work area using one of the following tools:
 - [Lakes and aquatic invasive species mapping tool](#)
 - [Lakes, Rivers and Wetlands with Aquatic Invasives](#)
4. Select the best [disinfection method for species present](#)

1. Review the Manual Code

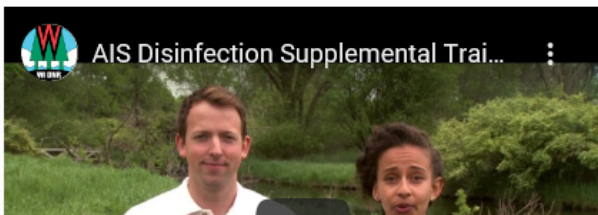
Council

AIS Efforts

ons

For more information, contact:


[DNR invasive species staff](#)





Manual Code

- Scope
- Policy
- Definitions
- Procedure
 - Decontamination & disinfection steps
 - Safety
 - Special instructions
 - Disinfectant sources
 - More information

State of Wisconsin Department of Natural Resources Manual Code # 9183.1 Boat, Gear, and Equipment Decontamination and Disinfection Protocol	
 Ed Eberle, Assistant Deputy Secretary	<u>06/16/2016</u> Date
Rescinds and replaces: 9183.1 Date 04-10-2015	Approved by OMT: 04-10-2015

I. SCOPE

This manual code applies to all Department of Natural Resources employees moving boats, gear, and equipment between waterbodies and/or crossing a barrier while moving from downstream to upstream on the same waterbody or a connected waterbody, whether or not the presence of aquatic invasive species is known. This manual code outlines the minimum requirements to be followed by employees, and does not preclude employees from taking additional actions.

Employees will require any agents or service providers through the specific contract or agreement conferring that agency status or engaging that service provision to follow this manual code. Compliance with this manual code may be considered reasonable precautions as defined by s. NR 40.02(44), Wis. Adm. Code. Manual Code 9183.1 was developed in 2007 to provide department employees boat and gear disinfection guidelines. Based on new research and discoveries, Manual Code 9183.1 was amended in 2015 to improve the department decontamination/disinfection policy. This manual code will be effective on June 16, 2016.

Employees are advised to include this manual code and associated BMP's requirements in applicable permits where allowed by the underlying regulatory authority or agreed to with the permittee. Each permitting program is subject to its own statutory and code standards that must be assessed when considering decontamination/disinfection requirements.

II. POLICY

It is the department's policy to follow proper protocol for decontamination/disinfection to ensure that employees are minimizing or eliminating the risk of spreading aquatic invasive species and/or pathogens through work activities, and to comply with ch. NR 40, Wis. Adm. Code, s. NR19.055, Wis. Adm. Code, and ch. 23, Wis. Stats.



BOAT, GEAR AND EQUIPMENT DECONTAMINATION AND

Invasive Species

1. [Manual Code #9183.1 \[PDF\]](#)
2. [Full BMPs for boat, gear and equipment decontamination \[PDF\]](#)
3. [Check](#) for species present in work area using one of the following tools:
 - [Lakes and aquatic invasive species mapping tool](#)
 - [Lakes, Rivers and Wetlands with Aquatic Invasives](#)
4. Select best [disinfection method for species present](#)

1. [Manual Code #9183.1 \[PDF\]](#)
2. [Full BMPs for boat, gear and equipment decontamination \[PDF\]](#)

Council

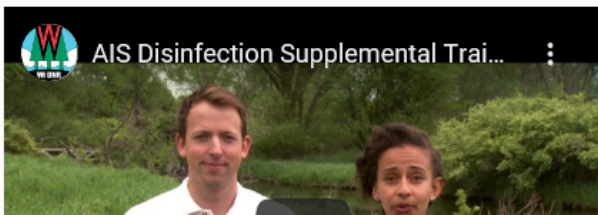
AIS Efforts

2. Review the Best Management Practices

4. Select the best [disinfection method for species present](#)

For more information, contact:

[DNR invasive species staff](#)



Best Management Practices for Boat, Gear and Equipment Decontamination

January 2020

Contents

- INTRODUCTION 2
- GENERAL PRACTICES 2
- DISINFECTANT SPECIFIC PRACTICES 3
- GEAR SPECIFIC PRACTICES 7
- ACKNOWLEDGEMENTS 11
- APPENDIX: LITERATURE REVIEW ON EFFICACY OF DISINFECTION METHODS BY SPECIES 12
 - Table 1 Efficacy of treatment methods for macrophytes and algae 12
 - Table 2 Efficacy of treatment methods for invertebrates. 13
 - Table 3 Efficacy of treatment methods for viruses and diseases. 14
- REFERENCES 15

Best Management Practices for Boat, Gear and Equipment Decontamination

January 2020

Contents

INTRODUCTION	2
GENERAL PRACTICES	2
DISINFECTANT SPECIFIC PRACTICES	3
GEAR SPECIFIC PRACTICES.....	7
ACKNOWLEDGEMENTS	11
APPENDIX: LITERATURE REVIEW ON EFFICACY OF DISINFECTION METHODS BY SPECIES	12
Table 1 Efficacy of treatment methods for macrophytes and algae.....	12
Table 2 Efficacy of treatment methods for invertebrates.	13
Table 3 Efficacy of treatment methods for viruses and diseases.	14
REFERENCES	15



Best Management Practices

dnr.wi.gov search "disinfection"

- General

General practices

Before During After

Before

- Be aware of infestations in your management area. The "[Where to find aquatic invasive species records \[pdf\]](#)" document has been created to assist in finding where species have

- Gear

Gear-specific methods

Personal gear Sampling gear Nets Boats Motors Heavy equipment

Personal gear

- To remove debris, scrub personal gear with a stiff-bristle brush and rinse with clean water

- Method

Method-specific information

While simple prevention methods, such as hand removal, can reduce the majority of AIS found on gear and equipment, additional decontamination methods are still required to get rid of any elements that may not be seen. The manual code has been developed with this in mind and gives employees a range of effective methods for disinfecting equipment, as well as the ability to choose which options are practical for specific situations. The following section will provide more detail on each disinfection option outlined in the manual code.

Steam Hot water Drying Virkon® Chlorine Freezing



General

- Before
 - Sample from least to most AIS
 - Work with landowners & use site gear
- During
 - Inspect & prevent while working
- After
 - Inspect, Remove, Drain
 - Disinfect



Gear

- Personal



Gear

- Personal
- Sampling



Gear

- Personal
- Sampling
- Nets



Gear

- Personal
- Sampling
- Nets
- Boats





Gear

- Personal
- Sampling
- Nets
- Boats
- Motors



Gear

- Personal
- Sampling
- Nets
- Boats
- Motors
- Heavy equipment





BOAT, GEAR AND EQUIPMENT DECONTAMINATION AND

Invasive Species

1. [Manual Code #9183.1 \[PDF\]](#)
2. [Full BMPs for boat, gear and equipment decontamination \[PDF\]](#)
3. **Check** for species present in work area using one of the following tools:
 - [Lakes and aquatic invasive species mapping tool](#)
 - [Lakes, Rivers and Wetlands with Aquatic Invasives](#)
4. Select best [disinfection method for species present](#)

1. [Manual Code #9183.1 \[PDF\]](#)
2. [Full BMPs for boat, gear and equipment decontamination \[PDF\]](#)
3. Check for
 - [Lakes and aquatic invasive species mapping tool](#)
 - [Lakes, Rivers and Wetlands with Aquatic Invasives](#)
4. Select the best [disinfection method for species present](#)

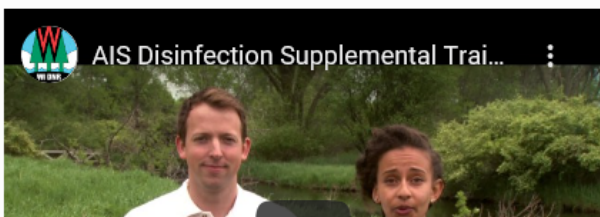
3. Check for species present

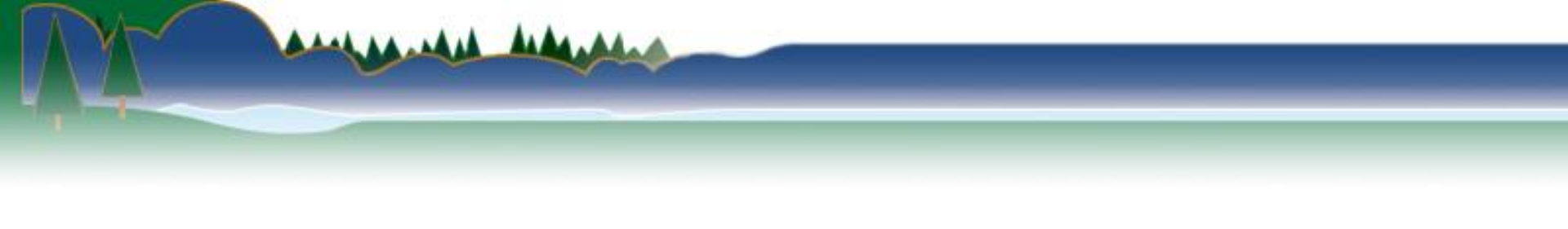
Council

MS 955-1

For more information, contact:

[DNR invasive species staff](#)





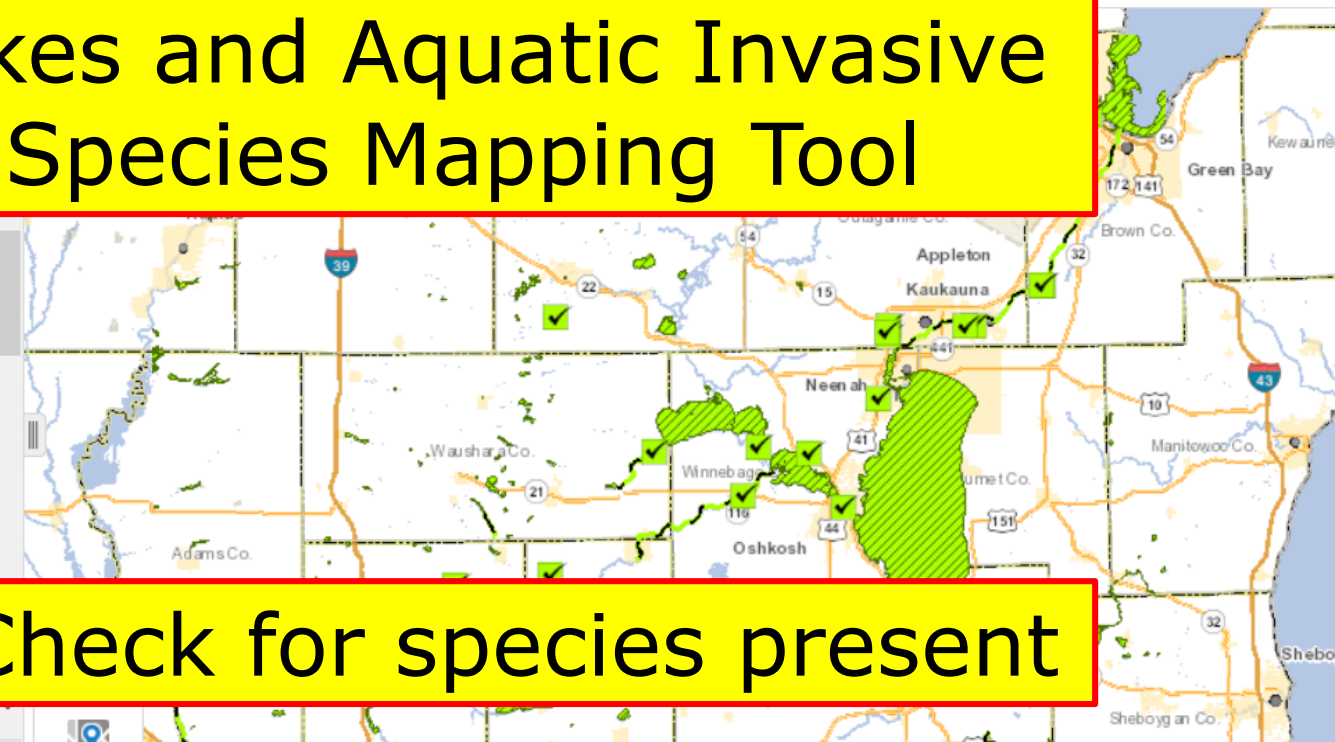
Navigation and Other Tools & Actions toolbar with icons for Show Layers, Show Legend, Pan, Zoom In, Zoom Out, Full State, Previous Extent, Bookmarks, Get Info, Print Map, and Feedback.

Lakes and Aquatic Invasive Species Mapping Tool

Layers

Filter Layers...

- Monitoring
- Education & Outreach
- Satellite Derived Water Quality
- Invasive Aquatic Plants
 - Brittle Waternymph (*Najas minor*)
 - Curly-Leaf Pondweed (*Potamogeton crispus*)
 - Eurasian Water-Milfoil (*Myriophyllum spicatum*)
 - Hybrid Water-Milfoil (Eurasian x



3. Check for species present



Aquatic Invasive Species

Location:

Lakes, Rivers, and Wetlands with Aquatic Invasive Species

Aquatic invasive species are a growing concern in Wisconsin. For more information, please visit the Aquatic Invasive Species Guidance. In general, species with a "no longer observed" status in Wisconsin are not currently considered to be present. However, it is important to recognize that the "no longer observed" status is not an exhaustive list of species. Some species may be present in Wisconsin but not reported. For more information, please visit the Aquatic Invasive Species Guidance. Information forms may be provided to requesters to the extent required by Wisconsin's Open Records Law [ss. 19.31-19.39, Wis. Stats.].

IS Status
h the
he "no longer
exhaustive so
e Aquatic
tion forms may

[To Excel](#)

< First < Prev Page 1 of 99 Next > Last >

Waterbody Name	Waterbody ID Code (WBIC)	Invasive Species
----------------	--------------------------	------------------

Adams County (28)

Arkdale Lake	1374300	Chinese Mystery Snail, Curly-Leaf Pondweed, Eurasian Water-Milfoil, Purple Loosestrife, Rusty Crayfish, Water Hyacinth
--------------	---------	--

3. Check for species present

Big Roche A Cri Cree		Mussel
----------------------	--	--------

Big Roche a Cri	1374800	Chinese Mystery Snail, Curly-Leaf Pondweed, Eurasian Water-
-----------------	---------	---

Report new AIS

- Collect photos
- Enter in SWIMS
- Report to DNR
- Verify & create record

REPORT INVASIVE SPECIES

We are working to keep invasive species out of Wisconsin. Early to respond rapidly and control invasives before they spread into below to report invasive species you have found.

Aquatic, Shoreline and Wetland

Terrestrial

NR40 species

AQUATIC, SHORELINE AND WETLAND

Check to see if the suspected invasive species has been previously reported on this waterbody or wetland. Search [waterbody](#) or [species](#) lists or refer to [AIS mapping tool and instructions \[PDF\]](#) for more search options. If the invasive species is not known to occur in the waterbody or wetland where you found it, report it to your [Regional DNR Aquatic Invasive Species Coordinator](#) by following the steps below. Report every suspected wetland invasive species not associated with a waterbody, except reed canary grass (unless the latter is a new, small stand adjacent to a un-infested, natural wetland).

REPORTING INSTRUCTIONS

▼ New invasive plant population

Species - Regional Coordinator



County	Coordinator	Phone	Email
Adams
Ashland
Barron
Bay
Beech
Berkshire
Boscawen
Brown
Buffalo
Calumet
Chippewa
Columbia
Dane
Dodge
Douglas
Dunn
Eau Claire
Franklin
Fond Du Lac
Fox
Grant
Green
Green Lake
Iowa
Jackson
Jensen
Jefferson
Juneau
Kewaunee
Koshong
Lafayette
Lancaster
Lincoln
Manitowish
Manitowishine
Marathon
Marquette
Menomonie
Monroe
Monroeville
Neenah
Neshota
Nichols
North
Northumberland
Oconto
Oconto County
Oneida
Outagamie
Ozaukee
Pierce
Plymouth
Port Washington
Price
Racine
Rock
Rock County
Shawano
Sheboygan
Shushong
St. Croix
St. Francis
St. Joseph
St. Louis
St. Vrain
Steuben
Taylor
Trempealeau
Town
Union
Waushara
Winchester
Wisconsin

dnr.wisconsin.gov/topic/Invasives/report.html

SWIMS

Surface Water Integrated Monitoring System

Wisconsin Department of Natural Resources

Surface Water Integrated Monitoring System (SWIMS)

Welcome to SWIMS

The Surface Water Integrated Monitoring System (SWIMS) is a water data system designed to ensure that staff and management have access to high quality surface water, sediment and aquatic invasives data in an accessible format.

For more information or to obtain access, please contact the SWIMS Help Team.

[SWIMS Intranet Homepage](#)
(DNR staff)



Enter your User ID and Password to sign in

User ID

Password

DNR Staff:

Log in with your Oracle ID and Password

Volunteers and Others:

Our log-in screen has changed. Log in with your Wisconsin User ID and Password above.



[Forgot your password?](#)

[Get a Wisconsin User ID and Password](#)



The Official Internet site for the Wisconsin Department of Natural Resources
101 S. Webster Street . PO Box 7921 . Madison, Wisconsin 53707-7921 . 608.266.2621



BOAT, GEAR AND EQUIPMENT DECONTAMINATION AND

Invasive Species

1. [Manual Code #9183.1 \[PDF\]](#)
2. [Full BMPs for boat, gear and equipment decontamination \[PDF\]](#)
3. [Check](#) for species present in work area using one of the following tools:
 - [Lakes and aquatic invasive species mapping tool](#)
 - [Lakes, Rivers and Wetlands with Aquatic Invasives](#)
4. Select best [disinfection method for species present](#)

1. [Manual Code #9183.1 \[PDF\]](#)
2. [Full BMPs for boat, gear and equipment decontamination \[PDF\]](#)

Council

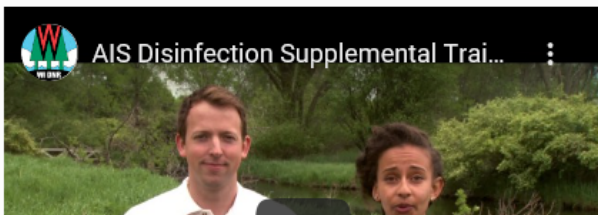
AIS Efforts

4. Select best disinfection for species

4. Select the best [disinfection method for species present](#)

For more information, contact:

[DNR invasive species staff](#)





Literature Review

- >80 scientific publications

Virucidal Activity of Two Iodophors to Salmonid Virus

DONALD F. AMEND AND JOHN P. PIETSCH

U.S. Bureau of Sport Fisheries and Wildlife
Western Fish Disease Laboratory, Seattle, Wash. 98115, USA

AMEND, D. F., AND J. P. PIETSCH. 1972. Virucidal activity of two iodophors to salmonid viruses. *J. Fish. Res. Bd. Canada* 29: 61–65.

North American Journal of Aquaculture 64:220–223, 2002
© Copyright by the American Fisheries Society 2002

Field Testing of Protocols to Prevent the Spread of Zebra Mussels *Dreissena polymorpha* during Fish Hatchery and Aquaculture Activities

WILLIAM J. EDWARDS,* LISA BABCOCK-JACKSON,¹ AND DAVID A. CULVER
*The Ohio State University,
Department of Evolution, Ecology, and Evolutionary Biology.*

Tolerance of the Asiatic Clam *Corbicula* spp. to Levels of Toxic Stressors—A Review

Francis G. Doherty

American Fisheries Society Symposium 29:217–225, 2002
© 2002 by the American Fisheries Society

Whirling Disease Prevention, Control, and Management: A Review

ERIC J. WAGNER
Fisheries Experiment Station, 1465 West 200 North, Logan, Utah 84321, USA
ewagner@erdc.usgs.gov

Viability of Aquatic Plant Fragments following Desiccation

Matthew A. Barnes, Christopher L. Jerde, Doug Keller, W. Lindsay Chadderton, Jennifer G. Howeth, and David M. Lodge*

Survival of the exotic Chinese mystery snail (*Cipangopaludina chinensis malleata*) during air exposure and implications for overland dispersal by boats

Application of Household Disinfectants to Control New Zealand Mudsnails

GEORGE J. SCHISLER AND NICOLE K. M. VIEIRA*
Colorado Division of Wildlife, Aquatic Research Unit.

Hydrobiologia (2011) 675:167–174
DOI 10.1007/s10750-011-0814-1

PRIMARY RESEARCH PAPER

Effects of desiccation on two life stages of an invasive snail and its native cohabitant

Allison M. Wood · Cody R. Haro · Roger J. Haro · Gregory J. Sandland

[Management Brief]

Aquatic Botany, 35 (1989) 167–180

Elsevier Science Publishers B.V., Amsterdam — Printed in The Netherlands

SEED DISPERSAL OF THREE NYMPHAEID MACROPHYTES

Limnol. Oceanogr., 58(6), 2013, 2171–2184
© 2013, by the Association for the Sciences of Limnology and Oceanography, Inc.
doi:10.4319/lo.2013.58.6.2171

Effects of chemical and physical conditions on hatching success of *Bythotrephes longimanus* resting eggs

Donn K. Branstrator,* Lyle J. Shannon, Meghan E. Brown,^a and Marte T. Kitson^b
Department of Biology, University of Minnesota Duluth, Duluth, Minnesota

Table 2 Efficacy of treatment methods for invertebrates.

AIS	Steam Cleaning (212°F)	Hot Water (140°F)	Drying (5 days)	Chlorine (500 ppm, 10 min)	Virkon (2:100 solution, 20 min)	Freezing (26°F†)
Faucet Snail	✓ 18*	✓ 18*	✗ 35	✗ 18	Ⓡ	Ⓡ
New Zealand mud snail	✓ 4, 65*	✓ 4, 65*	✓ 6*, 66*	✗ 76*	✓ 9, 10*, 74, 76, 83	✓ 4, 6*
Quagga Mussel (Adults)	✓ 7*, 16*	✓ 7*, 16*	✓ 14*	Ⓡ	✓ 9	Ⓡ
Quagga Mussel (Veligers)	✓ 4, 17, 80*	✓ 4, 17	✓ 69*	Ⓡ	✓ 9	Ⓡ
Zebra Mussel (Adult)	✓ 7*, 8*, 25	✓ 7*, 8*, 25	✓ 14*, 25*, 27	✓ 22*	Ⓡ	✓ 25, 27
Zebra Mussel (Veligers)	✓ 4, 80*	✓ 4	Ⓡ	✓ 22*, 25	Ⓡ	Ⓡ
Asian Clam	✓ 4, 37, 78	✓ 4, 37	✗ 4	✗ 37*, 38*	Ⓡ	Ⓡ
Spiny Water Flea (Adult)	✓ 7*, 47*, 80*	✓ 7*, 47*	Ⓡ	✓ 76, 83	✓ 76, 83	✓ 76, 83
Spiny Water Flea (Resting Eggs)	✓ 2*, 80*	✓ 2*	✓ 2*, 4	✗ 2	Ⓡ	✗ 2*
Bloody Red Shrimp	Ⓡ	✓ 83*	✓ 83*	✓ 83*	✓ 83*	Ⓡ
Rusty Crayfish	✓ †	✓ †	Ⓡ	Ⓡ	Ⓡ	Ⓡ

*Additional details:

†Based on the understanding that these organisms are regularly steamed and boiled for consumption

‡Frozen in water, not just in air; Hot water: 50°C (122°F) for >5 min (or 1 min at >50°C); Drying: ≥ 6 hr @ 17°C (63°F)

Table 2 Efficacy of treatment methods for invertebrates.

AIS	Steam Cleaning (212°F)	Hot Water (140°F)	Drying (5 days)	Chlorine (500 ppm, 10 min)	Virkon (2:100 solution, 20 min)	Freezing (26°F†)
Faucet Snail	✓ 18*	✓ 18*	✗ 35	✗ 18	Ⓡ	Ⓡ
New Zealand mud snail	✓ 4, 65*	✓ 4, 65*	✓ 6*, 66*	✗ 76*	✓ 9, 10*, 74, 76, 83	✓ 4, 6*
Quagga (A)	<ul style="list-style-type: none"> • Green "✓" = effective • Red "✗" = not effective • Blue "Ⓡ" = research needed 					
Quagga (Ve)						
Zebra (A)						
Zebra Mussel (Veligers)	✓ 4, 80*	✓ 4	Ⓡ	✓ 22*, 25	Ⓡ	Ⓡ
Asian Clam	✓ 4, 37, 78	✓ 4, 37	✗ 4	✗ 37*, 38*	Ⓡ	Ⓡ
Spiny Water Flea (Adult)	✓ 7*, 47*, 80*	✓ 7*, 47*	Ⓡ	✓ 76, 83	✓ 76, 83	✓ 76, 83
Spiny Water Flea (Resting Eggs)	✓ 2*, 80*	✓ 2*	✓ 2*, 4	✗ 2	Ⓡ	✗ 2*
Bloody Red Shrimp	Ⓡ	✓ 83*	✓ 83*	✓ 83*	✓ 83*	Ⓡ
Rusty Crayfish	✓ †	✓ †	Ⓡ	Ⓡ	Ⓡ	Ⓡ

*Additional details:

†Based on the understanding that these organisms are regularly steamed and boiled for consumption

‡Frozen in water, not just in air; Hot water: 50°C (122°F) for >5 min (or 1 min at >50°C); Drying: ≥ 6 hr @ 17°C (63°F)

Table 2 Efficacy of treatment methods for invertebrates.

AIS	Steam Cleaning (212°F)	Hot Water (140°F)	Drying (5 days)	Chlorine (500 ppm, 10 min)	Virkon (2:100 solution, 20 min)	Freezing (26°F†)
Faucet Snail	✓ 18*	✓ 18*	✗ 35	✗ 18	Ⓡ	Ⓡ
New Zealand mud snail	✓ 4, 65*	✓ 4, 65*	✓ 6*, 66*	✗ 76*	✓ 9, 10*, 74, 76, 83	✓ 4, 6*
Quagga Mussel (Adults)						Ⓡ
Quagga Mussel (Veligers)						Ⓡ
Zebra Mussel (Adult)						✓ 25, 27
Zebra Mussel (Veligers)	✓ 4, 80*	✓ 4	Ⓡ	✓ 22*, 25	Ⓡ	Ⓡ
Asian Clam	✓ 4, 37, 78	✓ 4, 37	✗ 4	✗ 37*, 38*	Ⓡ	Ⓡ
Spiny Water Flea (Adult)	✓ 7*, 47*, 80*	✓ 7*, 47*	Ⓡ	✓ 76, 83	✓ 76, 83	✓ 76, 83
Spiny Water Flea (Resting Eggs)	✓ 2*, 80*	✓ 2*	✓ 2*, 4	✗ 2	Ⓡ	✗ 2*
Bloody Red Shrimp	Ⓡ	✓ 83*	✓ 83*	✓ 83*	✓ 83*	Ⓡ
Rusty Crayfish	✓ †	✓ †	Ⓡ	Ⓡ	Ⓡ	Ⓡ

Superscripts reference citation used

*Additional details:

†Based on the understanding that these organisms are regularly steamed and boiled for consumption

‡Frozen in water, not just in air; Hot water: 50°C (122°F) for >5 min (or 1 min at >50°C); Drying: ≥ 6 hr @ 17°C (63°F)

Table 2 Efficacy of treatment methods for invertebrates.

AIS	Steam Cleaning (212°F)	Hot Water (140°F)	Drying (5 days)	Chlorine (500 ppm, 10 min)	Virkon (2:100 solution, 20 min)	Freezing (26°F†)
Faucet Snail	✓ 18*	✓ 18*	⊗ 35	⊗ 18	Ⓡ	Ⓡ
New Zealand mud snail	✓ 4, 65*	✓ 4, 65*	✓ 6*, 66*	⊗ 76*	✓ 9, 10*, 74, 76, 83	✓ 4, 6*
Quagga Mussel (Adults)	✓ 7*, 16*	✓ 7*, 16*	✓ 14*	Ⓡ	✓ 9	Ⓡ
Quagga Mussel (Veligers)	✓ 4, 17, 80*	✓ 4, 17	✓ 69*	Ⓡ	✓ 9	Ⓡ
Zebra Mussel (Adult)	✓ 7*, 8*, 25	✓ 7*, 8*, 25	✓ 14*, 25*, 27	✓ 22*	Ⓡ	✓ 25, 27
Zebra Mussel (Veligers)	✓ 4, 80*	✓ 4	Ⓡ	✓ 22*, 25	Ⓡ	Ⓡ
Flea (Adult)	80*	✓ 7*, 17*	Ⓡ	✓ 76, 83	✓ 76, 83	✓ 76, 83
Spiny Water Flea (Resting Eggs)	✓ 2*, 80*	✓ 2*	✓ 2*, 4	⊗ 2	Ⓡ	⊗ 2*
Bloody Red Shrimp	Ⓡ	✓ 83*	✓ 83*	✓ 83*	✓ 83*	Ⓡ
Rusty Crayfish	✓ †	✓ †	Ⓡ	Ⓡ	Ⓡ	Ⓡ




Footnotes provide additional details

Additional details:

†Based on the understanding that these organisms are regularly steamed and boiled for consumption

‡Frozen in water, not just in air; Hot water: 50°C (122°F) for >5 min (or 1 min at >50°C); Drying: ≥ 6 hr @ 17°C (63°F)

Table 2 Efficacy of treatment methods for invertebrates.

AIS	Steam Cleaning (212°F)	Hot Water (140°F)	Drying (5 days)	Chlorine (500 ppm, 10 min)	Virkon (2:100 solution, 20 min)	Freezing (26°F†)
Faucet Snail	✓ 18*	✓ 18*	✗ 35	✗ 18	Ⓡ	Ⓡ
New Zealand mud snail	 ✓ 4, 65*	✓ 4, 65*	 ✗ 76*	✗ 76*	✓ 76, 83*	✗ 76, 83*
Quagga Mussel (Adults)	 ✓ 7*, 16*	✓ 7*, 16*	 Ⓡ	Ⓡ	✓ 76, 83*	✗ 76, 83*
Quagga Mussel (Veliger)	 ✓ 4, 17	✓ 4, 17	 Ⓡ	Ⓡ	✓ 76, 83*	✗ 76, 83*
Zebra Mussel (Adult)	 ✓ 7*, 8*, 25	✓ 7*, 8*, 25	 Ⓡ	✓ 22*	Ⓡ	27
Zebra Mussel (Veliger)	✓ 4, 80*	✓ 4	Ⓡ	✓ 22*, 25	Ⓡ	Ⓡ
Flea (Adult)	80*	✓ 7, 5, 17	Ⓡ	✓ 76, 83*	✓ 76, 83*	✓ 76, 83*
Spiny Water Flea (Resting Eggs)	✓ 2* 80*	✓ 2*	✓ 2* 4	✗ 2	Ⓡ	✗ 2*
Bloody Red Shrimp	Ⓡ	✓ 83*	✓ 83*	✓ 83*	✓ 83*	Ⓡ
Rusty Crayfish	✓ †	✓ †	Ⓡ	Ⓡ	Ⓡ	Ⓡ

Footnotes provide additional details

*Additional details:

†Based on the understanding that these organisms are regularly steamed and boiled for consumption

‡Frozen in water, not just in air; Hot water: 50°C (122°F) for >5 min (or 1 min at >50°C); Drying: ≥ 6 hr @ 17°C (63°F)

Table 2 Efficacy of treatment methods for invertebrates

	Steam	Hot Water (F, ≤10 min)	Drying (5 days)	Chlorine (500 ppm, ≤10 min)	Virkon (2:100 solution, ≤20 min)	Freezing (26°F, ≤24hrs)
			⊗ 18,35	⊗ 18	Ⓡ 18	☑
			☑ 6*,66*	⊗ 21, 78*	☑ 10*, 76, 77	☑ 4,6*
		6*	☑ 14*,67	☑	☑ 9	☑
			☑ 69*, 79*	☑	☑ 9	☑
		,5,4,67	☑ 14,25*,67	☑ 11,19,22	Ⓡ	☑ 25,27,67,68
			Ⓡ	☑	Ⓡ	☑
		41,42,4	⊗ 4,44*,45	⊗ 36*,37*,38 *,39*,40	☑ 23	☑ 46*
		7*	☑ 4	☑ 78	☑ 78	☑ 78
			☑ 2*	⊗ 2, 78*	☑ 78	☑ 2*
			Ⓡ	Ⓡ	Ⓡ	Ⓡ
Rusty Crayfish	?	?	?	?	?	?

Drying, chlorine, & Virkon must be used with another method if resistant species are present

*Additional details:

² Frozen in water, not just in air; Hot water: 50°C (122°F) for >5 min (or 1 min at >50°C); Drying: ≥ 6 hr @ 17°C (63°F)

⁶ Drying: Must ensure hot and dry environment (>84°F for 24hrs; >104°F (40°C) for >2 hours); Freezing: < 27°F (



Literature Review

- Summarized reference

REFERENCES

1. Root, S., and C. M. O'Reilly. 2012. Didymo control: increasing the effectiveness of decontamination strategies and reducing spread. *Fisheries* 37(10):440-448.

Tested the effectiveness of liquid dish detergent, bleach, Virkon, and salt in killing Didymosphenia geminata. Study found that longer submersion times did not significantly increase mortality and that a one-minute submersion time would be sufficient for all treatments. Exact mortality rates are not listed for each treatment, however, a graph included in the paper shows the effectiveness for 1% Virkon solution at around 80% and the effectiveness for 2% bleach around 95%.

2. Branstrator, D. K., L. J. Shannon, M. E. Brown, and M. T. Kitson. 2013. Effects of chemical and physical conditions on hatching success of *Bythotrephes longimanus* resting eggs. *Limnology and Oceanography* 58(6):2171-2184.

Frozen in water, not just in air; Hot water: 50°C (122°F) for >5 min (or 1 min at >50°C); Drying: ≥ 6 hr @ 17°C (63°F). Chlorine solutions of 3400 mg L⁻¹ had no impact on hatching success when exposed for up to 5min.

3. Bruckerhoff, L., J. Havel, and S. Knight. 2013. *Survival of Invasive Aquatic Plants After Air Exposure and Implication for Dispersal by Recreation Boats*. Unpublished data.

Studied the impacts of drying on the viability of Eurasian watermilfoil and curly-leaf pondweeds. For Eurasian watermilfoil, single stems were viable for up to 24hrs while coiled strands were viable for up to 72hrs. For curly leaf pondweed, single stems were viable for 18hrs, and turions were still viable after 28 days of drying.

Decontaminate

- Inspect
- Remove
- Drain





Disinfect

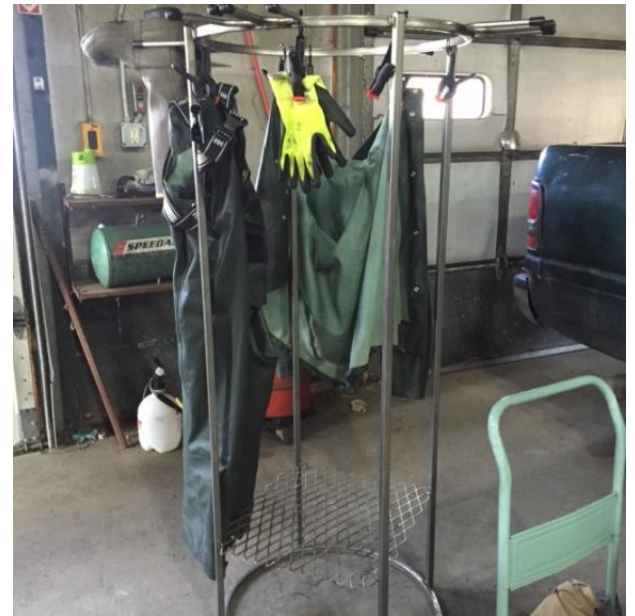
- Pick one of 4 options:
 - Dry five days
 - Hot water $\geq 140^{\circ}\text{F}$
 - 500 ppm chlorine
 - 2% Virkon Aquatic

Dry 5 Days

- Remove sediments first
- Soap and water or pressure wash, then store for 5 days
- Safety
 - No PPE required



Dry 5 Days



Hot Water > 140°F

- Remove organic debris
- ≥ 140 ° F
(car washes are not hot enough)
- Safety
 - Heat resistant gloves & clothing



Hot Water > 140°F





Chlorine Solution

- Consider shelf life (24 hours!)
- 500 ppm solution ~2.5 Tbsp/gal
- Check label concentration
- Soak 10 min
- Neutralize bleach if discharging to surface water
- Rinse with tap water
- Safety:
 - Emergency eyewash station, eye protection, and nitrile gloves
 - Stay upwind of spray

Sodium hypochlorite concentration (%)	Ounces chlorine solution per gallon water	Tbsp. chlorine solution per gallon water
5.0	1.28	2.56
5.25	1.22	2.44
8.25	0.78	1.55

Chlorine Solution



Virkon Aquatic

- Consider shelf life
- 2:100 solution ~5.4 Tbsp/gal
- Soak 20 min
- Safety:
 - Emergency eyewash station, eye protection, and nitrile gloves
 - Splash goggles and/or face shield
 - Respirators advised
 - Stay upwind of spray



Virkon Aquatic



Disinfect Everything!

- Make sure to disinfect waders/sandals/boots used for early spring launching, or work in wetlands or streams. ANYTHING THAT GOT WET!





Where is Decontamination Required?

- Lakes, ponds, streams, or wetlands.
- Applies to gear, machinery, footwear, everything that could pick up a seed, plant fragment, or a disease organism



When is Manual Code Level Disinfection Required?

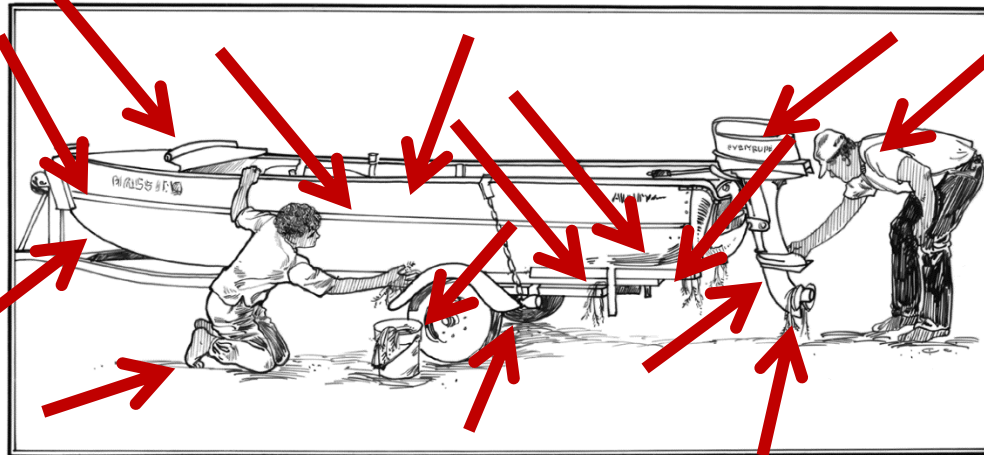
- Minimally, everyone must inspect, remove, and drain.
- If you're working under DNR grants or permits, you must ALSO disinfect per the Manual Code.



Support

- Regional DNR AIS Coordinator
- Prevention for general public
- Manual Code
- Best Management Practices
- Where to find AIS
- Species specific table
- Training video
- PowerPoint
- Question and Answer document

Questions?



Remember, we are the stewards – always disinfect!

