AIS SENTRY FIELD GUIDE

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

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Lake County Soil & Water Conservation District (SWCD)
with special focus on species and locations in
Lake County, North St. Louis County, and Cook County.

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Format of manual adapted from Minnehaha Creek Watershed District (MCWD)

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AIS SENTRY FIELD GUIDE

Public outreach campaigns from Minnesota SeaGrant and the Minnesota DNR, in addition to statewide requirements for watercraft cleaning and inspections, have led to a high degree of public awareness about AIS. However, it is difficult to reach every user of Minnesota's valuable lakes and mistakes and/or oversights still occur. There is still a need for public education and monitoring of inland water bodies in the Lake Superior and Rainy River basins to prevent the spread of AIS.

Lake County SWCD aims to narrow this gap by training and cultivating a network of citizen monitors. The AIS Sentry Guide is intended to be a resource to educate and empower community members to recognize and report suspicious sightings from across Northeastern Minnesota to prevent & limit the spread of AIS in our waters. Early detection of new incidents of AIS is critical to successful management. By catching new populations before they have had a chance to establish and spread into other parts of a water body, the chances of eradication are much higher, reducing or eliminating the impact on the ecosystem. The larger the established population of AIS, the more difficult and expensive it will be to manage long-term. This guide is best used as a supplement to in-person, hands-on training. For training opportunities near you, visit lakecountyswcd.org to learn about upcoming events, or contact our office to request more information.

When utilized over an extended period of time, this guide can assist concerned citizens in not only in spotting AIS, but also in noting more subtle changes to their favorite bodies of water. Changes in water quality such as increased algae blooms, changes in turbidity (how clear or cloudy the water is), or decreases in plant community diversity can all be signs that something is impacting the ecosystem. These disruptions of the ecosystem can make a water body more vulnerable to AIS.

Your help monitoring local waterbodies is key to mitigating the impact of AIS on Northeastern Minnesota.

Tips for being an effective AIS sentry

1. Get to know your sampling location well so you can recognize when something is not normal.
2. Complete at least **one monitoring session per month** during the season (fishing opener - ice in)
3. Respect DNR regulations regading invasive species.
4. Report suspected AIS to your Lake Association leader or local SWCD office as soon as possible and assist with any follow up required.
5. Observe best practices to prevent the spread of AIS, including to **"clean, drain, and dry"** watercraft.
6. To always keep personal safety a top priority. Always wear a personal flotation device and remain aware of other traffic while out monitoring. Check the forecast before heading out to avoid potentially unsafe weather conditions, and be sure to let someone know where you're going if heading out on the water alone.

What are your goals as an AIS sentry:

- Learn about new plants and animals?
- Protect your favorite fishing spot?
- Prevent AIS from establishing at your family cabin?
- Get involved in citizen science?

DEFINING AIS

For an organism to be considered an aquatic invasive species (AIS), it must meet a number of critera. First, organisms must live primarily in the water. They must also be a non-native species, or one not found in a particular area prior to being introduced either through human or natural activity. However, not all non-native species are considered invasive! Some non-native species do establish populations without being deemed invasive, such as the ring-necked pheasant. So, what makes an introduced species invasive rather than simply non-native?

The major difference between a non-native species and an invasive one is the impact on the ecosystem. Many non-native spcies fail to thrive in new environments or may encounter a predatory species in that ecosytem which keeps the non-native population in check, making their overall impact on the ecosystem little to none. In contrast, invasive species cause substantial changes to the ecosystems they are introduced to. Often, a species is deemed invasive because the ecosystem changes it causes lead to economic harm (such as vessels and infastructure damaged by zebra mussels), environmental damage (such as the numerous wetland habitat areas completely overrun by a single species of plant as has happened with non-native phragmites in other parts of the Great Lakes), or even threaten human health (such as toxic algal blooms, also known as red tides).

Invasive speces are often able to create significant changes in the ecosystems they colonize because of a number of factors common to them: they often reproduce at a pace that outmatches native species, they often lack natural predators to keep populations under control, and they can often be spread easily through the introduction of only a few individuals, or even fragments of an individual in the case of some plants. In this way, they can establish a reproducing population relatively quickly and begin outcompeting native species for resources such as food and shelter, leading to declines in native species and additional room in the ecosystem for the AIS population to grow.

In 2014, the Minnesota State Legislature allocated funding to all counties in the state of Minnesota to create and implement plans to reduce the impact of aquatic invasive species (AIS), defined under Minnesota statute 84D.019a as a non-native aquatic species that:

(1) causes or may cause economic or environmental harm or harm to human health; or
(2) threatens or may threaten natural resources or the sue of natural resources in the state

Photo: Lake Superior North Shore, Dave Hansen, UMN Extension

LAKE ECOLOGY 101

Limnology (the study of freshwater bodies of water) is a vast subject, but for the purpose of AIS surveying it is important to know the biological zones of lakes. Our goal in doing so is to help you understand where to focus your monitoring efforts. Almost all monitoring will occur along the shoreline, or in the littoral zone. The abundance of sunlight in the littoral zone promotes growth of phytoplankton, and in turn, growth of zooplankton populations. Within the littoral zone, the euphotic and benthic zones also touch. This is the zone most likely to have a combination of habitat and food sources needed for both aquatic and invasive aquatic species.

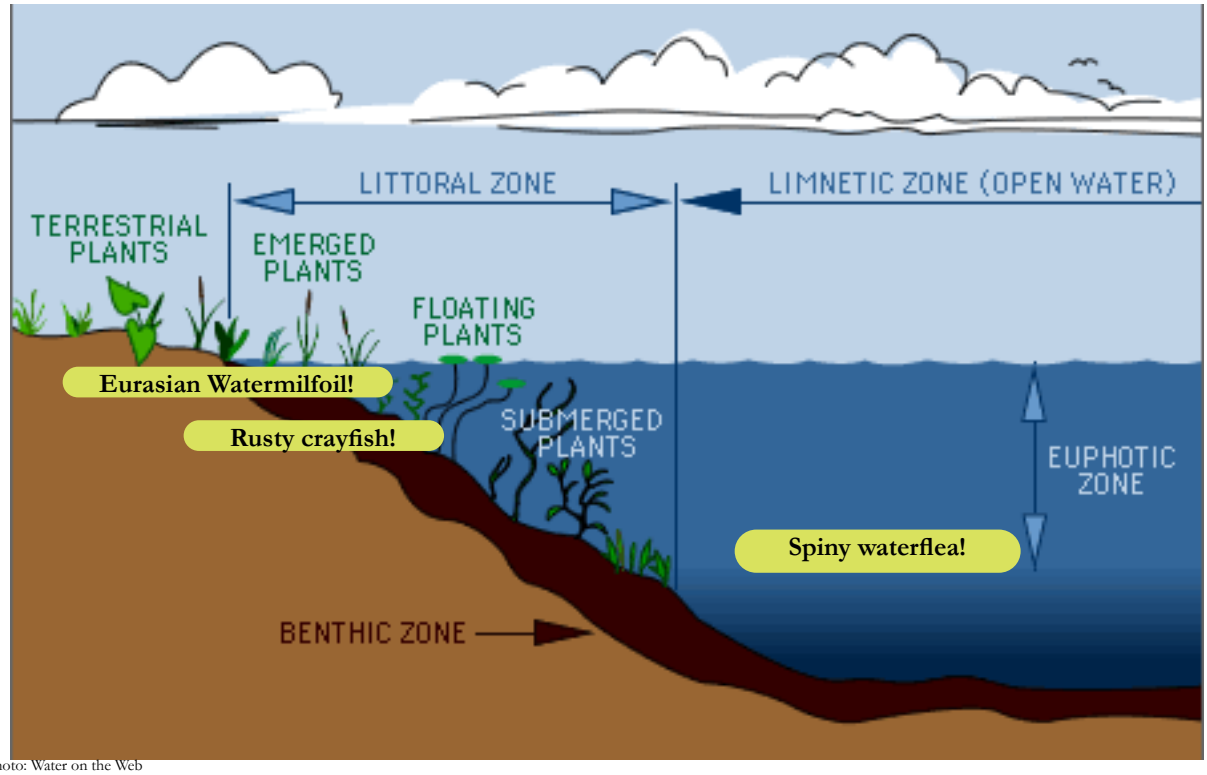


Photo: Water on the Web

Terminology

- Littoral Zone - the area where aquatic vegetation grows - the shallower portion of the lake, where sunlight can penetrate to reach the bottom with enough intensity to allow for the growth of rooted aquatic plants. The size of this zone varies for every lake because the depth to which light can reach depends on the water's turbidity (relative clarity or cloudiness)
- Limnetic Zone - the open surface water above a lake's deep water (surrounded by the littoral zone), where rooted plants cannot grow.
- Ephotic Zone - all area of the lake where enough sunlight exists for plants to grow. All of the littoral zone will exist within this zone as well as portions of the limnetic zone.
- Benthic Zone - another name for the lake bottom. The first few inches of this zone contain a variety of species, including mollusks like clams and snails, aquatic insects and their larvae, algae, bacteria, as well as roots of plants in the littoral zone.
- Plankton - a catch all term for tiny living things including bacteria, algae, and tiny invertebrates all of which float wherever the water takes them. Subgroups of plankton include zooplankton (animals) and phytoplankton (plants which synthesize their own food). Plankton can be found in all lake zones and are an important source of food for other lake inhabitants.

HOW TO PREPARE

1. Know which invasive species are already present in the lake or stream you are monitoring. A list of infested waters in the area is included as an appendix. The Minnesota DNR also keeps a list of AIS infested waters.

2. Determine a location to monitor. Hotspots for new invasive species are inlets and outlets, developed shorelines, rocky areas, and areas with frequent public use such as boat launches and fishing piers. Your own shoreline is also a great place to check.

3. If you are sampling multiple lakes, it is critical to properly clean your equipment to avoid unintentionally spreading an invasive species. Follow the rules of "Clean, Drain, Dry" – they're not just for boats! There is more information on how to properly clean your equipment in the "How to Disinfect" section.

Get curious!

8 Fun Facts about Aquatic Invasive Species (AIS)!

1. Spiny waterflea is carnivorous and sometimes eats its young!
2. Curly leaf pondweed can lead to algal blooms by causing an increase in nutrients like phosphorous after rapid & robust vegetation die-off occurs.
3. Flowering rush can grow in up to 10 feet of water!
4. Hydrilla stems can grow up to an inch per day!
5. Rusty crayfish was probably released into MN waterways as excess fishing bait.
6. New Zealand mud snails can decrease mayfly, stonefly, and caddisfly populations, altering freshwater ecosystems and resulting in impacts up the entire food chain!
7. Spiny waterflea can be in a lake at least up to 10 years before it is found: spines of spiny waterflea showed up in Lake Mendota 10 years before they were found in the water column.
8. Mystery snails were in Lake Vermilion 2-3 years before they were identified.

PREVENTION

STOP AQUATIC HITCHHIKERS!

Numerous campaigns have put forth materials to prevent the spread of AIS. Follow guidelines outlined here and visit campaign website or contact local government for more information.

Clean In Clean Out

When boating or fishing in Minnesota, protect your waters by following state aquatic invasive species laws.

1. Clean all visible aquatic plants, zebra mussels, and other prohibited species from any watercraft, trailers, and water-related equipment before leaving any water access or shoreland.
2. Drain water-related equipment (boat, ballast tanks, portable bait containers, motor) *and* drain bilge, livewell and baitwell by removing drain plugs before leaving a water access or shoreline property. Keep drain plugs out and water draining devices open while transporting watercraft.
3. Dry watercraft with a towel or for at least 5 days.
4. Dispose of unwanted bait, including minnows, leeches, and worms in the trash. It is illegal to release bait into a water body or release aquatic animals from one water body to another. If you want to keep your bait, please refill the bait container with bottled or tap water.

Habitattitude™
PROTECT OUR ENVIRONMENT
DO NOT RELEASE FISH AND AQUATIC PLANTS

Decontamination & Recommendations

- Spray, rinse, dry - Some invasive species are small and difficult to see at the access. To remove or kill them, take one or more of the following precautions before moving to another body of water, especially after leaving zebra mussel and spiny waterflea infested waters:
  - » Spray with high-pressure water
  - » Rinse with very hot water (120F for at least 2 min or 140F for at least 5 minutes)
- Run motor on personal watercraft for a few seconds to discharge water before leaving a water access
- Transport fish on ice - be prepared, bring a cooler

KNOW THE LAW: You may not...

- **Transport watercraft without removing the drain plug**
- **Arrive at a lake access with drain plug in place**
- **Transport aquatic plants, zebra mussels, or other prohibited species on any roadway**
- **Launch a watercraft with prohibited species attached**
- **Transport water from Minnesota lakes or rivers**

ASSEMBLING A MONITORING KIT

All GEAR IS OPTIONAL. Survey tools may, however, aid observation. Most survey tools can be made from common household items:

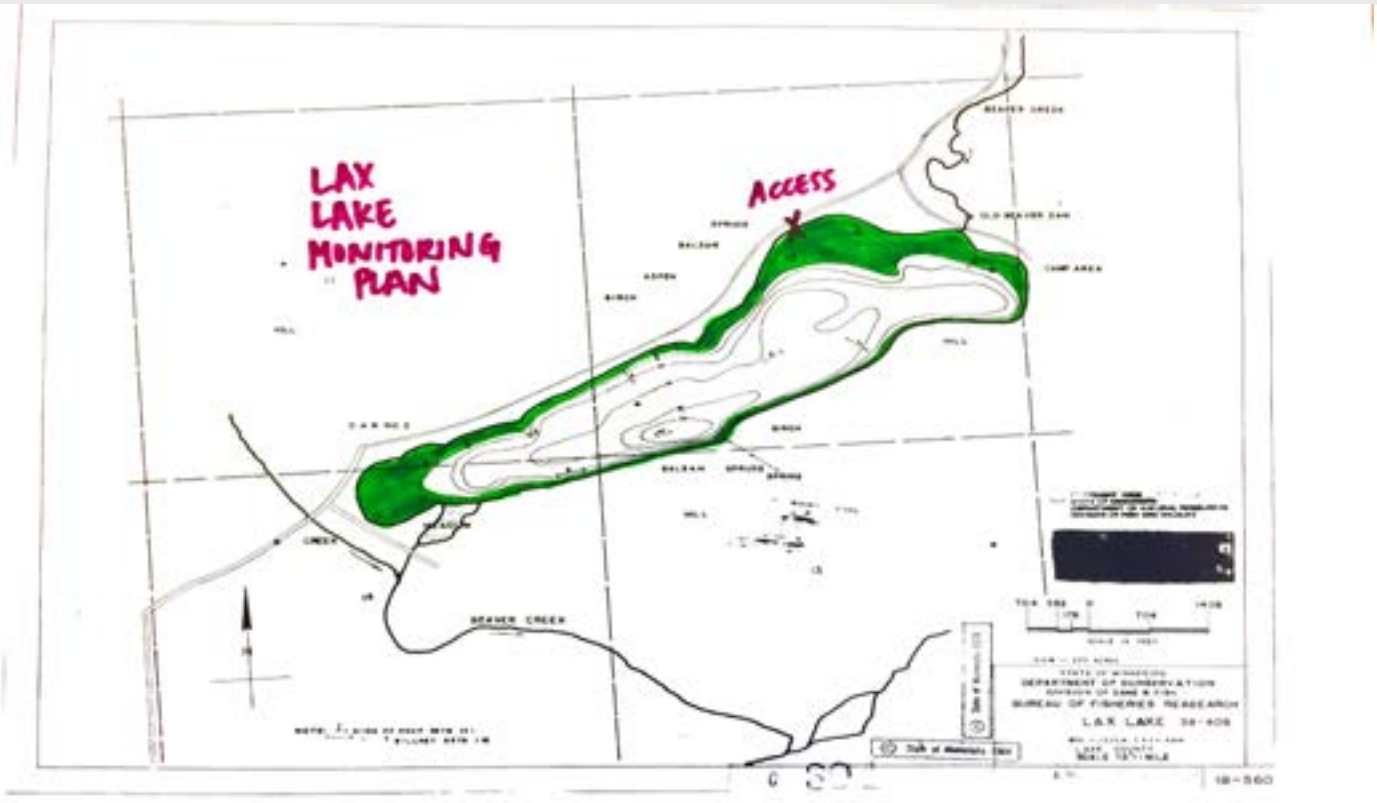
- GPS (on your smart phone - see Appendix)
- Hand scoop/strainer
- Underwater scope
- Hand lenses
- Containers for samples (such as ziploc bags)
- Bucket
- Sampling rake (can be made by fastening two rake heads together and attaching a rope, or utilize a single headed garden rake with a handle)
- Monitoring form/data sheet and clipboard
- Waders
- Pens, towels, hand sanitizer
- Polarized sunglasses for viewing underwater specimens
- Snorkel and mask
- Concrete block for zebra mussel sampling (to leave in the water)
- Boat and accompanying gear (i.e. Personal Flotation Device)
- Monafilament line and heavy weight for spiny waterflea sampling
- Plankton net (if sampling for spiny waterflea and if desired)

Photo: Citizen monitors use an underwater scope to view submerged aquatic plants. You can make your own scope by putting epoxy/acrylic on the bottom of a hollowed out bucket.

MAPPING YOUR SURVEY AREA

Creating a map of your waterbody is a way to better identify key areas to monitor for AIS. Lake depth maps are available for download for most lakes at the DNR Lakefinder website: www.dnr.state.mn.us/lakefind/index.html. State geological survey offices, USGS, Google Maps, Google Earth, etc. may have additional maps showing shorelines and wetland areas. The Avenza Maps App is a good way to download and utilize topographic maps on your smart phone. To develop a map of your lake first download a lake depth map from LakeFinder, then mark priority areas for monitoring:

1. **High risk areas** - points of public access and other areas of concentrated traffic (e.g. navigation channels) which should include the shoreline at least 100 feet to either side of the high risk zone and outward from the access until the bottom is no longer visible from the surface.
   - » Mark the public access on your map. You can find the public access, if you don't know where it is, on the "Recreation Compass" option on the left toolbar of LakeFinder (which has other cool data about your lake & surrounding area on it as well).
2. **Shoreline** - areas likely to provide suitable habitat for aquatic plants, such as shallow, sheltered coves or large stands of emergent vegetation.
3. **The entire littoral zone** (including all areas in the waterbody where sunlight reaches the bottom and rooted aquatic plants may grow).
   - » Highlight the littoral zone on your map. The littoral zone can be identified with help from the "Water Clarity" option on the left toolbar of LakeFinder. Lax Lake has a clarity averaging around 6 feet (seen in historical clarity data graph and average values underneath), so for Lax Lake highlight areas anywhere below 6 feet. Protected areas providing good plant habitat (e.g. inlets/outlets) should also be marked.
4. **Select areas that you will survey at least 1X per month.**



HOW TO SURVEY

1. **Identify a location to sample.** This could be in front of your cabin, a place designated by your lake association, or the public access at your lake/waterbody. Record GPS coordinates of the location and/or an address. Make observations about the lake habitat and weather.
2. **Shoreline** – Walk along the shoreline 100 feet in either direction of your survey location. Look for floating plant fragments, especially on the windblown side of the lake. Look for emergent plants. Look for purple flowers or any dense mats of vegetation. Scan the shoreline for snails, mussels, crayfish or other critters. Snails are hard to identify, but if you see a large number in an area, look closer as they are more likely to be invasive. Crayfish are quick, but recruit an ambitious crayfish catcher to aid in surveying. Crayfish can also be trapped overnight (more information in Appendix). Inspect any longstanding underwater structures for zebra/quagga mussels such as dock supports, submerged logs, rocks, etc. for any sign of zebra mussels.
3. **Shallow water areas** – Boat or wade around the shoreline of your lake and look for rooted plants (again, 100 feet in either direction of your survey location). Look into the water as you scan for plants or critters (easiest with polarized sunglasses). Surveying can be done with waders, rubber boots, or from a canoe or kayak. Take along a friend to aid in your exploration! Use an underwater scope or snorkel to search for submerged plants. Turn over rocks and logs to scan for snails. Use a small strainer to look in areas of the lake with a sandy or muddy bottom – scoop and strain the water and mud and place into a tub for closer examination.
4. **Deeper water areas (up to 20 feet)** – Go out in a boat (when available) and collect plants for identification. Use a rake with a long handle or rope to collect plant samples. Lower the rake to the bottom of the lake and drag the rake along the lake bed for 10-20 feet. Drag rake along designated survey area 100 feet in either direction of GPS point. Pull rake back up and remove plants; identify. Do not return any aquatic invasive species to the water, but dispose upon returning to shore as small fragments of plants can establish new colonies as they are carried along by lake currents or the wind (i.e. Curly Leaf Pondweed).
5. **You do not need to survey deeper waters than 20 feet.** AIS are hard to observe at this depth.
6. **Record the data from your survey, including both native and invasive species observed.** Data sheets for recording are in this manual (including a daily and a seasonal data sheet option), but you can also use a personal notebook if all information is included. Include quantitative measures when able (i.e. percent coverage or quantity found).

Surveying in total should not take you more than an hour after the first survey. You are primarily looking for anything odd about your water body, for something you think may be out of place.

We hope surveying helps you get to know your water body and the species present better!

1
Survey at least 1x per month

Photo: Throwing a rake to sample aquatic vegetation, Minnehaha Creek Watershed District.

SURVEYING

Zebra mussels on an uprooted plant.
Photo: Michael Missimi, Barataria-Terrebonne National Estuary Program, Bugwood.org.

While out boating: Survey the lake shore you pass by for plants (both submerged and emergent). Does anything look out of place? Snap a photo or take a closer look and identify. Really difficult to paddle or motor through? Suspect an invasive aquatic plant. If a motor or paddle pulls up aquatic plants, identify and record observations.

While out fishing: If you snag a weed, take a closer look at what you caught and identify what you can! Snap a photo to look at later or send along for further identification. Keep an eye out for spiny water-flea on fishing line.

While swimming/snorkeling: Dive for mussels and snails! Catch crayfish! Observe, record, and identify aquatic plants you find. Figure out what's living in your lake!

Nets or other sampling materials are never to be used on any other water body after being used in infested waters, unless sterilized and approved by professional staff. If you are sampling in known zebra mussel or spiny water flea infested waters, please use extra caution in separating equipment from that used in non-infested waters.

Zebra Mussels

Check for zebra/quagga mussels by hanging a sampler from the underside of your dock. The mussels will attach to almost any hard surface but a concrete block attached to a rope is an easy way to check. When checking, pull sampler out of the water and feel the surface with fingertips for small bumps. Zebra mussels can feel like sandpaper as juveniles. If sample is covered in muck, clean it off and shorten the rope so it hangs closer to the surface. Do not transfer to a different waterbody but leave in throughout the season and check occasionally for mussels.

Photo: Zebra mussels covering a motor, Steve Kynock, Michigan Sea Grant, Bugwood.org.

Spiny Waterflea

Photo: Spiny waterflea on monafilament, Darren Lilja, Lake SWCD.

To test for spiny waterflea, tow 50 yards of monofilament (equal to or less than 12 lb. test) with a heavy weight for 30 minutes at a slow pace along length of lake (i.e. kayak, canoe, or trolling motor not to exceed 3mph). The line should be weighted heavily enough at the end to nearly reach the lake bottom when trolling. If lake is large, drag line directly across and back again in a grid pattern to cover the deeper water in front of the sampling location (beyond 20 feet). Sketch drag area on map or record location. Pick up monofilament and observe for signs of spiny water flea. Identify and estimate quantity. Care should be taken when retrieving the weight as not to vibrate or knock off any specimens. Trolling distances and depth ranges should also be recorded, as well as weather and temperature observations.

IDENTIFICATION

I found what I think is a zebra mussel! Now what?

1. Use this book to identify any questionable species you have collected.
2. If you think you have found a new invasive species, take multiple photos both close up and far away, including the location and habitat where it was found.
3. Use a coin or ruler in the close up photos to show the size. For aquatic plants, try to spread out the leaf of the plant on your hand or another flat surface.
4. Record GPS Coordinates and any findings on a data sheet or notebook.
5. Submit photos and information by sending via email to Lake County SWCD.

You can also submit photos via the Great Lakes Early Detection Network (GLEDN).

Photo: Zebra mussel size comparison, California Department of Fish and Game, Bugwood.org.

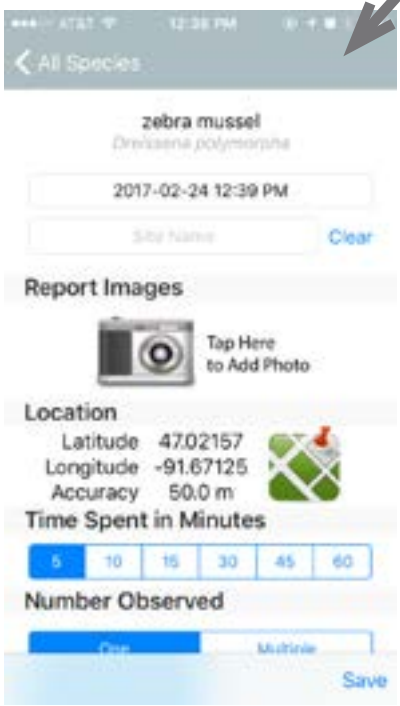
If you have questions about identification, first contact a lead AIS Sentry in your area (i.e. the leader of your Lake Association).

Without a lead contact or in case of no response, contact local government. Local governmental units will ensure state offcials and/or databases are notified and updated of any AIS findings.

Taking a photo with your phone: Outline species on white background and center. Use "grid" (under settings) for better focus.

Photo: Zebra mussels on rock, R. Wielopolski, Bugwood.org

You can find the GLEDN app on the app store. Report both affirmitive and negative sightings of AIS. Also report to county SWCD.



CONTACT INFORMATION

If you have an identification question and/or if you find what you suspect is an AIS: Contact your Lake Association or lead AIS person in the area.

Lake Vermilion - Jeff Lovgren, Vermilion Lake Association
Email: lovgren.jeff@gmail.com
Burntside Lake - Carrie Cusack or Reynold Mack, Burntside Lake Association
Email: carrieohlycusack@gmail.com and reynold.mack@comcast.net
White Iron Chain - Sara Kingston or Robin Vora, WICOL Lake Association
Email: wicolaely@gmail.com
Ely Area General: Bill Tefft, Email: efnbill@gmail.com

OR: _____

If you have an urgent identification question or need more specific information, contact the MNDNR. If for some reason you have prohibited species samples (better just to take photos), the only people who can legally receive and identify them are the DNR.

MNDNR AIS Specialist (DNR Region 2) - Rich Rezanka (in Grand Rapids)
Phone: 218-328-8821 / Email: richard.rezanka@state.mn.us

Area Fisheries Supervisors
Dean Paron, Finland
Phone: 218-353-8840 / Email: dean.paron@state.mn.us
Edie Evarts, Tower
Phone: 218-300-7803 / Email: edie.evarts@state.mn.us
Kevin Peterson, International Falls
Phone: 218-286-5220 / Email: kevin.peterson@state.mn.us
Cory Goldsworthy, Lake Superior
Phone: 218-302-3268 / Email: cory.goldsworthy@state.mn.us
Steve Persons, Grand Marais
Phone: 218-387-6021 / Email: steve.persons@state.mn.us

To report your findings monthly and/or if you cannot reach any of the above: Contact local government units.

Lake County SWCD (Ely Area esp. WICOL, Shagawa, Fall) - Darren Lilja
Email: darren.lilja@co.lake.mn.us
Lake County SWCD (North Shore/General county) - Liz Anderson
Phone: 612-232-1306 / Email: elizabeth.anderson@co.lake.mn.us
North St. Louis SWCD (Ely Area esp. Burntside/Vermilion) - Natalya Walker
Phone: 218-288-6142 / Email: natalya@nslswcd.org

AS NEEDED:

To report an AIS violation contact local law enforcement officers (Conservation Officer contact information included in the Appendix).

A NOTE ON MN REGULATIONS

The Minnesota DNR has classified invasive species into different categories. We are primarily concerned with regulated and prohibited status species. Please keep the following regulations in mind during your surveys:

Photo: Trap net whitefish on Saganaga, Jeff Gunderson, MN Sea Grant

Prohibited Species
Non-native invasive species which you are not allowed to possess, import, purchase, sell, propagate, transport, or introduce without a permit. These species are a high enough threat to MN ecosystems to warrant maximum oversight – these are the villains in the world of AIS.

Regulated Species
You are allowed to handle these species, but not to introduce them into a lake. For example, you can possess, import, propagate, transport, own, and sell a goldfish, but you are not allowed to release your goldfish into public waters.

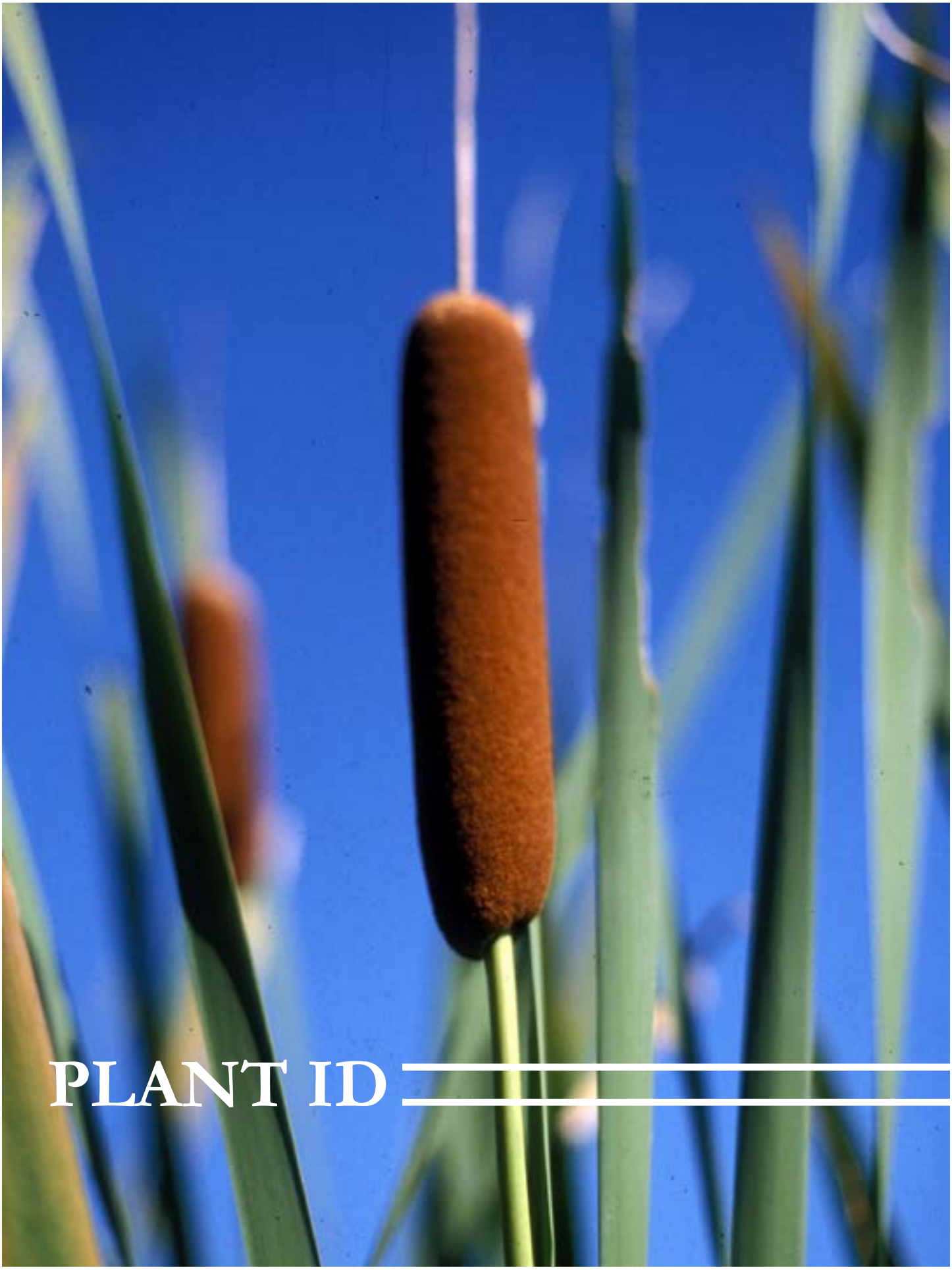
Additional notes on MN Statutes and Regulations related to AIS:

- You cannot transport any aquatic plants
- You cannot transport water from one lake to another in boats or other equipment
- Fish cannot be transported in water from infested lakes – plan ahead and transport fish on ice
- You cannot remove wild animals from any infested lake
- You cannot transport live crayfish from one waterbody to another

More information on MN fishing and invasive species regulations available in the Appendix!

Please do not keep samples of invasive species. Take ample photos and dispose of samples in the trash! It is illegal to transport invasive species, unless you are asked to deliver them for further identification directly to the MNDNR.

Photo: Round goby, Center for Great Lakes and Aquatic Sciences



PLANT ID

COMMON NATIVE PLANTS

Cattails (*Typha spp.*)
Helps stabilize marshy borders of lakes and ponds; helps protect shorelines from wave erosion; northern pike may spawn along shore behind the cattail fringe; provides cover and nesting sites for waterfowl and marsh birds such as the red-winged blackbird; stalks and roots are eaten by muskrats and beavers; the starchy roots, young flowering spikes, and pollen can be eaten by humans, too.

Broad-leaf Pondweeds
or "cabbage" (*Potamogeton spp.*)
Broad-leaf pondweeds provide excellent habitat for panfish, largemouth bass, muskellunge, and northern pike; bluegills nest near these plants and eat insects and other small animals found on the leaves; walleye use these pondweeds for cover.

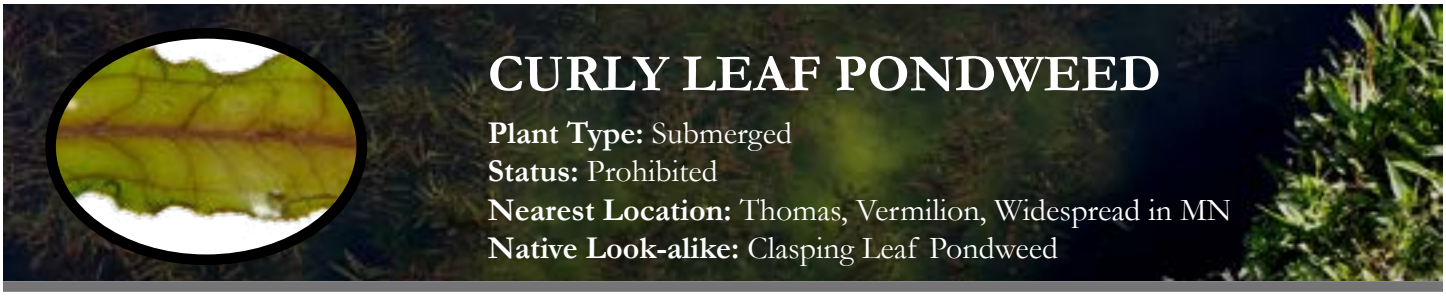
Chara (or Muskgrass)
Usually found in clear, hard water, chara is an advanced form of algae with a gritty feel due to mineral deposits on the leaf. Chara has a lighter green color than many other aquatic plants. Stabilizes bottom sediments; provides food for waterfowl and cover for fish. Chara also supports insects and other small aquatic animals, which are important foods for trout, bluegills, small mouth bass, and largemouth bass.

Coontail
(*Ceratophyllum demersum*)
Often confused with watermilfoil, coontail leaves are spiky and forked rather than feather-like. Many waterfowl species eat the shoots; provides cover for young bluegills, perch, largemouth bass, and northern pike; supports insects that fish and ducklings that eat. However, when growing densely, commonly causes nuisance conditions along shorelines.

Water lily
(*Nymphaea odorata*)
Provides excellent habitat for largemouth bass and sunfish; seeds are eaten by waterfowl; highly decorative - often planted in water gardens.

* Information taken and adapted from MNDNR Aquatic Plant Information Guide at http://dnr.state.mn.us/aquatic_plants

Photos: Chara photo courtesy Christine Lee, Minnesota Aquatic Invasive Species Center; Water lily photo courtesy public domain; all other photos courtesy Paul Skawiniski - *Aquatic Plants of the Upper Midwest*



CURLY LEAF PONDWEED

Plant Type: Submerged
Status: Prohibited
Nearest Location: Thomas, Vermilion, Widespread in MN
Native Look-alike: Clasping Leaf Pondweed

INVASIVE

Curly leaf pondweed
(*Potamogeton crispus*)

- Leaves are crinkly
- Fine-toothed leaf edges
- Leaf tips are blunt
- Alternative leaf branching
- Leaf base does not wrap around the stem
- Begins growing in early spring before other plants and dies back mid-summer
- Forms dense mats

NATIVE

Clasping leaf pondweed
(*Potamogeton richardsonii*)

- Slightly wavy leaves
- Smooth leaf edges
- Leaf tips come to a point
- Leaf base wraps around (clasps) the stem.
- Does not begin growing until summer
- Does not form dense mats

Photos: Paul Skawinski - *Aquatic Plants of the Upper Midwest*

FERN PONDWEED

Plant Type: Submerged
Status: n/a (native)

NATIVE

Fern Pondweed
(*Potamogeton robbinsii*)

- The only pondweed with branching inflourescences (clusters of flowers arranged on a stem)
- All submerged leaves; leaves are a darker color than other pondweed species (olive green to brown); linear shape and minutely toothed
- Leaf array looks like a palm frond
- Small flowers with 4 petal-like lobes occurring in spikes near the water's surface
- Dense colonies carpet muddy substrates of river bottoms & lake beds

NATIVE

Flat-stem Pondweed
(*Potamogeton zosteriformis*)

- Alternate, all submerged leaves without a stalk; leaves also have smooth edges and many veins
- Broad, flattened, sharp-edged stems up to 2meters distinguish this pondweed from other species
- Tiny, spiked flowers with 4 petal-like lobes

Photos: Paul Skawinski - *Aquatic Plants of the Upper Midwest*

LARGE-LEAF PONDWEED

Plant Type: Submerged
Status: n/a (native)

NATIVE

Large-leaf Pondweed
(*Potamogeton amplifolius*)

- Slender, cylindrical, sometimes spotted stem up to a meter or so long
- Submerged leaves with wavy eges up to 20cm long & may be folded; leaves have more veins than other pondleaf species
- Floating leaves opaque and oval-shaped up to 10cm long, leathery in texture with long petioles
- Small flowers with 4 petal-like lobes; up to 16 whorls

NATIVE

White-stem Pondweed
(*Potamogeton praelongus*)

- Less leave veins than Large-leaf pondweed and no leaf stalks
- Submerged, alternate, shiny, stalkless leaves with heart-shaped bases that clasp the stem
- Zigzag branching
- Small flowers clustered in whorls on emergent spikes

Photos: Paul Skawinski - *Aquatic Plants of the Upper Midwest*

BRITTLE NAIAD

BRITTLE NAIAD

Plant Type: Submerged
Status: Prohibited
Nearest Location: Staring Lake (Hennepin County)
Native Look-alike: Slender Naiad

INVASIVE

Brittle Naiad
(*Najas minor*)

- Noticeably toothed
- Brittle
- Re-curved leaves
- Usually very short

NATIVE

Slender Naiad
(*Najas flexilis*)

- Not toothed
- Flexible
- Leaves are mostly straight
- Can reach 3 feet in length

Photos: Paul Skawinski - *Aquatic Plants of the Upper Midwest*

EURASIAN WATERMILFOIL

Plant Type: Submerged
Status: Prohibited
Nearest Location: McCormick, Horseshoe, Gilbert Pit
Native Look-alike: Northern Watermilfoil

INVASIVE

Eurasian Watermilfoil
(*Myriophyllum spicatum*)

- 12-21 pairs of leaflets
- Leaves occur in whorls of four and are feathery
- Stems are limp and spaghetti-like out of water; range from reddish brown to pink
- Whorled flower spikes if at surface
- Can reproduce with just fragments
- Hybridization of Eurasian and native Northern watermilfoil is a serious concern - hard to identify, but pairs of leaflets are often in intermediate range (about 11)

NATIVE

Northern Watermilfoil
(*Myriophyllum sibiricum*)

- 5-10 pairs of leaflets (half as much)
- Stems are stiff and hold their shape out of the water - appears like a menorah
- Stems are whitish green
- Does not branch at the surface and forms winter buds in late fall and winter, unlike Eurasian Watermilfoil

Photos: Paul Skawinski - *Aquatic Plants of the Upper Midwest*

COONTAIL

Plant Type: Submerged
Status: n/a (native)

NATIVE

Coontail
(*Ceratophyllum demersum*)

- Similar to watermilfoil in appearance, but leaves are spiny & forked rather than feather-like
- Can be a nuisance species, but not considered invasive

NATIVE

Water Marigold
(*Bidens beckii*)

- Solitary flowers at the tip of an emergent stalk, emerged portion rising 6in above the water
- Flowers are about 1in across with 8 petals (may be notched at the top)
- Opposite leaves with an egg shape, occasionally whorled in 3s, present both above and below the surface of the water
- Leaves branch continuously rather than forked or singularly branching like milfoil

Photos: Paul Skawinski - *Aquatic Plants of the Upper Midwest*

HYDRILLA

Plant Type: Submerged
Status: Prohibited
Nearest Location: Not yet found in Minnesota
Native Look-alike: Canadian waterweed

INVASIVE

Hydrilla
(*Hydrilla verticillata*)

- Whorls (number of leaves attached to the same point) of 3-10
- Whorl of leaves is smaller or the same size as a quarter
- Fine-toothed (serrated) leaves
- Leaf has a vein down the center

Brazilian waterweed
(*Egeria densa*)

- Whorls of 4-8
- Fine-toothed leaves (need to use a hand lens to see)
- If in bloom, produces showy white flowers

NATIVE

Canadian Waterweed
(*Elodea canadensis*)

- Whorls of 3
- Whorl of leaves is smaller than a quarter
- Smooth edges

Photos: Paul Skawinski - *Aquatic Plants of the Upper Midwest*

STARRY STONEWORT

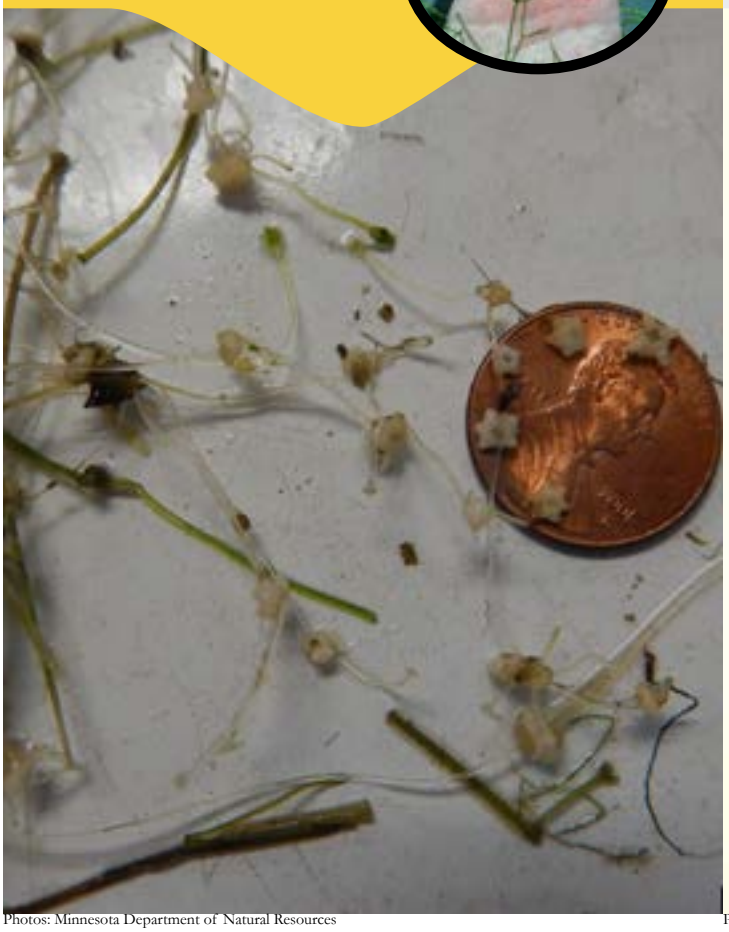
STARRY STONEWORT

Plant Type: Submerged
Status: Prohibited
Nearest Location: Lake Koronis, Winibigoshish, Upper Red
Native Look-alike: Muskgrass

INVASIVE

Starry Stonewort
(*Nitellopsis obtusa*)

- Stem is smooth and green but may have a white/gray coating of minerals covering the stem.
- Whorls of 4-8 branches; branchlets forked
- Star-shaped growths called bulbils are produced on clear threads at the base.



Photos: Minnesota Department of Natural Resources

NATIVE

Muskgrass
(*Chara sp.*)

- Rough, crunchy stems. May also have white/gray mineral coating.
- Skunky/musky smell.
- Whorls of 6 to 16 branches; shorter branchlets
- Prefers less oxygenated & harder waters, not generally found where mosquito larvae is present

Photos: Christine Lee, Minnesota Aquatic Invasive Species Research Center

COMMON BLADDERWORT

Plant Type: Emergent
Status: n/a (native)

NATIVE

Common Bladderwort
(*Utricularia macrorhiza*)

- Above water yellow, two-lipped flowers (look like snapdragons)
- Underwater, leaf-like stems with numerous small bulb "bladders"
- Carnivorous plant uses underwater "bladders" to capture small organisms through a vaccuum-like response when little hairs are triggered

Photos: Paul Skawinski - *Aquatic Plants of the Upper Midwest*

Photo: Linda Wilson, University of Idaho, Bugwood.org

PURPLE LOOSESTRIFE

Plant Type: Emergent
Status: Prohibited
Nearest Location: Lax Lake, Gitchi Gami Trail, Highway 53, Gabbro Lake
Native Look-alike: Fireweed

INVASIVE

Purple Loosestrife
(*Lythrum salicaria*)

- 4-10 feet high
- Multiple ridge or square (angular) woody stems often covered in downy hair
- Leaves opposite, smooth, lance-shaped
- Showy magenta-colored flower spikes and idividual flowers have 5-7 petals

Photo: Bruce Ackley, The Ohio State University, Bugwood.org

NATIVE

Fireweed
(*Chamerion/Epilobium angustifolium*)

- 4-9 feet
- Leaf veins are circular and do not terminate at leaf edge
- White central vein
- Alternate leafs (in contrast to opposite Loosestrife leaves)
- Rounded, rather than angular, stem

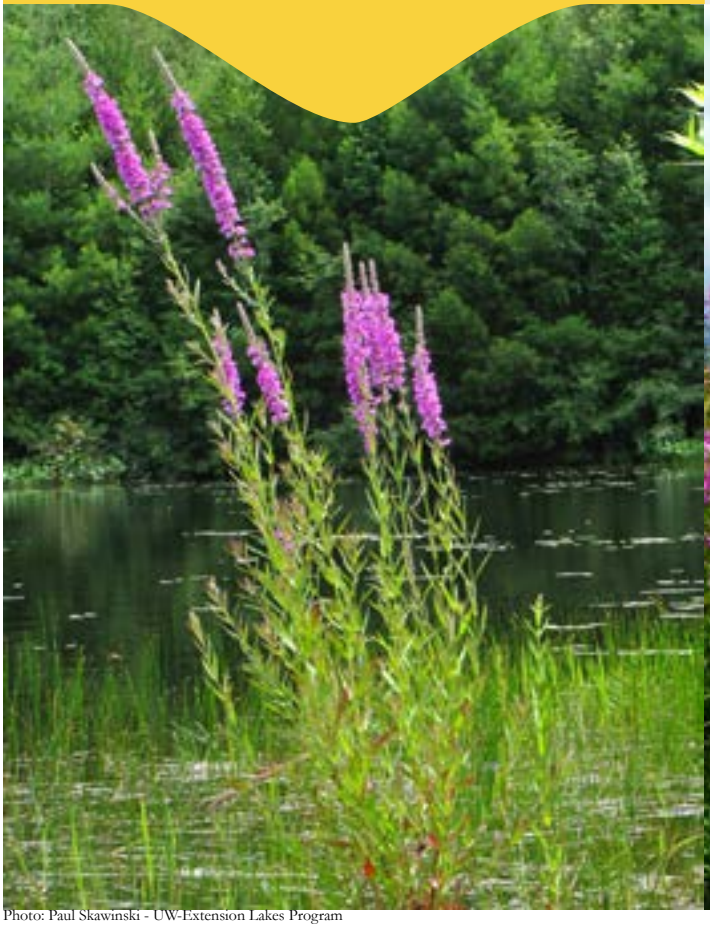


Photo: Paul Skawinski - UW-Extension Lakes Program

Photo: Paul Skawinski - UW-Extension Lakes Program

FLOWERING RUSH

Plant Type: Emergent
Status: Prohibited
Nearest Location: Beaver River
Native Look-alike: Joe Pye Weed

INVASIVE

Flowering Rush
(*Butomus umbellatus*)

- Easiest to identify when flowering
- Flowers grow in an umbrella-shaped cluster & each flower has 3 whitish pink petals
- Green stems resemble bulrushes but are triangular in cross section; no leaves on stem
- Grows to about 3ft in height
- Dense stands interfere with recreational lake use & crowd out native plants

Photo: Flowering rush flower, Paul Skawinski - UW-Extension Lakes Program

Photo: Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

NATIVE

Joe Pye Weed
(*Eutrochium maculatum*)

- Huge, puffy, purple/burgundy flower heads
- 1-8ft in height
- Upright, thick, round stems with a whorl of leaves at each node (unlike Flowering Rush); stems often bend under the weight of flowers when in full bloom
- Blooms in late summer

Photo: Steven Katovich, USDA Forest Service, Bugwood.org

NARROWLEAF CATTAIL

Plant Type: Emergent
Status: n/a
Nearest Location: Voyageurs National Park, Highway 1, Highway 2, Hybrid at St. Louis River
Native Look-alike: Broadleaf Cattail

INVASIVE

Narrowleaf Cattail
(*Typha angustifolia*)


Typha x glauca
(Hybrid Cattail)

- Up to 10ft in height
- Leaves slightly convex on back and narrow (0.2-0.5in)
- Flowering stalk is light green, stiff, and round in cross-section
- Soft seeds clustered in sausage-shaped cattail shape
- *Typha X glauca* (Hybrid Cattail) is similar to *angustifolia*
- Narrowleaf Cattail seed cluster/head is detached whereas broadleaf cattail head is attached

NATIVE

Broadleaf Cattail
(*Typha latifolia*)

- Obligate wetland species
- Sausage-shaped brown, fluffy, flowering head
- Spike is green when fresh & brown when mature
- Basal leaves are thin with parallel veins running the narrow length of the leaf
- Leaves look like little swords
- Cattails can be a great source of medicine and food - raw young shoots taste like cucumber!

Photos: Paul Skawinski - UW-Extension Lakes Program

YELLOW IRIS

Plant Type: Emergent/Shoreline & Wetland Perennial
Status: Regulated
Nearest Location: Thomas Lake, Stewart Lake
Native Look-alike: Blue Flag Iris

INVASIVE

Yellow Iris
(*Iris pseudacorus*)

- Broad, flat, sword-shaped leaves embracing the flower stalk
- Deep yellow flowers with three outer drooping sepals and brownish mottled markings
- 2-3 feet tall

ECOSYSTEM CONNECTIONS

Yellow Iris is most commonly introduced through water gardens!

NATIVE

Northern Blue Flag Iris
(*Iris versicolor*)

- 1.5-3.5 feet in height
- Each stalk has 3-5 flowers
- Down-drooping violet purple flower with dark purple veins
- Yellowish blot surrounded by white on the sepals
- Broad, flat, sword-shaped blue-green leaves
- Very similar to Yellow Iris when not flowering, but Blue Flag Iris is generally smaller

Photo: Public Domain

Photo: Katherine Hollins,
Great Lakes Phragmites Collaborative

NON-NATIVE PHRAGMITES

Plant Type: Emergent/Shoreline & Wetland Perennial
Status: Restricted
Nearest Location: Duluth, Highway 53
Native Look-alike: Native Phragmites

INVASIVE

Non-native Phragmites - Common Reed
(*Phragmites australis subsp. australis*)

- Can reach at least 15 feet in height
- Stems have a slightly ridged, rough texture
- Leaves blue-green, 15 - 20 inches long, 1 - 1.5 inches wide
- Flowers are purple in early development then change to golden later in the season
- Leaves and seed heads persist throughout the winter
- Often forms dense monocultures with hardy rhizomes

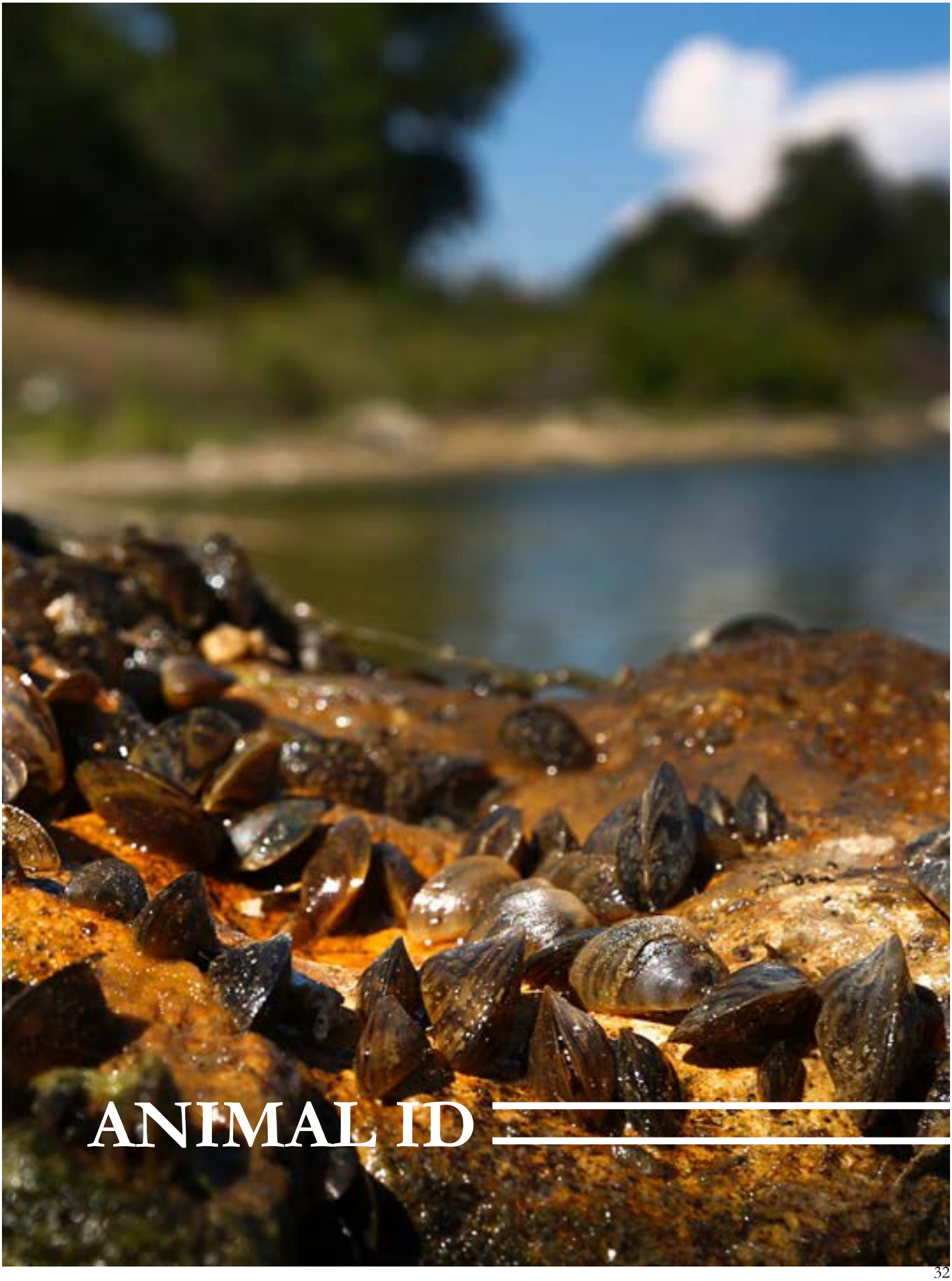
NATIVE

Native Phragmites - American Common Reed
(*Phragmites australis subsp. americanus*)

- 3 - 7 feet in height
- Leaves yellowish green 8 - 24 inches long, 1/3 - 1.5 inches wide
- Stems have a smooth texture and may be dark red at nodes and internodes
- Seed heads and leaves may not persist throughout the winter
- Stems may contain spots from a native fungus that has not adapted to non-native phragmites

Photo: Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Photos: Peter M. Dziuk and Katy Chayka, mnwildflowers.info



ANIMAL ID

ZEBRA MUSSELS

Animal Type: Shelled Animal
Status: Prohibited
Nearby Locations: Lake Superior, Gilbert Pit
Native Look-alike: Fingernail clams

INVASIVE

Zebra Mussel
(*Dreissena polymorpha*)

- Under 1 inch (up to 2)
- Black to brownish "D"-shaped shell with zebra-like dark and light stripes
- Usually in clusters of individuals
- Groups feel like fine sandpaper
- Juveniles are peppercorn-size
- Unlike most mussels, zebras have byssal threads/small attachment threads at hinge

INVASIVE

Quagga Mussel
(*Dreissena bugensis*)

- Thumbnail-size
- Pale colored shell or alternating brown to brownish stripes, pale near hinge
- Not "D"-shaped and cannot sit flat like zebra mussels
- Not yet in MN (Lake Michigan)

NATIVE

Fat Mucket Mussel
(*Lampsilis siliquoidea*)

- Most native mussels are significantly larger than Quagga or Zebra (not neccessarily look-alikes); up to 5in in length
- Fat muckets are one of the most widely distributed mussels in North America
- Fat muckets have a yellowish-brown color with green rays of various width
- Creek Heelsplitters (*Lasmigona compressa*), listed as a species of concern in MN and found in the area, are another native mussel at risk from Zebra and Quagga mussel infestations

ZEBRA MUSSELS ON NATIVE MUSSELS

Photo: Minnehaha Creek Watershed District

Photo: Rebekah D. Wallace, University of Georgia, Bugwood.org

Photo: Fat muckets marked after being scrubbed of Zebra Mussels - Mara Koenig, USFWS Midwest; Insert Photo: Wisconsin DNR

ASIAN CLAMS

Animal Type: Shelled
Status: n/a
Nearby Locations: Not yet found in NE Minnesota
Native Look-alike: Fingernail clams

INVASIVE

Asian Clam
(*Corbicula fluminea*)

- 1-2 inches
- Yellowish to blackish-brown thick, triangular shell
- Heavy, distinct, evenly spaced growth rings and very distinct ridges
- Prefers moving water with high oxygen levels; no tolerance for polluted or near freezing water
- May burrow several inches into the soil

NATIVE

Fingernail Clams
(*Sphaeriidae sp.*)

- 1/2 inch
- No attachment threads
- Hinge area rounded

Photo: Paul Skawinski - UW-Extension Lakes Program

FAUCET SNAILS

Animal Type: Shelled
Status: Prohibited
Nearest Location: Winnibigoshish, Superior
Native Look-alike: Fossaria Snail

FAUCET SNAIL

INVASIVE	NATIVE	NATIVE
Faucet Snail (*Bithynia tentaculata*)	**Limpet Snail** (*Ferrissia sp.*)	**Fossaria Snail** (*Fossaria sp.*)
• Up to 1/2inch (very small) • shiny, pale brown shell with 4-5 whorls • Opening is on the right when shell is pointed up • think lip • Prefers stable water levels and migrates to muddy zone in the fall	• No operculum, mantle serves as a lung • <10mm • Growth rings form a concentric shape on a single shell • No attachment threads • Hermaphroditic	• about 1/2 inch (very small) • Very similar to faucet snails, consult a professional to distinguish

Photo: Minnesota Department of Natural Resources, Bugwood.org

Photo: *Ferrissia fragilis,* Freswater Gastropods of North America, fwgna.org.

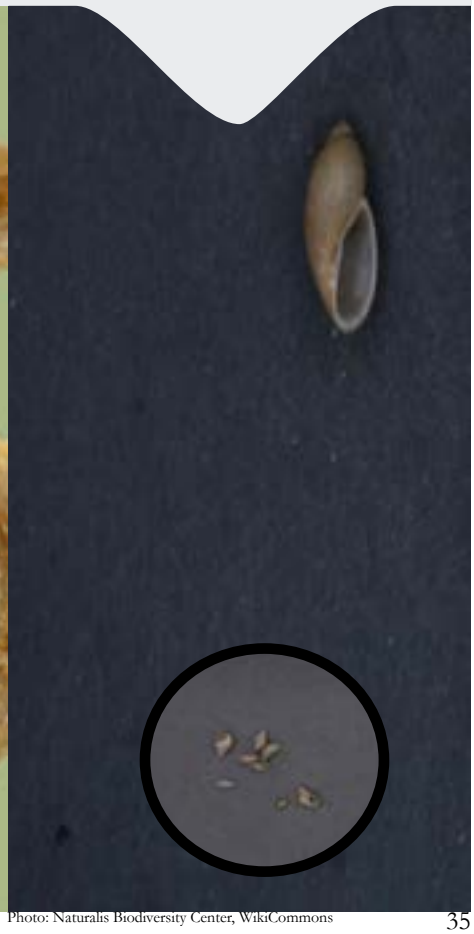
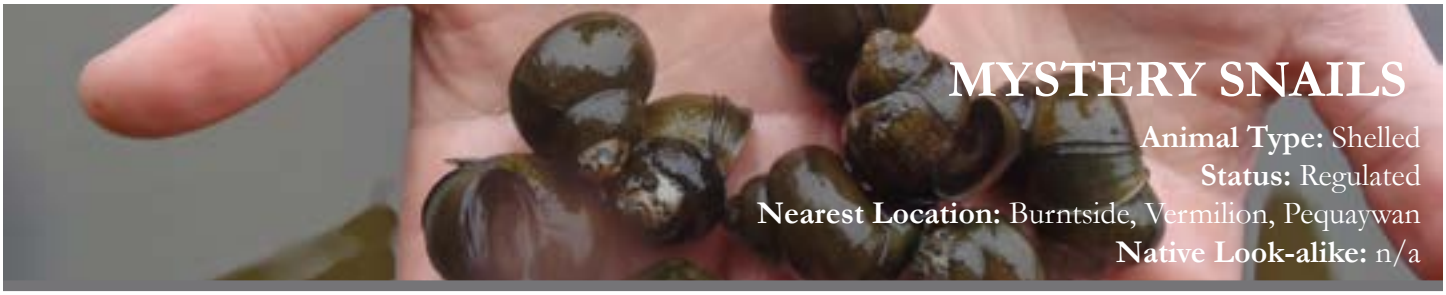


Photo: Naturalis Biodiversity Center, WikiCommons



MYSTERY SNAILS

Animal Type: Shelled
Status: Regulated
Nearest Location: Burntside, Vermilion, Pequaywan
Native Look-alike: n/a

INVASIVE

Mystery Snails (Banded and Chinese)
(*Viviparus georgianus* & *Cipangopaludina chinensis malleata*)

Both are large (golf ball-sized)
Banded:

- Olive-green shell with 4-5 whorls
- 4 reddish bands circle shell

Chinese:

- Light brown to olive-green shell with 6-7 tight whorls and fine growth rings
- Round or oval black lip
- Camoflages itself with a dark green covering similar to moss

Banded Mystery Snail

Chinese Mystery Snail

Photos: Paul Skawinski, UW Extension Lakes Program

INVASIVE

New Zealand Mudsnail
(*Potamopyrgus antipodarum*)

- Very tiny, up to 3/16 inch
- Dark gray, light to dark brown shell
- Cone-shaped with 7-8 right handed whorls separated by deep grooves
- Difficult to distinguish from native snails, but shell is more elongate
- Found in flowing and brackish rivers including water as deep as 60 feet
- Found in Lake Superior, not yet in NE MN
- Snails are hard to identify - contact a professional

Photo: Mohammed El Damir, Bugwood.org

SPINY WATERFLEA

Animal Type: Plankton
Status: Regulated
Nearest Location: Burntside, Shagawa, Fall, Basswood, Vermilion, Lake Superior
Native Look-alike: Native Waterflea

SPINY WATERFLEA

Photo: Gary Montz, 144, Bugwood.org

INVASIVE

Spiny Waterflea
(*Bythotrephes longimanus*)

- Tiny (1/2 inch) and translucent with a long, sharply barbed tail spine
- Dark eyespot is promiment
- Large numbers form clumps with black spots that feel like wet cotton

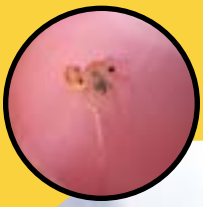


Photo: Jeff Gunderson, MN SeaGrant

INVASIVE

Fishhook Waterflea
(*Circopagis pengoi*)

- 1/4-5/8 inch with long tail spine ending in a "hook"
- promiment dark spot
- can form clumps with black spots that look and feel like wet cotton

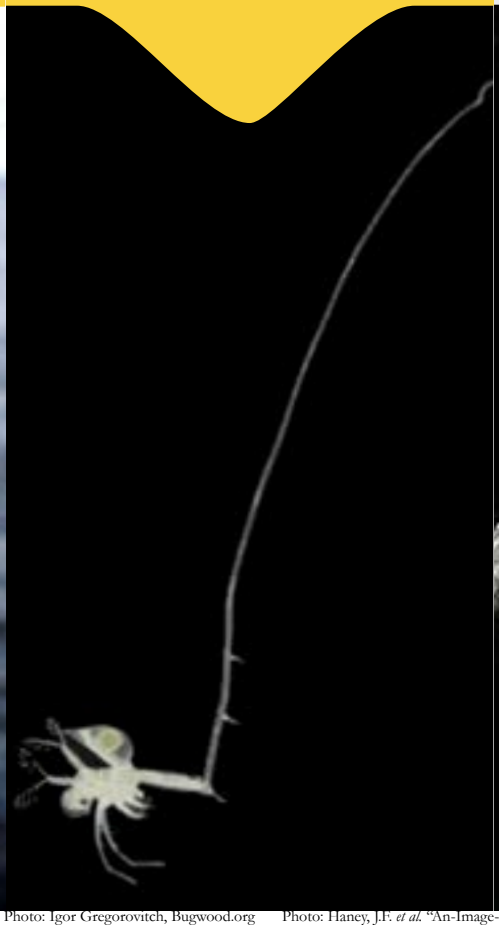


Photo: Igor Gregorovitch, Bugwood.org

NATIVE

Native Waterflea
(*Leptodora kindti*)

- Mostly transparant body
- Large compound eye
- Elongated abdomen
- 6 pairs of legs

Photo: Haney, J.F. *et al.* "An-Image-based Key to the Zooplankton of North America" version 5.0 released 2013. University of New Hampshire Center for Freshwater Biology <cfb.unh.edu> 7 Mar 2017

RUSTY CRAYFISH

RUSTY CRAYFISH

Animal Type: Crustacean
Status: Regulated
Nearest Location: White Iron, Shagawa, Fall, Dumbell
Native Look-alike: Northern Clearwater

INVASIVE

Rusty Crayfish
(*Faxonius rusticus*)

- Thick black bands with orange tips on claws
- Often "rust" color spots on sides of carapace
- Usually grey/green with rust color highlights especially on tail segments
- Generally larger than native species

Photos: Darren Lilja - Lake County SWCD

NATIVE/INVASIVE

Northern Clearwater Crayfish
(*Faxonius propinquus*)

* Native to Lake Superior but Invasive on inland lakes

- Top of abdomen (tail) has a dark stripe
- Claw tips orange/red with thinner black ring
- Usually a smooth olive/brown color; can be grey
- Commonly found in very clear waters on gravel or rocky bottoms
- Distributed statewide and very common

Photo: Darren Lilja, Lake County SWCD

Photo: Craig Roesler, Wisconsin DNR-Hayward

Photo: Chris Taylor, Illinois Natural History Survey

VIRILE CRAYFISH

Animal Type: Crustacean
Status: n/a (native)

NATIVE

Virile Crayfish
(*Faxonius virilis*)

- Color is highly variable
- Claws are usually blue and claw tips orange/red without black bands
- Somewhat speckled/mottled; two to four rows of angular spots on tail
- Straight claws
- Difficult to identify; consult a professional

NATIVE

Calico Crayfish
(*Faxonius immunis*)

- Mottled "camoflauge" pattern
- Usually different shades of brown/tan
- "Notched" claws
- Tuft of fibers present adjacent to claw hinge
- Typically found in soft bottom areas, usually with aquatic plants present
- Distributed statewide, but is uncommon

Photos: Darren Lilja - Lake County SWCD

RED SWAMP CRAYFISH

Animal Type: Crustacean
Status: Prohibited
Nearby Location: Tilde Lake (Clay County)
Native Look-alike: Calico, Virile Crayfish

INVASIVE

White River Crayfish
(*Procambarus acutus*)

- Pinkish-tan to brownish-olive color with a broad dark stripe along the abdomen
- Delicate looking claws
- May damage river banks and cause sedimentation of rivers including impacts on flood defences
- Not yet found in NE Minnesota

Photo: Michelle Woodford via Craig Roesler, Wisconsin DNR-Hayward

INVASIVE

Red Swamp Crayfish
(*Procambarus clarkii*)

- Up to 5 inches (with claws)
- Dark red body and claws with spiky, bright red bumps
- Black wedge-shaped stripe on underside
- Females can burrow
- Not yet found in NE Minnesota

Photo: Chris Taylor, Illinois History Survey, Bugwood.org

Photo: Jeff Gunderson, MN SeaGrant

RAINBOW SMELT

Animal Type: Fishes
Status: Regulated (Ruffe & Goby are Prohibited)
Nearby Location: Lake Superior
Native Look-alike: n/a

INVASIVE

Rainbow Smelt
(*Omserus mordax*)

- Up to 12 inches
- Shimmers colorfully in water but out of water fades quickly and smells like cucumbers
- Has an adipose fin
- Large teeth on jaws & tongue, large mouth
- Protruding lower jaw

Photo: Wayne Nelson-Stastny, South Dakota Game, Fish and Parks, Bugwood.org

INVASIVE

Ruffe
(*Gymnocephalus cernuus*)

- Up to 10 inches
- Olive to golden-brown with a whitish belly
- Spiny and soft dorsal fins connected
- Rows of dark spots in between spines
- Face exhibits a permanent "frown"
- Slimy & spiny when handled

Photo: Gary Cholwek, National Biological Service

INVASIVE

Round Goby
(*Neogobius melanostomus*)

- Rarely more than 7in long
- Mottled gray and brown
- single suction cup-like pelvic fin and black pot on rear margin of front dorsal fin
- Frog-like, bulging eyes

Photos: Paul Skawinski - UW-Extension Lakes Program

SEA LAMPREY

Animal Type: Submerged
Status: Prohibited
Nearby Location: Lake Superior
Native Look-alike: Silver, Chestnut Lamprey

SEA LAMPREY

INVASIVE	NATIVE	NATIVE
Sea Lamprey (*Petromyzon marinus*)	**Silver Lamprey** (*Ichthyomyzon unicuspis*)	**Chestnut Lamprey** (*Ichthyomyzon castaneus*)
• 12-20 inches • Jawless, parasitic, eel-like fish • Gray-blue back, metallic violet sides, silver-white belly • Suction-cup mouth with hook-like teeth and rasping tongue	• Much smaller than invasive Sea Lamprey (9-14 inches) • Grey color with silver belly • Sucking disk wider than head	• Much smaller than invasive Sea Lamprey (8-10 inches) • Dark olive/grey color with yellowish belly

Photo: Nikki Field; Photo Insert: Sea lamprey on lake trout, USFWS

Photo: Ellen Edmonson and Hugh Chrisp, New York Biological Survey

Photo: Joanna Gilkeson, USFWS Midwest

Photos: USFWS Midwest

VIRAL HEMORRHAGIC SEPTICEMIA (VHS)

Note: VHS cannot be transmitted to humans!

Animal Type: Viral disease affecting fish
Status: n/a
Nearby Location: Lake Superior (Michigan & Wisconsin)
Native Look-alike: n/a

INVASIVE

Viral Hemorrhagic Septicemia (VHS)

It is impossible to determine if fish have VHS by looking at them, and an infected fish might not exhibit all symptoms. Fish will eventually die from VHS. VHS causes:

- Bulging eyes
- Pale gills
- Darkened color, although gills and liver could be pale from bleeding
- Distended (fluid-filled) abdomen
- Bleeding around the eyes, base of fins, sides, and head
- Corckscrew swimming behavior

If you find a suspected diseased fish:
Do not attempt to identify on your own - VHS needs to be verified in a lab. Place the fish in a clean plastic bag and keep it on ice/cool (do not freeze). Call DNR Fisheries Offices (listed on contact information page) and/or the DNR Pathology Lab at 651-259-5096 right away for further instructions.

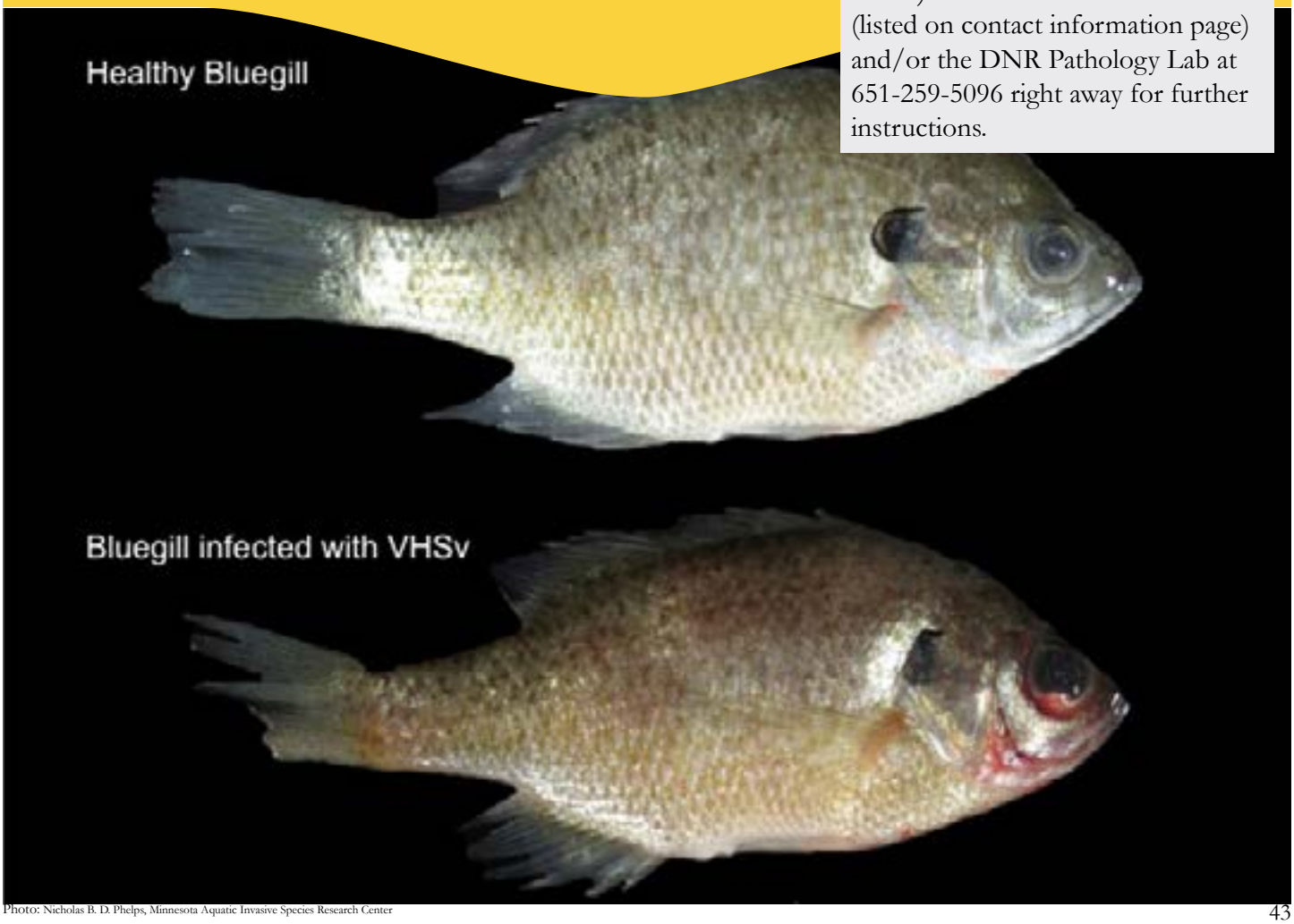


Photo: Nicholas B. D. Phelps, Minnesota Aquatic Invasive Species Research Center

HOW TO DISINFECT

- **INSPECT** all watercraft, trailers, and boating equipment. Remove any visible plants, animals, and mud *before* leaving any water access site (also check footwear and clothing).
- **DRAIN** water from boat, bait container livewell, bilge, impellor *before* leaving any water access. Rinse any equipment that has come in contact with the water.
- **DISPOSE** of unwanted bait in the trash. If you want to keep your live bait - you must replace water in bait containers with tap or spring water. *Never* release live bait into a waterbody, or release aquatic animals from one waterbody into another.
- Allow everything (boats, equipment, dogs) to completely dry for at **least 5 days** OR
- Rinse your boat and equipment with **hot tap water** (over 104F); OR
- Spray your boat and trailer with a **high pressure sprayer** (i.e. a car wash); OR
- Soak equipment in undiluted white vinegar for 20 minutes; OR soak for 30 minutes in a salt water bath (1/2 cup salt to 1 gallon of water); thoroughly rinse in tap water.

Clean Your Boat!

If you are moving to another body of water, please thoroughly disinfect any equipment using standard protocols from the National Oceanic and Atmospheric Administration (NOAA). Minnesota AIS decontamination locations and schedules at: DNR AIS Decon Sites. **Free boat cleanings are available at the following locations:**

Shagawa Lake, Sandy Point Landing
759 Pioneer Rd N, Ely, MN 55731

Burntside Lake, Van Vac Landing
2714 Van Vac Ln, Ely, MN 55731

Certified Decontamination at select times. Check hours of operation for the following at www.burntside.org

Lake Vermilion: rotating location
Certified Decontamination at select times. Check hours of operation for the following at www.vermilionlakeassociation.org/ais-prevention/boat-cleaning-stations/

Lil Dog Car & Pet Wash, Two Harbors
401 7th Ave, Two Harbors, MN 55616
Utilize the high pressure soak and rinse at the Self Service Station to clean boat of AIS. Not a verified decontamination station.

Rock Wood Lodge and Outfitters
50 Rockwood Rd, Gunflint Trail, Grand Marais, MN 55604
Boat wash free to the public. Not a verified decontamination station.

North Shore Car Wash, Grand Marais
400 W Hwy 61, Grand Marais, MN 55604
Coupon for $5 off self-serve boat washing available at NAPA. Not a verified decontamination station.

Lucky 7 Hurricane Car Wash
444 E Sheridan St., Ely, MN 55731
Utilize the Self Wash lane to clean your boat. Not a verified decontamination station.

*We discourage the use of carwashes for removing attached zebra mussels, as it may damage water collection equipment.

FIELD NOTES

APPENDIX A: DAILY DATA SHEET

Data Collectors		
Lead Observer Name	Phone Number	Email
Additional Data Collectors		
Date and Time		
Date	Start Time	End Time
Water Body Data		
Water Body Name		
Location (GPS Latitude/Longitude or your address)		
Sampling method (circle all that apply): walk shoreline, observe/wade shallow areas less than 3 feet, observe littoral zone via watercraft, plant drag with rake or other tool, crayfish trapping, fishing line drag method for spiny waterflea, zebra mussel sampler Additional sampling method notes:		
Observations		
Any invasive species observed? (circle one) YES NO	List invasive species observed:	
Where/how were invasive species discovered (i.e. under a rock I lifted up)?		
List native species observed:		
Did you call or email to report your findings? YES NO Are you sending photos of your findings? YES NO How many photos? _____		

APPENDIX B: SEASON DATA SHEET

Contact Details		
Lead Observer Name	Phone Number	Email
Additional Data Collectors		

Water Body Information
Water Body Name
Location (GPS Latitude/Longitude or your address)
Sampling method (circle all that apply): walk shoreline, observe/wade shallow areas less than 3 feet, observe littoral zone via watercraft, plant drag with rake or other tool, crayfish trapping, fishing line drag method for spiny waterflea, zebra mussel sampler Additional sampling method notes:

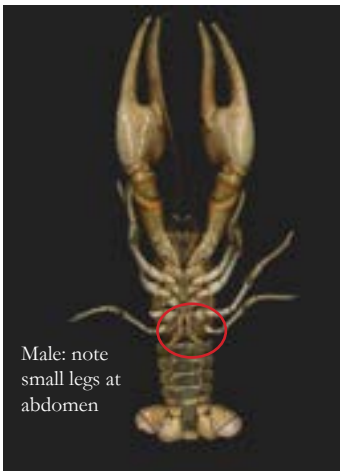
Observations

Date	Start Time	End Time	Weather Observations	Invasive species observed	Where/How discovered	Native species observed notes	Reported (y/n)

* All personally identifiable information collected on this form will be used only within the confines of the AIS Sentry program. Your personal information will not be shared except in the case of positive AIS identification in need of follow up and then only with our partner agencies.

APPENDIX C: CRAYFISH TRAPPING

Check MN regulations before trapping for crayfish! Crayfish are subject to MNDNR regulations.



- Place traps in previously established trap locations (marked with GPS) or place 3-6 traps at least 100cm apart on each lake in littoral zones at depths of 3-6 feet in coarse substrate (gravel, cobble, boulder) with adjoining aquatic vegetation. Use minnow traps modified for a 5cm entry hole.
- Label traps with permitting information consistent with DNR and attach a float.
- Leave traps out overnight (18-28 hours).
- Check MN fishing regulations for trapping laws before baiting traps.
- Check the trap in the morning and count and identify crayfish. Update data sheet.
- Always rinse vegetation from traps and let dry.

CRAYFISH MONITORING DATA SHEET						
LAKE:			TRAP DEPLOY DATE:			
COLLECTORS:			TRAP DEPLOY TIME:			
WEATHER NOTES:			TRAP RECOVER DATE:			
WATER TEMP:			TRAP RECOVER TIME:			
SPECIES/SEX	TRAP 1	TRAP 2	TRAP 3	TRAP 4	TRAP 5	TRAP 6
O. RUSTICUS (M)						
O. RUSTICUS (F)						
O. VIRILIS (M)						
O. VIRILIS (F)						
O. PROPINQUUS (M)						
O. PROPINQUUS (F)						
O. IMMUNIS (M)						
O. IMMUNIS (F)						

LAKE SKETCH WITH TRAP LOCATIONS, NOTES, ETC.:

After collection and identification, NATIVE crayfish will be released into the waterbody they were sampled from. Rusty Crayfish (*O. rusticus*) will NOT be released and will be destroyed (can be cooked in a crayfish boil).
Traps or other sampling materials are never to be used on any other water body after being used in infested waters, unless decontaminated.

APPENDIX D: CYANOBACTERIA MONITORING

Seen through the massive eutrophic bloom causing fish deaths and a decline in ecosystem health along the Gulf of Mexico, cyanobacteria is a health concern for waterways across the country. Cyanobacteria, also called blue green algae, is a small bacteria present in many water bodies. With increases in available nutrients such as phosphorus and nitrogen, cyanobacteria quickly increase the size of their colonies. As these colonies of bacteria thicken, they form a mass or "bloom" which can limit the amount of sunlight reaching the water, resulting in decreased photosynthesis for aquatic plants and eutrophic, or oxygen poor, conditions for fish. For walleye and other species requiring oxygen rich waters, blue green algae is a concern. Lake of the Woods has also had a few isolated cases of dog deaths after swimming in waters with a blue green algae bloom, as the bacteria contains toxins harmful to human and animal health.

Blue green algae blooms are transient and unpredictable, making them difficult for scientists to study. With the help of citizen monitoring, scientists can establish a pattern for blue green algae blooms and better research mitigation or prevention strategies. BloomWatch is a new program which encourages citizen monitoring. With a smartphone, you can download the BloomoWatch app and directly upload pictures of a suspected bloom (http://cyanos.org/bloomwatch/). You can also report observations online. Scientists will then study your pictures and determine whether the report is the pea soup color indicative of an actual bloom or a collection of pollen from trees or other plants.

Blue green algae bloom on left, lake without bloom on right of road.

Include blue green algae monitoring in your AIS Sentry work!

As you are out exploring lakes in the area this summer, keep an eye out for blue green algae blooms and report your findings using BloomWatch! You can download the BloomWatch App from your phone's App Store. Simply upload pictures and information about your waterbody to report a sighting of blue green algae. You can also report sightings online at cyanos.org.

Samples are subject to alteration with sunlight and temperature, but if you do find a bloom and would like to look at it microscopically, please contact Darren at Lake County Soil & Water Conservation District (SWCD): darren.lilja@co.lake.mn.us.

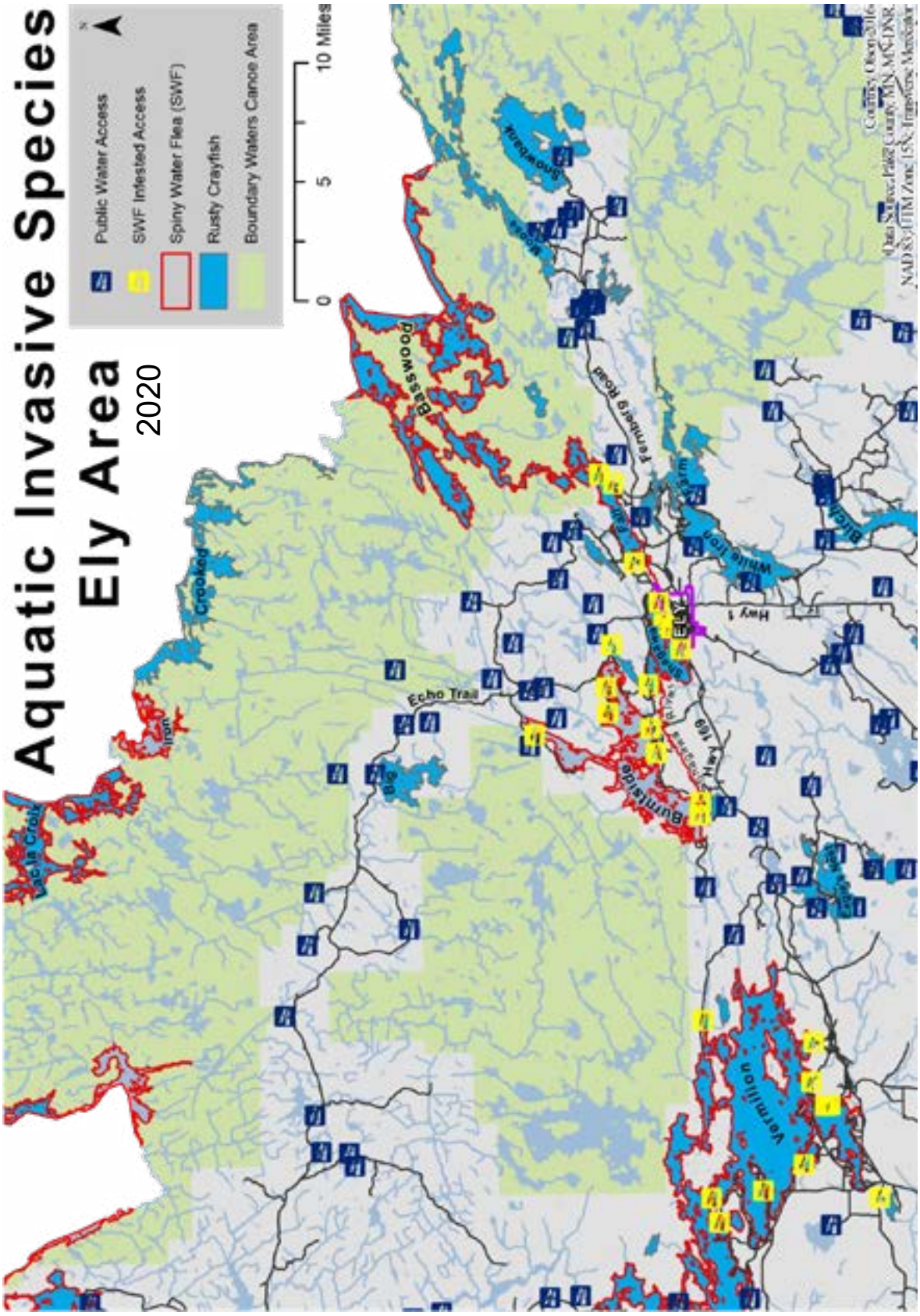
APPENDIX E: INFESTED WATERS LIST

Water Body	County	Species	DOW-Number
Artlip Lake	Lake	Zebra mussels	38002100
Bass Lake	St. Louis	Rainbow Smelt	69006300
Basswood Lake/River	Lake	Rusty crayfish, spiny waterflea	38064500
Big Lake	St. Louis	Rusty crayfish	69019000
Birch Lake (BWCA)	Lake	Rusty crayfish	38053200
Birch Lake	St. Louis	Rusty crayfish	69000300
Burntside Lake	St. Louis	Spiny waterflea, Mystery snails	69011800
Carp Lake	Lake	Rusty crayfish	38052100
Cedar Lake	Lake	Rusty crayfish	38081000
~~Crooked Lake (Finland)*~~	~~Lake~~	~~Rusty crayfish, zebra mussels~~	~~38002401~~
Dumbell Lake	Lake	Rusty crayfish	38039300
Ella Hall Lake	Lake	Rusty crayfish	38072700
Ensign Lake	Lake	Rusty crayfish	38049800
Fall Lake	Lake	Rusty crayfish, spiny waterflea	38081100
Farm/South Farm Lake	Lake	Rusty crayfish	38077900
Found Lake	Lake	Rusty crayfish	38062000
Garden Lake	Lake	Rusty crayfish	38078200
Houghtaling Creek	Lake	Zebra mussels	04010101-570
Kawishiwi River (S/N)	Lake	Rusty crayfish	38008000
Knife/South Arm Knife Lake	Lake	Rusty crayfish	38040400
Little Long Lake	St. Louis	Rainbow smelt	69006600
Melon Lake	Lake	Rusty crayfish	38052200
Moose Lake	Lake	Rusty crayfish	38064400
Newfound Lake	Lake	Rusty crayfish	38061900
Newton Lake	Lake	Rusty crayfish, spiny waterflea	38078400
Ojibway Lake	Lake	Rusty crayfish	38064000
Parent Lake	Lake	Rusty crayfish	38052600
Skull Lake	Lake	Rusty crayfish	38062400
Snowbank Lake	Lake	Rusty crayfish	38052900
Splash Lake	Lake	Rusty crayfish	38053100
Shagawa Lake	St. Louis	Rusty crayfish, spiny water flea	69006900
Stub Lake	Lake	Rusty crayfish	38078100
Sucker Lake	Lake	Rusty crayfish	38053000
Lake Superior	Lake	Rusty crayfish, spiny waterflea, zebra mussels, etc.	16000100
Tofte Lake	Lake	Rusty crayfish	38072400
~~Thomas Lake*~~	~~Lake~~	~~Curly leaf pondweed~~	~~38075100~~
Triangle Lake	Lake	Rusty crayfish	38071500
Lake Vermilion	St. Louis	Rusty crayfish, spiny waterflea, curly leaf pondweed	69037800
White Iron Lake	St. Louis	Rusty crayfish	69000400
Wolf Lake (Ely)	St. Louis	Rusty crayfish	69016100

* Recent surveys have not found any evidence of AIS previously reported

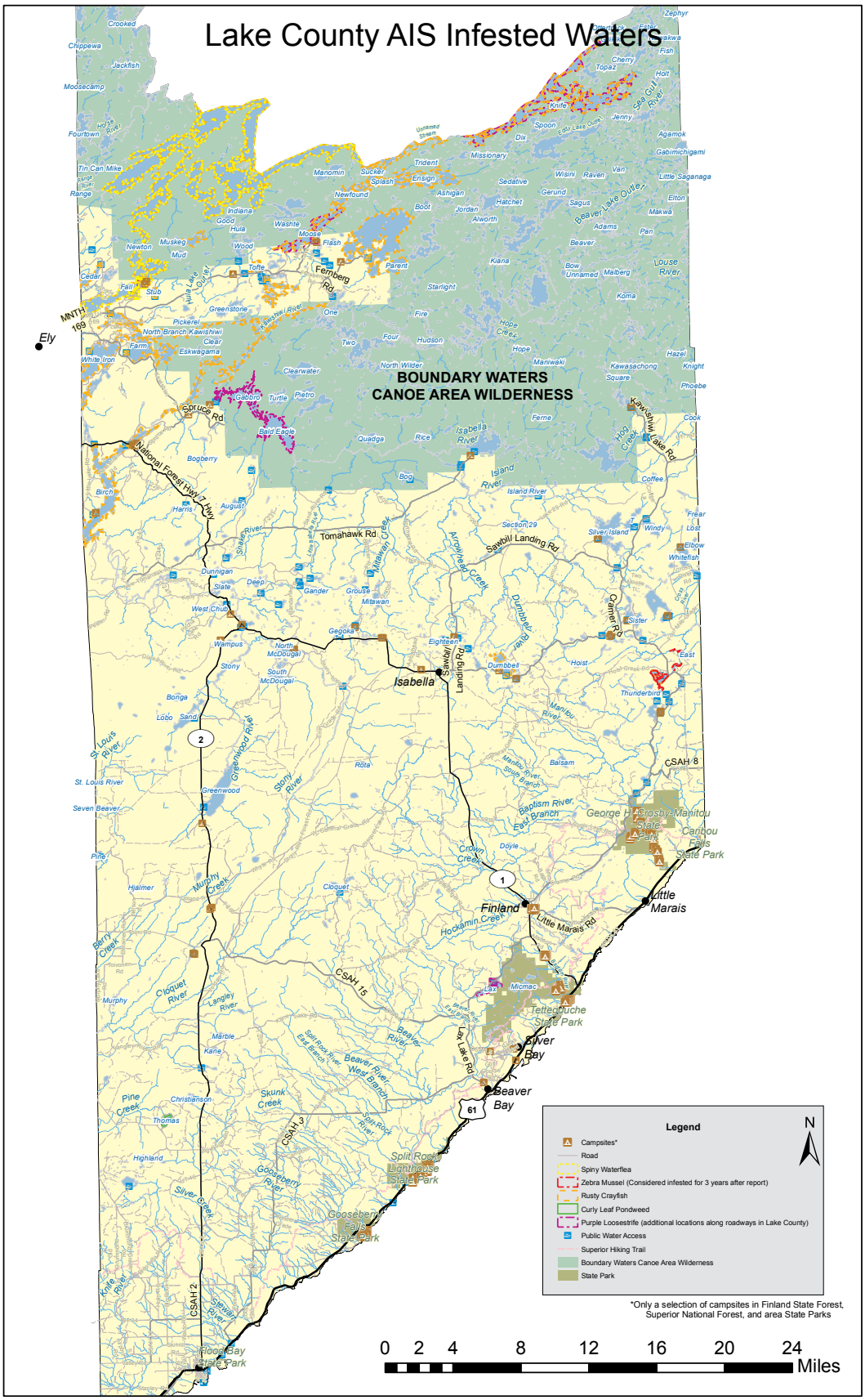
This is an area/local list of infested waters. For a current list of infested waters visit MNDNR at http://www.dnr.state.mn.us/invasives/ais/infested.html

APPENDIX F: MAPS



Disclaimer: Map and/or data not appropriate for use in establishment of property boundaries, in property descriptions, or for any legal purposes; not appropriate for navigation; not for use by third parties. Lake County SWCD makes no representation or warranties, expressed or implied, with respect to the use or reuse of the map and/or data provided herewith, regardless of format or the means of transmission. Map and/or data provided "as is" with no guarantee or representation of accuracy, currency, suitability, performance, merchantability, reliability, or fitness for any particular purpose. Lake County SWCD shall not be liable for any direct, indirect, special, incidental, compensatory, or consequential damages or third party claims that result from the use of this map and/or data, even if Lake County SWCD has been advised of the possibility of potential loss or damage . This map and/or data may not be used in states that do not allow this exclusion or limitation of incidental or consequential damages.

APPENDIX F: MAPS



Sonja Smerud 2017
Data Source: Lake County, MN; MN-DNR
NAD 83; UTM Zone 15N; Transverse Mercator

APPENDIX G: ADDITIONAL RESOURCES

Midwest Invasive Species Information Network - information on a broad range of invasive species, both aquatic and terrestrial. http://www.misin.msu.edu/training/

Stop Aquatic Hitchhikers and general AIS information: http://stopaquatichitchhikers.org/

Arrowhead Invasives Team: http://www.arrowheadinvasives.org/

Minnesota Department of Natural Resources:
Lake Finder
http://www.dnr.state.mn.us/lakefind/index.html
Invasive Species Laws
http://www.dnr.state.mn.us/invasives/laws.html
Current Fishing Regulations:
http://www.dnr.state.mn.us/fishmn/regs.html

University of Minnesota's AIS Detectors Program:
https://www.maisrc.umn.edu/ais-detectors

Minnesota Sea Grant's AIS Resource Pages:
http://www.seagrant.umn.edu/ais/index

Wisconsin Sea Grant Fish ID resources (also available as an app!):
http://www.seagrant.wisc.edu/home/Default.aspx?tabid=604

Books and/or Pdfs:

"A field Guide to Identification of Minnesota Aquatic Plants," Second Edition, University of Minnesota Extension, Mary Blickenderfer, Ph.D. http://www.extension.umn.edu/distribution/naturalresources/DD8242.html

"Through the Looking Glass," A field guide to aquatic plants - many and most of Minnesota's native and AIS are detailed in this book. http://www.uwsp.edu/cnr/uwexlakes/publications/laminates/laminates.asp

"Landscaping for Wildlife & Water Quality," Learn how to landscape your shoreline property to prevent shoreline erosion, resotre wildlife habitat, wildflowers, and clean water. http://www.comm.media.state.mn.us/bookstore/mnbookstore.asp?page=viewbook&BookID=67748&stocknum=310

"Aquatic Plants of the Upper Midwest - A photographic field guide to our underwater forests," Second Edition, Paul M. Skawinski. http://www.uwsp.edu/cnr-ap/UWEXLakes/Pages/resources/bookstore/APUM.aspx

MN DNR AIS Prevention Coordinator
Kelly Pennington
651-259-5131
Questions on a quatic invasive species permits, aquatic invasive species laws and regulations, education and public awareness, and risk assessment.

Area Conservation Officers:
To reach a conservation officer call: 1-888-646-6367
Silver Bay/Finland/Isabella Area - David Schottenbauer
Castle Danger/Two Harbors Area - Don Murray
Babbitt Area - Anthony Bermel
Ely Area #1 (Burntside) - Sean Williams
Ely Area #2 (White Iron - Knife Area) - John Velsvaag
Vermilion (Tower Area) - Marc Hopkins

Water Resource Enforcement Officer Region 2 - Mike Scott / Phone: (218) 390-4097

Contact and additonal information at http://www.dnr.state.mn.us/officerpatrolareas/index.html

Photo: Rusty crayfish, MN Sea Grant Jeff Gunderson

APPENDIX H: GETTING GPS COORDINATES FROM YOUR PHONE

If you have an iOS device:

1. Make sure you have location services on by navigating to: Settings > Privacy > Location Services > On. In the apps lilsted as using location services, ensure the compass app is allowed to use Location Services.
2. Exit the Settings menu.
3. Open the Compass application and current GPS coordinates should be listed at the bottom of the screen. The Compass app comes installed on iOS devices.

If you have an Android device:

1. Ensure your Location services are enabled, usually found on your Settings screen.
2. Open Google Maps - application comes installed on most Android Devices. You can also download a separate GPS application.
3. Hit the locator circle icon on the bottom right to zoom into your current location.
4. Tap and hold down over the blue dot indicating your current location until the application drops a red pin on your location - the GPS coordinates should display in the search box at the top of the application.

APPENDIX I: MN REGULATIONS

Non-Native Species Classifications from the MNDNR

Adapted from Minnesota DNR Invasive Regulations page: http://www.dnr.state.mn.us//invasives/laws.html

Prohibited Non-native Species

State laws and rules prohibit the possession, importation, purchase, sale, propagation, transportation, and introduction of prohibited invasive species without a permit. These are the species the DNR has reviewed and found to be of a high enough threat to warrant maximum oversight of any and all activities involving that species. Species listed on the Federal noxious weed list (with some exceptions) also fall into this category. The majority of AIS we are covering in this program fall into this classification.

Full list of Prohibited Non-Native Species: www.revisor.mn.gov/rules/?id=6216.0250

Regulated Non-native Species

It is legal to possess, import, purchase, propagate, transport, own, or sell a regulated invasive species, however a permit is required to introduce them into a free-living state, for example to release or plant them in public waters. The purpose of designating a species as regulated is to prevent the introduction of the species into the wild ecosystems. Examples of species on this list include the Chinese Mystery Snail and goldfish. These are species which are legal to own, buy, sell, eat, etc. but releasing them into the wild is illegal without a permit.

Full list of Regulated Non-Native Species: www.revisor.mn.gov/rules/?id=6216.0260

Unregulated Non-native Species

There are no invasive species permits related to unregulated Non-native species. In general, these are species that have been introduced intentionally, like the trout and salmon species stocked for fishing, or ring-necked pheasants, or species which have become so common that the DNR has ruled that the costs associated with control far outweigh the biological damage the species is potentially causing, such as the rock dove/feral pigeon. Remember, just because a species falls on this list does not mean they do not have legal protection or regulation under other laws, such as applicable licensing and seasons for fishing or federal laws protecting birds. Applicable permits are also require to release or stock these species.

Full list of Unregulated Non-native Species: www.revisor.mn.gov/rules/?id=6216.0270

Unlisted Non-native Species

Unlisted non-native species are those that are not listed as prohibited, regulated, or unregulated. Several steps must occur before an unlisted non-native species may be legally released into a free-living state: an application and supporting information must be filed with the DNR by the individual proposing to release the species, a thorough evaluation by the DNR, and designation of the species into an appropriate classification. This is the category for non-native species which the DNR has not yet made a classification ruling on.

SPECIAL REGULATIONS FOR AIS:

Crayfish regulations

The transportation of live native and invasive crayfish from one waterbody to another within the state is prohibited, except by permit issued by the DNR. Live crayfish or crayfish eggs may not be imported without a permit issued by the DNR. Live crayfish may not be sold for live bait or for use in aquariums. Live crayfish taken from a waterbody can only be used as bait in that same waterbody.

Rainbow smelt regulations

Rainbow smelt are a regulated species that can be harvested for human consumption. Smelt can also be bought or sold as long as it is not transported alive. It is illegal to use smelt for bait, live or frozen, unless it is used on waters on which it was harvested. Only DNR-approved frozen smelt can be used as bait in inland waters to prevent the spread of viral hemorrhagic septicemia (VHS).

Smelt fishing cannot be conducted in the French River, Sucker River, Little Sucker River, or Silver Creek. Check current DNR fishing regulations for additional information.

Additional considerations for bait

If you possess a current Minnesota fishing license, you can take an unlimited number of minnows or leeches for personal use as bait. Up to 12 dozen at a time can be transported, but fresh or bottled water must be brought to transport the bait (recall transport of water from a lake or stream is prohibited). Bait cannot be harvested from designated infested waters unless the water body harvested from is infested with Eurasian Watermilfoil only. In this case, minnows and leeches only can be harvested and the resulting bait is only used within the same body of water. Any unused bait cannot be disposed of in any water body.

APPENDIX I: MN REGULATIONS

Transportation prohibitions

Current state law prohibits transportation of all aquatic plants (with a few exceptions). This law will not only help prevent the spread of Eurasian watermilfoil, but it will also reduce the risk of zebra mussels being transported while attached to aquatic plants. In addition, it will reduce the inadvertent transport of other harmful plants into or within the state.

Under state law, it is unlawful to:

- transport aquatic plants, except as allowed in statutes ($100 civil penalty or misdemeanor)
- transport zebra mussels and other prohibited species of animals ($500 civil penalty or misdemeanor)
- place or attempt to place into waters of the state a boat, seaplane, or trailer that has aquatic plants ($200 civil penalty), zebra mussels, or other prohibited invasive species attached ($500 civil penalty or misdemeanor).

As of July 1, 2012, a boat lift, dock, swim raft, or associated equipment that has been removed from any water body may not be placed in another water body until a minimum of 21 days have passed.

Regulations on transport of water

As of July 1, 2012, the following regulations apply to the transportation of water in boats and other water-related equipment by boaters from all waters in the state ($100 civil penalty or misdemeanor):

- A person leaving waters of the state must drain all water from water-related equipment, including bait containers, live wells, and bilges, by removing the drain plug before transporting the watercraft and equipment from the water access or riparian property;
- Drain plugs, bailers, valves, or other devices used to control the draining of water from ballast tanks, bilges, and live wells must be removed or opened while transporting watercraft and water-related equipment;
- Emergency response vehicles and equipment may be transported on a public road with the drain plug or other similar device replaced only after all water has been drained from the equipment upon leaving the water body.
- The following are exempt from this subdivision:
  - » portable bait containers used by licensed aquatic farms
  - » portable bait containers used when fishing through the ice, except on waters designated infested for viral hemorrhagic septicemia (VHS)

Regulations in designated infested waters

The DNR designates waters that contain populations of Eurasian watermilfoil, faucet snail, New Zealand mudsnail, zebra mussel, ruffe, round goby, spiny water flea, VHS fish disease, and white perch as infested waters. Those waters will be posted with Invasive Species Alert signs at the public water accesses and listed in the annual DNR Fishing Regulations booklet. A full list of infested waters is available at DNR website at www.dnr.state.mn.us/invasives/ais/infested.html and a list of Lake County Waters is included in this manual in the Appendix.

The following regulations apply to activities in infested waters:

- taking wild animals (fish, frogs, crayfish, etc.) from infested waters for bait or aquatic farms is prohibited except for:
- commercial purposes by permit in some infested waters
- noncommercial bait harvest for personal use in waters that contain Eurasian water milfoil if:
- the infested waters are designated solely because they contain Eurasian water milfoil, and
- equipment for taking is a cylindrical minnow trap not exceeding 16 x 32 inches
- all nets, traps, buoys, anchors, stakes, and lines used for commercial fishing or turtle, frog, or crayfish harvesting in an infested water that is designated because it contains invasive fish, invertebrates, or certifiable diseases, as defined in section 17.4982, may not be used in any other waters

Regulations on transport of infested water

The following regulations apply to the transportation of water from infested waters:

- water from infested waters may not be used to transport fish except by permit
- water from infested waters may not be transported on a public road or off riparian property on infested waters except in emergencies or under permit ($200 civil penalty or misdemeanor)

The full State of Minnesota statute regarding invasive species is available at: www.revisor.mn.gov/statutes/?id=84D

The Minnesota Fishing Regulations are available at: www.dnr.state.mn.us/fishmn/regs.html