

Got zebra mussels? Now what?

An overview of what to expect and what you can (and can't) do about zebra mussels in your lake.

Ecosystem impacts

Zebra mussels are rapidly-reproducing filter feeders. Established populations siphon huge volumes of lake water every day and remove a significant amount of plankton from it, shunting nutrients from the water column to the bottom of lakes. This can have large scale impacts to water quality and lake food webs that include:

- **Increased water clarity**—this may seem like a good thing at first, but this generally means less food for small fish and other aquatic organisms and more light penetration in the water column.
- **More light**—which generally leads to more vigorous aquatic plant growth across a wider area of the lake. Both native and invasive plant species respond positively to this, but if invasive plants such as curlyleaf pondweed or Eurasian watermilfoil are already present, they will typically outcompete native species, potentially leading to nuisance growth levels.
- **Increased risk of harmful algal blooms**—During filter feeding, mussels reject toxic cyanobacteria while consuming non-toxic plankton, increasing a lake's overall proportion of blue-green algae. Blooms of filamentous algae (*Cladophora* spp.) may also increase in severity because this species benefits from more light in the water column, increased nutrients at the lake bottom, and more attachment substrate on zebra mussel shells.

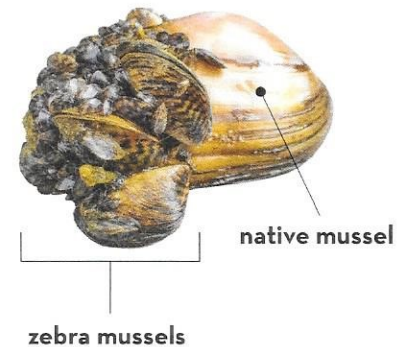
Zebra mussels and lake enjoyment

Swimming

- The sharp shells of zebra mussels can cut bare feet. Most lakeshore residents adapt to zebra mussels in their swimming areas by wearing water shoes and scraping encrusted mussels off of swim ladders with a putty knife or similar tool.
- Accumulations of empty zebra mussel shells on swimming beaches can also become a nuisance. A rake and shovel can be used to scrape zebra mussels into a pile and, if necessary, the sand can be conserved and shells filtered out using a mesh screen.
- There are several Minnesota companies that remove zebra mussels for homeowners. Depending on the situation, a team of divers uses a hot water pressure hose or manual removal methods to remove zebra mussels from riprap, piers, and larger rocks in the swimming area. Depending on the severity of the infestation, these services are typically needed 2-3 times per season.

Fishing

- Because increased water clarity directly impacts plant growth, abundance, and species composition, habitat conditions for fish survival, growth, and reproduction are impacted. This also changes predator prey interactions in fish, favoring some species over others. It is generally believed that these conditions favor species like northern pike, muskellunge, and bass, while disfavoring species like walleye that require darker, colder water.
- Research has shown that first year walleye in zebra mussel infested lakes grow more slowly and are 12-14% smaller at the end of their first summer than walleye in uninfested lakes. Slower growth during the first year is associated with higher mortality due to increased predation, lower energy reserves to help them survive through the winter, and delayed access to a wider range of prey.



Keys to identification

- Stripes are generally in zigzag pattern
- Pattern is variable; some may lack striping altogether and can be solid tan or brown
- Have a flat edge and won't topple over when set on it
- Shells form straight line when closed
- Range from 1/5 of an inch to 2 inches

Boats, docks, and lifts

- Zebra mussels can damage boats and engine systems if they are left in the water for prolonged periods. Storing boats on a lift prevents mussel establishment on or in motors, but it is important that the engine is trimmed or the boat is raised high enough to ensure that the lower unit stays out of the water between uses.
- If docks and lifts are removed from the water at the end of each boating season, zebra mussels are rarely able to reach densities that would pose a nuisance because attached mussels eventually die and fall off over the fall and winter. Remember that under Minnesota state law, if you must move a dock, lift or other water equipment to a different waterbody, all organisms must be removed whether they are dead or alive. Furthermore, the equipment must be out of the water for at least 21 days before it can be placed in another lake or river.

Irrigation systems

- Zebra mussels can clog intake screens and restrict flow inside the pipes of lake water irrigation systems. This may necessitate filtration system upgrades or result in higher maintenance expenses.

Reasons to maintain vigilance and optimism

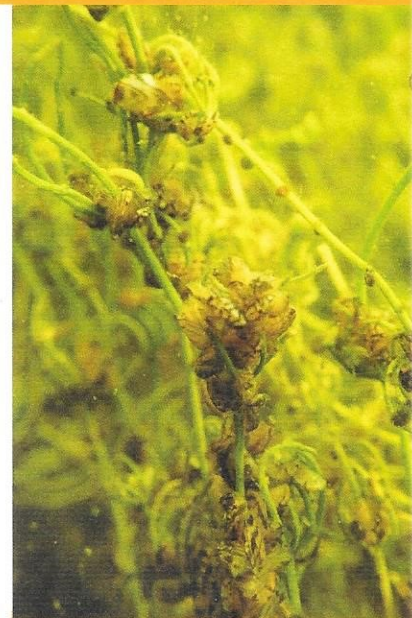
A new invasion of zebra mussels could make it seem like the battle against AIS is lost at your lake. In truth, the opposite is the case: this is the time to double down on outreach and future prevention efforts. Why? Every effort should be taken to ensure that your lake does not become the source population for the next new infestation of zebra mussels. Two, there is growing awareness about the effects of multiple introduced species within a water body. Zebra mussel populations in Minnesota lakes tend to become severe and then stabilize at more tolerable levels, but if additional AIS such as spiny water flea or starry stonewort are present, impacts could be far more severe than any of these species on their own.

Who should you call?

- If you're looking for a zebra mussel removal company or a dock installer, find an operator who is a MNDNR-certified Lake Service Provider. The MNDNR maintains a searchable, location-specific database of certified providers on its website.
- Some zebra mussel mitigation activities require permits from the MNDNR. Before undertaking any projects, contact your local MNDNR AIS Specialist.
- The Minnesota Aquatic Invasive Species Research Center is working toward solutions for all aspects of the zebra mussel problem, from reducing the risk of spread to improving population management methods to finding eradication tools. Visit the MAISRC website or contact Center staff for more information.

Minnesota Aquatic Invasive Species Research Center

The Minnesota Aquatic Invasive Species Research Center (MAISRC) is a nationally acclaimed research facility based at the University of Minnesota that focuses specifically on aquatic invasive species threatening the beloved waters of Minnesota. We work to develop an in-depth understanding of the biology and ecology of AIS—and the complex systems in which they live—to find vulnerabilities and weaknesses in their life cycles that can be targeted for control. We work with partners across the University, state, and country to maximize our impact and use the most technologically advanced and cost-effective methods available. You can learn more about our research on our website: www.MAISRC.umn.edu



Zebra mussels will attach to virtually any solid structure, including plants, rocks, native mussels, or man-made structures such as docks, pipes, and boats.



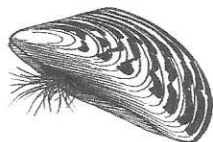
Juvenile zebra mussels and larvae can survive in water contained in bait buckets, livewells, ballast tanks, and motors. Always be sure to drain all water when leaving the lake and never pass up an opportunity for a hot water decontamination to prevent their spread.

Clean, drain, dispose information
MNDNR.gov/ais



What are zebra mussels?

Zebra mussels are small freshwater mussels that are not native to Minnesota. Adults range from ¼ to 1 ½ inches long and have yellow and brown striped shells. Unlike native mussels, they can attach themselves to hard surfaces in the water.



Zebra mussel
(*Dreissena polymorpha*)

Where did zebra mussels come from?

Zebra mussels are native to Eastern Europe and Western Russia. They have spread throughout much of Europe and Asia over the past 200 years. They were likely brought to North America in the ballast water of ships and were discovered in Lake Erie in 1988.

What problems can they cause?

Zebra mussels can:

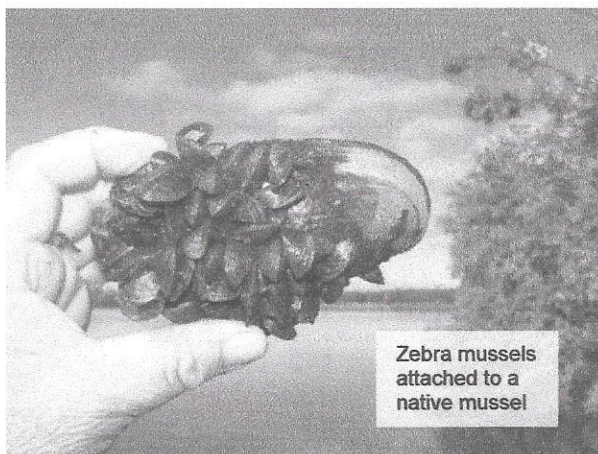
- clog irrigation intakes and other pipes,
- attach to boat motors and boat hulls, reducing performance and efficiency,
- attach to rocks, swim rafts and ladders where swimmers can cut their feet on the mussel shells,
- attach to and smother native mussels, and
- eat tiny food particles that they filter out of the water, which can reduce available food for larval fish and other animals, and cause more aquatic vegetation to grow as a result of increased water clarity.

Zebra mussels in Minnesota

Zebra mussels were discovered in the Duluth harbor in 1989. As of 2014, the DNR had documented zebra mussels in fewer than 100 water bodies in Minnesota. The DNR has listed a total of 213 water bodies as “infested” with zebra mussels, a regulatory classification which includes some water bodies that are connected to water bodies where zebra mussels have been found.

How do they spread?

Zebra mussels can attach to boats or aquatic vegetation and be carried to a different lake or upstream in a river. The microscopic larvae (called “veligers”) may be carried in bait buckets, live wells, or other water.



Zebra mussels
attached to a
native mussel

What should you do to prevent their spread?

Before you leave any water access, clean weeds and debris from your boat, remove drain plugs and keep them out while traveling, and dispose of unused bait in the trash. For additional recommendations see mndnr.gov/AIS.

Regulatory classification

Zebra mussels and quagga mussels (a related species) are both classified as *prohibited invasive species* in Minnesota. It is illegal to import, possess, buy, sell, transport, or introduce them into state waters.