

Zebra Mussels:

Questions and Answers for Inland Lake Managers

The zebra mussel invasion of North America has generated concern and anxiety among inland lake users and property owners about the potential impacts of zebra mussels on inland lakes. Despite the progress made in understanding the causes and consequences of the zebra mussel invasion, it is still impossible to predict exactly which lakes will be invaded or how they will be impacted. Inland water users armed with knowledge about the zebra mussel, however, can help prevent the spread and impacts of this exotic species.

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What are zebra mussels?

Zebra mussels are small (< 4 cm/1.5 in), bivalve (shell composed of 2 halves) molluscs (relatives of clams). Their shells characteristically have alternating light and dark bands (like a zebra) but may be entirely light or dark. Two species of zebra mussels have invaded North America, *Dreissena polymorpha* and *Dreissena bugensis*. *Dreissena bugensis* is also referred to as the quagga mussel. Discovered after the zebra mussel, the quagga mussel gets its name from an extinct relative of the zebra.

Where did they come from? How did they get here?

Zebra mussels are native to drainages of the Black, Caspian, and Aral seas in Eastern Europe-Western Asia (Eurasia). They were most likely brought to North America as larvae in ballast water of ships that traveled from fresh-water Eurasian ports inhabited by the mussels, across the Atlantic, and into the Great Lakes, where the ballast water and the zebra mussel larvae it contained were released.

How do they spread?

Zebra mussel larvae (called veligers) and adults can be spread by many mechanisms including water currents, anglers' bait buckets, and boaters' bilge and livewells. Adults can also be spread when they attach to boats and aquatic plants, which are then transported to other lakes. Aquatic plants are usually transported accidentally when they become entangled on the boat motor or the boat trailer's axle, license plate, lights, etc. Scientists currently believe that most inland lakes become infested by an introduction of adults rather than veligers.

How do zebra mussels reproduce?

Zebra mussels usually reach reproductive maturity by the end of their first year. Reproduction occurs through

spawning when sperm and eggs are released into the water. Spawning peaks at water temperatures of about 20 °C (68 °F). A fertilized egg results in a free-swimming, planktonic larva called a veliger. This veliger remains suspended in the water column for 1 to 5 weeks, and then begins to sink and search for a stable surface (e.g., rocks, aquatic weeds, water intakes, boat hulls) on which to live, grow, and reproduce.

Why should I be concerned?

Because zebra mussels can interfere with recreational use of a lake and can substantially alter its ecosystem, anyone who lives or plays on an inland lake should be concerned about the possible impacts of zebra mussels. Exactly which impacts will occur, however, is difficult to predict. The population size and therefore the potential impacts depend on several characteristics of the lake (e.g., turbidity, chlorophyll *a*, amount of hard substrate) that can affect zebra mussel populations. There are several possible impacts that could result, however, based on experiences in the Great Lakes and in inland lakes already invaded by zebra mussels. These scenarios are based on the facts that:

- 1) zebra mussels can attach to almost any hard surface;
- 2) each mussel can filter up to 1 liter (1.06 quarts) of water per day; and
- 3) their shells are sharp.

• A knack for attachment

Zebra mussels attach to unprotected, submerged surfaces by producing adhesive structures called byssal threads. Boats, boat motors, water intake pipes, submersible pumps, docks, floats, rocks, native mussels, and aquatic plants are all susceptible to being colonized by zebra mussels. Impacts of zebra mussel attachment to these objects range from inconvenience, to expensive repairs, to death (of native mussels).

• Fanatic filterers

Zebra mussels feed by drawing water into their bodies and straining out most of the suspended microscopic plants, animals, and debris for food. This process can lead to increased water clarity and a depleted food

supply for other organisms in the lake. Increased water clarity (and thus increased light penetration) can lead to an increase in the amount of rooted vegetation. A depleted food supply may affect the food web, including game fishes. The filtering process can also lead to blue-green algal blooms. When filtering, zebra mussels tend to reject blue-green algae, and spit them back into the water. These blue-greens are then able to thrive because other types of algae are reduced.

• **Caution: sharp edges!**

Zebra mussel shells can easily cut human skin. If they accumulate on beaches or in swimming areas, enjoyment and use of these resources can decline. Given this, as well as the other potential impacts discussed above, your ability to use an inland lake for recreation may decline if it becomes infested with zebra mussels.

Is my lake at risk for being invaded?

Because their physical and chemical characteristics fall within the ranges required by the zebra mussel, most of the lakes in the Great Lakes region are at risk for being invaded by this exotic species. The degree of risk for your lake can vary, however, depending on the specific values of these characteristics (see table below), especially water temperature (critical to growth and reproduction) and calcium (necessary for shell formation). Degree of risk also depends on a lake's connection to water bodies already infested with zebra mussels, including boats launched on your lake after being used in an infested waterway.

	Colonization Risk*		
	Low	Medium	High
Sustained maximum summer water temperature °C (°F in parentheses)	9-16 (48-61) 28-30 (82-86)	16-18 (48-64) 25-28 (77-82)	18-25 (64-77)
Calcium (mg/l)	≤20	20-25	≥25
Total hardness (mg CaCO ₃ /l)	≤45	45-90	≥90
pH	≤6.5-7.2 ≥9.0	7.2-7.5, 8.7-9.0	≥7.5-8.7
Dissolved oxygen (ppm)	≤4-6	6-8	8-10
Conductivity (μS)	≤22-36	36-82	≥82
Water velocity (m/s)	≤0.08-0.09 ≥1.25	0.09-0.10 1.00-1.25	0.1-1.0

**Table modified from C. R. O'Neill, Jr. 1996. The zebra mussel: impacts and control. New York Sea Grant, Cornell University, Ithaca, NY.*

How can I keep zebra mussels out of my lake?

Many lakes become infested with zebra mussels as a result of accidental introductions by humans. These introductions can be prevented. Property owners and other recreational water users can be informed about

zebra mussels and ways to prevent their spread through boat-landing signs, mailings, discussions at association meetings, etc. Studies have shown that the more effort that is put toward education, the more likely a recreational water user will take steps to prevent their spread. Some lake associations eager to reduce the likelihood of an introduction provide a boat washing station, and require its use before allowing a boat to launch into their lakes. Other lake associations require sterilization and quarantine of boats before they are allowed on their lakes. Your state natural resource agency can help you determine if quarantining your lake is a viable option.

How can I tell if zebra mussels are in my lake?

Your lake can be monitored for both zebra mussel veligers and adults. Veliger monitoring provides the earliest possible detection of an established population, thus allowing lake property owners to protect their equipment (e.g., intake pipes and boat motors) from being colonized by mature adult zebra mussels and settling veligers. Early detection also allows your lake users to take immediate steps to avoid spreading veligers to neighboring lakes. Sea Grant has developed a veliger monitoring kit that comes complete with sampling equipment, instruction booklet, instructional video, and expert analysis of the first pair of samples. These kits are available for \$300, or can be compiled from an equipment list provided by Sea Grant (see "How can I learn more?" on page 4).

Monitoring for adults provides information on the extent and magnitude of the zebra mussel infestation. You can monitor for adults by:

- 1) immersing hard substrates (e.g., concrete blocks) in areas around the lake and checking them periodically during summer and fall; and
- 2) checking submersed portions of recreational equipment (e.g., boats, dock supports, floats, etc.) when they are removed from the lake for winter storage.

It is important to monitor several areas of the lake because zebra mussels can be localized for a long period before they spread to other areas.

Your lake may already be part of a zebra mussel monitoring program. Therefore, check with local authorities and utilities before beginning a monitoring venture.

How can I reduce the impact of zebra mussels?

Boat motors should be flushed and thoroughly drained after boating to prevent zebra mussels from surviving and settling within the cooling system. Boat lifts can prevent zebra mussels from colonizing boat hulls. Frequent use (e.g., 1-2 times per week) of the boat at high speed can strip off any colonized mussels from the boat hull. Pontoon boats, however, may not reach sufficient speed to remove the mussels. Boat transoms, trim tabs, and rubber boots should be visually inspected; any attached zebra mussels can be removed by hand. Boats and boat motors can be further protected against zebra mussels through the use of protective paints and coatings. Zebra mussels will accumulate on docks and floats, but the mussels will die if the docks and floats are pulled up on land during the winter. Swimmers can protect their feet from cuts by zebra mussel shells by wearing sandals or swimsocks/aquasocks.

Water intakes can be protected by converting them to sand-filter intakes. Some property owners allow inexpensive intakes (e.g., PVC pipe) to become clogged, and replace them when necessary. Water pumps and a home's internal piping can be protected by installing a filter between the lake and the pump.

What have other lakes experienced?

- Jed Pearson (Fisheries Biologist, IN DNR) hasn't noticed any changes in the types or abundance of fish in Lake Wawasee (IN), which has been infested since 1991.
- Terry Griffith (Owner, Griffith's Wawasee Marina) has seen zebra mussels colonize hulls of infrequently used boats left in the water all summer, and one pontoon boater had problems with zebra mussels lodged in the motor's shift mechanism. He reports that most boaters use a boat lift, which stores the boat out of the water



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and therefore prevents zebra mussels from colonizing the hulls. Zebra mussels in motor cooling systems have not been much of a problem on Lake Wawasee.

- Randy Lang (Fisheries Program Specialist, IN DNR) recounted that state biologists have seen native mussels colonized with zebra mussels in several of Indiana's infested lakes. He also has heard complaints of zebra mussels colonizing dock pilings, float ladders, and swimming areas in Lake Wawasee.
- A baitshop near Lake Wawasee and property owners around Lincoln Lake (IL) have experienced zebra mussel-clogged intake pipes leading to their minnow tank and lawn sprinkling systems, respectively.
- Ladd Johnson (Assistant Professor, Laval University) and David Garton (Senior Research Scientist, Georgia Institute of Technology) conducted research on a number of inland lakes and noticed decreases in native mussels and changes in types of submersed, rooted vegetation after the lakes were invaded by zebra mussels.

Who should I contact if I find zebra mussels in my lake?

Preserve the zebra mussels with rubbing alcohol or by freezing, and call Sea Grant or your state natural resource agency (see "How can I learn more?" on page 4). Preservation of the specimen allows it to be positively identified by a biologist, and reporting your findings allows scientists to track the spread of zebra mussels. Reporting zebra mussel sightings also allows local authorities to share your findings with other users of the lake, allowing them to take appropriate precautions to protect their equipment and avoid spreading the mussels to other waterways.



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For additional copies of this fact sheet, contact Illinois-Indiana Sea Grant at 217-333-9448 or goettel@uiuc.edu.

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How can I learn more?

Inquire about other zebra mussel fact sheets that detail many of the subjects covered above. To obtain copies or to receive additional information, contact Illinois-Indiana Sea Grant (847/872-8677) or your local Department of Natural Resources (IL DNR: 847/294-4134, IN DNR: 317/232-4094), or visit the Sea Grant Nonindigenous Species Web site (<http://www.sgnis.org>).

Prevent the Spread

Steps for recreational water users

BEFORE leaving boat launch:

Inspect boat, trailer, and equipment, and remove any plants and animals.

Drain, on land, all water from the motor, livewell, bilge, and transom well.

Empty water from bait buckets on land, and dispose of unwanted bait in trash.

AFTER leaving boat launch:

Wash all equipment with 104° F water or a high pressure sprayer.

OR

Dry equipment for at least five days.

