Lake Notes

Zebra Mussels

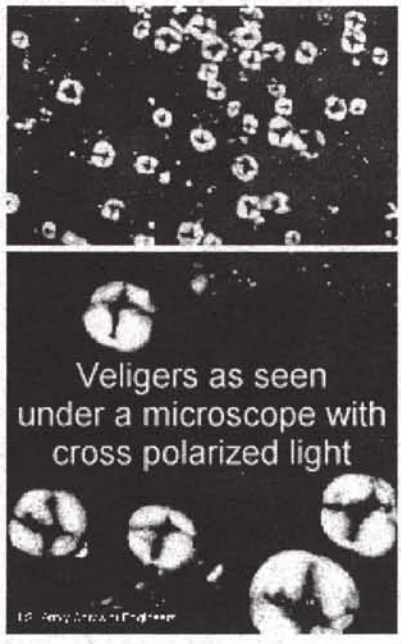
Zebra mussels are small mollusks native to lakes and rivers in eastern Europe and western Asia including the Caspian, Black, and Aral Seas and the Ural River. Mollusks are invertebrates belonging to the phylum Mollusca which also includes snails, clams, squids, and octopuses. Zebra mussels were probably carried to North America in 1985 or 1986 in the ballast water of ocean going ships that emptied their ballast in the Great Lakes ports. Infestation of North American waters by this exotic nuisance species has damaged natural ecosystems, industrial infrastructure, and recreational equipment including boats and motors.

Courtesy M. Van Bolt

Two species of zebra mussel have been introduced into North America: *Dreissena polymorpha* and *Dreissena bugensis*. *Dreissena polymorpha* was first discovered in the United States in 1988 in Lake St. Clair east of Detroit, Michigan; while *Dreissena bugensis* was first discovered in 1989 in Ontario, Canada at Lake Erie's Port Colborne. Zebra mussels got their name from the alternating dark and light stripes on their shells, like the stripes of a zebra. *Dreissena bugensis* is also called the quagga mussel. The name "quagga" refers to an extinct relative of the zebra. Zebra mussels can get up to two inches long, but usually average about one inch.

An "Explosive" Life Cycle

Zebra mussels have enormous reproductive potential and few predators in North America. Female zebra mussels can lay as many as a million eggs each summer when the water temperature reaches at least 50°F. They begin reproducing at the end of their first year of life and can live up to five years, although they usually live for only about two years in North American waters. Zebra mussels reproduce by releasing eggs and sperm into the water. The fertilized eggs develop into tiny, free-swimming larvae called *veligers* which are only about the size of the period at the end of this sentence. Veligers get their name because they have an organ with cilia (tiny hair-like structures) called a *velum* which they use for feeding and swimming. Veligers live in the water column for one to five weeks, traveling with water currents, until they develop an appendage called a "foot" for moving over surfaces and adhering to them. Ultimately, zebra mussels settle on a stable surface where they live, grow, and reproduce.



Courtesy Vermont DEC

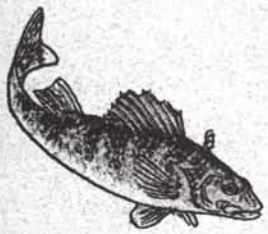
Because they attach to surfaces and are difficult to remove, zebra mussels are unusual freshwater mussels. Attaching firmly to surfaces is a common trait of salt water mussels, but not fresh water species. Zebra mussels generate a tuft of fibers, known as *byssal threads*, from a gland in their foot. These fibers produce an adhesive secretion that allows them to attach firmly to all sorts of underwater surfaces.

Oh, the Problems They Cause!

Ecological Damage

Zebra mussels are extremely efficient filter feeders, depleting resources at the base of the aquatic food web and thereby limiting the food supply available to other animals including fish and native mussels. Zebra mussels feed on microscopic plants (algae/phyto-plankton) and animals (zooplankton) that they obtain by filtering water. Even when zebra mussels do not digest these particulates, they bind them with mucus into pellets called *pseudofeces*, making the particulates unavailable as food for other organisms. One zebra mussel can filter about one quart (liter) of water per day, and large colonies filter vast amounts of water, removing important food resources at the same time.

In some cases, this food depletion may be responsible for declining fish populations. For example, some scientists suspect that zebra mussels may be causing a reduction in white fish and other fish populations in the Great Lakes. One of the food sources for these fish is the small, shrimp-like crustacean *Diporeia*, an important link in the aquatic food web. Because zebra mussels may be competing with *Diporeia* for food, this may be responsible for disappearing populations of *Diporeia*—which in turn results in the decline of fish species that eat *Diporeia.* The presence of zebra mussels also can lead to fish kills because the respiration and breakdown of waste products from large colonies of zebra mussels depletes dissolved oxygen in the water.



The presence of zebra mussels also may be contributing to the declining populations of native mussels. Currently about 70 percent of the 29 native mussel species are threatened, endangered, or thought to be in need of protection. Zebra mussels compete with native mussels for food and interfere with their movement, respiration, and reproduction by attaching to their shells. As many as 10,000 zebra mussels have been found attached to a single native mussel!

Infrastructure and Recreational Damage

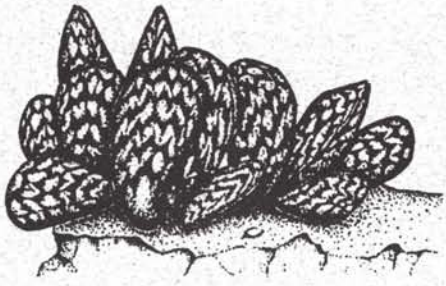
Zebra mussels are notorious for attaching to water intake pipes and reducing or completely blocking the flow of water to power plants, public water supply plants, and industrial facilities. Millions of dollars have been spent to clean zebra mussels out of intake pipes. In 1989, Detroit Edison in Monroe, Michigan (the largest fossil-fueled power plant in the world) had to shut down as a result of zebra mussels blocking their water system. Additionally, zebra mussels interfere with the recreational use of lakes by colonizing boat hulls and motors (including water intake pipes and pumps), resulting in inconvenience and in some cases, the need for expensive repairs. Zebra mussels also are sharp and can cut bare feet, and dead mussels are very smelly, both of which diminish the enjoyment of zebra mussel-infested beaches and swimming areas.

How Do They Spread?

Zebra mussels can spread through the movement of veligers with water currents. They also can spread from lake to lake when boats carrying zebra mussels are moved from an infested body of water to one that is not yet infested. Zebra mussels can attach directly to boats or to aquatic plants that become entangled on motors or trailers. Research indicates that most zebra mussel infestations occur when adult mussels are carried from one body of water to another. However, zebra mussels may also spread if veligers are present in bait or bait buckets that are carried between water bodies or if veligers are present in a boat bilge or livewell.

Abundance and Distribution

Once zebra mussels spread to an area, they have the potential to reach explosive numbers in a relatively short period of time. For example, zebra mussels first appeared in the Mississippi River in 1991, and less than ten years later some parts of the riverbed had as many as 20,000 mussels per square yard.



Courtesy Ohio Sea Grant College Program

Since zebra mussels were first found in Lake St. Clair in 1988, they have spread to all five Great Lakes, many inland lakes, and the major river systems of the midwestern United States including the Illinois, Mississippi, Ohio, Cumberland, Tennessee, Wabash, and Arkansas Rivers. Zebra mussels also have infested the St. Lawrence Seaway and Hudson and Mohawk Rivers in New York state. Zebra mussels were found for the first time in the Missouri River in 1999, in Virginia in an isolated quarry in 2002, and in Kansas in a reservoir in 2003. As of October 2003, the

following states and Canadian provinces were known to have zebra mussels in inland or border waters: Alabama, Arkansas, Connecticut, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, New York, Ohio, Oklahoma, Pennsylvania, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, Ontario, and Quebec.

What Lakes are at Risk?

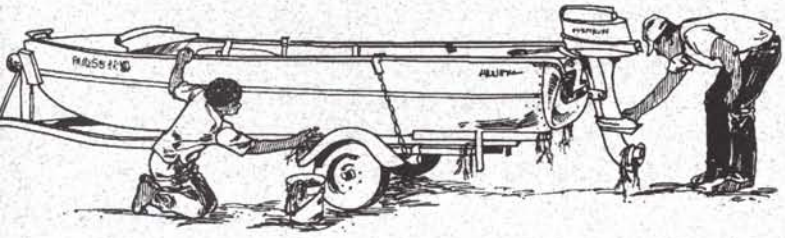
Most inland lakes in the Great Lakes region could become infested with zebra mussels, especially if they are in close proximity to other infested waters and are used for recreational boating. However, certain characteristics of a lake influence how extensive a zebra mussel population is likely to become if introduced. For example, lakes with either especially low (48-61°F) or especially high (82-86°F) sustained maximum summer water temperatures do not provide a good environment for zebra mussel reproduction and therefore are at low risk for a serious zebra mussel infestation. Lakes with especially low calcium levels are also at low risk because mussels need calcium for shell formation.

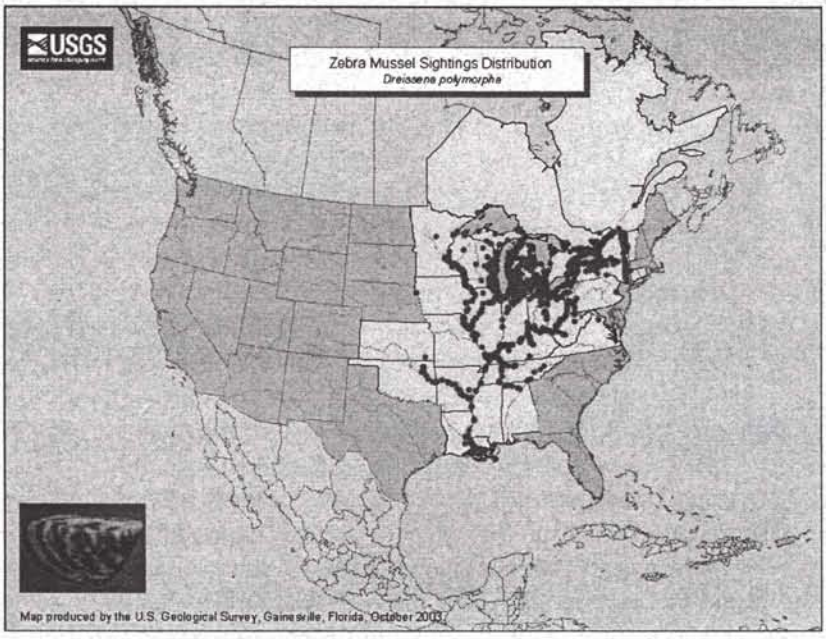
What Can You Do to Help?

One of the most important steps you can take to control the spread of zebra mussels is to become educated about zebra mussels and educate other lake users as well. Putting up informational signs and guidelines for cleaning equipment can help slow the spread of zebra mussels. Setting up boat and equipment inspection and washing stations at launch areas encourages people to follow boat and equipment cleaning guidelines.

Minimizing Spread

- Inspect boats and equipment for mussels and aquatic plants before leaving the waterway. Be sure to inspect the boat motor and trailer for entangled plants, especially around the axle, license plate, and taillights. All mussels and plants found should be removed and thrown into the trash—*NOT* onto the shore or back into the water.





2003 Zebra Mussel Distribution *Courtesy USGS*

- Drain all water from the boat, including bilge, transom well, engine cooling system, motor, and livewell before leaving the waterway. Also drain water from all other recreational equipment.
- Dry the boat and trailer in the sun for at least five days. If you are using the boat sooner, rinse off the boat, trailer, anchor, anchor rope, and other equipment with hot (104°F) water or with a pressure sprayer. Taking the boat to a self-serve car wash may be a convenient way to clean it.
- Do not transfer live bait from one waterbody to another. Either throw unused bait into the trash or give it to someone who will use it at the same body of water.

Reducing Impacts

- Use a boat lift to store your boat out of the water and thereby prevent zebra mussels from colonizing the hull.
- Visually inspect your boat regularly and pull or wash zebra mussels off.
- Remove docks and floats from the water for the winter in order to kill attached zebra mussels.
- Wear protective foot coverings such as sandals or aquasocks to avoid being cut by sharp zebra mussel shells.
- Discourage zebra mussels from colonizing pipes and pumps by converting to sand filter water intakes and/or by installing filters between the lake and pipe openings and pumps.

Monitoring

If you are interested in finding out whether zebra mussels have been found in a particular lake or if the lake is currently being monitored, contact the Illinois Environmental Protection Agency and Illinois-Indiana Sea Grant (phone numbers provided on this page) to inquire about the status of zebra mussels and monitoring efforts at the lake.

You can monitor for adult zebra mussels yourself by immersing hard substrates, such as concrete blocks, in several different places in the lake (especially near boat launches and inflowing streams and rivers). It is important to monitor in several areas because a zebra mussel population may be concentrated in one area of the lake before spreading to the rest of the lake. Check the blocks throughout the summer and fall for attached adult mussels. You also should check submerged equipment, such as dock supports and buoys, for attached zebra mussels when you remove them from the water for winter storage. If you are interested in sampling your lake for zebra mussel veligers, a veliger monitoring kit and instructions can be ordered from Illinois-Indiana Sea Grant. Upon request, Sea Grant also will provide an equipment list for people who wish to put together their own veliger sampling kit.

Reporting

If you suspect that you have found zebra mussels in your lake, call the Illinois Environmental Protection Agency, Illinois-Indiana Sea Grant, or Illinois Department of Natural Resources to report the finding (phone numbers provided on this page). You also can submit a report through the **Illinois Aquatic Nuisance Species web site (http://www.iisgcp.org/il-ans)**. Be sure to preserve some mussel specimens for positive identification by storing them in a leakproof container with rubbing alcohol.

For Further Information

For more information about or to report finding zebra mussels, contact the following organizations:

Illinois Environmental Protection Agency in **Springfield, IL ♦ (217) 782-3362**

Illinois-Indiana Sea Grant in **Zion, IL ♦ (847) 872-8677**

Illinois Department of Natural Resources in **Topeka, IL ♦ (309) 968-7531**

There also are many informative web pages about zebra mussels, including:

The USGS Zebra Mussel Information Web Site ♦ http://nas.er.usgs.gov/zebra.mussel

This web site provides access to the National Zebra Mussel Information Network. The Network's mission is to provide information on zebra mussel control and management. You can view distribution maps, general zebra mussel information and photographs, bibliographic references, and a list of key contacts for zebra mussel information and reporting.

100th Meridian Initiative Web Site ♦ http://www.100thmeridian.org

The 100th Meridian Initiative is a cooperative effort among state, provincial, and federal agencies to prevent the westward spread of zebra mussels and other aquatic nuisance species. Information about the spread and distribution of zebra mussels can be accessed through this site.

The Sea Grant Nonindigenous Species Web Site ♦ http://www.sgnis.org

This web site offers access to research publications and educational materials produced by Sea Grant programs and other research institutions about zebra mussels as well as other aquatic nuisance species.

Lake Notes . . . is a series of publications produced by the Illinois Environmental Protection Agency about issues confronting Illinois' lake resources. The objective of these publications is to provide lake and watershed residents with a greater understanding of environmental cause-and-effect relationships, and actions we all can take to protect our lakes.

This *Lake Notes* publication was prepared by Laura Barghusen and Holly Hudson of the Northeastern Illinois Planning Commission, Chicago, Illinois (www.nipc.org). Thanks are extended to Patrice Charlebois of the Illinois-Indiana Sea Grant College Program and Illinois EPA Headquarters staff for their review and comments. We would also like to acknowledge *Zebra Mussels: Questions and Answers for Inland Lake Managers*, Sea Grant Publication IISG-01-20, as a source of information for this publication.

For more information about other publications in this series and to request copies, please contact: Illinois Environmental Protection Agency, DWPC-Lakes Unit, P.O. Box 19276, Springfield, Illinois, 62794-9276; 217/782-3362; www.epa.state.il.us.

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