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# Zebra Mussels in the Great Lakes

A fact sheet from the Michigan Sea Grant College Program

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Zebra mussels are freshwater mollusks which were accidentally transported from Europe to North America in the mid 1980s. First discovered in Lake St. Clair in June 1988, the mussels quickly spread to Lakes Erie and Ontario and the St. Lawrence River. Since then, they have spread to all of the Great Lakes and a growing number of U.S. and Canadian inland waterways. They are expected to spread to the majority of the U.S. within a decade. The D-shaped, light-and-dark-banded zebra mussels are not the first non-native species to enter the Great Lakes. At present some 136 non-native species have been accidentally or purposely introduced into the Great Lakes.

Most zebra mussels are thumbnail-sized, but they can reach two inches (5 cm) long in their 2-year life span. Adult mussels can colonize many hard underwater surfaces such as spawning reefs, docks, boat hulls, commercial fishing nets, buoys, water intake pipes, native mollusks, and other zebra mussels.

## Methods of Transport

Zebra mussels migrated from their native Black and Caspian Seas to Europe via man-made canals. For almost 200 years the mussels have resided in the fresh waters of western and central Europe. Researchers believe that the mussels were accidentally transported to North America via ship ballast water. With the increased speed of ocean transport, zebra mussels and other non-native species are now able to survive the transoceanic journey.

Cargo ships take in ballast water to redistribute weight when cargo is unloaded. The water is loaded in one port and expelled in another, depositing anything present in the water. To reduce the incidence of accidental introductions via ballast water, some shippers now exchange fresh water from foreign ports with salt water before entering the fresh waters of North America.

There are many possible methods of transport within the Great Lakes and to inland waterways. Mussels can spread via commercial and recreational boat traffic, amphibious airplanes, scuba equipment, fish and bait transport containers, fishing gear, aquariums, research projects, school science projects, and wildlife.

In the eastern Great Lakes region zebra mussels have moved inland to New York's Erie Canal, Finger Lakes, Hudson River, Mohawk River, and Susquehanna River. Other inland sightings include the Chicago Canal, and Illinois, Ohio, Tennessee, and Mississippi Rivers. Zebra mussels have also been discovered in a number of inland lakes and rivers in Michigan.

## Successful Colonizers

Zebra mussels can cluster together in colonies of hundreds of thousands per square meter. The mussels' ability to quickly populate a body of water is due to a high reproduction rate and limited natural predators.

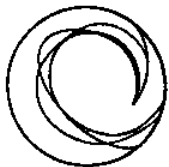
One mature female can produce up to 40,000 eggs in one season. The spawning season lasts as long as water temperatures exceed 39° F (4° C). Eggs are fertilized outside the shell and hatch within a few days. The young are microscopic larvae called veligers and can be carried great distances in water currents. Veligers float in the water an average of 8 to 14 days after which they must attach to a firm surface or they will die. Threadlike filaments (byssal threads) produced by the veligers and adult mussels are used to attach firmly to surfaces. Those mussels that attach and survive will transform into a double-shelled mollusk within three weeks and mature in a year.

Zebra mussels have few natural predators—mainly fish such as freshwater drum, carp, and sturgeon, and some diving ducks. These predators are not numerous enough in North America to have a significant impact on the large mussel populations.

## Impact on Great Lakes System

The mussels' explosive ability to populate vast areas of lake bottom has raised fears that they may negatively affect fish and other aquatic native species by altering the food web, changing the water chemistry, and physically disabling native species.

One zebra mussel can filter one liter (approximately one quart) of water per day. Dense colonies of mussels filtering tiny floating plants and animals (plankton) from the water are believed to cause increased water clarity in some areas. In the western basin of Lake Erie, water clarity has increased by 77 percent, or to 20 feet. It is not yet known what effect this has on the food web.



The Michigan Sea Grant College Program is a cooperative program of Michigan State University and the University of Michigan designed to support greater knowledge and stewardship of the Great Lakes and ocean resources.

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Researchers are studying whether the health and growth of fish are affected by the reduced amount of plankton. To date, walleye eggs in Lake Erie's spawning reefs have not been affected by the presence of their new neighbors. The effect of zebra mussels on egg survival of other fish species is not known but researchers have noted that native mussel populations have decreased. Native mussels cannot function with the accumulation of zebra mussels on their shells and quickly die.

### Costly to Industry

In addition to altering the Great Lakes ecosystem, zebra mussels have also disrupted water withdrawal operations by clogging water intake pipes. This has caused serious problems in the Great Lakes region, where about 655 billion gallons of Great Lakes water are withdrawn each day for use by more than 25 million people, thousands of crop and livestock farms, hundreds of lakeshore industries, and dozens of nuclear and fossil fuel power plants. Municipal and industrial plants which rely on raw water drawn from lakes and rivers are already spending hundreds of thousands of dollars to eradicate zebra mussels. The U.S. Fish and Wildlife Service forecasts 5 billion dollars in losses over the next decade to manufacturing, power, and municipal water intake facilities that use Great Lakes water.

High flow rates in water intake pipes provide a constant source of plankton for the filter-feeding mussels. Mussels cluster in mats on top of each other, lining the inside of pipes. These clusters become too heavy, slough off the pipes, lodge in intakes, and decrease water flow.

Great Lakes water users are encouraged to implement early zebra mussel detection programs patterned after established monitoring methods. If the mussels are discovered while in the pre-juvenile, or veliger stage, it is easier to forestall a major infestation.

### Recreation Hindered

Zebra mussels can disrupt Great Lakes recreational activities such as shipwreck diving, beach walking, and boating. Some shipwrecks have become heavily colonized by mussels to the extent that some wrecks are virtually unrecognizable. Beach recreation is hindered in some locations by large numbers of zebra mussels washing ashore and rotting, leaving a foul odor and razor-sharp shells.

Boaters should be cautious because zebra mussels can accumulate and grow in water intakes of both inboard and outboard boat motors, causing engines to overheat. Boats should not be left idle in the water for extended periods of time. With regular use, engine heat will keep mussels from colonizing inside most engine parts.

Mussels attach quickly to boat hulls and can affect boat handling capability, reduce fuel efficiency, and slow speed. If a boat hull feels grainy or gritty, it's likely to be covered with small zebra mussels. Boaters are advised to clean boat hulls and water trapping compartments before moving from infested to uninfested waters and to avoid using infested water to transport live bait. Microscopic larvae or veligers can be unknowingly transported in bilges, engine cooling systems, minnow buckets, live wells, and anywhere water

is trapped. For tips on how to avoid transporting mussels, contact the Sea Grant extension agent in your area.

### Methods of Control

Researchers are faced with the challenge of trying to find a way to eradicate zebra mussels while at the same time leaving native species unharmed. Although some treatments to control zebra mussels at specific sites have proven effective, eliminating the mussels on a lake-wide basis is not probable. Methods of mussel control such as chlorination, chemical treatment, ozone, heat, ultraviolet radiation, electrical shock, anti-fouling paints, and sonic vibrations are under experimentation. The use of biological agents, including toxic microorganisms, parasites, and spawning inhibitors is also being investigated. Michigan Sea Grant is currently funding zebra mussel research projects involving spawning inhibitors and ballast water exchange.

### How Far Can They Spread?

Zebra mussels can spread quickly from infested to uninfested waters. Mussel infestation is possible if water temperatures are between 39 and 81 degrees Fahrenheit, calcium levels are greater than 25 parts per million (necessary for mussel shell development and reproduction), and salinity levels are below 8 parts per thousand. Generally, these requirements exist in North America from the East Coast to the West Coast and from the southernmost states to southern Canada.

Zebra mussel sightings should be reported to Sea Grant or your Department of Natural Resources. Zebra mussel identification cards are available from Sea Grant.

### For More Information

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