

# ZEBRA MUSSEL

## Overview

Zebra mussels (*Dreissena polymorpha*) are small, fingernail-sized mussels native to the Caspian Sea region of Asia. Considered one of most damaging of the invasive species introduced to this country, zebra mussels were transported to the Great Lakes in ballast water from a transoceanic vessel. The ballast water, taken on in a freshwater European port, was subsequently discharged into Lake St. Clair near Detroit, where the mussel was discovered in 1988. Since that time, they have spread rapidly to all of the Great Lakes and waterways in many states, as well as Ontario and Quebec. Due to their aggressive spread and establishment throughout the Great Lakes, as well as the degree of connectivity between the Great Lakes basin and other major waterways (e.g., the Mississippi River), the zebra mussel also has spread to southeast and western portions of the United States.



One of the zebra mussel's most defining characteristics is its tendency to colonize hard substrates and surfaces (e.g., rocky bottoms and water intake structures) in high densities, with as many as tens of thousands living in a square yard. Zebra mussels have caused a great deal of economic damage by clogging intake pipes of water treatment and power plants as well as boat engine cooling systems. Unfortunately, solutions to these problems are few and not highly effective, resulting in high costs for cleaning and control measures. Zebra mussel colonization also has damaged historical shipwrecks in the Great Lakes.

Another priority concern is the deleterious effects that zebra mussels have had on local ecosystems. During the process of feeding, a single zebra mussel can filter up to a quart of water per day, reducing the amount of phytoplankton available for other organisms. Their filtration of phytoplankton causes other negative impacts, including increased water clarity that can result in changes to the ecological structure of the lake community. In addition, zebra mussels accumulate contaminants within their tissues to levels greater than concentrations in the water column, increasing the exposure of wildlife to contaminants. Zebra mussel infestations also threaten native mussel populations by attaching to the native species and essentially smothering them.

**Photo:** U.S. Geological Survey

## Identification

Zebra mussels are named for the striped pattern of their shells. Color patterns vary, and some specimens may have dark or light colored shells with no stripes. They are typically found attached to hard objects, surfaces, or each other by threads underneath the shells. Although similar in appearance to the quagga mussel (*Dreissena bugensis*), the two species are easily distinguished – when placed on a surface, zebra mussels are stable on their flattened underside while quagga mussels, lacking a flat underside, will fall over.

**Size:** Up to 2 inches in length

**Native range:** Black, Caspian, and Azov Seas

## Nonindigenous Occurrences

The first account of an established zebra mussel population was in 1988 in the Canadian waters of Lake St. Clair, a water body connecting Lake Huron and Lake Erie. The following year, zebra mussels spread from the Great Lakes basin and found their way into the Illinois and Hudson rivers. The Illinois River was the pathway through which they were introduced into the Mississippi River drainage, which covers over 1.2 million square miles. By 1990, zebra mussels had been found in all the Great Lakes.

**Means of Introduction:** The suspected vector of zebra mussel introduction to North America was a release of larval mussels during the ballast exchange of a single commercial cargo ship traveling from the north shore of the Black Sea to the Great Lakes. Its rapid dispersal throughout the Great Lakes and major river systems was due to the passive drifting of the larval stage (the free-floating “veliger”), and its ability to attach to boats navigating these lakes and rivers. Its rapid range expansion into connected waterways was probably due to barge traffic, transporting the attached mussels to locations where they were scraped or fell off during routine navigation. Other vectors contributing to the zebra mussel's expansion include recreational fishing and boating activities.

**Status:** Zebra mussel populations are established in all the Great Lakes, most of the large navigable rivers in the eastern United States, and in many inland lakes in the Great Lakes region. As of 2010, zebra mussels have either been collected or established in a range of states outside of the Great Lakes region, including: Alabama, Arkansas, California, Colorado, Connecticut, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Mississippi, Missouri, Nebraska, North Dakota, Oklahoma, Tennessee, Texas, Utah, Vermont, and West Virginia. Further spread of the zebra mussel to the western United States is of particular concern as their infestations extend ecological and economic impacts to a region already challenged with water management issues.

**Distribution Maps:** Geographic information on the location of aquatic invasive species sightings in the United States is made available through the U.S. Geological Survey, Nonindigenous Aquatic Species (NAS) program (<http://nas.er.usgs.gov>). The NAS distribution maps for the zebra mussel can be found at: <http://nas2.er.usgs.gov/viewer/omap.aspx?SpeciesID=5>.

**Significant Contributions Provided by:**

U.S. Geological Survey, Nonindigenous Aquatic Species Program. <http://nas.er.usgs.gov>

**References:**

- Illinois Environmental Protection Agency. Aquatic Exotics. <http://www.epa.state.il.us/water/conservation/lake-notes/aquatic-exotics/aquatic-exotics.pdf>

## Studies, Assessments and Management Plans

**Quagga-Zebra Mussel Action Plan for Western U.S. Waters (2010)**

Western Regional Panel on Aquatic Nuisance Species

[www.anstaskforce.gov/QZAP/QZAP\\_FINAL\\_Feb2010.pdf](http://www.anstaskforce.gov/QZAP/QZAP_FINAL_Feb2010.pdf)

This plan, submitted to the national Aquatic Nuisance Species Task Force in February 2010, summarizes current dreissenid mussel management strategies of agencies across all levels of government, identifies priority actions, and makes recommendations on ways to coordinate activities.

**Glen Canyon National Recreation Area Expanded Zebra Mussel Action Plan (2007)**

National Park Service U.S. Department of the Interior Glen Canyon National Recreation Area Arizona and Utah

<http://www.nps.gov/glca/parknews/upload/Expanded%20Action%20Plan.pdf>

An Action Plan to prevent the spread of zebra mussels in Lake Powell and the upper Colorado River. The Zebra Mussel Prevention Program was further expanded in May 2008, at which time both Lake Powell and the upper Colorado River were believed to still be free of the mussels.

**The Origin of the Great Lakes Zebra Mussels (2001)**

Ohio Sea Grant

[http://www.oar.noaa.gov/spotlite/archive/spot\\_zebramussels.html](http://www.oar.noaa.gov/spotlite/archive/spot_zebramussels.html)

Ohio Sea Grant research compared zebra mussels from sites in Eurasia and North America to establish genetic relationships among the different species. The zebra mussel's "family tree" showed that Lake Superior's populations had the closest genetic link with the founding populations from the Rhine River. The samples from lakes Huron and Erie seem to be related to those from the Netherlands and Poland. While Lake Ontario's samples showed Poland as a founding species, Hudson River mussels appeared to be different from all North American samples except Lake Superior's.

**Developing Environmentally Sound Methods and Strategies to Control Zebra Mussels at Public Facilities (1994)**

U.S. Army Corp of Engineers

<http://www.anstaskforce.gov/Species%20plans/Developing%2520Environmentally%2520Sound%2520Methods%2520and%2520Stra.pdf>

This paper provides a description of U.S. Army Corps of Engineers efforts to develop methods and strategies to control zebra mussels at public facilities. Research is focused on the following structures: 1) locks and dams; 2) vessels and dredges; 3) power facilities; and 4) reservoirs, water intakes, gages, and pumping stations.

## U.S. and Canadian Federal Resources

**Zebra Mussel Research Program**

U.S. Army Corps of Engineers

<http://el.erdc.usace.army.mil/zebra/>

**Zebra Mussel Information System**

U.S. Army Corps of Engineers

<http://el.erdc.usace.army.mil/zebra/zmis/>

**Zebra Mussel Fact Sheet**

U.S. Geological Survey-Great Lakes Science Center

[http://www.glsc.usgs.gov/main.php?content=research\\_invasive\\_zebramussel&title=Invasive%20Invertebrates0&menu=research\\_invasive\\_invertebrates](http://www.glsc.usgs.gov/main.php?content=research_invasive_zebramussel&title=Invasive%20Invertebrates0&menu=research_invasive_invertebrates)

**Zebra and Quagga Mussel Information Resource Page**

U.S. Geological Survey-Nonindigenous Aquatic Species

<http://nas.er.usgs.gov/taxgroup/mollusks/zebramussel/>

**Zebra Mussel Sightings Distribution**

U.S. Geological Survey-Nonindigenous Aquatic Species

<http://nas.er.usgs.gov/taxgroup/mollusks/zebramussel/zebramusseldistribution.asp>

**Zebra Mussel Species Profile**

U.S. Department of Agriculture-National Invasive Species Information Center

<http://www.invasivespeciesinfo.gov/aquatics/zebramussel.shtml>

### **Dynamic Map of Zebra Mussel Distribution**

National Atlas of the United States

[http://nationalatlas.gov/dynamic/dyn\\_zm.html](http://nationalatlas.gov/dynamic/dyn_zm.html)

### **Indicator: Invasion of Zebra Mussels and Quagga Mussels**

U.S. Environmental Protection Agency-Detroit River-Western Lake Erie Indicator Project

[http://www.epa.gov/med/grosseile\\_site/indicators/sos/dreissena.pdf](http://www.epa.gov/med/grosseile_site/indicators/sos/dreissena.pdf)

### **The Unfolding Story of the Zebra Mussel in the St. Lawrence River**

Environment Canada-Saint Lawrence Centre

<http://www.ec.gc.ca/Publications/1627FCAC-4B0E-4B88-A471-C69123EB09F9/The-Unfolding-Story-of-the-Zebra-Mussel-in-the-St.-Lawrence-River.pdf>

### **The Influence of Water Levels on Zebra Mussel Colonization of the St. Lawrence River**

Environment Canada-Saint Lawrence Centre

<http://www.ec.gc.ca/stl/default.asp?lang=En&n=1791EA71-1>

### **Zebra Mussel**

Sea Grant Nonindigenous Species Site (SGNIS)

<http://www.sgnis.org/www/zebra.htm>

### **Zebra Mussel**

National Sea Grant Network & Geographic Education Alliances-Exotic Aquatics on the Move

[http://www.iisgcp.org/exoticssp/zebra\\_mussel.htm](http://www.iisgcp.org/exoticssp/zebra_mussel.htm)

### **Zebra Mussel**

Aquatic Nuisance Species Task Force Species of Concern

[http://www.anstaskforce.gov/spoc/zebra\\_mussels.php](http://www.anstaskforce.gov/spoc/zebra_mussels.php)

### **Zebra Mussel**

Stop Aquatic Hitchhikers!

[http://www.protectyourwaters.net/hitchhikers/mollusks\\_zebra\\_mussel.php](http://www.protectyourwaters.net/hitchhikers/mollusks_zebra_mussel.php)

## **State and Provincial Resources**

### **Zebra Mussels: Questions and Answers for Inland Lake Managers**

Illinois-Indiana Sea Grant

<http://www.ilm-lakes.org/Artwork/zebra7.pdf>

### **Zebra Mussel Fact Sheet**

Indiana Department of Natural Resources

<http://www.in.gov/dnr/files/ZEBRA-MUSSEL.pdf>

### **Zebra Mussel Fact Sheet**

Michigan Sea Grant

[http://miseagrant.umich.edu/downloads/ais/fs\\_zebra\\_mussel.pdf](http://miseagrant.umich.edu/downloads/ais/fs_zebra_mussel.pdf)

### **Great Lakes Photography: Zebra Mussels**

Michigan Sea Grant

<http://www.miseagrant.umich.edu/photos/ais/zmussel.html>

### **Zebra Mussel**

Minnesota Department of Natural Resources

<http://www.dnr.state.mn.us/invasives/aquaticanimals/zebramussel/index.html>

### **Zebra Mussel**

Minnesota Sea Grant

<http://www.seagrant.umn.edu/ais/zebramussel>

### **Zebra Mussels Threaten Inland Waters**

Minnesota Sea Grant

[http://www.seagrant.umn.edu/ais/zebramussels\\_threaten](http://www.seagrant.umn.edu/ais/zebramussels_threaten)

### **Zebra Mussel**

New York Sea Grant- New York Invasive Species Web Site

<http://nyis.info/animals/ZebraAndQuaggaMussel.aspx>

### **How to Deal with Zebra Mussels**

Ohio Department of Natural Resources-Division of Wildlife

[http://www.dnr.state.oh.us/Home/wild\\_resourcessubhomepage/dealing\\_with\\_wildlifeplaceholder/NuisanceSpecieslandingpage/terrestrialnuisancewildlife/fishingnuisancezebra/tabid/5826/Default.aspx](http://www.dnr.state.oh.us/Home/wild_resourcessubhomepage/dealing_with_wildlifeplaceholder/NuisanceSpecieslandingpage/terrestrialnuisancewildlife/fishingnuisancezebra/tabid/5826/Default.aspx)

### **Zebra Mussel**

Ontario Federation of Anglers and Hunters-Invading Species Awareness Program

<http://www.invadingspecies.com/Invaders.cfm?A=Page&PID=1>

### **Zebra & Quagga Mussel Fact Sheet**

Pennsylvania Sea Grant

<http://seagrant.psu.edu/publications/fs/zebraquagga2007.pdf>

### **Zebra/Quagga Mussel**

Aquatic Invasive Species of Pennsylvania

<http://www.pserie.psu.edu/seagrant/ais/watershed/mussel.htm>

### **Zebra Mussels**

Wisconsin Department of Natural Resources

<http://dnr.wi.gov/invasives/fact/zebra.htm>

### **Alien Profile: Zebra Mussel**

Wisconsin Department of Natural Resources-Environmental Education for Kids

<http://www.dnr.state.wi.us/org/caer/ce/ee/critter/invert/zebramussel.htm>

### **Zebra Mussel Fact Sheet**

Wisconsin Sea Grant

<http://www.seagrant.wisc.edu/Home/Topics/InvasiveSpecies/Details.aspx?PostID=655>

### **Zebra Mussel Watch**

Wisconsin Sea Grant

<http://seagrant.wisc.edu/zebramussels/>