

QUAGGA MUSSEL

Overview

The quagga mussel (*Dreissena bugensis*), a mollusk native to Ukraine, followed the zebra mussel (*Dreissena polymorpha*) as the second dreissenid species from Eurasia to invade North America. Quagga mussels were first discovered in the Great Lakes in 1989 near Port Colborne of Lake Erie and then in 1991 in the Erie Canal and Lake Ontario. They were found coexisting with dense populations of zebra mussels. Although these invasive mollusks are genetically and morphologically distinct, both have biological characteristics allowing their establishment and spread to watersheds across the United States.

Quagga mussels are fingernail-sized freshwater mollusks that attach to objects and other organisms. While zebra mussels are generally limited to the colonization of hard substrates (e.g., rocky bottoms and water intake structures), quagga mussels are able to colonize soft substrate. This characteristic has allowed the quagga mussel to spread to areas of sand and sandy silt, such as the bottom of Lake Erie. Quagga mussels are also better able to flourish in low-food conditions than zebra mussels, allowing them to colonize less productive waters in much greater numbers. Similar to the zebra mussel, quaggas are extremely effective in filtering water for food, removing large amounts of phytoplankton and suspended particulates. By removing phytoplankton from the water, quagga mussels decrease the food supply for zooplankton and forage fishes, impacting the entire aquatic food web. Studies indicate that beginning around 2005, quagga mussel filtering dramatically reduced primary production (photosynthetic production of chemical energy) in lakes Michigan and Huron. There have been significant impacts to the spring bloom of diatoms (silica based algae) by quagga infestations, disrupting the lower food web. Dreissenid mussels, including the quagga, have been implicated in the basin wide crash of populations of *Diporeia*, a bottom-dwelling invertebrate that once served as an important food source for many Great Lakes fishes. In addition to altering food webs, quagga mussels accumulate contaminants within their tissues, which can affect wildlife that feed on the species. Similar to zebra mussels, quagga mussels clog water intake structures, such as pipes and screens, thereby reducing pumping capacity for power and water treatment plants and causing significant economic impacts to industries, companies, and communities. Recreation-based industries and activities also have been impacted by the quagga mussel as docks, breakwalls, buoys, boats, and beaches all have been heavily colonized by this species.



Photo: U.S. Geological Survey

Identification

While similar to the zebra mussel in appearance, a distinguishing characteristic of the quagga is its rounded underside. When placed on its side, a quagga mussel will topple over, whereas a zebra mussel will maintain its position. In general, quaggas are rounder in shape than zebra mussels and tend to be paler in color near the hinge. Color patterns vary widely with black, cream, or white bands; a distinct quagga morph has been found in Lake Erie that is pale or completely white.

Size: Up to about 1.5 inches in length

Native range: Dneiper River drainage of Ukraine

Occurrences in the Great Lakes Basin

The quagga mussel was first sighted in the Great Lakes in September 1989, when the species was found near Port Colborne in Lake Erie. However, recognition of the quagga as a species distinct from the zebra mussel did not occur until August 1991 when, a mussel with a different genotype was found in a random zebra mussel sample from the Erie Canal near Palmyra, New York. Following confirmation that this mussel was not a variety of *Dreissena polymorpha* (zebra mussel), the new species was named "quagga mussel" after an extinct African relative of the zebra. The quagga mussel is currently distributed in lakes Michigan, Huron, Erie, Ontario, as well as Lake St. Clair, Saginaw Bay, and throughout the St. Lawrence River north to Quebec City. Inland occurrences of quagga mussels also exist in Michigan, Wisconsin, Indiana, Minnesota, New York, Ohio, and Pennsylvania.

Means of Introduction: The introduction of the quagga mussel into the Great Lakes appears to be the result of ballast water discharge from transoceanic ships carrying larval mussels. Species of the genus *Dreissena* have a high potential for adaptation often leading to rapid expansion and colonization. Other factors that aid in the spread of this species across North American waters include larval drift in river systems or fishing and boating activities, allowing for overland transport and movement among water basins.

Status: Quagga mussels are of particular concern in the Great Lakes region, where they have replaced zebra mussels as the dominant dreissenid mussel and their populations continue to expand rapidly in deep, offshore areas. The quagga mussel has spread throughout the entire Great Lakes basin, along with the Mississippi River and lower Colorado River basins. Established or sighted quagga populations also have been documented in Arizona, California, Colorado, Kentucky, Missouri, Nevada, and Utah. Quagga mussels also have been found on trailered boats in several states (e.g., Washington and Oregon), increasing the likelihood of spread to new

areas. Further spread of the quagga mussels 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 quagga mussel can be found at: <http://nas2.er.usgs.gov/viewer/omap.aspx?SpeciesID=95>.

Significant Contributions Provided by:

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

References:

- Evans, M.E., G. Fahnenstiel, and D. Scavia. 2011. Incidental oligotrophication of North American Great Lakes. *Environmental Science & Technology* 45: 3297-3303.
- Fahnenstiel, G., S. Pothoven, and H. Carrick. Eds. 2010. The lower food web of Lake Michigan: long-term trends and the Dreissenid impact [Special Issue]. *Journal of Great Lakes Research* 36, Suppl. 3: 1-88.
- Mills, E.L., G. Rosenberg, A.P. Spidle, M. Ludyanskiy, Y. Pligin, and B. May. 1996. A Review of the Biology and Ecology of the Quagga Mussel (*Dreissena bugensis*), a Second Species of Freshwater Dreissenid Introduced to North America. <http://www.slocountywater.org/site/Frequent%20Downloads/Quagga%20Mussels/pdf/A%20Review%20of%20the%20Biology%20and%20Ecology%20of%20the%20Quagga%20Mussel.pdf>
- Pennsylvania Sea Grant. Quagga Mussel. Fact Sheet. http://pserie.psu.edu/seagrant/publications/fs/Quagga_Mussel_12-2003.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

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.

Impact of Zebra and Quagga Mussels (*Dreissena* spp.) on Freshwater Unionids (Bivalvia: Unionidae) in the Detroit River (1998)

Schloesser, D.W., W. P. Kovalak, G. D. Longton, K. L. Ohnesorg and R. D. Smithee

<http://sgnis.org/publicat/papers/schlkoval.pdf>

The goal of this study was to assess the impact of zebra and quagga mussel infestation on unionids (Bivalvia: Unionidae). Unionids were sampled in the Detroit River in 1982–1983, before mussels invaded the river, and in 1992 and 1994, after mussels invaded the river.

A Review of the Biology and Ecology of the Quagga Mussel (*Dreissena bugensis*), a Second Species of Freshwater Dreissenid Introduced to North America. (1996)

Mills, E.L., G. Rosenberg, A.P. Spidle, M. Ludyanskiy, Y. Pligin, and B. May.

<http://www.slocountywater.org/site/Frequent%20Downloads/Quagga%20Mussels/pdf/A%20Review%20of%20the%20Biology%20and%20Ecology%20of%20the%20Quagga%20Mussel.pdf>

From the Symposium Biology, Ecology and Physiology of Zebra Mussels presented at the Annual Meeting of the American Society of Zoologists, 4-g January 1995, at St. Louis, Missouri.

U.S. and Canadian Federal Resources

Dreissena Species FAQs, A Closer Look

U.S. Geological Survey-Florida Integrated Science Center

http://fl.biology.usgs.gov/Nonindigenous_Species/Zebra_mussel_FAQs/Dreissena_FAQs/dreissena_faqs.html

Quagga Mussel Sightings Distribution

U.S. Geological Survey - Nonindigenous Aquatic Species

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

Species Profiles: Quagga Mussel

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

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

State and Provincial Resources

Quagga Mussels Fact Sheet

Michigan Sea Grant
http://www.miseagrant.umich.edu/downloads/ais/fs_quagga_mussel.pdf

Great Lakes Photography: Quagga Mussel

Michigan Sea Grant
<http://www.miseagrant.umich.edu/photos/ais/quagga-mussel.html>

Quagga Mussel Fact Sheet

Pennsylvania Sea Grant
http://pserie.psu.edu/seagrant/publications/fs/Quagga_Mussel_12-2003.pdf

Zebra Mussel & Quagga Mussel – Fact Sheet

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

Quagga Mussels (*Dreissena bugensis*)

Wisconsin Department of Natural Resources
<http://dnr.wi.gov/invasives/fact/quagga.htm>

Quagga Mussel Classification Table

Wisconsin Department of Natural Resources
http://www.dnr.state.wi.us/invasives/classification/pdfs/LR_Dreissena_bugensis.pdf

Quagga Mussel - Alien Profile

Wisconsin Department of Natural Resources-Environmental Education for Kids
<http://www.dnr.state.wi.us/org/caer/ce/ee/critter/invert/quaggamussel.htm>