The Great Lakes Policy Report

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Mussel Madness

Special focus on how the quagga mussel has dethroned the zebra mussel

The Great Lakes Policy Report is a quarterly news report published by the Little Traverse Bay Bands of Odawa Indians Natural Resource Department's Environmental Services Program. The report features Great Lakes policy updates and relevant initiatives, projects, and issues.

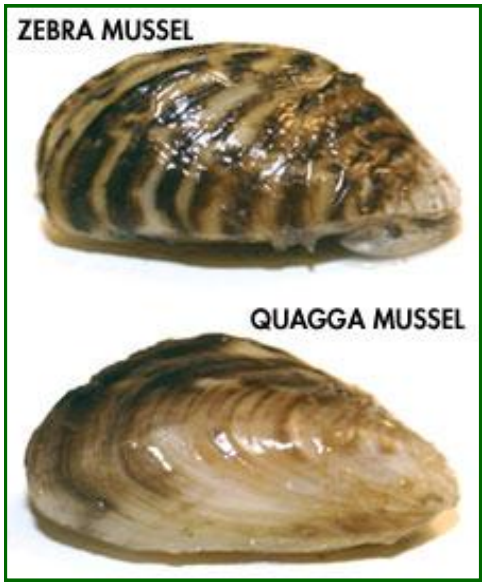
The report is meant to be an educational document, and does not express an opinion on the subjects discussed. Stories and information cited in this report are taken from a variety of sources including news articles, non-governmental reports, interviews, and government documents.

LITTLE TRAVERSE BAY BANDS OF ODAWA INDIANS
ODAWA NATURAL RESOURCE DEPARTMENT

Invasive Mussels: *Small Organisms Changing the Great Lakes in Big Ways*

Zebra and quagga mussels are two of the more well-known Great Lakes invasive species. Their combined impact continues to shape the Great Lakes ecosystem, commercial and subsistence fishing, business, and recreational activities. Zebra mussels (Dreissena polymorpha) were first identified in Lake St. Clair in 1986. Transported to the Great Lakes by ballast water (used for stabilization) in ocean going vessels, they are native to the Black and Caspian seas, in Europe and Asia. Quagga mussels (Dreissena rostriformis bugensis) arrived a couple of years later, first sited in Lake Erie in 1989. They are native to Ukraine. Both species are freshwater bivalve mollusks that are typically no bigger than an almond. Zebra mussels have a dark and light (zebra-like) pattern on their shells, but both species can have a combination of colors from off-white to dark brown. They are often found in clusters, attached to each other and other hard materials. Freshwater bivalve mollusks native to North America do not cluster. Zebra and quagga mussels have colonized all five of the Great Lakes; although according to researchers, "in Lake Superior they are found only in the harbors of Duluth, MN and Thunder Bay, ON" due to the lake's cold waters.

Invasive zebra and quagga mussels are having profound impacts on the Great Lakes ecosystem, including contributing to the decline in native mussel populations. Credit: Great Lakes Echo



Zebra and quagga mussels are similar in both colors and size, although quagga mussels tend to be a bit larger. Photo credit: U.S. Forest Service

Today zebra mussels are commonly cited as the main culprit for invasive mussel problems, but in actuality "quagga mussels are now the dominant invasive mussel species in the Great Lakes" according to researchers. The

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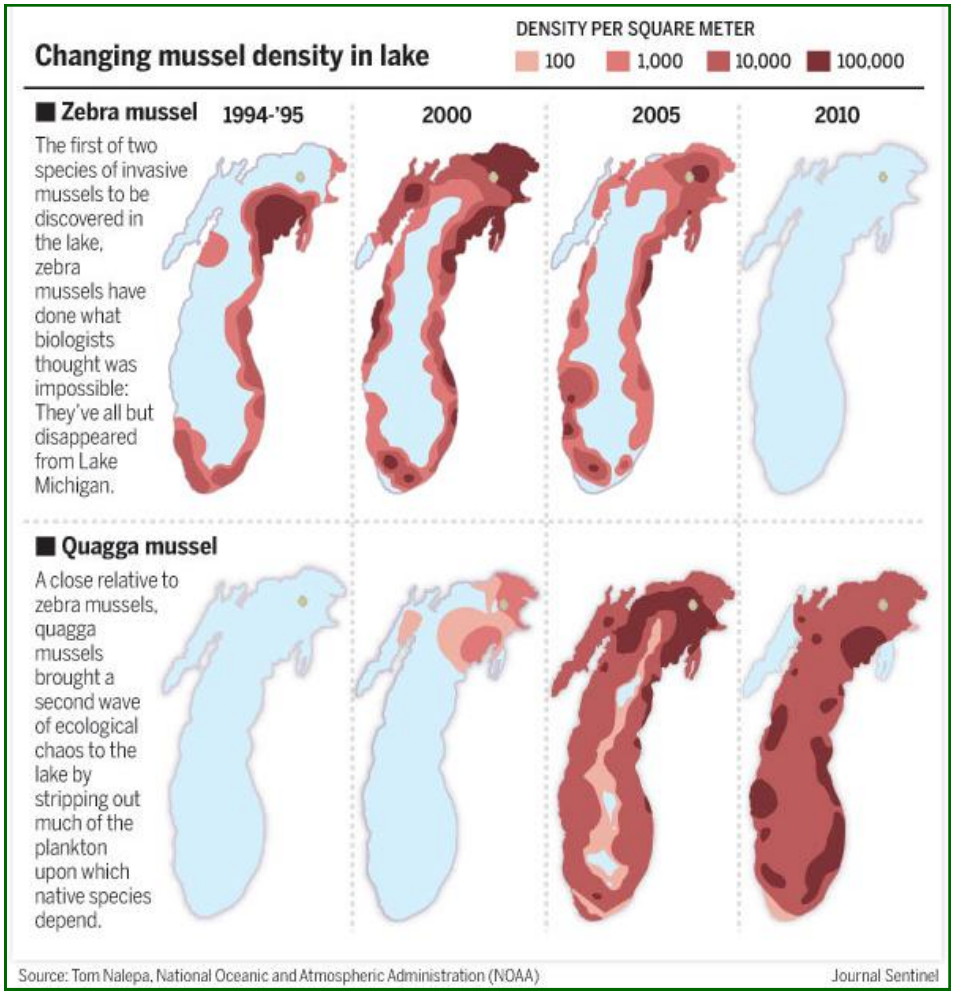
transition from zebra to quagga mussels has occurred over a relatively short period. For example, there were no quagga mussels present in Lake Michigan through the 1990s. Researchers estimate that there are now approximately 950 trillion quagga mussels in Lake Michigan alone. That equals roughly 500 million pounds of the small mollusk. In some areas the mussel density is so thick that large trawling nets can fill with them. Researchers have been able to catch 300 pounds of quagga mussels in a five minute trawl.

There are a couple important reasons why quagga mussels have flourished more than its invasive cousin. Quagga mussels are more successful at colonizing soft substrate (such as sandy lake bottoms) compared to zebra mussels, which typically require hard surfaces (such as rocks and man-made structures) to attach to. Additionally, quagga mussels are able to live in colder waters than zebra mussels. These two life traits allow quagga mussels to inhabit deeper, colder areas of the Great Lakes; areas that the zebra mussel cannot persist in.

Even though the quagga mussel has surpassed the zebra mussel in terms of quantity and impacts, both mussels result in the same types of consequences. Quagga and zebra mussels are extraordinary at filtering water. They remove large amounts of phytoplankton and particulate matter from the water, which is how they eat. By removing the phytoplankton, the invasive mussels out-compete the native zooplankton which normally feeds on phytoplankton. This competition has serious consequences for the rest of the Great Lakes food-web. As zooplankton have less and less food, their population decreases, removing an important food source for native fish species. The introduction and expansion of quagga and zebra mussels is credited with the decline of Diporeia, a native, shrimp-like organism in the Great Lakes (although research is still ongoing). For centuries Diporeia was the primary food source for most Great Lakes fish species at some point in their life-cycle, including the commercially valuable lake whitefish and the invasive, yet important prey fish – the alewife. On average, Diporeia densities in Lake Michigan have declined from 5,200 per square meter to 82 per square meter over the last 15 years (or about 96 percent).

Because whitefish have largely lost their staple food source, they have had to adapt. Resource managers are reporting that whitefish now mainly live off of a diet of invasive species. They are "eating the invasive mussels, invasive round gobies, invasive smelt, and invasive alewives."



Although zebra mussels can still be found in Lake Michigan (contrary to what the map appears to show), the quagga mussel population has exploded since 2000. Credit: Milwaukee Journal Sentinel

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Another impact associated with the large amount of water filtered by the invasive mussels is the increases in water transparency (clarity). Each mussel can filter approximately a quart of water a day. That adds up to a lot of filtered water when you remember that Lake Michigan alone contains billions of them. This allows light to penetrate deeper into the water, warming it, and fostering harmful algal blooms. For example, this process can result in Cladophora growth (although other contributing influences include increased nutrients and warmer water temperatures). Cladophora is a bottom-dwelling nuisance algae that washes up on shore in rotting, smelly clumps after it dies, and can harbor harmful bacteria. In addition, the clumps of algae usually contain mussels and other crustaceans, attracting hungry gulls and other waterbirds. The congregating birds result in the release of significant amounts of fecal material, which contains the bacteria E. coli. In localized waters, gulls can be the primary cause of harmful E. coli concentrations – putting human health at risk.

Researchers are also looking at zebra and quagga mussels' link to increased botulism outbreaks. In the Great Lakes region, about 52,000 waterbird deaths were attributed to type E botulism from 2002 to 2006. Type E botulism is a toxin that can reduce muscle function and cause paralysis. Research indicates that the mussels promote the growth of the bacteria responsible for type E botulism, and by filtering large amounts of water the botulism toxin concentrates in the invasive mussels. Some species of fish and waterbirds feed on the invasive mussels which allow toxins to bio-accumulate in their bodies and affect their survival. Humans can get botulism poisoning if the toxin is ingested by eating infected fish or animals.

Zebra and quagga mussels have harmful consequences for native mussels as well. The invasive mussels often attach to the shells of native mussels, reducing their ability to move, feed, and breed, and ultimately killing the native mussels. Although individually quagga mussels are relatively small, taking up little space on the lake bottom, collectively they can colonize vast areas on soft substrates. They reduce habitat complexity and displace native species as the density of the population increases.

In addition to the environmental and ecological impacts these invasive mussels have on the Great Lakes (and other waterbodies), they also have serious economic impacts in the region. As mentioned earlier, the invasive mussels disrupt the natural food-web and have serious impacts on commercially viable fish populations. Additionally, many of the same fish species are important for subsistence fishing. Zebra and quagga mussels attach to hard substrates such as water intake structures.

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Rocks on lake bottom in 1986 before zebra mussels. Note absence of algae and the natural cloudiness of the water.

Rocks on lake bottom in 2001 after zebra mussels. Note algae-covered rocks and increased clarity of the water.

The invasive zebra and quagga mussels have profoundly changed the processes of Lake Michigan. The picture above compares water clarity and algae growth before and after the presence of the invasive mussels in Lake Michigan. Photos credit: UMW School of Freshwater Sciences.

GREAT LAKES POLICY WATCH

In this section you can find current legislation and proposed regulations related to the Great Lakes. When applicable public comment periods and information on how to comment will be given.

Rules and Regulations

New York State has proposed to establish a "Vessel Waste No Discharge Zone" for the NYS area of Lake Erie stretching from the Pennsylvania-New York State boundary to include the upper Niagara River to Niagara Falls. The state believes that there is adequate facilities for the safe and sanitary removal and treatment of sewage from all vessels and therefore vessels do not need to discharge from any sewage, whether treated or not, into Lake Erie waters. More information and comment process can be fount www.regulations.gov

The Great Lakes Ecological and Economic Protection Act of 2013 was introduced into the U.S. House in mid-July 2013 by Representative Joyce. This bill mirrors a bill in the U.S. Senate with the same name introduced in late June 2013 by Senators Levin and Kirk. The two bill would authorize the Great Lakes Restoration Initiative at $475 million annually for through 2018; reauthorizes other federal programs related to the Great Lakes. More information at http://healthylakes.org/news-events/press-release/coalition-supports-new-great-lakes-bill/

During July several Michigan House bills related to state regulations of the hydraulic fracturing ("fracking") process. Among the changes, the bills would strengthen chemical disclosure requirements in fracking; requires public participation in the fracking process; and allows counties or townships to regulate fracking. More information can be found at http://www.legislature.mi.gov

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A pile of Cladophora and invasive mussels wash ashore on the coast of Lake Michigan. Credit: U.S. National Park Service

Mussel populations become so large that these pipes clog, which requires water treatment plants and power plants to continually spend money to remove the invasive mussels. One recent report estimates that 106 power plants using Greta Lakes water spend $130 million annually to remove invasive mussels from their facilities. Nuisance algal blooms, caused in part by the invasive mussels' ability to filter large amounts of water, cause harm to local tourism economies when beaches must be closed, limiting relational opportunities, due to health concerns. Government agencies spend millions of dollars annually to control aquatic invasive species and prevent these types of impacts.

Zebra mussels have arguably become the Great Lakes poster-child for invasive species impacts, although quagga mussels are currently having larger effects on the system. At least partially because of the media attention on the invasive mussel, there have been large gains in educating the public on invasive species control and prevention. More water users are cleaning their boats, boat trailers, and gear to make sure they are not spreading harmful invasive species to new locations. Boat wash stations and other preventative technologies are gaining use in local communities. Resource managers are developing monitoring and rapid response plans. And new and improved regulations are being implemented to prevent the introduction of new species to the Great Lakes. It has been several years since a new invasive species has been introduced through shipping vessels' ballast water – a vector that has contributed many current aquatic invasive species.

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Great Lakes RESTORATION

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