Quagga mussels: 950 trillion tiny time bombs in our lakes?
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By Jeff Alexander | Muskegon Chronicle MLive.com
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Howard Meyerson | The Grand Rapids PressGreen is not always good: Smelly, slimy blooms like this on the tip of South Fox Island in Lake Michigan are directly related to the explosion of quagga mussels.

A crew of government scientists was measuring water clarity recently in Lake Michigan, several miles offshore of Frankfort, when they saw something none had thought possible.

“The water was gin clear … you could see 90 feet down,” said Gary Fahnenstiel, a senior ecologist at the National Oceanic and Atmospheric Administration’s Great Lakes field station in Muskegon.

In areas of Lake Michigan not influenced by plumes of sediment from rivers, water clarity has more than doubled during the past decade, according to government data.

“Parts of Lake Michigan are now clearer than Lake Superior,” Fahnenstiel said. “If you want to see what Lake Michigan looked like 400 years ago, before Europeans arrived in this area, go to Big Sable Point in April or May and you can see it.”

For that, we can thank — or curse — the 950 trillion foreign quagga mussels blanketing much of Lake Michigan’s bottom.

Two decades after ocean freighters accidentally imported zebra and quagga mussels into the Great Lakes, the dime-sized mussels have dramatically increased water clarity by filtering huge quantities of fish food and nutrients out of the water.

The result: a clearer lake that is becoming an increasingly barren, hostile environment for fish and other aquatic life, particularly salmon and the fish they eat.
“People want their lakes to have the water of a swimming pool and the fishery of a trout pond,” Fahnenstiel said. “You can’t have both.”
There are 186 invasive species in the Great Lakes, 57 of which were imported by ocean freighters that reach the lakes through the St. Lawrence Seaway.
Quagga mussels are widely regarded as the most destructive invasive species to colonize the Great Lakes, surpassing even the ravenous sea lamprey.
The reason: Quagga mussels control the distribution of food and nutrients throughout the Great Lakes they have invaded, which affects every level of the food chain. Sea lamprey affected only fish populations.
Researchers said the mussels, which are native to the Caspian Sea in eastern Europe, have brought the ecosystem of the world’s sixth largest lake — Lake Michigan — to its knees. Quaggas even have displaced zebra mussels and now account for 99 percent of all mussels in the lake, according to scientific data.

Howard Meyerson | The Grand Rapids PressLake killers? A bed of invasive mussel shells 2 to 3 feet deep lines the shore of South Fox Island in Lake Michigan. The bleached, dead shells most likely were zebra mussels -- although that lake invader of yesteryear is difficult to distinguish from its more dangerous successor, the quagga mussel.
“These mussels are causing the biggest changes we’ve ever seen in Lake Michigan,” said Thomas Nalepa, a research biologist for NOAA’s Great Lakes Environmental Research Laboratory. “I can’t see any of these changes being good for fish.”
There are about 500 million pounds of quagga mussels in Lake Michigan. That’s four times the weight of all prey fish species combined, according to Nalepa.
The zebra mussel invasion of Lake Michigan in the 1990s, followed by the more extensive spread of quagga mussels over the past decade, has fundamentally altered how the lake functions.
Under normal circumstances, nutrients like phosphorus and tiny plants and animals called plankton were distributed throughout the waters of Lake Michigan, supporting fish and other aquatic life at all depths.

Quagga mussels have radically changed that dynamic. The mussels act like a giant sponge, sucking vast quantities of plankton and nutrients to the lake bottom, where it won't benefit many of the lake's inhabitants.

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Several key indicators of ecosystem health have been on a steady downward trend since zebra and quagga mussels arrived, according to scientific data compiled by state and federal agencies. Consider:

Phosphorus concentrations in Lake Michigan have dropped by 40 percent since 1990. Phosphorus fuels biological activity in freshwater ecosystems; too much phosphorus is bad for lakes, as is too little.

The level of biological productivity in the lake has decreased 30 percent since 1990. The change is akin to a farm producing 30 percent less food.

Plankton populations are crashing. The annual bloom of phytoplankton in the lake, which jumpstarts the lake's ecosystem every spring, no longer occurs.

The volume of prey fish, the small fish that larger fish eat, decreased 71 percent over the past decade as nutrient-hogging quagga mussels colonized the lake bottom. Prey fish abundance is now a fraction of what it was in 1973, when scientists began keeping records.

Adult alewives, the primary food source for salmon, are struggling. The 4,712 metric tons of adult alewives in Lake Michigan last year was a record low.

Diporeia, a tiny freshwater shrimp that was the most abundant source of fish food in the Great Lakes before zebra and quagga mussels invaded, have nearly vanished from Lake Michigan.

The mussel-induced food shortage has caused many species of fish in the lake, including alewives, whitefish and salmon, to shrink.

Quagga mussels also are fueling noxious algae blooms around the Great Lakes. The blooms have caused bacterial pollution that forced beach closures and triggered botulism outbreaks that killed countless fish and more than 70,000 fish-eating birds over the past decade.

Quagga mussels increase water clarity, which allows sunlight to penetrate deeper in the water. That added sunlight, combined with the mussels trapping phosphorus on the lake bottom (where algae grows) create ideal growing conditions for algae.

Storm-driven waves rip the algae off the lake bottom and it washes ashore, covering beaches with a blanket of smelly, decomposing vegetation. The algae that washes ashore often contains high levels of bacteria and contributes to the growth of the botulism bacterium.

Some species of fish eat zebra and quagga mussels that have concentrated the botulism bacterium in their bodies. Those fish become paralyzed by the botulism. The birds then

eat the fish, become paralyzed by the botulism and drown. Zebra and quagga mussels aren't affected by the botulism bacterium because they don't have a neural system; fish and birds do. The botulism in the lake is natural and has always been there; it's only a threat to people who might eat a fish or bird that died from botulism poisoning.

Problems caused by zebra and quagga mussels are being felt in all of the Great Lakes except Lake Superior, which doesn't have enough calcium in its water to support the formation of zebra or quagga mussel shells.

Changes wrought by quagga mussels have made the difficult job of managing Lake Michigan's artificial salmon fishery even more vexing.

Fish managers face the daunting task of maintaining the lucrative salmon fishery in the face of a shrinking supply of fish food. And they must do it against a backdrop of rapid, unprecedented changes that quagga mussels have inflicted on the lake.

DNR research biologist Randall Claramunt said fish managers have maintained a strong Lake Michigan salmon fishery, despite the mussel invasion, by reducing the number of chinooks stocked in the lake. He said a bumper crop of newborn alewives last year was proof that cuts in salmon stocking are working.

Still, uncertainty lingers about the future of the salmon fishery.

"The 2010 alewife year class will sustain the salmon in the short term. But how long will that last?" Claramunt asked. "That's a question that still needs to be answered."

As it stands now, quagga mussels clearly are in control of Lake Michigan's ecosystem, Fahnenstiel said.

"As long as invasive species control the metabolism of the lake, we've lost control of the system," he said.

Claramunt and other fish biologists disagreed with Fahnenstiel's assessment. They said the number of salmon and other predatory fish in the lake has just as much influence on the overall health of the fishery as quagga mussels.

The difference is that quagga mussels, unlike fish, are controlling the distribution of nutrients, food and energy in the lake. That affects every level of the ecosystem, from the smallest organisms at the base of the food chain to predatory fish and birds at the top.

Jim Johnson, a DNR research fishery biologist who tracked the collapse of Lake Huron's salmon fishery in 2003-2004, said nobody knows how the quagga mussel story will play out in lakes Michigan, Huron, Erie or Ontario.

"The forage base and lower food web are changing every year," Johnson said. "That's our main concern — the lakes are just changing too fast for us to keep up with them."

Jeff Alexander is an award-winning environmental journalist and the author of two critically acclaimed books. He covered Great Lakes issues for 20 years for several Michigan newspapers; he now writes for several nonprofit organizations, including the National Wildlife Federation.