

onearth

Lake Erie Death Watch

BY BARRY YEOMAN

August 31, 2011

Brought back from the brink once before, a Great Lake again faces biological collapse

On a cloudy morning in early August, Peter Bichier steers a 26-foot motorboat from an Ohio marina toward the Canadian border. The waters of Lake Erie are nearly transparent here, a reminder of why this southernmost of the Great Lakes supports a multi-billion-dollar fishing and vacation industry. But as the research vessel turns west toward the Michigan shoreline, the water grows murky, clogged with a toxic blue-green algae called microcystis that, on sunnier days, forms a stinky scum on the lake's surface.

Bichier, a research technician at the University of Toledo's **Lake Erie Center**, dangles a long, white plankton net off the side of the boat, then hauls it in and filters the sludgy water into a canister for testing back in the lab. "Dogs get sick when they drink this," he says: **three in Ohio died** last year after swimming in a contaminated inland lake not far from here, and nine people got sick (including one with memory loss and partial blindness) after skin contact.

After a decades-long absence, blue-green algae is again flourishing in Lake Erie -- and it's never been worse than it is this summer. The algal infestation is just one of many factors that biologists in Ohio, Michigan, and elsewhere say are pointing toward an ecosystem in danger of collapse.

The lake's center contains a growing dead zone, devoid of oxygen during summer months. Invasive species such as zebra and quagga mussels are wreaking havoc with its ecology. The fish that make Lake Erie a tourism draw, including yellow perch and smallmouth bass, are seeing their predators grow and their habitats shrink. Ducks, loons, and mergansers that feed on lake fish have died in recent summers from botulism poisoning. Swimmers in some areas have been advised this year not to swallow the water.

What would it mean to lose one of our Great Lakes? The environmental and economic calamity could devastate the region's tourism, sport fishing industry, drinking water supply, and wildlife, and could also take a toll on human health. And there would be plenty of blame to go around, from changing agricultural methods to inattentive politicians to weaknesses in our nation's bedrock

environmental protections -- many of which can partially trace their existence to concern over Lake Erie in the first place.

Erie is the most fertile of the Great Lakes: It contains only 2 percent of their water but 50 percent of their fish. Its biological abundance, and its location in a densely settled corner of the Midwest, make the prospect of collapse all the more frightening. If conditions grow worse, imploding native fish populations could decimate Lake Erie's recreational fishing industry. (Fishing generates \$7 billion a year throughout the Great Lakes.) The water supply for 11 million people could become undrinkable without expensive treatment. And blue-green algae, linked to **liver cancer in China and fatal poisonings in Brazil**, could pose a grave threat to people here, too, particularly if ingested.

"If we don't turn this around, someone whose health is already compromised -- a very young person, a very old person, someone less tolerant of the toxin -- is likely to die," says aquatic biologist Jeffrey Reutter, director of Ohio Sea Grant and Ohio State University's Stone Laboratory in Lake Erie.

The lake itself nearly died once before. In 1969, *Time* magazine practically **wrote its obituary**, describing how "each day, Detroit, Cleveland and 120 other municipalities fill Erie with 1.5 billion gallons of inadequately treated wastes, including nitrates and phosphates. These chemicals act as fertilizer for growths of algae that suck oxygen from the lower depths and rise to the surface as odoriferous green scum." Between human sewage and pollution from steel, paper, and automobile plants, *Time* said, Lake Erie was "in danger of dying by suffocation."

John Hartig remembers riding his bicycle down to the Detroit River, which flows into Lake Erie, to fish -- and seeing its water turned black and purple from industrial waste. Now a biologist who manages the **Detroit River International Wildlife Refuge**, Hartig also watched as the oil-fouled Rouge River, which eventually empties into Lake Erie, caught fire in 1969, sending flames 50 feet into the air. (He chronicled the disaster in his 2010 book *Burning Rivers*.) "I saw the smoke from my house," he says. "You don't get that image out of your brain."

Back then, Americans responded -- not just to "what they were seeing, but also to what they were smelling," says Hartig. "There were front-end loaders taking algae off the bathing beaches and dead fish. The lake had gone anaerobic. That means no oxygen. That means the smell of rotten eggs." Those scenes, and the fires on Cleveland's Cuyahoga River, which empties into Lake Erie, provoked an outcry that helped trigger some of the great advances of the early 1970s: the first Earth Day, the Environmental Protection Agency, the Endangered Species Act -- and the Clean Water Act, which (along with a U.S.-Canadian agreement) forced wastewater-treatment plants to sharply reduce the phosphorus they were dumping into Lake Erie. Coupled with bans on phosphate laundry detergents (which supplied up to 50 percent of the phosphorus in sewage), those reforms led to a two-thirds reduction in the main nutrient feeding the lake's harmful algae.

Without phosphorus, the organisms couldn't bloom, die, and deplete oxygen from the lake as they decomposed (creating a condition called hypoxia). Moreover, restrictions on mercury, DDT, and other toxins helped bring back fish such as walleye, a popular local dish, and birds such as the bald

eagle. "We literally went from being the poster child for pollution problems to the Walleye Capital of the World," Reutter says.

Beginning in the mid-1990s, though, harmful algae and the dead zone began reappearing. The problem has accelerated steadily over the past decade. The magnitude of this year's problem became evident two weeks ago, when Thomas Bridgeman, an aquatic ecologist at Toledo's Lake Erie Center, notified his colleagues that there was twice as much microcystis in the water this summer as last. It was the largest crop since the center began measuring the algae in 2002 and considerably greater than the next-largest year, 2009.

In late August, Ohio state officials **posted signs** on two Lake Erie beaches, Kelleys Island and Maumee Bay State Park, warning swimmers not to swallow the water and to avoid algae scum. Fishermen were distributing photos showing water the color of pesto. And in an August 29 NASA satellite photo, the lake's westernmost portion looked as though it were covered entirely by a garish green cloud.

"We are now at the levels of algal blooms and hypoxia that we were at in the 1970s," says Bridgeman. "We're back to the bad old days."

And this time, with clean-water regulations and programs already under attack and a whole new set of scientific challenges, the problem could be much harder to fix.

Deadly Intruders

As big as the forces arrayed against Erie's recovery are, some of the modern culprits driving it back toward collapse are the size of a fingernail.

In the late 1980s, oceangoing ships accidentally discharged **zebra and quagga mussels** into the Great Lakes. The mussels, which come from river deltas around Europe's Black and Caspian Seas, hitchhiked in the water those ships draw into their "ballast" tanks at port to provide stability. Once the ballast water and the mussels were dumped in Lake Erie, they colonized its bottom and fundamentally altered its ecology. In essence, they teamed up with another invasive species, the round goby, a fish from the same region that feeds on the mussels.

The gobies not only outcompete other small bottom dwellers; they also prey on smallmouth bass, a favorite Lake Erie sport fish. "We've been scuba diving out in the lake," says Tyler Lawson, a biologist at Stone Laboratory. "The bottom is literally crawling with these round gobies. We've seen at times 20 gobies sitting in a circle around a smallmouth-bass nest, just waiting to rush in to eat all those eggs."

The mussels weren't around in the 1960s, the last time the lake nearly choked on algae, but they've proven to be important players in its return and in the growth of the lake's hypoxic dead zone. Zebras and quaggas are efficient feeders; they consume algae so thoroughly that they initially make

the water clearer. But they're also picky eaters: As they feast on "good algae" that forms the base of Lake Erie's food chain, they reject toxic blue-green algae like microcystis. This gives microcystis an advantage by removing its competitors. Clear water also helps sunlight penetrate the lake's surface, which in turn stimulates more algal growth. Finally, the mussels excrete phosphorus in a form algae can easily consume. You could hardly design a more deadly toxic-algae-creating machine.

The algae at the surface, in turn, plays its part to make the lake's depths more toxic. When microcystis dies and sinks in the lake's waters, the decomposition process sucks up oxygen. This is a special problem in Erie's Central Basin, where the lake is exactly the wrong depth. It's deep enough to form a colder, self-contained bottom layer in the summer -- so much colder, in fact, that it doesn't mix with the upper layer. It's as if an invisible barrier separates them. But that bottom layer is so shallow that it contains limited oxygen. If rotting algae uses all the oxygen, it creates a perfect breeding ground for botulism toxin, which the mussels and gobies transfer efficiently up the food chain when they are preyed on by larger animals.

And woe be to the creatures that depend on that oxygen for survival. Yellow perch, which are popular sport and commercial fish, prefer living and feeding in Erie's bottom waters, says Don Scavia, director of the University of Michigan's **Graham Environmental Sustainability Institute**. When that cold layer goes hypoxic, it forces the perch to Erie's surface water. There, the temperatures are too warm and their preferred food from near the seabed is unavailable. Driven from their normal habitat, the fish also become easy pickings for predatory walleye and bass. "They're calling this the squeeze play on the yellow perch," Scavia says.

Poison Harvest

While the mussels and gobies are doing their best to destroy the lake from within, outside forces are also threatening Erie, which "has become a different lake since the '80s," says Scavia. Not only have zebras and quaggas altered the food web, but climate change appears to have lengthened the hypoxia-prone warm season. Lake temperatures, measured at municipal intake pipes, have increased steadily over the past half-century. So have air temperatures.

On top of that, the amount of phosphorus pouring into the lake is on the rise again -- often in a form that microcystis can easily consume.

Researchers studying where this phosphorus comes from have identified multiple sources, ranging from garden chemicals to sewer overflows containing human waste. But the prime suspect is agriculture. In 1974, 56 percent of Lake Erie's phosphorus came from "point sources" like wastewater treatment plants, where contaminants run out of a pipe, whereas 35 percent came from "non-point sources" such as agriculture, according to researchers at Heidelberg University in Tiffin, Ohio, and the University of Wisconsin-Green Bay. (The rest came from other sources like the atmosphere.)

By 2007 that ratio had inverted: 72 percent of the phosphorus in the lake came from non-point sources and 16 percent from point sources.

Part of the problem is that farmers are using fertilizers in new ways -- applying it in the fall and winter, when there are no crops to absorb the nutrients, and spreading it onto the surface rather than tilling it into the soil. "So it sits there for six months, waiting to be washed away by the rainwater," says Peter Richards, a research scientist at Heidelberg University's **National Center for Water Quality Research**.

The result is more runoff into Lake Erie and its tributaries. While the total amount of phosphorus is lower than 20th century levels, more of today's phosphorus comes in a chemical form that makes it easier for both crops and algae to absorb. As climate change triggers more extreme weather, adds Scavia, fiercer storms seem to be flushing more of the chemicals into the lake.

"There's not a whole lot we can do, in the near term, about the changing climate," Scavia says. "It's baked in. And we can't do a whole lot about the zebra and quagga mussels. They're already here. So we have to adjust what we can adjust to compensate -- and that's reducing the loads from those agricultural sources."

Which is as politically daunting a prospect as one could imagine.

Can We Save Lake Erie Again?

One afternoon I take a ferry to Put-in-Bay, Ohio, a Victorian-style resort town on a Lake Erie island. Built around a waterfront park, it's packed with vacation amenities like kayak rentals and an old wooden carousel. Children wearing funny hats dodge golf carts on the downtown streets. Pleasure boats bob near the harbor. The scene reminds me of what a clean lake means for the region's economy, particularly as the Midwest loses manufacturing jobs.

"It's a driver for being a competitive region," John Hartig had told me. "Progressive cities throughout the world would give their eye teeth to look out and see Lake Erie, to see the fish, to see the bird migrations."

From Put-in-Bay, I hop a smaller vessel to Gibraltar Island, home to Ohio State's Stone Laboratory. The biological field station is hosting some of the region's state legislators and congressional staffers, part of a two-day teach-in about lake issues. We meet zebra mussels up close. We watch a trawl pull in round gobies alongside their native competitors. We take in panoramic views of surrounding islands as we learn about the 114,500 tourism jobs and \$10 billion a year in visitor spending that Lake Erie generates in Ohio alone. We meet a fearsome (albeit dead) **Asian carp** and hear about the chaos that would ensue if the exotic fish made it into the Great Lakes from the Illinois River Basin.

Overseeing the event is Reutter, Stone Lab's director. His job today is convincing these policymakers that the region's future depends on their swift action. Lake Erie is fixable, he says, because it replenishes itself so quickly. Much like a river flowing downstream, the lake flows from the Detroit River in the west to Niagara Falls in the east. It has a replacement rate of 2.7 years -- meaning that's how long it would take the last drop to flow over Niagara Falls if its source were somehow plugged. (By contrast, Lake Superior, the largest Great Lake, would take almost two centuries to empty.)

"If we could again reduce the loading of phosphorus by two-thirds -- that's the same amount that we had to reduce it in the '60s, '70s, and '80s -- the lake will again respond," the biologist says. "We would probably be done with the harmful forms of algae. And we'd have a great fishery." Reutter is old enough to glean hope from Erie's first turnaround. "I remember in the '70s thinking we'd never be able to accomplish that two-thirds reduction," he says. "But we did."

Can we do it again? Or have we lost this sort of can-do spirit of the 20th century? Have we grown so politically and culturally polarized that another Lake Erie rebirth becomes impossible? Among many people I interviewed, a Midwestern optimism prevailed. Not only do technologies improve, they reminded me, but political climates shift. Regionally, Erie's deterioration has created a consensus that the status quo is no longer acceptable. In June, representatives from the private sector, local governments, regulatory agencies, and civic and environmental groups formed the Lake Erie Improvement Forum, which hopes to develop solutions to specific problems such as agricultural runoff and wastewater treatment.

Still, the obstacles are formidable. The Clean Water Act primarily regulates point sources of pollution from the likes of wastewater treatment facilities and power plants, which can be clearly measured. It takes a less direct approach to non-point sources like agriculture. Regulators, as a result, are forced to rely on voluntary cooperation from farmers. "I don't have a legal hook on non-point source," says Ohio EPA Director Scott Nally. "So we need to use the tools we have today."

And don't expect those tools to expand any time soon. "The agricultural community is trying to resist regulation," Reutter says, flatly.

In fact, the current fight is to keep from losing the *existing* tools. When it returns from summer recess, the U.S. Congress is planning to take up environmental spending. House Republicans declared their priorities in **an appropriations bill** that would hack funding for the EPA's Great Lakes Restoration Initiative to about half its 2010 level. The initiative cleans up toxic chemicals, fights invasive species, and protects watersheds from runoff -- many of the things that are necessary to keep Lake Erie from biological collapse.

The bill would also withhold EPA funding from any Great Lakes state that tries to control invasive species with ballast-water standards tougher than the U.S. Coast Guard's, a provision favored by the **shipping industry**, which says it's too hard to comply with a patchwork of state regulations.

"Clearly our economy is suffering," says Reutter. "People can misuse that opportunity to try to reduce regulation and claim the regulations are causing the problem. We know that's not true on Lake Erie. The improvement in the ecosystem created thousands and thousands of jobs between 1975 and the late 1980s. Charter-fishing businesses increased from 34 to over 800. We now have 300 marinas just on the Ohio shoreline. We have over 12,000 people employed in the boating industry. If we do damage to the system, we're going to hurt all of those businesses."

When I visited Toledo's Lake Erie Center, aquatic biologist Thomas Bridgeman gave me a stark political assessment. "I worry that, as a society, we won't be able to summon the will to change our watershed practices in a way that reduces nutrient loading," he said. "We've done all the easy things, and agriculture is a large and entrenched system of economics and politics and all sorts of factors that to me seem hard to budge."

If his fears prove correct, Lake Erie will further deteriorate. Only this time it might not rise from the dead again.

NRDC: SAVING A GREAT LAKE



Thom Cmar

Q&A with Thom Cmar, an attorney with NRDC's Midwest program.

Why does Lake Erie hold such importance to environmentalists?

One of the seminal moments in the history of environmental law was when the Cuyahoga River, which flows into Lake Erie, caught fire in the late 1960s. That event, as much as any other, created the awareness that we needed a more stringent, science-based framework to address water and air pollution. At the time, Lake Erie was widely declared to be dead, because it had massive inputs of pollution from factories and wastewater treatment plants. The Clean Water Act was passed in 1972 in part to address that problem, and it worked, but it wasn't a perfect success.

Read the rest [here](#).