

H₂O

Nuisance algae cause a stink

By Jennifer Yauck

Late summer—it's the time of year when the days get shorter, the air gets cooler, and, in some places, the shore of Lake Michigan gets—well, downright stinky.

Although your nose may suggest otherwise when visiting certain lakefront locales—like the shoreline just north of Bradford Beach or at Warnimont and Grant Parks—the source of the offending odor isn't sewage, manure, or even dead fish. Rather, it is a green, wispy alga known as *Cladophora*.

Cladophora grows naturally on rocks and hard surfaces along the coastlines of Lake Michigan and other Great Lakes. But since the late 1990s, the amount of *Cladophora* growing in the lakes has been abnormally high, creating problems. Foul-smelling mats of the rotting algae accumulate on shore, negatively impacting property values, tourism, and recreation. These excess algae also clog water intake pipes at power plants, and may contribute to outbreaks of botulism in birds like loons and plovers. *Cladophora* is especially problematic in August and September, when it sloughs off the lake bottom and washes ashore.

Harvey Bootsma, a scientist at the Great Lakes WATER Institute, is investigating the causes of this algal excess. According to Bootsma, *Cladophora* plagued the Great Lakes in the 1960s and 1970s, fueled by dissolved phosphorus that entered the water through industrial and municipal discharges, agricultural runoff, and products like detergents and fertilizers.

But phosphorus levels in the open lakes began declining in the 1970s—a result of pollution controls implemented under the 1972 Clean Water Act and the binational Great Lakes Water Quality Agreement—and the *Cladophora* outbreaks largely disappeared in the 1980s and 1990s.

That makes its current resurgence all the more unexpected. “We are meeting the target level for phosphorus in the open lakes,” said Bootsma, “but still have a *Cladophora* problem.”



A diver samples *Cladophora* at the bottom of Lake Michigan for analysis in the lab.

One possible explanation for that problem is that the algae are taking up phosphorus from the nearshore lake areas, where levels of the nutrient may be higher than levels in the open lakes due to inputs from rivers. According to Bootsma, monitoring data collected at the junction of the three major Milwaukee rivers emptying into Lake Michigan show that phosphorus concentrations there have been rising since 1990.

Still, he said, “something bigger is going on,” because *Cladophora* is a problem even in areas of the lakes that don't have river inputs. That “something” may be invasive quagga mussels, Bootsma and other scientists suspect.

But the mussels also contribute to the *Cladophora* problem in another way: they capture phosphorus that enters the lake in its particulate form and excrete it as dissolved phosphorus, the form the algae use. Quagga mussels, therefore, can boost the amount of phosphorus available to *Cladophora*.

Quagga mussels are voracious filter-feeders; a one-inch long mussel can filter over a quart of water per day. Since their arrival in Lake Michigan around 1990, the lake's naturally cloudy water has become three times clearer. As a result, sunlight has been penetrating deeper into the water, enabling greater *Cladophora* growth.

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phosphorus, the form the algae use. Quagga mussels, therefore, can boost the amount of phosphorus available to *Cladophora*. In the lab and in the lake, Bootsma and a team of technicians and students have been running tests to quantify how much phosphorus mussels of various sizes excrete under certain feeding and temperature conditions. The results indicate that mussels can be a major source of dissolved phosphorus for the nearshore zone.

Another “something” that may be influencing the algae's growth is change in temperature. *Cladophora* grows better in warmer water, and Lake Michigan's nearshore water temperatures on the Wisconsin coast have risen almost two degrees Fahrenheit in the past 25 years.

Along with researching the causes of excessive *Cladophora* growth, Bootsma and his

What You Can Do

One simple thing you can do to help reduce the amount of phosphorus in our waters is to use fertilizer wisely—by purchasing only low-phosphorus fertilizers, avoiding spreading fertilizer on pavement where it can get washed into waterways, or forgoing the use of fertilizer altogether.

colleagues are seeking a way to manage the algae. He recently developed a mathematical model that incorporates data on all of these factors—light, temperature, dissolved phosphorus that comes directly from rivers, and particulate phosphorus that is converted by mussels—and accounts for their influences on the algae's growth. The model suggests that in order to reduce *Cladophora* to a target level of 50 grams of dried algae per square meter (about four to six times less than current levels), dissolved phosphorus from rivers—the only factor humans can influence directly—must be cut in half.

Just how to achieve this recommended goal has yet to be determined, however. But it will undoubtedly require the combined efforts of industries, municipalities, and everyday citizens. And Bootsma cautions that once the target is reached, it would likely be another four to 10 years before the lowered levels take their full effect on *Cladophora* growth. “It's not going to be a quick fix,” he said.

The Great Lakes WATER (Wisconsin Aquatic Technology and Environmental Research) Institute is the largest freshwater academic research institute in the Great Lakes region. More information: glwi.uwm.edu.