**Invasive species compound toxic algae risk**

By Tom Henry, Blade Staff Writer

Conventional wisdom says western Lake Erie’s toxic algae is supported by commercial farm runoff, animal manure, sewage spills, faulty septic tanks, and other major sources of nutrients responsible for putting much of the excessive phosphorus and nitrogen in the water.

But that’s not the whole story.

As Great Lakes scientists probe deeper into the weeds on this issue, they find such contributing factors as invasive species and climate change also foster algal growth.

Invasive species and climate change don’t cause algal blooms, but they worsen them.

That message often gets lost or misunderstood by a confused public that gets bombarded with information and wants to assign blame to a single issue, even though science doesn’t work that way.

Invasive mussels’ effect and the complex interplay of land, water, and climate began getting more attention after a paper published last month in the scientific journal Water Resources Research, co-authored by University of Michigan and National Oceanic and Atmospheric Administration scientists.

In their report, which followed Toledo’s algae-induced water crisis in early August, the scientists concluded that western Lake Erie has been primed for algal blooms by a number of factors beyond springtime phosphorus inputs and warm summer months.

**Not just phosphorus**

Western Lake Erie’s algal blooms — which reappeared in 1995 after a 20-year absence — have consistently grown bigger and stronger since 2002, they contend.

While Lake Erie indeed gets too much phosphorus, that factor isn’t the trend’s only explanation, the report said.

“There may be more going on than just phosphorus loading,” said Daniel Obenour, the lead author, formerly of the University of Michigan Water Center. “Phosphorus loading doesn’t explain everything.”

Take invasive species.

Since at least 1996, scientists such as David Culver, a retired Ohio State University zoologist, have gotten down to the nitty-gritty of invasive mussels’ spit and excrement.

Mr. Culver is among several scientists who believe invasive mussels selectively spit out microcystis, the most dominant form of toxic algae in western Lake Erie. He also believes they excrete most of the phosphorus they take in because they have trouble digesting it.

When zebra mussels first came into North America from eastern Europe via ships’ ballast water in 1986, establishing colonies in Lake St. Clair, the public took note of how fast they made Great Lakes’ water clearer.

Through the years, their cleansing effect reached a tipping point. Scientists have said at numerous conferences during the past decade or so that lake quality has backslid, both in aesthetics and in its delicate ecological balance.

Zebra mussels were overtaken by their larger and more adaptable cousin, quagga mussels, which likewise hitched rides from eastern Europe via ocean-crossing ships’ ballast water.

Zebra mussels’ decline has been more than offset by increases in quagga mussels. The net effect has been a great mussel abundance during the past decade, according to the U.S. Geological Survey.

“We’re thinking it may have been the increase in mussels,” Don Scavia, a University of Michigan aquatic ecologist and director of the Graham Sustainability Institute, said of the reasons behind Lake Erie’s greater susceptibility to algae growth. Mr. Scavia is a co-author of the new UM/​NOAA study.

**Fussy filterers**

Both species of mussels — quaggas and zebras — are amazing filter-feeders, and there are billions of them. But nature made them picky eaters.

According to Henry Vanderploeg, a NOAA scientist who contributed to a book called *Quagga and Zebra Mussels: Biology, Impacts, and Control*, those invasive mussels have sensors near their tiny mouths that tell them when microcystis is headed their way.

They spit out what they don’t want while eating “good stuff” in the water column, Mr. Vanderploeg said.

That includes tiny organisms, plant particles, and the many healthy, productive forms of algae known as diatoms that support the food chain for native fish.

Invasive mussels also aren’t fond of phosphorus.

Their bodies absorb it if they have a nutrient deficiency. But there’s so much phosphorus in the lake now that they excrete most of what they ingest.

An individual, thumbnail-sized mollusk’s impact may seem insignificant, but when billions colonize a lake bottom, their effects may create imbalances that make it easier for algae to grow.

“In general, we tend to think of filter-feeders as nonselective,” Mr. Vanderploeg said. “They do have sensors, and it [microcystis] goes to a mouth internally. They spit it out as pseudo-feces. They just get rid of it almost instantaneously.”

Mr. Obenour, now an assistant professor of civil engineering at North Carolina State University, said mussels “don’t remove phosphorus from the system; they just change how it is cycled through the system.”

“Now because of changes in the lake, it requires less of a phosphorus load to initiate these blooms,” he said.

**Climate subtleties**

Climate change often is characterized by drama: a greater propensity for floods, droughts, hurricanes, and violent weather.

Although NOAA records show the Midwest has experienced a 51 percent increase in thunderstorms dropping 3 inches or more of rain in a single day since the 1960s — a statistic used to amplify concerns about farm runoff and sewage spills — far less is known about more subtle effects.

Ohio, for example, has had warmer winter nights for nearly four decades. That has kept Lake Erie ice from forming as quickly and as often most winters, with last winter’s polar vortex invasion of Arctic air creating a notable exception.

The UM/​NOAA paper does not suggest algal blooms’ greater frequency is a result of warmer temperatures; in fact, it notes that “late-summer Lake Erie water surface temperature has not increased significantly over the study period, suggesting that warming is not the primary cause of larger blooms.”

The report proposes a more subtle climate-change impact, one that has gone largely unnoticed but played into more algal growth: longer periods of calm winds between those violent summer storms.

“Future research could examine whether other climate change factors, such as increasingly calm summer conditions, may better explain this increasing trend in bloom susceptibility,” the paper states.

Algae thrives in warm, nutrient-rich water — but especially when calm water allows mats to form.

Other contributing factors could be an increasing reservoir of microcystis seed colonies in lake sediment and bottom vegetation, part of what scientists believe is the lake’s internal load: seeds, nutrients, and other matter that can regenerate algal blooms more easily from one season to the next.

Identifying other contributing factors and understanding the roles they play in priming Lake Erie for algal growth doesn’t mean they will be fixed immediately, if ever.

The U.S. and Canadian governments have tried for decades to slam the door on invasive species, with limited success. Resources that had been focused on quagga and zebra mussels has shifted to Asian carp. Land-based invasives like the emerald ash borer have gotten eradication efforts funded by the U.S. Department of Agriculture and other agencies because of that beetle’s devastation of highly valuable commodities from ash trees across North America.

Climate change is a global problem with myriad political obstacles. Scientists agree that even if the world came to an agreement to reduce emissions, it would take years to have a positive impact on the Great Lakes region.

**Higher threshhold**

In February, the International Joint Commission — the State Department-level agency that has advised the United States and Canada on common-boundary water issues since 1909, called for a 37 percent decrease in phosphorus loading in Lake Erie’s agriculturally dense Maumee River watershed.

The Ohio Phosphorus Task Force called for a 40 percent reduction throughout northwest Ohio in 2013.

Scientists said those proposed reductions in phosphorus — ambitious as they may sound — probably won’t be enough, given the difficulties in addressing invasive species, climate change, and other forces at work that may be exacerbating algal growth.

“Because of the lake’s susceptibility to phosphorus, even larger reductions may be necessary,” Mr. Obenour said. “We need to see the system reach some sort of equilibrium.”

Algal blooms likely are to return each summer as long as Lake Erie “remains in this heightened state of susceptibility,” Mr. Scavia said, which “means we need to better understand what is driving the increased susceptibility and whether it can be controlled, or if deeper phosphorus reductions are needed.”