



# One world, two Great Lakes

How Africa's Lake Victoria offers a  
glimpse of Lake Erie's future.

By **Brian Owens, Great Lakes Now**

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A tropical lake in Central Africa might not seem like the first place you would look to gain insights into North America's Great Lakes. But that's just what researchers from Bowling Green State University (BGSU) in Ohio have been doing for the past three years.

Lake Victoria is the largest of Africa's Great

Lakes, the second largest in the world after Lake Superior. George Bullerjahn, an ecologist at BGSU, says Lake Victoria — situated between Kenya, Uganda and Tanzania — makes a very good surrogate for studying harmful algal blooms in Lake Erie, both now and to predict what the future might hold.



The part of Lake Victoria where Bullerjahn and his colleagues focused their work, the Winam Gulf in Kenya, is similar to western Lake Erie in many ways, he said. It's shallow with limited water exchange with the rest of the lake and lots of nutrient inputs from agricultural run-off and sewage. And despite its location in the tropics, the climate has some similarities too.

"Even though Lake Victoria is found right on the equator it is actually not beastly hot, it's temperate, it's elevated at about 3,800 feet in altitude," Bullerjahn said. "And so basically every day there is like an average or slightly warmer than average summer day on Lake Erie."

Exactly the conditions in which potentially harmful cyanobacteria thrive. And as the climate warms, today's Lake Victoria may offer a window into what the future might hold for Lake Erie.

“Since 1980 there’s been a 70% loss of ice mass in Lake Erie due to climate change, and we’re now looking at. a few decades from now, a situation where Lake Erie doesn’t freeze,” Bullerjahn said. “Since we’re looking at a lake which doesn’t freeze in Africa, could that inform what Lake Erie might be like decades in the future?”

## Model lake



Lake Victoria’s Winam Gulf is a body of water similar to Lake Erie, and could potentially be a model for the Great Lake in a warming climate. (Photo Credit: George Bullerjahn/Bowling Green State University)

Using one lake to study what might happen in

another is an everyday occurrence for Scott Higgins, a senior scientist at the International Institute for Sustainable Development's Experimental Lakes Area (ELA). The ELA, a collection of 227 small lakes in northern Ontario, is used to studying the effects of everything from acid rain to oil spills on lake ecosystems, and to predict how those things will translate into larger lakes around the world.

"There are millions of lakes around the planet and we can't study all of them intensively, but many of them have problems we need to address," Higgins said.

Bullerjahn's studies in Lake Victoria hit particularly close to home, according to Higgins, because the ELA was set up in 1969 in part to address the problem of algal blooms on Lake Erie.

"Early studies at the ELA were instrumental in changing policies around the management of the Great Lakes," he said.

Lake Victoria can make a particularly good model for studying algae in Lake Erie because the "endless summer" of Lake Victoria means that you can basically eliminate temperature as a variable that affects the blooms, said

as a variable that affects the blooms," said Higgins.

"There is a lot to learn from more stable tropical ecosystems to help inform the management of temperate lakes," he said. "It's much easier to tease apart the other mechanisms that drive the blooms."

## Algal blooms



Researchers are aboard a vessel used to sample different sites across Lake Victoria's Winam Gulf for different types of cyanobacteria. The researchers recently completed a genetic survey of cyanobacteria in the lake, which will help local officials track potentially dangerous cyanobacterial harmful algal blooms. (Photo Credit: Lauren Hart/University of Michigan)

For three years Bullerjahn, with funding from

the National Science Foundation, brought together scientists and graduate students from the United States and Kenya to sample the algae in Winam Gulf. The idea was to not only forecast what might happen in Lake Erie in the future, but also to fill a gap in knowledge about Lake Victoria itself by making a genetic catalogue of the algae that live there, said Lauren Hart, a PhD student at the University of Michigan who was involved in the project.

“Prior to our study, you couldn’t compare the metagenomic data from Lake Erie to metagenomic data to Lake Victoria to see if there are any similar stories or similar organisms between these lakes,” she said.

Hart identified a type of algae called *Dolichospermum* as the most dominant bloom-forming organism in Lake Victoria, as well as others called *Microcystis* and *Planktothrix* that were more abundant in shallow and cloudy water. All three types are also found in harmful blooms in Lake Erie. In fact, the *Microcystis* algae, which is the kind that currently causes the most problems in Lake Erie, was genetically very similar between the two lakes.

“That’s important because the genomes really decide what types of toxic molecules the organism can make,” Hart said.

The fact that *Dolichospermum* dominated blooms in Lake Victoria was interesting, as it is better adapted to colder climates and is now beginning to take over the blooms in Lake Erie later in the season. Higgins said that could be a real problem in the future.

Toxic algae require nitrogen to grow, and unlike *Microcystis*, *Dolichospermum* is able to pull nitrogen directly from the air. Since most of the sites studied in Lake Victoria had little nitrogen in the water it is not surprising that *Dolichospermum* would dominate. But there was still a significant amount of *Microcystis* present, which Higgins says could indicate that *Dolichospermum* is helping to support *Microcystis* by bringing more nitrogen into the ecosystem.

Since most efforts to control *Microcystis*-dominated toxic blooms in Lake Erie focus on reducing the amount of nitrogen that gets into the lake from agricultural run-off, the growing presence of a nitrogen-fixing partner could jeopardise those efforts.

“Lake Victoria is a warning flag — if you

Lake Victoria is a warning flag. “If you reduce nitrogen in western Lake Erie you may not reduce the risks of toxicity to a large extent,” Higgins said.

The work shows that focusing on reducing phosphorous as well, which *Dolichospermum* also requires, will help to both reduce the size and toxicity of blooms, according to Higgins.

## Local benefits



People use the water of Lake Victoria's Winam Gulf to bathe, wash dishes and wash clothes. A team of researchers from North America and Kenya recently completed a genetic survey of cyanobacteria in the lake, which will help local officials track potentially dangerous cyanobacterial harmful algal blooms. (Photo Credit: Lauren Hart/University of Michigan)



While many of the insights gained from studying algae in Lake Victoria may help improve the management of Lake Erie in the future, Bullerjahn's project is also intended to have more immediate benefits for the people in Kenya who depend on the lake.

Three major towns, including Kisumu, Kenya's third-largest city, as well as many smaller communities are "totally dependent on the lake for survival." Lake Victoria is used for drinking water as well as washing and fishing, says Julia Obuya, a Kenyan scientist who worked on the project and is now a PhD student at BGSU.

Many of those communities have little or no capacity to treat the water they use, even when blooms are present, relying instead on simple filtration techniques or boiling. As a result, toxic blooms are taking a toll on their health.

"They're seeing health effects like skin issues, stomach problems, even being hospitalized, but they don't always understand where they are coming from," said Obuya.

Obuya's part of the project involved working with communities to raise awareness of the dangers of blooms and encouraging them to

dangers of blooms and encouraging them to use other water sources, such as boreholes or rainwater collection when blooms are present.

Lewis Sitoki, an environmental scientist at the Technical University of Kenya in Nairobi, says this year there have been severe blooms near Kisumu that forced some water treatment plants to close temporarily. Which is why it is important to know where the blooms are and what species and toxins are present so that the population can be advised on how to deal with it.

The project bringing together U.S. and Kenyan scientists is an important step towards improving water management in both countries, according to Sioki.

“There are lessons we can learn here about how to manage water resources better in Lake Victoria, Lake Erie and elsewhere.”

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*Featured image: A greenish tint to the water of Lake Victoria's Winam Gulf indicates a cyanobacterial harmful algal bloom. (Photo Credit: George Bullerjahn/Bowling Green State University)*

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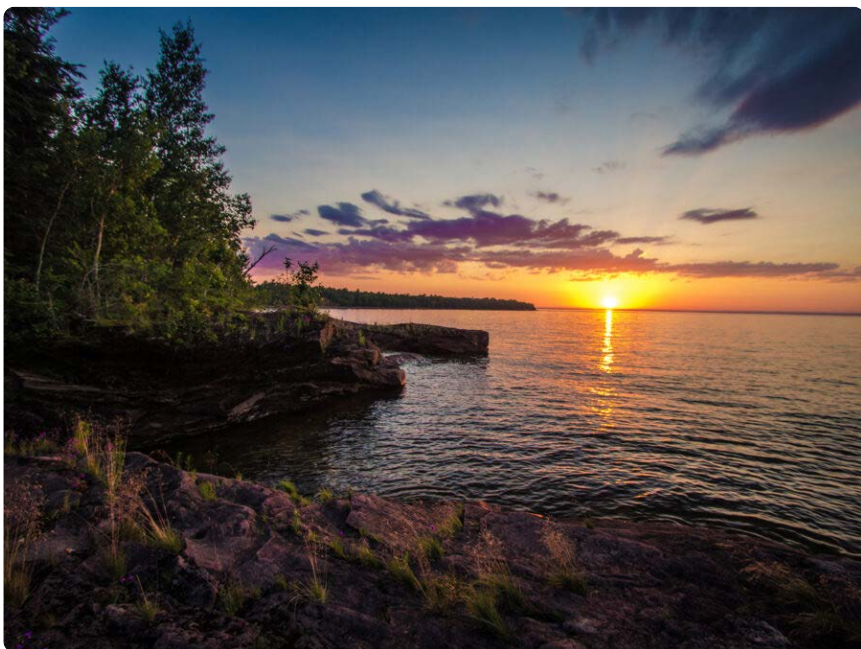


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