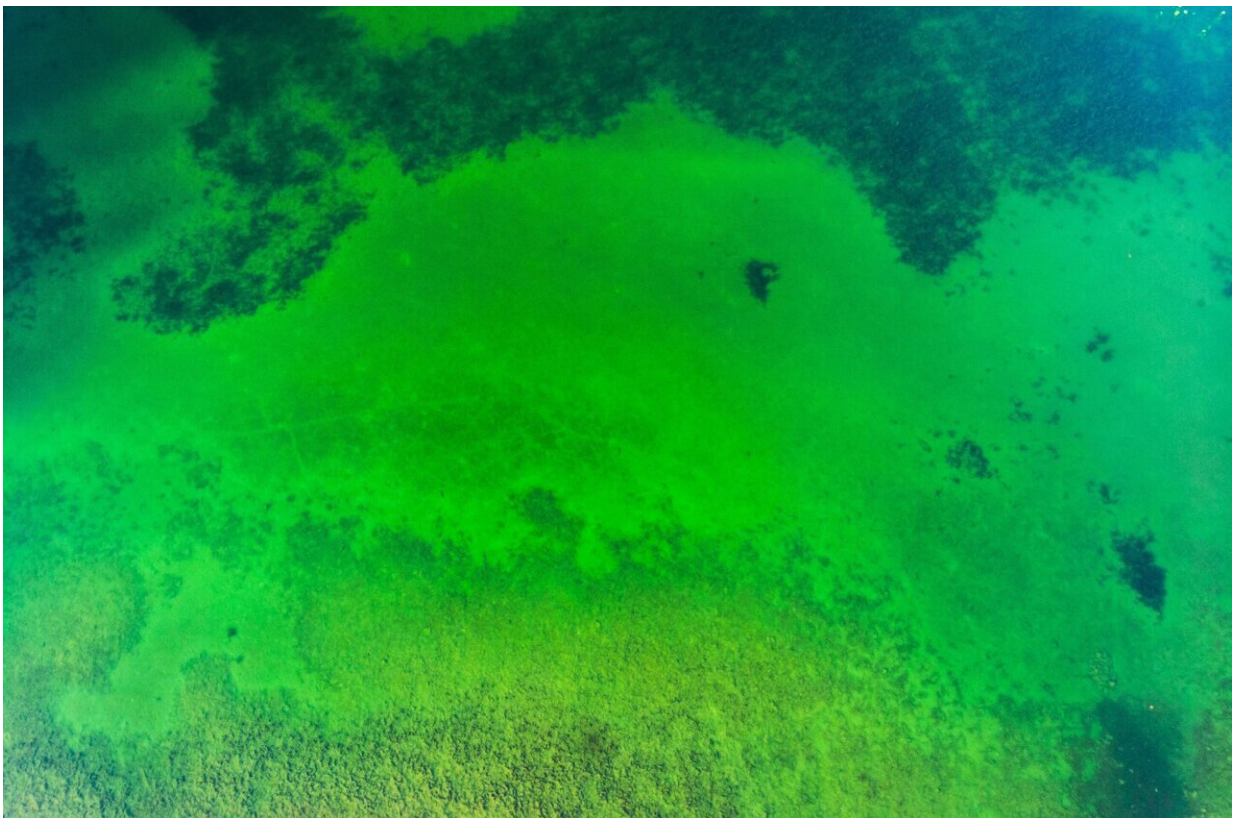


Algae blooms, which can threaten drinking water and human health, pop up regularly and may increase

November 19 2021, by Morgan Greene



Credit: Unsplash/CC0 Public Domain

Barges carrying mounds of coal toward St. Louis passed by Starved Rock at a snail's pace, inching past yellow-orange trees and sandstone

canyons. A bald eagle hovered above a path leading hikers toward Lover's Leap. Near the Starved Rock Lock and Dam, a pinch point along the Illinois River, the water was dull and unremarkable.

But the area is home to a problem that taints waters throughout the state: toxic algae blooms.

In June, its surface was streaked with neon green. The bloom, one of dozens sampled this year throughout Illinois, contained levels of a potent toxin more than 30 times above the advised state recreational standard.

Blooms of cyanobacteria, or [blue-green algae](#), happen when, given the right mix of conditions including temperature, sunlight and [excess nutrients](#), the microscopic organisms proliferate to the extent that it sometimes looks like someone dumped paint in the water.

The rise of blooms appears to be connected to human-caused climate change. Along with nutrient overload from intense storms, warming air temperatures—and in turn warming water temperatures—can feed blooms.

The frequency of algae blooms is likely to increase, a Great Lakes climate assessment noted. And they come with a cost—whether through the price of water treatment, dog deaths or risks to human health.

Microcystin, the most prevalent toxin in Illinois waters and the one in the Starved Rock bloom, can cause skin rashes, diarrhea and coughing. More extreme exposure can lead to liver damage.

Illinois' formal monitoring program for harmful algae blooms began in 2013, after an especially hot summer resulted in eye-popping levels of toxins. Today, the Illinois EPA routinely monitors sites including some public water supply intakes such as those in Lake Michigan, and also

responds to reports of possible blooms, keeping an eye on regular offenders, including the shallow, calm area near Starved Rock.

"There's always concern that you're going to have a banner bad year. There's always hope that you're not going to find much," said Gregg Good, surface water section manager with the Illinois EPA. "Hot, dry weather, you're going to probably find more."

Toxins hit 'holy moly' level

In Illinois, toxic blooms turn up in certain bodies of water nearly every year.

Algae blooms can be a nuisance, causing problems for organisms that depend on access to light, which blooms block, and oxygen, which blooms deplete. Researchers are still trying to figure out why only some blooms are toxic, and the conditions that might make toxin production more likely.

In the mid-2000s, as reports of blooms grew in the Midwest, the state began collecting water samples. Microcystin was found in about half of 366 samples between 2005 and 2008; nearly all were in the low range. But, given the right conditions, blooms could become more toxic, researchers warned.

Then came 2012—Illinois' hottest year on record. From May through August, Illinois also saw its fourth driest period on record, according to National Oceanic and Atmospheric Administration data.

"It was a drought year, a lot of the nutrients were not taken up by corn crops," Good said. "Big rainfalls in the fall, and a lot of nutrient runoff in the lakes."

A primary driver of algae blooms is phosphorus, which can end up in waterways from sewage treatment plants, or after farm fertilizer and manure is washed away, especially during intense storms.

Candlewick Lake in Boone County, which was the discharge site of a wastewater treatment plant decades ago, turned up a microcystin level of 14,800 micrograms per liter, prompting a "holy moly" comment in one state presentation.

In Winnebago County, Westlake—a few miles from sewage plant discharge and adjacent to a golf course—had a microcystin level of 31,500 micrograms per liter—a "holy holy moly moly" result. The World Health Organization's recreational marker for a high probability of adverse health effects was above 20 micrograms per liter.

In Illinois, microcystin levels jumping from the tens to the thousands garnered some attention.

"That was a big red flag," Good said.

And other states had already created programs for blooms.

"For us to think that we were immune to harmful algal blooms in the state of Illinois was ridiculous, so we started up the program," Good said.

The Starved Rock bloom occurred in one of nearly 70 water bodies sampled this year, from northern Lake to southern Johnson counties, according to Illinois EPA data. Toxic blooms have been confirmed as late as November in previous years.

This summer, in addition to microcystin, the agency tested for two neurotoxins for the first time; no significant levels were detected.

About a quarter of the water bodies sampled as of late October had microcystin concentrations greater than 20 micrograms per liter, with a handful having concentrations in the hundreds and thousands, but nothing close to 2012 levels.

Today, challenges involve continuing to get the word out.

"Certainly more and more people know about what a harmful algal bloom is now," Good said.

'A lot we don't know'

Samples from Lake County—where 134 of 148 assessed lakes are classified by the state EPA as "impaired" for esthetic quality, aquatic life or fish consumption—account for a significant chunk of this season's toxic blooms.

That's largely due to excess phosphorus levels, said Mike Adam, deputy director of environmental health with the Lake County Health Department. Once a lake is on the list, it can be difficult for it to move off. Phosphorus can linger in soils for years.

About 40% of lakes nationally have too much phosphorus, according to the most recent EPA assessment. Cyanobacteria in lakes, along with the detection of microcystin, was also on the rise.

Generally, a good recipe for blooms seems to be heavy spring rain that washes in nutrients, and then warm, dry weather that cooks up cyanobacteria, Adam said. But even the lakes most prone to blooms don't necessarily pose an annual problem.

"There's still a lot we don't know about how these blooms occur and the dynamics of them," Adam said.

Scientists are studying blooms throughout the Great Lakes region, and trying to figure out why they're surfacing in places as surprising as Lake Superior, one of the largest freshwater bodies in the world. Climate change appears to be a main driver.

In Illinois, scientists expect to see the state become warmer and wetter, with extremes including exceptionally [warm days](#), more intense rains and longer dry spells. Average daily temperature has already increased by as much as 2 degrees in much of the state, and an Illinois climate assessment found that warming of 4 degrees or more is possible by the end of the century, depending on different emissions scenarios.

Despite some hopeful developments that came out of the pivotal climate conference this month in Glasgow, some experts say staying within 1.5 degrees Celsius of warming—the global threshold scientists believe could lead to things getting significantly worse—is highly unlikely.

One concern with climate change in Illinois is that different species of algae may find the shifts amenable—meaning more species moving into Illinois that can potentially produce toxins.

"We've seen it with ticks and mosquitoes," Adam said. "It's going to happen, too, with algae."

There are some efforts to engineer blooms, including at Campus Lake in Jackson County, a regular site for toxic cyanobacteria.

Jia Liu, associate professor at Southern Illinois University at Carbondale, is leading a team of student researchers experimenting with solar power and magnetic nanomaterials that could reduce the toxicity of blooms by degrading cyanotoxins and removing phosphorus through absorption.

The bloom this season lasted from early July through September,

comparable to other years, Liu said.

Short-term and long-term solutions to clean up the lake have been considered. In part, Liu said, that's because blooms can deter people from wanting to walk by a green lake or lower home values. And algae blooms are "related to the quality of life."

Monitoring the Illinois River

Upstream of the Starved Rock Lock and Dam, there's a connection to nutrients coming out of Chicago and its suburbs. That includes the wastewater of more than 5 million people, with occasional sewage overflows, and runoff from cities of paved surfaces. Downstream, the river's slope flattens, and tributaries are largely surrounded by farmland, where nutrients in fertilizer and manure make their way into waters after a heavy rain.

While the algae bloom season in Illinois may be coming to a close, the drivers behind the green slicks are gaining strength. Illinois is not only missing bench marks for nutrient reduction, but nitrogen and especially phosphorus loads—the majority from agriculture—have increased significantly above a baseline period, according to the latest nutrient reduction strategy report for the state.

On a recent morning, Jim Duncker removed an algae tracker near the lock and dam ahead of the arrival of cooler temperatures, and checked on a probe collecting water data. A new system to monitor phosphorus and nitrogen in close to real-time was in place on a platform above the river.

"This site has had relatively frequent blooms in the last couple years, and so it was a site that's of interest," said Duncker, basin coordinator for the U.S. Geological Survey. "It's still a ways downstream but there's concern

there, that if there were a major bloom that persisted, Peoria would probably have to address their water supply."

Lakes have long been the focus of algae blooms, but rivers are not immune. A harmful bloom in the Ohio River in 2015 covered hundreds of miles of water.

The Illinois River basin, which includes nearly 30,000 square miles from southeast Wisconsin to northwest Indiana, carries the largest phosphorus load in the state and is among the sites chosen by the USGS for a major monitoring effort to improve water science.

The research could assist scientists in understanding harmful algae blooms.

The Illinois River basin involves a lot of people who use the water for a range of uses, said Jessica Garrett, a USGS hydrologist who studies harmful algae blooms. "We've got the barge traffic, we've got drinking water sources, we've got recreational uses."

Among researchers' questions are what turns a bloom toxic and how an algae community changes throughout an event. There are different species of algae, and different strains within species that may or may not have toxin-producing genes. By tracking metrics including the balance of nutrients, temperature, stream flow and the influence of storm events, scientists hope to follow blooms through their course.

"Some algae are a nuisance, or they make the water green, but there's a distinction between that and then something that creates a harmful situation, either because it's choking up intakes or motors, or because it's producing toxins, or other deleterious effects on taste and odor," Garrett said.

During the Starved Rock bloom, researchers employed sensors, lab samples and satellite imagery to learn about the water.

After about two weeks and widespread rainfall, the river rose, flow increased and microcystin levels dropped.

Storms can wash out a bloom. But those stirred up nutrients can lead to a later [bloom](#).

"Even if we limit new nutrients going into the system we still have all these other nutrients that can be remobilized," Garrett said.

Ideally, Duncker said, researchers will be able to one day get ahead of algae blooms, picking up on favorable conditions, alerting agencies and health departments, and offering a heads-up.

"If we can advance the science to the point where we can be a little more predictive and less reactionary, that would be a win."

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