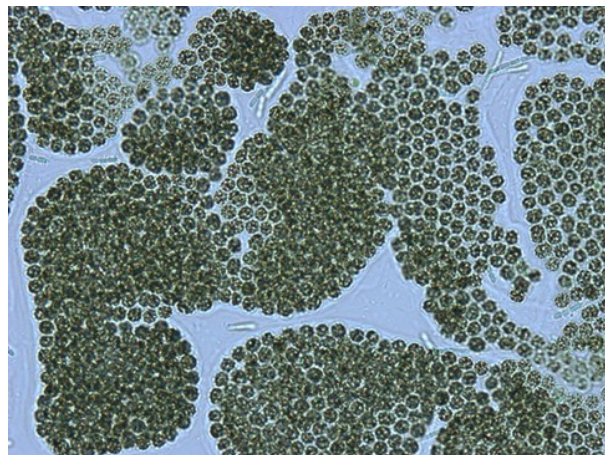




Blue-green Algae Create Temporarily Toxic Waters

The Issue

- Since 2007, cyanobacteria (blue-green algae) blooms have occurred with some frequency at Isle Royale National Park. Visible algal blooms are a common occurrence on Lake St. Croix (part of the St. Croix River National Scenic Riverway) in the summer, especially in the last decade. A single, but large, outbreak occurred on Lake Superior within the Apostle Islands National Lakeshore in 2012.
- These algae can produce toxins that kill fish and other aquatic life and pose a hazard to humans, pets, and wildlife.
- There are more than 40 freshwater species of toxic cyanobacteria, five of which are common in the Great Lakes region. These five species can produce nerve toxins (neurotoxins), liver toxins (hepatotoxins), and skin toxins (dermatotoxins).
- Blooms most often form in mid-summer to early fall, when certain conditions give cyanobacteria a competitive advantage over other algal groups. Blooms are more likely to occur when nutrient levels (especially phosphorous) and water temperatures are high.



The colonial cyanobacteria, *Microcystis aeruginosa*, is the most common source of toxic algal blooms in nutrient-rich freshwater. This species caused an algae bloom in the Apple River Sloughs area of the St. Croix National Scenic Riverway in 2012. Photo 100X magnification by Will Hobbs.

Cyanobacteria at Great Lakes Network National Parks—Three Examples

Lake Richie, Isle Royale National Park

Lake Richie is located on the northeast end of Isle Royale National Park and is a popular lake for camping and fishing. The lake is relatively shallow with an average depth of only about 10 m (30 ft), which makes the lake susceptible to re-suspension of bottom sediments (including nutrients) during storms that mix the water. Despite the fact that the only major external source of nutrients to the lake is through atmospheric deposition (Isle Royale is more than 20 miles from the nearest shore of Lake Superior, and Lake Richie has no development around it), an algal bloom occurred in the lake in 2007. The algal bloom consisted of a cyanobacterium called *Lyngbya birgei*. Researchers, park staff, and visitors have witnessed additional algal blooms at Lake Richie and other park lakes during most years since 2007. A sediment core collected from the bottom of Lake Richie in 2007 was analyzed to assess long-term changes in the species of algae present over the last (approximately) 150 years. Results showed that 2007 was the first time in the last 150 years that an algae bloom occurred. Subsequent blooms since 2007 may indicate that a change in the lake's ecosystem has taken place.

Apple River Sloughs, St. Croix National Scenic Riverway

In comparison to most large river systems throughout the U.S., the St. Croix River has relatively clear and clean water. However, in places with little-to-no river current, such as backwaters, sloughs, reservoirs, and Lake St. Croix, warm nutrient-rich waters often produce algal blooms in late summer. In August 2012 a park visitor canoeing near the Apple River Sloughs noticed what appeared to be an algae bloom. Analysis of water samples collected at the time confirmed the presence of a colony-forming cyanobacterium called *Microcystis aeruginosa*. What made this occurrence unique was that algal mats were found in the main channel of the river where river currents and moving water usually prevent their formation.

Near shore waters of Lake Superior, Apostle Islands National Lakeshore

A massive storm dumped up to 10 inches of rain in areas of east central Minnesota over two days in June 2012, causing flooding in many areas, including the St. Louis River, which discharges into the far western end of Lake Superior. The sediment- and nutrient-laden flood waters could be seen from space, and the plume eventually extended into the waters around the Apostle

What are cyanobacteria?

Cyanobacteria, also known as blue-green algae, are a family of single-celled organisms that proliferate in warm, nutrient-rich fresh waters and estuaries. Many cyanobacteria species naturally produce toxic compounds called microcystins within their cell walls. When a cell dies or ruptures, microcystins are released into the water. Human and animal exposures to microcystins have the potential to result in skin rashes, eye irritations, respiratory symptoms, and liver damage.

From U.S. EPA TechBrief (April 2012),
www.epa.gov/etv

Islands National Lakeshore. In mid-July a thick bloom of cyanobacteria was reported at beaches along the southern Lake Superior shoreline, and samples were collected at Meyers Beach within the national lakeshore. The samples consisted of at least two types of cyanobacteria (*Dolichospermum* and *Microcystis*), both of which can produce toxins.

What It Could Mean

Warmer water temperatures, longer growing seasons, and increased frequency of mixing in the water column (which re-suspends nutrients) may have contributed to the algal blooms.

There is no way to look at a bloom and know if it does or does not contain toxins, so the continued occurrence of algal blooms could create problems for hikers and campers in need of safe drinking water at shoreline campsites such as at Lake Richie and Lake Desor. Neither filtering nor boiling water eliminates the toxins. Further, algal blooms on park lakes will prevent other recreational activities including swimming because some of the toxins cause skin irritation simply by coming in contact with contaminated water. Fortunately, not all algal blooms produce toxins, but the conditions that cause toxin production are the subject of much study, especially given predictions of blooms occurring more frequently.

Studies of lake sediments in Great Lakes Network parks show biological and geochemical changes have occurred in many lakes after the 1970s and into the 1980s. Because the lakes are spread across a wide region and are in protected and relatively pristine areas, it is unlikely that surrounding land use caused these changes. Instead, climate-related mechanisms are thought to be the cause and may include: 1) shorter duration of ice cover that leads to earlier warming of surface water, earlier and longer water stratification, and longer growing seasons; and 2) increased frequency or intensity of summer storms that may lead to increased availability of nutrients when lake waters mix more frequently.

The great potential for further environmental change within the protected borders of the national parks shows that water quality and biological monitoring programs are an essential part of park resource management. Monitoring of general water quality and intensive monitoring of temperature will continue. Park managers will post signs warning visitors of unsafe waters due to algal blooms where needed. The long-term changes to the lakes and the life within them remains to be seen.



A cyanobacteria bloom on Lake Richie (Isle Royale) in August 2010 turned the water a pea green color.



A sediment plume moves along the south shore of Lake Superior after a two-day storm in June. The storm caused severe flooding, which led to increased run-off that swept high amounts of nutrients into Lake Superior. This burst of nutrients is believed to have contributed to a blue-green algae bloom that occurred on the west side of the Apostle Islands. *This 1 July 2012 satellite image provided courtesy of University of Wisconsin-Madison Space Science and Engineering Center's MODIS Today website (<http://ge.ssec.wisc.edu/modis-today/>).*

For Further Reading

Harmful Algal Blooms–Data and Products

www.glerl.noaa.gov/res/Centers/HABS/habs.html

