Toxic Cyanobacteria: Ecology, Problems and Management

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GIA Winter Meeting
March 4, 2017

Bottom Line: cyanobacteria are everywhere--we cannot eliminate it--we need to control it.

1. What is Cyanobacteria and what does it look like?

Often called blue-green algae, but actually is NOT algae. Cyanobacteria is a very common **bacteria** that is as old as the Earth, 3.5 billion years old. It "invented" photosynthesis, deriving energy from the sun. It's found wherever there's moisture and light, including deserts in Iraq. It is part of the natural biota of all lakes, unlike many toxins or biota introduced by humans such as mercury or coliform bacteria.

Cyanobacteria are small/invisible but they can form large, conspicuous "blooms" on the surface of water that look like blue-green scum. One type called Nostoc, is found on lake bottoms, and looks like green marbles.

Cyanobacteris is promoted by:
Nutrients, especially phosphorus
Warm temperatures
Thermocline stability (Thermocline refers to a horizontal layer of water in a lake with a particularly steep temperature gradient; Stratification increases with temperature)
Low light (low water clarity)

There is a link between global warming and cyanobacteria blooms. (Hans Paerl, *Science* 2008.)

2. How many kinds are there?

Many, many kinds!

3. Are they all toxic?

No, but some definitely contain liver, skin and nerve toxins.

Among blooms that usually occur in late-summer, early fall, 75% are toxic.

A literature review conducted in 2013 found 231 cases of dogs who died; there was a recent case on Lake Champlain in 2015.

In 2016, Zebra mortality in South Africa was linked to cyanobacteria.

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Cyanobacteria might be implicated in the disappearance of loons from certain lakes; studying bio-accumulation in loons now.

If you see a Cyanobacteria bloom, assume it's toxic.

*****Boiling the water increases its toxicity*****

4. Cause Human Health Problems?

YES! Health hazards have been documented since 1878, but it's vastly under-measured.

Cyanobacteria has been linked to neurological disorders such as ALS, Alzheimers and Parkinson's Disease. A common theme is ALS proximity to certain lakes. For example, physicians at Hitchcock Hospital have identified clusters of ALS patients in Enfield NH, near Lake Mascoma which had a series of blooms in the 60s and 70s. Studying the possibility that inhalation of cyanotoxins can cause human illness

In Brazil (1996) human mortalities during dialysis were traced to contaminated water.

5. Threat to Gilford Islands?

Potentially, yes. Generally speaking, the water quality of Winnipesaukee is "not terrible, but not pristine either." (See https://www.des.nh.gov/organization/commissioner/pip/factsheets/bb/documents/bb-16.pdf) The good news is that Winnipesaukee is large, with a proliferation of islands that help to create lots of different eco systems, a "lake of lakes."

Microcystins, toxins produced by cyanobacteria, have been detected in all lakes sampled in the NH Lakes Microcystin Survey. (http://wrrc.unh.edu/sites/wrrc.unh.edu/files/media/pdf/rr65.pdf) It's a question of how much.

Monitoring of nutrients, especially phosphorus which comes from lawn fertilization, soil erosion, impervious surfaces, agriculture, and failing septics, is critical to controlling cyanobacteria. Is there a "tipping point" for risk of toxic cyanobacteria? Following the "Almost 10s rule," (phytoplankton toxicity per biomass) parts of Winni are getting very close.

The recent ice-out phosphorus surveys on Winni have demonstrated phosphorus levels of between 4.9 and 8.9 parts per billion. Some areas seem to be more at risk than others; Moultonboro, for example, is getting close to 9. (View survey map in the powerpoint of this presentation on the GIA web site or online at http://www.tuftonboro.org/sites/tuftonboronh/files/uploads/winnipesaukee_ice_out_surveys.pdf)

By way of comparison, during the 2014 bloom that shut down the drinking water in Toledo, the numbers were in the 20s.

6. What can be done?

Must starve cyanobacteria, deprive it of nutrients, especially phosphorus. Phosphorus numbers can be brought down; it disappears into the sediment. Education is critical to minimize nutrient loading into lakes:

- Shoreline buffers
- Good root systems
- Erosion reduction
- Vegetative buffers

Look for opportunities to protect the Watershed.
See http://winnipesaukeegateway.org

Get Involved! Free training programs!
Need to increase water sampling in wider variety of locations to understand your particular “lake within the lake.”

- Track water quality
- Track cyanobacteria
- “Bloom Watch” - Document Blooms - See http://cyanos.org

Addendum: We omitted the data from the major "bloom" that occurred 6/28/11 to 7/1/11 on the west side of Bear Is. and Meredith Neck. NH DES posted a warning for the 3 days: "do not swim, do not drink and do not let pets in the water." On 6/27/11 the phosphorus level in the area tested at 17.7 ppb, more than double the maximum accepted level, the air temp was 80* F and the water temp was 71* F. The levels of the cyanobacteria "anabaena" were high. These are the typical factors that lead to blooms. The cause of this bloom was never fully determined.

Notes taken by Deborah Kelley-Milburn, Welch Island

The Powerpoint slides of Dr. Haney’s presentation will be loaded onto the GIA web site.

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