

Summer of Growth

Bill Jones

Here it is early July and we already have numerous reports of excessive production of algae and aquatic plants in many Indiana lakes . . . and it is still early in the summer. Speculation is that the wetter-than-usual spring allowed more nutrient-enriched runoff to flow off the land (from freshly fertilized farm fields and residential lawns) and into lakes. These fertilizers can then grow more algae in our lakes.

During the first two weeks of July, our Indiana Clean Lakes Program team has been sampling lakes in Steuben County and we found numerous lakes with excessive algae growth or extensive rooted plant growth. Much of the excessive algae growth is from the phylum or group called “blue-green algae.”

Algae groups are classified largely according to color. There are the *green algae* where the dominant pigment is chlorophyll, the same pigment in grasses and most leaves. The *yellow-brown algae* have both chlorophyll and carotene pigments that yield a yellow-brown color. The *blue-green algae* contain chlorophyll and a blue pigment called phycocyanin, which combined give them a blue-green color.

The blue-green algae are called *cyanobacteria* by aquatic biologists because this group of algae has some characteristics similar to bacteria. Like bacteria, the blue-greens have no internal structures – no nucleus, no *chloroplasts* (the site of photosynthesis), or other organelles. The color in the blue-greens is distributed throughout the cells and is not concentrated in highly visible chloroplasts (Figure 1).

However, unlike bacteria, blue-green algae are photosynthetic. They convert light energy from the sun into chemical energy through the process of photosynthesis. Of course, nutrients such as phosphorus and nitrogen are required for plant growth and some blue-greens can convert (or fix) nitrogen gas in the water and atmosphere into nitrogen plant nutrient within specialized cells called *heterocysts* (Figure 2).

When we collected algae from Big and Little Otter lakes in Steuben County, the sample looked very brown in color. Under the microscope, we could see that this sample was dominated by a diatom called *Fragilaria* and a yellow-brown alga called *Dinobryon* (Figure 3). Diatoms commonly achieve their highest abundance in Indiana lakes in the early summer, before the water warms up. Diatoms have outer walls composed of silica so they look like transparent crystals except for the yellow-



Figure 1. Dinobryon, a vase-like, yellow-brown alga. The dark structures are chloroplasts that contain the color pigments.

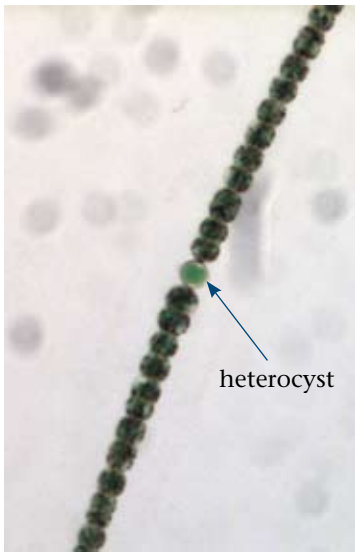


Figure 2. *Anabaena*, a filamentous colonial blue-green alga. The clear structure in the middle is a heterocyst, the site of nitrogen fixation. Note that the color in this blue-green is distributed evenly throughout the cells.

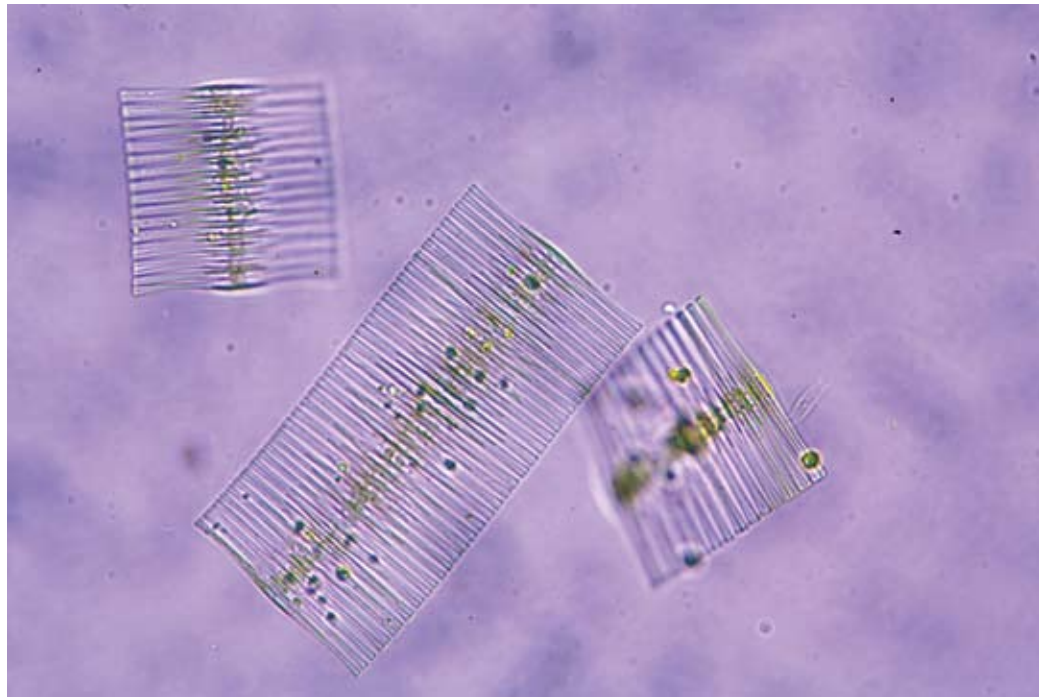


Figure 3. *Fragilaria*, a diatom with transparent cell walls, forms picket fence-like flat colonies. This alga was the dominant genera in Big and Little Otter lakes.

brown chloroplast at the center of each cell (Figure 3).

Marsh Lake, also in Steuben County, is surrounded by wetlands. The algae sample we collected in early July was also very dense and greenish in color. The blue-green alga, *Aphanizomenon*, was the dominant genera in our Marsh Lake sample. *Aphanizomenon* has very thin filaments of multiple cells each. It often forms nuisance blooms and can produce toxins (Figure 4).

Blue-green algae usually do not achieve their highest populations until mid-summer because they thrive in warm water, so we were surprised to see *Aphanizomenon* in such abundance. It is surprising to see such dense growth of blue-greens so early in the summer in northern Indiana.

Citizens have also called me this summer to ask about all the algae. One citizen in Martin County in southern Indiana dropped off a water sample at our SPEA lab that was green with algae. He had never seen green water in his small lake so green. This particular sample was full of another blue-green alga called *Oscillatoria* (Figure 5).



Figure 4. The very thin filaments are *Aphanizomenon*, a colonial blue-green alga.

From this brief description, you can get an appreciation for the variety of algae forms and characteristics. They are a fascinating group of single-cell plants that are an essential part of lake food chains. The algae, like most other plants, are *primary producers*. They convert light

energy from the sun into chemical energy that is stored in plant tissue. *Primary consumers* such as the shrimp-like zooplankton herbivores in water or cows on land consume this chemical energy to make animal tissue. This energy then proceeds up the food chain to higher organisms (Figure 6).

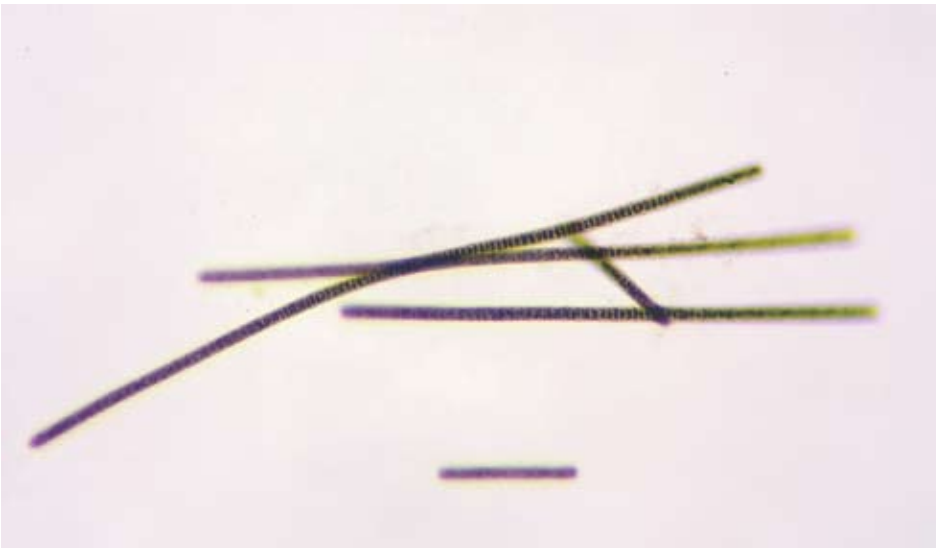


Figure 5. Oscillatoria is another filamentous colonial blue-green alga that is commonly wider than the thin filaments of Aphanizomenon in size. This Martin County lake was thick with them.

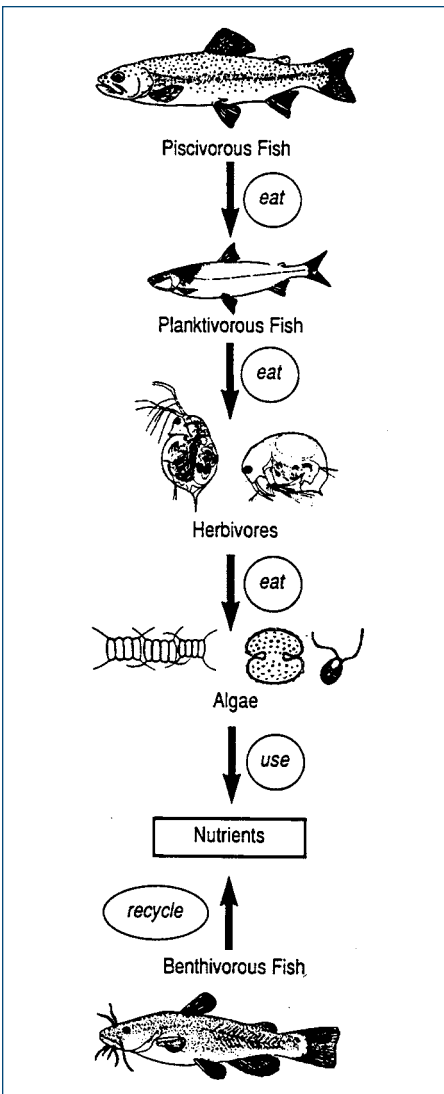


Figure 6. A simple aquatic food chain. Plants, such as algae, form the base of most food chains in water and on the land.

So, without primary producers like the algae, there would be no energy to grow fish and other aquatic organisms. However, too much algae is an indication of ecological imbalance in lakes. The goal of most lake management activities, be it watershed treatment or fisheries management, is to re-establish a balanced and sustainable ecological community within our lakes.

Algal Toxins

Beth Bosecker and Bill Jones

We've written about algal toxins in previous issues of *Water Column* (see the fall 2007 or fall 2005 issues) but this important issue is worthy of regular coverage. Blue-green algae achieve their densest growth in the hot days of mid- to late-summer. These times of excessive algal growth and subsequent dieback cause stress in the algae

that promotes the formation and release of algal toxins.

Common blue-green algae found in all of our Indiana lakes are among those that are capable of forming toxins. The two major types of algal toxins are those that cause neurological damage (neurotoxins) and those that cause liver damage (hepatotoxins).

What Should I Look for to Avoid Toxic Algae?

The toxic strains of blue-green algae usually have heavy surface growths of pea-green colored clumps, scum, or streaks, with a disagreeable odor and taste. These can have a thickness similar to motor oil and often look like thick paint in the water. Algae blooms usually accumulate near the shoreline where pets and children have easy access and the water is shallow and more stagnant. It is important to keep a watchful eye on children and pets so that they do not enter the water. Water with any of the characteristics listed below is symptomatic of a blue-green algae bloom and may contain toxins:

- a neon green, pea green, blue-green, or reddish-brown color
- a bad odor
- foam, scum, or a thick paint-like appearance on the water surface
- green or blue-green streaks on the surface, or accumulations in bays and along shorelines (Figures 7 and 8)

What are the Risks and Symptoms?

Pets and farm animals have died from drinking water

Table 1. Representative Algal Toxins.

Toxin	Target	Algal Organism
Anatoxins	Nerves	<i>Aphanizomenon</i> , <i>Anabaena</i> , <i>Oscillatoria</i>
Saxitoxins	Nerves	<i>Anabaena</i> , <i>Aphanizomenon</i> , <i>Lyngbya</i>
Microcystin	Liver	<i>Microcystis</i> , <i>Anabaena</i> , <i>Oscillatoria</i>
Cylindrospermopsis	Liver	<i>Cylindrospermopsis</i> , <i>Aphanizomenon</i>



Figure 7. Floating mats of *Microcystis* on Salamonie Reservoir.

Figure 8. Streaks from a blue-green algae bloom on University Lake, Monroe County.

containing toxic blue-green algae (or licking their wet hair/fur/paws after they have been in the water). Blue-green algae toxins have been known to persist in water for several weeks after the bloom has disappeared.

The risks to humans come from external exposure (prolonged contact with skin) and from swallowing the water. Symptoms from external exposure are skin rashes, lesions, and blisters. More severe cases can include mouth ulcers, ulcers inside the nose, eye and/or ear irritation, and blistering of the lips. Symptoms from ingestion can include headaches, nausea, muscular pains, central abdominal pain, diarrhea, and vomiting. Severe cases could include seizures, liver failure, respiratory arrest – even death, although this is rare. The severity of the illness is related to the amount of water ingested, and the concentrations of the toxins.

Are Some People More at Risk?

Yes. Some people will be at greater risk from toxic blue-green algae than the general population. Toddlers tend to explore the shoreline of a lake, causing greater opportunity for exposure. Based on body weight, children tend to

swallow a higher volume of water than adults, and therefore could be at greater risk. People with liver disease or kidney damage and those with weakened immune systems are more susceptible to algal toxins.

Here are Some Tips on What You Can Do, and Things to Avoid

- Be aware of areas with thick clumps of algae. Keep animals and children away from the water.
- Don't wade or swim in water containing visible algae. Avoid direct contact with algae.
- Make sure children are supervised at all times when they are near water.
- If you do come in contact with the algae, rinse off with fresh water as soon as possible.
- Don't boat or water ski through algae blooms.
- Don't drink the water, and avoid any situation that could lead to swallowing the water.

Is It Safe to Eat Fish from Lakes that are Under a "Health Alert"?

The toxins have been found in the liver, intestines, and pancreas of fish. Most information to

date indicates that toxins do not accumulate significantly in fish tissue, which is the meat that most people eat. It is likely that the portions of fish that are normally consumed would not contain these toxins. However, it is ultimately up to the public to decide whether they want to take the risk, even if it is slight. Fishing is permitted at lakes that are under a Health Alert, but anglers may want to consider practicing catch-and-release at these lakes.

What Can be Done About Algal Toxins?

The key to preventing the formation of algal toxins is to prevent algal blooms in the first place. The primary weapon to reduce algal blooms is nutrient control and the primary nutrient to control is phosphorus. Identifying and reducing phosphorus delivery to streams and lakes is the goal of many Section 319, LARE, and Indiana CLP programs. We know where phosphorus comes from: agricultural fertilizers, livestock waste, residential lawn and garden fertilizers, and internal release of phosphorus from lake sediments. Reducing the use and loss of phosphorus from these sources is something we all can work on.

If you see or suspect an algal bloom on your lake, pond, channel, or even retention pond, report it to your local Health Department. In Indiana, local health departments have jurisdiction regarding public health at beaches and pools, and on lakes. Your local health department may, in turn, contact the Indiana State Department of Health.

Further Information

Our Indiana Clean Lakes Program Website has a color poster with guidelines for avoiding toxic algae that you can enlarge, print, and post. More information about toxic algae will be added to our Website soon. The CLP Website address is: <http://www.indiana.edu/~clp/>. Follow the links to "Publications" and "Factsheets" to find the poster.

For more reading, the summer 2009 issue of *LakeLine*, the quarterly magazine of the North American Lake Management Society (www.NALMS.org), is devoted to algal toxins.

NORTHERN INDIANA LAKES FESTIVAL

The first Northern Indiana Lakes Festival was held on Saturday, June 27, 2009, at Center Lake in Warsaw. This one-day event made a splash in local awareness and appreciation for our lakes through education, experience, fun and celebration!

Lakes are among our most valuable resources. They are vital to our economy, our environment, and our very sense of community. And who among us hasn't been touched in some way by the beauty and serenity that lakes can bring to our hectic lives? Important as our lakes are to life, it is easy to take their services for granted.

The Northern Indiana Lakes Festival puts our lakes in the

spotlight! The first festival was judged a success by all.

1st Lakes Festival Highlights!

- More than 1000 children and adult visitors
- 15 nonprofit & education booths, 32 water-oriented business booths including the Kosciusko Marine Dealers' boat show
- 20 family-friendly programs throughout the day including the Lake City Skiers and Billy B environmental song & dance man
- Surveys representing over 675 attendees rated the festival overall as "Excellent"
- Activities included a pancake breakfast, ecotours by canoe, fishing, youth activities, water splash and play area, food booths, and door prize drawings.



The festival was sponsored by Tippecanoe Watershed Foundation and by Kosciusko County Lakes and Streams. Plan to attend the 2nd Northern Indiana Lakes Festival next year.

Perspectives

"It's not the years in your life that count.
It's the life in your years."

– Abraham Lincoln



WATER COLUMN

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WaterColumn newsletter at:
<http://www.indiana.edu/~clp/>
under "Publications."

Have you checked out the Indiana Clean Lakes Program Web page lately? Take a look at <http://www.indiana.edu/~clp/> and see what's new and happening with the program and with Indiana lakes!

Mosquito Control

With the frequent and heavy rains that much of the state has received thus far in 2009, mosquitoes are at nuisance proportions. Mosquitoes can be annoying and sometimes pose a serious risk to public health. In certain areas of the United States, mosquitoes can transmit diseases like West Nile Virus and equine encephalitis. Mosquitoes lay their eggs in almost any standing water that is calm.

Here are some tips that homeowners can use to help combat the breeding of mosquitoes on their property:

- Eliminate standing water in rain gutters, old tires, buckets, plastic covers, toys, or any other container where mosquitoes can breed.
- Empty and change the water in bird baths, fountains, wading pools, rain barrels, and potted plant trays at least once a week to destroy potential mosquito habitats.
- Drain or fill temporary pools of water with dirt.
- Keep swimming pool water treated and circulating.

For more information, see this U.S. EPA Website: <http://www.epa.gov/pesticides/health/mosquitoes/>.

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