Harmful Algal Blooms:
Prevention and Treatment for Landowners

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Photo credit: Eugene Braig

Harmful algal blooms (HABs) in our lakes and rivers have been grabbing headlines and occasionally the attention of legislators for several years now. “Unsightly,” “odiferous,” and “potentially toxic” are all words that can describe these organisms. In this fact sheet, we’ll discuss some basics of the organisms contributing to HABs, the factors that promote their growth, potential associated problems, and some possible management and mitigation actions you can take on your property.

The culprit

This fact sheet will only address HABs that result from blooms of so-called “blue-green algae,” the group of organisms technically known as *cyanobacteria*. They are not true algae but do behave and appear similar to algae. Like all algae and plants, they contain chlorophyll *a* for photosynthesis. Cyanobacteria rarely have common names, but some of the more prominent species’ scientific names may be familiar to the general public.

Those that drift in the open water are referred to as planktonic. They include *Microcystis* (Figure 1), *Planktothrix*, *Aphanizomenon* (Figure 2), *Dolichospermum* (formerly known as *Anabaena*), and some others. Benthic algae grow attached to bottom sediments and can break free to float to the surface as mats. While some benthic forms are common to larger water bodies, one type that’s likely to grow in ponds is *Oscillatoria* (Figure 3) and its close relatives. With experience, some superficial appearances of cyanobacteria blooms are recognizable with the naked eye. However, positive identification usually isn’t possible without the aid of a microscope.

Figure 1. A *Microcystis* bloom on a private lake.

Figure 2. An *Aphanizomenon* bloom densely concentrated by wind in a cove of a small lake.

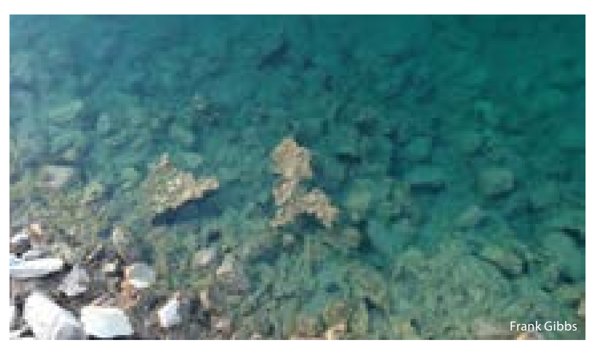
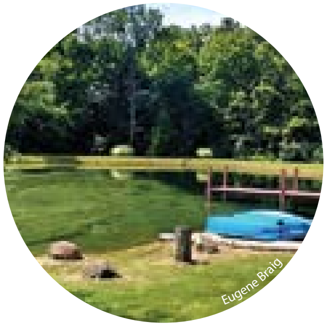


Figure 3. An *Oscillatoria* bloom in the dyed water of a farm pond.

The causes

The primary cause of HABs is excessive nutrient loads, especially phosphorus (P) and nitrogen (N). Aquatic growth tends to be most directly responsive to P concentrations because P is ordinarily the limiting nutrient in fresh water. Phosphorus can enter ponds and lakes from the watershed (all the land area that drains to a common body of water). This occurs particularly with spring rains, especially if the landscape has been fertilized, but it also can occur other times of the year. Soluble P can also be liberated from sediments and become available to fuel a bloom if a pond or



lake loses oxygen from deep water during summer stratification, which is when the water forms separate layers due to density differences.

Unlike true algae, many HAB-forming species can utilize atmospheric nitrogen. If the N:P ratio falls too low, cyanobacteria species can become dominant.

Summer typically brings reduced rainfall and higher temperatures that promote evaporation. As water evaporates, lower water levels concentrate remaining nutrients. Most HAB-forming species also grow better at higher temperatures. Thus, summer often results in conditions that favor HABs.

Related problems

Harmful algal blooms are so named because many of the associated organisms have the potential to produce toxins (often called "cyanotoxins") that can affect the liver, nervous system, or cause skin irritation. Some of those liver and nerve toxins are among the most toxic substances known. However, the presence of a HAB-forming organism does not necessarily mean cyanotoxins are being produced. To be certain, the water needs to be tested. Testing can be expensive and should probably be a higher priority for sites that are accessible by the public or are used as domestic water sources, for livestock or irrigation, or in aquaculture production. Boiling will not remove cyanotoxins and is likely to concentrate them.

Another problem is that high biomasses of any photosynthesizing organism put dissolved oxygen (DO) on a roller-coaster ride of extremes. Under the light of day, net DO production (a byproduct of photosynthesis) is high, but the dark of night (or even an extended period of cloud cover) creates net consumption via respiration. This can be severe enough to deplete oxygen supplies, resulting in low-oxygen stress in aquatic organisms and, in some cases, fish kills.

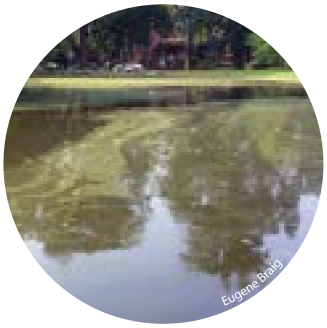
What to do?

The following recommendations may not apply to ponds or lakes where shoreline ownership is shared or to waters that are connected to other surface waters (e.g., by streams). Any type of management action—such as application of herbicides, algaecides, dyes, aeration, or others—whether in a large lake or small pond, may require a permit from your state regulatory agency. Be aware that some chemicals can only be added to a water body by a state-certified applicator. Check local regulations that may apply before taking any management action (your local Extension office can often help with this). If pesticide application is permitted for your location, be certain to carefully read and understand product labels before applying. It is a violation of federal law to use pesticides in a manner inconsistent with their labeling.

PREVENTING HABS ON YOUR PROPERTY

Being proactive by managing and preventing nutrients, especially P, from entering water bodies is the best option for reducing HABs. Once HABs reach problematic concentrations, management can become challenging, impractical, or even impossible, particularly on larger sites. Some strategies for preventing HABs from becoming established are listed below.

- If you are digging a new pond, minimize nutrient inputs from the watershed. Select a site that is not likely to receive runoff from agricultural fields or drainage tile. Pond design should minimize the watershed size while still maintaining a full pond. For more information, see the USDA publication *Ponds – Planning, Design, Construction*.[1]
- For existing lakes and ponds, minimize the application of nutrients (especially P) near the water body and within the watershed.



- Plant or maintain healthy vegetated buffers around lakes and tributaries. Vegetation surrounding water bodies will help absorb and filter nutrients entering a lake or pond.
- Installing a properly designed diffuser aeration system will circulate pond water and make some cyanobacteria species less competitive by mixing buoyant species to deeper water. Aeration can help maintain oxygen levels but is impractical on larger lake sites.
- Maintain some coverage of submerged vegetation in your lake or pond. If one of your objectives is managing a fishery, consider having coverage of at least 15%–40% of the site's area. The greater the coverage within that range, the greater the benefit to the habitat and to water quality. Nutrients taken up by aquatic plants are no longer available to fuel the growth of HABs. Since aquatic plants have varied growing seasons, your plant assemblage should consist of diverse native species so the benefits remain throughout the season. Be aware that maintaining your desired coverage of vegetation is likely to require active management.
- Nutrients can be proactively removed from the water column using phosphorus-binding chemicals, most commonly aluminum sulfate (buffering with lime if necessary) or lanthanum (less problematic, more effective, but more expensive).
- Nontoxic dyes are often applied to ponds to suppress excessive growth of aquatic plants. Dyes may have some limited use in suppressing HABs but will also suppress competitors against HABs.

TREATING HABS ON YOUR PROPERTY

It's important to remember that treating HABs provides a temporary fix and may alleviate the problem in the short term but does not take the place of prevention. Once established, HABs are challenging to treat, making prevention the most critical action you can take to address HABs on your property.

Before pursuing treatment options, consider potential consequences especially in ponds or small lakes. Any treatment of a large bloom in warm water may cause a drop in oxygen levels and potentially kill fish, even overwhelming a diffuser aeration system.

Cyanobacteria respond to algaecides like true algae do, but they can be tenacious.

- Copper products are most commonly applied to planktonic blooms. Repeat treatments with sodium carbonate peroxyhydrate (also called sodium percarbonate) are becoming more common when planktonic blooms concentrate as surface scums. This chemical is more benign than copper formulas and has less potential for residual side effects.
- Persistent benthic blooms are most effectively treated in multiple stages: sodium carbonate peroxyhydrate on the first day and a copper formula the next.
- Whenever applying a pesticide, be certain to read and understand the product label. If needed, make sure you obtain a permit from the proper regulatory agency for using certain chemical products in surface waters.

Killing a HAB will not remove any toxins already present and may actually release toxins from the dying cells. Temperature, water clarity (and thus penetration by sunlight), biological activity, and other factors will determine the time it takes for cyanotoxins to degrade to harmless substances. To determine if a toxin remains, you'll need to test the water for that toxin. However, repeat testing can become expensive.

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This factsheet was developed by the Algal Bloom Action Team, a collaboration of water professionals, researchers, and educators from the national network of Water Resources Research Institutes, the North Central Region Water Network, and Cooperative Extensions from the 12 states in the North Central Region of the United States.

More information at:
northcentralwater.org/habproject

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[1] United States Department of Agriculture (USDA). 1997. *Ponds – Planning, Design, Construction.* https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_030362.pdf