

Blue-Green Algae In Wisconsin Waters

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General Information

Please Note: The Wisconsin Department of Natural Resources is not currently conducting any routine monitoring for blue-green algae or blue-green algal toxins. If you are (or your lake association is) interested in collecting samples for analysis, please contact the Wisconsin State Laboratory of Hygiene at 1-800-442-4618.

What are blue-green algae?

Blue-green algae, also known as Cyanobacteria, are a group of photosynthetic bacteria that many people refer to as "pond scum." Blue-green algae are most often blue-green in color, but can also be blue, green, reddish-purple, or brown. Blue-green algae generally grow in lakes, ponds, and slow-moving streams when the water is warm and enriched with nutrients like phosphorus or nitrogen.

When environmental conditions are just right, blue-green algae can grow very quickly in number. Most species are

buoyant and will float to the surface, where they form scum layers or floating mats. When this happens, we call this a "blue-green algae bloom." In Wisconsin, blue-green algae blooms generally occur between mid-June and late September, although in rare instances, blooms have been observed in winter, even under the ice.

Many different species of blue-green algae occur in Wisconsin waters, but the most commonly detected include *Anabaena* sp., *Aphanizomenon* sp., *Microcystis* sp., and *Planktothrix* sp. It is not always the same species that blooms in a given waterbody, and the dominant species present can change over the course of the season.

How do blue-green algae differ from true algae?

Blue-green algae, like true algae, make up a portion of the phytoplankton in many water bodies. However, blue-green algae are generally not eaten by other aquatic organisms, and thus are not an important part of the food chain. True algae (e.g., green algae) are very important to the food chain. They are known as "primary producers", a name given to living organisms that can convert sunlight and inorganic chemicals into usable energy for other living organisms. Most algae are microscopic and serve as the main supply of "high energy" food for larger organisms like zooplankton, which in turn are eaten by small fish. Small fish are then eaten by larger fish, and both small and large fish are eaten by mammals, raptors, and people.

What are the concerns associated with blue-green algae?

Concerns associated with blue-green algae include discolored water, reduced light penetration, taste and odor problems, dissolved oxygen depletions during die-off, and toxin production. Discolored water is an aesthetic issue, but when blue-green algae reach bloom densities, they can actually reduce light penetration, which can adversely affect other aquatic organisms

both directly (e.g., other phytoplankton and aquatic plants) and indirectly (e.g., zooplankton and fish that depend on phytoplankton and plants). Blue-green algae blooms can be quite smelly, and though it is recommended that people never drink raw water, blue-green algae have been known to affect the taste of drinking water that comes from surface waters experiencing a bloom. Here in Wisconsin, most of the state relies on groundwater, rather than surface water, for drinking water. When a blue-green algae bloom dies off, the blue-green algae cells sink and are broken down by microbes. This breakdown process requires oxygen and can create a biological oxygen demand. Increases in biological oxygen demand result in decreases in oxygen concentration in the water, and this can adversely affect fish and other aquatic life, and can even result in fish kills.

Blue-green algal toxins are naturally produced chemical compounds that sometimes are produced inside the cells of certain species of blue-green algae. These chemicals are not produced all of the time and there is no easy way to tell when blue-green algae are producing them and when they are not. When the cells are broken open, the toxins may be released. Sometimes this occurs when the cells die off naturally and they break open as they sink and decay in a lake or pond. Cells may also be broken open when the water is treated with chemicals meant to kill algae, and when cells are swallowed and mixed with digestive acids in the stomachs of people or animals. The only way to be sure if the toxins are present is to have water samples analyzed in a laboratory using sophisticated equipment.

Are blue-green algae blooms a new problem?

No. Fossil evidence suggests that blue-green algae have been around for millions of years. Scientists have recorded blue-green algae blooms dating back to the 12th century and they have documented the toxic effects to livestock for more than 100 years. However, it is possible that the frequency and duration of blooms are increasing in

some Wisconsin waters as a result of increased nutrient concentrations. Nutrients, particularly phosphorus and nitrogen, can be carried into water bodies as a result of many human activities, including agriculture, discharge of untreated sewage, and use of phosphorus-based fertilizers and detergents.

What is *Cylindro* and how is it different?

Cylindrospermopsis raciborskii, also referred to as "Cylindro," is a blue-green algal species that is not native to Wisconsin. Recent reviews of archived samples by DNR scientists have shown that Cylindro has been present in some southern Wisconsin lakes dating back to the early 1980s. It is likely that migratory waterfowl brought this algae to Wisconsin and other Midwestern states. In lakes where Cylindro has been detected, blooms typically occur any time between late July and late September. Cylindro is different from many other blue-green algae in that it does not typically float to the surface to form scums. Thus, it can be difficult to see a bloom of this species. Cylindro is capable of producing more than one toxin, including cylindrospermopsin, which can affect the liver. However, to date, cylindrospermopsin has not been detected in any Wisconsin waters.

Why do blooms sometimes appear overnight?

Even if you can't see blue-green algae floating on the surface of the water, that doesn't mean they aren't there. Blue-green algae can be suspended at various depths in the water, and their location depends on a number of factors. The most important of these are light and nutrients (phosphorus and nitrogen). Many species of blue-green algae have evolved to be able to control their buoyancy as the availability of light and nutrients change with the time of day and local weather conditions. At night, when there is no light, cells are unable to adjust their buoyancy and often float to the surface, forming a surface scum. So this scum can literally appear overnight and may linger

until wind and waves scatter the cells throughout the water body.

Should I get treat a blue-green algae bloom with a chemical to get rid of it?

No. Treatment of a surface water that is experiencing a blue-green algae bloom with an herbicide or algaecide may kill the blue-green algae, but any toxin(s) contained in the cells will be released at once, resulting in a slug of toxin(s) in the water. So while the bloom may no longer be visible, toxin(s) may be present for some period of time following treatment. It is best to stay out of a water experiencing a bloom and wait for the bloom to dissipate on its own.

What can be done to reduce the frequency and intensity of blue-green algae blooms?

There are no quick or easy remedies for the control of blue-green algae once they appear in a lake or pond. Reducing the amount of nutrients that wash into our lakes and ponds will eventually reduce the frequency and intensity of blue-green algae blooms, but it may take a long time and a lot of community involvement to effectively change the nutrient concentrations in a water body. This is because there may still be large amounts of nutrients in the sediment at the bottom that may continue to serve as food for the blue-green algae.

Regulatory agencies like the Wisconsin Departments of Natural Resources and Agriculture, Trade, and Consumer Protection are working with communities around the state to reduce stormwater runoff, and to encourage agricultural practices that reduce soil erosion while maintaining high crop yields. Locally, landowners and interested citizens can help minimize the problems associated with algal blooms by working together with partners in their watershed to reduce the amount of nutrients that reach nearby lakes, streams, and ponds. You can help reduce nutrient

concentrations by promoting the following practices in your community:

- Use lawn fertilizers only where truly needed
- Prevent yard debris (e.g., leaves, grass clippings, etc.) from washing into storm drains
- Support local ordinances that require silt curtains for residential and commercial construction sites
- Plant and maintain vegetative buffer strips along shorelines of lakes, ponds and streams. Note: Native plants are much more effective at filtering runoff than the typical grass species found on residential lawns.

Has the Wisconsin Department of Natural Resources conducted any monitoring for blue-green algae?

The WI DNR conducted a two-year study to investigate the frequency, severity, and duration of blue-green algae blooms, including information on which species of blue-green algae are present over the course of the summer. We also looked for the presence and concentrations of specific toxins: anatoxin-a (a neurotoxin), microcystin-LR (a hepatotoxin), and cylindrospermopsin (a cytotoxin). Samples were (for the most part) collected from five lakes in each of five regions, five times over the course of each summer (2004 and 2005). Samples were also collected from eight ponds in the south central region of the State. It is important to note that we chose to sample sites where blue-green algae blooms had occurred in the past or where they could potentially occur, based on nutrient concentrations. Therefore, this was not a random sample of lakes and ponds meant to represent all lakes and ponds in Wisconsin. Also, unlike the beach monitoring study for bacteria, this study was not designed to provide real-time information on the presence of blue-green algae or blue-green algal toxins, and only a limited number of surface waters could be monitored in each region of the state.

However, when DNR received information from the State Laboratory of Hygiene on the presence of high counts of blue-green algae or on the presence of blue-green algal toxins, this information was shared with the local public health agency. Only the Department of Health and Family Services, or the local public health agency has the authority to close a beach.

The total number of samples collected in the statewide monitoring study was 187 in 2004, and 194 in 2005. Blue-green algae were present in 74% of all samples collected in both 2004 and 2005 (again, samples were collected from sites where we believed the potential for blooms was high). Blooms occurred in all regions of the state, with the biggest “hot spots” in the west central and south central regions. Species of blue-green algae most commonly detected included *Anabaena* sp., *Aphanizomenon* sp., *Microcystis* sp., and *Planktothrix* sp.. Alerts were sent out to local public health agencies when concentrations of blue-green algae likely exceeded the World Health Organization (WHO) guideline of 100,000 cells/mL. This concentration represents a “moderate risk to human health”. The total number of alerts sent out was 33 in 2004 and 42 in 2005. A subset of the total number of samples collected was analyzed for toxins at the end of each summer (45 samples in 2004, and 34 samples in 2005). Microcystin-LR (a hepatotoxin) was the toxin detected most frequently and in the highest concentrations. This toxin was detected in the northern, south central, and west central regions of the state. The toxin anatoxin-a (a neurotoxin) was detected in samples collected in the northern and south central regions, and its presence was associated with a dog death in 2004. The toxin cylindrospermopsin was never detected.

Potential Effects on Humans and Animals

Can blue-green algae make me sick?

Yes, it is possible for blue-green algae to cause illness. Blue-green algae are capable

of producing several different toxins. People may be exposed to these toxins through contact with the skin (e.g., when swimming), through inhalation (e.g., when motor boating or water skiing), or by swallowing contaminated water. Types of toxins and potential health effects include the following:

Dermatotoxins and Gastrointestinal Toxins— These toxins affect the skin and mucous membranes, and can cause allergy-type reactions such as rashes, eye/nose/throat irritation, and asthma, as well as headaches, fever, and gastroenteritis (nausea, stomach cramps, vomiting, diarrhea). Examples include lyngbyatoxin and lipopolysaccharide endotoxins.

Hepatotoxins— These toxins affect the liver and other internal organs, and can cause gastroenteritis, tissue damage, muscle weakness, paralysis, and respiratory failure (with acute exposure), tumors, and possibly liver cancer (with long-term, chronic exposure). Examples include microcystins and nodularins.

Cytotoxins— These toxins also affect the liver and other organs (though through a different mode of action than hepatotoxins) and can cause malaise, headache, anorexia, vomiting, chromosome loss, DNA strand breakage, and damage to organs. An example is cylindrospermopsin.

Neurotoxins— These toxins affect the central nervous system and can cause seizures, paralysis, respiratory failure or cardiac arrest. Examples include anatoxin-a and saxitoxin. (Saxitoxin is the same toxin associated with red tide and paralytic shellfish poisoning in marine systems).

Are children more vulnerable than adults?

Yes. Children may be at greater risk than adults for two primary reasons:

1. Children love to play in the water, but typically do not understand the health risks as well as adults. As a result, they may drink the water

- because they are thirsty or swallow it accidentally while swimming.
2. Children weigh less, and so a smaller quantity of toxin may trigger an adverse effect.

Can blue-green algae make my pet sick?

Animals are not necessarily more sensitive to blue-green algal toxins than humans. However, many animals, such as dogs and cattle, enjoy being in the water, even if there is an unsightly green scum layer floating on top. When such a bloom is present, animals may consume large quantities of blue-green algae if they drink the water, and if those blue-green algae happen to be producing toxin(s), the animals can become very ill, and even die. Symptoms of blue-green algal toxin poisoning may range from lethargy and loss of appetite to seizures, vomiting, and convulsions. Dogs are particularly susceptible to blue-green algal poisoning because scums can attach to their coats and be swallowed during self-cleaning.

Should I let my pets or livestock drink or swim in water containing algal blooms?

No. Animals can become extremely ill, and even die, after swallowing water containing blue-green algae. As public awareness has increased, so has the number of reports from veterinarians that blue-green algal toxins may have played a role in the deaths of dogs where other causes were not obvious. It is possible that the number of dogs that die from exposure to blue-green algae is an underreported statistic.

Drinking Water Concerns

Can I be exposed to blue-green algae or blue-green algal toxins through my drinking water?

Exposure to blue-green algae or blue-green algal toxins is unlikely if your water is provided by a municipal drinking water agency. For most Wisconsin residents and tourists, drinking water is provided by underground water sources that do not contain blue-green algae or blue-green algal toxins. While Lake Michigan and Lake Superior serve as water supplies for many communities on or near those lakes, there is no reason to worry since the water is pumped from far offshore, in deep water areas that are not affected by blue-green algal blooms.

Rainbow Lake in Waupaca County and Lake Winnebago are the only two Wisconsin inland lakes that serve as water supplies for area communities (Appleton, Neenah, Menasha, and Oshkosh). While blue-green algae blooms may occur on these lakes in summer, studies have shown that blue-green algal toxins are removed by the local utilities' routine water treatment processes.

Keep in mind that water that is not treated may pose risks far beyond those associated with blue-green algae. All natural surface waters contain bacteria, algae, viruses, and other pathogens that if consumed may pose health risks to humans, pets, and other domestic animals. No one should ingest raw lake or pond water at any time.

How do water treatment plants deal with blue-green algae?

While most municipal drinking water treatment plants with surface water supplies do not regularly monitor for algal toxins, they do use treatment techniques that would remove the toxins if they were present. Conventional water treatment facilities can

remove the cells of algae and other growing organisms by adding chemicals that bind them together. As the cells clump together, they become heavier and fall to the bottom of settling basins. Additional removal is obtained by filtration and through the use of activated charcoal. Studies conducted by scientists from the University of Wisconsin and the State Laboratory of Hygiene in the late 1990s did not detect any significant concentrations of algal toxins in the finished drinking water of several communities using Lake Winnebago as their water supply.

Can I treat my water at home to remove blue-green algae and their toxins?

There are a number of home water treatment options available to provide filtered water. Some of these systems include an activated charcoal step that will help remove certain chemicals like algal toxins if maintained and operated properly. However, variability in the design of the products on the market and in the operation and maintenance by homeowners prevent state health officials from declaring these products fail-safe.

Can I cook using water with blue-green algae in it?

No. Boiling water does not remove blue-green algal toxins. Because it is impossible to detect the presence of toxins in water by taste, odor or appearance, you are better off assuming they may be present.

What about using water with blue-green algae for washing?

If blue-green algae are visible, try to find a better source of water for washing food (i.e., fruits, vegetables, etc.), dishes, and clothes. Also avoid bathing or showering in water containing blue-green algae, as skin contact with the blue-green algae may lead to skin irritation or other adverse health effects.

Recreational Water Concerns

Can water containing blue-green algae blooms be used for recreational activities?

Because local health officials cannot easily determine when blue-green algal toxins are being produced, anyone considering recreation on or in the water should use common sense. Simply put, if a scum-layer or floating mat is present, do not recreate in or on that water. The chance for health effects is greater if you or your children participate in water-related activities such as swimming, wading, water or jet-skiing, or wind surfing. Try to find areas where a blue-green algae bloom is not present.

Is it safe to let your children or pets swim in ponds (e.g., farm ponds, stormwater detention ponds, golf course ponds)?

By design, many farm ponds, golf course ponds, and stormwater detention ponds are constructed to trap nutrients, eroded soil, and other debris. By doing so, they prevent such materials from reaching nearby lakes, ponds, and streams. But because more nutrients may be available and because these types of ponds are generally more shallow and warm, it is possible for them to experience more frequent blue-green algae blooms (which may produce toxins). Again, a common sense approach is recommended for such ponds: if a scum layer or floating mat is present, do not let your children or pets swim.

Is there a risk to SCUBA divers who swim in blue-green algae blooms?

It may not always be possible to avoid swimming in blue-green algae blooms. Rescue SCUBA divers may be required to

swim in areas where a bloom is present. In those cases, divers should try to minimize the ingestion of water during the course of the dive. Divers should also shower or rinse off thoroughly after exiting the water, and clean all gear after use. Divers who show any signs of illness after exposure should seek medical attention.

Do blue-green algae pose a risk to competitive swimmers such as triathletes?

When organizers establish the schedule and pick a course for a triathlon, they have no way of knowing whether or not a blue-green algae bloom will be present in the swim area. To the degree possible, race organizers are encouraged to establish a course that minimizes the exposure of participants to blue-green algae blooms. Race organizers may also want to consider having a rinse station established near the swimming finish area. All participants are encouraged to minimize the ingestion of water during the course of the event. As is the case in any organized race, participants should seek medical attention if they show any signs of illness during or after the event.

Fish Consumption Concerns

Can I eat fish from water containing blue-green algae?

Some blue-green algal toxins have been shown to accumulate in the tissues of fish and shellfish, particularly in the viscera (liver, kidney, etc.). Whether or not the accumulation levels are sufficient to pose a risk to humans is uncertain, although it would depend in part on the levels of consumption and on the severity of the blue-green algae blooms where the fish or shellfish were caught or collected.

The Wisconsin Department of Natural Resources has not received any reports of people becoming ill after eating fish caught in areas where a blue-green algae bloom

was present. The World Health Organization advises that people who choose to eat fish taken from water where a blue-green algae bloom is present eat such fish in moderation and avoid eating the guts of the fish, where accumulation of toxins may be greatest.

Important Note About Hygiene

All natural surface waters contain bacteria, algae, viruses, and other pathogens that if consumed may pose health risks to humans, pets, and other domestic animals (e.g., cattle, swine). No one should ever ingest raw water.

Measures People Can Take to Protect Themselves

- Do not swim in water that looks like "pea soup", green or blue paint, or that has a scum layer or puffy blobs floating on the surface
- Do not boat, water ski, etc. over such water (people can be exposed through inhalation)
- Do not let children play with scum layers, even from shore
- Do not let pets or livestock swim in, or drink, waters experiencing blue-green algae blooms
- Do not treat surface waters that are experiencing blue-green algae blooms with any herbicide or algaecide-- toxins are released into the water when blue-green algae cells die
- Always take a shower after coming into contact with any surface water (whether or not a blue-green algae bloom appears to be present; surface waters may contain other species of potentially harmful bacteria and viruses)

Measures People Can Take to Help Reduce Future Blue-Green Algae Blooms

- Maintain native vegetation along shorelines as buffer areas
- Minimize activities that result in erosion
- Reduce the amount of fertilizer used on lawns
- Use only phosphorus-free fertilizer when possible
- Fix leaking septic systems
- Use only phosphorus-free detergents in dishwashing machines

Contact Information

If you think you are experiencing symptoms related to exposure to blue-green algae (e.g., stomach cramps, diarrhea, vomiting, headache, fever, muscle weakness, difficulty breathing), contact your doctor or the Poison Information Hotline (800-222-1222) right away.

If your pet displays symptoms such as seizures, vomiting, or diarrhea after contact with surface water, contact your veterinarian right away.

For more information about contacting your local health department, check the [Department of Health and Family Services Web site](#).

For more information on potential health effects of blue-green algae, contact Dr. Mark Werner, Department of Health and Family Services, at (608) 266-7480.

For more information on the ecology of blue-green algae or environmental factors that influence their growth, contact Jim Vennie, Department of Natural Resources, (608) 266-2212.

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