BLUE-GREEN ALGAE

COMMON NAMES: Blue-green algae, cyanophytes, cyanobacteria

SCIENTIFIC NAME: There are a variety of cyanobacteria to be concerned about in Indiana. They include *Cylindrospermopsis* spp., *Microcystis* spp., *Anabaena* spp., *Aphanizomenon* spp., and *Pseudoanabaena* spp.

DISTRIBUTION: Blue-green algae are present in almost all United States freshwater bodies.

Blue-Green Algae (courtesy of Florida Department of Environmental Protection, http://www.dep.state.fl.us/water/bgalgae/photos.htm)

DESCRIPTION: Cyanobacteria are true bacteria, but differ from other bacteria by having photosynthetic ability. Blue-green algae can occur as microscopic single cells, strands of cells called trichomes, or accumulations of cells called colonies. An algal bloom is an increase in the number of algal cells such that there is a reduction in water quality. Some species (about 50 of the 1,500 species) of blue-green algae can produce toxins; this must be evaluated by a toxicity analysis.

LIFE CYCLE BIOLOGY: Cyanobacteria can fix gaseous nitrogen, and are efficient at storing phosphorus. Buoyancy of this species varies due to the changing size of their internal pockets of gas. These alga cells can migrate in calm waters in response to nutrient or light gradients. Some species of blue-green algae produce akinetes which are structures similar to spores. Akinetes are capable of living in sediments for months and even years and then "seed" a water body. Optimal conditions for cyanobacteria growth are high temperature long sunny days, high levels of phosphorus and nitrogen, and calm winds which allow the cells to migrate to the surface. Reproduction takes place through trichome fragmentation, the splitting of the chain of cells, and is promoted by photosynthesis.

PATHWAYS/HISTORY: The earliest documented case of toxic blue-green algae was in Australia's Lake Alexandria in 1878 which caused livestock and pets to become sick and die. Fifty-five human deaths were attributed to water tainted with cyanobacteria toxins which was used in a kidney dialysis clinic in Brazil in 1996.

Cylindrospermopsis raciborskii (Cylindro) was first discovered in Indiana in August of 2001 in Ball Lake, Steuben County. At that time, a heavy bloom was occurring but only trace amounts of toxin were present. This was shocking since Cylindro was thought to be a tropical and sub-tropical species. Prior to the Ball Lake discovery, in the United States, Cylindro was usually only found in waters in the southeastern states. A study was undertaken in 2002 and 2003 to determine the distribution and abundance of Cylindro in Indiana (http://www.spea.indiana.edu/clp/FinalCylindro%20Web.pdf). Of the 182 lakes sampled by Indiana University in the study, 19 tested positive for Cylindro. The majority of the positive samples were collected in August. This is not surprising since the species is generally known as a tropical species and would experience its highest growth in Indiana in late summer when the water is warmest. The presence of toxins was not evaluated during the study and needs to be further evaluated. The highest Cylindro density ever reported in the U.S. was from Lake Lemon in Monroe County in 2005, 2.1 million cells per milliliter. Other Midwestern states were plagued with high Cylindro counts in the summer of 2005 due to the hot and dry conditions (W.W. Jones, personal communication, Sept 2005).

Besides Cylindro, other taste fouling or toxin producing blue-green algae species have been found in Indiana water supply lakes. Algaecide treatments are commonly performed in some water supply lakes to reduce the negative effects of cyanobacteria. Although numerous species of blue-green algae capable of producing toxins are present in Indiana, rarely does toxin production occur. While fortunate in this regard, it is unclear why little toxicity has been observed.

DISPERSAL/SPREAD: Blue-green algae can spread naturally through connected waterways, but humans can also contribute to its dispersal. Through movement from one water body to another, humans can carry blue-green algae with them on trailers, boats and in bait buckets thus aiding in its spread.

RISKS/IMPACTS: High concentrations of the cyanobacteria that produce toxins can cause serious problems. In humans, these toxins have been reported to cause skin and eye irritation, dermatitis, gastroenteritis, diarrhea, vomiting, liver damage, nervous system damage, damage to the kidneys and respiratory tract, nausea, headache, and even death. Livestock and wildlife may suffer skin irritation, convulsions, liver problems, paralysis, constipation, abortion, or death. For more in depth information on human risks, you can visit http://www.state.in.us/dnr/fishwild/fish/cylind.htm.

Fish and other aquatic organisms can be affected during blue-green algae blooms by extreme day/night fluctuations in dissolved oxygen and pH of the water. These wide fluctuations can occasionally trigger fish kills.

Many species of blue-green algae give the water a foul taste and odor. In high concentration periods, water intake filtration systems can become blocked. Water treatment plants must use specialized purification techniques to remove the taste associated with these cyanobacteria. Large blooms can also be unsightly as some will form surface scum on bodies of water.

MANAGEMENT/PREVENTION: Water movement can be increased to dissuade growth of blue-green algae. Algaecide treatments can be employed but require diligence and repetitive treatment. Long-term control of algae and nuisance plants usually involves land management that prevents excessive nutrient loading from surrounding land. Several state and federal agencies in Indiana are working actively with local communities and landowners to improve land use management and protect water quality. If you are interested in participating in these efforts, please contact any of the following programs:

- Indiana State Department of Agriculture and the Indiana Soil and Water Conservation Districts (http://www.in.gov/isda/2394.htm)
- IDNR Division of Fish and Wildlife's Lake and River Enhancement Program (http://www.in.gov/dnr/fishwild/lare/)
- Indiana Department of Environmental Management's Watershed Planning Section (http://www.in.gov/idem/programs/water/wsp/index.html)

Like all invasive species, the key to preventing their spread is knowledge! Here are some things you can do to reduce the likelihood of spreading cyanobacteria.

- ✓ Rinse or remove all mud, debris, and plant fragments from equipment and wading gear before entering another body of water.
- ✓ Drain all water from the boat and live well before leaving the launch area.
- ✓ To reduce the chances of coming into contact with toxic blue-green algae, it is recommended to restrict swimming and not allow animals to drink water that is "pea-soup green".

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