

Green Scums Can Ruin a Day at the Beach: New Hampshire's Response to Toxic Cyanobacteria

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Toxins associated with cyanobacteria have generated increased attention in the public health field during the last 10-15 years. This increased attention is a result of spectacular cyanobacteria blooms throughout the world that have resulted in the death of livestock, pets and increased cases of human illnesses, including the death of one human in the mid-west in which microcystins were the likely cause.

Attention has also been directed towards cyanobacteria in New Hampshire's lakes and ponds. In 2004, two public beaches experienced long-term cyanobacteria advisories and two others experienced short-term advisories; and at least three lakes experienced lake-wide cyanobacteria blooms. Similar numbers of lakes with cyanobacteria were documented in 2005. Thirteen waterbodies were issued cyanobacteria advisories during the 2006 summer season. The increase of cyanobacteria advisories was likely the result of the extreme weather patterns of heavy wetfall and increased watershed runoff to lakes.

In 1998, the World Health Organization published a Drinking Water Guideline value for one frequently occurring cyanotoxins, Microcystin-LR of 1ug/L (WHO 1998). Other countries used the WHO guidelines to set their own standards for microcystin in drinking water. The USEPA is currently developing a microcystin standard for drinking water and recreational waters.

So what exactly are cyanobacteria? Cyanobacteria (formerly classified as blue-green algae) are prokaryotes (a unicellular organism having cells lacking membrane) capable of performing photosynthesis and many are capable of fixing (converting into a biologically useable form of) nitrogen. They are present in virtually all natural environments including many extreme environments like hot springs and are likely found in many New Hampshire lakes. Cyanobacteria may appear as single cells, colonies, or filaments. Some cyanobacteria species can regulate cell buoyancy that determines cell depth in the water column allowing them to out-compete algal species for light and food sources. Their competitive nature combined with optimal phosphorus loading may accelerate cyanobacteria blooms. Severe blooms impact the tourism industry as people avoid lakes with unsightly pea soup or bluish green colored scums and foul odors. In some cases, the blooms may cover the entire water body but in most cases, you will find them congregated as large scums on the windward shoreline. In severe cases, the high cell count leads to low dissolved oxygen, increased ammonia which cause fish kills.

A few species of cyanobacteria produce toxins that may be released into the water upon cell lysis (destruction) or death. There are four common cyanobacteria to New Hampshire's lakes and ponds that produce toxins. These toxins may be hepatotoxins (liver and kidney), neurotoxins (central nervous system) or dermatotoxins (skin irritants) capable of causing both acute and chronic illnesses. Cyanobacterial neurotoxins are extremely potent and, in general, interfere with nervous system function. Cyanobacterial hepatotoxins include microcystins that cause widespread liver damage and dysfunction. Acute effects, such as skin and mucous membrane irritations, can occur after short term exposure with water containing these toxins. Chronic effects, such as liver, kidney, and central nervous system damage, can occur over a period of time from ingestion of water containing large amounts of toxins. Recreational exposure to cyanobacteria toxins is a major concern.

Below is a list of common New Hampshire cyanobacteria, the toxins they produce, routes of exposure, and common side-effects.

Genus	Common Toxins	Exposure	Side-Effects
<i>Anabaena</i>	Anatoxins (neurotoxin), Microcystins (hepatotoxin)	Swimming (skin contact and swallowing water), showering (if drawing water from lake), water sports, boating (aerosols from spray).	Nausea, vomiting, diarrhea, general malaise, severe thirst, skin and mucous membrane irritation, <u>staggering, and paralysis.</u>
<i>Aphanizomenon</i>	Saxitoxins (neurotoxin)	Swimming (skin contact and swallowing water), showering (if drawing water from lake), water sports, boating (aerosols from spray).	Numbness of lips and mouth extending throughout the body, motor weakness, respiratory and muscular paralysis.
<i>Microcystis</i>	Microcystins	Swimming (skin contact and swallowing water), showering (if drawing water from lake), water sports, boating (aerosols from spray).	Nausea, vomiting, diarrhea, general malaise, severe thirst, skin and mucous membrane irritation.
<i>Oscillatoria</i>	Anatoxins, Microcystins, Aplysiatoxins (dermatotoxin)	Swimming (skin contact and swallowing water), showering (if drawing water from lake), water sports, boating (aerosols from spray).	Nausea, vomiting, diarrhea, general malaise, skin and mucous membrane irritation.



Microcystis

DES has taken a proactive approach to protect public health by becoming the first state in the nation to issue public beach advisories to counter public health concerns from cyanobacteria scums. Any suspected scum should be reported to DES. Biologists will collect samples at any beach with reported scums. If a microscopic identification reveals that greater than 50 percent of the cell count originates from possible toxin producing cyanobacteria, an advisory is issued at the public beach and a press release is sent to the local papers. Samples are also collected for microcystin analyses. The Limnology Center is equipped to perform Enzyme Linked Immunosorbent Assays (ELISA) for determination of total microcystin concentration (MCs). Results from the ELISA test will confirm the presence of microcystin and the level of concentration.

If you suspect a cyanobacteria bloom is occurring at your lake or pond, please collect a sample (if possible) and call DES Limnology Center immediately at (603) 271-3414 or contact the cyanobacteria hotline at 603-419-9229.