Microcystis: Toxic Blue-Green Algae

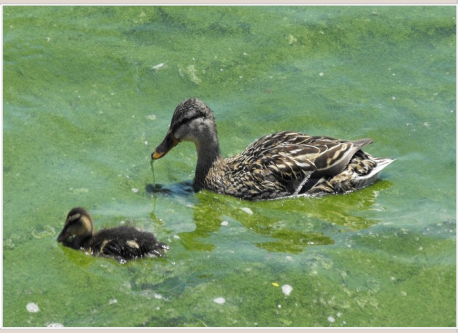
What are *Microcystis* blooms and why they are a problem?

Figure 1. Mat of *Microcystis* on the surface of a water body.

Microcystis aeruginosa is a single-celled blue green alga, or cyanobacterium, that occurs naturally in surface waters. *Microcystis* can proliferate to form dense blooms and mats under certain conditions (see Figure 1). Many variants of these cyanobacteria produce multiple toxins, including the potent liver toxin, microcystin. When *Microcystis* die, their cells break open, releasing the toxin microcystin into the water. Ingestion of water or algal cells containing microcystin has produced adverse effects in fish, dogs, cats, livestock and humans.

What effects do *Microcystis* blooms have on humans and animals?

People swimming in dense *Microcystis* blooms have experienced irritation such as skin rashes, burns, and blistering of the mouth. Ingestion or inhalation of water containing dense bloom material may cause vomiting, nausea, headaches, diarrhea, pneumonia, and fever. Ingestion of significant levels of the toxin microcystin can cause liver damage and dysfunction in humans and animals. No deaths from ingestion of microcystins have been reported in humans. However, dogs, wildlife and livestock have died following exposure to this toxin.



What causes *Microcystis* blooms?

Microcystis blooms typically thrive in warm, turbid, and slow-moving waters. The blooms with the highest biomass occur in waters that are high in nitrogen or phosphorus (eutrophic waters). *Microcystis* also require sufficient light intensity to conduct photosynthesis, which results in blooms. In California, cyanobacteria proliferate in the early summer through late autumn and may last for two-four months. *Microcystis* may be present in the water in the absence of visible blooms because the mats can sink below the surface.

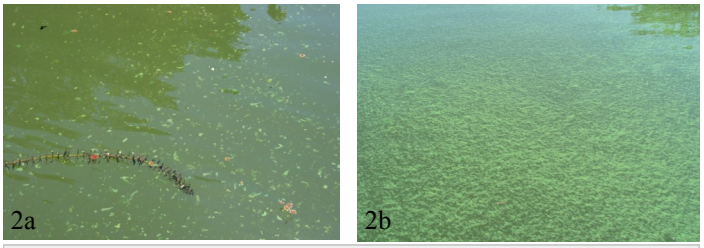


Figure 2. Recent pictures of microcystis blooms in the Delta. Inset 2a, Old River; 2b near Mildred Island

How are humans and animals exposed?

The most common route of exposure to microcystin is drinking water, followed by recreational exposures and food supplements. Typical water treatment processes do not fully remove microcystin that might be present in drinking water supplies stored in reservoirs. Swimming and playing in water that contains, or recently contained, *Microcystis* blooms is another common exposure route. Children have the highest risk of exposure since they tend to unintentionally ingest water while swimming. Microcystin can move through the aquatic food web, exposing fish and shellfish, as well as the people that consume them. Microcystin does not remain in edible fish and shellfish tissues for more than a few weeks. However, people that frequently consume sport fish caught from a water body that supports *Microcystis* blooms have a higher risk of exposure. Dogs can ingest large amounts of *Microcystis* cells when they clean their coats after playing in water. Livestock, wildlife and dogs are exposed through drinking water and containing *Microcystis* or ingesting algal mats.

Where have blue-green algal blooms occurred in California?

Microcystis blooms are occurring with greater frequency in California than in the past. The map below identifies the locations of known recurrent algal blooms in our state. The location of blooms identified in the map reference all strains of blue-green algae, including *Microcystis*. Information on the locations of *Microcystis* blooms exclusively is not available.

Preventing *Microcystis* Blooms

Any efforts to prevent nutrients from running off of lawns, pastures, or agricultural fields will reduce the frequency and severity of toxic blue-green algae blooms as well as other types of nuisance blooms. For the homeowner, this means carefully using fertilizers on lawns as well as preventing run-off when watering. Replacing lawns with native plants will reduce or eliminate the need for fertilizer and will cut water use by 75% (an added benefit). *Microcystis* thrives when the nitrogen:phosphorus ratio is less than 15 parts nitrogen (N) to 1 part phosphorus(P). When the ratio of N:P is greater than 20:1, non-toxic algae predominate. Agriculturalists can play a major role in reducing BGA blooms by also carefully controlling the use of fertilizers. Water agencies can contribute to solving this problem by increasing the flushing of waterways through releases of water from dams. These releases increase mixing of different layers of water downstream and decrease water temperature, both of which are unfavorable for toxic *Microcystis*. In rivers, any actions that increase flow rate will minimize the conditions which foster blooms.

Guidelines for avoiding exposure to *Microcystis* and microcystin

- Never drink from water containing visible blue-green algal blooms.
- Do not allow children or pets to play in water that contain algal blooms.
- Follow the advice on all postings and signs located at waterbodies.
- If you suspect exposure, wash affected area with water and contact a physician.
- If you think a waterway contains microcystin, report it to your local Health Department or Regional Water Quality Control Board.

Sources of Additional Information

Websites with useful information:
General Health: http://ww2.cdph.ca.gov/healthinfo/environhealth/water/Pages/Bluegreenalgae.aspx
Updated information, including newly identified locations, see *Blue Green Algae Voluntary Guidance Document* posted at: http://www.waterboards.ca.gov/water_issues/programs/bluegreen_algae/

Ackowledgements: This factsheet was prepared by T. Le, student intern, Ecotoxicology Program, Office of Environmental Health Hazard Assessment, with support from a Prop. 50 grant from CALFED. For more information, contact Regina Linville at rlinville@oehha.ca.gov or P. Lehman at plehman@water.ca.gov.

Version 2: February, 2009