

# *epi*TRENDS

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## **Harmful Algal Blooms**

Harmful algal blooms (HABs) occur in both freshwater and marine systems. Freshwater HABs, also known as cyanobacteria and their toxins, refers to aquatic phytoplankton/bacteria growth that may produce toxins harmful to people, animals, or the environment. This issue will mainly focus on freshwater HABs.



Cyanopigment dispersal during toxic bloom dissipation at Lake McDonald, WA. Photo: Sally Abella King County Department of Natural Resources.



Dolichospermum sp. responsible for a microcystins advisory in Pacific County, WA 2021

## **Freshwater Harmful Algal Blooms**

Freshwater HABs are primarily caused by cyanobacteria, formerly known as “blue-green algae.” The growth of these aquatic organisms is promoted by warm temperatures, increased nutrients such as nitrogen and phosphorus from residential or agricultural use of fertilizers entering the water, low water flows during droughts, and other environmental changes. A cyanobacterial bloom may cause discoloration or scum on water’s surface but can also occur without any visible change to the water. In addition, not all visible blooms have harmful effects. Therefore the only way to know if an algal bloom is toxic is through testing the water.



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HABs may produce cyanotoxins that can negatively impact humans, pets, livestock, wildlife, and other animals. Some dense blooms may not produce toxins, while water that looks clear can have high levels of toxins. Cyanotoxins include neurotoxins (e.g., anatoxins, saxitoxins), hepatotoxins (e.g., microcystins, cylindrospermopsins), and dermatotoxins.

Exposures to cyanotoxins in recreational water or drinking water can occur through:

- Direct skin or eye contact when swimming or recreating in contaminated water
- Swallowing contaminated drinking water or recreational water
- Consuming contaminated fish or shellfish
- Inhaling toxins from aerosols or droplets from water

<b>Freshwater and Marine Harmful Algal Blooms: Associated Algae, Toxins and Signs and Symptoms by Exposure</b>		
<b>Water Body</b>	Freshwater	Marine
<b>Type of aquatic algae</b>	Cyanobacteria	Microalgae (diatoms, dinoflagellates)
<b>Toxins produced</b>	Microcystins, anatoxins, saxitoxins, cylindrospermopsins and others	Brevetoxins, azaspiracids, ciguatoxins, domoic acid, okadaic acid, dinophysistoxins and others
<b>Skin contact or inhalation</b>	Skin, eye, nose or throat irritation; respiratory illness	Skin, eye, or throat irritation; shortness of breath, coughing, sneezing
<b>Ingestion (swallowing water or eating contaminated seafood)</b>	Abdominal pain, headache, neurologic symptoms, vomiting, diarrhea, liver damage, kidney damage	Nausea, vomiting, diarrhea, abdominal pain, peripheral or central nervous system symptoms (e.g., paralytic, diarrhetic or domoic acid shellfish poisoning)

While freshwater exposures to HAB toxins are often associated with swimming or other outdoor recreational activities, drinking water distribution systems that draw from contaminated bodies of water can also be a source of exposure. In 2014, an algal bloom in Lake Erie resulted in unsafe levels of microcystin in drinking water. In response, the city of Toledo, Ohio issued a water advisory for over 400,000 people to use alternate water sources for drinking, cooking, and bathing. Summit Lake in Thurston County, Washington, experienced an anatoxin-a bloom in 2017 that closed the lake as a drinking water source for over 470 homes, and Salem, Oregon closed their water system (serving 192,000 people) due to cyanotoxins in 2018.

***illnesses Associated with Harmful Algal Blooms***

A variety of illnesses in humans and animals have been associated with cyanotoxins. The nature and severity of the illness depends on the route of exposure, the amount of toxin, the type of toxin, and the length of time exposed. Symptoms usually begin within hours of exposure and can last for a few days, although chronic exposure to liver toxins can present symptoms long after exposure (e.g., a daily swimmer exposed to microcystins over months can develop liver issues over time).

Skin or eye exposure can cause rashes, swelling, sores, and visual disturbance. Inhaling aerosolized water can result in nose and throat irritation, cough, chest tightness, wheezing, and shortness of breath. Ingestion can cause abdominal pain, vomiting, diarrhea, and neurologic effects (such as confusion and tingling sensations), and liver or kidney damage; severe cases from

ingestion can result in death. Non-specific symptoms reported during outbreaks include headache, dizziness, back pain, muscle aches, weakness, and fatigue

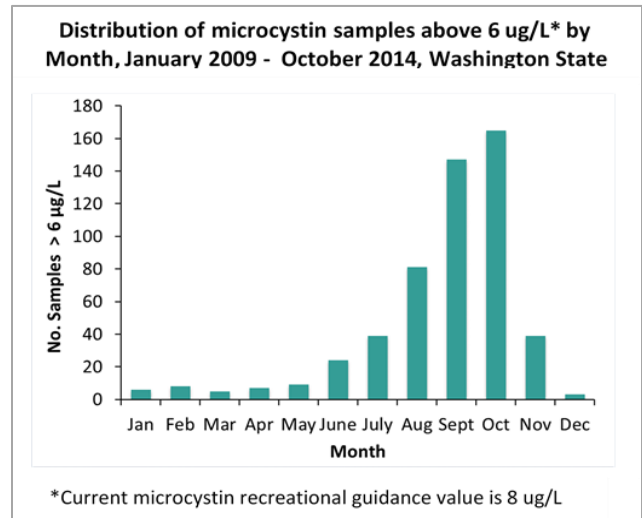
Identifying illnesses associated with HABs is typically a diagnosis of exclusion, based on symptoms, reported exposures, and ruling out other possible causes. Liver function tests may be useful when exposure to hepatotoxins (e.g., microcystins) may have occurred.

Illnesses have also been described in animals after exposure to algal toxins. With longer skin exposures or higher levels of ingestion than a person would typically experience, animals have had severe symptoms such as excessive salivation, weakness, staggered walking, difficulty breathing, or convulsions. Death in animals has occurred within hours or days of exposure.

*Surveillance:* Citizens and health care providers (including veterinarians) should report suspected human and animal HAB-associated illnesses to their local health jurisdiction. Local health jurisdictions should report all suspected human or animal HABs-associated illnesses or deaths to the Department of Health (DOH) Office of Communicable Disease Epidemiology (206-418-5500). DOH can advise or assist with illness investigations. DOH will facilitate reporting of human and animal cases to the CDC via CDC's the One Health Harmful Algal Bloom System (OHHABS) and reporting of human HABs-associated illness outbreaks via the National Outbreak Reporting System (NORS).

**LHJs should report all suspected human or animal HABs-associated illnesses or deaths to the DOH Office of Communicable Disease Epidemiology at 206-418-5500.**

*Water monitoring.* The Washington State Department of Ecology's Freshwater Algae Monitoring Program, in partnership with the King County Environmental Laboratory, identifies algal blooms, does toxicity testing for residents and local health jurisdictions, and has a searchable database showing testing results



([nwtoxicalgae.org](http://nwtoxicalgae.org)). Five years of lake monitoring show a seasonal pattern for microcystin concentration, with the majority of elevation sample result during late summer and early fall. Not all lakes follow this pattern – blooms can occur earlier in the summer and others even in mid-winter. Climate change may expand the number of lakes experiencing HABs.

A decade ago, DOH collaborated with local health jurisdictions (LHJs) and other agencies to develop a three-tier Lake Management Protocol for posting lakes with toxic algal blooms. DOH received six-month of funding in January 2021 to update standards using EPA's recreational guidance, incorporate county input regarding a two-tiered versus the current three-tiered lake management protocol, update signs with additional languages for posting at state waters, and develop and communicate methods for reporting animal and human health illnesses to DOH by lake managers/LHJs and by DOH to CDC's (OHHABS) national database.

In May 2021, a DOH survey to LHJs, tribal nations and other agencies asked how to improve Washington’s HAB lake management approach. Based on responses, two major updates have been incorporated:

- Addition of an informational sign for year-round posting at lakes with a history of blooms
- Adoption of a two-tier protocol (WARNING and DANGER signs).

In addition, the primary messages were translated into seven languages identified by lake managers and validated using census data based on an approach developed by King County. Languages were ranked by the number of people and percentage of speakers for the east and west side of the state, allowing informed use of one set of signs statewide. A statewide webinar/workshop allowed discussion of survey responses and directed future collaborations.

**Prevention**

Practices that help prevent algal growth in lakes include properly applying fertilizers so that nutrients are not washed into fresh or marine waters, picking up animal waste and encouraging natural vegetation along lake shorelines.

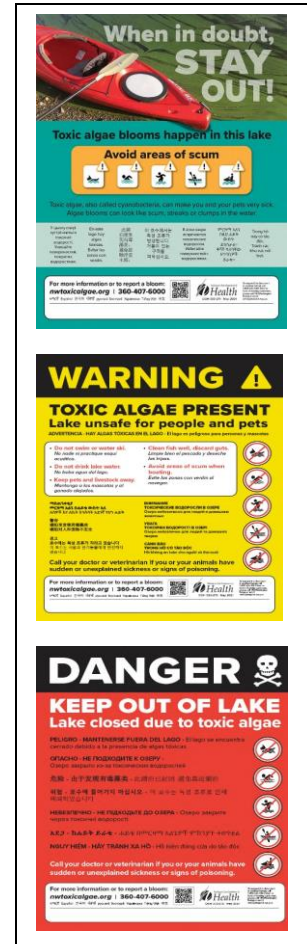
People should protect themselves, their pets, and livestock from possible exposure to contaminated water. Drinking directly from lakes and rivers should be avoided even when the water looks clear. In addition, people and their animals should avoid going into or playing in a body of water that:

- Has foam, scum, or algal mats on the surface
- Smells bad
- Looks discolored
- Contains or is near dead fish or other dead animals (e.g., lake with dead fish on its shore)

If a water advisory is issued, the water should not be used for any purpose. Boiling the water does not inactivate the toxins, and skin exposure should be avoided. It is important to provide alternative sources of safe drinking water, particularly for children, pets and livestock.

If people think that they or their animals had recent exposure to water contaminated with a harmful algal bloom, they should rinse their bodies with clean, fresh water as soon as possible. People or owners of pets exhibiting signs or symptoms of a HAB-associated illness should consult with a health care provider or veterinarian and mention the recent exposure.

Although reported illnesses from harmful algal blooms are currently rare in Washington State, several animal deaths have been reported over the years. Toxic blooms can occur in any month of the year, with most high toxin concentrations observed during August and September, and climate change could increase this problem in future years. People or their animals who engage in recreational activities in these waters could be at risk. Simple precautions can prevent exposure to water contaminated with HABs.





## Resources

DOH overview:

[doh.wa.gov/CommunityandEnvironment/Contaminants/BlueGreenAlgae](http://doh.wa.gov/CommunityandEnvironment/Contaminants/BlueGreenAlgae)

DOH water system guide:

[doh.wa.gov/CommunityandEnvironment/Contaminants/BlueGreenAlgae/Resources](http://doh.wa.gov/CommunityandEnvironment/Contaminants/BlueGreenAlgae/Resources)

DOH Cyanobacteria Resources:

<https://www.doh.wa.gov/CommunityandEnvironment/Contaminants/BlueGreenAlgae/Resources>

Washington State Department of Ecology:

[ecology.wa.gov/Research-Data/Monitoring-assessment/Puget-Sound-and-marine-monitoring/Marine-algae-plankton](http://ecology.wa.gov/Research-Data/Monitoring-assessment/Puget-Sound-and-marine-monitoring/Marine-algae-plankton)

Washington State Toxic Algae (Freshwater algae bloom monitoring program):

[nwtoxicalgae.org](http://nwtoxicalgae.org)

CDC overview:

[cdc.gov/habs](http://cdc.gov/habs)

Reporting (One Health Harmful Algal Bloom System-OHHABS):

[cdc.gov/habs/ohhabs](http://cdc.gov/habs/ohhabs)

CDC prevention and control:

[cdc.gov/habs/prevention-control](http://cdc.gov/habs/prevention-control)

**Fact Sheet**

**Harmful Algal Blooms**  
**Water System Guidance**

March 2015  
DOH 331-031

Cyanobacteria, or “blue-green algae,” occur naturally in freshwater lakes, ponds, and river impoundments. Some cyanobacteria blooms generate toxins called cyanotoxins. These toxins can harm people and pets that drink water containing cyanotoxins—or play, wade, swim, or water ski in lakes with toxic blooms.

Cyanotoxins may cause health effects such as skin rashes and lesions, vomiting, gastroenteritis, headaches, and eye, ear, and throat irritations. More severe symptoms affect the liver or the nervous system.

Washington hasn’t documented many incidents of toxic cyanobacteria in surface water sources used for drinking water, but this problem does occur. This publication explains how to protect your water system, how to get water samples tested for cyanotoxins, and common types of cyanotoxins. If you need help, call your local health jurisdiction or us. We work with local health to determine needed actions, if any, based on sampling results.

**Protecting your water system**

**Reduce introduction of cyanobacteria into the treatment plant.**

- Don’t recycle backwash water.
- Use an alternate water source or adjust your intake to minimize the amount of cyanobacteria entering the treatment plant.

**Optimize filtration to remove cyanobacteria intact. This will prevent release of toxins in cells.**

- Don’t use an algicide if a bloom is present. It will break cells and release toxins.
- Minimize preoxidation prior to filtration; it can break cells. Some preoxidation may still be needed for effective treatment performance.

**Reduce or remove algal toxins by oxidation and adsorption.**

Powdered activated carbon (PAC), granular activated carbon (GAC), and post filtration disinfection (chlorine and ozone) can effectively remove or chemically oxidize cyanotoxins.

**Getting water samples tested for cyanotoxins**

The Department of Ecology’s Freshwater Algae Control Program funds a laboratory to conduct toxicity tests of lake samples for four cyanotoxins: microcystins and cylindrospermopsins (liver toxins) and anatoxin-a and saxitoxins (nerve toxins). See sampling instructions on the next page.

**Check NWToxicalgae.org** for historical information and the latest data on Washington’s lakes.

*Blue-green algae occur naturally in freshwater lakes, ponds, and rivers.*

Photo: Tyler Moore

Washington State Department of Health  
COMMUNITY AND ENVIRONMENTAL HEALTH SERVICES

HELPING TO ENSURE SAFE AND RELIABLE DRINKING WATER