



Cyanobacteria Blooms of New Hampshire

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Cyanobacteria...

- Formerly known as Blue-Green Algae
- Photosynthetic bacteria, they are not actually algae
- Inhabitants of Earth for over 3.5 billion years
- Thousands of species and hundreds of toxins
- Ubiquitous in the environment and globally



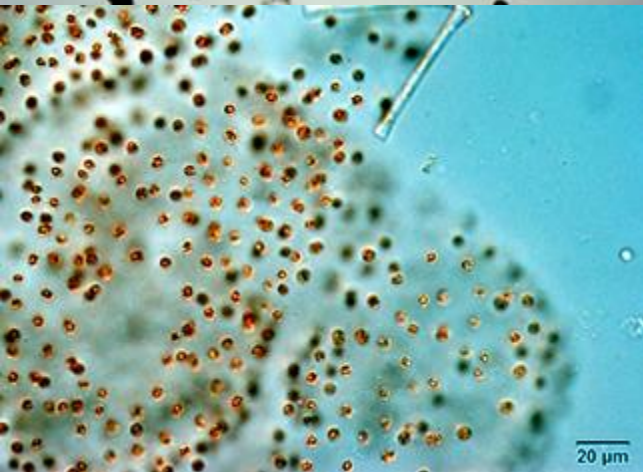
Cyanotoxin	Mode of action and/or symptoms
Microcystins (nearly 100 variants)	Hepatotoxic, targets the liver and digestive organs, tumor promoting, inhibition of protein phosphatases. Acute gastroenteritis, chronic tumor promotion.
Nodularins (similar in structure to microcystins)	Similar to microcystins, but not as toxic and common in brackish or marine systems.
Anatoxin-a	Neurotoxic, inhibits acetylcholine receptors (neurotransmitter). Fast-acting and may cause seizures or death (i.e. common for dogs or others animals to ingest and die).
Anatoxin-a (S)	Neurotoxic, similar to anatoxin-a (S)
Saxitoxins	Neurotoxic, blocking voltage gate of sodium ion channels. More common to marine organisms.
Cylindrospermopsins	Toxic to multiple organs, neurotoxic and genotoxic, affecting neurons and genes.
Lyngbyatoxins	Tumor promotion
BMAA/DAB	Neurotoxic, chronic exposure may be linked to neurodegenerative diseases such as ALS. (Individuals can have a genetic precursor).

This is not a complete list of the cyanotoxins



Microcystis

Each type of cyanobacteria have their own growth requirements, produce toxins differently, and play a different role in the aquatic food web based on size, shape and habitat.



Aphanizomenon



Oscillatoria



Anabaena

Woronichinia



Planktothrix



Gloeotrichia

Cyanotoxins- case studies and evidence for toxicity in various scenarios....

- 1998 Haemodialysis, Brazil incident (*Aphanocapsa*)
- 2018 Florida incident (synergistic toxicity of marine and fresh HABs)
- Disorientation and death of marine mammals
- Otter deaths of San Fran Bay
- Aquatic food web bioaccumulations
 - Fish - biomagnifications and accumulation to tissues
 - Shellfish - especially in digestive systems (hepatopancreas)
- Crops- surface and uptake to fruits and leaves, sprayed on surfaces and difficult to remove
- Cattle/livestock deaths
- Dissolved toxins (extracellular) release from blooms
- Air- aerosolized cells and toxins
- ALS and other neurodegenerative diseases (BMAA)
- Avian illness- top predatory birds affected by toxins –related to avian vacuolar myelinopathy (AVM)
- Fish death- depletion of oxygen and side effects of toxins
- Dog deaths...



Canine Cyanotoxin Poisonings in the United States (1920s–2012): Review of Suspected and Confirmed Cases from Three Data Sources

Lorraine C. Backer, Jan H. Landsberg, Melissa Miller, Kevin Keel, and Tegwin K. Taylor

“reported 67 suspected or confirmed cases of canine intoxications associated with HABs. Of these 67 cases, 58 (87%) followed exposure to fresh waters and 1 (1%) followed exposure to marine waters.”

“...duration of illness ranged from <1 day to 6 weeks.”



“Dog's death fuels lake cyanobacteria scare”

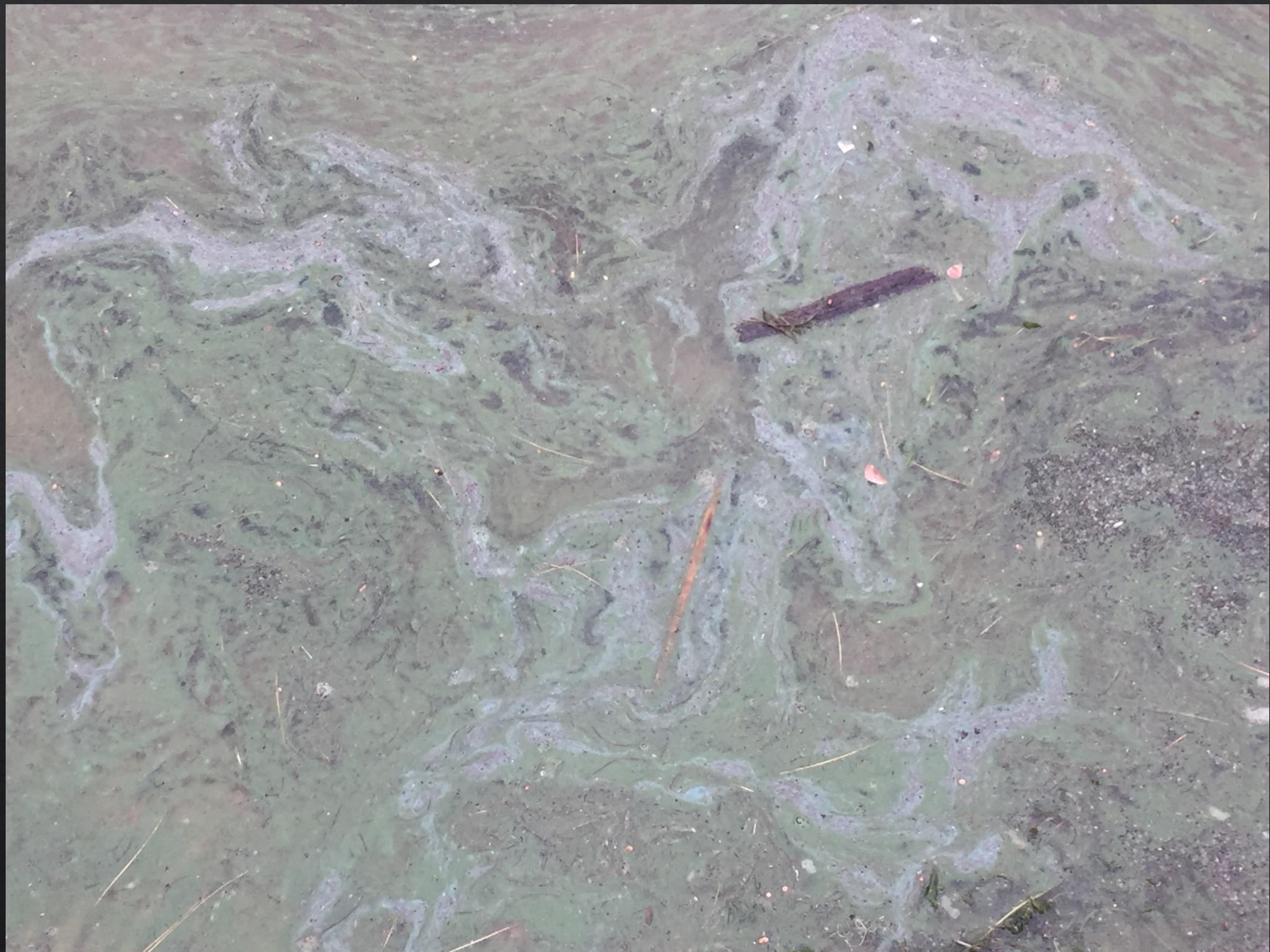
<http://www.burlingtonfreepress.com/story/news/local/2015/08/12/death-dog-heightens-cyanobacteria-concerns/31555091/>



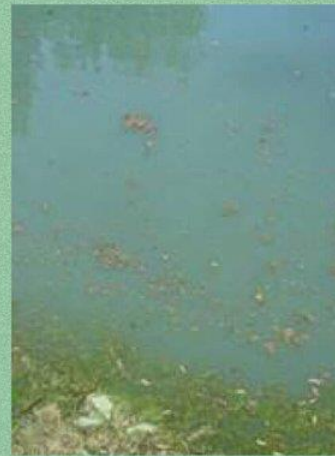
Constantly
changing due to
wind, currents...

Timeline of
events...



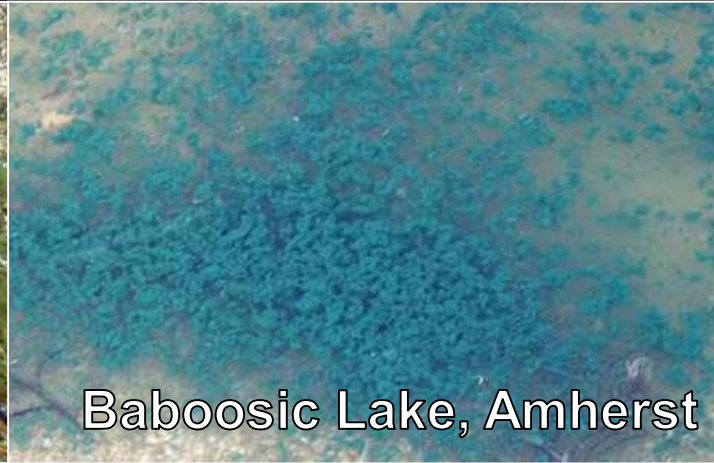








Robinson Pond, Hudson



Baboosic Lake, Amherst



Halfmoon Pond, Kingston



Willand Pond, Somersworth

Lake Monomonac, Rindge



Bow Lake, Northwood



Showell Pond, Sandown

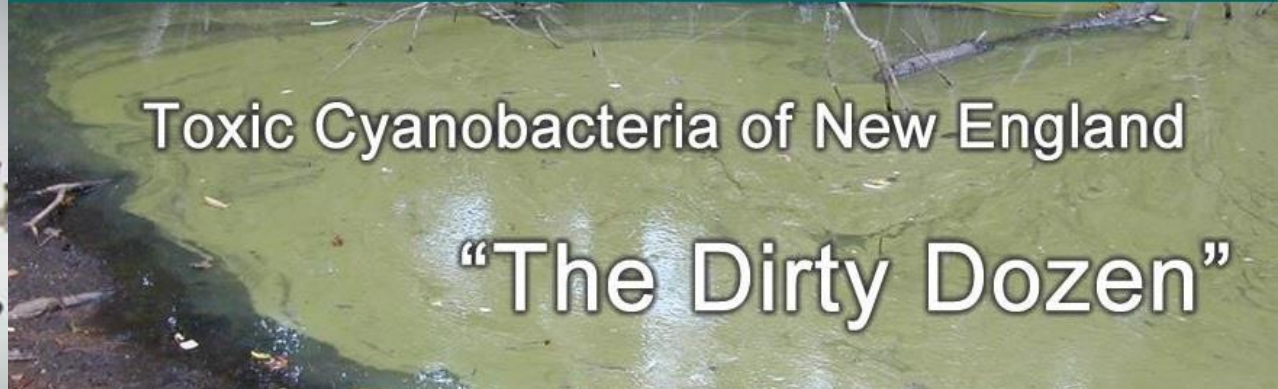


March's Pond, New Durham

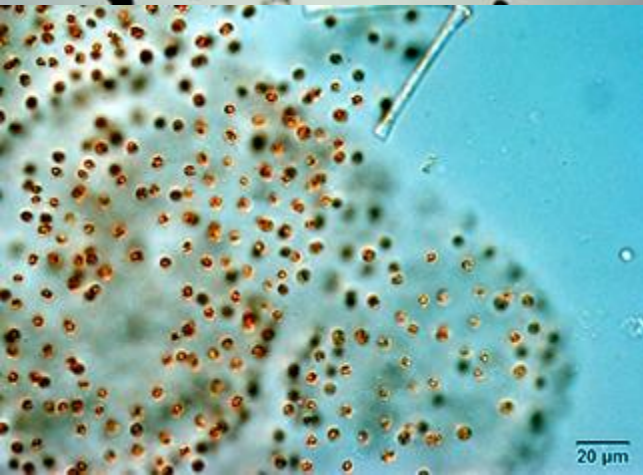




Microcystis



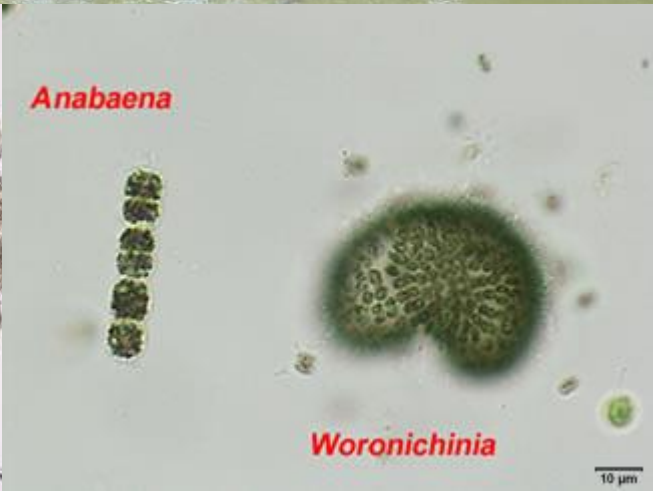
Toxic Cyanobacteria of New England
“The Dirty Dozen”



Aphanizomenon



Oscillatoria



Anabaena

Woronichinia



Planktothrix



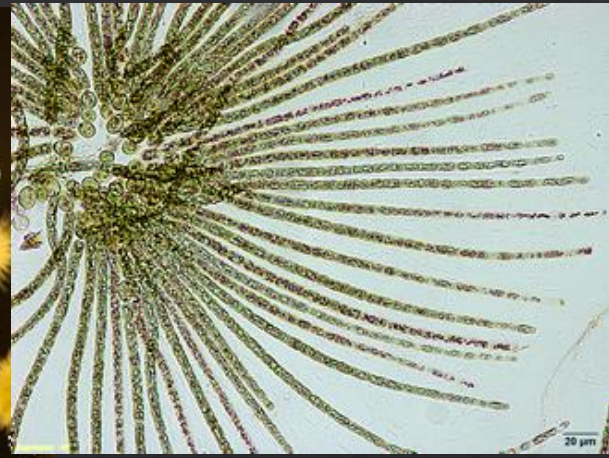
Gloeotrichia

Unique Cyanobacteria

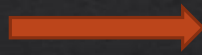
◇ Gloeotrichia



- ◇ Lake Winnepesaukee
- ◇ Lake Sunapee



◇ Nostoc



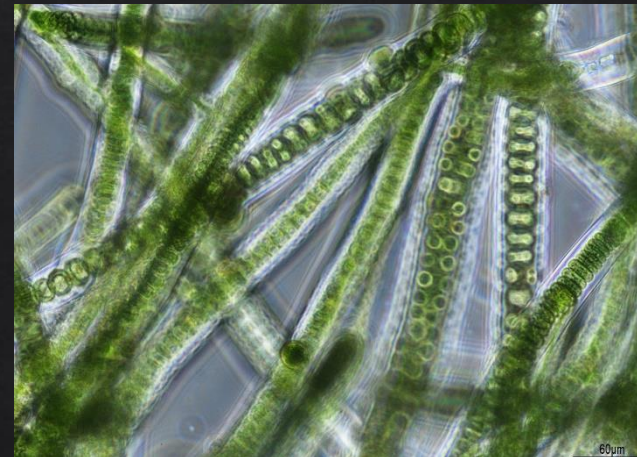
- ◇ Pawtuckaway



◇ Stigonematales



- ◇ Lake Winnepesaukee



Normal microscope illumination

Picoplankton (picocyanobacteria)

Identification by epifluorescence

Magnification: 25.20 x
Exposure Time: 60.7 ms

20 μ m

Chlorophyll fluorescence illumination

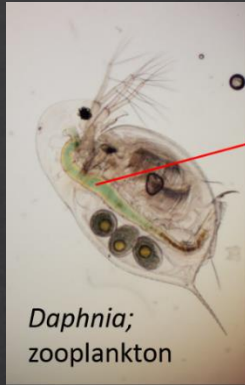
Magnification: 25.20 x
Exposure Time: 909.1 ms

20 μ m

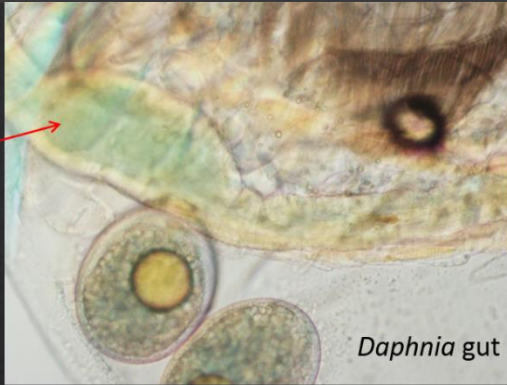
Phycocyanin fluorescence illumination

Magnification: 25.20 x
Exposure Time: 45.0 s

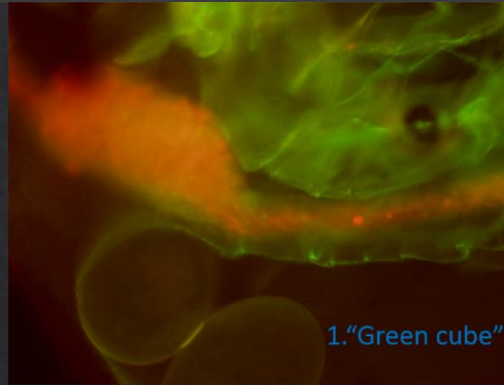
20 μ m



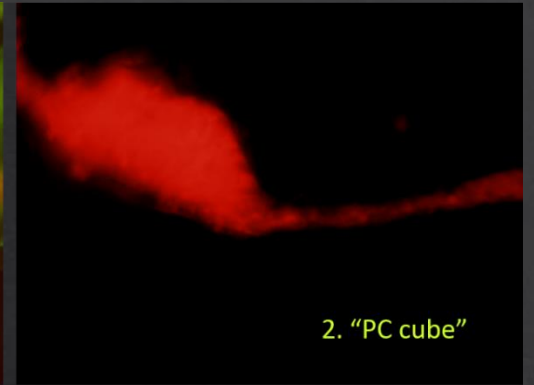
Daphnia;
zooplankton



Daphnia gut



1. "Green cube"



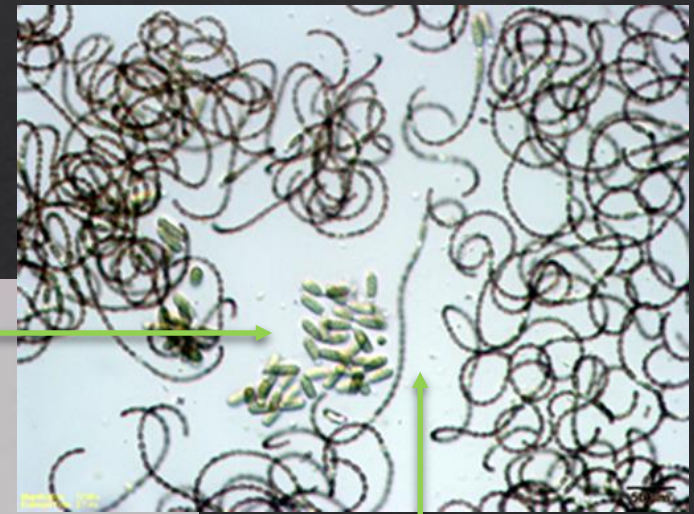
2. "PC cube"



Anabaena (Dolichospermum)

Fall blooms-mixed assemblages, though
akinetes begin to settle for future growth

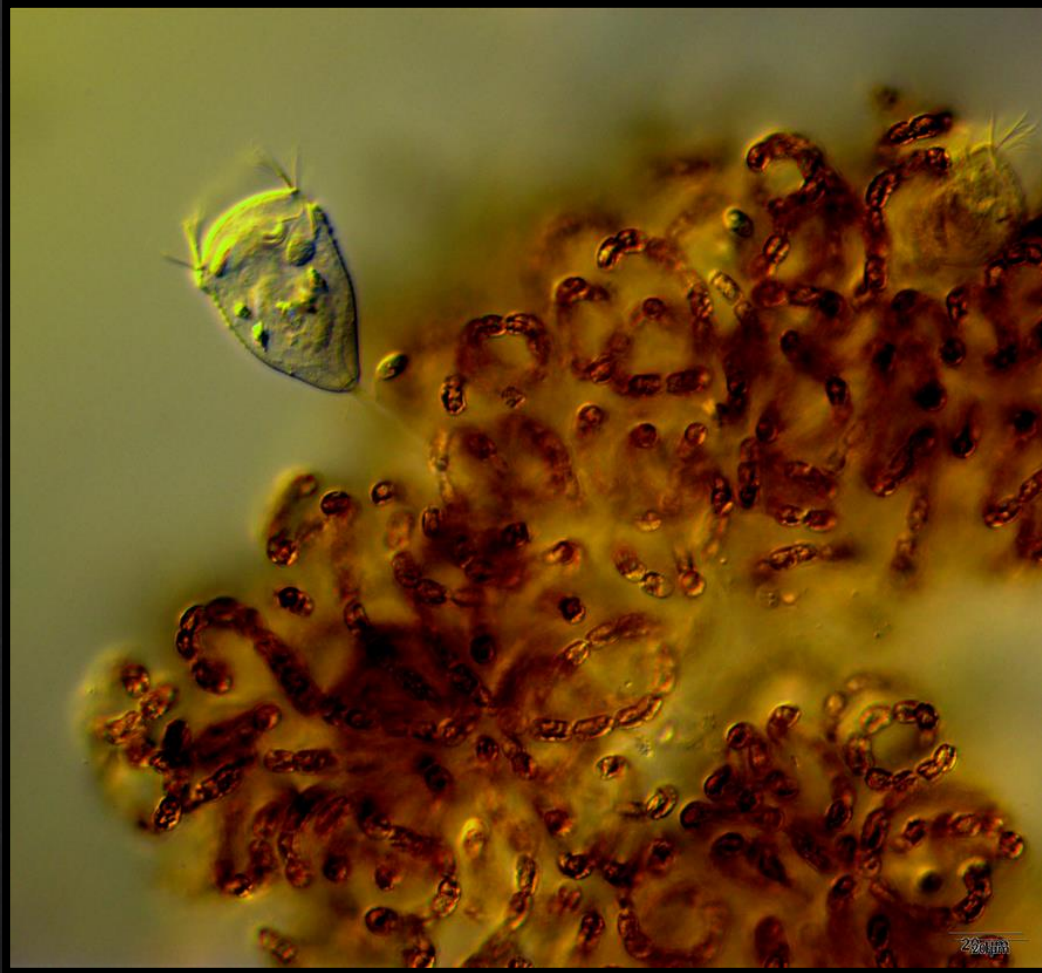
Early in the summer (June)-
Anabaena dominant



*Often smells musky,
earthy, like dirt*

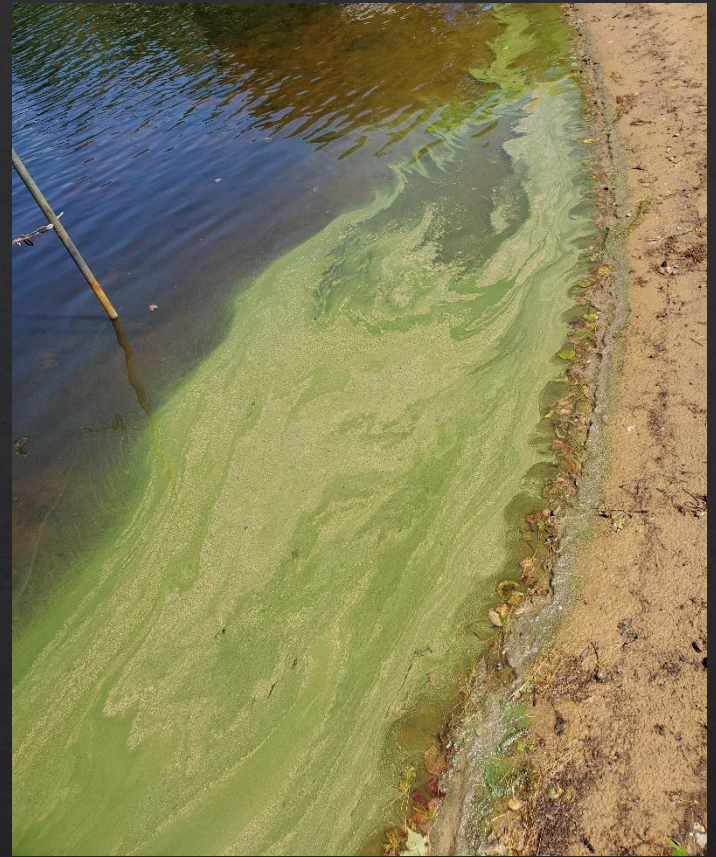
Average cell count/colony-
~250 cells
~diameter of colony (um)





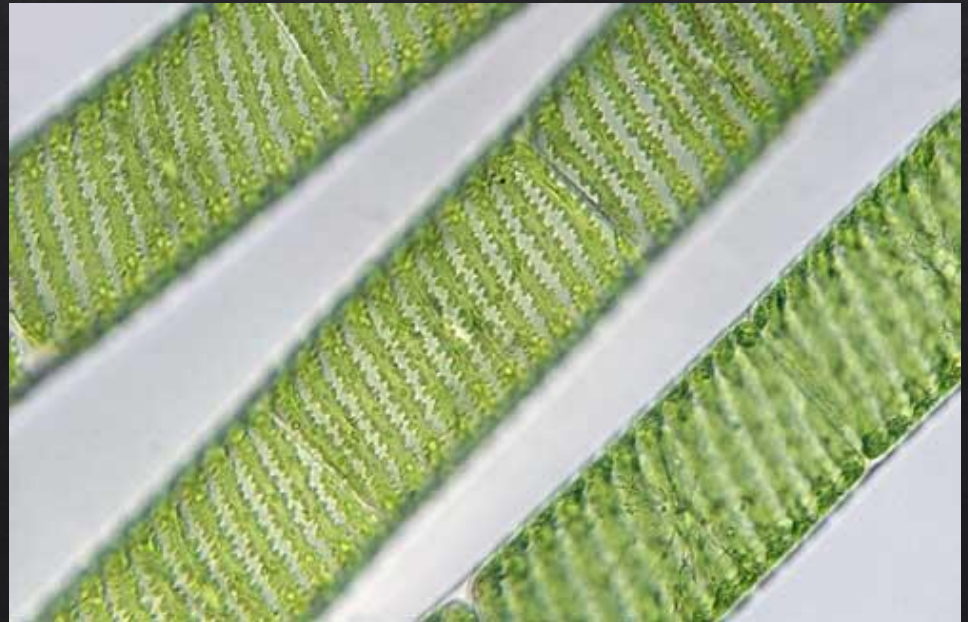
Anabaena (*Dolichospermum lemmermannii*)

Commonly mixed with pine pollen in June



Other “bloom” complaints -Non-cyanobacterial

- Most common- filamentous green algae such as *Mougeotia* or *Spirogyra*.
- Sometimes appear slimy, foamy, bright green-yellow
- Slimy mats or clumps can surface or hover in the water column, just beneath the surface.
- Also found along the shoreline or in shallow water.
- Mats can contain a diverse range of other organisms including phytoplankton (sometimes a few strands of cyanobacteria), protists and zooplankton mixed within it.



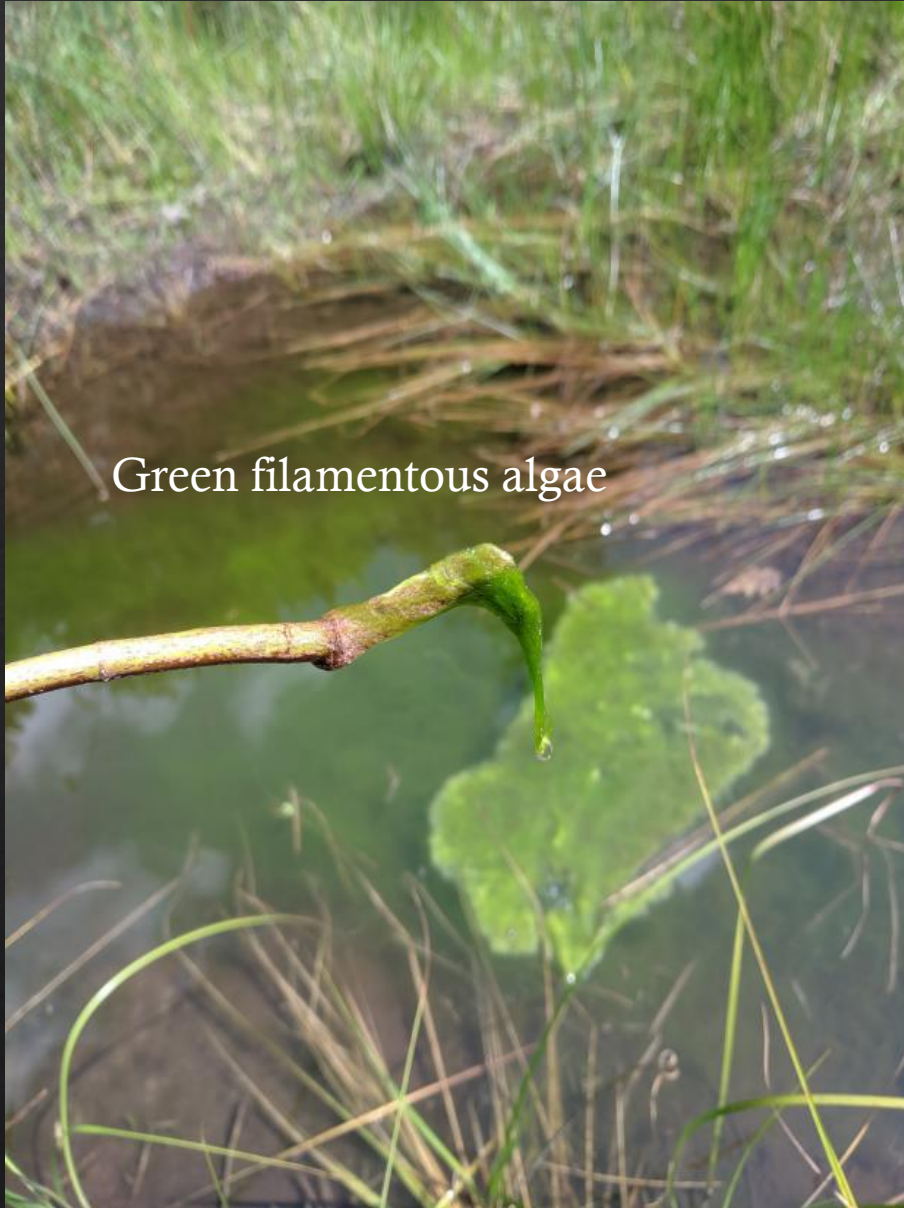
Check NHDES fact sheets:

<https://www.des.nh.gov/organization/commissioner/pip/factsheets/bb/documents/bb-65.pdf>



Green filamentous algae...

Try the “stick test”....



Cyano blooms will cloud the water ...



Green filamentous algae will stick as a slimy mass...

Every Lake is Unique

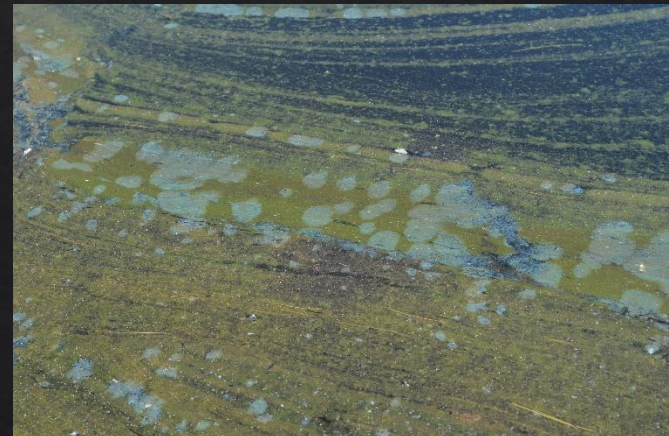


So how do we fix it?

BARLEY STRAW
BACTERIAL BIOMANIPULATION
CHLORINE COMPOUNDS
CLAY AND SURFACTANT FLOCCULATION
COPPER ALGAECIDES
DREDGING
FLOATING WETLANDS
FLUSHING, HYDRAULICS, AND DRAWDOWN
MIXERS, AERATORS, AND DIFFUSERS
MONITORED NATURAL ATTENUATION
NANOBUBBLING
NANOPARTICLES (IRON-BASED)
ORGANIC BIOCIDES
OZONATION
PHOSPHORUS-BINDING COMPOUNDS
PERMANGANATE
PEROXIDE APPLICATION
SHADING WITH DYES (LIGHT FILTERING)
SKIMMING AND HARVESTING
ULTRASOUND

Each lake is unique

- Quick fixes do not always work.
- Applications must be carefully considered.
- Expensive.
- Continuous...
- Short vs. Long term effects?
- Creating a more toxic environment?





What is NH doing about blooms?

NH has an increased awareness and interest in the subject of cyanobacterial blooms.

Monitoring/Outreach, Research and Discussions

- Local stakeholders
- Volunteers
- Universities
- EPA
- NHDES

NHDES Drinking Water and Groundwater Bureau

Cyanotoxin Grants for Public
Water Systems:
Up to \$10,000

NHDES Jody Connor Limnology Center

Free services for analyses:

Identification

Cell count

Toxicity

Advisory

NHDES Watershed Management

Watershed Assistance:

Watershed Management Plans

\$\$\$

SOAK up the rain:

Best practices at the waters edge



Report your sightings

Blooms may occur...

- On beaches
- At boat launches
- Along inaccessible shorelines
- In front of private residences
- As patches around the lake surface
- As benthic mats
- Attached to rocks or substrates
- Deep within the water column
- Anywhere on the lake!

Photos are critical in spreading awareness...

- Shoreline accumulations rapidly change
- Weather, wind and currents may shift
- Water disturbance from boats or other recreational activities can alter the conditions of the reported bloom sighting.

Please report what you are seeing!

603-848-8094

NH Cyano Hotline- 603-848-8094

Sampling is not encouraged. Please avoid blooms!

Call NHDES and text (or email) a photo if possible!
and we will coordinate sampling....

Download the BloomWatch app (Cyanos.org)

Bloom details should include:

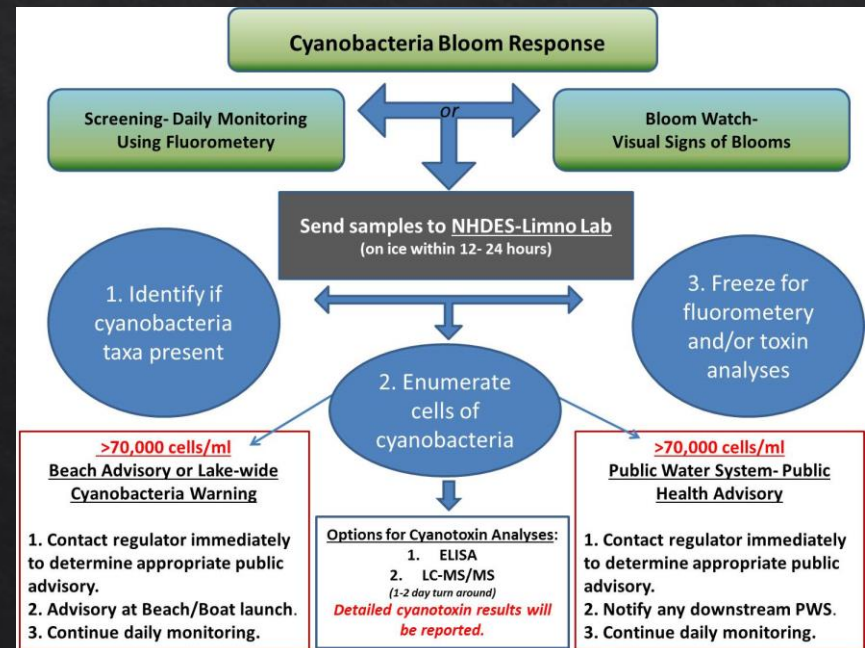


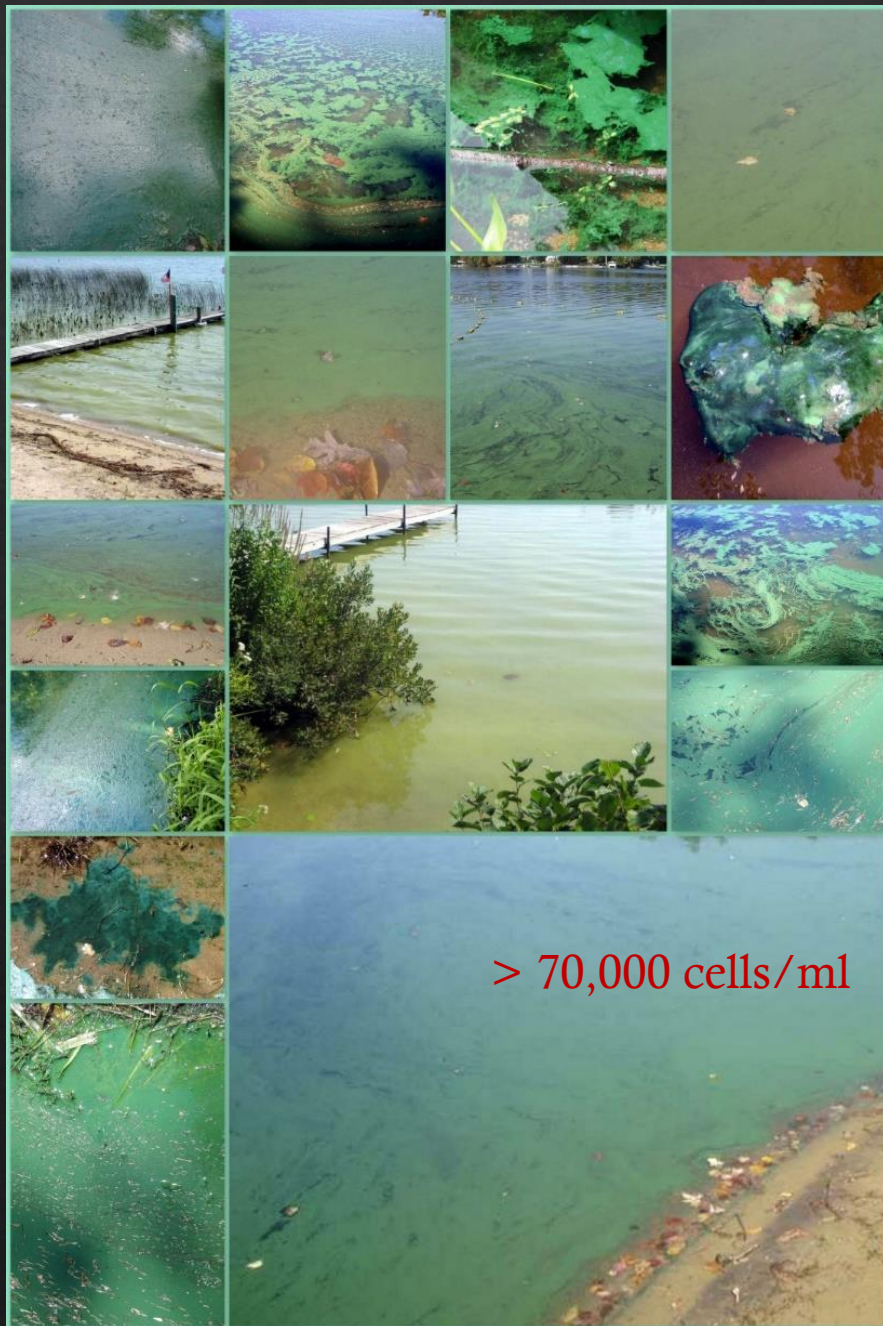
- Name and contact info
- Waterbody Name
- Waterbody Town
- Station ID and/or description
- Latitude/Longitude
- Date, time, weather conditions
- Photo or description of severity and dimensions of scum
- Water conditions and notes if possible (e.g. clarity, level, & temperature if possible)

1. Identify
2. Enumerate
3. Freeze for Cyanotoxin Analyses
4. Cyanobacteria Advisory

- **>70,000 cells/ml**

- Town notified
- Sign posted
- Press Release
- Map
- Social Media





> 70,000 cells/ml

ADVISORY

High levels of potentially toxic
CYANOBACTERIA
have been identified in this water

**WATER CURRENTLY NOT
SUITABLE FOR WADING
OR SWIMMING!**

Exposure to blue-green scums may cause nausea, vomiting, diarrhea, or fever in humans and pets.

Anyone who comes in contact with blue-green scum should rinse off with fresh water

All current advisories posted at www.des.nh.gov.
Click "beach advisory" in left column

CONTACT INFORMATION:
NHDES Beach Program
29 Hazen Dr.; Concord, NH
(603) 271-0698
beaches@des.nh.gov



<http://des.nh.gov>



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- ➔ Rules/Regulatory
- ➔ Contact Us

Welcome!

New Hampshire Department of Environmental Services

[Investigation into the presence of Per- and Polyfluoroalkyl Substances \(PFASs\) in New Hampshire](#)

NHDES News

[more news...](#)

- June 20, 2019
NH Coastal Program Announces Results Of Resilient Tidal Crossings Project
- June 14, 2019
Public Information Meeting NHDES To Provide Update On East Kingston PFAS Investigation
- June 14, 2019
State REMOVES Cyanobacteria Advisory For Franklin-Pierce Lake (Jackman Reservoir) In Hillsborough, NH
- June 5, 2019
Milestone Of Statewide High Resolution Elevation Data Has Been Reached
- May 29, 2019
National Dam Safety Awareness Day Is May 31, NHDES Encourages Residents To Learn About The Benefits And Risks Associated With Dams In Their Area
- May 24, 2019
Town Of Gorham And Strafford Regional Planning Commission Recognized For Source Water Protection Efforts
- May 20, 2019
Coastal Program Announces Request For Proposals For New Hampshire Coastal Resilience Municipal Planning Grants
- May 15, 2019
27th Annual New Hampshire Fourth Grade Water Science Fair And Poetry Winners Announced
- May 14, 2019



Air Quality
Beach Advisory
Cyanobacteria
Drinking Water Advisory



search this site

NHDES Calendar

4	5	6	7
11	12	13	14
18	19	20	21
25	26	27	28

The Department

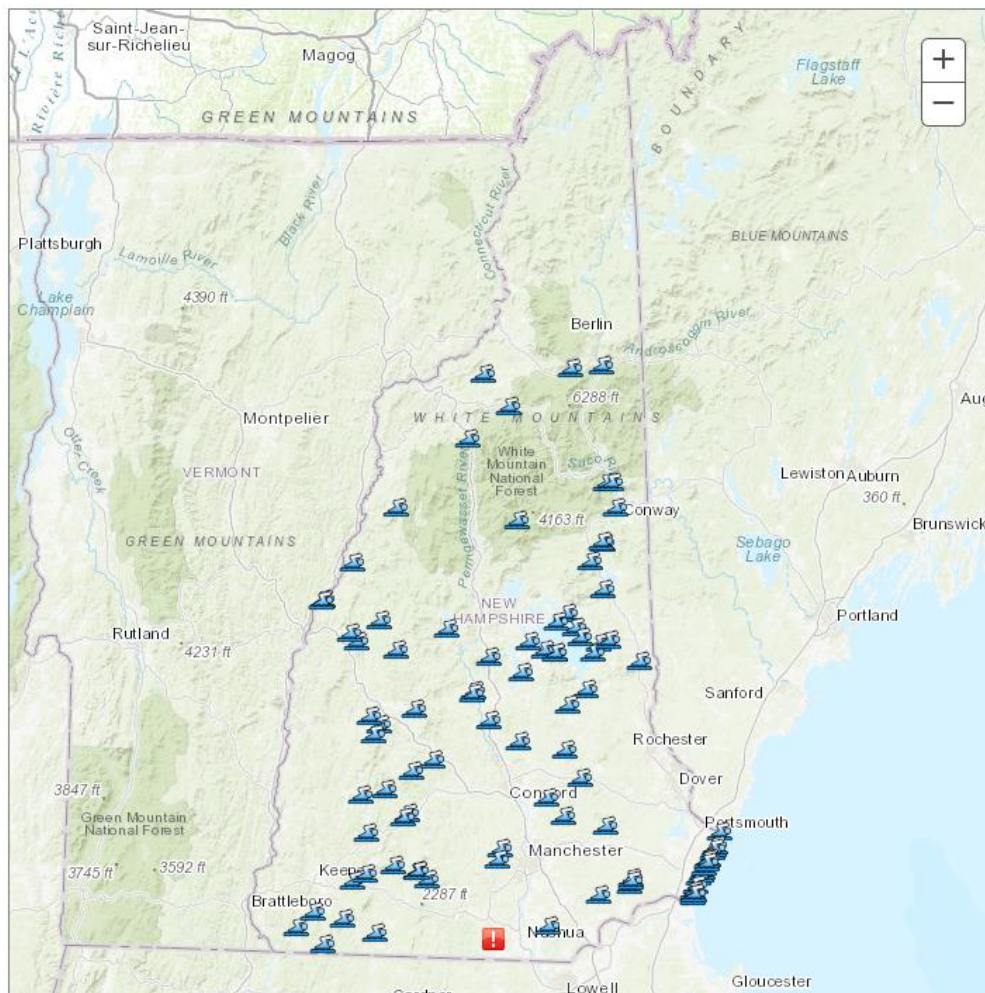
- ➔ Commissioner
- ➔ Air Resources
- ➔ Waste Management
- ➔ Water Division
- ➔ Boards and Commissions

Quick Links

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- ➔ Air Quality For
- ➔ Certification/T
- ➔ Directions to N
- ➔ Disaster Prepa
- ➔ & Response
- ➔ Emergency Ph
- ➔ Employment
- ➔ Opportunities

Wednesday, May. 29, 2019

Current Beach Advisories as of May 29, 2019



Legend

- ☒ Most Recent Samples Meet Standards
- ☒ Cyanobacteria Advisory

[Return to Full Extent](#)

Note: The map may not display accurate icons for a short time after any update. The [charts below](#) listing advisories and warnings are updated instantly by DES Beach Program staff.

Warnings are typically issued during the “swim season”, between Memorial Day and Labor Day. Extended until blooms subside, often occurring into late Fall.



Current Beach Advisories

Advisories are updated daily during the swim season. Beaches are only listed here if the most recent fecal bacteria or cyanobacteria sample analysis exceeded state standards. Results are available through the [OneStop database](#).

Beach sampling/monitoring is conducted between Memorial Day and Labor Day.

For beach and advisory details, sampling results, and yearly reports, conduct a OneStop search.

Summary reports of monitoring seasons are also available at: http://des.nh.gov/organization/divisions/water/wmb/beaches/beach_reports/index.htm.

Follow the NHDES Beach Advisories Twitter Feed. [NHDES Beaches Advisories Twitter Feed](#).

To receive future Beach Advisory Newsletters, join the NHDES E-Mail List. <https://www.des.nh.gov/media/enews/index.htm>.

For explanations about advisories and procedures, please visit the Beach Advisories page: <http://des.nh.gov/organization/divisions/water/wmb/beaches/advisories.htm>.

There are currently no beaches with fecal bacteria warnings issued in the State of New Hampshire.



Cyanobacteria Lake Warnings

Lakes without designated beaches or areas of a lake away from a designated beach are issued [cyanobacteria](#) lake warnings when a large algae bloom is observed. Lakes with cyanobacteria warnings are re-inspected weekly.

Date of Warning	Description of Warning
10/6/2017	STATEWIDE - The beach advisory and lake warning system for fecal and cyanobacteria implemented by the New Hampshire Department of Environmental Services (NHDES) has ended for 2017 as the formal swim season is over. The NHDES will resume monitoring and updating this site in May 2018.

Lakes are resampled every week during an advisory until the bloom has dissipated and cyanobacteria concentrations are below the state threshold of 70,000 cells/ml.

Press Releases...

[NHDES Home](#) > [Media Center](#) >

Media Center

FOR IMMEDIATE RELEASE

DATE: June 20, 2019

CONTACT: Amanda McQuaid (603) 271-0698 (O), 848-8094 (C)

des.nh.gov

twitter.com/NHDES

State Issues Cyanobacteria Advisory for Captains Pond in Salem, New Hampshire

Concord, NH – A cyanobacteria bloom has been observed on Captains Pond in Salem, NH. Samples collected from a shoreline exceeded the State threshold of 70,000 cells/ml of cyanobacteria. Samples contained cyanobacteria taxa; Anabaena/Dolichospermum. Cell counts ranged from 107, 500 cells/ml to 6.25 million cells/ml from areas from various accumulations along the shoreline. Surface blooms can rapidly change and accumulate in various locations around a waterbody. As a result, the New Hampshire Department of Environmental Services (NHDES) has issued a cyanobacteria advisory for those who use the waterbody for recreation. Please continue to monitor your individual shorelines for changing conditions and avoid contact.

NHDES monitors public beaches and public waters of the state for cyanobacteria. Once a cyanobacteria advisory has been issued, NHDES returns to affected waterbodies weekly until the cyanobacteria standards are again met. NHDES advises lake users to avoid contact with the water in areas experiencing elevated cyanobacteria cell conditions. NHDES also advises pet owners to keep their pets out of any waters that have a cyanobacteria bloom.

This advisory is not based on a toxin evaluation and is intended as a precautionary measure for short term exposure. Cyanobacteria are natural components of water bodies worldwide, though blooms and surface scums may form when excess nutrients are available to the water. Some cyanobacteria produce toxins that are stored within the cells and released upon cell death. Toxins can cause both acute and chronic health effects that range in severity. Acute health effects include irritation of skin and mucous membranes, tingling, numbness, nausea, vomiting, seizures and diarrhea. Chronic effects may include liver and central nervous system damage. Be cautious of lake water that has a surface scum, changes colors, or appears to have green streaks or blue-green flecks aggregating along the shore.

The cyanobacteria advisory went into effect on June 20, 2019 and will remain in effect until NHDES confirms that cell concentrations of the bloom have subsided.



PUBLIC

GOV

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NHDES Cyanobacteria Alerts

Jun-20-2019	State Issues Cyanobacteria Advisory for Captains Pond in Salem, New Hampshire
Jun-19-2019	State Issues Cyanobacteria Advisory for Willand Pond in Dover/Somersworth, New Hampshire
Jun-14-2019	State REMOVES Cyanobacteria Advisory for Franklin-Pierce Lake (Jackman Reservoir) in Hillsborough, NH
Jun-10-2019	State Issues Cyanobacteria Advisory for Franklin-Pierce Lake in Hillsborough, New Hampshire
Jun-10-2019	State Issues Cyanobacteria Advisory for Silver Lake in Hollis, New Hampshire

Select Language ▼

Powered by [Google Translate](#)



Air Quality
Beach Advisory
Cyanobacteria
Drinking Water Advisory

NH Department of Environmental Services | 29 Hazen Drive | PO Box 95 | Concord, NH 03302-0095
(603) 271-3503 | TDD Access: Relay NH 1-800-735-2964 | Hours: M-F, 8am-4pm

Stay tuned for an updated website for NHDES....



Twitter @NHDES_Beaches



NH Beach Inspector

@NHDES_Beaches



[#cyanobacteria](#) [#bloom](#) on Captains Pond in Salem, NH. Sampling ASAP with details to follow. [@NHDES](#)



3:55 PM - 19 Jun 2019

Cyanos.org

[OVERVIEW](#)

[BLOOMWATCH](#)

[CYANOSCOPE](#)

[MONITORING](#)

[NEWS](#)

CYANOBACTERIA MONITORING COLLABORATIVE

THREE COORDINATED MONITORING PROJECTS TO LOCATE AND UNDERSTAND
HARMFUL CYANOBACTERIA

[GET INFORMED](#)

[GET INVOLVED](#)

[GET IN TOUCH](#)

Volunteer Involvement



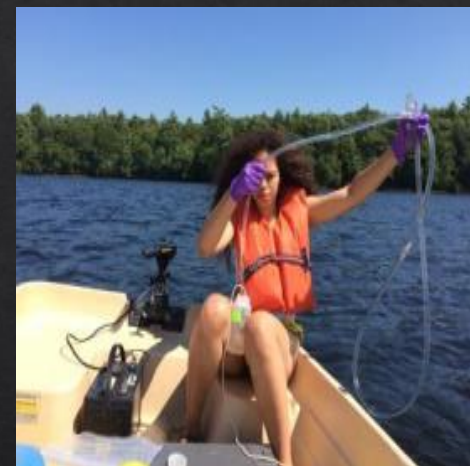
bloomWatch

- General public
- No connection to established VM/CBM program
- Good for tracking blooms
- Generating awareness



cyanoMonitoring

- Best if involved with established VM/CBM program
- Experienced volunteers
- Easy to train for sample collection
- Need an organization for processing/analysis



cyanoScope

- Interested/dedicated individuals
- University education/research
- Agencies, water suppliers



Bloom Watch App Coming soon....

<https://www.youtube.com/watch?v=-lV2xELELJ8>



(NE) Cyanobacteria Monitoring Collaborative

www.cyanos.org

Bloom Watch

Multi-Tiered Approach to
(Citizen Science Based) Cyanobacteria
Monitoring

View Data

Submit Data

Resources

Media

Feedback

Questions

Analyses

Forum

Wiki

Observations

Map

Locations



Legend

Project Headquarters

Single Observation

Many Observations

Search by Observation Name:

Example: Site 1

Search

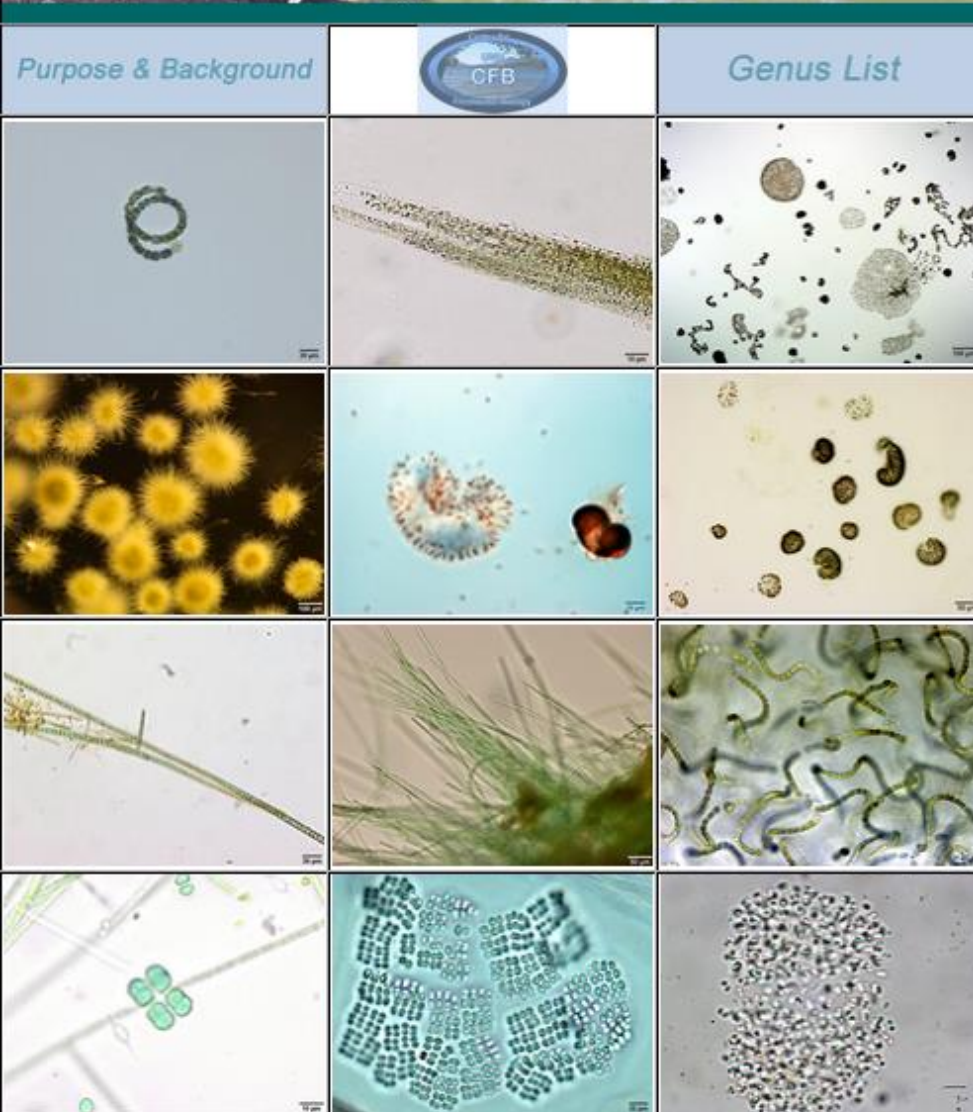
Reset Map

Map data ©2017 Google Terms of Use

Toxic Cyanobacteria of New England

"The Dirty Dozen"

cyanoScope



On-line Key to Bloom-Forming Potentially-Toxic Cyanobacteria

<http://www.cfb.unh.edu/CyanoKey/indexCyanoQuickGuide.html>



Public awareness and citizen-science on the rise!



Your involvement makes a difference...

- Be on the look out for blooms. Your report helps identify these events so that others can be aware.
- Inform your neighbors. You could prevent someone or their pet from getting sick.

Eyes on the water...

- Weed Watchers
- VLAP
- LLMP

- Protect the watershed by implementing...

Best Management Practices at the Waters Edge

1. [New Hampshire Homeowner's Guide to Stormwater Management](#)
2. [Landscaping at the Water's Edge: An Ecological Approach](#)
3. [Native Plants for New England Rain Gardens](#)
4. [Directory of Landscape Professionals Trained in Ecological Landscaping for Water Quality](#)

des.nh.gov

Rain Gardens



Thank you!

Questions?

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HAB@des.nh.gov

