

Cyanobacteria—What You Need to Know About Toxic Blooms in Our Lakes

Kate Langley Hastings

Cyanobacteria HAB Program Manager

NHDES

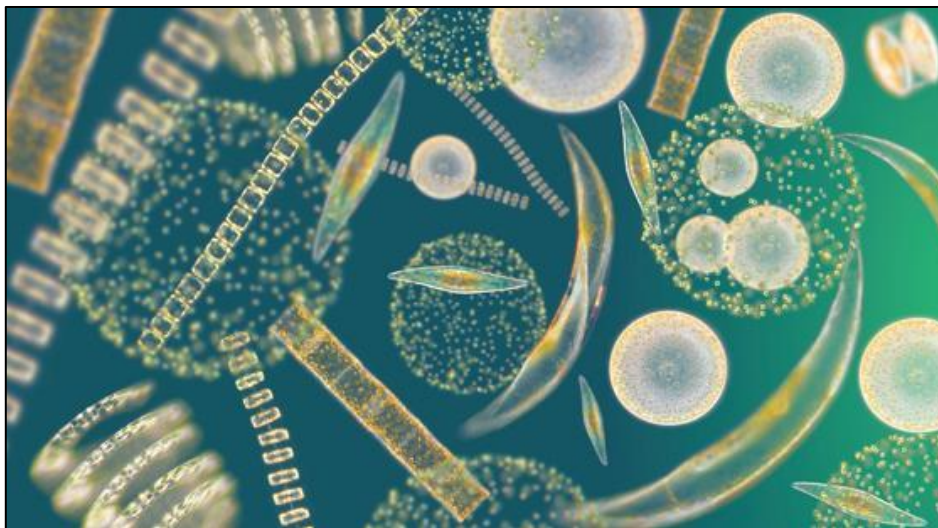
Introduction



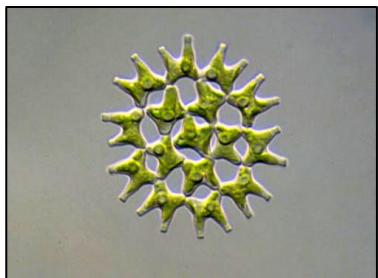
Kate Langley Hastings
NHDES, Cyanobacteria HAB Program
kate.l.hastings@des.nh.gov
603-848-8094

Phytoplankton

- Greek for “plant” “drifter”
- Photosynthetic
- Basis of aquatic ecosystems

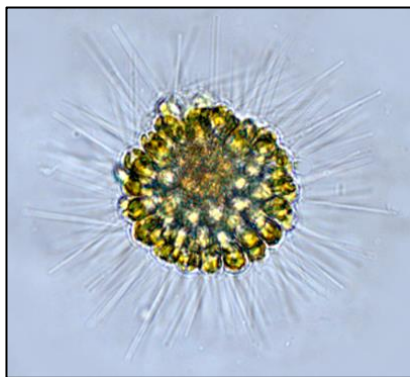


Green algae



Pediastrum

Golden-brown algae



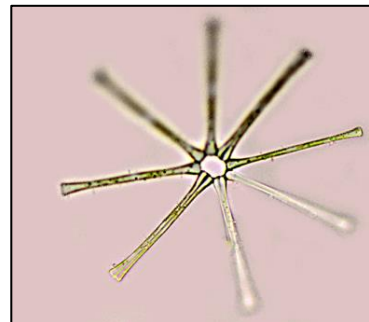
Chrysophaerella

Dinoflagellates



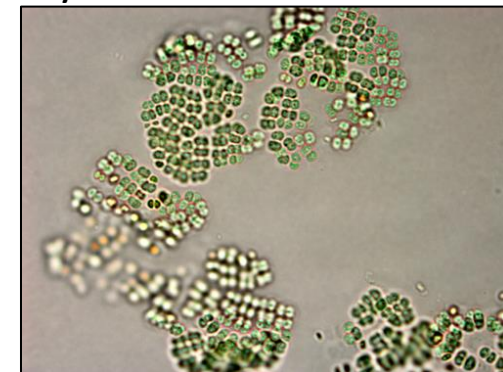
Ceratium

Diatoms



Asterionella

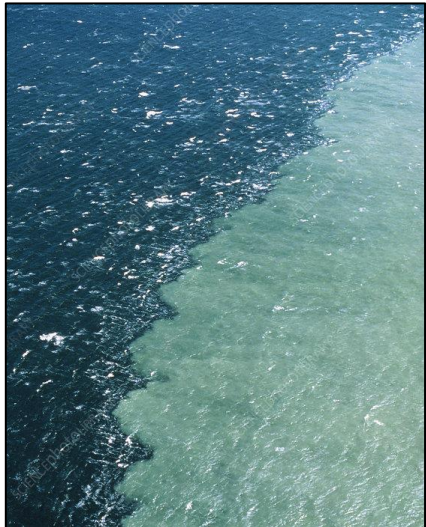
Cyanobacteria



Merismopedia

Cyanobacteria

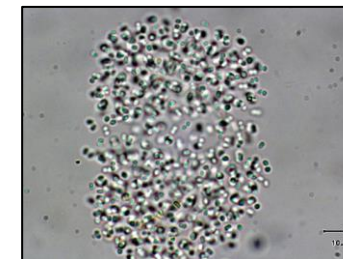
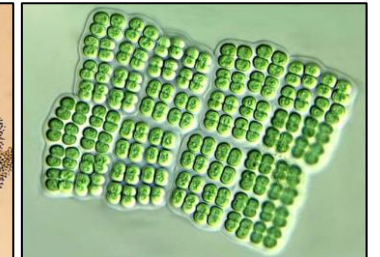
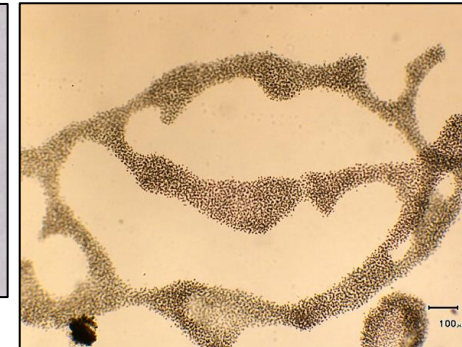
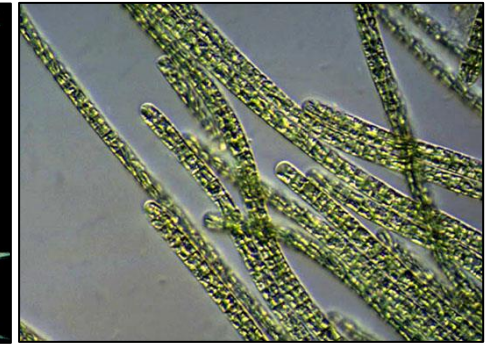
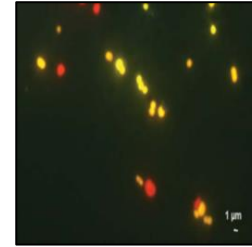
- Originated ~3.5 billion years ago
- Oxygenated the planet with the byproduct of photosynthesis
- Are ubiquitous in aquatic and terrestrial ecosystems
- Diverse group of organisms



The Diversity of Cyanobacteria

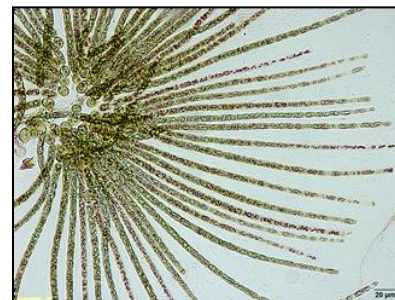
Common Cyanobacteria Genera of New Hampshire	Typical Form Observed	Associated or Known Toxins
Anabaena/Dolichospermum	Filaments	Microcystins, Anatoxin-a, Anatoxin-a (S), Saxitoxins, Cylindrospermopsin
Anabaenopsis	Filaments	Microcystins
Aphanizomenon	Rafts of Filaments	Anatoxin-a, Anatoxin-a (S), Saxitoxins, Possibly Microcystins
Aphanocapsa/Aphanothece	Colonies or Single Cells	Microcystins
Coelosphaerium	Colonies	Microcystins
Chroococcus/Gloeocapsa	Colonies	Possibly Microcystins
Gloeotrichia	Macroscopic Colonies	Microcystins
Lyngbya/Phormidium	Benthic Filaments	Microcystins, Lyngbyatoxins, Anatoxin-a
Merismopedia	Rafts of Colonies	Microcystins
Microcystis	Variations of Colonies	Microcystins, Anatoxin-a
Nostoc	Macroscopic Colonies	Microcystins, Nodularins
Oscillatoria/Planktothrix	Filaments	Microcystins, Cylindrospermopsin
Spirulina	Filaments	Microcystins
Synechococcus/Synechocystis	Single Cells, Rarely Colonial	Microcystins and Saxitoxins
Woronichinia	Dense Colonies	Microcystins

Credit: Amanda McQuaid



Unique Cyanobacteria

Gloeotrichia
Lake Winnepesaukee
Lake Sunapee



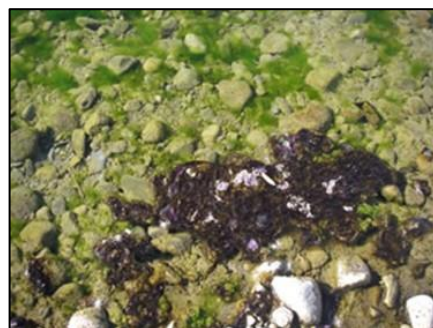
Macroscopic Colonies

Nostoc
Pawtuckaway



Benthic Mats

Stigonematales
Lake Winnepesaukee



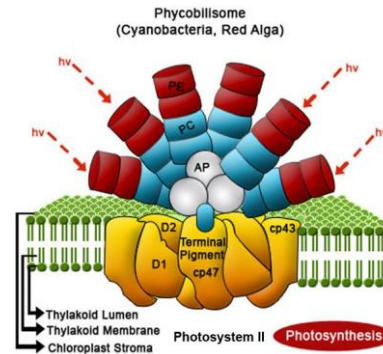
Cyanobacteria Blooms



- Rapid growth
- Rise to surface and create scums
- Blooms are very dynamic
 - Surface during calm mornings, then resuspended in the water column
 - Move to another part of a water body
 - Can last for a single day, to a full summer
- Unsightly, displeasing
- Ecological damage
- Toxicity of blooms
 - Elevated concentrations can pose a threat to public health
 - Toxicity (type of toxin and amount) can change rapidly over the course of a bloom

Cyanobacteria competitive advantages

- Phycobilins: Accessory pigments on chlorophyll
 - Expand the range of light the chlorophyll can harvest
 - Phycocyanin (PC), Phycoerythrin (PE), and Allophycocyanin (AP)
- Fix atmospheric nitrogen through special structures called heterocysts
- Akinetes, resting cells that can survive undesirable conditions
- Regulate their buoyancy
 - Move towards nutrients and light



Increasing cyanobacteria blooms



- Eutrophication
 - Excess nutrients from watershed
 - Agriculture, fertilization, land-use changes, urbanization
- Climate change
 - Warmer temperatures, shorter periods of ice cover, longer periods of stratification
 - Extreme weather, different rain patterns
- Increased awareness

How do you manage cyanobacteria blooms?

- Watershed management plans are essential
 - Identify sources, recommend best management practices, low impact development methods etc.
 - Long term solution
- Removing cyanobacteria through chemical treatment
 - Temporary solution





Cyanotoxins

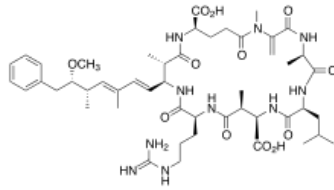
Cyanotoxins

- Produce a range of toxins with various modes of action and resulting symptoms
 - Neurotoxins
 - Hepatoxins (liver)
 - Tumor promoters
 - Toxic to multiple organs
- Acute and chronic toxicity in humans, wildlife and pets
 - Individuals with compromised immune systems may have worse reactions
- Documented cyanotoxicity symptoms
 - Dermal irritations, eye and nose irritations, general malaise, fever
 - Nausea, vomiting, diarrhea, gastroenteritis
 - Tingling, numbness, seizures
 - Nervous system and organ failure
 - Death

Cyanotoxin	Mode of action and/ or symptoms
★ Microcystins (over 200 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
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. (Though individuals may have a genetic precursor).
Notes: <ul style="list-style-type: none"> • This is not a complete list of the cyanotoxins. • Exposure can occur through drinking, food, dietary supplements, inhalation, and/ or by dermal contact, and has occurred by haemodialysis (with contaminated water). Dermal-toxins, causing rashes on skin may occur. Synergistic effects of the cyanotoxins may also occur. • Cyanotoxins may have varying effects on individuals with higher implications for those with a compromised immune system. 	

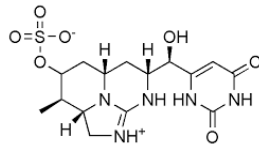
Credit: Amanda McQuaid

Microcystins



- Most common cyanotoxins found worldwide, and in NH
- Potent hepatotoxin and tumor promoter
 - Acute and chronic toxicity
- MCs are extremely stable compounds (4-14 days)

Cylindrospermopsin



- Not found as frequently in NH freshwater
- Toxic to multiple organs, neurotoxic and genotoxic
 - Toxicity exerted on kidney, spleen, thymus, heart and gastrointestinal tract
- Not always cell bound – released into the water column during cell growth
- Stable in the environment

Table. Recommended magnitude for cyanotoxins.

Microcystins	Cylindrospermopsin
8 µg/L	15 µg/L

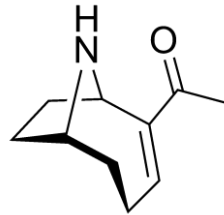
(EPA, 2019)

Cyanotoxin	Drinking Water Health Advisory (10-day)	
	Bottle-fed infants and pre-school children	School-age children and adults
Cylindrospermopsin	0.7 µg/L	3.0 µg/L
Microcystins	0.3 µg/L	1.6 µg/L

(EPA, 2019)

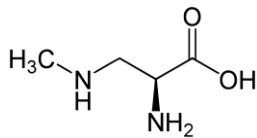
(Zhang 2015)





Anatoxin-a and anatoxin-a(S)

- Acute toxicity: Very fast death factor
 - Potent neurotoxin
 - Inhibits acetylcholine receptors (neurotransmitter)
 - Seizures and death (common for dogs and other animals to ingest and die)
- Not stable compounds

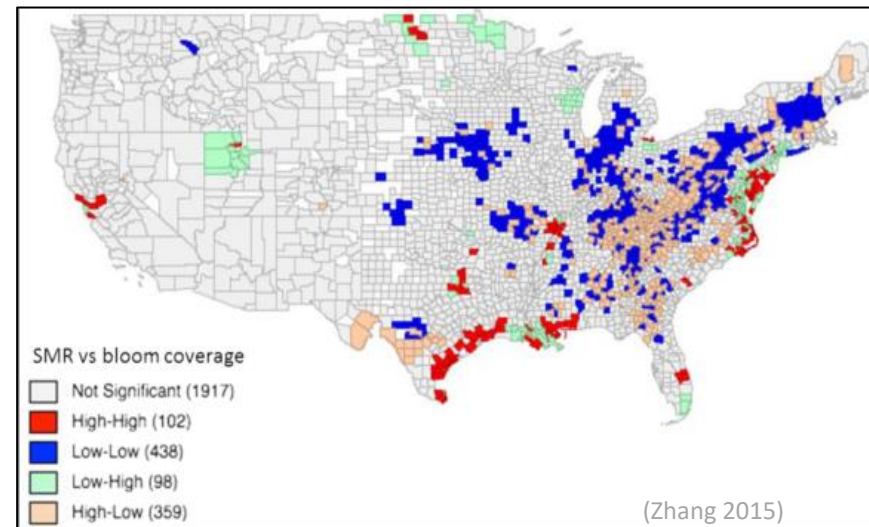
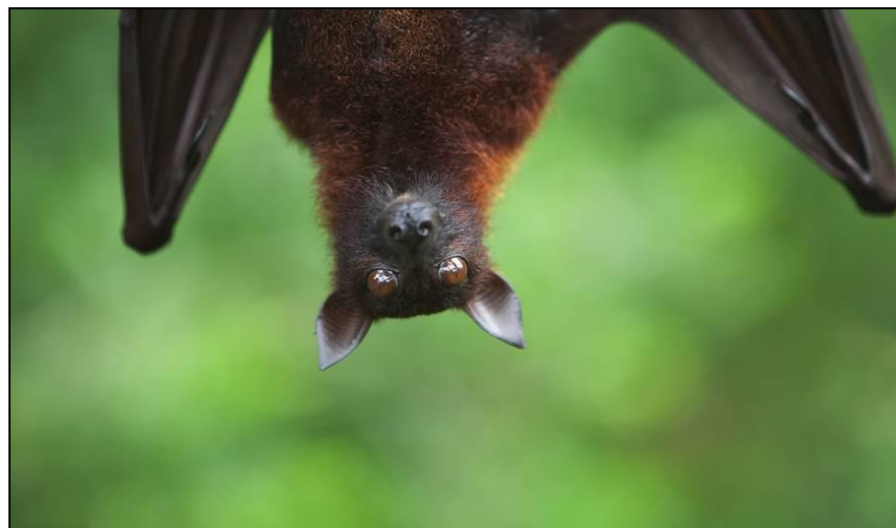


BMAA

- Non protein encoding amino acid
 - Potentially disrupts protein folding
- Chronic toxicity
 - Potentially leads to ALS and other neurodegenerative diseases
- Bioaccumulates through the food web

Cyanotoxicity in Humans

- 1996 Hemodialysis microcystins exposure in Brazil (Azevedo *et al.*, 2003)
- Non-alcoholic liver disease incidence with HAB occurrence (Zhang *et al.*, 2015)
- 2018 Florida incident (synergistic toxicity of marine and fresh HABs) (Peacock *et al.*, 2018)
- BMAA implicated in ALS / Parkinsonism dementia complex (Cox *et al.*, 2017)



Cyanotoxicity in Animals

- Avian illness- top predatory birds affected by toxins –related to avian vacuolar myelinopathy (AVM) (Wilde et al., 2005)
- Fish death- depletion of oxygen and cyanotoxicity (Landsberg et al., 2020)
- Liver failure caused otter deaths in San Francisco Bay (Miller et al., 2010)
- Cattle/livestock deaths – 72 cows dead out of 170 in 24 hours (Odriozola and Salamanco, 1984)
- Dog deaths...



Canine Cyanotoxin Poisonings in the United States (1920s–2012): Review of Suspected and Confirmed Cases from Three Data Sources (Backer et al., 2013)

“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.”

Routes of exposure to cyanotoxins



- Ingestion
 - Drinking water
 - Unintentional ingestion via swimming
 - Food
 - Fish
 - Shellfish
 - Crops – surface and uptake to fruits and leaves

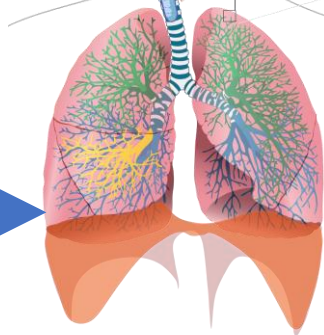
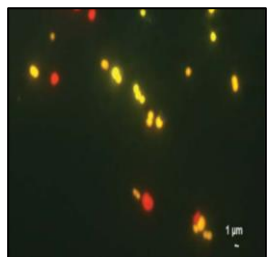
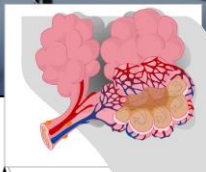
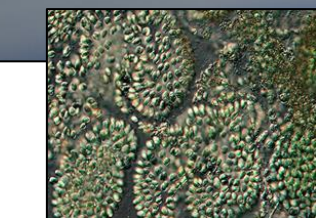


- Inhalation
 - Recreation
 - Showering
 - Living near a lake

10-fold higher toxicity and availability when MCs are inhaled vs. orally ingested (Wood *et al.* 2011)



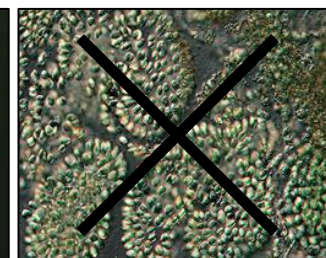
Cyanobacteria Aerosols



Cyanobacteria cells in nasal cavities and lung tissue

(Facciponte *et al.* 2018)

- Aerosols are dominated by picocyanobacterial
 - I never saw full colonies on air filters

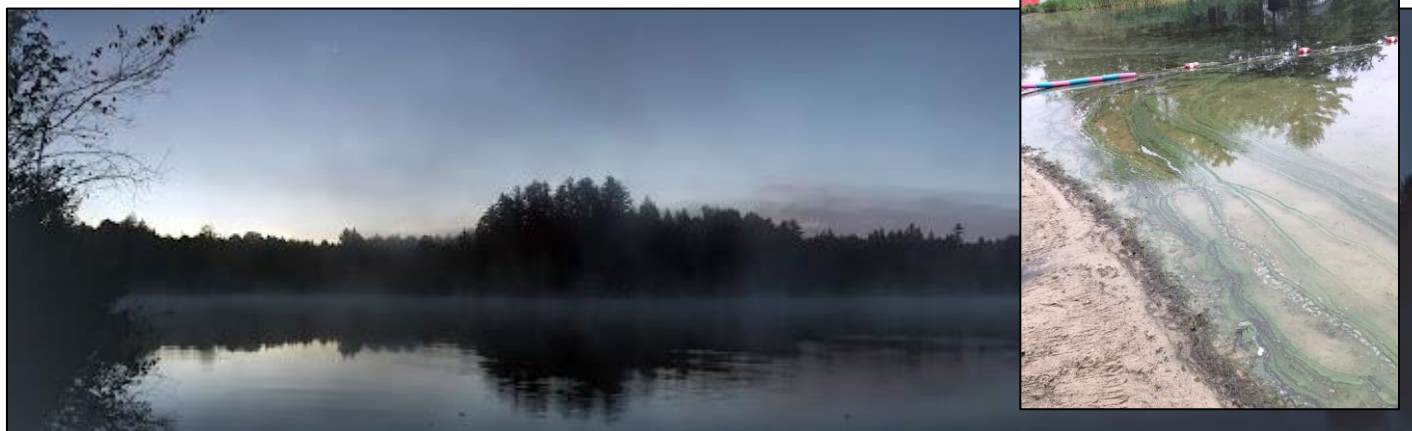


- Measured MCs from aerosols were very low
 - Not a cause for immediate concern for acute toxicity
 - Chronic exposure?



NHDES Cyanobacteria HAB Program Overview

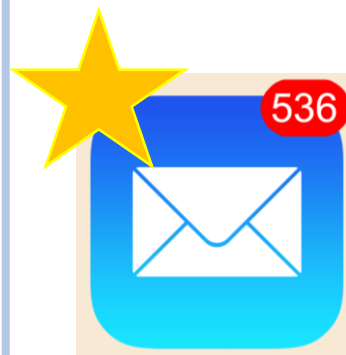
NHDES Cyanobacteria HAB Program Overview



1) Take photos, and get a sense of how much area the bloom is covering



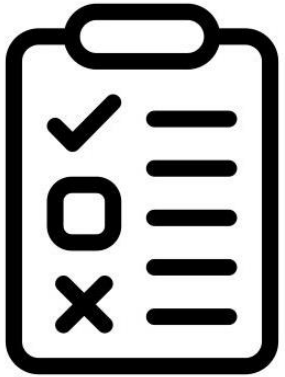
2) Report it to NHDES



hab@des.nh.gov



603-848-8094



Information to include in your report (email, text or phone call)

- Your full name and contact info
 - o Email and phone number
 - Waterbody name
 - Waterbody town
 - The location of the bloom
 - Description of severity and dimensions of scum
 - Photos
 - Date, time
 - Weather conditions, or any other notes that may help describe the situation
- 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!

Next Steps

- If you are comfortable doing so, take a sample
- If you are not comfortable, NHDES will coordinate sampling

Until you get results

- Don't wade, swim, or drink the water
- Keep pets or livestock out
- Wash with fresh water if you've made contact

When in doubt, stay out!



Sampling Instructions

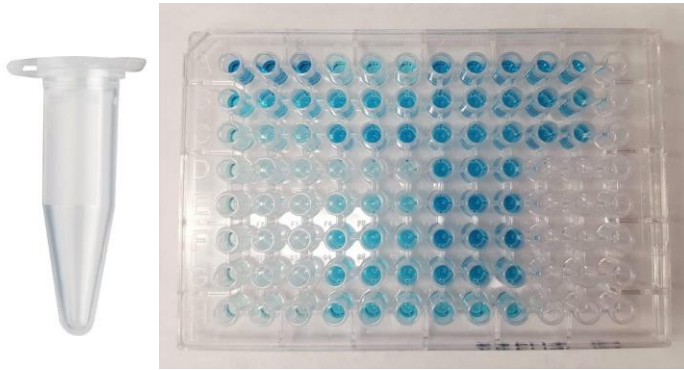
- Plan your **personal protective equipment**
 - Gloves, mask, sampling pole
- Label a sample jar (clean glass or hard plastic jars are best)
 - o Sampler's Name and contact information
 - o Waterbody Name and Town
 - o Sample collection address
 - o Sample description (i.e. "worst part of bloom", "surface skim", "nearshore", "town beach").
 - o Date and time
- Collect a sample by skimming the surface of the water through the bloom
- Rinse off bottles if bloom residue covers the outside of the bottle
- Wash hands after handling bloom material
- Place sample on ice or in a refrigerator until it's delivered to the Concord NHDES



Sample Drop Off

- Monday through Friday 8:00 am - 3:00 pm
- Coordinate with Kate Hastings (603-848-8094) when samples will be delivered
- There will be a black bin outside the DES office at the DMV facing entrance labeled "Cyanobacteria Sample Drop Off" (29 Hazen Drive, Concord NH)
- Confirm sample drop off by texting 603-848-8094

Toxin Analysis



- Subsamples are taken for future toxin analysis via ELISAs

Table. Recommended magnitude for cyanotoxins.

Microcystins	Cylindrospermopsin
8 µg/L	15 µg/L

(EPA, 2019)

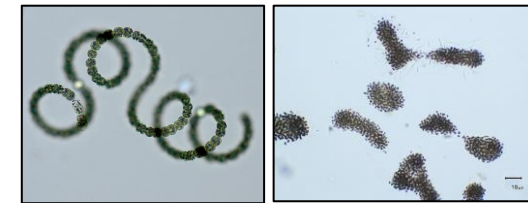
70,000 cells/mL

- Limitations: expensive, time intensive, delayed results, many different cyanotoxins

Microscopic Analysis



Samples are identified and enumerated within 24 hours



< 70,000
cyanobacteria cells/mL
ALERT may be issued

> 70,000
cyanobacteria cells/mL
ADVISORY issued

Two-tiered response based on cyanobacteria density

ALERT

- Local warning to be on the lookout about cyanobacteria
 - Cyanobacteria below the advisory, but could develop into something more significant
 - If the bloom has passed by the time the sample is analyzed (weekends!)
 - Issued based on a photo and description of the bloom prior to sampling
- Resampled if residents inform us about continued presence / changing conditions

ADVISORY

- **Lake wide** warning that cyanobacteria density exceeds 70,000 cells/mL
 - Water is currently unsuitable for wading or swimming, do not come in contact with bloom material, keep children and pets out of the water
- Lakes are resampled weekly, until the cyanobacteria cell concentration drops below 70,000 cells/mL

ALERT and ADVISORY communication

ALERT

- Circulated to the local community around the water body to be on the look out for developing cyanobacteria
- Direct communication to:
 - Those who submitted cyanobacteria reports
 - Lake associations



ADVISORY

- Direct communication to:
 - Those who submitted cyanobacteria reports
 - Lake associations
 - Health Officers
- Announcement is shared publicly through many channels
 - On the Beach Advisory map/webpage
 - Physical signs at public beaches
 - NHDES press release and social media
- When advisories are lifted, all channels are alerted again

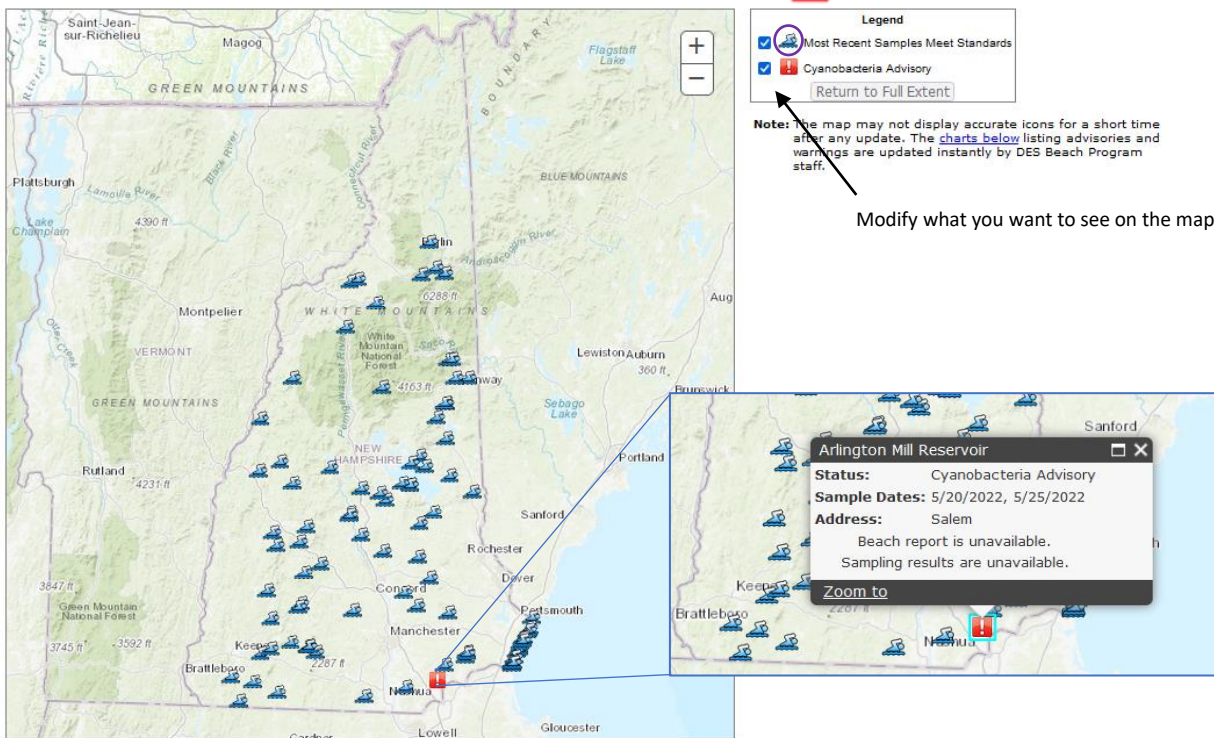


Beach Advisory Map



https://www4.des.state.nh.us/WaterShed_BeachMaps/

Current Beach Advisories as of May 28, 2022



Water Sampling

The Beach Inspection Program monitors public beaches for fecal bacteria during the swim season, between Memorial Day and Labor Day. The Harmful Algal and Cyanobacterial Bloom Program monitors waterbodies whenever cyanobacteria blooms are reported. Current advisories for both beach bacteria and cyanobacteria blooms are posted on this map.

Current Beach Advisories

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

State Water Quality Criteria

Marine (Enterococci) Water Quality Criteria:

- 1 sample > 104 counts/100 ml

Freshwater (E. coli) Water Quality Criteria:

- 1 sample > 158 counts/100 ml, or
- 2 samples > 88 counts/100 ml

Beach bacteria advisories are updated daily during the swim season. Beaches are only listed if the most recent fecal bacteria analysis exceeded state criteria. For beach advisory details, sampling results, and yearly reports, conduct a search at [NHDES OneStop](#).

Current Cyanobacteria Bloom Advisories

Date of Advisory	Description of Advisory
5/20/2022	ARLINGTON MILL POND, SALEM. A possible toxin-producing cyanobacteria (blue-green algae) bloom has been spotted appearing as green and blue-green dense clouds, accumulating at the surface and along the shorelines. Cyanobacteria blooms are widespread around the lake in coves and beaches. Please be advised that conditions can change and bloom conditions may disperse around on the lake. Lake users should avoid contact with the water in areas experiencing cyanobacteria bloom conditions and keep children and pets out.

Cyanobacteria advisories are issued when there are blooming conditions and cyanobacteria cell concentrations exceed 70,000 cells/ml in recreational waters. Inspections and sampling are conducted weekly until the bloom subsides. For more information, please visit [Harmful Algal Blooms | NH Department of Environmental Services](#).



Follow the [NHDES Beach Advisories Twitter Feed](#) for updates on fecal bacteria and cyanobacteria advisories.



To receive the (beach and cyanobacteria bloom) Advisory Newsletters, join the [NHDES E-Mail List](#).

For more information, please visit [Healthy Swimming | NH Department of Environmental Services](#).



Advisories are posted as NHDES Press Releases



Join the N.H. Department of Environmental Services Email Mailing List

Choose the news you want to receive from the list below

* Email Address

First Name

Last Name

Address

Company

Email Lists

- Air Quality Action Day Alerts
- Beach Advisories
- Drought
- Environmental News (Primary NHDES newsletter)
- Press Releases (announcements by NHDES)



Cyanobacteria

For Immediate Release
May 20, 2022

Contact

Kate Hastings
(603) 848-8094 | HAB@des.nh.gov

State Issues Cyanobacteria Bloom Advisory for Arlington Mill Pond/Reservoir in Salem, NH

Concord, NH – A cyanobacteria bloom has been observed on Arlington Mill Pond. Widespread and dense surface accumulations are present in all coves, and at all observed beaches. Samples were collected on May 20, 2022, and cyanobacteria (*Dolichospermum*) were observed in concentrations up to 300,000 cells/mL in areas of highest observed accumulations. Advisories are issued when cyanobacterial cell concentrations exceed 70,000 cells/mL. As a result, NHDES has issued a cyanobacteria bloom advisory for those who use the waterbody for recreation. The advisory is not based on a toxin evaluation and is intended as a precautionary measure for short-term exposure.



Surface blooms can rapidly change and accumulate in various locations around a waterbody. Please continue to monitor your individual shorelines for changing conditions. NHDES advises lake users to avoid contact with the water in areas experiencing elevated cyanobacteria cell conditions, also known as a bloom. NHDES also advises pet owners to keep their pets out of any waters that have a cyanobacteria bloom.

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 flocks aggregating along the shore.


The cyanobacteria advisory went into effect on May 20, 2022, and will remain in effect until NHDES confirms that cell concentrations of the bloom have subsided.

- Visit the NHDES Beach Program website for photos and more information about cyanobacteria at [Harmful Algal Blooms](#).
- Updates on cyanobacteria advisories may be obtained on the [Beach Advisory Mapper](#).
- Follow the [Beaches twitter feed](#).


If you notice anything resembling cyanobacteria, please refrain from wading, swimming or drinking the water. Keep all pets out of the water and contact NHDES immediately. Please call NHDES to report a cyanobacteria bloom at <tel:+16038488094> or email HAB@des.nh.gov.



ADVISORIES are shared on social media



@NHDES_Beaches



NH Beach Inspector
@NHDES_Beaches


For safe swimming, we sample coastal and freshwater beaches for bacteria. Social Media Policy: des.nh.gov/sites/g/files/...

New Hampshire Beaches
www4.des.state.nh.us/WaterShed_Bea...
Joined August 2008

104 Following 2,265 Followers

Tweets Tweets & replies Media Likes

NH Beach Inspector @NHDES... · 20 May
#cyanobacteria #bloom advisory issued for Arlington Mill Pond, Salem.
@NHDES
www4.des.state.nh.us/WaterShed_Bea...



NH Dept Env Services



@NHDES



NH Dept Env Services ✓
@NHDES Follows you

Our mission is to protect, maintain and enhance environmental quality and public health in NH. Social Media Policy: rb.gy/oive6y

Concord, NH des.nh.gov
Joined January 2009

769 Following 6,862 Followers

Followed by @NHEnvirothon, Phosphoria, NH Public Health, and 54 others

Tweets Tweets & replies Media Likes

NH Dept Env Services @NHDES · 15h
FIELD WORK FINDINGS: A baby painted turtle was spotted by a NHDES VLAP Intern at Baptist Pond in Springfield. #NH



NH Department of Environmental Services


3.6K followers · 576 following
@NHEnvironmentalServices

Contact us

Posts About Photos Videos Mentions

Details
Page · Environmental Service
des.nh.gov

NH Department of Environmental Services · 15h
FIELD WORK FINDINGS: A baby painted turtle was spotted by a NHDES VLAP Intern at Baptist Pond in Springfield.



@nhenvironmentalservices


366 Posts 1,175 Followers 282 Following

NHDES
Government organization
Protecting, maintaining and enhancing New Hampshire's environment and public health since 1987.
linktr.ee/nhdes

Followed by seacoast_science_center, unhexextension and 3 others

Follow Message

Contest Winn... #OneThing4E... #ThisIsNH




Thank you for your support and cooperation.

The success of this program is dependent on communities.
You are “our” eyes across the state, and a voice for your
community's health!

A challenge: Many reports come in on the weekends

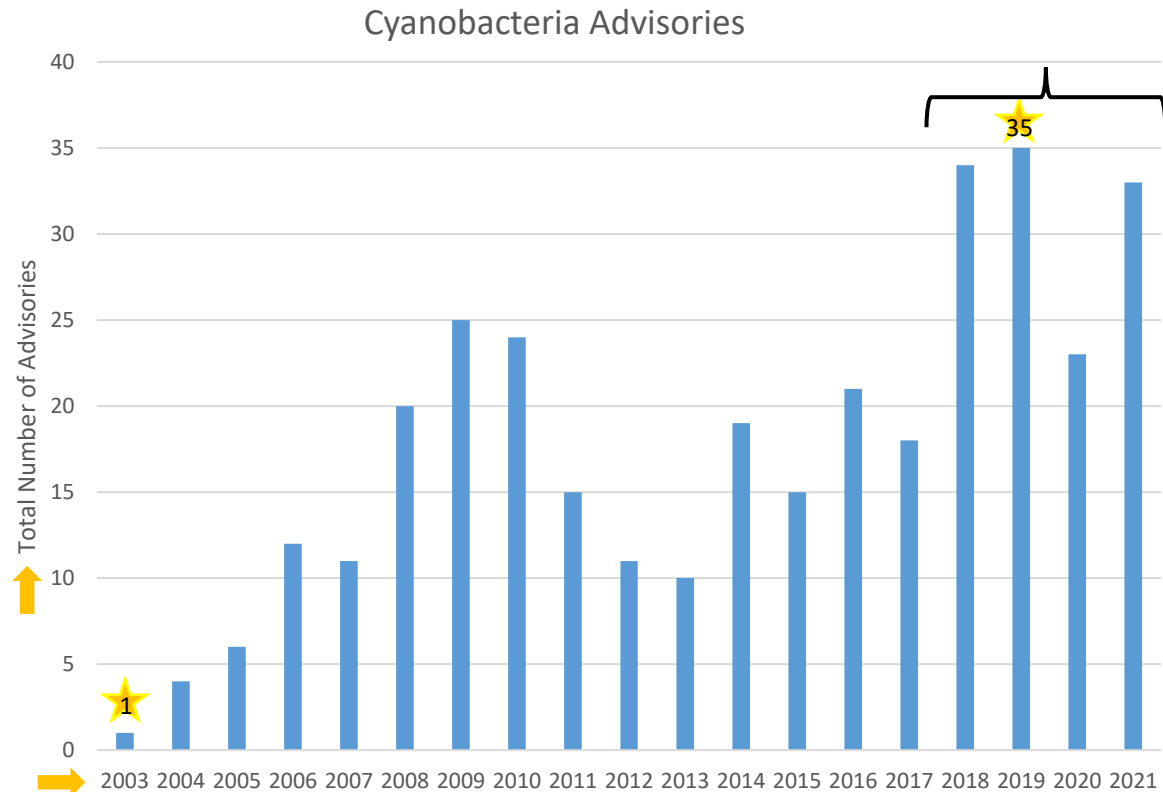
- The lab is closed for sample analysis
- Report before the weekend
- If you are comfortable safely taking a sample, and delivering it to the Concord NHDES office on Monday mornings, that will help expediate getting results
- Blooms are transient – they may be gone by Monday morning
- *When in doubt stay out* and communicate with your community!

A request: Collecting contacts



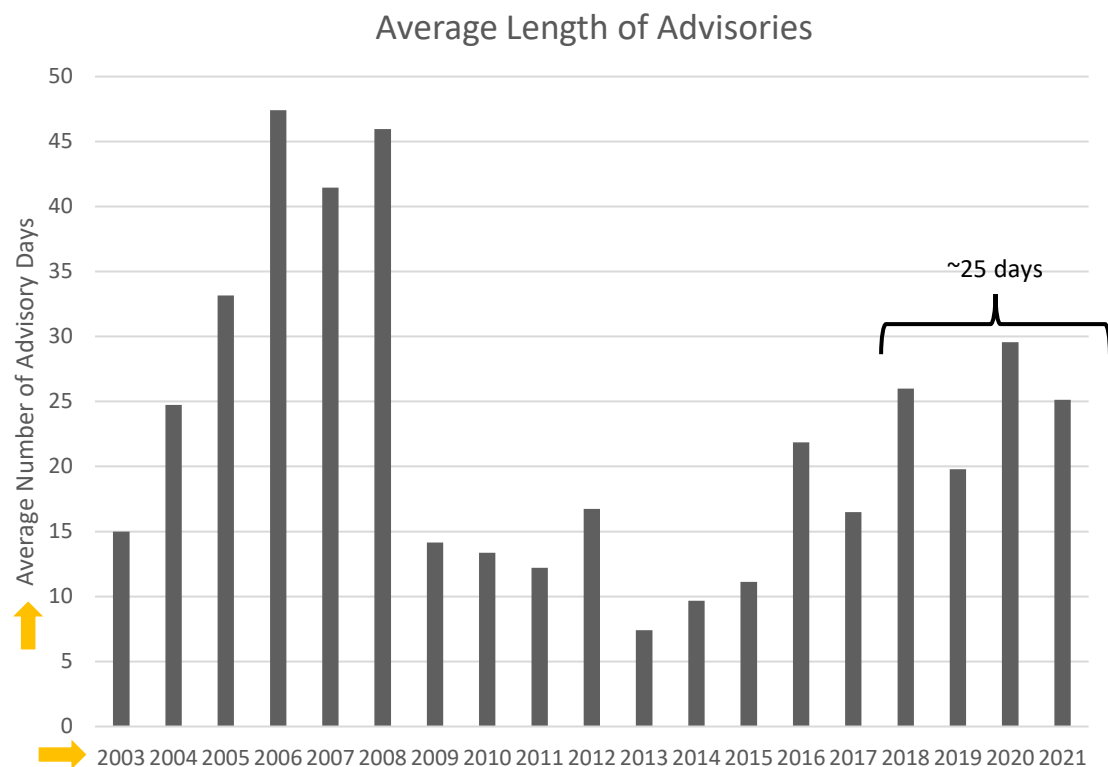
NH Cyanobacteria Advisory Trends Over Time

Cyanobacteria Advisories Over Time



- Some water bodies have multiple advisories per year
 - 2021, 33 advisories, 27 waterbodies
- While there has been an increase in total advisories over time, there is not a significant increase in advisory days since 2003
- Reaction-based program
 - Samples are primarily collected when they're reported
 - Increased public awareness
 - More reports = more advisories
- Advisories keep people and pets safe!

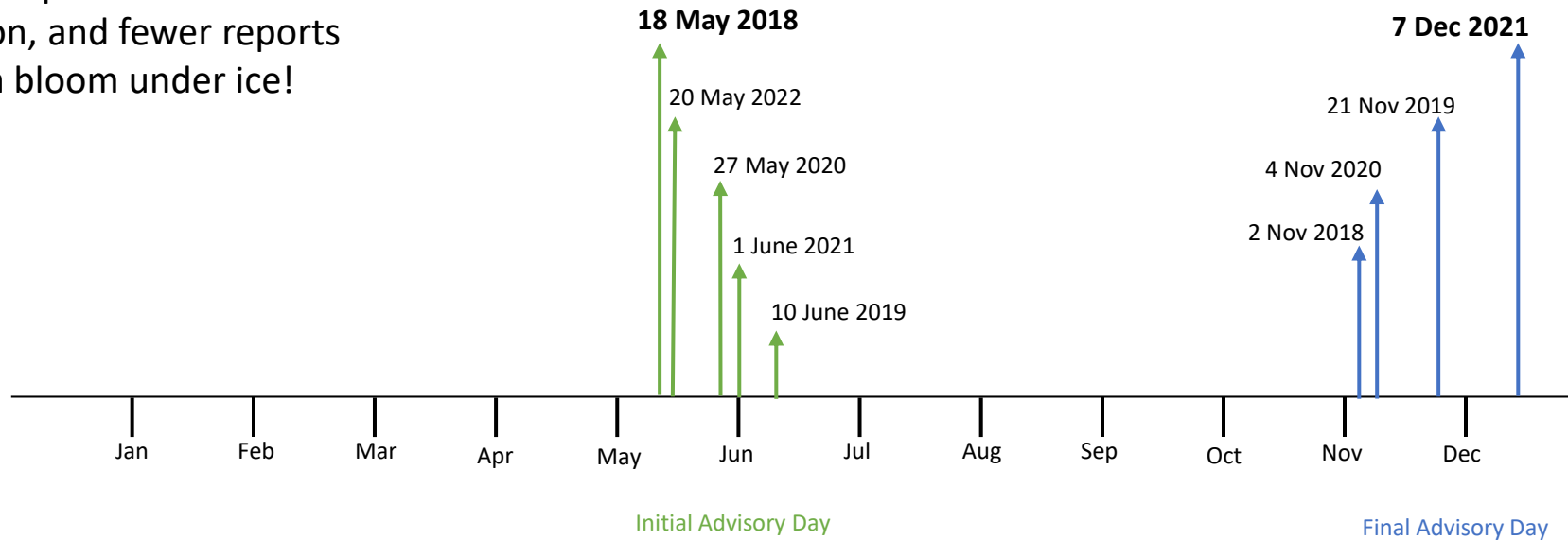
“How long is this going to last”



- Depends on many factors
 - Water body, nutrient inputs, weather, etc.
- In the last four years:
 - Shortest advisory was 2 days
 - Longest advisory was 132 days

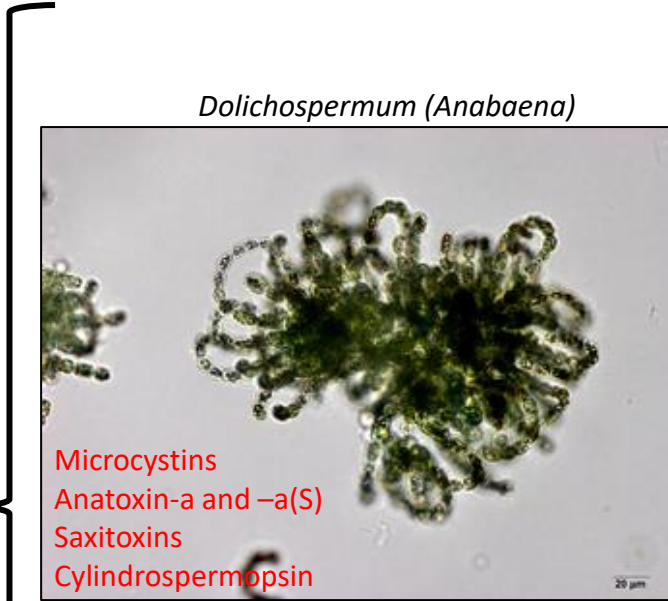
Seasonality of Advisories

- NHDES has issued cyanobacteria advisories from May through December
 - Primarily during the typical growing season
 - Colder temperatures mean less recreation, and fewer reports
 - They can bloom under ice!



Most common cyanobacteria present

All are known toxin producers



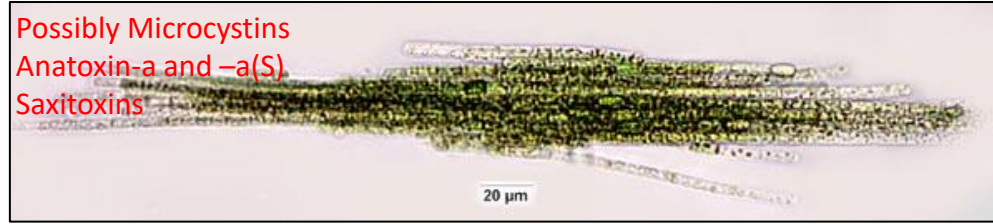
Taste and odor compound producer: smells musky, earthy, like dirt

Dolichospermum dominant in early summer (June)

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

Aphanizomenon

Possibly Microcystins
Anatoxin-a and -a(S)
Saxitoxins

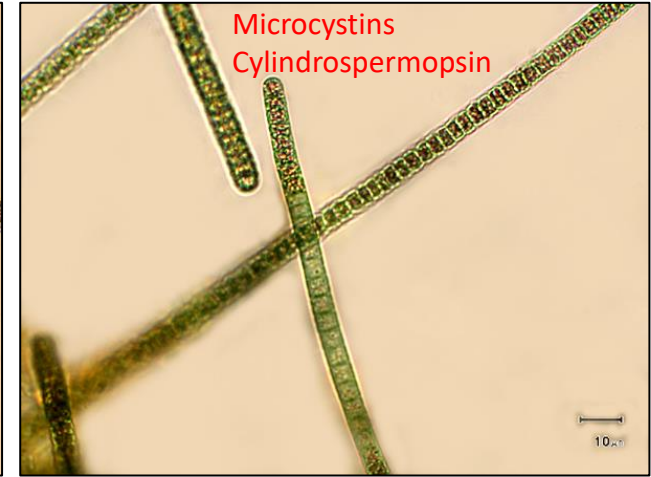


Microcystins
Anatoxin-a and -a(S)



Microcystis

Microcystins
Cylindrospermopsin

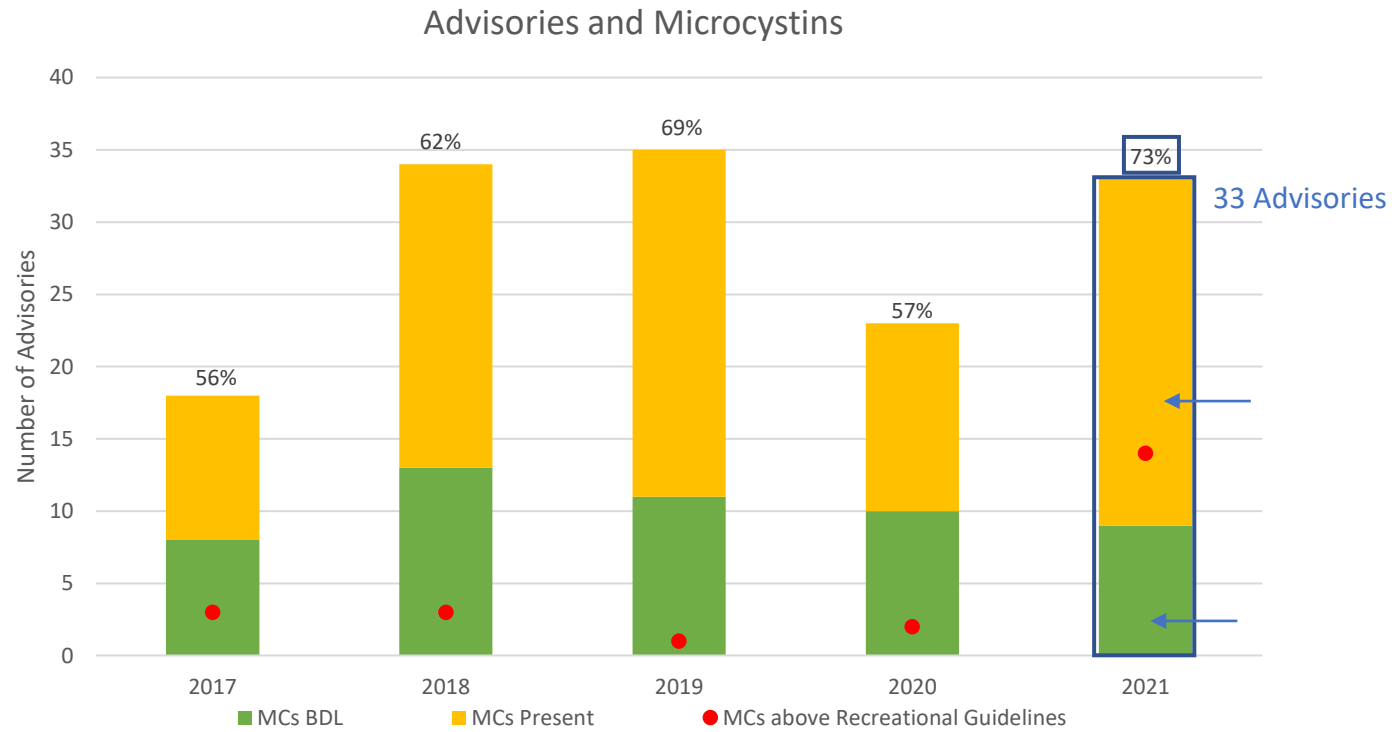


Planktothrix (Oscillatoria)

*** Types and levels of cyanotoxicity can vary unpredictably.

Microcystins (MCs) in NH Cyanobacteria Blooms

*** Types and levels of cyanotoxicity can vary unpredictably



- Percent of advisories with detectable MCs varies per year
 - 56% to 73%
- Number of advisories with toxin levels above the 8 $\mu\text{g}/\text{L}$ recreational limit varies
 - 1 to 14

Microcystins are not the only cyanotoxin. . .

2020 Cyanotoxin Analysis

*** Types and levels of cyanotoxicity can vary unpredictably

	Below Detectable Level
	Toxin Present
	Toxin above Recreational Guideline (MCs and CYN only)
	Not Tested

Advisory Number	Dominant Cyanobacteria Taxa	Date Advisory Issued	# of Advisory Days	MCs (ppb)	CYN (ppb)	ATX (ppb)	BMAA (ppb)
1	<i>Anabaena/Dolichospermum, Microcystis, Woronichinia</i>	5/27/2020	14	Yellow	Green	Yellow	Green
2	<i>Dolichospermum (D. lemmermannii)</i>	6/2/2020	8	Yellow	Green	Yellow	Yellow
3	<i>Dolichospermum (D. lemmermannii)</i>	6/3/2020	7	Green	Green	Green	Green
4	<i>Microcystis, Woronichinia</i>	6/9/2020	10	Red	Yellow	Yellow	Green
5	<i>Anabaena/Dolichospermum, Woronichinia, Oscillatoria</i>	6/17/2020	2	Yellow	Green	Yellow	Green
6	<i>Anabaena/Dolichospermum</i>	6/19/2020	5	Yellow	Green	Yellow	Green
7	<i>Microcystis, Woronichinia, Dolichospermum</i>	6/29/2020	52	Green	Yellow	Green	Yellow
8	<i>Planktothrix, Aphanocapsa, Pseudoanabaena</i>	7/10/2020	66	Green	Yellow	Green	Green
9	<i>Woronichinia</i>	7/10/2020	132	Yellow	Green	Green	Green
10	<i>Planktothrix</i>	7/16/2020	47	Green	Green	Yellow	Yellow
11	<i>Chrysochloris, Planktothrix, Spirulina</i>	7/16/2020	61	Green	Green	Yellow	Yellow
12	<i>Anabaena/Dolichospermum, Microcystis, Aphanizomenon</i>	7/20/2020	10	Yellow	Red	Yellow	Yellow
13	<i>Planktothrix</i>	7/30/2020	46	Green	Green	Yellow	Green
14	<i>Dolichospermum (D. lemmermannii)</i>	7/30/2020	6	Green	Green	Yellow	Yellow
15	<i>Anabaena/Dolichospermum</i>	8/12/2020	14	Yellow	Green	Yellow	Green
16	<i>Anabaena/Dolichospermum, Microcystis</i>	8/17/2020	37	Yellow	Green	Yellow	Yellow
17	<i>Planktothrix</i>	8/18/2020	24	Green	Green	Green	Green
18	<i>Anabaena/Dolichospermum, Microcystis</i>	8/18/2020	17	Yellow	Green	Green	Green
19	<i>Microcystis wesenbergii</i>	9/4/2020	19	Yellow	Not Tested	Green	Not Tested
20	<i>Chrysochloris</i>	9/9/2020	58	Green	Green	Green	Green
21	<i>Scytonema, Stigonema, Tolypothrix, Lyngbya</i>	9/10/2020	27	Yellow	Green	Yellow	Yellow
22	<i>Microcystis, Aphanizomenon, Woronichinia, Dolichospermum</i>	9/29/2020	10	Red	Green	Green	Green
23	<i>Woronichinia, Microcystis, Dolichospermum</i>	10/14/2020	8	Yellow	Green	Not Tested	Green

No toxins present

All toxins present

Majority have a mix of toxins

Cell counts help standardize our response, instead of focusing on just one toxin.



What is the NHDES doing about Cyanobacteria HABs

- Performed the first Alum treatment in almost 40 years
- Participation in HB1066

Program Development

- Dedicated position established in 2019
- More samples analyzed each year
 - 350 samples in 2018
 - 775 samples in 2021
- Toxin analysis for Microcystins completed annually
- Alert system established in 2020
- Regular communication with the public through many channels (advisories map, social media, press releases)
 - CyanoHABs history added to Lake Mapper





Thank you!



Questions?

General cyanobacteria information on our website:

<https://www.des.nh.gov/water/healthy-swimming/harmful-algal-blooms>

Current Beach Advisories Map:

https://www4.des.state.nh.us/WaterShed_BeachMaps/

Cyanobacteria Advisories History:

<https://nhdes.maps.arcgis.com/apps/webappviewer/index.html?id=1f45dc20877b4b959239b8a4a60ef540>

Kate Langley Hastings
NHDES, Cyanobacteria HAB Program
kate.l.hastings@des.nh.gov
603-848-8094



- (Azevedo *et al.*, 2002) <https://pubmed.ncbi.nlm.nih.gov/12505349/>
- (Backer *et al.*, 2013) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3798876/>
- (EPA, 2019) <https://www.epa.gov/sites/default/files/2019-05/documents/hh-rec-criteria-habs-document-2019.pdf>
- (Facciponte *et al.* 2018) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6159226/>
- (Landsberg *et al.*, 2020)
<https://www.sciencedirect.com/science/article/abs/pii/S1568988320300494#:~:text=In%20this%20case%2C%20fish%20mortality,McInnes%20and%20Quigg%2C%202010>)
- (Miller *et al.*, 2010) <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0012576>
- (Odriozola *et al.*, 1984) <https://pubmed.ncbi.nlm.nih.gov/6443833/>
- (Peacock *et al.*, 2018) <https://www.sciencedirect.com/science/article/pii/S1568988318300258>
- (Wilde *et al.*, 2005) <https://pubmed.ncbi.nlm.nih.gov/15892059/>
- (Wood *et al.* 2011) <https://pubs.rsc.org/en/content/articlelanding/2011/em/c1em10102a/unauth>
- (Zhang *et al.*, 2015) <https://ehjournal.biomedcentral.com/articles/10.1186/s12940-015-0026-7>