

Blue-green Algae and What They Mean for Your Recreation in Wisconsin's Lakes

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Wisconsin Lakes Partnership Convention
and Water Action Volunteers Symposium
April 12, 2019



Definitions

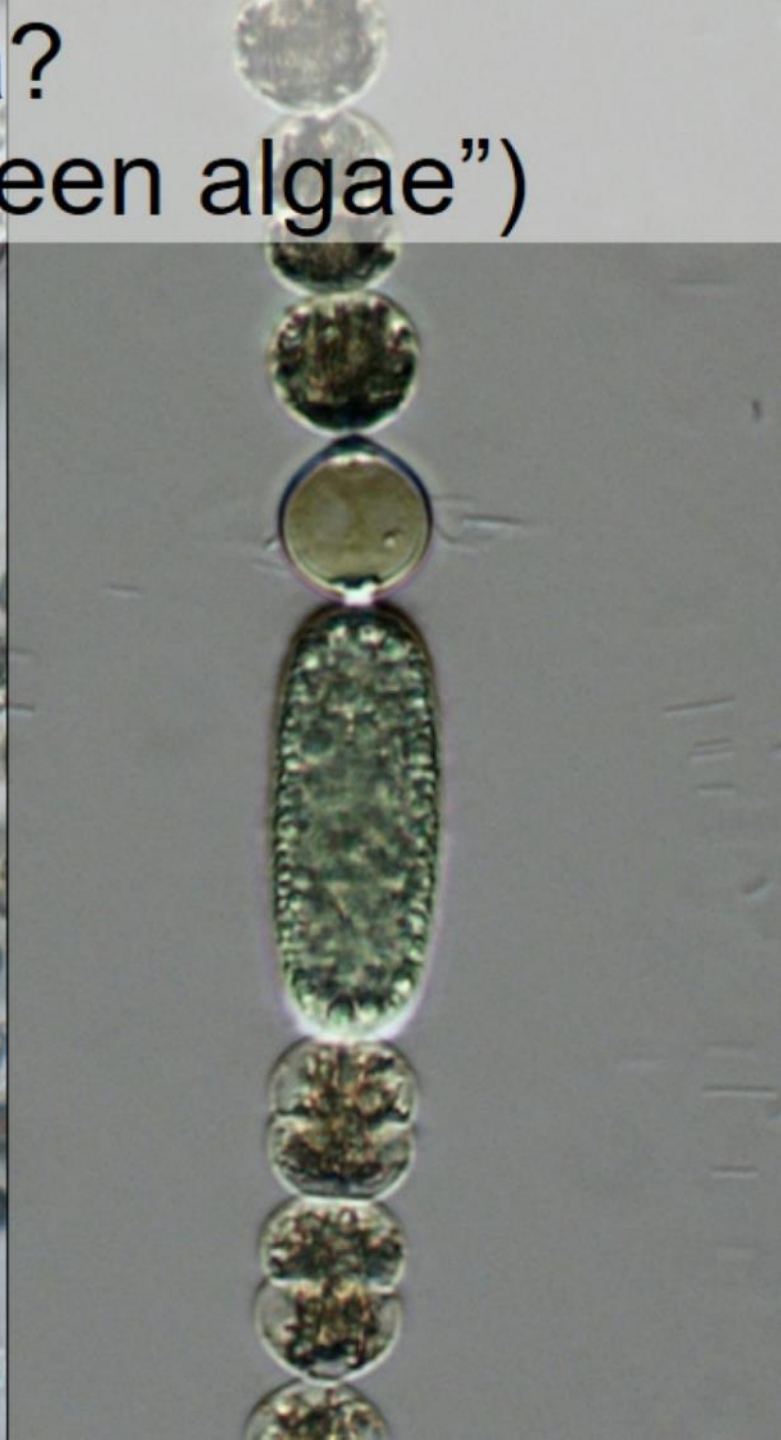
blue-green algae = cyanobacteria

bloom =

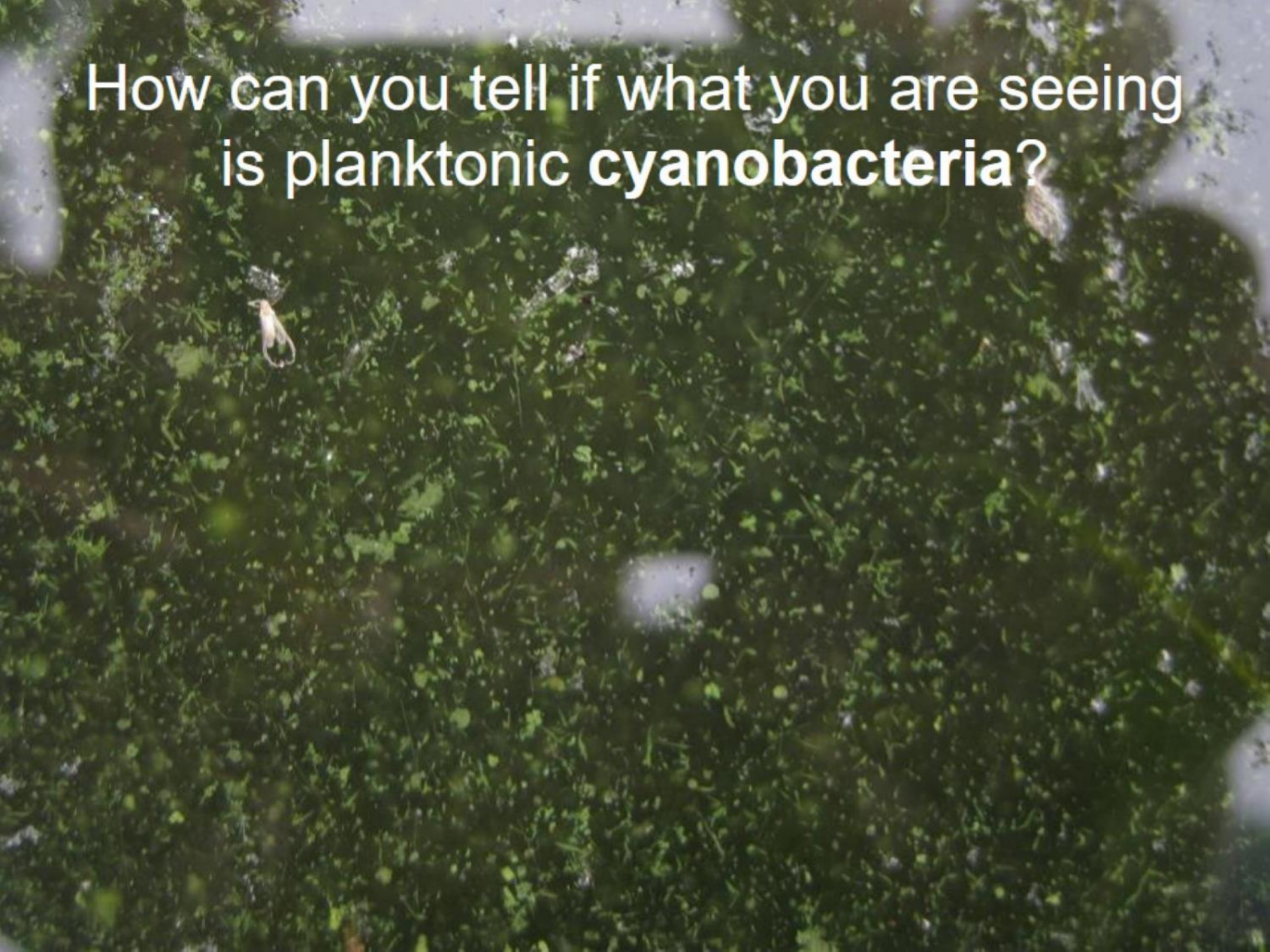
excessive growth to nuisance levels

Harmful Algal Blooms = HABs

What are cyanobacteria?
(also known as “blue-green algae”)



How can you tell if what you are seeing
is planktonic **cyanobacteria**?

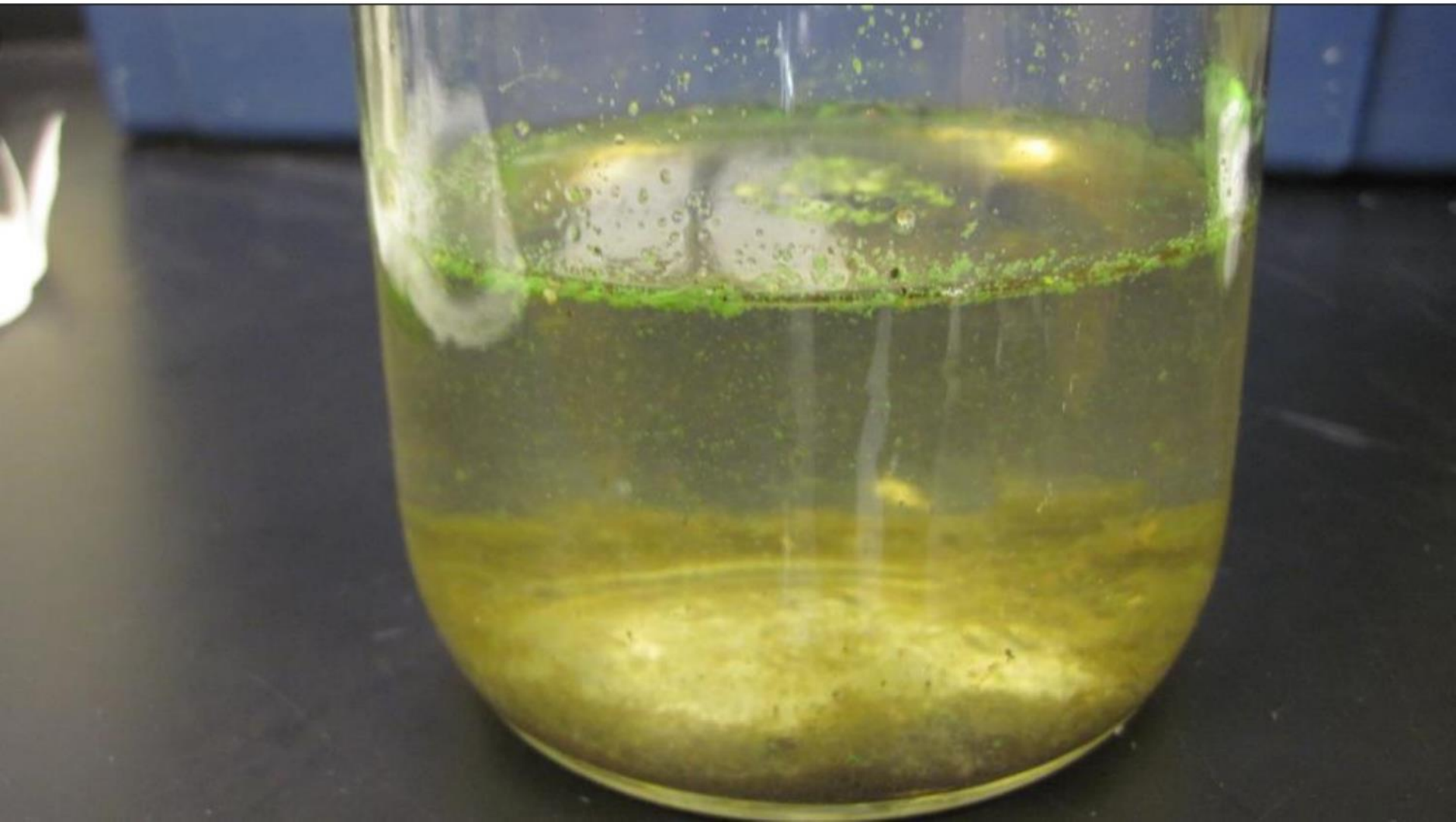




Look for tiny green specks in
water or green “dust” on surface
- this is **cyanobacteria / blue-green algae.**

How do I tell if I am seeing cyanobacteria or something else?

“Jar Test” – does it form a floating layer?



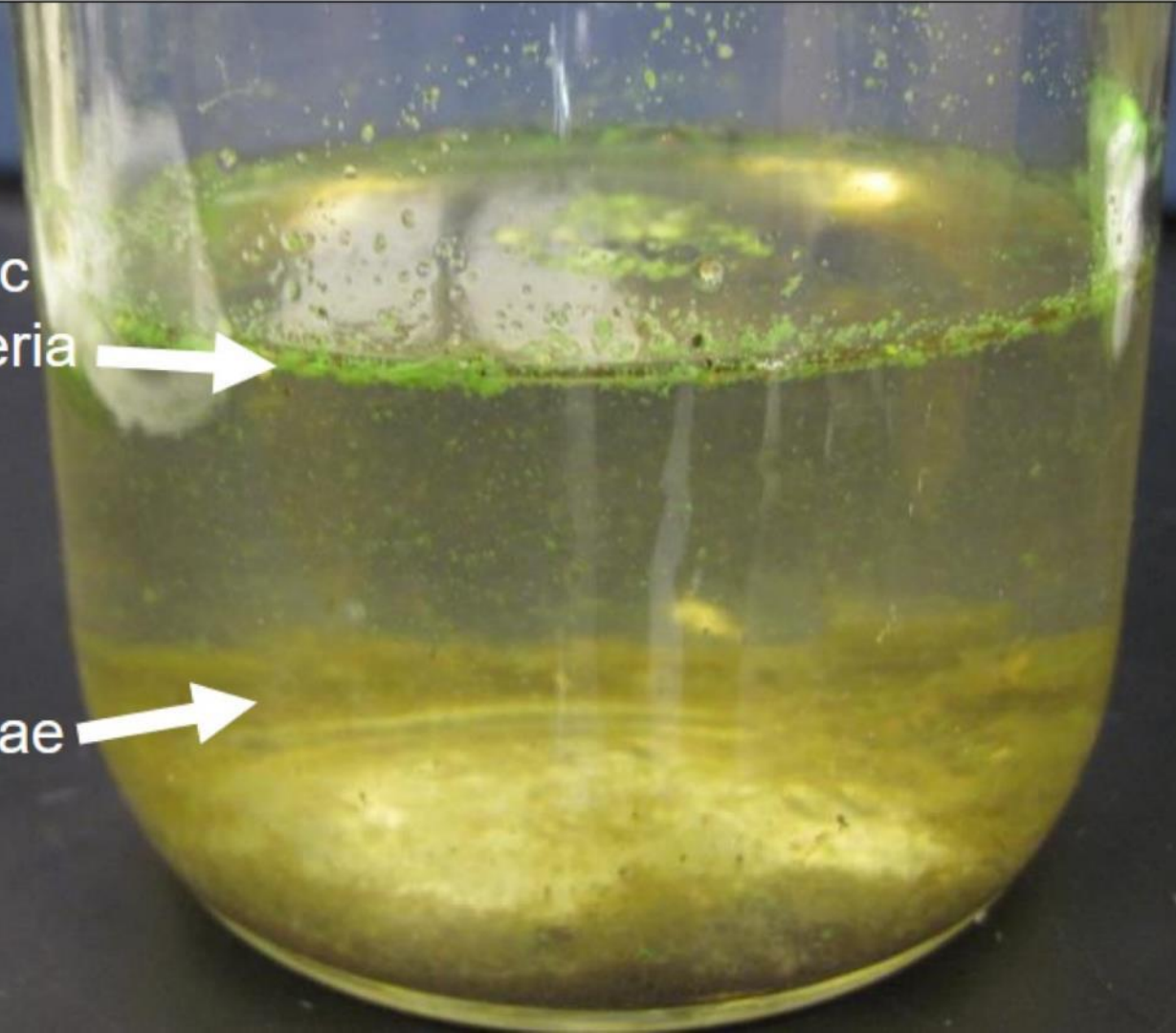
How do I tell if I am seeing cyanobacteria or something else?

“Jar Test” – does it form a floating layer?

Planktonic
cyanobacteria
float



True algae
sink



How do I tell if I am seeing cyanobacteria or something else?

“Jar Test” – does it form a floating layer?

Planktonic cyanobacteria



True algae



Minnesota Pollution Control Agency

“Simple, no-cost tests for blue-green algae”

(Search for “Minnesota jar test”)

tinyurl.com/y8jfxpg

Duckweeds have roots.

Watermeal has an oval or spherical shape but lacks roots.

Lemna, *Spirodela*, *Wolffia*
has roots has roots no roots

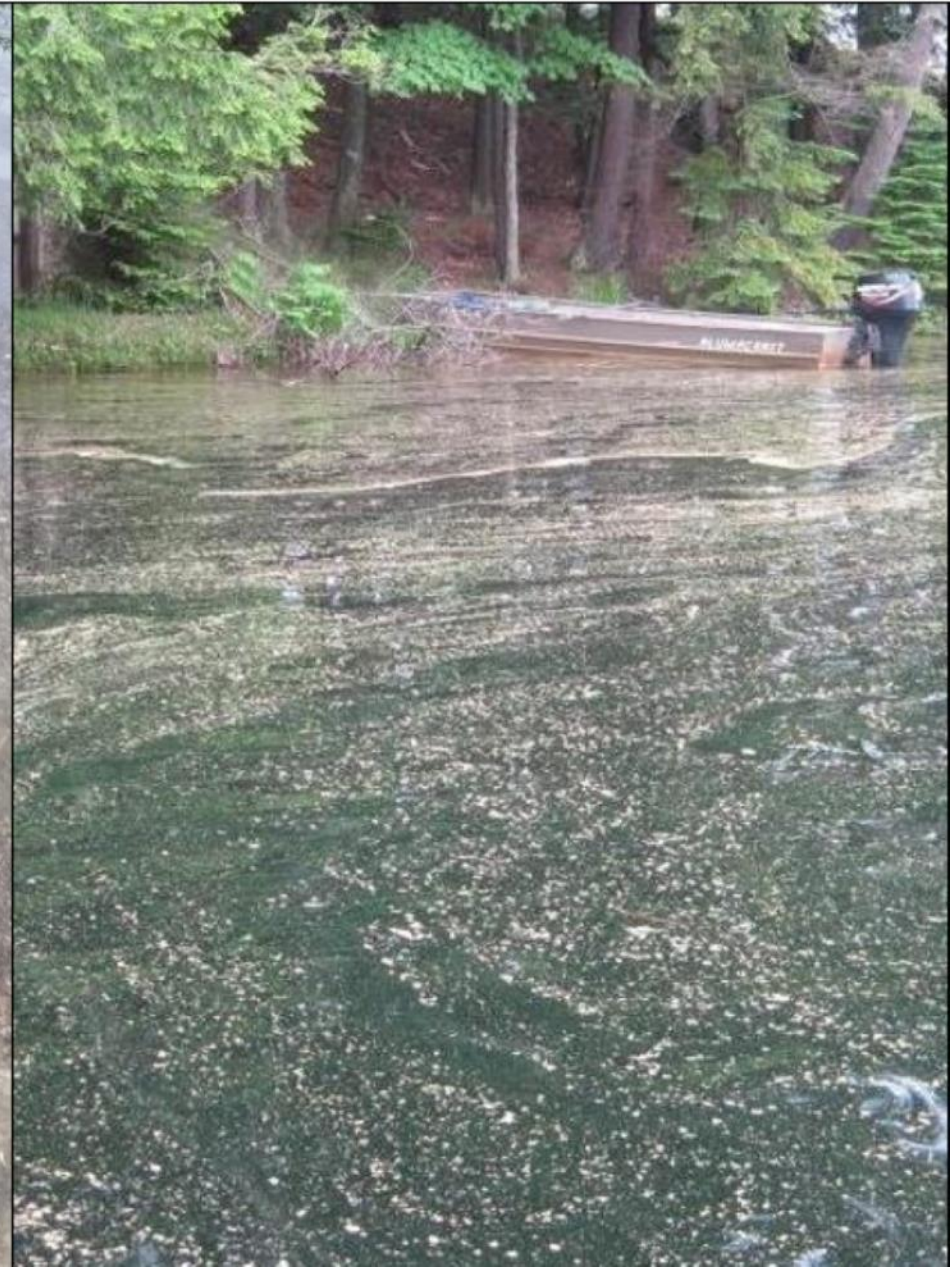


Virginia Tech Weed I.D. Guide

Watermeal (*Wolffia*)
Tiny, firm, grainy



Pollen can look like cyanobacteria, but it is pale yellow, and you will also see yellow dust accumulating on surfaces on land.



What about floating mats?



How do I tell if I am seeing cyanobacteria or something else?

“Stick Test” – is it filamentous green algae?
(there is 1 exception, so look at color too)



Minnesota Pollution Control Agency
“Simple, no-cost tests for blue-green algae”
tinyurl.com/y8jfxpg



M. Nault

Filamentous Green Algae



“pea soup” appearance:
cyanobacteria bloom



growing



J. Williamson

decomposing
pigments are released



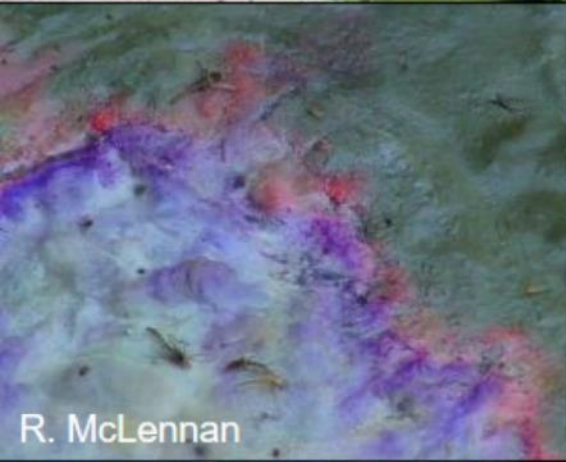
M. Meade

filamentous
green algae



B. Butterfield

Blooms may be many different colors.



What causes harmful blooms?

- Excess nutrients (P & N) fertilize growth
- Warm water and calm weather

The details are more complicated...



Bloom details are more complicated

- Physical: depth, flushing, shape
- Chemical: internal nutrient cycling, micronutrients, herbicides
- Biological: competition or allelopathy from plants; zebra mussels, carp
- Watershed: nutrient inputs

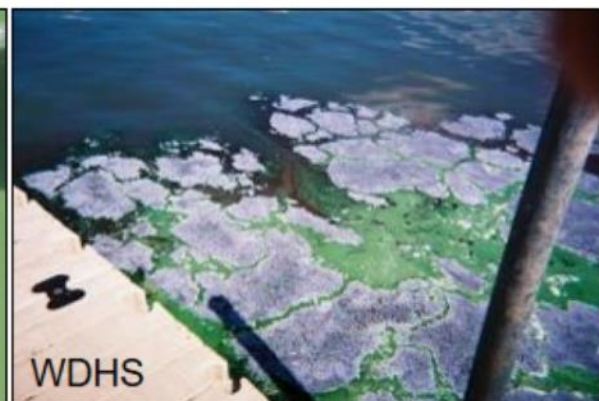
Wisconsin's Changing Climate

More frequent extreme precipitation, warmer water temperatures, and longer ice-free growing seasons promote cyanobacterial blooms.



Hazards of cyanobacterial blooms

- Impact aquatic food webs and oxygen levels.
- Some species can make liver, cell, or nerve toxins if conditions are right.
- Swallowing or inhaling toxins in water droplets can cause illness; they may irritate the skin in sensitive individuals.
- **Not all cyanobacteria make toxins, and toxins are not made all the time.**



Exposure Routes: Aerosolization by wind or waves?



Lake Erie north of Catawba Island
September 27, 2017

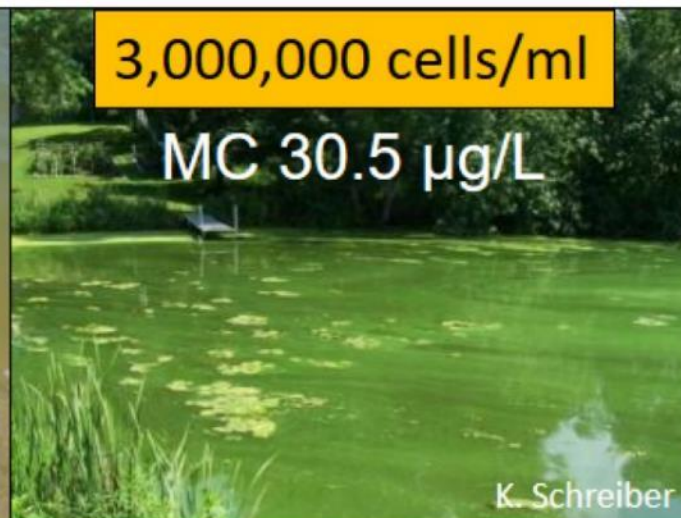
β -*N*-methylamino-L-alanine (BMAA)

- Amino acid; made by cyanobacteria.
- Linked to neurodegenerative diseases via chronic exposure.
- Other environmental exposures may play a role.
- There may be a genetic component to vulnerability - Cox 2009.
- Not all evidence supports link to neurodegenerative diseases.
- Lack of verified testing methods across studies.
- Exposure studies used dosing beyond environmentally relevant levels.
- Reviewed in Chernoff et al. 2017.

WHO Recreational Guidelines

Probability of Adverse Health Effects	Cell Density (cells/ml)	Microcystin-LR ($\mu\text{g/L}$)	Chlorophyll ($\mu\text{g/L}$)
Low	< 20,000	< 10	< 10
Moderate	20,000-100,000	10 – 20	10 – 50
High	100,000-10,000,000	20 – 2,000	50 – 5,000
Very High	> 10,000,000	> 2,000	> 5,000

Graham *et al.* 2009, based on WHO 2003 *Guidelines for Safe Recreational Water Environments*



US EPA *Draft* Recreational Guidelines

Draft Recreational Advisory Levels for Cyanotoxins	
Microcystins (MC)	Cylindrospermopsin (CYN)
8 µg/L	15 µg/L

Swimming Advisory: not to be exceeded on any day
(also dually proposed as Ambient Water Quality Criteria)

- Based on toxins' **chronic** effects on target organs (liver, kidney), not on **acute** effects (e.g., allergic reactions, vomiting, diarrhea).
- Take children's smaller size into account.
- Not enough data to determine cell densities or pigment levels (chlorophyll or phycocyanin) correlated with these toxin concentrations.

Who issues advisories or closes beaches in Wisconsin?

Chapter 254.46 Beaches. The department or a **local health department** shall close or restrict swimming, diving and recreational bathing if a human health hazard exists in any area used for those purposes on a body of water and on associated land and shall require the posting of the area.



DNR has the responsibility for advisories and beach closures at State Park and State Forest properties.

Monitoring Blooms for Recreation

- Most likely at public beaches, not other areas of lakes.
- Blooms may change significantly between time of sample collection and when testing results are available.
- Posting advisories should be left to public health officials.

You can see the blooms that are of highest concern

Planktonic (free-floating) blooms are visible either as surface scums or mixed into water in high concentration (“pea soup” appearance)

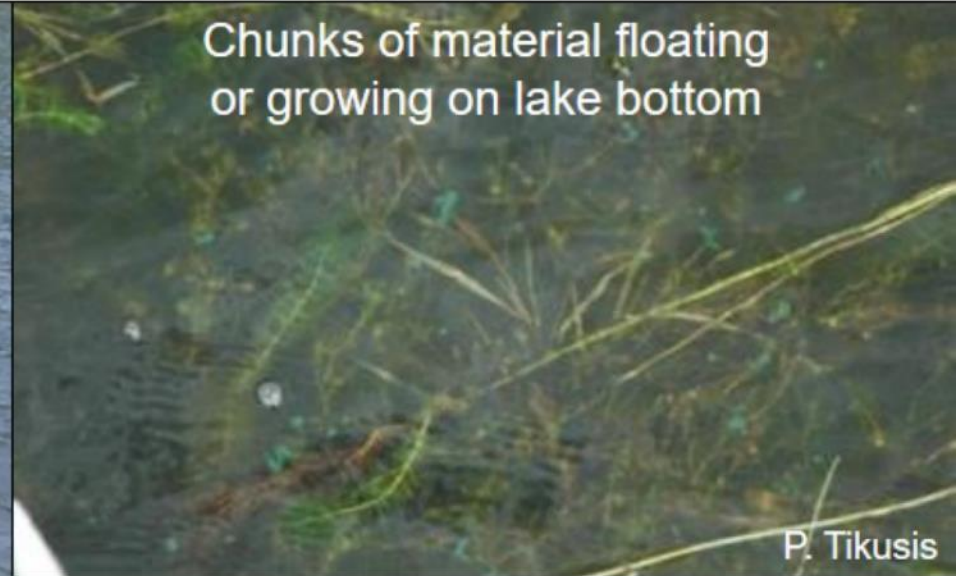


What about other situations?

Blooms patchy or in small areas

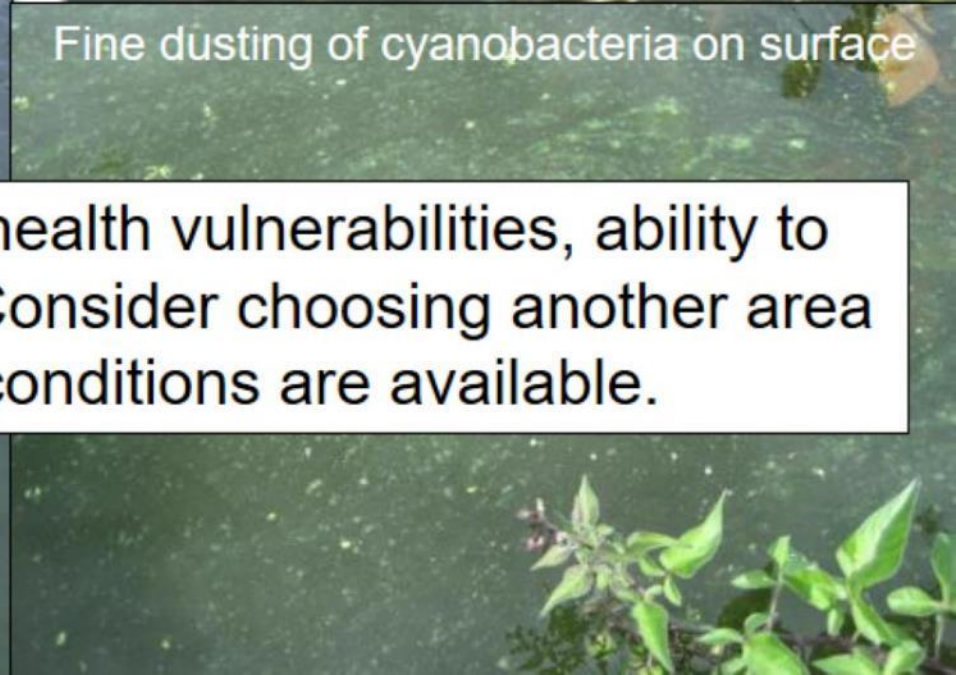


Chunks of material floating or growing on lake bottom



P. Tikusis

Fine dusting of cyanobacteria on surface



Judgment call – account for health vulnerabilities, ability to keep water out of the mouth. Consider choosing another area for recreation if better conditions are available.

How to be safe?

- Avoid swimming in and boating through blue-green algal scums and “pea soup” water.
- **Can you see your feet in knee-deep water?** If not, avoid ingesting any water.
- Choose the **clearest** water possible for small children and pets.
- Always shower after swimming in a lake, river, or pond.
- Try to avoid swallowing water, no matter how clean it looks (especially after a rainstorm!)



K. Schreiber, WDNR



**When in doubt,
keep out!**

Keep your pets safe!

- Animals don't instinctively know if water is safe.
- Provide clean drinking water.
- Keep pets out of scummy water, and wash them off immediately after they swim.
- Don't allow dogs to eat dried scum on shore or floating mats.
- Don't irrigate lawns with scummy water if pets eat grass.



How do we get rid of it?



Control or treatment: there is no silver bullet

- Consideration of any treatment has to take other uses and non-target organisms into account.
- Any treatment should not induce toxin release.
- Any treatment needs to have peer-reviewed scientific studies demonstrating efficacy in large systems and safety for non-target organisms.
- Effective treatments will likely involve multiple methods, including reduction of nutrient input.

Cyanobacteria Assessment Network

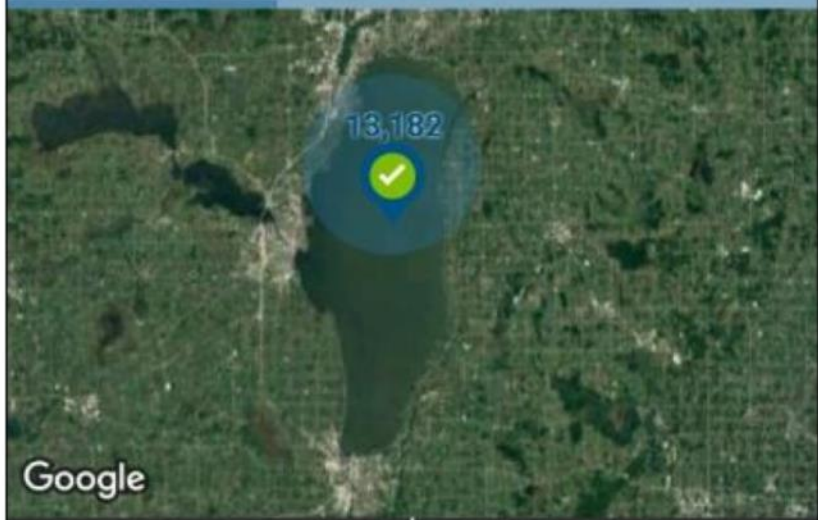


EPA, NASA, NOAA, & USGS

Data from NASA/USGS
LANDSAT & European Space
Agency Sentinel satellite
missions

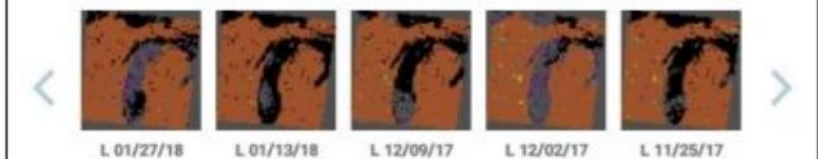
Most inland lakes are too
small for satellite monitoring.
**Toxins cannot be detected
via remote sensing.**

Android app in beta testing,
public release in 2019.



Satellite:OLCI Product:Cyano

↓ 71,931 cells/mL since previous data (Max: 58,884, Valid: 7)



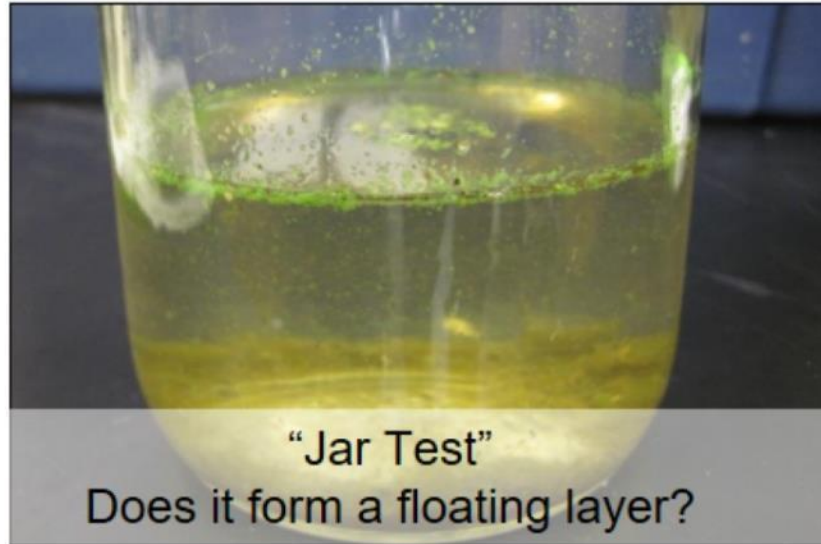
Composite cyanobacteria cell count maximums (over 1 week) are updated weekly.

Caveats:

Lag in data availability from ESA.
Thin clouds & ice may register as blooms.
Data better for lakes > 900m (0.56 mile).
Data are most reliable for open water in the middle of a lake. Pixels containing land & water are not accurate so this is not suitable for assessing blooms near shore.

Consider this a research level tool.

How can I help track blooms in Wisconsin?



Please let the DNR know about significant bloom events!
DNRHABS@wisconsin.gov

Bloom location, size, duration, photos

- DNR cannot test for each bloom, but knowledge of blooms helps us to track where HABs are a public health burden.
- Most bloom-tracking apps/websites DO NOT report to DNR.
- The exception is bloomWatch: <https://cyanos.org/bloomwatch/> BUT follow-up information by states to bloom reporters is not supported.

