

Harmful Cyanobacterial Blooms: An Emerging Public Health Issue in Wisconsin's Waters



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Wisconsin Department
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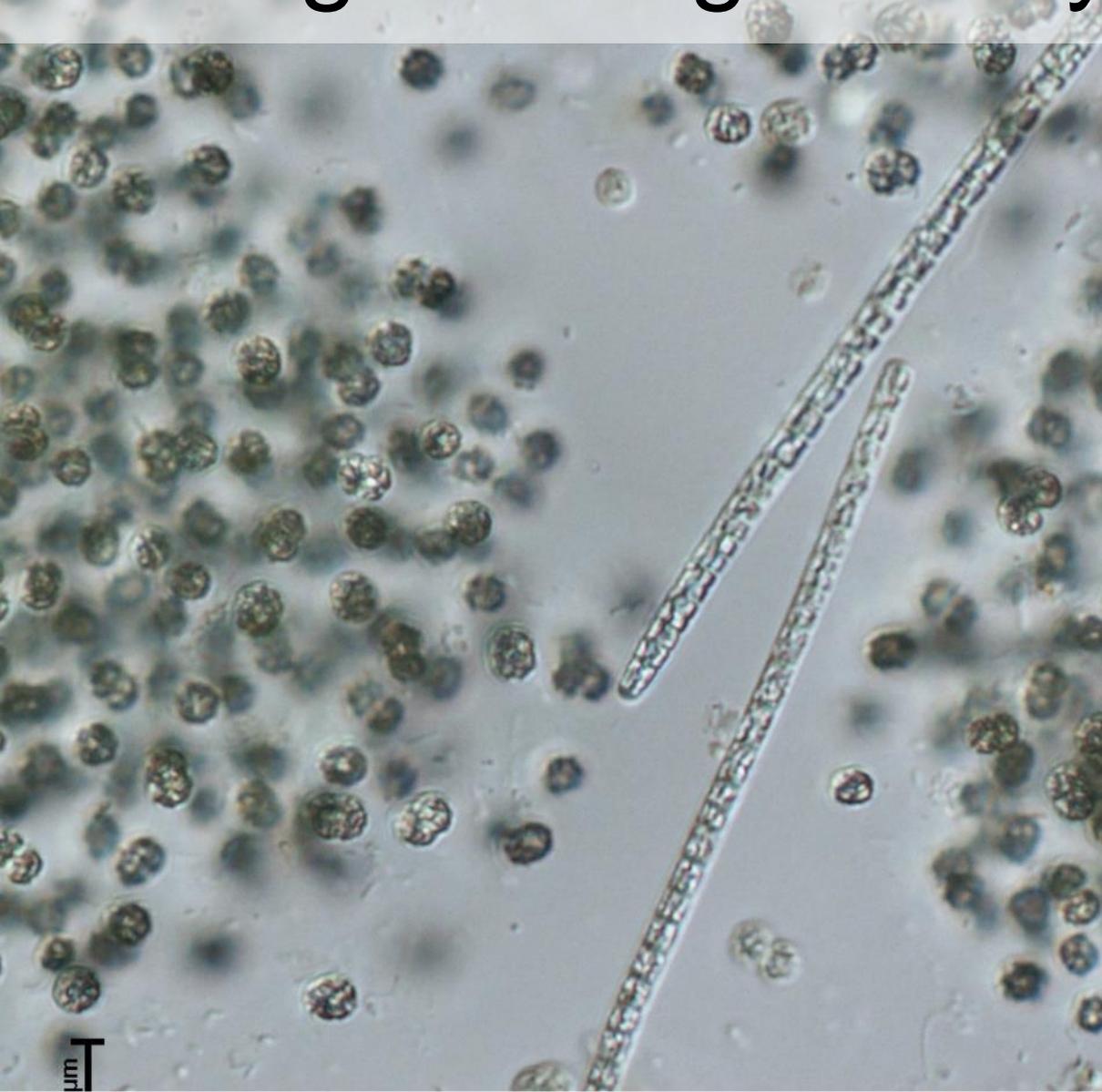
Amanda Koch

Wisconsin Division of
Public Health



Wisconsin Waters 2020: Focusing on Resilient Lakes & Rivers

Blue-green Algae = Cyanobacteria

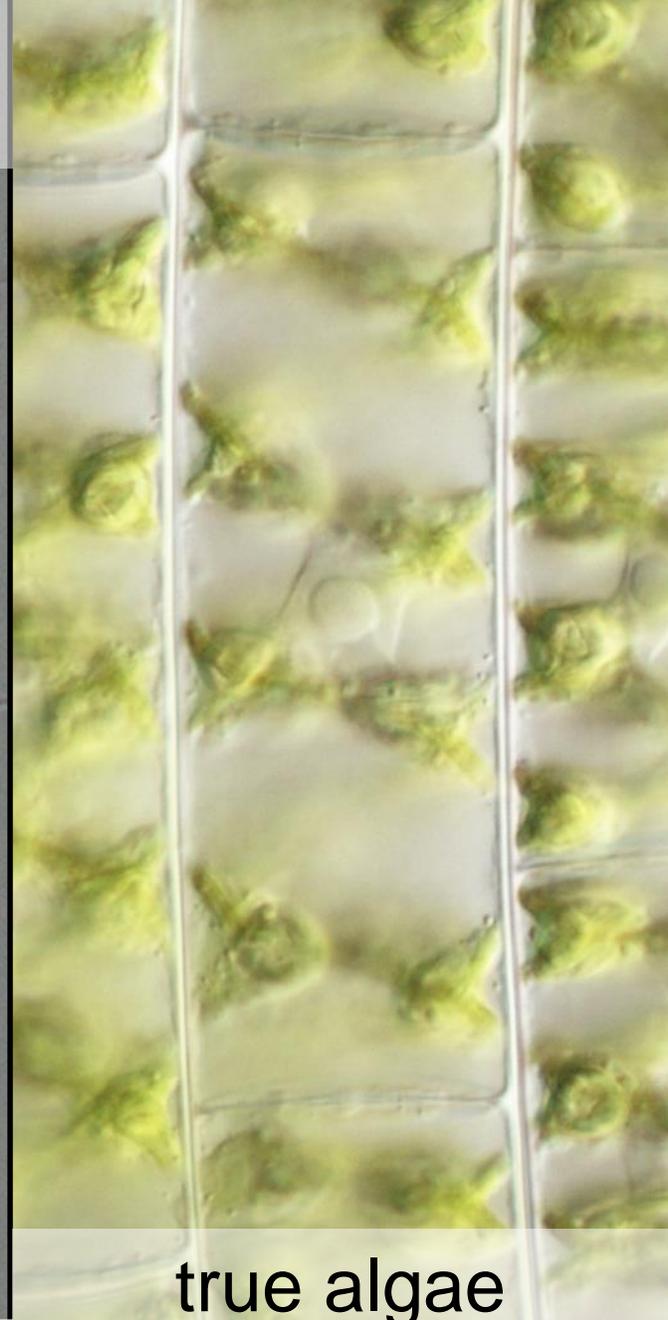


10 μm

cyanobacteria



cyanobacteria



true algae
(*Spirogyra*)

What is a bloom?

Bloom = excessive growth to nuisance levels.
Harmful Algal Blooms = HABs.
No official quantification exists.

Blooms: Planktonic



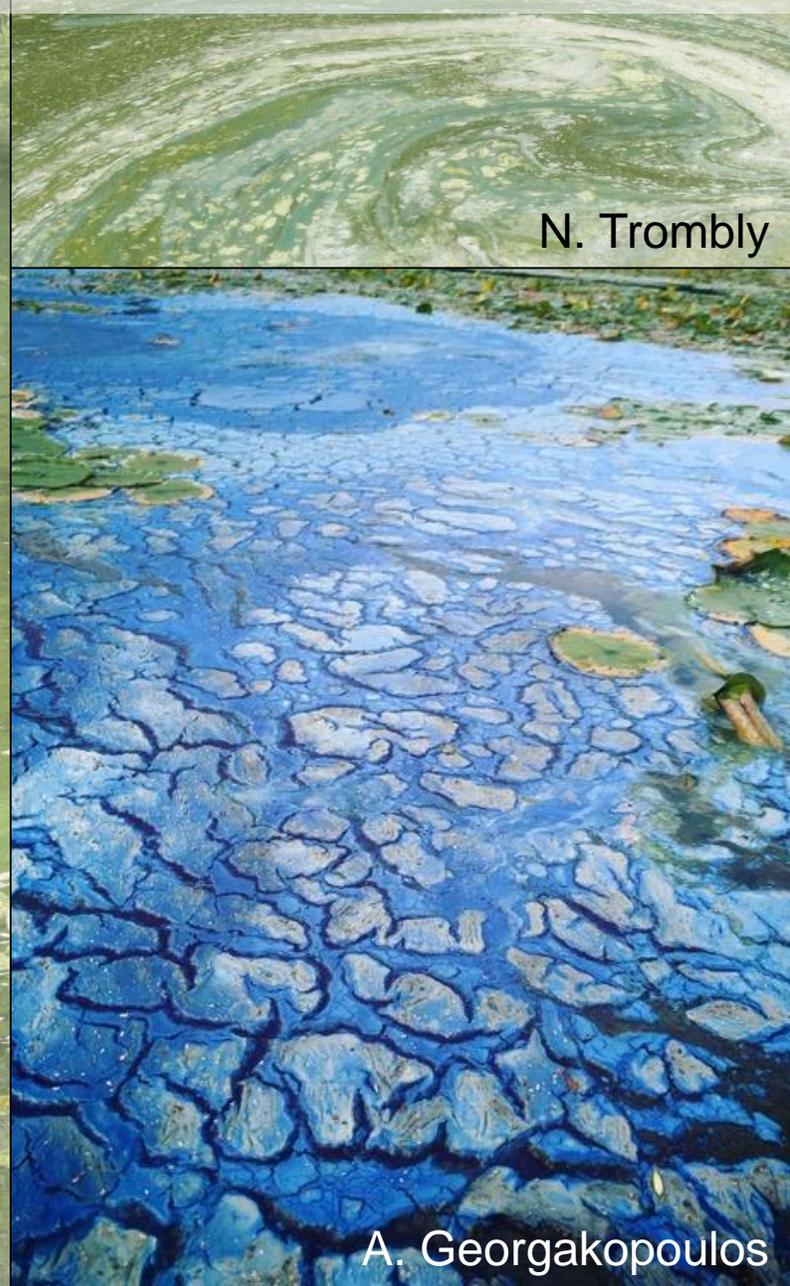
Blooms: Planktonic Scums (“spilled paint”)



J. Lepsch



T. Johnson



N. Trombly

A. Georgakopoulos

Blooms: Wind-driven Accumulations



S. Prellwitz



S. Giblin

Blooms: Floating Mats from the Lake Bottom



“pea soup” appearance:
cyanobacteria bloom

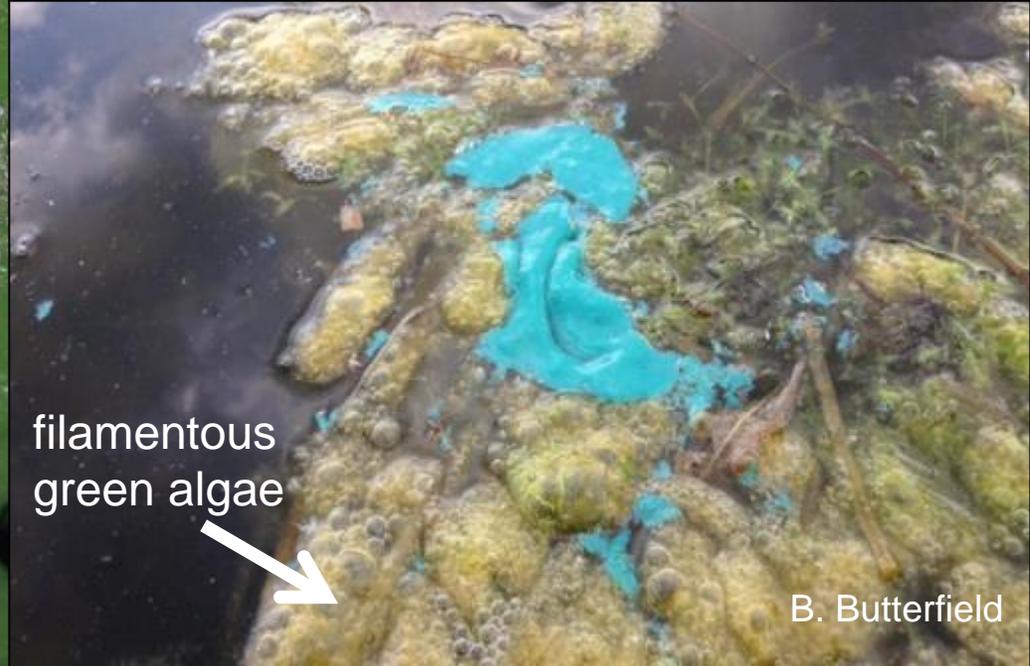


decomposing
pigments are released



M. Meade

filamentous
green algae



B. Butterfield

Blooms may be many different colors.

Unknown CLA Volunteer



R. McLennan



N. Trombly



T. Moris



DLSD



J. Williamson



WDHS



J. Williamson



A. Dryja



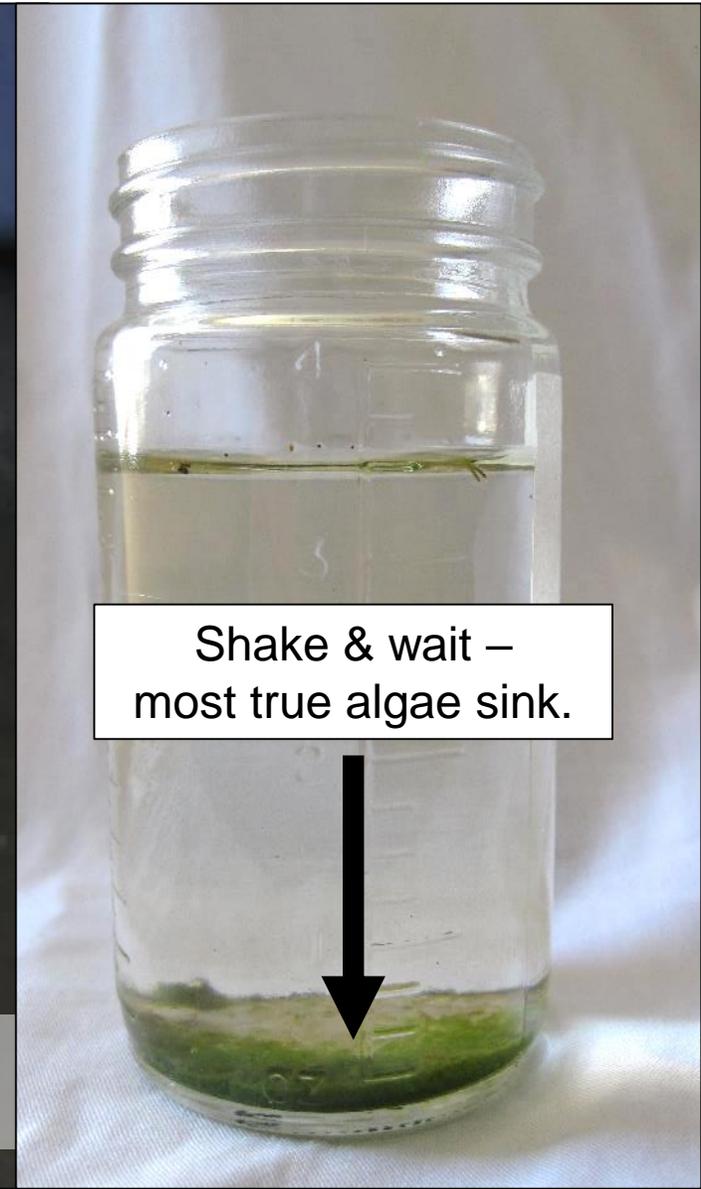
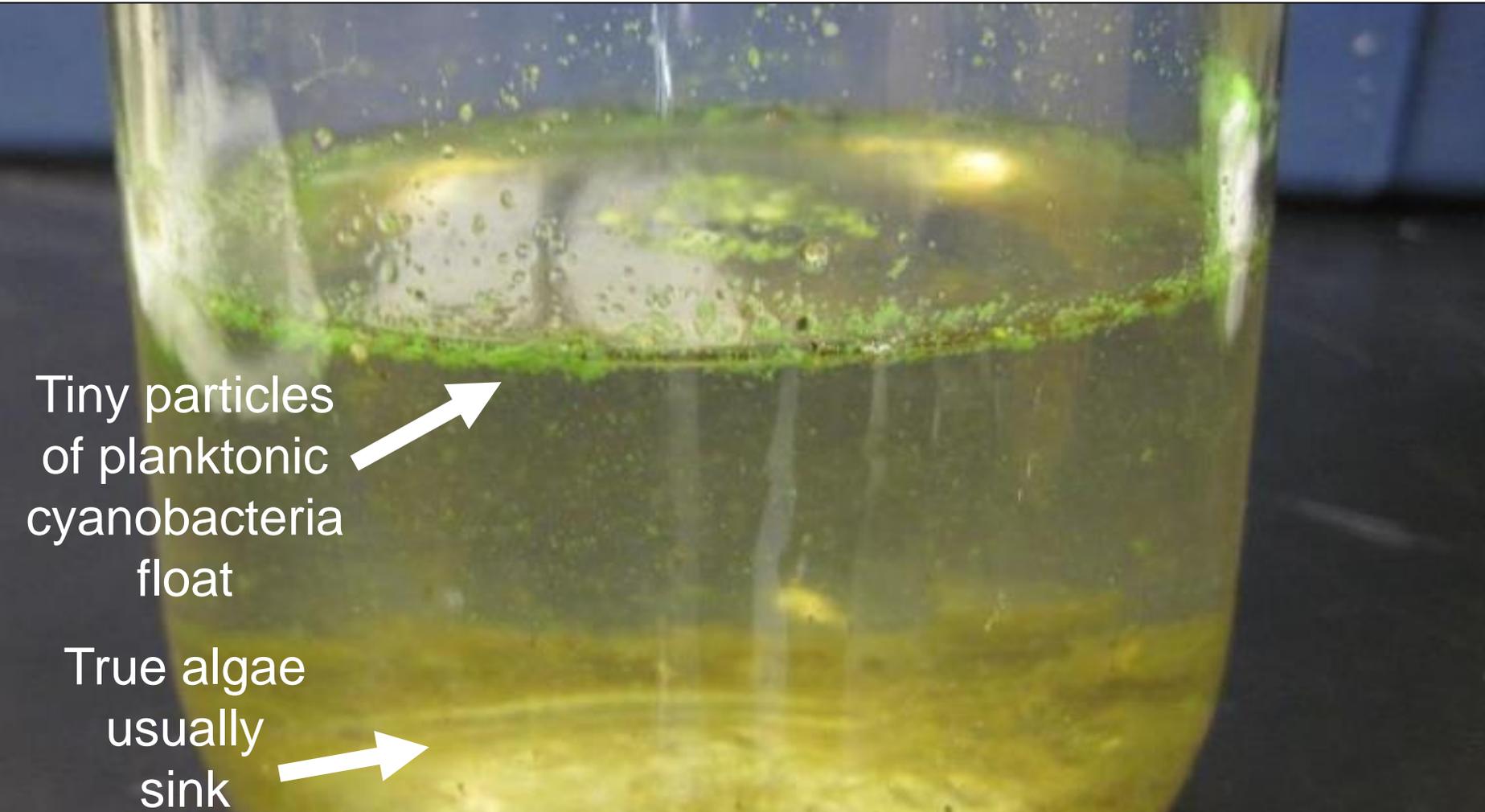
Finn Ryan, yaharaproject.org



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

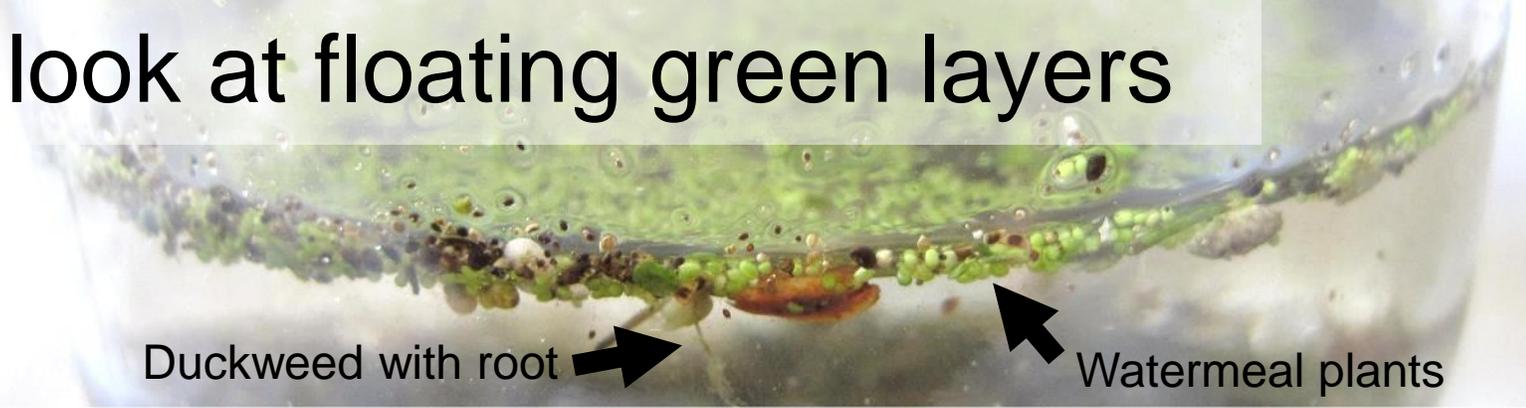
Look for tiny green specks in
water or green “dust” on surface
- this is **cyanobacteria / blue-green algae**.

How do I tell if I am seeing cyanobacteria or something else? “Jar Test” – does it form a floating layer?



Minnesota Pollution Control Agency “Simple, no-cost tests for blue-green algae”
(Search for “Minnesota jar test”) tinyurl.com/y8jfxxpg

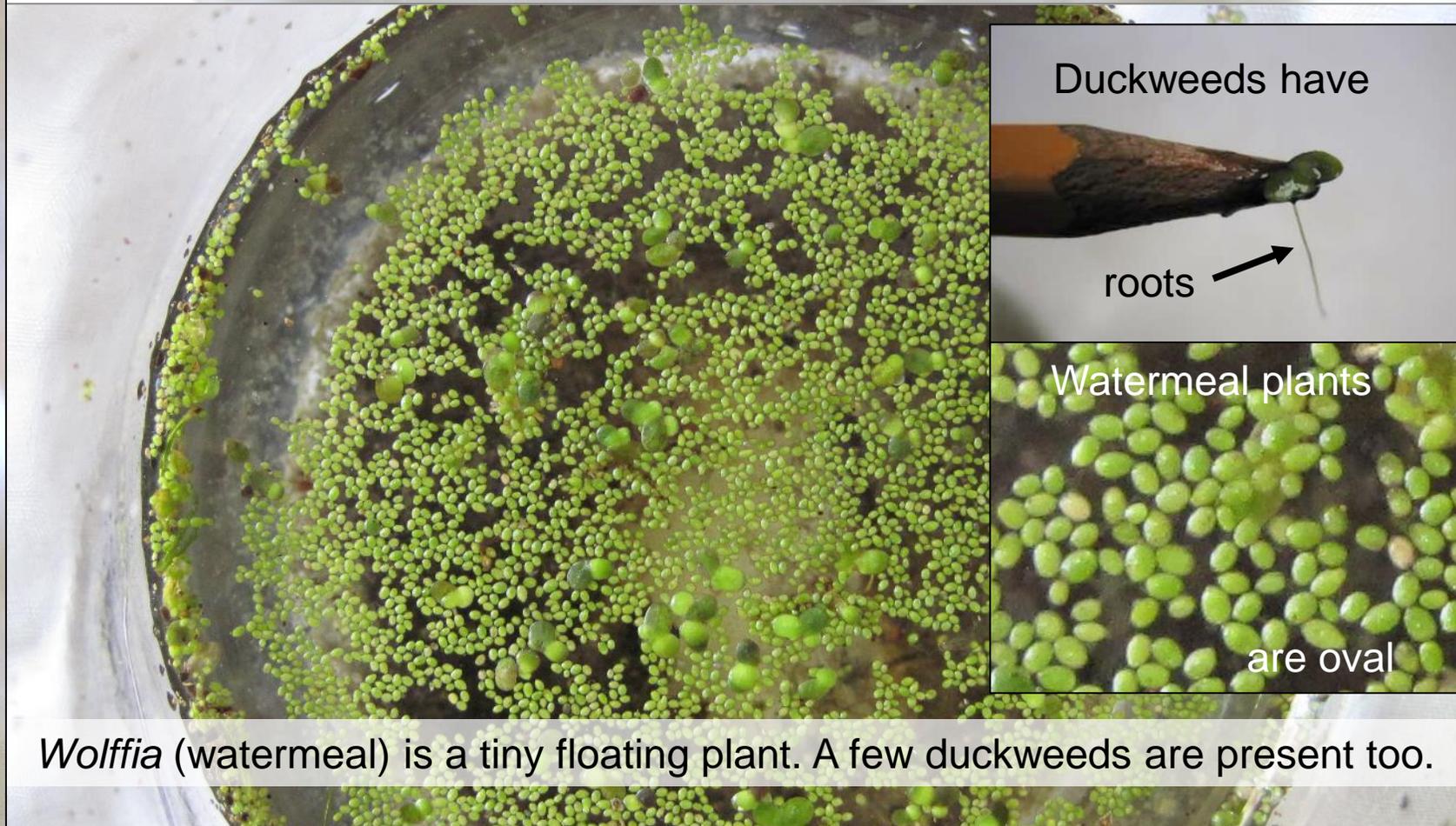
Take a close look at floating green layers



Duckweed with root

Watermeal plants

Green layer floats, but contains tiny leaf green plants with regular outlines.



Duckweeds have

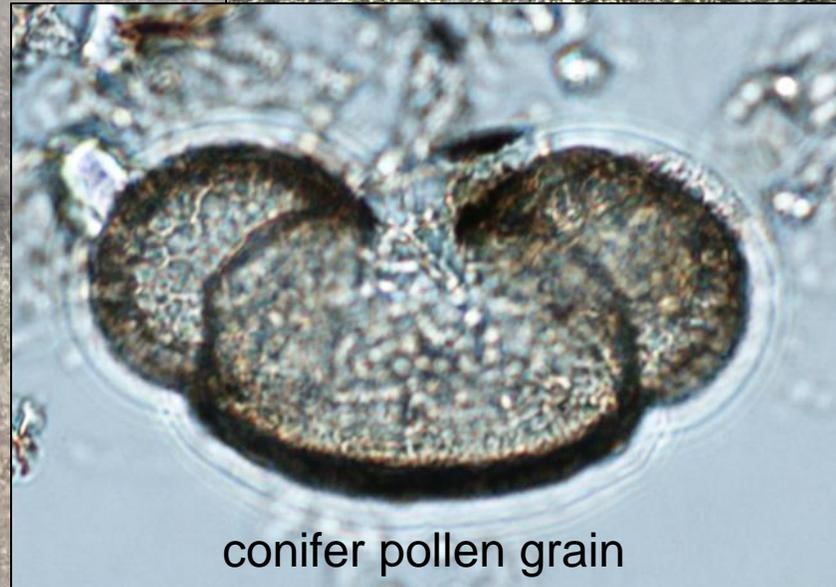
roots

Watermeal plants

are oval

Wolffia (watermeal) is a tiny floating plant. A few duckweeds are present too.

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

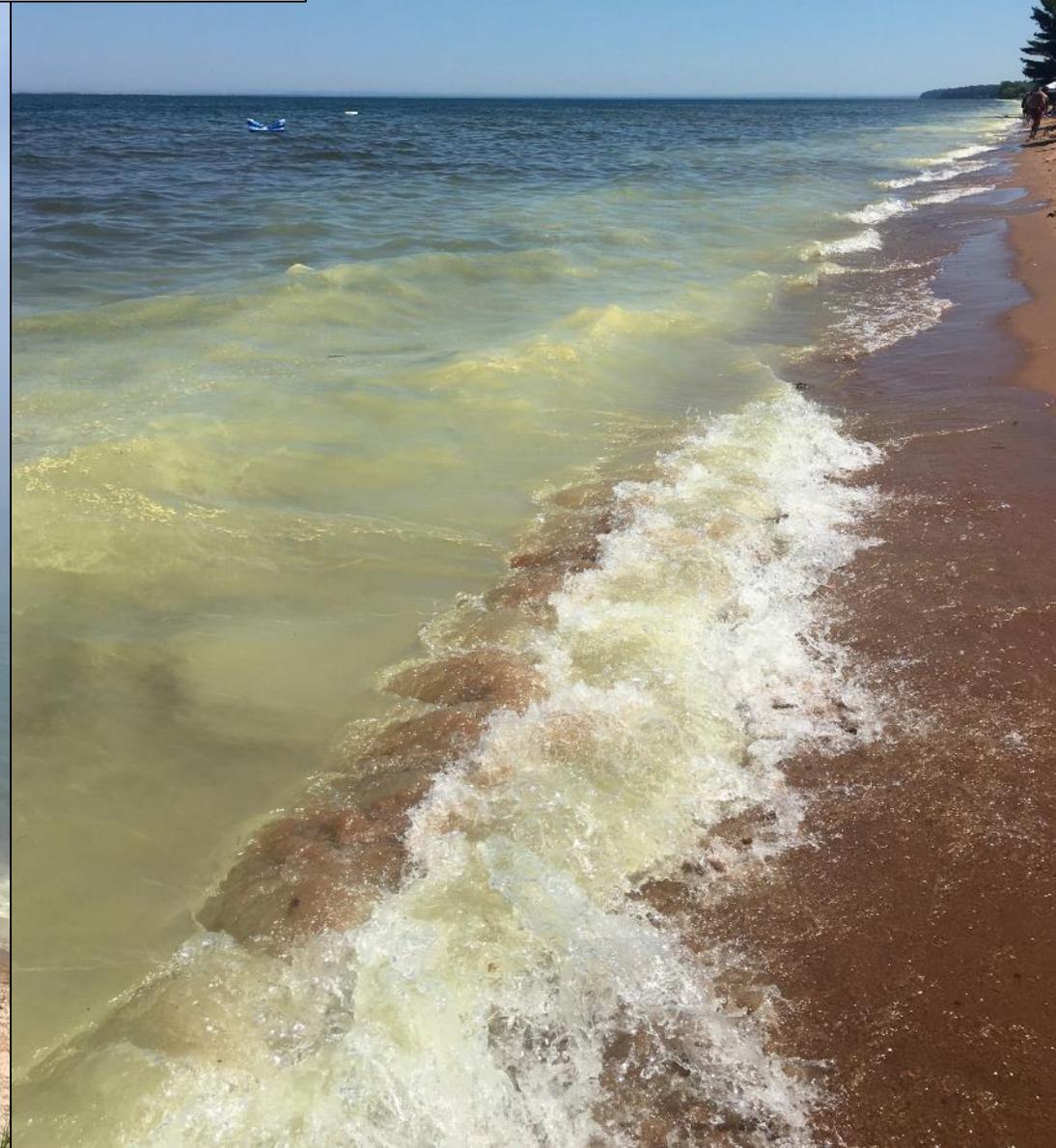


conifer pollen grain

Lake Michigan 2019
K. Larson

Great Lakes aren't immune to pollen accumulations

Lake Superior 2019
C. Dray

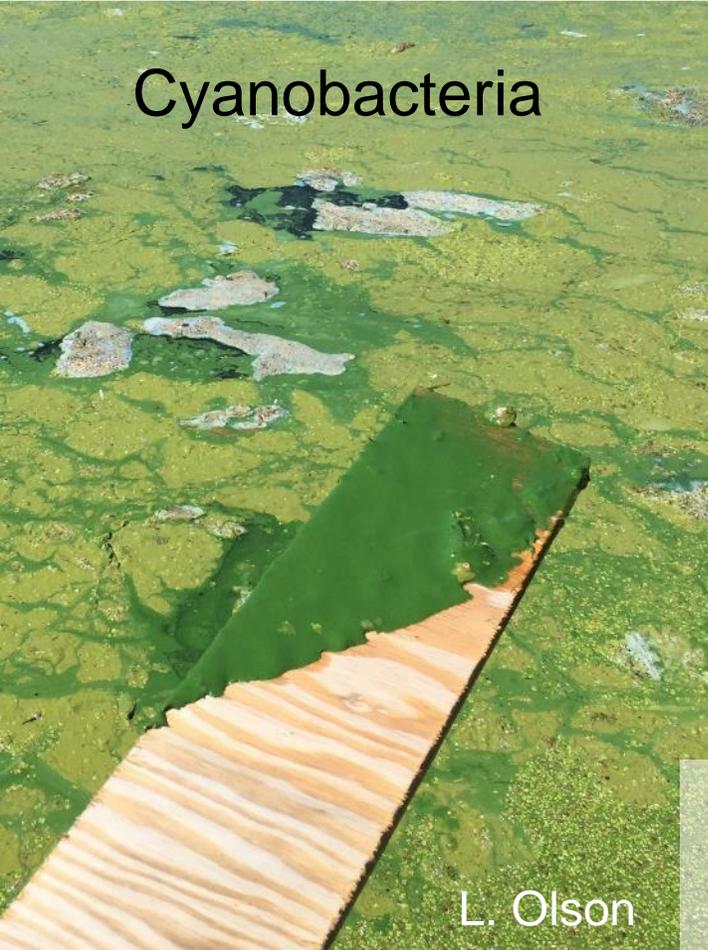


What about floating mats?



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

“Stick Test” – does it coat a stick like paint?
Does it drape over a stick like green hair?
(There is 1 exception, so look at color.)



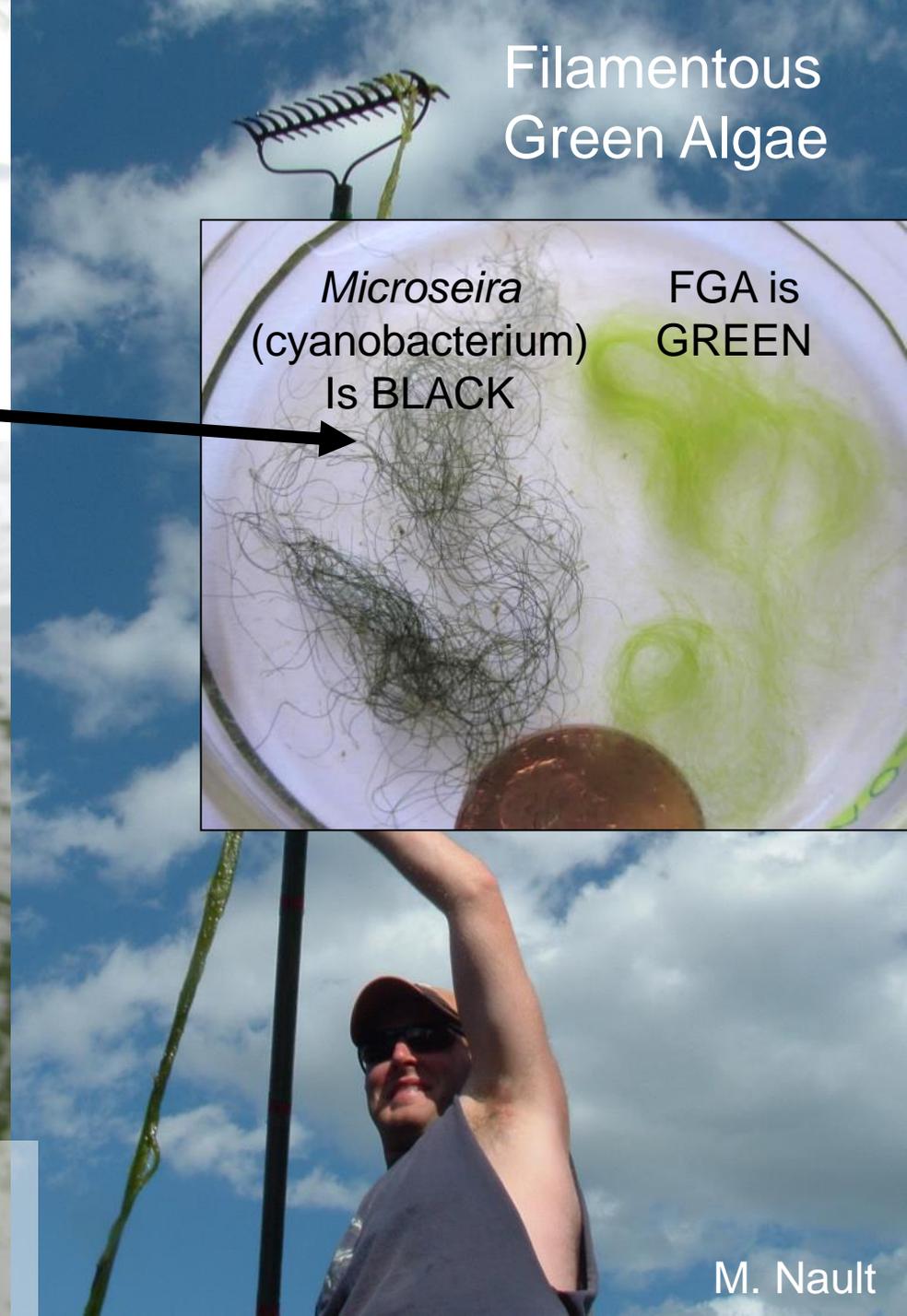
Cyanobacteria

L. Olson



Filamentous Green Algae

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



Filamentous Green Algae

Microseira
(cyanobacterium)
Is BLACK

FGA is
GREEN

M. Nault

What causes harmful blooms?

- Excess nutrients (P & N) fertilize bloom growth.
- Warm water and calm weather promote scums.
- Shallow reservoirs and impoundments may be particularly vulnerable to blooms.

ANY waterbody can have a bloom because cyanobacteria are in ALL waterbodies.

What is the DNR doing to prevent HABs? Nutrient reduction efforts.

Once nutrients like phosphorus get into a lake, they are very difficult to remove.

It's not just the DNR! Point source regulation and non-point BMPs are implemented through cooperation of:

Municipalities

Counties

Producers

Land & Watershed Groups

UW-Extension

State & Federal Agencies

**Nutrient reduction efforts are not a “quick fix”
and it takes time to produce results.**

dnr.wi.gov/topic/SurfaceWater/nutrientstrategy.html

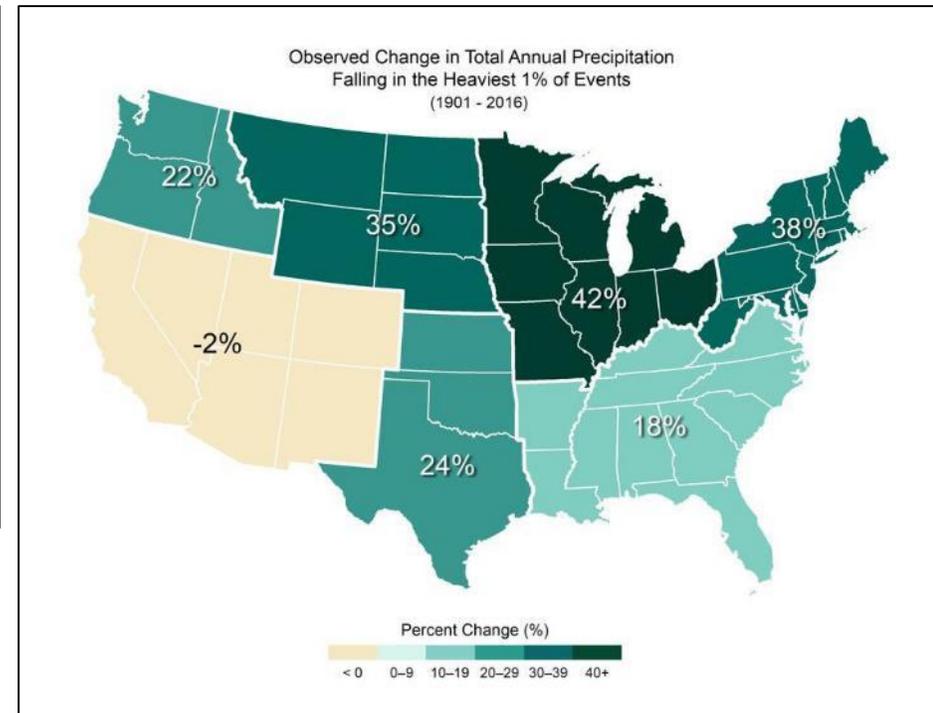
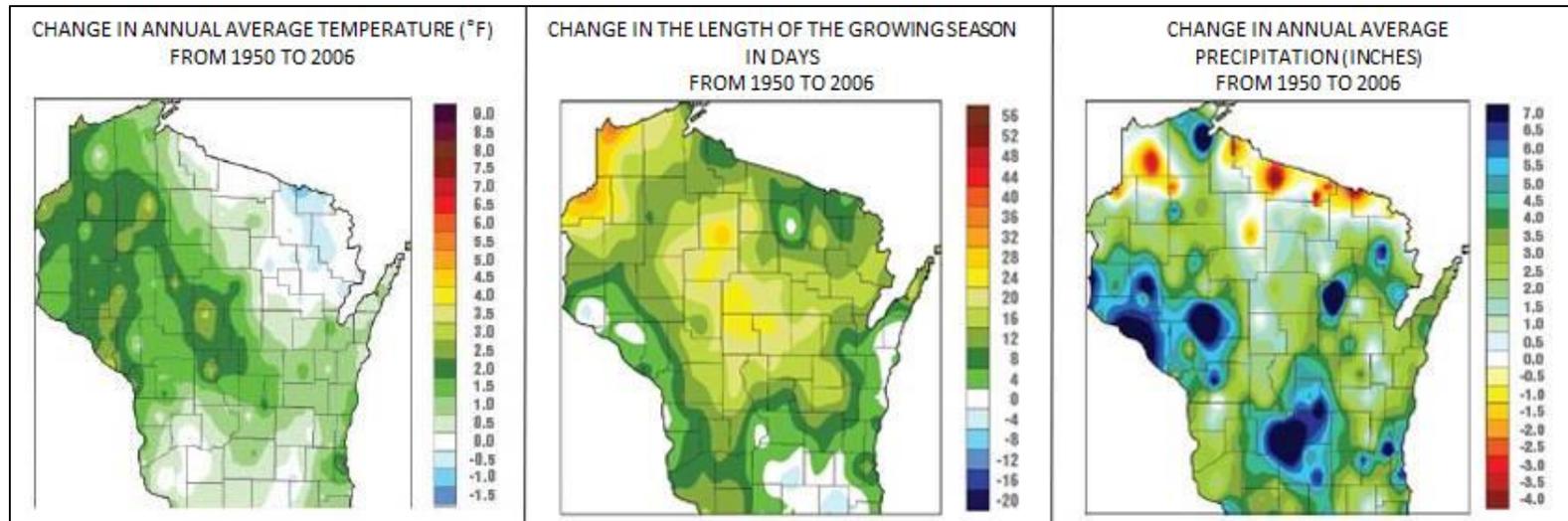
When HABs occur, how can we get rid of them?

Carefully evaluate bloom control & bloom removal claims.

- Independent peer-reviewed science?
- Effects on non-target organisms or other lake uses?
- Scalable beyond the lab or small ponds?
- Pseudo-science?
- Can the method result in toxin release?
- Effective treatments will likely involve multiple methods, including reduction of nutrient input -- there is no “silver bullet.”

Are blooms more frequent?

More rain falling in single-day events
in 1986-2016 compared to 1901-1985



- Yes – worldwide evidence
- Warmer water temperatures
- Longer ice-free growing season
- Heavy rains & snowmelt: extra nutrients

Midwest: **42%** increase in
heaviest single-day events
in past 30 years

U.S. Global Change Research Program
GlobalChange.gov

Wisconsin Initiative on Climate Change Impacts 2011:
Wisconsin's Changing Climate: Impacts and Adaptations

How can I help?

- Decrease runoff (& nutrients) into lakes.
- Inspect & maintain septic systems.
- Manage aquatic plants responsibly.
- Prevent the spread of aquatic invasive species.
- Keep leaves & yard waste out of streets.

Healthy Lakes Program of WI. Lakes

https://healthylakeswi.com

ABOUT ▾ BEST PRACTICES ▾ GRANTS ▾ RESULTS ▾ RESOURCES ▾

healthylakeswi.com

350 FT² N

Improve wildlife habitat, natural beauty, and privacy, and decrease runoff.

Native Plantings include grasses and wildflowers with shrubs and trees. Choose an option based on your property and interests – from bird/butterfly habitat to a low-growing garden showcasing your lake view.

[LEARN MORE](#)

 I own lakeshore property.

You can make a difference. Learn about Healthy Lakes best practices for your property and how to find help.

[Get Started](#)

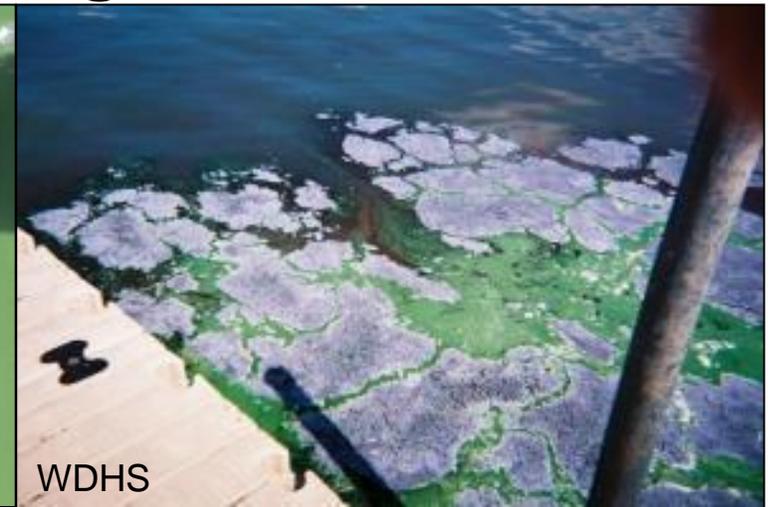
 I'm an eligible grant applicant.

Qualified lake associations, lake districts, municipalities, and tribal governments can apply for Healthy Lakes grant funding on behalf of multiple lakeshore property owners.

[Get Started](#)

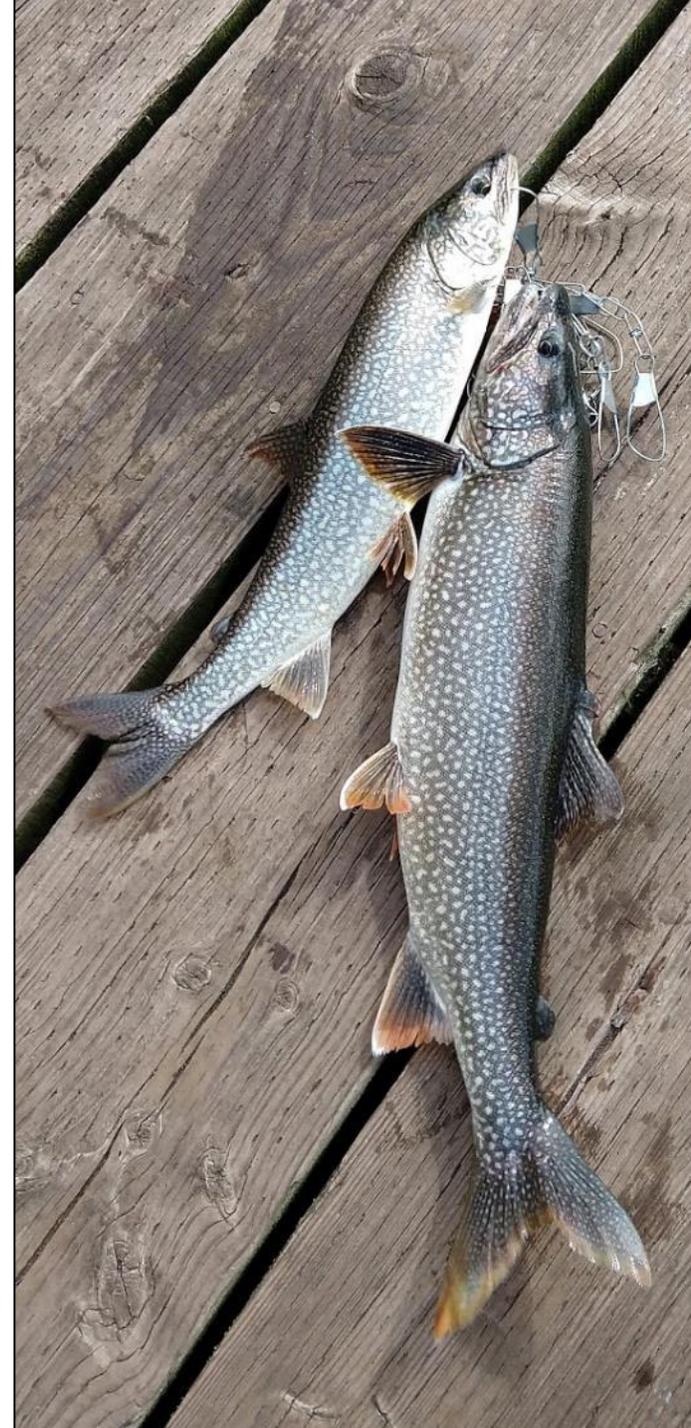
What We Know: Exposure Routes & Toxins

- Ingestion, inhalation, skin exposure
- Liver & kidney toxins: microcystin & cylindrospermopsin
- Neurotoxins: anatoxins and saxitoxin
- Dermatotoxins: lipopolysaccharides
- **Not all cyanobacteria make toxins, and toxins are not made all the time.**
- **You can't tell if toxins are present by looking at a bloom.**



Toxin Research: Fish Consumption

- Not all of the health risks from cyanotoxins in fish are currently known.
- Toxins may accumulate in organs, so only eat fillets.
- Rinse fillets well with clean water before cooking or freezing.
- Fish from waters with recurring blooms may have off-flavors from taste & odor compounds.
- Oregon Health Authority fact sheet:
<https://tinyurl.com/yywwbvdv>
(search for “Oregon Health fishing algae”)



Toxin Research: Aerosolization by wind or waves as an exposure route

Great Lakes: May et al. 2018 Environ. Sci. Technol. 52:397-405

-- HAB material assessed in lab-generated aerosols

Inland lakes: Olson et al. 2020 Environ. Sci. Technol. 18 Mar 2020

-- microcystin detected in lab-generated aerosols

Toxin Research: β -*N*-methylamino-L-alanine (BMAA)

Non-protein amino acid

Hypothesized link 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.

Some exposure studies use levels beyond what is environmentally relevant.

Reviewed in Chernoff *et al.* 2017 tinyurl.com/y5sx3u2l

How can public health agencies quantify risk?

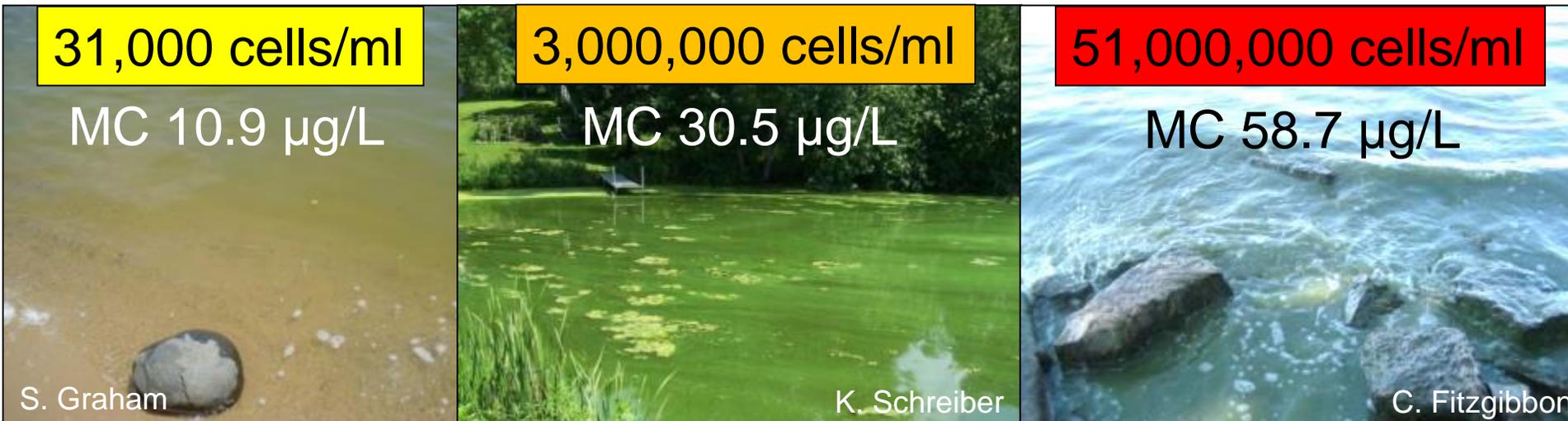


WHO Recreational Guidelines*



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*



*Based on the risks to ADULTS from ingesting water containing PLANKTONIC blooms. Risks are higher for children & animals.

US EPA Recreational Guidelines

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' effects on liver & kidneys, not on **acute** effects (e.g., allergic reactions, vomiting, diarrhea).
- Take **children's** smaller size into account.
- Not enough data to set advisory levels for anatoxin or saxitoxin.
- Not enough data to determine cell numbers or pigment levels correlated with these toxin concentrations.

Where can I get beach closure information?

- www.wibeaches.us – Mostly *E. coli* bacteria testing. Includes Great Lakes, State Parks, & State Forests. See the tab for “Inland Beaches” to get to county beach websites.

Most public health agencies in Wisconsin do not monitor beaches for blue-green algae. Even in lakes that are monitored, blooms can change between the time of sampling and when testing results are available, so **it's important to assess conditions for yourself before swimming.**

Monitoring Challenge: Patchy in Time & Space



Wind can create highly localized bloom conditions, even in lakes with low nutrient levels & low HAB risk.

You can see the blooms that are of highest concern

Judgement calls?

Chunks of material floating or growing on lake bottom

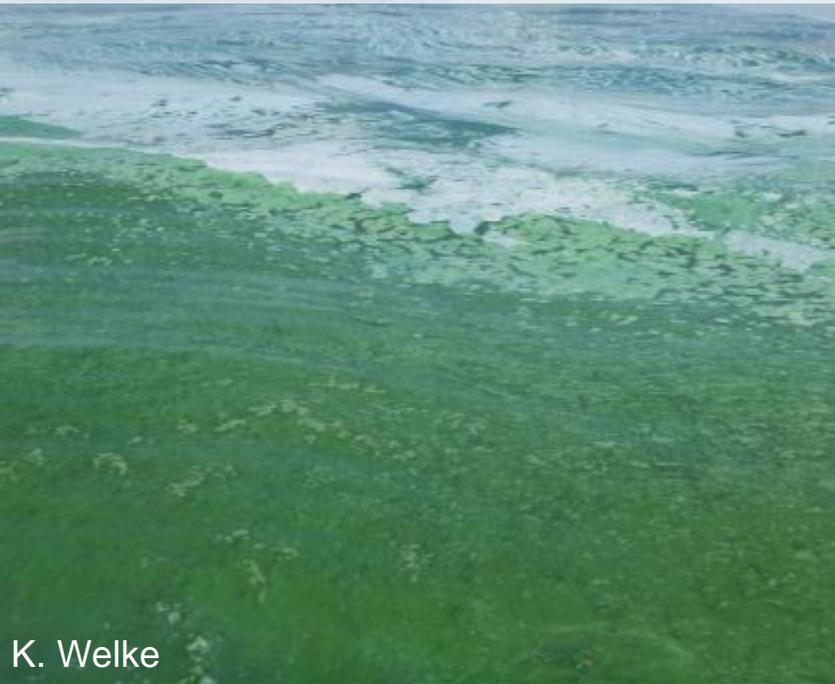


S. Caven

Fine dust on surface



Surface scums or opaque “pea soup” water indicate **possible high toxin concentrations** *if toxins are being produced.*



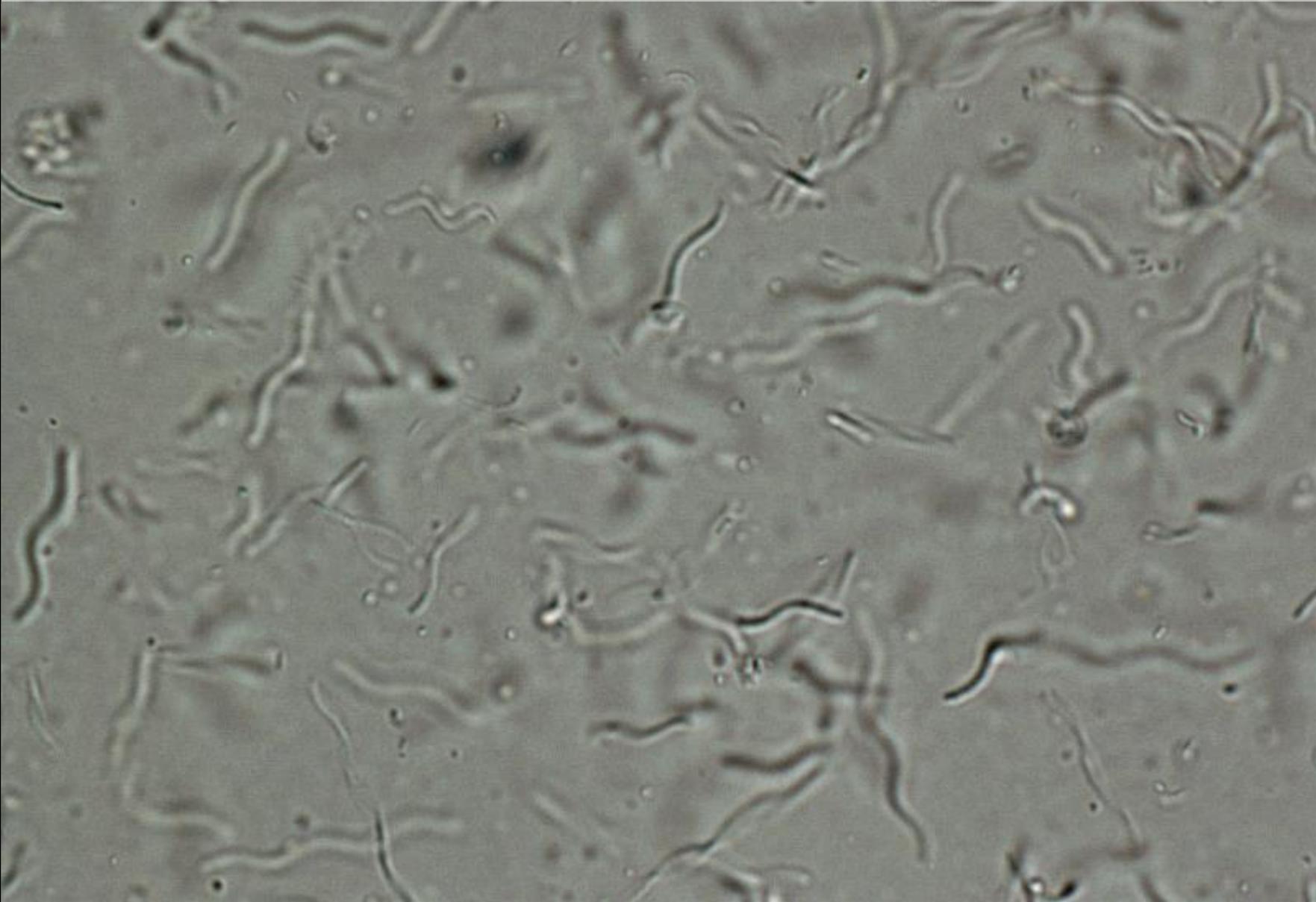
K. Welke

Water is never 100% safe – other bacteria, viruses, and parasites may be present.

Filamentous green algae do NOT produce toxins, but decomposing mats (or accumulation of any other decomposing organic material) could harbor **excess bacterial growth.**



You wouldn't want this in your mouth, would you?



How can I stay 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, choose a better place to swim.
- Choose the **clearest** water possible for small children and pets. **Avoid swimming in shallow, warm, stagnant water bodies.**
- 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!

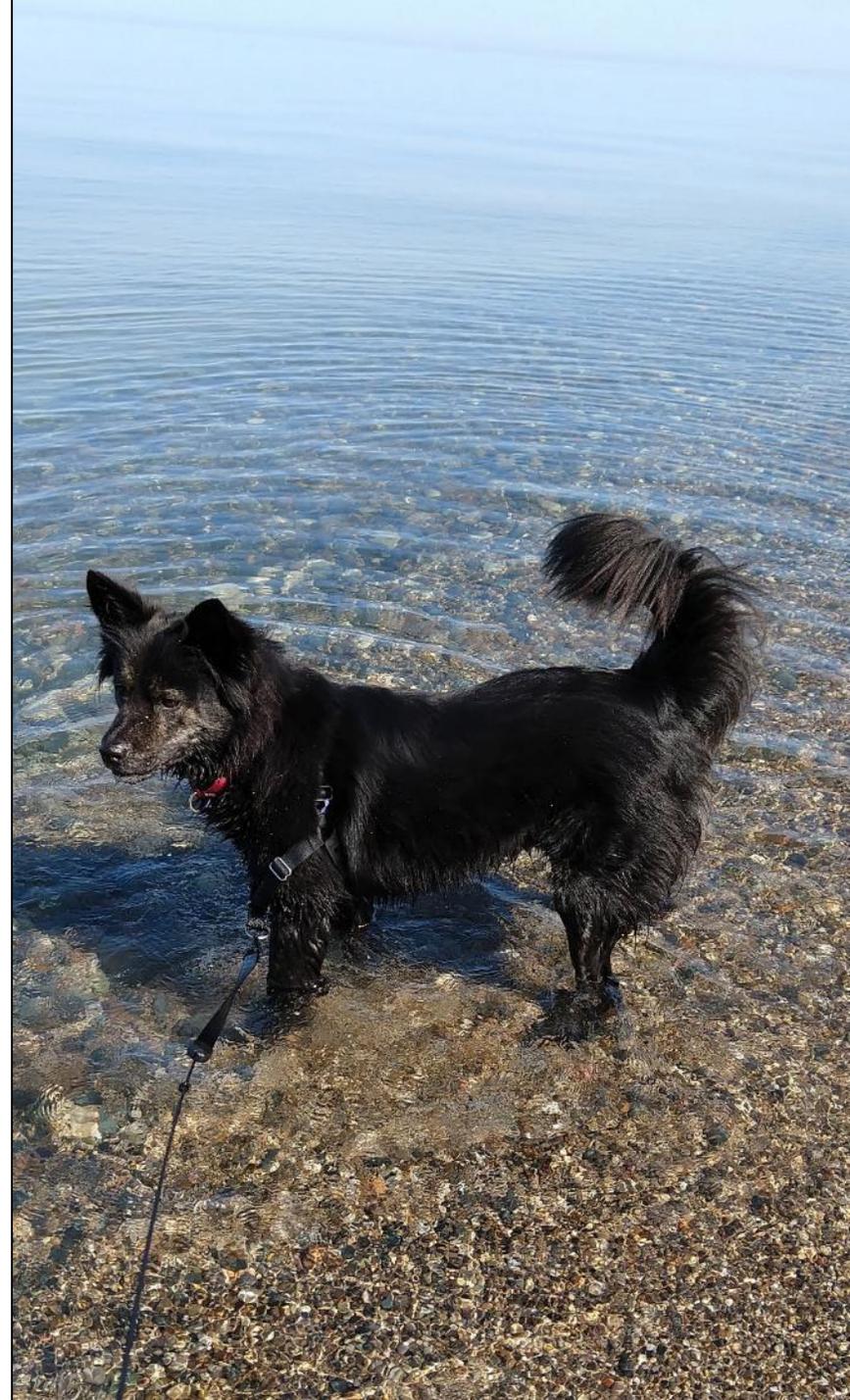
Water intoxication and **heat stroke** share symptoms with cyanotoxin poisoning.

Give your dog frequent breaks from playing in water.

Use flat objects for retrieval to minimize water ingestion.

Provide access to shade.

Do your dogs or cats eat grass? Don't use lake water to irrigate your lawn during a bloom.



Reduce risks from cyanotoxins and waterborne pathogens:

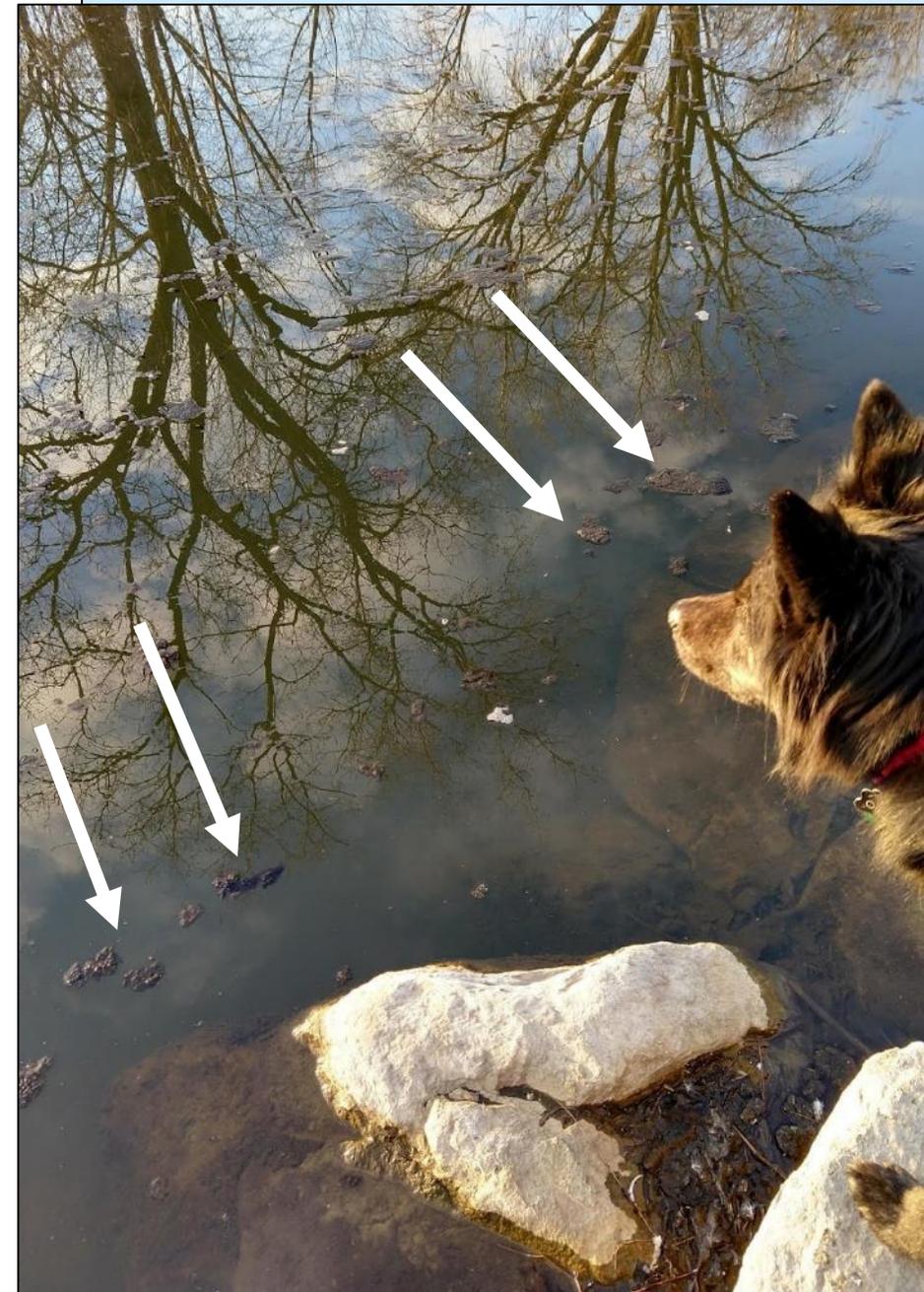
Supervise dogs & keep them out of unsafe conditions.

Choose the clearest, cleanest water you can find for dogs to swim in. **Avoid swimming in shallow, warm, stagnant water bodies.**

Always provide clean drinking water.

Prevent pets from drinking untreated water to protect against parasites, waterborne diseases, and cyanotoxins.

Wash dogs off with clean water after swimming, so they don't ingest cyanobacteria from their fur.



Business Licenses & Regulations Recreation Env. Protection Contact Join DNR

Blue-Green Algae

General Humans & Animals Drinking Water Recreation Protect Yourself Resources

Contact and General Information

If you think you are experiencing symptoms related to exposure to blue-green algae (e.g., stomach cramps, diarrhea, vomiting, headache, fever, muscle weakness, difficulty breathing), contact your doctor or the Poison Information Hotline (800-222-1222) right away.

If your pet displays symptoms such as seizures, vomiting, or diarrhea after contact with surface water, contact your veterinarian right away.

Report a Case with potential health effects caused by blue-green algae, visit the [Department of Health Services \(see link\)](#), or contact the Bureau of Environmental and Occupational Health at 608-266-1120.

For more information about contacting your local health department, check the [Department of Health Services Web site \(see link\)](#).

If you are (or your local community is) interested in collecting samples for analysis, please contact the **Wisconsin State Laboratory of Hygiene** at (800)442-4618. The Wisconsin Department of Natural Resources is not currently conducting any routine monitoring for blue-green algae or blue-green algal toxins.

What are blue-green algae?

Blue-green algae, also known as Cyanobacteria, are a group of photosynthetic bacteria that many people refer to as "pond scum." Blue-green algae are most often blue-green in color, but can also be blue, green, reddish-purple, or brown. Blue-green algae generally grow in lakes, ponds, and slow-moving streams when the water is warm and enriched with nutrients like phosphorus or nitrogen.

When environmental conditions are just right, blue-green algae can grow very quickly in number. Most species are buoyant and will float to the surface, where they form scum layers or floating mats. When this happens, we call this a "blue-green algae bloom." In Wisconsin, blue-green algae blooms generally occur between mid-June and late September, although in rare instances, blooms have been observed in winter, even under the ice.

Lake Name:

Lakes

Find a lake.

Blue-green algae

Blue-green algae blooms appeared earlier and in more lakes this summer than usual. Learn more about these blooms and the health risks they can pose.

Contact information
For information on Lakes in Wisconsin, contact:
[Wisconsin DNR, Lakes](#)
Division of Water
Bureau of Water Quality
[Blue-Green Algae Contacts](#)

dnr.wi.gov

Search for "algae"

dhs.wisconsin.gov

WISCONSIN DEPARTMENT of HEALTH SERVICES

About DHS Data & Statistics Diseases & Conditions Health Care & Coverage Long-Term Care & Support Prevention & Healthy Living Partners & Providers Certification, Licenses & Permits

Topics A-Z: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Prevention & Healthy Living Environmental Health Water Blue-Green Algae

Blue-Green Algae

Understanding Algae
Health Concerns
Algal Bloom Photos
Keeping our Lakes Clean
For Health Professionals
Resources and Links
Contact Us

The Wisconsin Department of Health Services, Division of Public Health (DPH) collects information about human and animal illness resulting from exposure to blue-green algae. Tracking illness information will help DPH measure the problem of blue-green algae in our lakes and rivers.

If you get sick after swimming in a Wisconsin lake or river, please report possible algae-related illness. This program does not provide medical treatment, so if you are experiencing severe symptoms seek medical attention immediately.

When in doubt, stay out!

NEW!
For healthcare providers: beginning 7/1/2018, report any suspected human cases of Cyanobacteria and Cyanotoxin Poisoning electronically through WEDOS or by mailing or faxing a completed Acute and Communicable Disease Case Report, I-44151 to the address on the form.
For members of the general public and veterinarians: call 800-256-1120 to complete the online form (limited).

Report illnesses in humans & animals online

Please let the DNR know about significant bloom events!
DNRHABS@wisconsin.gov or (in the works) DNR website
 Bloom location with lake, town, & county name, size, duration, photos
 DNR cannot test for each bloom, but knowledge of blooms helps us to track where HABs are a public health burden.

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