

The background of the slide is a microscopic image of blue-green algal blooms, showing various cellular structures and pigments in shades of blue, green, and yellow.

Blue-Green Algal Blooms in Wisconsin: Their Identification, Ecology, and Potential Health Effects

**Wisconsin Lakes Partnership Convention
April 24, 2015**

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Bureau of Science Services**

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Blue-green algae

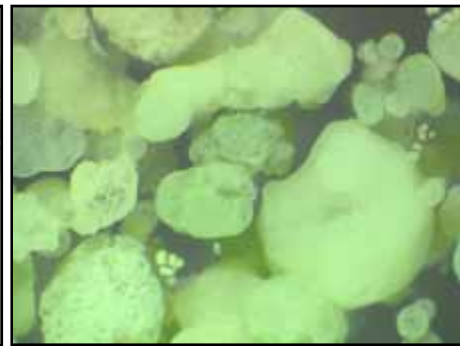
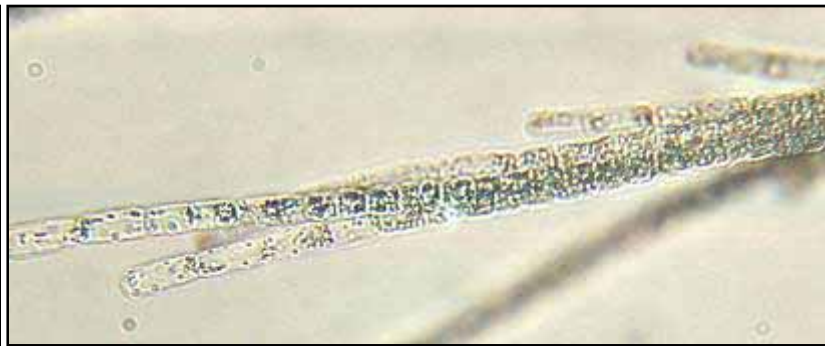
What are they & what do they look like?

When, where, and why do they bloom?

Are they toxic? Can I even go in the water?

Blue-green algae are a little different

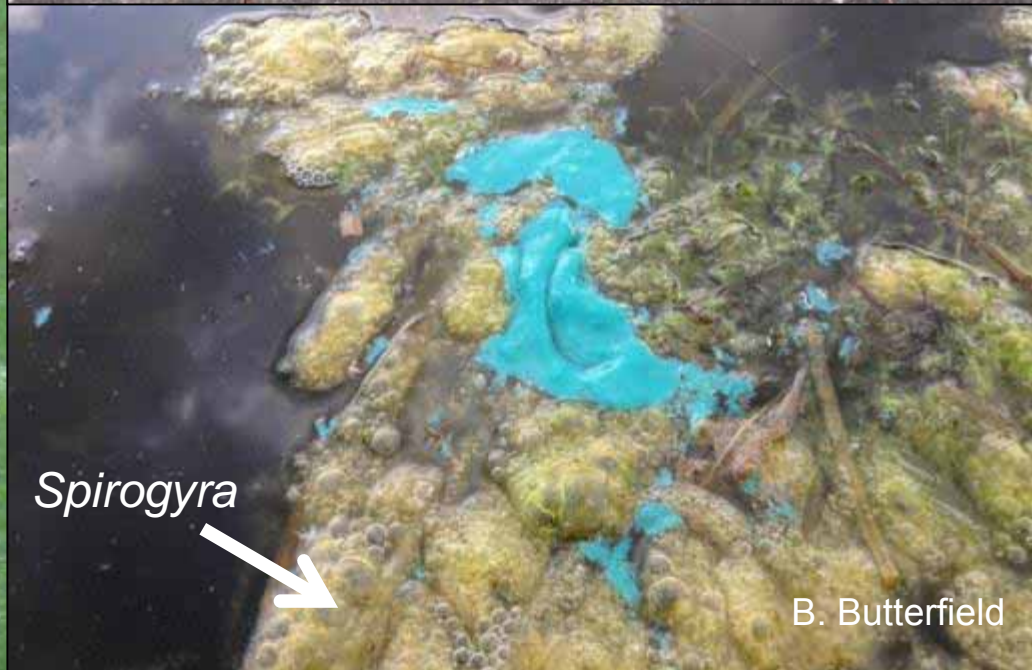
- Photosynthetic bacteria (cyanobacteria)
- Native to every lake & river in Wisconsin
- Buoyancy: they regulate position
- Temperatures: they like it hot
- Toxins: produced by some species



“Blue-green” is misleading



Intact blooms are most often green in color.





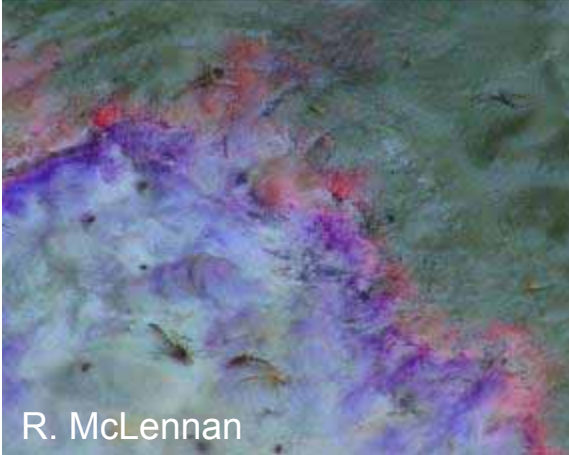
R. McLennan



N. Trombly



T. Moris



R. McLennan



J. Williamson



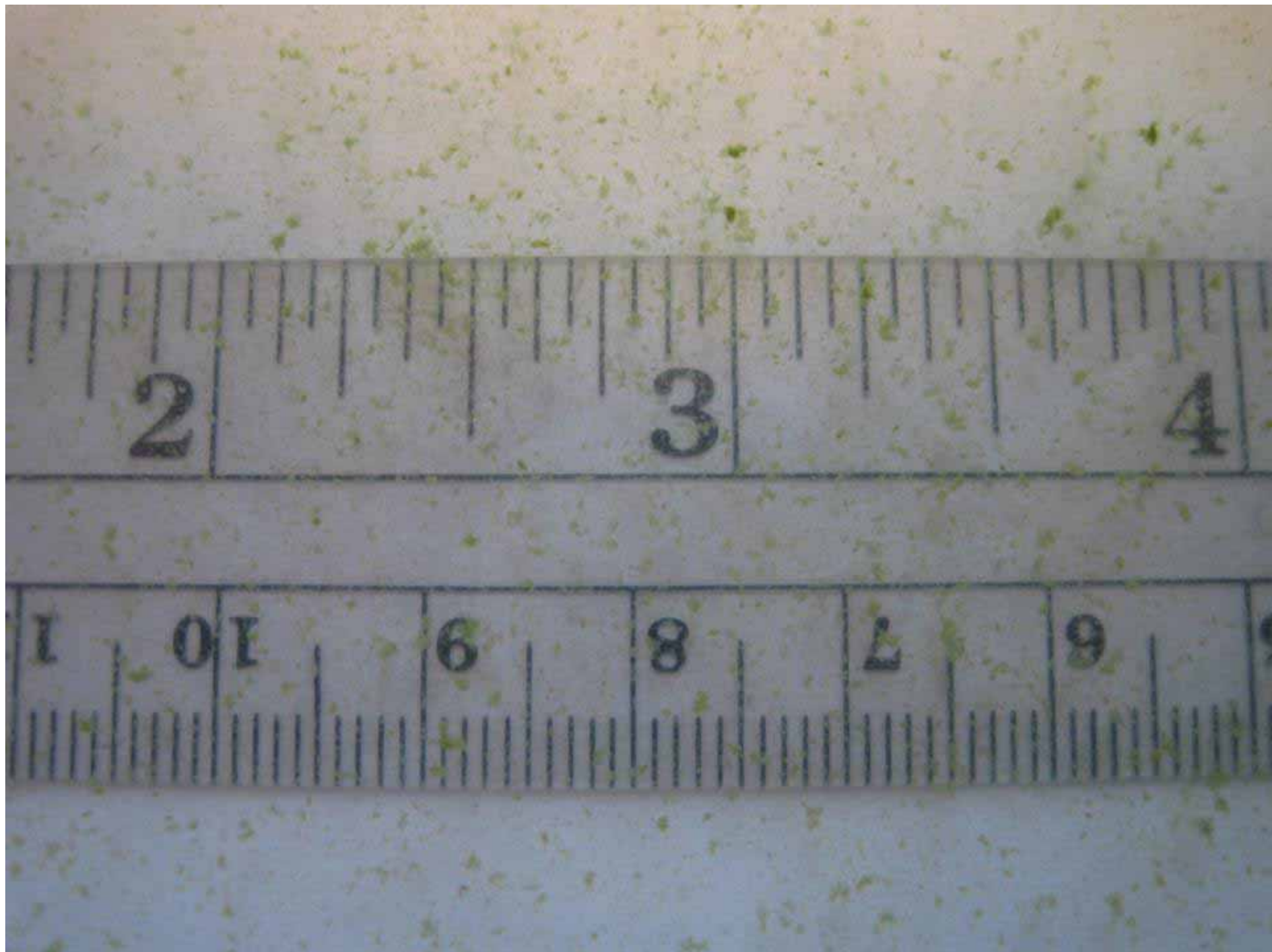
WDHS



J. Williamson

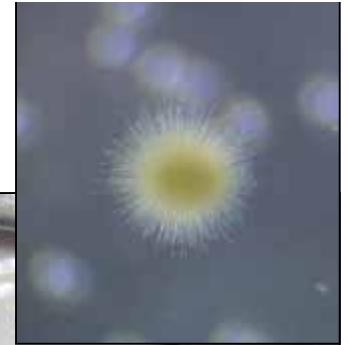


A. Dryja



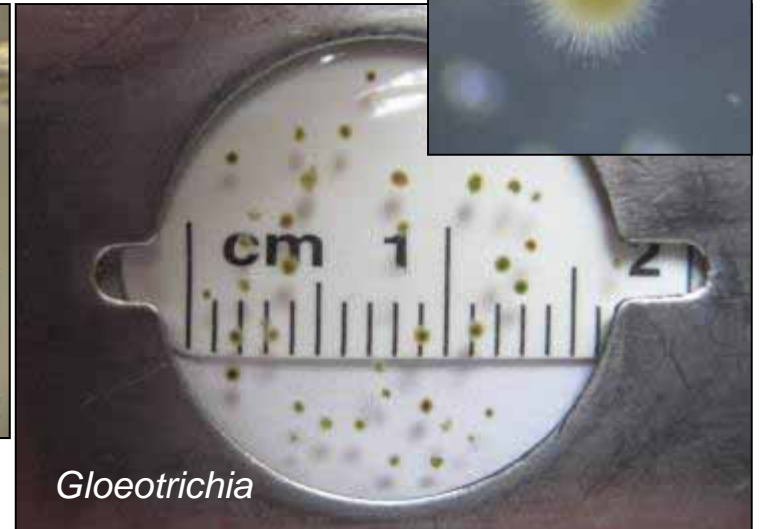


Planktonic blue-green algae

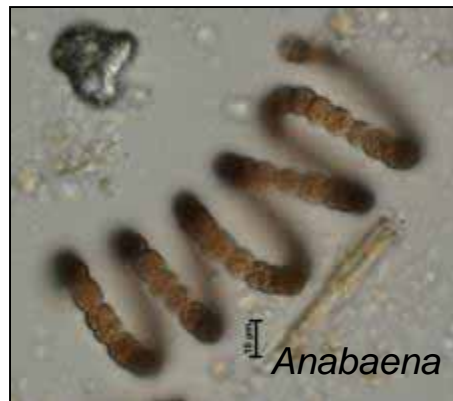
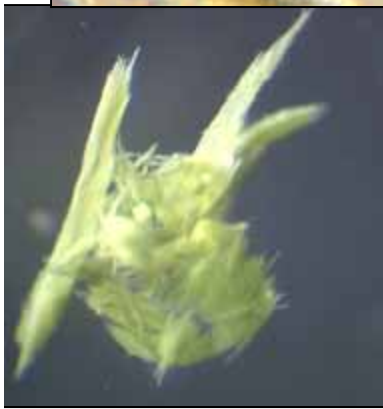


Aphanizomenon

50 μm

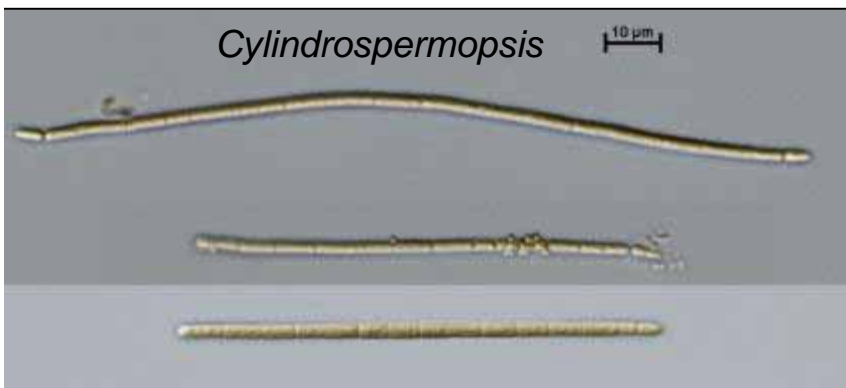


Gloeotrichia



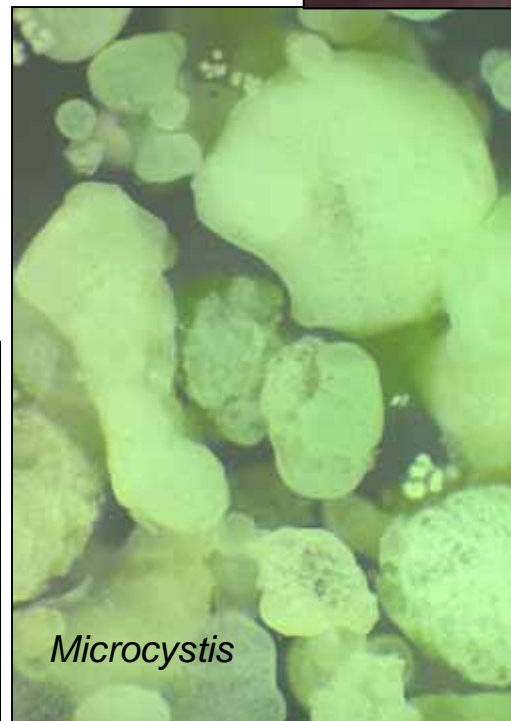
Anabaena

10 μm



Cylindrospermopsis

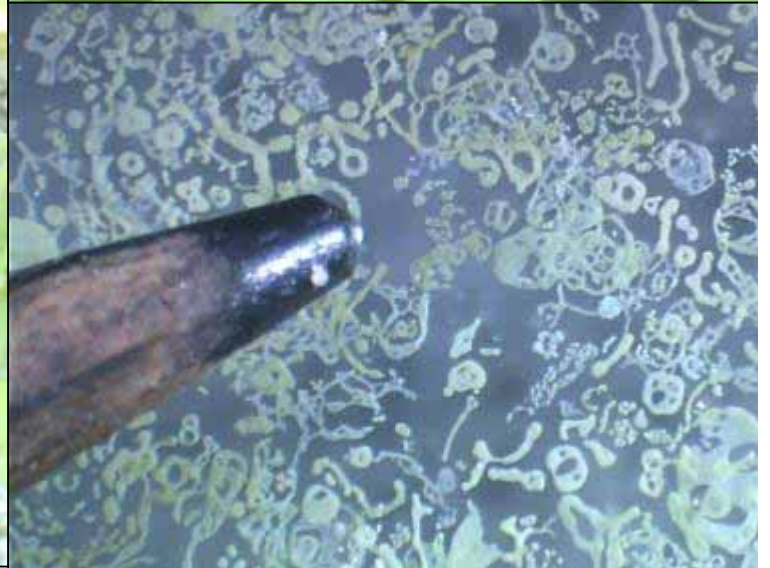
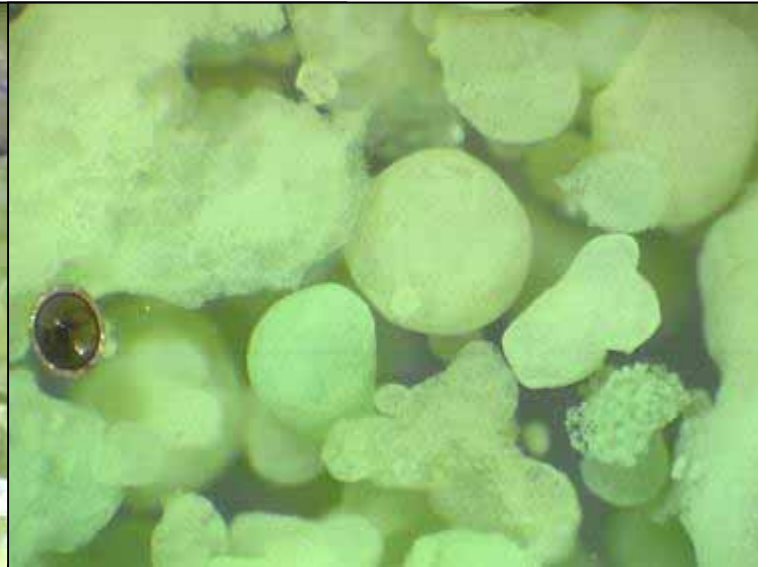
10 μm



Microcystis



Microcystis



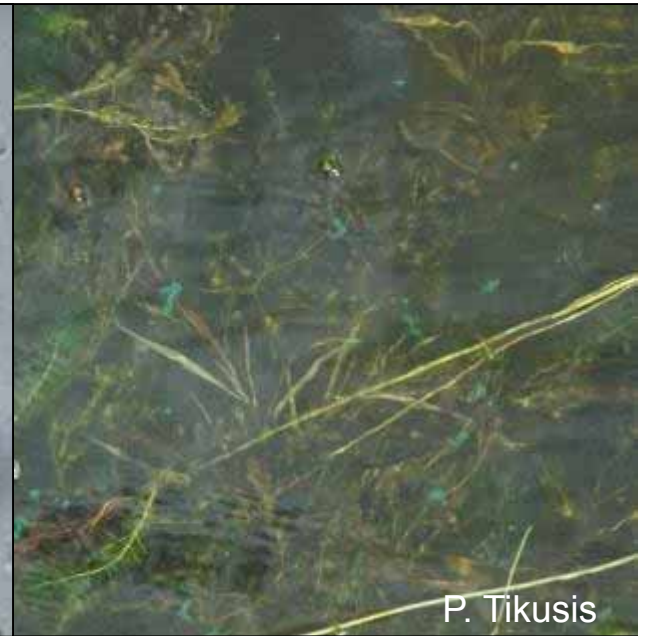
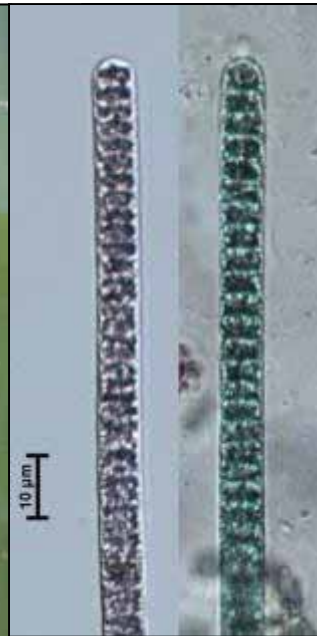
Aphanizomenon

Tiny grass clippings

Floating Algal Mats: *Oscillatoria*, *Lyngbya*, *Plectonema*, *Planktothrix*



J. Masterson



P. Tikusis

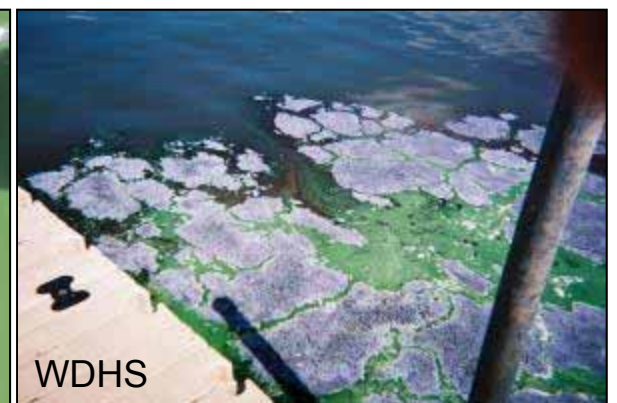


P. Tikusis



Hazards of blue-green algae blooms

- Blooms impact aquatic life.
- Some strains can make liver, cell, or nerve toxins if conditions are right.
- Toxins may irritate the skin in sensitive individuals; swallowing or inhaling them in water can cause illness.
- **Not all blue-green algae make toxins, and toxins are not made all the time.**



What causes harmful blooms?

- Excess nutrients are fertilizer for growth
- Primarily P, but N is important too
- Warm water and calm weather



The details are more complicated...

- Species and strains
- Cell biochemistry
- Micronutrients (iron)
- Dissolved carbon
- Zebra & quagga mussels; carp
- Nutrients & cells from lake sediments



“Favorable environmental conditions”
– Mark Vander Borgh, NCDENR

Adaptations of blue-green algae present management challenges

- Grow better in high water temperatures
- Store phosphorus for later use
- Nitrogen fixation in some species



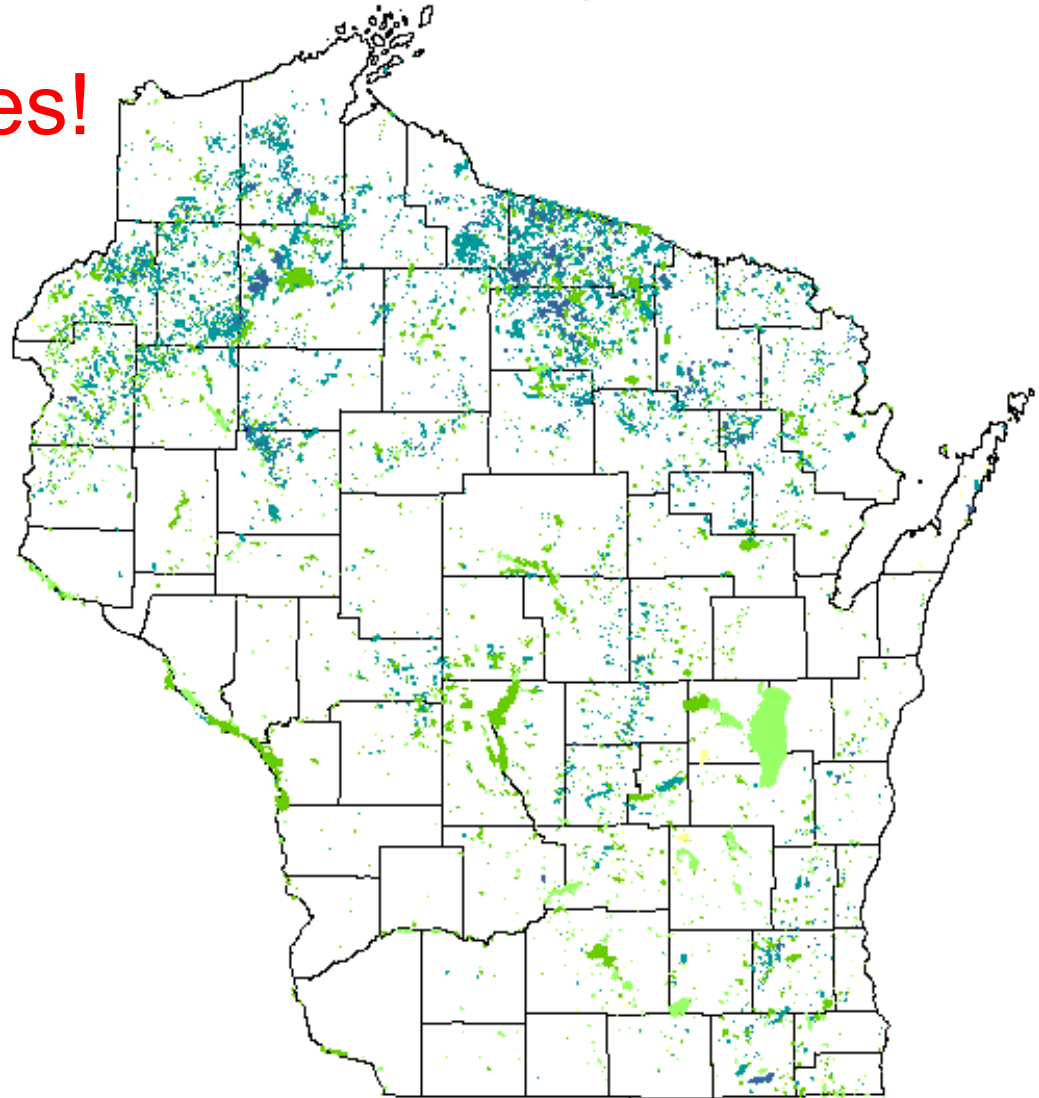
Keep nutrients out of the lake!

What lakes have blue-green algae?
Where are blooms most likely to occur?

They are in ALL lakes!

Blooms likeliest in:

- Lakes with large watersheds
- Shallow lakes
- Impoundments



**Historical harmful algal blooms
in Wisconsin
(where were toxins detected?)**

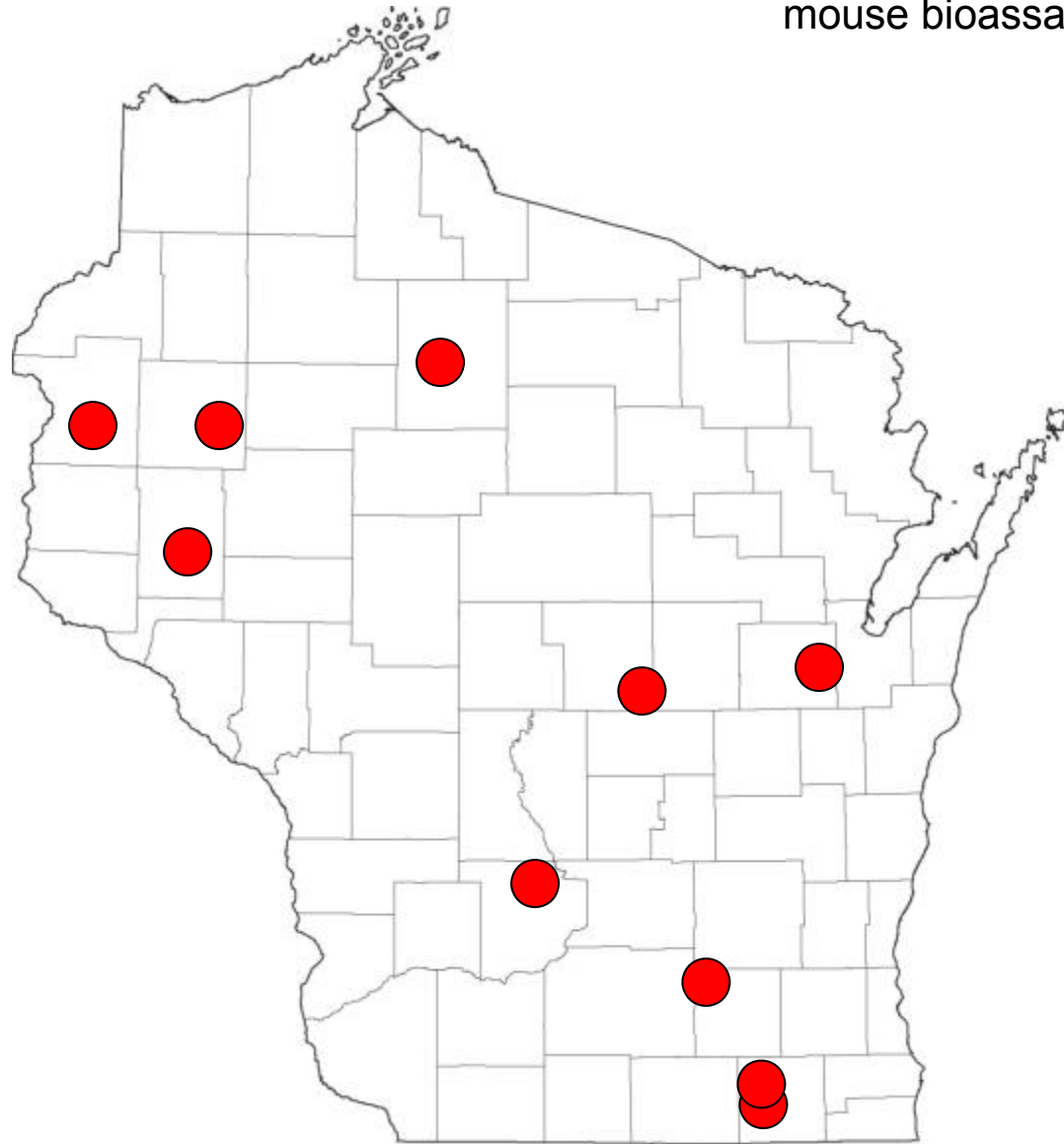


Cyanobacterial Toxins 1967-1969

Karl 1970

20 sites

● Toxicity determined via mouse bioassay



Cyanobacterial Toxins 1986

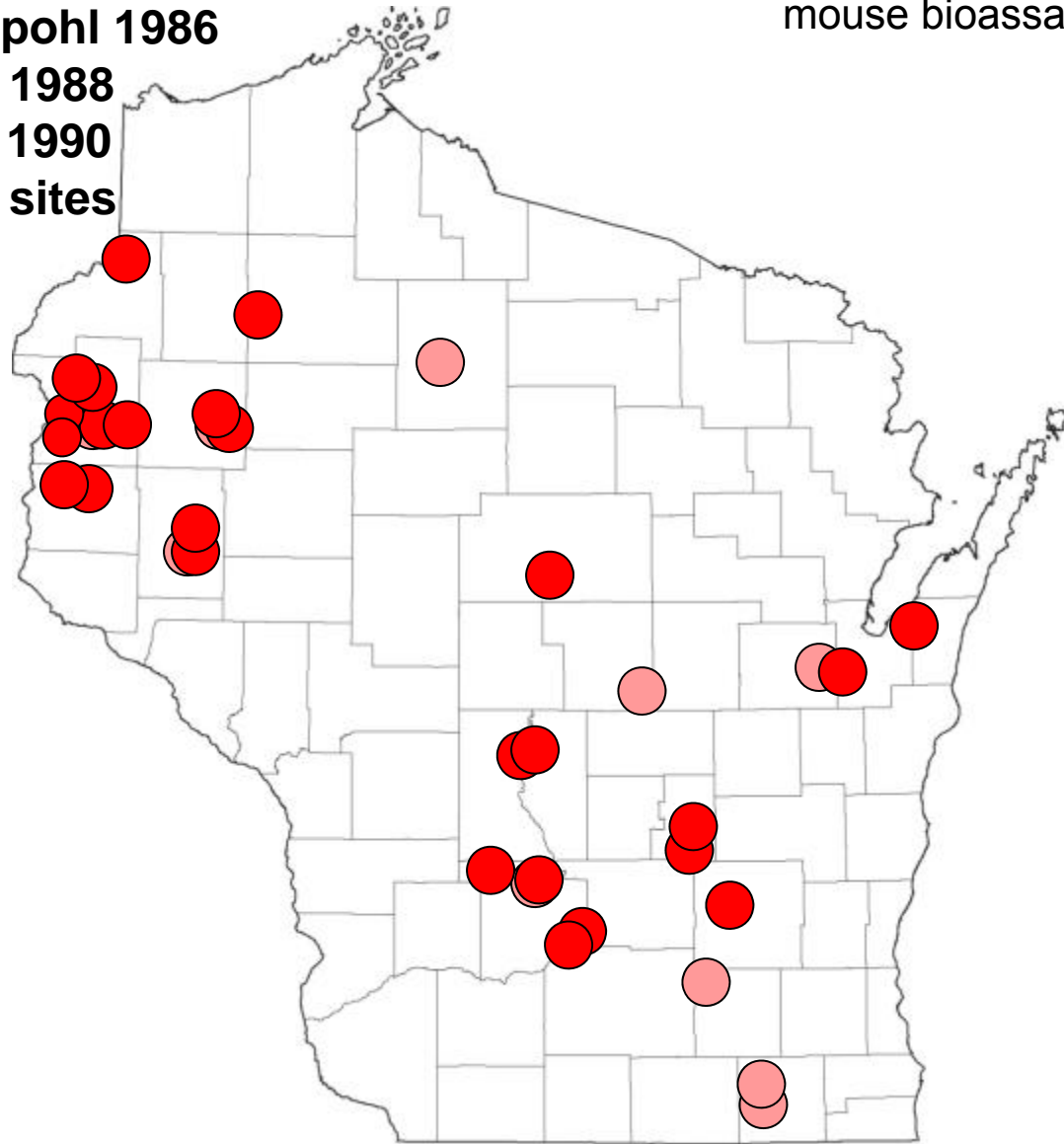
Vennie & Wedepohl 1986

Sonzogni et al. 1988

Repavich et al. 1990

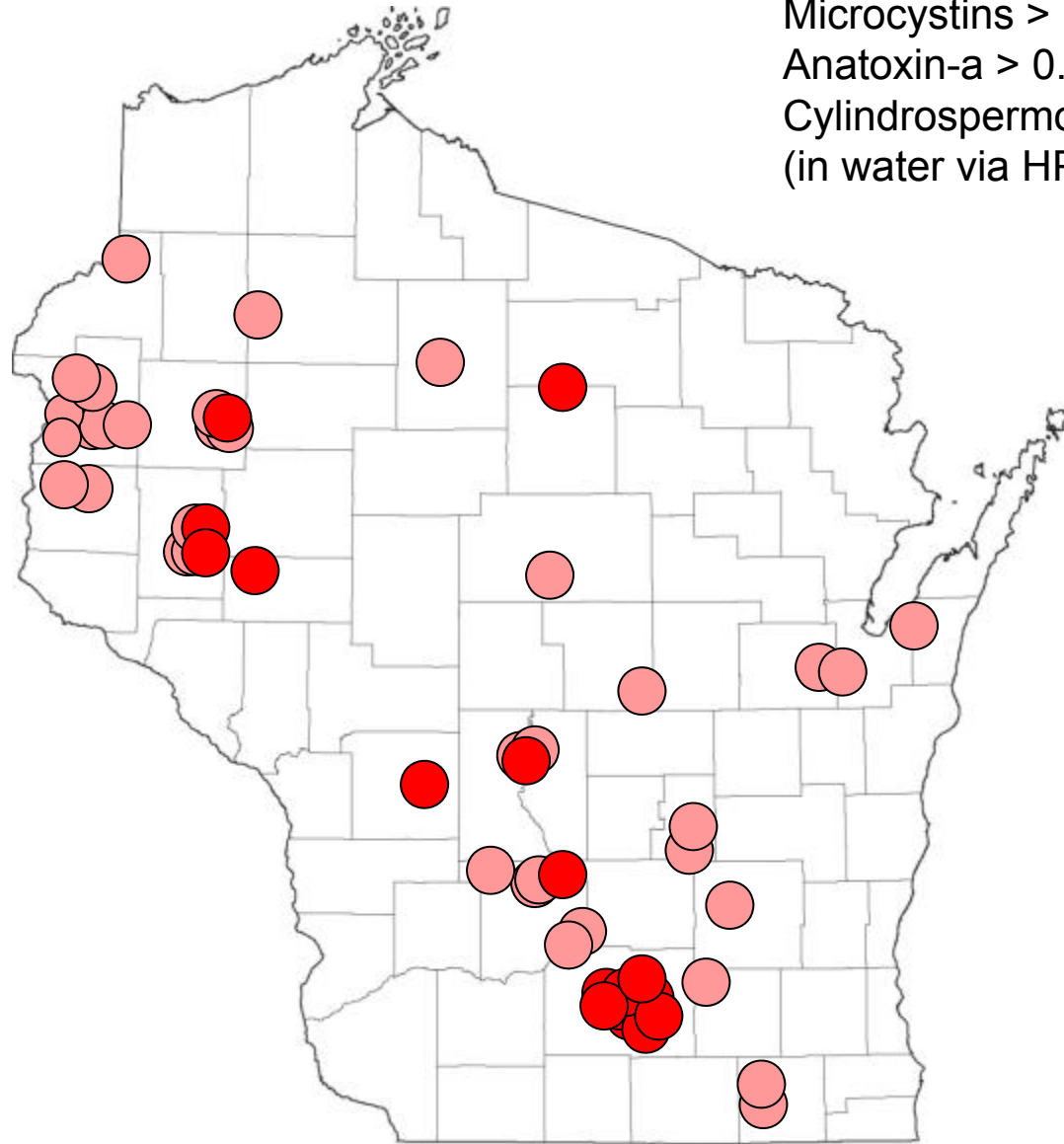
86 lake & pond sites

● Toxicity determined via mouse bioassay

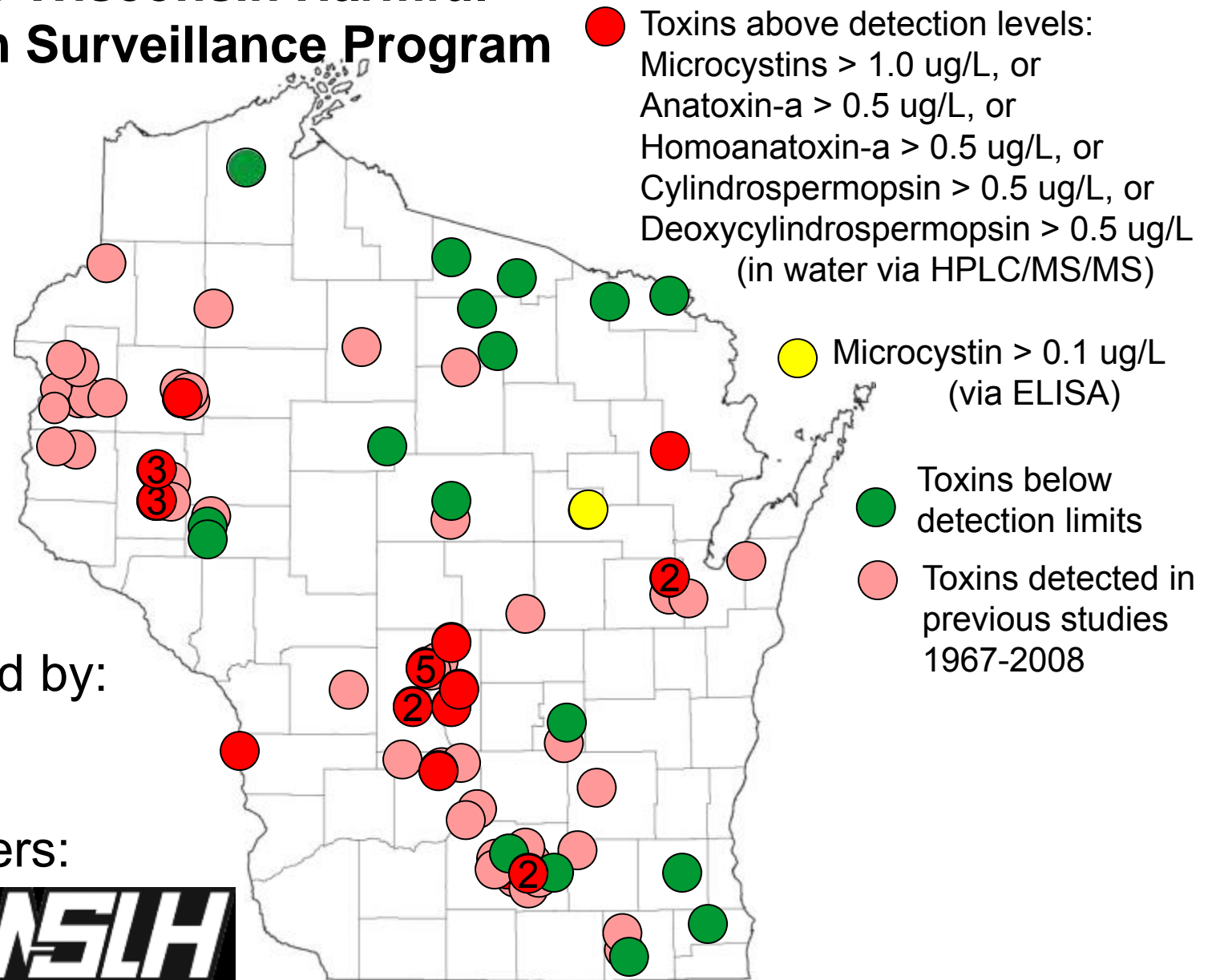


Cyanobacterial Toxins 2004-2008

● Toxins above detection levels:
Microcystins > 1.0 ug/L, or
Anatoxin-a > 0.5 ug/L, or
Cylindrospermopsin > 0.5 ug/L
(in water via HPLC/MS/MS)



2009-2013 Wisconsin Harmful Algal Bloom Surveillance Program



Project funded by:



Project partners:



Numbers indicate multiple sampling dates for a single water body.

World Health Organization Guidelines

Probability of Adverse Health Effects	Cell Density (cells/ml)	Microcystin-LR (ug/L)	Chlorophyll (ug/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 World Health Organization's 2003 *Guidelines for Safe Recreational Water Environments*



31,000 cells/ml



S. Graham

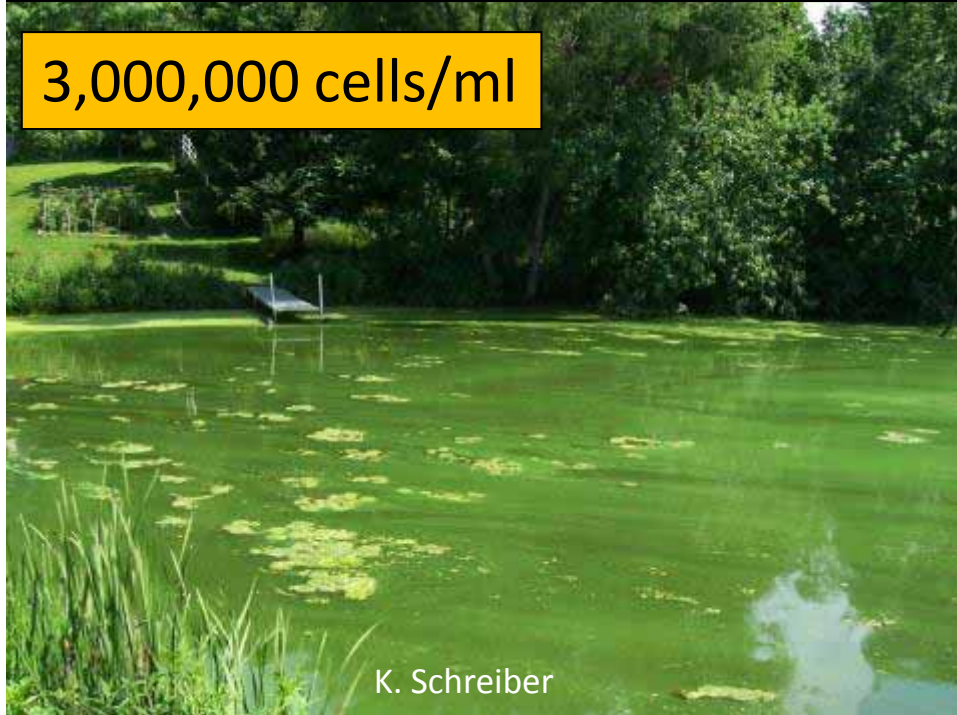
255,000 cells/ml

Cylindrospermopsis



N. Trombly

3,000,000 cells/ml



K. Schreiber

51,000,000 cells/ml



C. Fitzgibbon

Are they toxic? Can I even go in the water?



Look for advisory signs

Posted by public health officials

Lack of posted advisory does not mean that algal blooms will not occur in that lake!



J. Williamson

Can't we test more?

Blooms change rapidly

Results can be slow

Expensive!

<http://bit.ly/1bF5YwK>

(Does not imply endorsement by WDNR or WDHS)



Are they toxic? Can I even go in the water?

How does the water look?

Can you see your feet in knee-deep water? Milkshake, pea soup, or paint?



Do you have a lot of allergic sensitivities?
Skin exposure might affect you.



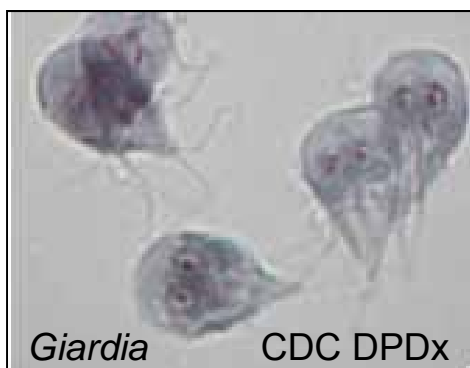
Are they toxic? Can I even go in the water?



Does the water smell?

Geosmin, 2-methylisoborneol (MIB) – earthy, musty odors
Graham et al. 2010: geosmin & MIB co-occurred with toxins <http://bit.ly/1dPjZGC>

Cyanotoxins can still be present without odors



Try to avoid swallowing water, no matter how clean it looks (especially after a rainstorm!)

E. coli, *Giardia*, *Cryptosporidium*, *Shigella*, Norovirus, other pathogens...

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.
- Always shower after swimming in a lake, river, or pond.
- Keep pets out of scummy water, and wash them off immediately if they swim or wade in during a bloom.



**When in doubt,
keep out!**

What about fish?

- Algal toxins have not been shown to accumulate to acutely toxic levels in the fillet (in most conditions)
- Clean thoroughly and discard the viscera and guts
- Wash hands after handling fish caught during an algal bloom



Blue-green algae - YouTube - Windows Internet Explorer

http://www.youtube.com/watch?v=CGG50pFBEH8&feature=player_embedded

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Blue-Green Algae

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Wisconsin's Harmful Algal Blooms Program

Wisconsin's Harmful Algal Blooms program collects information about human and animal illness and death resulting from exposure to blue-green algae. Tracking illness information will help the Wisconsin Division of Public Health 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, best keep out!



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Last revised: March 03, 2011

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Protecting and promoting the health and safety of the people of Wisconsin
The Official Internet site of the Wisconsin Department of Health Services

dnr.wi.gov and dhs.wisconsin.gov
Search for "algae"



S. Graham



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Division of Water Quality