

**Blue-green algae in Wisconsin: their
identification, potential health effects, and
determination of safe levels for recreation**

Wisconsin Lakes Partnership Convention

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Blue-green algae



What are they & what do they look like?

When are they a problem?

What are the health impacts of their toxins?

How can I tell if the water is safe?

What are blue-green algae?

- Photosynthetic bacteria (cyanobacteria)
- In all lakes & rivers in Wisconsin
- Buoyancy: they regulate position
- Temperatures: they like it hot
- Toxins: produced by some species

Look for tiny green specks in water or green “dust” on surface



Don't mistake duckweeds, watermeal, or pollen for blue-green algae

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



Watermeal (*Wolffia*)
Tiny, firm, grainy

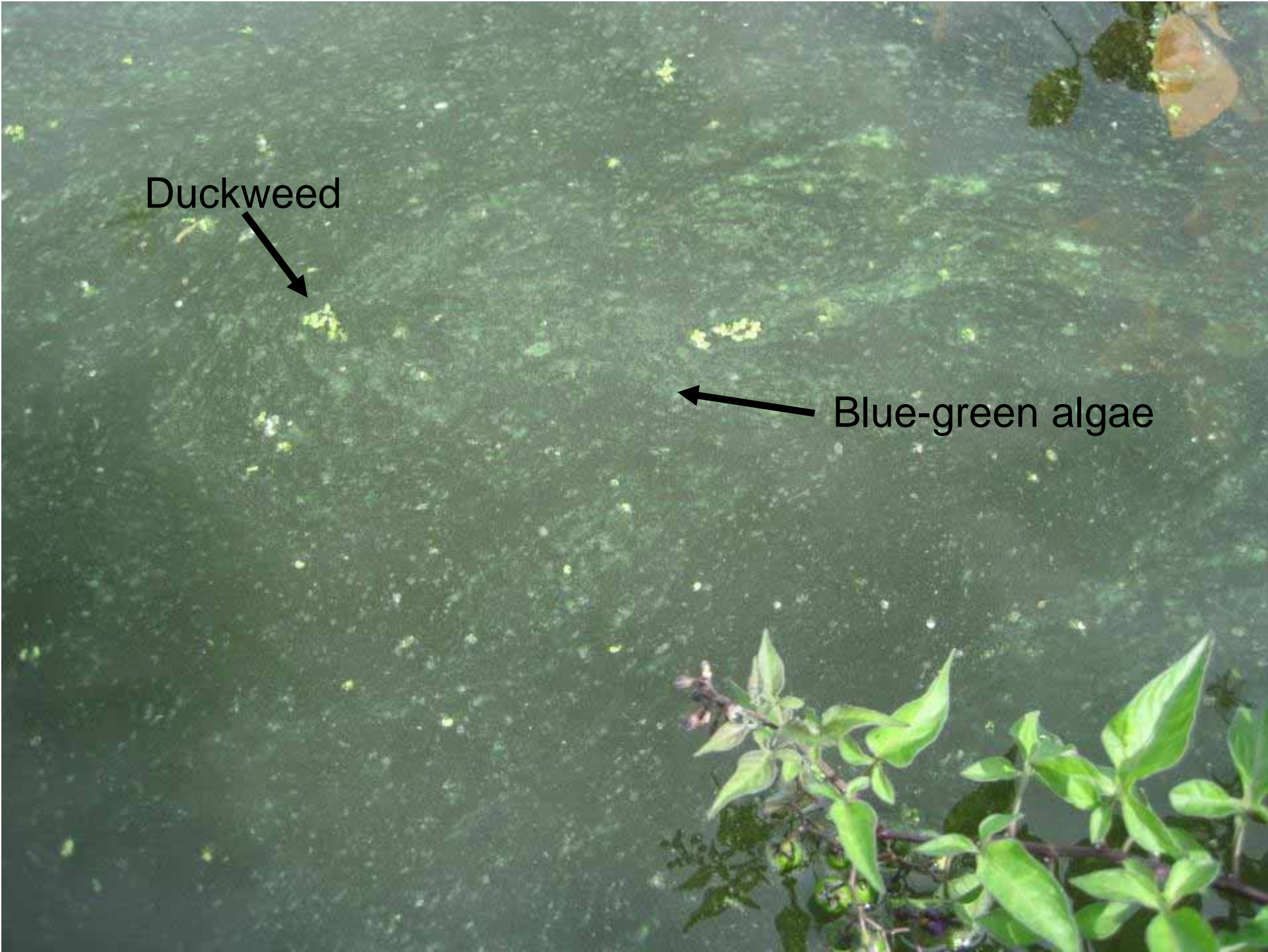


Look for similar yellow "dust" on land, especially on cars parked under trees

Duckweed



Blue-green algae



Don't mistake filamentous green algae for blue-green algae

Spirogyra & relatives

slippery texture, hairlike, unbranched



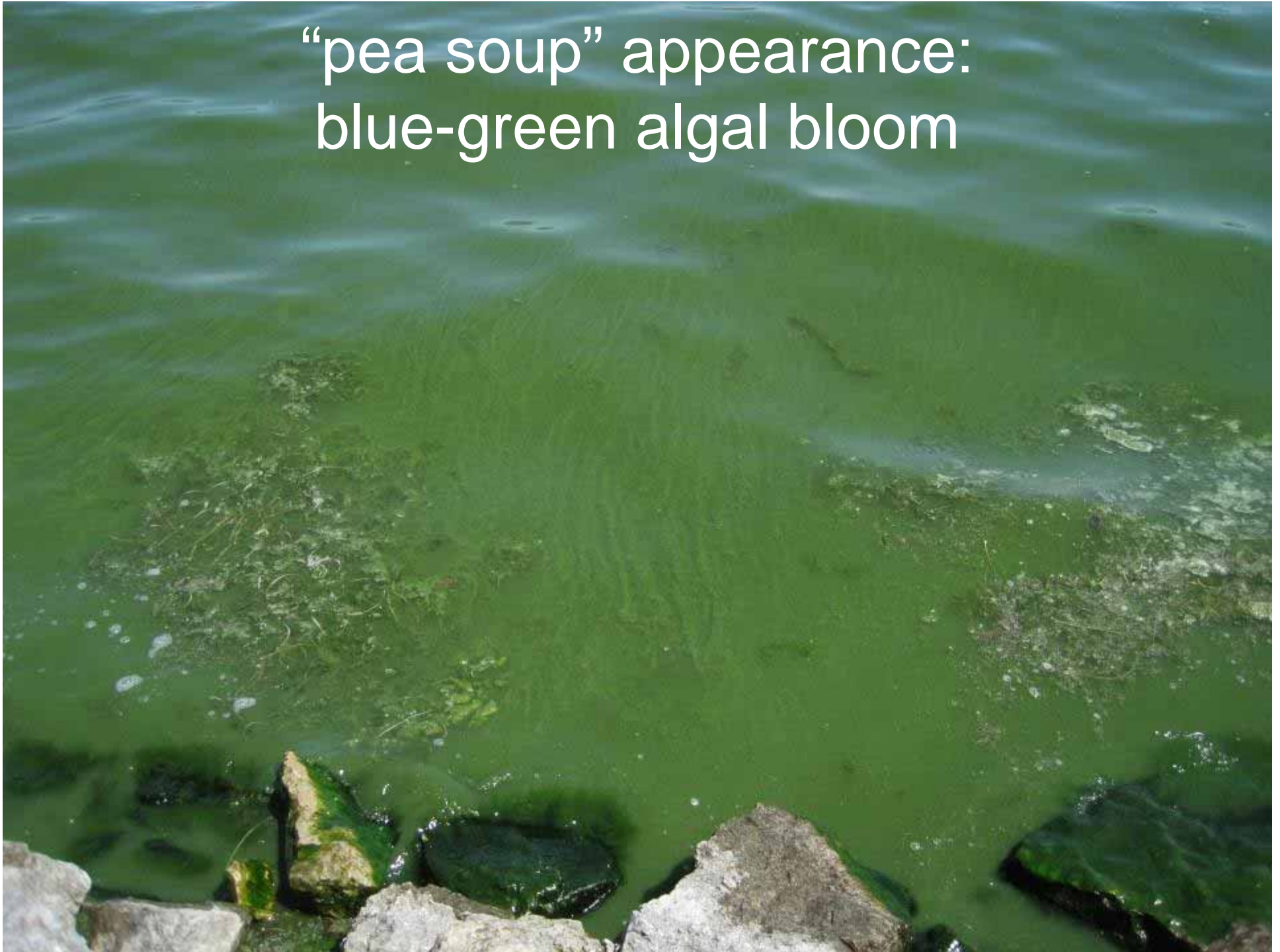
Cladophora & relatives

wet cotton texture, usually branching



Long, **GREEN**, and hair-like : not blue-green algae

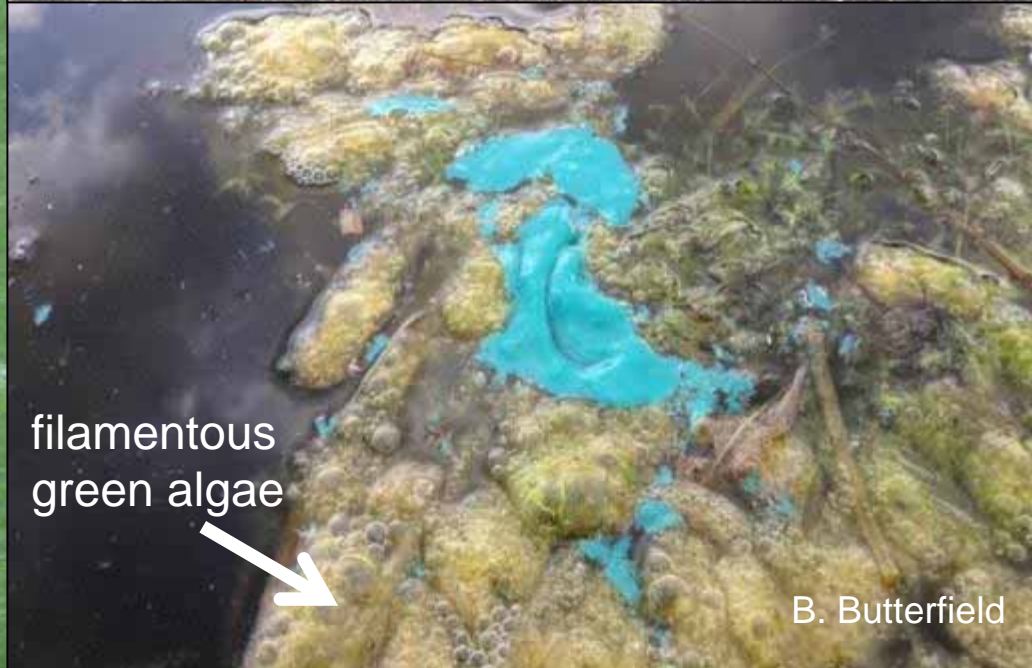
“pea soup” appearance:
blue-green algal bloom



“Blue-green” is misleading



Intact blooms are most often green in color.



Blooms may be many different colors.



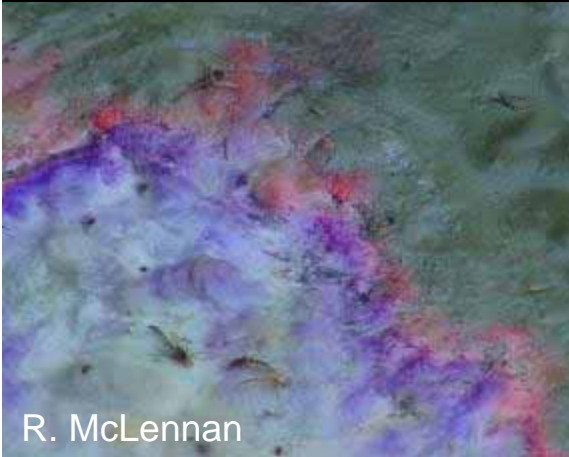
R. McLennan



N. Trombly



T. Moris



R. McLennan



J. Williamson



WDHS



J. Williamson

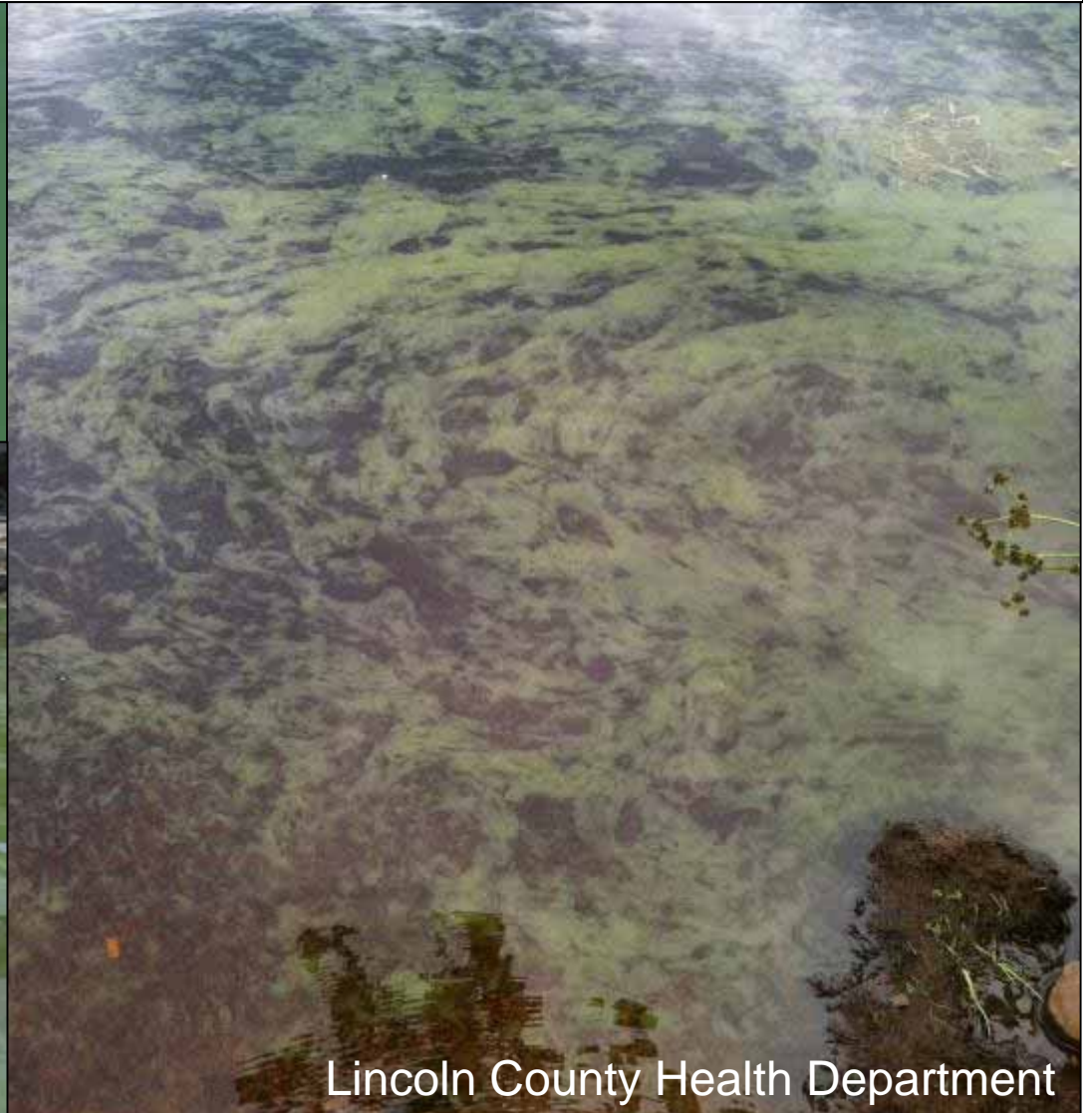


A. Dryja

Planktonic bloom-forming cyanobacteria

Small; green or other colors (khaki or tan to olive green)

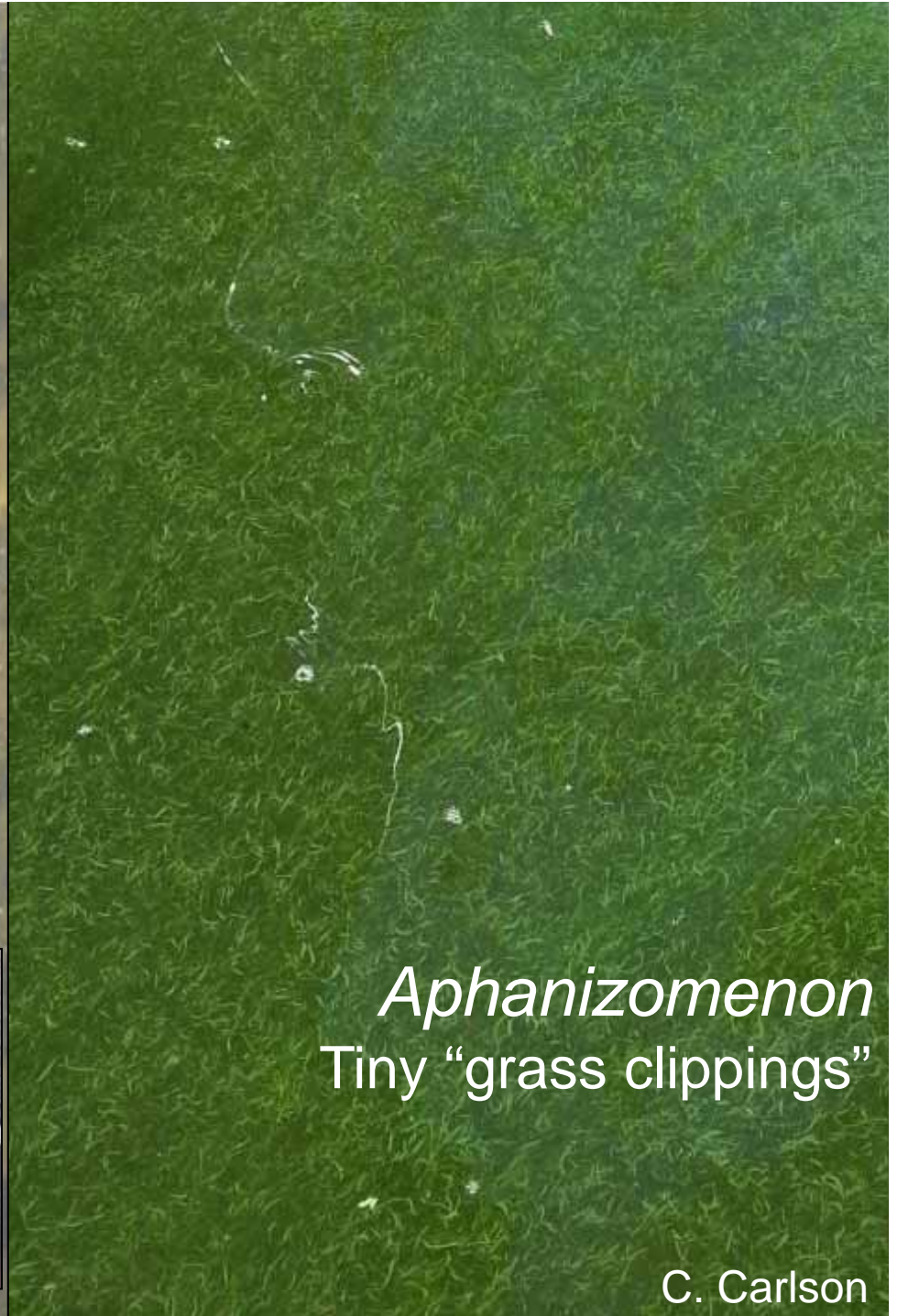
Most require microscopic examination for identification





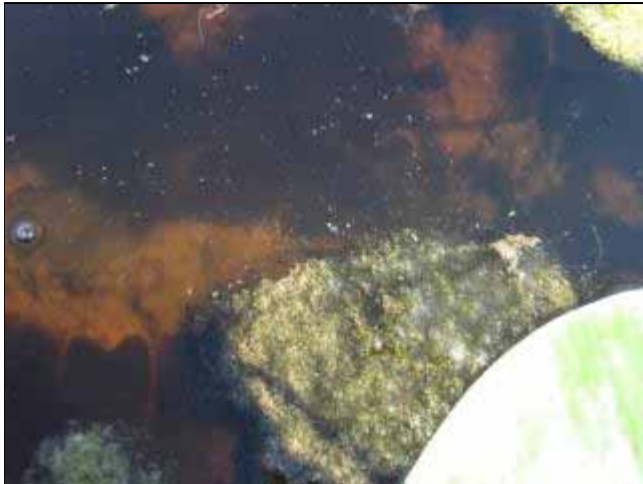
Gloeotrichia

Pinhead-sized balls
Can bloom in
oligotrophic &
mesotrophic lakes



Aphanizomenon
Tiny “grass clippings”

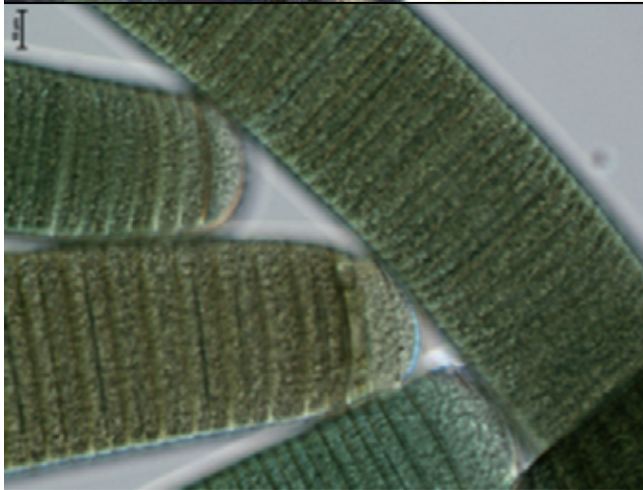
Bottom-dwelling cyanobacterial mats... that float



D. Daulton



J. Klosiewski



P. Tikusis

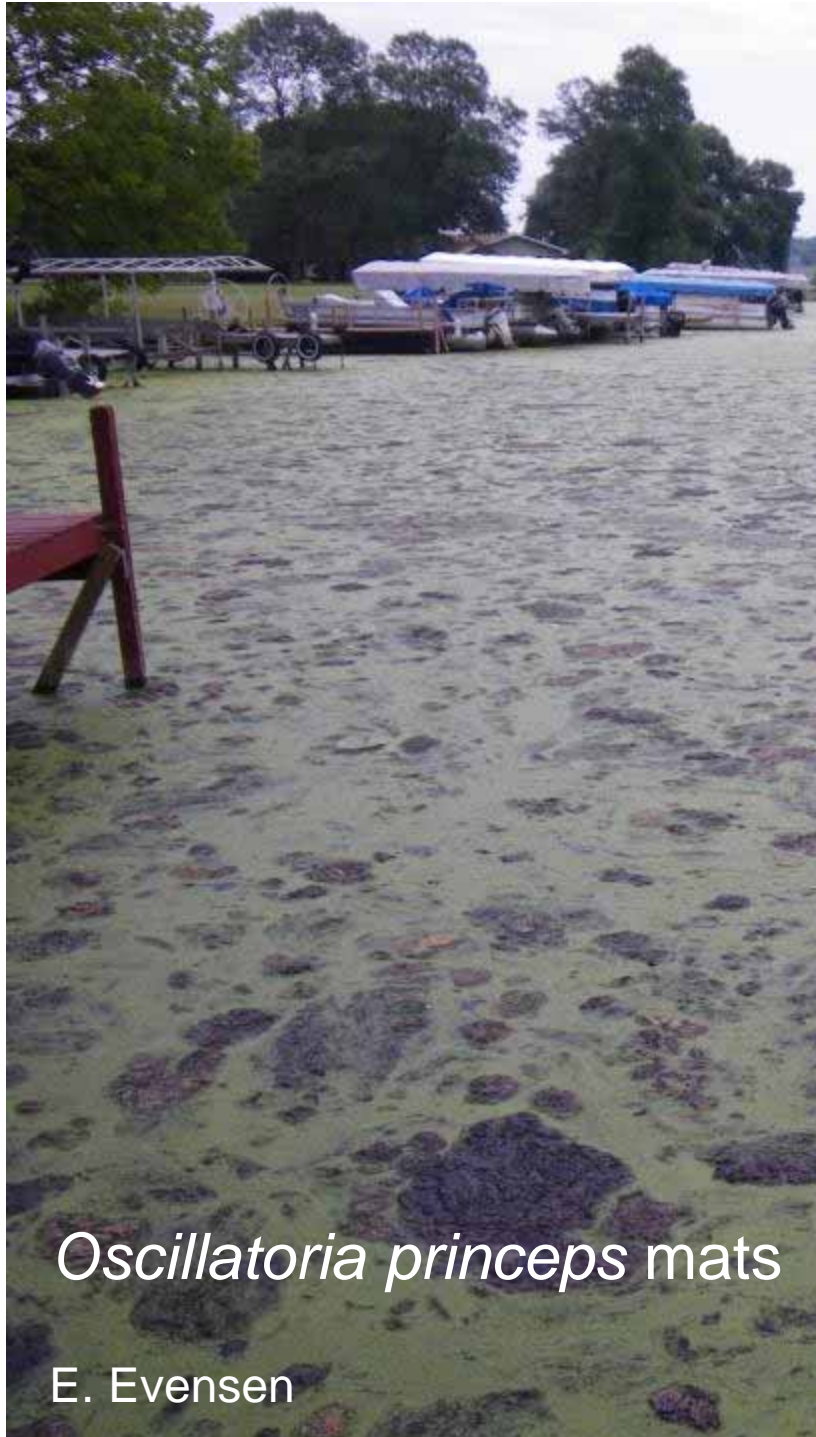


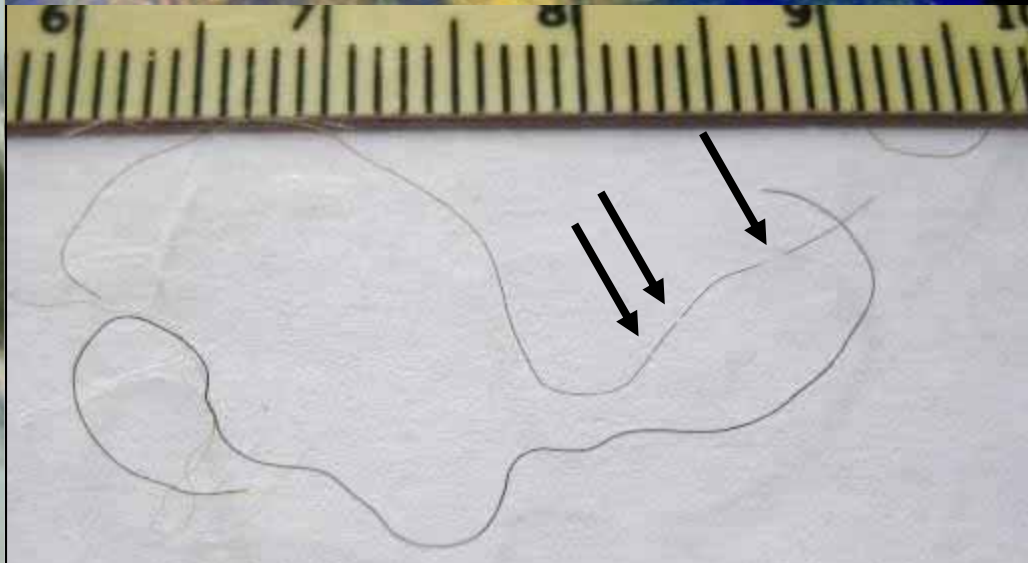
J. Masterson

Need sunlight on the lake bottom.
Brightly colored pigments in some species help them to grow in low light levels.

Filaments are usually very narrow and short, less than a quarter inch in length.





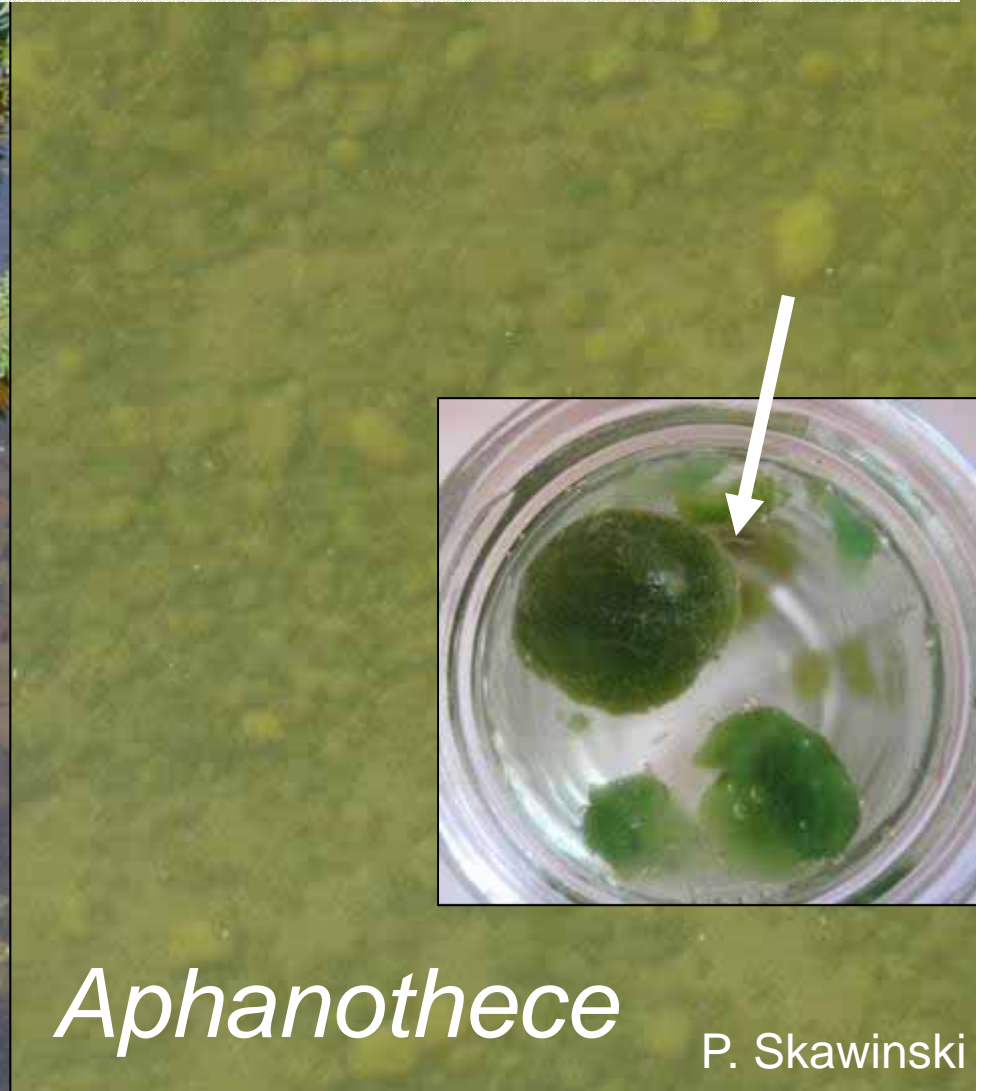


The length exception... *Lyngbya wollei* (AKA *Microseira*)
Long black "hairs," some with "breaks" visible

Bottom-dwelling mats host diverse assemblages of organisms.

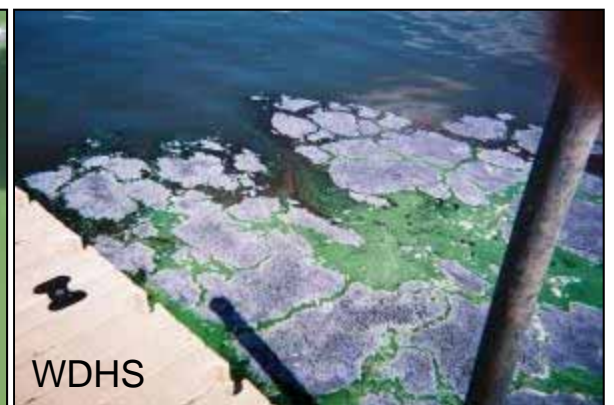


Bottom-dwelling cyanobacterial colonies
May occasionally float to the surface
Need sunlight on the lake bottom & clear water



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.**



What causes harmful blooms?

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

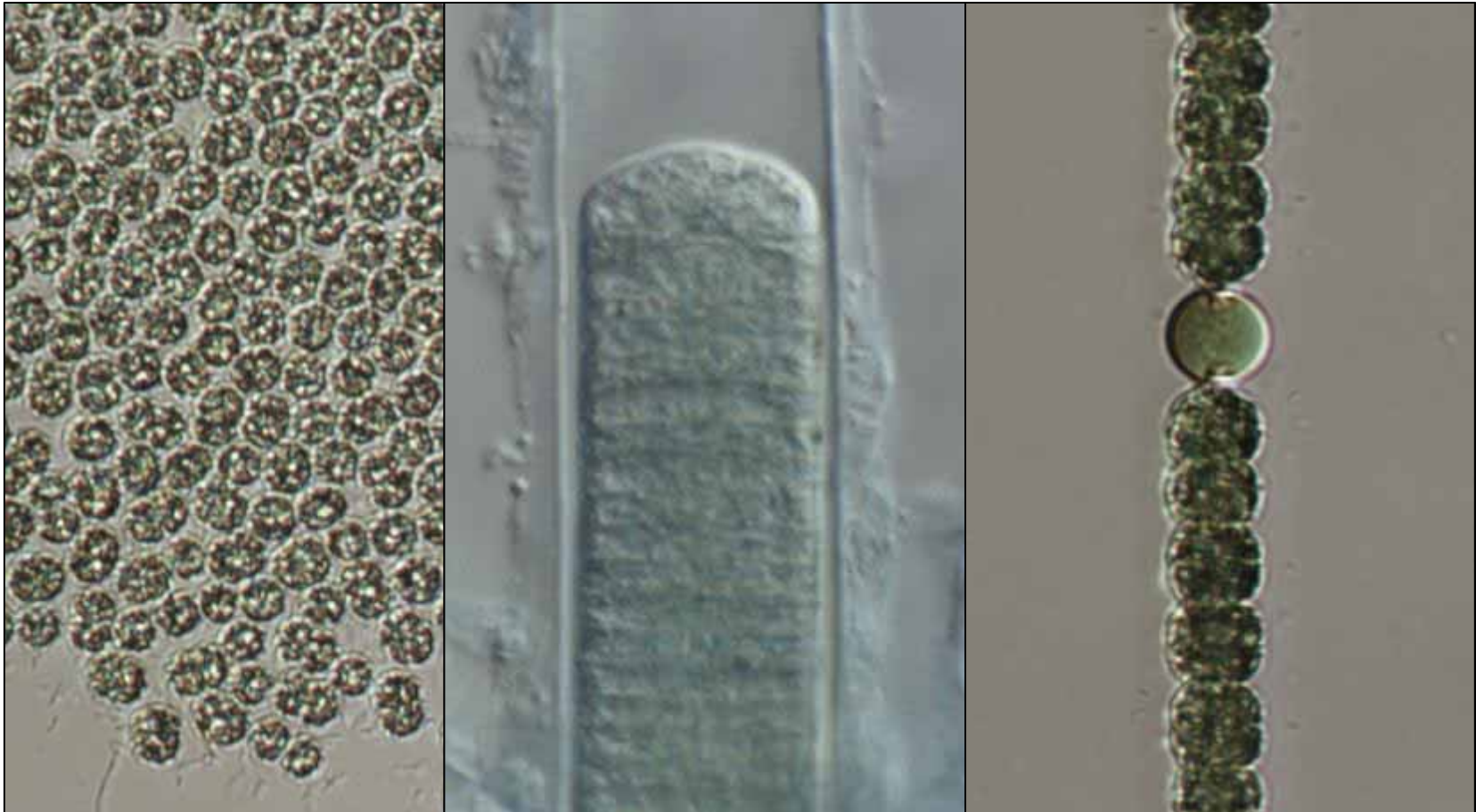
The details are complicated...



Bloom details are complicated:

Cell level

- Species & strains
- Cell biochemistry



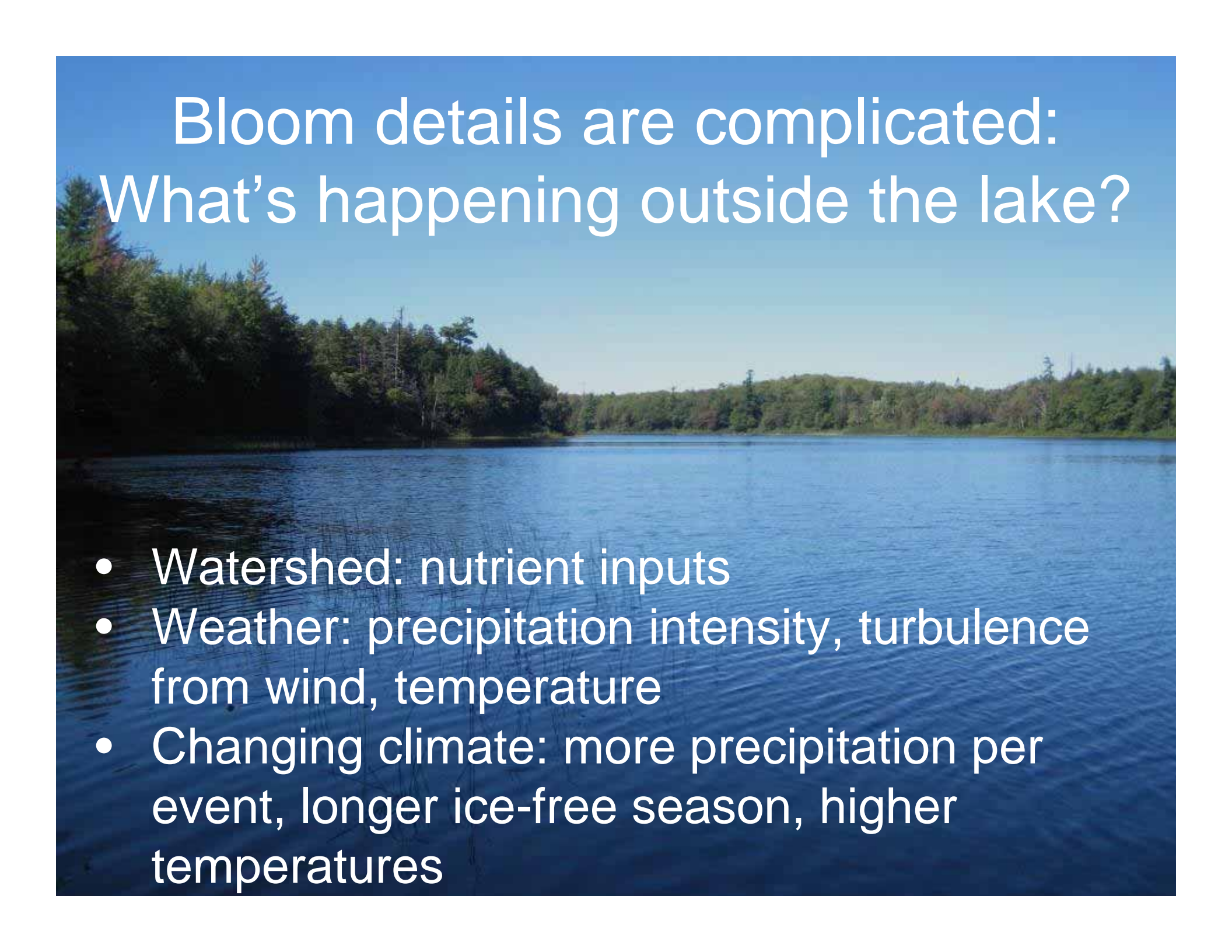
Bloom details are complicated: Population characteristics



- Community composition
- Nitrogen fixation
- Effects of non-cyanobacterial organisms

Bloom details are complicated: Lake characteristics

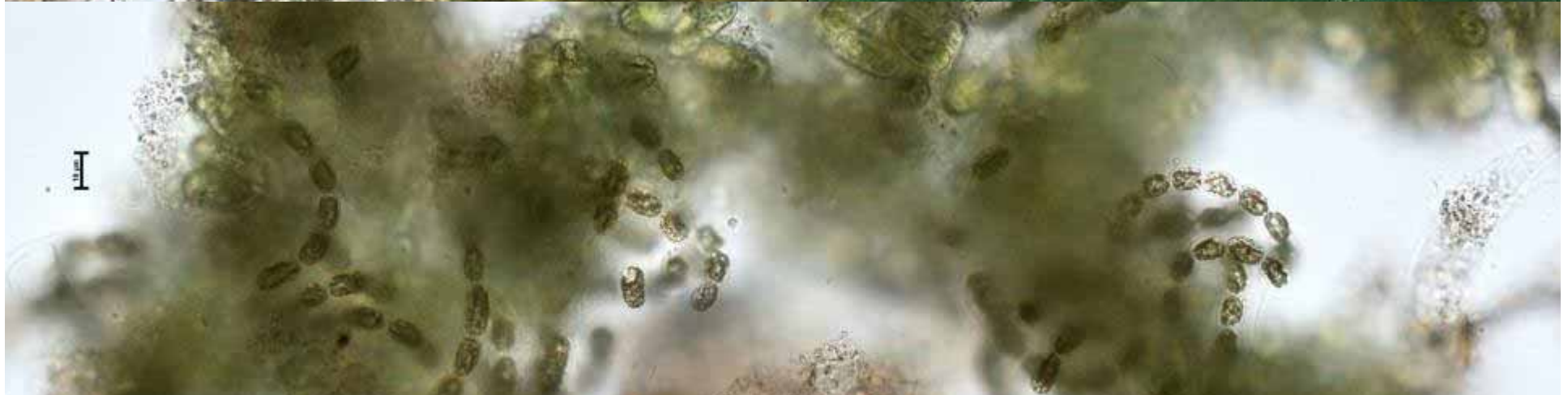
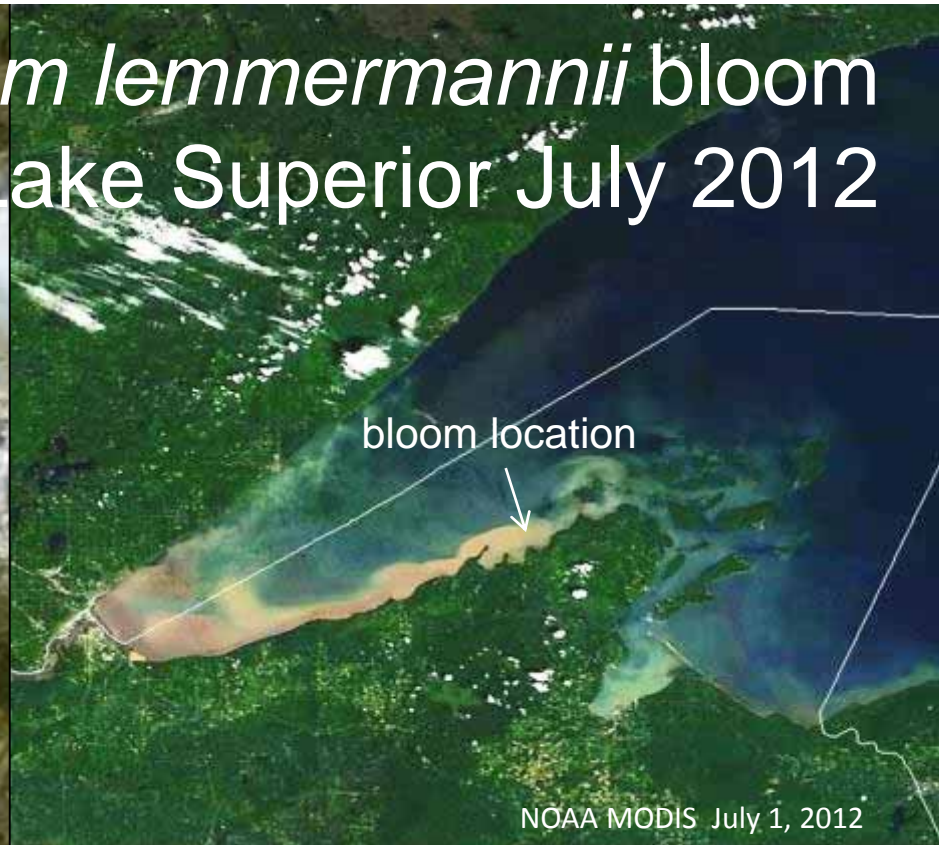
- Physical: depth, flushing, shape
- Chemical: internal nutrient cycling, iron, dissolved carbon, herbicides
- Biological: competition or allelopathy from plants, carp, zebra mussels, spiny water fleas



Bloom details are complicated: What's happening outside the lake?

- Watershed: nutrient inputs
- Weather: precipitation intensity, turbulence from wind, temperature
- Changing climate: more precipitation per event, longer ice-free season, higher temperatures

“Anecdota” 1: *Dolichospermum lemmermannii* bloom
Lake Superior July 2012

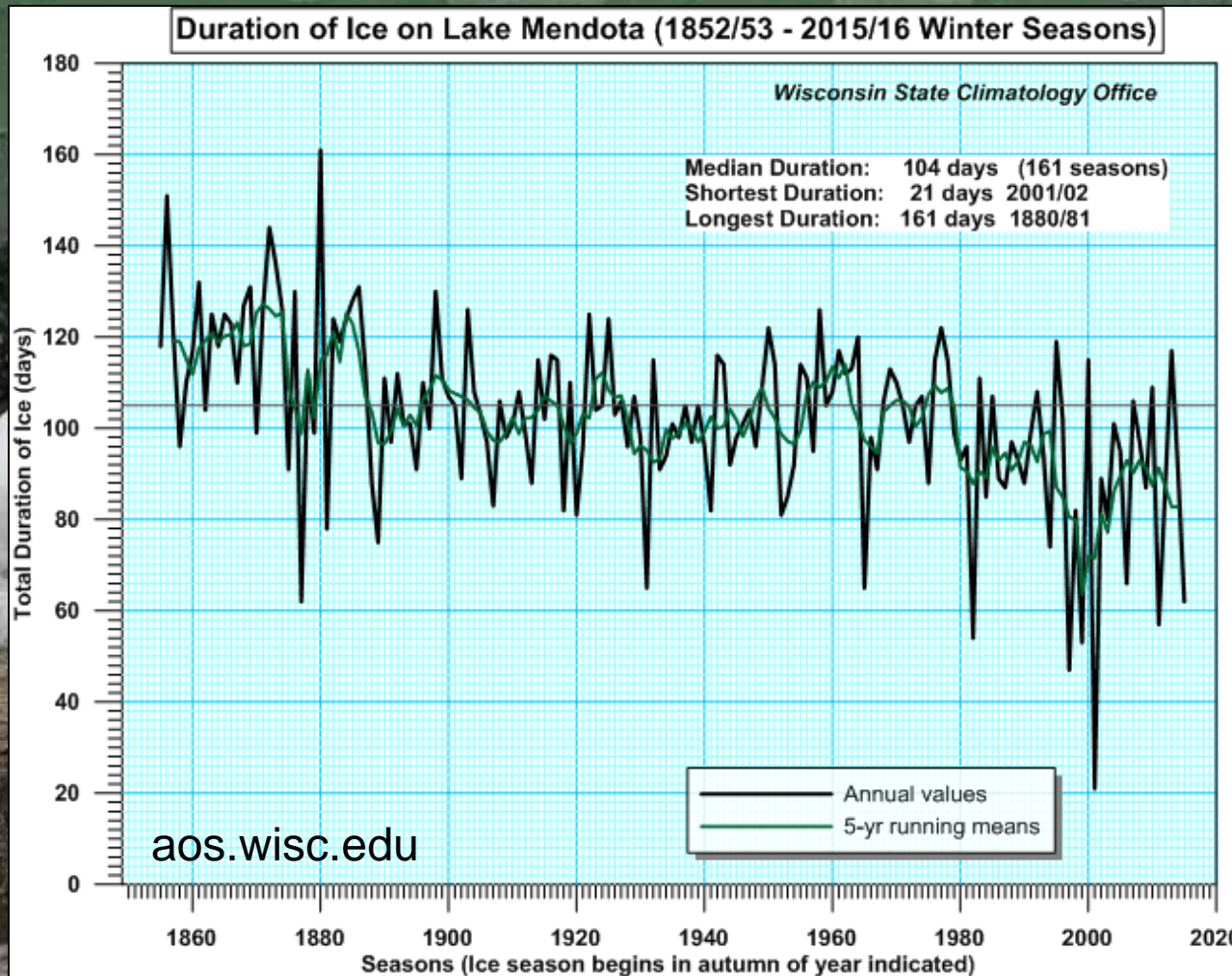


500-year flood event was followed by high temperatures.

“Anecdota” 2: Lake Mendota December 6, 2015

Anneville *et al.* 2015 – “... lakes have an ecological memory by showing that a warm winter can influence subsequent seasonal succession in the cyanobacteria community.”

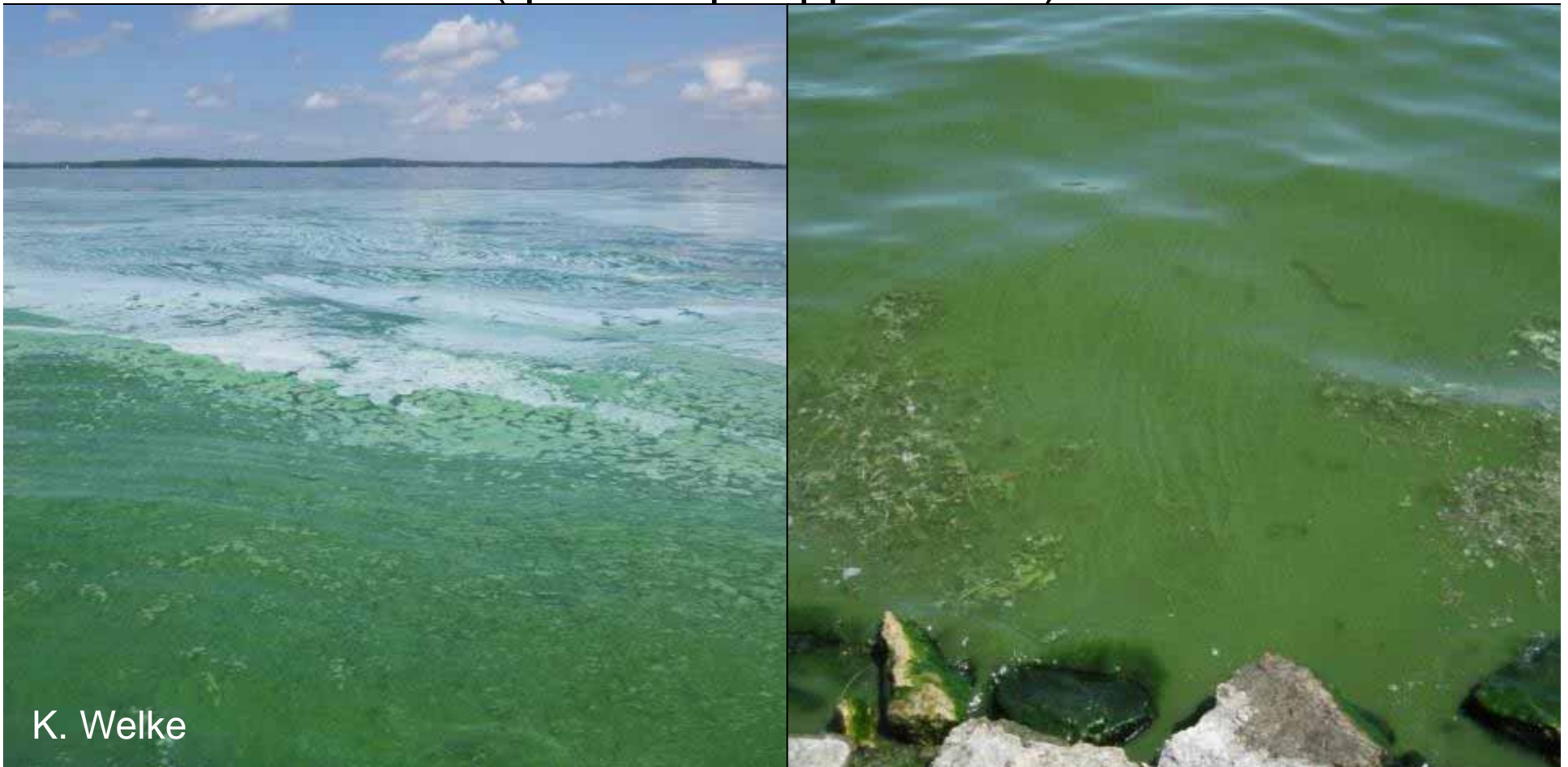
Ecosystems 18(3):441-458

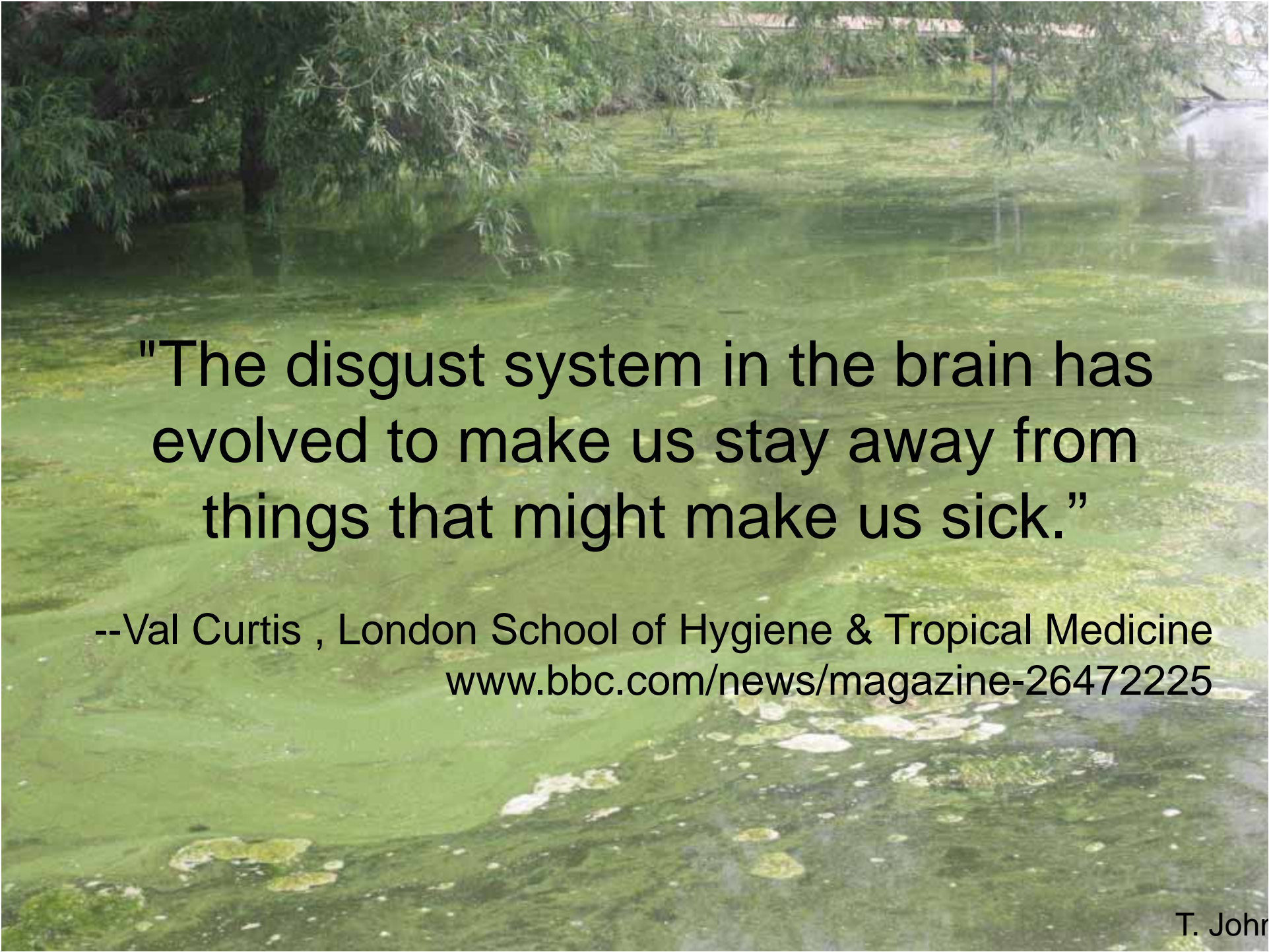


photographer unknown,
Clean Lakes Alliance

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)





"The disgust system in the brain has evolved to make us stay away from things that might make us sick."

--Val Curtis , London School of Hygiene & Tropical Medicine
www.bbc.com/news/magazine-26472225

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*



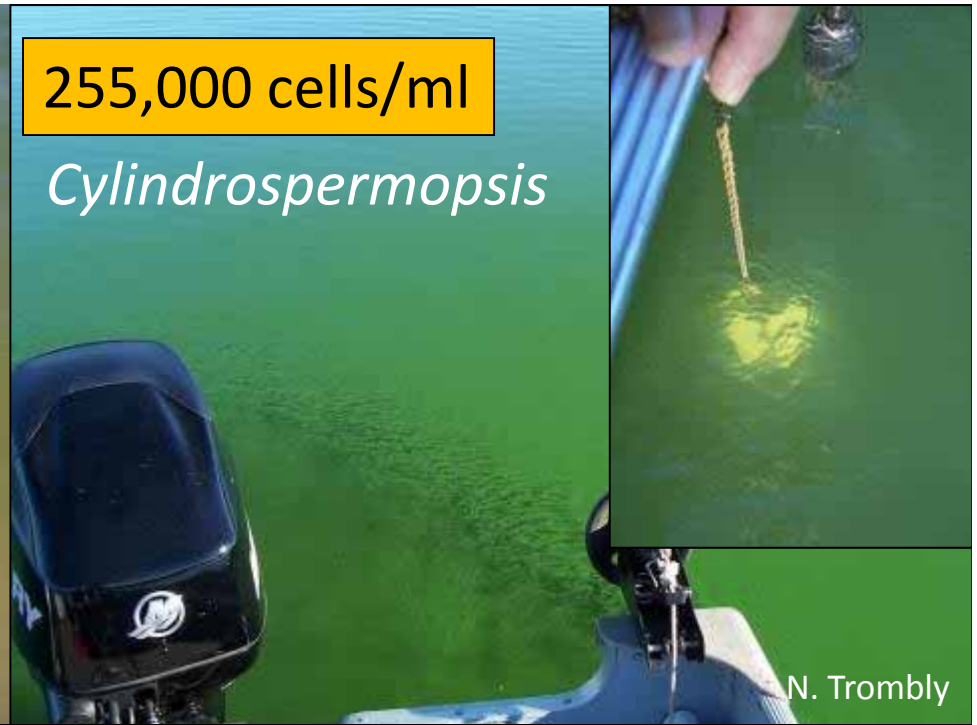
31,000 cells/ml



S. Graham

255,000 cells/ml

Cylindrospermopsis



N. Trombly

3,000,000 cells/ml



K. Schreiber

51,000,000 cells/ml



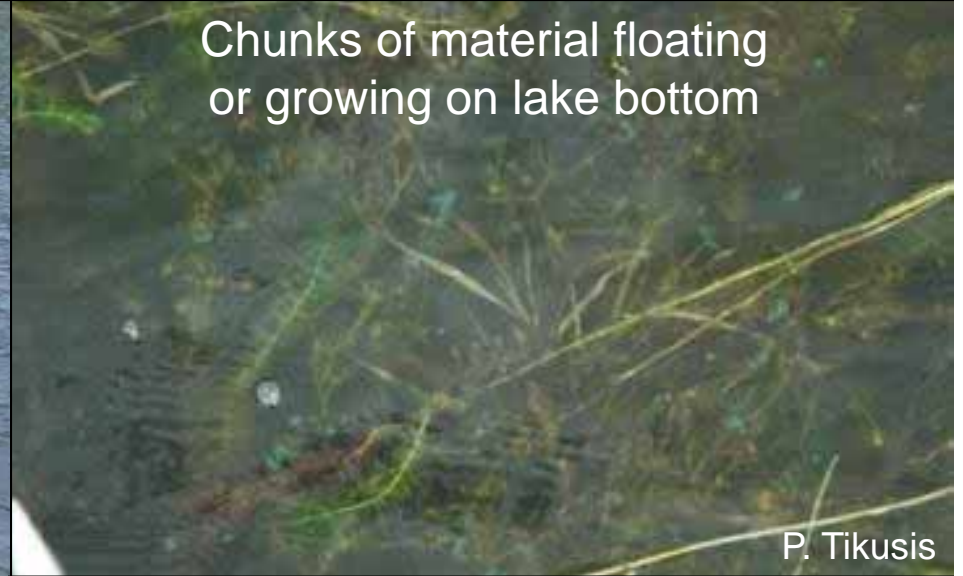
C. Fitzgibbon

What about other situations?

Blooms patchy or in small areas

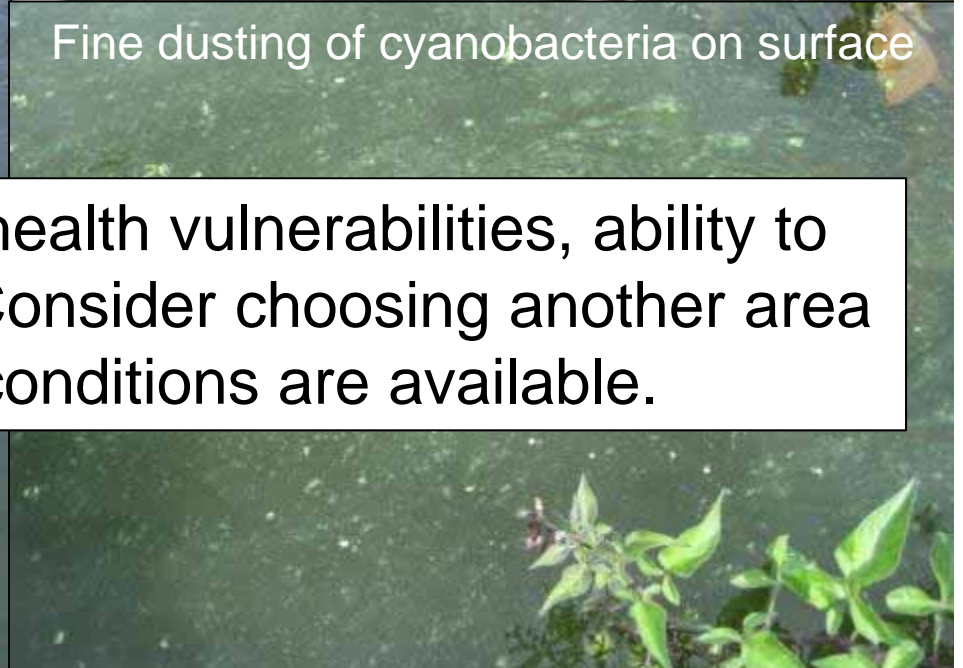


Chunks of material floating or growing on lake bottom



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.
- 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!)



**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.



Blue-green algae - YouTube - Windows Internet Explorer

http://www.youtube.com/watch?v=CGG50pFBEhI&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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Search for "algae"