

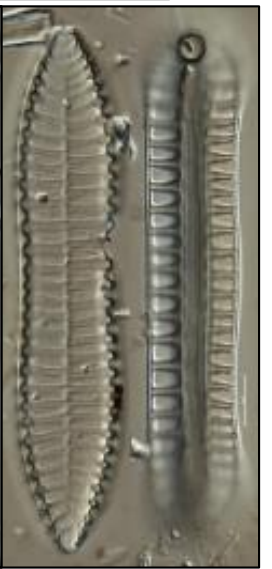
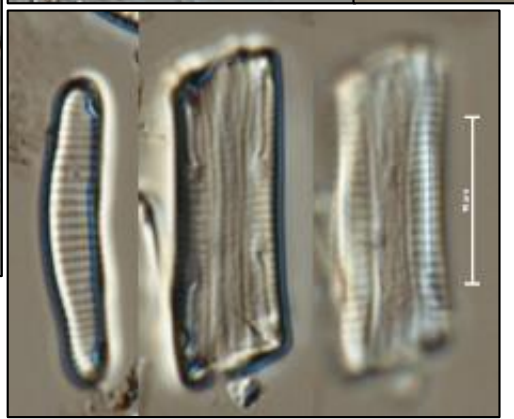
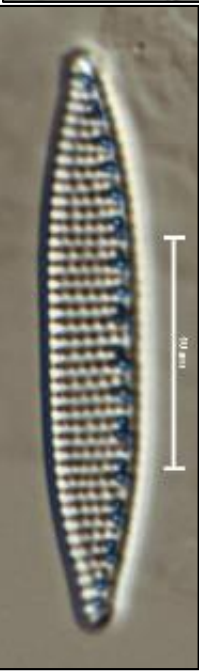
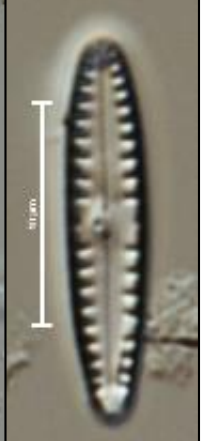
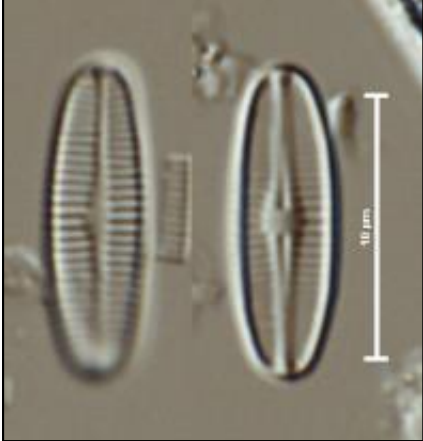
# **Introduction to Cyanobacteria: Identification, Ecology, Health Effects, and Tracking**

**Wisconsin Waters 2020:  
Focusing on Resilient Lakes & Rivers**

**Gina LaLiberte  
Wisconsin Department of Natural Resources**

**[Gina.LaLiberte@wisconsin.gov](mailto:Gina.LaLiberte@wisconsin.gov)**

All photos by Gina LaLiberte unless otherwise attributed.



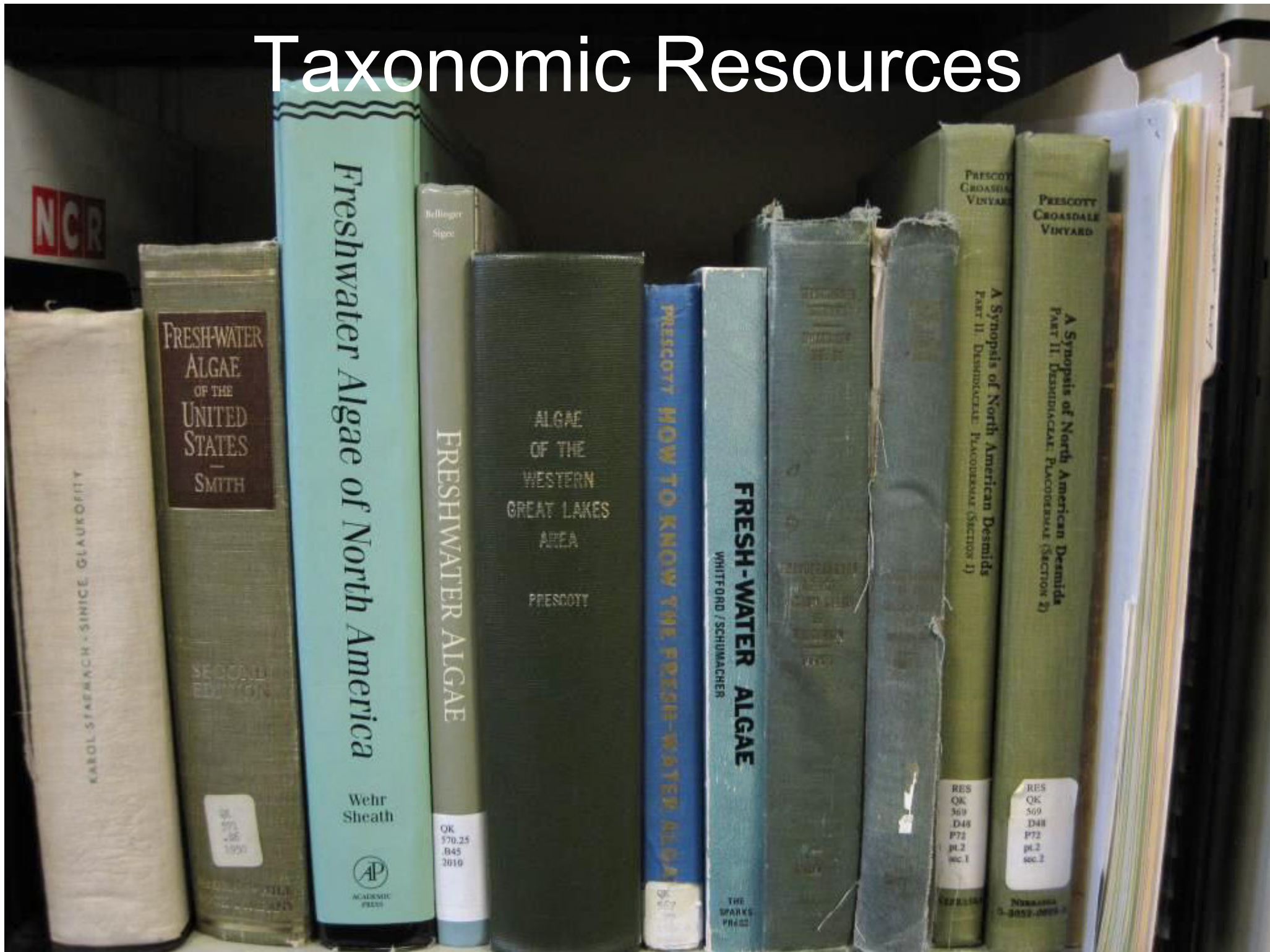


T. Johnson

# Workshop Agenda

- Resources
- Cyanobacteria identification basics
- Algae identification basics
- Cyanobacteria health impacts & recreational guidelines

# Taxonomic Resources



571  
1967

How To Know  
**THE FRESH-WATER ALGAE**

1959

An illustrated key for identifying the more common Fresh-water Algae to genus, with hundreds of species named and pictured and with numerous aids for their study.

by  
G. W. PRESCOTT, Ph.D.  
Professor of Botany  
Michigan State University

*Woods Hole Oceanographic Institution  
Clark Reading Room*

MARINE  
BIOLOGICAL  
LABORATORY  
LIBRARY  
WOODS HOLE, MASS.  
W. H. O. I.



WM. C. BROWN COMPANY  
*Publishers*  
DUBUQUE, IOWA

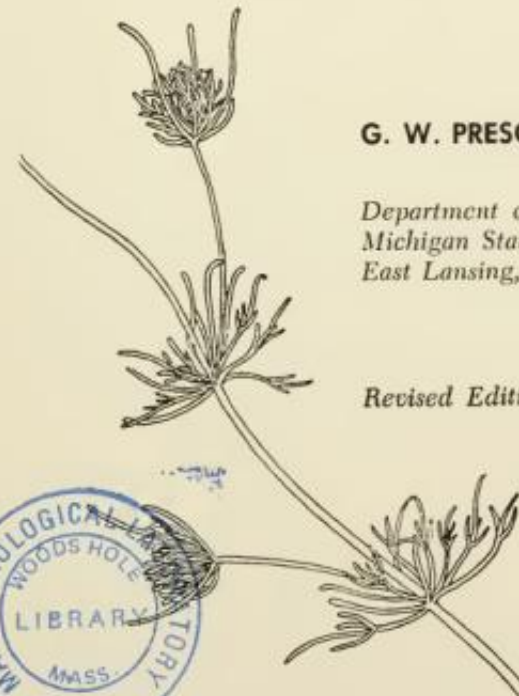
**ALGAE**  
OF THE  
**WESTERN GREAT LAKES AREA**

With an Illustrated Key to the Genera of Desmids and Freshwater Diatoms

G. W. PRESCOTT, Ph.D.

*Department of Botany and Plant Pathology  
Michigan State University  
East Lansing, Michigan*

*Revised Edition*



WM. C. BROWN COMPANY PUBLISHERS  
Dubuque, Iowa

# Freshwater Algae

Identification, Enumeration and Use as Bioindicators

Second Edition

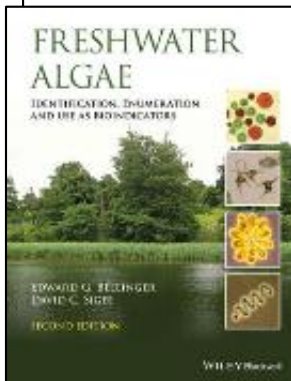
**Edward G. Bellinger**

*Department of Environmental Sciences and Policy,  
Central European University, Hungary*

and

**David C. Sigeo**

*School of Earth, Atmospheric and Environmental Sciences,  
University of Manchester, UK*



**WILEY** Blackwell

# Freshwater Algae of North America

Ecology and Classification

Edited by

**John D. Wehr**

*Louis Calder Center—Biological Station  
Fordham University  
Armonk, New York, USA*

**Robert G. Sheath**

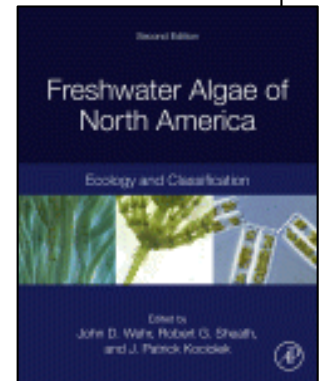
*Department of Biological Sciences  
California State University San Marcos  
San Marcos, California, USA*

**J. Patrick Kociolek**

*Department of Ecology and Evolutionary Biology and Museum of Natural History  
University of Colorado  
Boulder, Colorado, USA  
University of Michigan Biological Station  
Pellston, Michigan, USA*



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Academic Press is an imprint of Elsevier



## Field and Laboratory Guide to Freshwater Cyanobacteria Harmful Algal Blooms for Native American and Alaska Native Communities



Open-File Report 2015–1164

U.S. Department of the Interior  
U.S. Geological Survey



# *Süßwasserflora von Mitteleuropa: Cyanoprokaryota* Komárek & Anagnostidis 2008-2013

Süßwasserflora von Mitteleuropa

H. Ettl G. Gärtner  
H. Heynig D. Mollenhauer (Hrsg.) 19/1

J. Komárek K. Anagnostidis

**Cyanoprokaryota**

1. Teil: Chroococcales

**Spektrum**  
GUSTAV FISCHER

Süßwasserflora von Mitteleuropa

B. Büdel G. Gärtner  
L. Krienitz M. Schagerl (Hrsg.) 19/2

J. Komárek K. Anagnostidis

**Cyanoprokaryota**

2. Teil: Oscillatoriales



Süßwasserflora von Mitteleuropa  
Freshwater Flora of Central Europe

B. Büdel G. Gärtner L. Krienitz  
M. Schagerl (Hrsg. / Eds.)

J. Komárek

**Cyanoprokaryota**

3. Teil / Part 3:  
Heterocytous Genera

19/3

Springer Spektrum



# WI Cyanobacteria Resources



Blue-green algae - YouTube - Windows Internet Explorer

http://www.youtube.com/watch?v=C6G50pfBEhI&feature=player\_embedded

File Edit View Favorites Tools Help

Favorites Suggested Sites (2) Suggested Sites

Blue-green algae - YouTube

YouTube

Blue-green algae

WIDNRTV · 176 videos

6,371

Subscribe 419



WISCONSIN DEPARTMENT OF HEALTH SERVICES

About DHS Topics A - Z Programs & Services Partners & Providers Reference Center

## Blue-Green Algae

<a href="#">Harmful Algal Blooms Home</a>	<a href="#">Understanding Algae</a>	<a href="#">Health Concerns</a>	<a href="#">Keeping Our Lakes Clean</a>	<a href="#">Images of Algal Blooms</a>	<a href="#">Resources and Links</a>	<a href="#">Contact Us</a>
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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!**



[Back to Environmental Health Resources](#)

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

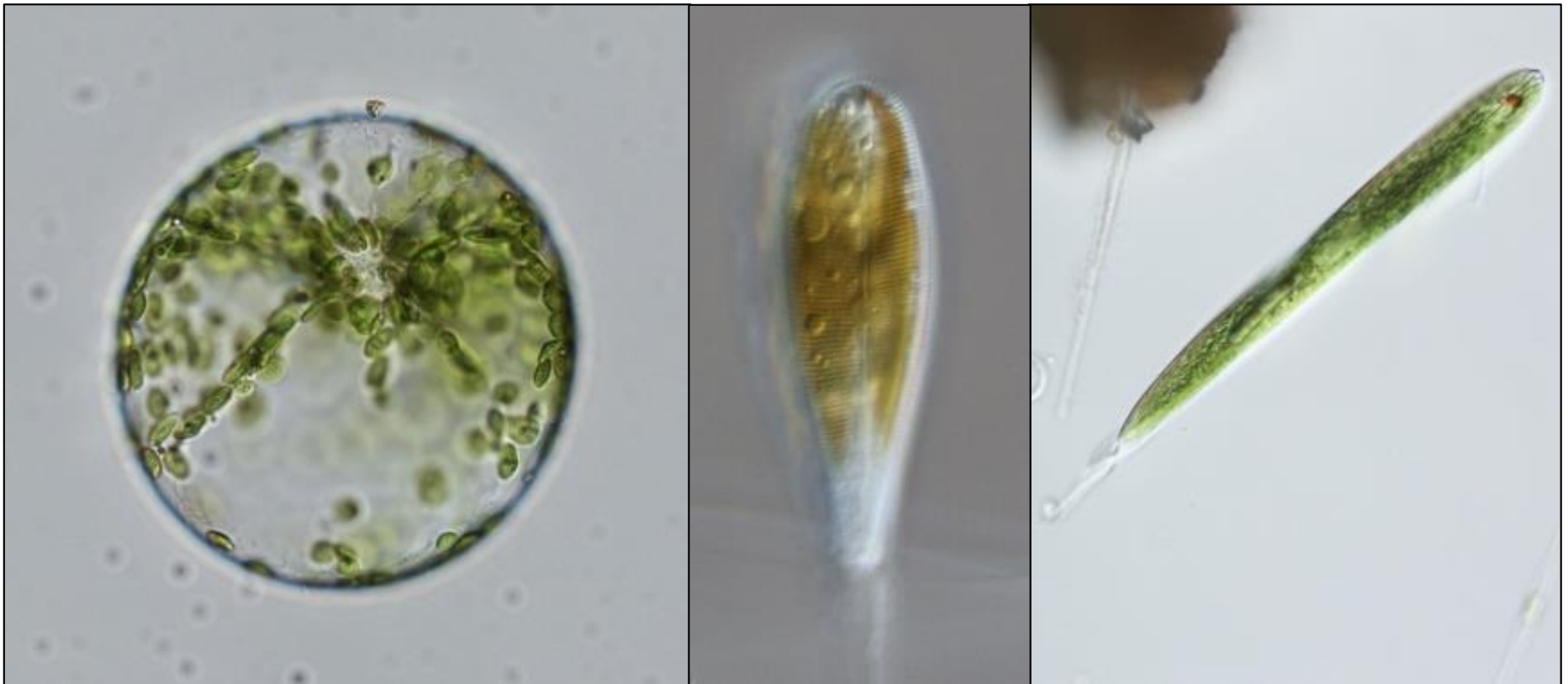
dnr.wi.gov and dhs.wisconsin.gov  
Search for "algae"

# Caveats

- Introduction to cyanobacteria
- Tools to ID cyanobacteria vs. other algae
- Resources for accurate communication

# What are algae?

- Have chlorophyll, like plants
- Lack specialized tissues, unlike plants
- They grow everywhere, even in deserts
- From tiny unicells to giant kelp



# Cyanobacterial species vs. strains

- Cyanobacteria (blue-green algae) are true bacteria
- Bacteria only divide – no sexual reproduction
- Different genetic profiles can evolve within each cyanobacterial species – these are strains.

# Key features for identification

- **Color.** All algae have chlorophyll-a. Many have additional pigments.
- **Texture:** stringy and hair-like? Tiny particles in water? Does it drape over your fingers or run right through them?
- **Shape** of colonies.
- In most cases, light microscopy is necessary.

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

2

3

4

1

01

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8

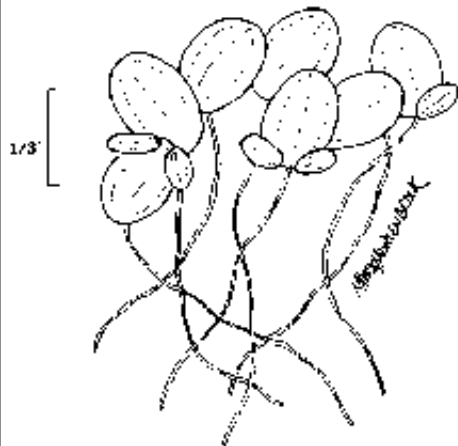
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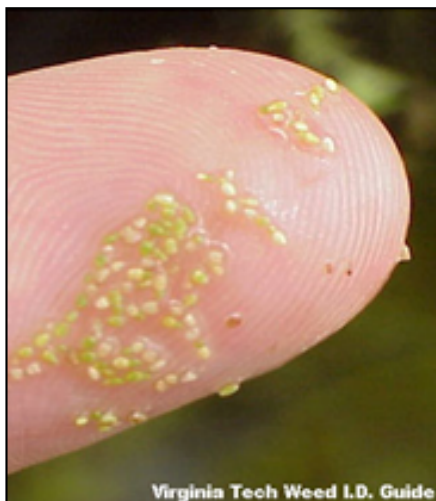
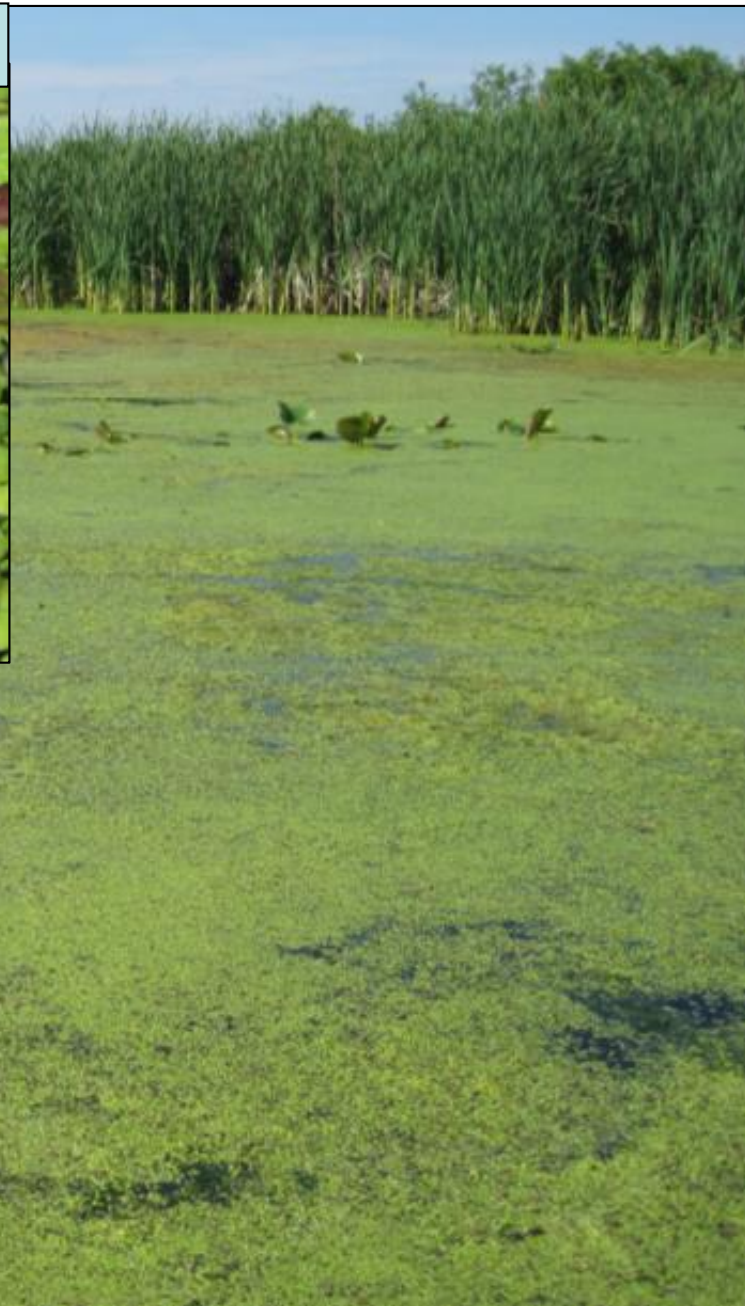


# Don't mistake duckweeds or watermeal for blue-green algae

Duckweeds (*Lemna*, *Spirodela*) have roots



*Lemna*, *Spirodela*, *Wolffia*

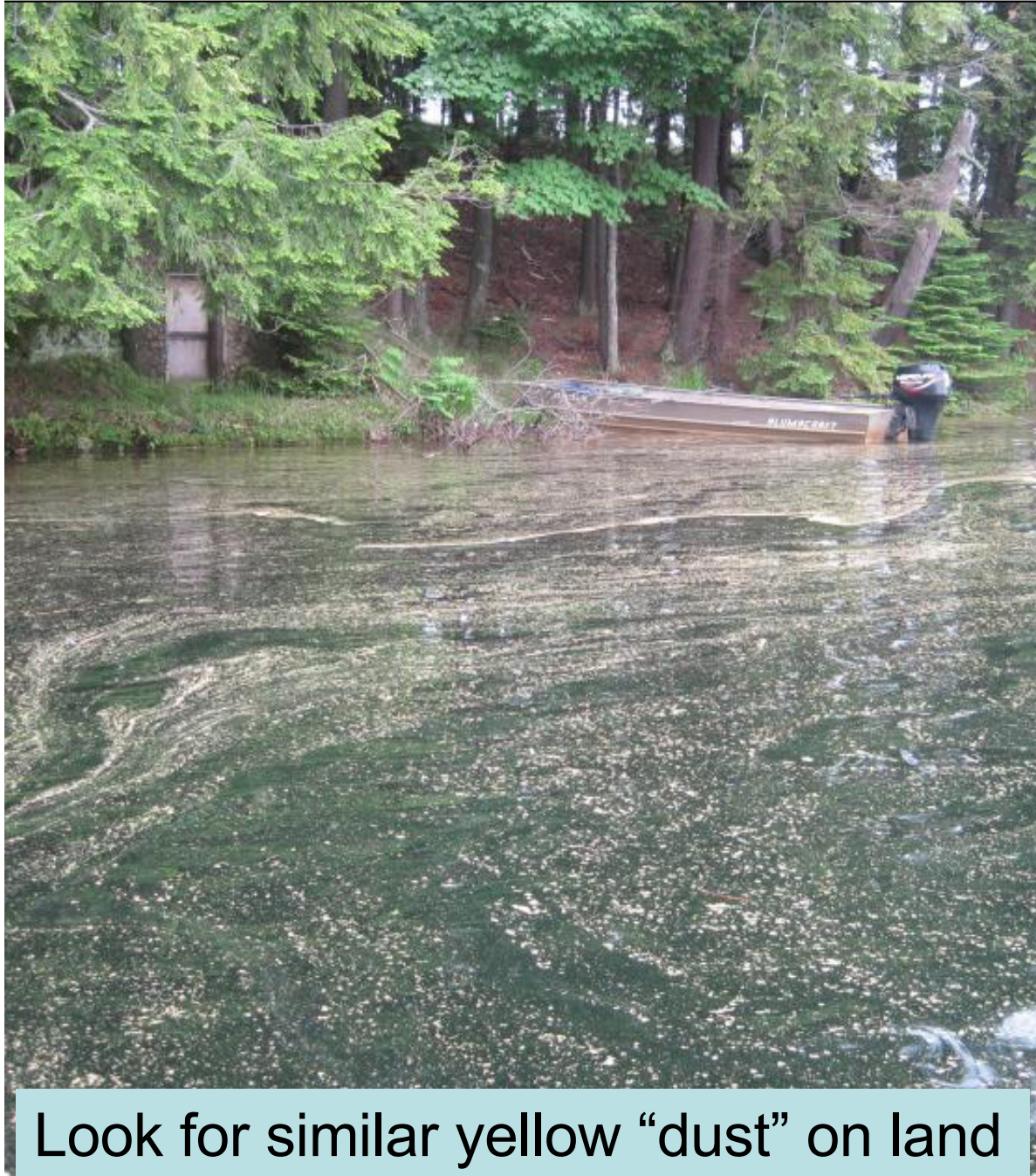


Virginia Tech Weed I.D. Guide

Watermeal (*Wolffia*)  
Tiny, firm, grainy



# Don't mistake yellow pollen for blue-green algae



Look for similar yellow "dust" on land

Lake Michigan 2019  
K. Larson

Great Lakes aren't immune  
to pollen accumulations

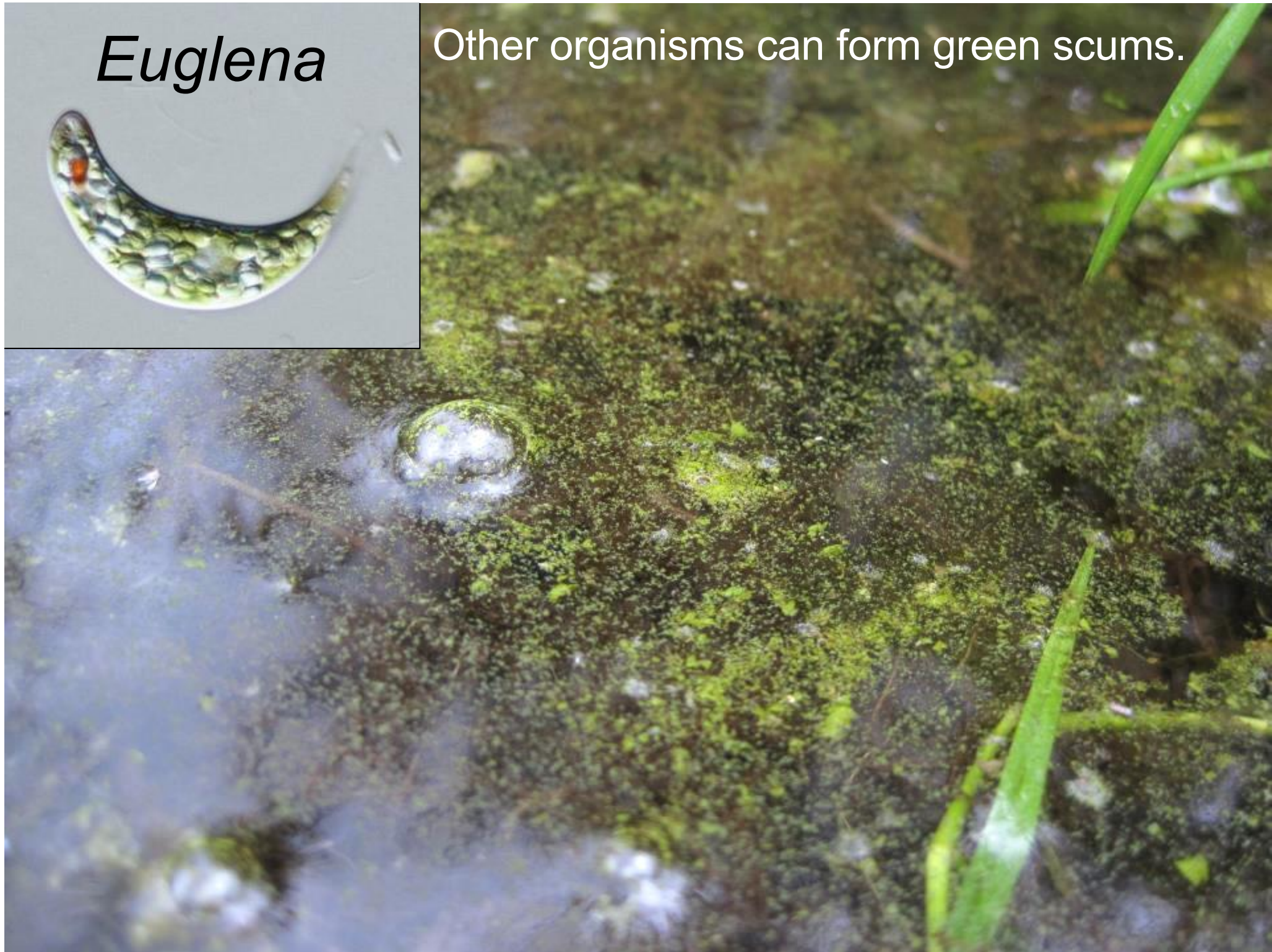
Lake Superior 2019  
C. Dray



*Euglena*



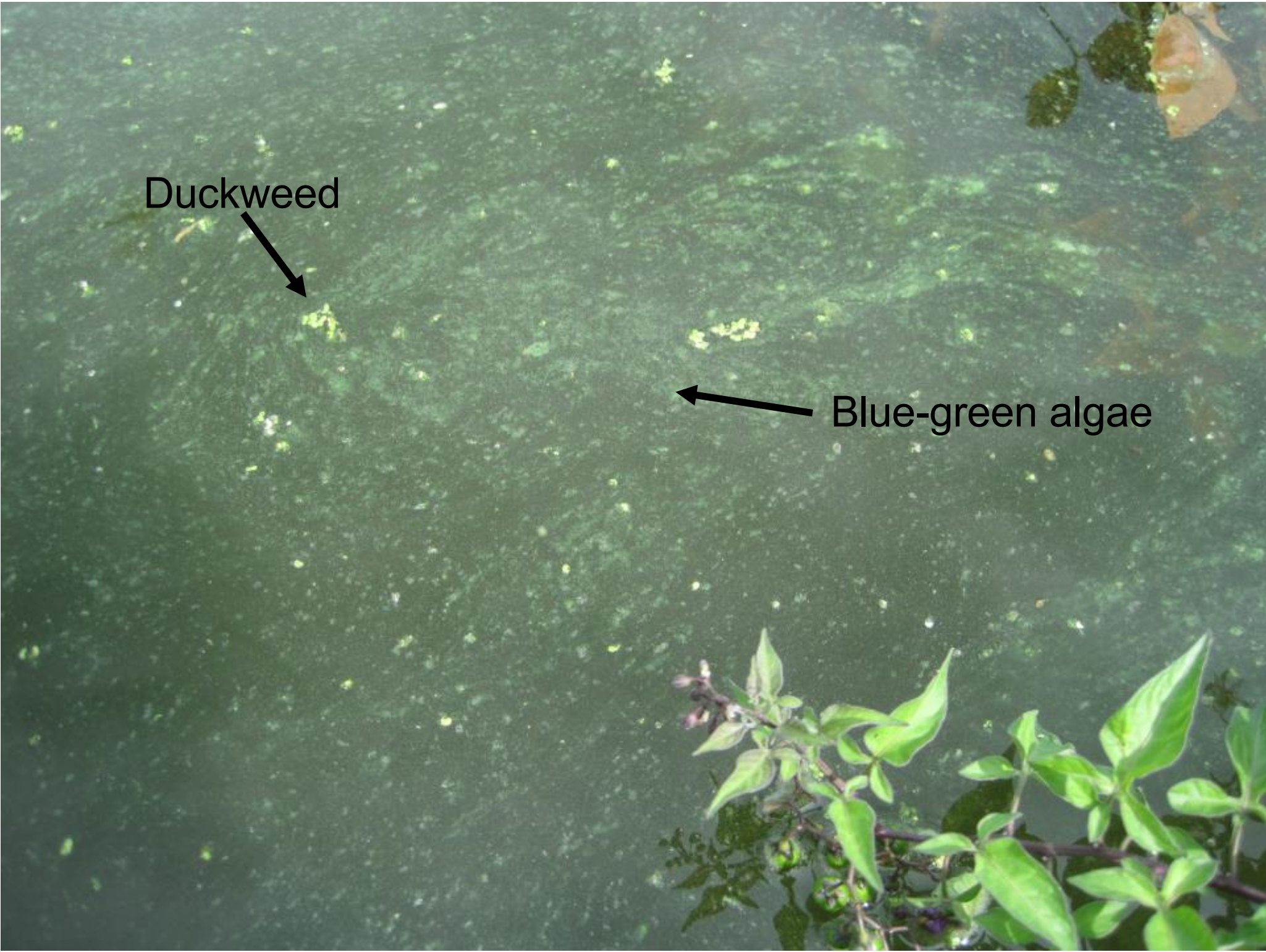
Other organisms can form green scums.



Duckweed



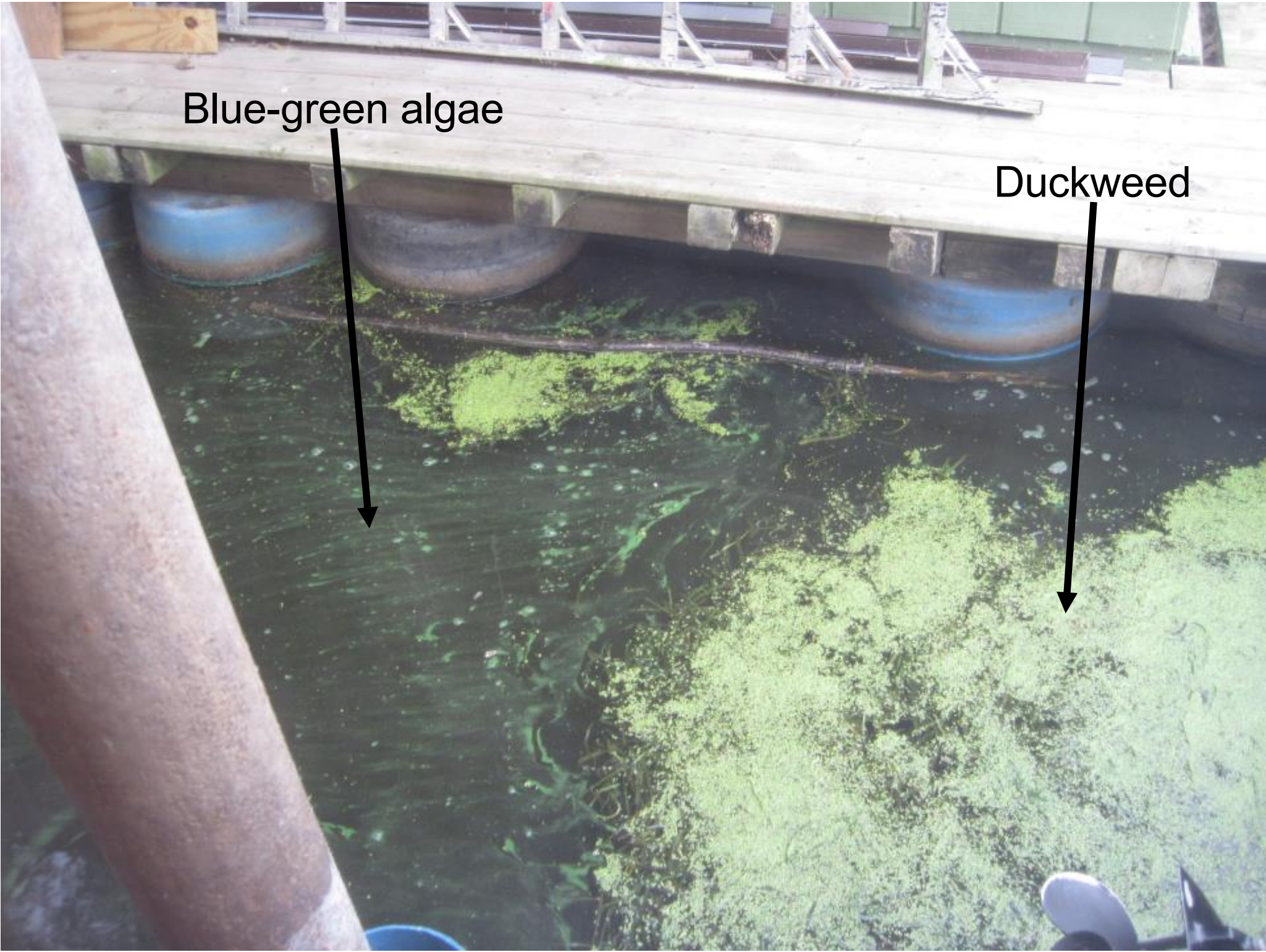
Blue-green algae



Blue-green algae



Duckweed





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

## *Spirogyra* & relatives

slippery texture, hairlike, unbranched



## *Cladophora* & relatives

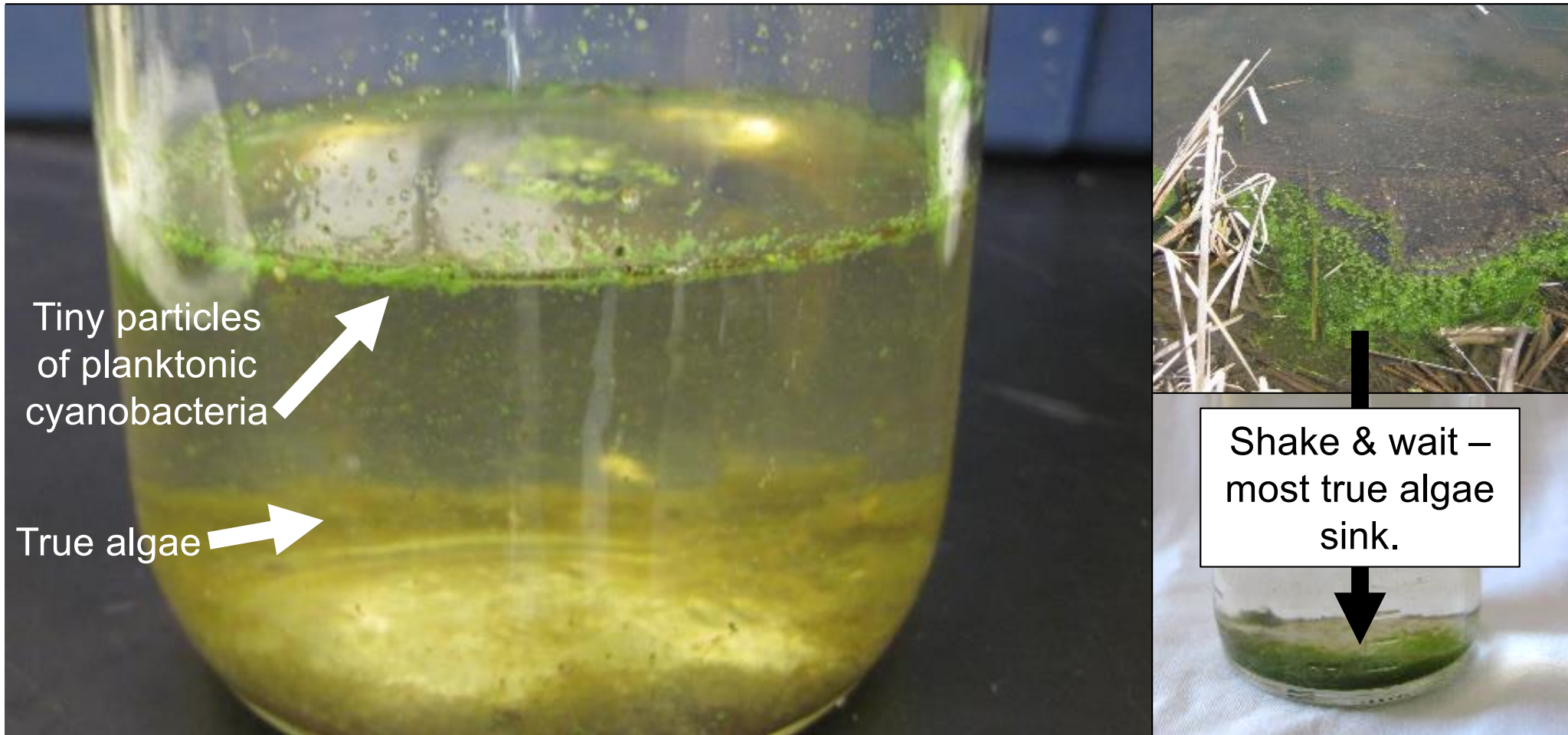
wet cotton texture, usually branching



S. Pfeiffer

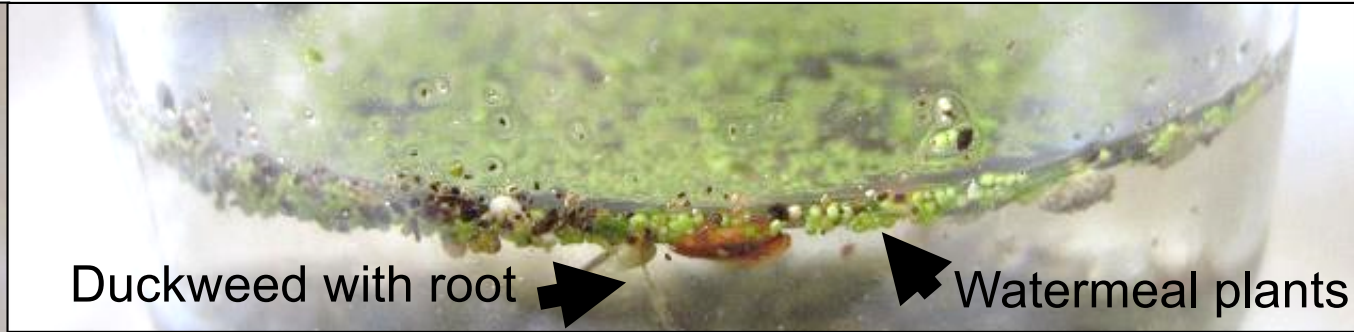


How do I tell if I am seeing cyanobacteria or something else? “Jar Test” – does it form a floating layer?



Minnesota Pollution Control Agency “Simple, no-cost tests for blue-green algae”  
(Search for “Minnesota jar test”) [tinyurl.com/y8jfxpg](https://tinyurl.com/y8jfxpg)

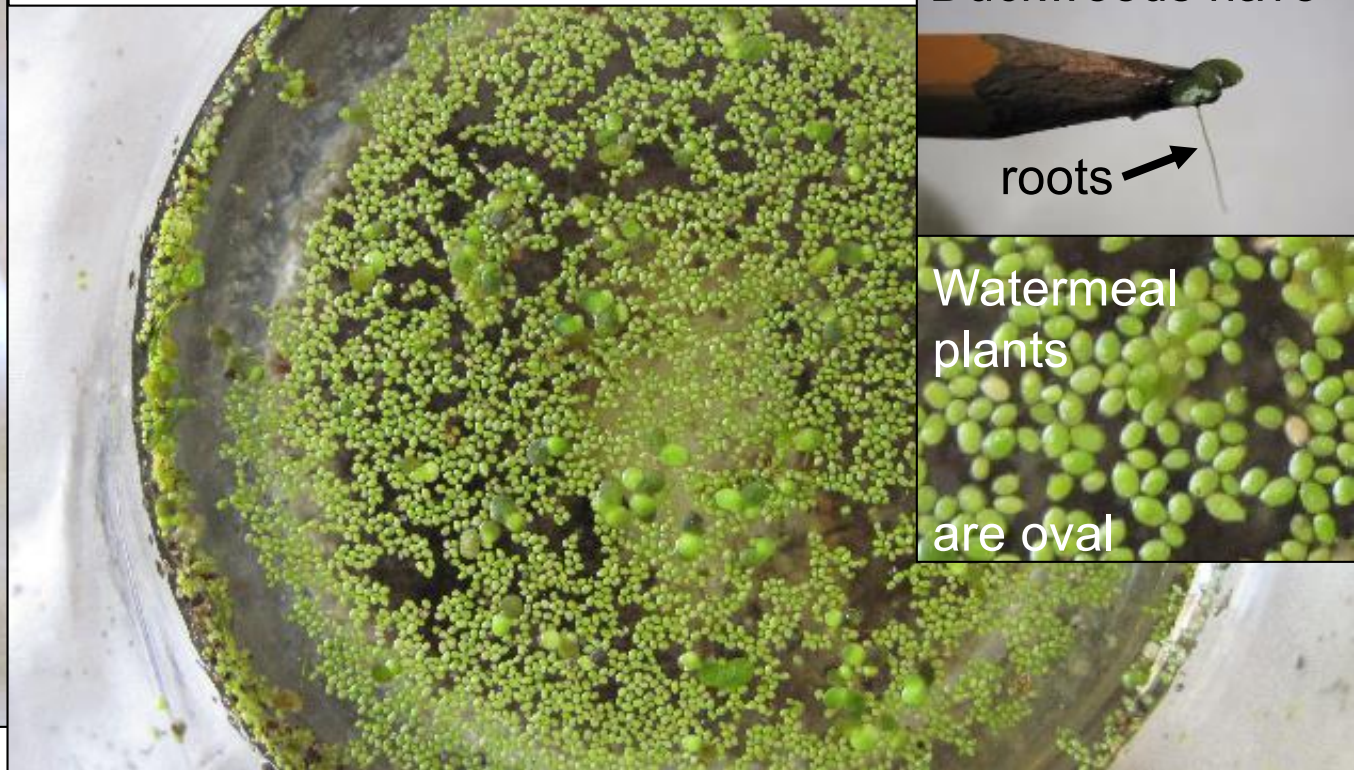
# Take a close look at floating green layers



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.

# How do I tell if floating mats are 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.)

Filamentous Green Algae

Cyanobacteria

Filamentous Green Algae

L. Olson

M. Nault

Minnesota Pollution Control Agency

“Simple, no-cost tests for blue-green algae” [tinyurl.com/y8jfxpvg](http://tinyurl.com/y8jfxpvg)

# “Blue-green” is misleading



Growing blooms are most often green in color.

growing

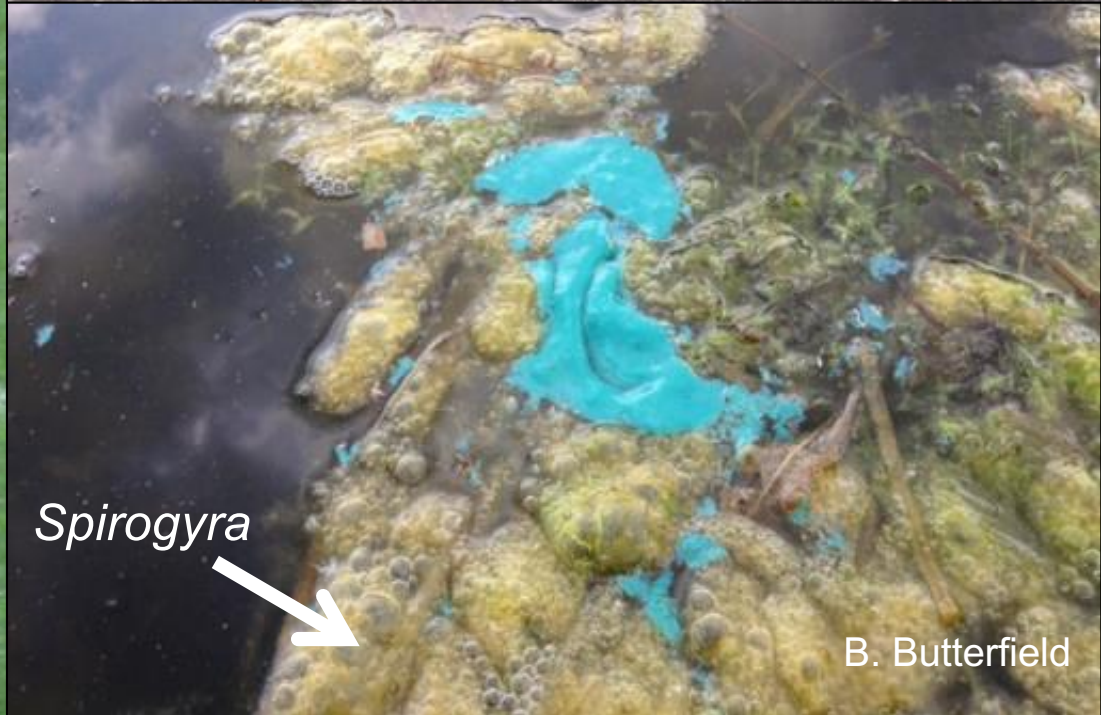


J. Williamson

decomposing  
pigments are released



M. Meade



*Spirogyra*



B. Butterfield





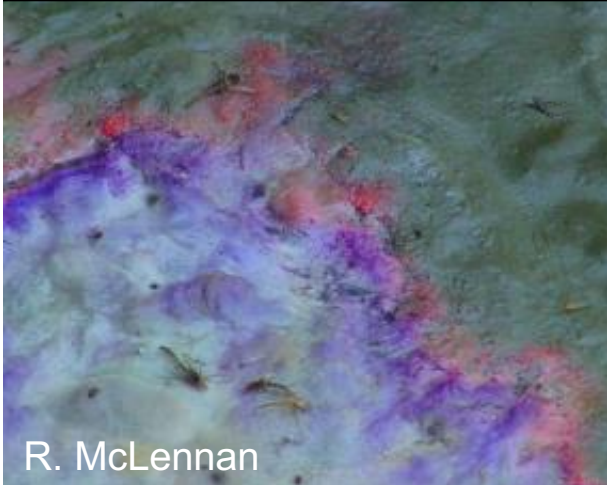
R. McLennan



N. Trombly



T. Moris



R. McLennan



J. Williamson



WDHS



J. Williamson



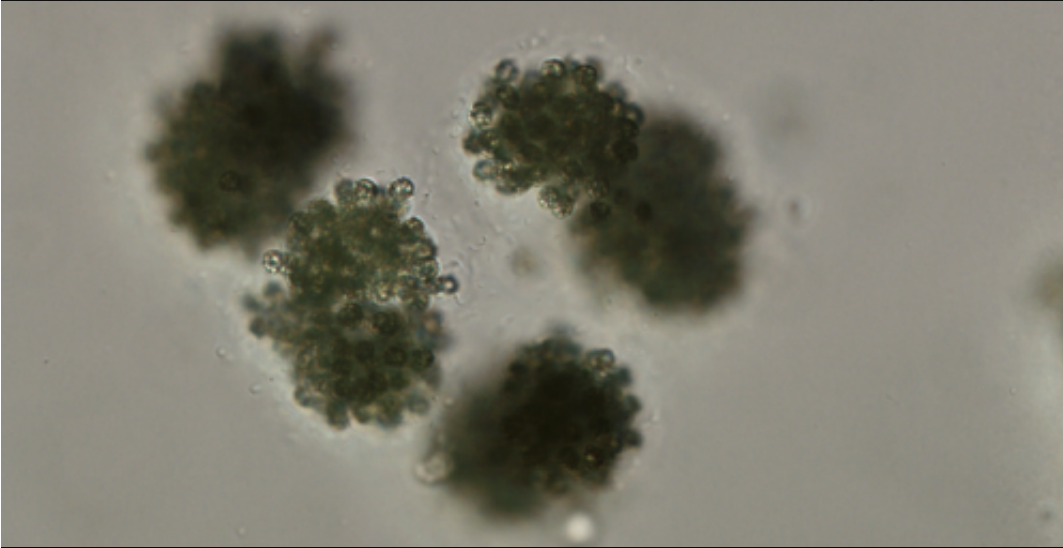
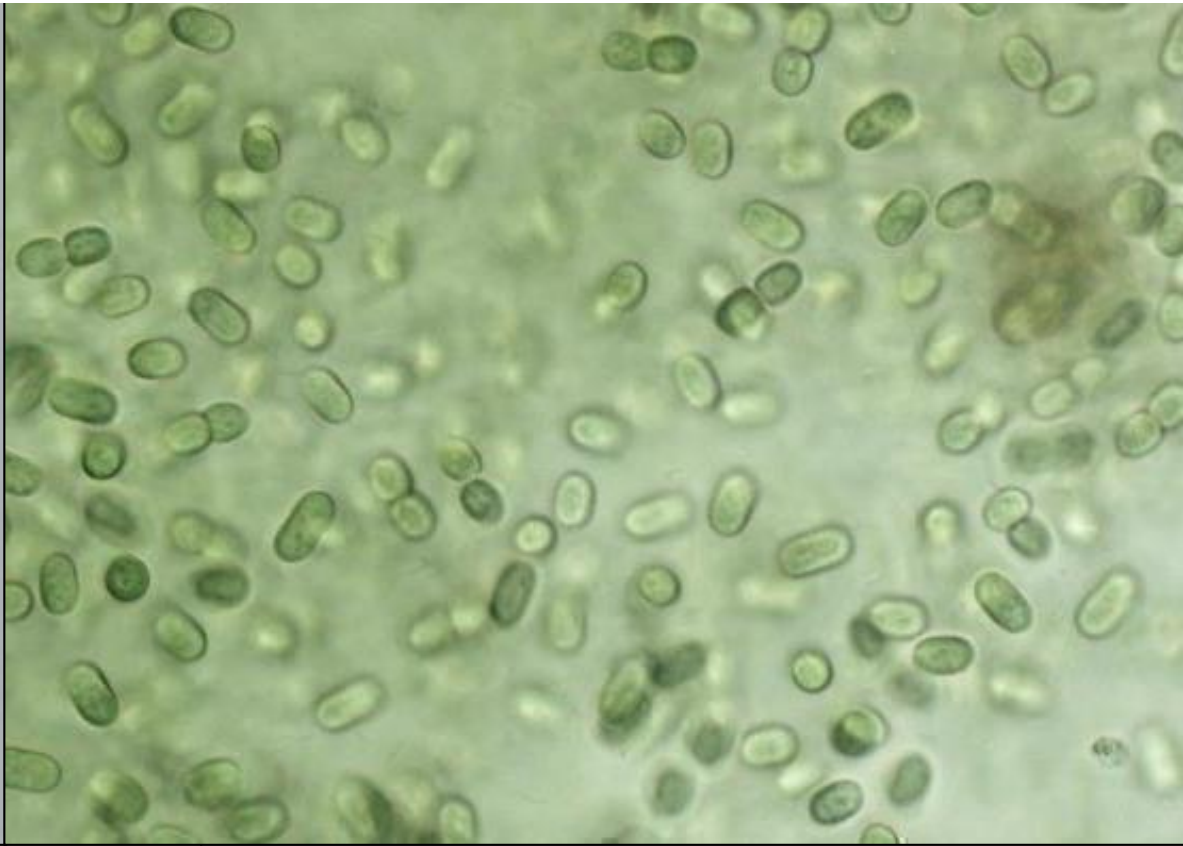
A. Dryja

# Orders of Cyanobacteria



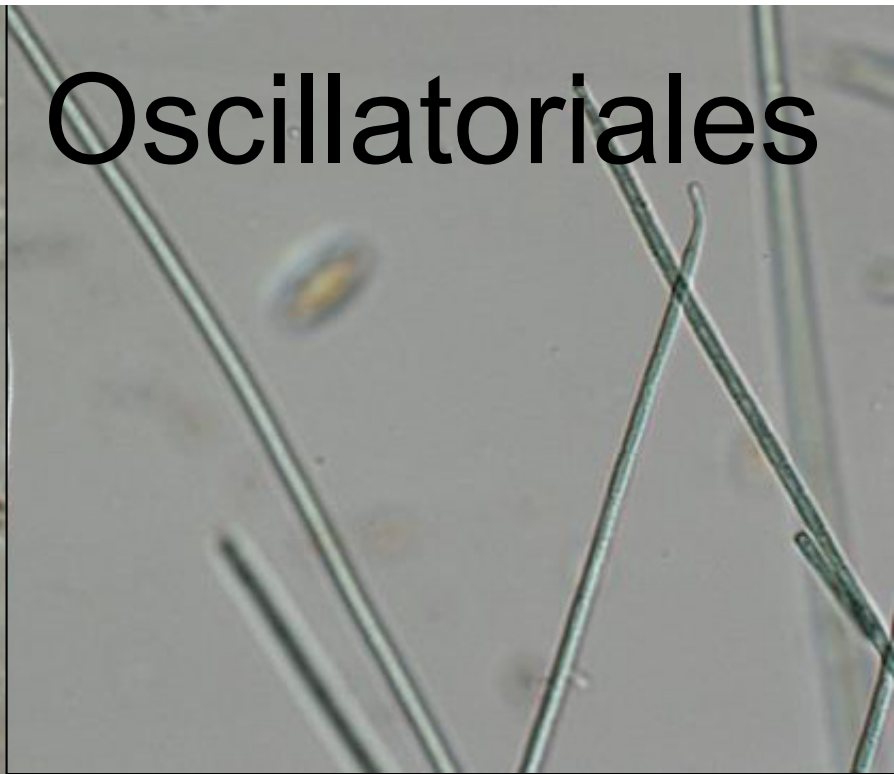


# Chroococcales



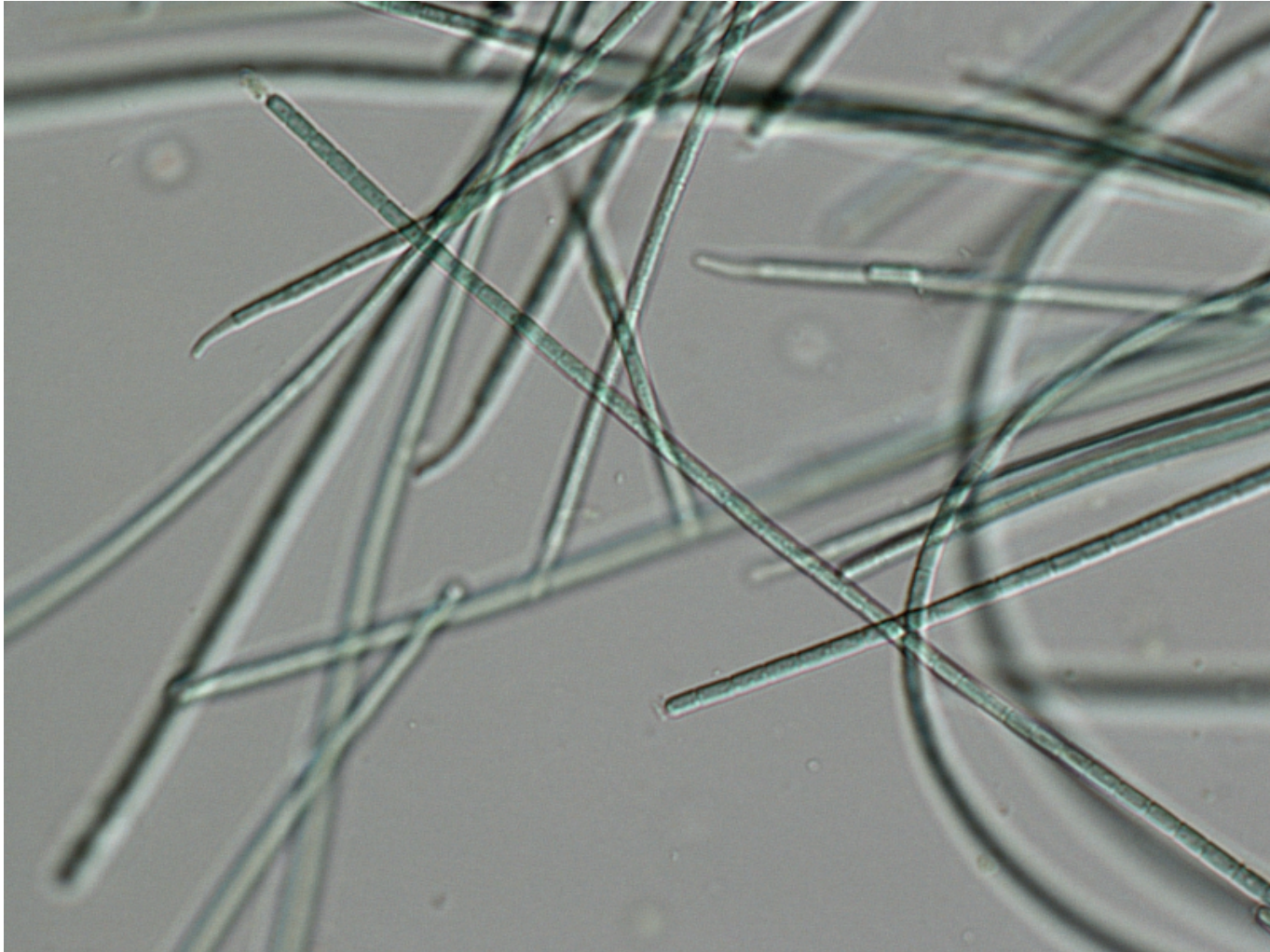
Single cells or colonies of (mostly) spherical or ovoid cells

# Oscillatoriales

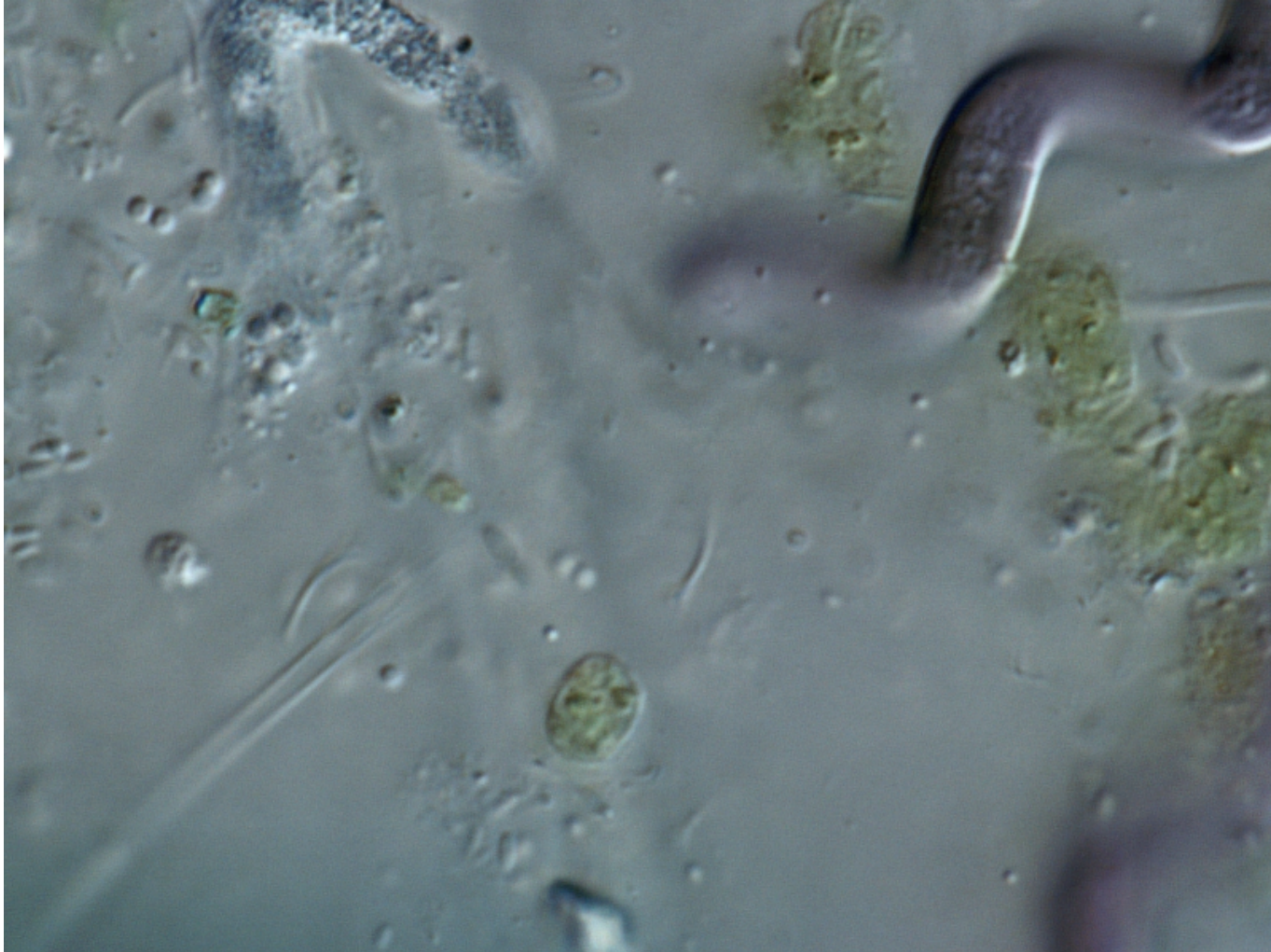


Uniseriate, unbranched trichomes (filaments)

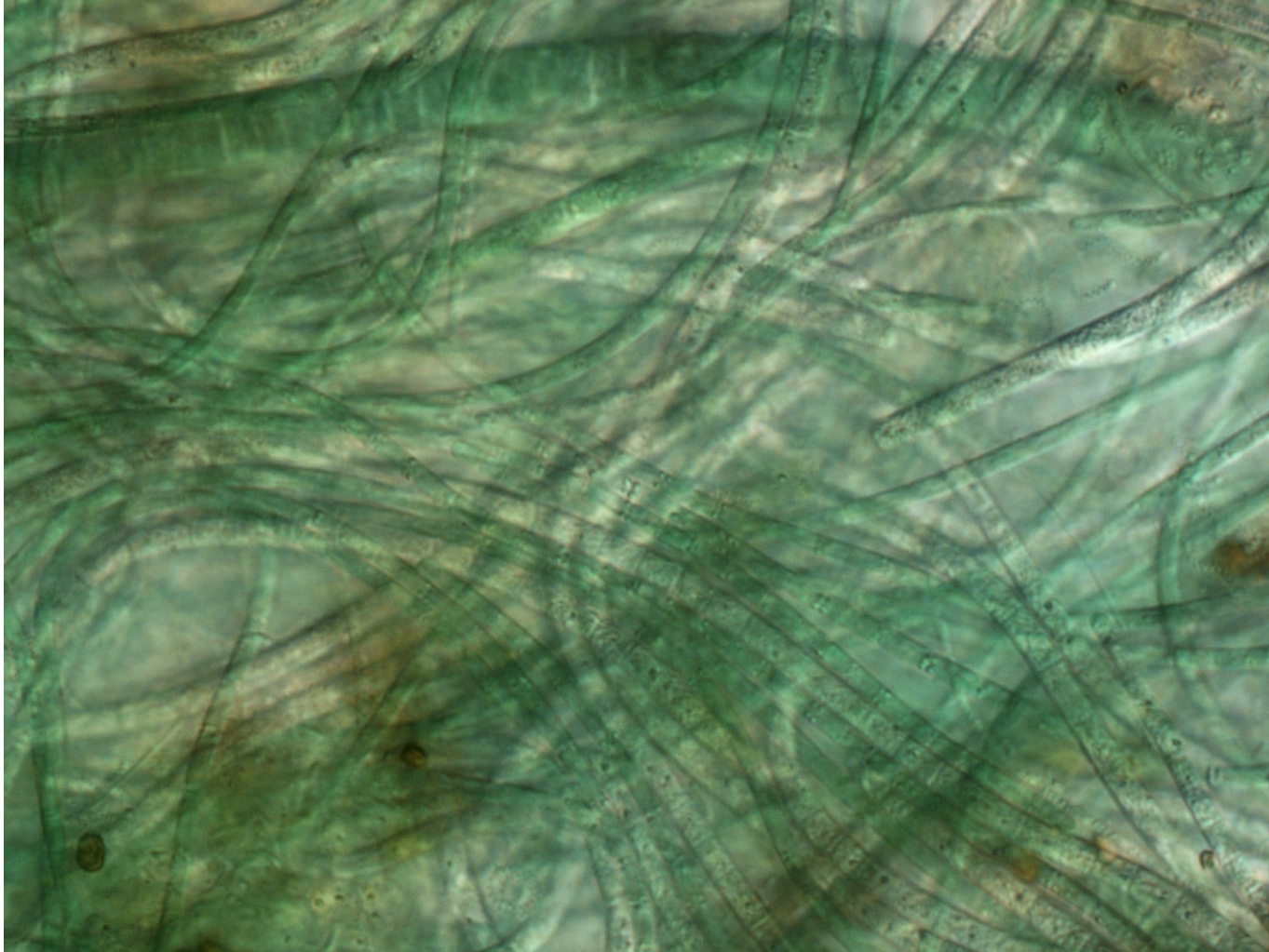
# Some Oscillatoriales are motile



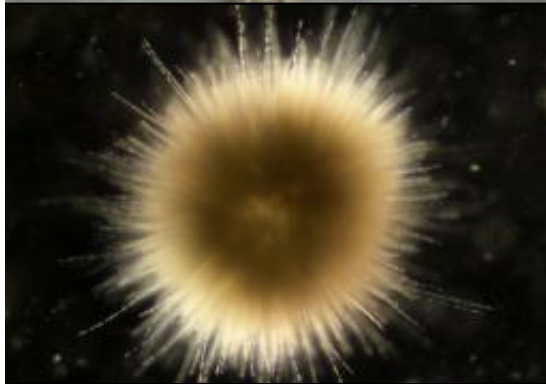
# Some Oscillatoriales are motile



# Some Oscillatoriales are motile



# Nostocales

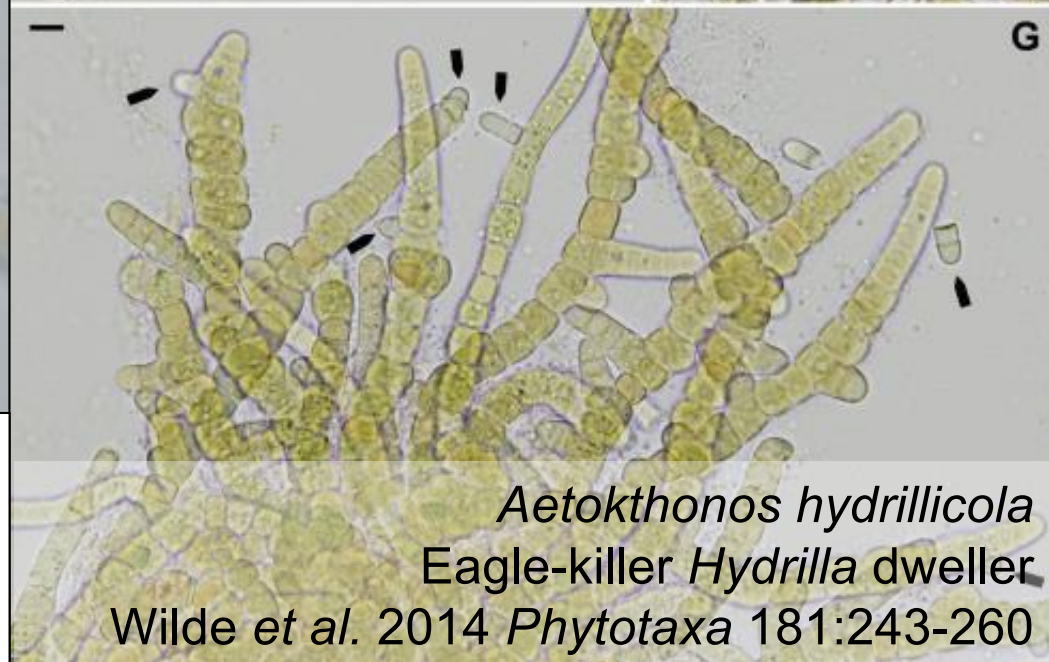
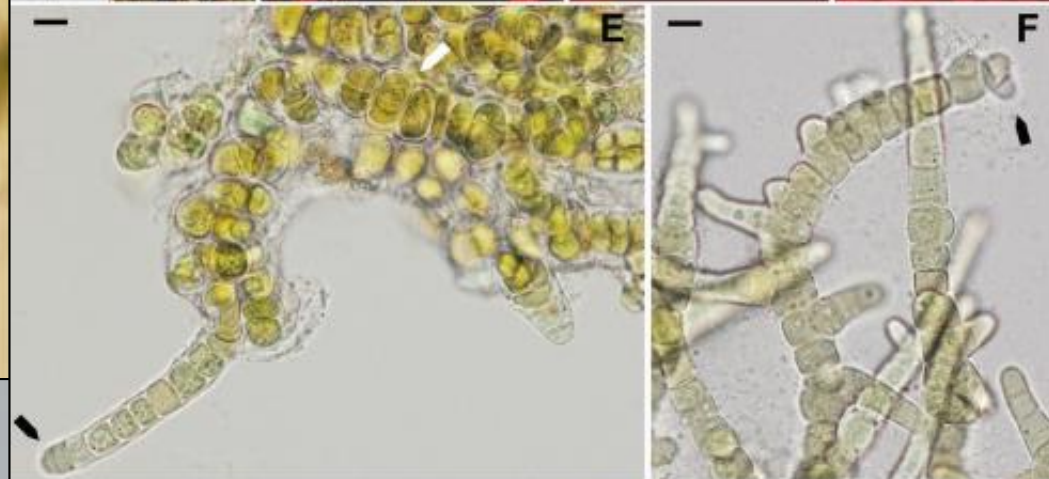
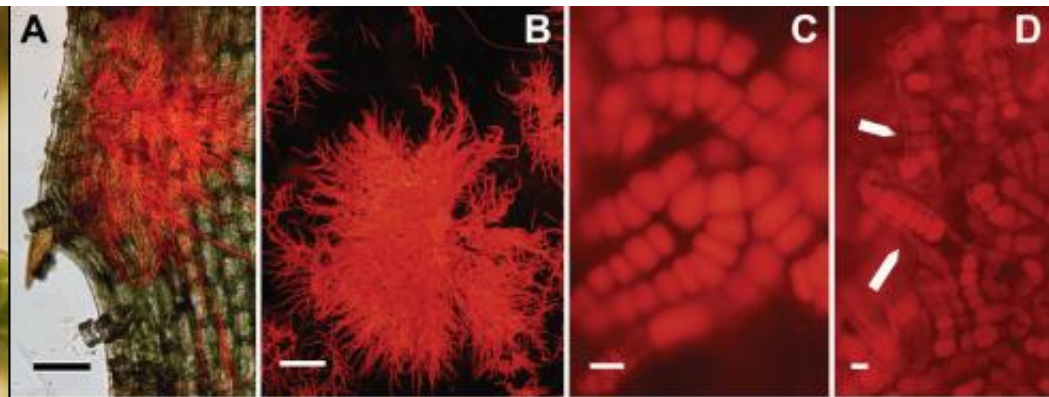


Heterocytes for  $N_2$  fixation, false branching, uniseriate

# Stigonematales

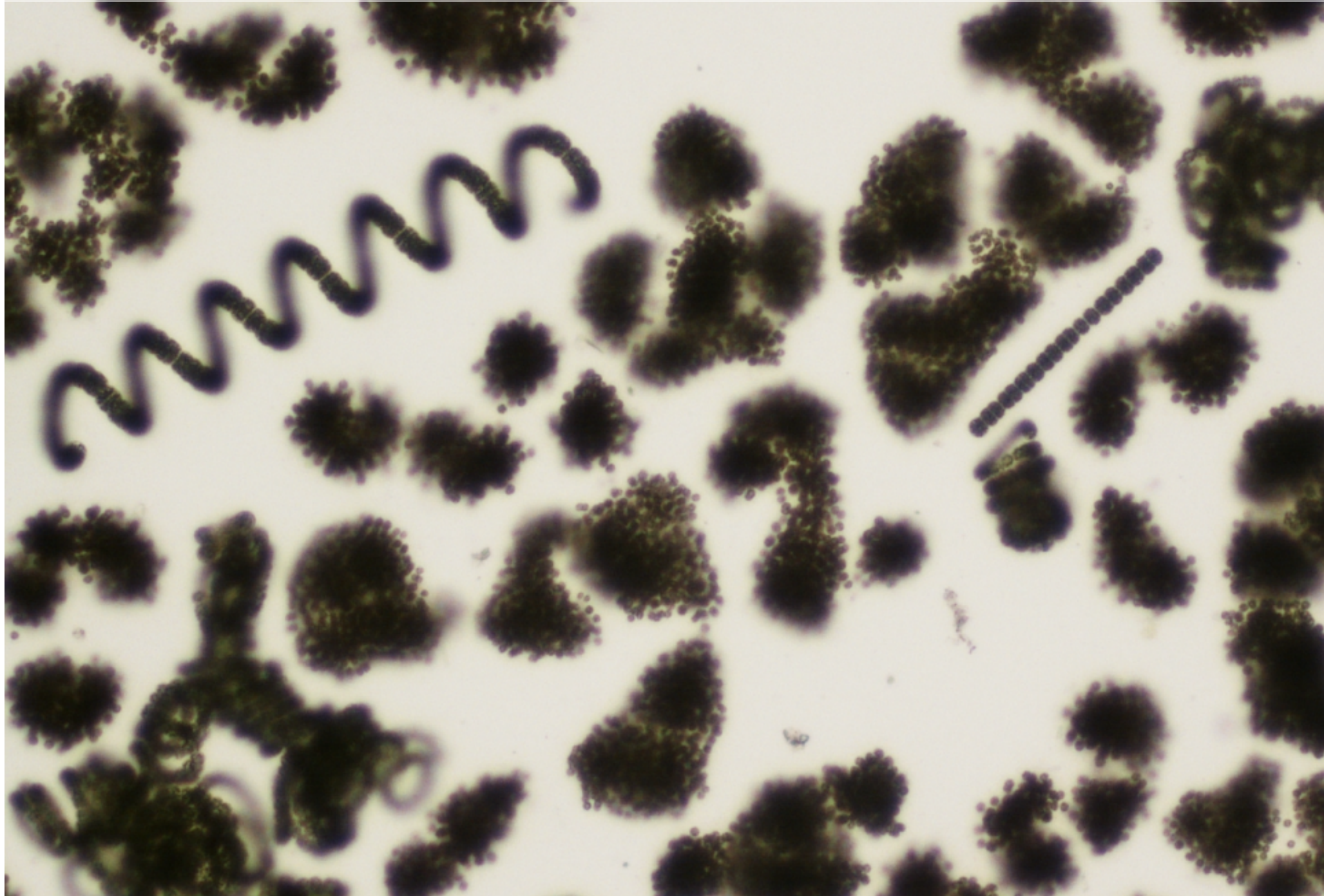


Heterocytes for N<sub>2</sub> fixation,  
true branching, multiseriate



*Aetokthonos hydrillicola*  
Eagle-killer *Hydrilla* dweller  
Wilde et al. 2014 *Phytotaxa* 181:243-260

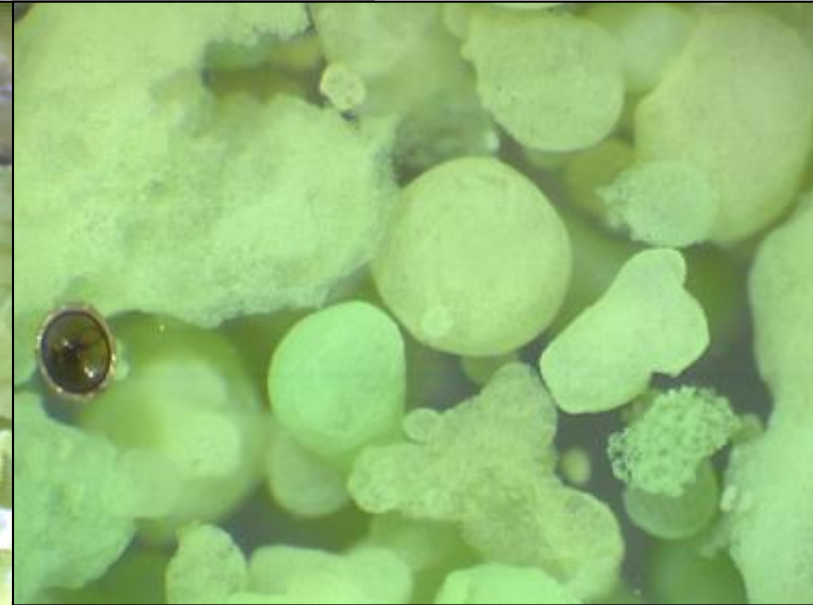
PLANKTONIC BLOOMS: *Microcystis* and other buoyant species appear black when viewed with a microscope, due to light refraction by the gas vesicles in the cells.





# *Microcystis*

The most common bloom-forming cyanobacteria genus in Wisconsin lakes

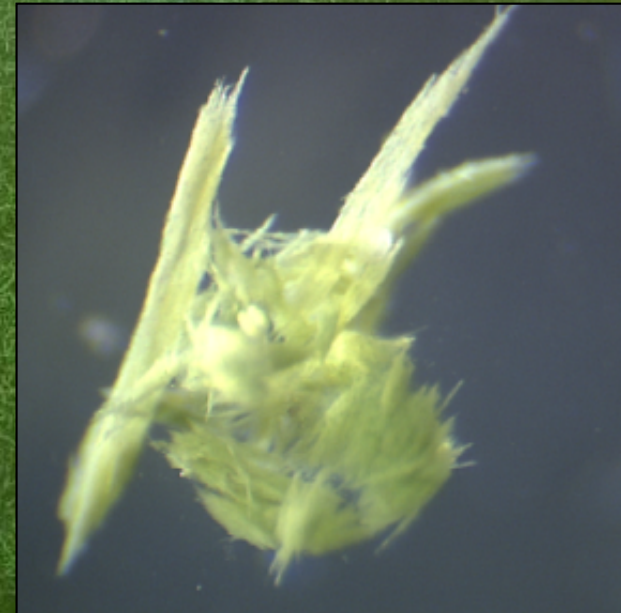


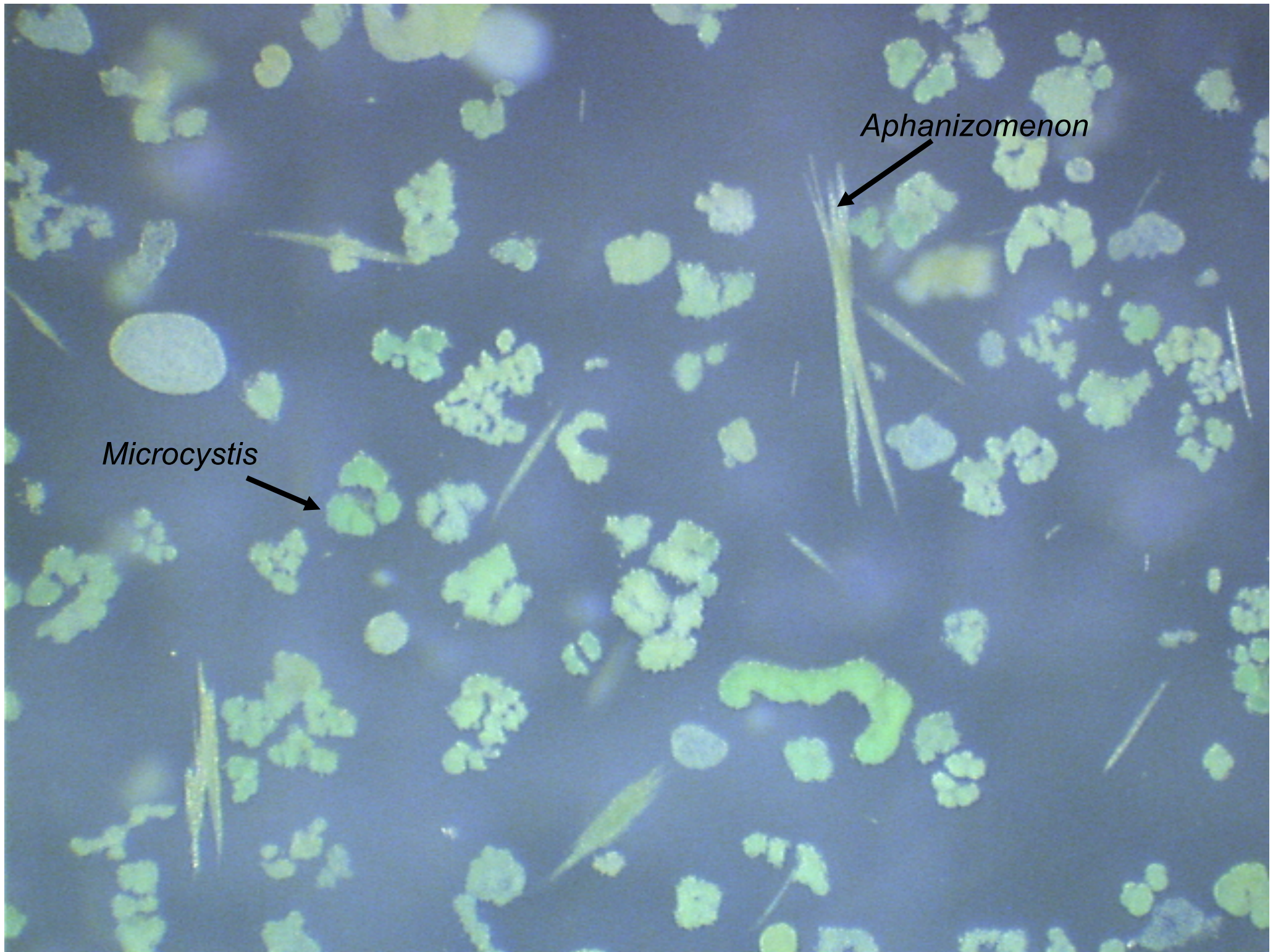


# *Aphanizomenon*

Tiny grass clippings

C. Carlson





*Aphanizomenon*

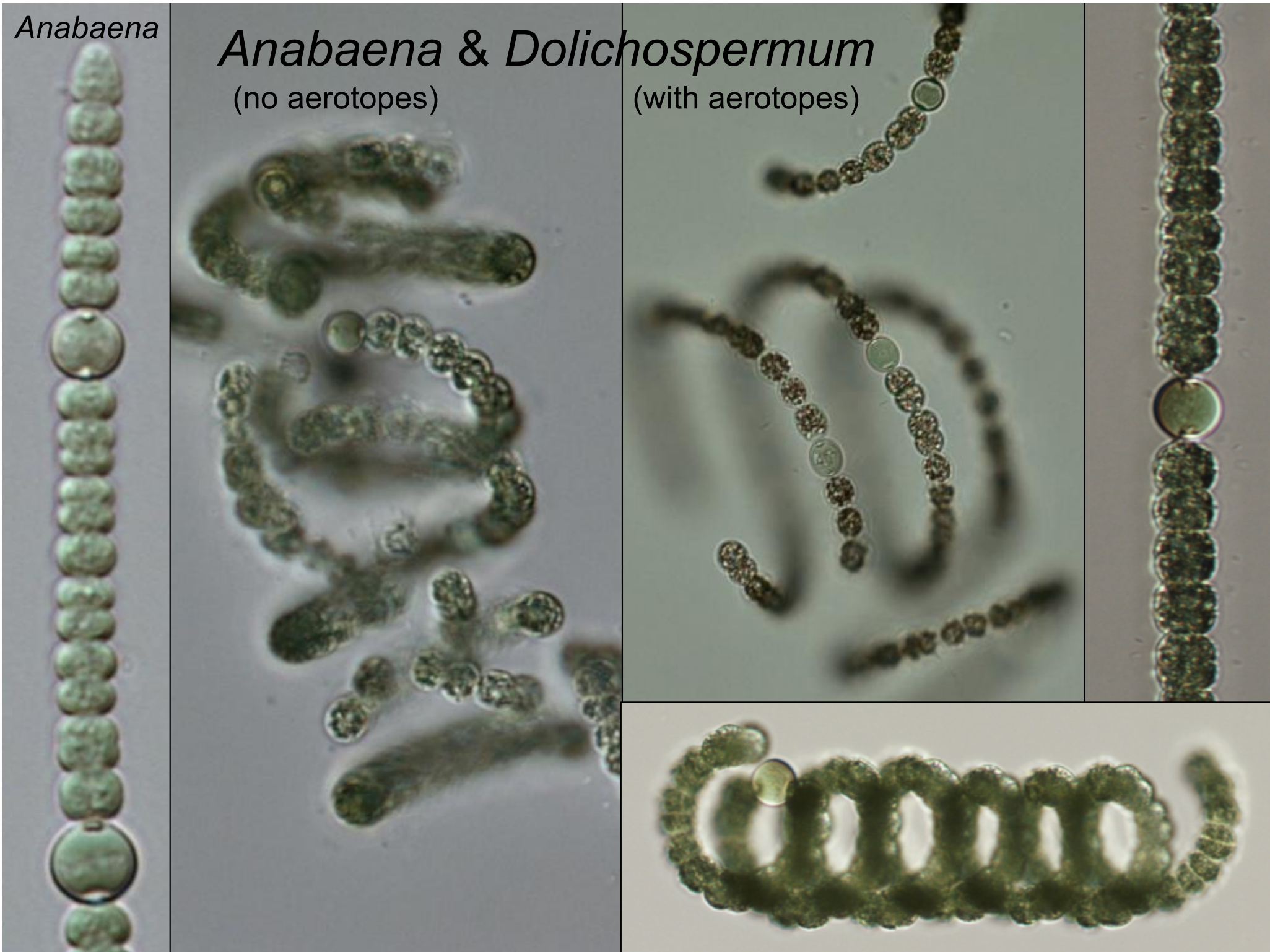
*Microcystis*

*Anabaena*

*Anabaena & Dolichospermum*

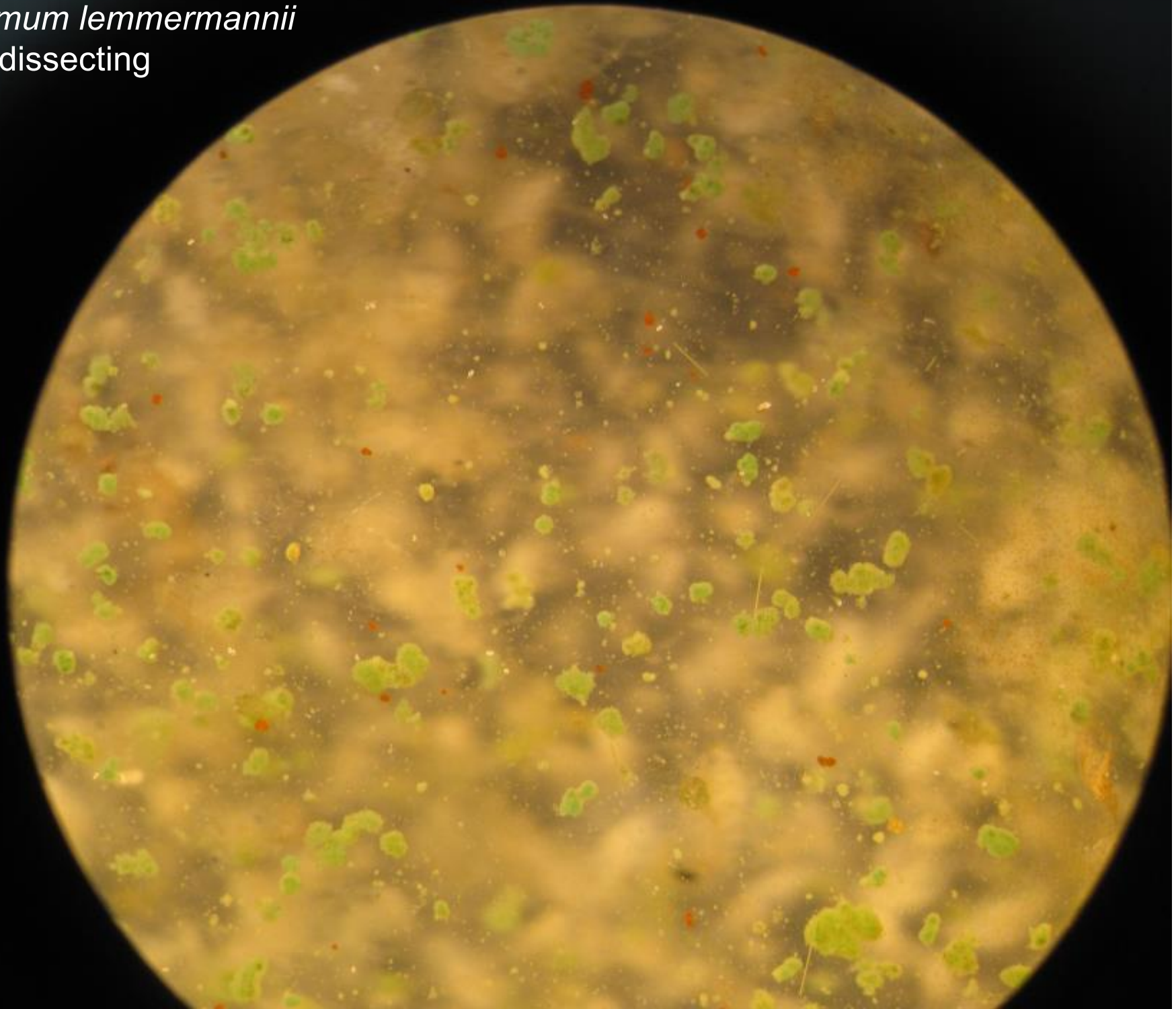
(no aerotopes)

(with aerotopes)

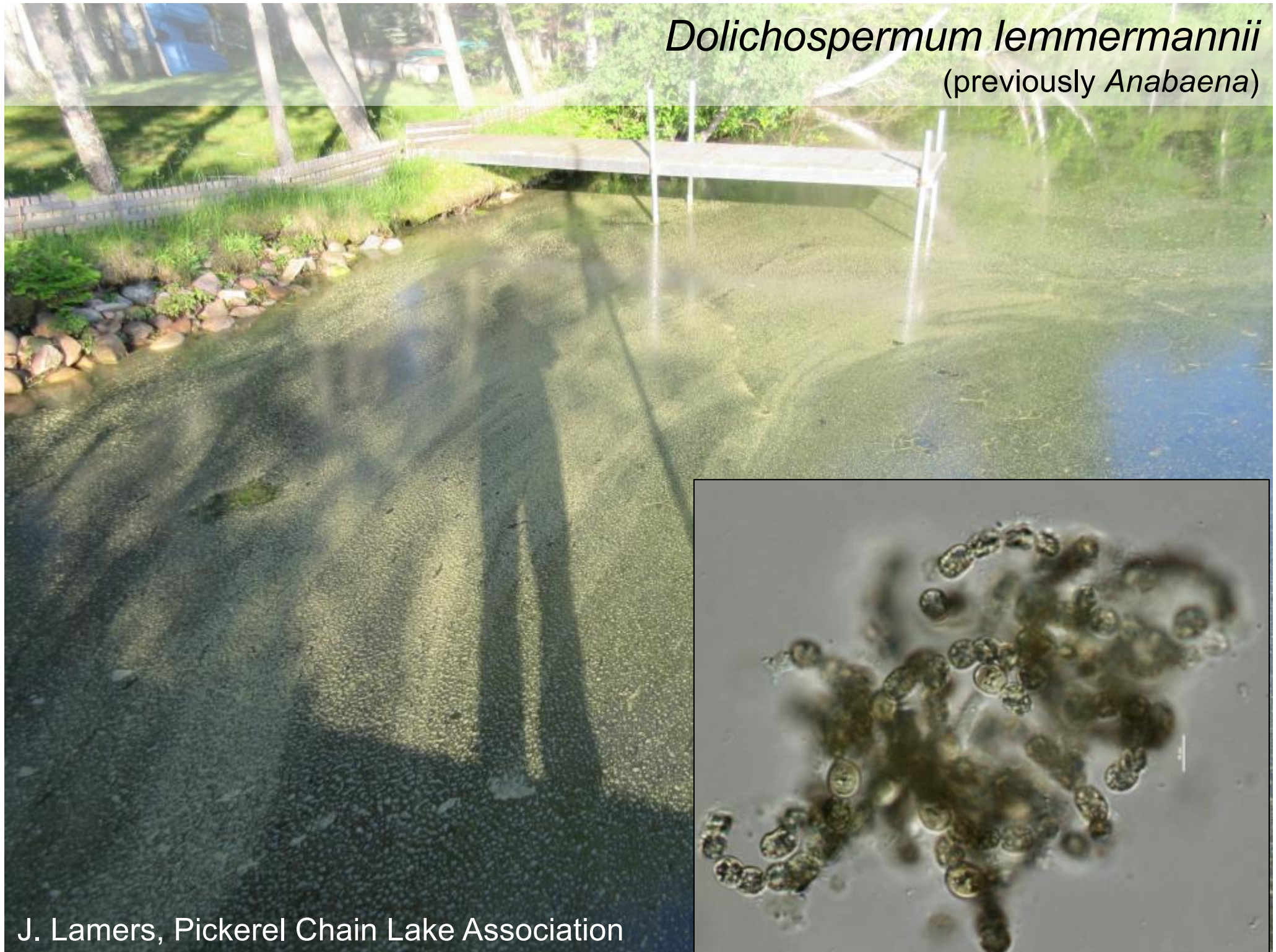




*Dolichospermum lemmermannii*  
viewed with dissecting  
microscope



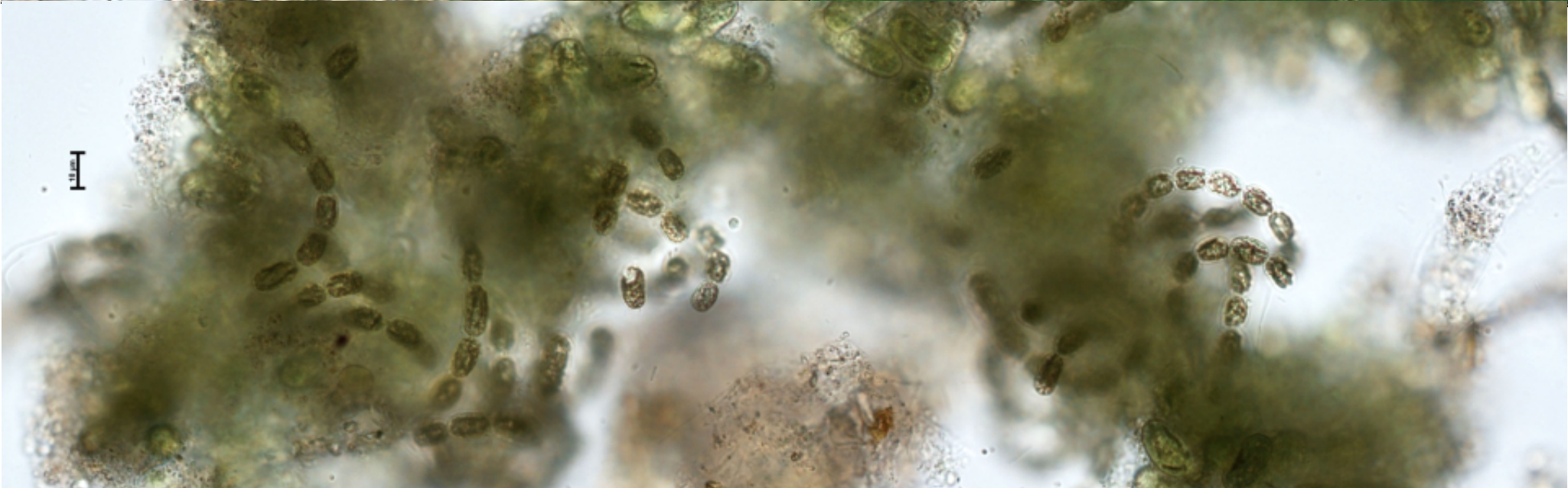
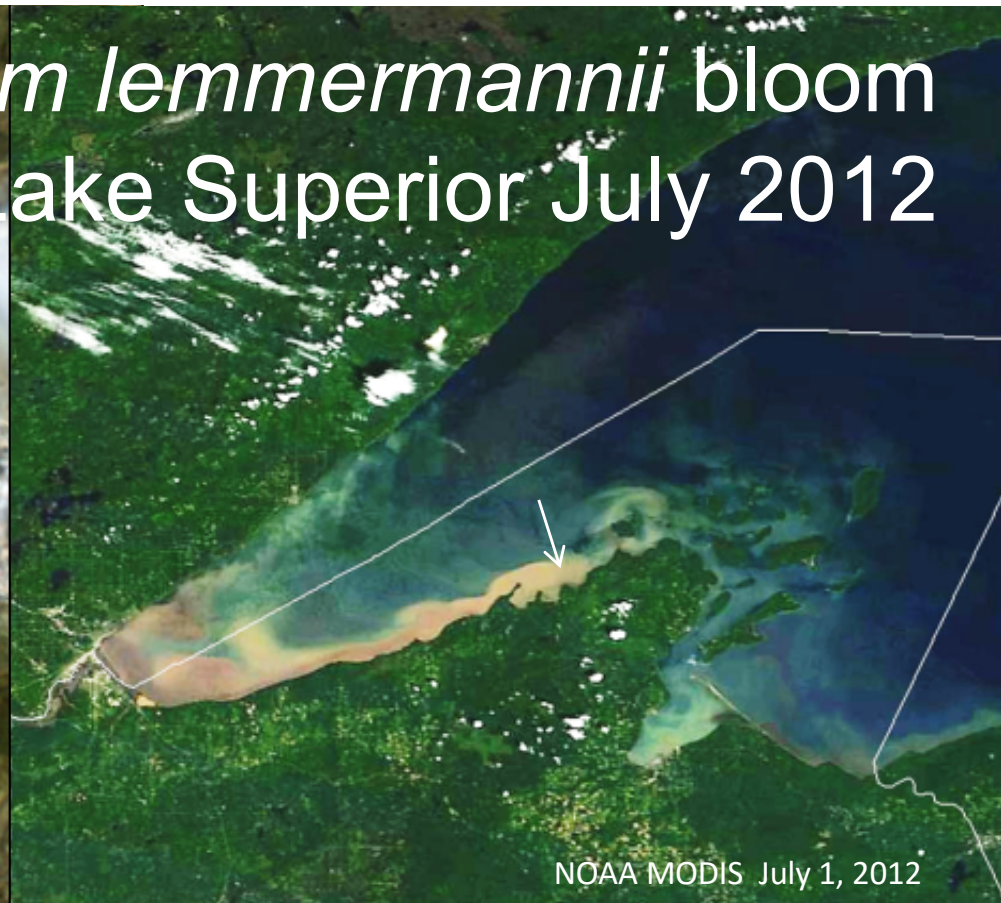
*Dolichospermum lemmermannii*  
(previously *Anabaena*)



J. Lamers, Pickerel Chain Lake Association



*Dolichospermum lemmermannii* bloom  
Lake Superior July 2012





Bob Sterner  
@bobsterner

Perhaps unprecedented surface algal bloom at @LakeSuperior shore at Cornucopia, WI yesterday. We are coordinating with Apostle Islands NPS to sample today. Photo by Brenda Lafrancois. Nutrients, warming, wind, what have you done?

@bobsterner  
August 10, 2018



8:11 AM · Aug 10, 2018 · Twitter for iPhone

84 Retweets 102 Likes

## *Algae Bloom in Lake Superior Raises Worries on Climate Change and Tourism*



New York Times  
August 29, 2018

Scientists collecting samples of the algae. Lake Superior is one of several major bodies of water where algae blooms have drawn scientific scrutiny. Brenda Moraska Lafrancois

By Christine Hauser

Aug. 29, 2018



In 19 years of piloting his boat around Lake Superior, Jody Estain had never observed the water change as it has this summer. The lake has been unusually balmy and cloudy, with thick mats of algae blanketing the shoreline.

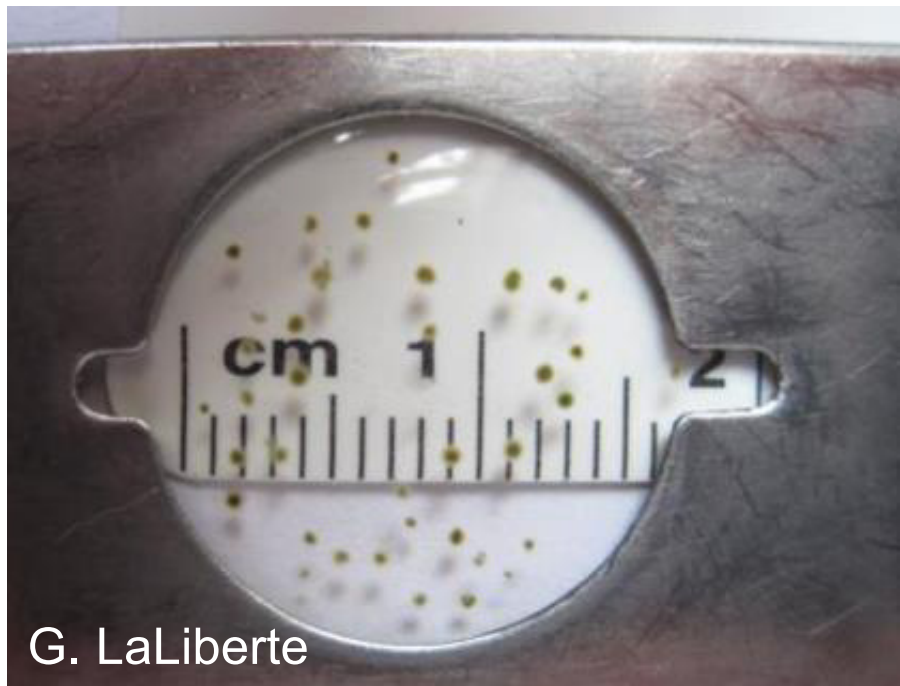
# *Gloeotrichia echinulata*

Not usually associated with toxic bloom events, although some populations have been shown to produce microcystin at low levels.  
Blooms may be increasing, even in low-nutrient lakes.  
Resting cells overwinter in lake sediments.

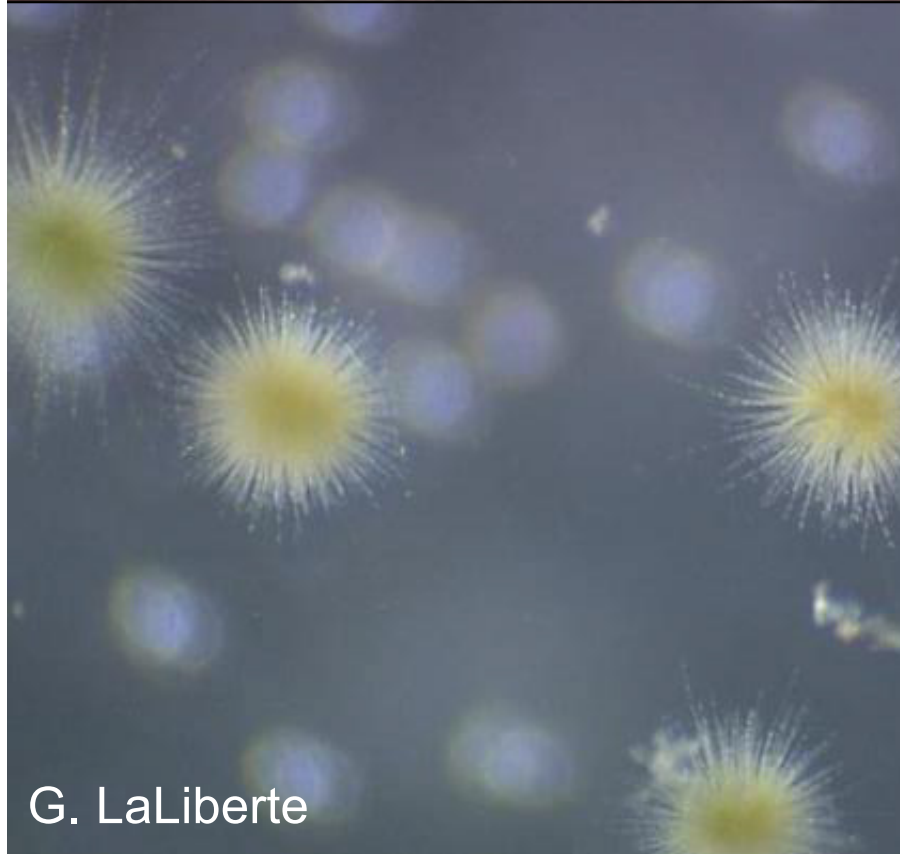


Dense *Gloeotrichia* colonies

J. Williamson, Polk County Land & Water Resources Department



G. LaLiberte

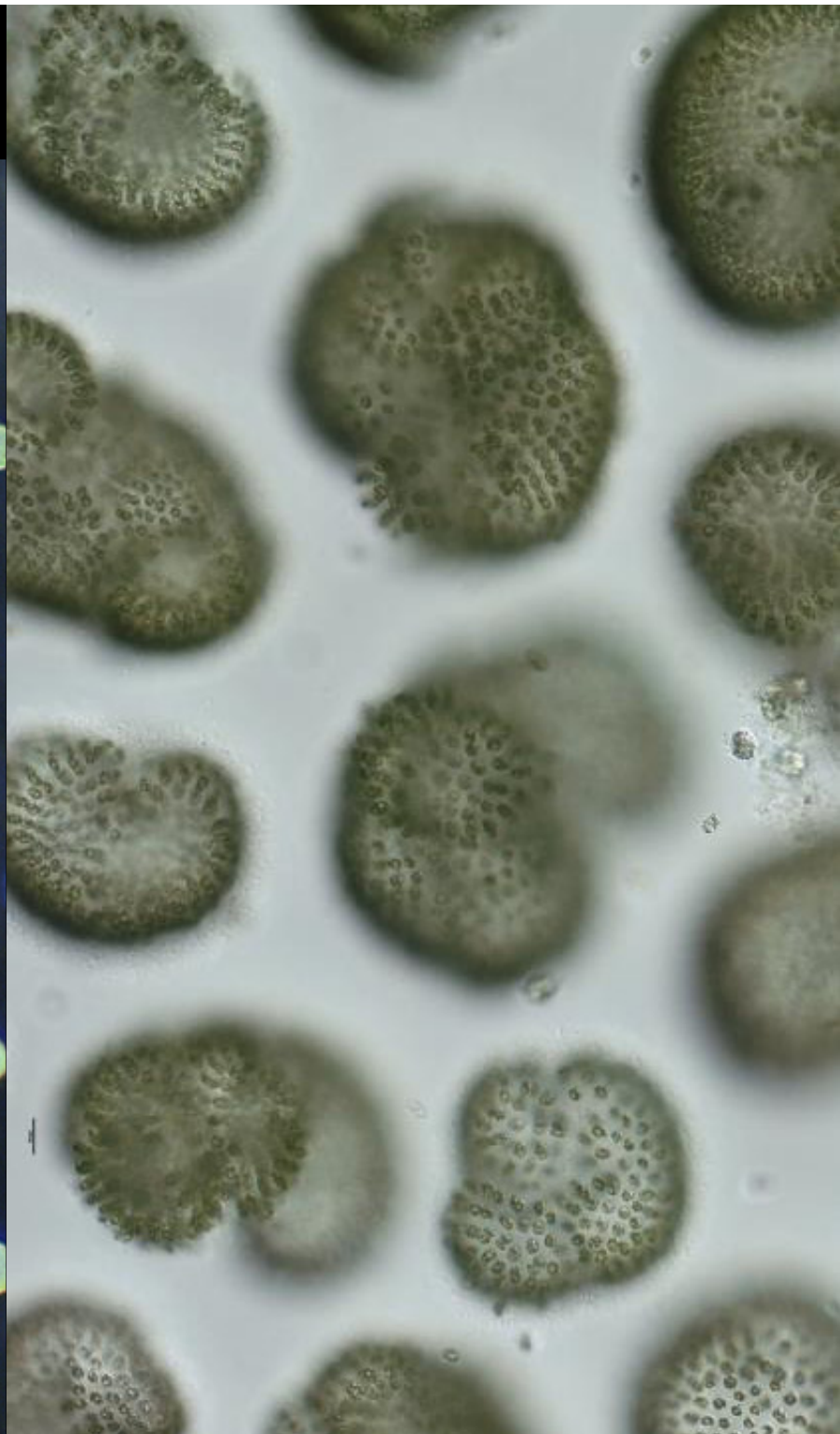
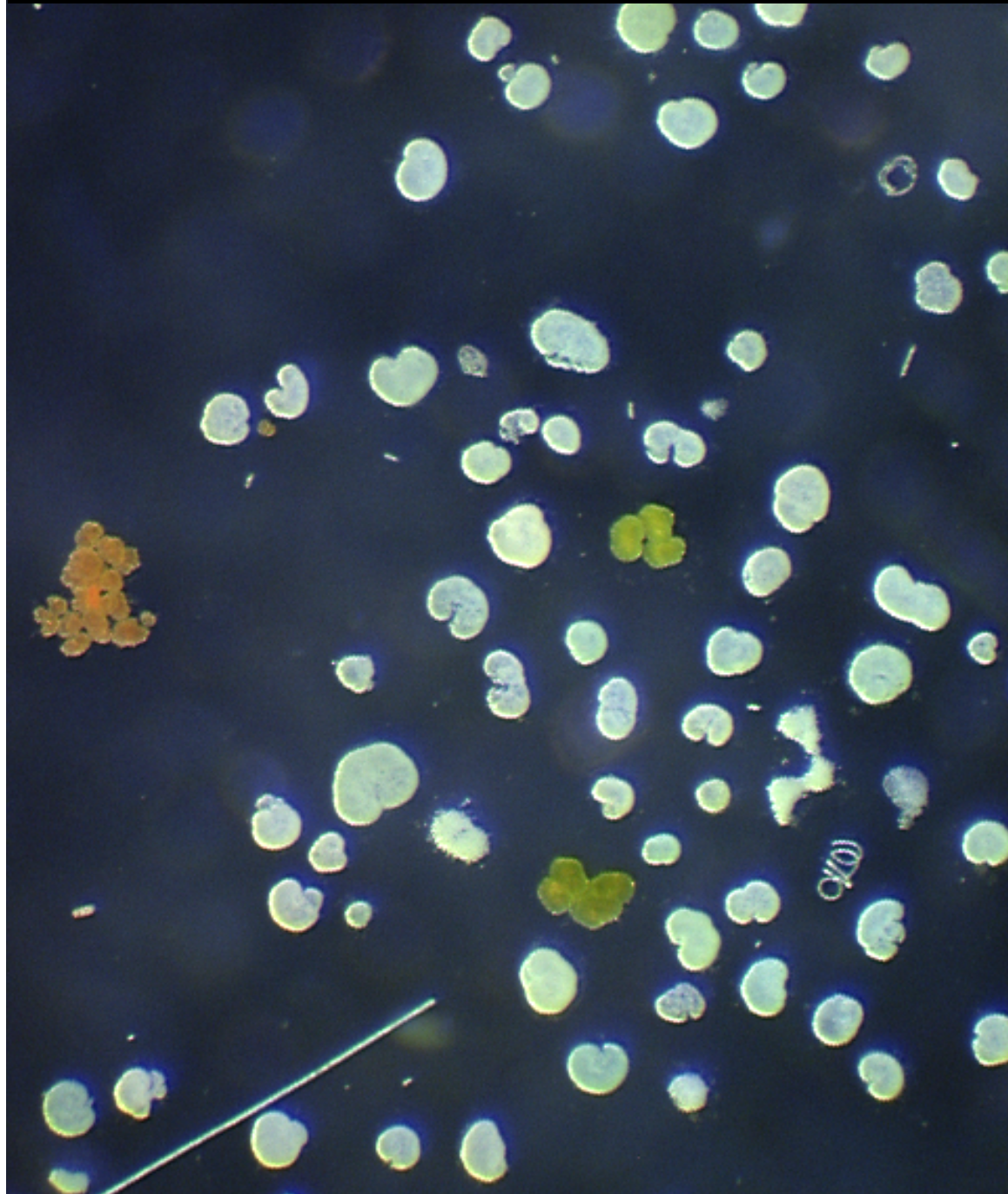


G. LaLiberte

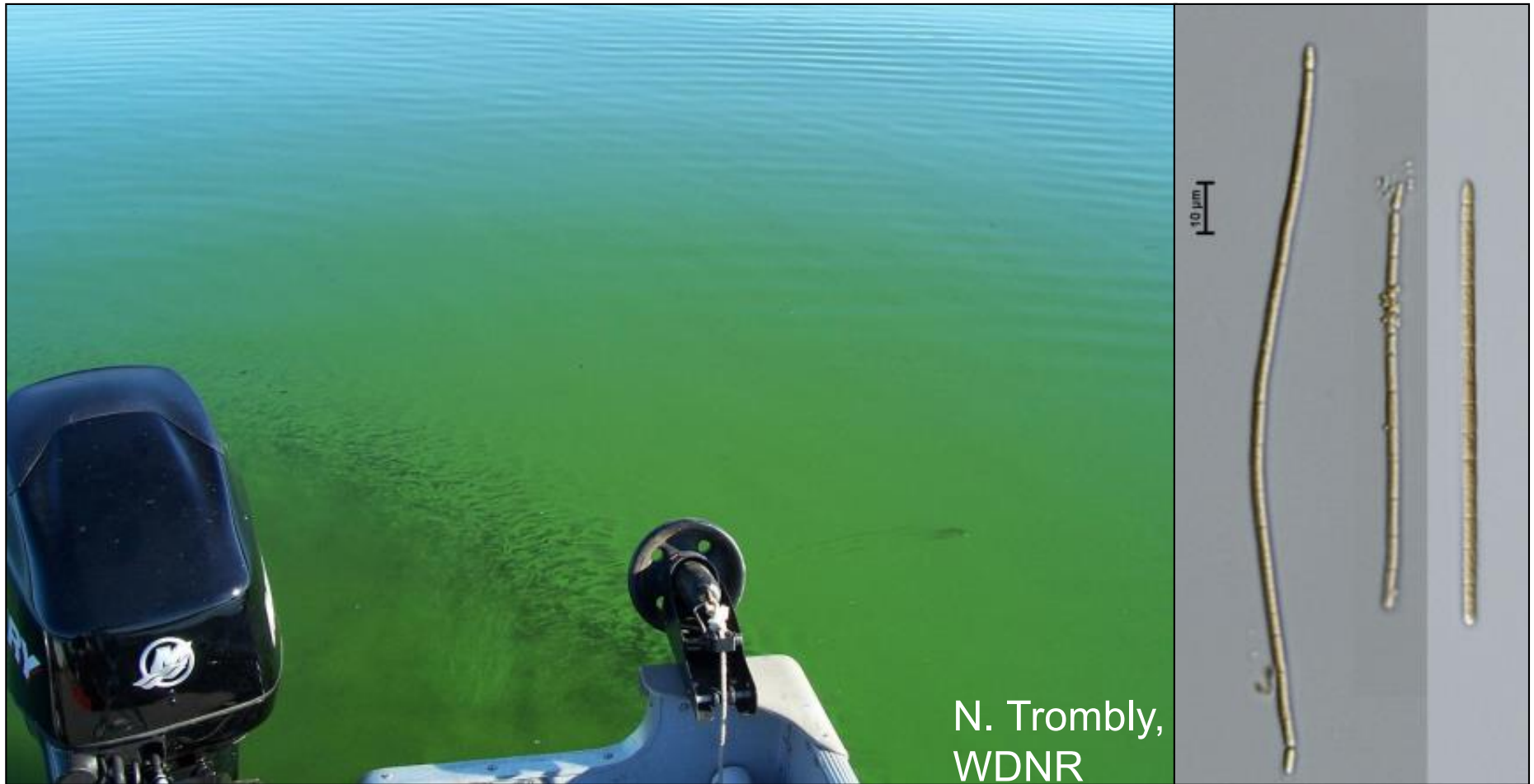


*Gloeotrichia echinulata*  
Clean Lakes Alliance Monitoring Volunteer

*Woronichinia*  
(formerly *Coelosphaerium*)



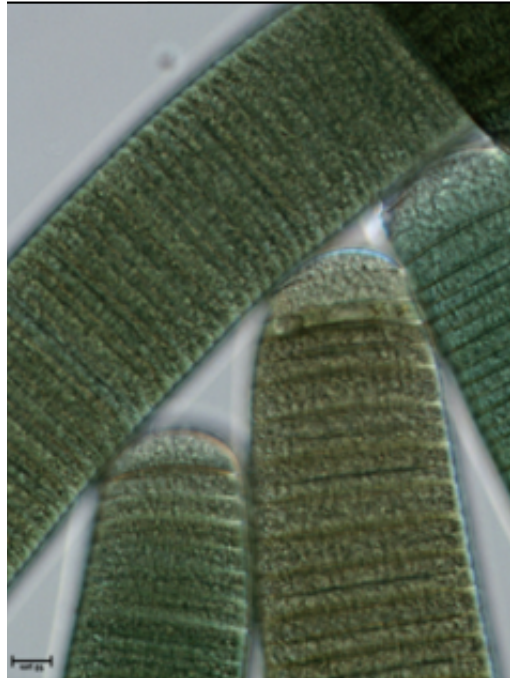
# *Cylindrospermopsis raciborskii*



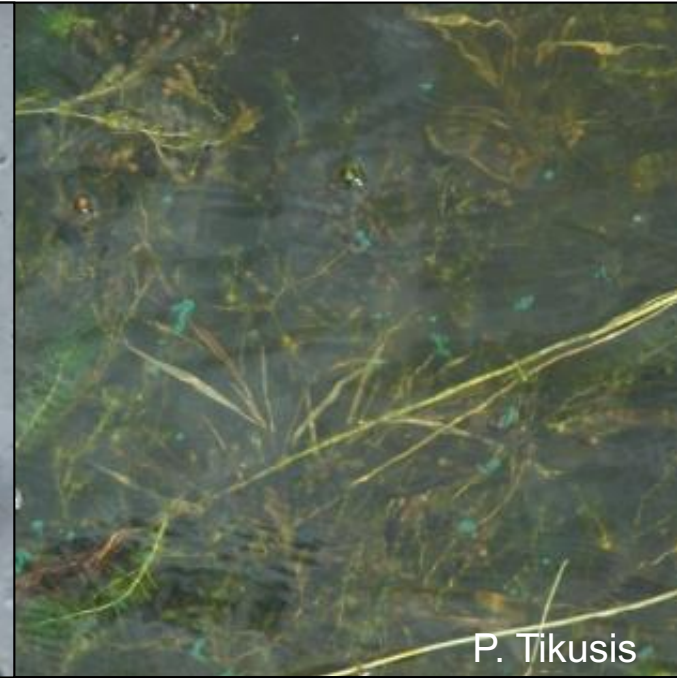
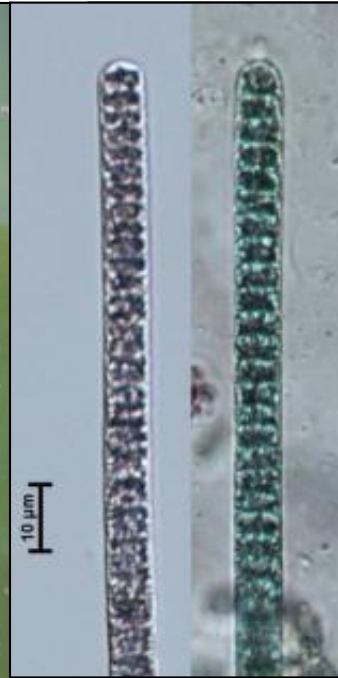
Blooms may occur at depth

NR40 Prohibited species; subtropical but expanding its range in temperate regions

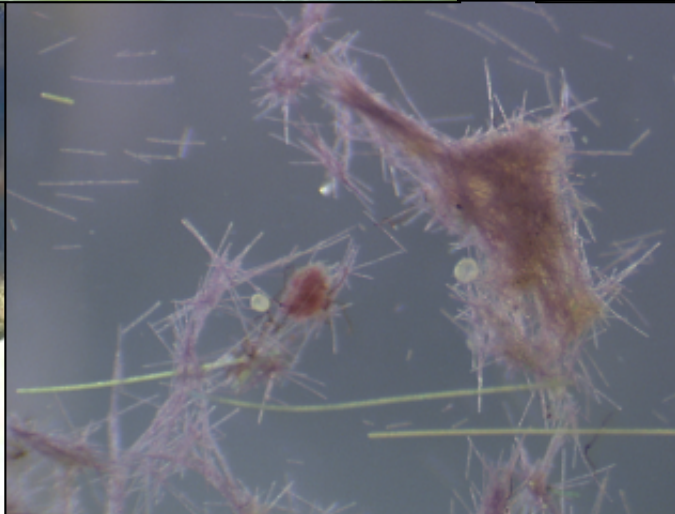
# Floating Benthic Algal Mats: *Oscillatoria*, *Lyngbya*, *Plectonema*, *Planktothrix*



J. Masterson



P. Tikusis



P. Tikusis



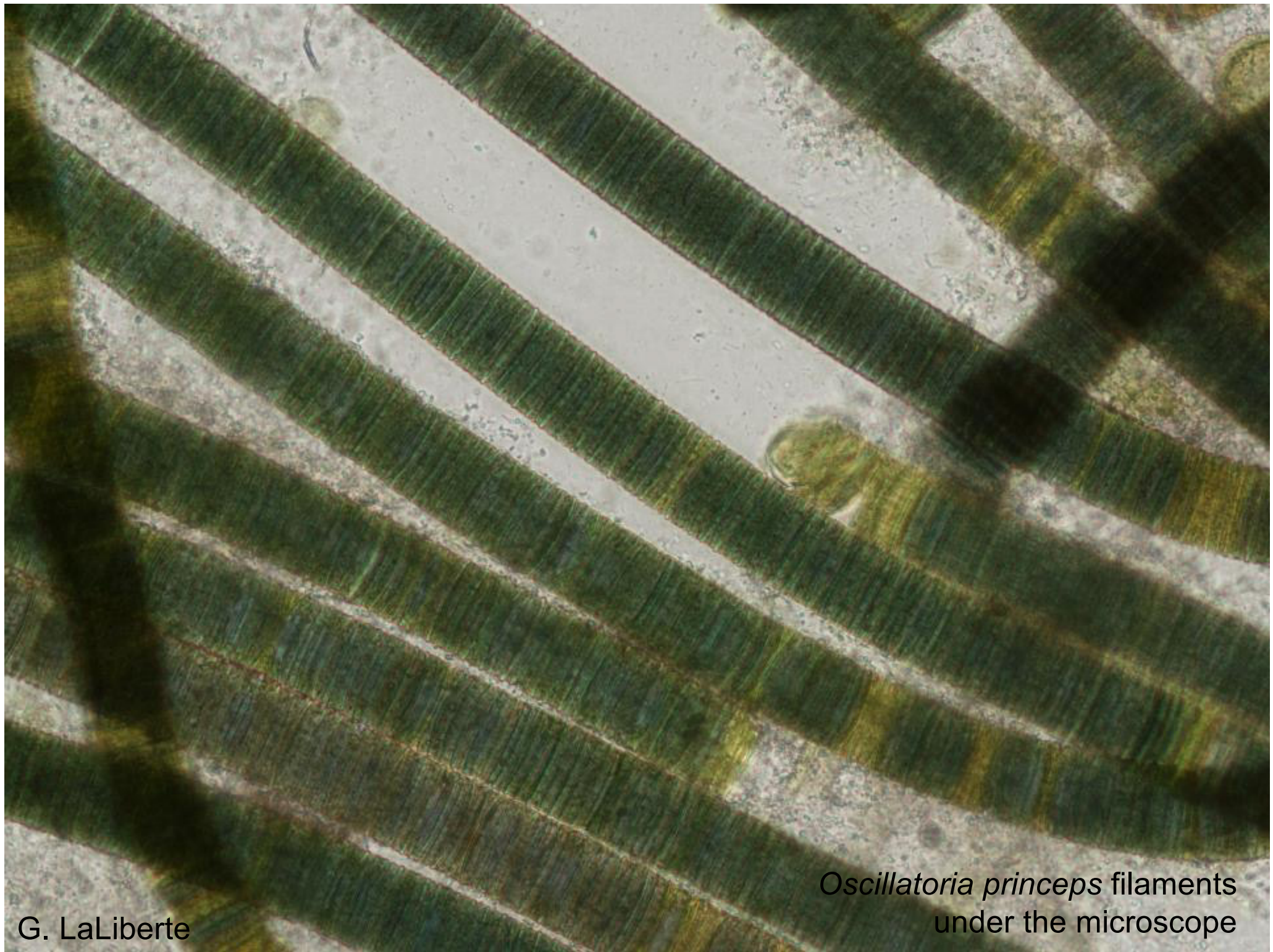


*Oscillatoria princeps* mats

E. Evensen

Filaments are more evident in water.  
These filaments are very long for cyanobacteria – up to 10 mm.

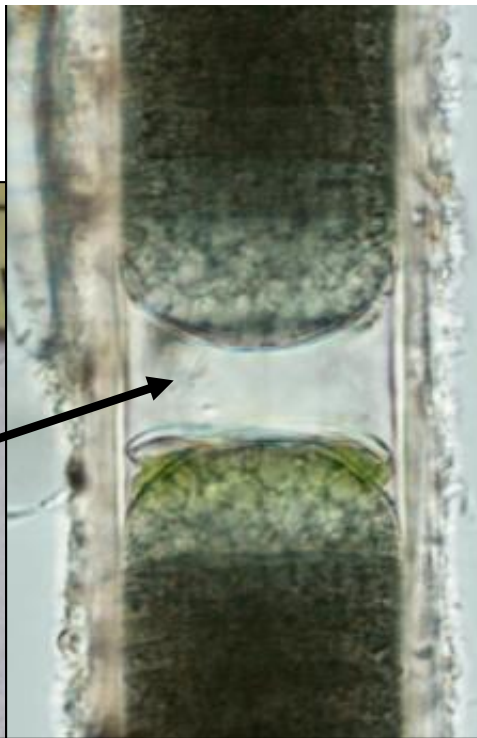
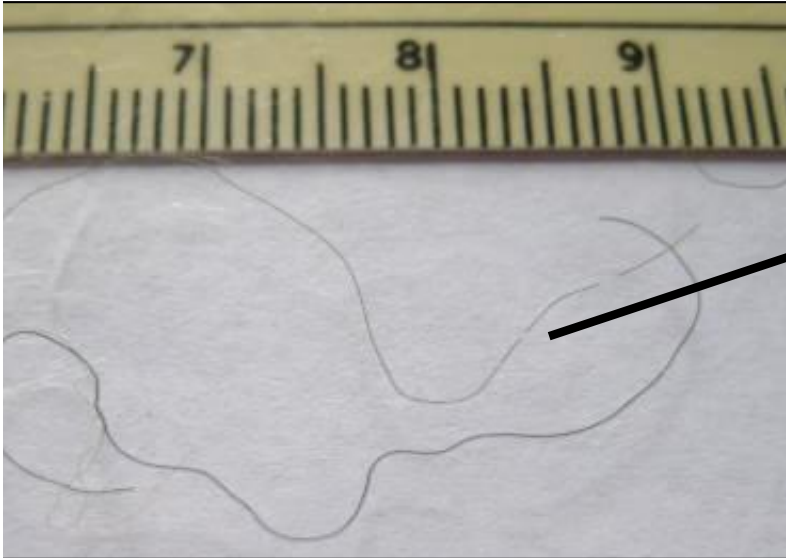




G. LaLiberte

*Oscillatoria princeps* filaments  
under the microscope

*Microseira wollei*  
(formerly *Lyngbya*, *Plectonema*)



Up to several cm long - huge for a cyanobacterium.  
“Breaks” are gaps between trichomes inside sheath.



R. Clements

False branching  
may occur

*Microseira wollei*  
forming balls in Lake Erie









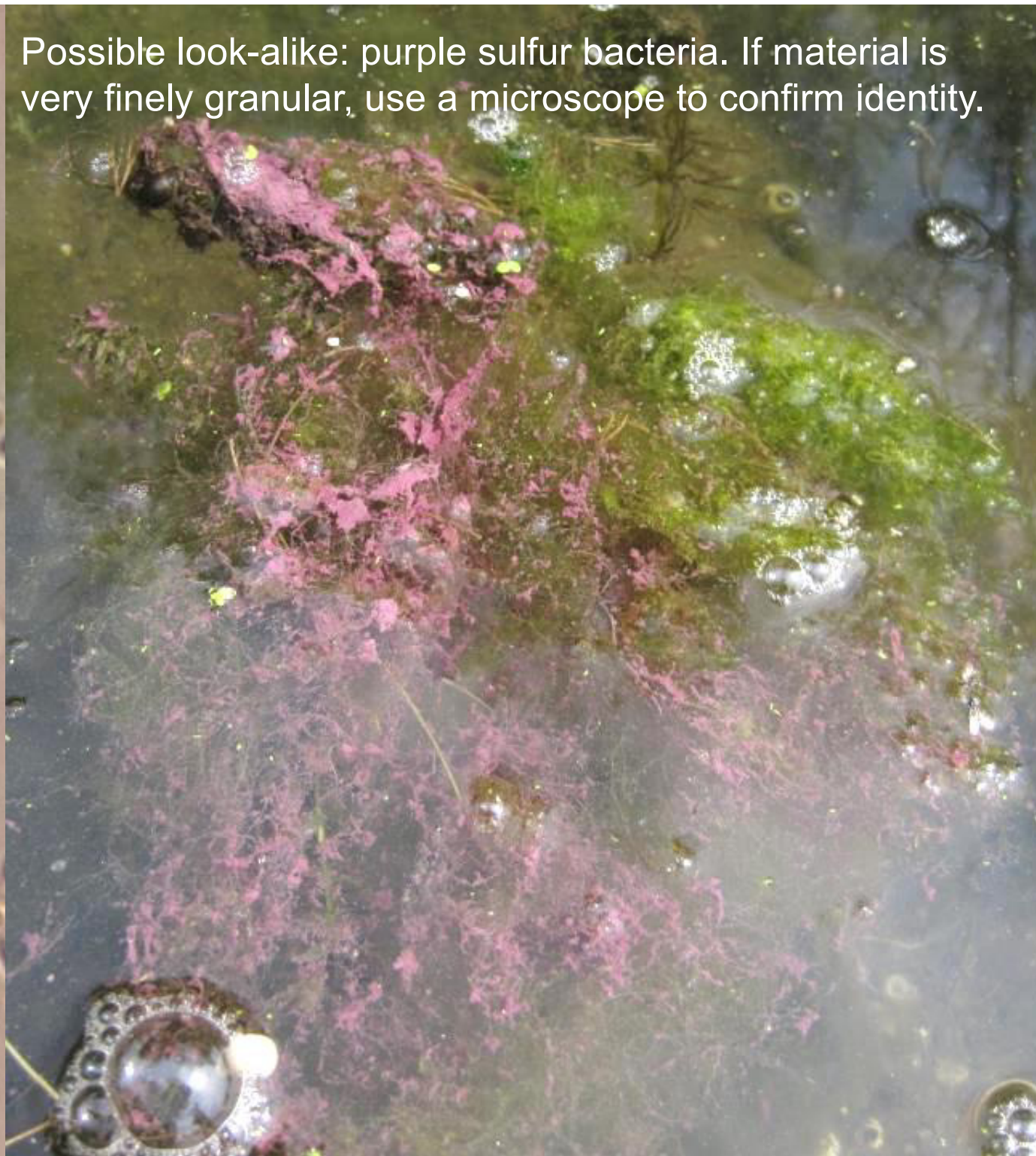
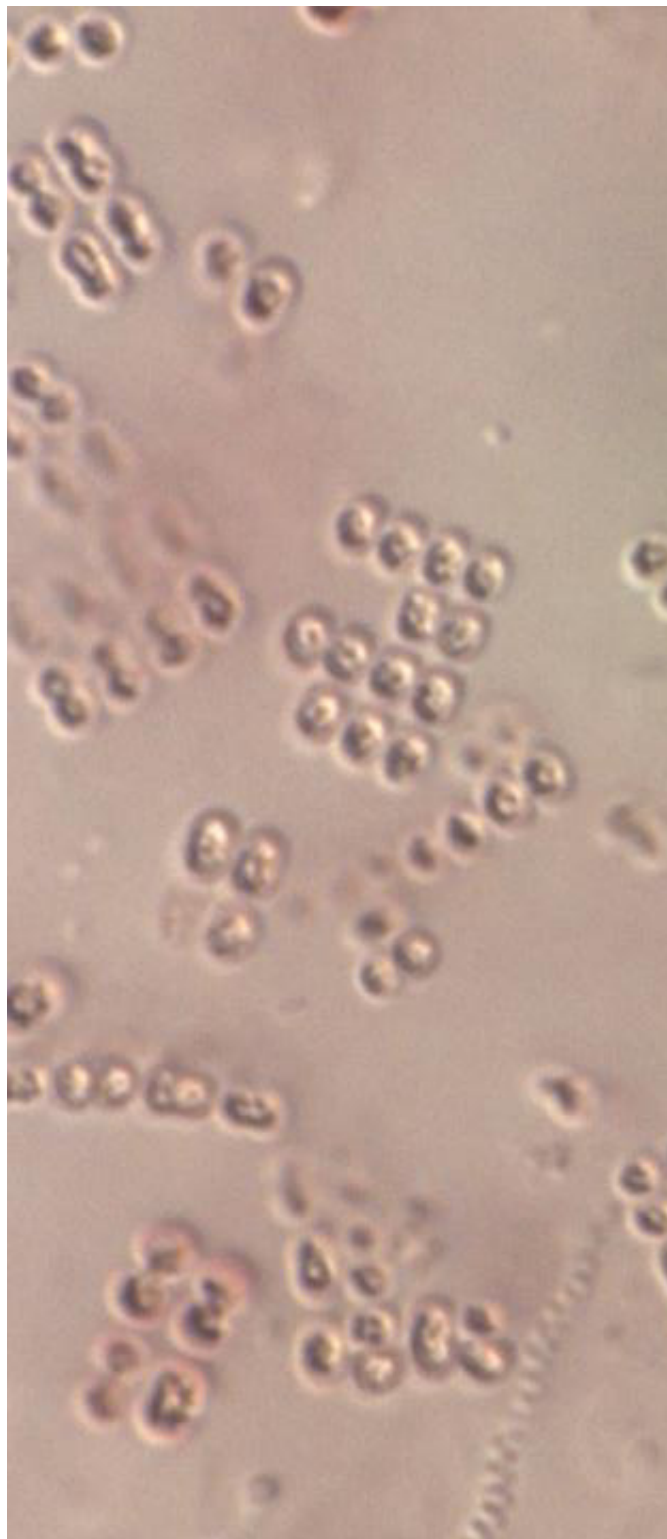
D. Daulton



J. Klosiewski



Possible look-alike: purple sulfur bacteria. If material is very finely granular, use a microscope to confirm identity.



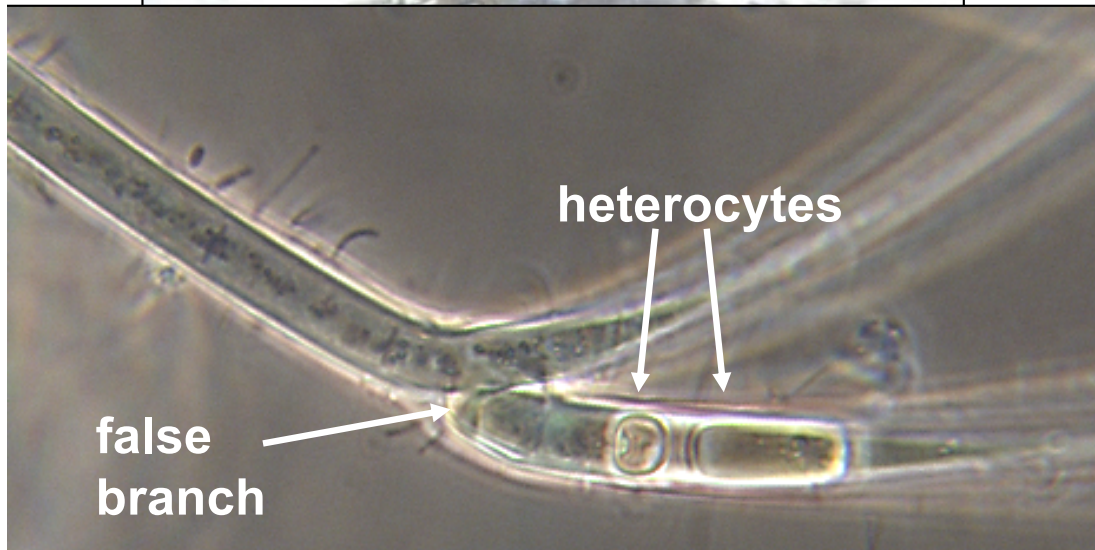
# *Tolypothrix*

Can form balls on lake bottoms that later float to surface

Microscope needed for identification

False branching; heterocyte at branch

Olive-green to brown color







D. Blumer

## *Aphanothece* & *Aphanocapsa*

Colonies consist of small spherical or ovoid cells

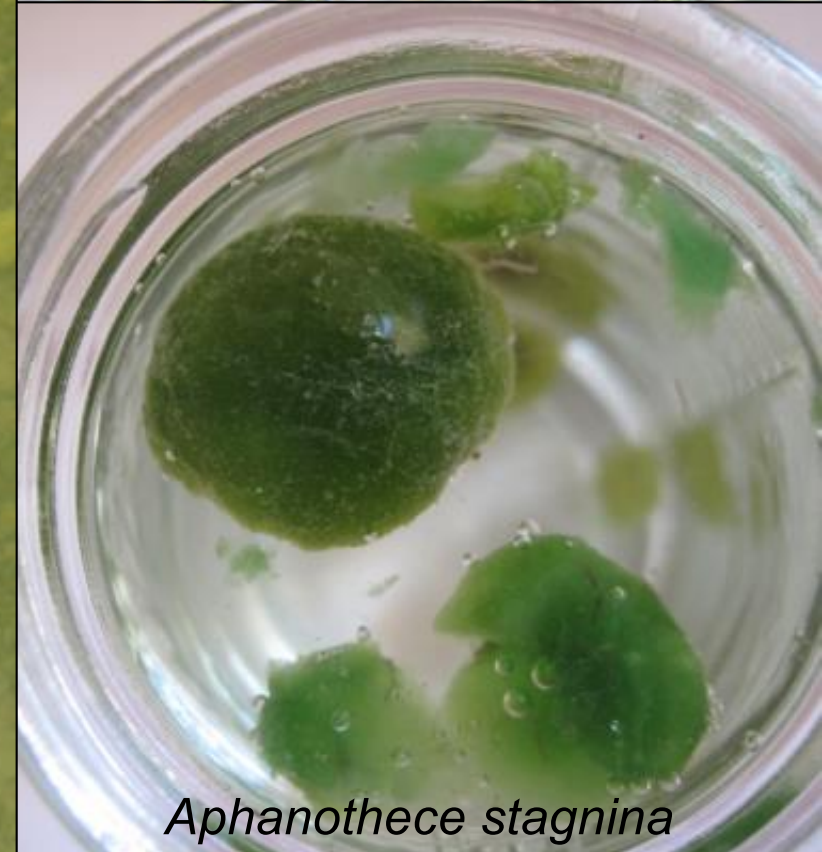
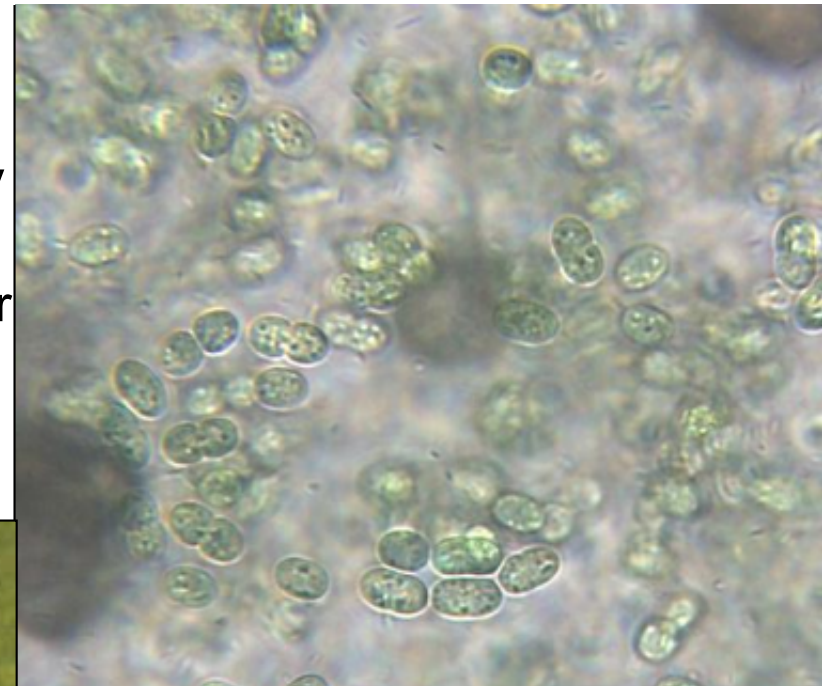
Difficult to identify to species – microscope necessary

### *Aphanothece stagnina*:

Globular or irregular colonies up to a few cm diameter

May form large masses on lake beds, or float

May contain calcite crystals





## *Nostoc*

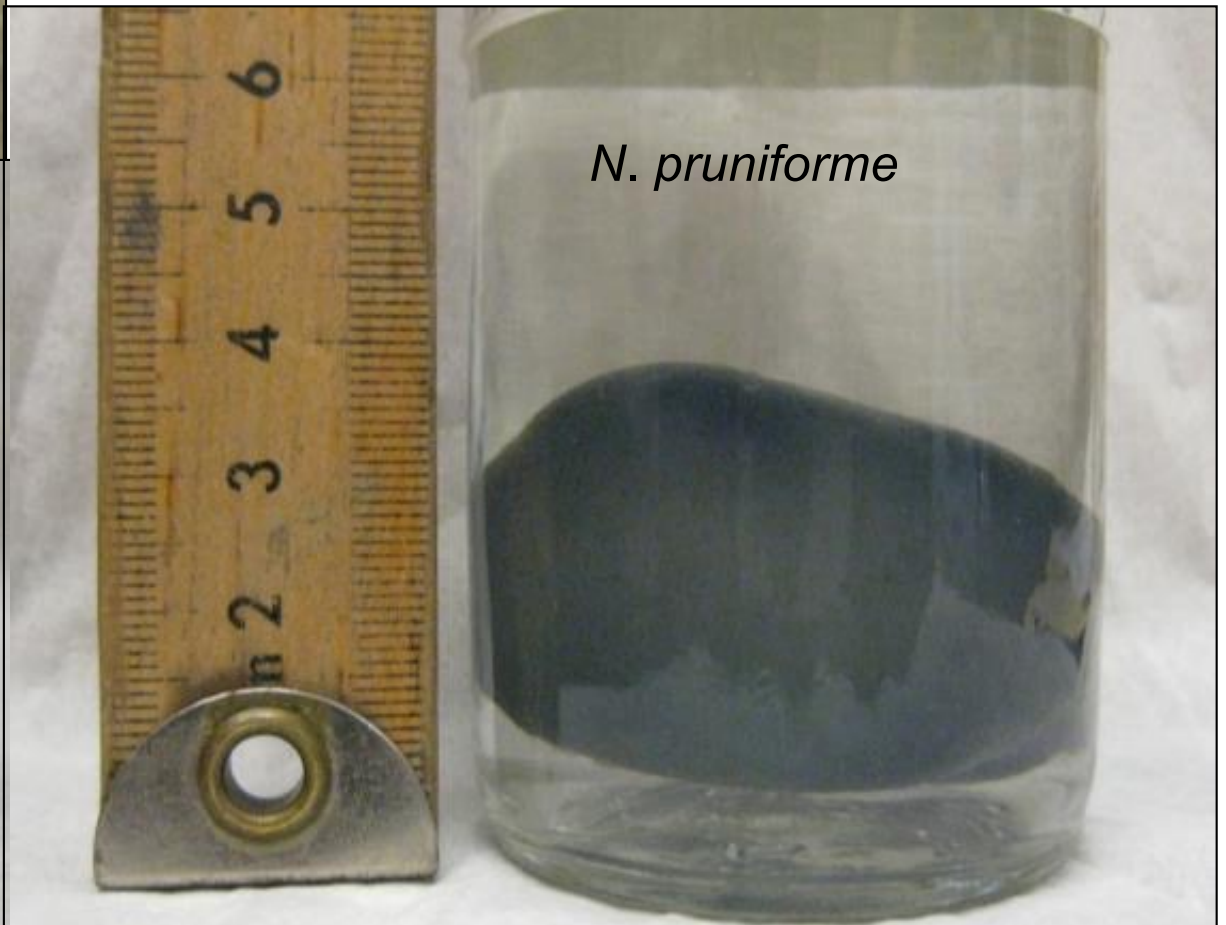
Aquatic species: pinhead to egg-size, on lake bottom or floating

*N. pruniforme*: “lake plums,” “mare’s eggs”



Colonies consist of unbranched filaments in a firm gelatinous matrix

Filaments have heterocytes – *Nostoc* uses them to fix atmospheric nitrogen



*Nostoc zetterstedtii*: “lake blackberries”

Rare! Red-list species in Europe

Prefers *Lobelia* & *Isoetes* lakes (oligotrophic, clear water)

Replaced by *N. pruniforme* as lake water becomes more eutrophic



Please let me know if you find *N. zetterstedtii* or *N. pruniforme*! [Gina.LaLiberte@wisconsin.gov](mailto:Gina.LaLiberte@wisconsin.gov)



# *Nostoc commune*



Terrestrial!

Star jelly, witches' butter  
*French: Crachat de lune*  
(moon spit)

Outer mucilage layer  
often dark yellow

Black and crispy when  
dehydrated  
Rehydrates & is more  
noticeable after rain



That's not goose poop!

COULD BE MISTAKEN FOR NOSTOC: *Ophrydium versatile*


Colonial protozoan

Internal symbiotic algae (*Zoochlorella*) give colonies their green color

Soft, gelatinous texture

Colony may be attached to plants, on the lake bottom, or broken free and floating



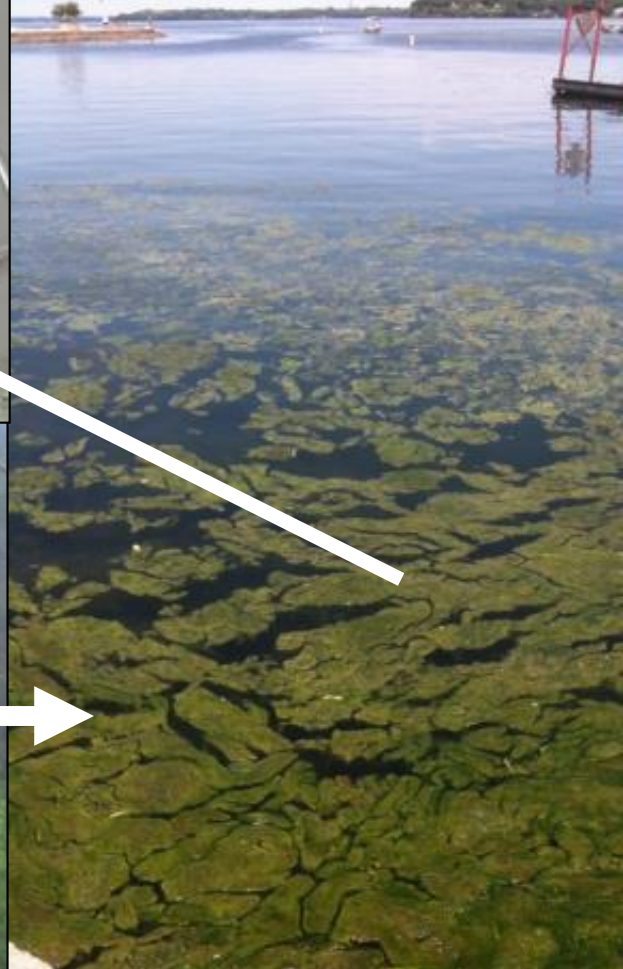
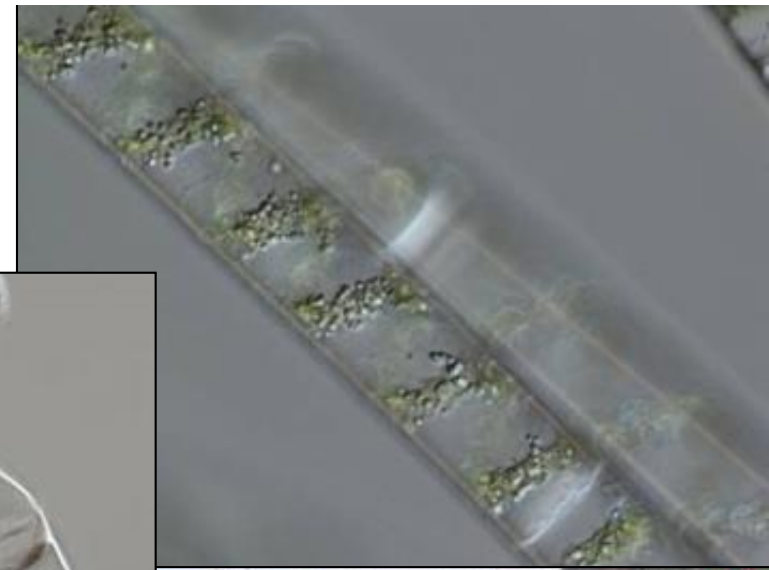


# Beyond the Look-Alikes: Algae Common in Wisconsin

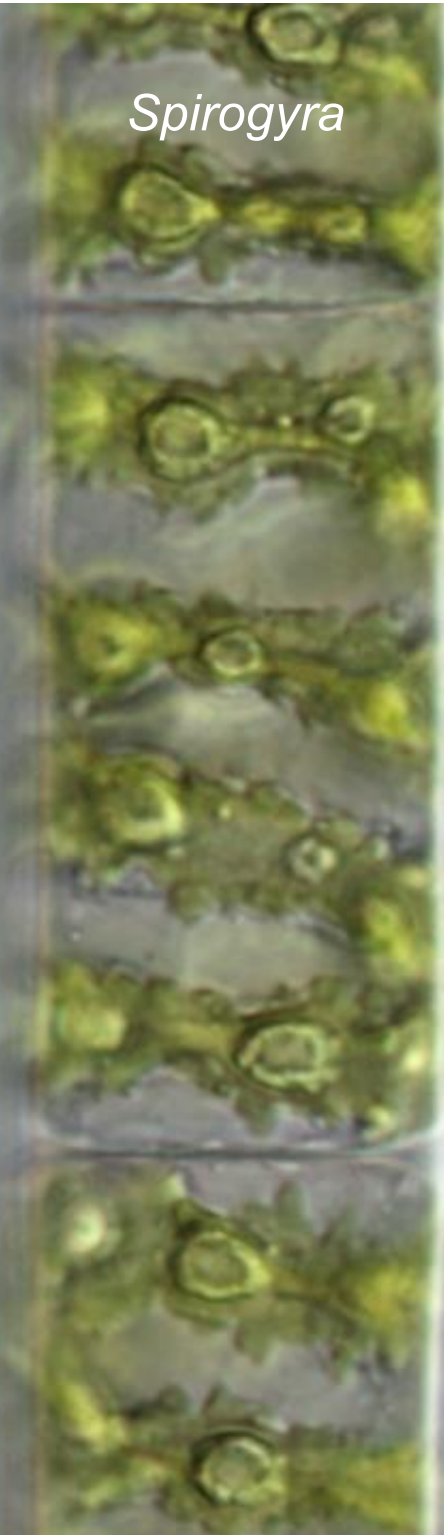
# Unbranched Green Filamentous Algae (Chlorophyta)



Unbranched filamentous green algae:  
*Spirogyra* and relatives *Mougeotia* & *Zygnema*  
“water silk,” “frog spit”  
Secretes pectin, giving it a slippery texture



*Spirogyra*



*Mougeotia*



*Zygnema*

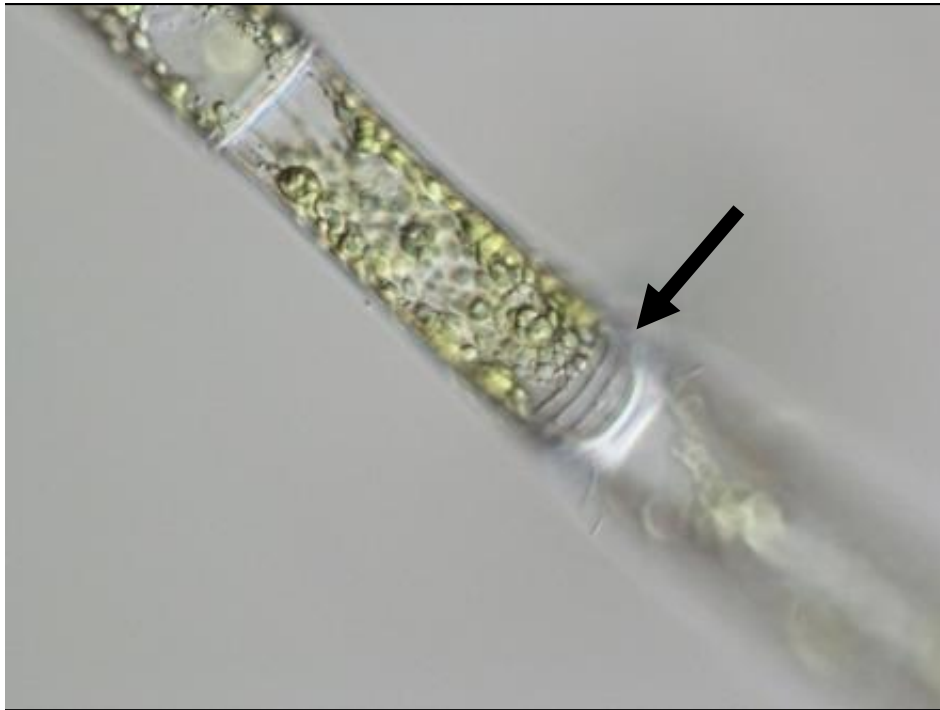


## Unbranched filamentous green algae: *Oedogonium*

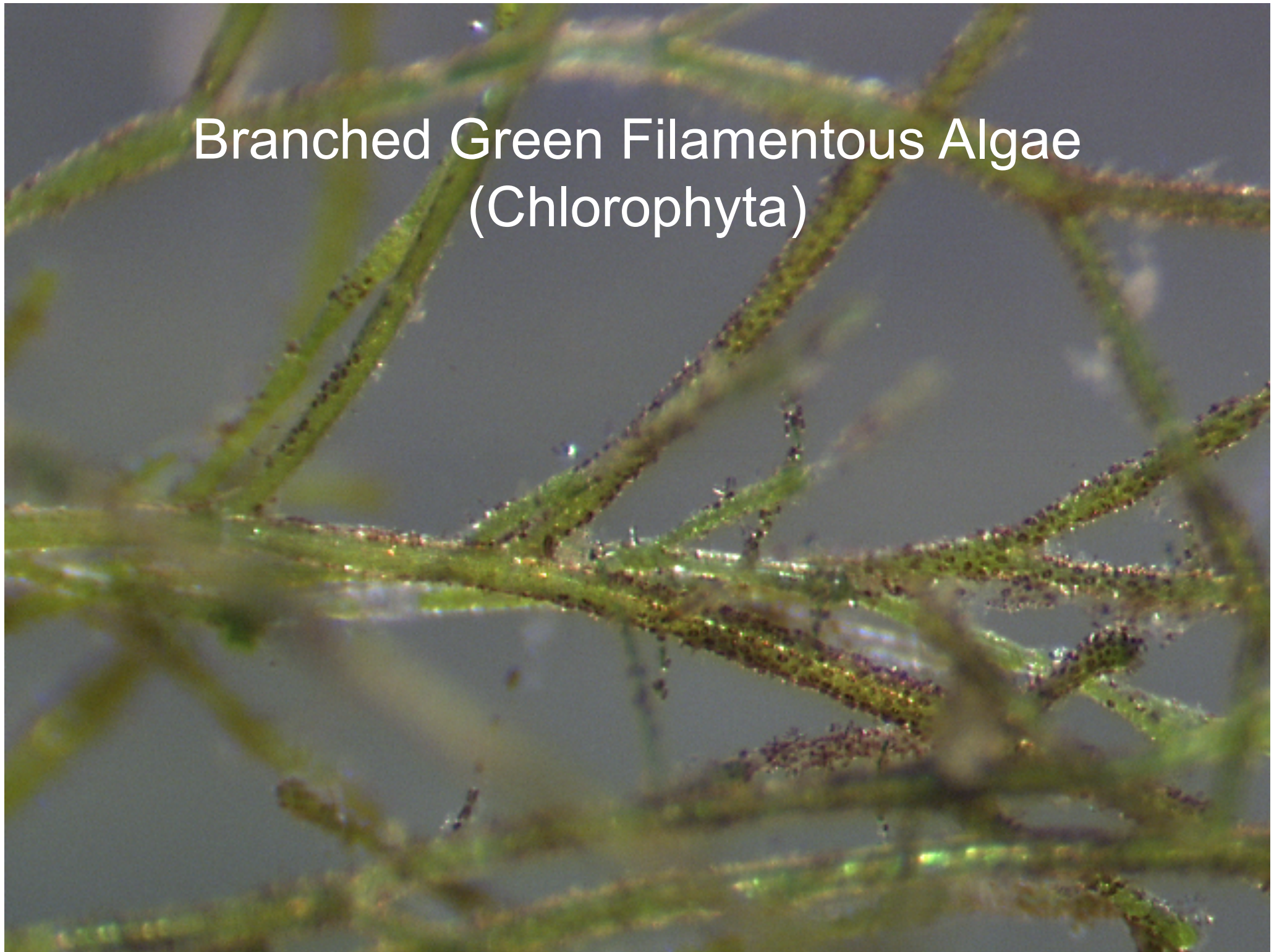
Often covered with epiphytic algae and mixed in with other filamentous greens

Microscope needed for identification

Rings of apical caps from cell division are a key diagnostic feature



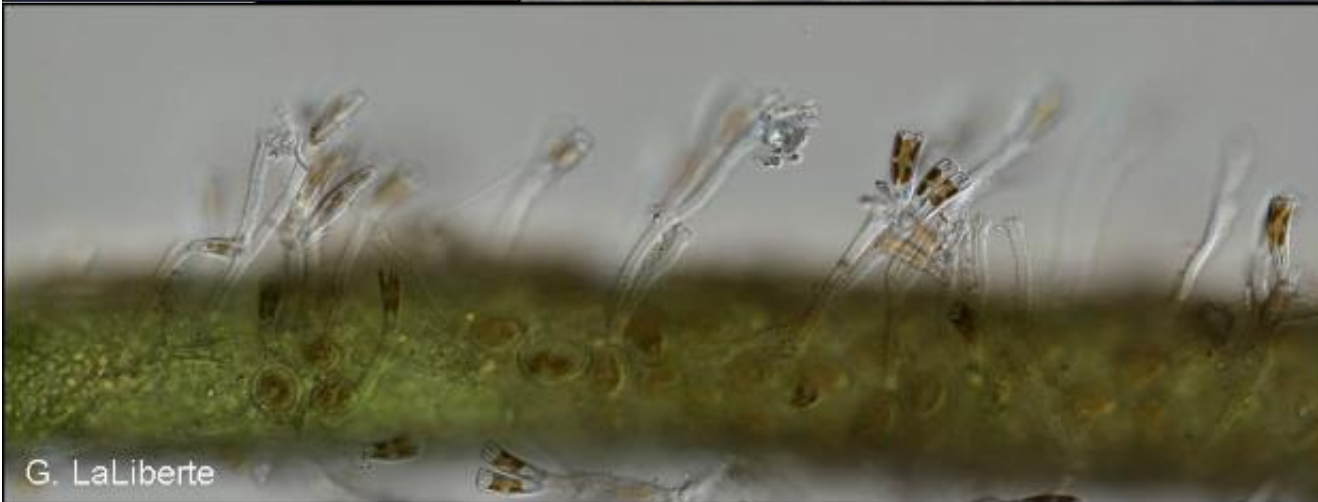
Branched Green Filamentous Algae  
(Chlorophyta)





## CHLOROPHYTA: *Cladophora*

Microscope needed for identification, but cottony, highly branched greens on hard substrates are usually *Cladophora*. Some large, coarse species have few branches.



Older portions are often covered with algal epiphytes. Diatoms make it appear to be a golden-brown color.

## CHLOROPHYTA: *Cladophora* & *Rhizoclonium*

Microscope needed for identification

Phenotypically plastic so they are difficult to identify to species

*Cladophora* species with minimal branching are confused with related *Rhizoclonium*

Often entangled with macrophytes or forming nuisance growths

Large, coarse filaments (>40  $\mu\text{m}$  diameter) are most likely *Cladophora*



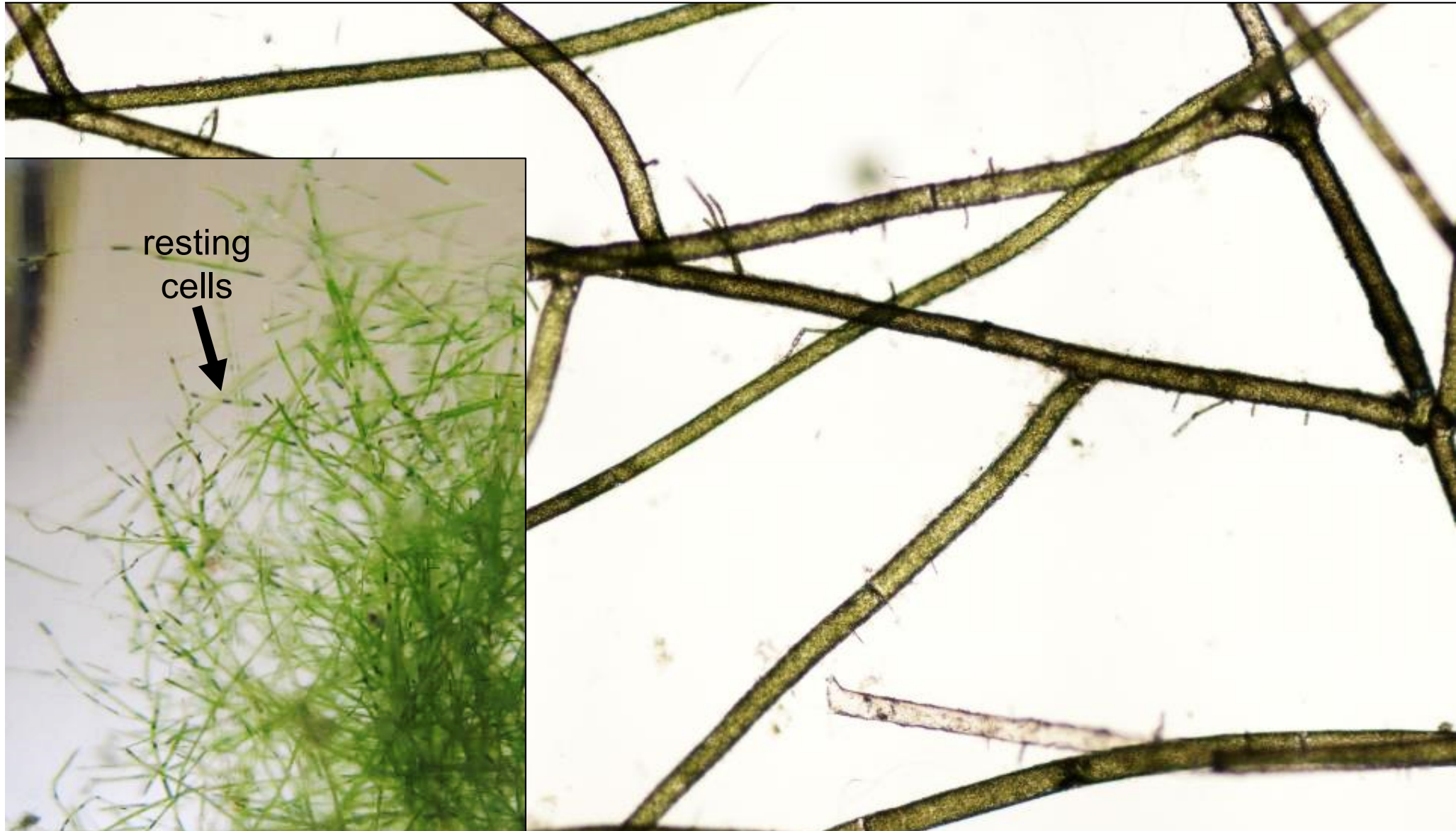
CHLOROPHYTA: *Aegagropila linnaei*

(formerly *Cladophora profunda* var. *Nordstedtiana*, *Cladophora aegagropila*)

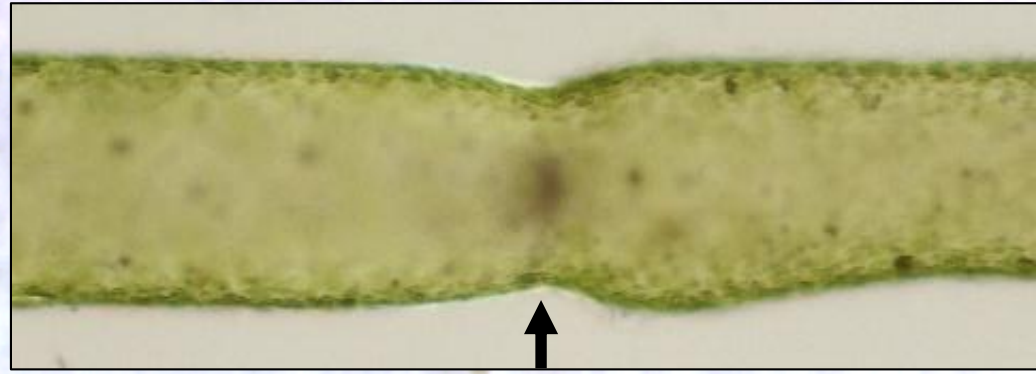
Coarse, branched, somewhat crispy texture. Side branches are lateral and subterminal. May form round “lake balls” (*marimo* in Japanese) from rolling around on lake bottoms.



CHLOROPHYTA: *Pithophora* Also known as “horsehair algae.”  
Microscope needed for identification. Branching and coarse, rough texture.  
Branches are at right angles and cells are long. Resting cells appear as dark ovals.  
Notorious for forming nuisance growths floating or entangled in macrophytes.



CHLOROPHYTA: *Dichotomosiphon tuberosus*



Filaments lack true crosswalls and have only constrictions with "pinched" appearance.

Branches are in pairs at constrictions in filaments.

# Other Green Algae (Chlorophyta)



CHLOROPHYTA: *Hydrodictyon reticulatum* “Water net”  
Each cell can grow into another colony.  
Prefers high pH.

G. LaLiberte



G. LaLiberte



G. LaLiberte

## CHLOROPHYTA: *Chaetophora*

Small, firm, gelatinous lumps which are difficult to compress; can take a branched form

Commonly attached to plants in lakes, especially rushes

Branching can be seen with a microscope







# 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.**



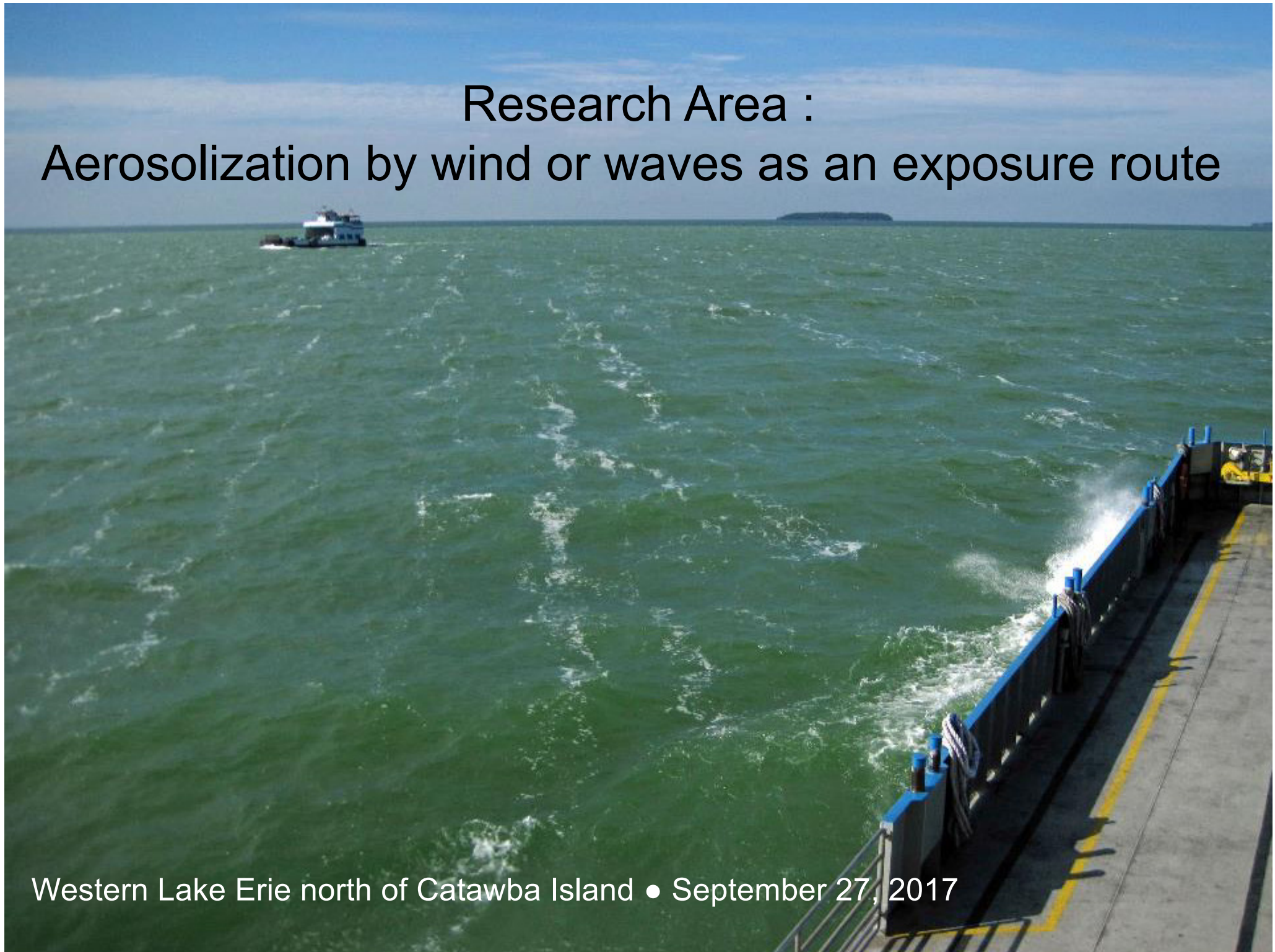
# Research Area: Fish Consumption

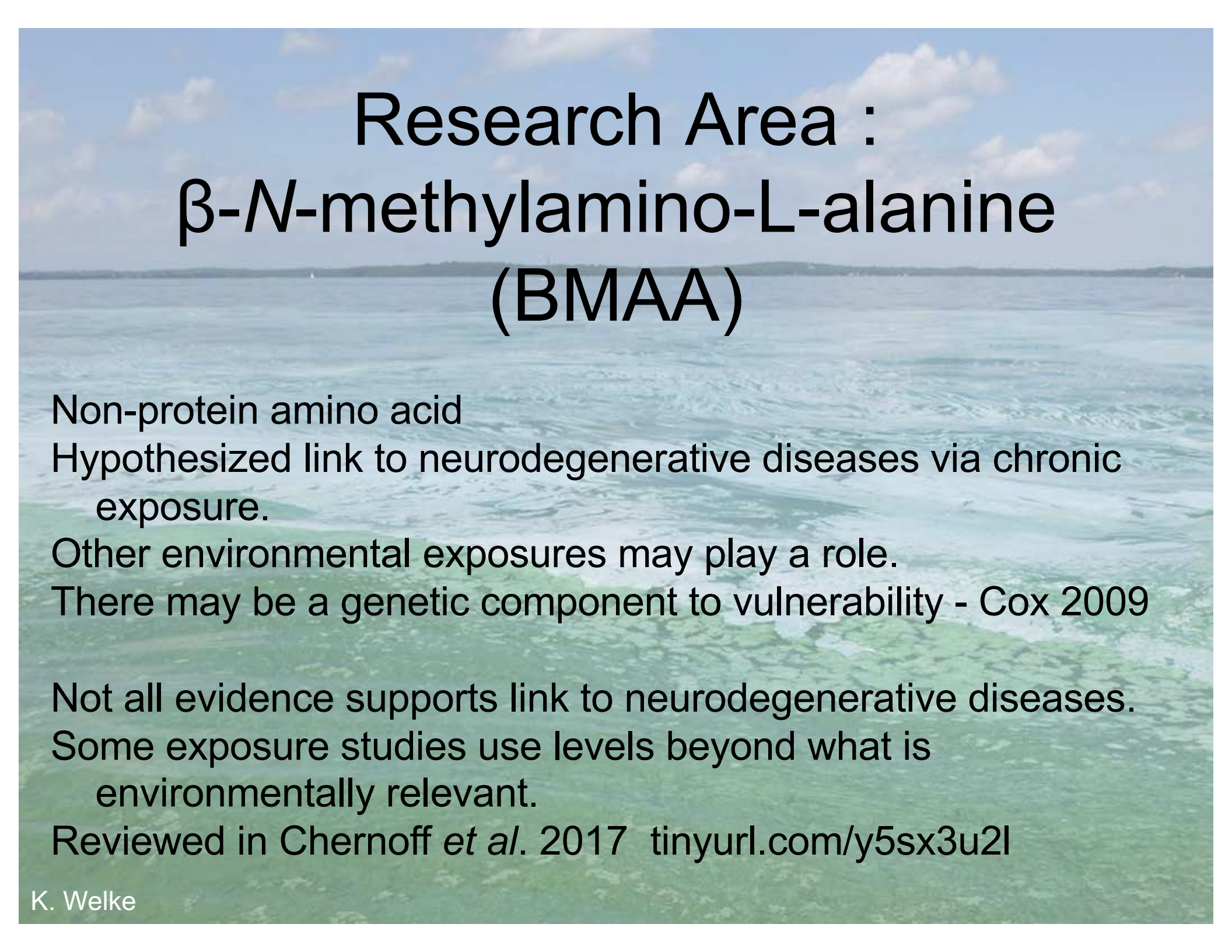
- Not all of the health risks from cyanotoxins in fish are currently known.
- Toxins may accumulate in organs, so only eat fillets.
- Rinse fillets well with clean water before cooking or freezing.
- Fish from waters with recurring blooms may have off-flavors from taste & odor compounds.
- Oregon Health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



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

Western Lake Erie north of Catawba Island • September 27, 2017





# Research Area : $\beta$ -*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](https://tinyurl.com/y5sx3u2l)

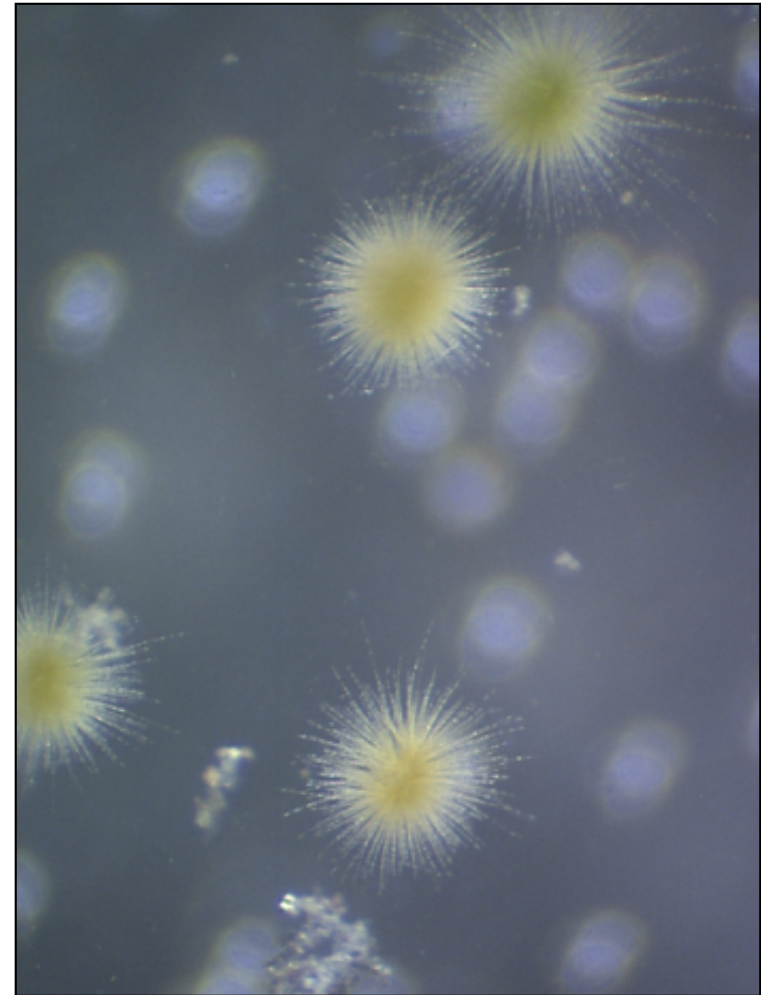
# What causes harmful blooms?

- 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.**

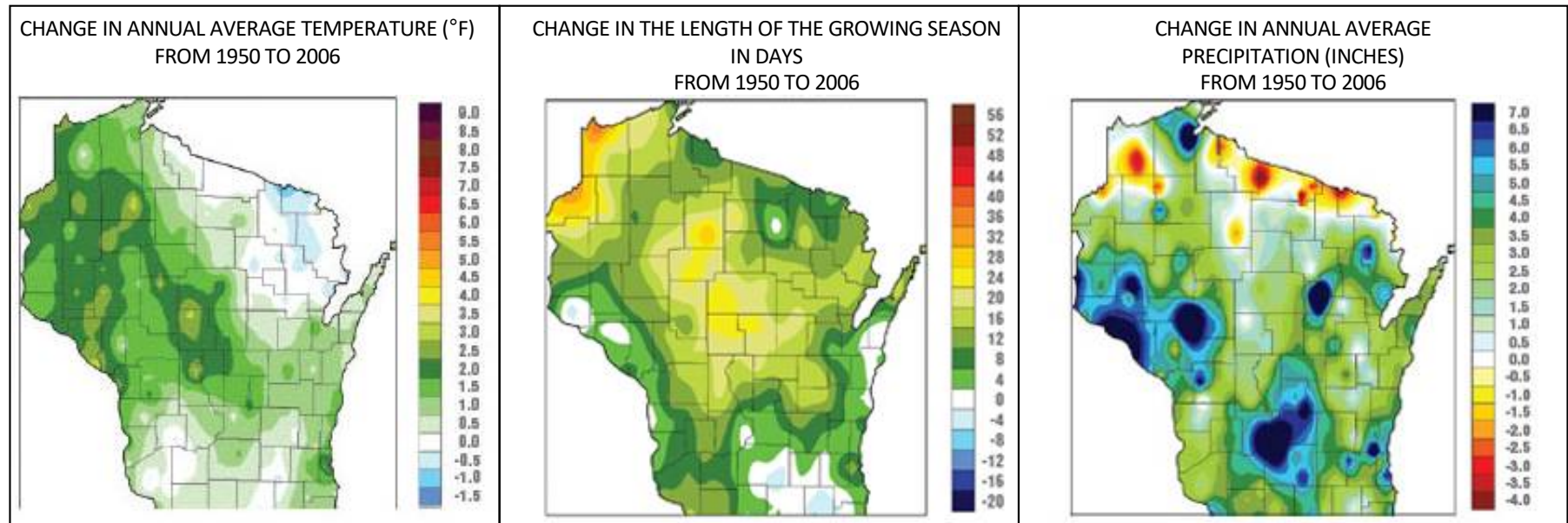
# The details are more complicated...

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



“Favorable environmental conditions”  
– Mark Vander Borgh, NCDENR

# Are blooms more frequent?



- Yes – worldwide evidence
- Heavy rains & snowmelt: extra nutrients
- Drought –lower, warmer water
- Earlier warming & extended warming may lead to blooms



# How do I get rid of it?

Chemical treatment usually not permitted – killed cells can release toxins in 1 big dose.

Other “solutions” are often ineffective or treat the symptom, not the cause.

Reduce nutrient input, but internal loading can continue to fuel blooms.

Methods should be supported by peer-reviewed science and address effects on non-target organisms.

# Toxins

- We have a good idea of what common planktonic species contain strains that can make toxins.
- We know much less about uncommon or infrequently occurring species.
- About 2700 described species worldwide.
- Research carefully – unless you know the full story, inadequate information may cause you undue concern.

# How to tell if it's safe?

- What does the water look like?
- Can you see your feet?
- How does it smell?
- For pets, does the water look like something YOU would want in your mouth?
  
- Has there been a recent heavy rain?  
(higher bacteria levels)

# Who is at risk

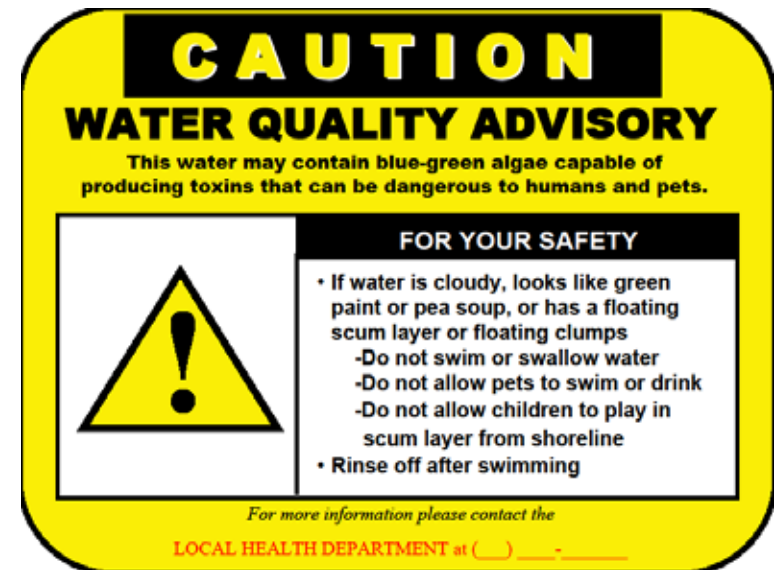
- Children, especially small children.
- People with compromised immune systems.
- People with allergies may have greater sensitivity.
- Animals.

# Can I do my own testing?

- Yes – Wisconsin State Laboratory of Hygiene
- Keep in mind blooms may change significantly between time of collection and when results are available – concentration, toxin production
- Posting advisories should be left to public health officials

# Who issues advisories?

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 at State Park and State Forest properties.**

# 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)

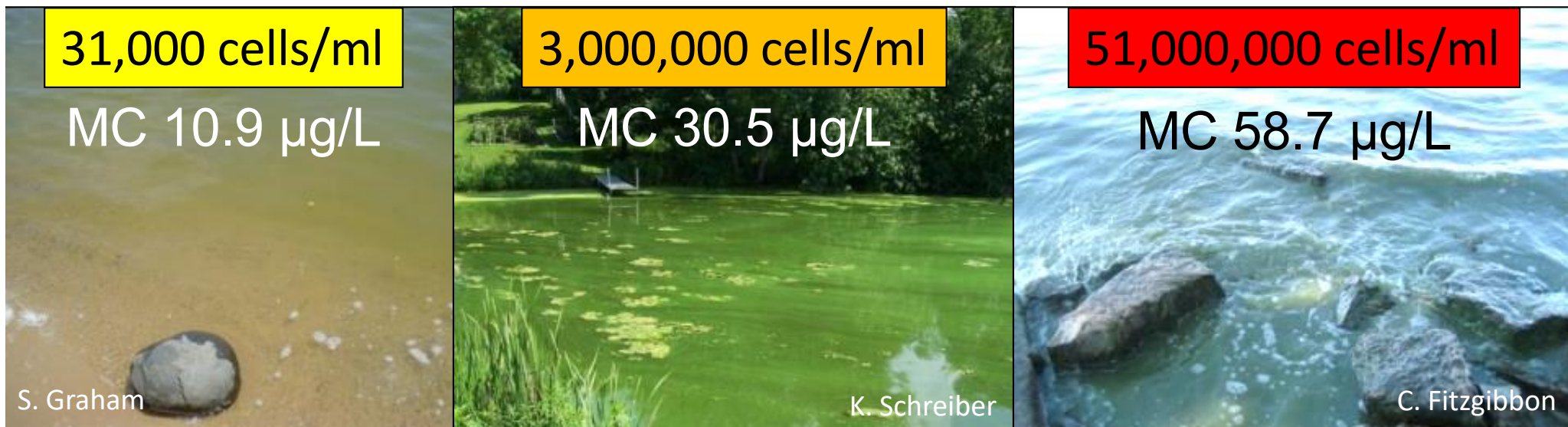
- Based on toxins' effects on target organs (liver, kidney), not on acute effects (e.g., allergic reactions, vomiting, diarrhea).
- Take children's smaller size into account.
- Not enough data to determine cell densities or pigment levels (chlorophyll or phycocyanin) correlated with these toxin concentrations.

<https://www.epa.gov/wqc/recreational-water-quality-criteria-and-methods>

# 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*





# Signs for tribal & local public health and other agencies

## IS IT BLUE-GREEN ALGAE ...OR SOMETHING ELSE?

Blue-green algae are bacteria known as cyanobacteria and are a natural part of water bodies. With enough sunlight and nutrients, cyanobacteria can grow quickly and form a blue-green algae bloom.

- Blooms often look like spilled paint or pea soup and can change the color of the water to green, blue, turquoise, purple, tan, or white.
- Blue-green algae can produce toxins that can make people and animals sick.
- In Wisconsin, blooms are most common in the summer, or May to September.
- Blooms have look-alikes, so use your best judgment when choosing a spot to swim. Do not swim in discolored water or where you see foam, scum, or algal mats.

HARMFUL	NOT HARMFUL
 Green water that looks like pea soup	 Long, hair-like filamentous green algae
 Surface scum that looks like spilled paint	 Yellow plant pollen
 Floating globs or mats	 Tiny, green floating plants (duckweed)

To learn more about blue-green algae and their health effects, visit [www.dhs.wis.gov](http://www.dhs.wis.gov) and search "algae".

Wisconsin Department of Health Services  
Division of Public Health  
Bureau of Environmental and Occupational Health  
P-424210 (05/2019)

## SCAN before you SWIM

A blue-green algae bloom may be present. Blue-green algae can produce toxins that can make people and animals sick.

Be alert! Avoid water that:

 Is discolored or streaky	 Looks like spilled paint or pea soup
 Has floating scum, globs, or mats	 Has small green dots floating in it

- Do not swallow lake water or touch foam, scum, or algal mats.
- Do not let pets swim in scummy water or lick algae off their fur.
- Rinse fish with fresh, clean water and throw away guts before cooking and eating.
- Do not swim in areas where you cannot see your feet in knee-deep water.

For questions, call \_\_\_\_\_

To learn more about blue-green algae, visit [www.dhs.wis.gov](http://www.dhs.wis.gov) and search "algae".





Wisconsin Department of Health Services | Division of Public Health  
Bureau of Environmental and Occupational Health | P-024210 (05/2019)

# CAUTION

## BLUE-GREEN ALGAE (CYANOBACTERIA) BLOOM MAY BE PRESENT IN THE WATER

Blue-green algae can produce toxins that can make people and animals sick.

Be alert! Avoid water that:

 Is discolored or streaky	 Looks like spilled paint or pea soup	 Has floating scum, globs, or mats	 Has small green dots floating in it
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- Do not swallow lake water or touch foam, scum, or algal mats.
- Do not let pets swim in scummy water or lick algae off their fur.
- Rinse fish with fresh, clean water and throw away guts before cooking and eating.
- Do not swim in areas where you cannot see your feet in knee-deep water.

Call your doctor, the Wisconsin Poison Center, or your veterinarian if you or your animals have sudden sickness or signs of poisoning.  
Wisconsin Poison Center: 800-322-3322

For questions or to report a blue-green algae-related illness, call \_\_\_\_\_


To learn more about blue-green algae, visit [www.dhs.wis.gov](http://www.dhs.wis.gov) and search "algae".

WISCONSIN DEPARTMENT OF HEALTH SERVICES  
BUREAU OF ENVIRONMENTAL AND OCCUPATIONAL HEALTH

# BEACH CLOSED

## BLUE-GREEN ALGAE (CYANOBACTERIA) BLOOM PRESENT

Blue-green algae can produce toxins that can make people and animals sick.

 KEEP YOURSELF AND YOUR PETS OUT OF DISCOLORED WATER AND DO NOT TOUCH FOAM, SCUM, OR ALGAL MATS

Call your doctor, the Wisconsin Poison Center, or your veterinarian if you or your animals have sudden sickness or signs of poisoning.  
Wisconsin Poison Center: 800-322-3322

For questions or to report a blue-green algae-related illness, call \_\_\_\_\_

To learn more about blue-green algae, visit [www.dhs.wis.gov](http://www.dhs.wis.gov) and search "algae".

WISCONSIN DEPARTMENT OF HEALTH SERVICES  
BUREAU OF ENVIRONMENTAL AND OCCUPATIONAL HEALTH

Also available as  
bookmarkers

<https://www.dhs.wisconsin.gov/water/bg-algae/health-pros.htm>

# Communication Caveats

- DON'T terrify your audience.
- Know who has the responsibility for issuing advisories. ALWAYS work with local public health officials (tribal, county, municipal) if there is a need to communicate risk to the public for a given water body.
- Be absolutely certain that a “bloom” is actually cyanobacteria!
- Recognize that conditions can change rapidly, so results may not reflect current conditions.
- Learn to identify impaired conditions, but recognize that toxins may persist after blooms abate, or may be produced by less noticeable benthic cyanobacteria.

# Satellite Monitoring

A satellite image of a city, likely Chicago, showing a dense urban area with a grid of streets and buildings. The image is overlaid with a large, irregular black shape that covers a significant portion of the city. Within this black shape, there are two distinct areas of bright green, suggesting a specific data layer or analysis. The green areas are concentrated in the upper-left and lower-right parts of the black shape. The overall image has a slightly grainy, high-resolution appearance typical of satellite imagery.

LANDSAT –  
16 day interval + processing

# Lake Erie Harmful Algal Bloom Forecast



## Lake Erie Harmful Algal Bloom Bulletin

25 September, 2017, Bulletin 22

The *Microcystis cyanobacteria* bloom continues in the western basin along- and offshore the Michigan and Ohio coasts from Maumee Bay east into the central basin, and northeast to the Ontario coast. Observed winds since Thursday (9/21-9/25) caused an increase in surface concentrations. Scums were visible within Maumee Bay extending northeast to the Ontario coast. Measured toxin concentrations are below recreational thresholds throughout most of the bloom extent, but concentrations can exceed the threshold within Maumee Bay and in the western basin extending towards the Ontario coast where the bloom is most dense (appearing green from a boat).

Forecast winds (2-5kn) today through Wednesday (9/25-9/27) may increase the potential for scum formation. Forecast winds today through Thursday (9/25-9/28) may limit the transport of remaining *Microcystis* concentrations.

Please check Ohio EPA's site on harmful algal blooms for safety information: <http://epa.ohio.gov/habalgae.aspx>. Keep your pets and yourself out of the water in areas where scum is forming. NOAA's GLERL provides additional HAB data: [https://www.glerl.noaa.gov/res/HABs\\_and\\_Hypoxia](https://www.glerl.noaa.gov/res/HABs_and_Hypoxia). The persistent cyanobacteria bloom in Sandusky Bay continues.

-Davis, Lalime

The images below are "GeoPDF". To see the longitude and latitude under your cursor, select "Tools > Analyze > Geospatial Location Tool".

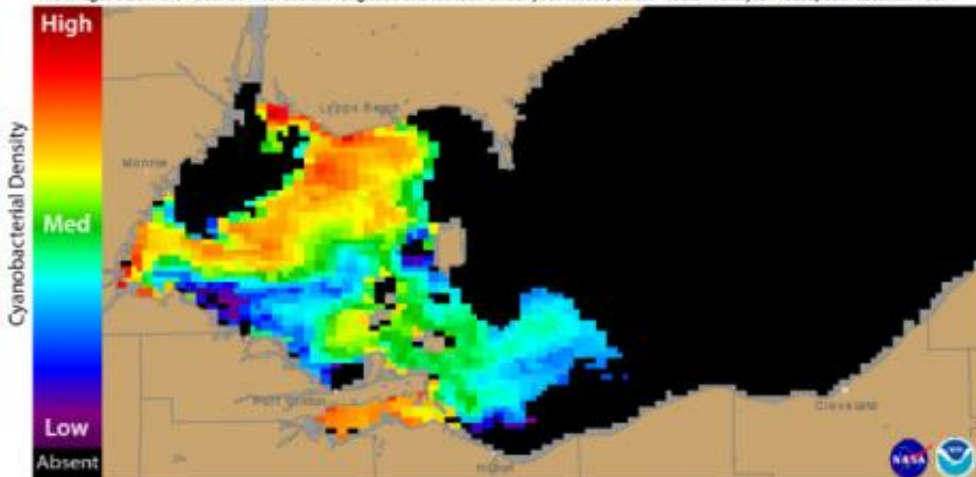
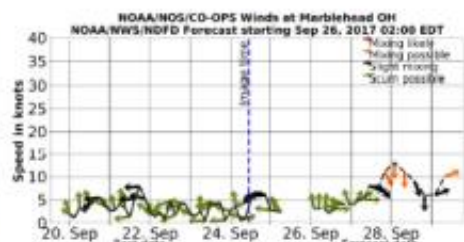


Figure 1. Cyanobacterial index from NASA MODIS-Terra data collected 24 September, 2017 at 11:55 EST. Grey indicates clouds or missing data. The estimated threshold for cyanobacteria detection is 20,000 cells/mL.



Figure 2. Cyanobacterial Index from NASA MODIS-Terra data collected 24 September, 2017 at 11:55.



Wind speed and direction from Marblehead, OH. Blooms mix through the water column at wind speeds greater than 15 knots (or 7.7 m/s).

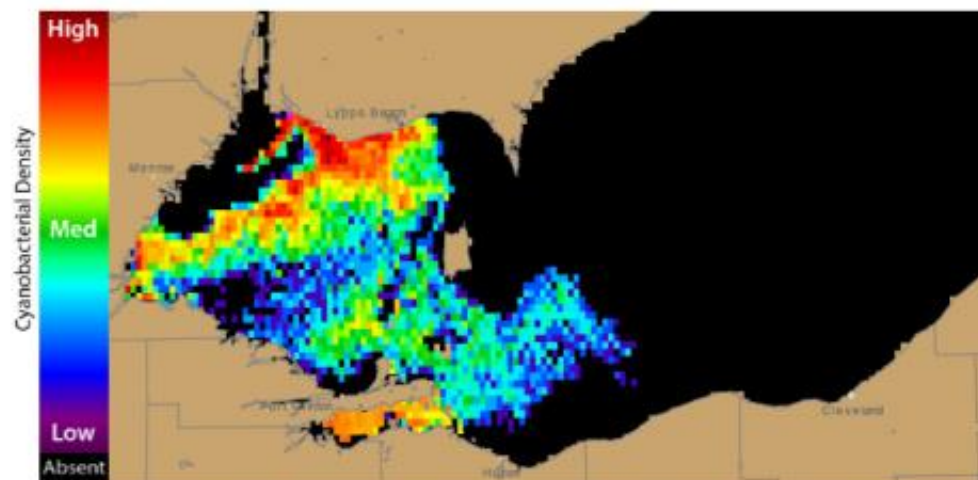


Figure 3. Nowcast position of bloom for 25 September, 2017 using GLFS modelled currents to move the bloom from the 24 September, 2017

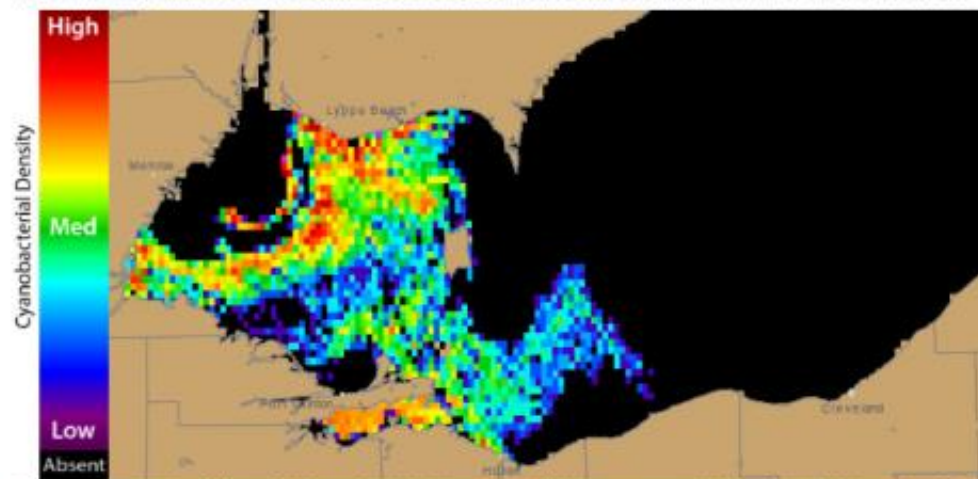
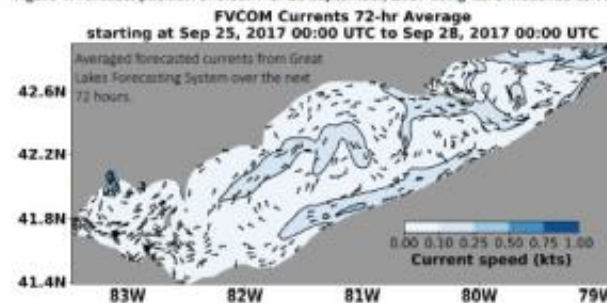


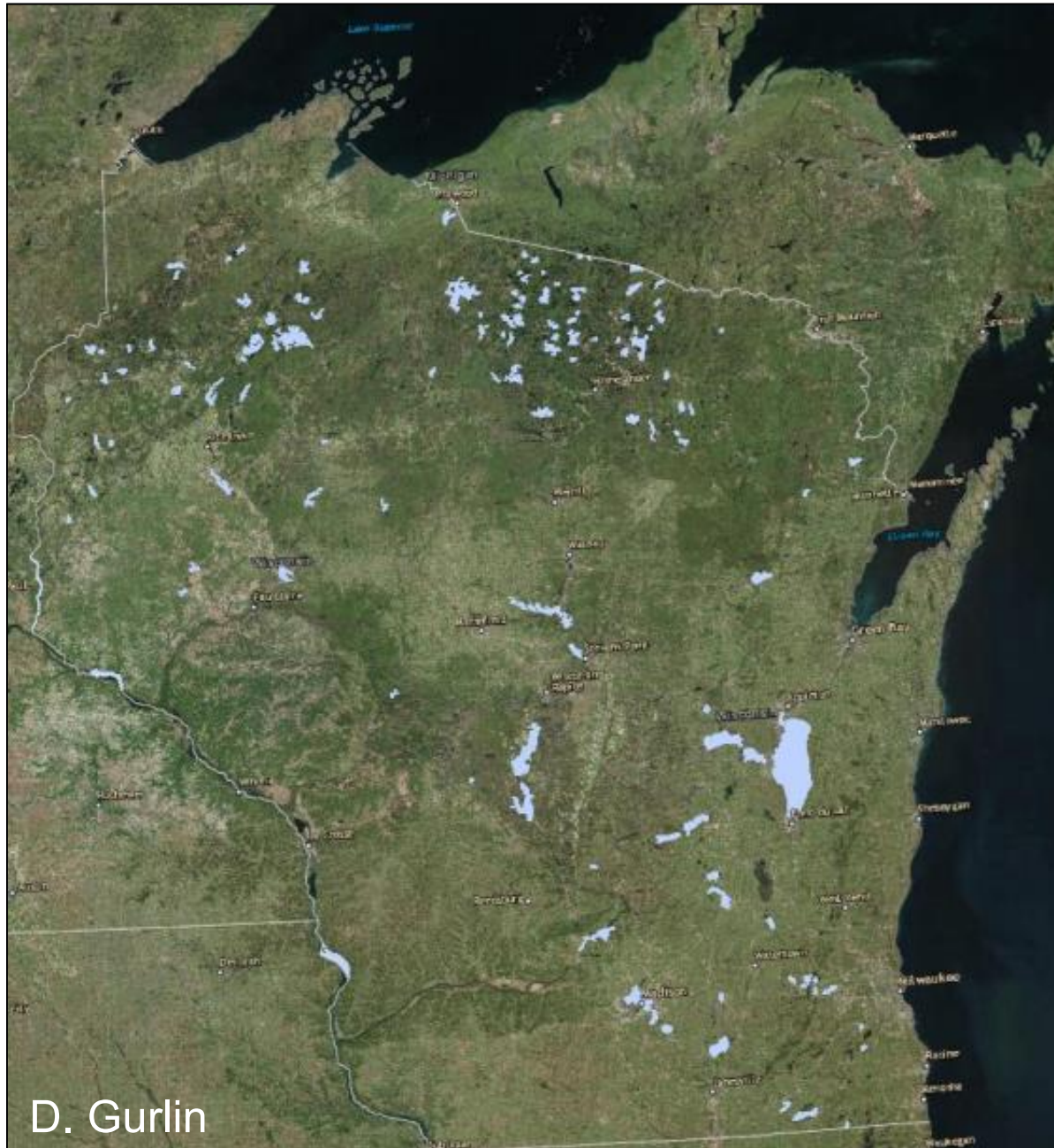
Figure 4. Forecast position of bloom for 28 September, 2017 using GLFS modelled currents to move the bloom from the 24 September, 2017



For more information and to subscribe, please visit the NOAA HAB Forecast page: <https://tidesandcurrents.noaa.gov/hab/lakeerie.html>

For more information and to subscribe to this bulletin, go to: <https://tidesandcurrents.noaa.gov/hab/lakeerie.html>

# Cyanobacteria Assessment Network

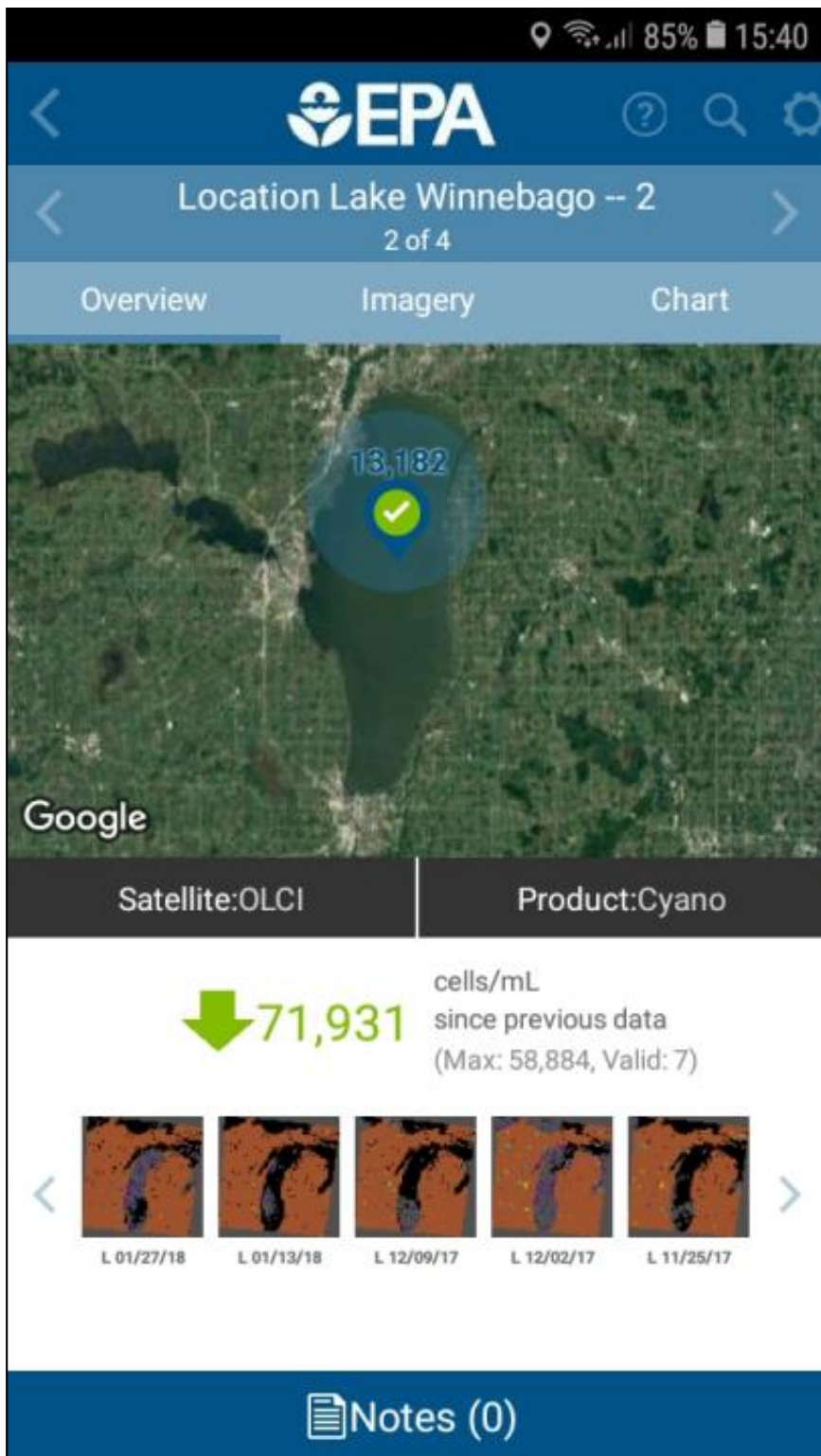


EPA, NASA, NOAA, & USGS

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 is public & web  
platform is in development.



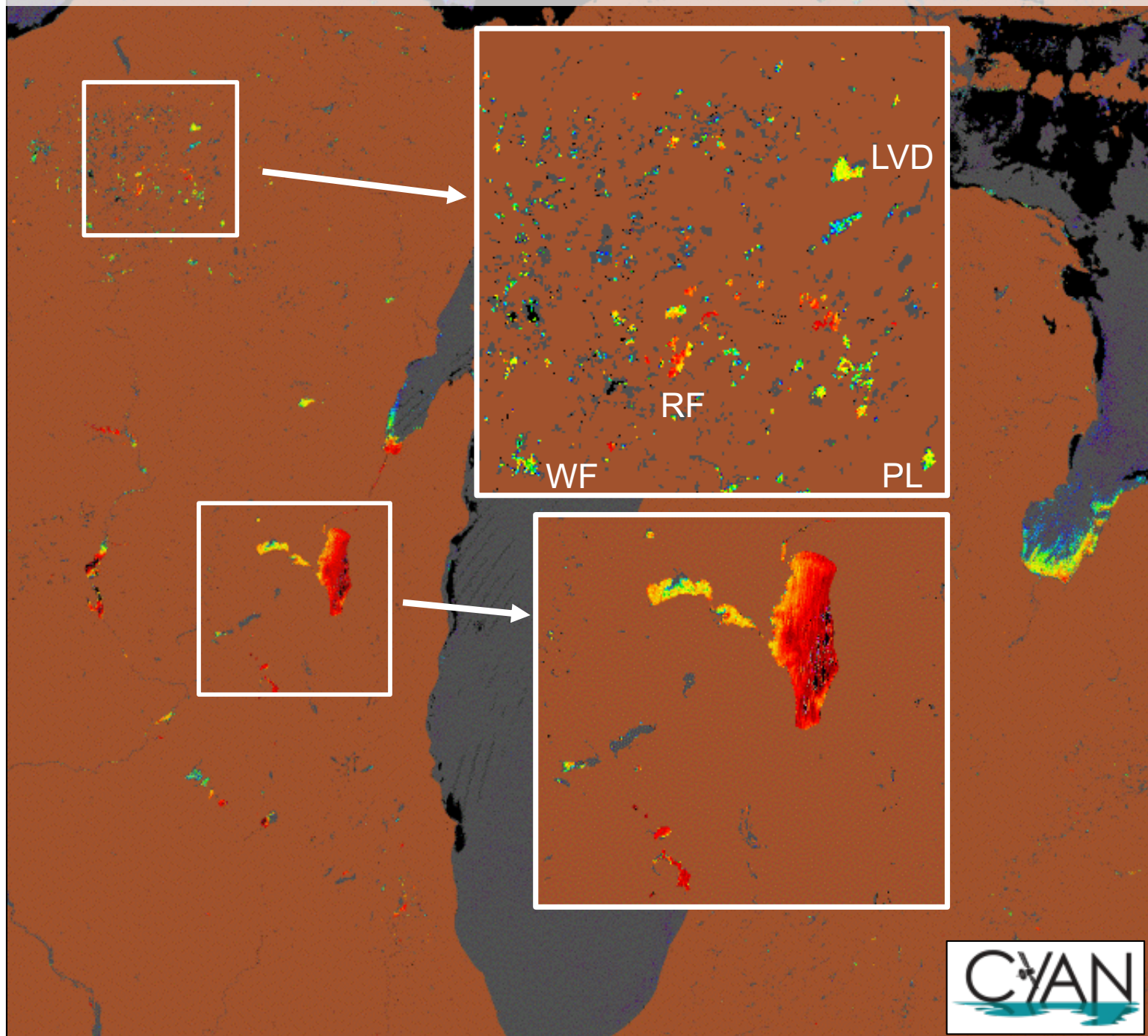
Composite cyanobacteria cell count maximums (over 1 week) are updated weekly.

Caveats:

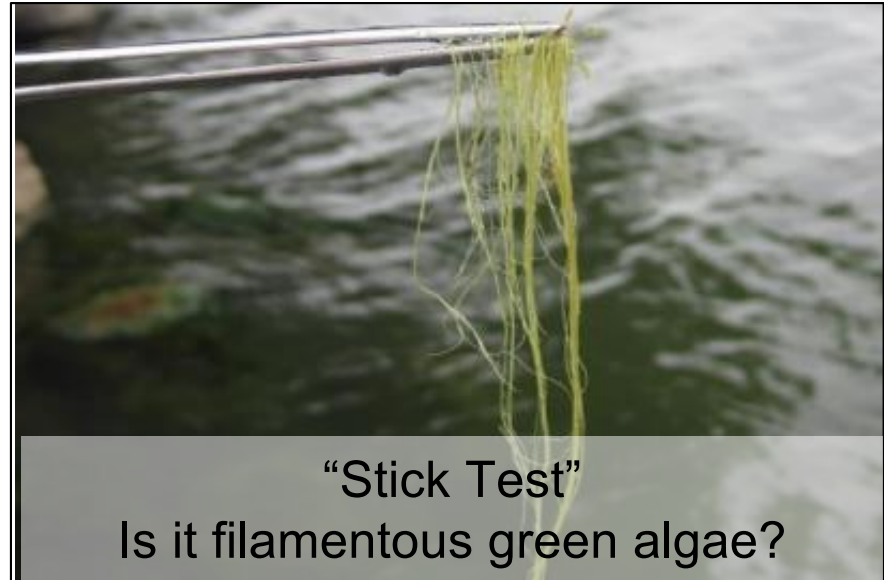
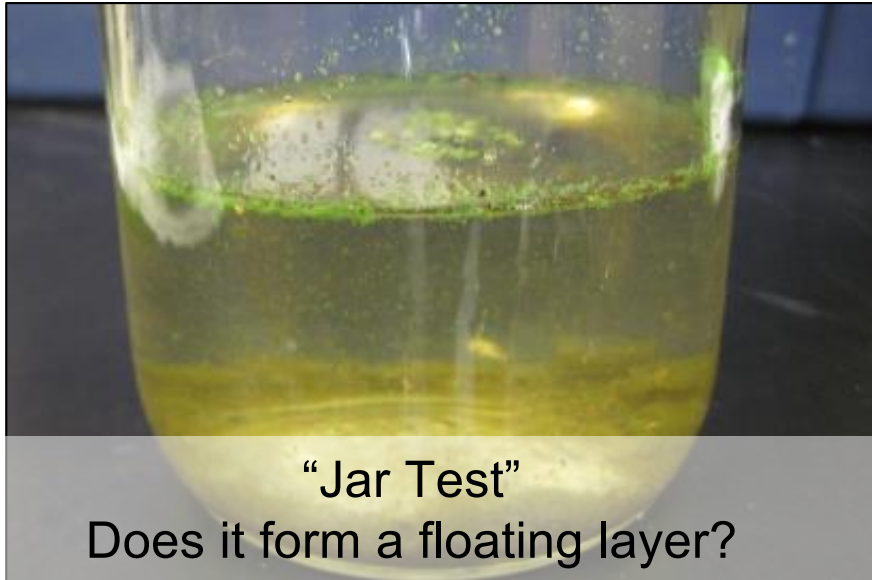
Thin clouds & ice may register as blooms. Data better for lakes > 900m (0.56 mile). **Data are most reliable for open water in the middle of a lake.** Pixels containing land & water are not accurate so **this is not suitable for assessing blooms near the shore.**

Consider this a research level tool that's appropriate for the largest ~150 lakes in Wisconsin.

7-day composite value from August 27, 2017 through September 2, 2017



# How can I help track blooms in Wisconsin?



**Please let the DNR know about significant bloom events!**  
**[DNRHABS@wisconsin.gov](mailto: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.

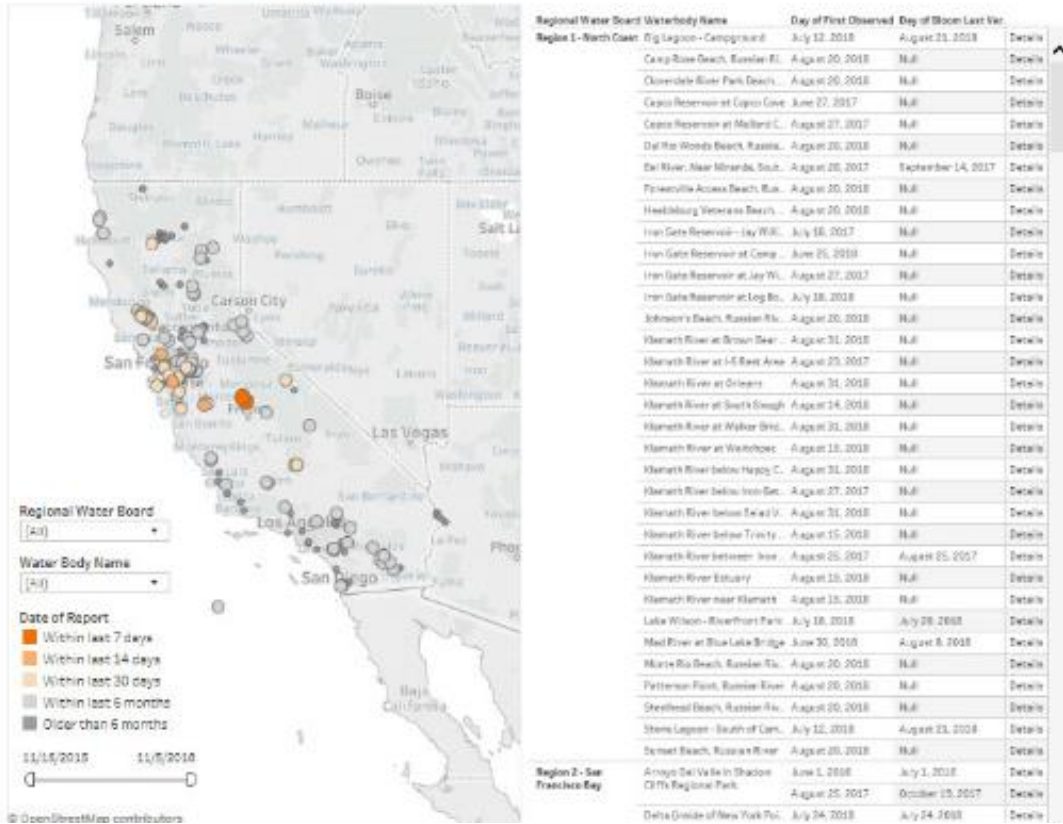


# In the works from WI Department of Natural Resources... online bloom reporting and mapping

This map only shows locations where harmful algal blooms (HABs) have been voluntarily reported. California currently does not have adequate funding for a statewide routine monitoring program so monitoring data is limited. A waterbody with no data is not an indication that a bloom is not present. Dots represent reported locations with pop-up windows providing additional data for each HAB incident such as field and/or lab results. Several routine monitoring programs exist for some locations (Klamath Basin, East Bay Regional Parks, Clear Lake, and reservoirs along State Water Project), which may share monitoring data to present in this map.

Note - The exact location, extent, and toxicity of the reported bloom may not be accurate and may not be affecting the entire waterbody. Please use data presented in this map for general purposes only, as it may contain errors. The data are subject to change as new information is received. Please check back for daily updates.

\* To download the full data set, click the download button located on the bottom right of the map below. A recent copy of the HAB Incidents Report data set is also available as a ".csv" file on the California Open Data Portal.





[https://mywaterquality.ca.gov/habs/where/freshwater\\_events.html](https://mywaterquality.ca.gov/habs/where/freshwater_events.html)

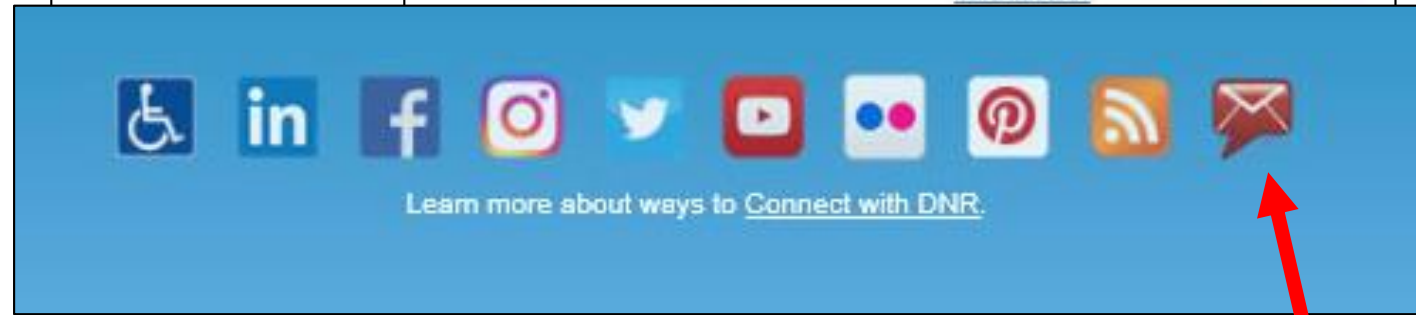
# How can I get updates?

Updates to the DNR blue-green algae website, HAB tracking, and webinars will be posted to GovDelivery.

Subscribe to email or text updates – check the box for “Blue Green Algae” under the Lakes heading, and submit.

Lakes

- Aquatic Plants
- Blue Green Algae 
- Citizen Lake Monitoring
- Lake Information
- Lakes Calendar 
- Lakes-L Blog
- Red Swamp Crayfish



[dnr.wi.gov](http://dnr.wi.gov)



# If there's no public health testing, how can you stay safe?

Learn what to look for.

Use common sense.

Avoid submerging your head if water contains lots of particles or debris.

This will help to protect you from other bacteria, viruses, and parasites.

Keep water out of your mouth!

10  $\mu\text{m}$

A microscopic image showing a dense population of various microorganisms in water. The organisms include long, thin, rod-shaped bacteria, some with flagella, and smaller, more rounded or curved forms. The background is a light, slightly grainy grey. A vertical scale bar on the right side indicates a length of 10 micrometers.

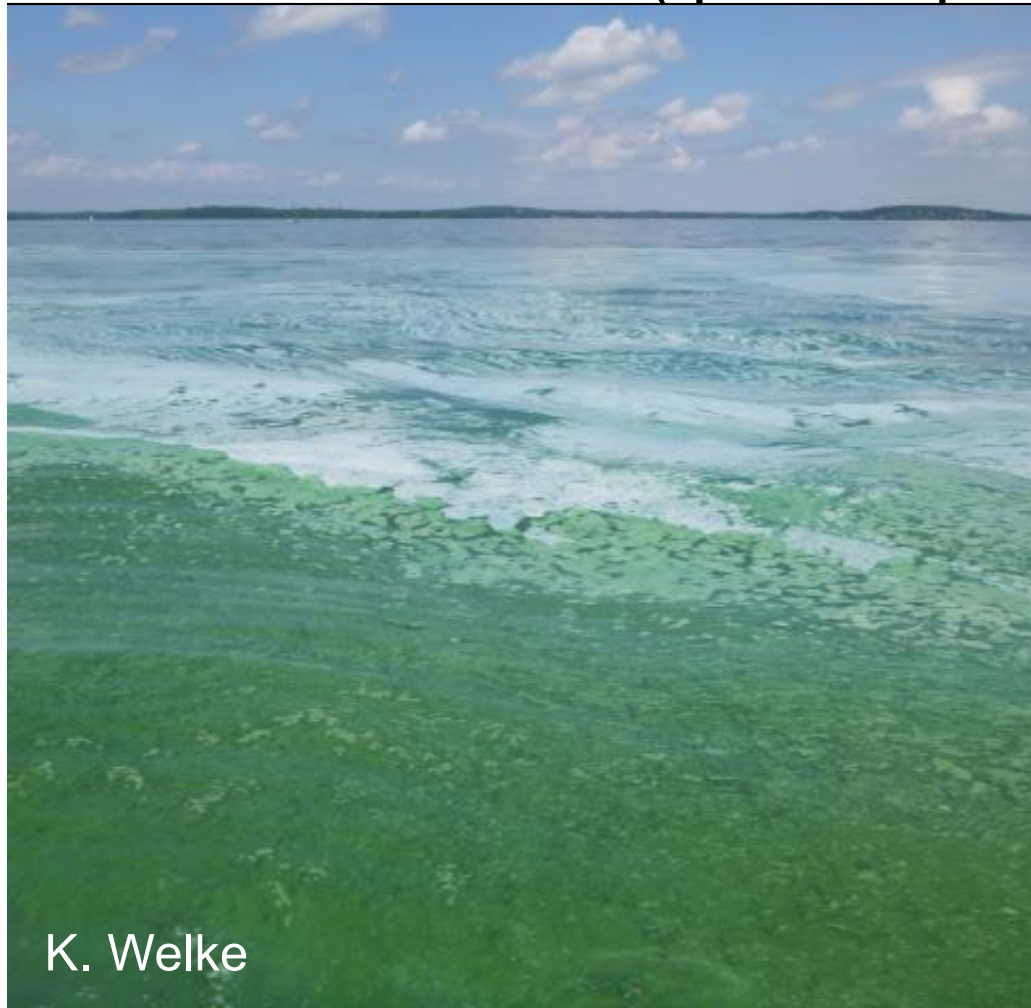
Sometimes the risk is obvious.



2014 North Carolina  
Division of Water Quality

# 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, 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 & 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, & cyanotoxins.

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



**Report illnesses in humans & animals online, or call 608-266-1120**

**NEW!**  
 For healthcare providers: beginning 7/1/2018, report any suspected human cases of Cyanobacteria and Cyanotoxin Poisoning electronically through WED65 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 608-266-1120 or complete the online form (Harmful Algal Bloom (HAB) Illness or Sighting Survey, F-00152) to report any blue-green algae blooms and related human or animal illnesses to the Wisconsin Harmful Algal Blooms Program.

**Blue-Green Algae**

**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 website](#), 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](#).

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.

[dhs.wisconsin.gov](http://dhs.wisconsin.gov) Search for "algae" [dnr.wi.gov](http://dnr.wi.gov)

Please let the DNR know about significant bloom events!  
**[DNRHABS@wisconsin.gov](mailto: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.

[Gina.LaLiberte@wisconsin.gov](mailto:Gina.LaLiberte@wisconsin.gov)