

Blue-green Algae: The Effects of Their Blooms in Wisconsin Waters

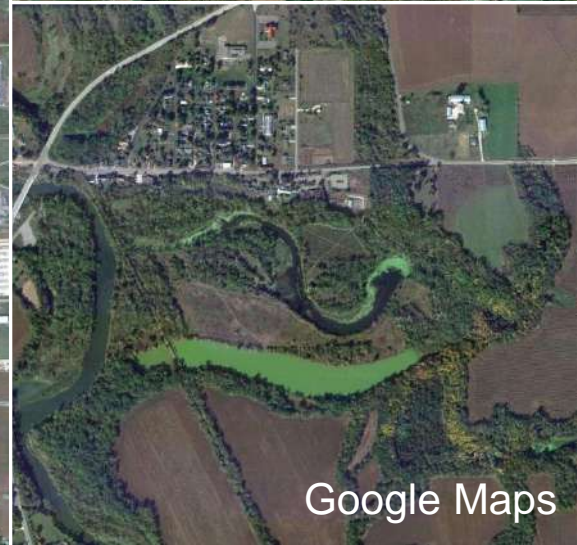
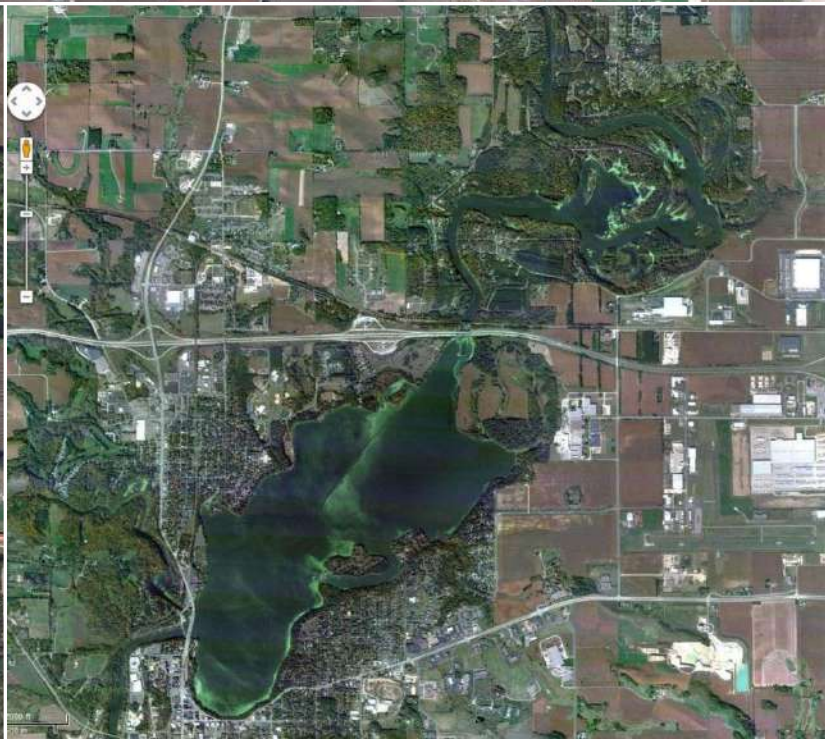
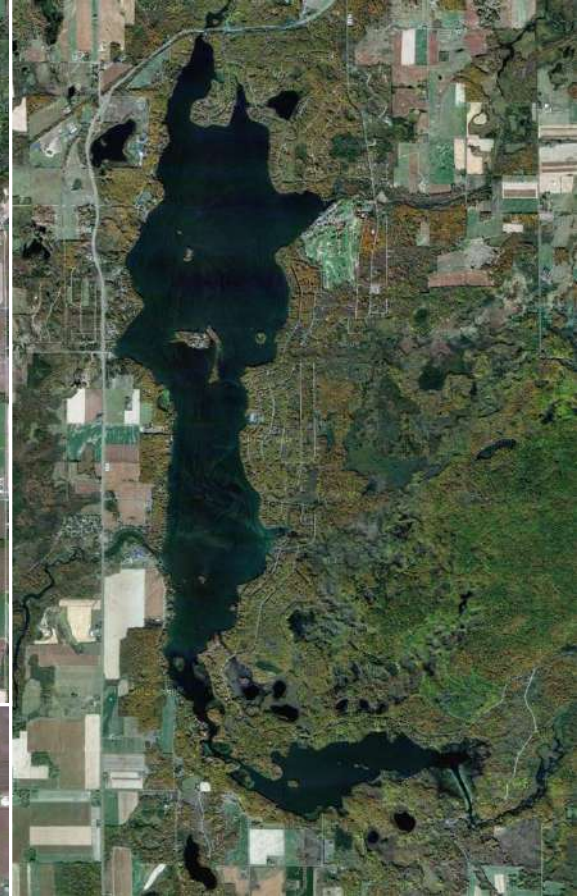
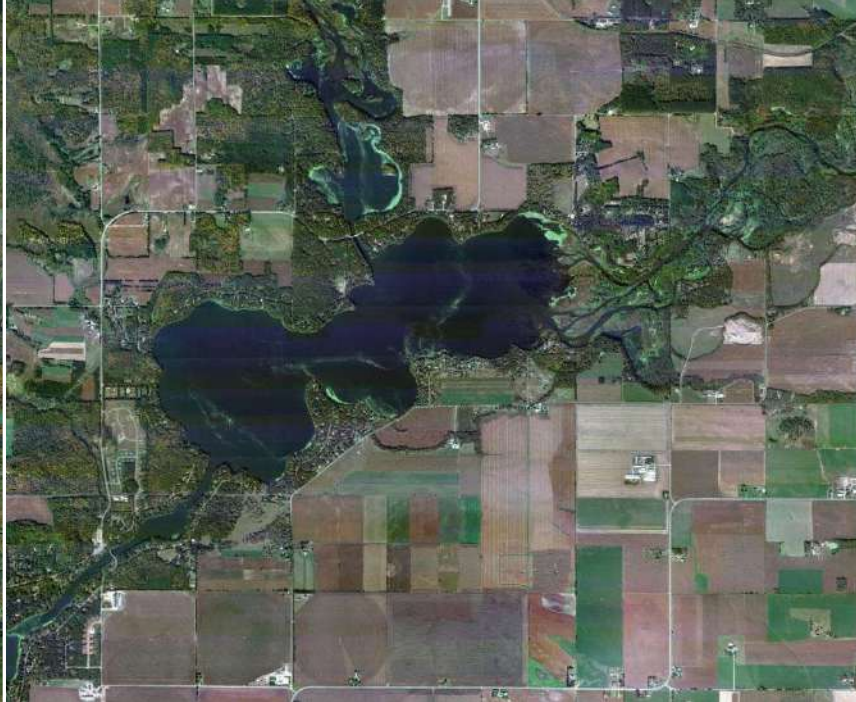
Red Cedar Watershed Conference

March 14, 2012

Gina LaLiberte

**Wisconsin Department of Natural Resources
Bureau of Science Services**

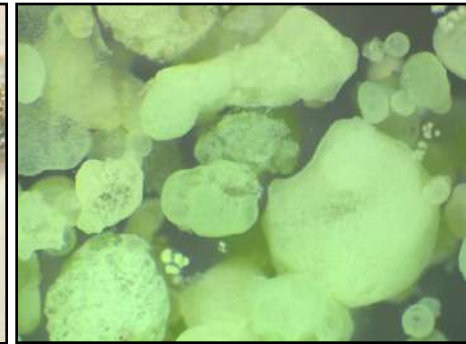
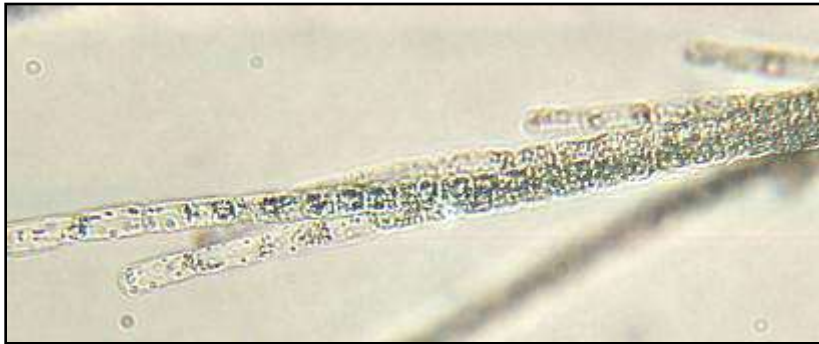




Google Maps

What are blue-green algae?

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

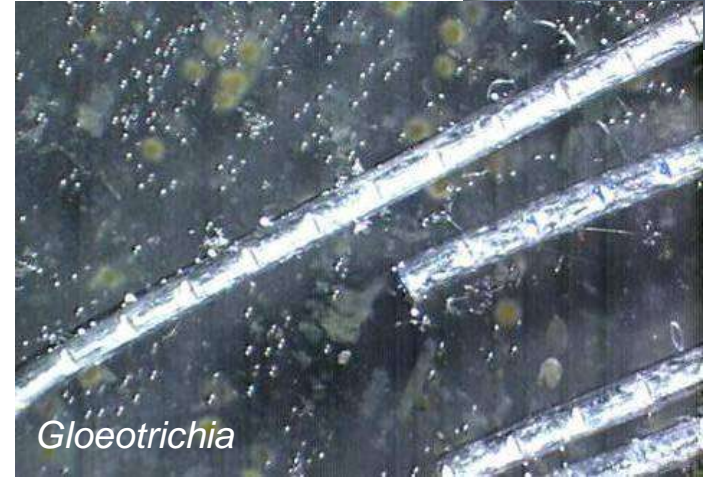


Planktonic blue-green algae



Aphanizomenon flos-aquae

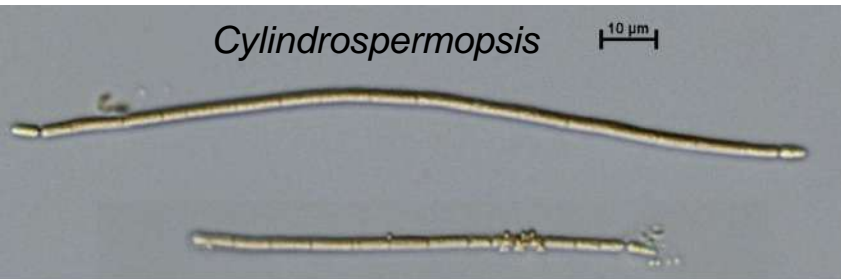
Lake Seven, Sheboygan Co., WI 11-27-06



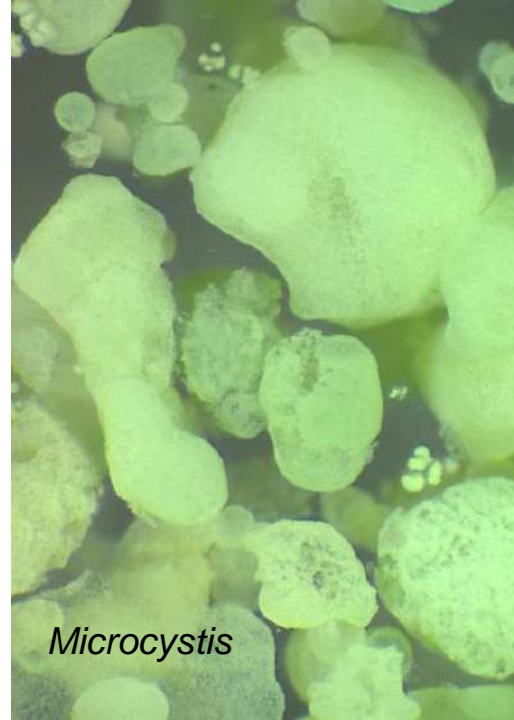
Gloeotrichia



Anabaena



Cylandropermopsis



Microcystis



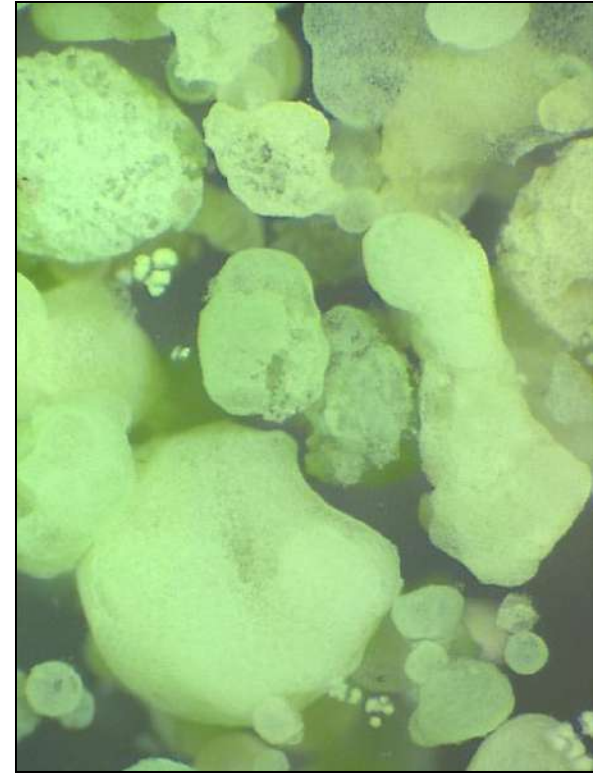
Seasonality of algae



diatoms



green algae



blue-green algae

Blue-green algae's adaptations present management challenges

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



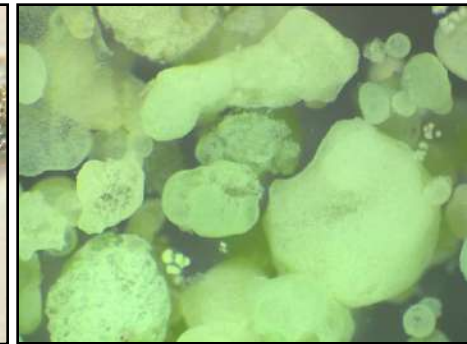
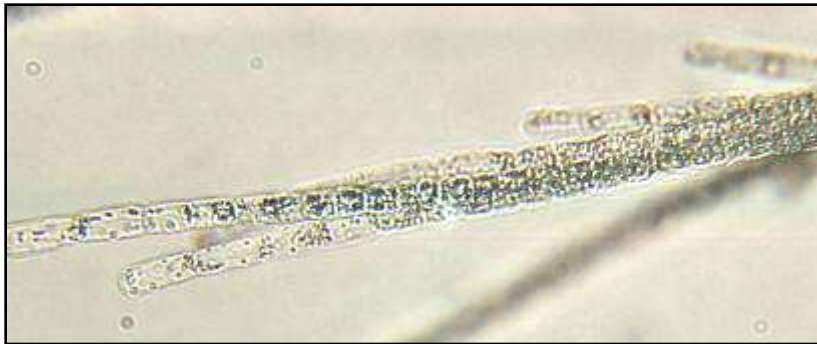
What causes harmful blooms?

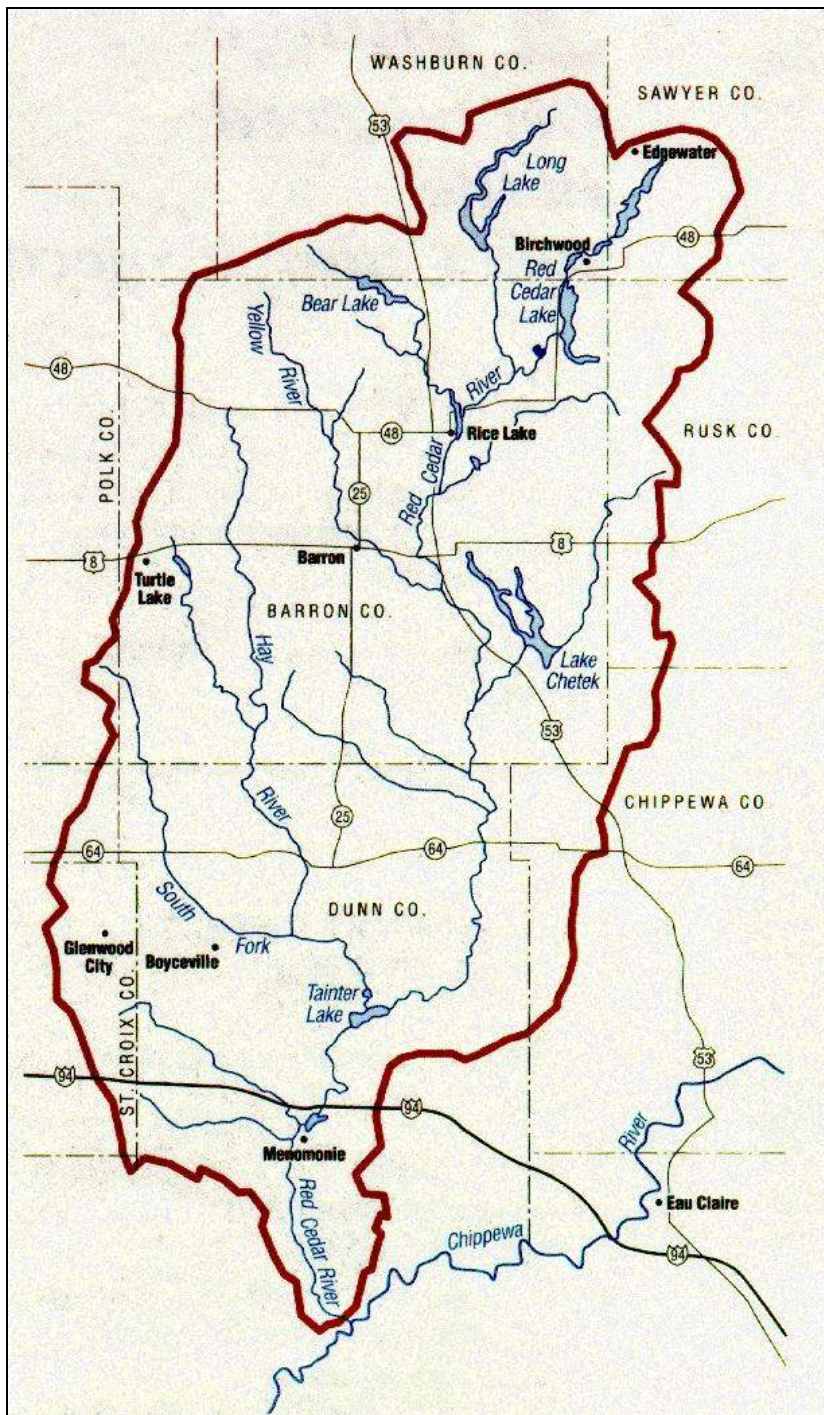
- Excess nutrients, primarily phosphorus
- Warm water and calm weather



Hazards of blue-green algae blooms

- They may form nuisance 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 them in water can cause illness.
- **Not all blue-green algae make toxins, and toxins are not made all the time.**





Harmful algal blooms
in Wisconsin

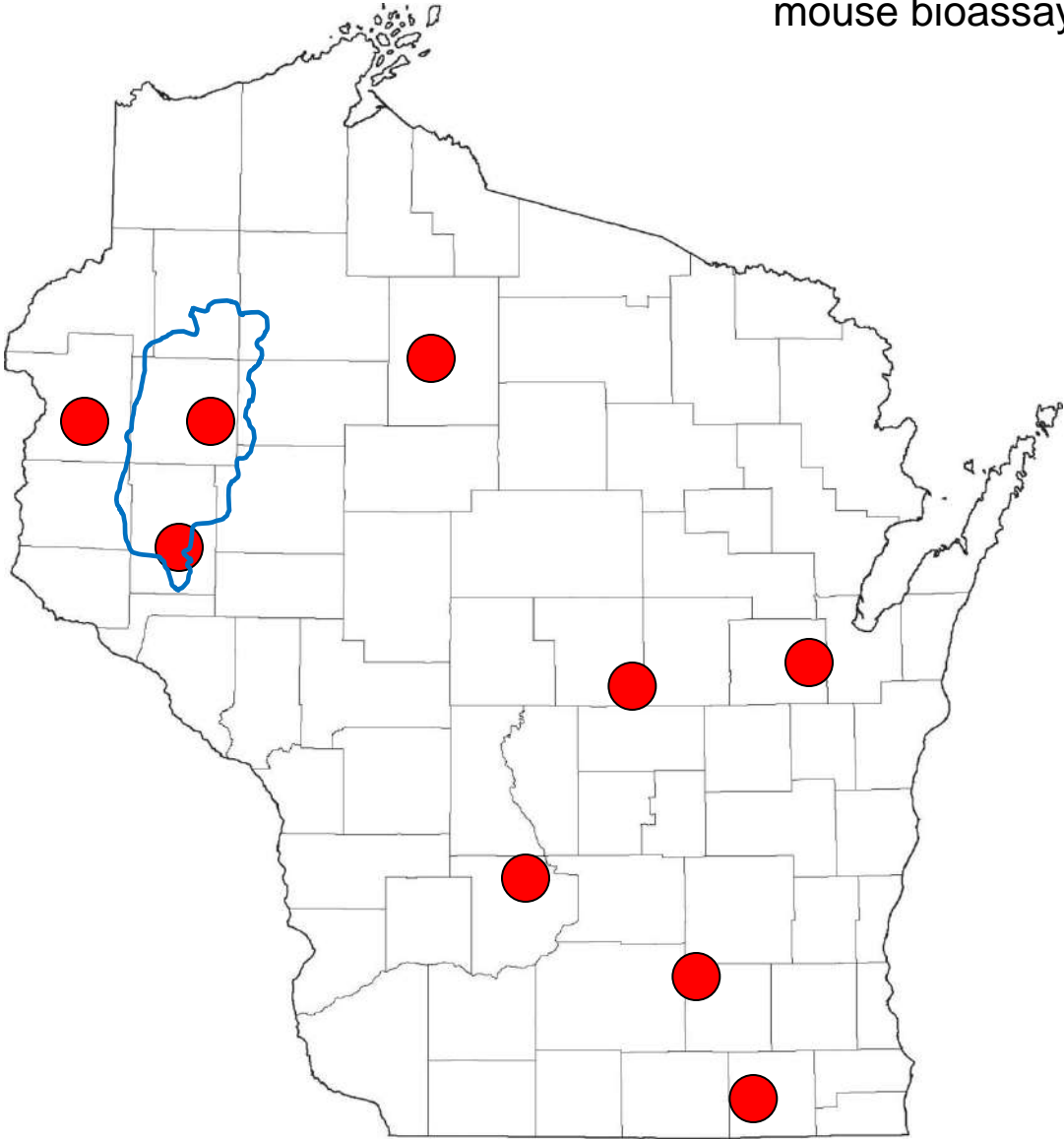
1967 to present

Cyanobacterial Toxins 1967-1969

Karl 1970

20 sites

● Toxicity determined via mouse bioassay



Cyanobacterial Toxins 1983

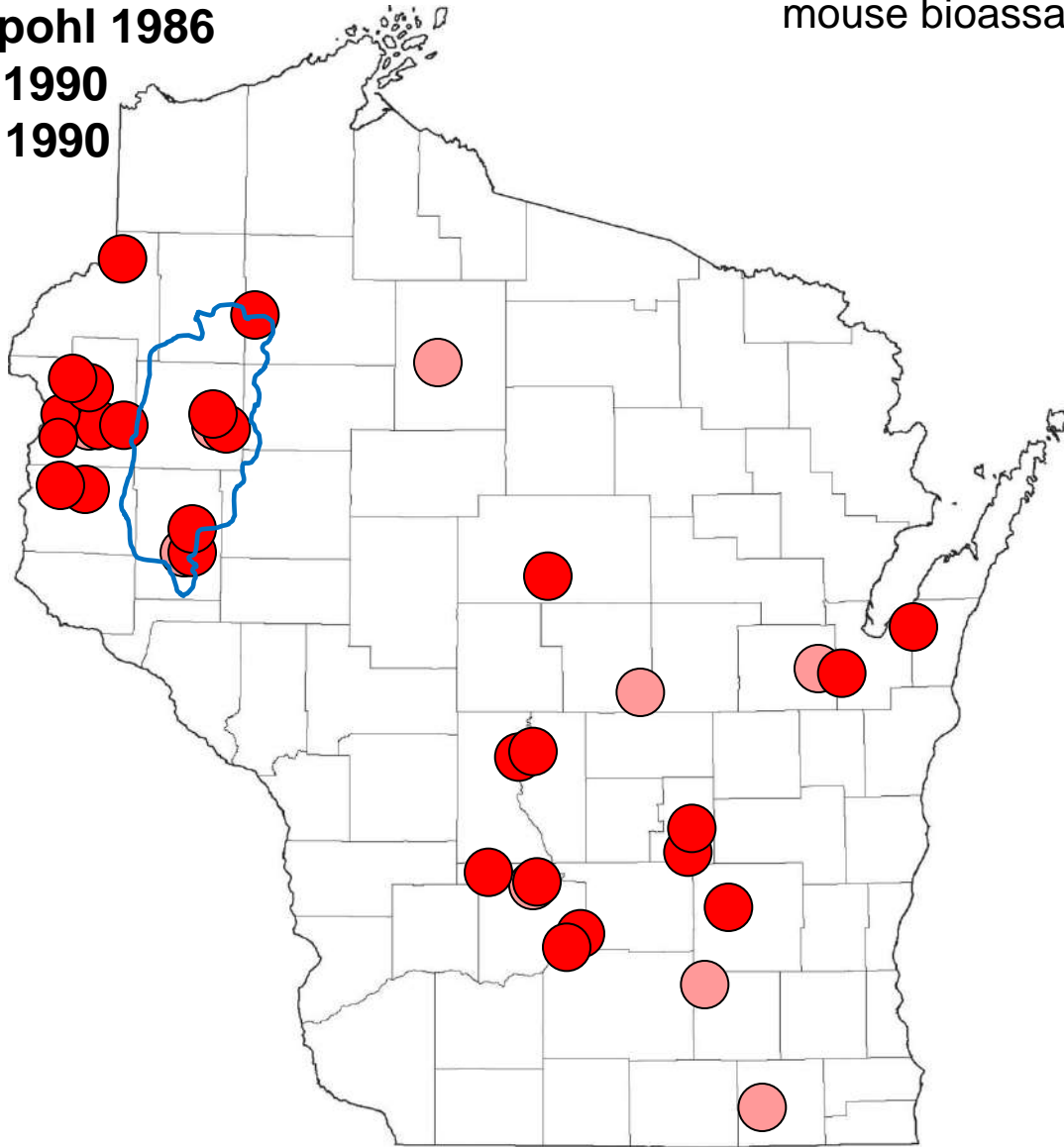
Vennie & Wedepohl 1986

Repavich et al. 1990

Sonzogni et al. 1990

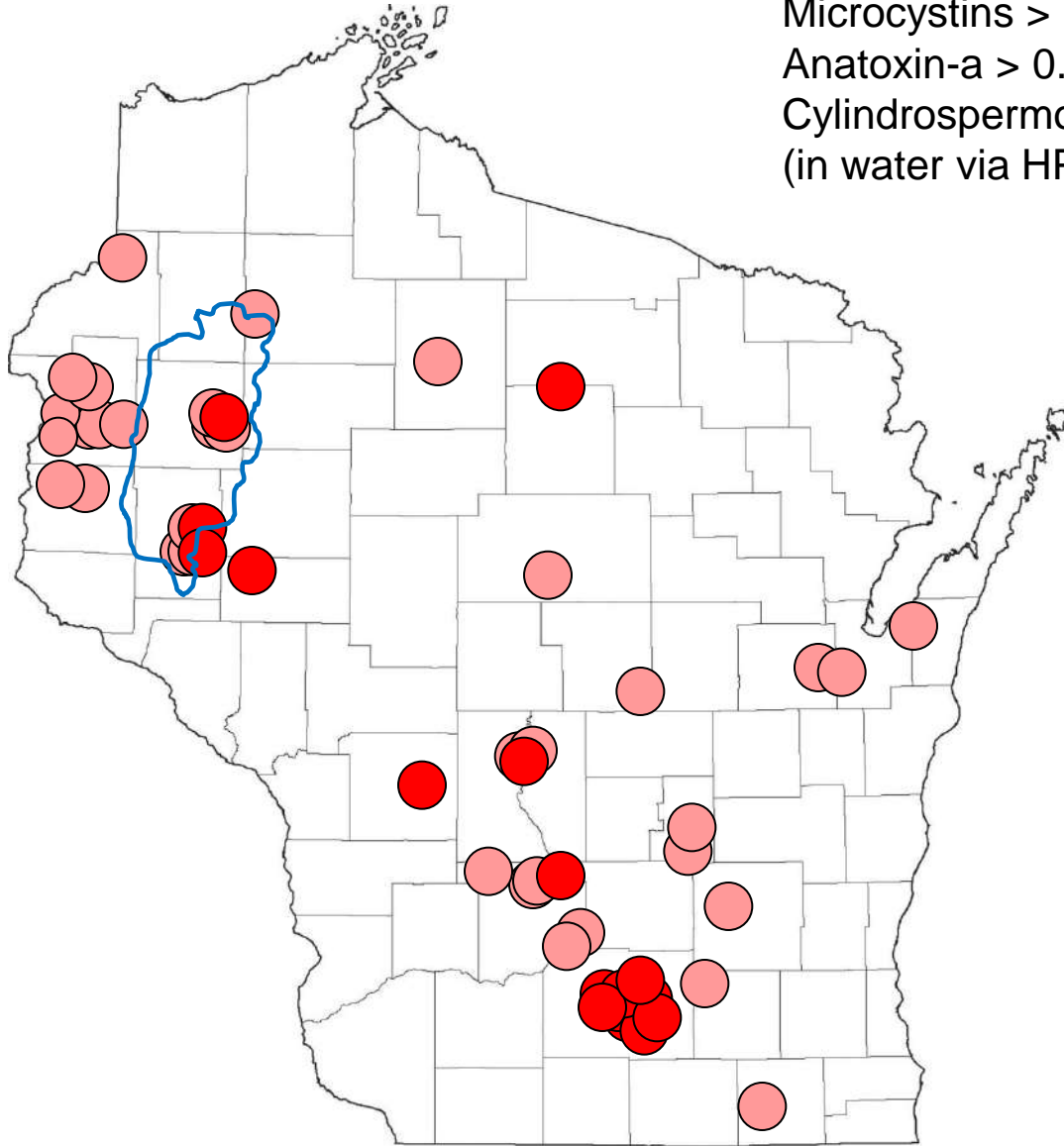
86 sites

● Toxicity determined via mouse bioassay



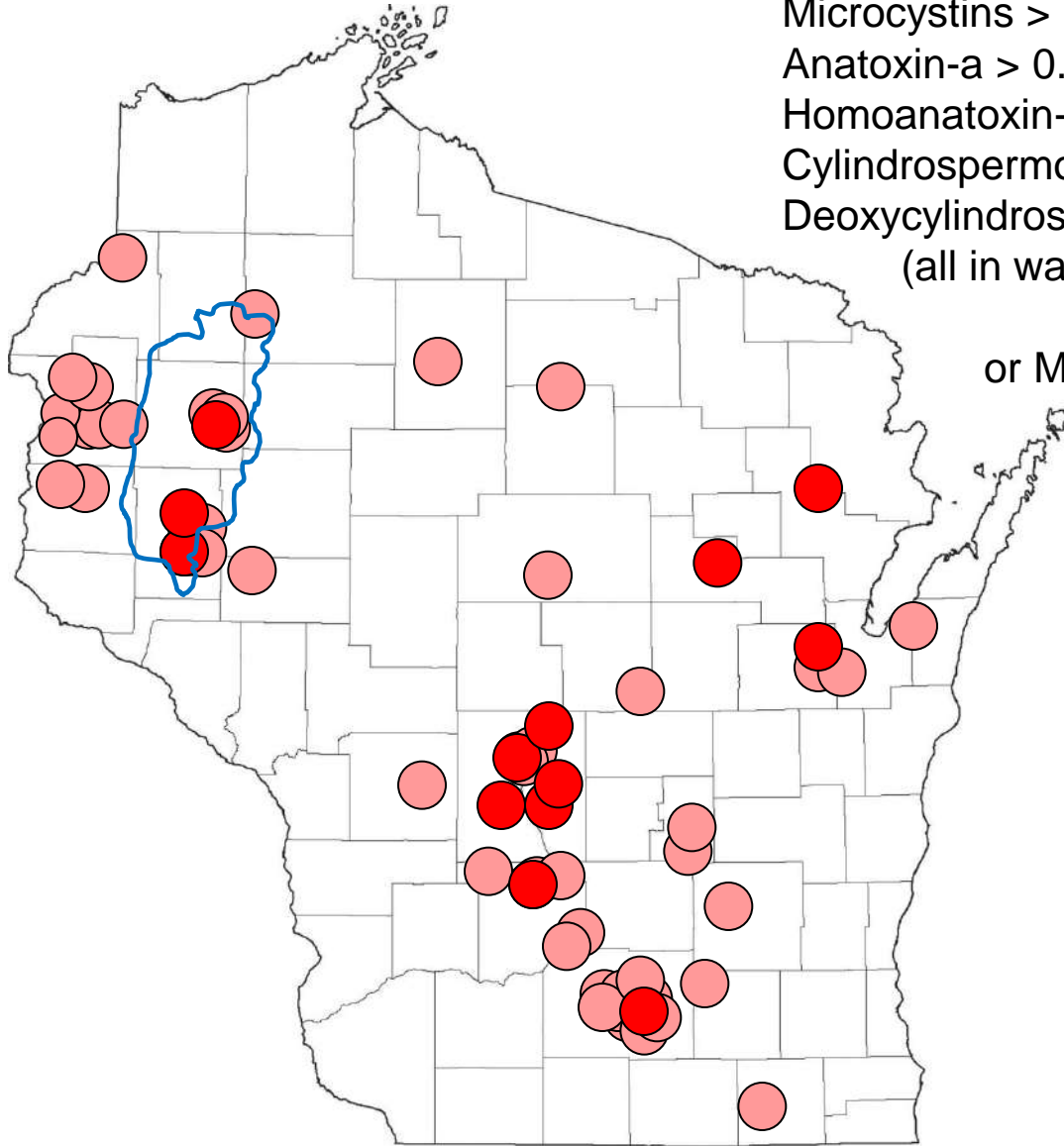
Cyanobacterial Toxins 2004-2008

● 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)



Cyanobacterial Toxins 2009-2012

- Toxins above detection levels:
Microcystins > 1.0 ug/L, or
Anatoxin-a > 0.5 ug/L, or
Homoanatoxin-a > 0.5 ug/L, or
Cylindrospermopsin > 0.5 ug/L, or
Deoxycylindrospermopsin > 0.5 ug/L
(all in water via HPLC/MS/MS),
or Microcystin > 0.1 ug/L
(via ELISA)



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*

CAUTION

WATER QUALITY ADVISORY

This water may contain blue-green algae capable of producing toxins that can be dangerous to humans and pets.



FOR YOUR SAFETY

- If water is cloudy, looks like green paint or pea soup, or has a floating scum layer or floating clumps
- Do not swim or swallow water
- Do not allow pets to swim or drink
- Do not allow children to play in scum layer from shoreline
- Rinse off after swimming

For more information please contact the
LOCAL HEALTH DEPARTMENT at () - - -

31,000 cells/ml



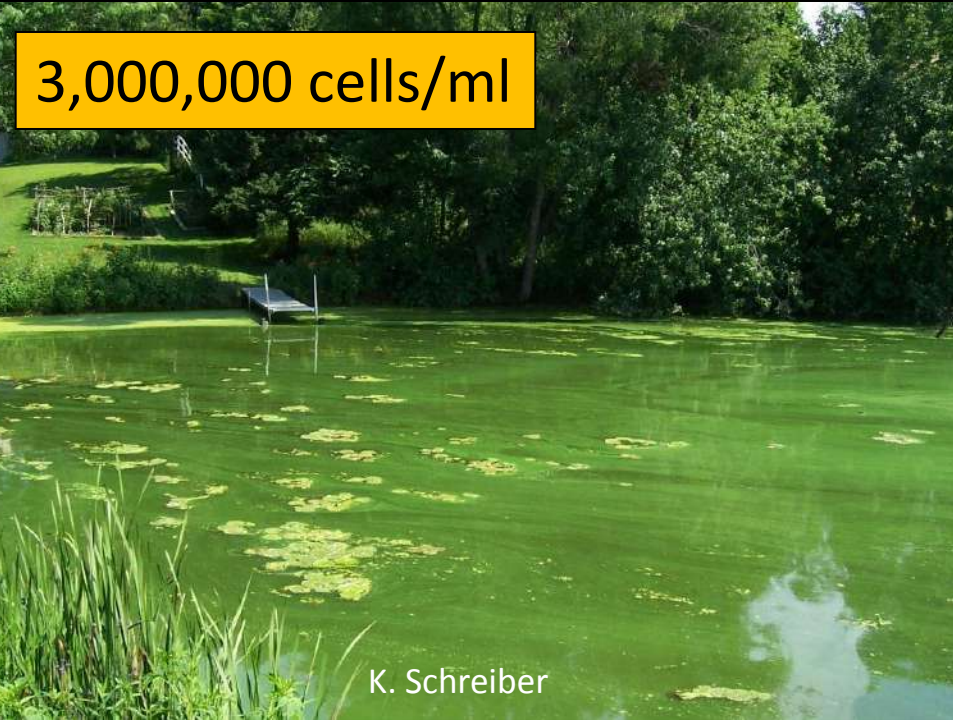
S. Graham

51,000,000 cells/ml



C. Fitzgibbon

3,000,000 cells/ml



K. Schreiber

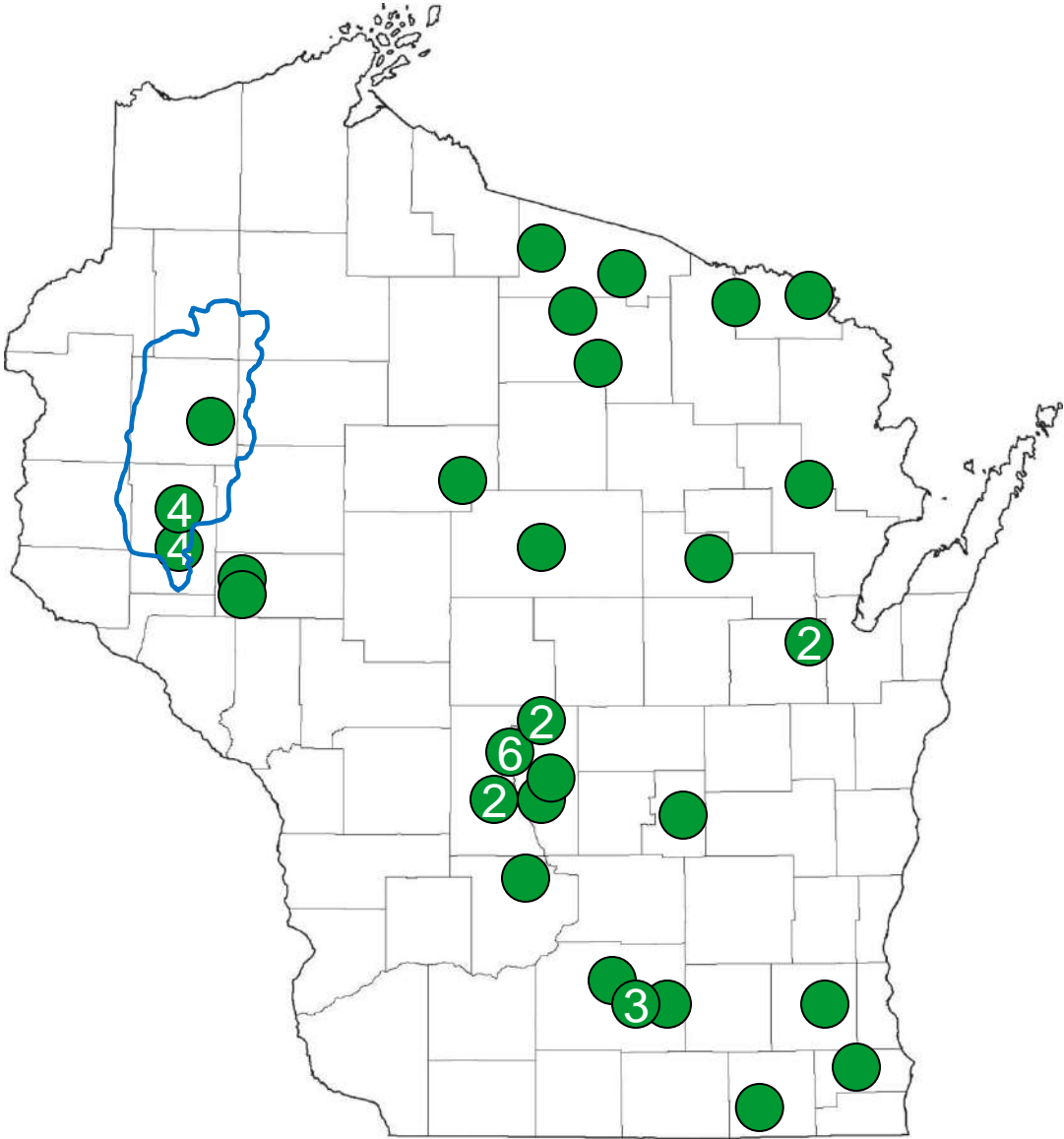
255,000 cells/ml

Cylindrospermopsis



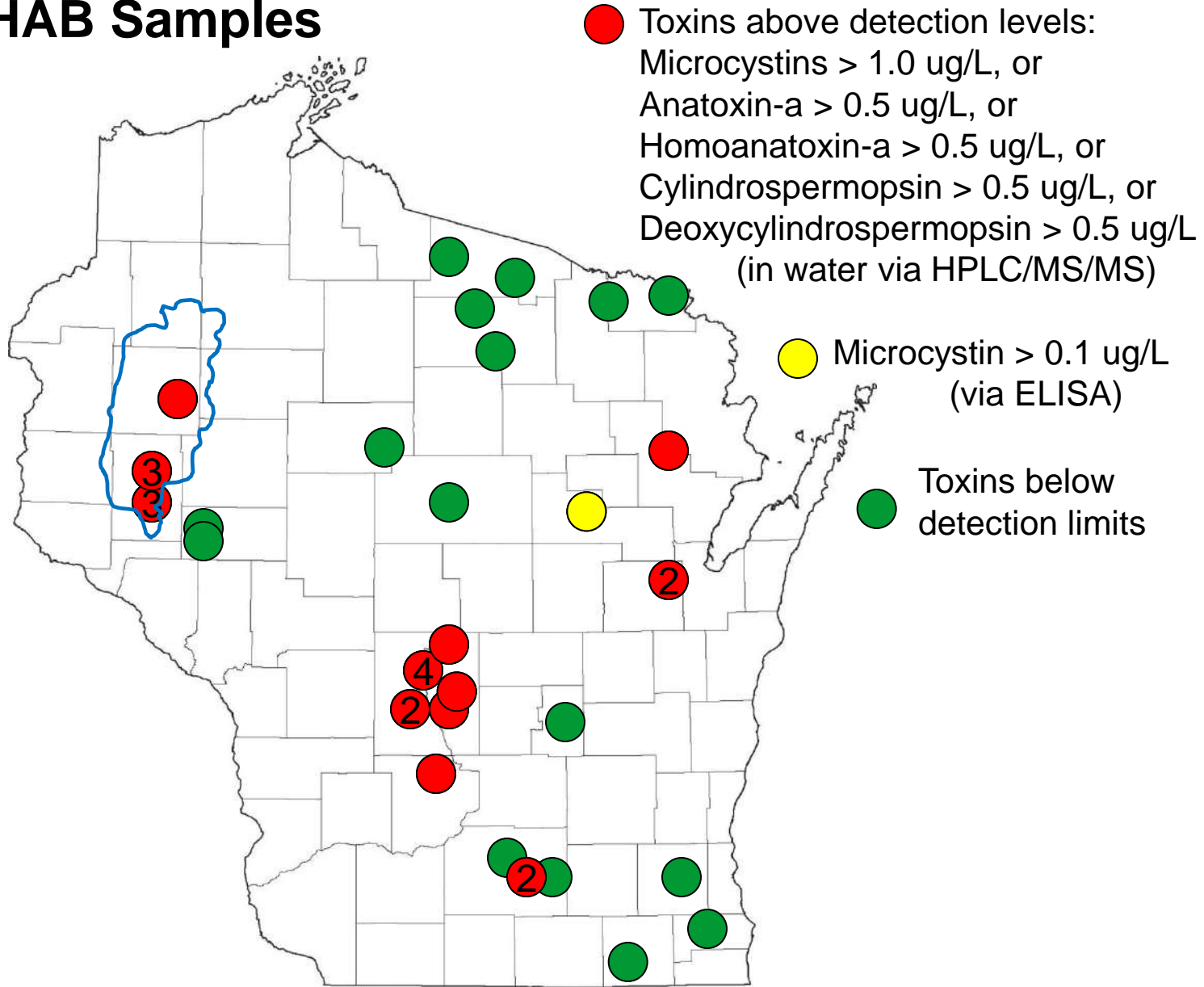
N. Trombly

2009-2012 HAB Surveillance Program Samples



Numbers indicate multiple sampling dates for a single water body.

2009-2012 HAB Samples



Numbers indicate multiple sampling dates for a single water body.


Blue-green algae - YouTube - Windows Internet Explorer

http://www.youtube.com/watch?v=CGG50pFBEl8&feature=player_embedded

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Blue-green algae

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Blue-Green Algae


Harmful Algal Blooms Home	Understanding Algae	Health Concerns	Keeping Our Lakes Clean	Images of Algal Blooms	Resources and Links	Contact Us
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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

<http://dnr.wi.gov/lakes/bluegreenalgae>

<http://www.dhs.wisconsin.gov/eh/bluegreenalgae/>

Remote Sensing



Experimental Lake Erie Harmful Algal Bloom Bulletin

National Centers for Coastal Ocean Science and Great Lakes Environmental Research Laboratory

8 August 2012; Bulletin 10

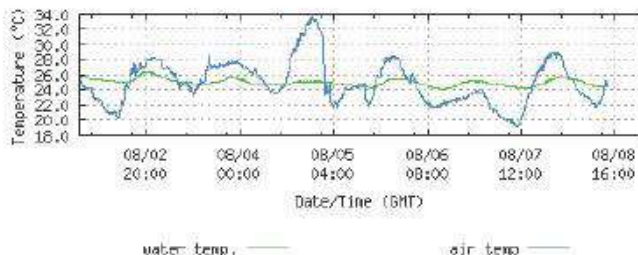
There are no confirmed blooms of cyanobacteria at this time. The water temperature is warming and we are entering the time of year when cyanobacteria blooms generally begin. The features along the western (Michigan) shoreline north from Maumee Bay indicate potential cyanobacteria blooms and should be monitored. The mild intensity area east and north of Sandusky Bay is a likely continuation of the feature tracked over the last few weeks. The feature is unconfirmed as cyanobacteria at this time, but looks suspicious.

- Dupuy, Wynne, Briggs



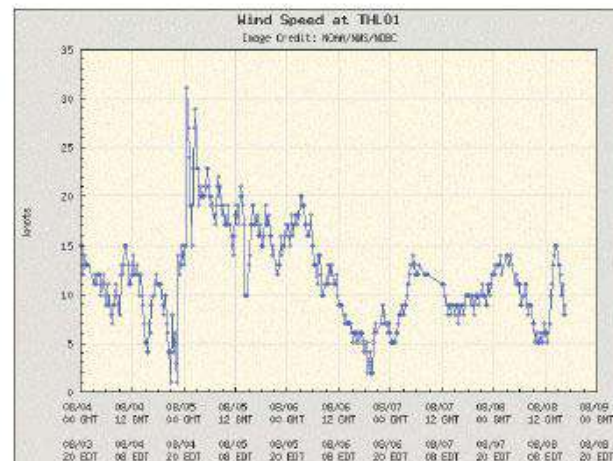
MODIS Cyanobacterial Index from 6 August 2012.

NOAA/NOS/CO-OPS
Air/Water Temperature Plot
9063079 Marblehead, OH
from 2012/08/02 - 2012/08/08



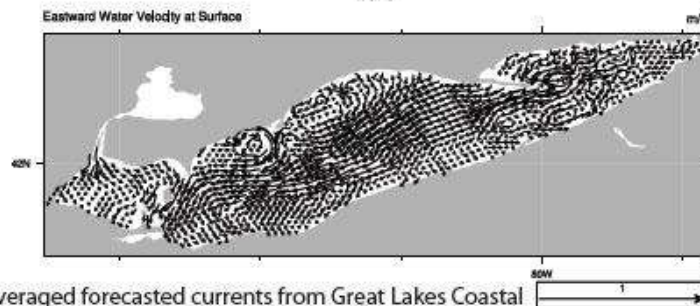
Air and Water Temperature from Marblehead, OH. From: NOAA/Center for Operational Oceanographic Products and Services (CO-OPS).

To subscribe to this bulletin, go to:
http://www.glerl.noaa.gov/res/Centers/HABS/lake_erie_hab/signup.php



NDBC forecast wind conditions from 8 August 2012. Observed from Toledo Light Station (THL01)
From: NOAA/National Data Buoy Center (NDBC)

200401



Averaged forecasted currents from Great Lakes Coastal Forecasting System over the next 72 hours.

How to be safe?

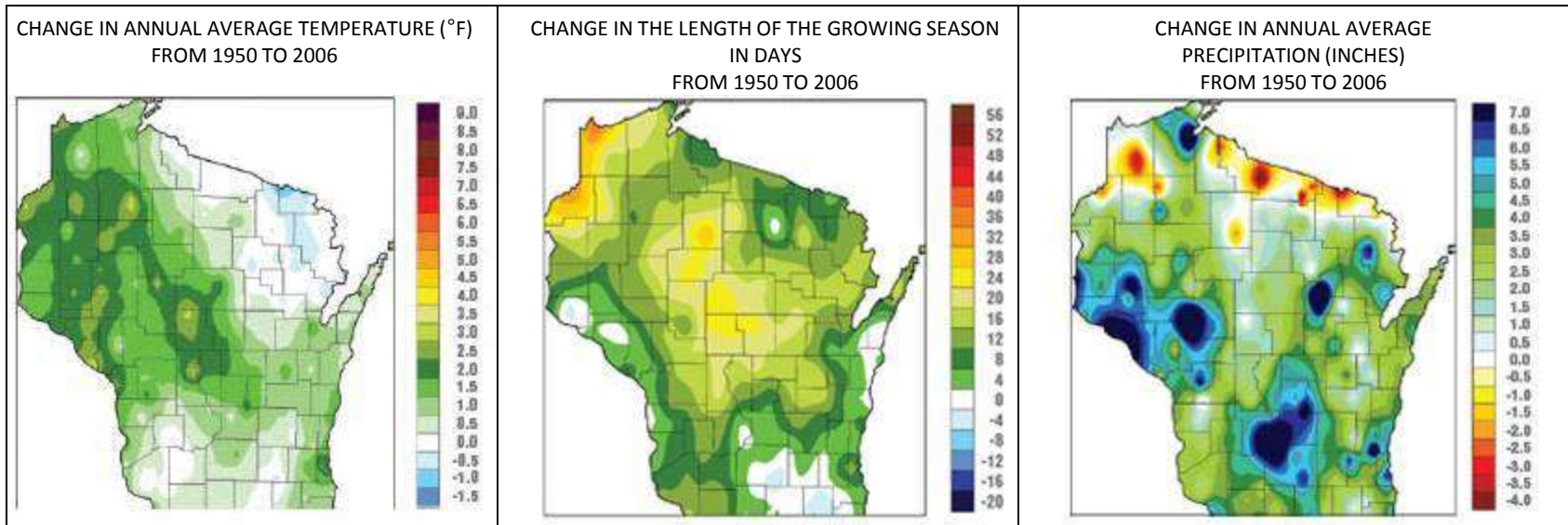
- Avoid swimming in and boating through blue-green algal scums and “pea soup” water.
- **Can you see your feet in knee-deep water?** If not, avoid ingesting any water.
- Always shower after swimming in a lake, river, or pond.
- Keep pets out of scummy water, and wash them off immediately if they swim or wade in during a bloom.
- **When in doubt, keep out!**





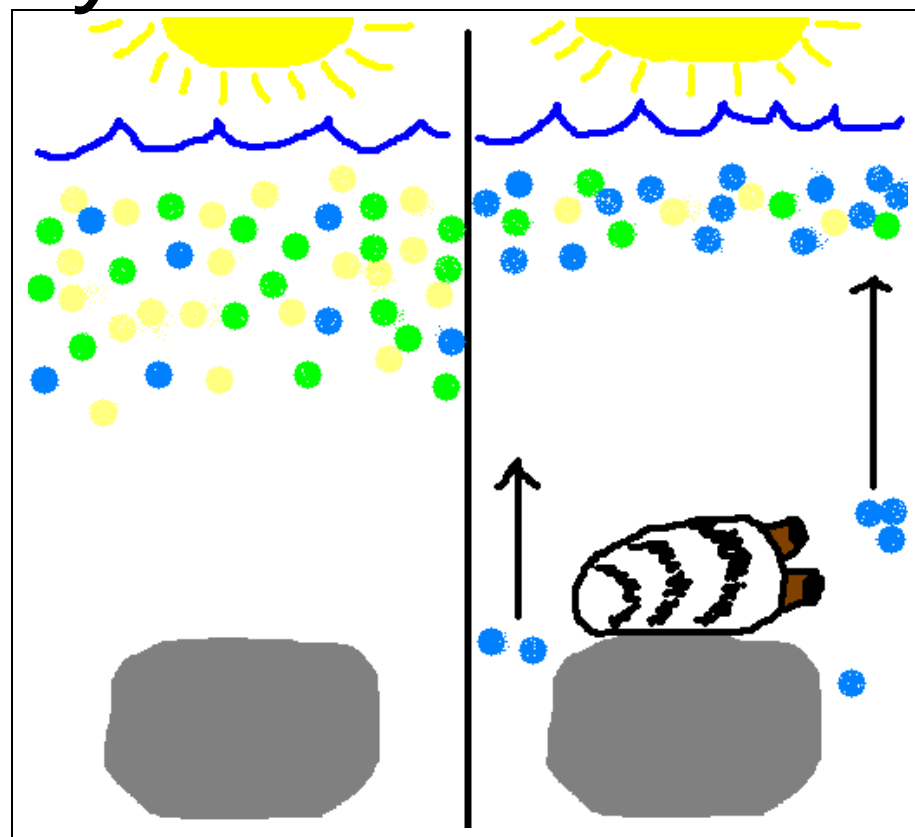
What can we expect in the future?

Seasonal & Regional Trends



- Heavy rains & snowmelt: extra nutrients
- Earlier warming & extended warming may lead to blooms
- Invasive species?

Dreissenid mussel effects in Lake Erie: *Microcystis*



Mussels reject *Microcystis* when feeding
Microcystis regulates its buoyancy and can
move back up in the water column.

An aerial photograph of a vast ocean with a greenish-blue hue. The water's surface is covered in intricate, swirling patterns of white foam and light green, likely due to phytoplankton or wave action. The perspective is from a high angle, looking down at the water's surface. The text "Questions?" is centered in the middle of the image.

Questions?