



Michigan Harmful Algal Bloom Stakeholder Workshop

Hosted by
NOAA Center of Excellence for
Great Lakes and Human Health &
Michigan Sea Grant



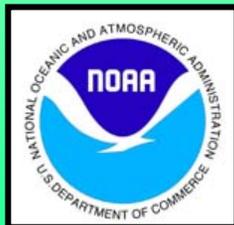


Michigan Sea Grant

- Cooperative program between MSU & UM
- Supports research, outreach and education to enhance sustainable use of the Great Lakes and Michigan's coastal resources
- Extension educators serve all of Michigan's coastal regions

NOAA Center of Excellence for Great Lakes and Human Health

“The overall purpose of the Center is to use a multidisciplinary approach to understand and forecast coastal-related human health impacts for natural resource and public policy decision-making”





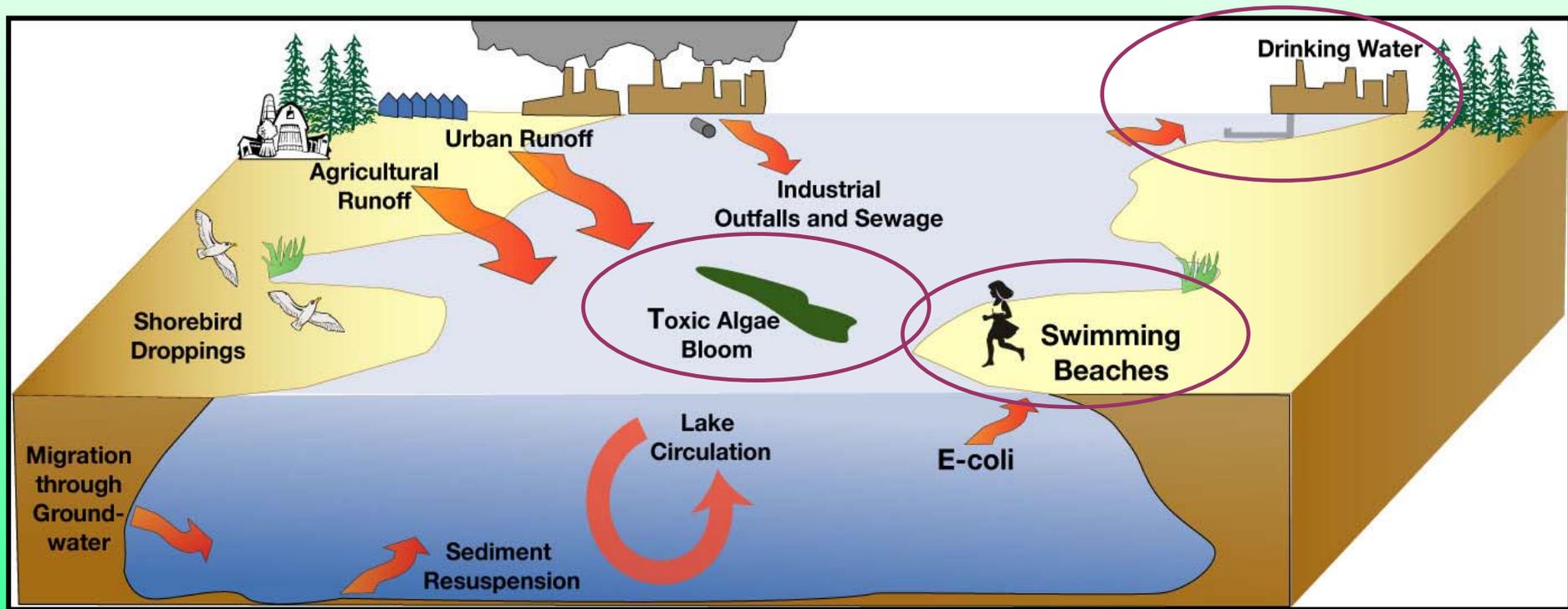
OHH Overview



- 3 Centers competitively funded
 - Great Lakes Environmental Research Laboratory- Ann Arbor, MI
 - Northwest Fisheries Science Center- Seattle, WA
 - Hollings Marine Laboratory- Charleston, SC



Factors Contributing to Human Health in the Great Lakes



NOAA Center of Excellence for Great Lakes and Human Health

- Dr. Stephen Brandt, Director
- Steering Committee
 - Dr. Stephen Brandt- GLERL
 - Dr. David Schwab- GLERL
 - Dr. Joan Rose- Michigan State University



CENTER OF EXCELLENCE FOR GREAT LAKES AND HUMAN HEALTH



- GLERL is the lead of the Center
- Partnerships with Michigan State University, EPA Chicago, EPA Athens, USGS, Florida Institute of Oceanography, NOAA NOS Beaufort Laboratory, University of Michigan, NOAA NOS Silver Springs, Michigan Sea Grant and the Great Lakes Human Health Network





Specific Research Focus

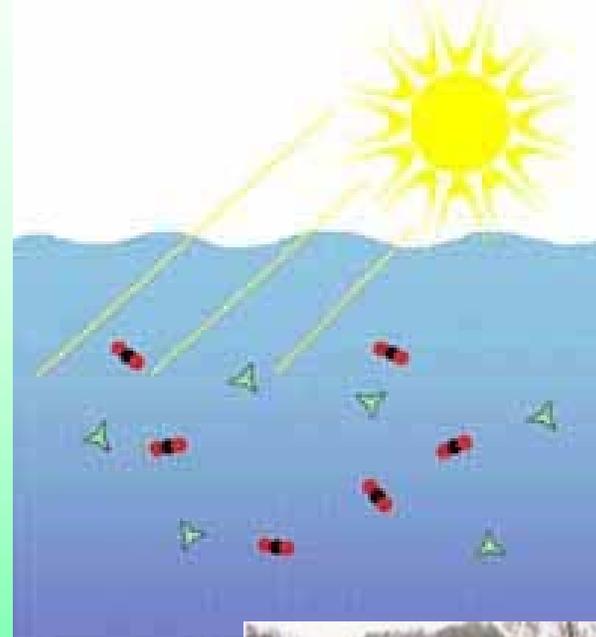
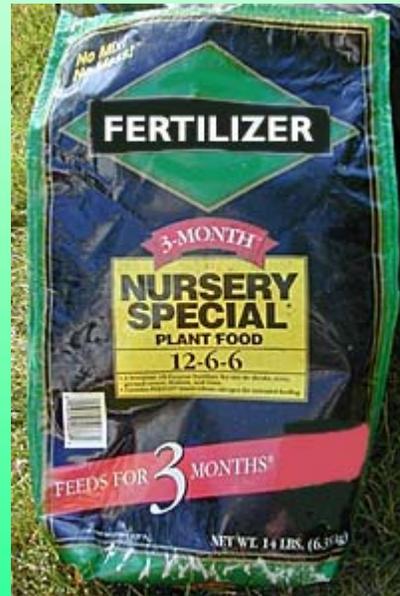


- Water Quality (e.g. drinking water)
- Beach closures
- Harmful Algal Blooms

**Climate – Meteorology – Hydrology –
Hydrodynamics – Biology/Chemistry**

What causes an Algae Bloom?

- Sunlight
- Nutrients
- Temperature



Different types of Algal Blooms

- Can wash up on shore in mats
- Not known to produce toxins
 - But can potentially harbor E.coli and other pathogens
 - Mats (on beach and in water) have contained E. coli
- Peak growth often occurs early summer
- When blooms die, float to surface and can wash up onshore
- Benthic (bottom dwelling)
- Macroalgae (grow up to 3 ft long)



What are Harmful Algal Blooms (HABs)?

- Algal blooms are common
 - Dense population of cells
- Cyanobacteria or algae that produce toxins
 - Released as bacteria or algae dies
 - Harmful to aquatic life and humans
- Most algal blooms do not produce toxins

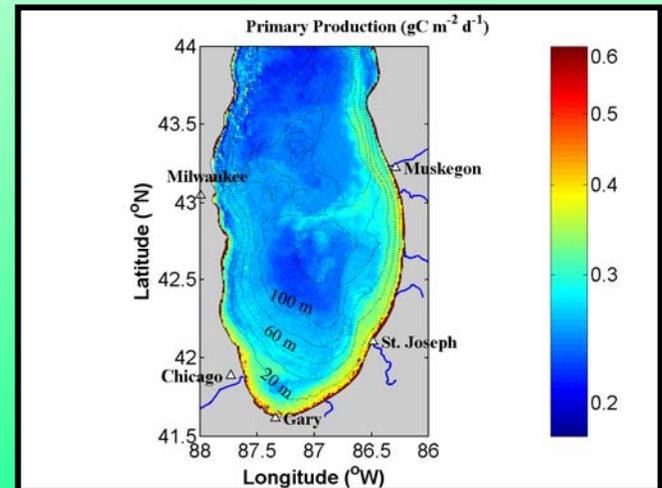
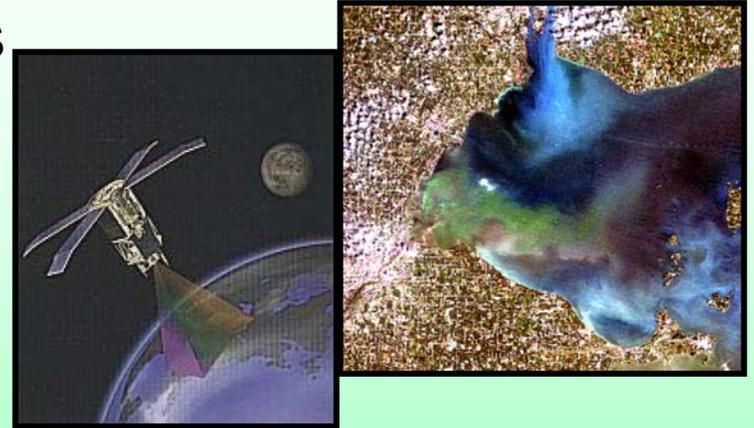


Toxins produced by freshwater planktonic cyanobacteria

Toxin type	Primary organ affected	Produced by
microcystins	liver	<i>Microcystis</i> <i>Anabaena</i> <i>Oscillatoria</i>
anatoxins	nervous system	<i>Anabaena</i> <i>Aphanizomenon</i> <i>Oscillatoria</i>
saxitoxins	nervous system	<i>Anabaena</i> <i>Aphanizomenon</i> <i>Cylindrospermopsis</i>
cylindrospermopsins	liver	<i>Cylindrospermopsis</i> <i>Aphanizomenon</i>
LPS	skin irritant	all of the above

Harmful Algal Blooms: Goals

1. Increase understanding of causes and consequences of cyanobacteria (e.g. ZM effect, toxin production etc.)
 - Regulation of toxin gene
 - Determine role of environmental factors
2. Develop models for cyanobacteria/toxins using hydrodynamics
3. Develop remote sensing – All platforms
4. Integrate into ecological forecasting models





HAB Projects

- Focus: Determining factors that influence *Microcystis* blooms
- 6 different CEGLHH research projects associated with *Microcystis* and microcystin
- Includes research partnerships and collaborations with 5 different institutions

Saginaw Bay Project

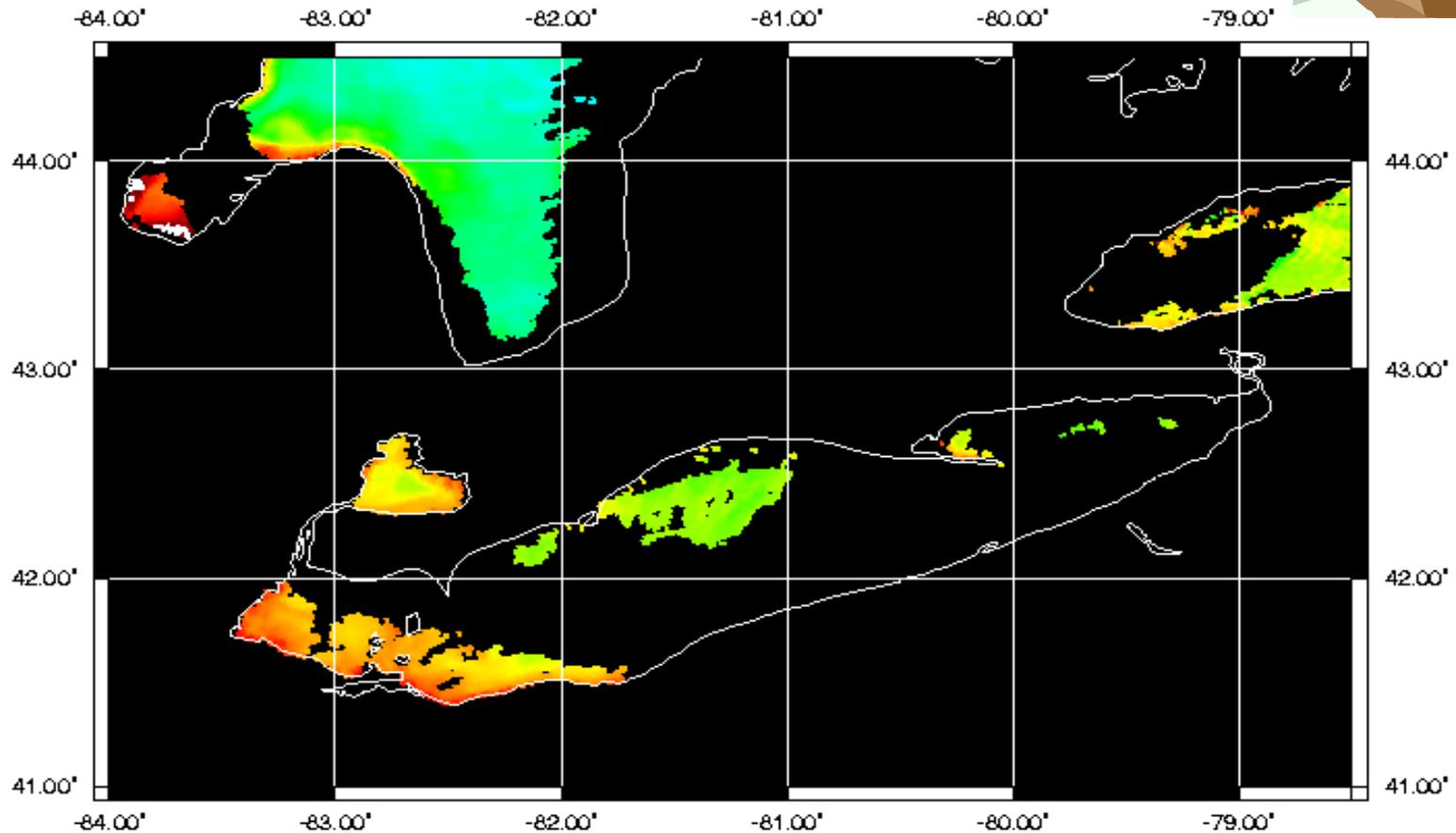
“Microcystin Concentrations in *Microcystis* in Saginaw Bay and Western Lake Erie and Factors Controlling Microcystin Production”

- Led by Dr. Gary Fahnenstiel , GLERL
- Designed to answer research questions relating to the community dynamics of algal blooms in the Great Lakes

Project Dynamics

- Regular sampling of four sites
 - Bear Lake, Muskegon Lake, Saginaw Bay, western Lake Erie
- Satellite images (experimental MODIS chlorophyll products) are used to guide sampling
- Samples subjected to an initial screening based on an ELISA technique for microcystin quantification

Detecting HABs

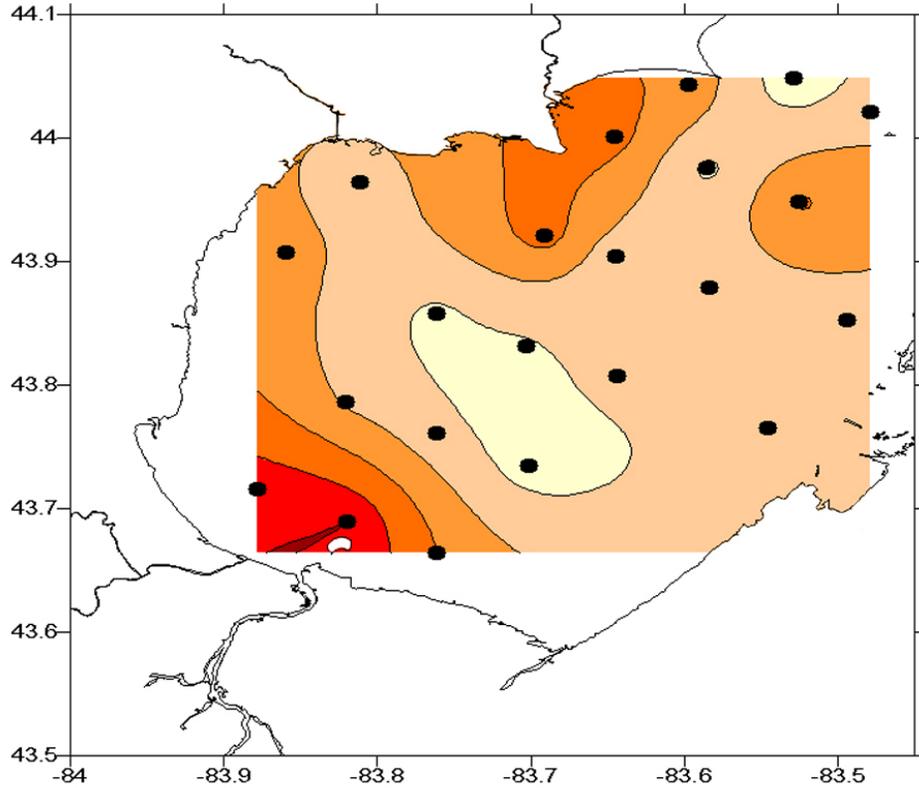


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Chlorophyll Concentration (mg/m^3)
0.01 0.1 1 10 60

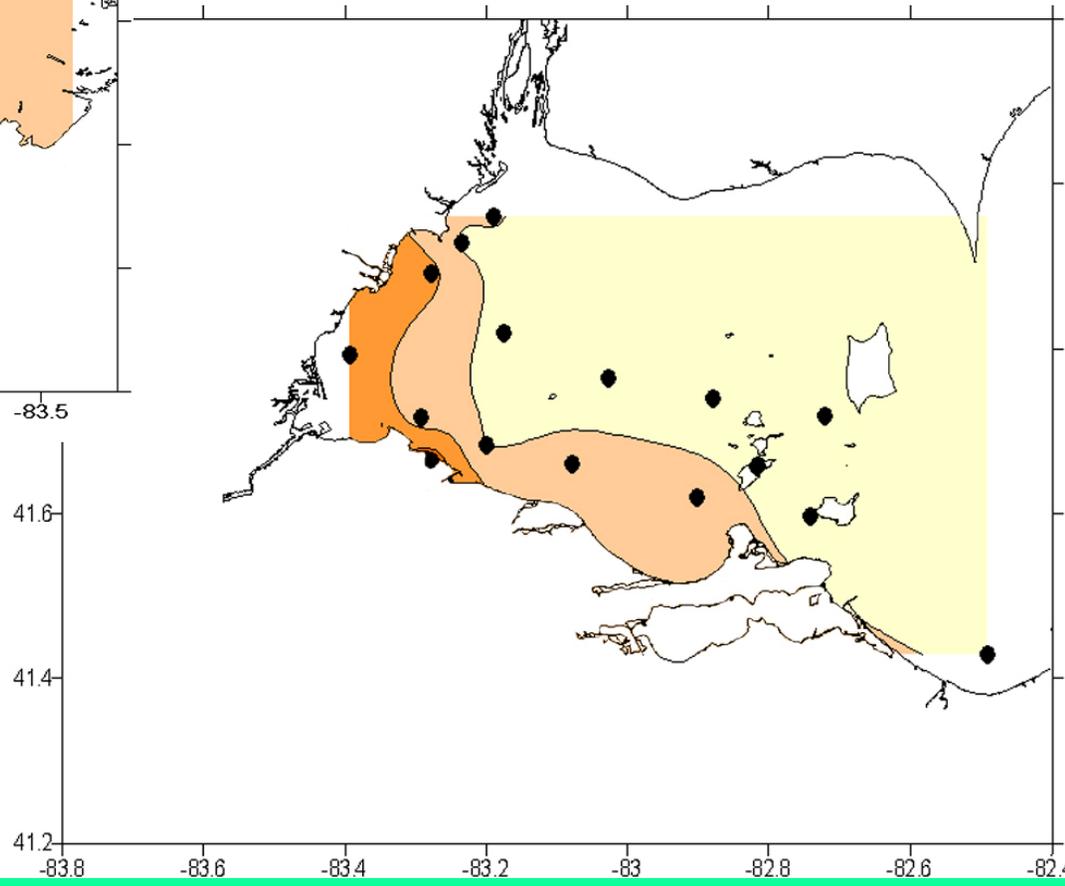


Intracellular total microcystin by HPLC



Saginaw Bay

western Lake Erie





HAB Event Response Website

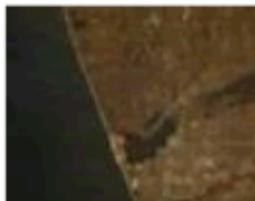
Click on photos to link to microcystin concentrations.

Bear Lake



Located just east of Lake Michigan...

Muskegon Lake



Located just east of Lake Michigan...

Saginaw Bay



Located just west of Lake Huron...

Western Lake Erie



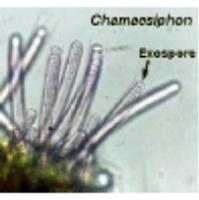
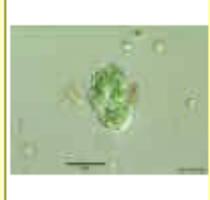
The data appearing on these pages is generated based on an event response research program. The project was not designed to monitor waters for potential human health impacts - it was designed to answer research questions relating to the community dynamics of algal blooms in the Great Lakes. However, the project leaders and the Center of Excellence for Great Lakes and Human Health feel strongly that when research reveals human health implications, the responsible course of action is to make that data as publicly available as possible.

Web Features

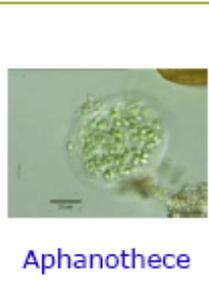
- State Public Health Directory
- Algal FAQs
- Information on other HAB research projects
- Newsroom
- Algae Photo Gallery
- Links to other HABs programs

Great Lakes Blue-Green Algae Genera

Unicells and small colonies (<8 cells)

		NA			
Chamaesiphon	Chroococcus	Gleochaete	Glaucozystis	Synechococcus	Spirulina

Globular colonies

					NA
Coelosphaerium	Gomphosphaeria	Aphanocapsa	Coccochloris	Aphanothece	Rhabdoderma

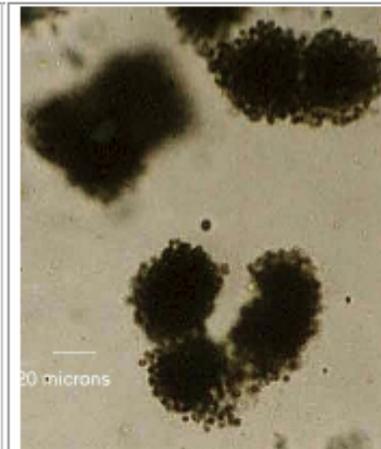
Microcystis spp.

M. aeruginosa (aka *M. flos-aquae*, *M. ichthyoblade*, *M. novacekii*, *M. viridis*, and *M. wesenbergii*), *M. incerta* (aka *M. pulverea*), *M. smithii*

Taxonomy and Scientific Profile: [Cyanodb](#)

Irregular colonies enclosed in mucilage - *M. flos-aquae* occurs in globular colonies. Cells may appear black, brown or purple and are very dense. May float and produce surface scums. Some species/strains may produce [toxins](#) (microcystins and lipopolysaccharides).

D- *Microcystis* is a dominant member of the summer phytoplankton assemblage in Lake Erie.



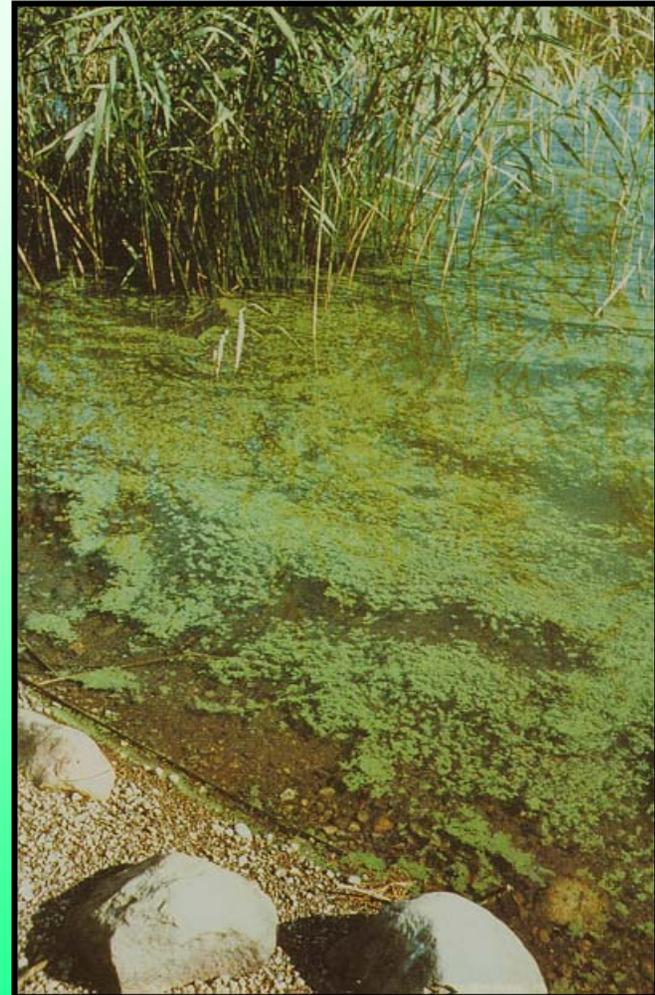
Should we be concerned?

- Have we underestimated toxin concentrations?
 - We measured toxin in particles only
 - We sampled out in the middle of each lake
 - We sample at 0-1m depth

WHO Recommended Guidelines

Drinking water = $1\mu\text{g/L}$

Recreational = $20\mu\text{g/L}$





Please visit us on the web!

<http://www.glerl.noaa.gov/res/Centers/HumanHealth/>

Join HABCOMM listserv to foster communication between diverse groups interested in HABs.

To join, send email:

`majordomo@great-lakes.net`

Subject: subscribe habcomm