

Harmful Algal Blooms in Western Lake Erie

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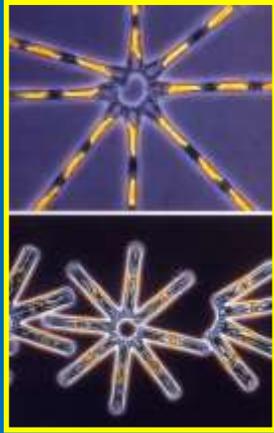


Algae are tiny plant-like organisms that live in water



There are hundreds of species of algae in Lake Erie.
Most are beneficial.

Major groups in Lake Erie



Diatoms



Greens



Blue-greens
(Cyanobacteria)

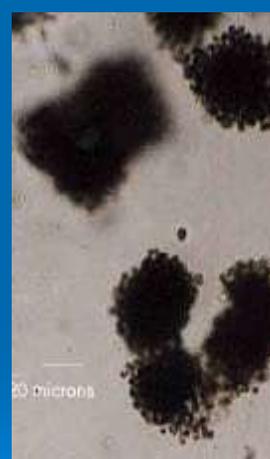
Cyanobacteria in Lake Erie



Anabaena



Aphanizomenon



Microcystis

Factors leading to cyanobacteria blooms

- Seasonal patterns

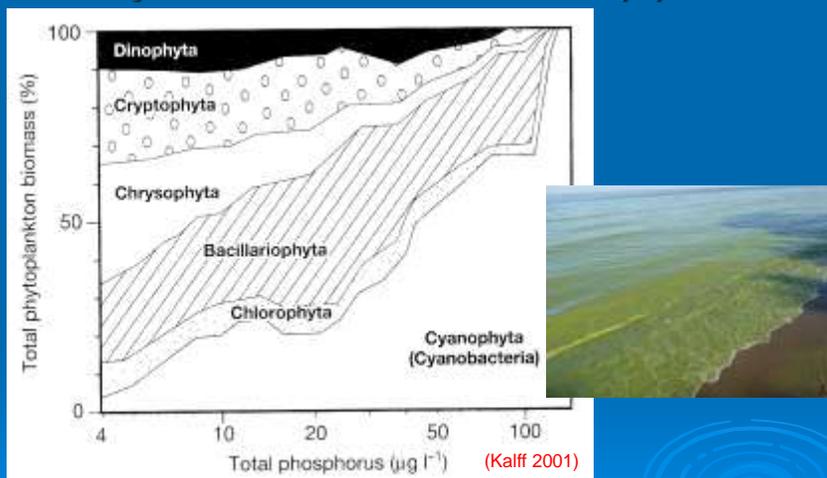
- Late summer is cyanobacteria season.



Factors leading to cyanobacteria blooms

- Phosphorus concentration

- High P concentrations result in dominance by cyanobacteria



Eutrophication of Lake Erie

- 1920 to 1964 Lake Erie algae biomass increased nearly 6 fold.
- Diatoms replaced by cyanobacteria.
- Harmful algal blooms led to passage of the GLWQA

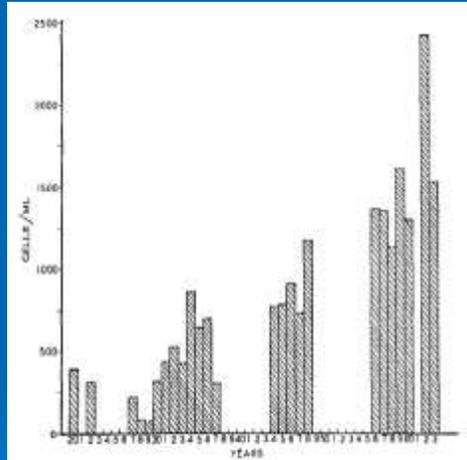
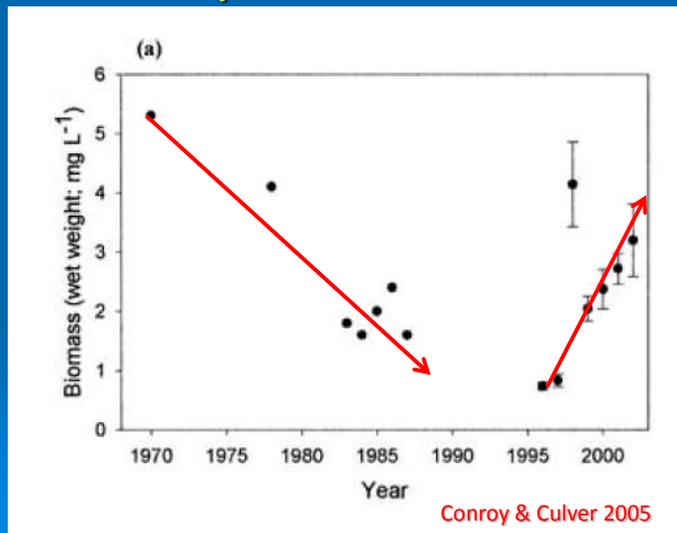


FIG. 1. Average phytoplankton cells per milliliter for all years with complete records, 1920 to 1963 (2 weeks of records are lacking for 1960 near the height of the autumnal phytoplankton maximum).

Davis 1964

Recovery and recent return to eutrophic conditions



Conroy & Culver 2005

Microcystis bloom August 2003



Why should we care?

Harmful Algal Blooms produce toxins

- *Microcystis* produces microcystin
 - Fatal poisonings in Brazil 1988, 1996
 - Pets poisoned in the USA
- Rotten smell, fouled beaches – public perception of lake as polluted.
- Contribute to central basin Dead Zone
- Economic cost, additional \$3K-\$4K/day water treatment
- Harmful to sport fish recruitment (\$1B fishery)

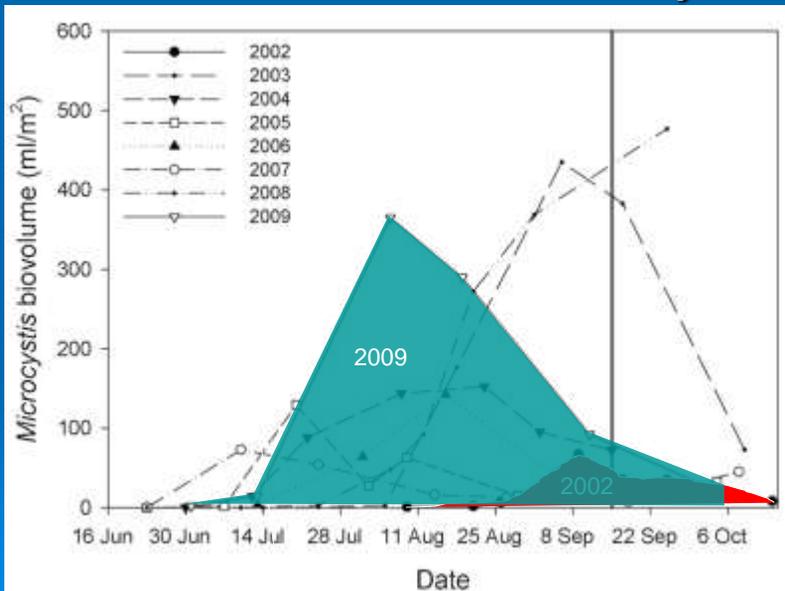


Field Methods (2002-2012)

- 6 sites sampled biweekly
- 112 um mesh plankton net
- Nutrients

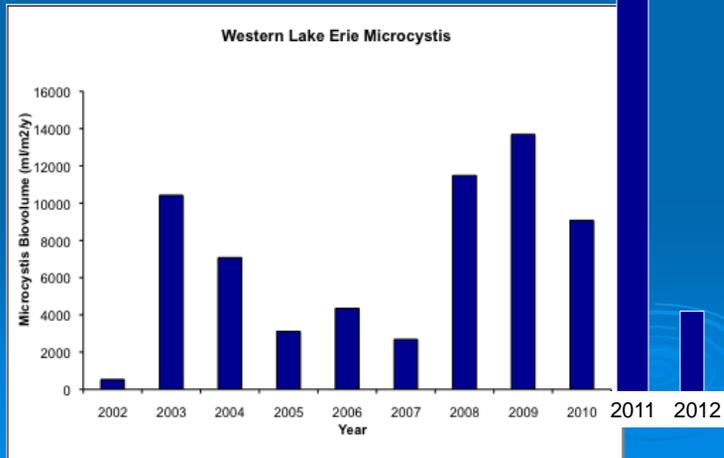


Annual estimate of *Microcystis*



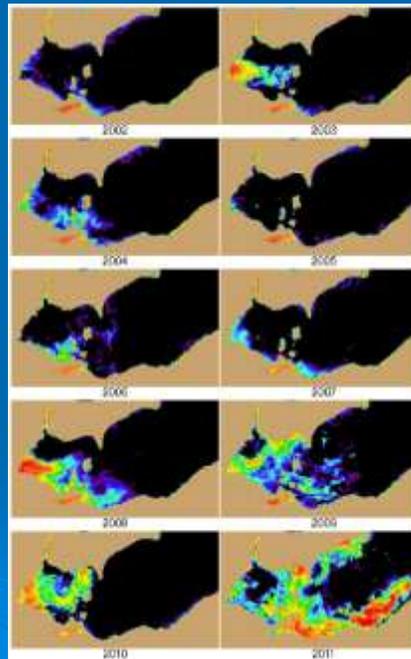
Microcystis in Lake Erie

- The *Microcystis-Anabaena* bloom of 2011 was the largest in recent years (possibly ever) in our sampling region



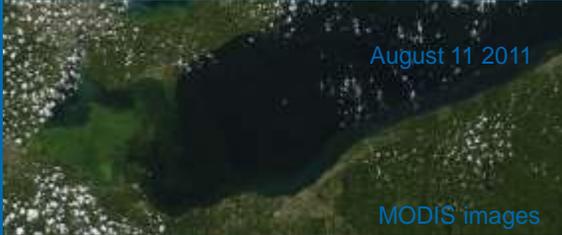
Lake Erie harmful algal blooms 2002-2011

(From Stumpf, et al. 2012)



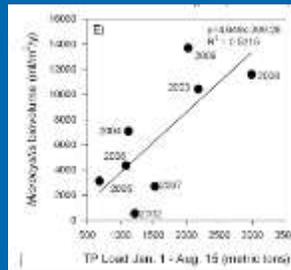
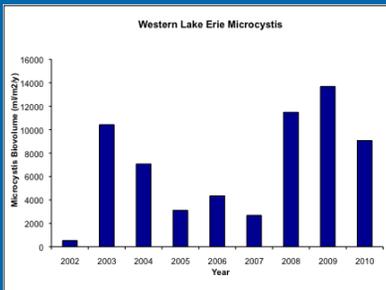
2011

2012



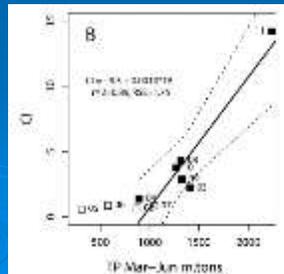
What accounts for the large interannual variation in *Microcystis* blooms?

-What is the effect of Maume River P loading?



Bridgeman et al. (in prep)

The best predictor of *Microcystis* annual crop is the cumulative TP load from the Maume River in the spring-Summer.



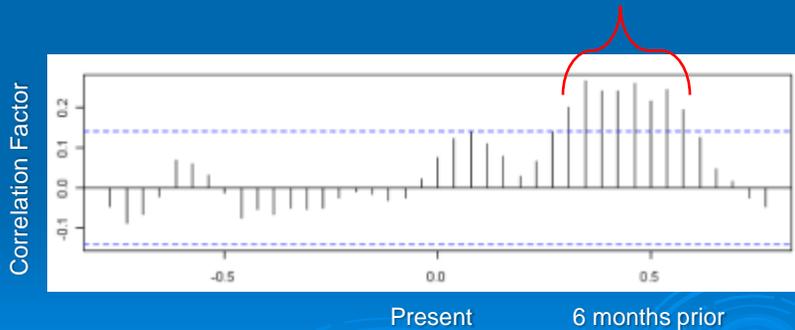
Stumpf et al. (2012)

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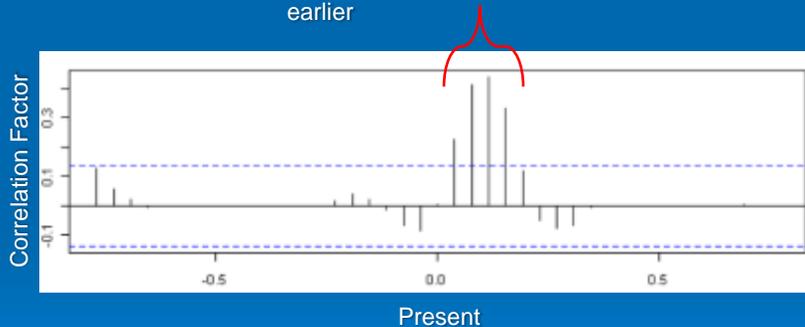
Time series analysis, 2002-2009

Summer *Microcystis* is somewhat correlated to Total P loading 4-6 months earlier



Phosphorus load vs. *Microcystis* time series analysis 2002-2009

Summer *Microcystis* is highly correlated to Dissolved Reactive P loading 4-8 weeks earlier



The Point: Not all P loading is created equal.
Timing of loads is very important.

Lyngbya wollei, a new nuisance cyanobacterium in Lake Erie (2006)



Let's get back to this!

