Lake Erie Algal Source Tracking (LEAST)

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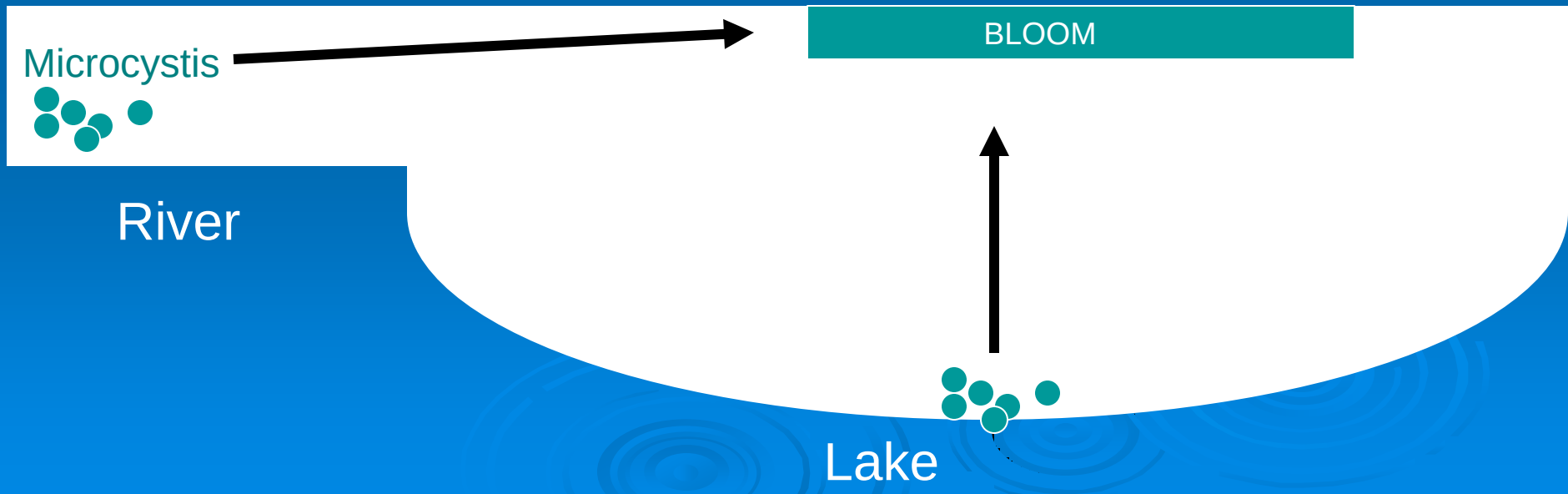
Objectives of LEAST Project

I. Determine the relative contribution of the Maumee River system and lake sediments as a source of algal biomass leading to *Microcystis* blooms in western Lake Erie.

- Extensive lake –river - sediment sampling on 3 dates (before bloom, incipient bloom, mid-bloom)



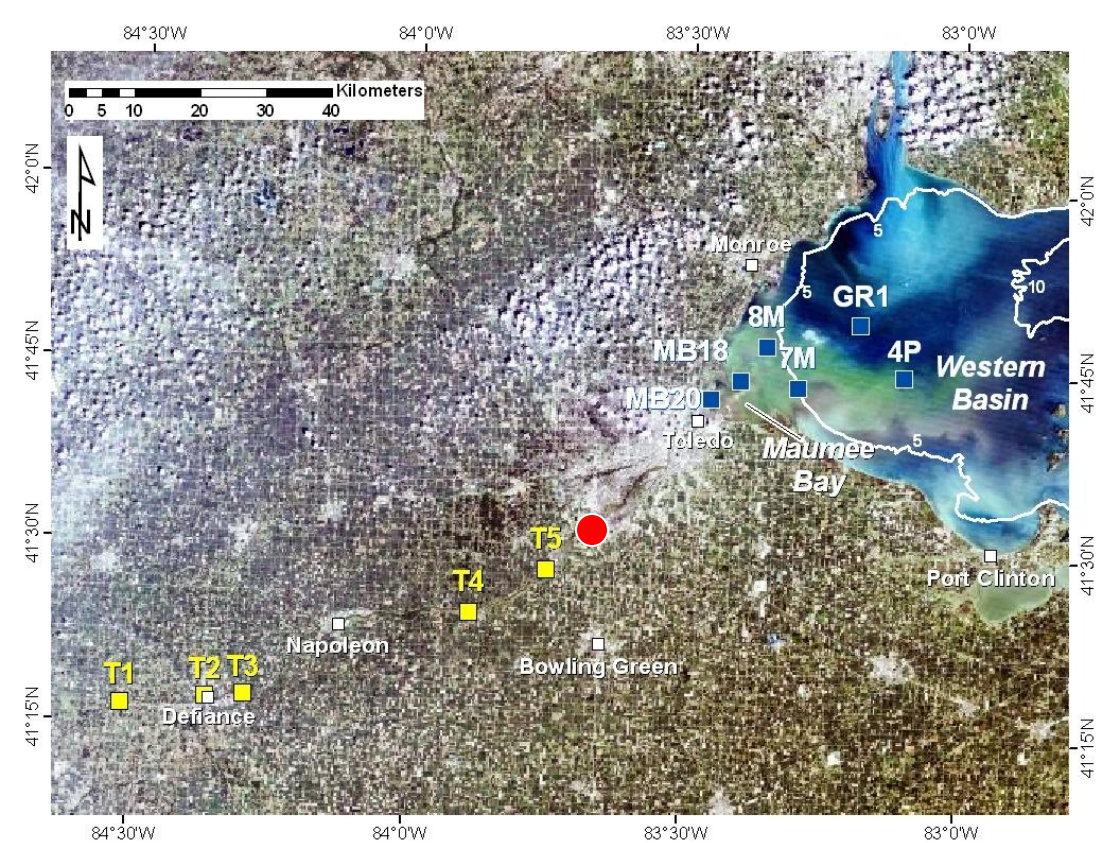
LEAST Sampling

5 Maumee River sites

6 Lake sites (plus accessory sites & dates)

Dates: June 16, August 6, September 11

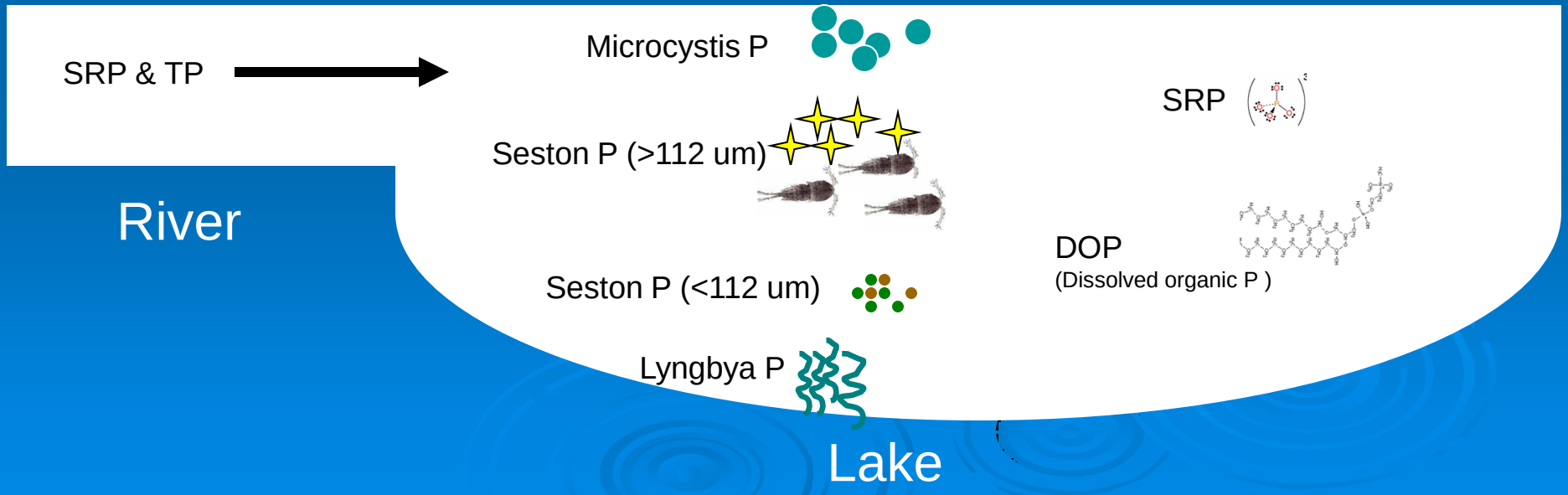
- (Waterville sampler July 9 – Sept. 18 alt days)



- T1= The Bend
- T2 = Rt. 66 Bridge
- T3 = Independence Dam
- T4 = Mary Jane Thurston State Park
- T5= Farnsworth Metropark

Objectives of LEAST Project

II. Determine how phosphorus in western Lake Erie is partitioned into various categories.



Objectives of LEAST Project

III. Miscellaneous:

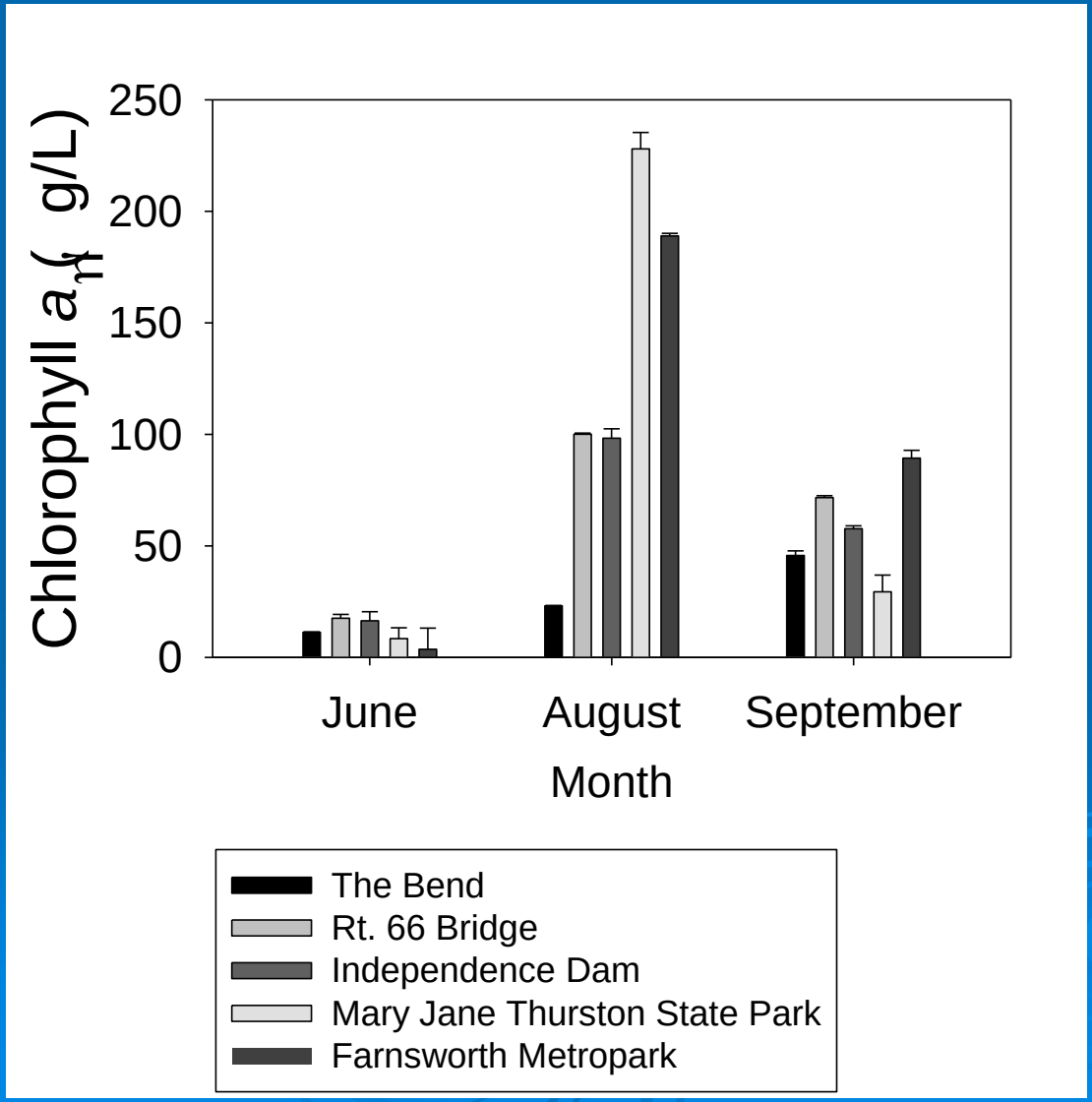
1) Compare methods (chlorophyll analyses, cell counts, fluoroprobe, and volumetric)
2) Microcystin toxin in river and lake vs. cell counts
3) *Lyngbya wollei* distribution, seasonal growth, habitat

Methodologies

- Boat/ Wading
- YSI Multiprobe and PAR meter
- Fluoroprobe
- Water Samples
  - Nutrients
  - Chlorophyll *a*
  - Phytoplankton
  - *Microcystis*
  - Microcystin

Maumee River:
Temporal/ Spatial Trends in Chlorophyll *a*

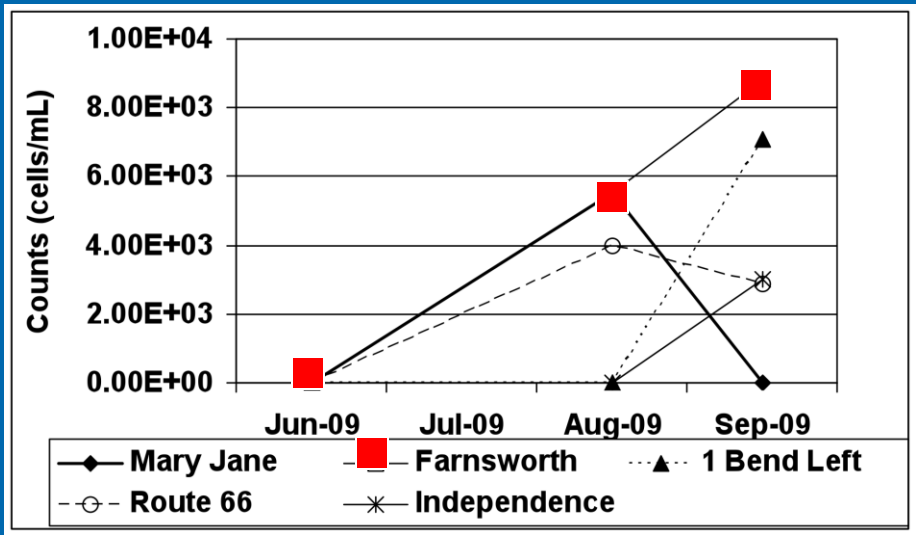
Chl-a (ug /L)



Microcystis cell counts in river

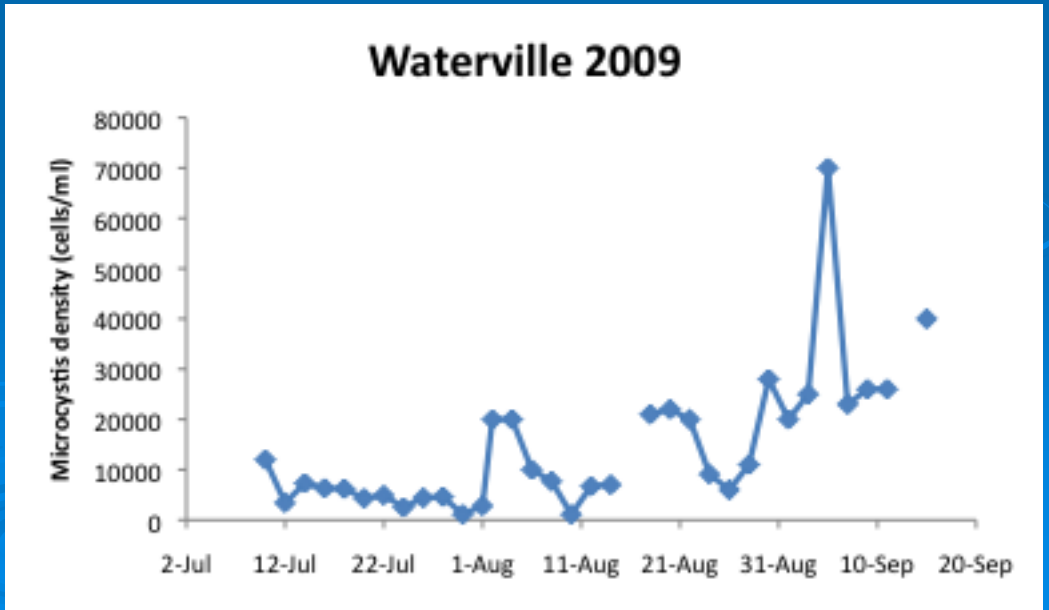
3 Main sampling dates

- Little *Microcystis* found in river mid-June
- *Microcystis* varied greatly with location in August and September
- *Microcystis* increased steadily at furthest downstream site (Farnsworth)

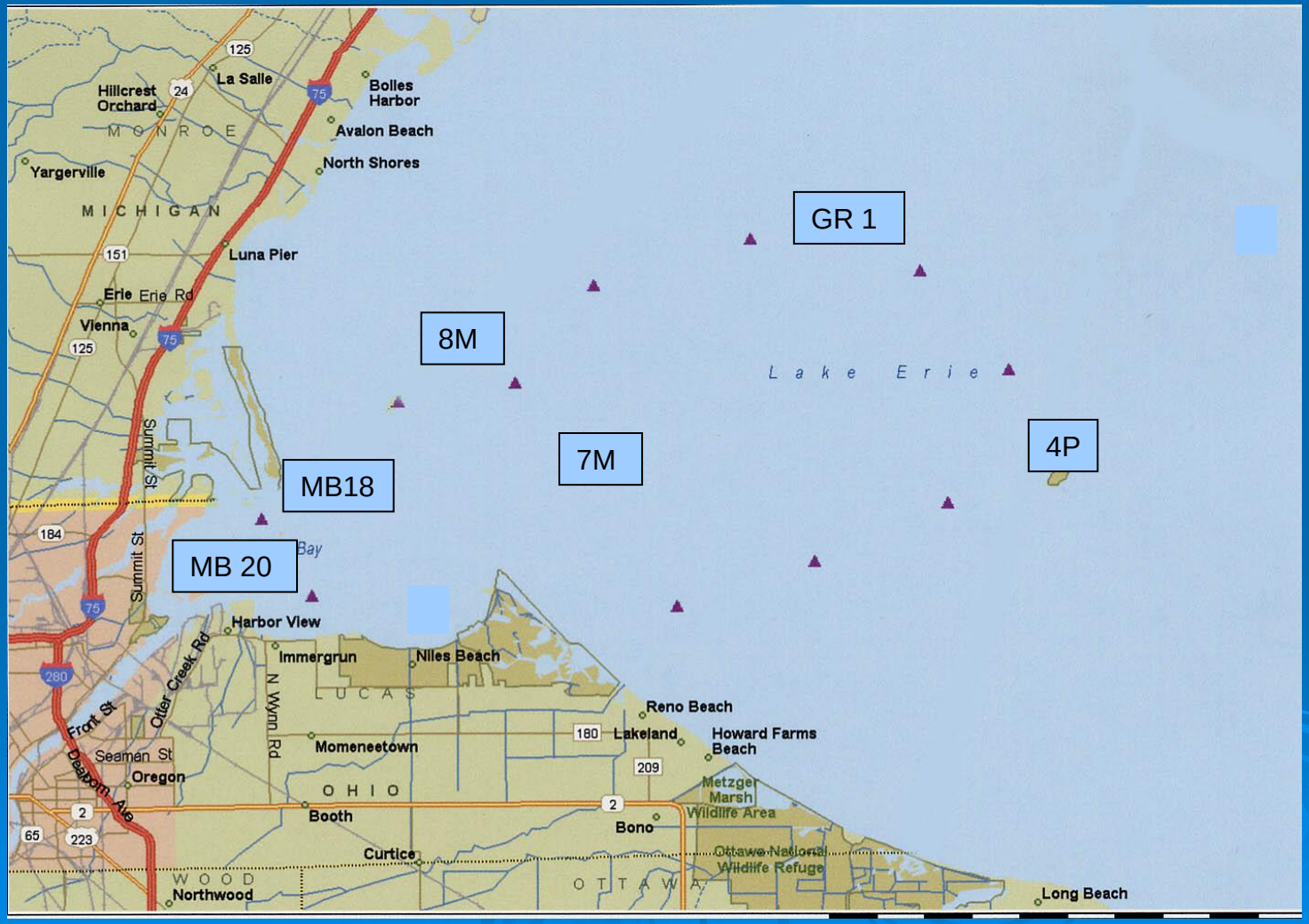


Waterville Sampler

- *Microcystis* increased steadily July-September

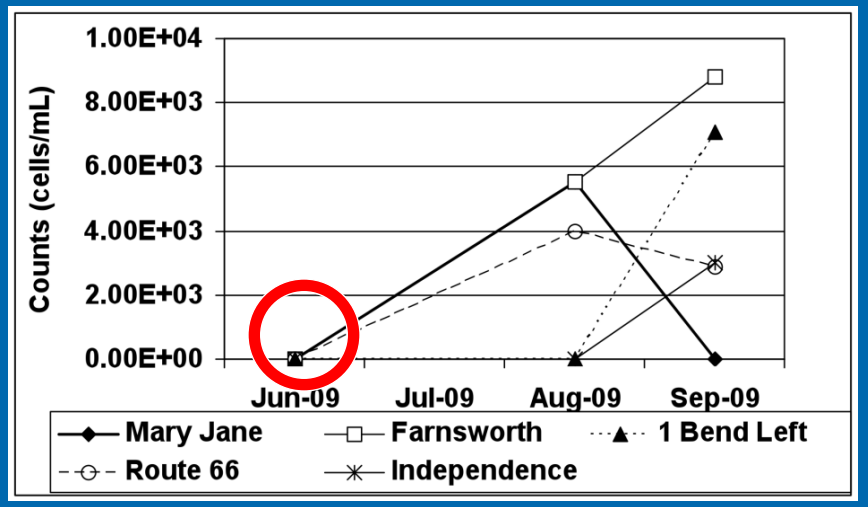


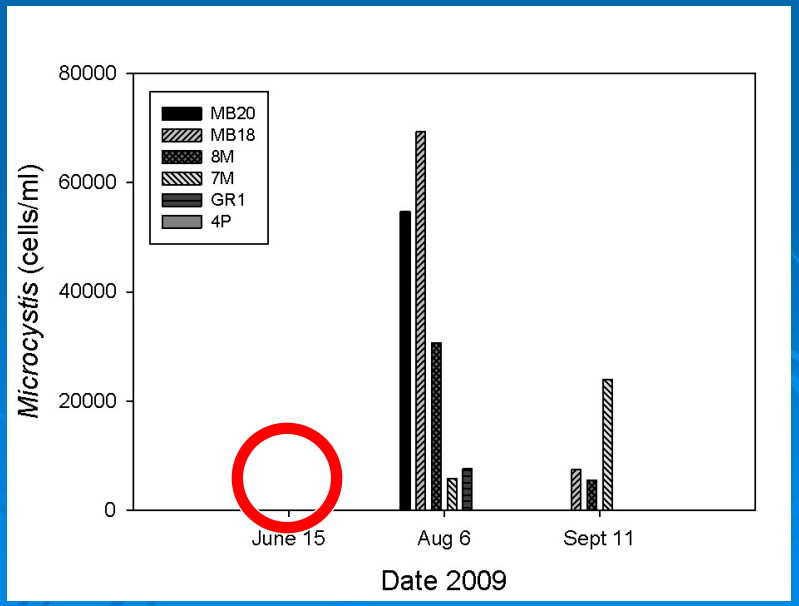
Lake Sites


GR 1
8M
7M
4P
MB18
MB 20
Lake Erie
Bay
La Salle
Bolles Harbor
Hillcrest Orchard
MONROE
Avalon Beach
Yargerville
North Shores
MICHIGAN
Luna Pier
Erie
Erie Rd
Vienna
Summit St
Harbor View
Immergrun
Niles Beach
LUCAS
Otter Creek Rd
N Wynn Rd
Front St
Seaman St
Oregon
Dearborn Ave
Momeneetown
OHIO
Booth
Curtice
WOOD
Northwood
Reno Beach
Lakeland
Howard Farms Beach
Metzger Marsh Wildlife Area
Bono
Ottawa National Wildlife Refuge
OTTAWA
Long Beach

Microcystis in River and Lake

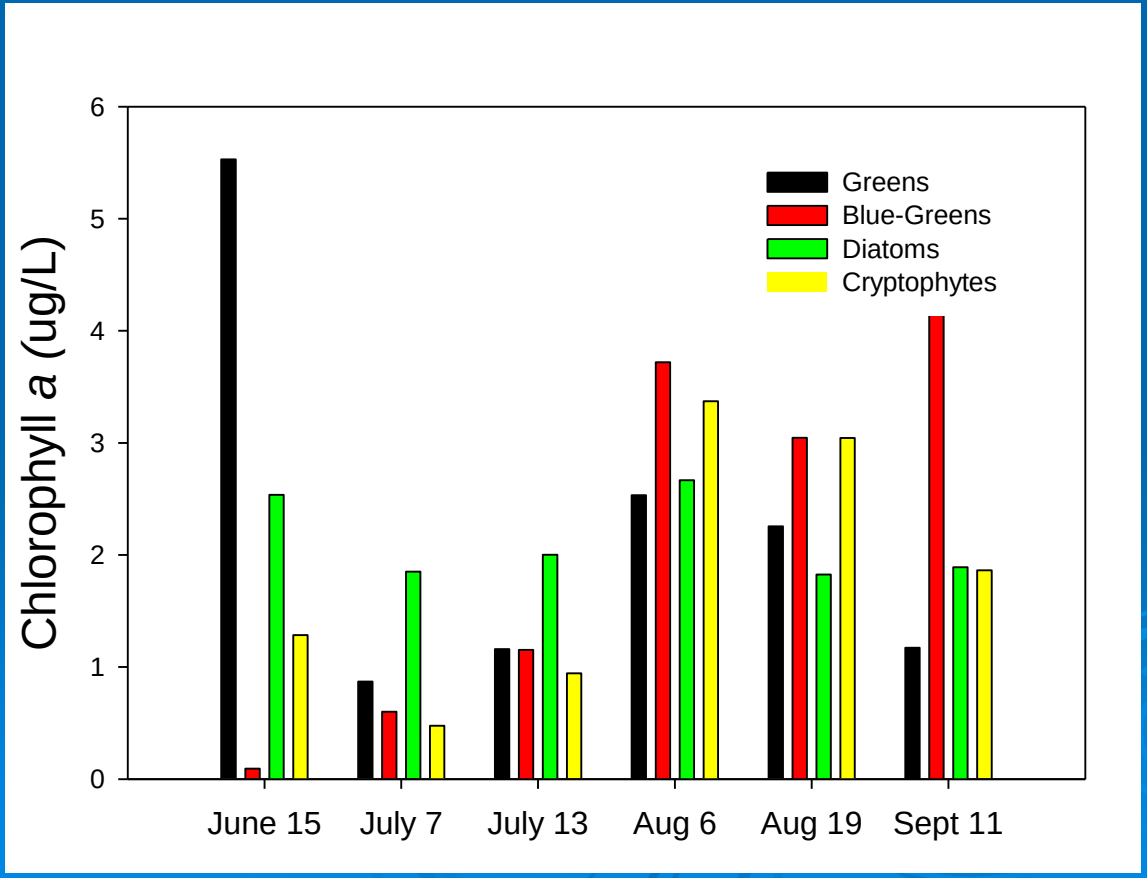
- Very little *Microcystis* found in river or lake in mid-June
- Large increase in *Microcystis* counts in both river and lake in August





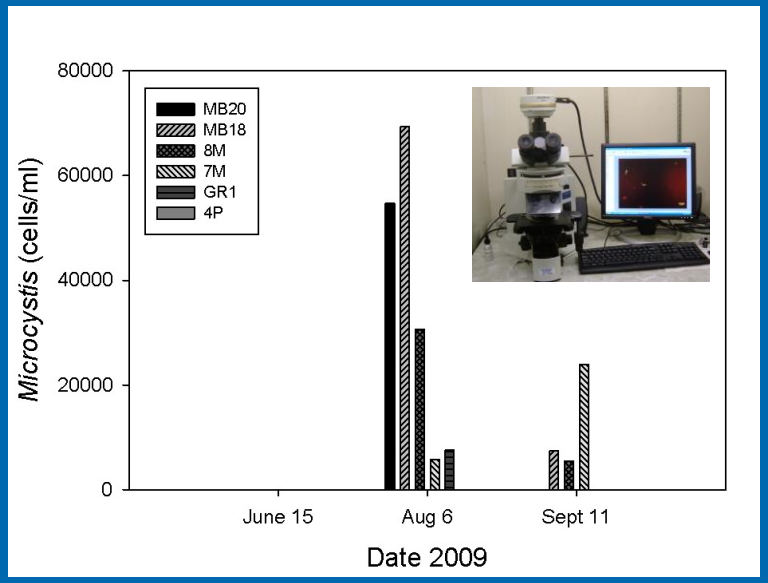
Microcystis in Lake

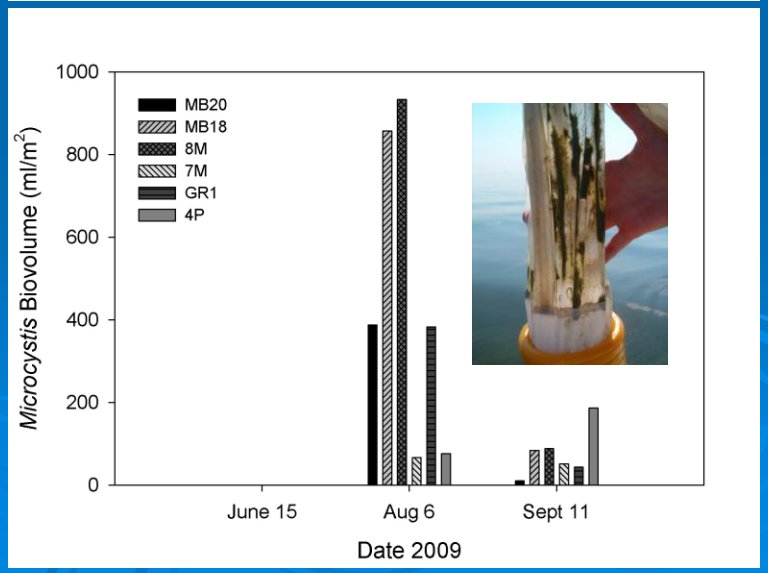
- Fluoroprobe results indicate cyanobacteria (Microcystis) was dominant from early August – September



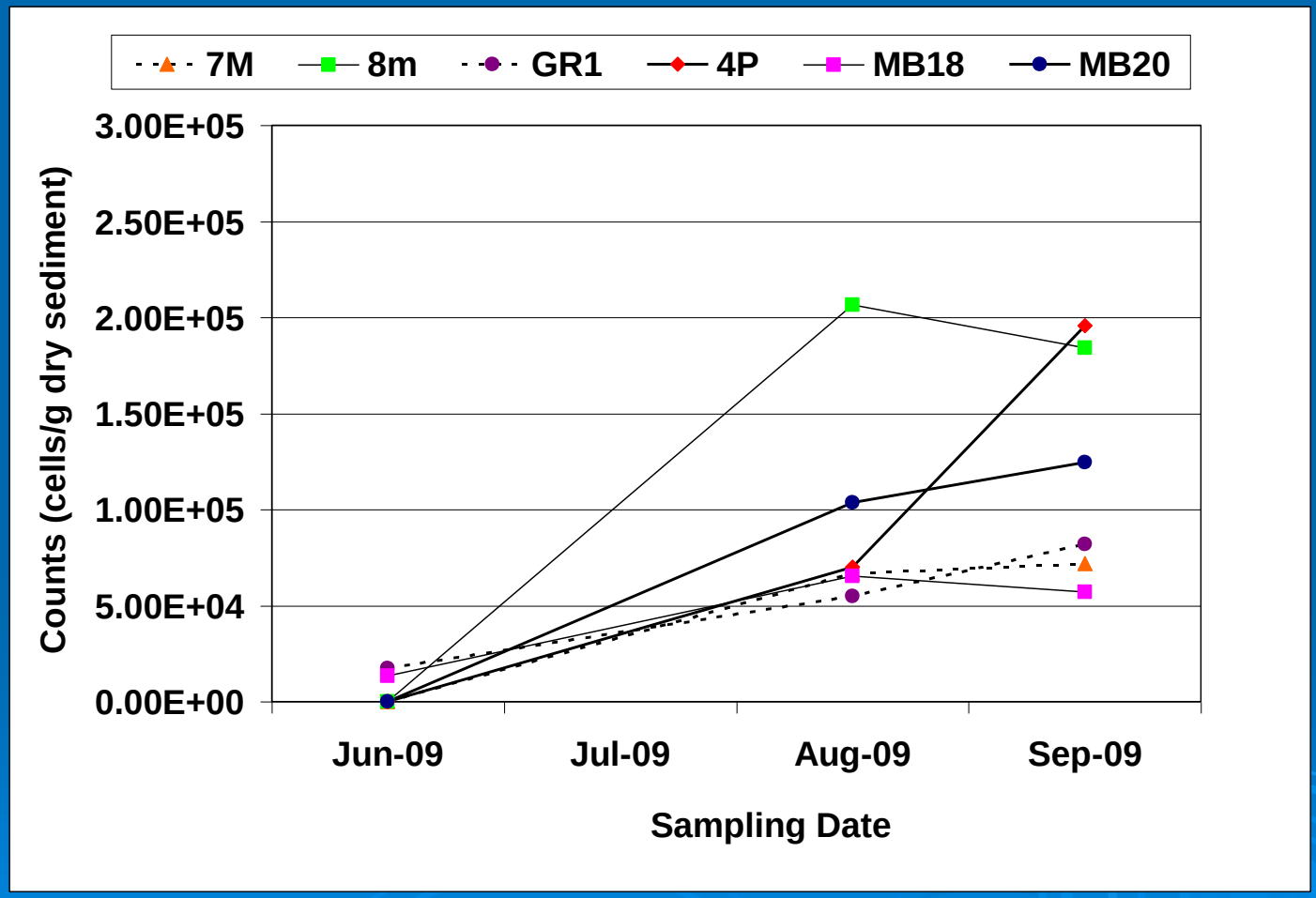
Microcystis in Lake

- Cell counts and plankton tows agree
- Greatest concentration of Microcystis in August is near river mouth
- Greatest biovolume/m^2 of Microcystis is further offshore. (greater surface scum)



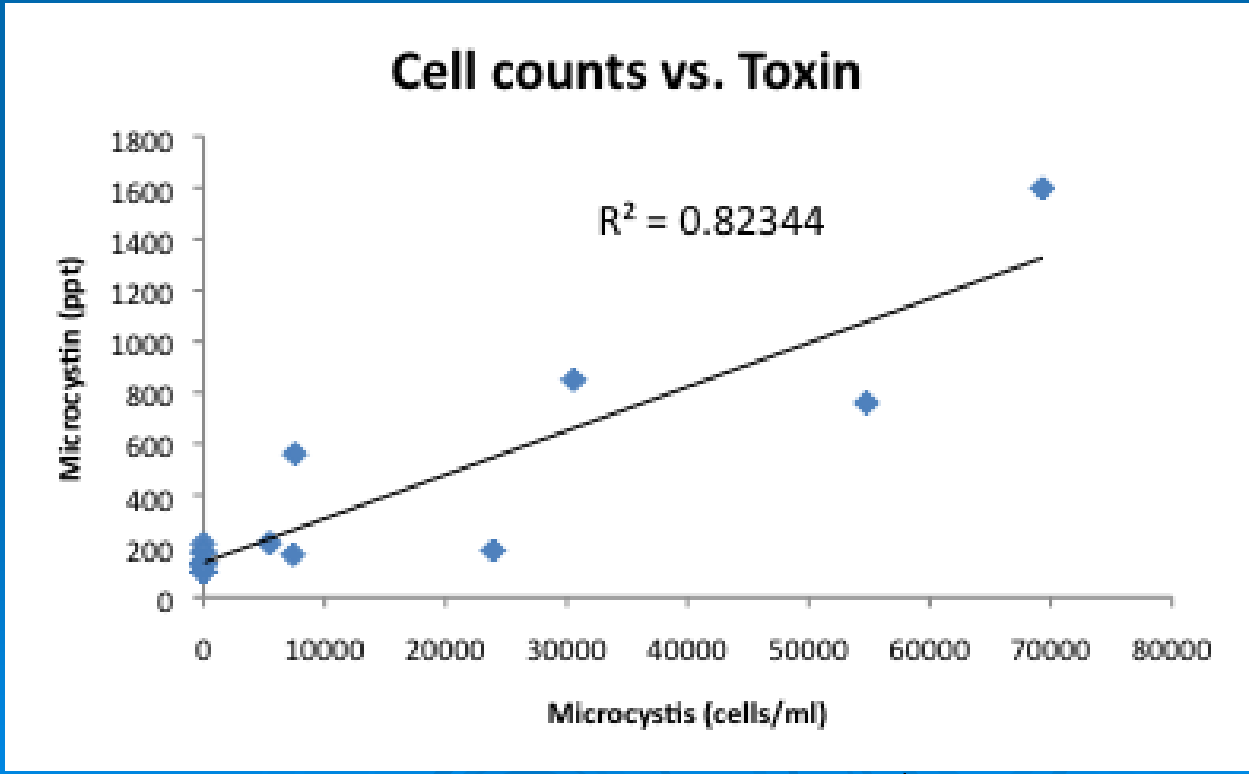


Microcystis in lake sediments



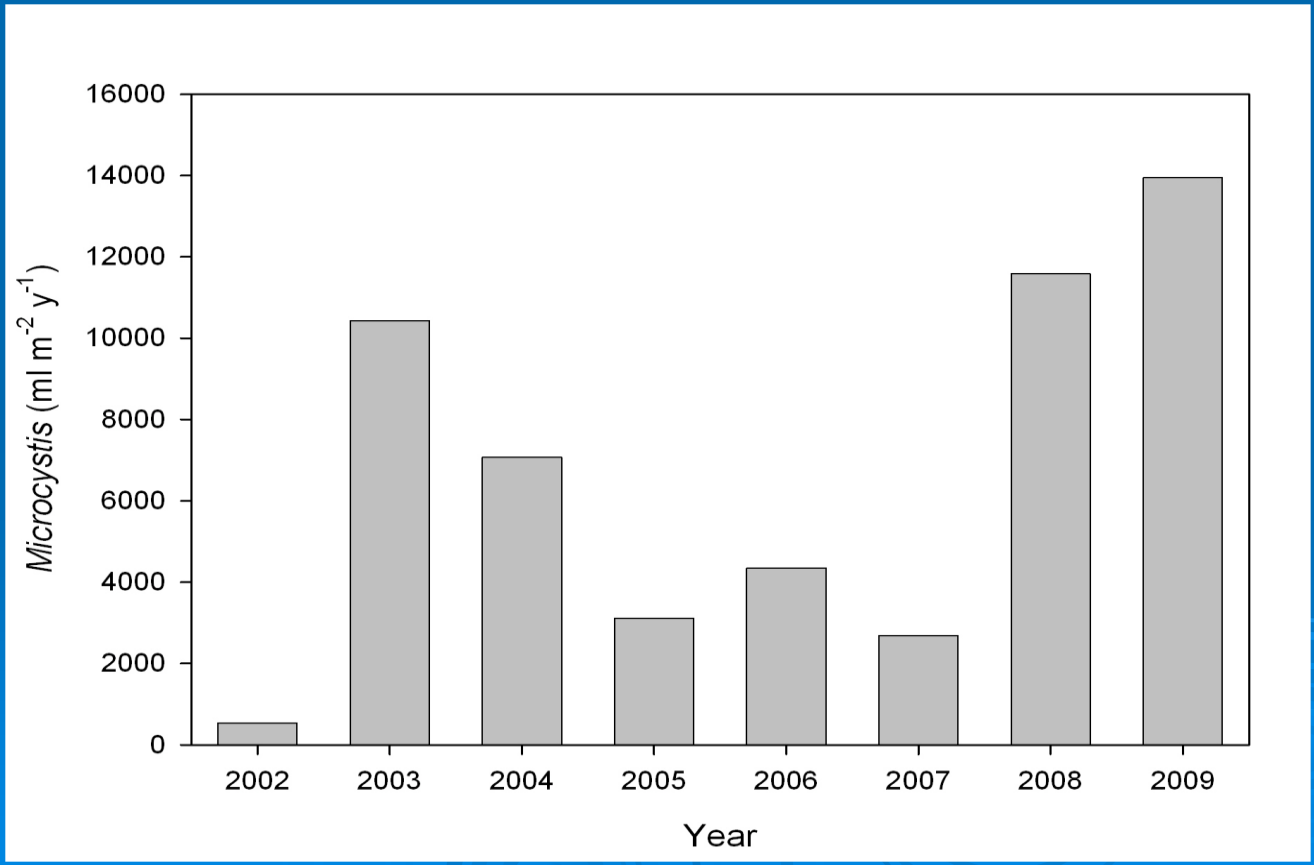
Microcystis in Lake

- Microcystin toxin concentration was positively correlated with cell concentration



Microcystis in Lake

- The *Microcystis* bloom of 2009 was the largest in recent years.



Microcystis Conclusions

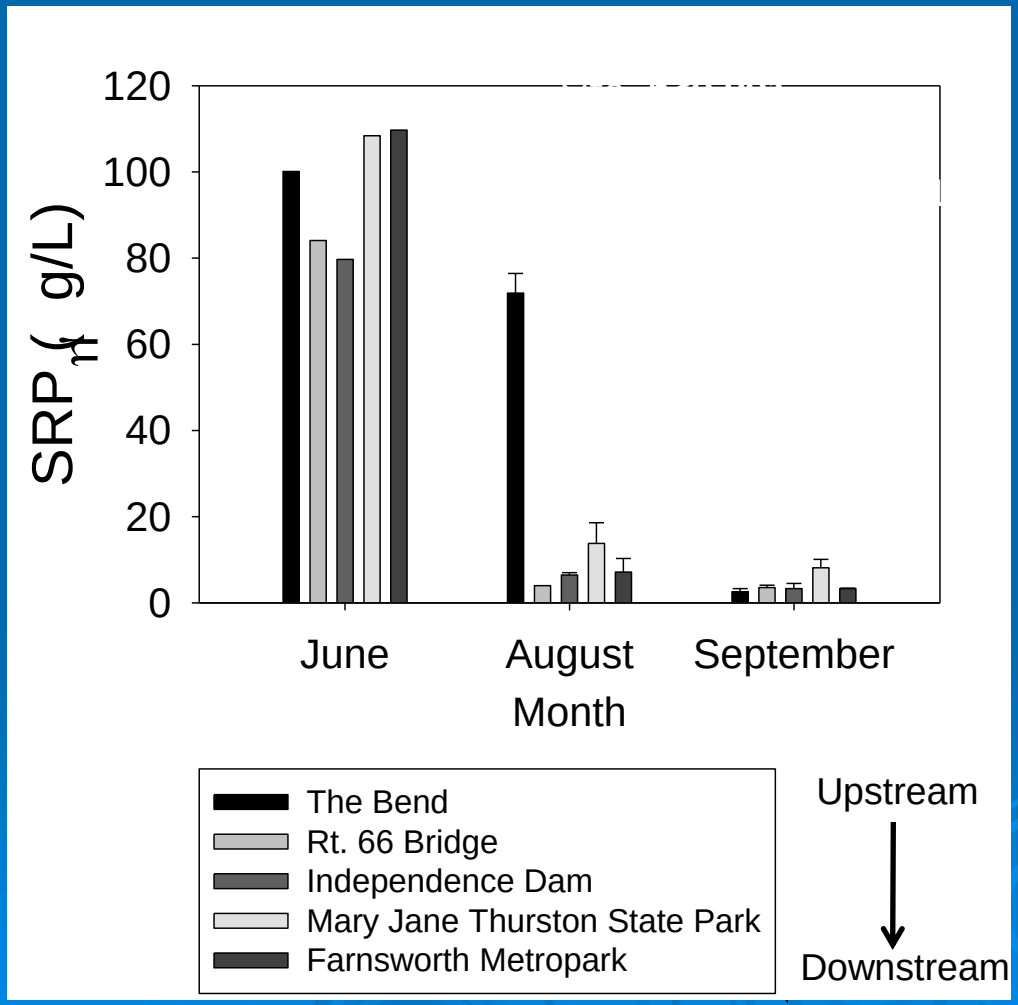
- No definitive “source” of *Microcystis* identified
  - Present in all locations (except lake water) in earliest sampling
  - Microcystis trends coincide between river, lake, and lake sediments
- Microcystin toxin concentration was related to cell concentration.
- 2008 and 2009 were worst bloom years since 2002.

Phosphorus Tracking

Maumee River:

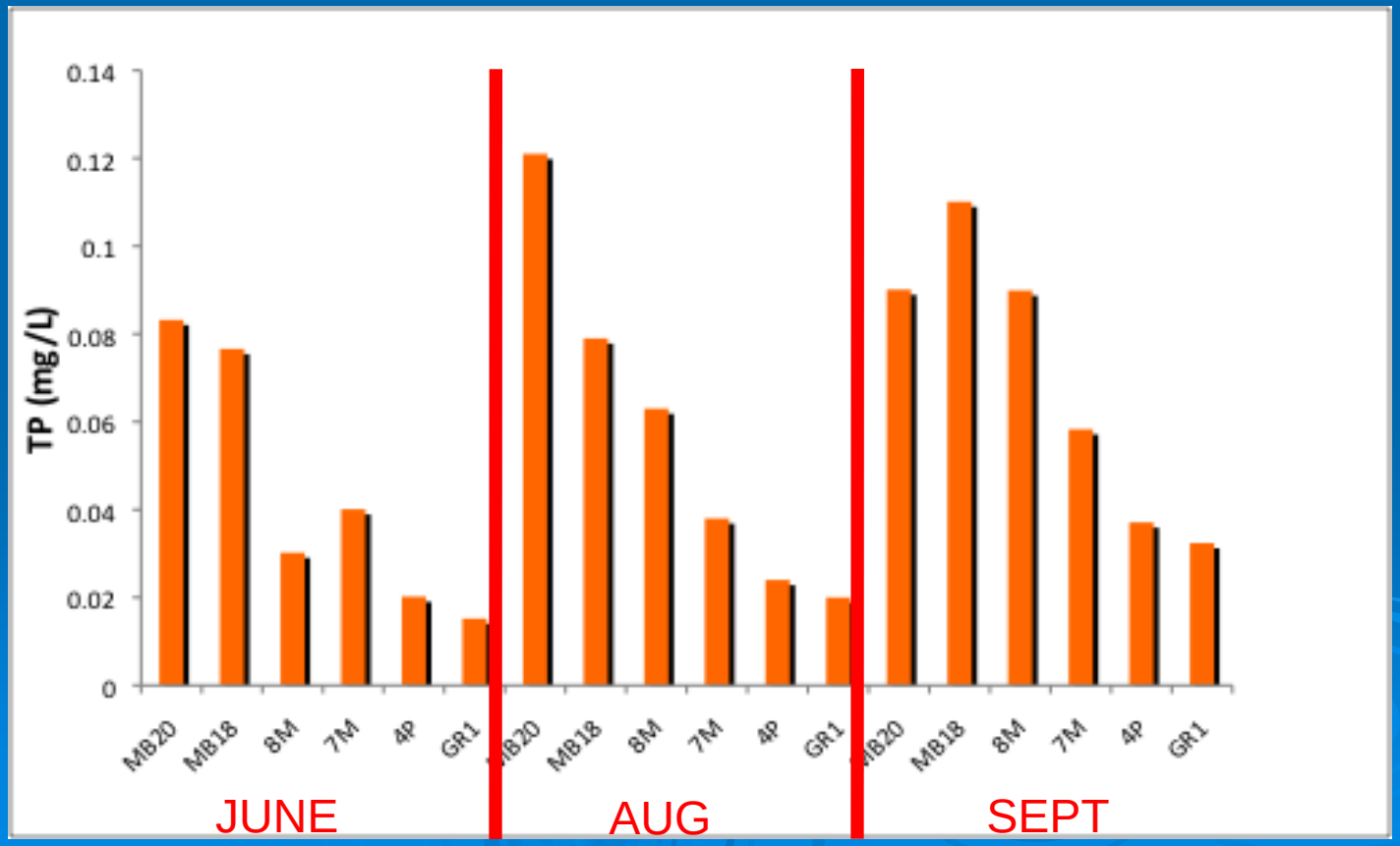
Temporal/ Spatial Trends in Soluble Reactive Phosphorus

SRP (ug /L)



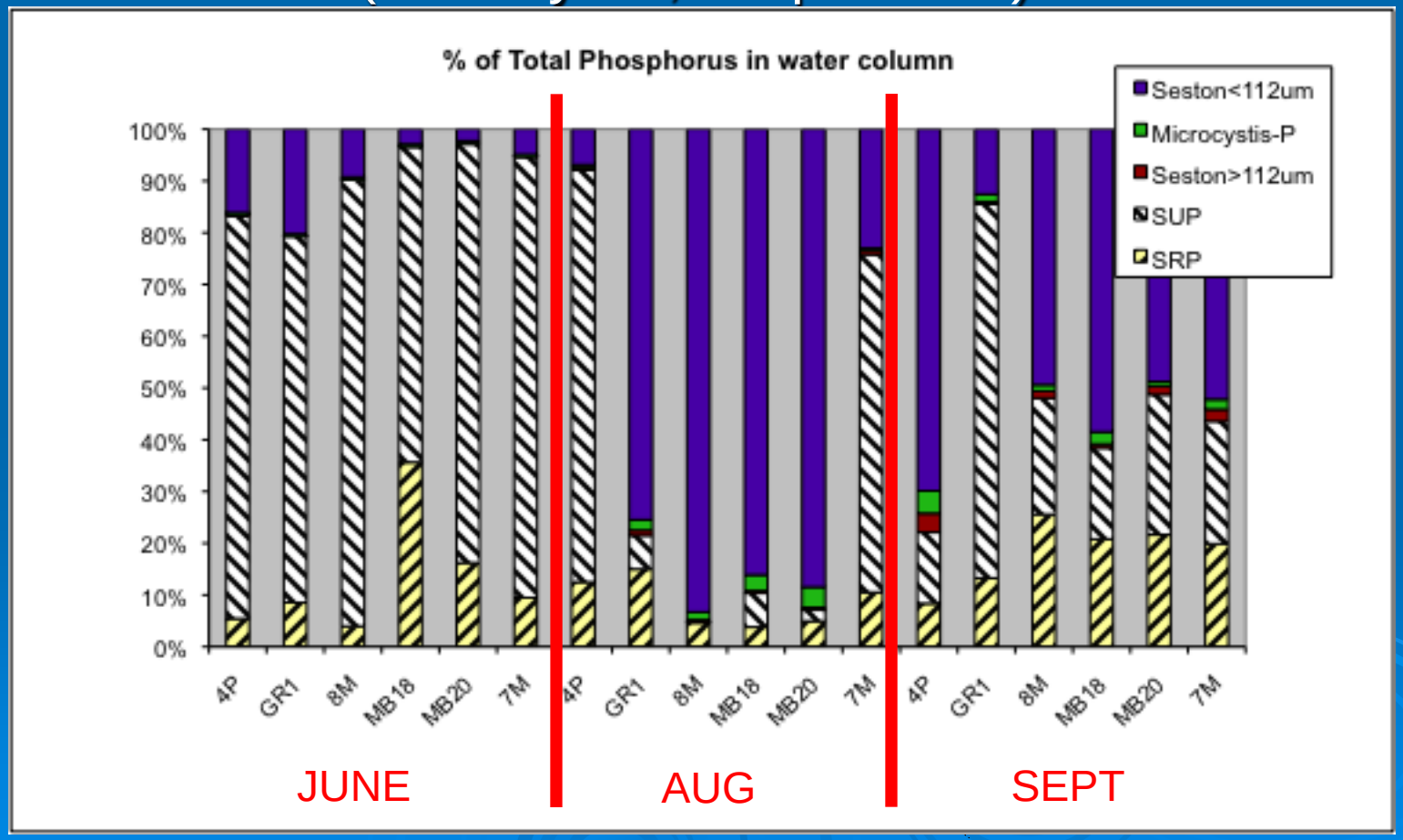
Lake Erie:
Total Phosphorus Trends

- Gradient from river mouth to offshore
- Increasing P over the summer

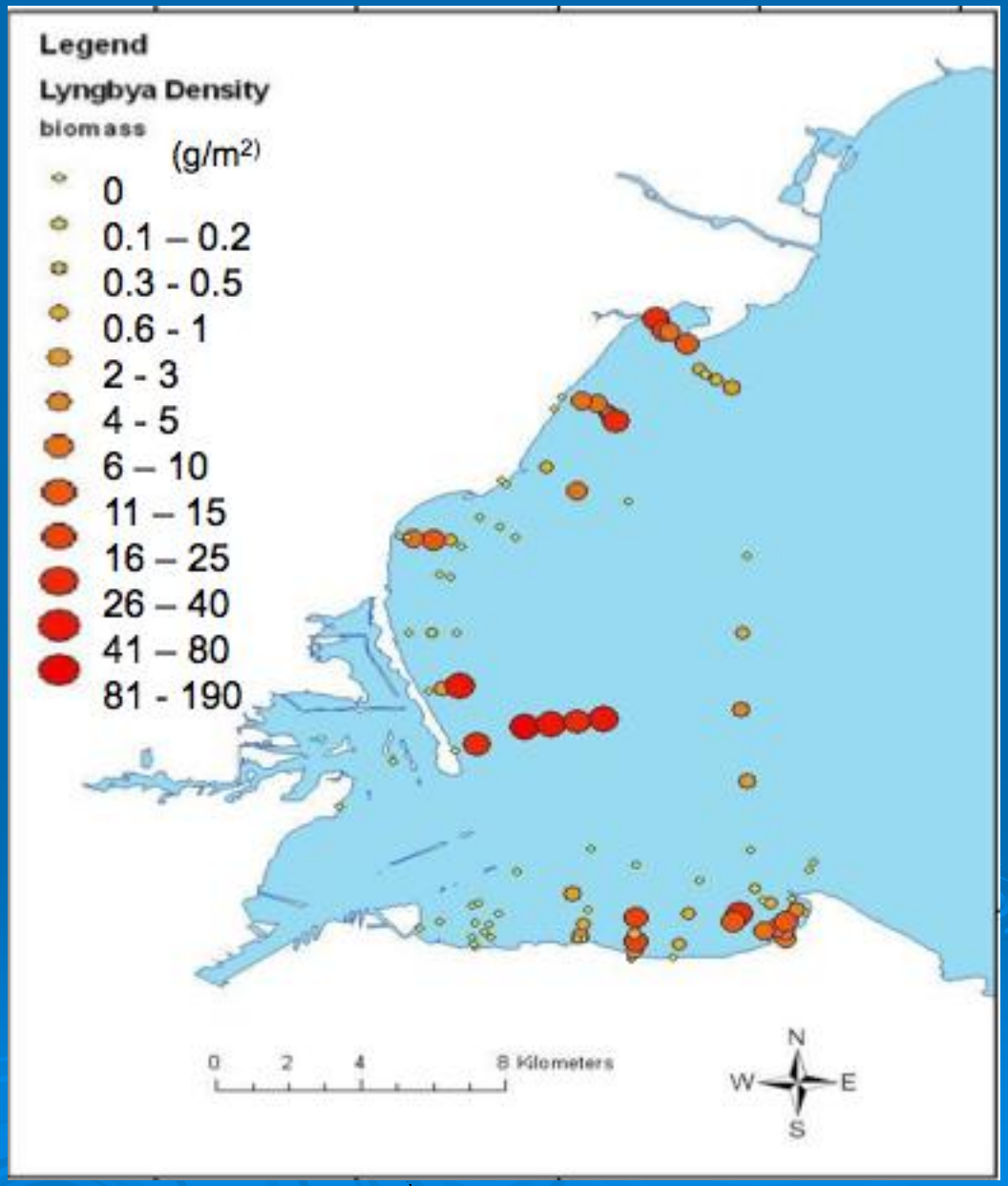


Lake phosphorus partitioning

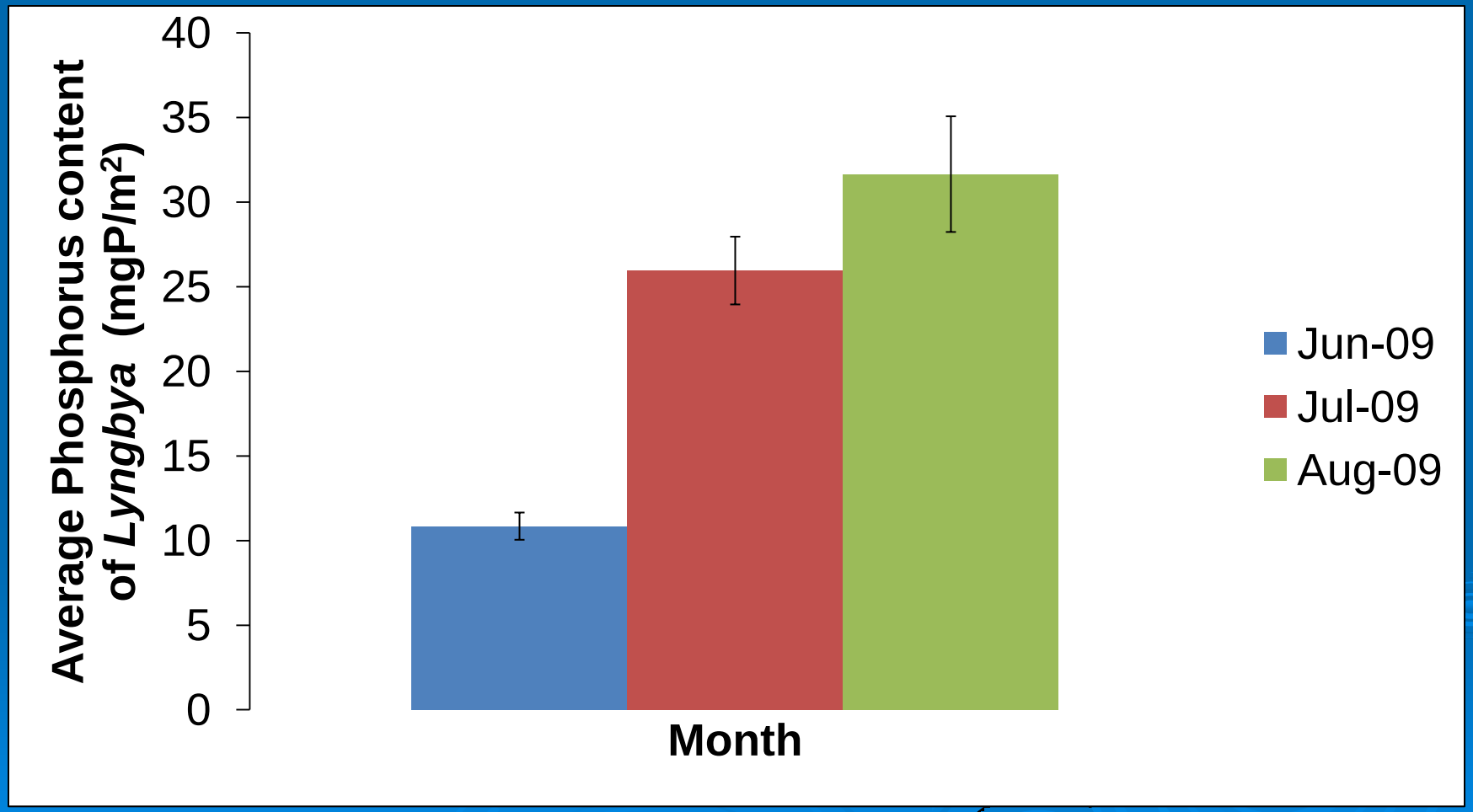
- Mostly dissolved organic P in June
- Mostly small particulate P (<112 um) in August
- Plankton P (Microcystis, zooplankton) is low



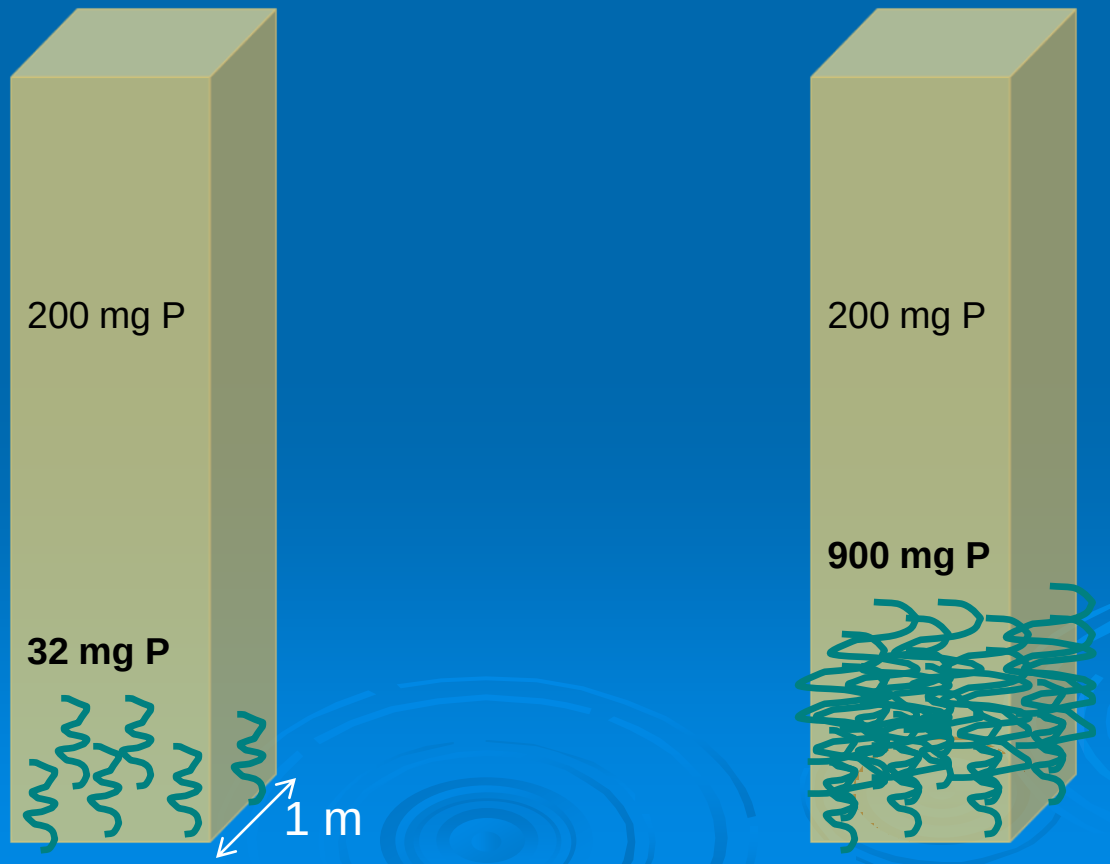
Lyngbya wollei density in western Lake Erie



Phosphorus content of *Lyngbya* increases from June - August

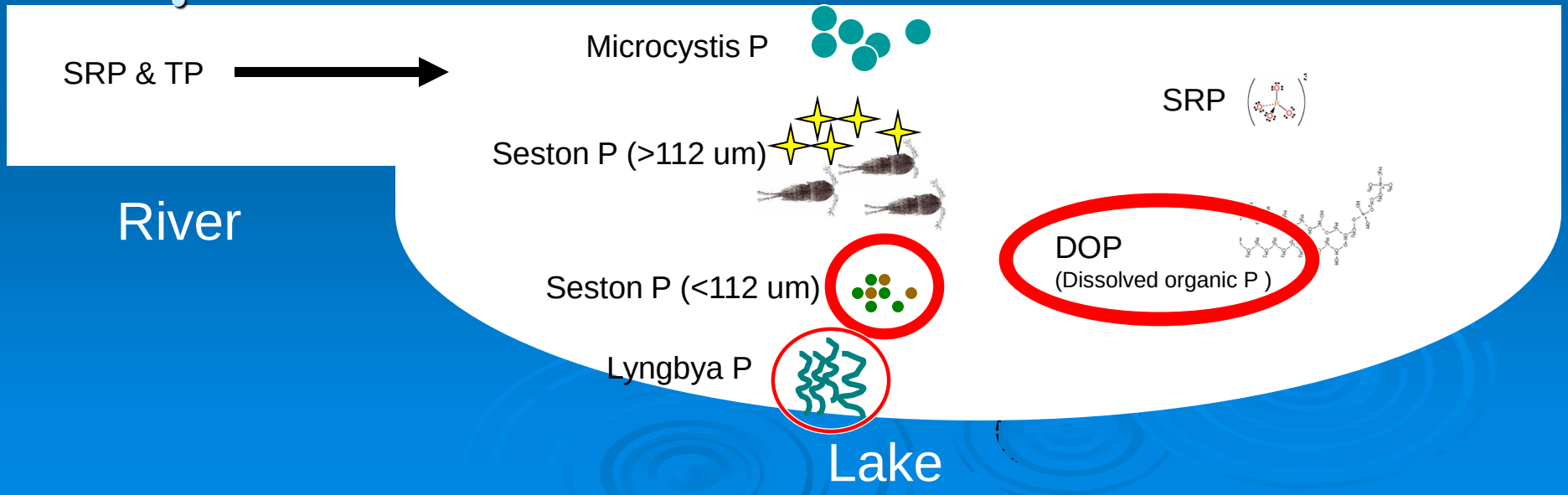


- On average, about 15% of phosphorus per square meter in western Lake Erie is contained in *Lyngbya.*
- In dense mats, *Lyngbya* may contain ~4x more P than the water column



Conclusions

- There is a lot of phosphorus, but most water column P is in dissolved or small particle form (not *Microcystis,* diatoms, or zooplankton)
- Given that *Microcystis* is usually P-limited, rates of conversion from DOP and small seston P to SRP may be important
- On average, about 15% of phosphorus per square meter in western Lake Erie is contained in *Lyngbya*, **a new compartment.**
-



Questions?

Lake Erie Center