Harmful Algal Blooms in the Fox Valley:
Recent Patterns of Cyanobacteria Abundance and Composition in the Fox-Wolf Watershed and Green Bay

Bart De Stasio

Biology Department

LAWRENCE UNIVERSITY
APPLETON, WISCONSIN 54912

Imagery courtesy of the Environmental Remote Sensing Center University of Wisconsin-Madison

Zebra Mussels in Lake Winnebago and Green Bay

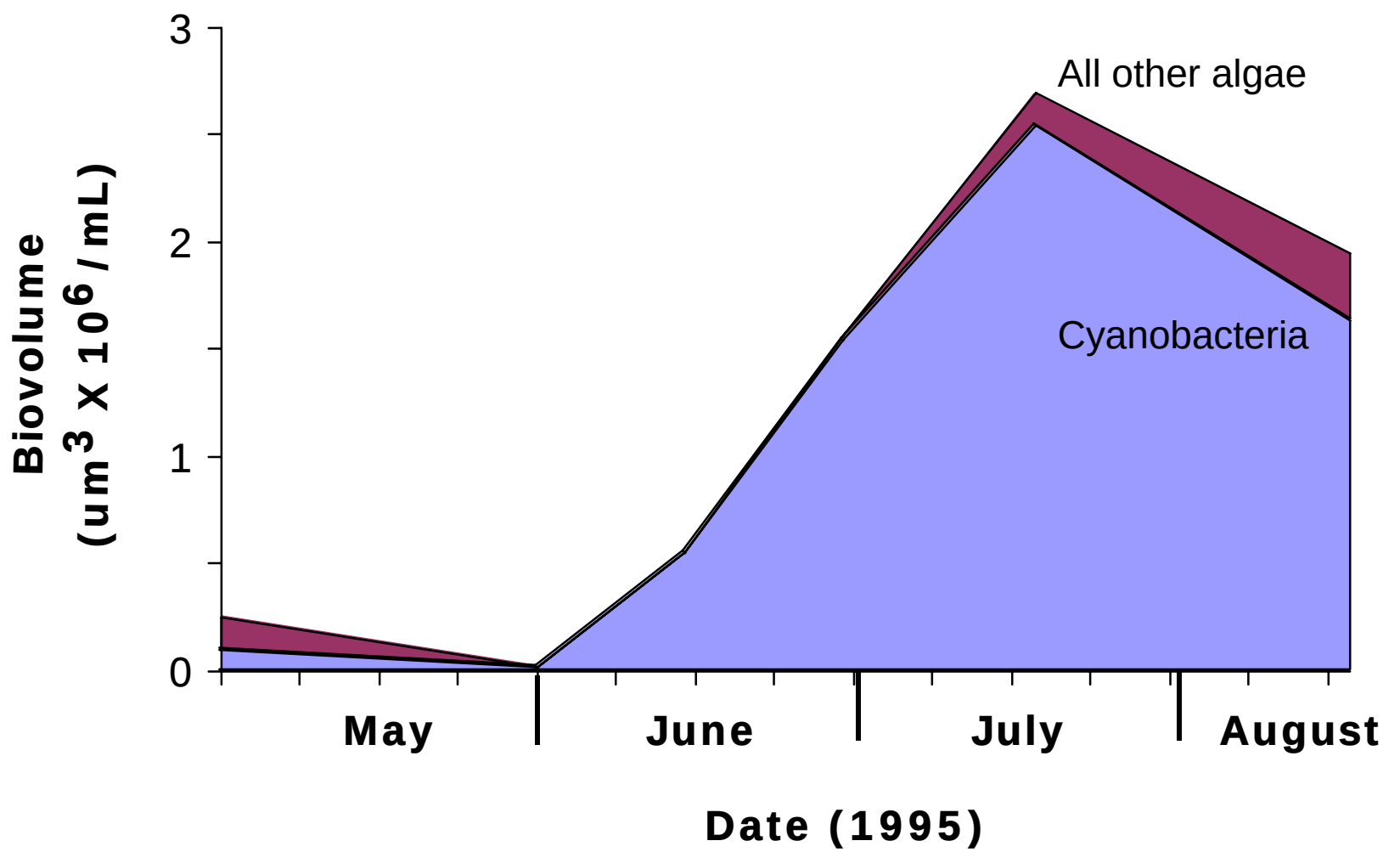
- First established:
  - Green Bay 1992
  - Winnebago 1999
- Study Goals:
  1. What are the effects of zebra mussels on water quality?
  2. What are the effects on lower food web interactions?

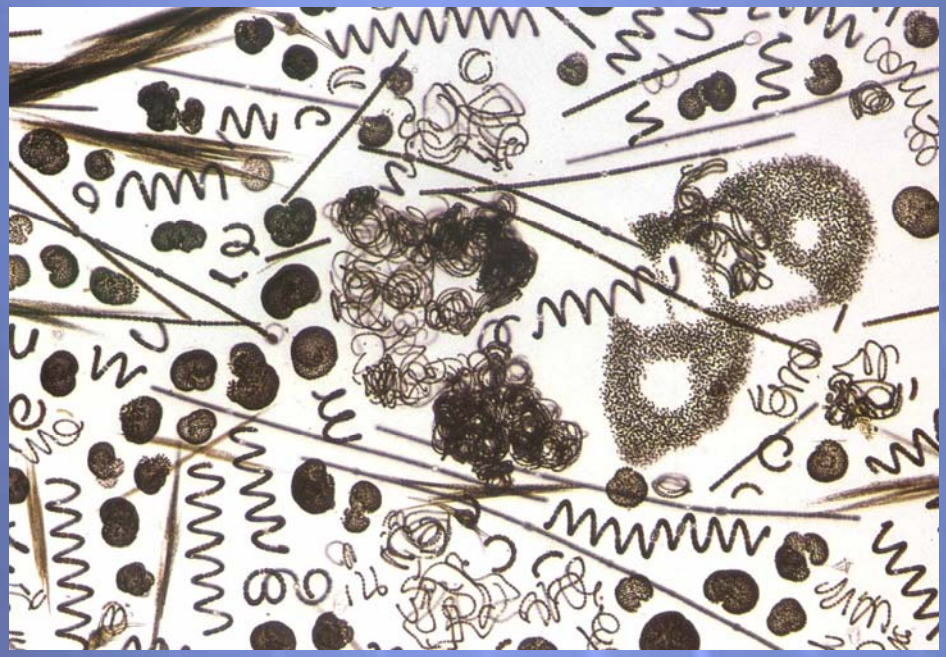
Obvious Effects along Shorelines

Imagery courtesy of the Environmental Remote Sensing Center University of Wisconsin-Madison

Lake Winnebago Phytoplankton Dynamics

(Pre-invasion)

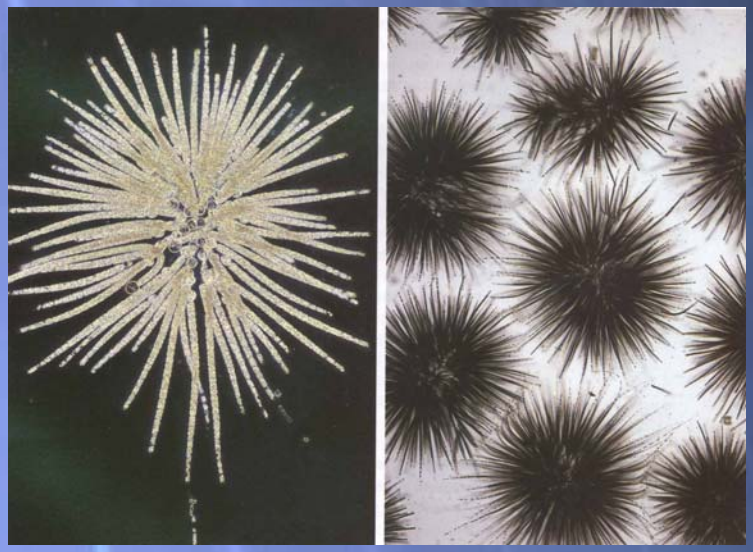




Typical Winnebago Algae Community

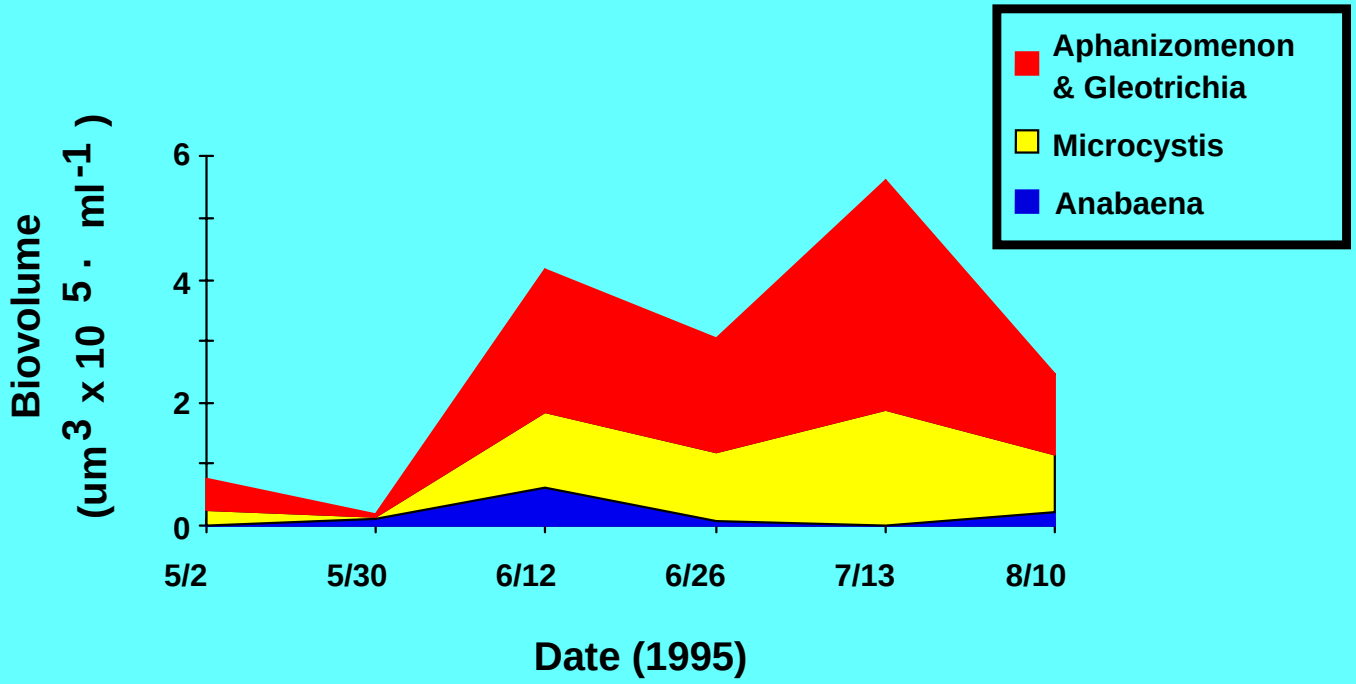
Aphanizomenon

(“Fannie”)

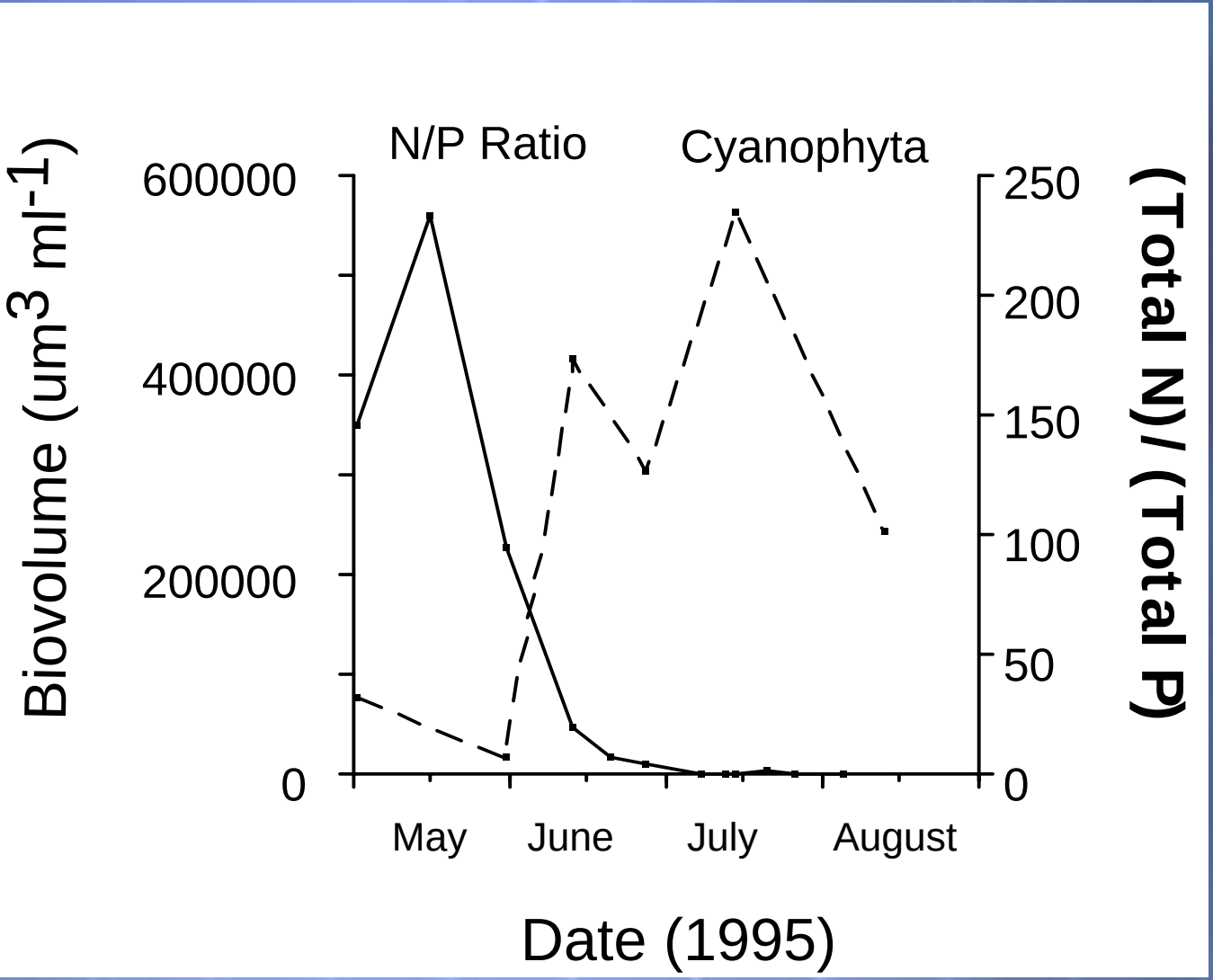


Gleotrichia

Lake Winnebago
Cyanobacteria Abundance



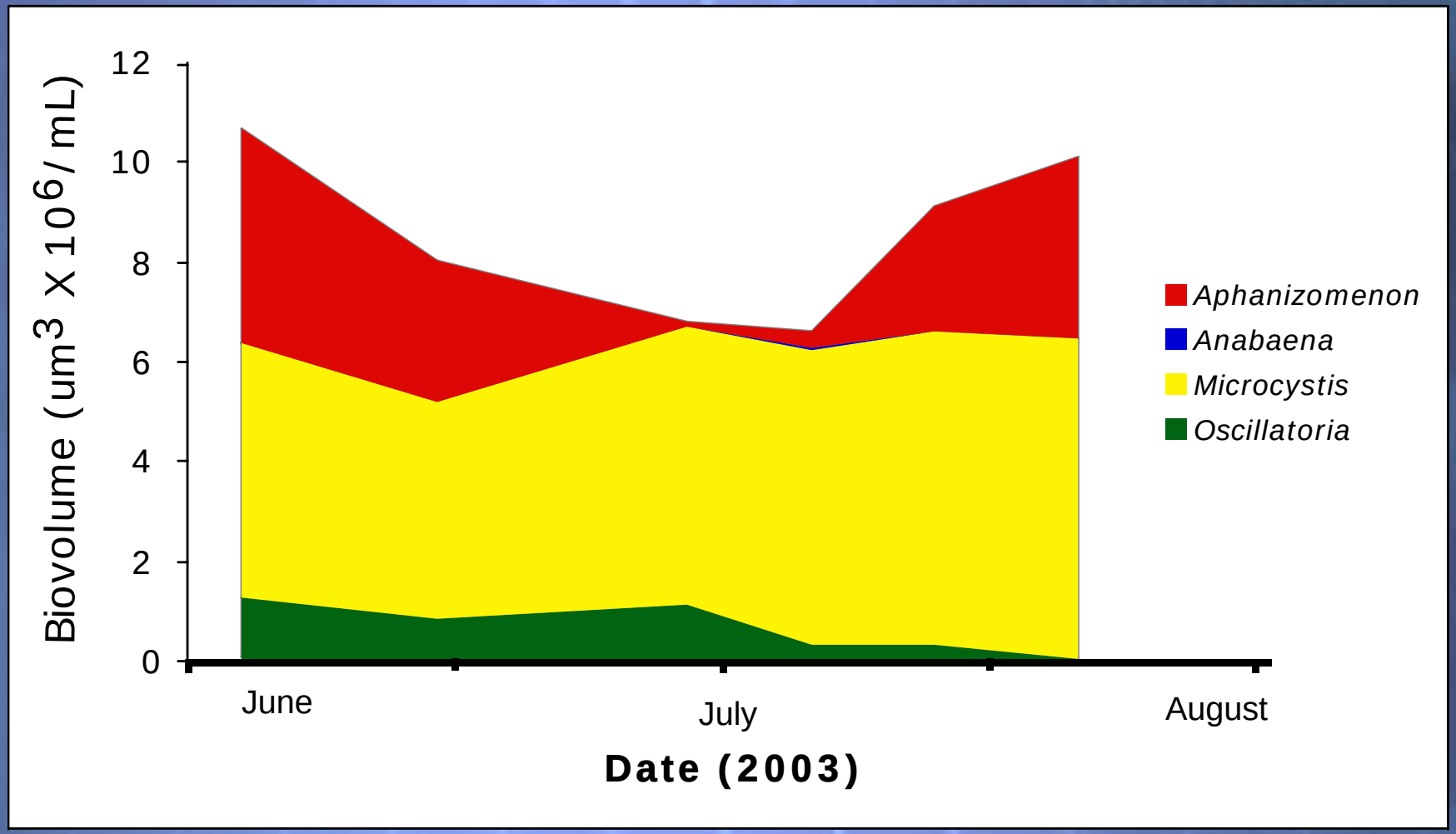
Winnebago Cyanobacteria Dynamics



Winnebago Summer 2003

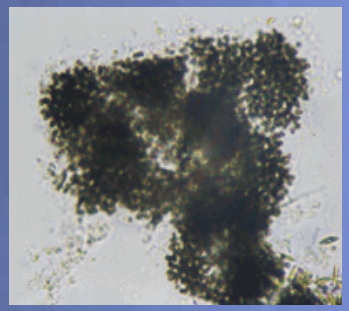
(Post-invasion)

Winnebago Cyanobacteria 2003



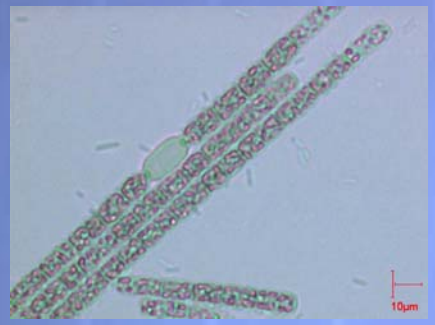
Phytoplankton

Cyanobacteria



Microcystis

Anabaena

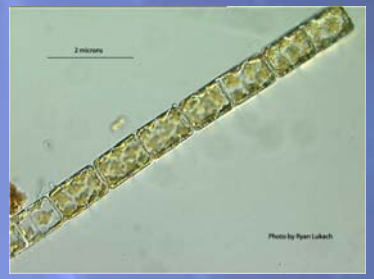


Aphanizomeon

Diatoms

Stephanodiscus

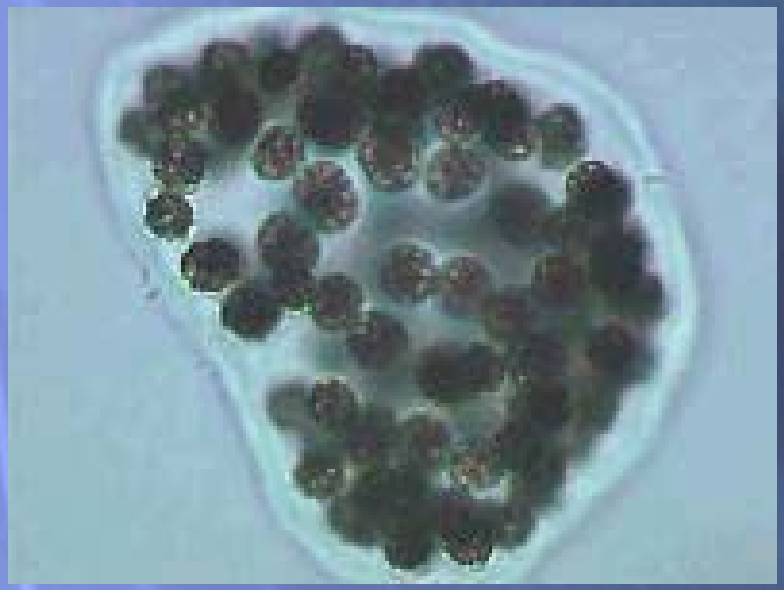
Navicula



Aulacoseira

Cyanobacteria with a mucus sheath

Anabaena

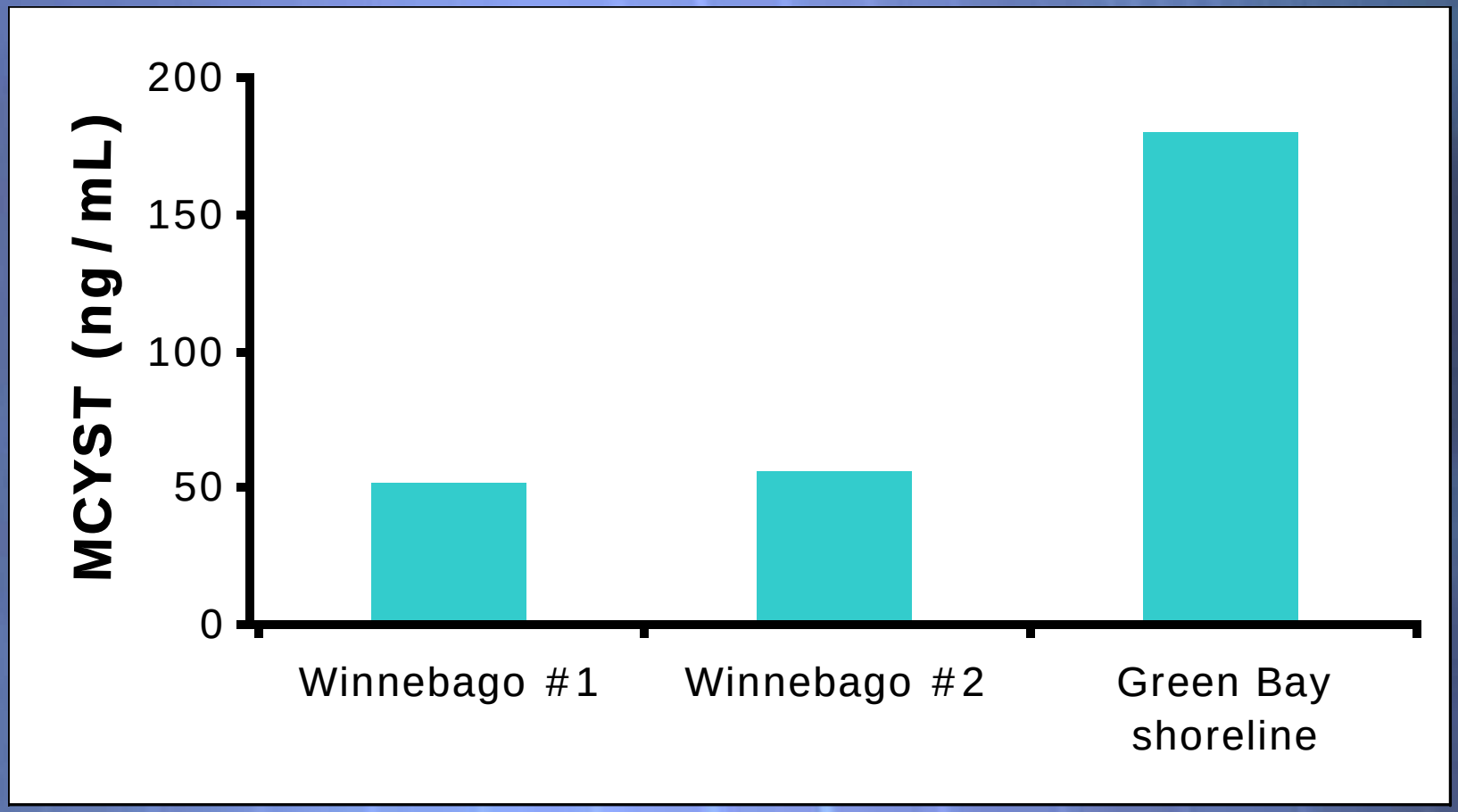


Microcystis

Capsule significantly decreases *Daphnia* survivorship and feeding rates

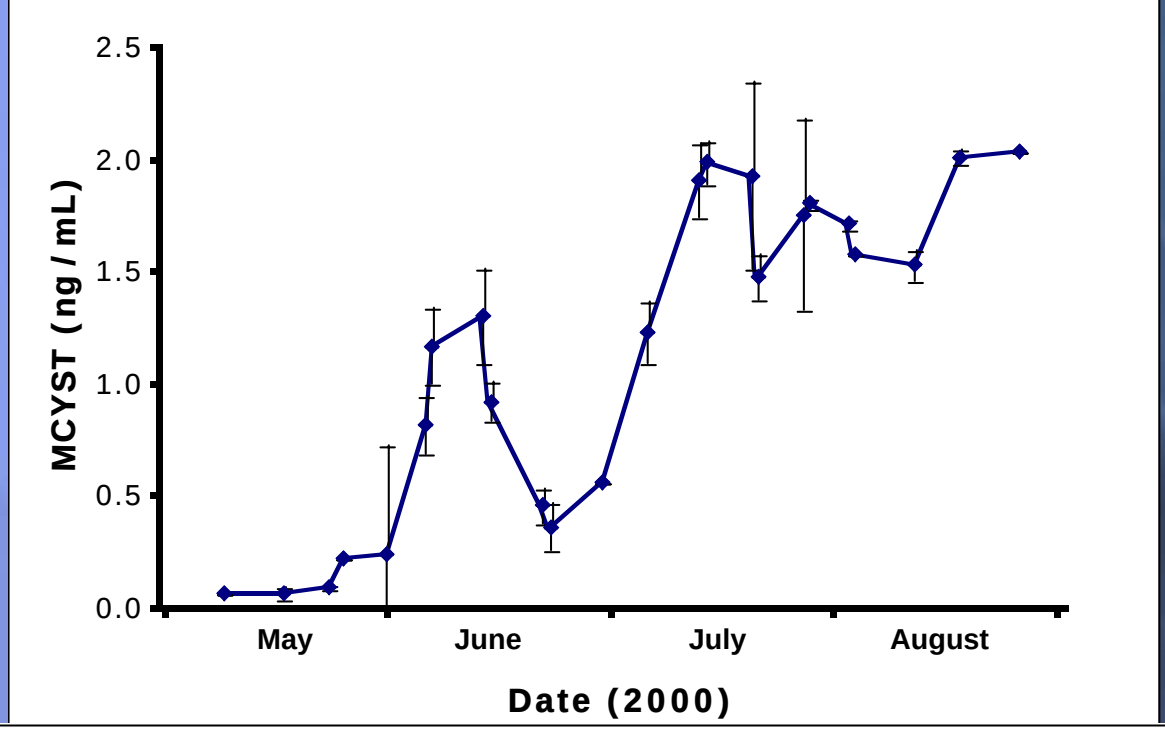
(Trabeau et al. 2004)

Fox-Wolf Microcystin Data

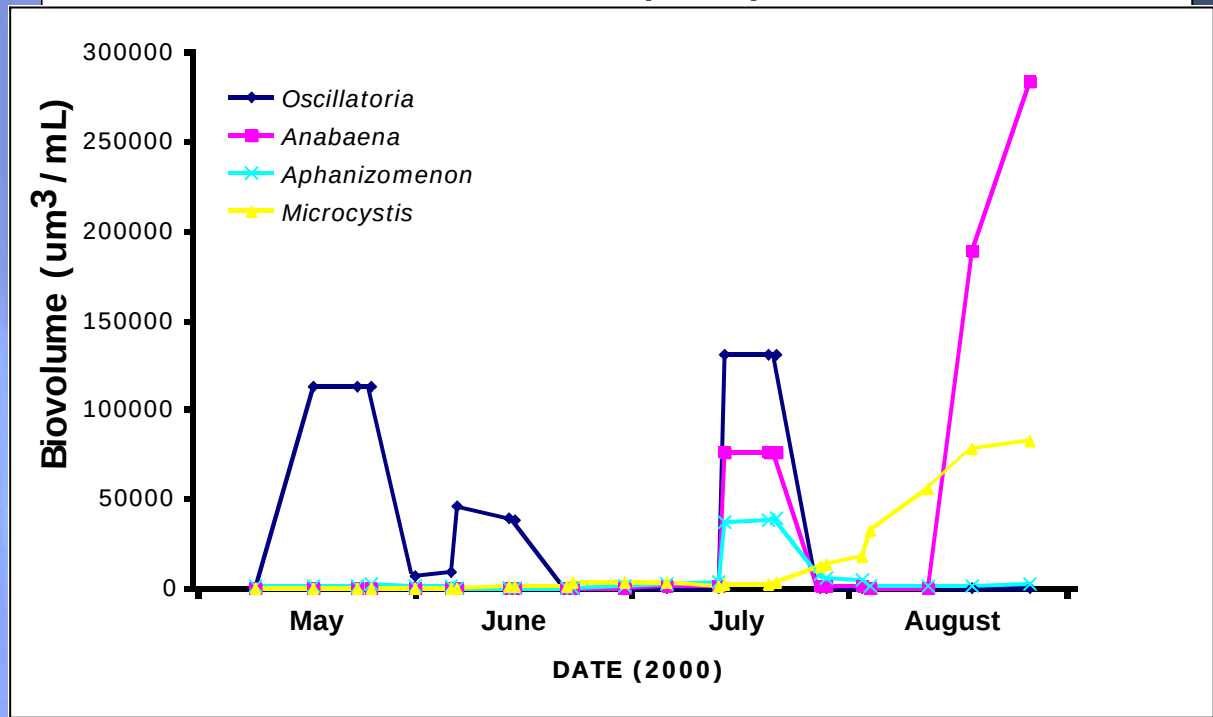


Data Source:
McDermott et al. 1995

Winnebago Microcystin Concentration



Winnebago Cyanobacteria



Data Source:
C. McDermott
and
B. De Stasio

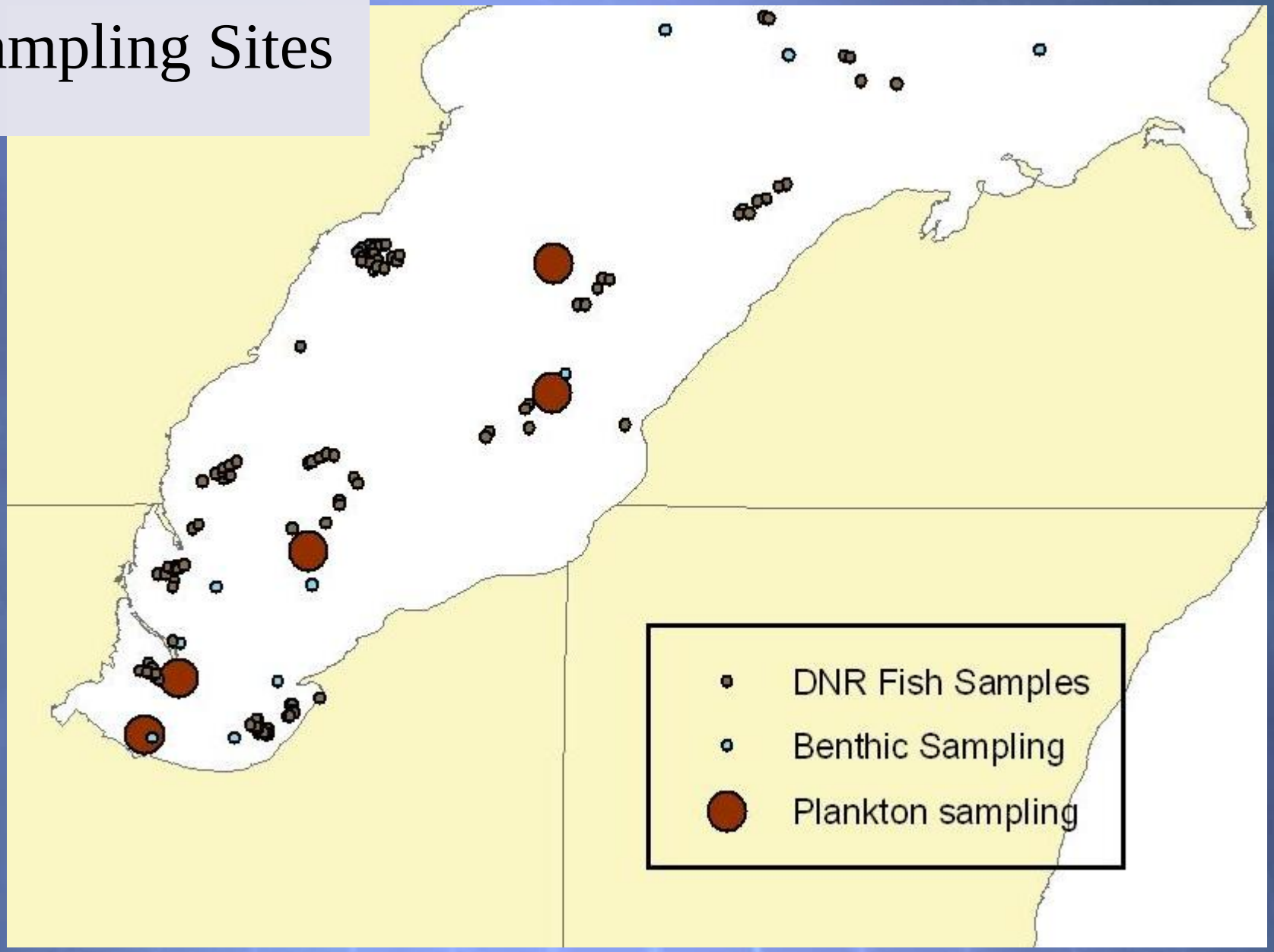
Winnebago Phytoplankton

(Pre- vs. Post-invasion)

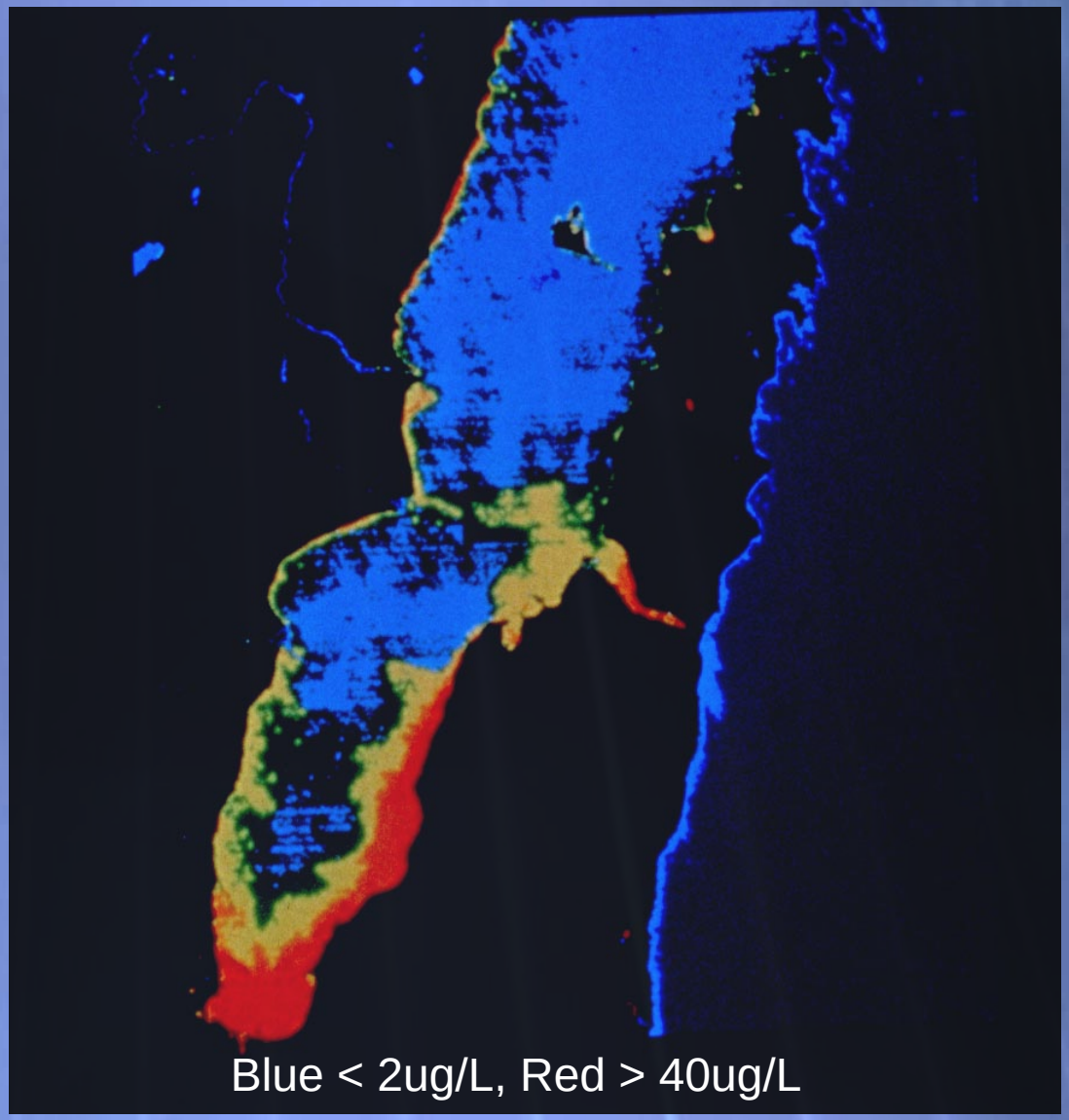
- Trend toward increased total abundance following invasion
- Shift in dominance from *Aphanizomenon* to *Microcystis*
- Increase in diatoms following invasion

Imagery courtesy of the Environmental Remote Sensing Center University of Wisconsin-Madison

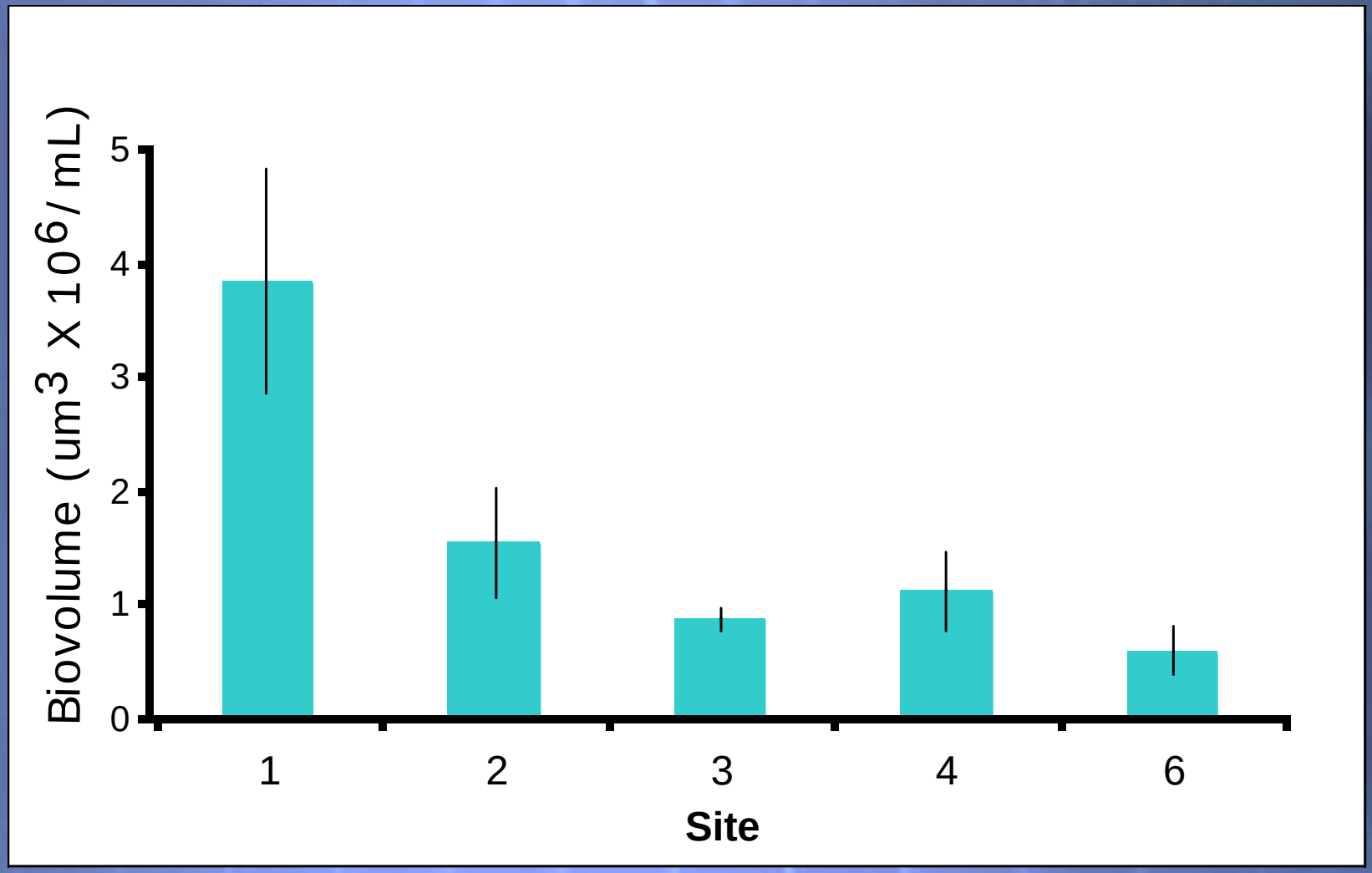
Sampling Sites



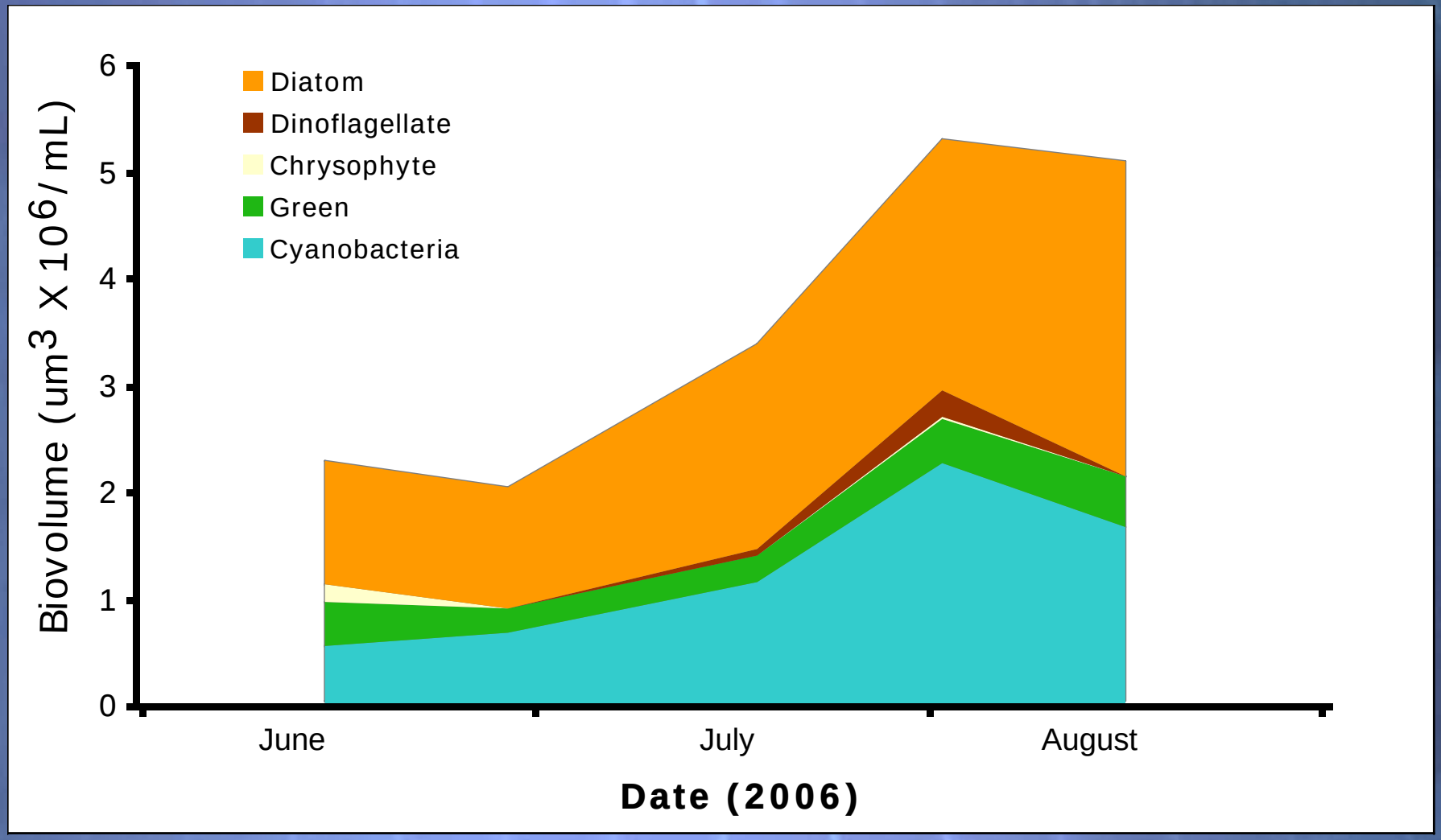
Chlorophyll a - July, 1984



Green Bay Cyanobacteria 2004

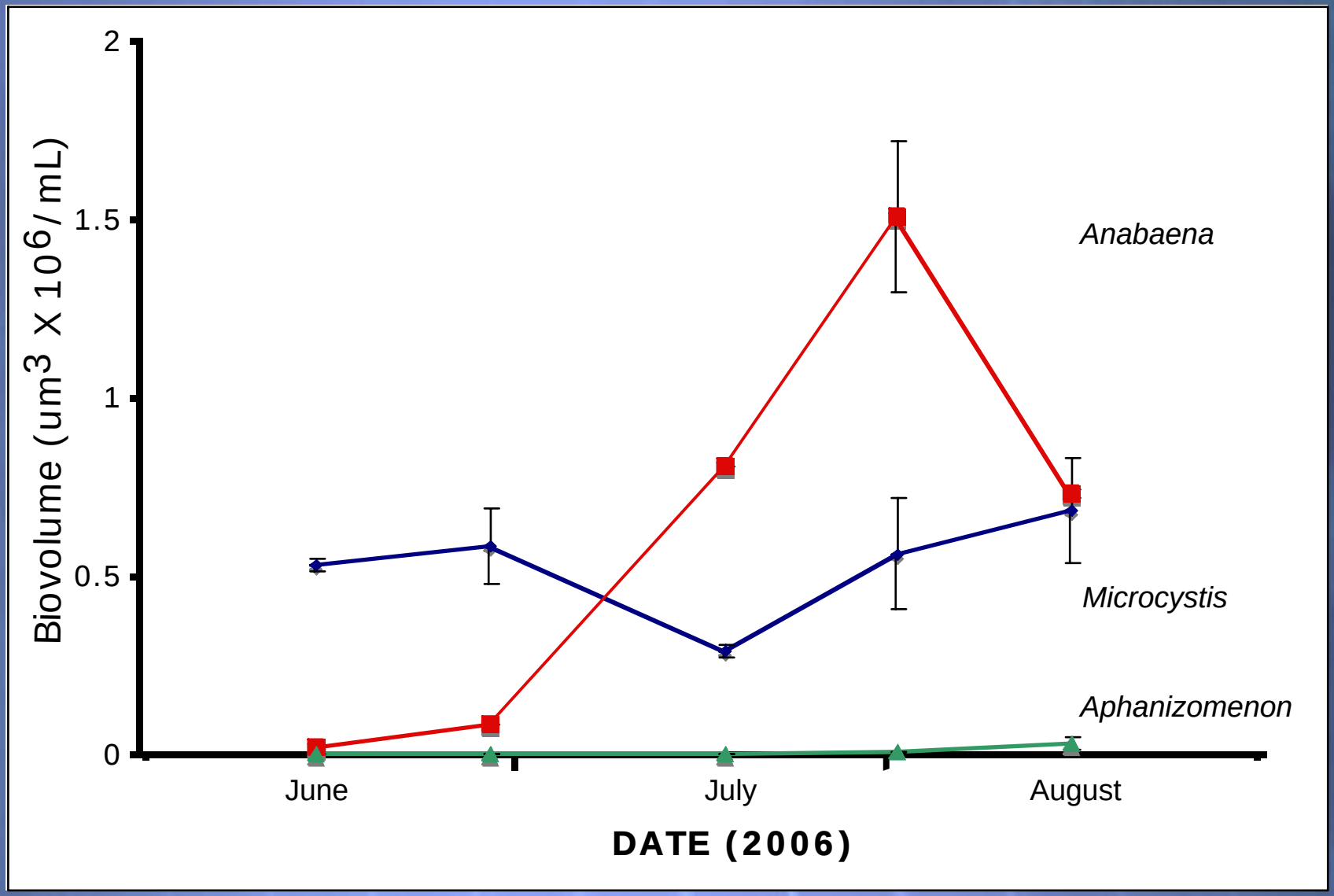


Green Bay Phytoplankton GB2 - 2006

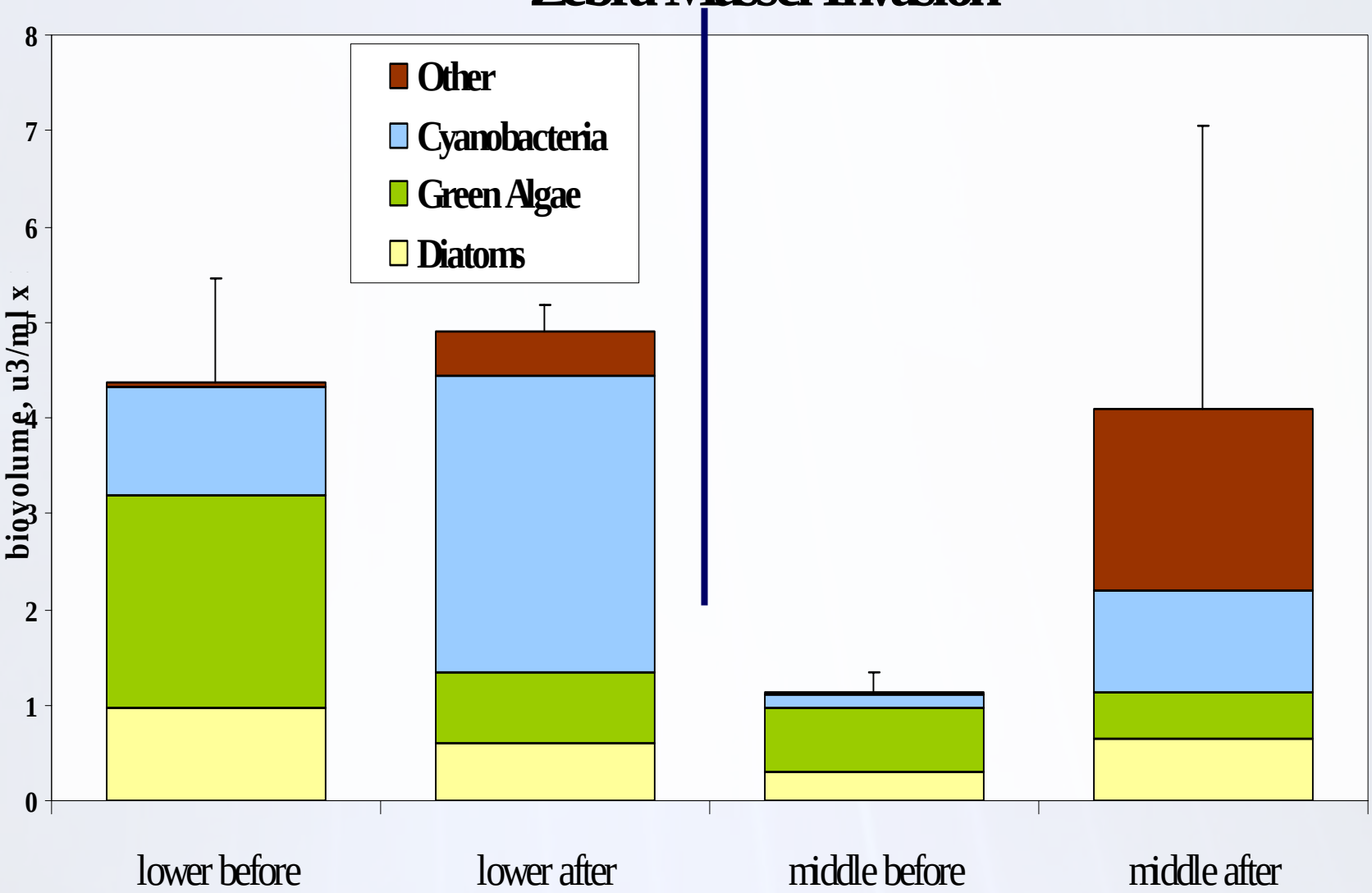


Lower Bay Cyanobacteria - 2006

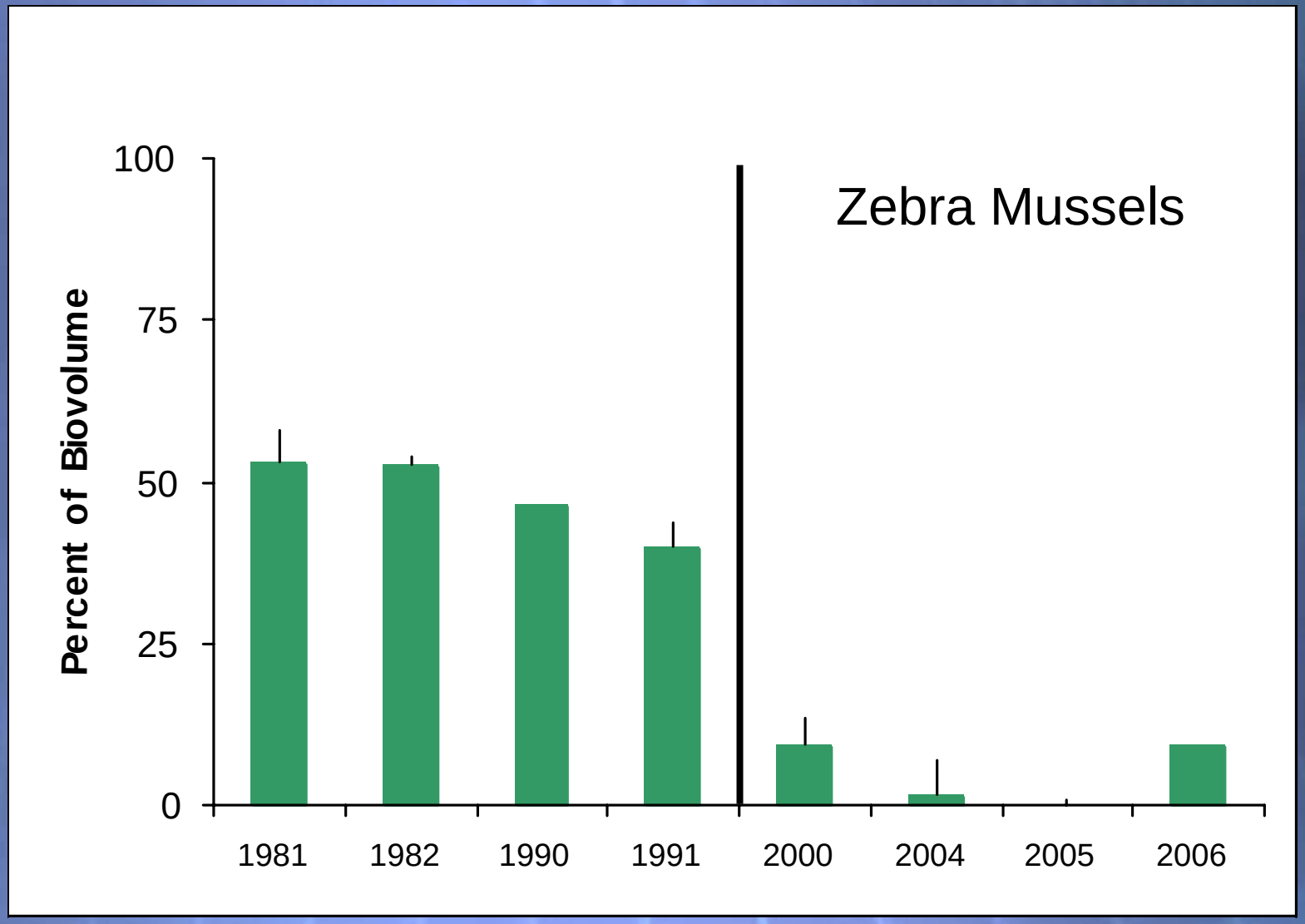
(mean +/- 1 S.E.)



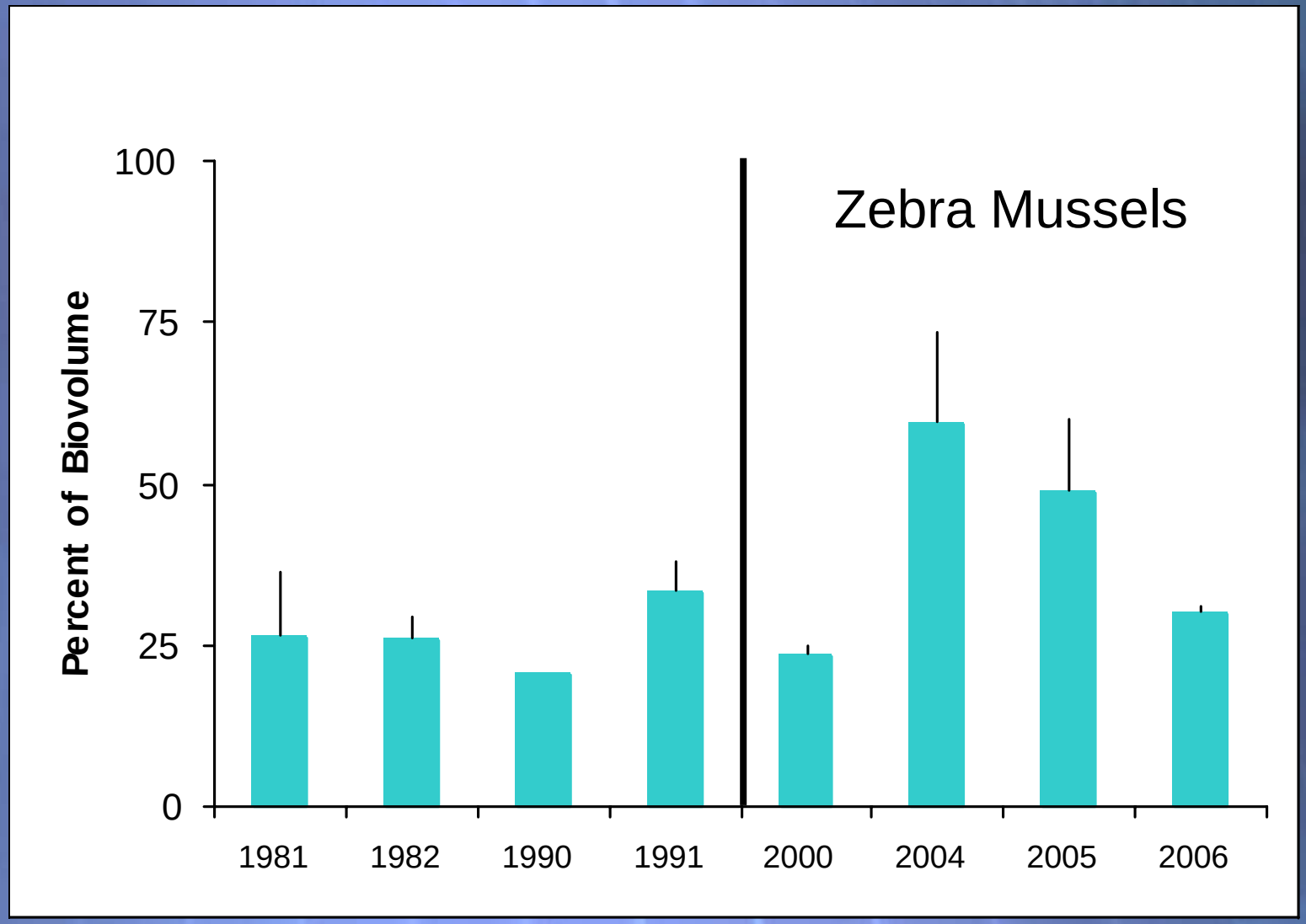
Green Bay Phytoplankton Community Before and After Zebra Mussel Invasion



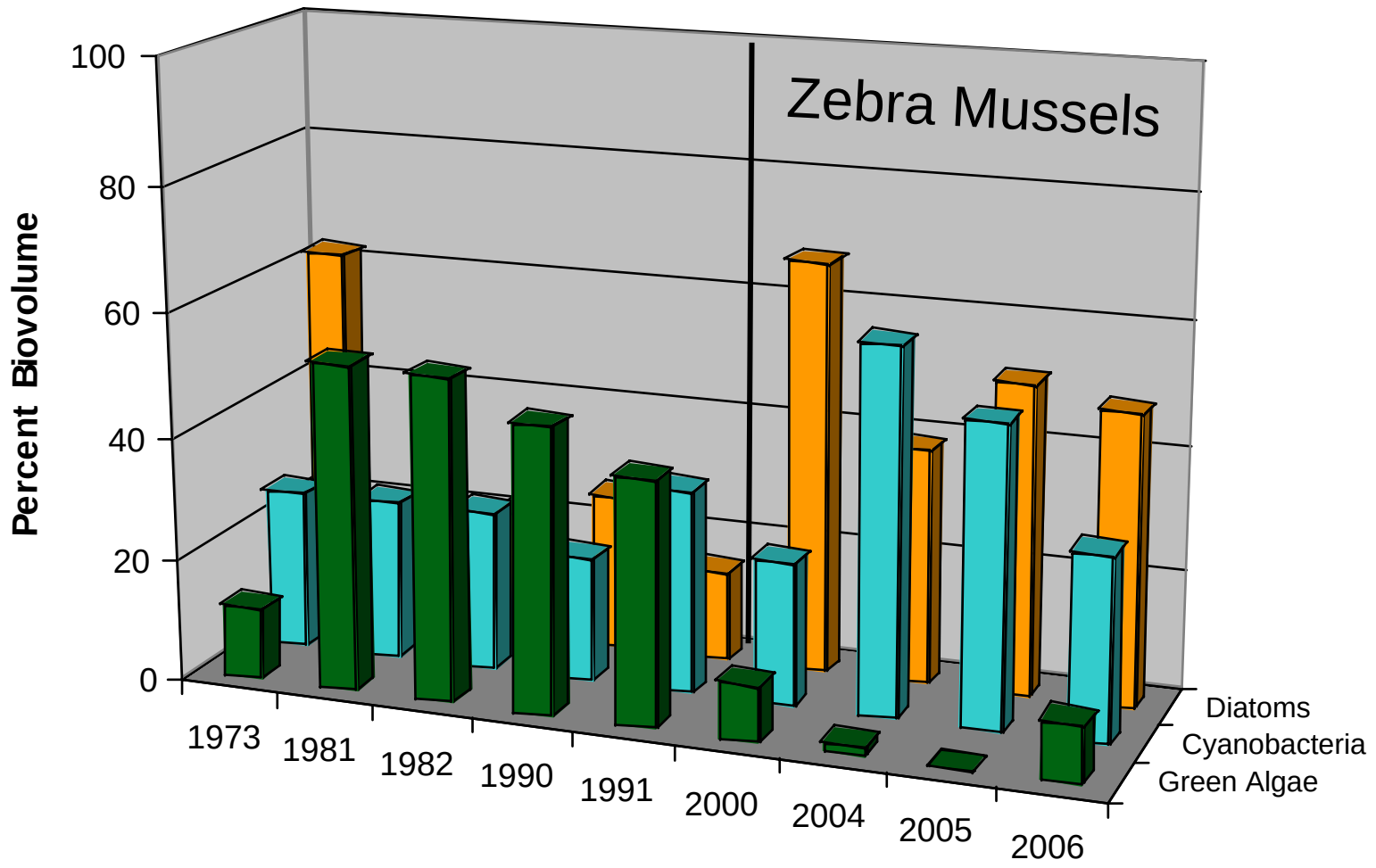
Green Algae in Lower Green Bay



Cyanobacteria in Lower Green Bay



Lower Green Bay



Green Bay Phytoplankton

(Pre- vs. Post-invasion)

- Phytoplankton biomass higher after invasion

Green Bay Phytoplankton

(Pre- vs. Post-invasion)

- Phytoplankton biomass higher after invasion
- Cyanophyta (e.g. *Microcystis*) higher after invasion

Green Bay Phytoplankton

(Pre- vs. Post-invasion)

- Phytoplankton biomass higher after invasion
- Cyanophyta (e.g. *Microcystis*) higher after invasion
- Diatoms higher after invasion

Green Bay Phytoplankton

(Pre- vs. Post-invasion)

Changes in phytoplankton likely driving changes in zooplankton abundance in lower bay

Combination of zooplankton and mussel grazing has impact on phytoplankton in middle bay

Acknowledgements

- Green Bay Food Web Information Network Participants
  - Sea Grant Institute
  - Wisconsin DNR
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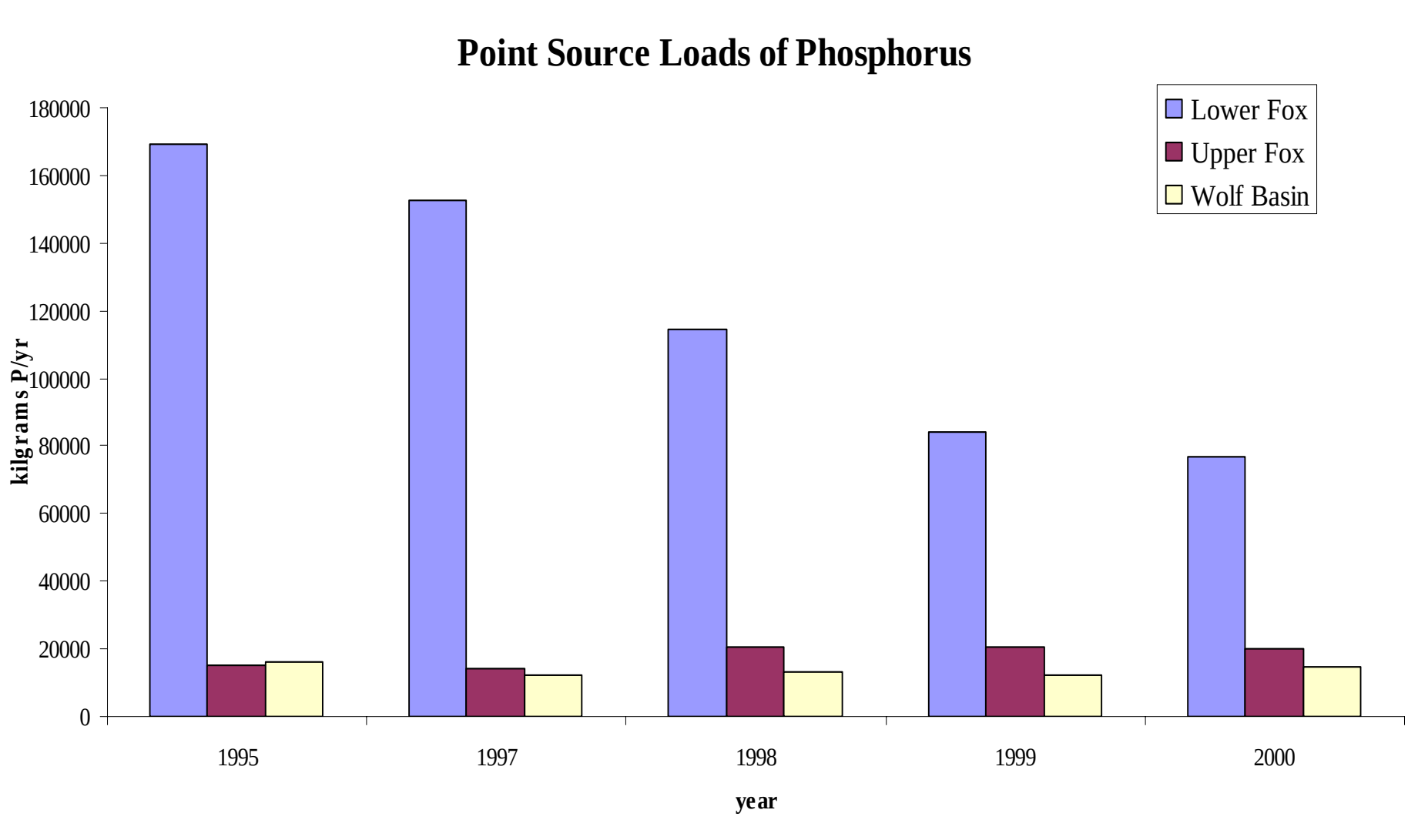

Data from Klump et al.