

Building a collaborative water quality monitoring strategy for a changing St. Louis River Estuary

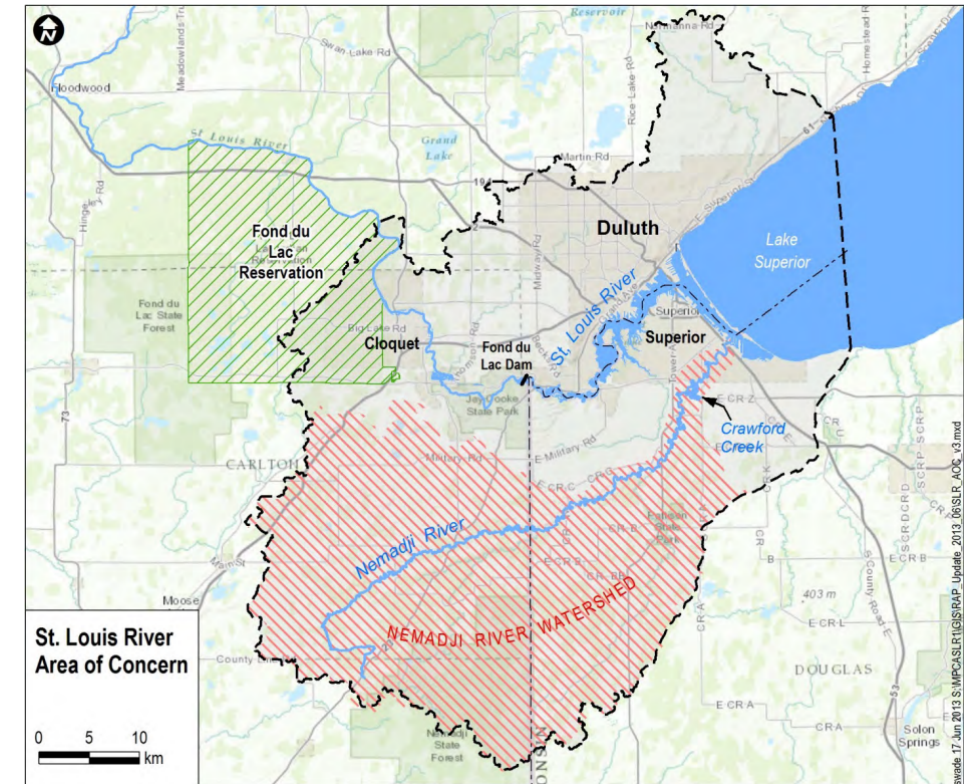
Euan D. Reavie
Hannah Ramage
Chris T. Filstrup



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What do we know now?



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Roadmap to delisting the Area of Concern (established 1987)



BUI	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
BUI 1: Fish Consumption Advisories													●
BUI 2: Degraded Fish and Wildlife Populations				●									
BUI 3: Fish Tumors and Other Deformities				●									
BUI 4: Degradation of Benthos										●			
BUI 5: Restrictions on Dredging											●		
BUI 6: Excessive Loading of Sediments and Nutrients				●									
BUI 7: Beach Closings and Body Contact Restrictions						●							
BUI 8: Degradation of Aesthetics			●										
BUI 9: Loss of Fish and Wildlife Habitat													●

MPCA and WDNR 2013

Wastewater Treatment Facilities

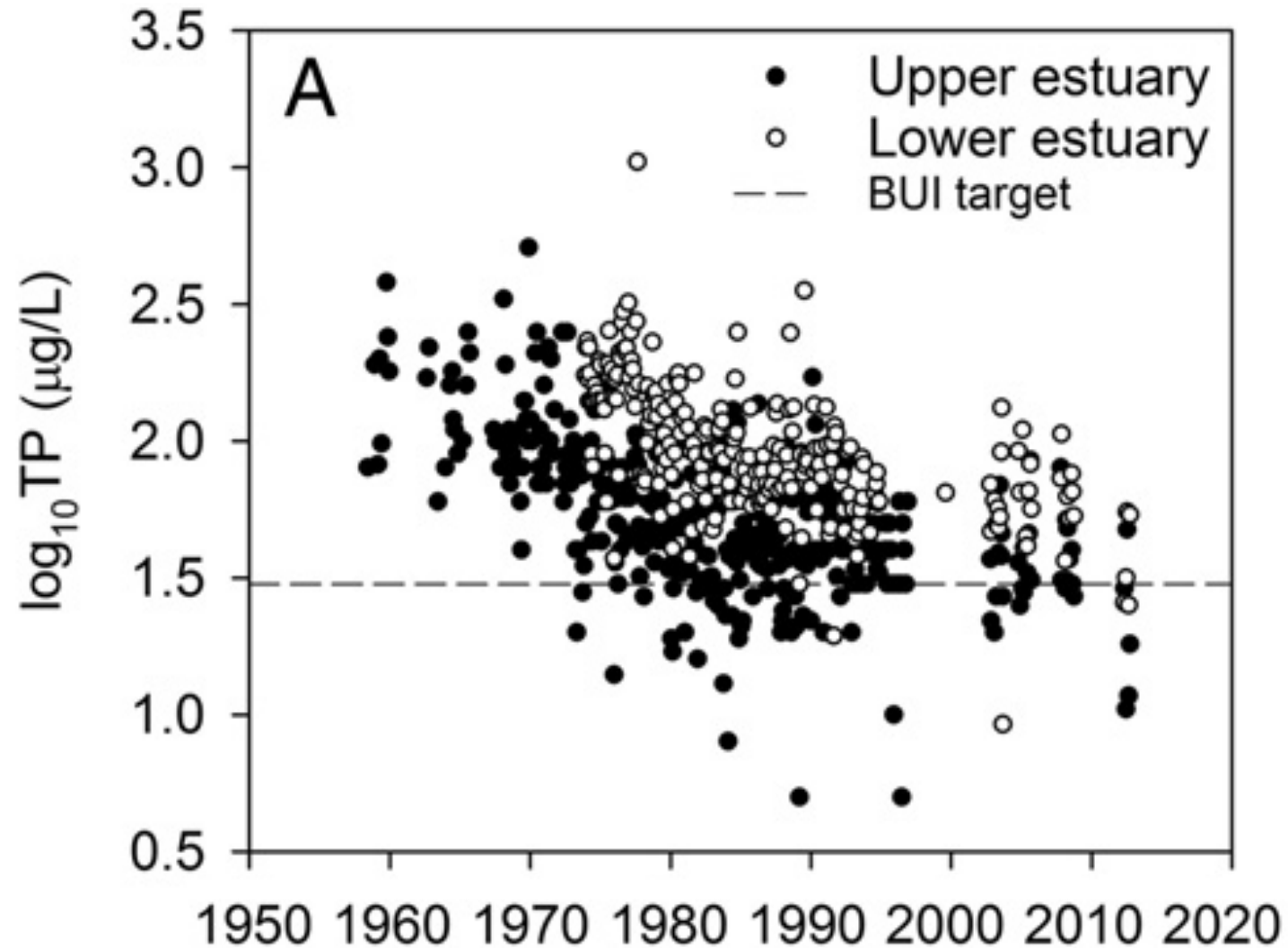


Installed 1958 in Superior, WI



Installed 1978 in Duluth, MN

Reductions in measured phosphorus



Paleolimnology in the AOC

J Paleolimnol (2018) 59:373–395

<https://doi.org/10.1007/s10933-017-0014-8>

ORIGINAL PAPER

Paleolimnology of a freshwater estuary to inform Area of Concern nutrient delisting efforts

Elizabeth E. Alexson · Euan D. Reavie · Richard P. Axler · Sergiy V. Yemets · Pavel A. Krasutsky · Mark B. Edlund · Robert W. Pillsbury · Diane Desotelle

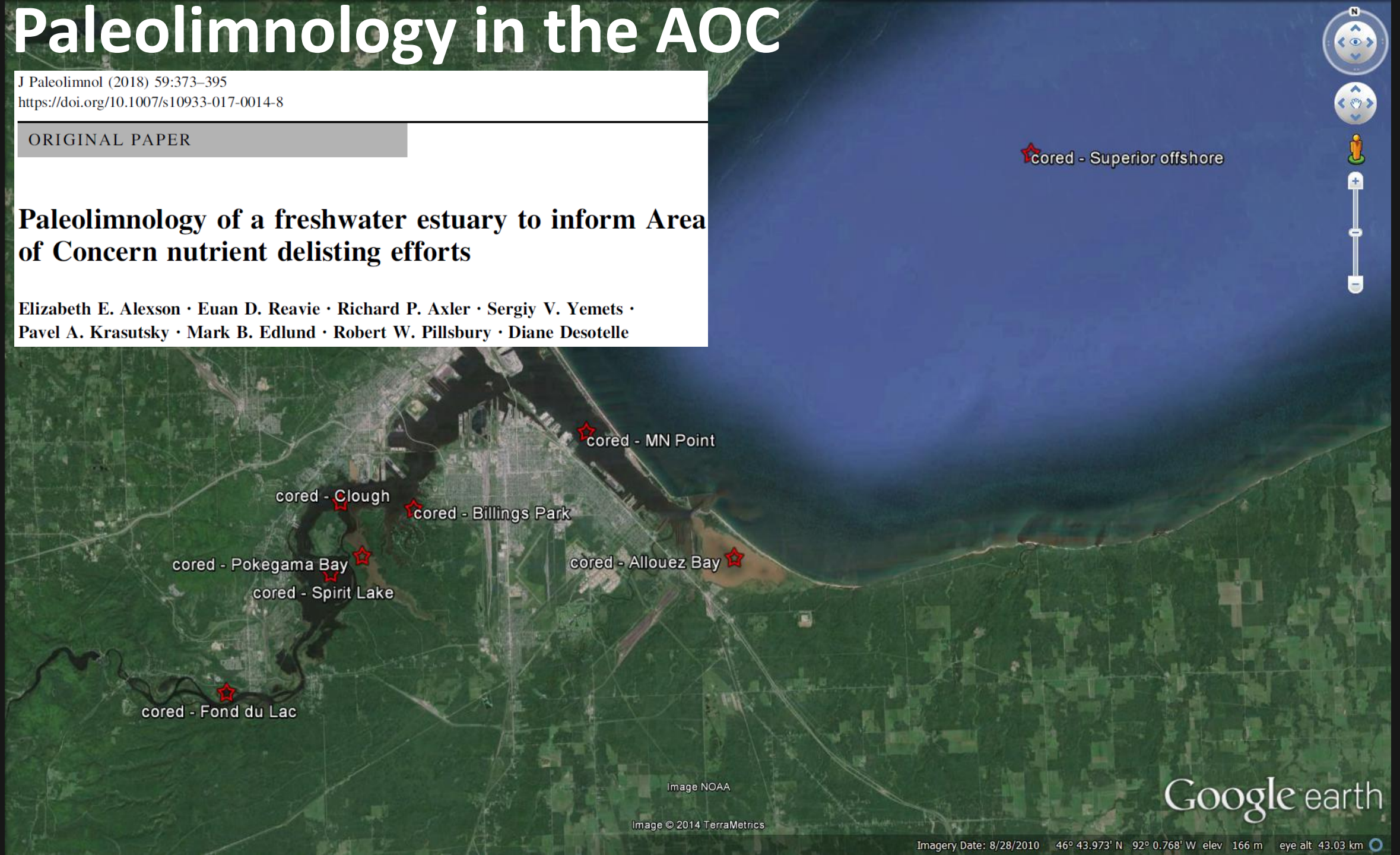


Image NOAA

Image © 2014 TerraMetrics

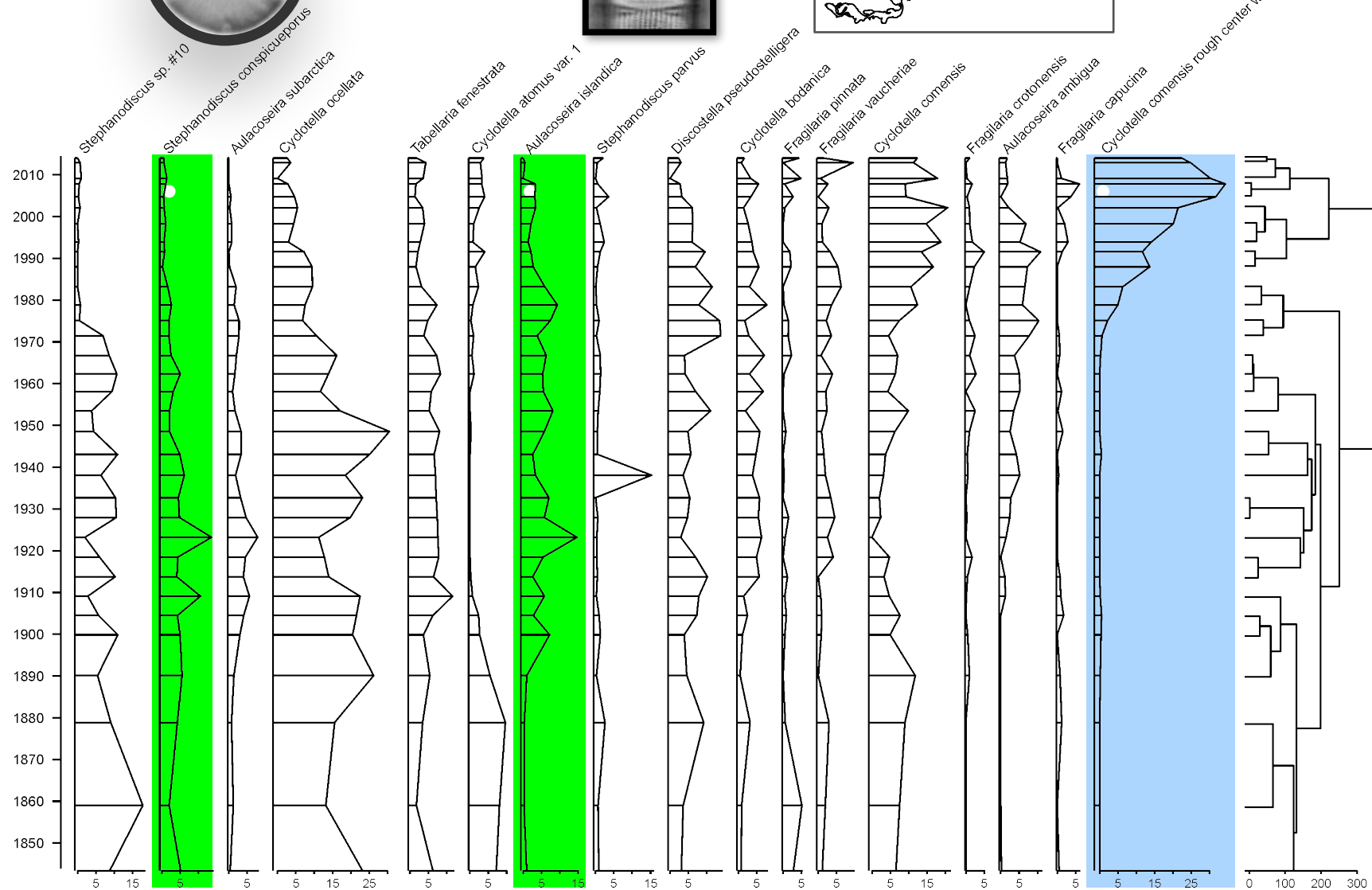
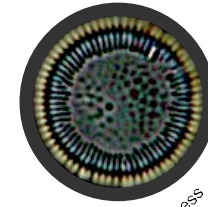
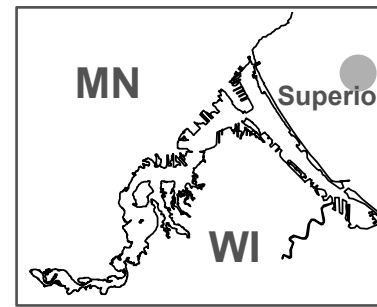
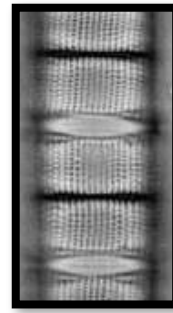
Imagery Date: 8/28/2010 46° 43.973' N 92° 0.768' W elev 166 m eye alt 43.03 km

Google earth

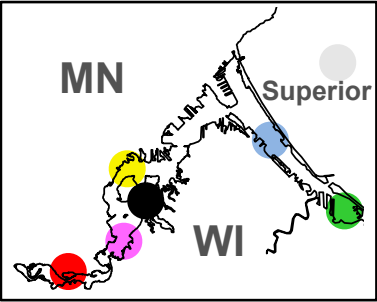
Coring 2014



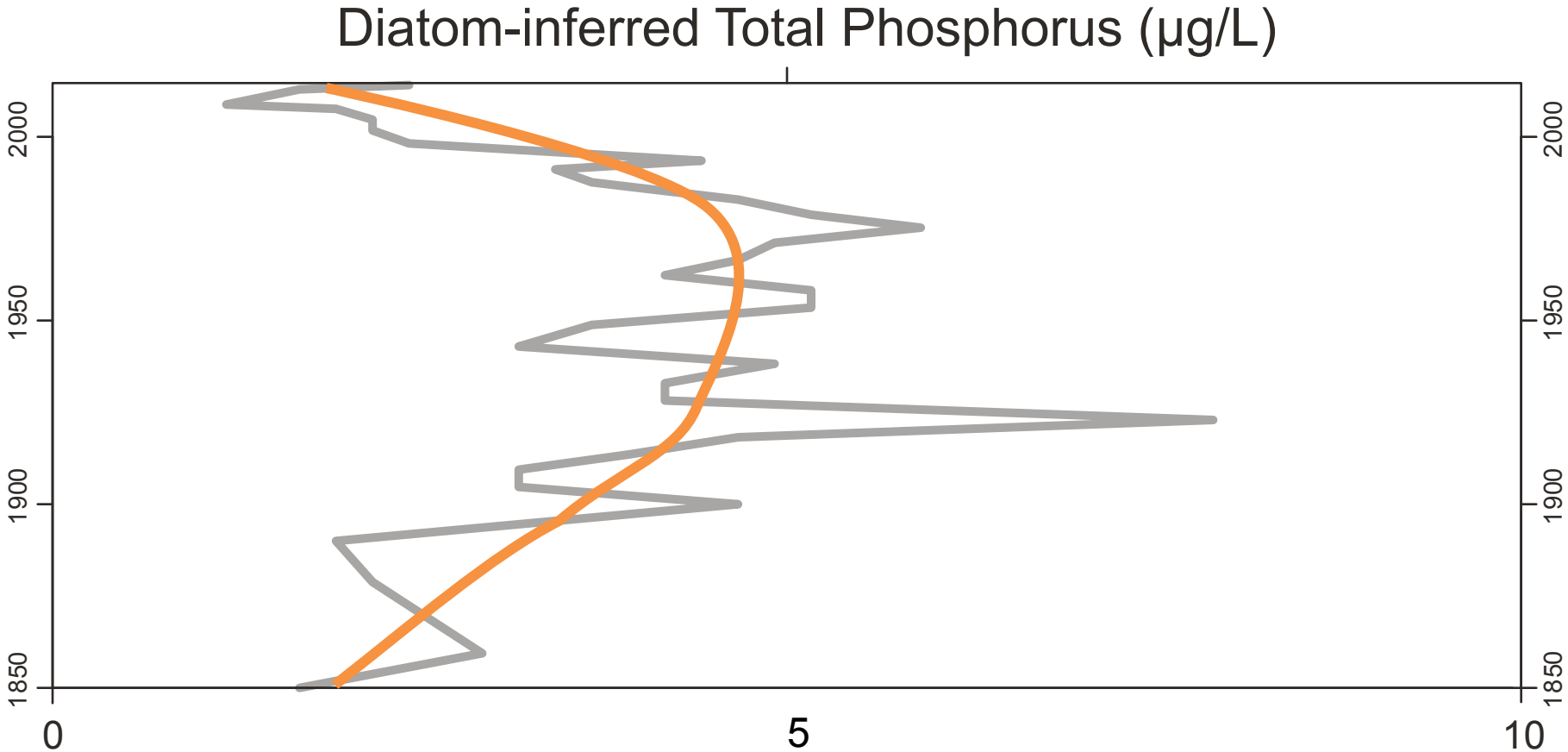
Superior diatoms



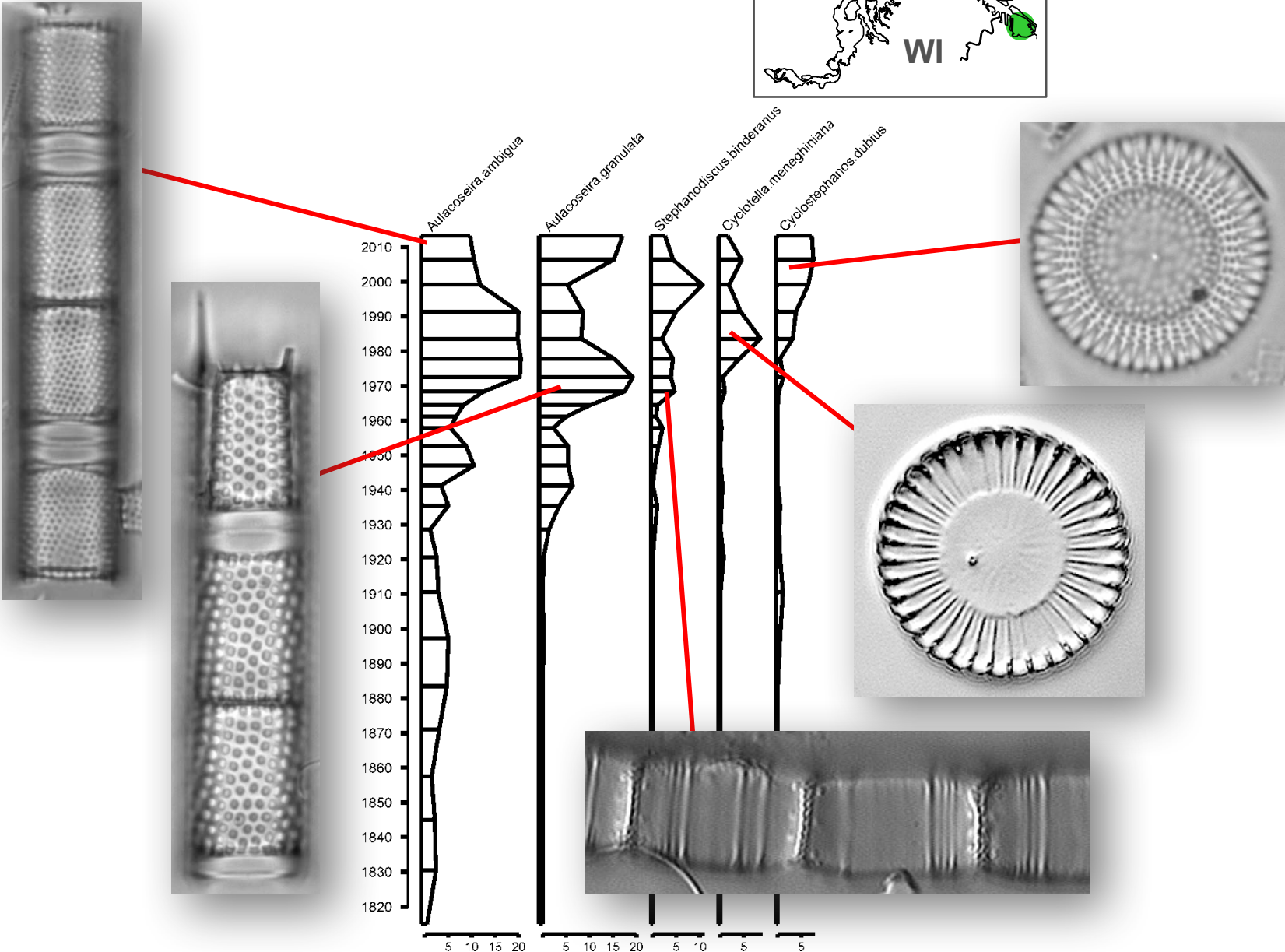
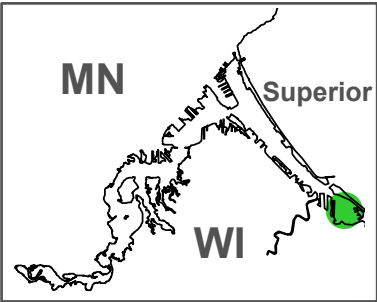
Diatom-inferred P:
Superior West
GOOD NEWS!



Superior West



Allouez Bay – NOT SO GOOD NEWS



The nutrient story...

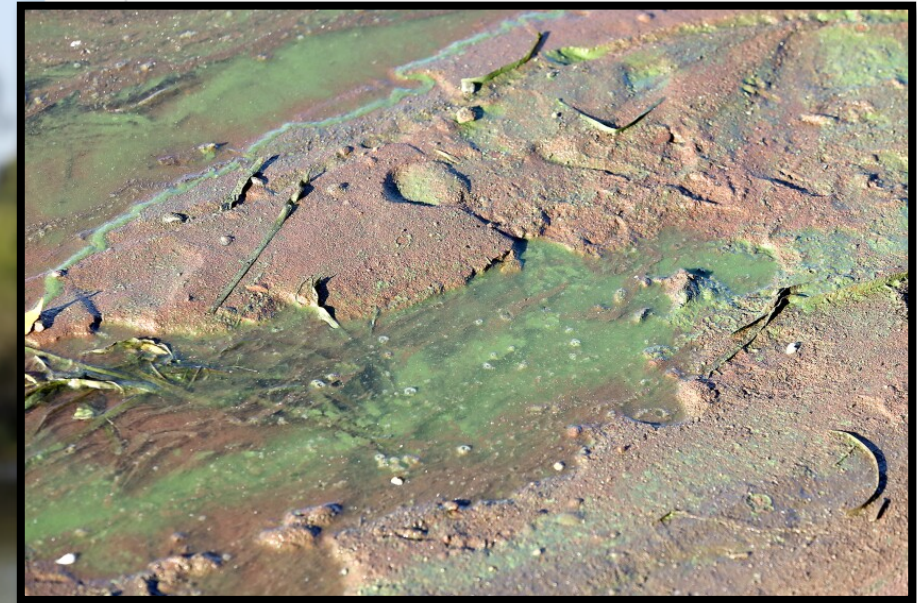
(What is the status of water quality in recent decades?)



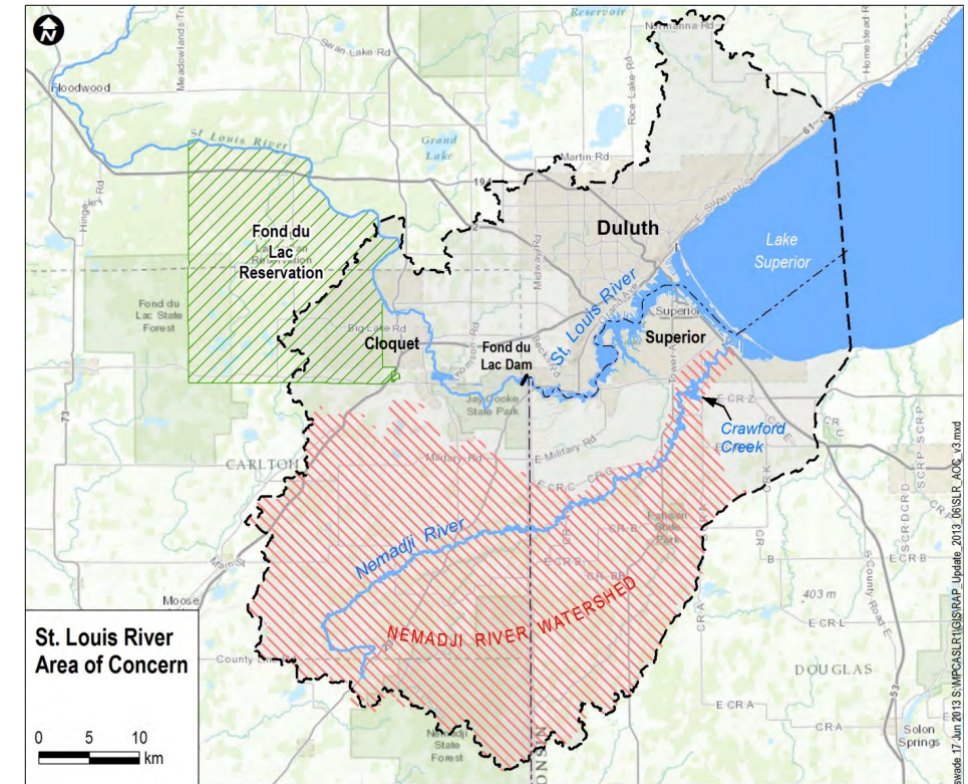
Algae blooms close Barker's Island beach

The photosynthetic bacteria can be harmful to people and pets through contact, ingestion or inhalation.

Superior Telegram
September 13, 2021



What do we need to know?

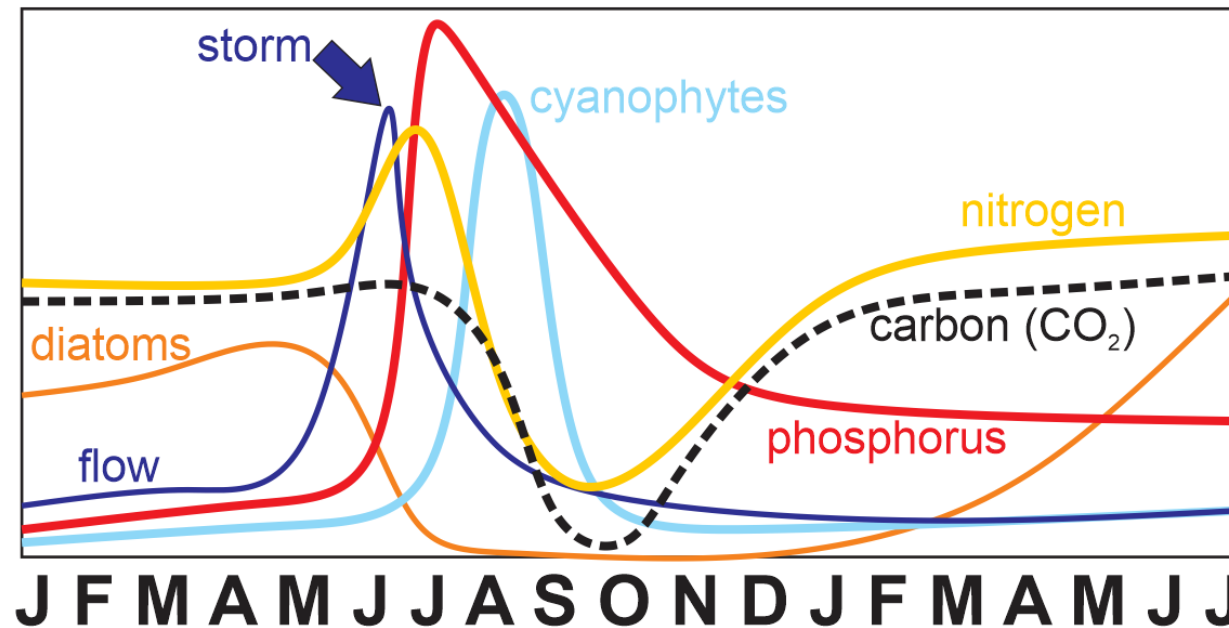


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Why is this happening?

- Blooms tend to occur weeks after extreme storms in western Superior (Sterner et al. 2020, *L&O* 65: 2984-2998)
- What are stoichiometric drivers?



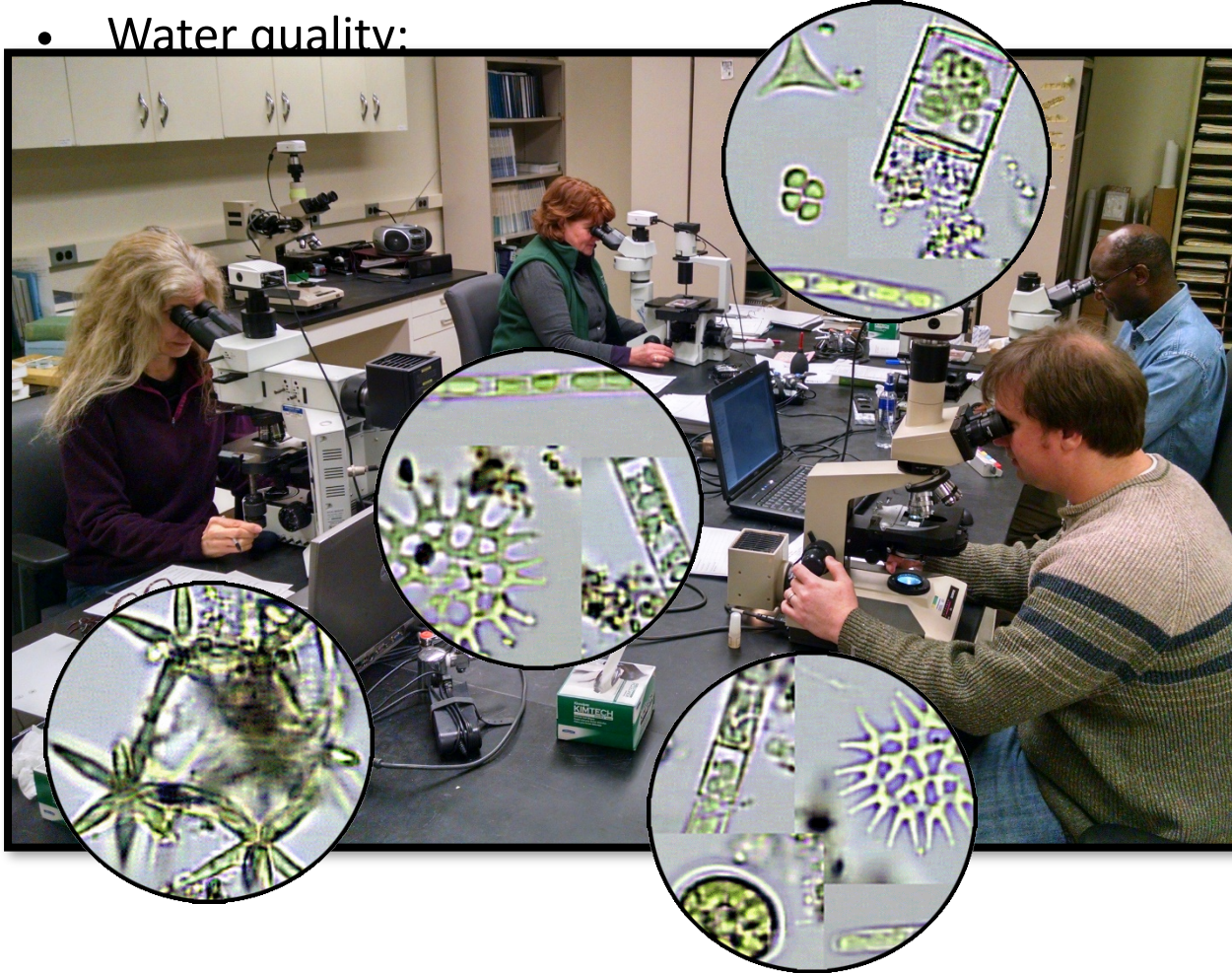
What do we need to monitor conditions into the future?



What is in a “sample set”?

From a specific location/time:

- Algal collection for community analysis (microscopy)
- Water quality:



What is in a “sample set”?

From a specific location/time:

- Algal collection for community analysis (microscopy)
- Water quality:
 - chlorophyll-a
 - total suspended solids
 - total phosphorus
 - orthophosphate,
 - total nitrogen
 - nitrates + nitrites
 - ammonia
 - total organic carbon
 - dissolved organic carbon
 - alkalinity
 - sonde standards (temperature, salinity, conductivity, pH, dissolved oxygen, turbidity, total algae fluorescence, dissolved organic carbon)
 - Secchi depth (clarity)



Sampling plans

- Sampling Jan. 1, 2023 – Sept. 30, 2024.
- 8 stations
- 304 sample sets
- Sampling every ~2 weeks; opportunistic higher frequency around storm events and/or blooms



Analysis plans

- Redundancy

Are we characterizing the system?

- Cause and effect

What is driving algal abundance?



Thank you!

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 @Milk_in_a_bag_

