

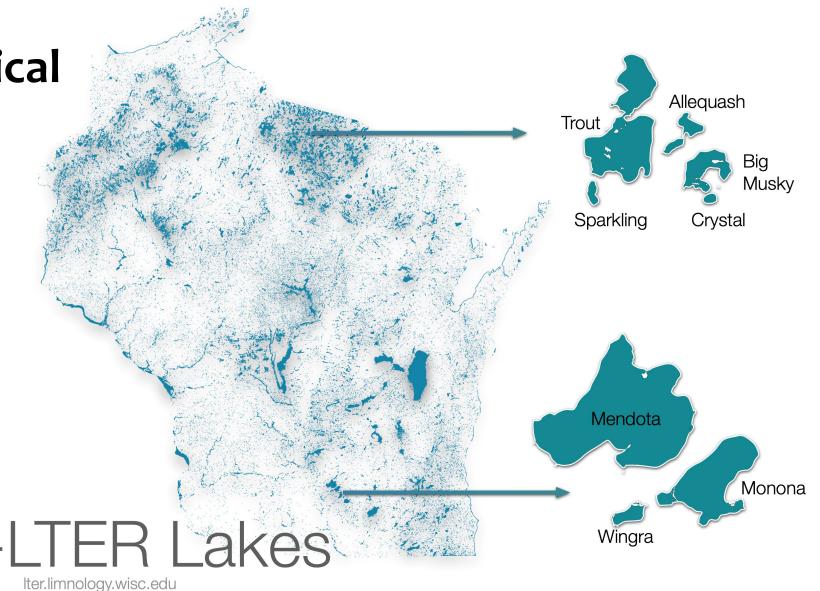
North Temperate Lakes

Long-Term Ecological Research Program

Continuously funded by the National Science Foundation for the past four decades

 Advance understanding of long-term lake dynamics

Generate and share long-term datasets



"Some of us remember that there was less snow last winter, or fishing was better a couple of years ago. It is the unusual person who senses with any precision changes occurring over decades.

Because we are unable to sense slow changes directly... processes acting over decades are hidden in

## 'the invisible present'

In the absence of long-term research, serious misjudgments can occur in our

### attempts to manage

the environment."

- John Magnuson, Center for Limnology





 Monthly, year-round monitoring of water quality on Mendota, Monona, Wingra

- Samples collected at multiple depths
- Summer surface sampling on Waubesa and Kegonsa



# **Physical Variables** Water clarity (Secchi depth) Dissolved oxygen • Stratification Yahara Lakes summer water clarity Secchi Depth (m)

2002

2006

2010

Year

2014

2018

2022

1998

Photo: Hilary Dugan

Lake

Depth (ft)

2026

Mendota

Monona



## **Water Chemistry**

- Nutrients (N + P)
- pH
- Carbon
- Chloride
- Cations (e.g., iron)

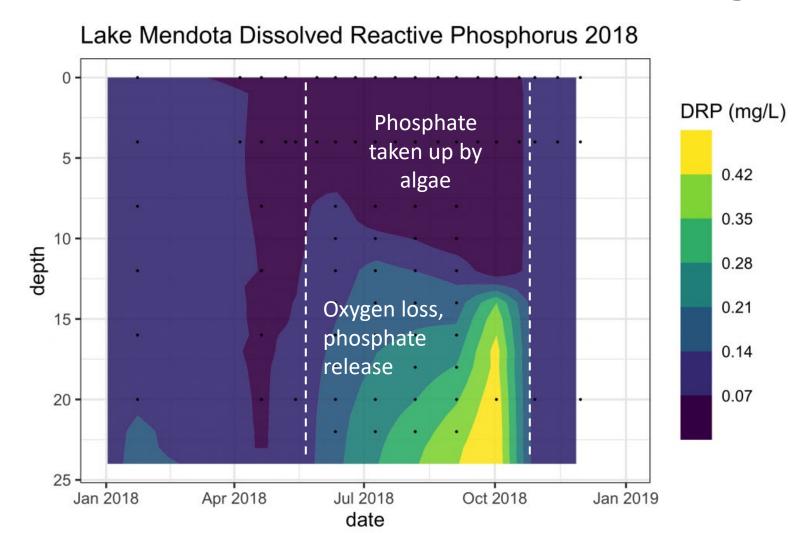




## **Biological Variables**

- Chlorophyll (index of algae abundance)
- Zooplankton
- Fish Biodiversity Surveys
- Aquatic Plant Surveys

# Comprehensive Monitoring to Understand Mechanisms Controlling Water Quality



- Mechanism:
  stratification leads to
  oxygen loss in bottom
  waters, release of
  phosphate from
  sediment
- Changing weather patterns altering this mechanism – how is water quality responding?



# **High Frequency Sensors**

- Measurements every minute of:
  - Temperature
  - dissolved oxygen
  - pH
  - Chlorophyll
  - Phycocyanin (index of cyanobacteria abundance)

#### **Condition Details**





Wind Speed **3.44 m.p.h.** 



Air Temperature 85.46° F





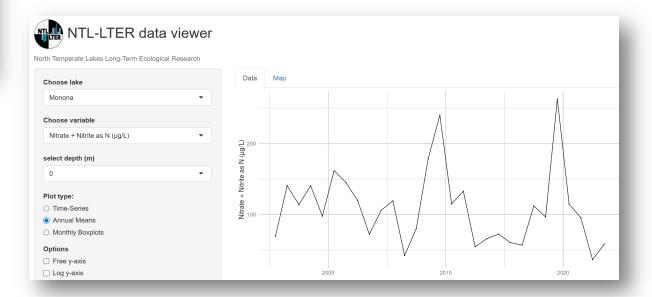
#### **Top Indirect-Impact Actions**

- 1. Continue to work together as Yahara CLEAN Compact members. Maintain ongoing member meetings to collaborate on recommended actions, report progress, and coordinate around new initiatives. Ongoing collaboration should consider how actions might affect the watershed phosphorus mass balance, among other factors.
- 2. Increase participation in producer-led watershed groups. Expand farmer involvement in conservation planning and practice adoption through continued learning, information sharing, and distribution of cost-share incentives.
- 3. Complete an inventory of shoreline and beach conditions. Establish guidelines and criteria for the sustainable design, development, management, and restoration of shorelines and public beaches.
- 4. Increase E. coli testing at public beaches. Focus efforts on beaches shown to be most susceptible to problems. Assess E. coli bacteria sources at beaches with high closure rates so corrective measures can be taken.

5. Continue to track and report progress. Use and support the annual State of the Lakes Report as a means of outreaching to the community. Support continued maintenance and operation of stream-gaging stations that track changes in phosphorus loading.

Renew the Blue

# Consistent, comprehensive, offshore water quality data for over 30 years



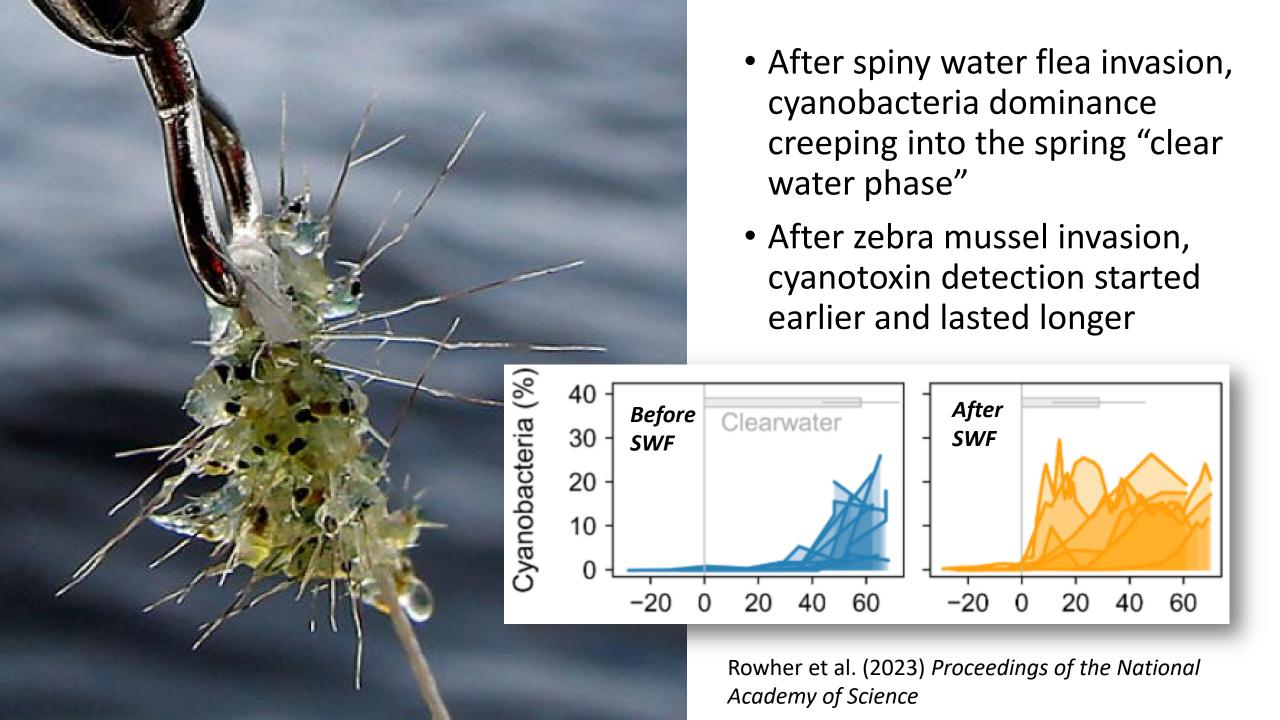
#### Dane County Water Quality Plan

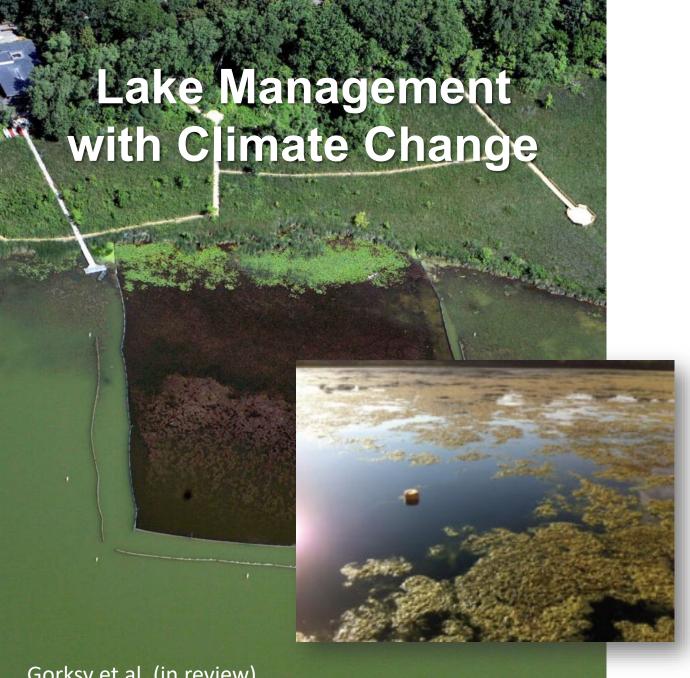
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**Appendix B Update** 

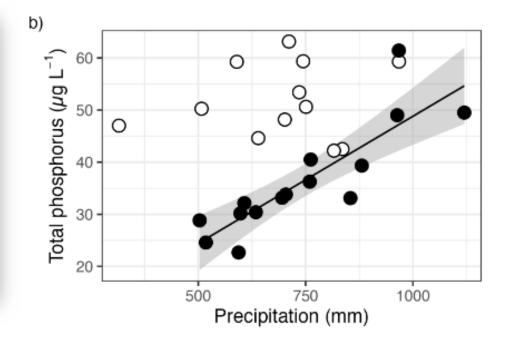
**Surface Water Quality Conditions** 



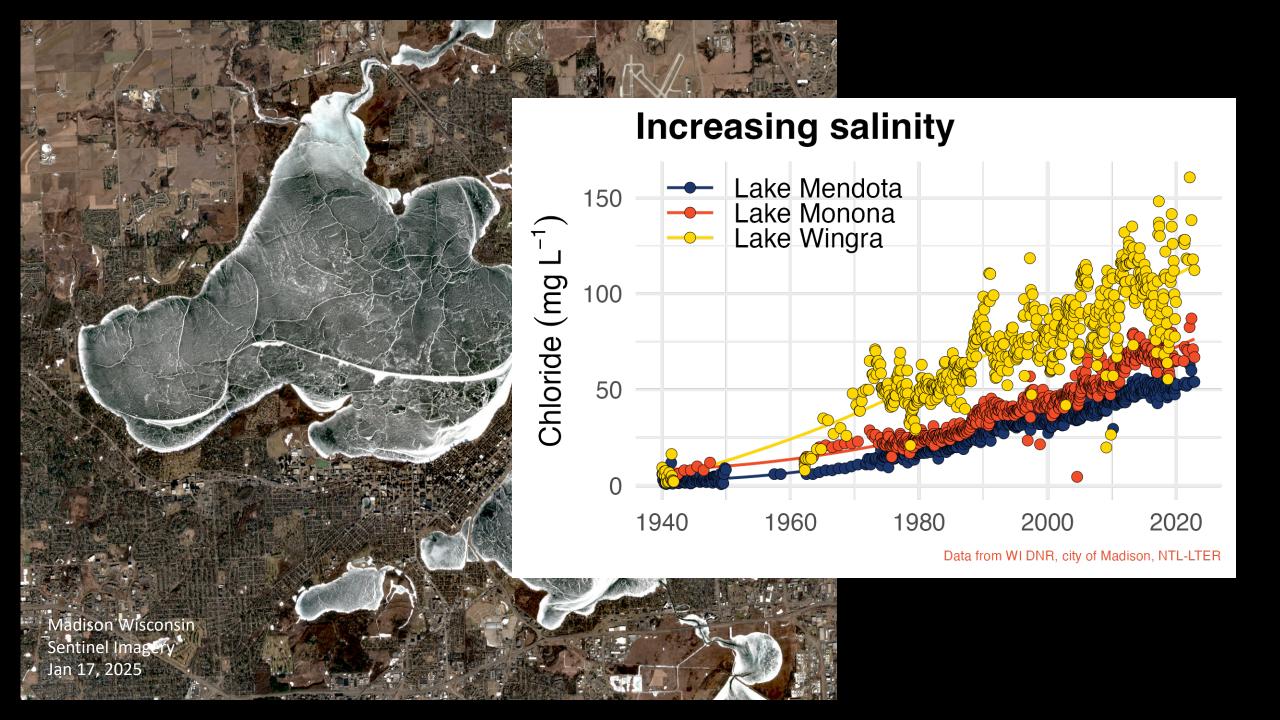




- Carp removal in Wingra very successful, sustained
- After removal, nutrient concentrations in Wingra are sensitive to precipitation
- Filamentous algae influenced by rain and zooplankton

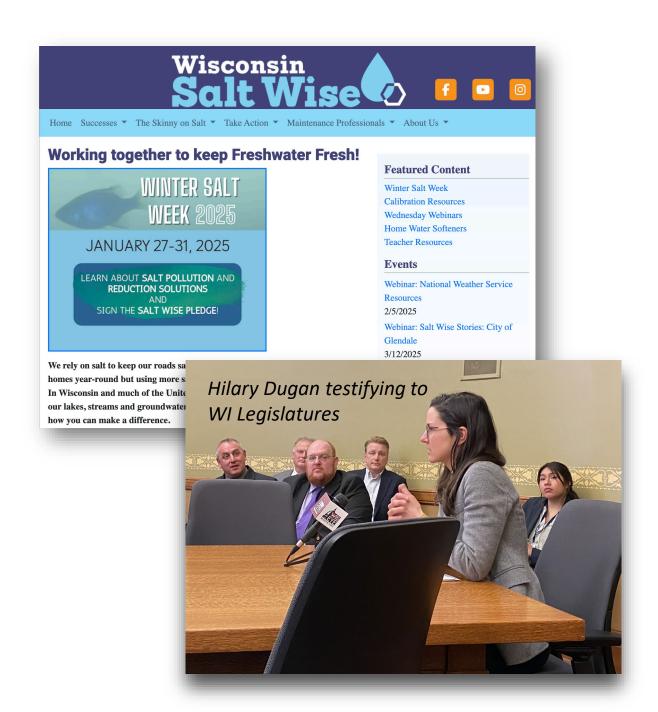


Gorksy et al. (in review)



# Salt impacts water resources

- Disruption of aquatic organismal development
- Effects on biogeochemical cycling
- Changes water density → physics
- Plant growth and diversity
- Changes soil texture
- Increases contaminant transport
- Favors non-native species
- Degrades drinking water quality and infrastructure







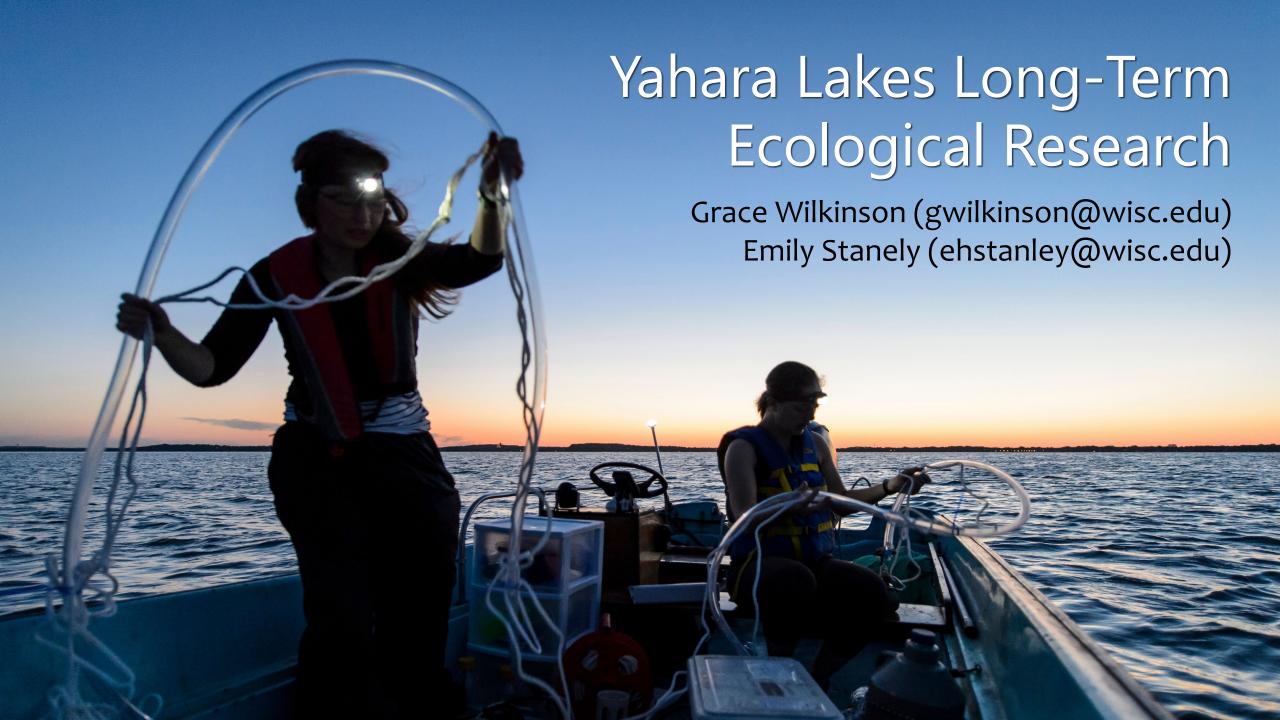


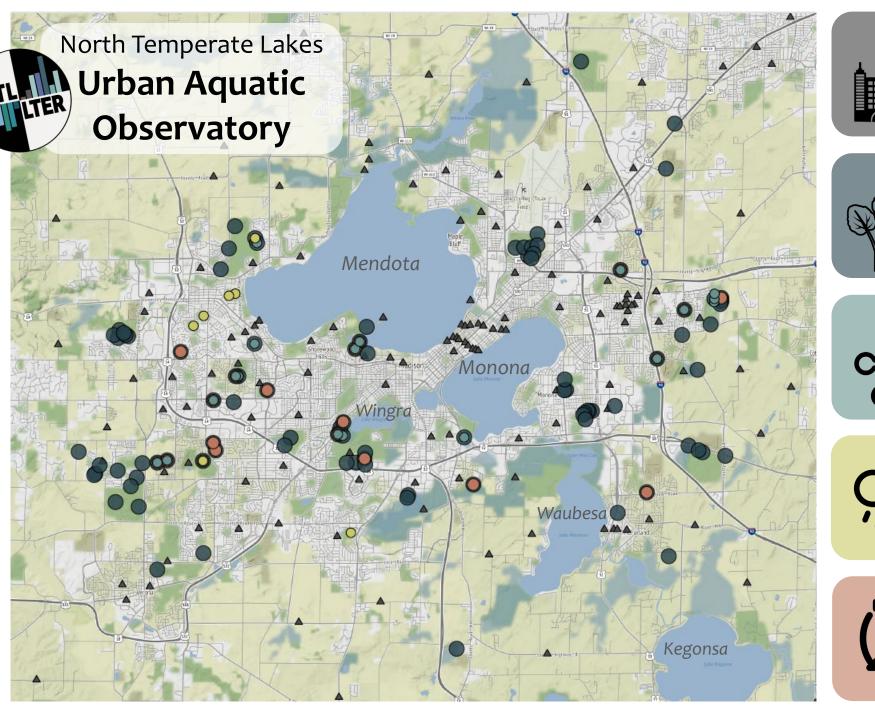




Turning Science into Stewardship









heat island, canopy cover



community structure (68)



GHG, carbon stock (20)



temporal dynamics (7)



hydrology, storms (20)