The Coastal Lakes Observing Network (CLONet): a combined community – university – state monitoring and research program

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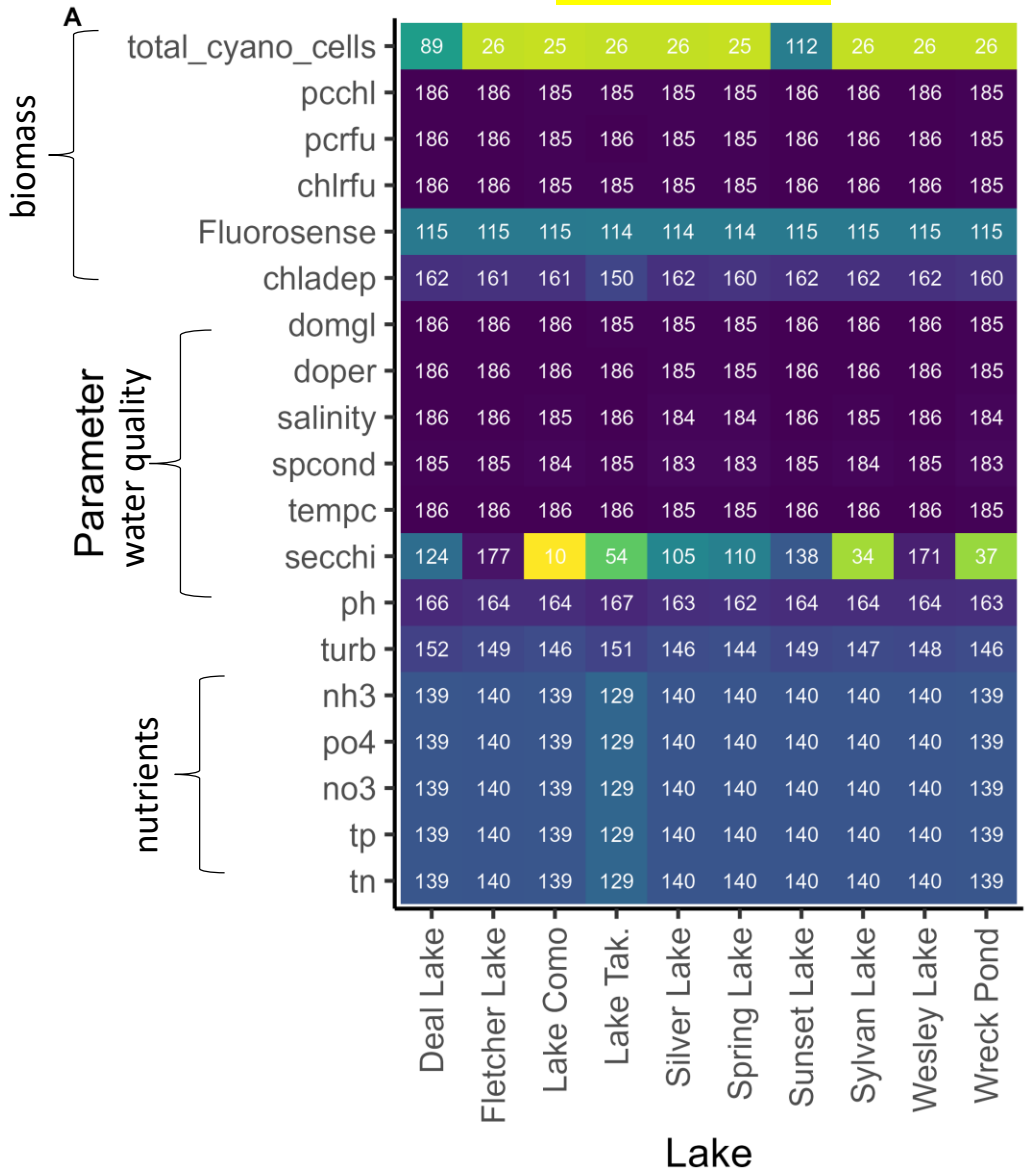
2. Monmouth University, Urban Coast Institute, West Long Branch, NJ

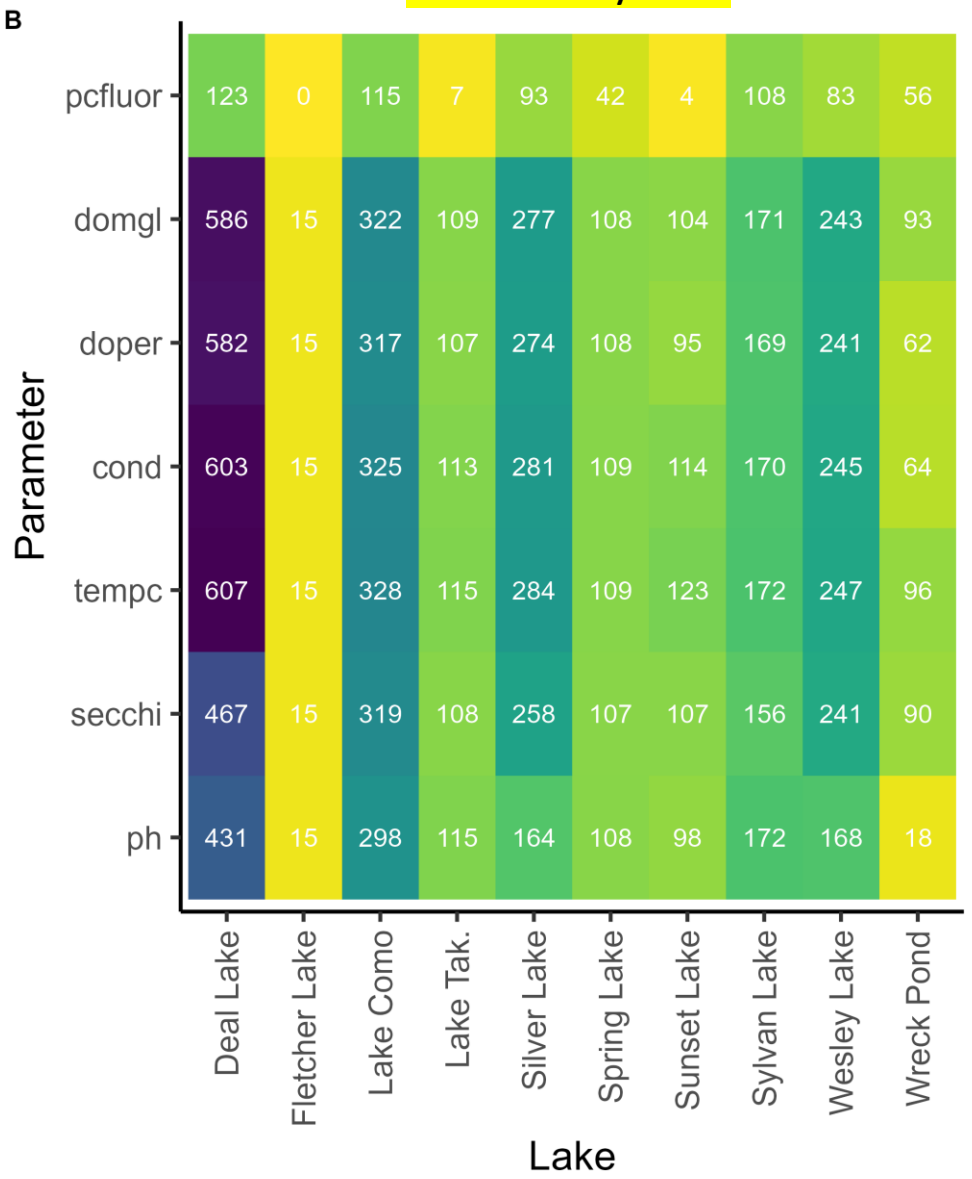
June 23, 2025
Monmouth University
Coastal Lakes Meeting

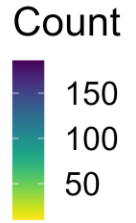
Data inventory – PHAB and community projects

PHABLab data



Community data





Rainfall data - https://njdep.rutgers.edu/rainfall/ NWS Multisensor Precip. Estimator

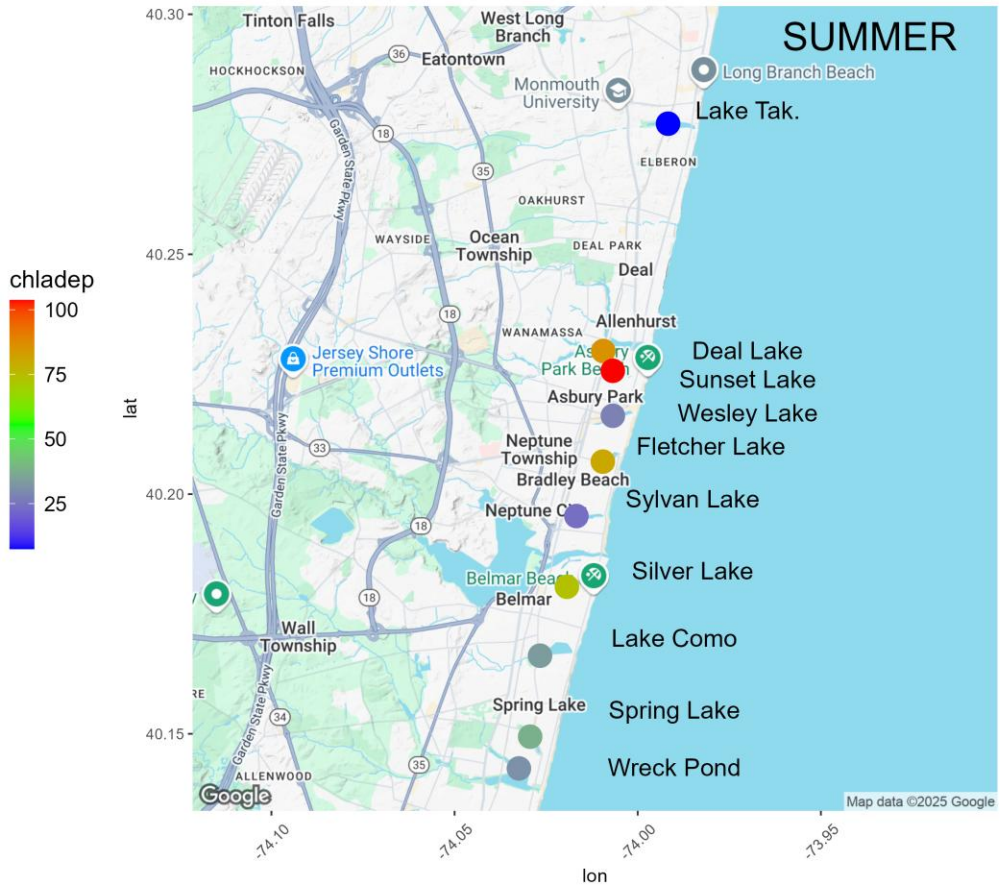
Watershed data – Area, Pop. Density, Land use / Land Cover

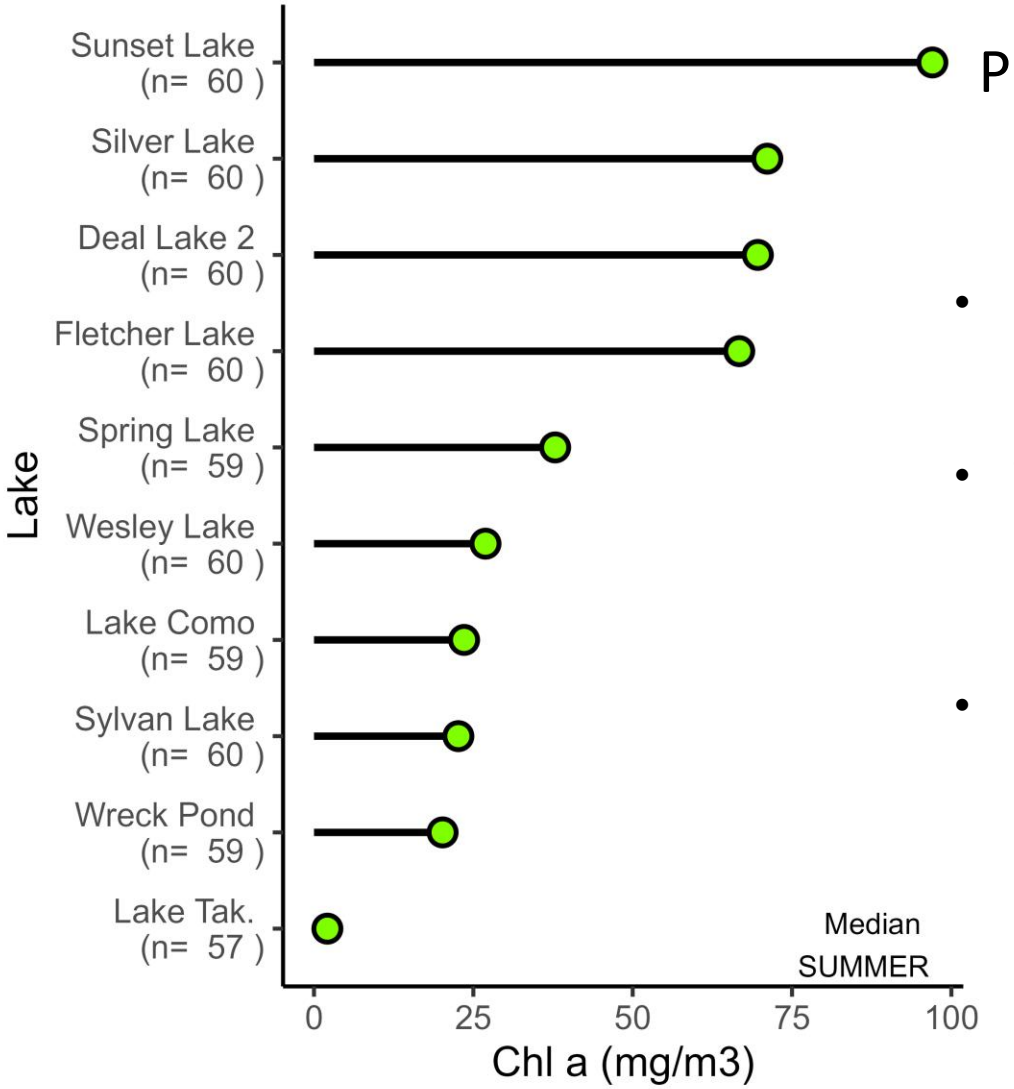
PHAB & Community Sampling Over Time

https://jadolf-phab-apps.shinyapps.io/CLONet_data_explorer/

Chl *a* (phytoplankton biomass)

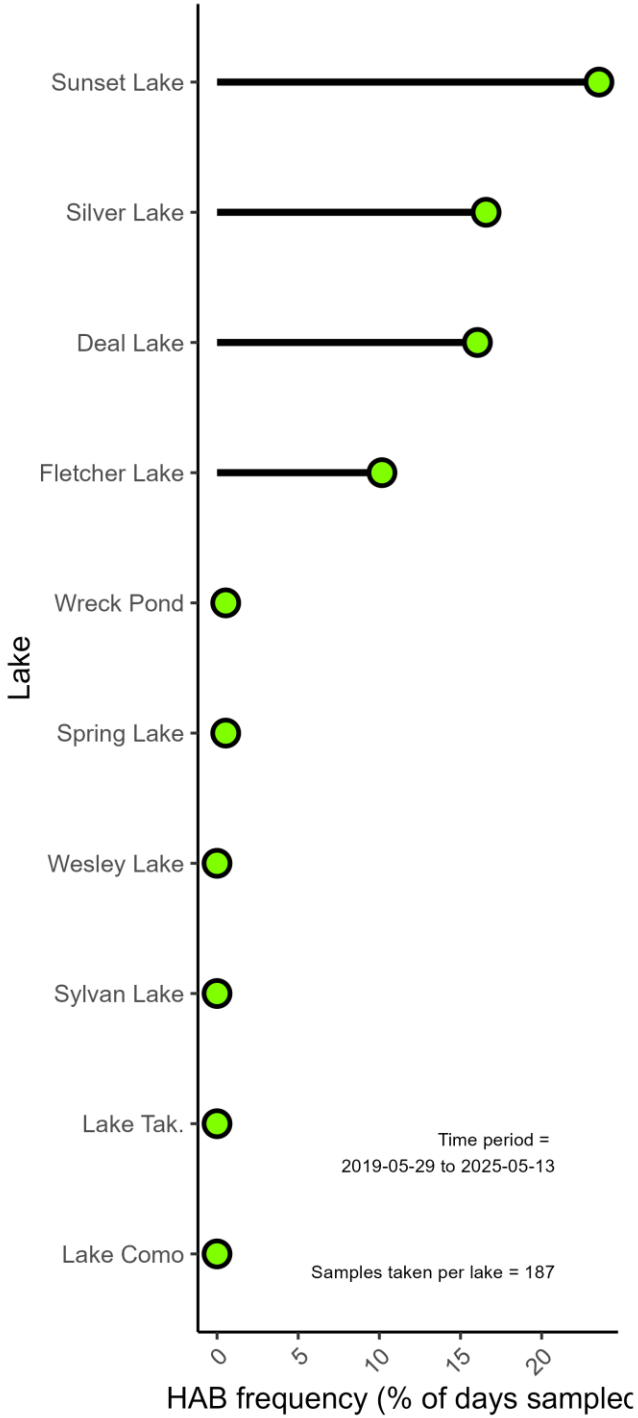
A measurement of the pigment (Chl *a*) shared by all phytoplankton. High Chl *a* is an indication of eutrophication caused by nutrient over-enrichment. **This is a good "metric" for improvements to water quality in coastal lakes.**

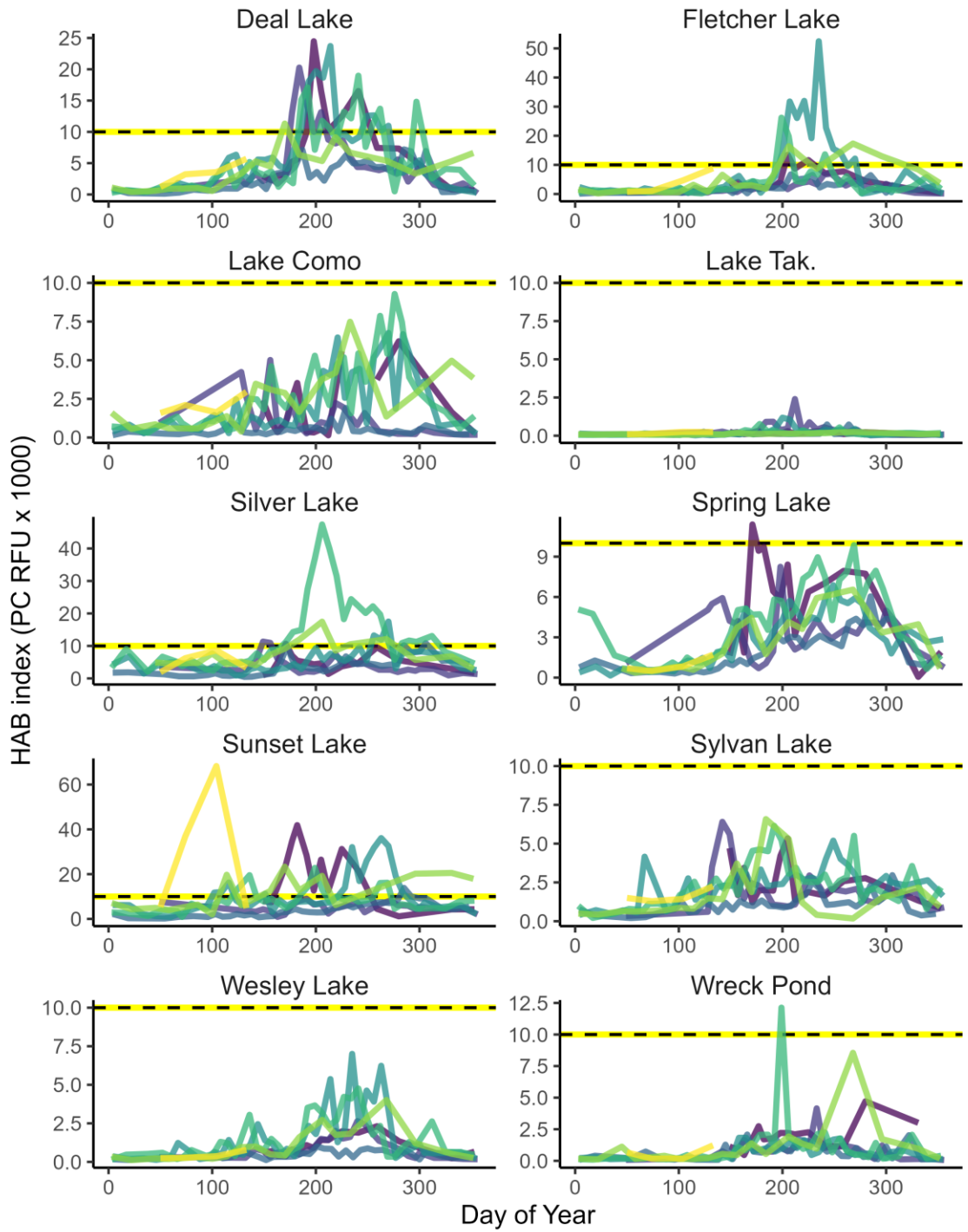




PHAB / NJDEP data has shown:

- A wide range among lakes
- Trophic status based on Chl *a* is more variable than based on Secchi
- May be a better target for restoration



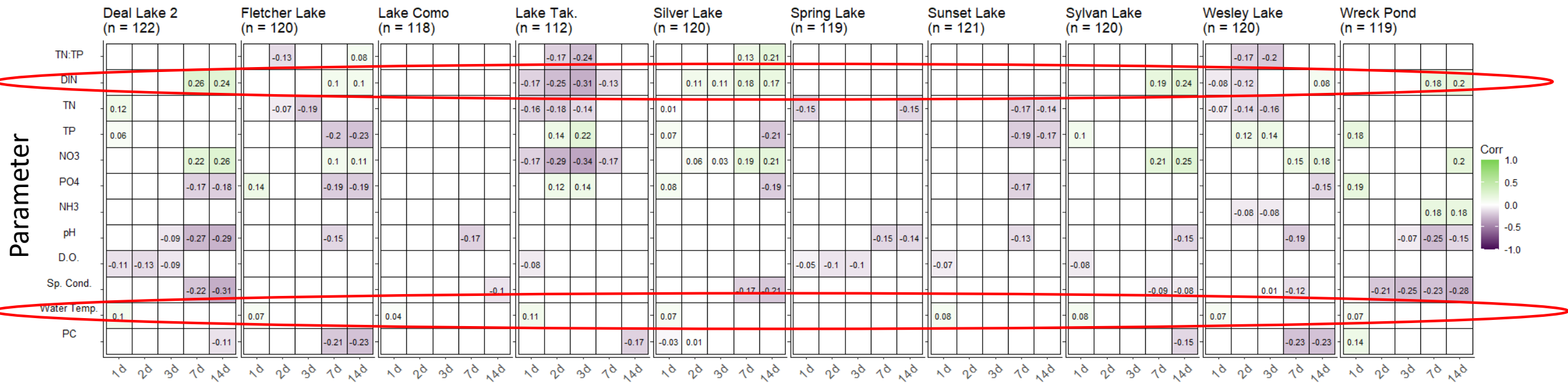


Harmful Algal Bloom days:

- The top 4 “Habbiest” lakes showed signs of HABs 10 – 25% of days sampled.
- Other lakes never show HAB signs
- **Reduction in (or low) # HAB days is a good goal for lake restoration**

Rainfall influences coastal lakes

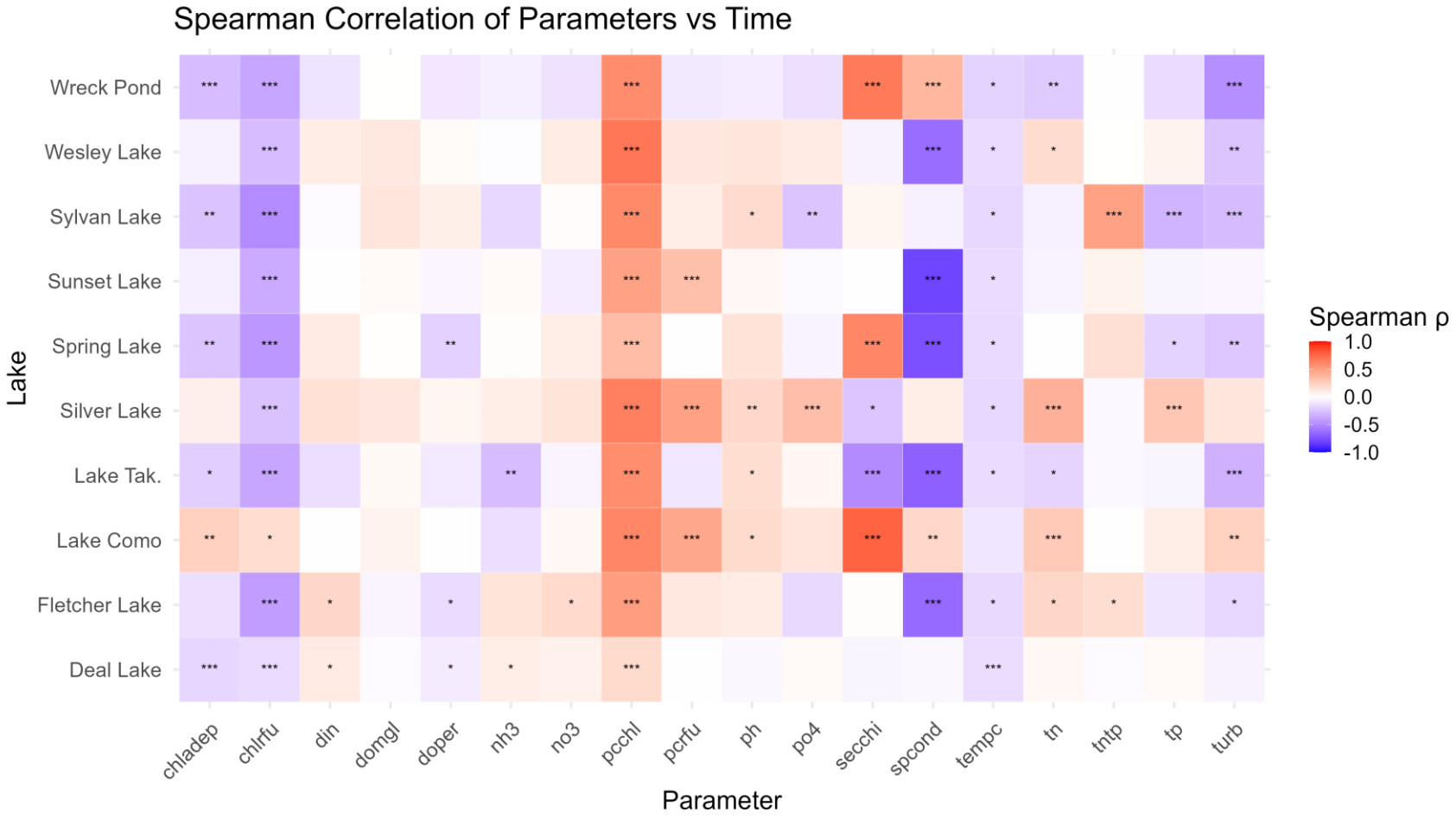
Rainfall brings nutrients to the lakes, feeding algal growth and eutrophication. **This points to the importance of watershed restoration for coastal lake restoration!**



Cumulative period of rainfall (days)

Trends over time

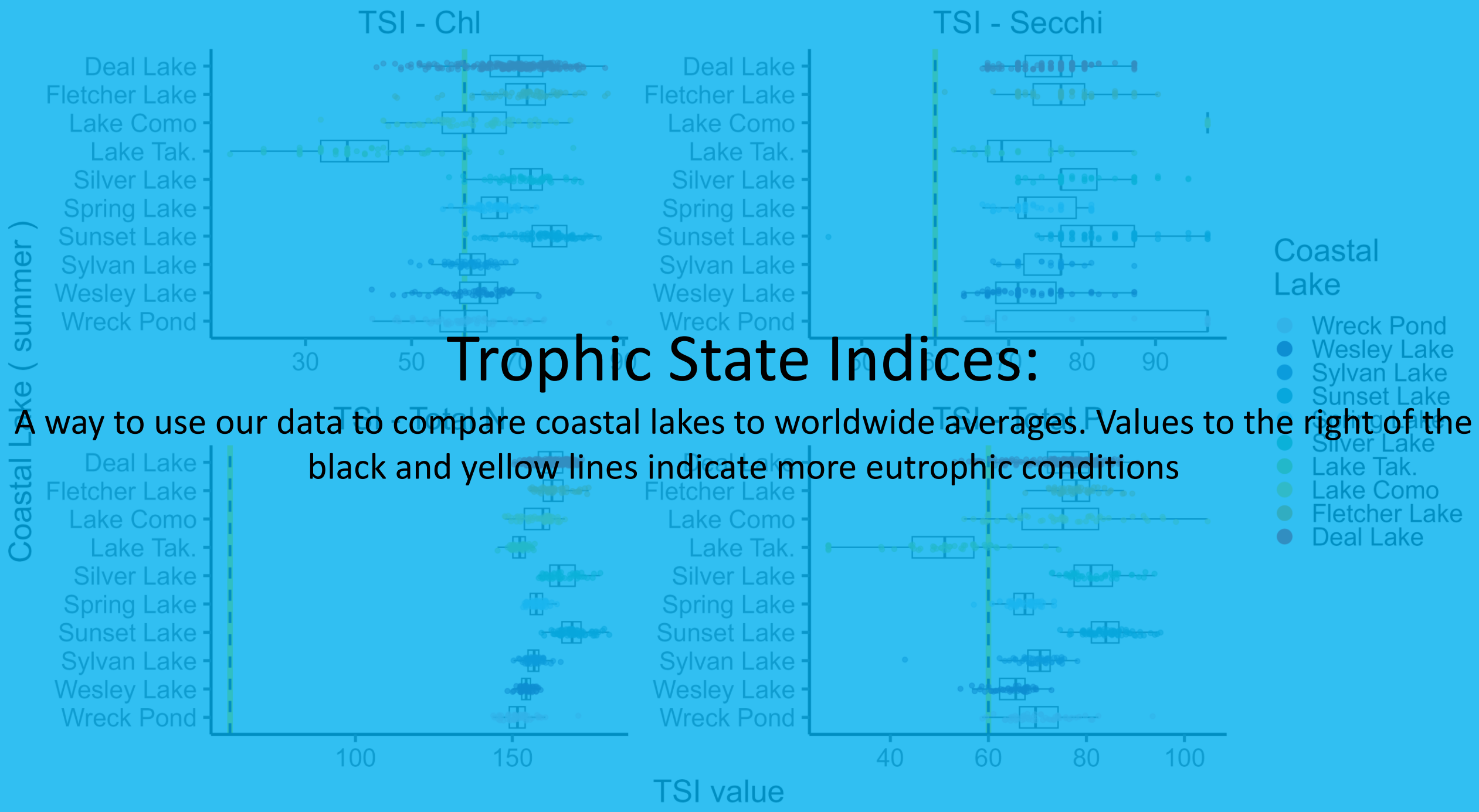
Long datasets like CLONet allow us to detect potential changes over time – an important way to track restiration

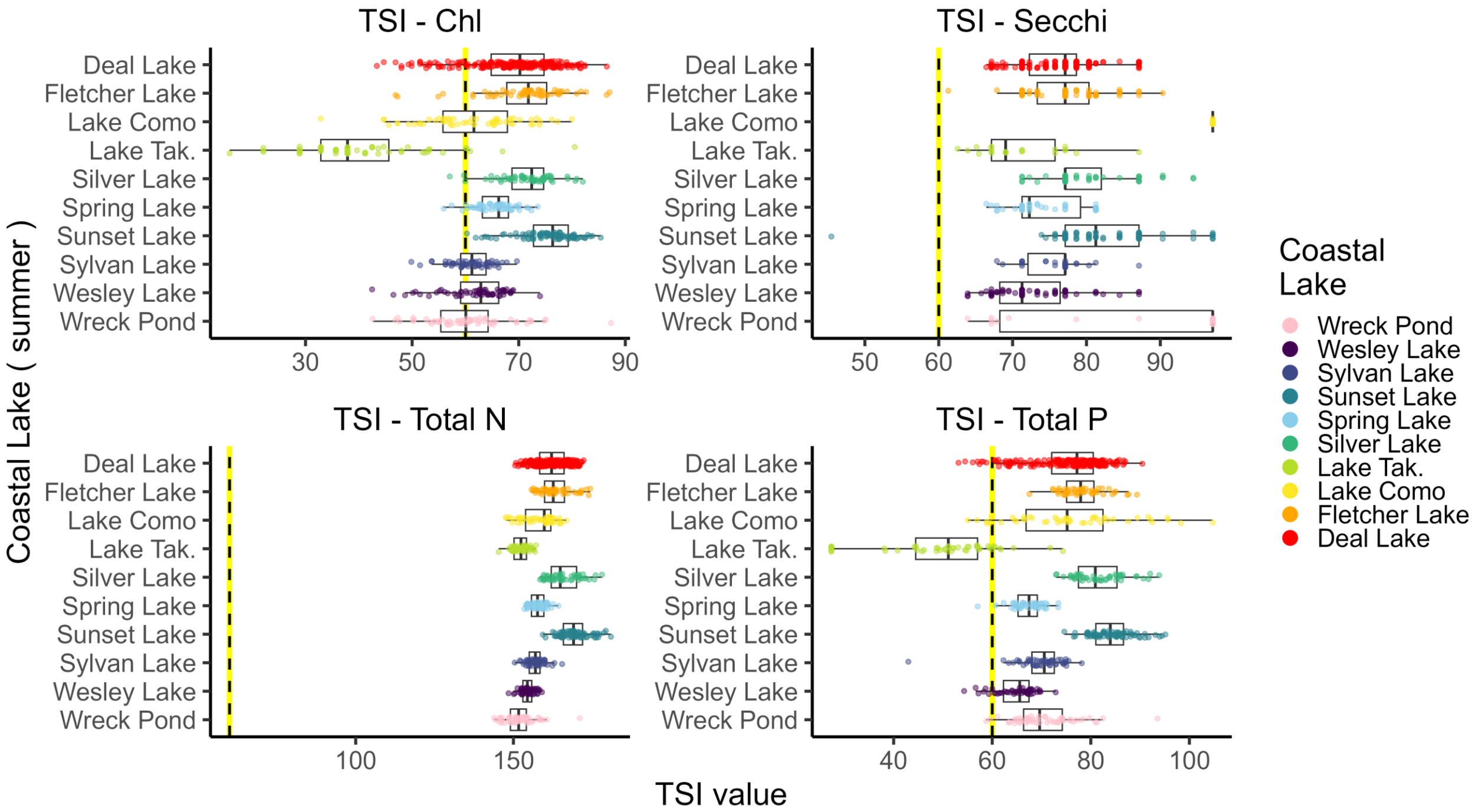


- Just beginning to look at this
  - Red = increasing
  - Blue = decreasing
  - Biggest trend popping up is increase in cyanobacteria in Lake Como, Silver Lake, and Sunset Lake

Trophic State Indices:

A way to use our data to compare coastal lakes to worldwide averages. Values to the right of the black and yellow lines indicate more eutrophic conditions



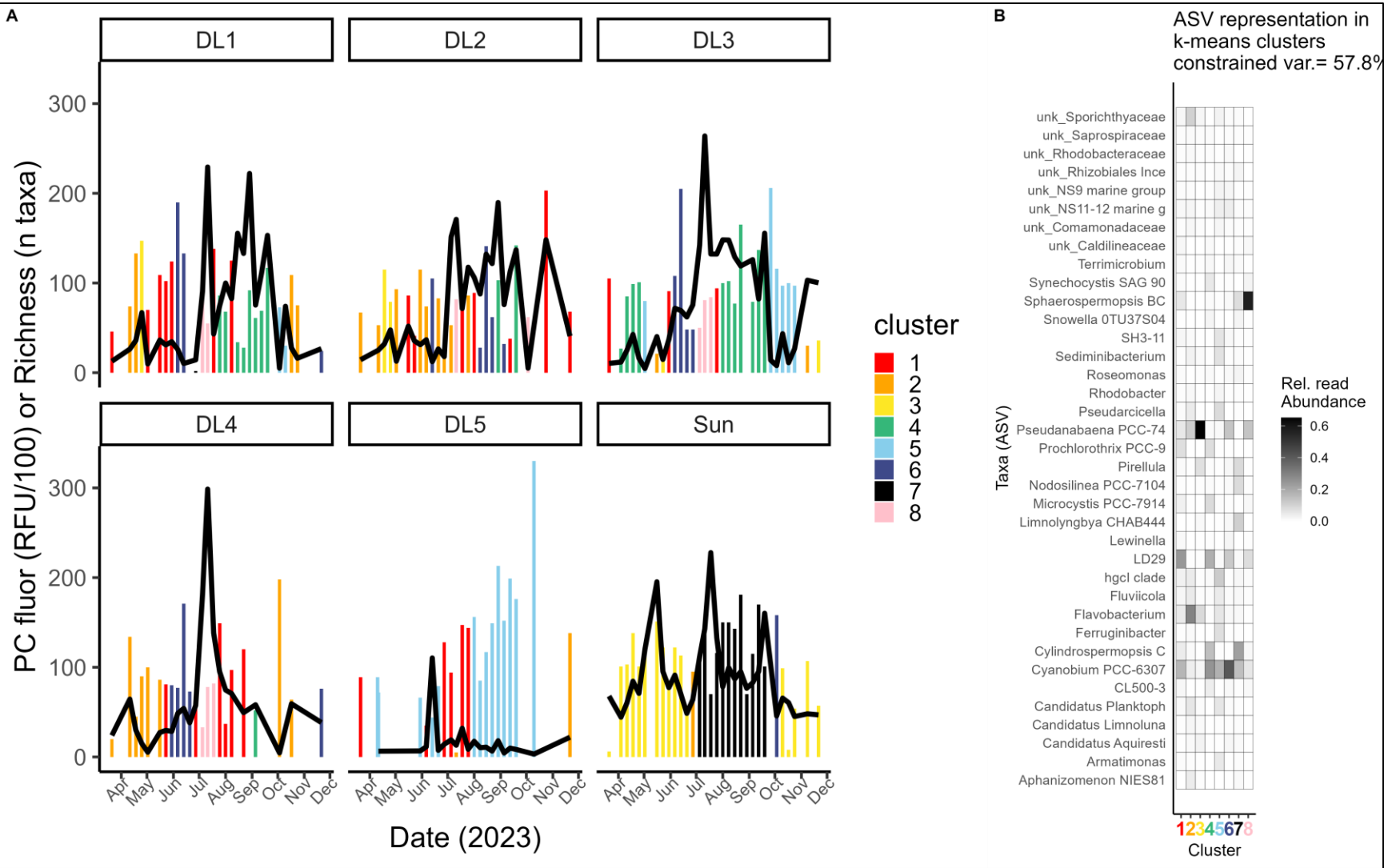

TSI - Chl
TSI - Secchi
TSI - Total N
TSI - Total P
Deal Lake
Fletcher Lake
Lake Como
Lake Tak.
Silver Lake
Spring Lake
Sunset Lake
Sylvan Lake
Wesley Lake
Wreck Pond
30
50
70
90
50
60
70
80
90
100
150
40
60
80
100
Coastal Lake (summer)
TSI value
Coastal Lake
Wreck Pond
Wesley Lake
Sylvan Lake
Sunset Lake
Spring Lake
Silver Lake
Lake Tak.
Lake Como
Fletcher Lake
Deal Lake

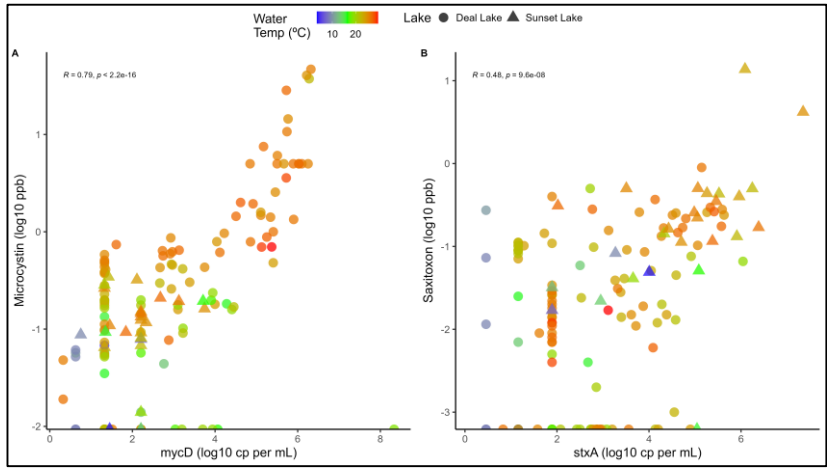
Harmful Algal Blooms in Select New Jersey Coastal Lakes

Final report submitted to NJDEP May, 2025

A portion of this work used environmental DNA, qPCR, and metabarcoding to identify specific genetic signals associated with HABs and toxicity. *New potential tools for monitoring and management of HABs.*

Diederik Boonman-Morales at the US HAB symposium 2024





Conclusions

- Coastal lakes show a range of conditions but share in common conditions that indicate degraded / eutrophic conditions that can and should be improved.

- Community and PHAB / NJDEP data both show strong relationships between stormwater runoff and lake conditions – **Watershed Management!**

- Community / PHAB / NJDEP data points to specific problems and provides important baselines from which improvements can be tracked as restoration activities proceed.

Thank you for your attention

- Questions?

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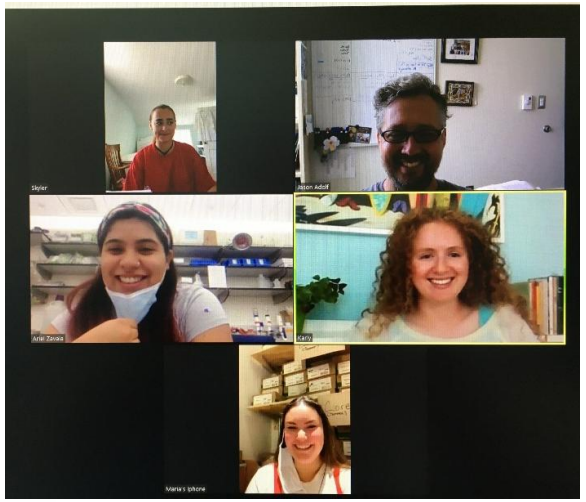
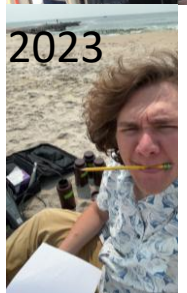
MONMOUTH UNIVERSITY PHABLAB

monmouth_phab_lab





Deal Lake Dissolved oxygen

Deal Lake Ocean connectivity

Acknowledgements

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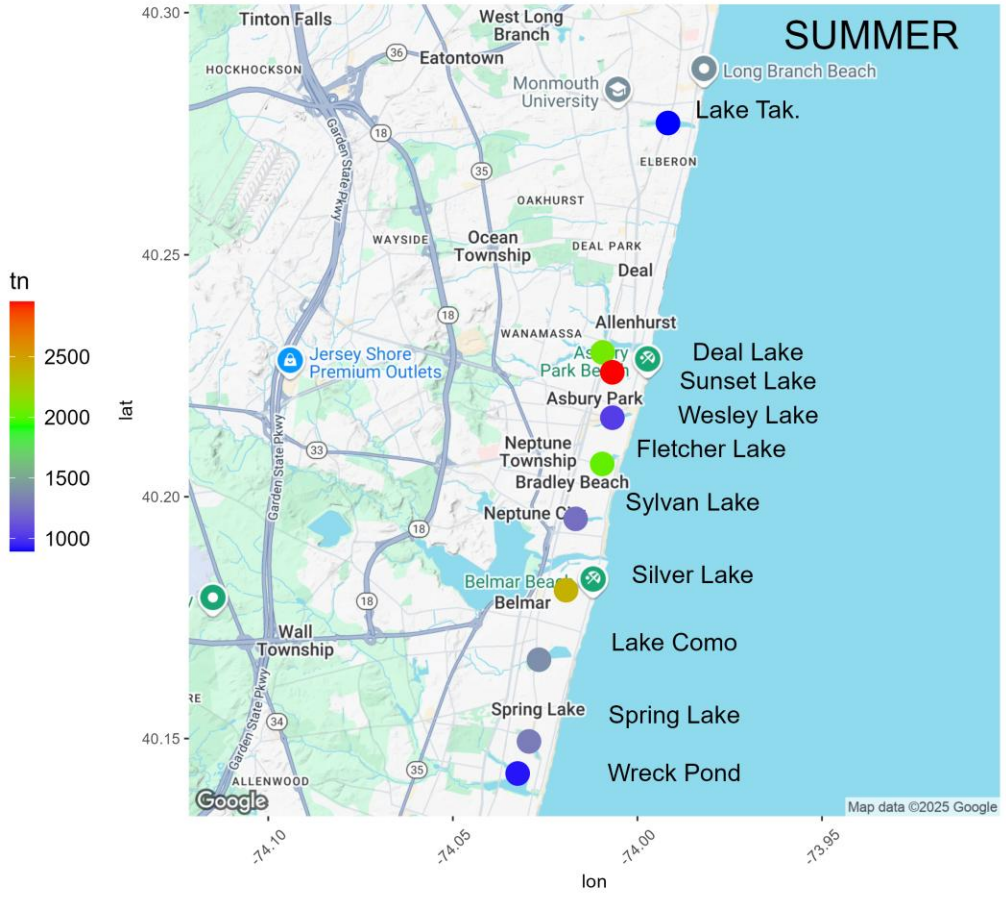
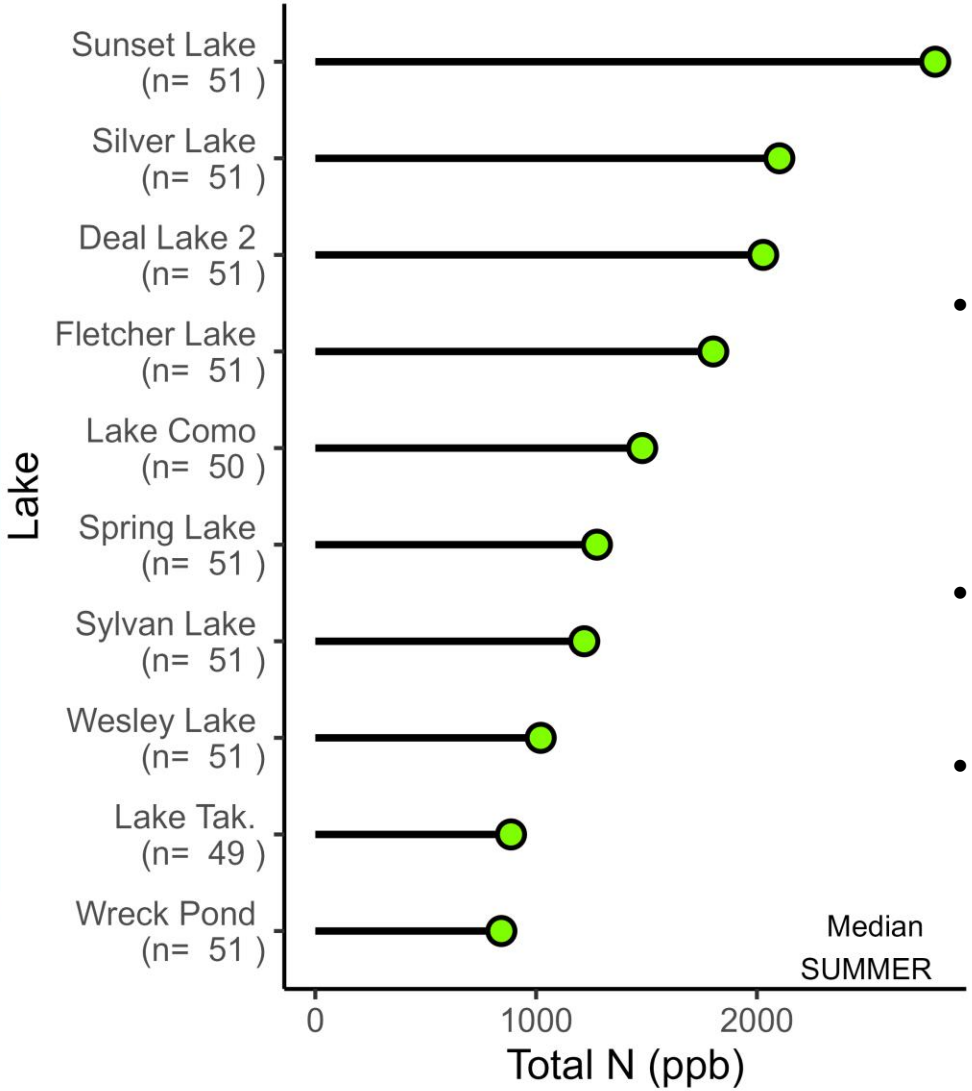
NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

Robert Schuster, Bill Heddendorf, Eric Ernst, Bri Morgan, Dawn Thompson, Sherri Shifrin, Rob Newby

Total Nitrogen

A chemical measurement of all the N in the lake, includes dissolved and particulate fractions. TN is a common indicator of eutrophic conditions (along with Total Phosphorus).



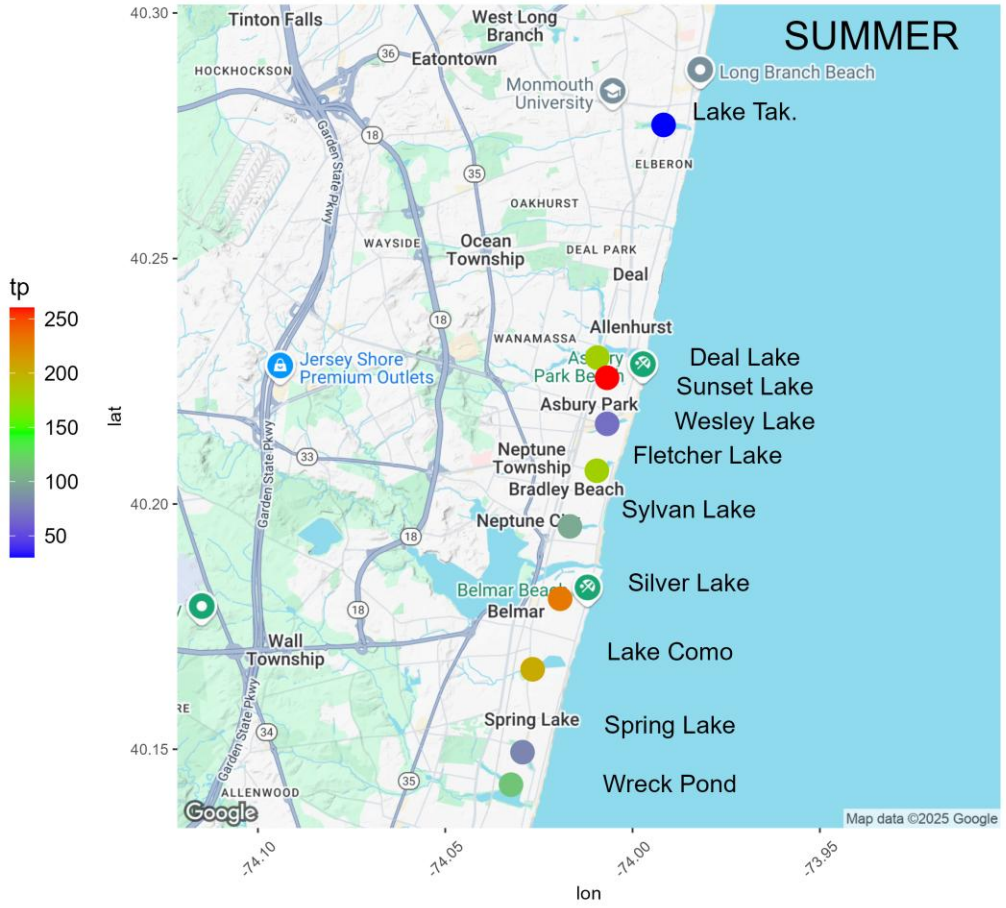


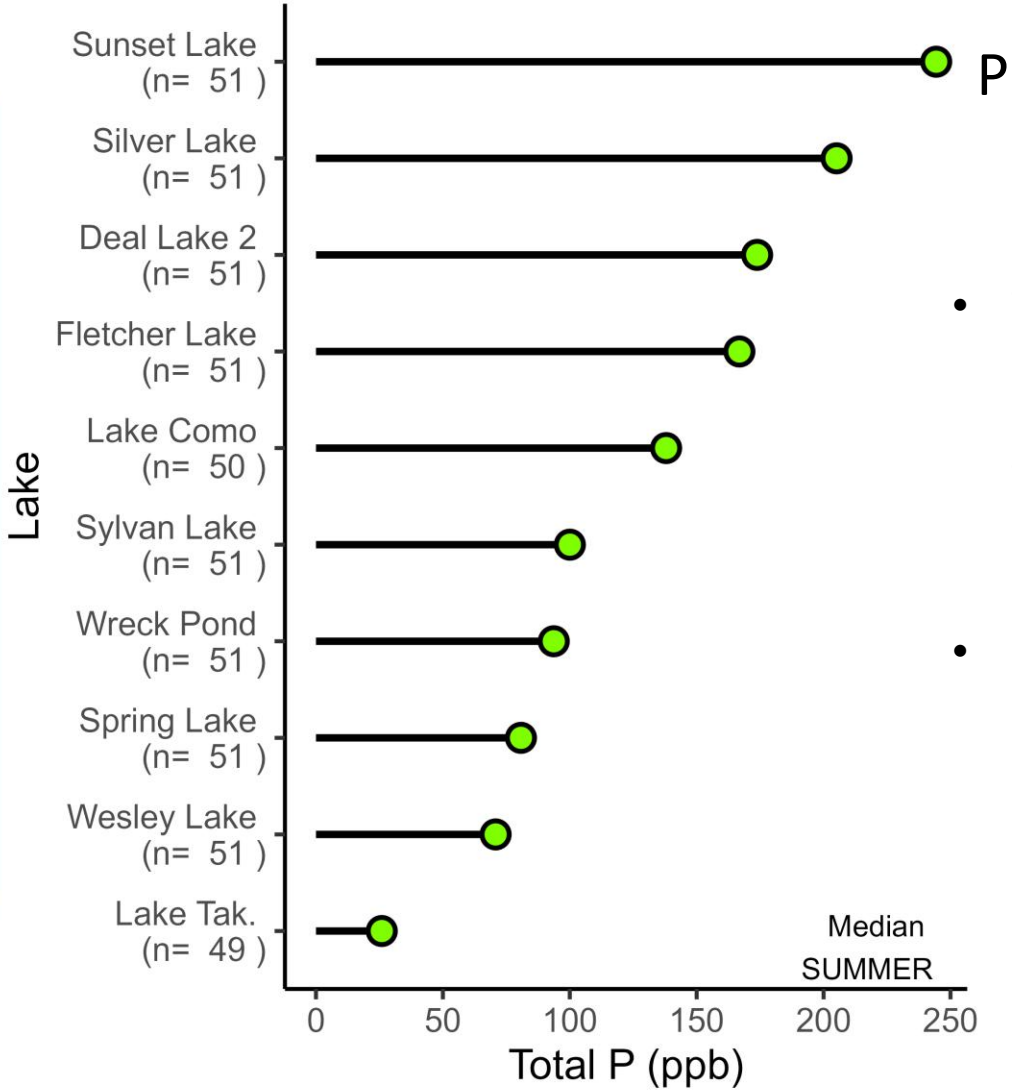
PHAB / NJDEP data has shown:

- Coastal lakes have relatively high TN compared to other NJ lakes
- HABs and TN tend to go together
- In summer, lakes can be N-limited (e.g. more N, more algae)

Total Phosphorus

A chemical measurement of all the P in the lake, includes dissolved and particulate fractions. TP is a common indicator of eutrophic conditions (along with Total Nitrogen).

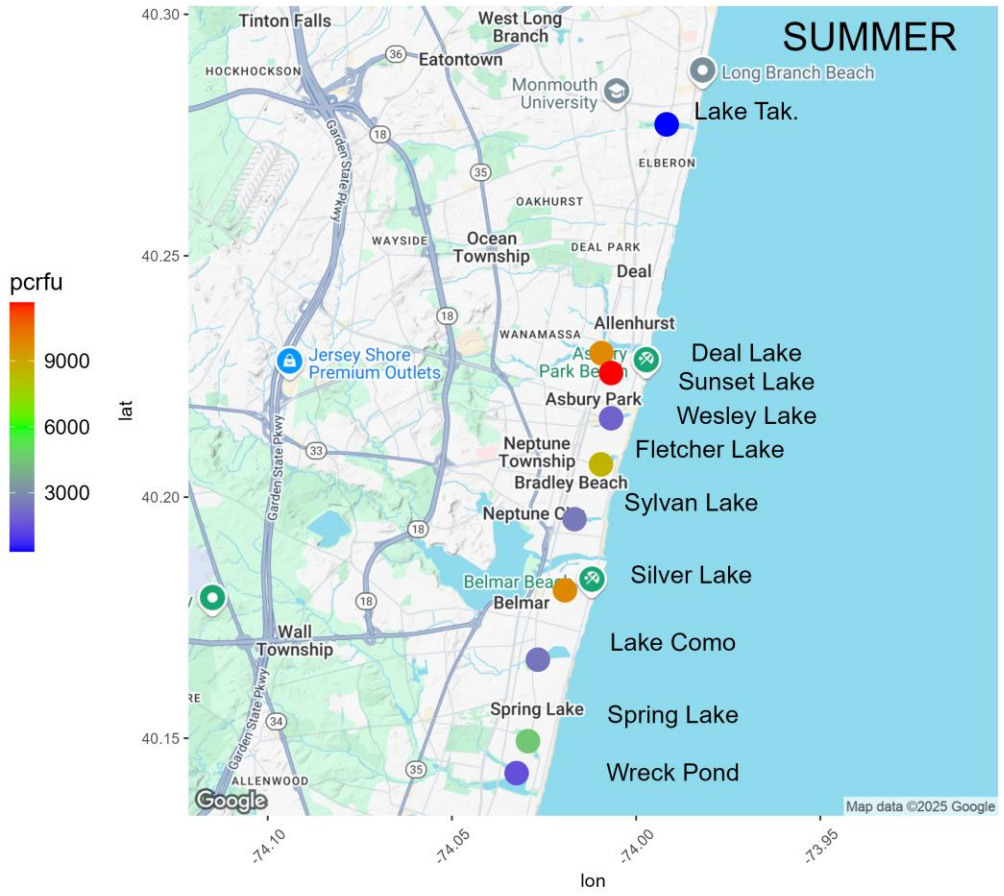


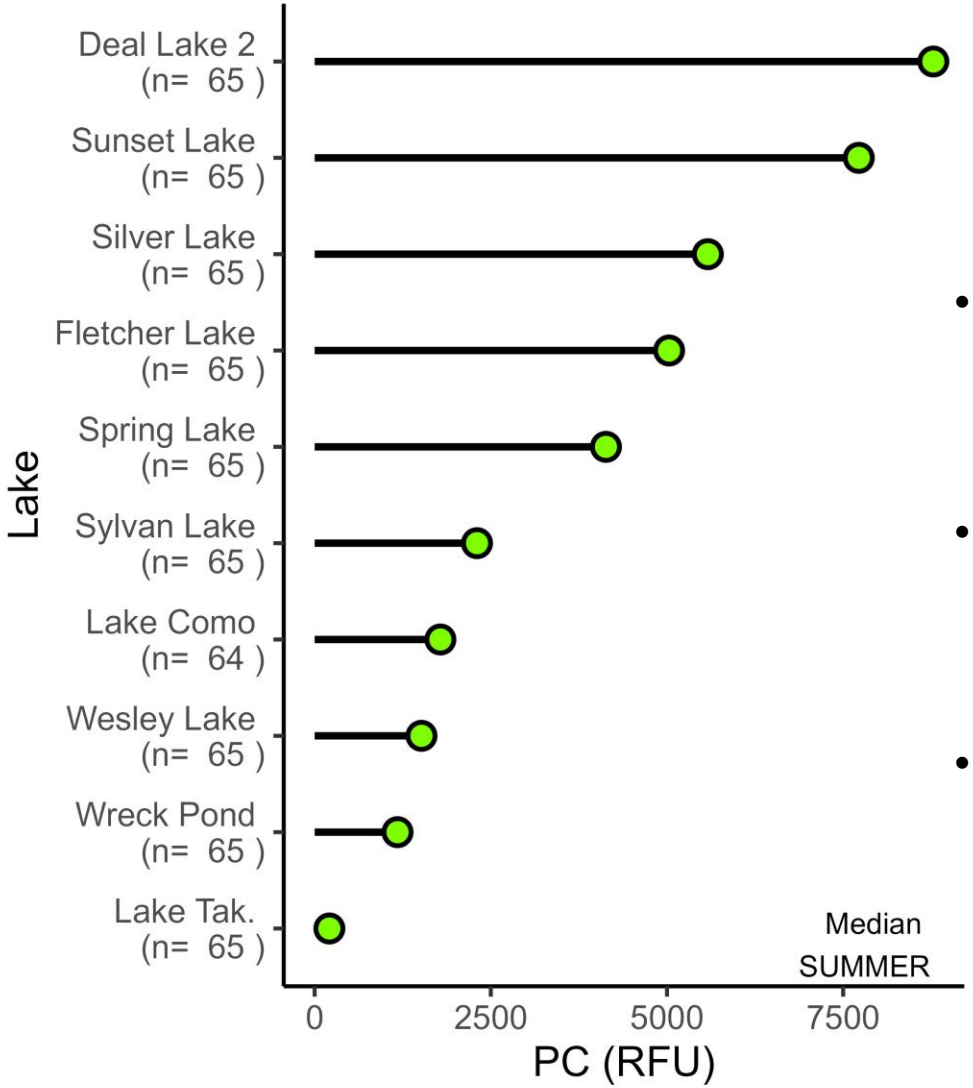


PHAB / NJDEP data has shown:

- TP tends to track TN in coastal lakes, except in Lake Takanassee where TN:TP is higher than in other lakes
- In summer, lakes appear to generate excess P from sediments during HABs

HAB biomass index





PHAB / NJDEP data has shown:

- HABs are currently a problem affecting some lakes more than others
- Summer is the main HAB season, but not exclusively
- Strong relationships with cyanobacterial cell counts

Analysis of CLONet Citizen Science Collected Water Quality Data

Olivia Fowles, Anthony Stirone, and Brandon Govea

Coastal Lakes Summer Summit
June 23, 2025

CLONet
Coastal Lakes Observing Network

Background

- CLONet (Coastal Lakes Observation Network) citizen scientists measured the water quality of ten coastal lakes in Monmouth County from 2019 to the present
- Our team has performed preliminary analyses on the collected water quality data

Why is this important?

Deal Lake

Variables

Water quality parameters measured:

- Conductivity (ppm)
- Dissolved Oxygen (%)
- Dissolved Oxygen (mg/L)
- Water Temperature (Celsius)
- Secchi Depth (ft)
- pH
- Cyanobacteria Fluorescence

Research Question

Do the water quality parameters studied in 10 Monmouth County coastal lakes change throughout time and across lakes?

Benefits

- Learn how effective previous restoration projects were at improving the water quality of the lakes

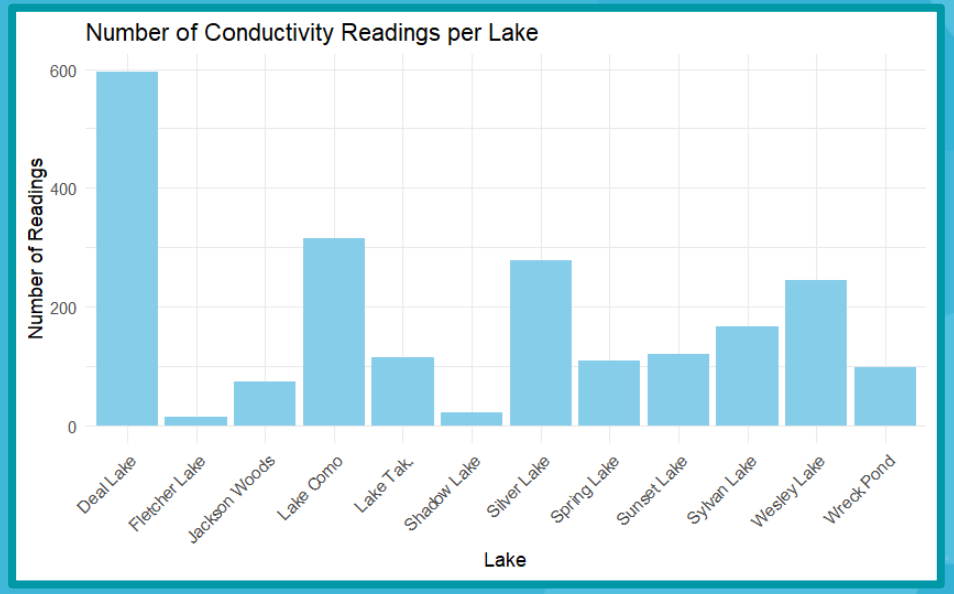
- Shows that data collected through the use of citizen science can be used to better understand our environment

Methods

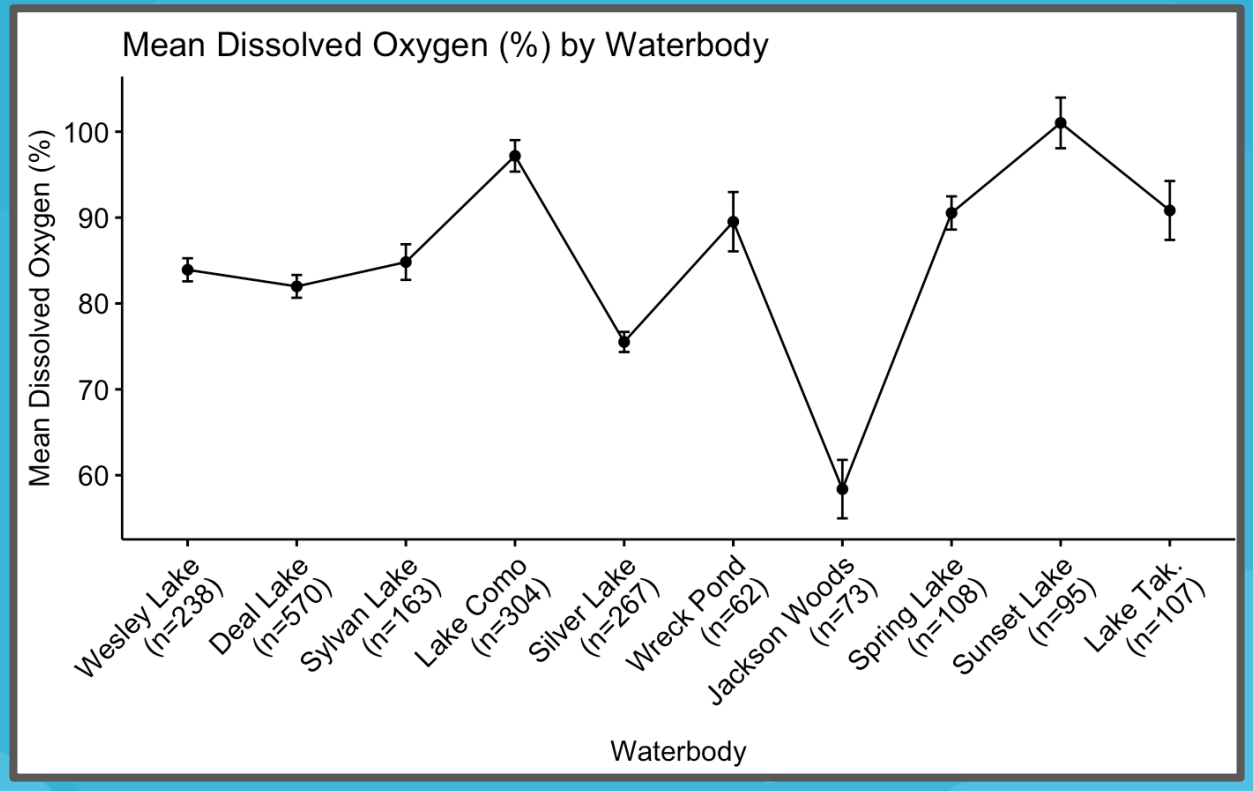
- Several statistical tests were conducted to understand how water quality varied across lakes and throughout the duration of the project:
  - One and Two-Factor Analysis of Variance (ANOVA) and Kruskal Wallis significance tests and post-hoc tests:
    - **Analyzes differences in water quality between lakes**
  - Spearman test (robust time series analysis)
    - **Identifies trends in water quality over time**

General Takeaways

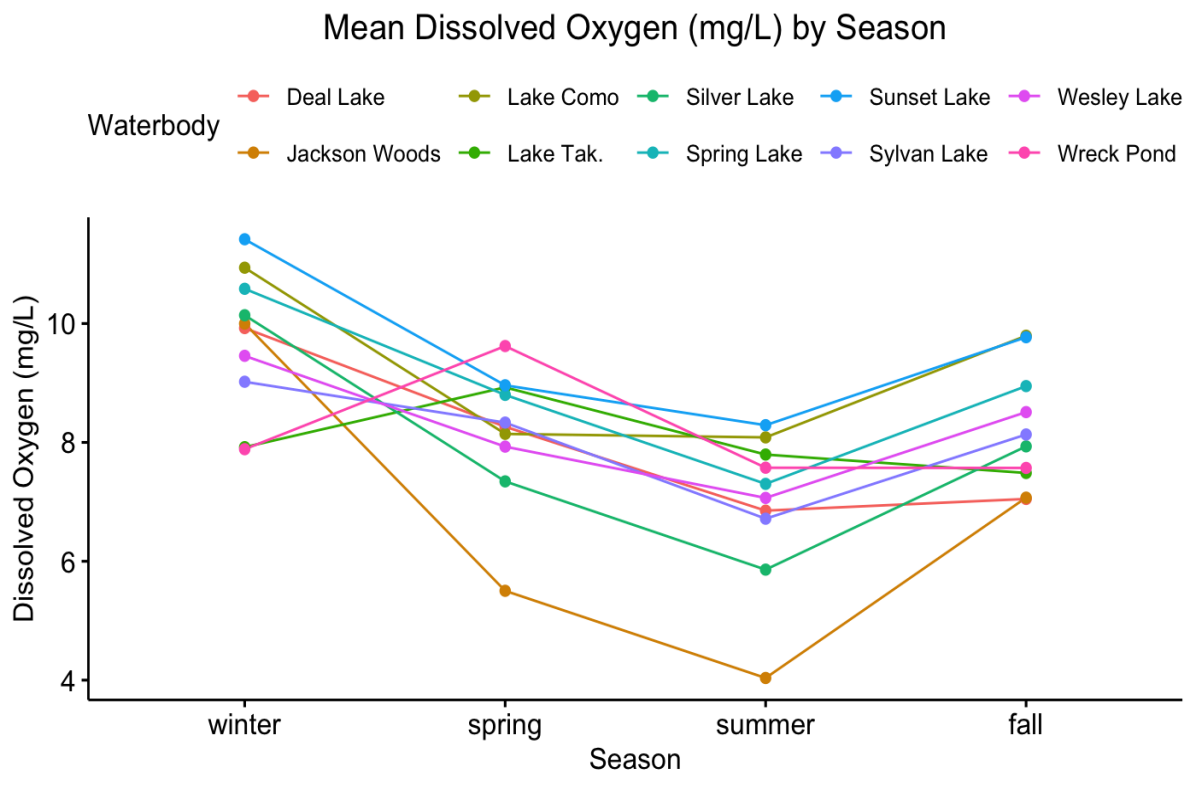
- Difference in Sample Sizes
- Seasonal Trends
- Several trends in water quality parameters
  - degradation/restoration



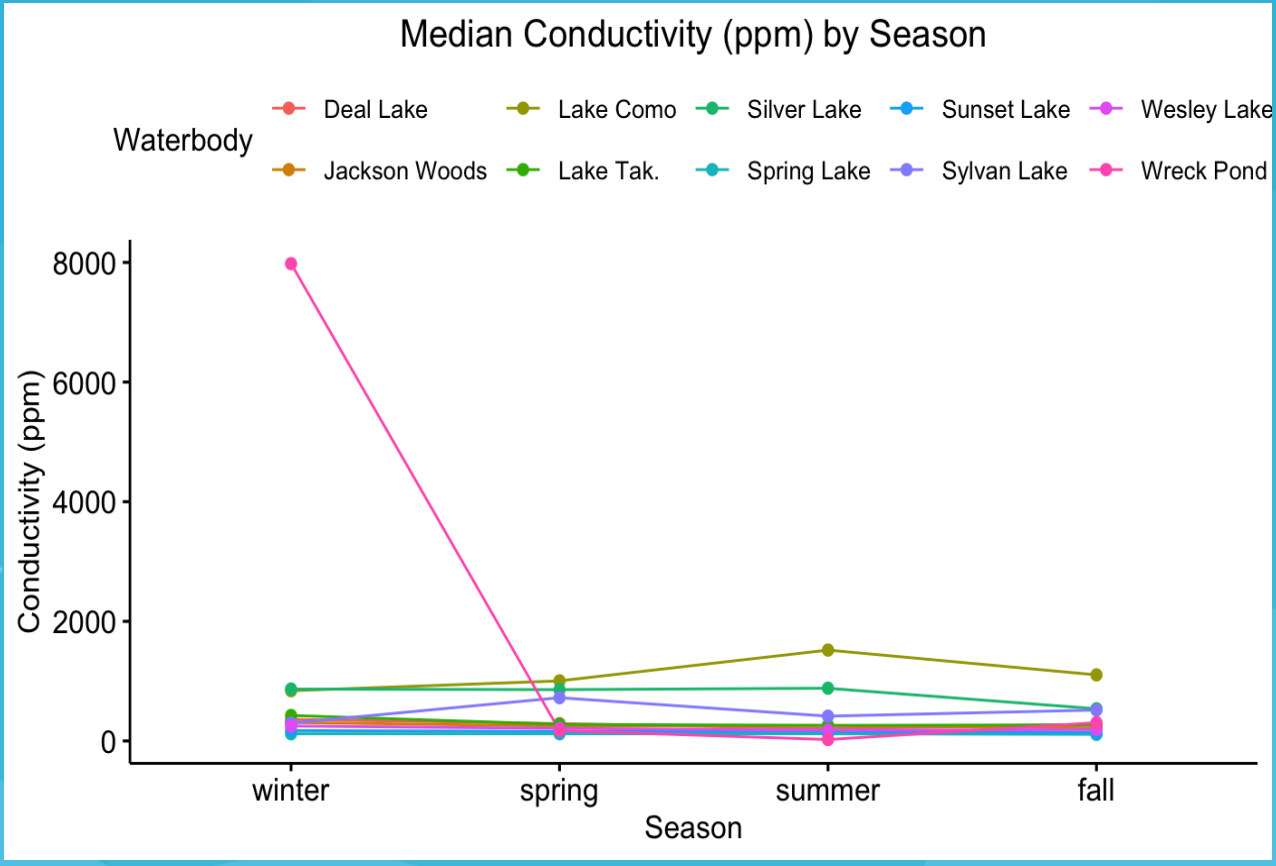
One-Way ANOVA



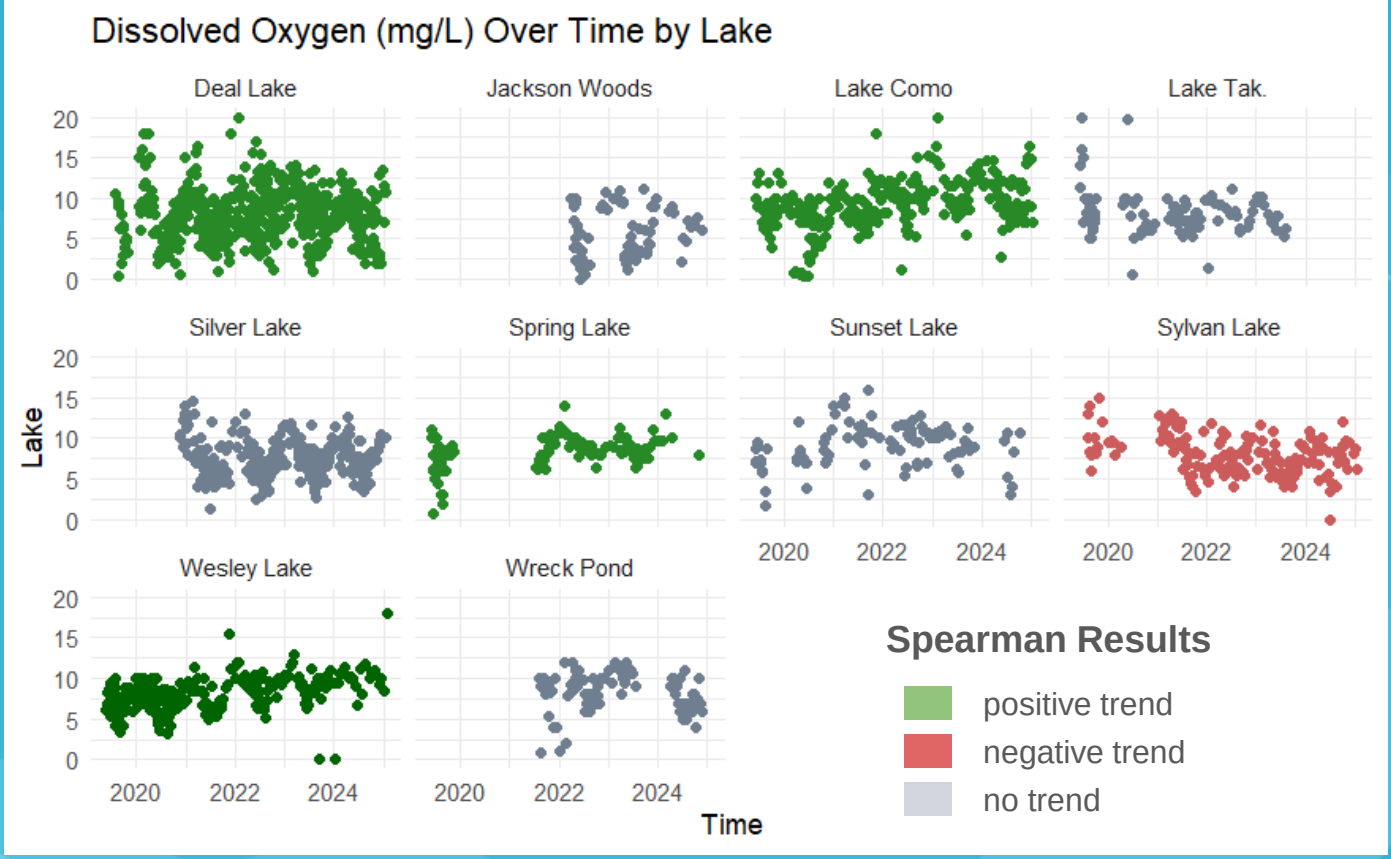
Two-Way ANOVA



Two-Way ANOVA (cont.)

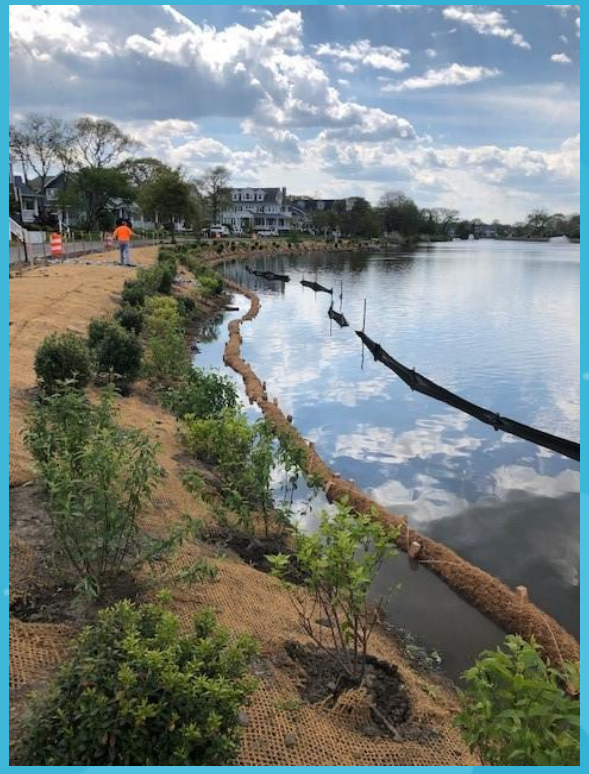


Spearman Test Results



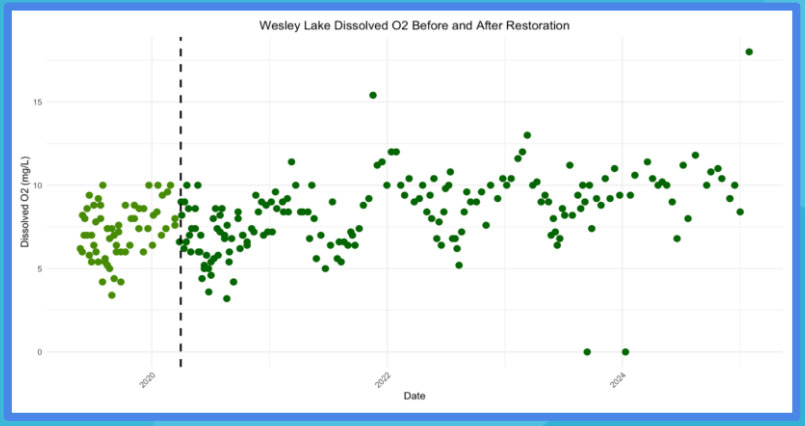
Sylvan Lake Restoration

- Living shoreline project (2019)
- Stone/wood retaining walls removed
- Biologs were placed along shoreline
- Native plant species planted
- Intended to improve water quality
- After project: conductivity increased, dissolved oxygen decreased, and secchi depth increased



Wesley Lake Restoration

- Floating wetlands project (2020)
- Floating platforms of native plants that are designed to improve water quality and specifically increase dissolved oxygen
- After project: increase in dissolved oxygen was observed



Conclusion

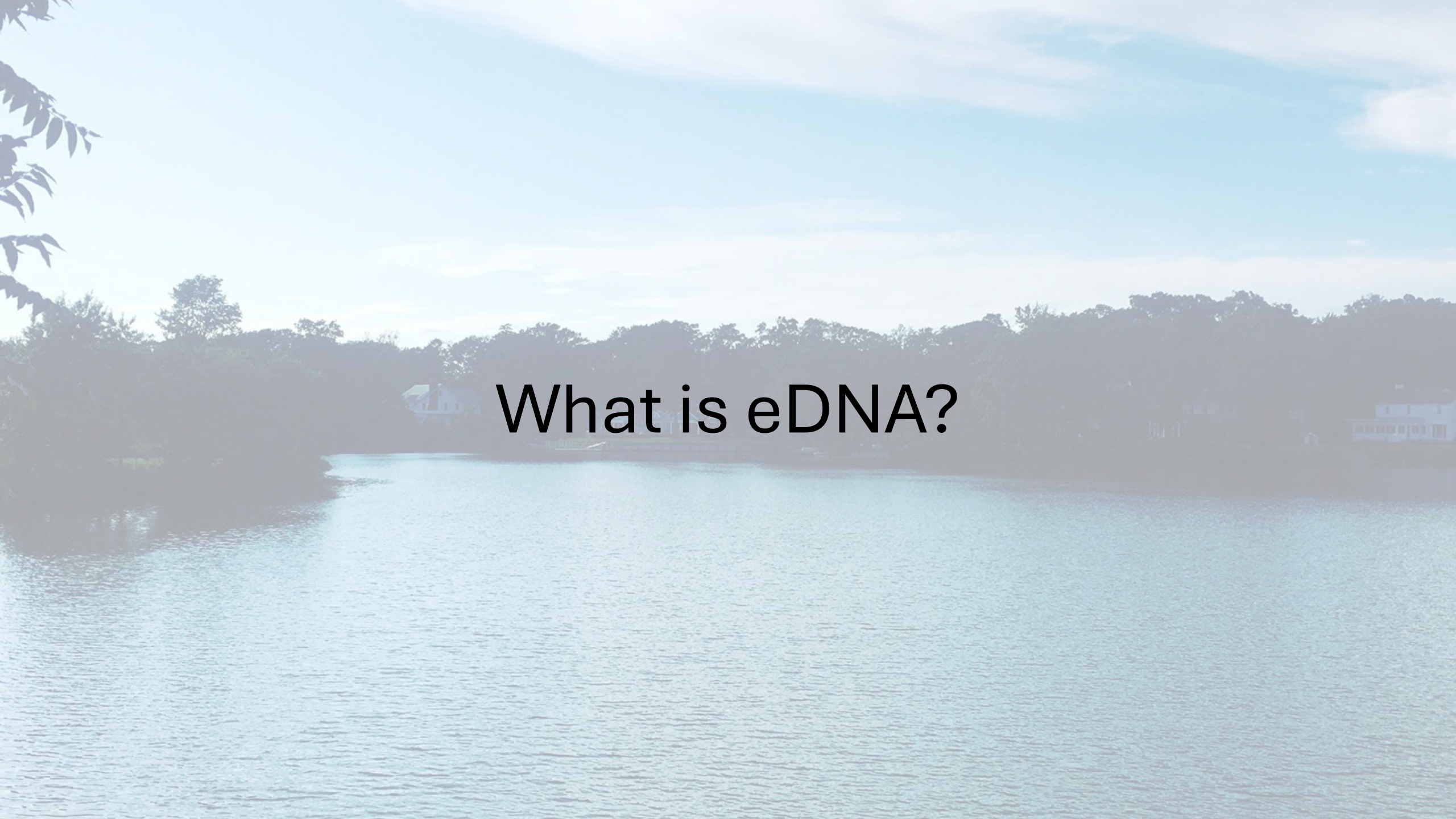
- Gives citizen scientists and management organizations insight for potential restoration efforts
- Illustrates how citizen science is an effective method for collecting data and getting people involved in conservation

Conclusion

- Consistent sampling is critical for accurate analyses of variables over time
- Further study should focus on the causes of observed trends and how water quality may have changed due to previous restoration efforts in these lakes
- Observing seasonal trends can aid further research
- CLONet website

Fish Community Analysis using eDNA in 2 New Jersey Coastal Lakes: Deal Lake and Sunset Lake

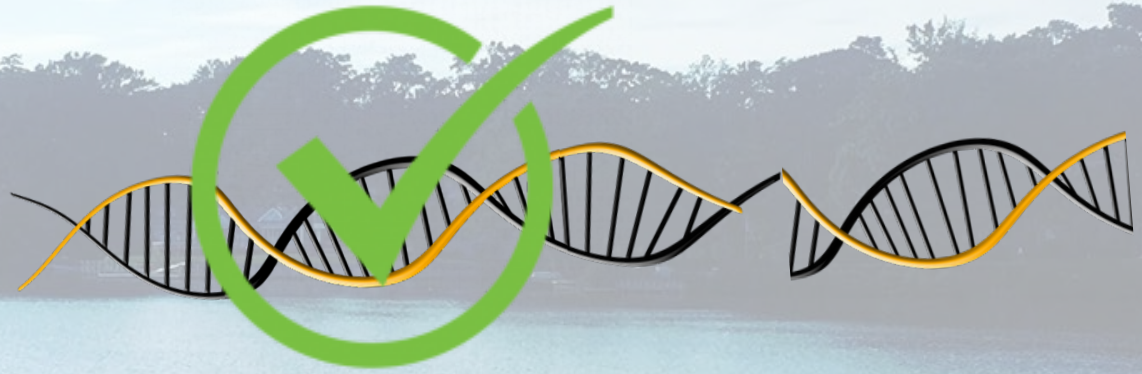
By: Dylan DiBella



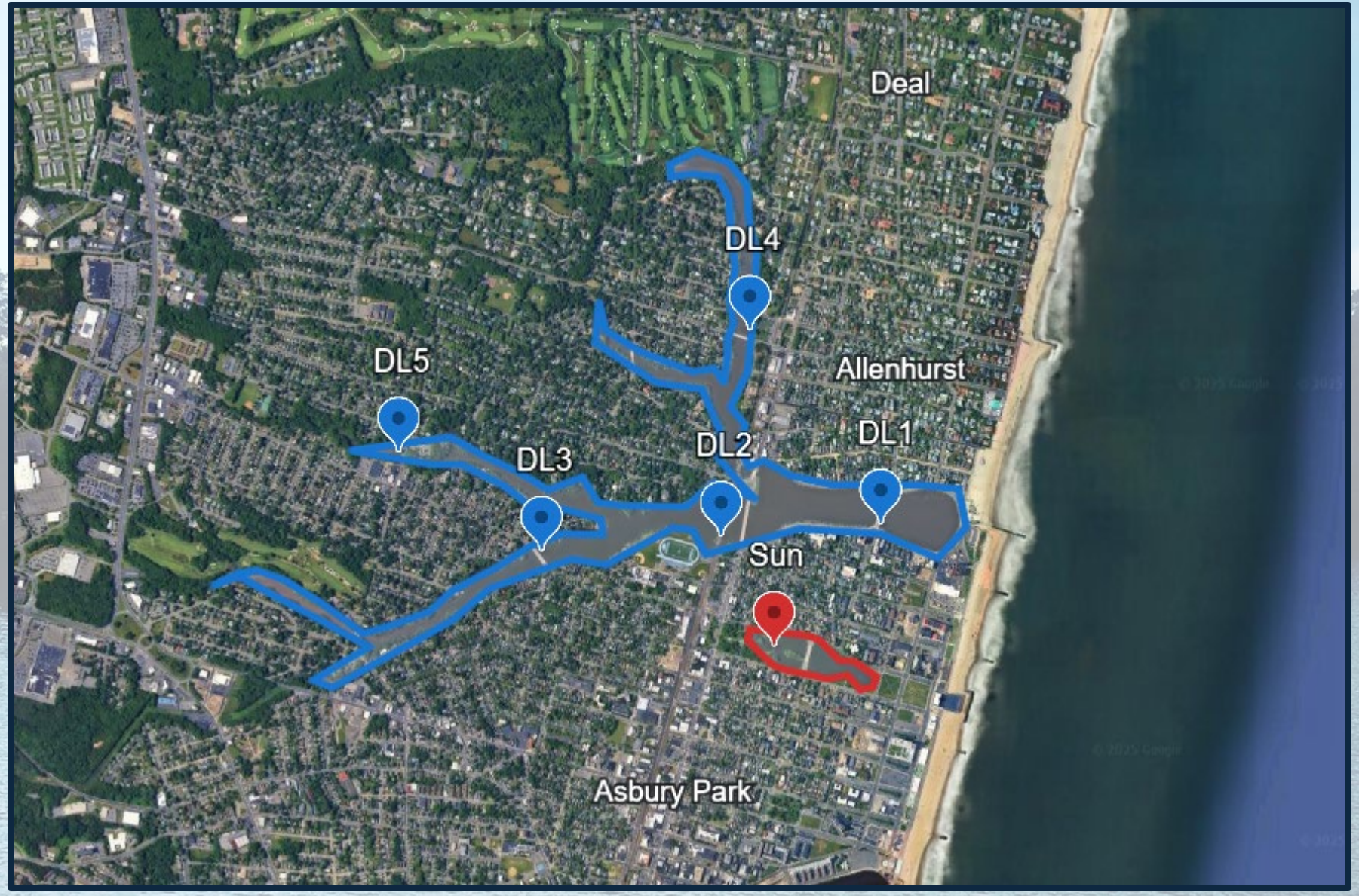
What is eDNA?

eDNA Sample

Reference Sequence



- What species are present?
- What is the relative abundance of these species?
- How do these species differ between lakes?
- How does abundance differ between the lakes?
- What are the most abundant species in each lake?


Deal
DL4
DL5
Allenhurst
DL2
DL1
DL3
Sun
Asbury Park

Deal Lake

1.

Bluegill
Lepomis macrochirus

2.

American gizzard shad
Dorosoma cepedianum

3.

White perch
Morone americana

Sunset Lake

1.

Brown bullhead
Ameiurus nebulosus

2.

Pumpkinseed
Lepomis gibbosus

3.

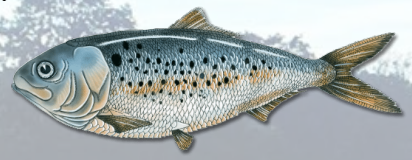
Golden shiner
Notemigonus crysoleucas

Deal Lake

4.

Common carp
Cyprinus carpio

5.



Atlantic menhaden
Brevoorita tyrannus

6.

River herring
Alosa aestivalis

7.

Golden shiner
Notemigonus crysoleucas

8.

Pumpkinseed
Lepomis gibbosus

9.

American eel
Anguilla rostrata

10.

Brown bullhead
Ameriurus nebulosus

Sunset Lake

4.

American gizzard shad
Dorosoma cepedianum

5.

Bluegill
Lepomis macrochirus

6.

White perch
Morone americana

7.

American eel
Anguilla rostrata

8.

Grass carp
Ctenopharyngodon idella

8.

Silver carp
Hypophthalmichthys molitrix

9.

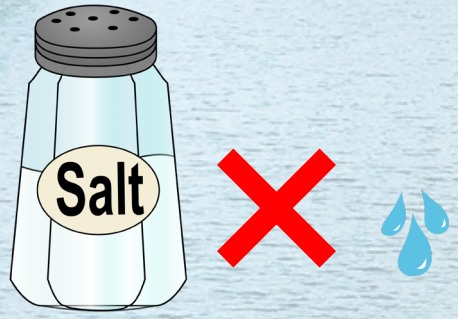
Common carp
Cyprinus carpio

10.

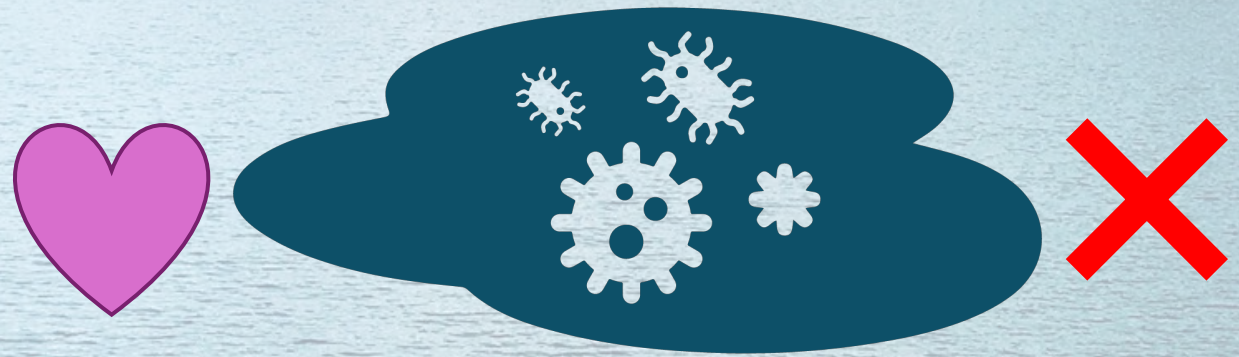
Largemouth bass
Micropterus salmoides


Why do we see these differences?

Taxon (ASV)	Salinity	Temperature	Dissolved Oxygen	PCRFU
Am_eel				+
Am_gizzard_shad			+	
Atl_mackerel		-		
Atl_menhaden_LS16_or_river_herring				-
Atl_silverside		-		
Brown_bullhead	-			
Catfish_sp	-			
Golden_shiner	-			
Pumpkinseed_Lepomis	-			
White_perch				-



Taxon (ASV)	Salinity	Temperature	Dissolved Oxygen	PCRFU
Am_eel				+
Am_gizzard_shad			+	
Atl_mackerel		-		
Atl_menhaden_LS16_or_river_herring				-
Atl_silverside		-		
Brown_bullhead	-			
Catfish_sp	-			
Golden_shiner	-			
Pumpkinseed_Lepomis	-			
White_perch				-



What do these results tell us?

Why is this important?

What are the limitations to this approach?

Funded by the New Jersey Department of Environmental Protection
through an agreement with EPA under Contract Numbers SR21-007 & SR23-010

Big thank you to Rob Newby and the New Jersey Department of Environmental Protection for their continued support on this project