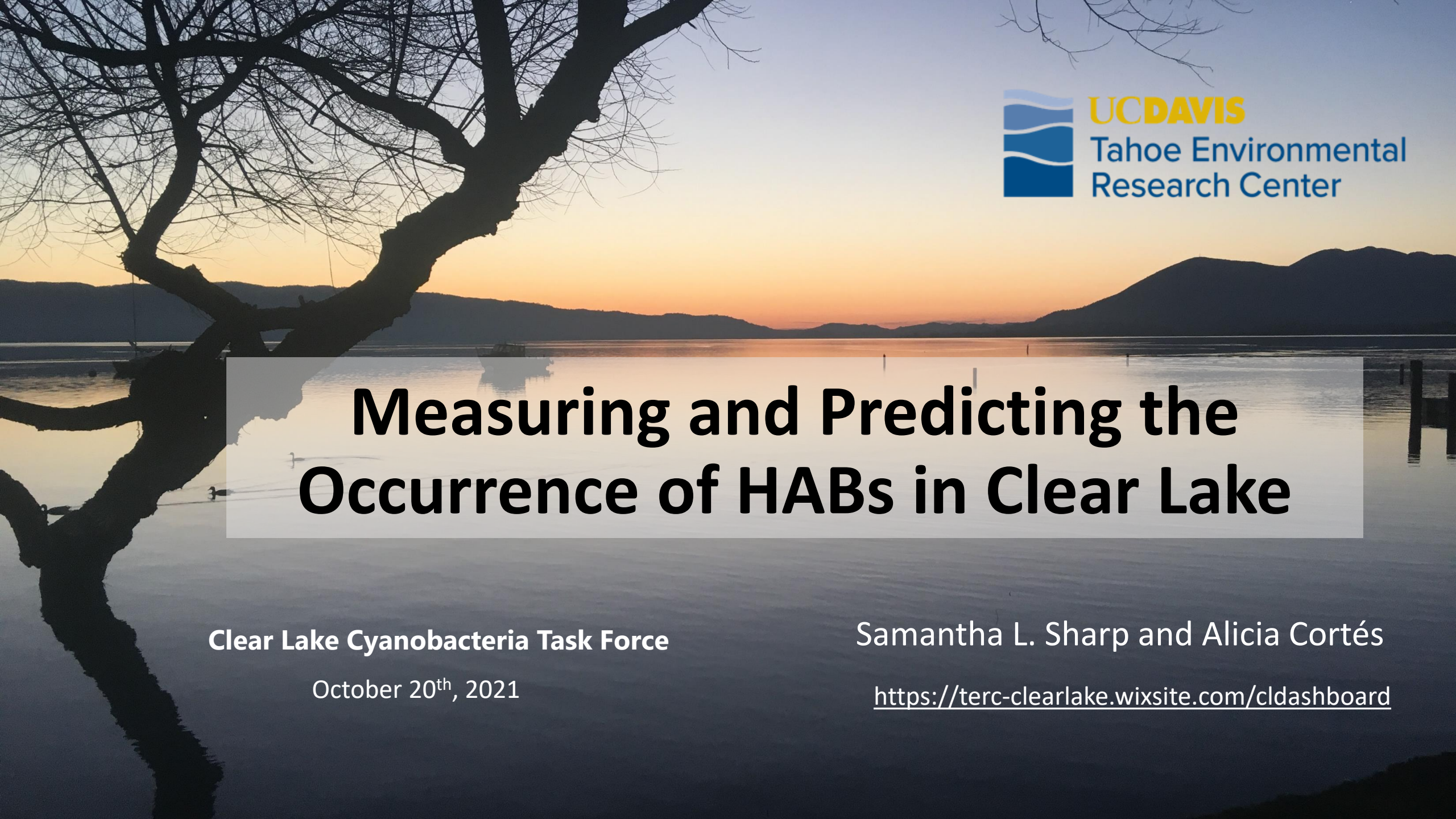


UCDAVIS
Tahoe Environmental
Research Center

# Measuring and Predicting the Occurrence of HABs in Clear Lake

**Clear Lake Cyanobacteria Task Force**

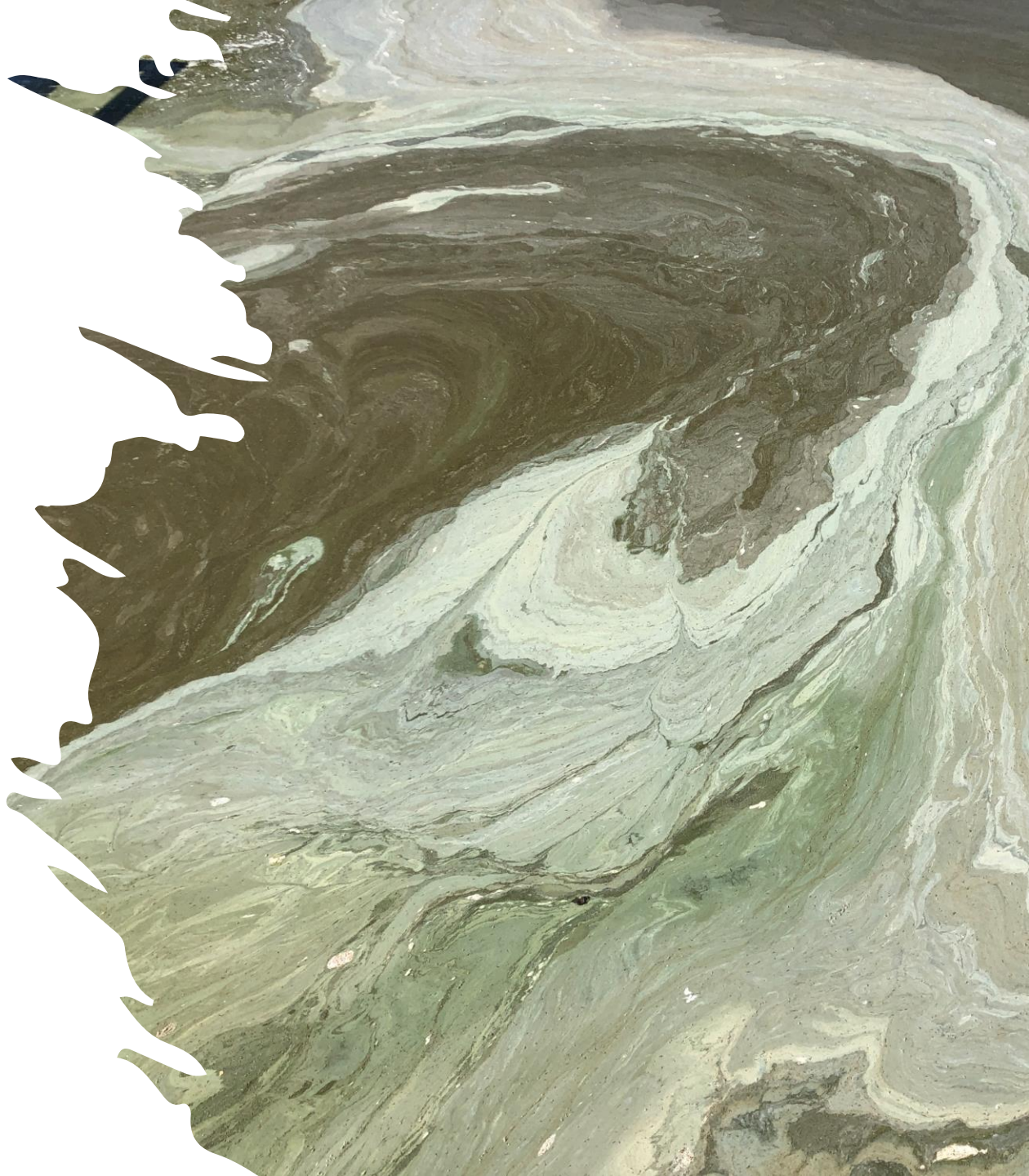
October 20th, 2021

Samantha L. Sharp and Alicia Cortés

https://terc-clearlake.wixsite.com/cldashboard

# Measuring HABs in Clear Lake

Samantha L. Sharp



# First Publication

frontiers in Environmental Science

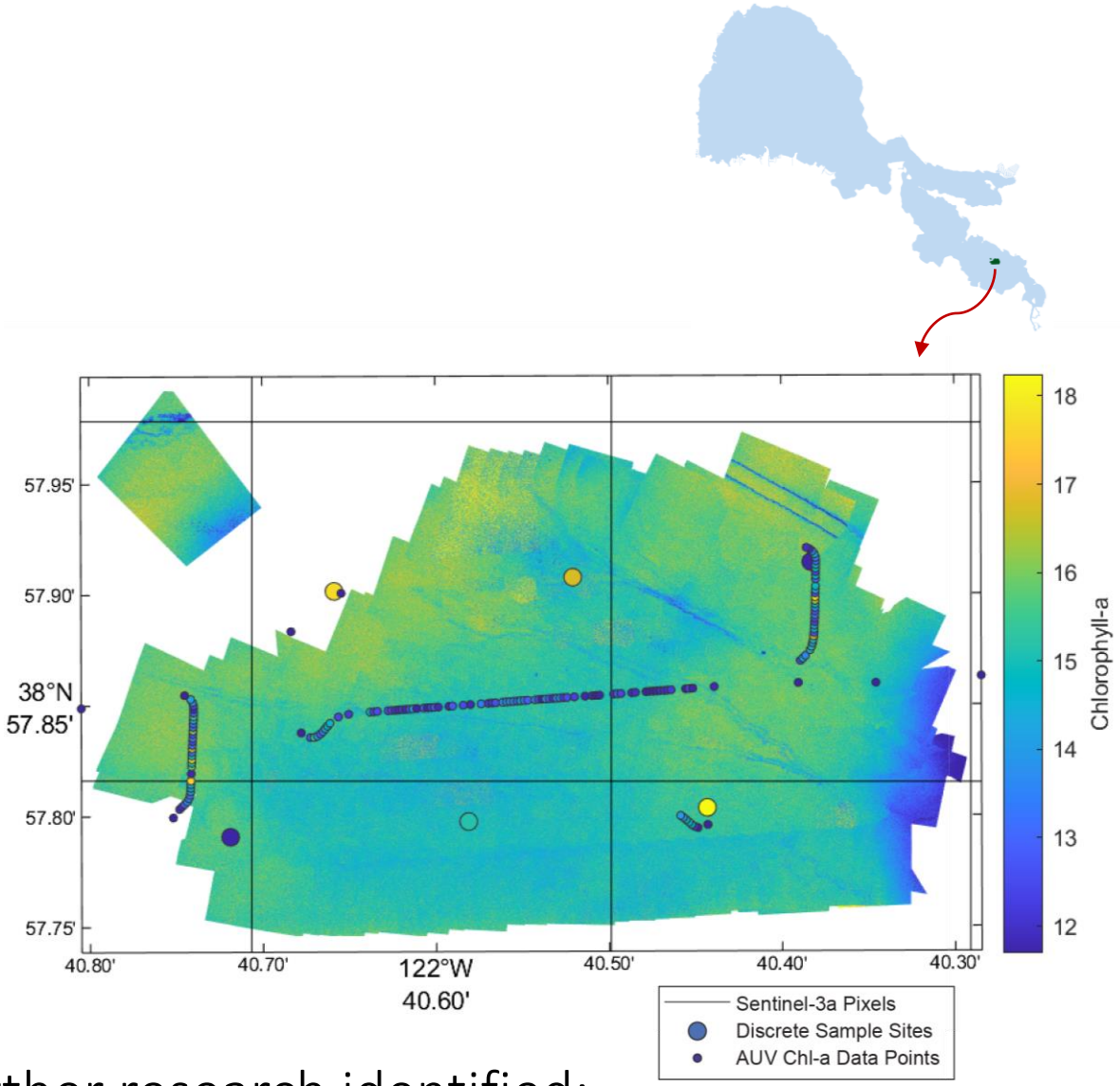
ORIGINAL RESEARCH
published: 15 April 2021
doi: 10.3389/fenvs.2021.612934

## Quantifying Scales of Spatial Variability of Cyanobacteria in a Large, Eutrophic Lake Using Multiplatform Remote Sensing Tools

*Samantha L. Sharp[1,2]*, Alexander L. Forrest[1,2], Keith Bouma-Gregson[3], Yufang Jin[4], Alicia Cortés[1,2] and S. Geoffrey Schladow[1,2]*

*[1]Department of Civil and Environmental Engineering, University of California, Davis, CA, United States, [2]Tahoe Environmental Research Center, University of California, Davis, CA, United States, [3]Office of Information Management and Analysis, California State Water Resources Control Board, Sacramento, CA, United States, [4]Department of Land, Air and Water Resources, University of California, Davis, CA, United States*

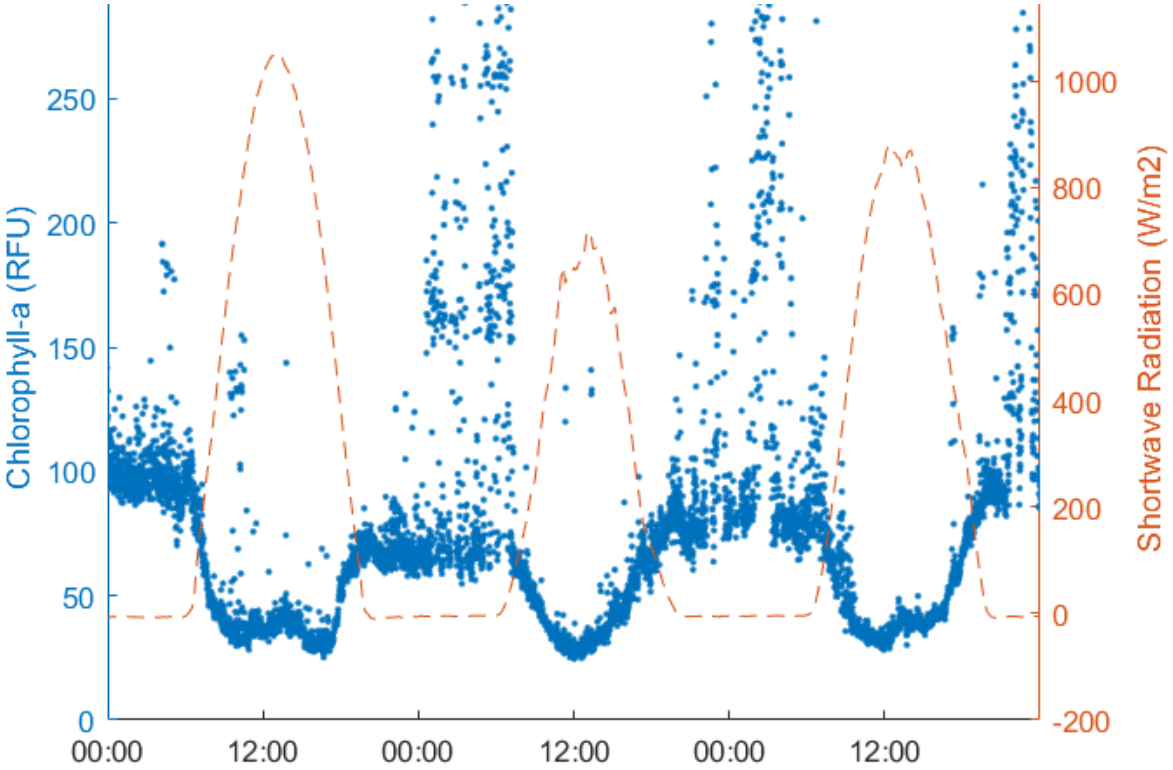
Take a picture to download the full paper of pilot study

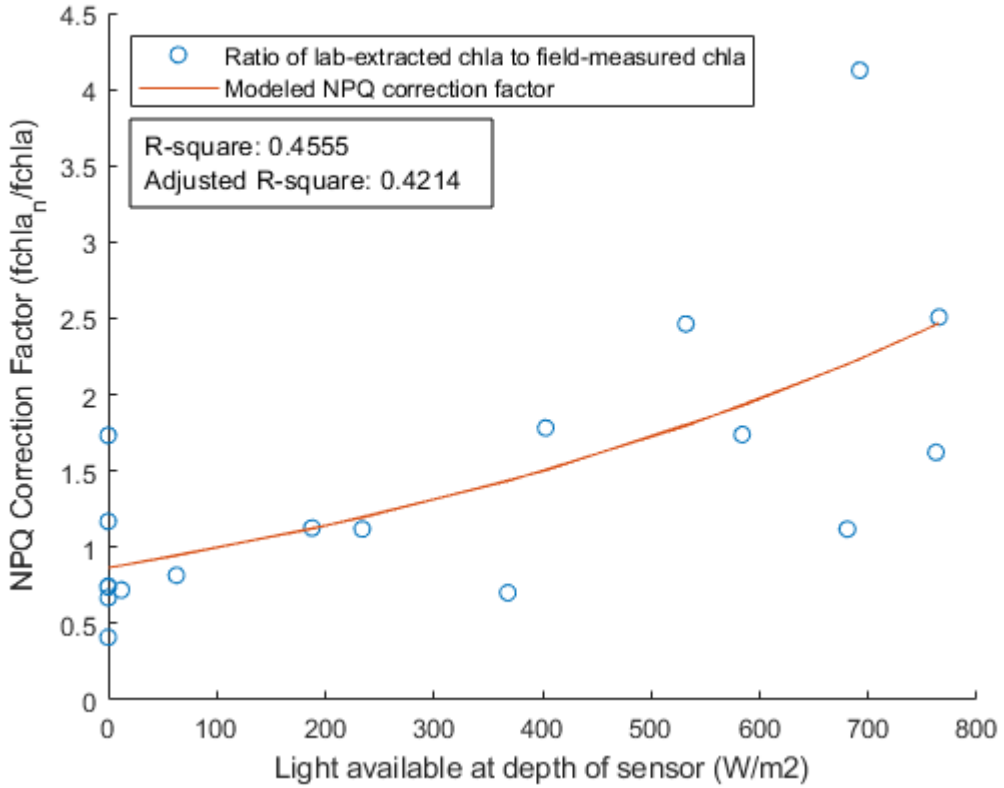



Further research identified:

1. Issue with non-photochemical quenching
2. Need for cyanobacteria species identification

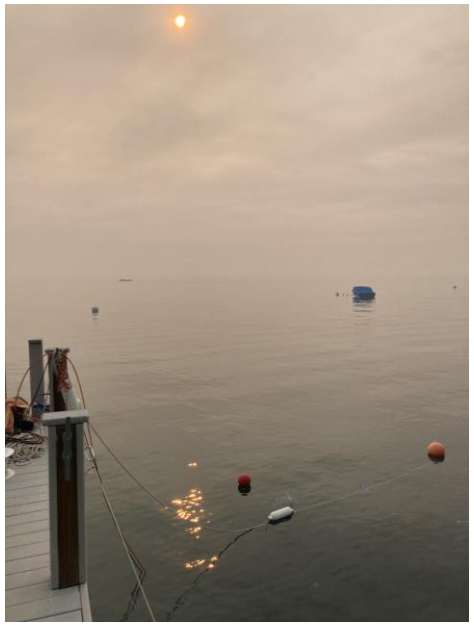
# Non-photochemical quenching (NPQ)




Problem: NPQ results in a diurnal reduction in fluorescence measurements

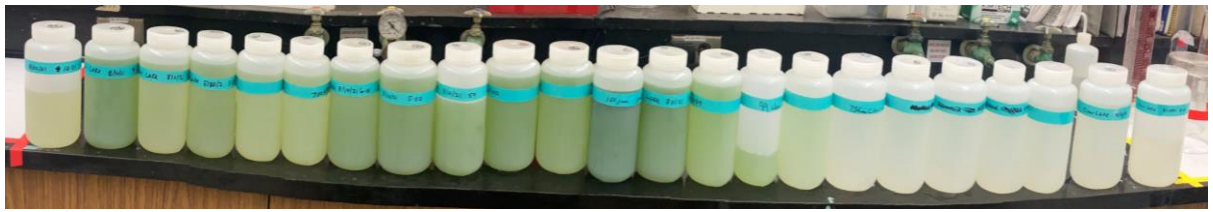
Goal: Develop a method to correct NPQ impacts to fluorometer measurements



Lake Tahoe, Aug 6, 2021 (experiment cancelled due to hazardous smoke conditions)

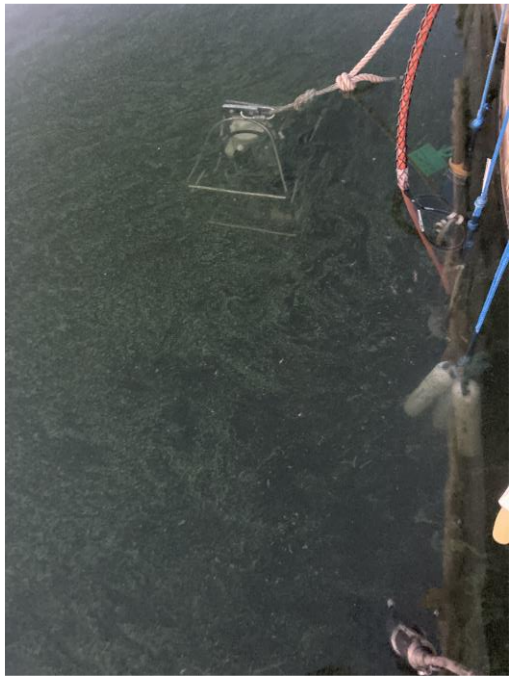
Lake Tahoe, Aug 19, 2021

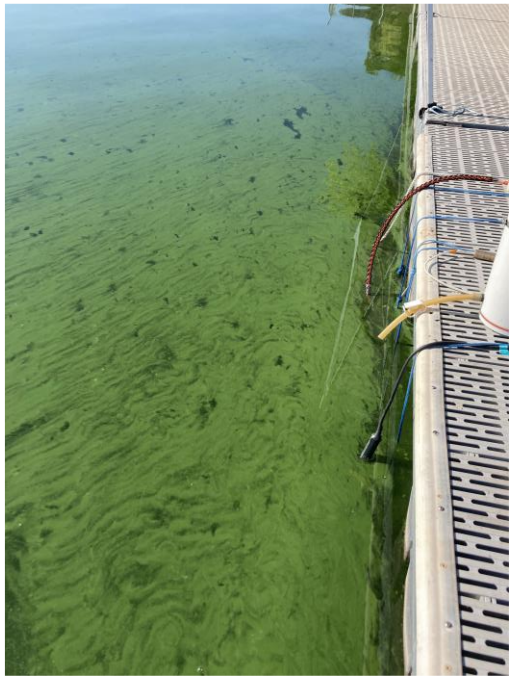
Harmful algal bloom event at Clear Lake during experiment, Aug 10, 2021



Variability in samples collected at Clear Lake, Aug 10, 2021

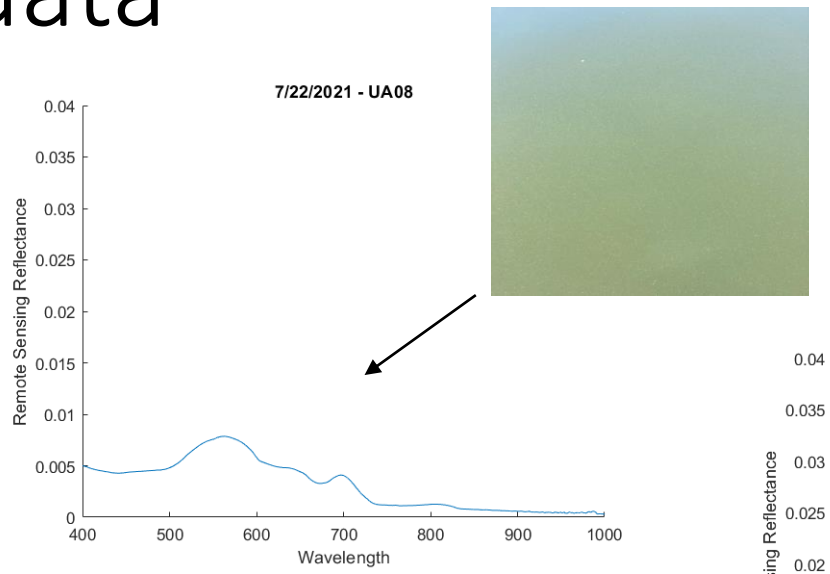
Instruments deployed at Clear Lake, viewed twice during experiment, Aug 10, 2021

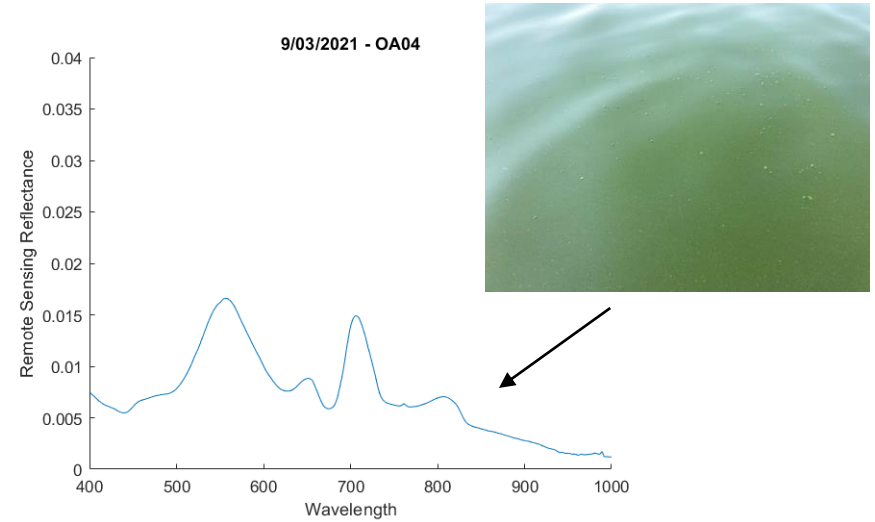


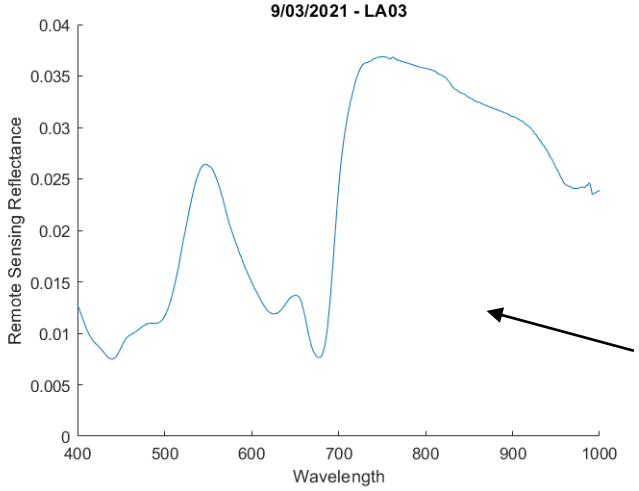


# Cyanobacteria species identification from hyperspectral data

Data collection in Clear Lake,
July 22, 2021



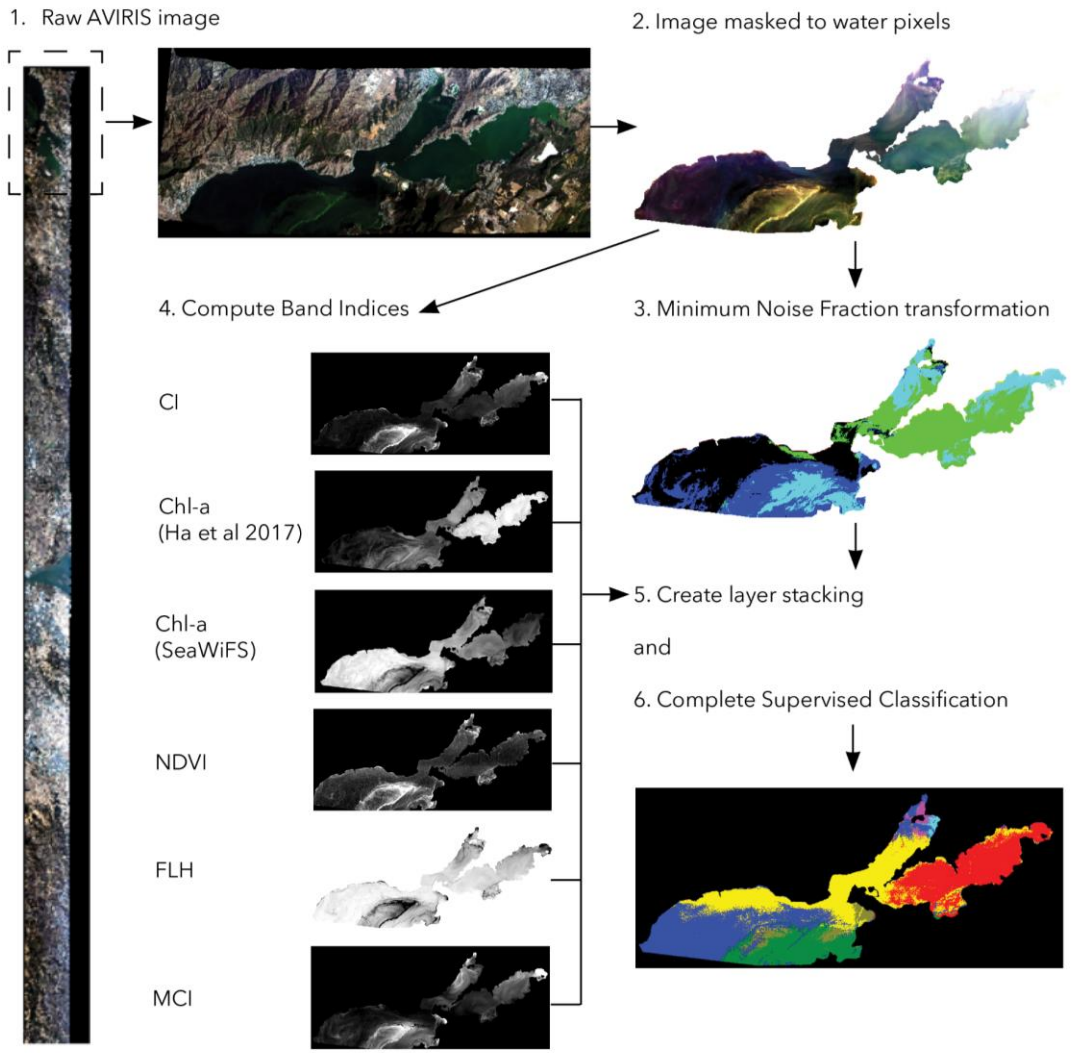



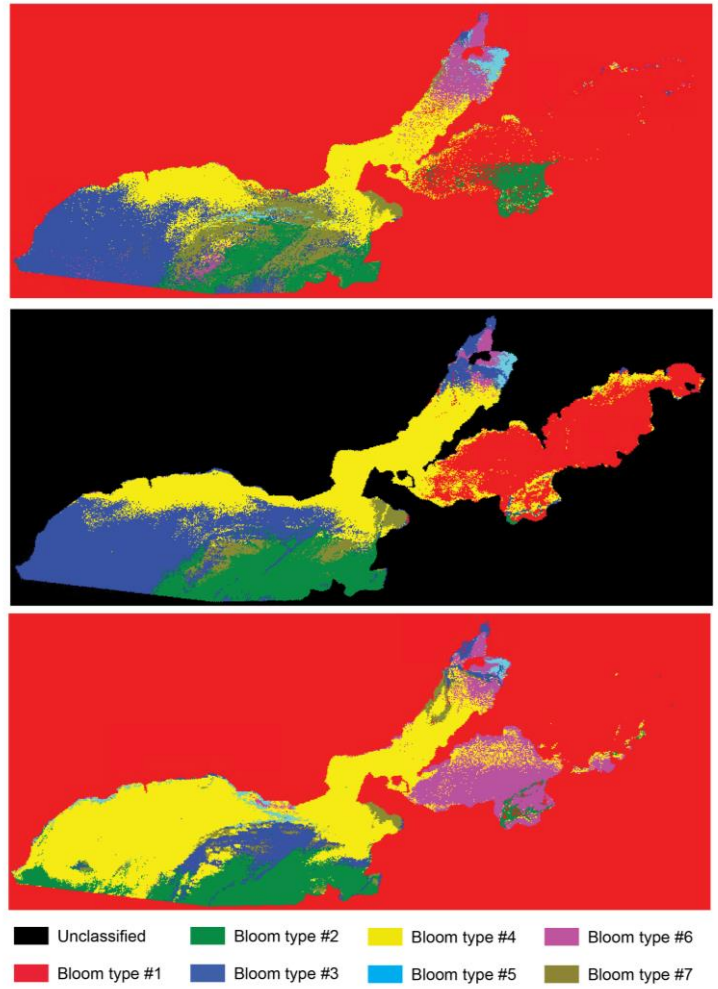
# Data processing workflow

<u>Ultimate goal</u>: use hyperspectral data to distinguish bloom type

Preliminary analysis using past AVIRIS and in situ data shows proof of concept




# Result



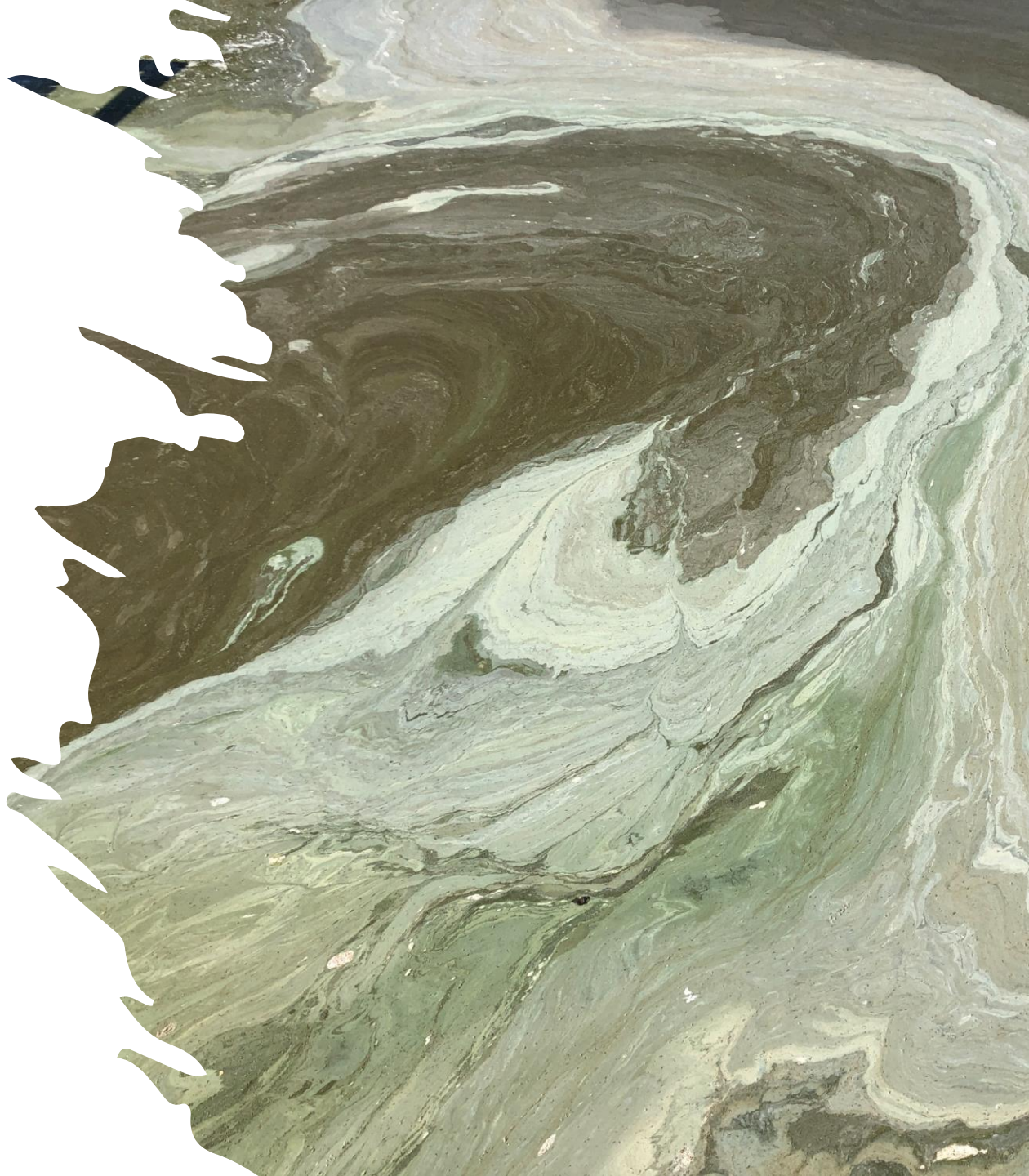
# Summary

1. NPQ correction will allow for improved cyanobacteria data collection to validate the CI for Clear Lake

2. Evaluating use of hyperspectral data for cyanobacteria bloom type discrimination will support tools for future satellite deployments

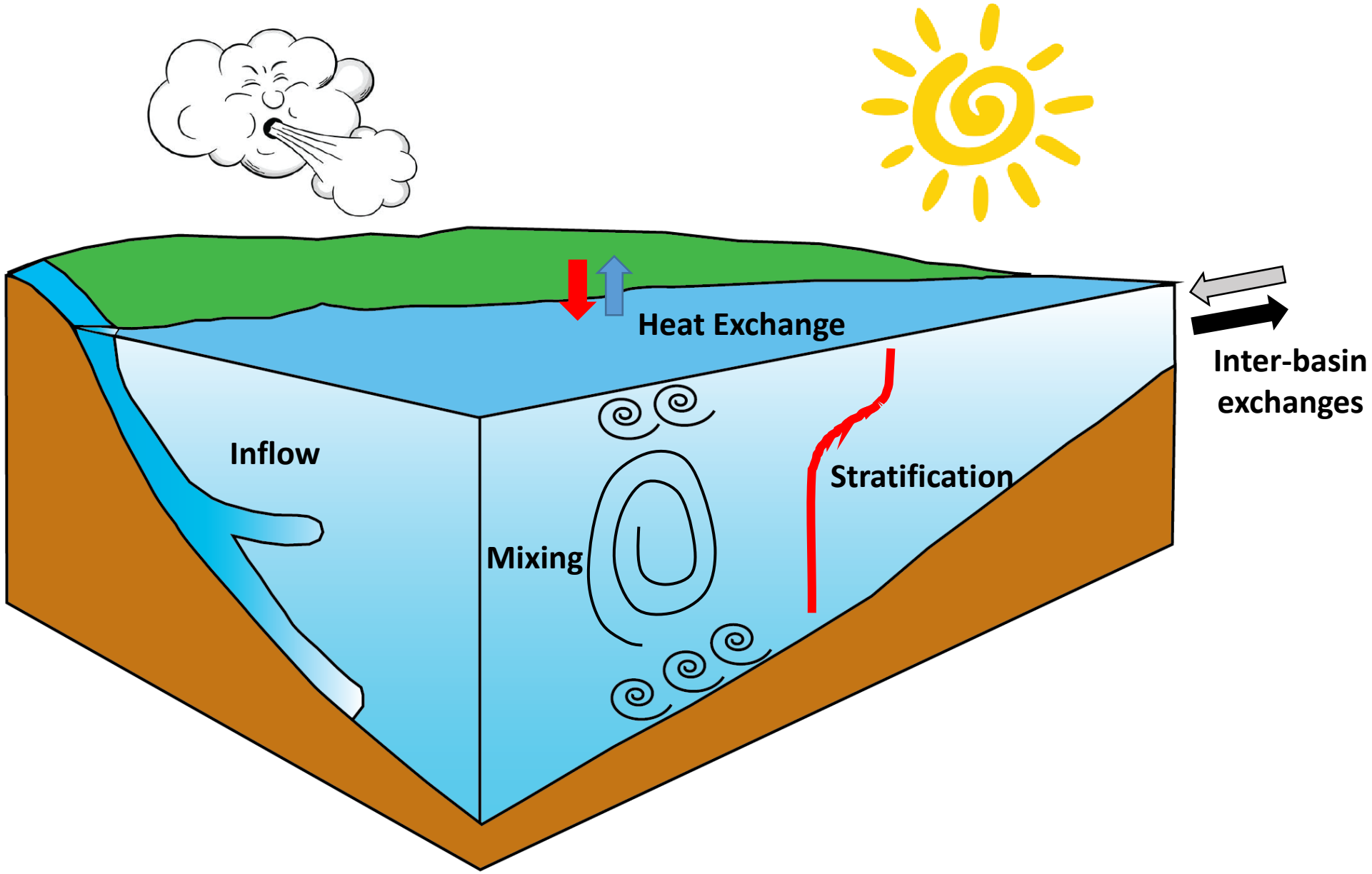
# Predicting the Occurrence of HABs in Clear Lake

Alicia Cortés



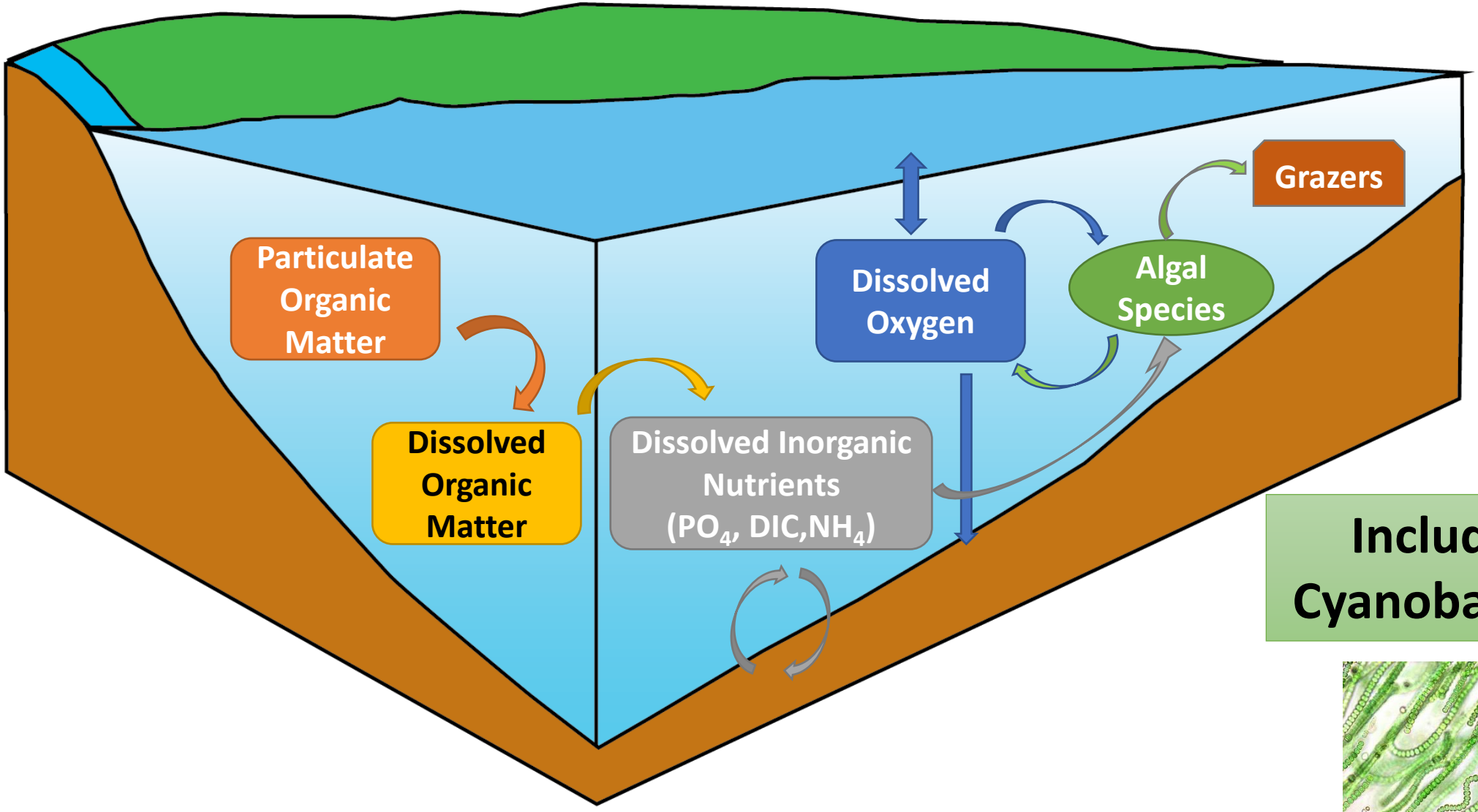
# 3D Hydrodynamic Lake Model

How does the water move?



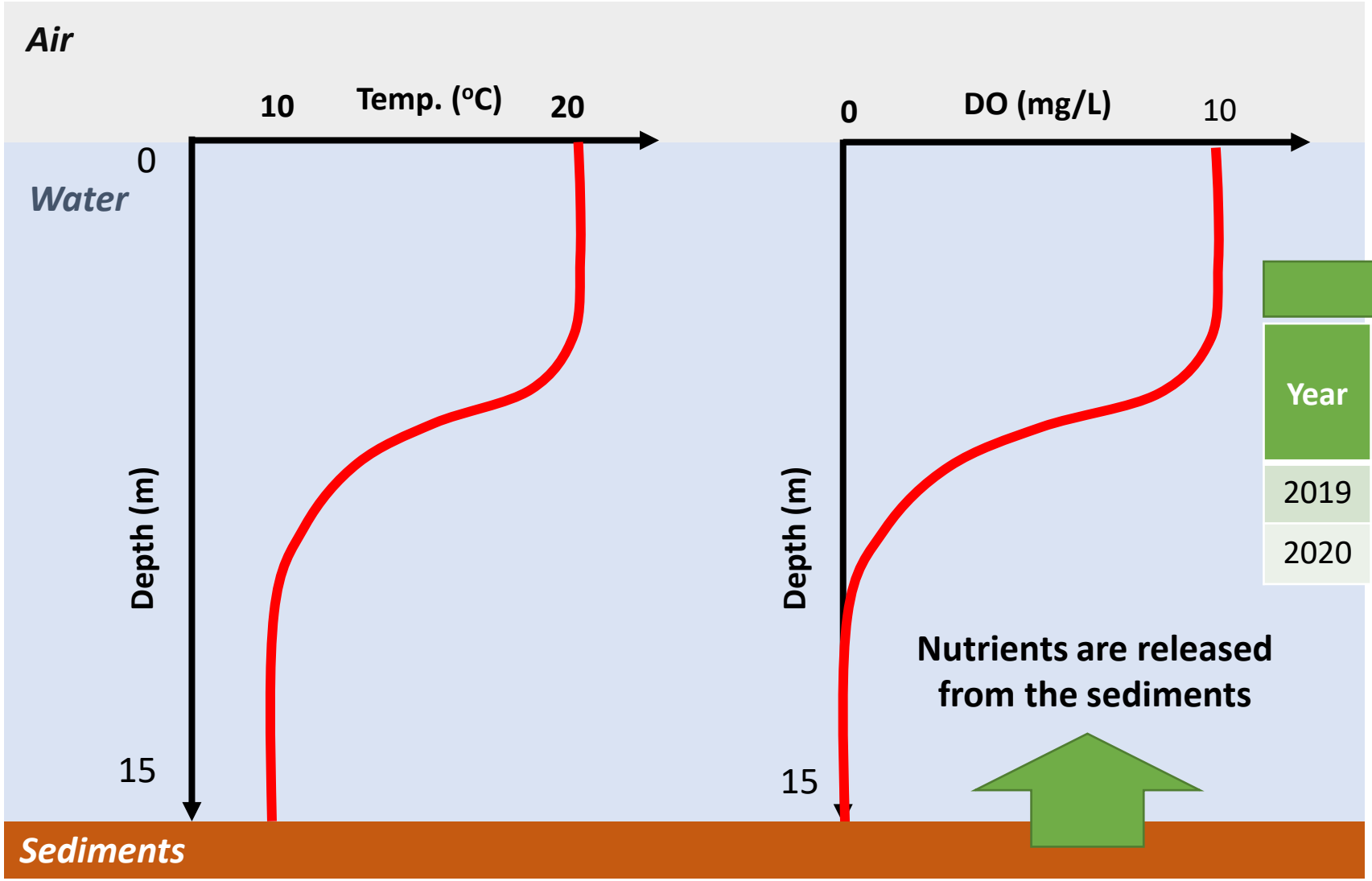
# 3D Bio-geochemical Lake Model

How does the lake production change?




**Including Cyanobacteria**

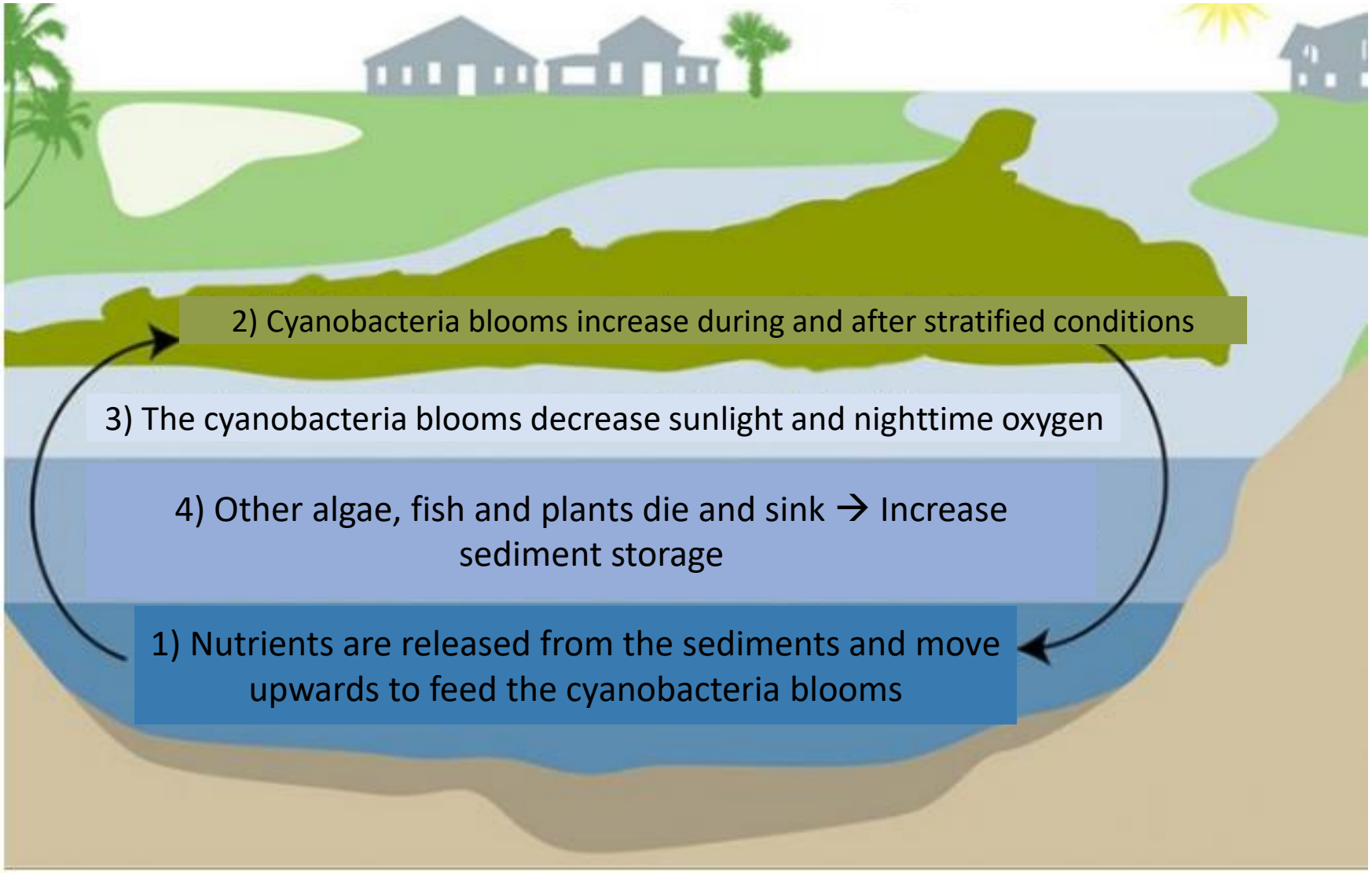
# Stratification, Dissolved Oxygen, Nutrients and HABs




| Total Phosphorus (MT) | | | |
|---|---|---|---|
| Year | Max Observed | Annual External Input | Net Observed Internal (June – Oct) |
| 2019 | 471.5 | 123 | 348.5 (74%) |
| 2020 | 654.8 | 20.5 | 634.3 (97%) |

*Credit: Micah Swann*

# Prediction of the Onset of Cyanobacteria Blooms

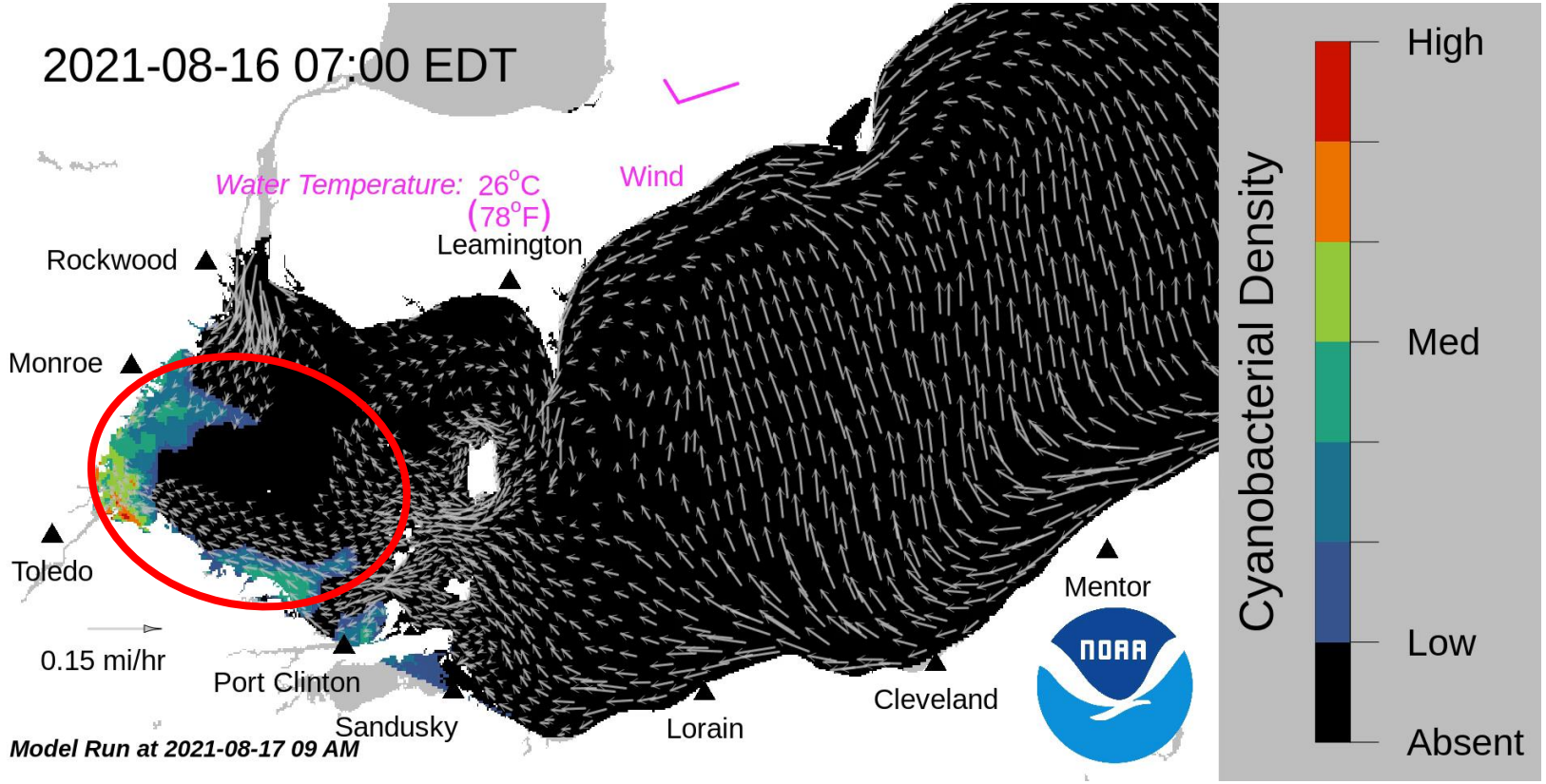


# Prediction of the Location and Movement of Cyanobacteria Blooms

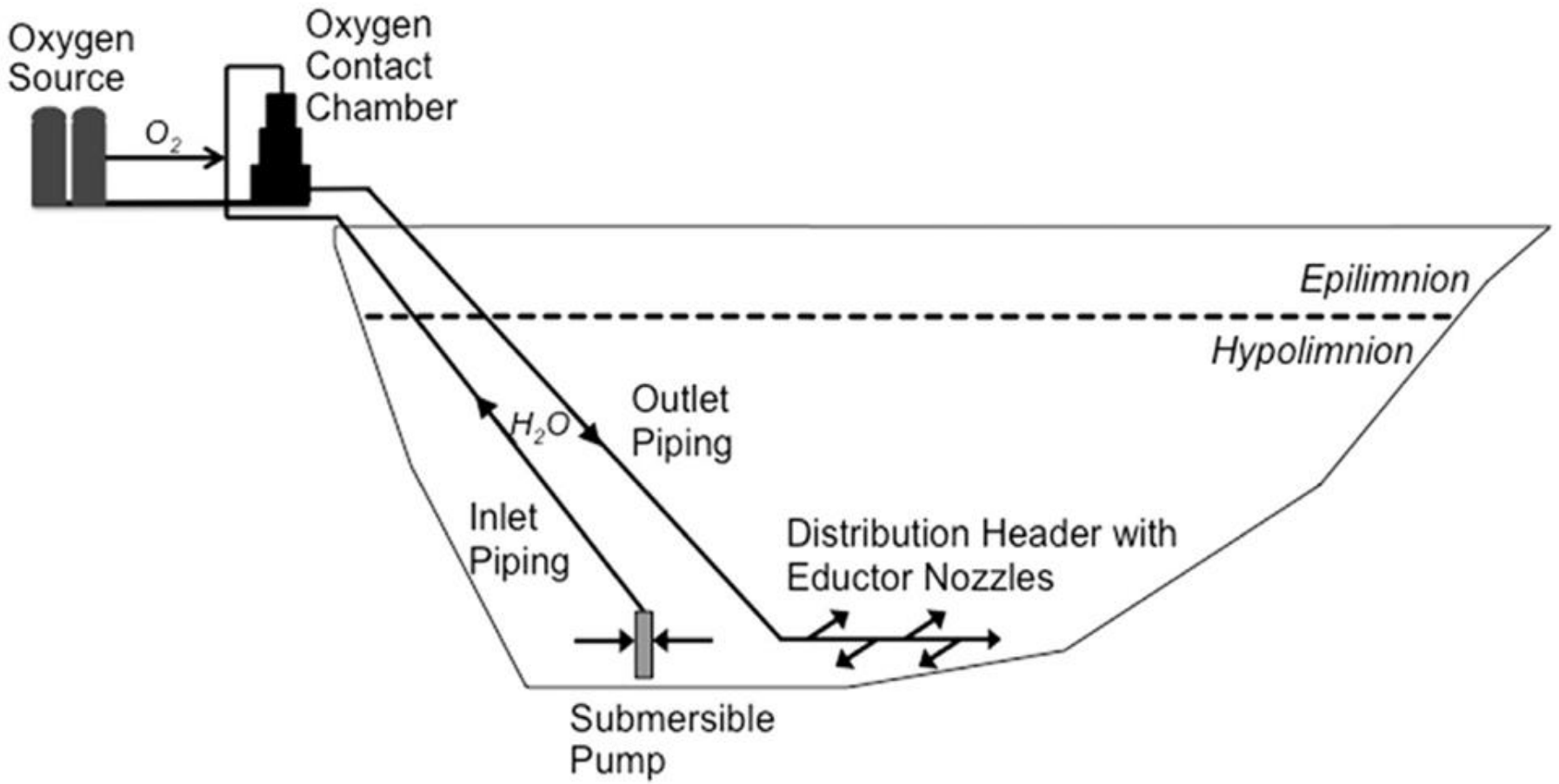
NCCOS | NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

Lake Erie Harmful Algal Bloom Forecast

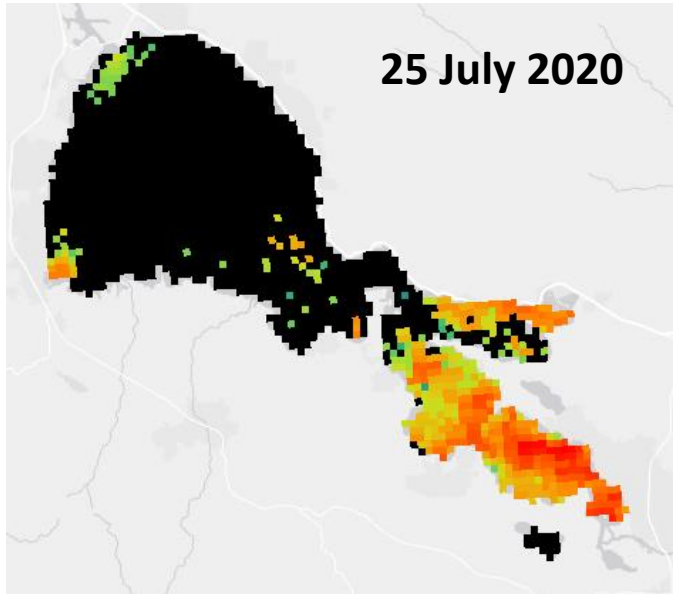
https://coastalscience.noaa.gov/research/stressor-impacts-mitigation/hab-forecasts/lake-erie/

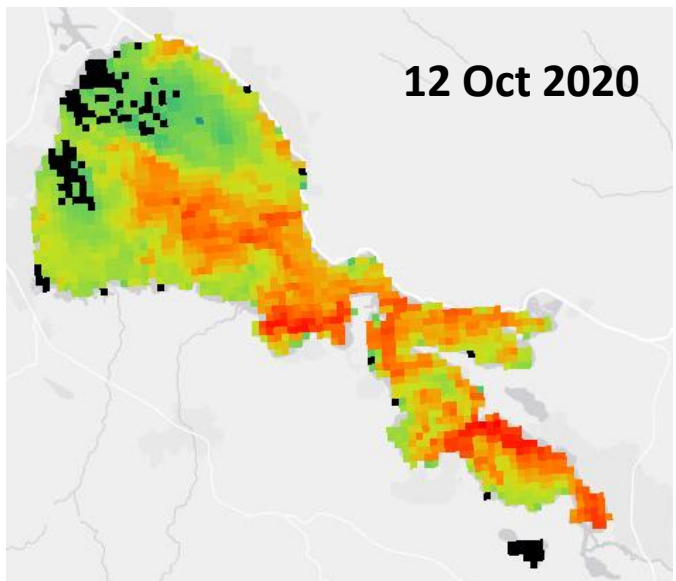


# Modeling Restoration Strategies to Reduce Cyanobacteria Blooms: Hypolimnetic Oxygenation System

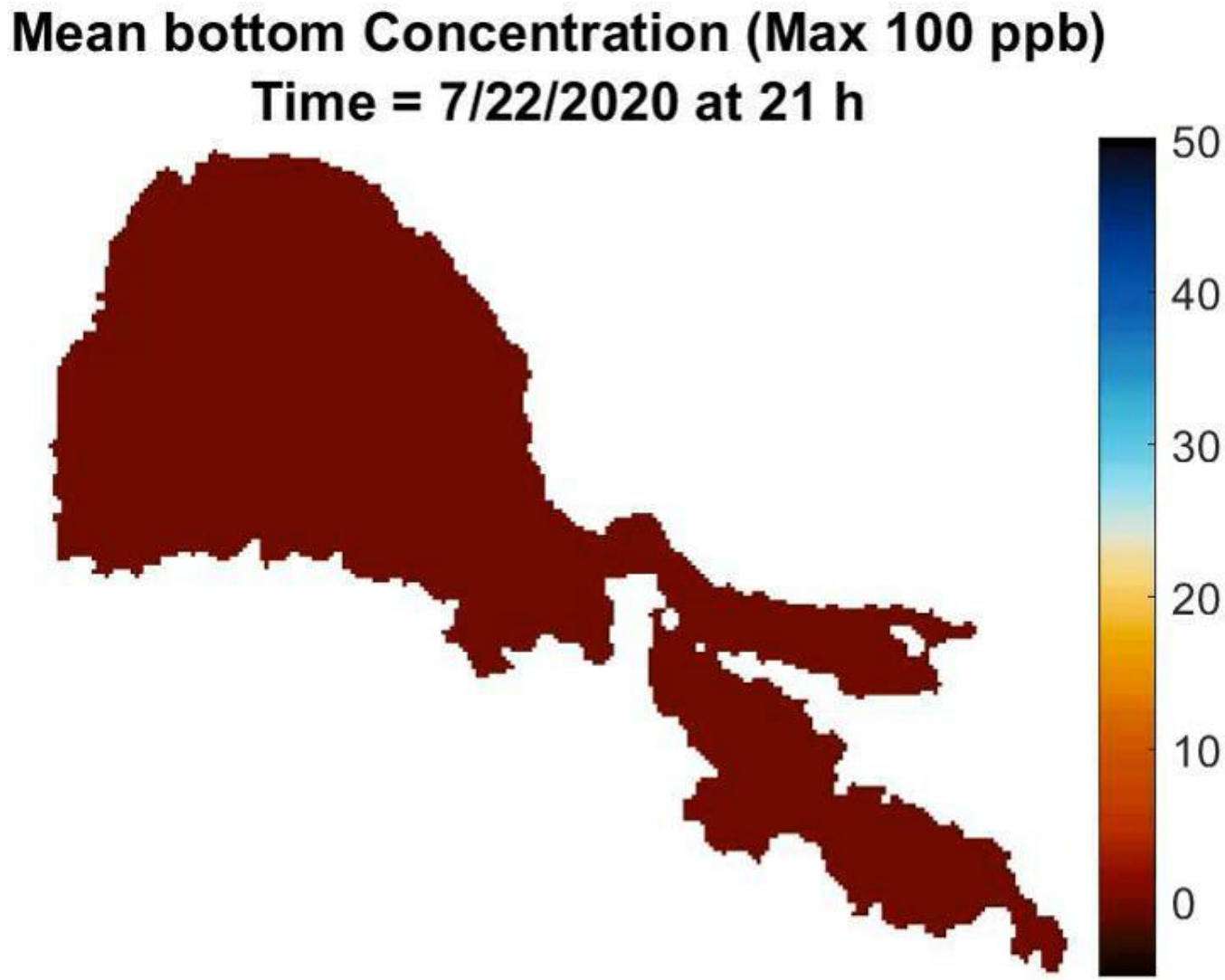



*Gerling et al. 2014. First report of the successful operation of a side stream supersaturation hypolimnetic oxygenation system in a eutrophic, shallow reservoir*



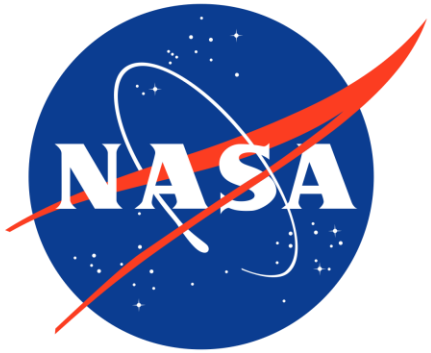

https://fhab.sfei.org/



# Additional Collaborators and Funding Sources





# Research Team

https://terc-clearlake.wixsite.com/cldashboard

**Thank you!**
**Questions?**

| Name | Position |
|---|---|
| Geoff Schladow | Principal Investigator (PI) |
| Alex Forrest | Co-PI |
| Steve Sadro | Co-PI |
| Alicia Cortes | Project Scientist |
| Lidia Tanaka | Project Scientist (Phycologist) |
| Shohei Watanabe | Data manager & Project Scientist |
| Anne Liston | Research Associate (Chemistry) |
| Steven Sesma | Research Associate (Chemistry) |
| Katie Senft | Research Associate (scuba & field) |
| Brandon Berry | Research Associate (scuba & field) |
| Samantha Sharp | Graduate Student |
| Micah Swann | Graduate Student |
| Nicholas Framsted | Graduate Student |
| Ruth Thirkill | Graduate Student |
| Kanarat (Job) Pinkanjananavee | Graduate Student |
| Carmen Woods | Project administration |
| Lindsay Vaughan | Technical Staff |