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
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

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

Variability in samples collected at Clear Lake, Aug 10, 2021
Cyanobacteria species identification from hyperspectral data

Data collection in Clear Lake, July 22, 2021
Ultimate goal: use hyperspectral data to distinguish bloom type

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

- Inflow
- Heat Exchange
- Inter-basin exchanges
- Stratification
- Mixing
3D Bio-geochemical Lake Model

How does the lake production change?

- Algal Species
- Particulate Organic Matter
- Dissolved Organic Matter
- Dissolved Oxygen
- Dissolved Inorganic Nutrients (PO₄, DIC, NH₄)
- Grazers
- Including Cyanobacteria
Stratification, Dissolved Oxygen, Nutrients and HABs

Nutrients are released from the sediments

Total Phosphorus (MT)

<table>
<thead>
<tr>
<th>Year</th>
<th>Max Observed</th>
<th>Annual External Input</th>
<th>Net Observed Internal (June – Oct)</th>
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</thead>
<tbody>
<tr>
<td>2019</td>
<td>471.5</td>
<td>123</td>
<td>348.5 (74%)</td>
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<tr>
<td>2020</td>
<td>654.8</td>
<td>20.5</td>
<td>634.3 (97%)</td>
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Credit: Micah Swann
Prediction of the Onset of Cyanobacteria Blooms

1) Nutrients are released from the sediments and move upwards to feed the cyanobacteria blooms.

2) Cyanobacteria blooms increase during and after stratified conditions.

3) The cyanobacteria blooms decrease sunlight and nighttime oxygen.

4) Other algae, fish and plants die and sink → Increase sediment storage.
Prediction of the Location and Movement of Cyanobacteria Blooms

Lake Erie Harmful Algal Bloom Forecast

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
Mean bottom Concentration (Max 100 ppb)

Time = 7/22/2020 at 21 h

https://fhab.sfei.org/
Additional Collaborators and Funding Sources

[Logos of various organizations]
Research Team

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

Thank you! Questions?

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
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<tbody>
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