AN INTEGRATED APPROACH TO BASIN-SCALE WATER QUALITY MODELING IN CLEAR LAKE, CA

Micah Swann

YCFCWCD Board of Directors Meeting

May 14, 2019

UC Davis, Department of Civil and Environmental Engineering

UCDAVIS Tahoe Environmental Research Center

UCDAVIS Civil and Environmental Engineering

Agenda

- Indian Valley Reservoir Survey
  - Motivation
  - Methods
  - Results
- Clear Lake Water Quality Modeling
  - Background
  - Objectives
  - Lake Monitoring Network

SURVEYING INDIAN VALLEY RESERVOIR (NOV 2018)

UC Davis Research Vessel on IVR (November 18th, 2019)

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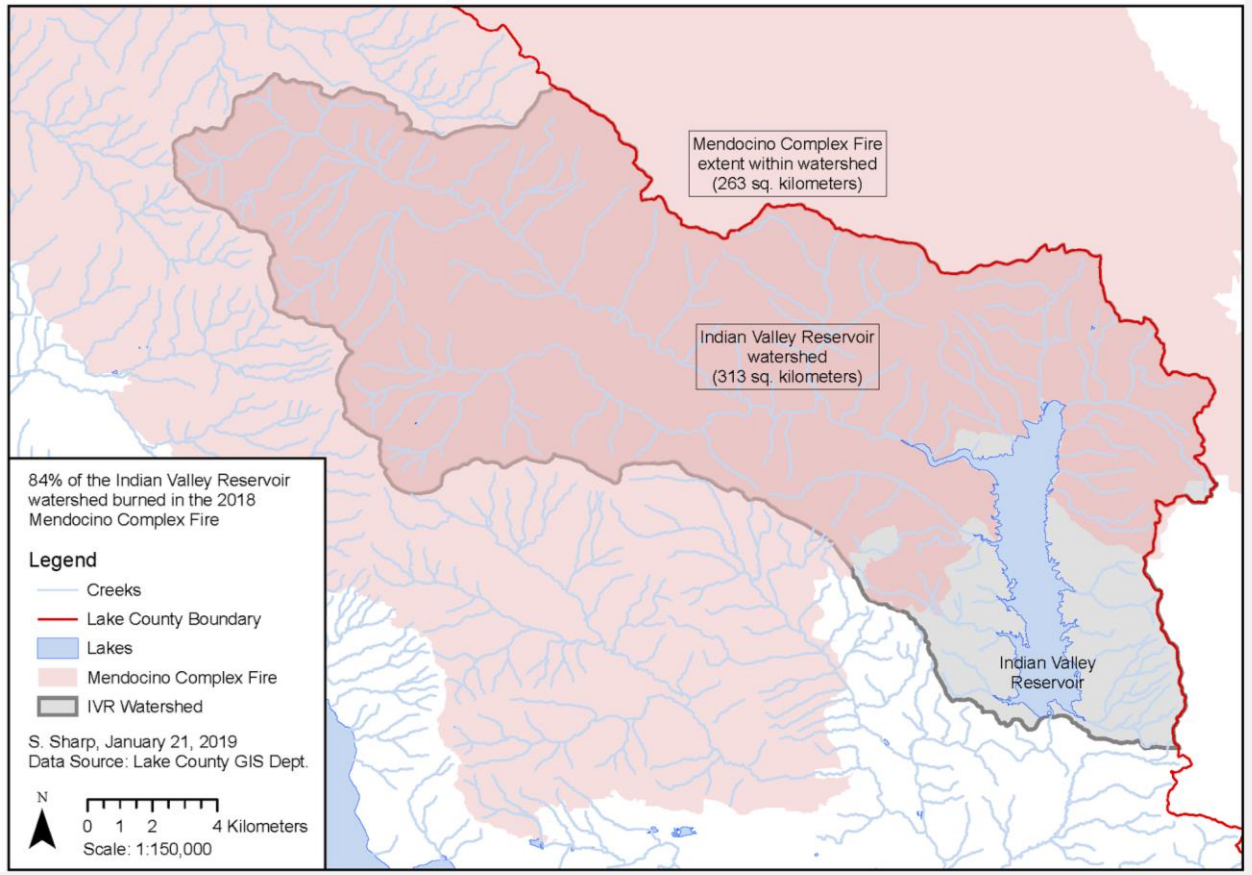
MOTIVATION

- No full-basin bathymetric survey has been conducted since reservoir construction (1975)
- 2018 Mendocino Complex Fire burned over 80% of IVR watershed



Impact of 2018 Mendocino Complex Fire on Indian Valley Reservoir

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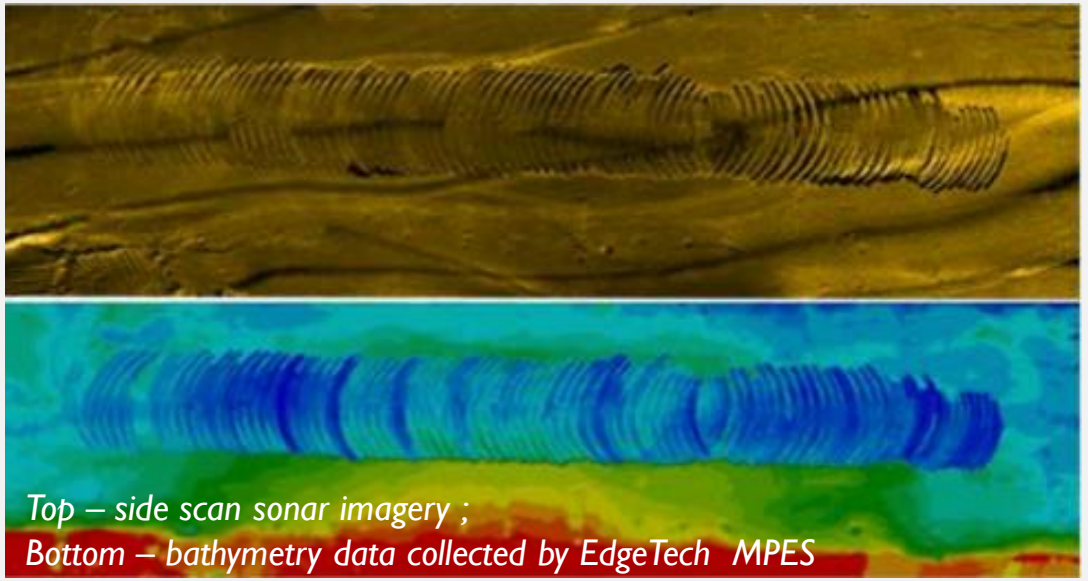
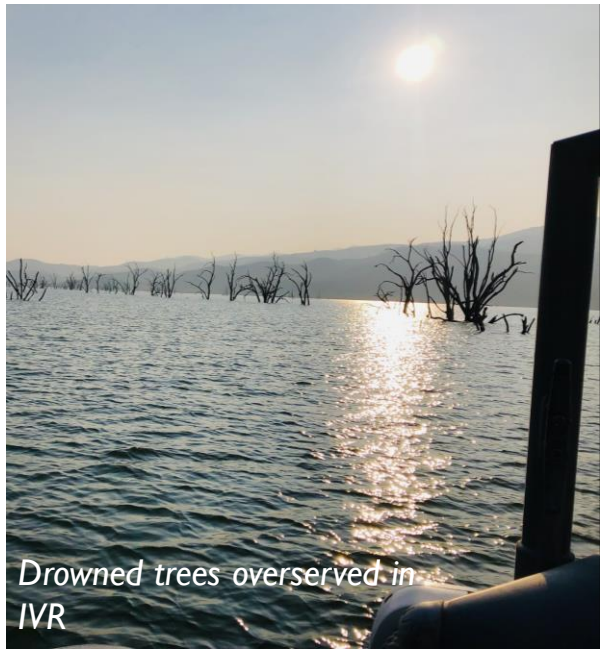
METHODS

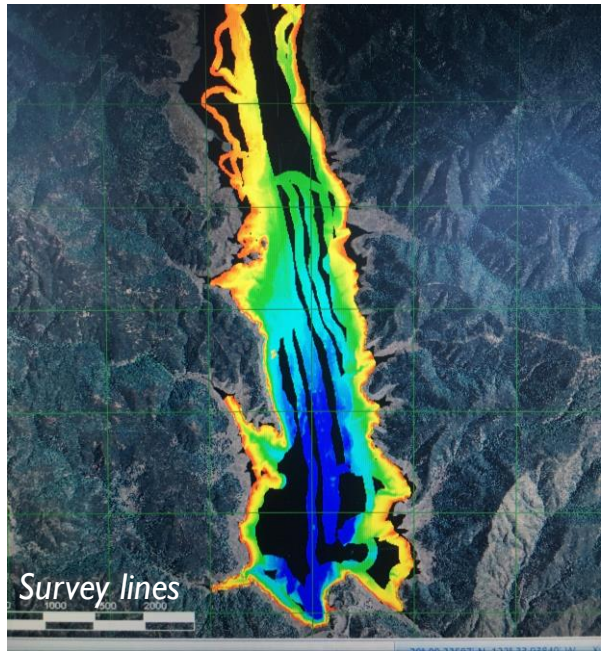
- Surveyed IVR in November 2018, prior to start of 2018-2019 storm season
- Utilized a boat-mounted EdgeTech 6205 Multi-Phase Eco Sounder
  - Combined Bathymetric and Side Scan Sonar
- Post-processed survey product by interpolating between data points to create a full coverage survey

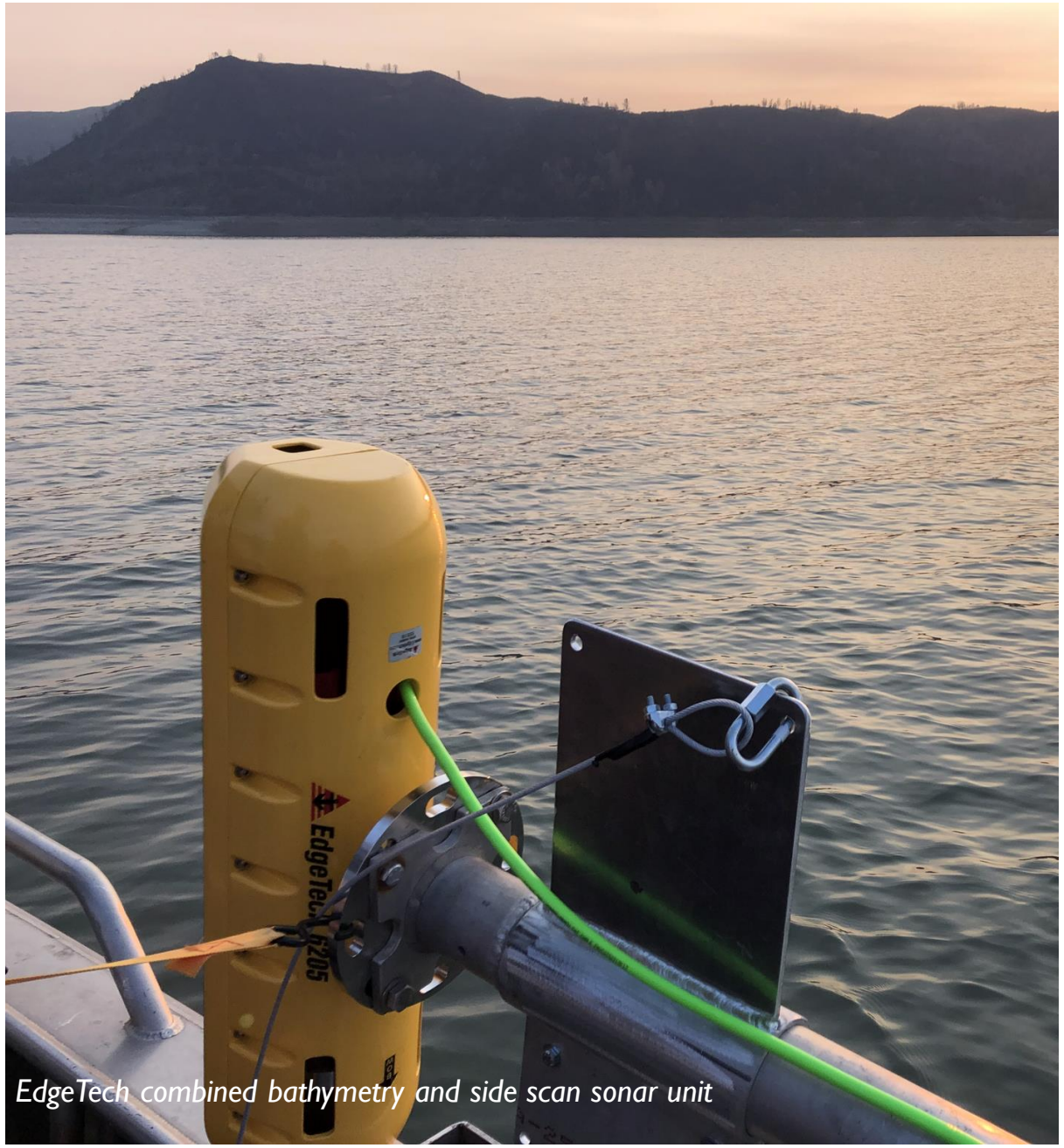


Top – side scan sonar imagery ;
Bottom – bathymetry data collected by EdgeTech MPES

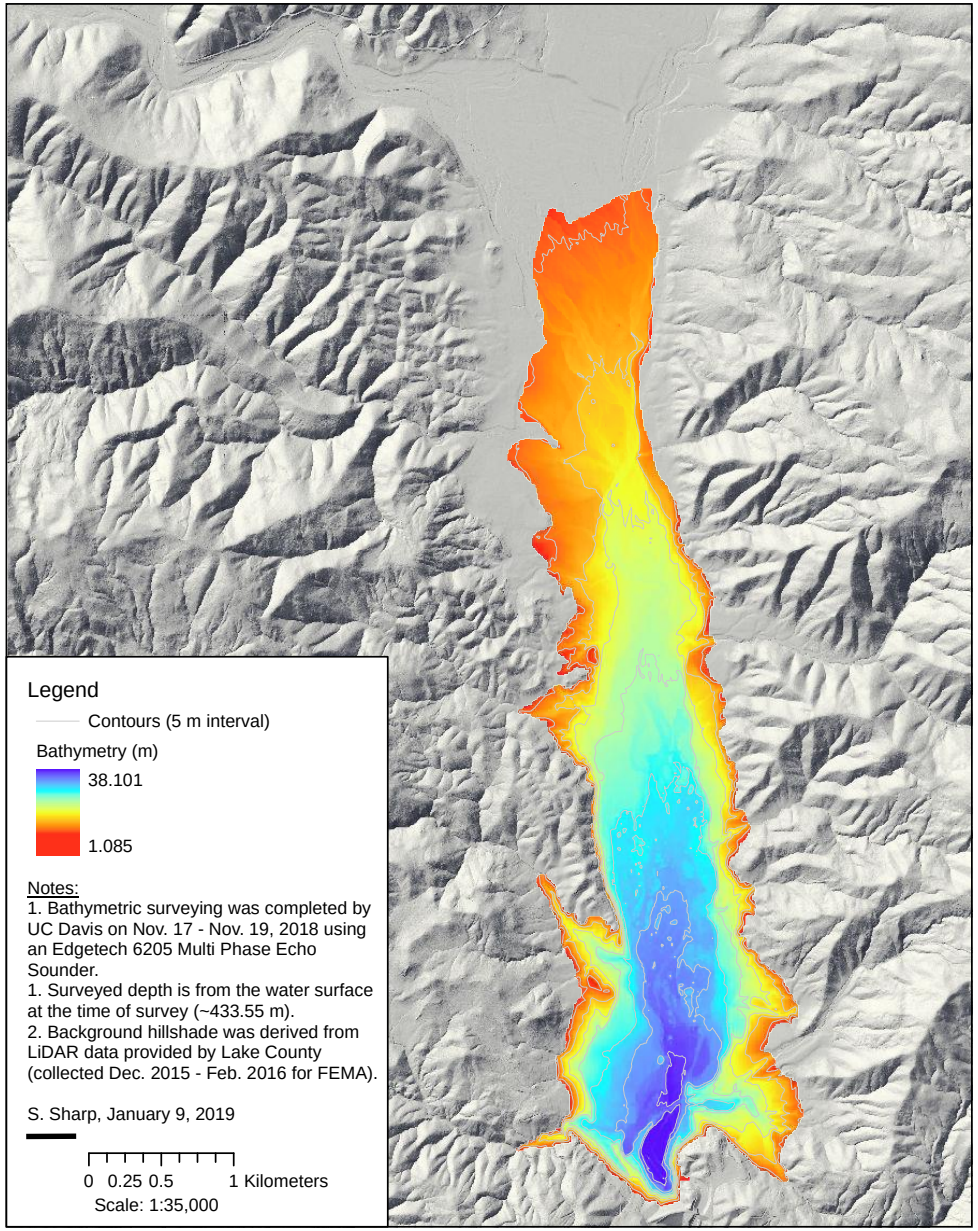
UC Davis Survey Vessel ~ Bob Richards


Drowned trees overserved in IVR


Survey lines



EdgeTech combined bathymetry and side scan sonar unit



Indian Valley Reservoir
November 2018 Bathymetry

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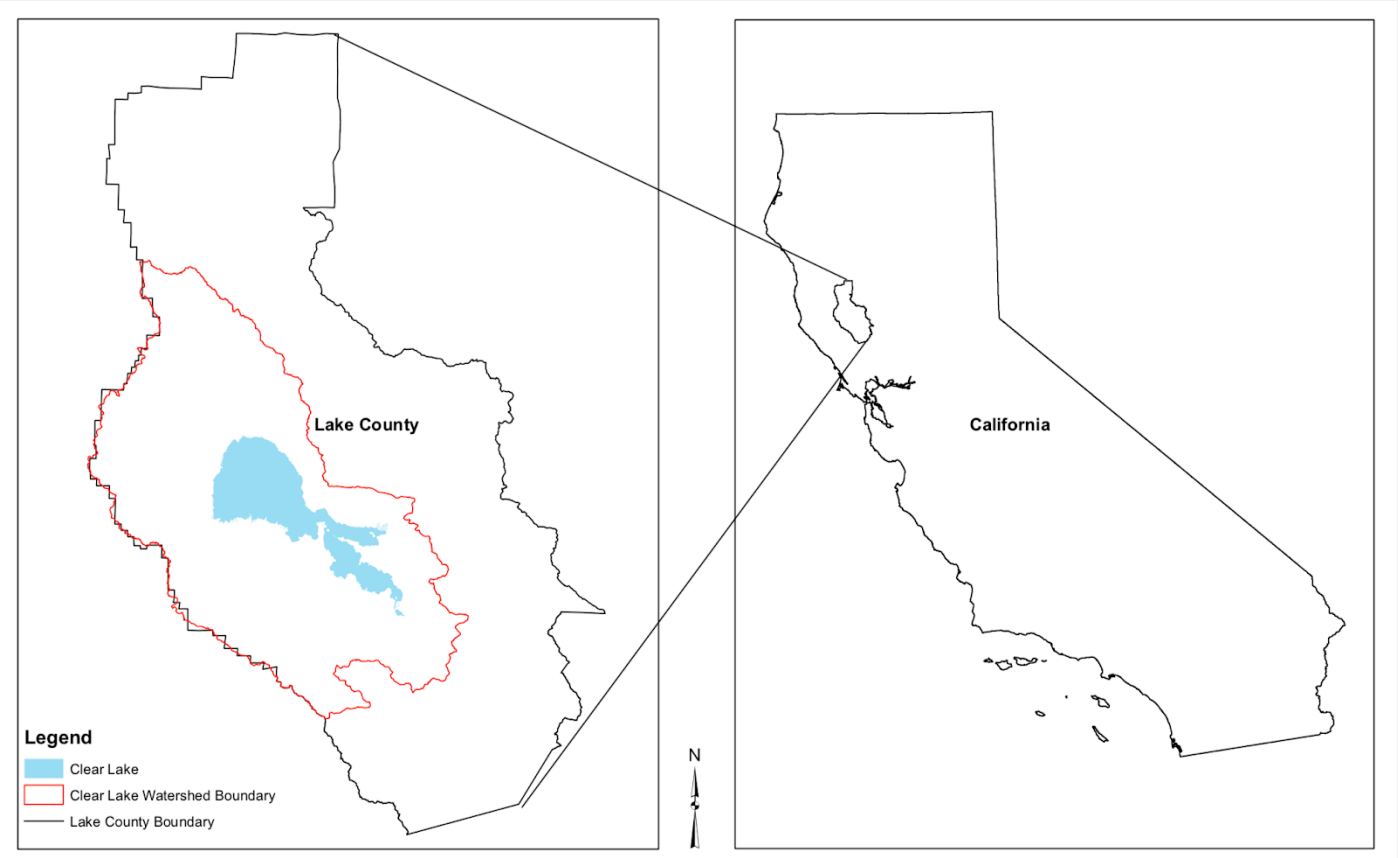
NEXT STEPS

- Currently post-processing data to generate reservoir storage table estimate
    - Resolving datum issues between sonar and LIDAR data
- Plan to return in next six month for follow-up, post storm-season survey
    - Can compare survey result to calculate annual sediment accumulation rate

CLEAR LAKE

Background

- Largest freshwater lake in California
- Very shallow
- Naturally eutrophic
- Oldest lake in North America



Location of Clear Lake CA – *Clear Lake Integrated Watershed Management Plan*

Historical Water Quality Challenges

- Sulfur Bank Mercury Mine
- Cyanobacteria and algal blooms
- Wildfires


Sulfur Bank Mercury Mine


Cyanobacteria bloom in Clear Lake (2016)
Photo courtesy of Holly Harris

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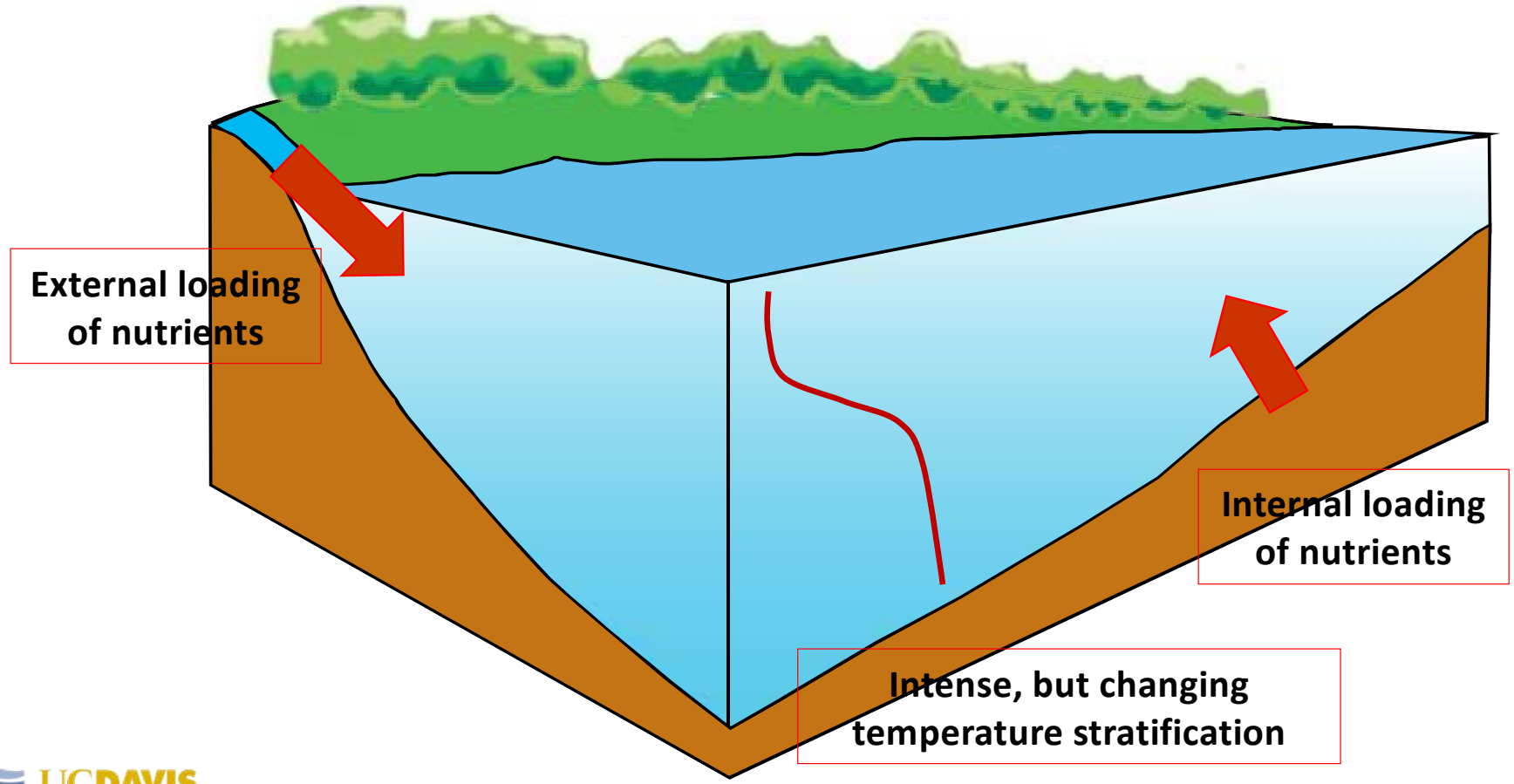
OBJECTIVES

- Collect and analyze high-frequency in-situ field data, sediment and surface water samples to quantify current lake conditions
- Develop a model to investigate the dominant driver of lake eutrophication
  - External vs internal nutrient loading
- Provide recommendations to Blue Ribbon Committee for the Rehabilitation of Clear Lake based on monitoring data and model outputs

Fundamental Question - What drives eutrophication and blue-green blooms?



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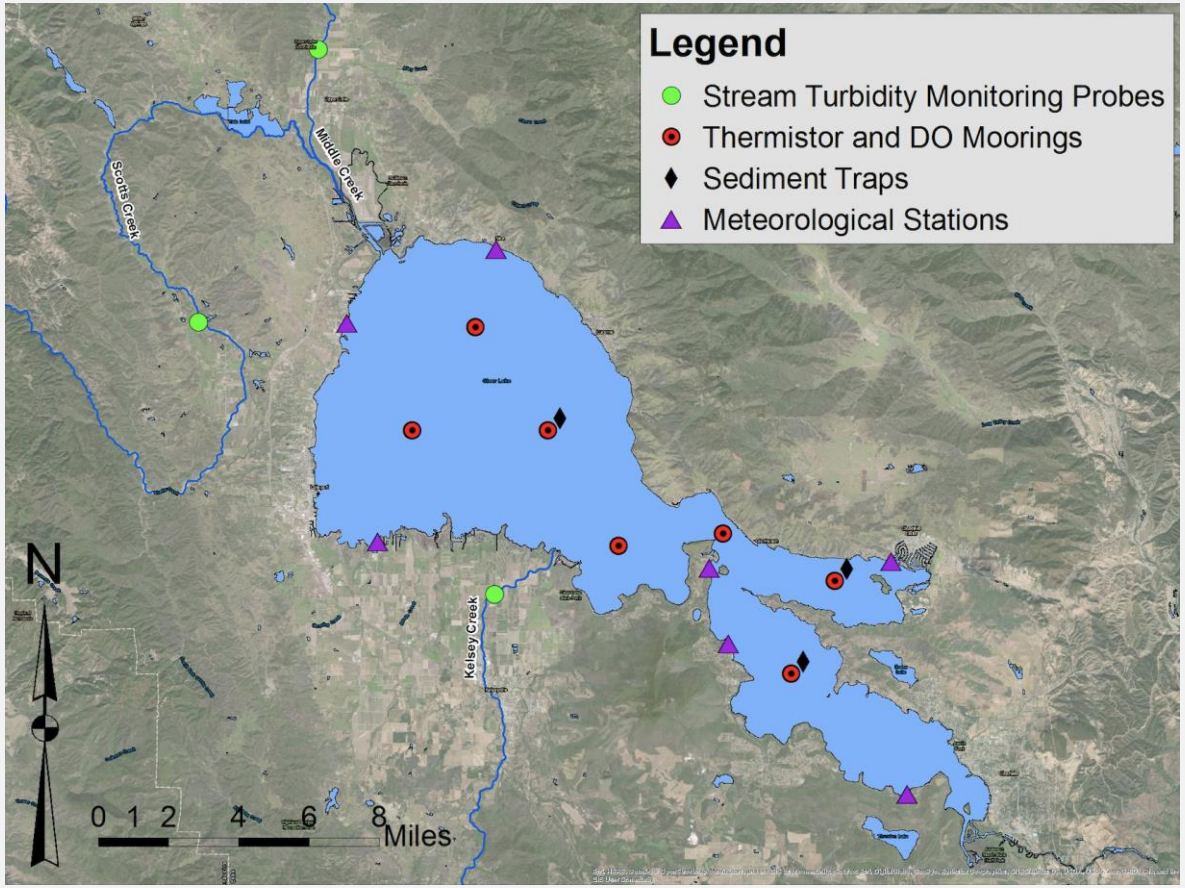
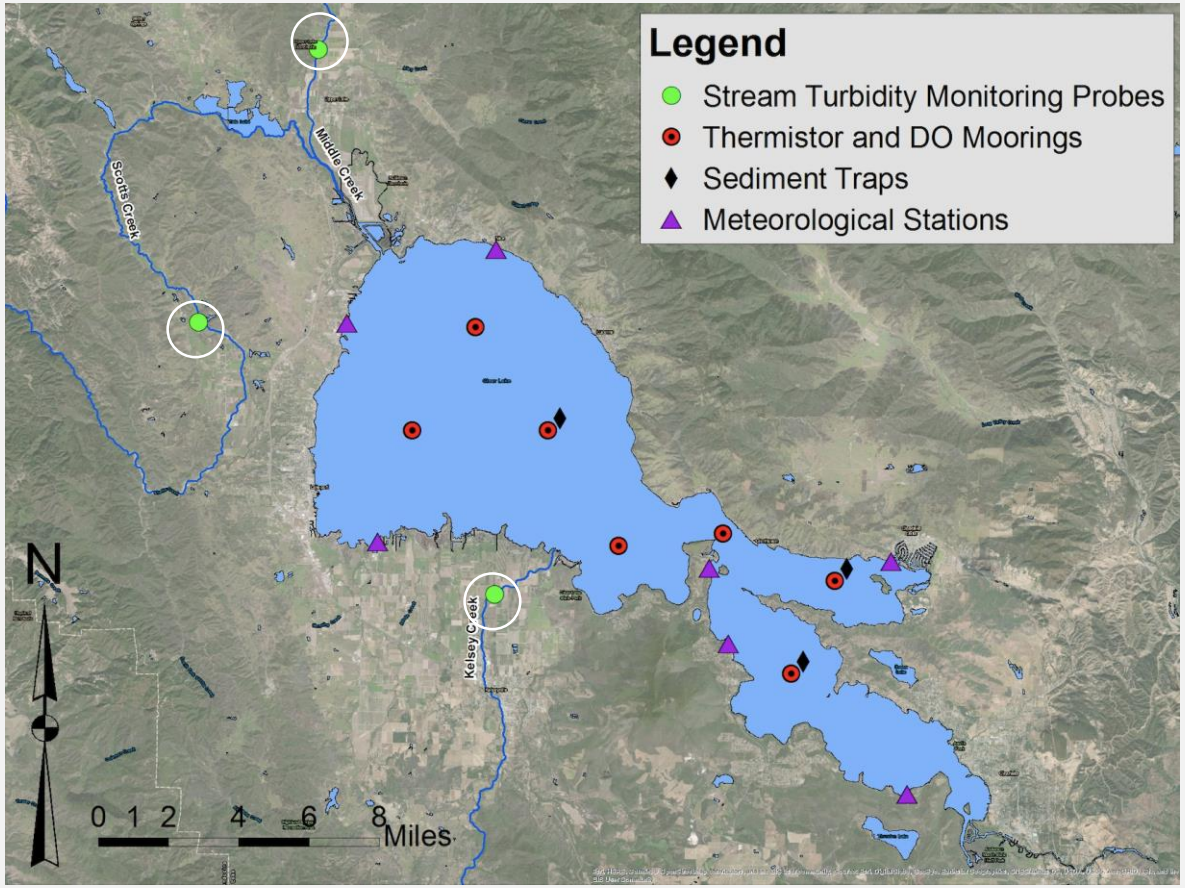
LAKE MONITORING NETWORK

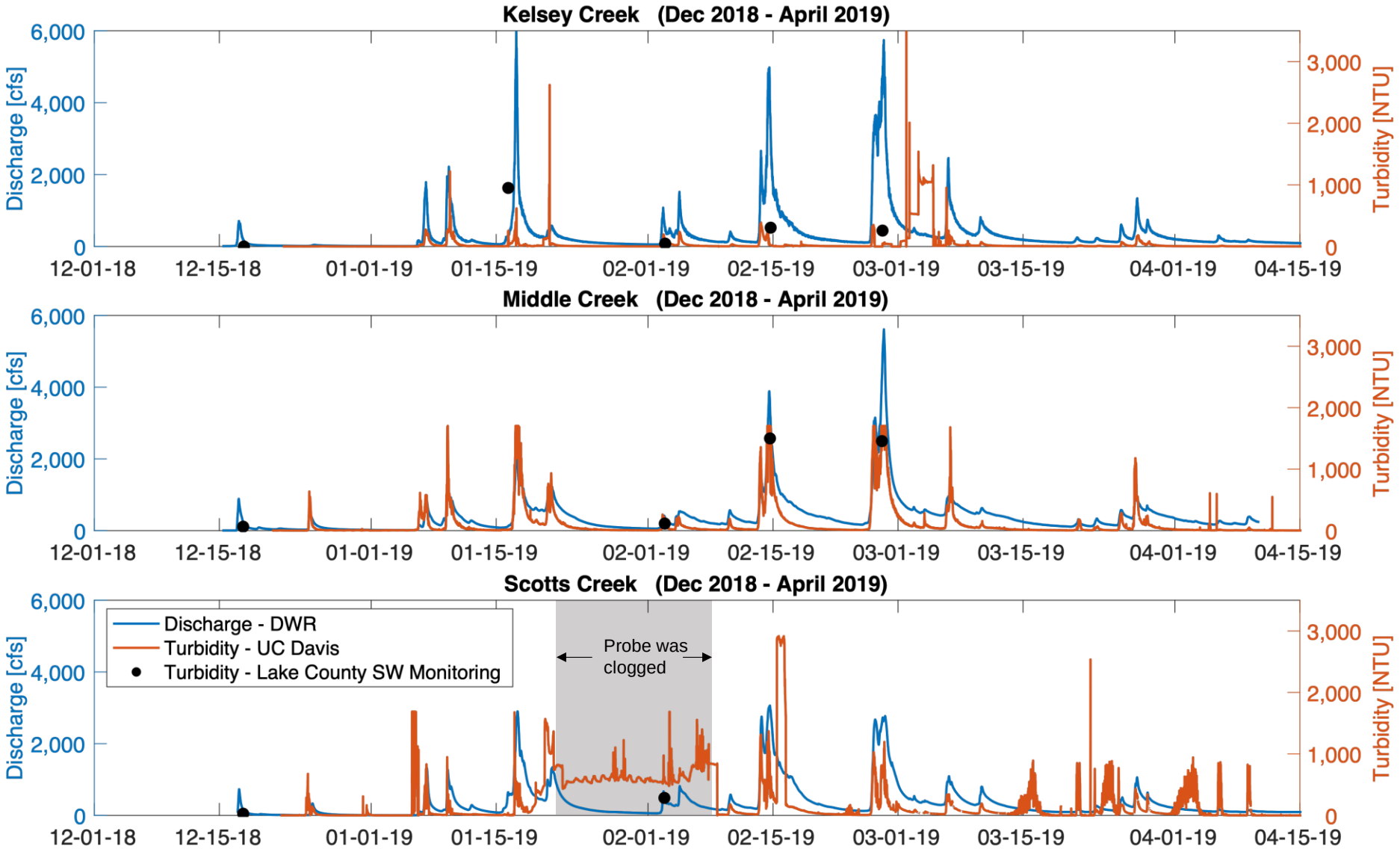
- Stream monitoring sites
- Lake moorings
- Sediment traps
- Meteorological sites



STREAM MONITORING

- In-situ optical turbidity sensors in primary tributaries to lake
- Used to estimate sediment and nutrient loading





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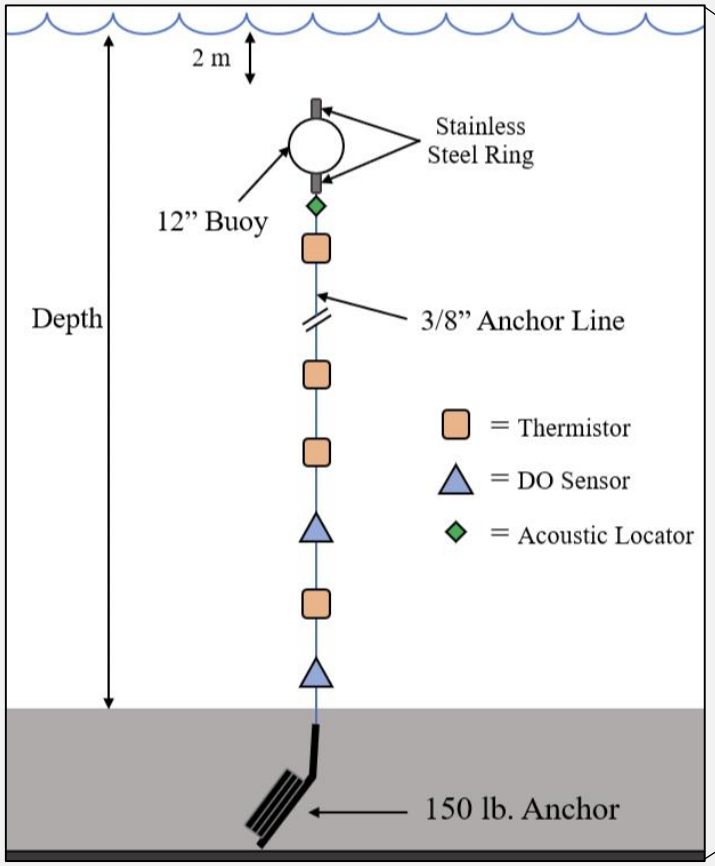
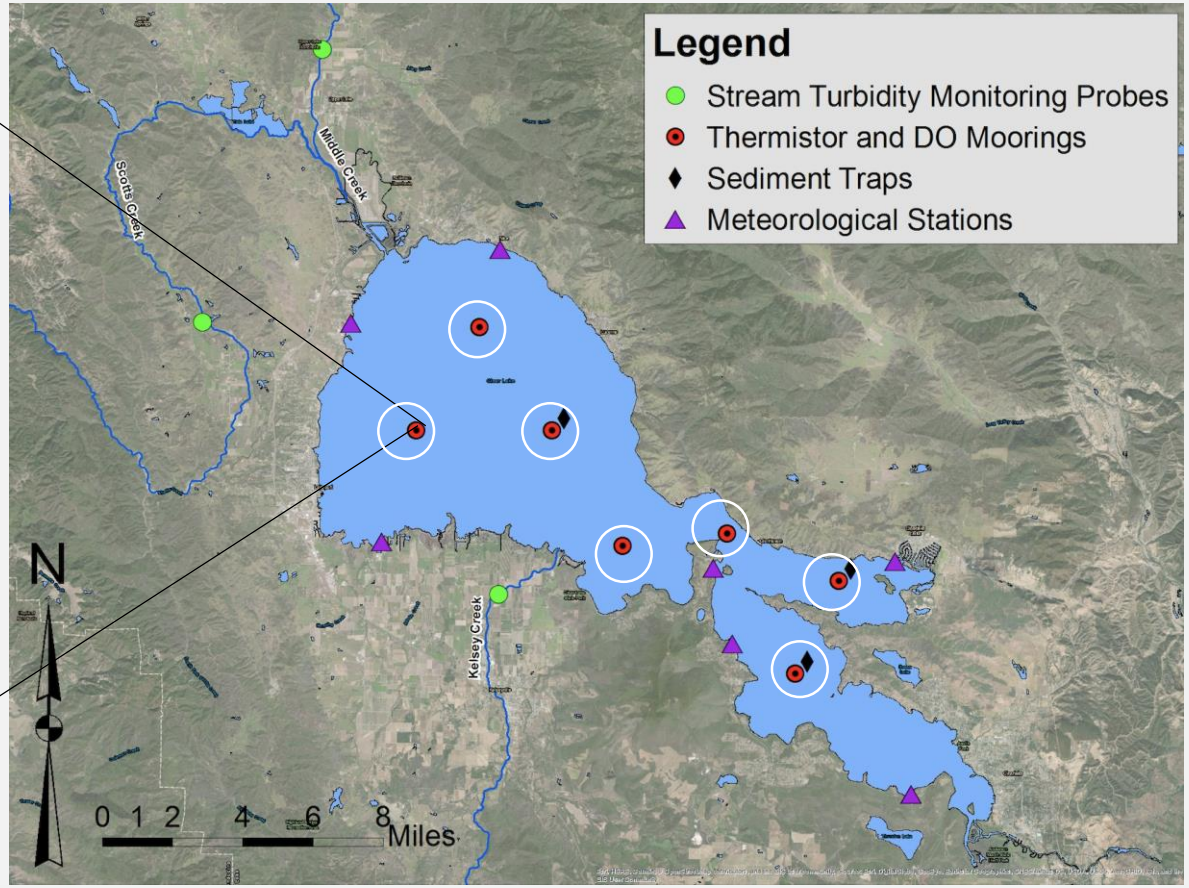
LAKE MOORINGS





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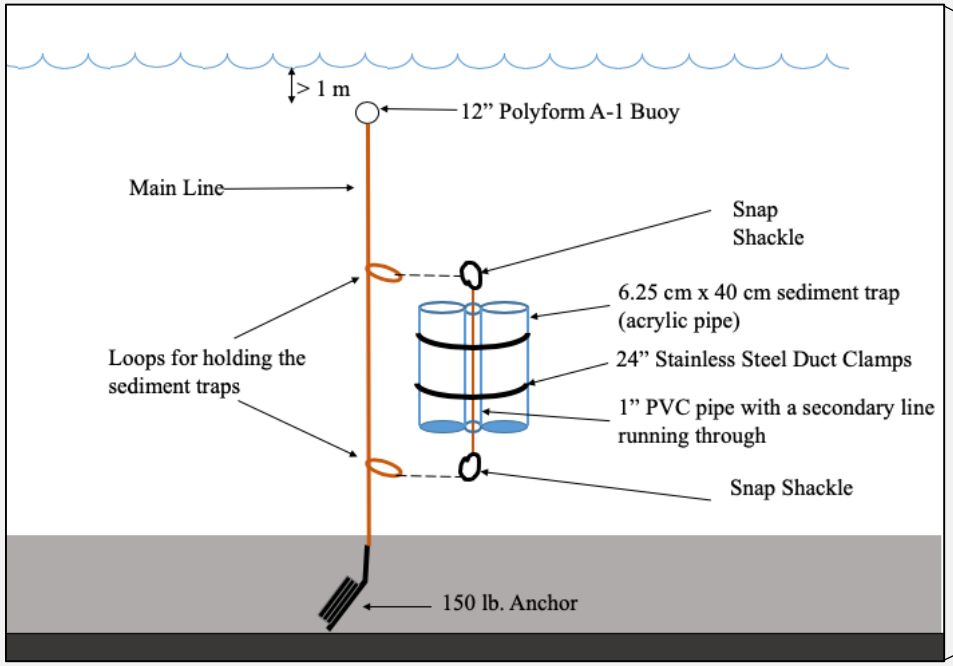
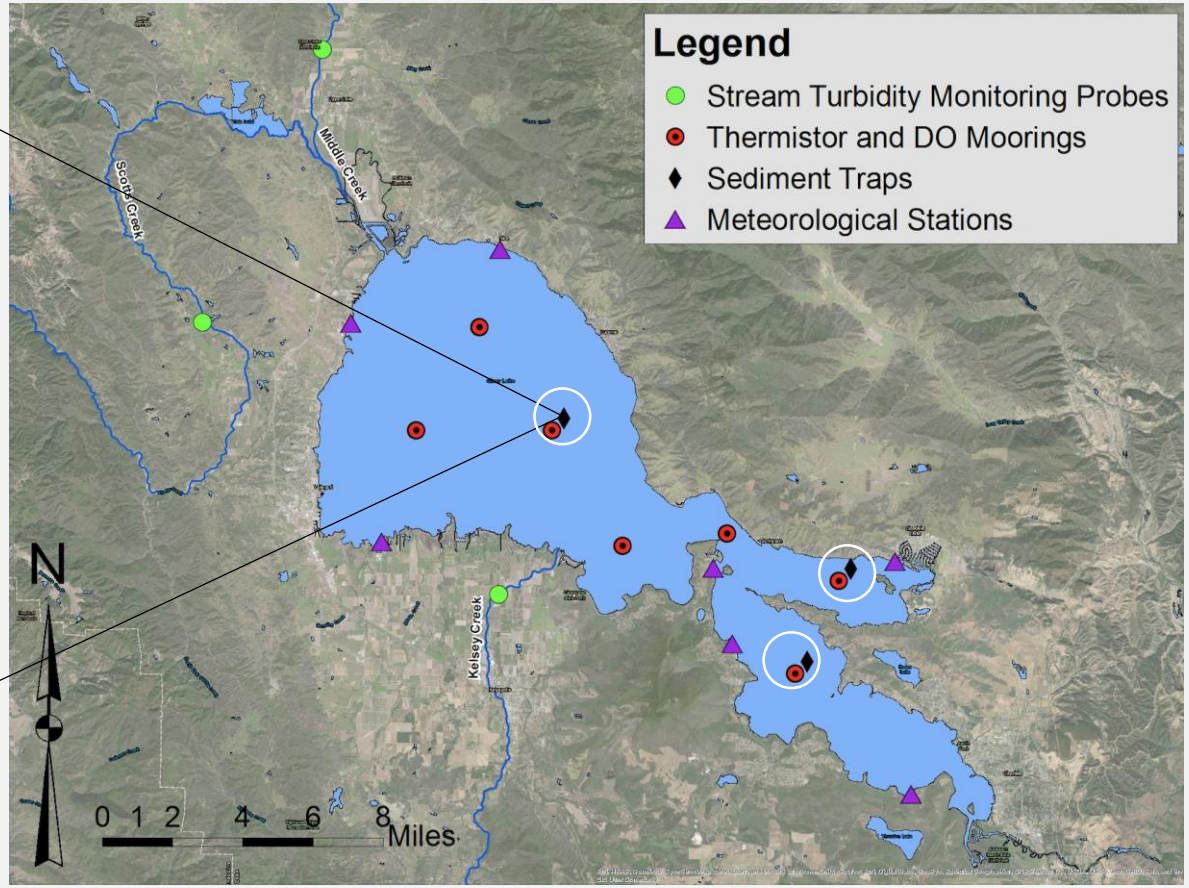
WATER QUALITY SAMPLING

Drew Stang prepares a CTD profiler for deployment

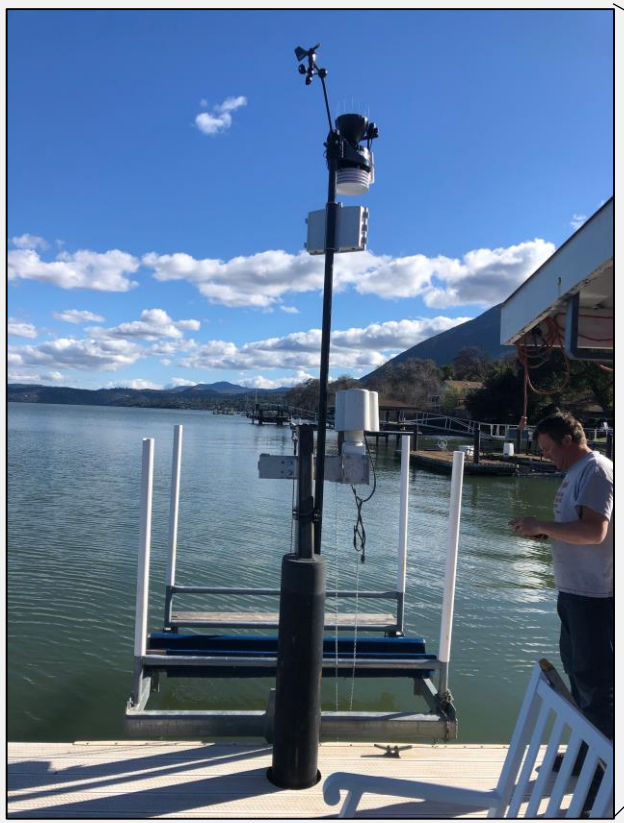
Field filtering water samples

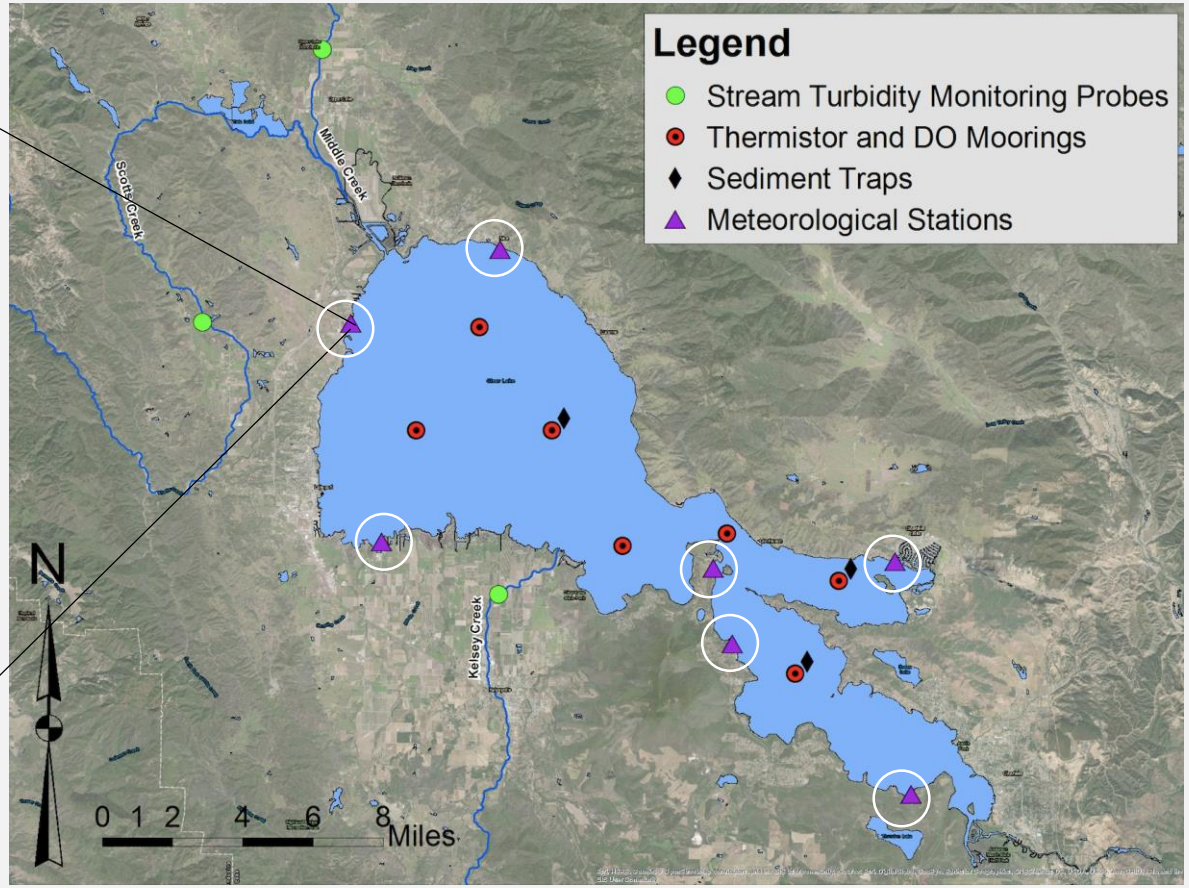
SEDIMENT TRAPS



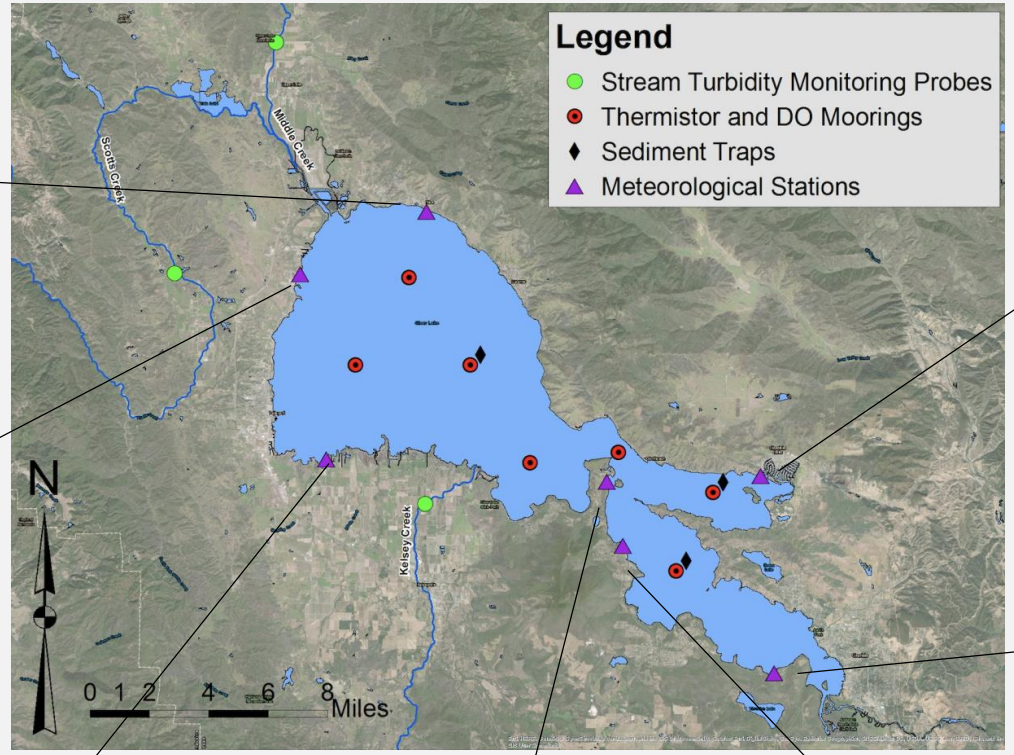


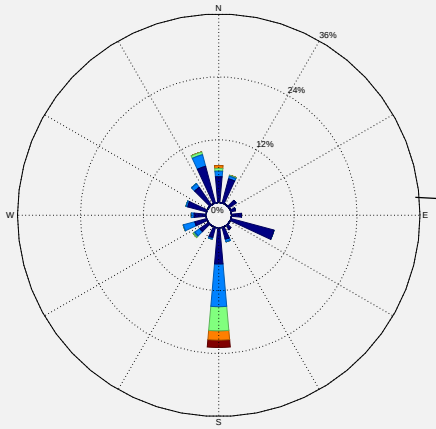
METEOROLOGICAL SITES

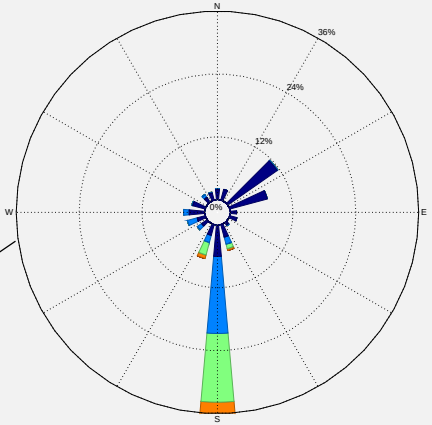


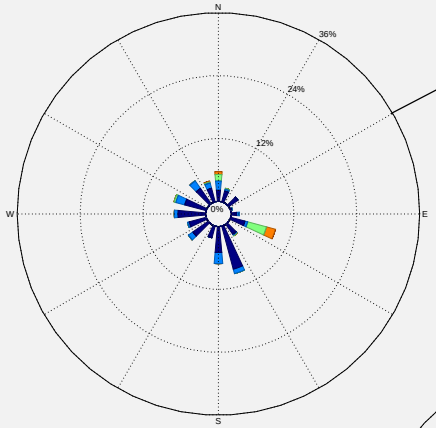


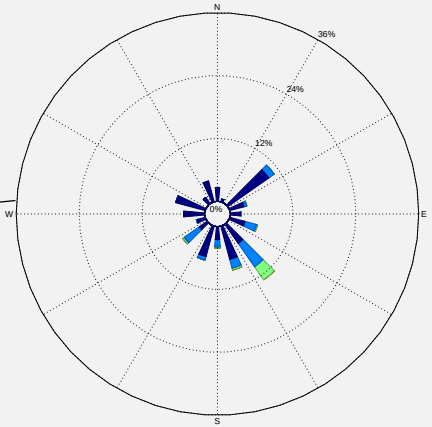
VARIABILITY IN WIND FORCING

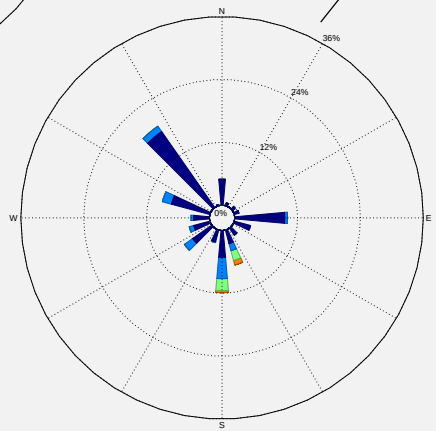


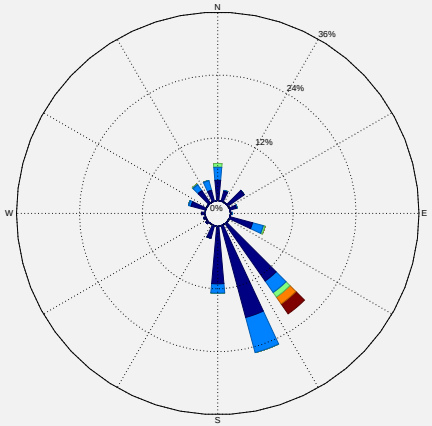


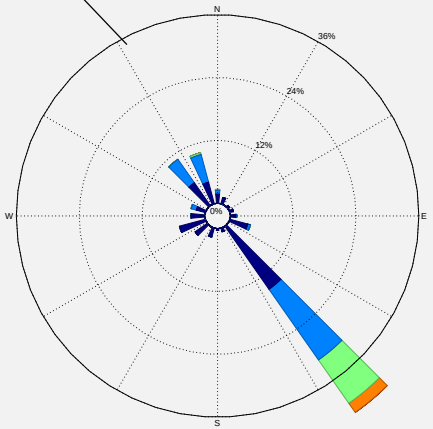












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Wind Speeds in mph
$W_S \geq 20$
$15 \leq W_S < 20$
$10 \leq W_S < 15$
$5 \leq W_S < 10$
$0 \leq W_S < 5$

ACKNOWLEDGMENTS

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- YCFCWCD
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- Tahoe Environmental Research Center
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Local Partners

- Lake County Water Resources Department
- Big Valley Band of Pomo Indians
- USGS
- DWR
- US EPA
- Blue Ribbon Committee for the Rehabilitation of Clear Lake

Research Team

- Prof Geoffeory Schladow (Co-PI)
- Prof Alex Forrest (Co-PI)
- Prof Steve Sadro (Co-PI)
- Alicia Cortes (external advisor)
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- Steve Sesma (lab chemist)
- Drew Stang (graduate student researcher)
- Samantha Sharp (graduate student researcher)
- Nick Framstead (field technician)
- Raph Townsend (field technician)
- Shohei Wantanabe (data manager)

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QUESTIONS?