

# Fall 2021 Updates SSTF



Lyons Biogeochemistry Lab

Caroline Hung

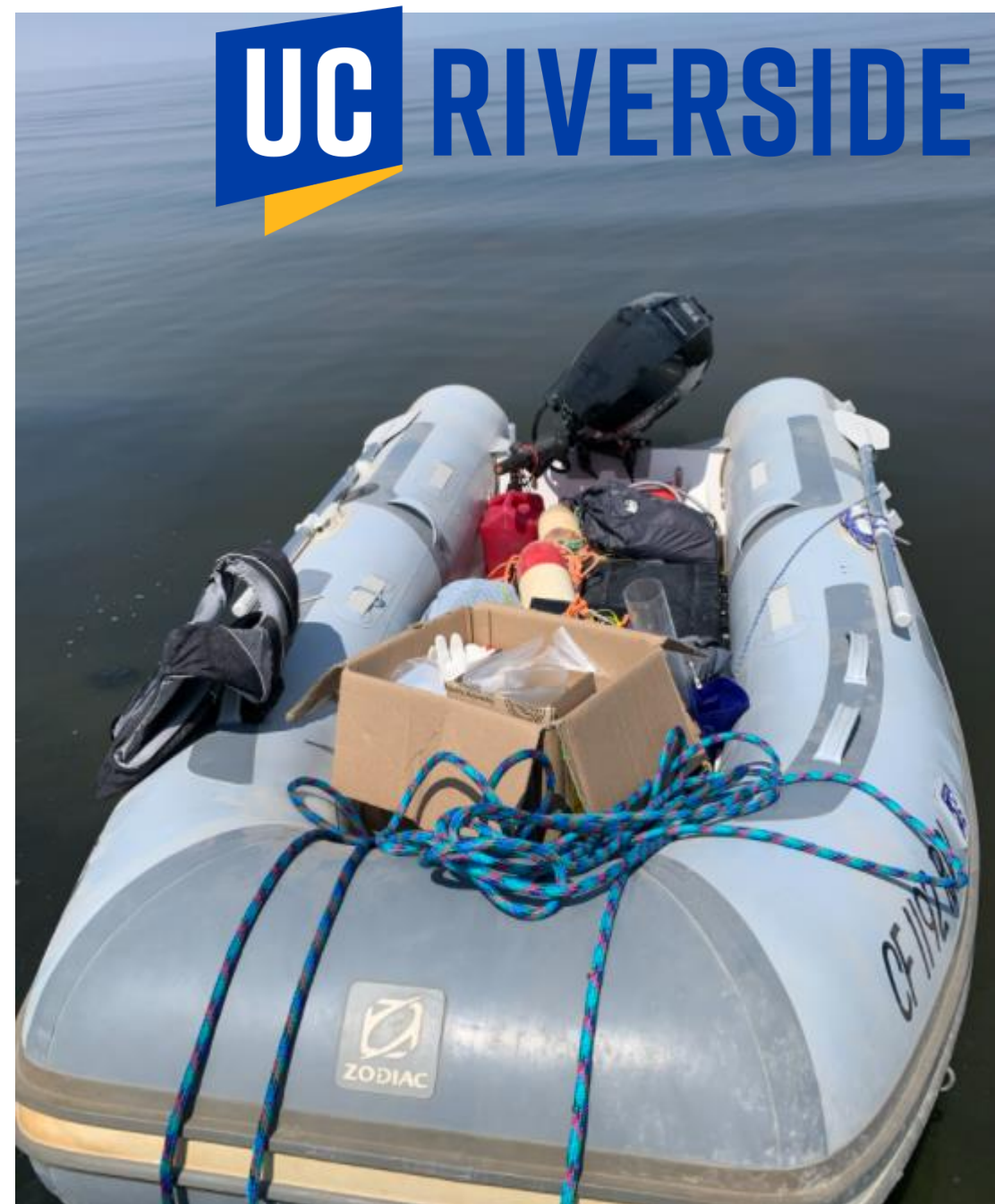
Dr. Charlie Diamond





# Research Objectives

- Characterize biogeochemical cycling of relevant elements to understand the system at the highest possible level of detail
  - Aid in understanding and interpreting paleoenvironmental proxies
  - Potential implications for environmental and public health hazard remediation



- While our work is still in fairly early stages, two themes have made themselves clear.

1) The water level is receding, leading to increases in both the salinity and the logistical challenge of launching a boat

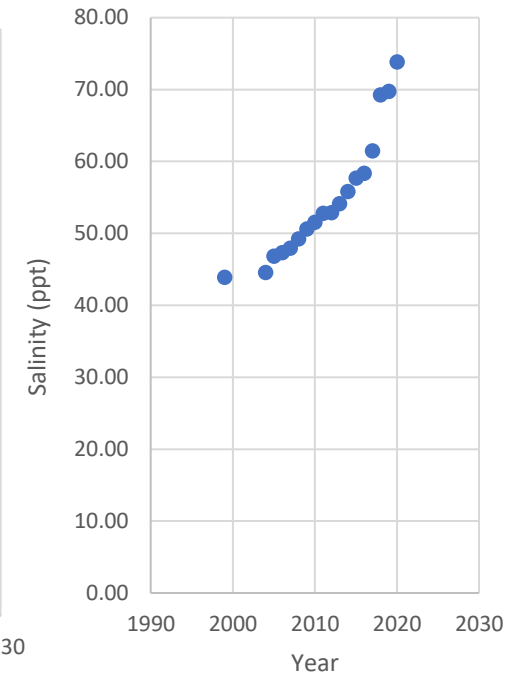
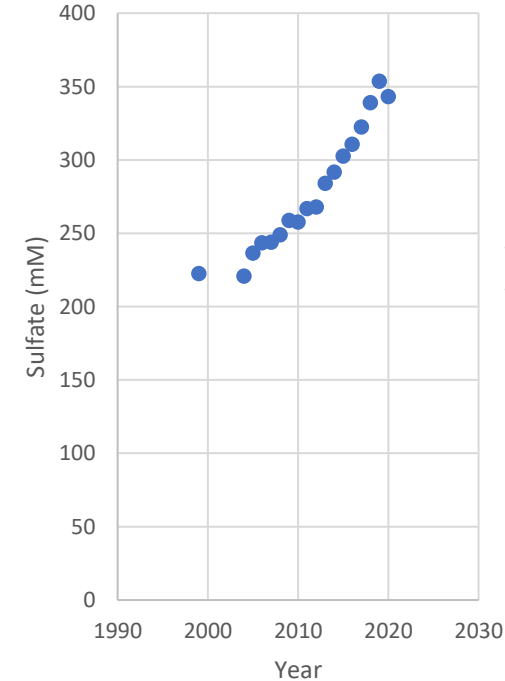
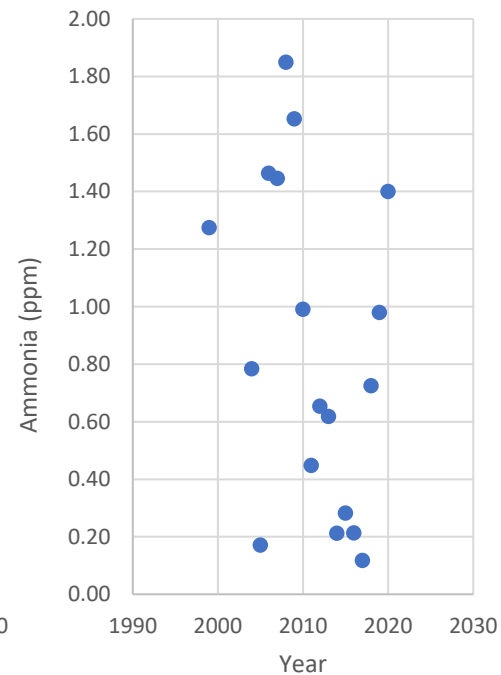
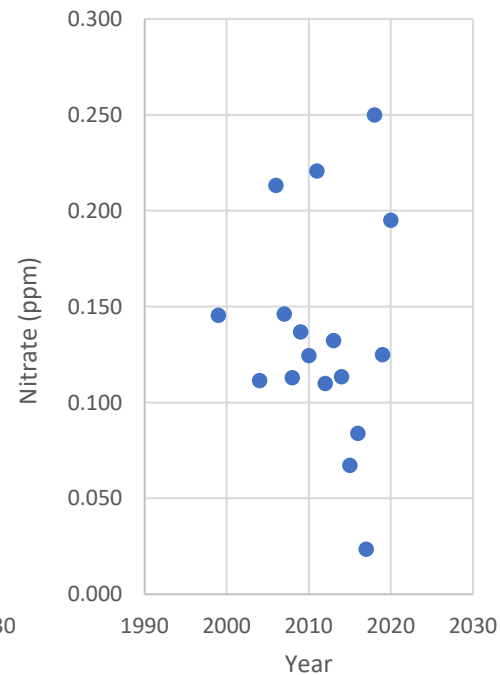
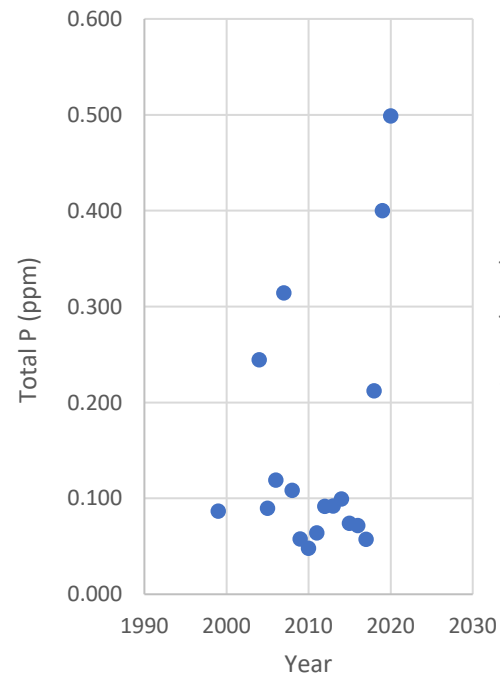
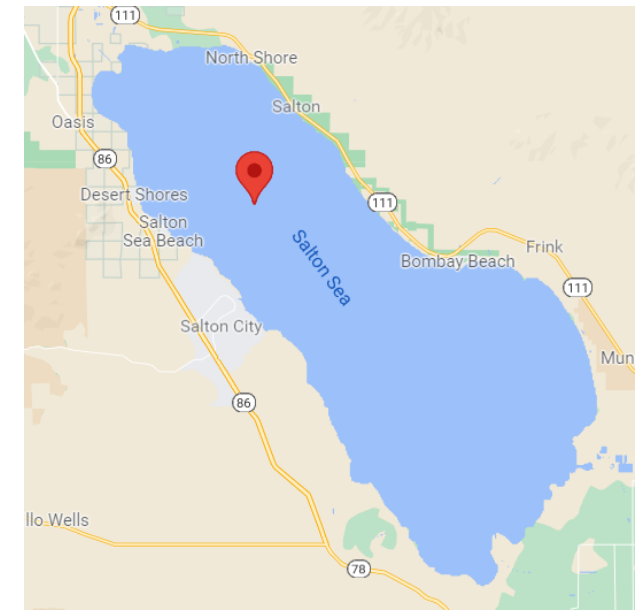


2) The agriculture in the region is contributing enormous amounts of nutrients to the lake, which drive nearly every aspect of the biogeochemistry and ecology



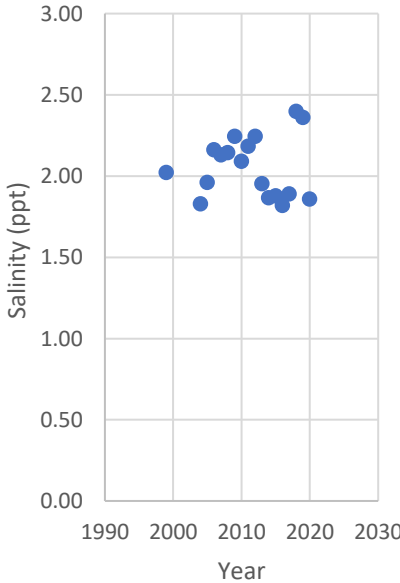
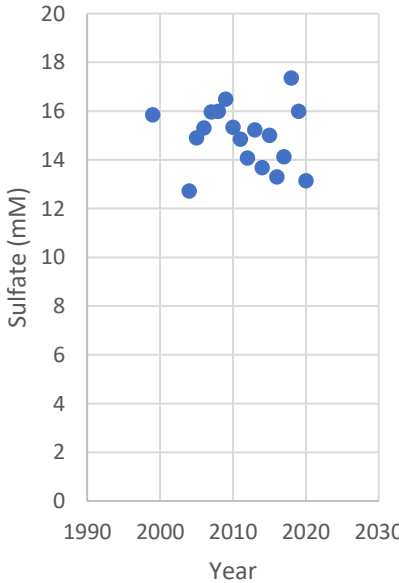
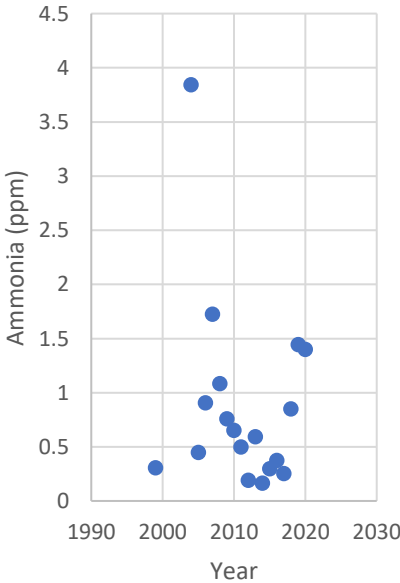
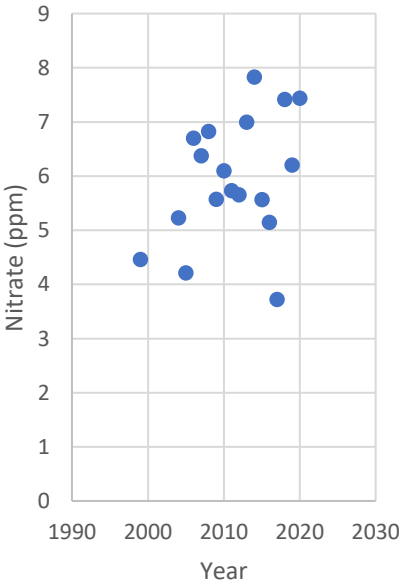
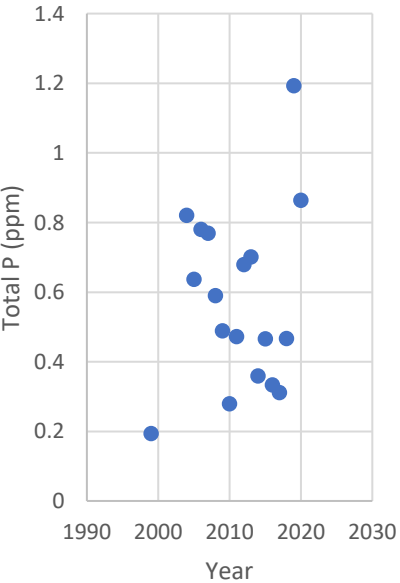
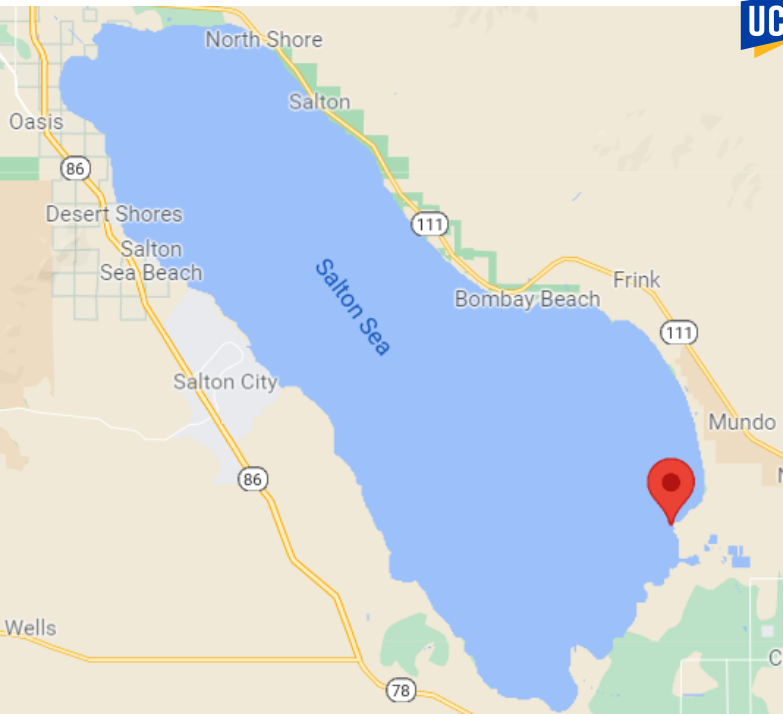
# Bureau of Reclamation Data

## Surface waters in N. Depocenter



# Bureau of Reclamation Data

Alamo River Mouth in the S.  
(57% relative contribution of all riverine input)





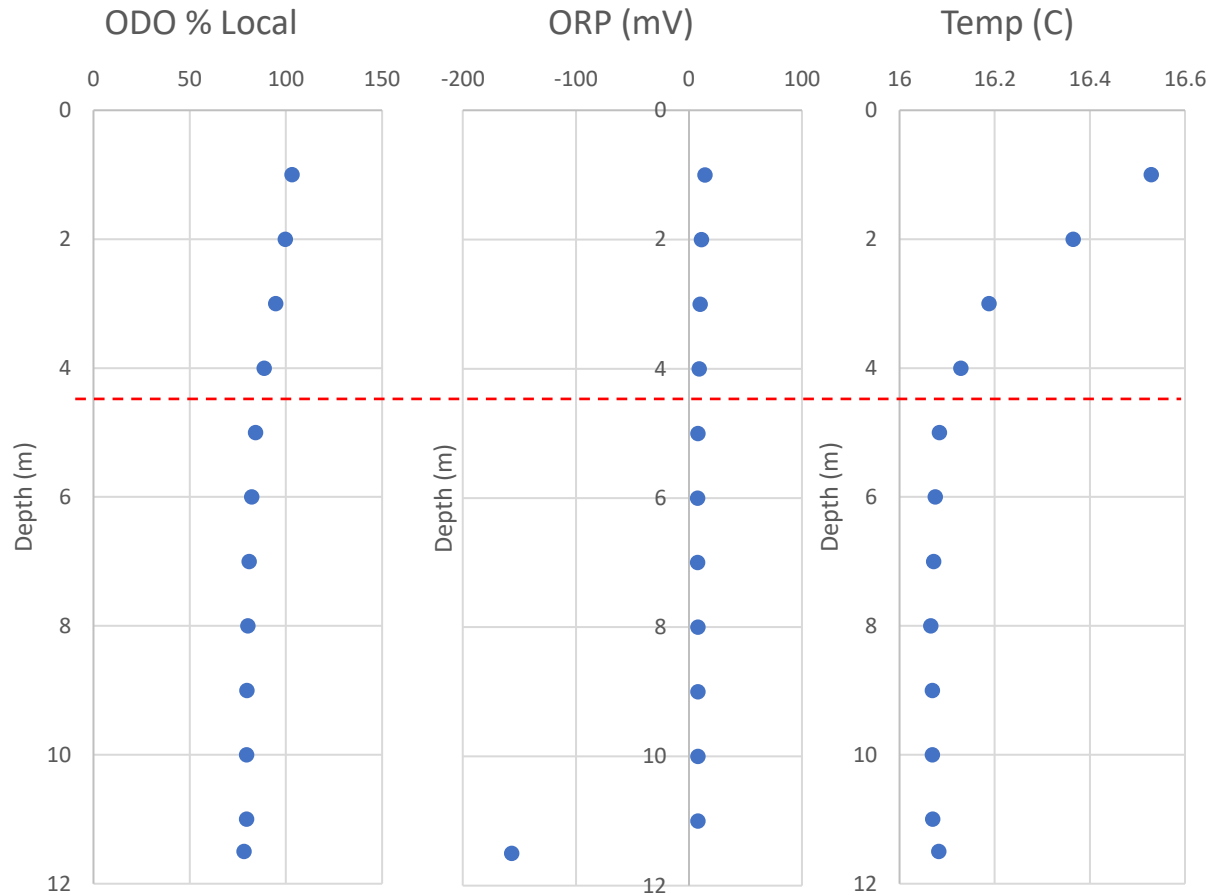
# Issues surrounding Eutrophication

- Sonny Bono National Wildlife Refuge/Audubon Partners (birds bugs algae)
- CA Waterboard??
- Must understand the source, sink and fate of the biogeochemical cycling to tackle best remediation strategy



# Water Column Profiles-S. Depocenter

12/13/2020 Winter 

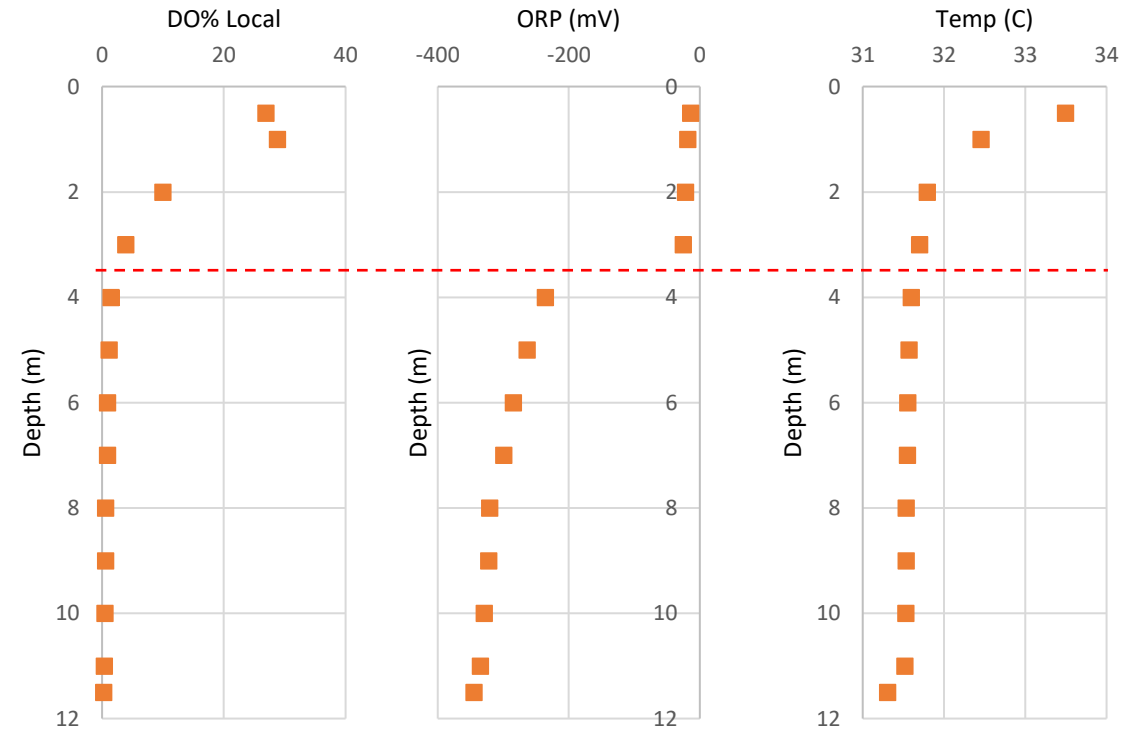
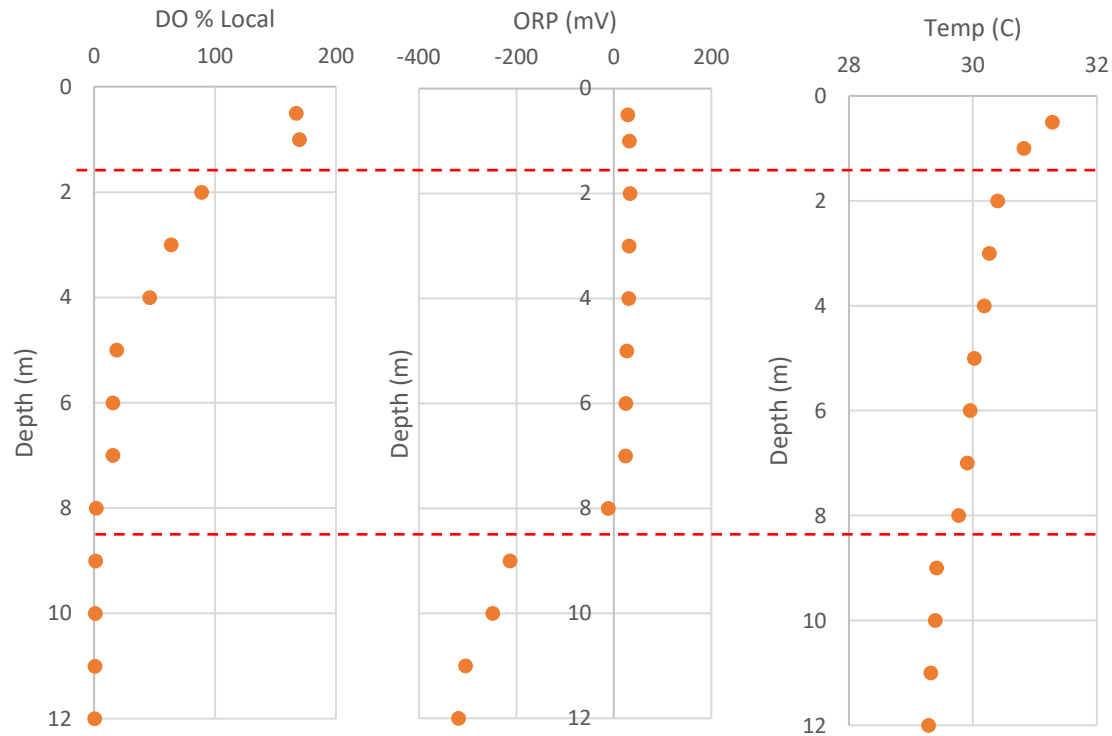


# Water Column Profiles-S. Depocenter

8/12/2020 Summer Background Day

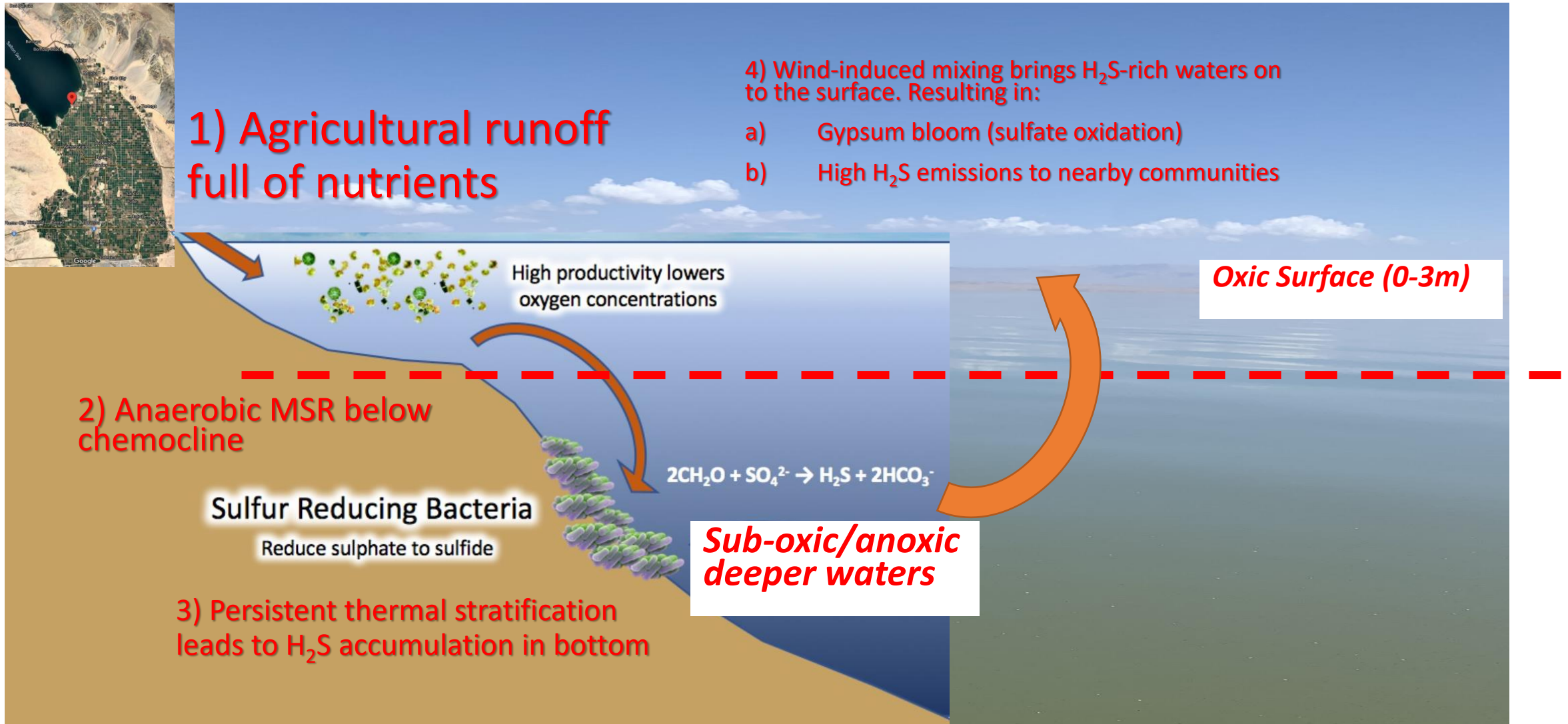


8/30/2020 Summer Mixing/Greentide Day

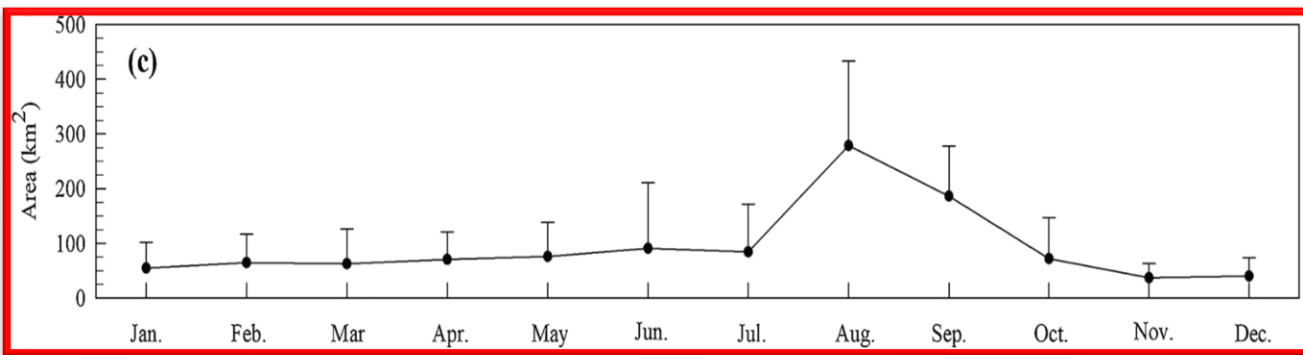
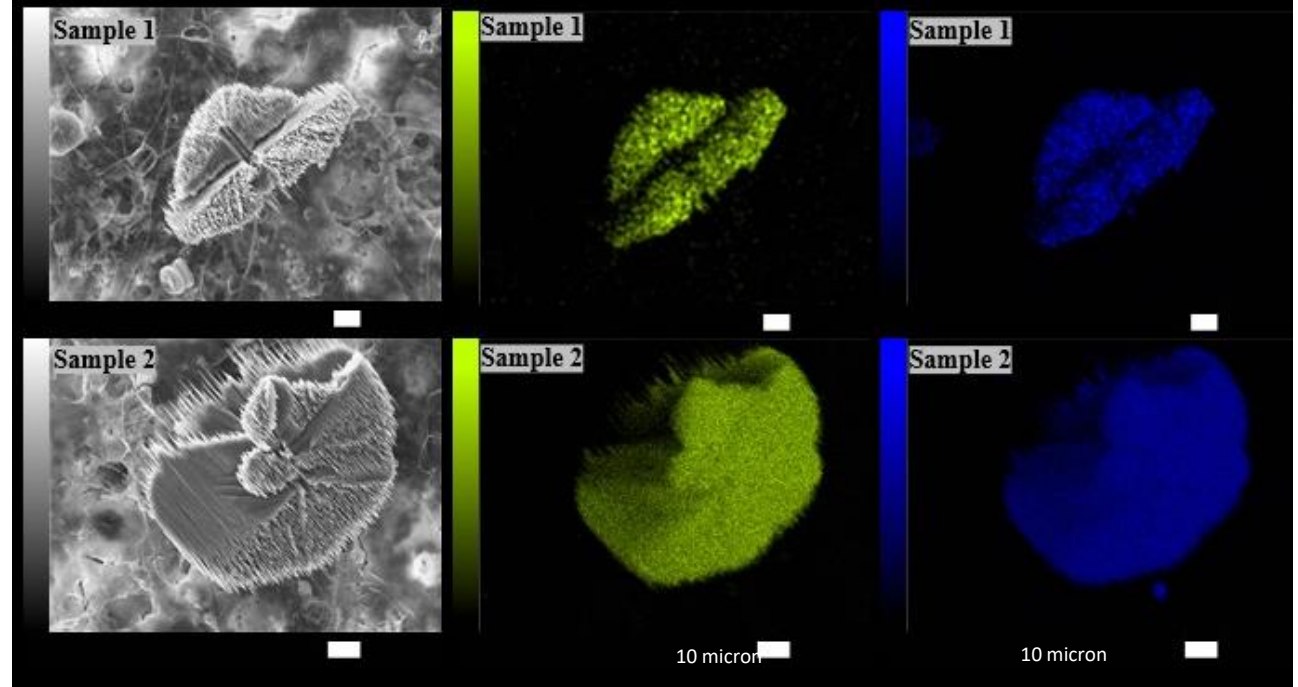
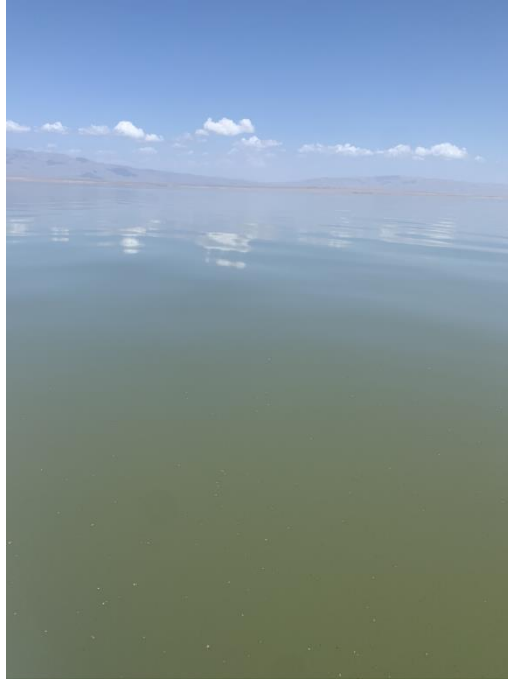




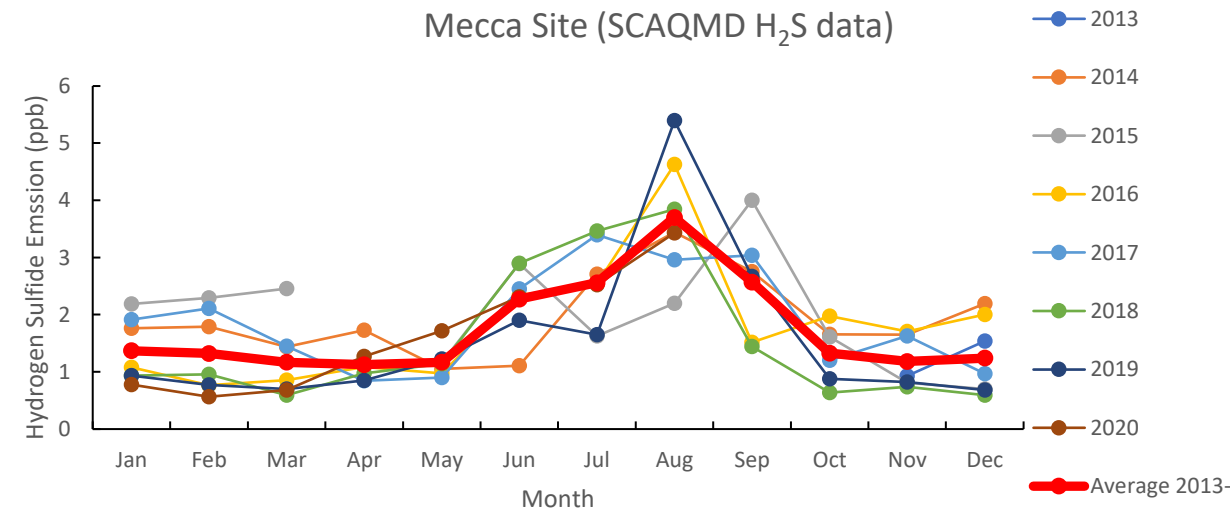
# Mixing events in the Summer, aka “Greentide”



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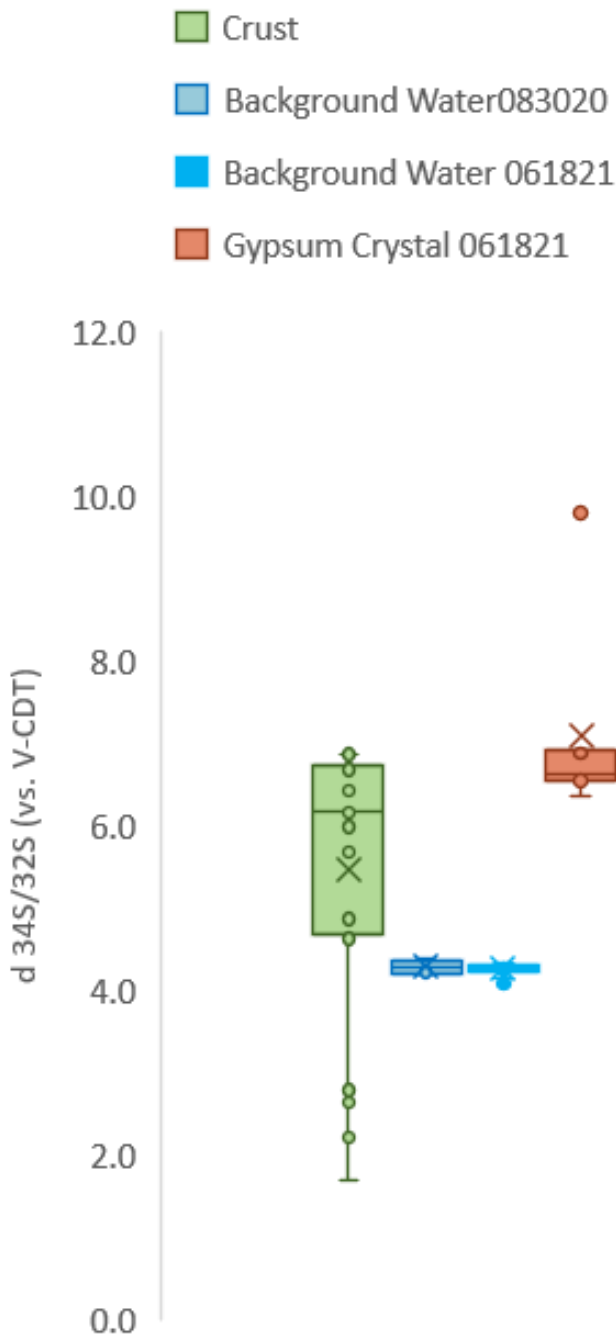
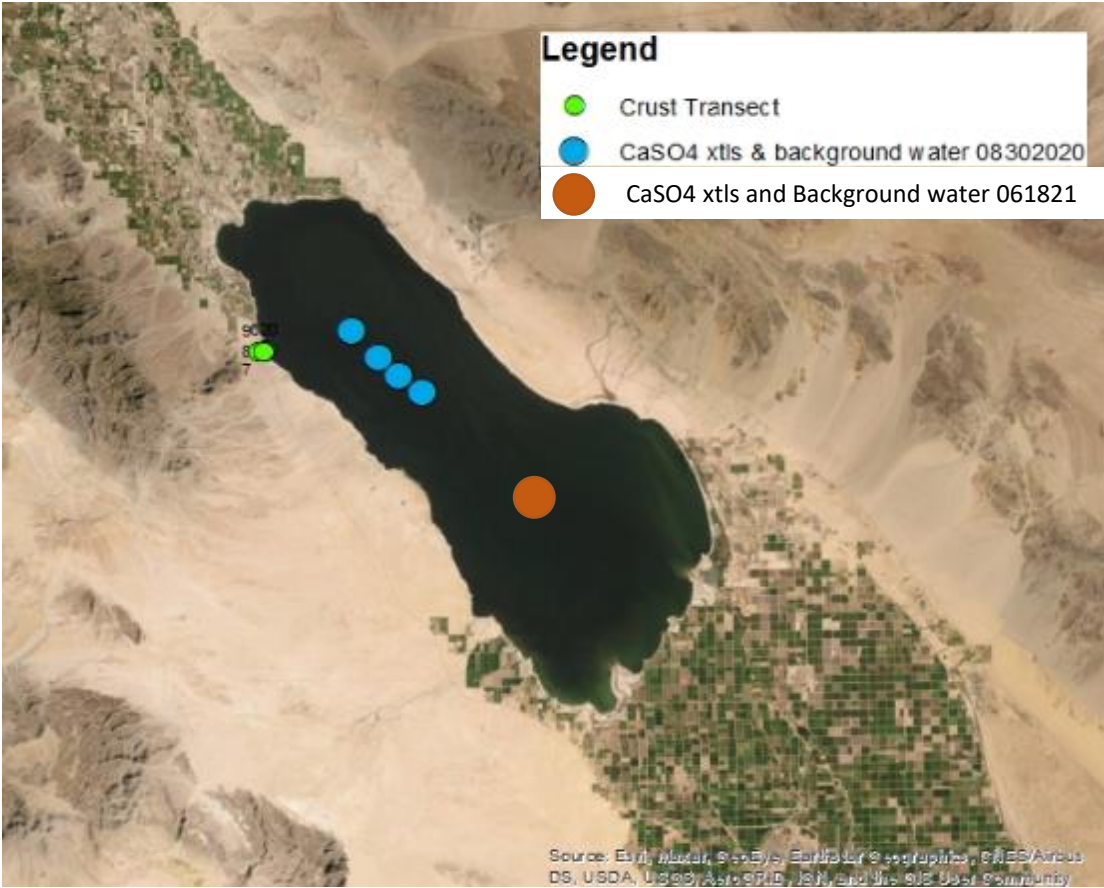


Greentide areal extent from Ma et al., 2020





# Sulfate Isotopes fingerprint Marginal Crustal Formation from Greentides Events



# Sulfur Cycle

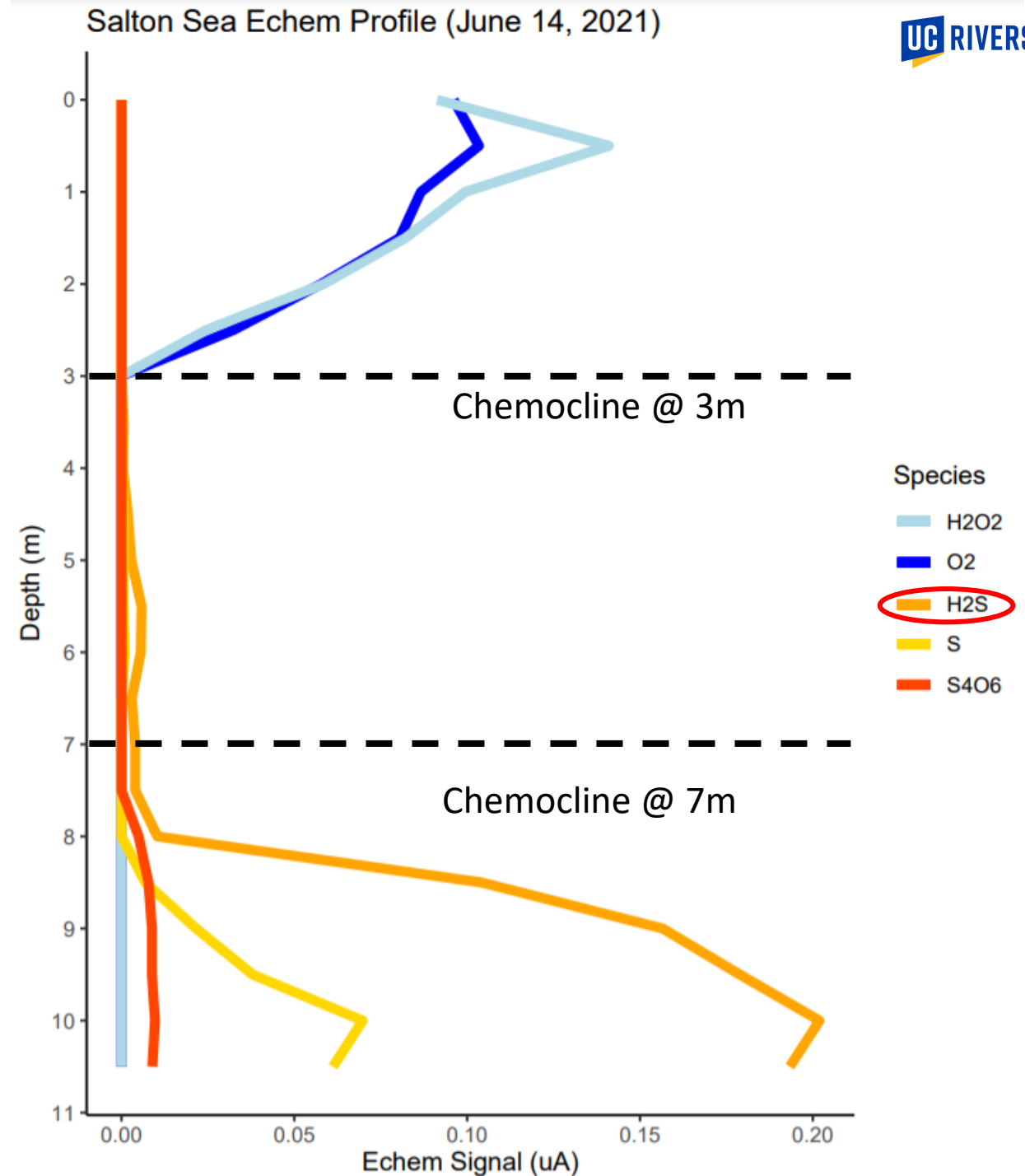
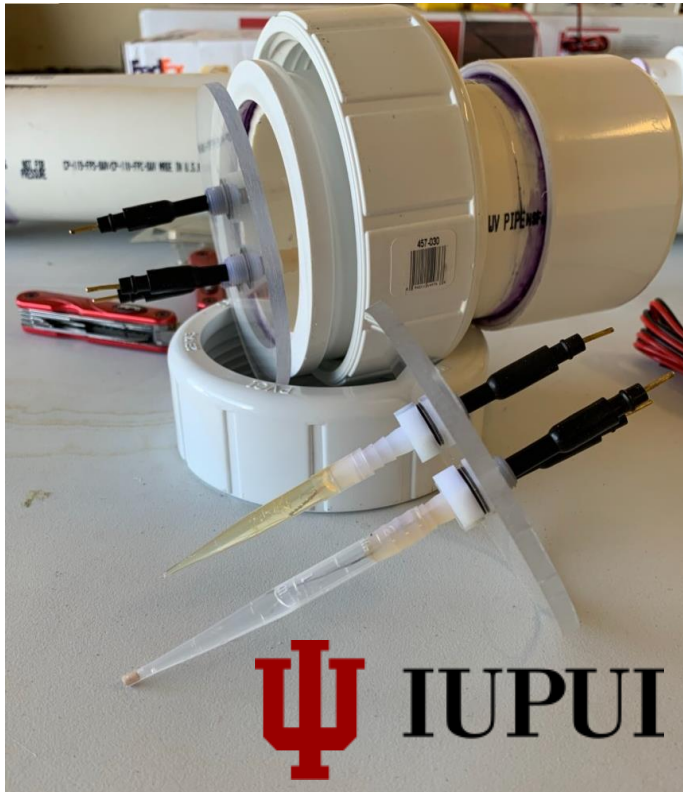
- UCLA Tina Treude (trace MSR in water column; measure sulfate reduction rate)
- UCR Porter lab (sulfide emission forecasting)
- UCR Aronson lab (microbial community)
- IUPUI Greg Druschel and John Shukle (water column voltammetry)

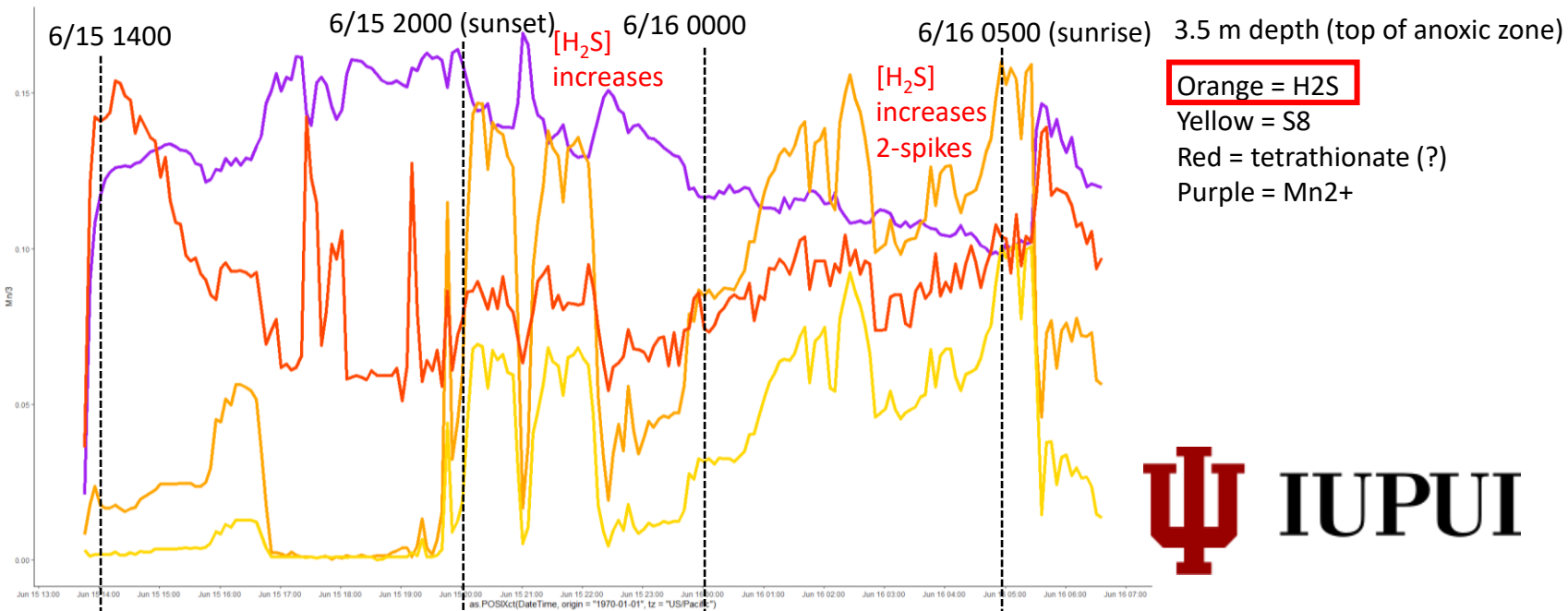




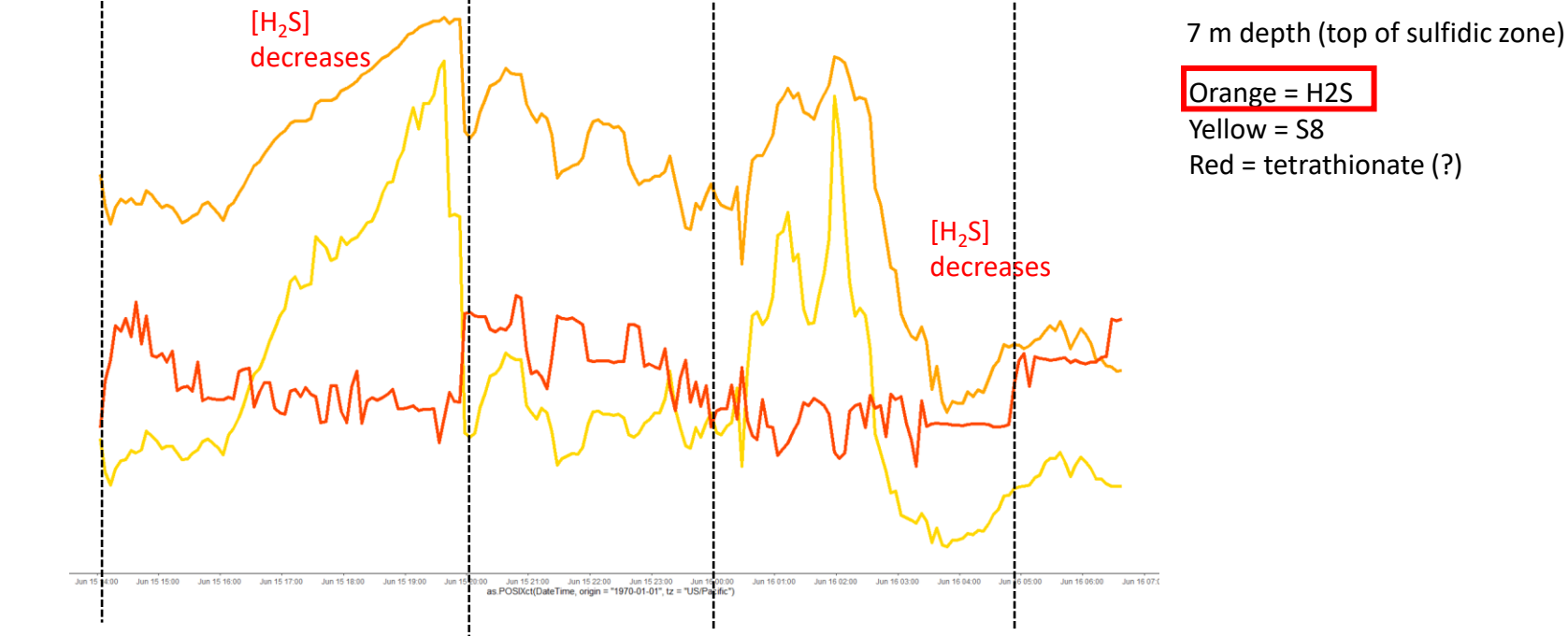
# Voltametric Probe- Diurnal and Seasonal Mixing

- Show continuous data on redox cycling in water column





- Continuous sampling: June 15-16, 2021
- Caveat: data for 2 days instead of 3 weeks due to software issue



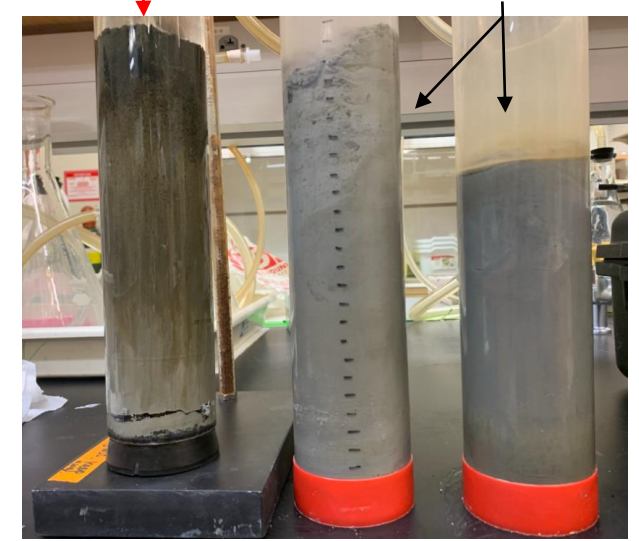
- Tomorrow: we will deploy improved probes in N. and S. depocenter for 1 month
- What we do know: multiple processes at work (mainly oxygen production AND wind- and temperature- driven mixing of water)

# Sedimentation in the lake

- Public health policy requires a thorough understanding of the potential hazard posed by trace metals and other toxic substances
- We are currently routinely recovering sediment cores for elemental analysis
  - There is an enormous amount of heterogeneity in the composition, distribution, and thicknesses of sedimentary layers
  - We have only begun digesting and analyzing core material, but preliminary results are not necessarily what we would have expected
- A systematic characterization of the entire lake through the recovery and analysis of evenly spaced cores is well within our technical and logistical abilities, it would be a good proposal
- UCR Aronson lab; dust samples for trace metal x microbial analyses
- UCR Grey lab; Pb-210 for sediment accretion rate and grain size analysis

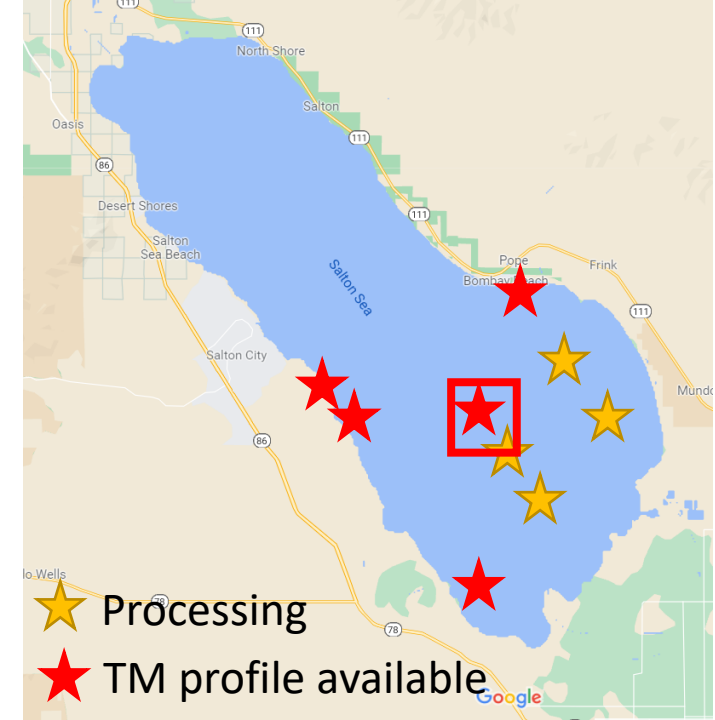
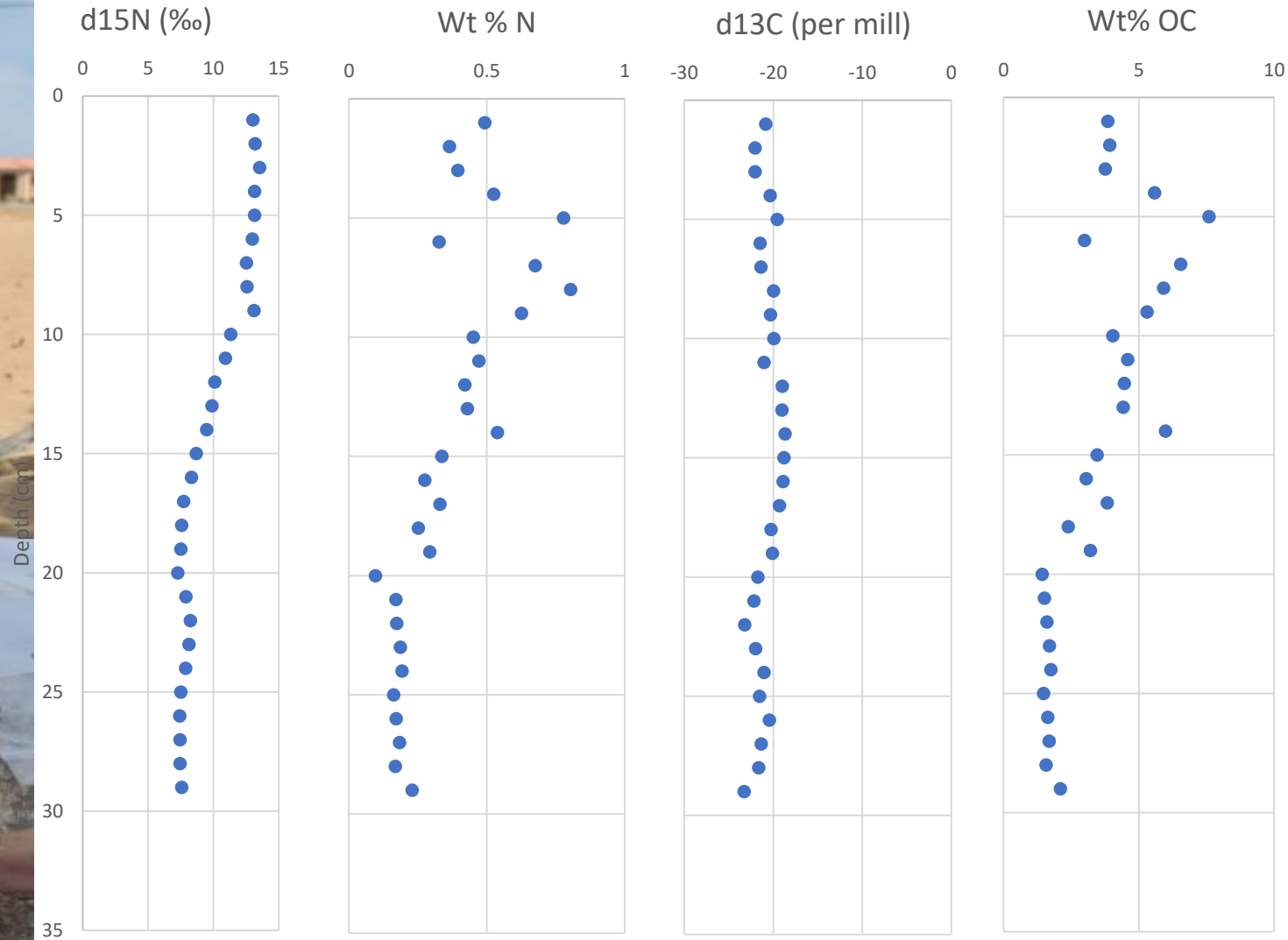


Cores from SE margin





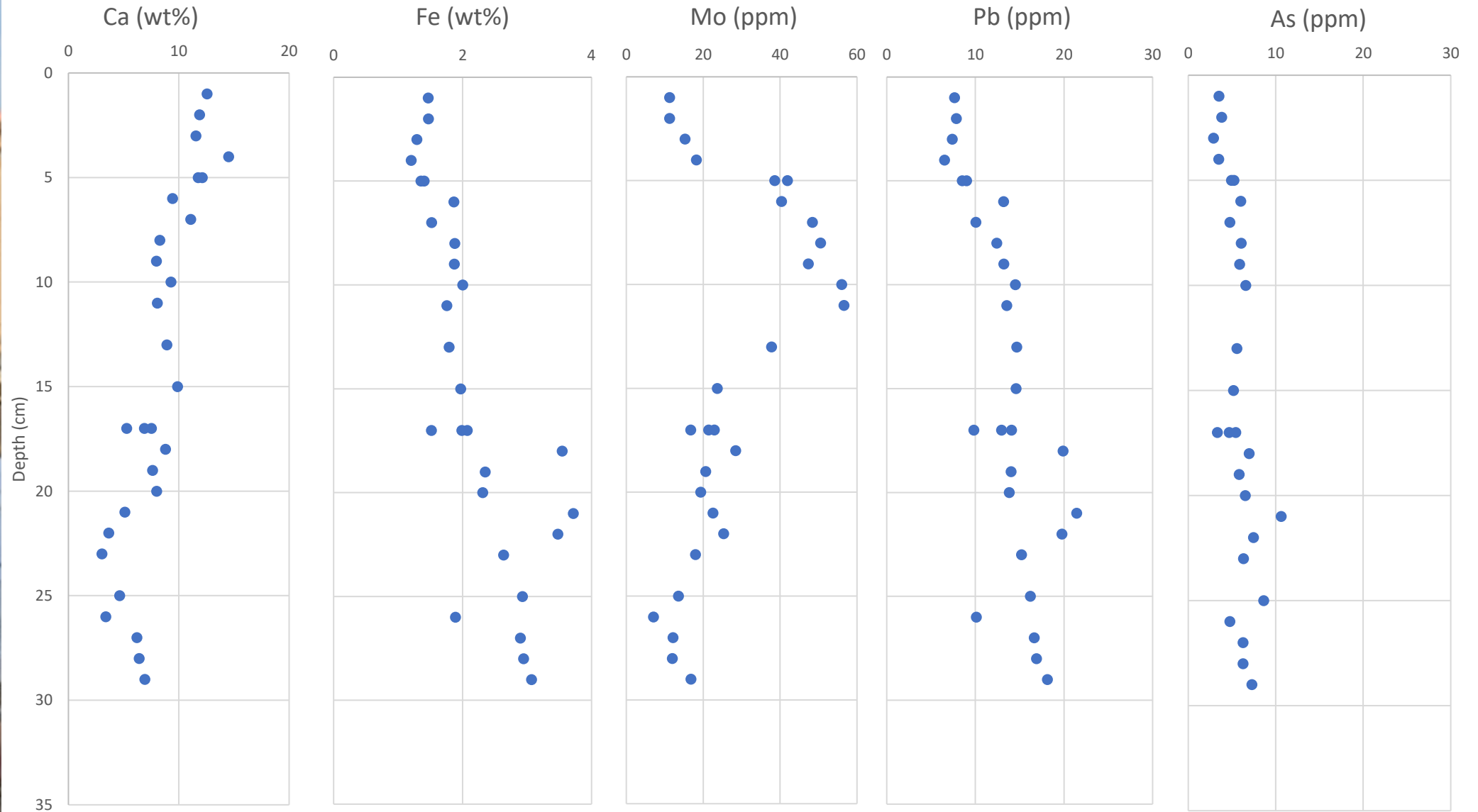
# ★ S. Depocenter



Analyses done by Ying in EDGE/Fogel Lab

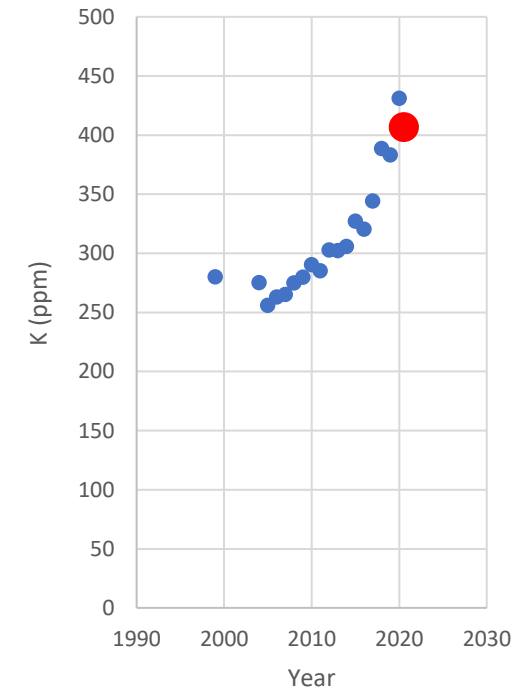
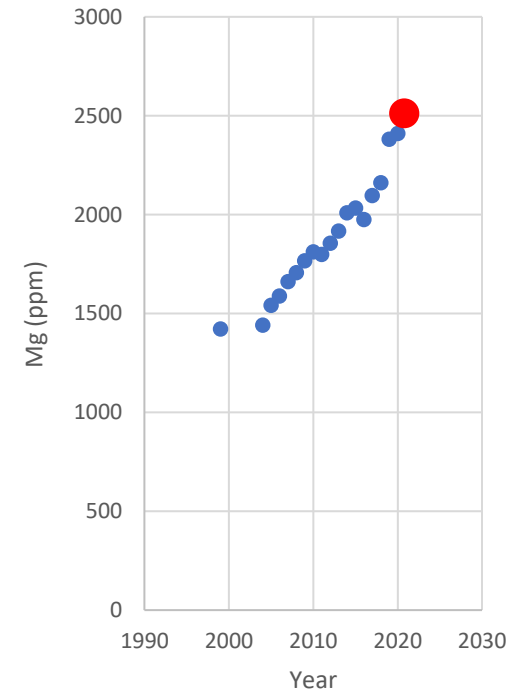
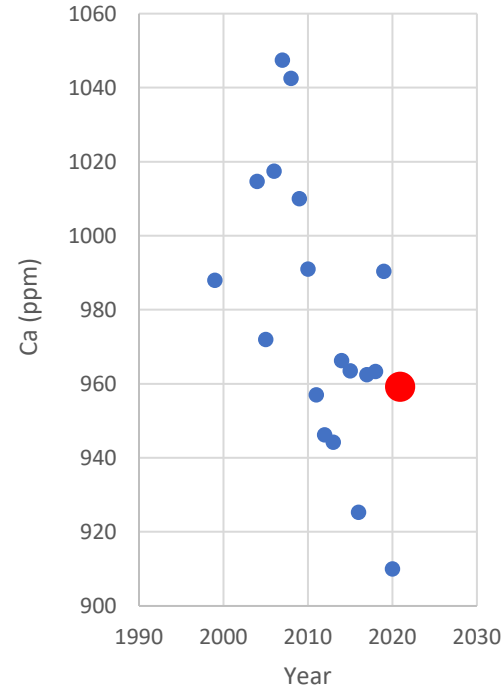
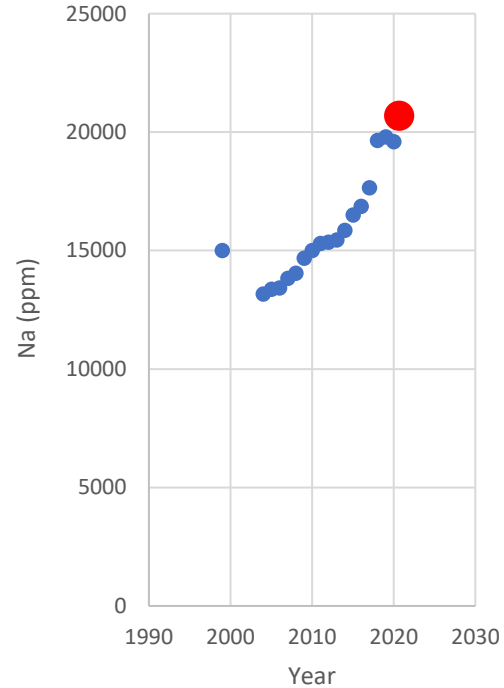


# Southern Depocenter



# Surface water major element

Blue: Bureau of Reclamation Data  
Red: 2021 Lyons Lab



Colorado 1960s (Berner and Berner, 1996)

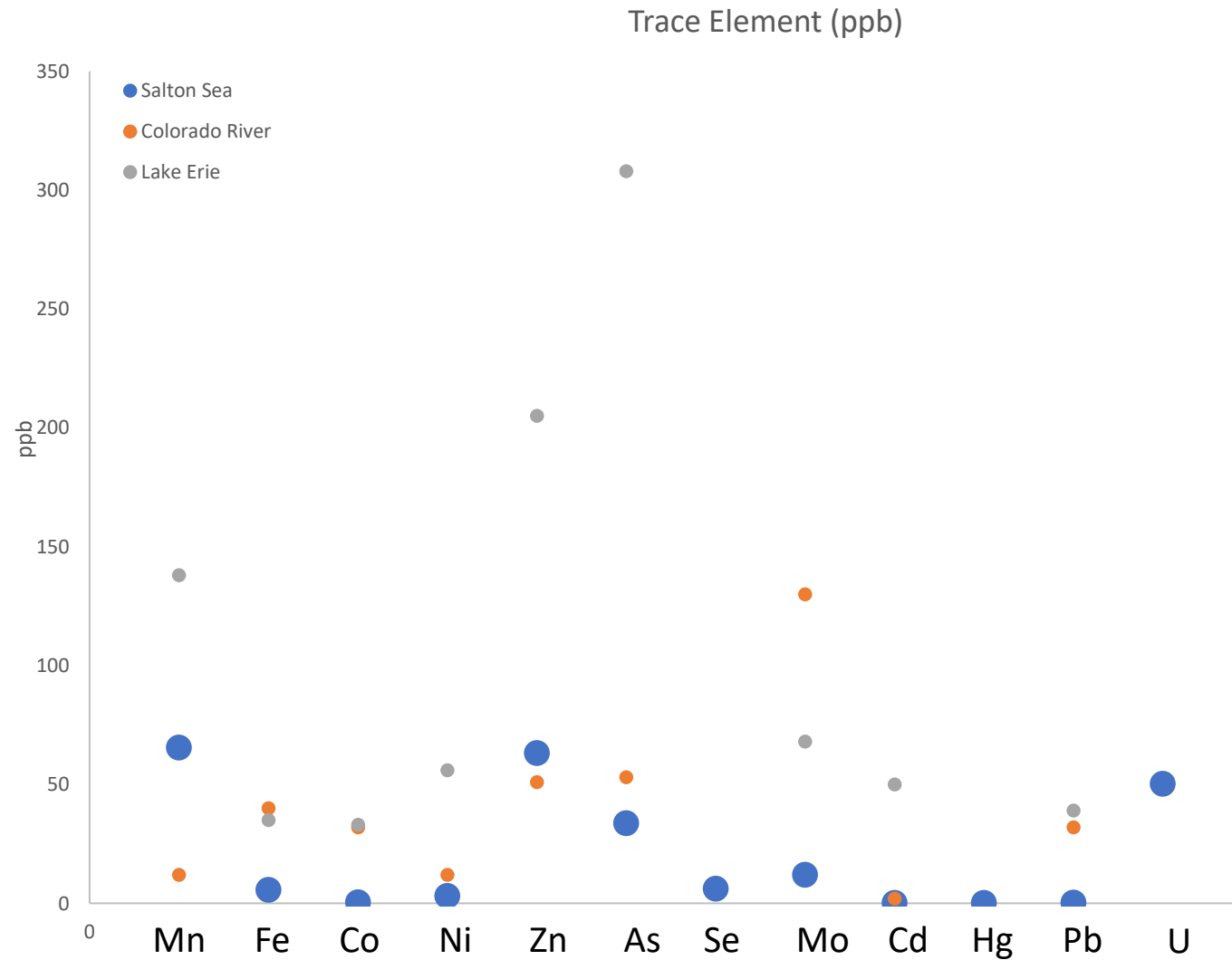
Na: 95 ppm

Ca: 83ppm

Mg: 24ppm

K:5ppm

# Surface water trace metal



SS data from Lyons Lab

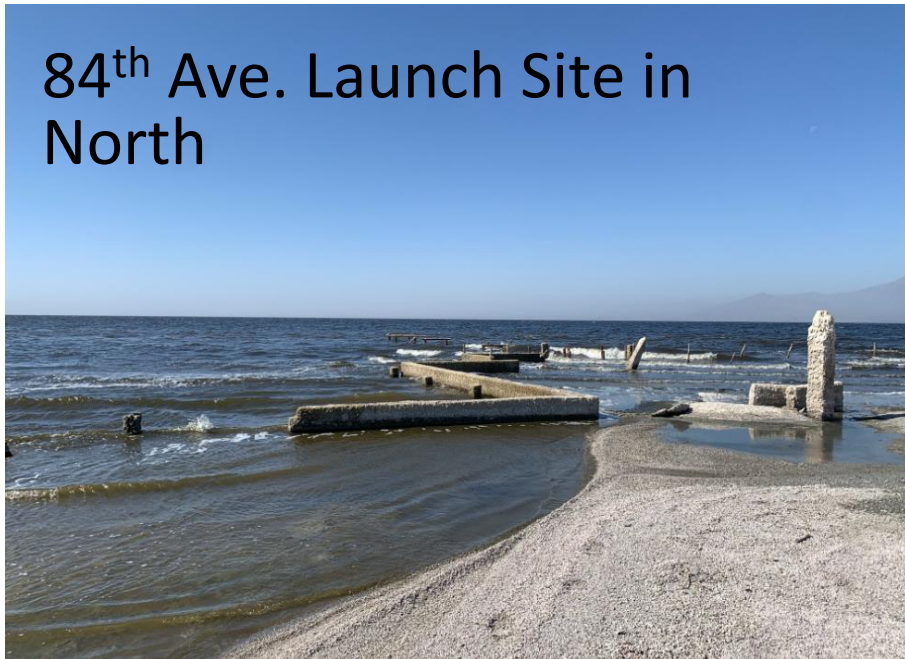
Colorado R. and Lake Erie data from Kopp and Kroner (1967)

# Community Objectives

- Community Science: volunteers to measure water quality in the North
  - Ryan Sinclair; Loma Linda Medical University, Public Health
  - UC San Diego/Scripps postdocs and grad student
  - Alianza Non-profit
  - AGU Thriving Earth Exchange

Whitewater R. Monitoring

84<sup>th</sup> Ave. Launch Site in North



Desert shore inner canal

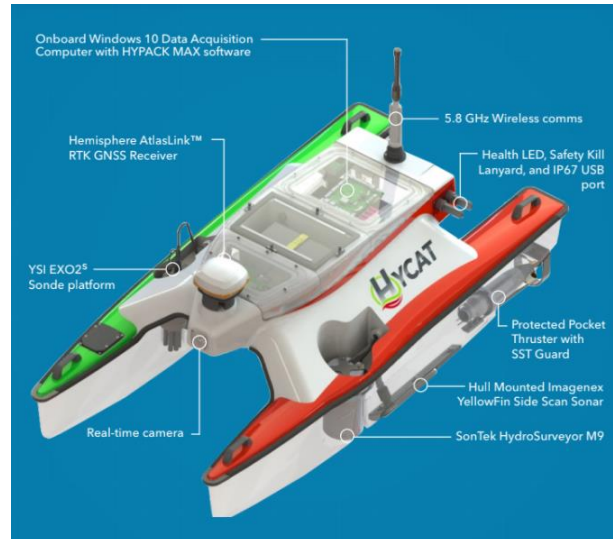
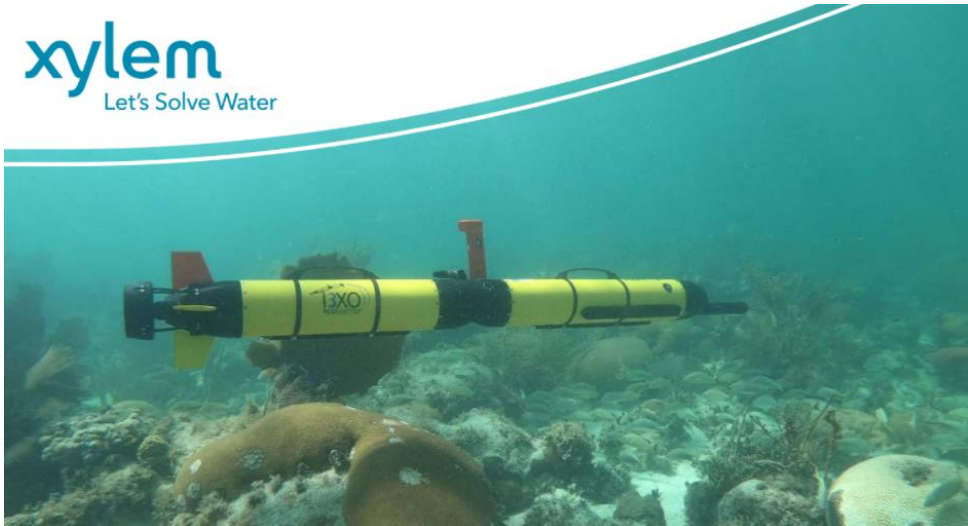




# Community Objectives (cont.)

- YSI Autonomous Water Vehicle Demo (need representatives from agencies in exchange for data)
- Continue raising awareness by submitting smaller grants in a variety of formats (written, video, etc)
- Proposal?

xylem  
Let's Solve Water



xylem  
Let's Solve Water



DB600 REAL-TIME DATA BUOY

ALL-IN-ONE, RUGGED, REMOTE MONITORING SYSTEM

# Moving forward



Receding shorelines and sinking muds present serious logistical challenges that are worsening with time

- Institutional sector: SSTF; UC system-wide support
- Government sector: State/Fed agencies; align with state goals to access funding
- Energy sector: Li extraction; part of the remediation strategy?

