Response of Primary Production to Changing Conditions in Salton Sea Water Chemistry

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Ridge 2 Reef
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Background

Salton Sea water chemistry has been continually changing since its formation in the early 20th century (Holdren et al., 2002). Once a freshwater desert lake, this body of water has become nearly twice as saline as the Pacific Ocean. Salts are leached from its sediments where the Gulf of California had previously existed. The lake is also primarily fed by agricultural runoff heavy in salt content. High evaporation rates exacerbate these factors.

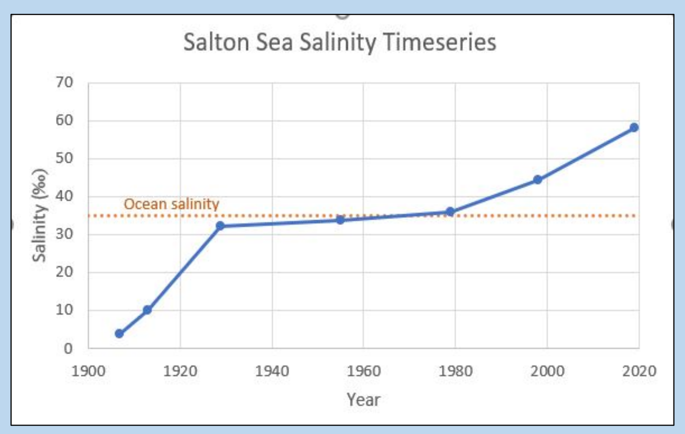

Figure 1. Timeseries of salinity over the span of the Salton Sea's most current existence.

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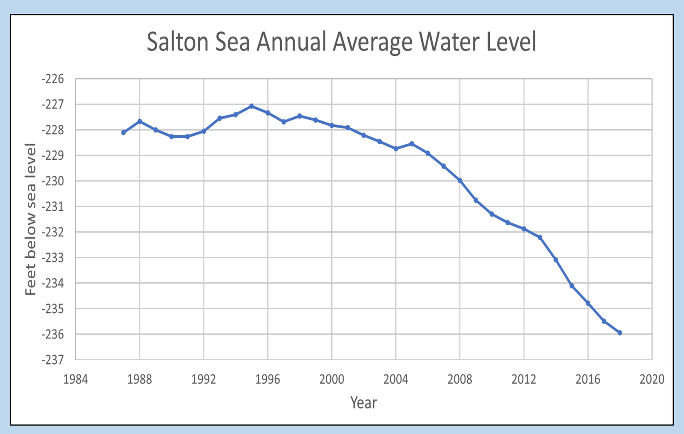

Figure 2. Timeseries of Salton Sea surface height from 1987 to 2018.

Methods

- 60-hour mesocosm incubation performed in southern source river of the Salton Sea
- Water collected from Obsidian Beach received five and ten percent treatments of both salinization and dilution
- Samples collected and analyzed at 12, 36, and 60-hour time points
- Overall Phytoplankton abundance was measured by in vivo chlorophyll-a detection using a Turner Designs Trilogy Fluorometer
- Picoeukaryote population evaluated using a NovoCyte benchtop flow cytometer

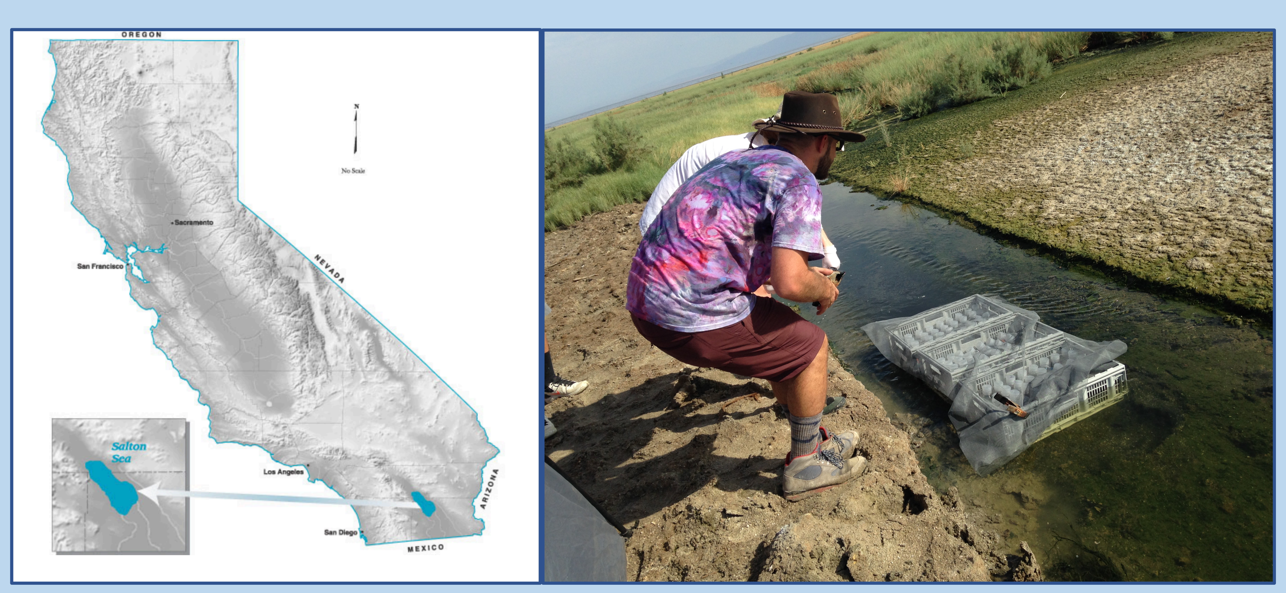

Figure 3. Map of California and location of Salton Sea (left). Incubation site near the mouth of the New River.

Hypothesis

Rapid changes in water chemistry may have detrimental effects on primary production overall abundance and species distribution. The current state of the Salton Sea may support only the most resilient species of phytoplankton which support all higher trophic levels. Recent policies driving accelerated change could see the collapse of the ecosystem if present species fail to adapt to the new environment.

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Results

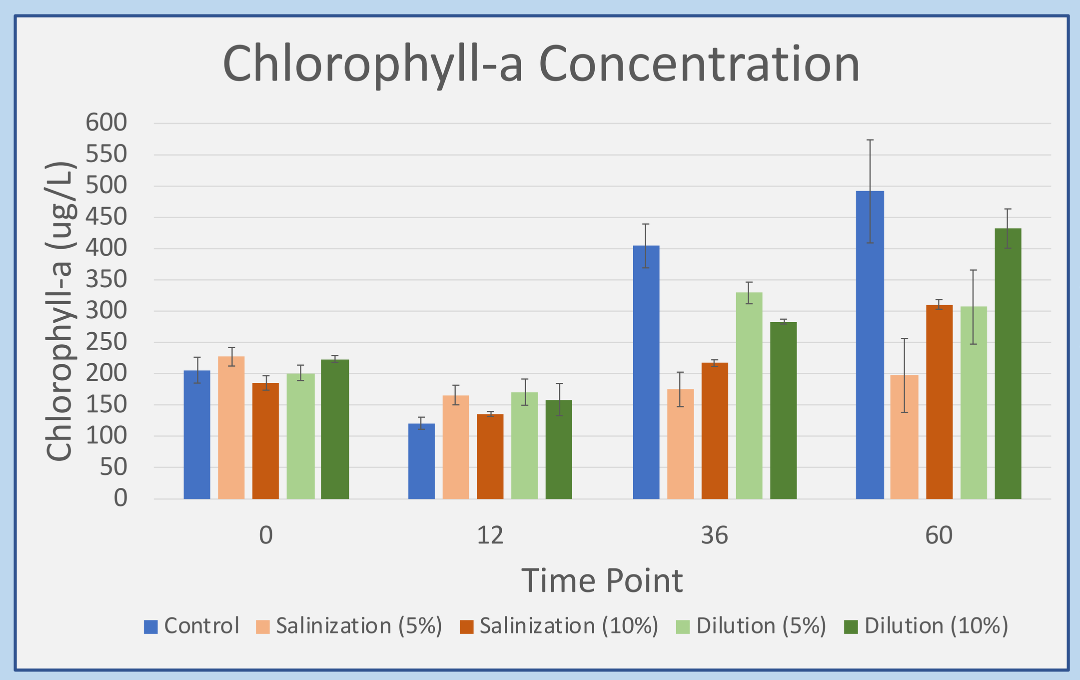

Figure 4. In vivo chlorophyll-a concentration (ug/L) for each of the five treatments during the four incubation time points. Blue represents the experimental control while salinization and dilution treatments are displayed in orange and green, respectively.

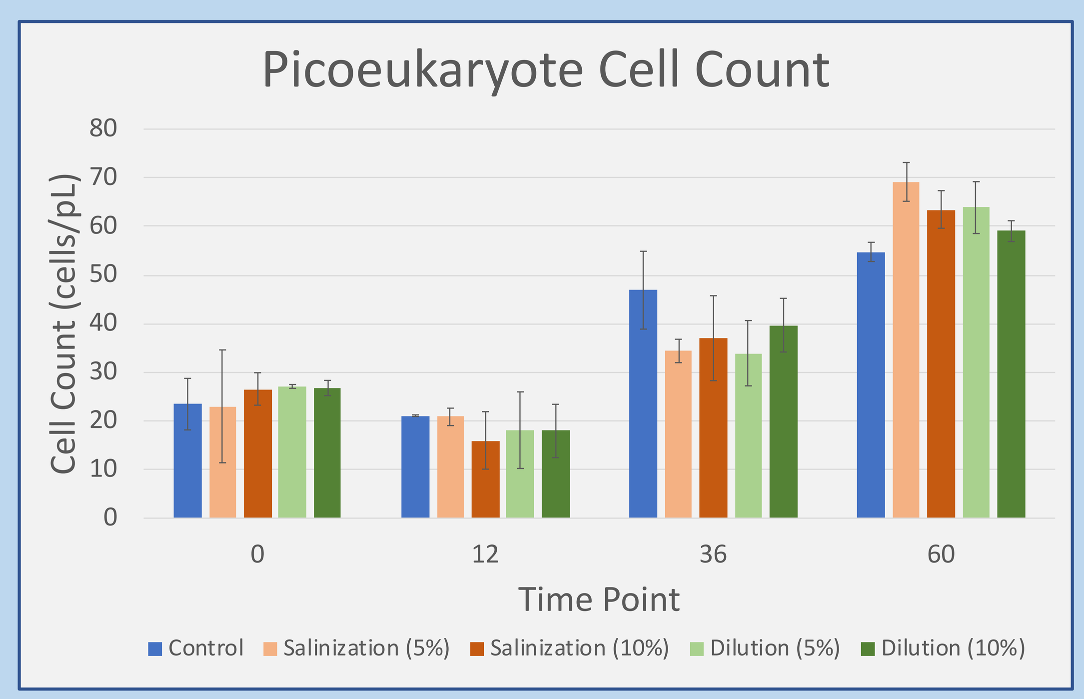

Figure 5. Picoeukaryote density (cells/pL) for each of the five treatments during the four incubation time points. Blue represents the experimental control while salinization and dilution treatments are displayed in orange and green, respectively.

- All treatments resulted in growth throughout the duration of the experiment
- Overall phytoplankton abundance increased most when present conditions were maintained
- Chlorophyll concentrations declined with increased salinity
- Picoeukaryote growth rates favored changing conditions at final time point
- A five percent increase in salinity resulted in the highest increase in picoeukaryote abundance

Conclusion

The current assemblage of phytoplankton within the Salton Sea display a high degree of adaptability to changing conditions in water chemistry. However, the data suggest that rapid changes may favor the growth of the smaller picoeukaryote species. This result may have implications on nutrient cycling, carbon uptake, and trophic transfer efficiency at this location.

Future Analysis

- Macronutrient analysis will be performed to determine uptake rates during incubation
- Distribution of larger phytoplankton (diatom and dinoflagellate) species will be enumerated using inverted light microscopy

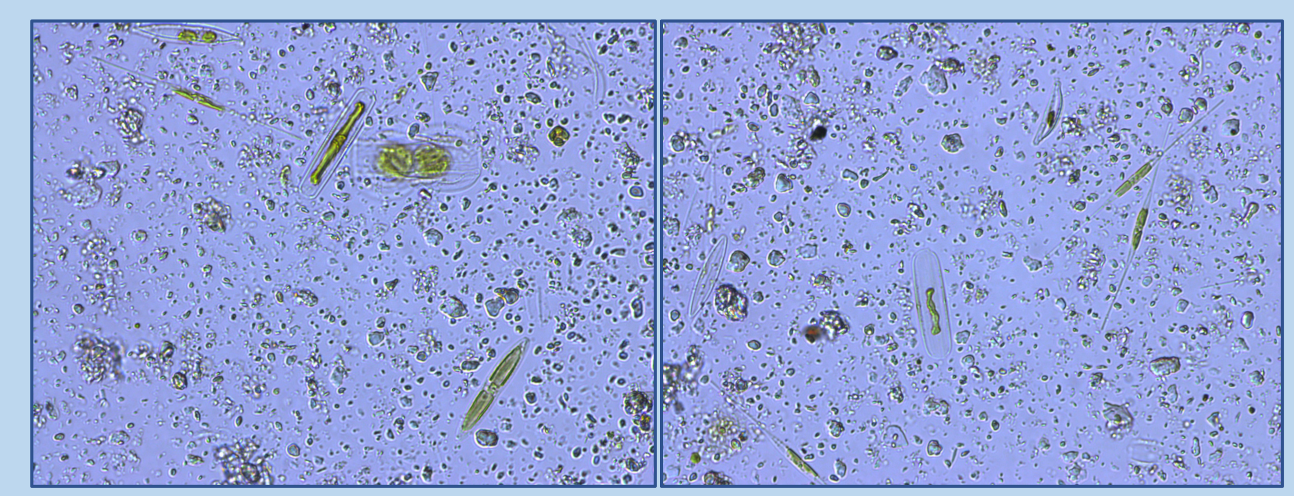

Figure 6. Images taken via inverted light microscopy of initial sample collection to highlight dominant diatom species. Left and right and panels indicate *Navicula* and *Nitzschia*, respectively.

References

Holdren, G. C. & Montaño, A. Chemical and physical characteristics of the Salton Sea, California. *Hydrobiologia* **473**, 1–21 (2002).

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