How Changes in Salinity Affect the Chlorophyll Content of *Salicornia pacifica*

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Introduction

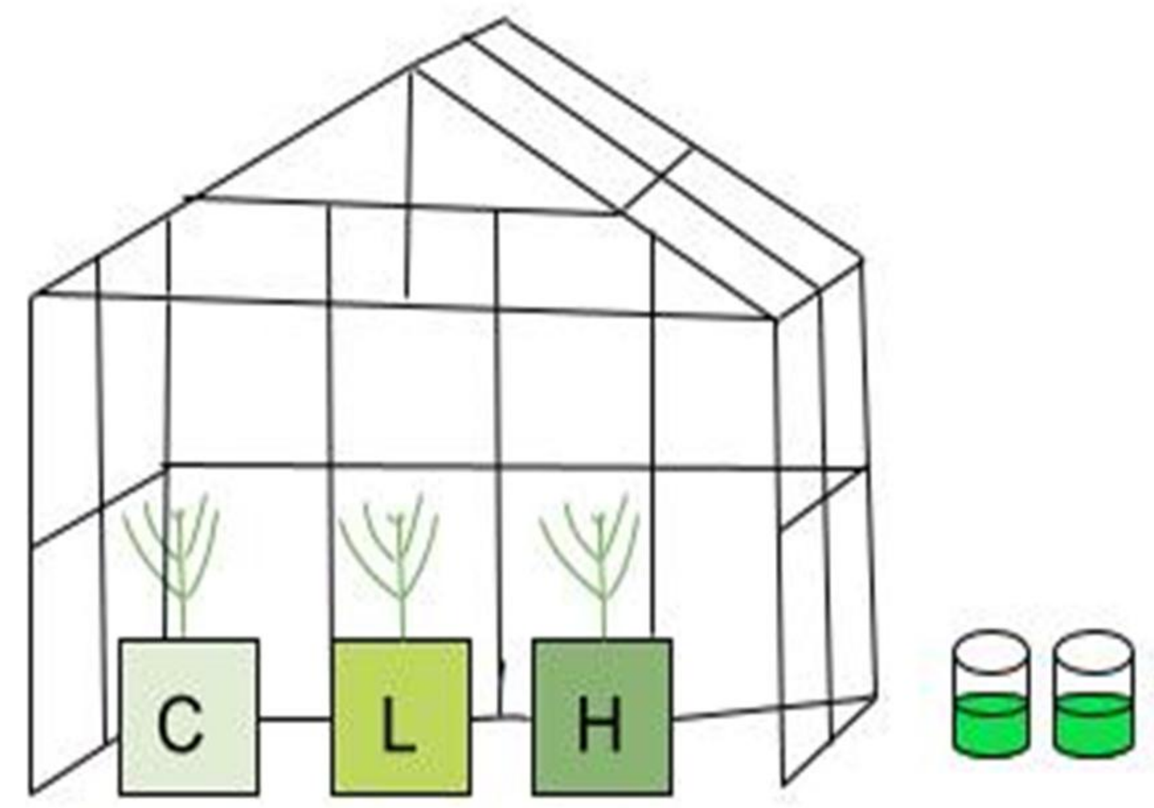
- *Salicornia pacifica*, or pickleweed, is a halophyte native to California wetlands. As a halophyte, it is adapted to saline conditions and the adverse impacts that come with living in these environments, including:
  - Osmotic stress: Caused by a potential difference between the soil and plant which hinders water uptake
  - Oxidative stress: Occurs when reactive oxygen species accumulation inhibits stomatal opening, resulting in less CO_2 absorption
- Climate change fueled drought, rising sea levels, and more frequent inundation is expected to increase soil salinity in wetland ecosystems.
- Previous studies have shown that as soil salinity increases, chlorophyll decreases in *Salicornia* species. However, we would gain a better understanding through direct quantification of how they are related.

Research Question

How do changes in salinity impact the chlorophyll content of *Salicornia pacifica*?

Methods

- Pickleweed seeds were collected from UCSB's North Campus Open Space, which is a slough near UCSB's campus.
- The seeds were grown in individual pots in a greenhouse and separated into three different salinity treatment groups: control (< 3 mS/cm), low (15 mS/cm), and high (30 mS/cm).
- Sample collection occurred in three rounds, approximately 10 months, 11 months, and 12 months after germination.
- Vegetative portions of each plant were harvested, and chlorophyll extracts were created from each plant.
- Extracts were analyzed on a spectrophotometer at absorbance values of 646, 663, and 710 nm.
- To calculate chlorophyll content using the measured absorbances, the Prometheus Chlorophyll Extraction and Determination equations were used (Poorter and Berkel 2010).
- ANOVA was used to examine treatment differences (Rstudio).



Results

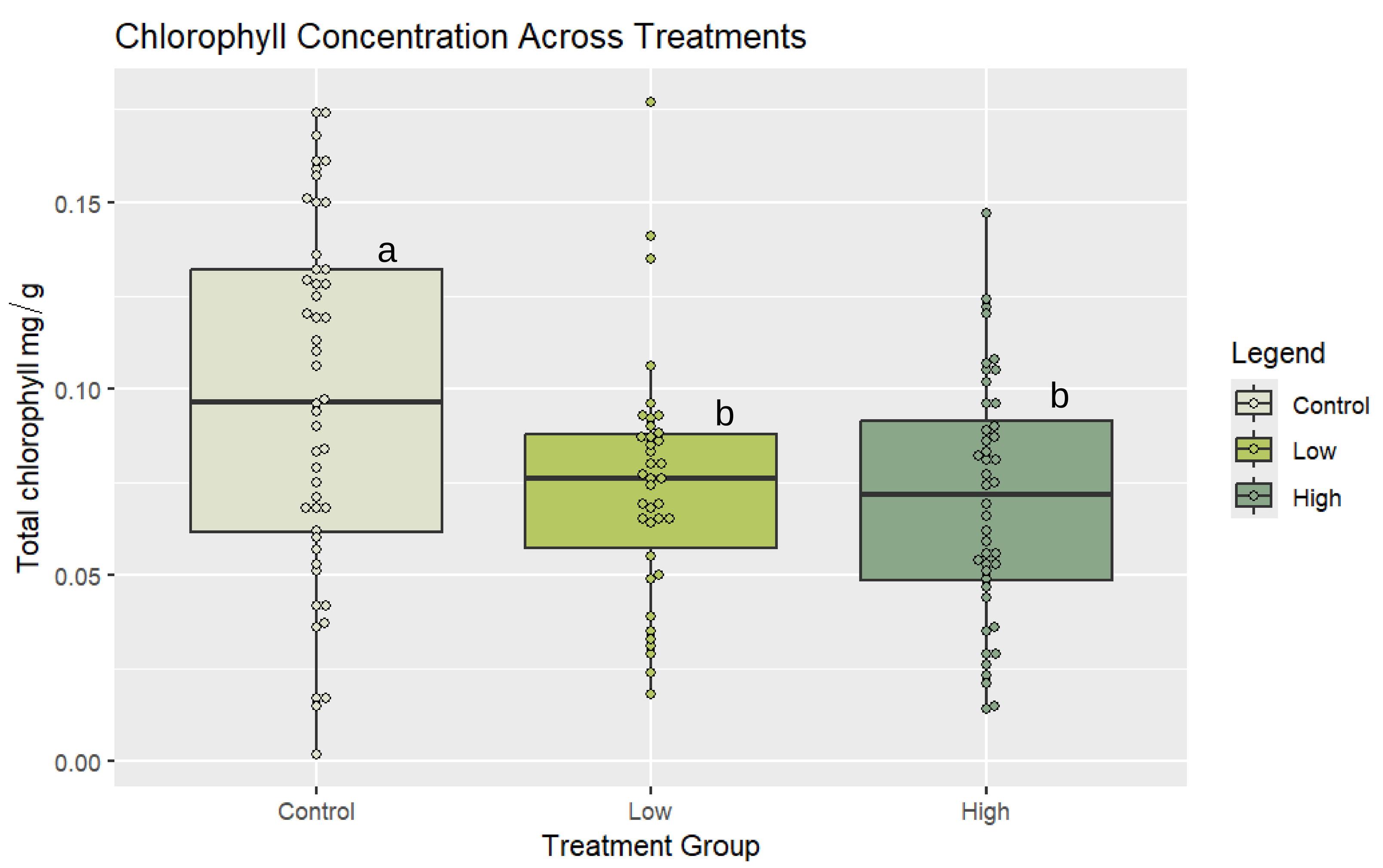


Figure 1: Chlorophyll concentration in milligrams per gram of fresh weight across treatment groups.

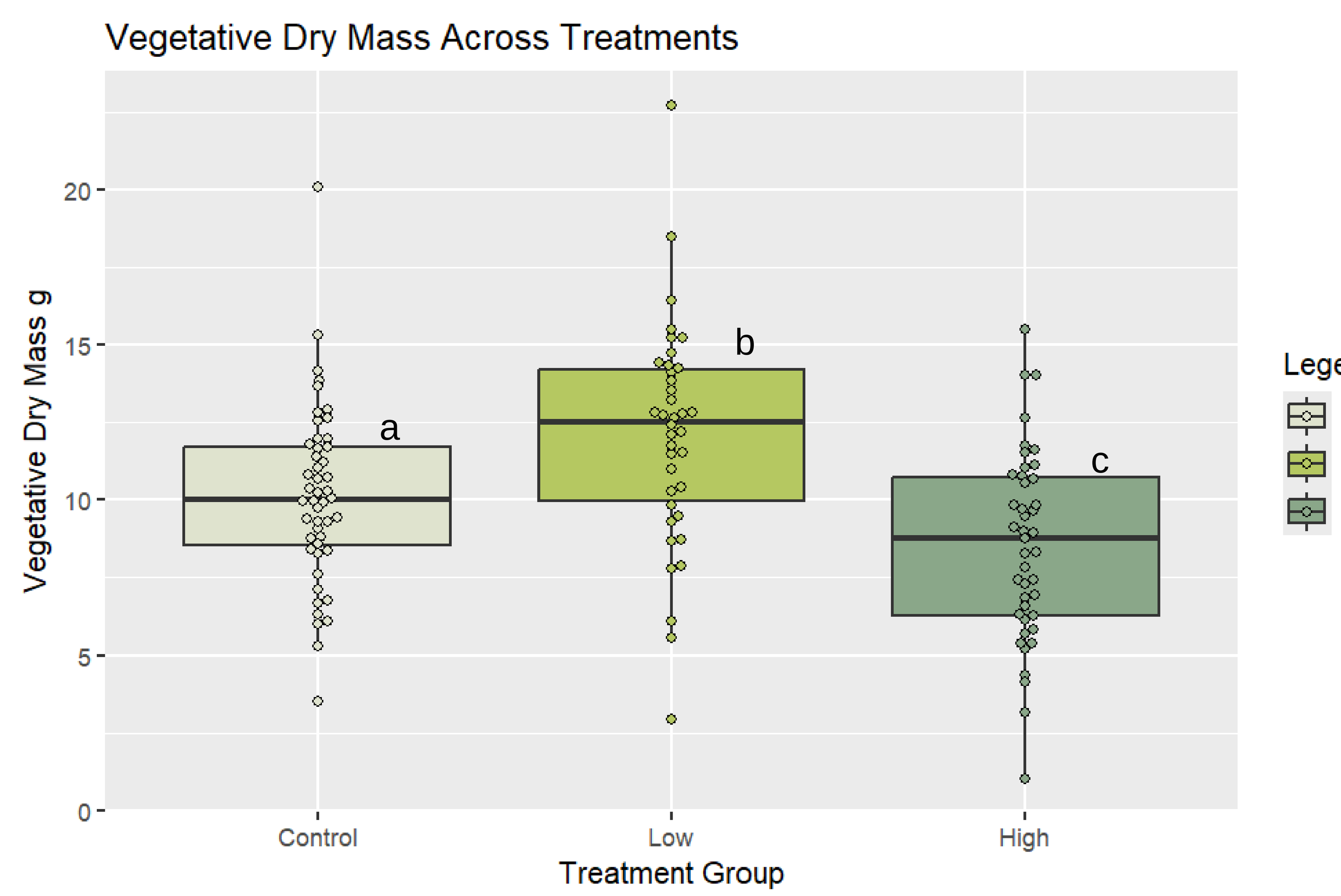


Figure 2: Vegetative dry mass in grams across treatment groups.

Note: letters indicate statistical significance

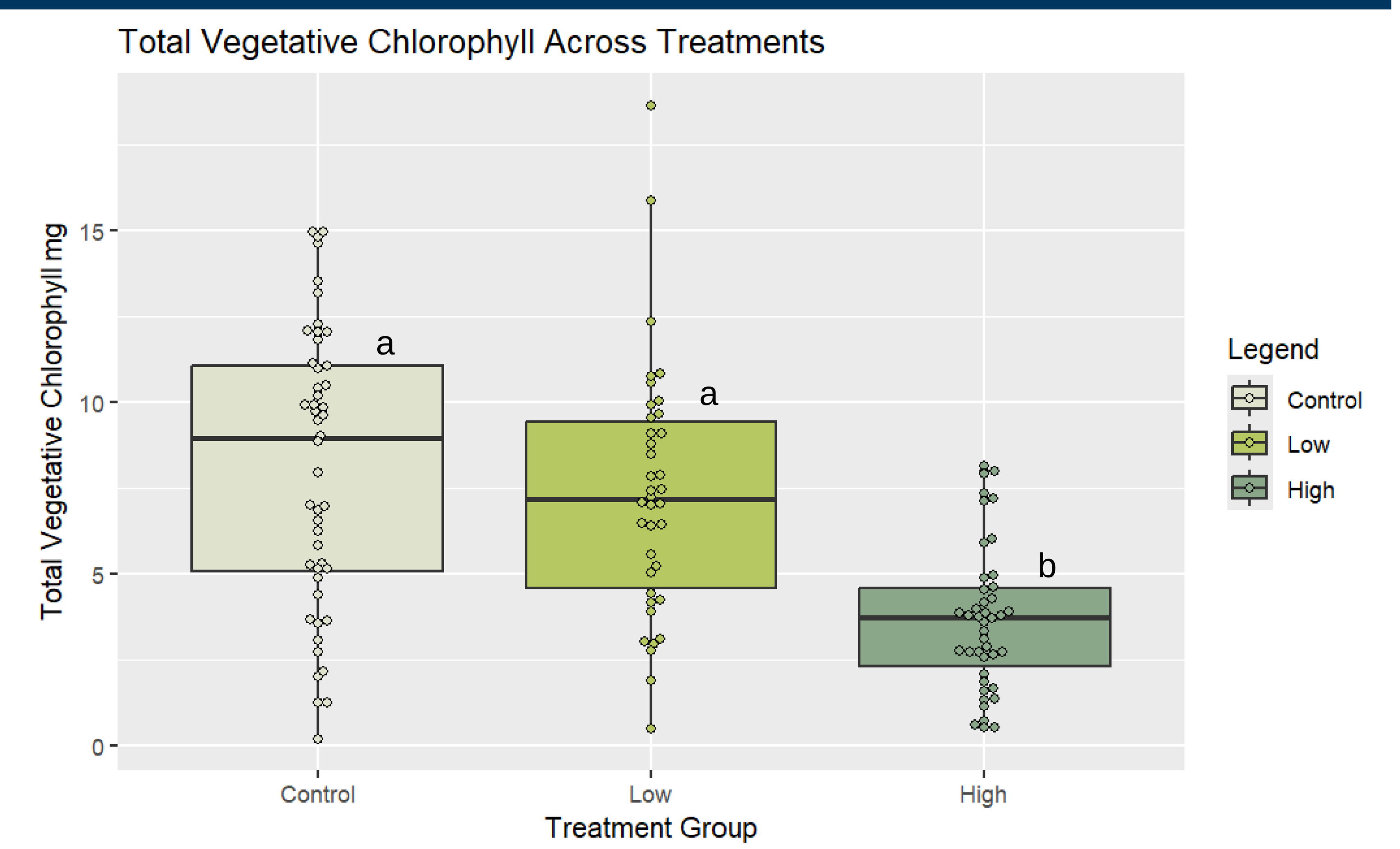


Figure 3: Chlorophyll content in milligrams for the entire vegetative biomass across treatment groups.

Conclusions and Further Work

- Chlorophyll concentration in *Salicornia pacifica* decreases at higher soil salinities – the control group had 31% more chlorophyll per gram of fresh weight than the low group, and 39% more than the high group.
- Looking only at chlorophyll concentration does not give the whole picture because plant vegetative biomass is greater at low salinity but lower at high salinity. This could explain why the total dry biomass chlorophyll content of the control and low groups are similar, even though the concentration in the low group is less.
- Total biomass chlorophyll content was lowest in high salinity, indicating reduced photosynthetic capacity.
- Reduced photosynthetic capacity has implications for the resiliency of wetlands in which pickleweed is a major biomass component, as these ecosystems will likely see carbon sequestration, biodiversity, pest and disease resistance, and wildlife habitats all decrease.

Future steps

- A similar study could be conducted over a longer time period in order to determine if pickleweed adapts to salt stress over time.
- Soil salinity could be monitored and controlled better throughout the growth of the plant. This would allow for quantification of the relationship between specific electrical conductivity measurements and chlorophyll content or concentration.

Selected References

Sack L., Cornwell W.K., Santiago L.S., Barbour M.M., Choat B., Evans J.R., Munns R., Nicotra A. (2010) A unique web resource for physiology, ecology and the environmental sciences: PrometheusWiki. Functional Plant Biology 37, 687-693.

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