Studying Species Interactions in a Restored Salt Marsh Ecosystem in Jamaica Bay

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Introduction

- Saltmarshes in Jamaica Bay are declining due to nutrient pollution and sea-level rise, resulting in the loss of over 1,400 acres of marshland since 1924.
- The planting of saltmarsh cordgrass (*Spartina alterniflora*) has helped to rebuild marsh structure and promote beneficial microbial processes.
- Ribbed mussels (*Geukensia demissa*) live among the grasses and remove excess nutrients that damage the environment.
- This research focuses on species interactions in restored marsh areas and how the interactions with cordgrass contribute to the health and functioning of the ecosystem.

Objectives

- Determine if the potential herbivory by waterfowl affects the stem height and density of saltmarsh cordgrass.

-Investigate the success of transplanting ribbed mussels to the West Pond Living Shoreline and how the populations alter biogeochemical cycling and sediment characteristics.

-Evaluate the effect that the addition of ribbed mussels has on the growth of saltmarsh cordgrass.

Figure 1: Grazing of *Spartina alterniflora* in April 2024

Figure 2: Grazing of *Spartina alterniflora* in April 2024

Study Site

The living shoreline is located next to the West Pond on Jamaica Bay. Fencing and flagging was added to deter waterfowl.

Methodology

- 15, 0.25 m^2 plots were placed throughout the marsh. 10 of these plots were closed using plastic mesh and 5 were kept open.

- 50 mussels were placed into 5 open plots and 5 closed plots in order to compare the potential effects of mussel additions. There were also 5 plots left empty as a control.

- Sediment and porewater was sampled to measure nutrients and organic content from all 15 plots.

-Within the open and closed plots, saltmarsh cordgrass was exposed to both its natural environment (open) and an excluded space (closed).

- The lengths of 15 of the tallest stems and the amount of stems were measured in each 0.25m^2 plot.

Ribbed mussels

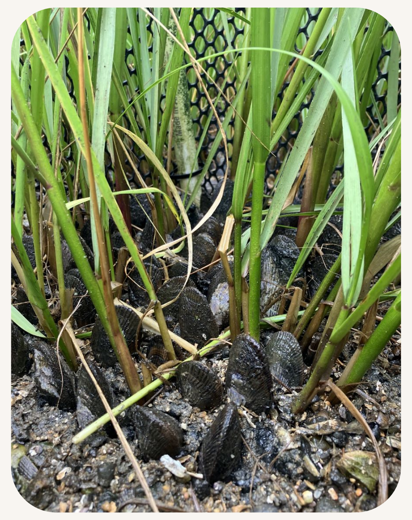

Figure 3: Ribbed mussels in caged plot

Saltmarsh cordgrass

Figure 4: Caged and open plots

Results & Discussion

Herbivory Prevention Through Fencing

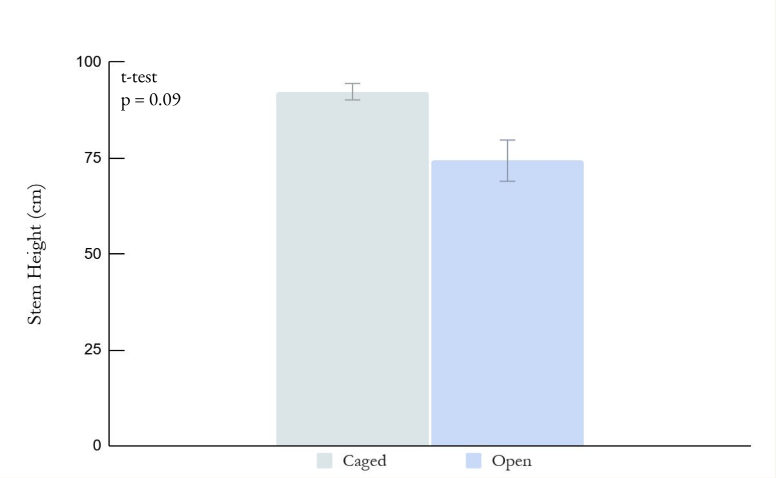

Figure 5: Saltmarsh cordgrass stem heights in caged and open field plots.

- *Saltmarsh cordgrass was marginally taller when protected with fencing.*

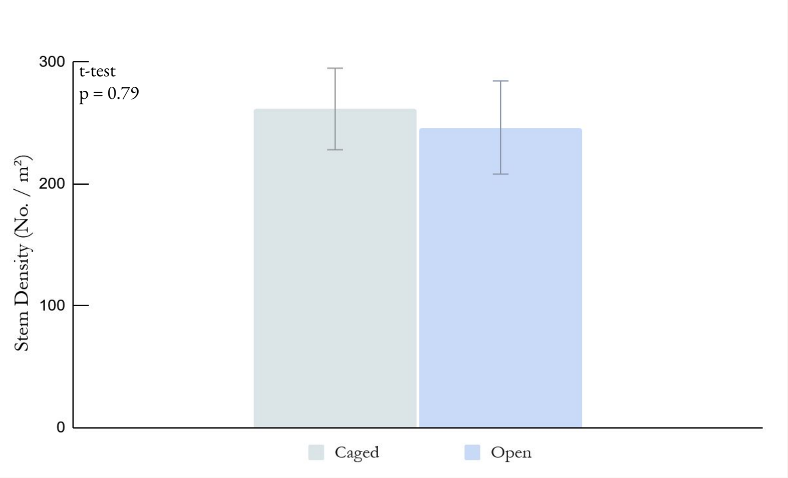

Figure 6: Saltmarsh cordgrass stem density in caged and open field plots.

- *Saltmarsh cordgrass stem density was similar between open and protected plots.*

Mussel Transplant Success

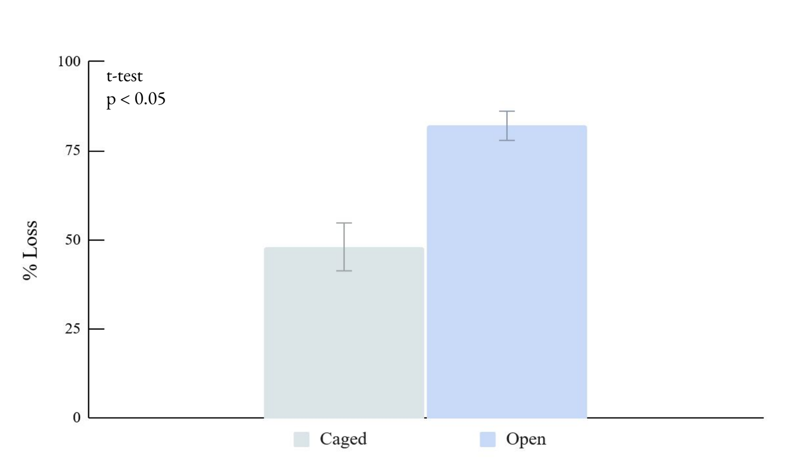

Figure 7: The % of mussel loss observed in caged and open field plots.

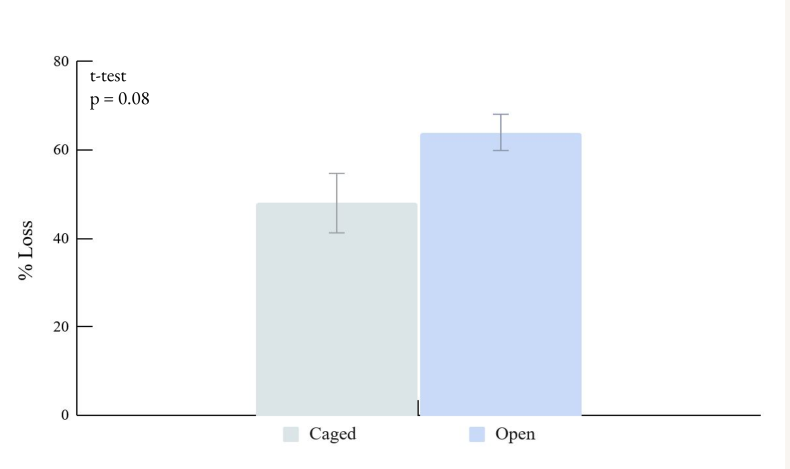

Figure 8: Calculated % of mussels lost due to predation.

- *Plot fencing prevented the loss and predation of transplanted mussels, which provided an opportunity for the mussels to thrive and positively impact the salt marsh.*

Results & Discussion

Porewater Nutrients Following Mussel Transplant

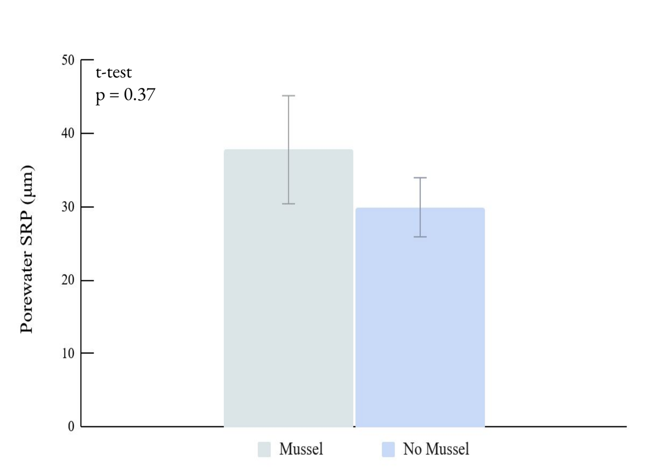

Figure 9: Porewater soluble reactive phosphorus (SRP) in mussel and control plots.

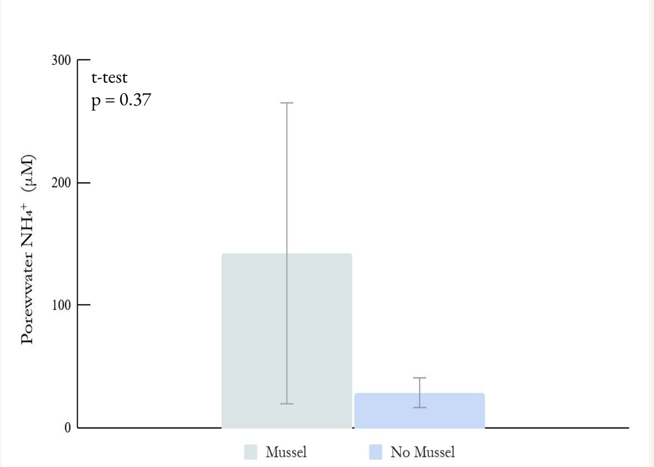

Figure 10: Porewater ammonium (NH_4^+) in mussel and control plots.

- *Transplanted mussels increased nutrient availability in sediments which could be used to support saltmarsh cordgrass growth and promote nutrient cycling.*

Mussel Alterations to Plant and Sediment Characteristics

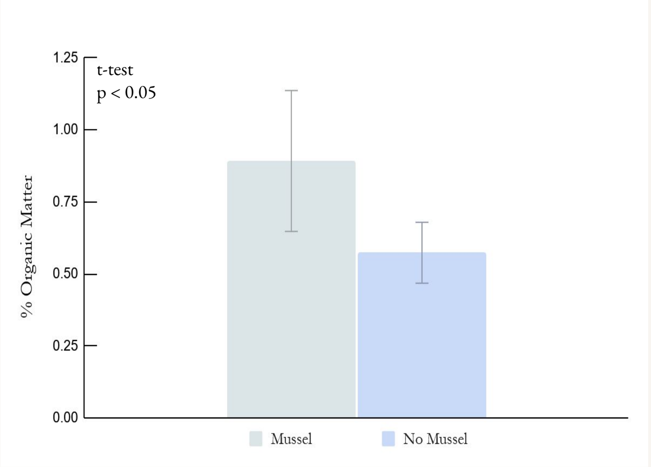

Figure 11: Sediment organic content in mussel and control plots.

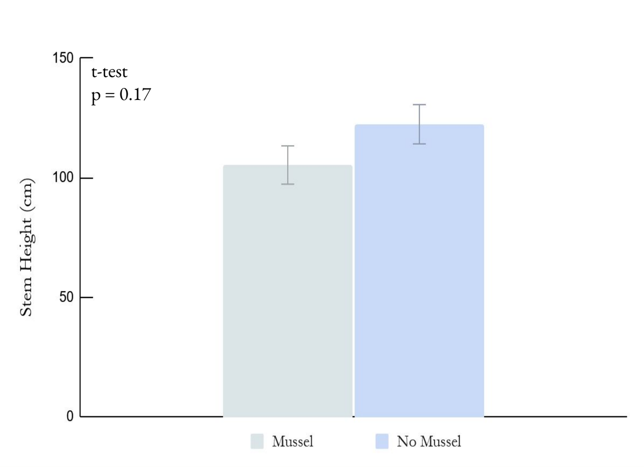

Figure 12: Cordgrass stem heights in mussel and control plots.

- *Mussel filtration and biodeposition likely increased sediment organic matter which helps saltmarsh cordgrass grow vertically to keep pace with sea-level rise.*
- *Although saltmarsh cordgrass had access to higher nutrients, it did not increase its stem height.*

Conclusion & Next Steps

- Species interactions are important drivers of the structure and functioning of constructed salt marshes.
- Future studies could be performed over a longer time frame to better capture impacts of the ribbed mussel–saltmarsh cordgrass interaction.

Acknowledgments

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