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Algae, Macroinvertebrate and Water Quality Relationships at North Campus Open Space

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Introduction

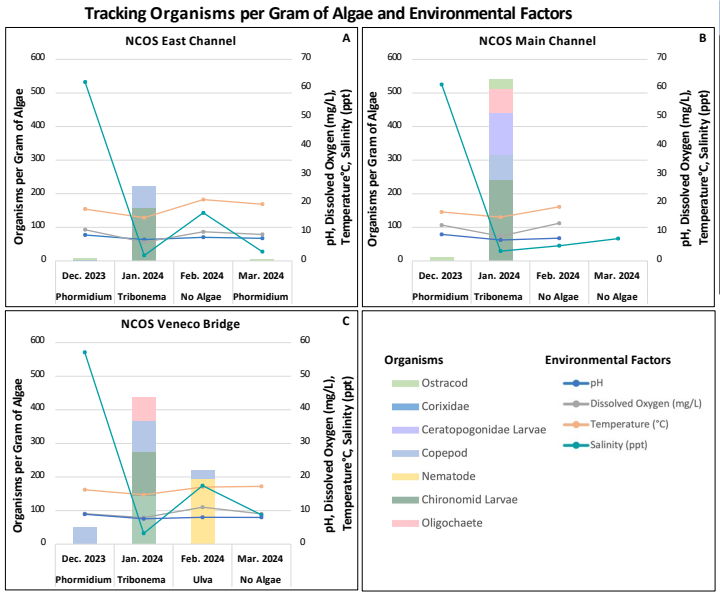
- The Devereux Slough in the North Campus Open Space (NCOS) is a dynamic ecosystem characterized by its temporary open-closed estuarine nature, primarily dictated by seasonal rainfall. Following significant winter precipitation, the slough breaches, permitting seawater influx and tidal variations that alter estuarine dynamics (Cheadle Center for Biodiversity and Ecological Restoration & Environmental Science Associates, 2016).
- Algae are primary producers through photosynthesis and provide essential sustenance and habitat for aquatic macroinvertebrates.
- Macroinvertebrates serve as vital indicators of stream health due to their short life cycles and limited mobility, reflecting changes in water quality (Agouridis, 2015). Additionally, they support higher trophic levels by providing a food source.
- Environmental factors such as salinity, temperature, pH, and dissolved oxygen influence the abundance and composition of algae, subsequently impacting macroinvertebrate populations.

Purpose

This ongoing study aims to highlight the complex interactions between algae, macroinvertebrates, and environmental factors in the Devereux Slough and understand local microalgal salinity tolerance.

Methods

- About one gram of algae was collected monthly at three sites: NCOS Veneco Bridge (NVBR), NCOS Main Channel (NMC), and NCOS East Channel (NEC).
- A YSI meter was utilized to measure dissolved oxygen (mg/L), temperature (°C), and salinity (ppt), and a pH meter was also used.
- The algae samples were observed under a microscope and identified using *Common Freshwater Algae of the United States* (Gary E. Dillard). After identification, the macroinvertebrates present within the algae were separated and sorted.
- After sorting, the algae samples were filtered and rinsed with 70% isopropyl alcohol to separate debris and sediment from the algae. The samples were then dried in an oven for 24 hours to evaporate the liquid. Then, a dry weight of the algae is taken to calculate the number of macroinvertebrates per gram of algae.
- Additionally, algae samples were collected from Phelps Bridge and introduced to a filtered aquarium environment where oxygen and temperature levels were kept relatively constant. An average of 1.0 ppt of sea salt was introduced to the system every three days over six weeks. After each addition, measurements of average cell wall density, level of green pigment, and degree of movement among all observed moving samples were recorded.



Figures 1. Combined bar and line chart comparing the mass of organisms per gram of algae to environmental data at sites A (NEC), B (NMC), and C (NVB).

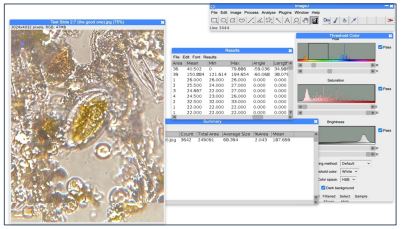


Figure 2. ImageJ algae photo processing.

Figure 3. Map of sampling locations.

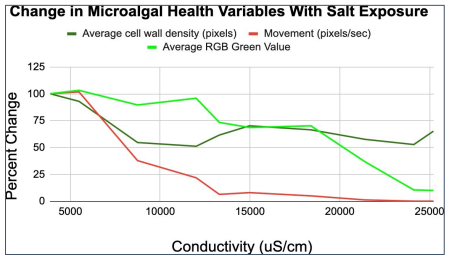


Figure 4. Sampling at NEC.

Figure 5. Line graph representing relative change in each of three experimental variables from original conditions.

Results

- Among the observed genera of algae, Tribonema emerges as a prominent habitat, showcasing the highest abundance and diversity of macroinvertebrates, particularly chironomid larvae and copepods.
- Phormidium was observed the most, in a broader range of water values than Tribonema.
- Microalgae movement and green pigment levels were found to be disproportionately inhibited by rising salinity, with 100% and 90.05% decreases, respectively, from original levels since the beginning of the data collection period, while we observed a 34.81% decrease in cell wall density.

Discussion

- Phormidium has lower macroinvertebrate abundance and diversity across the sample sites and dates and appeared at a wider pH, temperature, dissolved oxygen, and salinity range than the other observed algae, indicating that it may contribute to ecosystem stability, providing a consistent habitat and food source for macroinvertebrates.
- Tribonema appears to be the habitat preference of a large abundance and diversity of macroinvertebrates when conditions are closer to freshwater. The slough broke three days after the January 2023 sampling when Tribonema was found, meaning abundant rainfall and a high water level resulted in these conditions.
- The aquarium study shows that algal health decreases with increased salinity. This could make algae a less optimal habitat for macroinvertebrates as the water conditions get closer to saltwater.
- It's important to note the limitations present during sampling. The fact that abundant algae was not always accessible or readily available, causing variation in the sample size and potentially the true amount of macroinvertebrates in the algae, underscores the need for more comprehensive studies.
- Algae and the abundance of macroinvertebrates within it are important because changes can impact higher trophic levels. Understanding the importance of algae as a habitat and food source for macroinvertebrates is essential for promoting the conservation and restoration of wetlands, informing decision-making processes to preserve and restore ecosystem health.

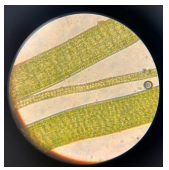


Figure 6. Ulva algae.

Figure 7. Phormidium algae.

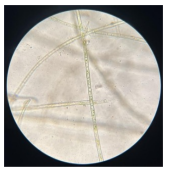


Figure 8. Tribonema algae.

Acknowledgements

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