Aquatic Invertebrate Monitoring at Devereux Slough

Ashley Grinstead, Justin Huitema, Megan Norman, Hayden Vega, Vicente Villaseñor, Alison Rickard

Contact: rickard@ccber.ucsb.edu

Background

This project initially began as a way for the Santa Barbara Audubon Society to monitor the overall health of the **Devereux Slough**, a wetland area in Goleta, CA, which is a part of Audubon's Important Bird Area (IBA). The Slough is home to a number of migrant and wintering bird species, including the Snowy Plover, whose population is in decline due to habitat loss and human pressures.

The Devereux Slough is divided into two management areas, **Coal Oil Point Reserve (COPR)** and **North Campus Open Space (NCOS)**. While COPR has been a protected reserve since 1970, NCOS was previously developed and restoration efforts have been ongoing since 2017 by the Cheadle Center for Biodiversity and Ecological Restoration (CCBER). This project allowed us to study the development of the NCOS system while comparing it with the more established COPR system. Since then, it has developed into a collaboration with CCBER and many undergraduate volunteers.

Objectives

- Generate data to aid in the management of the NCOS and COPR Estuary-Slough.
- Generate data in a cost-effective manner; where 'cost' also includes the human and infrastructural resources required.
- Develop a largely self-sustaining undergraduate program to collect and analyze the data.
- Maintain the Devereux Slough as a healthy habitat for birds
- Quantitively evaluate the health of the Slough through measuring diversity and abundance of aquatic invertebrates over time.
- Help better understand how the newly constructed wetland develops into an established wetland.

Experimental Approach

The goal of sampling is to collect a representative sample of the taxa and water quality at all 12 Devereux Slough sampling sites. During the sample collection, there were pH and YSI meters recording dissolved oxygen, conductivity-specificity, salinity, water temperature, and pH. For the YSI meter, two recordings were taken, one at 10cm below the water surface and one 5cm above the bottom sediment. To collect the samples, a 250 µm filtered beaker method (FB250) and eDNA (Environmental DNA) were used to collect aquatic macroinvertebrates species. At the CCBER Roost Lab, the FB250 samples were inspected under a microscope and sorted by invertebrate taxa. We then send E-DNA samples to an external lab to have the taxa DNA further specified.

Results

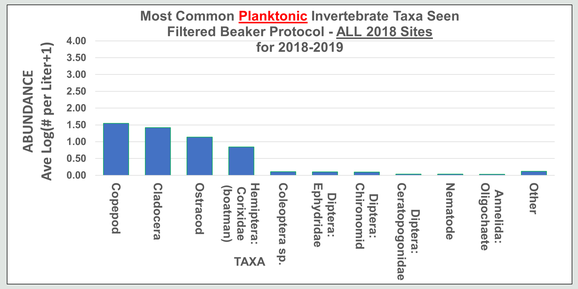
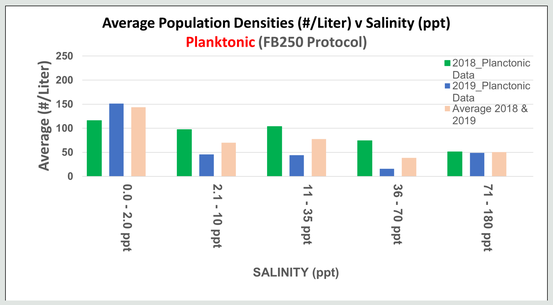


Figure 1: This graph shows the average density of each planktonic invertebrate taxa seen at all sites in 2018, collected by the filtered beaker method. It is notable that four main taxa comprise the majority of organisms in the sample sites (Senesac, 2022).

Figure 2: This graph shows comparisons between population densities of invertebrates (Copepod, Cladoceran, Ostracod, Hemiptera, Diptera, nematode, Annelida). Displayed in the graph are the averages of species density among all taxa and sites (COPR and NCOS) for 2018 and 2019. An average of both years is also displayed. Note the vertical difference in bars (Senesac, 2022).



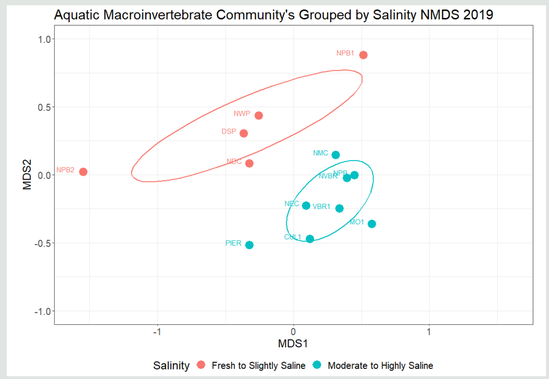
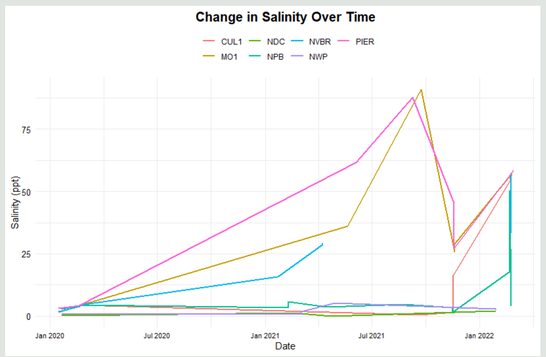


Figure 3: This graph shows the relative salinity of the sites in COPR and NCOS and compared to the similarity of taxa of invertebrates found at each site.

Note: the data clusters by the mix of species found at each site, and the axes are values for multidimensional scaling, indicating how similar species diversity was at each site to the others (Rickard, 2022).

Figure 4: This graph shows the change in salinity over time, graphed for seven sites over the course of two years at a depth of 10cm. It was found that salinity was relatively stable for all sites with an exception for MO1, and PIER which had an Interquartile range (fluctuation) of about 25ppt. Note each site has a limited set of data, about 15 points per site, so that may add to the data's invariability and variability (Grinstead, 2022).



Discussion

- There appears to be a negative, linear relationship between salinity and taxa abundance (Figure 2)
- Taxa diversity is strongly influenced by salinity, as sites similar in salinity often have similar species present (Figure3).
- NCOS and COPR are subject to significant seasonal fluctuations in salinity (Figure 4)

These experimental findings are indicative of the health of Devereux Slough. The data in figures 2, 3, and 4 demonstrate the potential influence of salinity as an indicator of invertebrate taxa abundance and potential wetland health. Our results highlight the difficulty of collecting data over long periods of time. Figure 2 represents the most recent data collection, and even though there was a sufficient sample size, having more data would be able to support how salinity affects invertebrate species abundance. Figures 1 and 4 are also limited to two data pools from 2018 and 2019. Due to COVID-19, data collection was halted and this interfered with the temporal relationships this lab was attempting to build. This study aims to reveal the comparative difference in macroinvertebrate species diversity and abundance over time as conservation continues to increase through the NCOS wetlands, particularly using it as a model to prompt conservation efforts in other locations. The results of this experiment serve as a foundation for future discovery of how water quality can be a great indicator of the state of a wetland. Future experiments will include analyzing groundwater sample collection, soil cores, and assessing the difference in eDNA collection. These investigations will provide CCBER with insight into the variability of macroinvertebrate species under certain conditions. By incorporating these additional variables, and with a longer study period, the lab hopes to find conclusive information on the relationship between these macroinvertebrate species.

Acknowledgements

Many thanks to Steven Senesac who first began the aquatic invertebrate monitoring project in 2017, and whose report is cited here, for providing the leadership and financial support which allow us to continue our research in 2022. Thank you to all the UCSB undergraduate volunteers who helped to collect data. Thank you to Lisa Stratton, who creates opportunities, like the Aquatic Invertebrate Monitoring program, within CCBER that continue to open doors for students and young scientists. Lastly, thank you to the supportive staff, led by Alison Rickard, who has left a lasting impact on all the undergraduates involved in this lab.

References

Rickard, A., & Stratton, L. (2022). North Campus Open Space Restoration Project Monitoring Report: Year 4 (2021). https://escholarship.org/uc/item/4mc6h09z

Santa Barbara Audubon. (n.d.). Important Bird Areas: Goleta Coast. https://www.audubon.org/important-bird-areas/goleta-coast.

Senesac, S. (2022). Aquatic Invertebrates of the Devereux Slough 2018-19. https://escholarship.org/uc/item/55848339.