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Abstract: As part of a broad innovative research and education program, a group of scientists, educators, and secondary-school students performed some of the first-ever community analyses of the wetlands in Bahía de los Angeles, Baja California, Mexico. Four wetlands were surveyed for epifauna, plants, fish, and various sediment characteristics in order to broadly characterize habitat and community structure. We found that faunal species diversity was higher at the largest sites and in mangrove habitats, while abundance was higher in salt marsh (*Salicornia*-dominated) habitats. Both resident and non-resident fishes were found within the wetlands, with patterns consistent with the hypothesis of a strong nursery function for these habitats. Further, each individual wetland had a distinct faunal assemblage. These data not only support the important role of these wetlands in providing ecosystem functions such as increasing biodiversity and providing nursery and foraging habitat for fishes and birds, but also demonstrate that the loss of even a small wetland would potentially decrease (beta) biodiversity in the larger bay ecosystem. Further studies in the region are made even more urgent by numerous pending development plans in the bay, which will undoubtedly increase the anthropogenic disturbance of these sensitive habitats. This study is an example of how combining science, education, and outreach can create powerful results for conservation and communities alike.

Introduction: Bahía de los Angeles (BLA) is positioned in Baja California, Mexico 400 miles south of the U.S. - Mexico border on the Sea of Cortez (Figure 1). The wetlands of BLA are located around the bay as well as on an island within the bay. Their location near the small community of BLA has left them relatively pristine, yet unstudied. However, recently several of the wetlands in BLA were identified as potential sites for development.

To better understand how these wetlands function and how they might be affected by future development, our study sought to characterize the habitat and community structure of four wetland sites in BLA.

This study will contribute to ProNatura, a non-profit organization, in their efforts to preserve the wetlands around Bahía de los Angeles.



Figure 1. BLA in Baja California, Mexico.



Figure 2. Wetland research sites in BLA.

Methods:

- Four wetland sites in BLA, El Rincón, Coronado Island, Punta Arena, and Las Animas (Figure 2), were studied.
- Each site was divided into three habitat types – tidal flats, salt marsh and mangroves. Tidal flats have predominantly no plant cover, the salt marsh is dominated by *Salicornia virginica* and *Batis maritima*, and mangroves consist of *Rhizophora mangle*.
- The data presented here are from sampling performed in the summer of 2005. To measure plant cover, epifauna, and sediments, 100-200m transects were run in each habitat type within each wetland site. Ten quadrats were evenly spaced along the transect. In each quadrat we determined plant cover, and counted epifauna and structure (holes). In odd-numbered quadrats, we measured sediment salinity, planted pitfall traps, and collected soil to determine soil moisture and particle size composition.
- Fish traps were used to gather data on fish utilizing the wetlands. Five fish traps were set in front of the wetland, 10 within (dispersed among the three habitat types) and 5 away from the wetland.

Results: There was high variability in epifaunal abundance both within and among wetlands. (Figure 7). Each wetland had a distinct faunal assemblage (Figure 6). There were no consistent overall differences between habitats in epifaunal abundance or species richness (Figure 3). However, there were significant differences in epifaunal abundance and species richness between wetlands (Figure 4). The wetlands themselves and the nearby waters provided habitat for both resident and non-resident species (Figure 5).

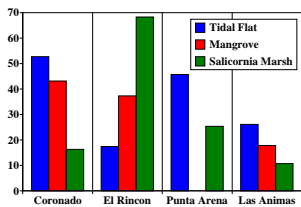


Figure 7. Mean epifaunal abundance per quadrat in each habitat at each wetland sampled.

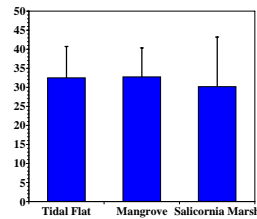


Figure 3. Mean total epifaunal abundance and species richness per quadrat in each habitat type, across all wetlands. Error bars are ± 1 s.e. ANOVA, $p \geq 0.10$.

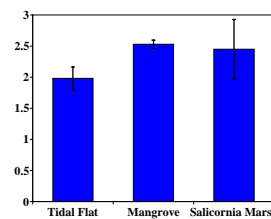


Figure 4. Mean total epifaunal abundance and species richness per quadrat at each wetland. Wetlands sharing similar letters are not significantly different (Tukey's HSD, $p \geq 0.05$). Error bars are ± 1 s.e.

Wetland	Total Epifaunal Taxa	Number of Unique Taxa
Coronado	8	3
El Rincón	12	4
Punta Arena	7	1
Las Animas	13	4

Figure 6. Total number of taxa captured in quadrats at each wetland site, across all habitats. "Unique taxa" are those not found in any other wetland.

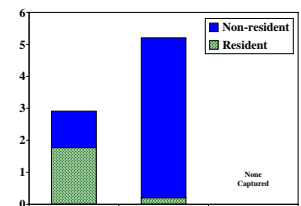
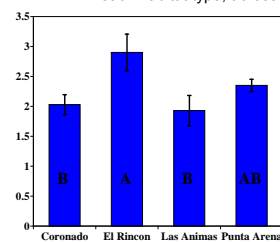
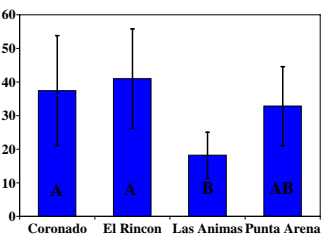


Figure 5. Mean number of fishes per trap captured within, "near" (within 30m) of wetland, and "away" (>150m from wetland). Resident species are those that spend their entire life cycle within the wetland itself, while non-residents are those that spend some portion of their life cycle outside of wetlands. Note that all non-residents were captured within wetlands, and 100% near wetlands were juveniles.

Discussion: An outcome of this research is the generation of some of the first ever baseline data for the region's threatened wetlands. However, we have only begun to study their role and describe their communities in BLA.

Since habitat type does not determine the types of epifauna found, we conclude that other environmental factors that are site dependent, such as currents, may play an important role in determining community structure. While epifauna did not show a habitat preference across wetlands, a two-way ANOVA did show significant differences, thus implying that there was an interaction between sites and habitats. We found that total epifaunal taxa was highest at El Rincón and Las Animas, possibly due to their larger size, and in mangrove habitats, perhaps because their roots provide shade and structure. Interestingly the site with the highest number of epifaunal taxa, Las Animas, had the lowest species abundance. This may be due to competition. Because some sites had higher diversity while others had greater abundance, we determined all of the sites and habitats to be extremely important. In addition, each site had at least one unique species. The loss of any of these sites could affect the overall biodiversity of the region. Impacting the wetlands also influences fish that live in the wetlands as well as those in the bay as we found several nursery species in front of the wetland. Neither nursery nor resident fishes were found in fish traps set away (>150m) from the wetland, reiterating the importance of these ecosystems to a diversity of fishes.

This research provides a baseline and serves to guide future studies of these areas. These data have already been used by a Mexican non-profit organization (ProNatura) in their efforts to protect and preserve these wetlands, and will continue to be collected and analyzed in coming years to expand our understanding of the structure and function of these threatened habitats and their communities.

TITLE? The students, educators, and scientists, who conducted this research, are part of Aquatic Adventures' BAHÍA program. This program engages students from one of the San Diego region's most underserved high schools in authentic scientific research, while providing extensive supports and instruction before, during, and after the research experience. Students travel to BLA where they spend 5 weeks working alongside U.S. and Mexican scientists. Through their participation students build their expertise and skills towards a future in the sciences, while making tangible contributions to ongoing research.

To learn more about the BAHÍA program, contact: www.aquaticadventures.org/BAHIA, sharafisler@aquaticadventures.org, dmtalley@sfsu.edu

