PROGRESS REPORT

Eliza C. Moore

Project title: *Seagrass habitat structure: relative effects of structural complexity and location within the patch on epifaunal abundance and diversity.*

Submitted to the Environmental Committee
Unified Port of San Diego

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Since receiving the student grant for research in San Diego Bay (SDB) I've conducted the field experiments and made significant progress processing samples to collect data on the organismal community in SDB's eelgrass beds. The goal of this work is to learn more about how epifaunal crustaceans and gastropods utilize eelgrass habitat depending on its structure. The project is novel in that few researchers study habitat structural effects on the community at more than one scale. By looking at community differences between eelgrass of different shoot density (patch scale) and in different locations within the bed (landscape scale) I hope to gain a more realistic understanding of how organisms perceive their habitat.

My first objective was to conduct surveys of SDB's naturally occurring eelgrass beds to measure variability in habitat complexity (patch scale attributes: shoot density, shoot length, and biomass) within the landscape, as well as measure prey (mobile epifauna) and predator (fishes) between seagrass edge and interior (landscape scale attributes). I collected core samples of the seagrass from 3 sites within the bay, and analyzed the data to look for differences in shoot density from the outer edge, inner edge (1 meter in from the sand-seagrass interface), and interior (6m in from the edge) of the bed. Figure 1 shows these data from 2 of the 3 sites surveyed. The habitat complexity, here measured as shoot density, increases from the outer edge of the bed towards the interior. This covariation in structure makes clear the need to study the habitat at more than one scale. For instance, figure 2 shows the distribution of shrimp collected from the same 3 locations within the beds. While the shrimp increase in density from the outer edge to the interior, we're unable to say if this difference is due to the bed locations (landscape scale) or the shoot density differences (patch scale). As a part of this first objective I also surveyed the fish distributions between habitat edge and interior. These data can be seen in figure 3, where fish abundances similarly increase from the edge to interior.

My second objective was to conduct a manipulative experiment to assess the relative and interacting influences of habitat complexity, location within the bed (edge or interior), and predation pressure on the prey community. Epifaunal prey colonized experimental plots of varying complexity (dense or sparse shoots), location, and predation treatments. To vary the level of predation I enclosed a subset of plots in predator-exclusion cages. After collecting the epifauna for counting and identification, I saw little effect of bed location on total abundance (fig. 4). However, epifauna were typically more abundant in dense plots compared to sparse, likely due to more available habitat. Predation treatment had little effect on overall abundance, however, when we look just at shrimp (a primary prey organism for resident fishes), we do see a caging effect (fig. 5). Shrimp were more abundant in plots with predators excluded than predators present. Shrimp were more abundant in dense plots compared to sparse, but showed little difference between edge and interior. This suggests that the natural distribution we saw in surveys (see fig. 2) was due to patch scale complexity and not bed location. I also analyzed the epifaunal data to look for differences in the diversity of the communities within each treatment (fig. 6). Although the trend was not strong statistically, there was slightly lower diversity in sparse plots at the edge compared to dense in the same location.

I was able to present these data at the annual meeting of the Western Society of Naturalists in November of 2007. In the coming months I will continue to process

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samples from this summer to increase my sample sizes and power to detect community differences between treatments. For this I will also enlist the help of undergraduate assistants in the lab. I expect to finish my final report as scheduled in late spring/early summer.

Objective 1 - Survey – Preliminary analyses

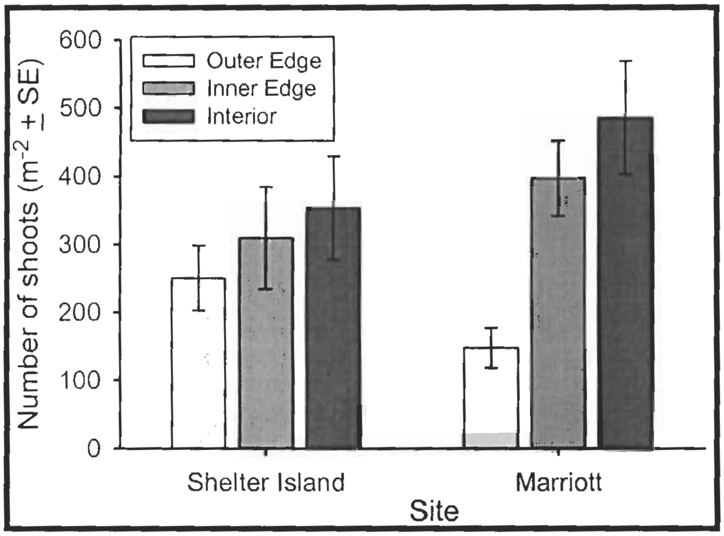

Figure 1:
Eelgrass shoot density at 3 locations within a bed, measured at 2 sites (Shelter Island and Marriott). The increase in shoot density from the outer edge to interior is statistically significant ($p = 0.004$) in a 2 way ANOVA.

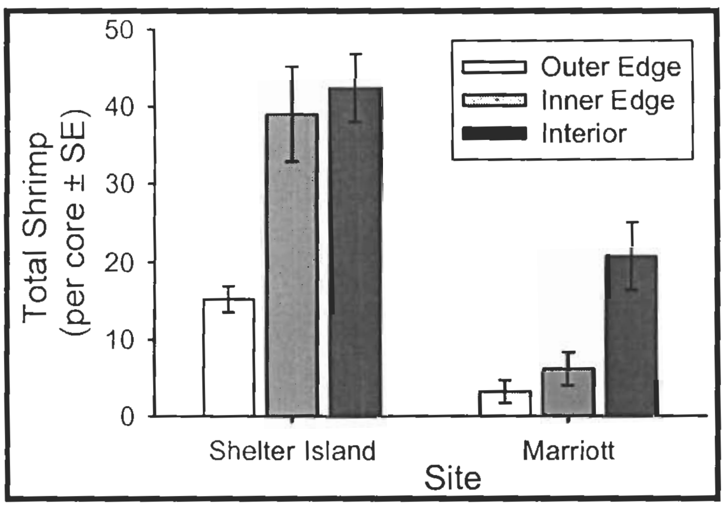

Figure 2:
Total shrimp abundance at three bed locations. There was strong evidence that the abundance of shrimp increases from outer edge to interior but that increase differed in magnitude between sites (2-way ANOVA site*location $p = 0.067$).

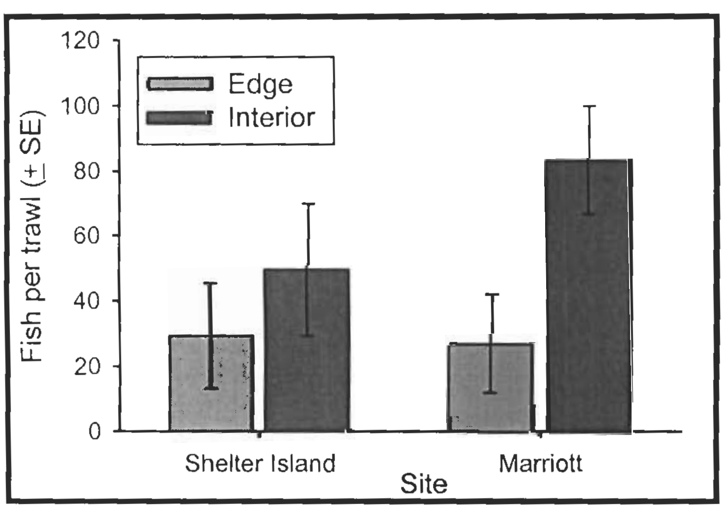

Figure 3:
Fish abundances between edge and interior. Trawl sampling did not allow for separate edge measurements. 2-way ANOVA revealed strong evidence that the location effect is significant ($p = 0.052$).

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Objective 2 – Caging experiment – Preliminary analyses

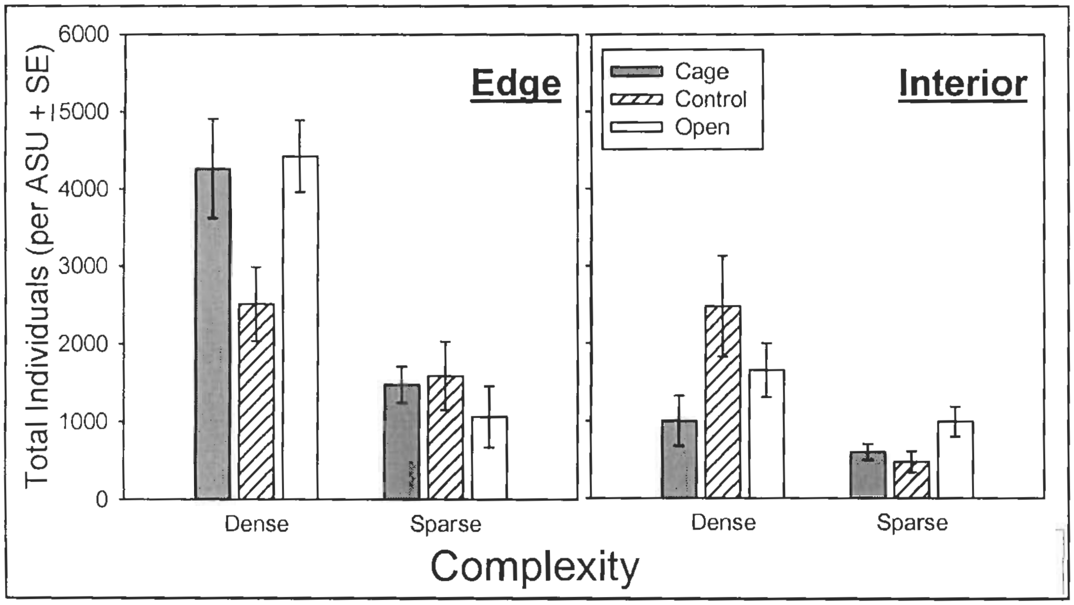

Figure 4:
Total epifaunal abundance between caging treatments. 2-way ANOVA were run separately by location. At the edge, there was significant effect of complexity ($p < 0.001$). In the interior, complexity effects varied with predation treatment (interaction $p = 0.061$).

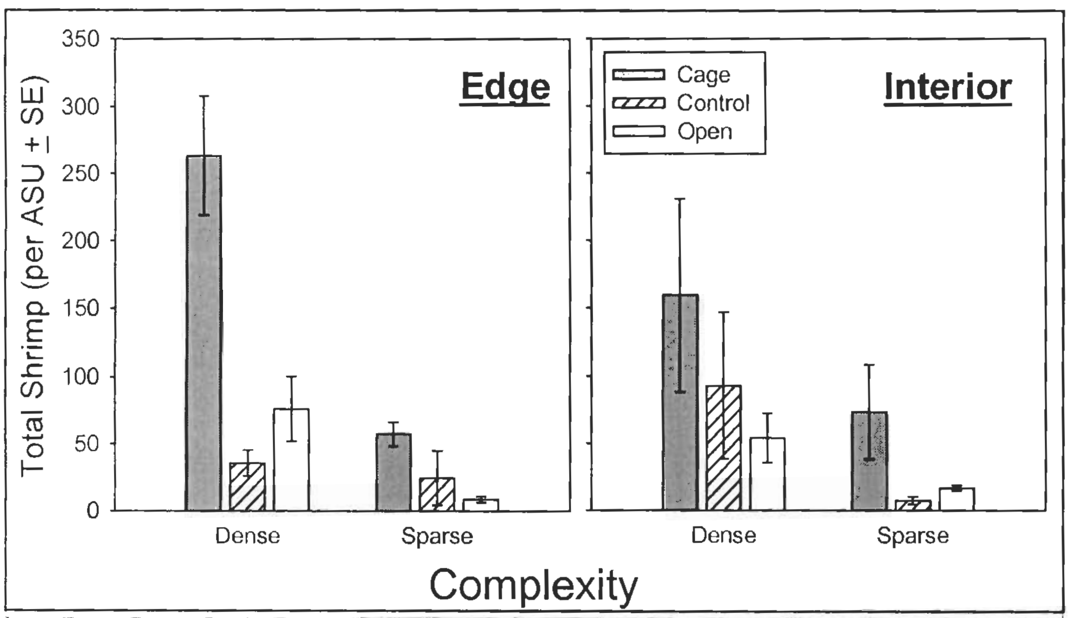

Figure 5:
Total shrimp abundance between caging treatments. Shrimp decreased in abundance from dense to sparse shoots and from caged to open plots (3-way ANOVA complexity and predation both $p < 0.001$) but no evidence for location differences was seen.

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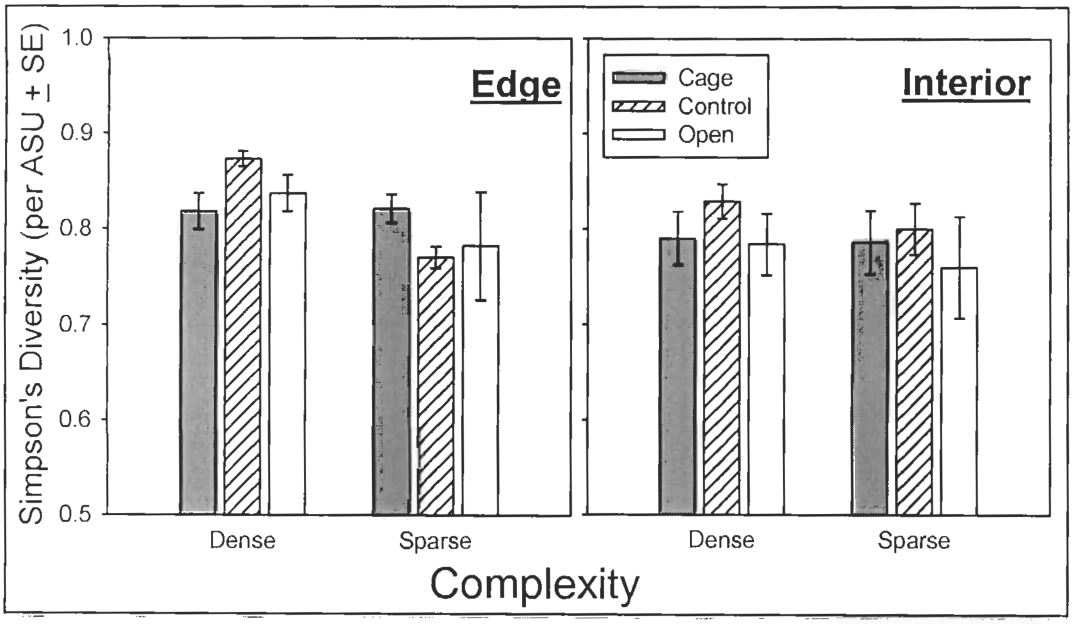

Figure 6: Simpson's diversity index is the probability that 2 individuals taken from a sample are of different taxa. Little evidence was seen for treatment effects, but at the edge there was a slight decrease with complexity (2-way ANOVA $p = 0.054$).