Introduction

A growing body of research explores the biotic and abiotic factors influencing sea urchins’ choice of microhabitat. Researchers have studied the effects of predation and competition (Farina et al. 2016, Stevenson et al. 2015), food availability (Lawrence 1975), and climatic factors, including dissolved oxygen and pH (Sato et al. 2017) in habitat choice. Urchins prefer complex, heterogeneous habitats. Azzarello et al. (2014) studied the relationship between habitat characteristics and urchin abundance in Western Australia, finding that urchin density correlates with macroalgae in areas with greater habitat complexity, because they are suitable for burrowing or hiding in nooks and crannies (Azzarello et al. 2014). Herbivorous urchins inhabiting seagrass meadows are influenced by multiple factors when deciding where to locate themselves. Lytechinus variegatus is one such urchin, often inhabiting seagrass beds of Thalassia testudinum throughout Florida and the Caribbean (Serafy 1979). L. variegatus, like most regular echinoids, is a generalist herbivore, eating mainly living and detrital seagrass and macroalgae (Lawrence 1975). L. variegatus is known for its covering behavior, in which it packs up items from the environment with its tube feet and holds them up on its back. Gaps in the literature remain with regards to the relation between its diet and covering behavior and its preferred habitat.

Research Hypotheses

We hypothesize that (i) L. variegatus will preferentially select microhabitats that have a higher dead T. testudinum cover and (ii) L. variegatus will preferentially select microhabitats that have a course substrate.

Methods

To test our hypothesis, we sampled the habitat of L. variegatus using 0.5 x 0.5 m quadrats. We swam in a set direction from our starting point, stopping at each individual we found. The variables were percent cover of each living T. testudinum, dead T. testudinum, macroalgae, and substrate of both shells. We sampled Triton Flats, a mud flats area off of Long Key in the Florida Bay. A quadrat was laid along a transect. These were lifted to see what macroalgae, living T. testudinum, and density of L. variegatus in the quadrat were estimated to the nearest 5%.

The measurements we took to qualify substrate were percent cover of shells greater than 2 cm in diameter and fragments of coral. These were estimated by what area of the quadrat had visible coral or shells directly on the surface. If objects were resting inside the area of the quadrat on top of the substrate, these were lifted to see what elements of the substrate they were resting on. In the case of objects or organisms with holdfasts, only the area surrounding those objects or organisms were estimated. All components of coral and benthic substrate were estimated to the nearest 5% cover.

Discussion

The lack of correlation between L. variegatus density and percent cover of dead T. testudinum indicates that it is not plausible to assert that L. variegatus preferentially choose their habitats based on detrital T. testudinum abundance based. A future study that accounts for other sources of food may be able to better predict L. variegatus density. We found a significant positive correlation between percent cover of coral and percent cover of L. variegatus, and between percent cover of shells and density of L. variegatus. These correlations support our second hypothesis that L. variegatus preferentially selects habitat with a course substrate, characterized by higher percent cover of shells and coral fragments such as Pinctes porites.

Although L. variegatus may be attracted in some measure to both dead T. testudinum for food and course substrate for cover material in their habitat, our data show that percent cover of dead T. testudinum and Pinctes porites are significantly negatively correlated. This finding makes sense, given that seagrasses like T. testudinum might grow better in the absence of coarse substrates.

The interaction between dead T. testudinum cover and the percent cover of coral in the benthic substrate can have two interpretations. One interpretation is that in areas with a high percent cover of coral, there could be an incentive for L. variegatus individuals to be in areas that also have a higher amount of dead T. testudinum as a food source. On the other hand, it could also be true that in areas with a high percent cover of T. testudinum, an individual would then have an incentive to be in an area with a higher amount of coral in the benthic substrate to cover with. Clearly, our hypothesized ecological model is limited and incomplete, but it does not fail to raise questions and insights. Confounding factors (lides, bathymetric pressure, etc.) that we did not measure cannot play a significant role in where individuals reside. In future studies, standardizing our methods more by using belt transects or larger quadrats laid along a transect may increase the repeatability of the study and create a more robust data set. In future studies, sampling more sites in the Florida Bay may increase the generalizability of this research.

Acknowledgements

Thanks to the Goshen College Biology Department for supplies and use of the lab and boat, Dr. Ryan L. Sensing for guidance throughout the project and data analysis, and Joel Gerig for assistance and guidance throughout the project.

References


Chapman, R. C., & McCorkindale, J. B. (2010). Expansion of extertat hospiters under laboratory conditions does not impact the feeding or foraging behavior of parapoikilids of the coral reef sea urchin (Lytechinus variegatus). Marine & Freshwater Research, 61(11), 1395-1402. doi:10.1071/MF10110


Chapman, R. C., & McCorkindale, J. B. (2010). Expansion of extertat hospiters under laboratory conditions does not impact the feeding or foraging behavior of parapoikilids of the coral reef sea urchin (Lytechinus variegatus). Marine & Freshwater Research, 61(11), 1395-1402. doi:10.1071/MF10110
