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HOW FAH IS FAH? CHANGES IN HERBIVORY ON *THALASSIA TESTUDINUM* WITH DISTANCE FROM THE REEF

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Abstract. Coral reef patches are often surrounded by halos of barren sand that grade into turtle grass beds of increasing height and density. This gradient has been alternatively attributed to fish (Randall 1965) and urchin (Ogden 1973) grazing. These organisms forage close to the reef which serves as refuge from their predators. Given the scarcity of predators in Discovery Bay, Jamiaca, we wanted to determine the presence or absence of this halo effect here. We measured parrot fish and urchin herbivory by anchoring 29 clusters of uneaten turtle grass at 5 m intervals along two transects (5 - 70 m and 2.5 - 72.5 m) from the reef crest.Overall herbivory on *Thalassia testudinum* (from both parrot fish and urchins) did not change with increasing distance from the reef crest. Despite the lack of a clear halo we did find strong evidence for niche separation between herbivore species. Parrot fish fed almost exclusively within 50 m of the reef crest while urchin herbivory was seen beyond 50 m.

Key Words: *halo effect, niche separation, parrot fish,* Sparisoma *spp.*, Scarus *spp.*, Tripneustes, *turtle grass, urchin*

INTRODUCTION

Many studies have shown that fish and urchin herbivory can profoundly impact the *Thalassia testudinum* community, but few have provided definitive mechanisms for the spatial patterns of turtle grass near coral reefs. Hay (1981) found higher herbivory near structurally complex areas suggesting that predation pressure in open areas may limit herbivore foraging ranges away from reef refuges. Patches of barren sand are often found in areas closest to the reef and are surrounded by areas of closely cropped *Thalassia* which give way to thicker *Thalassia* beds. This "halo" and gradient of herbivory has been attributed to grazing fish (Randall 1965) and urchins (Ogden 1973) which inhabit the reef for refuge from predators.

We examined the effect of distance from the reef on the amount of parrot fish and urchin herbivory on *Thalassia* in Discovery Bay, Jamaica. The Halo Hypothesis predicts that refuge provided by the reef would lead to lower fish and urchin herbivory at increasing distances from the reef. Alternately, over fishing in the Discovery Bay area may have relaxed predator avoidance behavior, so that both fish and urchins may range considerable distances from the reef to forage on turtle grass.

METHODS

We measured parrot fish and urchin herbivory on leaves of Thallasia over a 24 - hour period in the back reef at Discovery Bay, Jamaica. On 25 February 1998, we anchored 29 clusters of uneaten turtle grass (6 leaves per cluster) at 5 m intervals along two transects: 5 - 70 m and 2.5 - 72.5 m from the reef crest. *Thalassia* blades with roughly equal ammounts of ephiphyls were chosen to avoid differences between clusters. Grass clusters were anchored on the fore reef floor in ~1 to 1.5 m of water in areas alternating between turtle grass and bare substrate. We collected the clusters 24 hr later and assessed the extent of parrot fish and urchin herbivory as percent leaf eaten. Using regression analysis we examined the effect of distance on total herbivory. We then plotted percent herbivory versus distance for each herbivore type. We analyzed differences in amount of herbivory by each herbivore near (0 - 50 m) and far (50 - 75 m) from the reef crest using Wilcoxon and Kruskal Wallis non-parametric tests.

RESULTS

Overall herbivory on *Thalassia testudinum* (from both parrot fish and urchins) did not change with increasing distance from the reef crest ($r^2 = 0.0001$, $P = 0.95$). In examining herbivory by herbivore type, we noticed that the

herbivore responsible for most of the herbivory switched from parrot fish to urchins at ~ 50 m (Fig. 1). Parrot fish herbivory was significantly higher 0 - 50 m from the reef crest than from 50 - 75 m (X^2 = 11.19, P < 0.001; Table 1). Urchin herbivory was significantly higher farther from the reef (50 - 75 m) than it was near the reef (0 - 50 m)(X^2 = 13.86, P < 0.001; Table 1).

DISCUSSION

We did not observe the predicted halo effect, as overall herbivory did not change with distance from the reef. However, we evidenced very little parrot fish herbivory past 50m from the reef, suggesting that the fish are taking refuge from predators in the reef and thus preferentially grazing on the grass closest to the reef (Randall 1965). In Discovery Bay this behavior is particularly interesting given the scarcity of larger predatory fish in the area. Perhaps the fish derive other benefits from living in the reef or the behavior is strongly genetically fixed and not responsive to changes in the surrounding environment.

Discovery Bay has only very small populations of *Diadema*, the urchin widely held responsible for causing the halo effect (Ogden 1973). The urchin herbivory in this study was likely caused by the common *Tripneustes ventricosus* and *Lytechinus variegatus* which appeared prevalent in the study area. Almost all urchin herbivory was observed further than 50m from the reef. While herbivory near the reef was caused allmost exclusivly by parrot fish. This suggests a niche separation between the parrot fish and urchins, although the mechanism for this separation is not clear. Further studies examining potential mechanisms of this niche differentiation would help determine the nature of the herbivory patterns and the changing role of *Tripneustes*. in the backreef of Discovery Bay.

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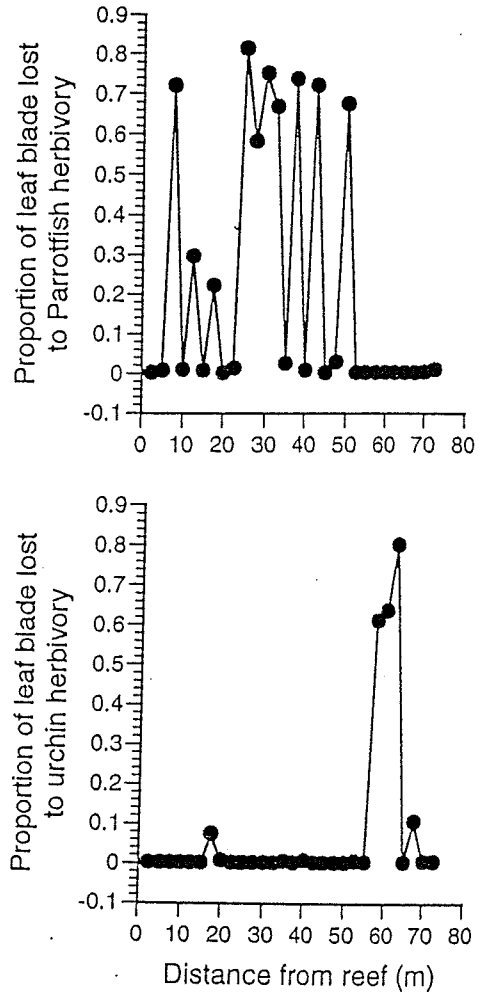

FIG. 1. Proportion herbivory on turtle grass blades by parrot fish and urchins.

Table 1. Proportion of herbivory on *Thallasia testudinum* at different differences from the reef. Proportion of herbivory represents the mean porportions of leaves eaten by a herbivore.

Distance from reef (m)	Herbivore Type	Proportion of Herbivory	SE
Near (0-50)	Parrot fish	0.3128	0.0764
Far (50-75)	Parrot fish	0.0011	0.0009
Near (0-50)	Urchin	0.0042	0.0036
Far (50-75)	Urchin	0.2413	0.1128