DIURNAL AND SPATIAL VARIATIONS IN *THALASSIA* HERBIVORY BY REEF FISH

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Abstract. *Thalassia testudinum* was used to assess diurnal and spatial variation in reef fish herbivory. At three times of day, *Thalassia* blades were placed near and far from a reef in Discovery Bay, Jamaica. Constant rates of herbivory were observed among sites and time periods. Lack of temporal and spatial patterns may have resulted from low piscivore presence in the Discovery Bay area.

Key Words: diurnal variation, herbivory, predation, reef fish, spatial variation, Thalassia testudinum

INTRODUCTION

Several studies have shown diurnal variation in reef fish foraging behavior (Hay *et al.* 1983). Grazing by herbivorous fish tends to be most intense in the morning and relatively low in the afternoon and evening (Hay *et al.* 1983). This decrease in the rate of herbivory during the day was attributed to increased risk of predation. It is not clear, however, how this temporal pattern of herbivory affects spatial variations in herbivory. Reefs offer refuges for fish during periods of low activity and high risk of predation. When predation risk is low, herbivorous fish may choose to swim farther from the reef to feed on turtle grass. We hypothesized that in addition to the diurnal variation in herbivory rates on the turtle grass, *Thalassia testudinum*, there is a correlation between rate of herbivory and distance from the reef. We expected more herbivory at sites farther from the reef in the morning than in the afternoon. However, we predicted that herbivory would always be lower at the site farther from the reef because of higher predation risk in the open *Thalassia* beds.

METHODS

On 21 February 1996, we collected *Thalassia* leaves in the back reef at Discovery Bay, Jamaica. We prepared 540 blades by cutting each to 17 cm, and by cutting off the tips (< 2 cm) of each blade so that all blades had the same appearance. We assembled devices to hold the blades in place by attaching two clothespins to one large bolt, and placing 6 blades of Thalassia in each clothespin.

On 22 February 1996, we chose two sites where *Thalassia* was abundant: one near (< 1 m from) the reef and one approximately 10 m from the reef. We haphazardly placed 8 bolts containing a total of 15 clothespins in each location. To examine temporal variation in herbivory, we placed treatments for three time periods: morning = 0600 - 0900; afternoon = 1200 - 1630; night = 1630 - 1930. To correct for the longer afternoon time period, we standardized for herbivory per 3 hour time period.

After the allotted time, all blades were collected and pooled for the near site and the far site. We counted the number of grazed blades, defined as blades with one or more bites, and calculated the percent of herbivory (= number of leaves with one or more bites/total number of leaves x 100). Herbivory across distance and time treatments was analyzed with a Chi-square test.

RESULTS

Herbivory patterns on *Thalassia* showed little variation between sites or time of day (Fig. 1). There was no significant difference in the herbivory across either time of day or distance from reef ($X^2 = 0.77$, df = 2, P > 0.95).

DISCUSSION

These data showed no significant spatial or temporal difference in herbivory rates on *Thalassia*. This lack of variation suggests that some fish eat at all time periods during the day. Past studies that contradict our results have been conducted in systems with high piscivore abundance which causes the small herbivorous fishes to hide during the day. Discovery Bay lacks predation pressure from large piscivorous fish (J. Gilbert, pers. comm.), probably allowing herbivorous fish to feed throughout the day. This difference may account for the lack of diurnal variation in herbivory.

Contrary to our prediction, the amount of herbivory

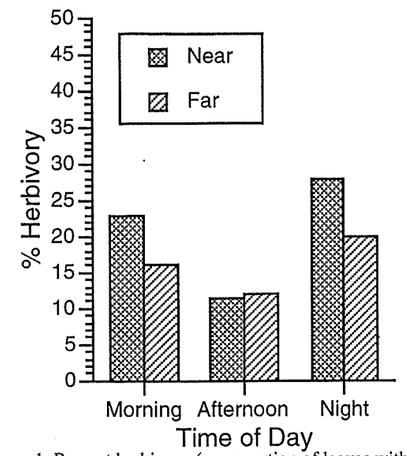

Figure 1. Percent herbivory (= proportion of leaves with > 1 bite) on experimental plots of *Thalassia* at three times of day and different distances (1 and 10 m) from the reef (n = 466). Data collected at Discovery Bay, Jamaica.

near and far from the reef was similar at all times of day. If herbivores use the reef for protection, the risk of moving away from the reef to feed must be outweighed by the benefits of the food received. The fish fed equally near and far from the reef, indicating that predation risk was not a factor in where the herbivores fed. Because there are few predatory fish at Discovery Bay, the herbivores experience less risk when feeding in open water (Hay *et al.* 1983).

In general, herbivory rates were low. The blades were set out for only three hours, and this may not have been long enough for noticeable effects. In addition, low herbivory rates may be related to site selection. There may have been less herbivory in our sites than in other *Thalassia* beds: the beds we chose were isolated from other *Thalassia* patches and were composed of short blades, perhaps not as strong of an herbivore attractant as abundant, long blades. Comprehensive studies including longer time periods may further the understanding of temporal fish foraging behavior. Future studies correlating predation pressure to distance that fish travel from the reef may aid in the understanding of herbivore activity.

LITERATURE CITED

Hay, Mark E., Tina Colbourn, and Daphne Downing. 1983. Spatial and temporal patterns in herbivory on a Caribbean fringing reef: the effects on plant distribution. Oecologia **58**: 299-308.