

THE EFFECTS OF DAMSELFISH TERRITORIALITY AND EPIPHYTE LOAD ON PARROTFISH HERBIVORY OF *THALASSIA TESTUDINUM*

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Abstract: Parrotfish are the most prominent herbivores of *Thalassia testudinum*, a common sea grass in the back reef of Discovery Bay, Jamaica. Parrotfish feed on turtle grass to obtain nutrition from the epiphytes growing on these blades. Three-spot damselfish defend territories that often include blades of *Thalassia testudinum*. We hypothesized that parrotfish herbivory would be affected by epiphyte load and damselfish territoriality. We predicted that herbivory would increase with epiphyte load, and decrease inside damselfish territories. Damselfish territoriality, epiphyte load, and the interaction between the two affected parrotfish herbivory of turtle grass. The interaction is described by the fact that damselfish territoriality was more influential in high epiphyte treatments than low. Herbivory was highest on grass with high epiphyte load outside damselfish territories and lowest on grass with low epiphyte load inside territories. Epiphyte load appears to be the more important factor in determining herbivory of *Thalassia testudinum*.

Keywords: back-reef ecology, optimal foraging, *Stegastes partitus*, turtle grass

INTRODUCTION

Herbivores are conspicuous elements of coral reef communities, where they dominate in number and biomass (Ogden, 1978). Of the exclusive herbivores, members of the parrotfish family (Scaridae), and sea urchins are the prominent grazers of *Thalassia testudinum*, a common species of sea grass (Ogden 1976). In the reef located north of the Discovery Bay Marine Laboratory, Discovery Bay, Jamaica, parrotfish feed on turtle grass to obtain nutrition from the epiphytes on these blades (J. J. Gilbert, pers. comm.). On this same reef, three-spot damselfish (*Stegastes planifrons*) defend territories that may include patches of turtle grass. Previous studies have shown less overall algal grazing by non-territorial herbivorous fishes and urchins in areas defended by three-spot damselfish, and we extrapolated this algal defense to make predictions about the effect of territories on turtles grass herbivory (Foster 1987).

We hypothesized that parrotfish herbivory would be affected by epiphyte load and damselfish territoriality. We predicted that herbivory would increase with epiphyte load, and decrease inside damselfish territories. We predicted epiphyte load would be the stronger factor determining parrotfish herbivory because parrotfish eat the blades for the nutritional value of the epiphytes. We therefore predicted higher herbivory on high epiphyte load blades inside territories than low epiphyte

blades in undefended areas, because parrotfish would be more likely to venture inside territories for highly nutritional grass blades than eat undefended blades with little or no nutritional value.

METHODS

We conducted our study on 25 - 26 February 1998 on the backreef of Discovery Bay. We collected *Thalassia testudinum* blades with high epiphyte loads (> 75% coverage in upper 10 cm) and low epiphyte loads (< 10% coverage). We cut all blades to 15 cm in length (measured from tip), secured six blades of similar epiphyte load with a clothespin for each replicate, and attached a weight and a buoy to each. We placed four high epiphyte load and seven low epiphyte load bunches in territories defended by three-spot damselfish (one replicate per damselfish territory). We placed six high epiphyte load and five low epiphyte load bunches in turtle grass patches that were not defended by damselfish. The variation in replicate numbers was due to starting the experiment with unequal sample sizes and to the failure to recover one of the replicates in the high epiphyte, damselfish territory treatment. After 24h we collected all samples and assessed herbivory by calculating the percent of each blade lost. We analyzed the arcsin transformed data with a two-way ANOVA, comparing the effects of epiphyte load, damselfish territory,

and the interaction between the two. A Tukey-test was used for pairwise comparisons.

RESULTS

Herbivory was significantly affected by both epiphyte load ($F_{3,18} = 15.97$, $P = 0.001$), and damselfish territoriality ($F_{3,18} = 34.58$, $P < 0.001$). Damselfish territoriality had less of an effect in low epiphyte treatments than in high epiphyte treatments ($F_{3,18} = 11.05$, $P = 0.004$). Parrotfish herbivory was significantly greater on turtle grass blades with high epiphyte load in areas not defended by threespot damselfish than on blades in the other three treatments ($P < 0.05$, Fig. 1). Some evidence of sea urchin herbivory was found on one turtle grass blade across all replicates, so urchin herbivory was considered to be negligible in our study site and time frame.

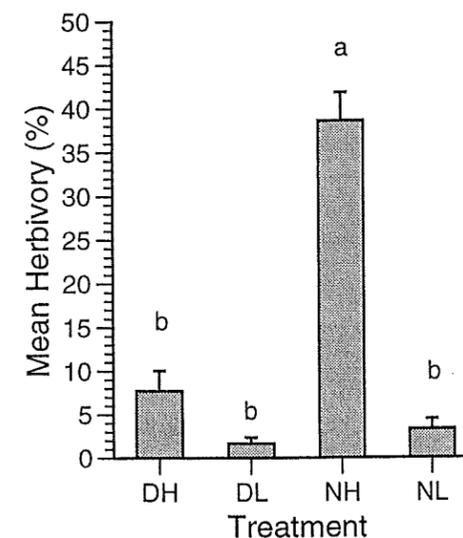


FIG. 1. Mean (± 1 SE) percent of turtle grass blades lost to herbivory in four treatments (D = damselfish territory, N = no damselfish, H = high epiphyte load, L = low epiphyte load). Values with the same letter are not significantly different ($P > 0.05$).

DISCUSSION

Turtle grass herbivory by parrotfish is influenced by many factors, both biotic and environmental. Our study examined the effects of two of these factors and found that both damselfish territoriality and epiphyte load were important to the amount of parrotfish

herbivory on blades of turtle grass. Proximity of grass to other blades of turtle grass, proximity of grass to the reef, reduction of parrotfish by overfishing, and turbidity are some examples of other factors that may influence turtle grass herbivory by parrotfish in Discovery Bay.

Natural variation in the amount of epiphytes present on blades of grass may be due to different levels of turbidity and/or different amounts of turbulence in different regions of the back reef. Three-spot damselfish were common in the deeper waters of the back reef and defended territories that included turtle grass blades with many different levels of epiphytes. As predicted, in our experimental blade treatments, parrotfish preferred blades with high epiphyte load over blades with low epiphyte load and also preferred blades located outside damselfish territories to those located inside territories. Because we observed three-spot damselfish aggressively attacking parrotfish that invaded their territories, it follows that the time spent trying to get around a defending damselfish may be better spent foraging in areas of undefended grass blades.

The fact that damselfish presence was more influential to parrotfish herbivory in high epiphyte treatments than in low epiphyte treatments indicates a clear interaction between damselfish territoriality and epiphyte load. Apparently, parrotfish can assess the quality of a turtle grass blade based on its epiphyte load and are likely to endure damselfish aggression only when the food gain (macroalgal or epiphyte-rich *Thalassia*) is high enough. Grass blades with low epiphyte load are not likely to be eaten, regardless of damselfish presence, probably because parrotfish do not gain much energy from eating them.

LITERATURE CITED

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