teresting to discover how sensitive the fish are to intermediate levels of epiphyte cover.

By finding a difference in herbivory on laterally adjacent scraped and unscraped portions of leaf segments, we have controlled for the effect of leaf age and have compared only epiphyte cover. In so doing, we have produced results which support and further explain previous findings that parrotfish graze preferentially on algae-encrusted areas of *Thalassia* leaves (Dols, et al. 1989).

Studies of the effects of grazing on *Thalassia* populations would be interesting. Detrimental effects of parrotfish grazing may be minimized, since the fish eat old, epiphyte-covered leaves that may be less profitable to the plant than new leaves. Green turtle and sea urchin herbivory may also have an effect on *Thalassia* populations, which should be addressed in other studies.

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SITES FOR DIFFERENTIAL PARROTFISH HERBIVORY ON *THALASSIA TESTUDINUM*

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Abstract. The presence of epiphytes on *Thalassia testudinum* blades has been shown to increase herbivory by parrotfish. Intraspecific variation in *Thalassia* palatability (both leaves with and without epiphytes) could promote the development of other secondary cues influencing herbivory on the leaves. We tested the hypothesis that parrotfish bite-marks on *Thalassia* leaves would serve as a secondary cue, further increasing herbivory, at the Discovery Bay Marine Laboratory, Discovery Bay, Jamaica. Our results show no significant effect of previous bite-marks on further parrotfish herbivory. However, our data show a trend in the direction predicted. (JLB)

Introduction (ALG)

Parrotfish often travel in schools when feeding on leaves of *Thalassia testudinum* (John Gilbert, pers. comm.). They have been shown to selectively feed on leaves covered with epiphytes in preference to leaves free of epiphytes. This is probably due to higher nutritional content (Lobel and Ogden 1981). A parrotfish entering a *Thalassia* bed will find bitten and non-bitten leaves. Since the previous fish have selectively fed on plants with high epiphyte cover, the next fish might associate previous bite marks with a high epiphyte load and hence high nutrition. In this way, previous bite marks might reinforce direct visual areas of epiphyte presence, and therefore we predicted that there would be more herbivory on *Thalassia* blades that have evidence of previous herbivory than on blades showing no herbivory.

Also we attempted to separate out the strength of the proposed secondary cue from the primary cue by using blades carrying the normal epiphyte load and blades scraped of epiphytes.

Methods (TCB)

Undamaged *Thalassia testudinum* was collected from a 2m deep bed to the northwest of Discovery Bay Marine Lab, Jamaica. Enough blades were collected to yield 240 undamaged 15cm lengths. Blades were cut to 15cm and treated in 4 ways: (i) unscraped, (ii) unscraped, with five simulated parrotfish bites, (iii) scraped, and (iv) scraped with five simulated parrotfish bites. Scraped leaves had all epiphytes removed from both sides. Parrotfish bites were simulated using a hole punch; we punched five half-circles evenly along the edges of the *Thalassia* blades.

Each treatment had 60 blades divided into 10 groups of 6, and attached at the end with a clothespin. One clothespin of each treatment was tied to a weight (4 pins per weight). The treatments were distributed around the *Thalassia* bed between 0630 and 0700. They were retrieved ~10h later (between 1630 and 1730). We counted the number of parrotfish bites taken from each group of six blades. In the case of the punched blades, we counted only bites beyond the 30 we

originally made. Some blades were missing their top half – for these we counted the bites we could see and added five bites as an estimate of herbivory on the missing half. We considered this to be a conservative measure of bites taken on the half we couldn't see.

Table 1. Amount of herbivory on *Thalassia testudinum*. (total # bites/6-leaf-treatment [#leaves half gone])

replicate	I	II	III	IV
1	10	9[1]	1	0
2	0	10	1	0
3	6	15	0	1
4	25	8[1]	0	0
5	0	3[1]	0	0
6	3	9[3]	0	0
7	0	9	0	0
8	0	0	1	1
9	0	0	0	2
10	0	0	4	0
Total	44	63[6]	7	4

Treatments: (I) Epiphytes, not punched; (II) Epiphytes, punched; (III) Not scraped, punched; (IV) Scraped, punched.

RESULTS (JLB)

The presence of an epiphyte load on *Thalassia* leaves was shown to increase herbivory on these leaves (107 bites to 11 bites; $p<0.001$, Table 1). A two-way ANOVA performed on the two treatments found no interaction between the effects of epiphyte load and previous parrotfish bites ($p>0.05$, Table 2). Two tests were performed on the effect of parrotfish bite marks on herbivory. A two-way ANOVA found no significant effect on herbivory ($p > 0.1$, Table 2). A Wilcoxon 2-sample test comparing unscraped punched and unpunched leaves found no significant effect of previous bite marks on herbivory ($U=64.5$, $p > 0.1$).

Table 2. Results of ANOVA: punched vs. scraped leaves.

	F	p
A: punched	2.36	$0.25 > p > 0.1$
B: scraped	13.12	$p < 0.001$
A x B	3.26	$0.1 > p > 0.05$

DISCUSSION (CNO)

Our results demonstrate that epiphyte presence on *Thalassia testudinum* blades is the stronger factor affecting the amount of parrotfish herbivory. We might expect that it is more energetically efficient for the fish to forage on the nutrient-rich epiphyte-covered grass since the algae growing on the leaf surfaces, in combination with the leaves, provide the fish with higher nutrient levels than do the leaves stripped of epiphytes.

Although statistically insignificant, the differences between the amount of herbivory on punched and unpunched leaves shows a trend of parrotfish preference for punched leaves. The fish may use the punches as cues of previous herbivory. The increased herbivory on some leaves may also be due to differing palatability of *Thalassia testudinum* leaves. Better leaves will have more bites, signaling to other fish the quality of the food.

The area used in this study had an abundant supply of *Thalassia testudinum*. Our results might have shown more significance if the tests had been performed in a higher herbivory environment.

LITERATURE CITED

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