Table 3. Characteristics of fruiting plants and an estimate of total fruit biomass by site.

Fruiting tree	DBH	# of fruits	Ind. fruit mass (g)	Total mass(g)
Palo Verde				
Bamboo	–	120	0.008g	1
x11				10
x15				15
x6				6
x6				6
x20				20
x7				7
?		70	0.2	14
Legume	8cm	300	1.2	360
Calycophyllum		immeasurable		
Pseudobombax	103cm	10	25.3	253
Luehea	12cm	30	15.3	460
Luehea	75cm	20	15.3	306
Bursera		300-400	3.6	1260
Acrocomia	–	20	1.6	32
Calycophyllum		–.	–	–
Jaquina		15	3.6	54
			Total Mass/Plot	2.798 kg
Monteverde				
?	2cm	250	0.14	35
?	1cm	5	3.0	15
Palmaceae	60	6400	2.3g	14,720
?	75	104	4.0	40000
?	1	15	0.3	4.5
Melastomaceae	25	106	0.014	14,000
?	2	150	0.14	21
?	4	100	0.14	14
?	2	150	0.24	36
?	2	20	25	50
Melastomaceae	10	700	0.72	504
?	2	8	0.4	3.2
			Total Mass/Plot	69.402kg
Corcovado				
?	30	20	500	10000
Piper	2-3cm	31	1.2	37.2
Virola	60	800	3	2400
Piper	many	55	1.2	66
Piper	many	16	.5	8
Piper	many	8	.5	4
Piper	many	6	.5	3
Piper	many	2	.5	1
Chrysophila	10	350	2.3	805
			Total Mass/Plot	13.3kg

THE DISTRIBUTION OF PARROTFISH BITES ON BLADES OF *THALASSIA TESTUDINUM*

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Abstract. Parrotfish herbivory on the seagrass *Thalassia testudinum* is often concentrated toward the tips of the blade. We tested whether grazing parrotfish cue in on the presence of epiphytes or simply chose the tips of the leaves. Are parrotfish who graze *Thalassia testudinum* responding directly to the presence of epiphytes, or are they programmed to bite near the blade tip? We found that on *Thalassia* blades with a uniformly high epiphytic load, parrotfish did not preferentially bite at the tip. This suggests parrotfish do not have a programmed response to graze at the tips, but are seeking out high epiphytic load. (JLD)

INTRODUCTION (SAW)

Thalassia testudinum is a common sea grass that is eaten by herbivorous fish, in particular parrotfish. Grazers on *Thalassia* obtain nutrition from the blades, but mostly from the epiphytes on them. Epiphytic growth is most abundant on the tip of the blade; consequently this is where most herbivory occurs. We hypothesized that herbivory would be evenly distributed if epiphyte load was evenly distributed.

METHODS (SAW)

Thalassia testudinum blades were collected on 16 February 1992, 50m offshore from Discovery Bay Marine Laboratory, Jamaica. Three treatments of blades were prepared: (i) Three 10cm grass segments having >75% epiphyte cover were stapled together to represent a consistent epiphyte load, (ii) Normal blades (30cm long) with high epiphyte load nearest the tip were stapled two times to control for the presence of staples, (iii) Normal blades without staples. Groups of five blades from each treatment were clamped together with a clothespin. Two groups of treatment 1 were combined with a single group of treatments 2 and 3. All 4 groups were tied to a common weight and placed 100m offshore from Discovery Bay Marine Laboratory. Five such weighted groups were placed within a 10m area at 1700, 17 February 1992. All leaves were collected the next day at 1100. Number of bites per treatment were noted for three areas on each blade: base, middle and tip.

RESULTS (JLD)

We found that there was no significant difference between the number of parrotfish bites on natural leaves and on stapled leaves (χ^2=2.70, p>0.1; Table 1). There was also no significant difference in the total number of parrotfish bites between our treatment and an expected even distribution (χ^2=3.65, p>0.1; Table 1). We did find a significant difference between our treatment and the natural leaves (χ^2=21.01, p<0.005; Table 1), and between our treatment and the staple control (χ^2=10.36, p<0.01; Table 1).

Table 1. Number of parrotfish bites on various *Thalassia* leaves.

Location on leaf	Natural control	Stapled control	Treatment
Base	0	1	11
Middle	2	3	10
Tip	35	23	19

DISCUSSION (KAI)

In order to test for the effect of epiphytes on leaf herbivory we created *Thalassia* blades of equal epiphytic load by stapling the tips of blades together. The effect of the staples was tested by comparing herbivory on a stapled control blade (with normal epiphytic load) and a manipulated control (regular blade stapled three times). It may have been better to make the manipulated control out of three cut sections of grass stapled together, but we did not feel this was critical. We found that the presence of staples did not effect herbivory.

When we compared the position of bites (number of bites at the tip, middle, and base) on the experiment blades to the number of bites on the corresponding stapled controls, we found a highly significant difference. This suggests that the fish are feeding on the entire surface of the blade with uniform epiphytic load, whereas they concentrate their feeding only at the epiphyte-rich tips of unmanipulated blades. This indicates that herbivorous fish are not constrained in their behavior to feed at the tips of a leaf; they appear to choose areas of high epiphytic load wherever they are. We also found that fish do not graze significantly more on any portion of a blade when epiphyte distribution is uniform; herbivory is randomly distributed on all portions of the blade.

The older portions of *Thalassia* blades are at a severe disadvantage due to colonization by epiphytes. Epiphytes have two negative effects, first they decrease photosynthetic activity by shading leaves. Second, as illustrated in this paper, they cause tissue loss by increasing fish herbivory.