Grazing Pressure on Epiphytic Community of Thalassia testudinum

Jim:
excellent study and presentation —
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4 March 80

Introduction

In Caribbean costal zones one is likely to encounter extensive seagrass beds. These beds are generally dominated by Thalassia testudinum or turtle grass, with lesser populations of manatee and shoal. These beds sustain a complex association of organisms. The blades of the seagrasses provide a substrate and possibly nutrients for a rich epiflora (Harlin '80). This includes crustose coralline algae as well as a variety of filamentous types. The seagrass blades are also populated by a variety of sessile particulate feeders such as foraminiferans, and polychaete worms. The blades are extensively grazed by a diverse group of motile inverts, among which are the echinoids, gastropods and asteroids. There are also a number of fish thought to be responsible for the observed grazing pressure (Ogden '8_).

Working in the lagoon areas of Discovery Bay, Jamaica, I set out to answer two questions:

1) What is the effect of grazing on the epiphytic community found on the blades of Thalassia testudinum?

2) What is the relative importance of blade tissue and epiphytic organisms for macroconsumers (specifically fish + urchins)

The first question arose in response to observation, both in the field and in the lab, of the clear dominance of the epiflora of Thalassia blades by crustose red algae (Erythrocladia sp.) Theories have been put forth suggesting that grazing of coralline rock has selected for the dominance of calcareous algal forms and resulted in the relative paucity of fleshy types (Lecture J. Gilbert). It appears plausible that the dominance of calcareous algae on Thalassia blades ~~was~~ is a result of grazing pressure as well. I have attempted to assess this postulation by marking uncolonized new shoots in a control area and experimental area (wire mesh excluding grazers) and qualitatively and quantitatively recording colonization after a five day period.

Although a large number of motile inverts and fish are known to feed both by grazing epiphytes from blades and by taking actual bites from the blade, work in tracing the primary food source to the seagrass or the epiphyte is incomplete. I was unable to attack this question directly for it would involve sophisticated laboratory equipment not available (Ex. mass spectrometric analysis of relative concentrations of C^{13}/C^{12} in plant food and consumer tissue) I therefore set out to answer a corollary question: Given the choice would the macroconsumers select for a blade heavily encrusted with algae or a blade scraped free of all colonizers?

This question was approached with both in situ and in lab experimentation. In lab experimentation involved construction of artificial Thalassia bed containing encrusted and scraped plants, to which the sea urchin Tripneustes sp. was added. (originally intended to add striped parrot fish as well, but unable to catch.) In situ experiment involved construction of similar artificial Thalassia bed placed adjacent to natural bed and recording damage done by grazers after three days.

Materials + Methods

The in situ exclosure was constructed of cast iron frame and 5 mm mesh wire screening. The dimensions of the exclosure were 75 cm (l) x 45 cm (w) x 30 cm (h). At 1600 hours 2/24/80 it was placed in the Thalassia bed behind the west reef, midway between the shoreline and the wind direction instrument mounted on a pole at the reef crest. The seagrass bed here is moderately dense and appears healthy. In situ observation indicated, as expected, crustose coralline reds dominate epiflora. I spotted several tripneustes, scattered molluscs, and schools of feeding striped parrot fish. The latter group appears to glean blades as well as take nips. A study of grazing in this lagoon area (Tom Susek, '79 Bio FSP) indicates that average of 72% of blades have fish bite marks, 33% have urchin damage, and 13% are unbitten.

Before setting down the enclosure I cleared the area of echinoids, molluscs, and asteroids. 10 undamaged new shoots (avg 5 cm) were marked with a hole puncher. Next to the enclosure 10 new shoots were also marked, chosen at random from an area also 45 cm x 75 cm.

NOTE: Sampling a larger number of

new shoots impossible for there is only 1 per plant and 10 is the approximate density of plants. 2/29/80 at 1200 hours ~~the~~ exper. and control blades were cut at the base of the plant and collected in separate plastic bags. They were returned to ~~the~~ lab and measured to determine net growth for 5 days. They were ~~then~~ examined under a dissecting scope at 2.5X in 5 cm segments. All epiflora + fauna present on the blade was recorded.

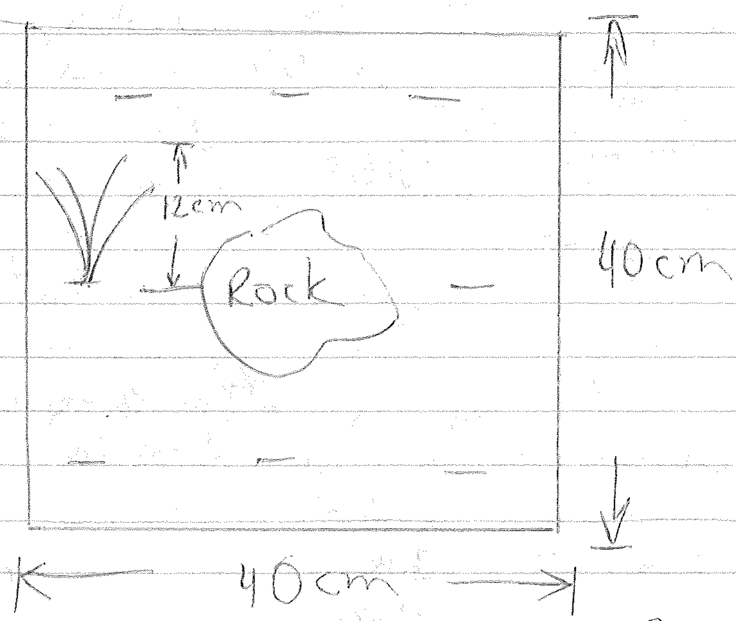
Construction of artificial Thalassia bed in lab: Thalassia blades were sorted into most and least heavily encrusted w/coralline red algae. I then scraped the remaining algae off of the less encrusted blades with a razor blade. A twelve cm segment was ~~then~~ clipped from ~~the~~ middle. The same approx. section was clipped from the heavily encrusted blade. I neglected the partially decaying tips and newest sections of ~~the~~ shoot in an attempt to keep age constant and isolate degree of encrustation as the only variable.

Five bundles of four blades of

encrusted and 5 bundles of scraped were then oriented alternately along bottom of aquarium at 6 cm intervals. Plants were examined four times daily: 0800, 1200, 1500, 2100. Observations were made from outside tank - plants not removed until termination of experiment. At termination total damage ~~x~~ (i.e. bite marks) accrued by feeding of Tripneustes (3) over the ~~three~~ day period determined. Percent of encrusted type bitten vs scraped type calculated (Note: Tripneustes chosen, as this sea urchin is readily available in natural environment and according to Greenway '76 consumes ½ weekly production of Thalassia bed.)

I originally intended to complete replicate experiment with striped parrotfish. This is a herb. fish which is common in the lagoon areas of Discovery bay and Thalassia is a major part of the diet (According to Ogden '76, T. testudinum accounted for 88% of gut contents) However, I was unable to catch the striped parrotfish or any other common seagrass feeder such as stoplight parrot or surgeonfish.

Construction of in situ artificial Thalassia bed: Same procedure for creating scraped + encrusted artificial Thalassia plants (i.e. bundles) used as for in lab aquaria. Slits were made with a jigsaw in square sheet of plywood (dimension 40 cm x 40 cm) and the bundles were inserted. It was a tight fit which afforded protection from wave surge removing bundles. 12 cm extended from the surface of the board. 4 encrusted + 4 scraped bundles



Above set-up was placed on sand bottom at eastern edge of lagoon behind west reef. Observed in this lagoon area: lg schools (~30) of feeding striped parrot fish, surgeonfish, Tripneustes, Diadema (night snorkel), scattered molluscs

After 3 days artificial bed collected and blades examined for fish and urchin bites.

Table #1 RESULTS

Results of Colonization Experiment:

	control	experimental (grazers excluded)
avg Blade length	10.47 cm	10.44 cm
" growth rate	1.09 cm/day	1.09 cm/day
% cover encrusting red	7.12%	7.89%
	significant difference (Student t-tes	
blades w/ filamentous algal forms	10%	77.8%
no. polychaetes avg / blade	8.4	17.8
	very highly significant difference	
additional organisms found on blades (totals for sample of 10)	1 annelid larvae	26 encrusting bryozoan colonies 14 hydroids 12 veligers 20 OTU (operational taxonomic units)

give P-values

In Situ Grazing Results:

Table # 2 % Blades Damaged

encrusted type:	urchin bites	31.3
	fish bites	68.8
	unbitten	12.5
unencrusted type:	urchin bites	0
	fish bites	6.3
	unbitten	93.8

Figure # 1 Damaged Blades, encrusted

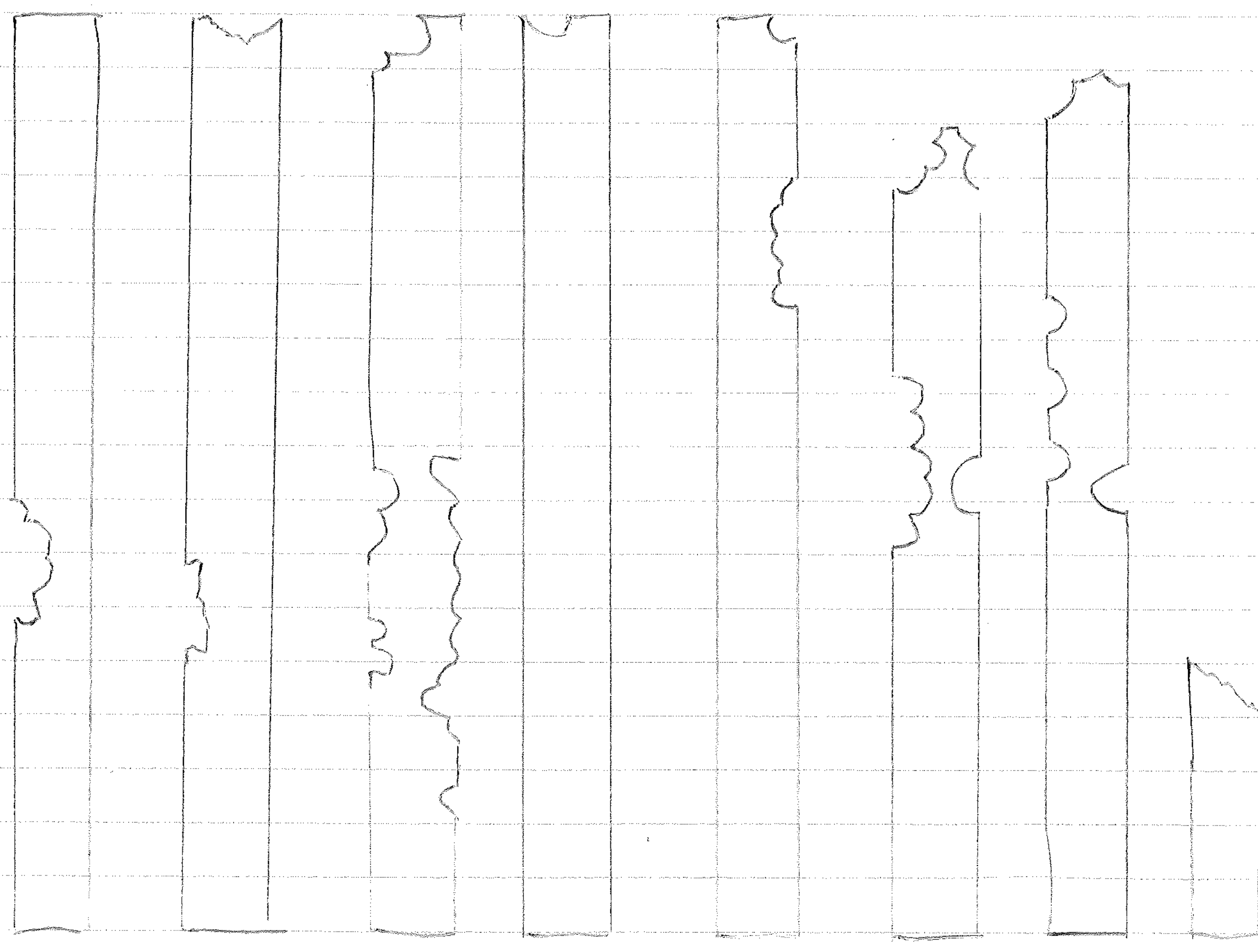


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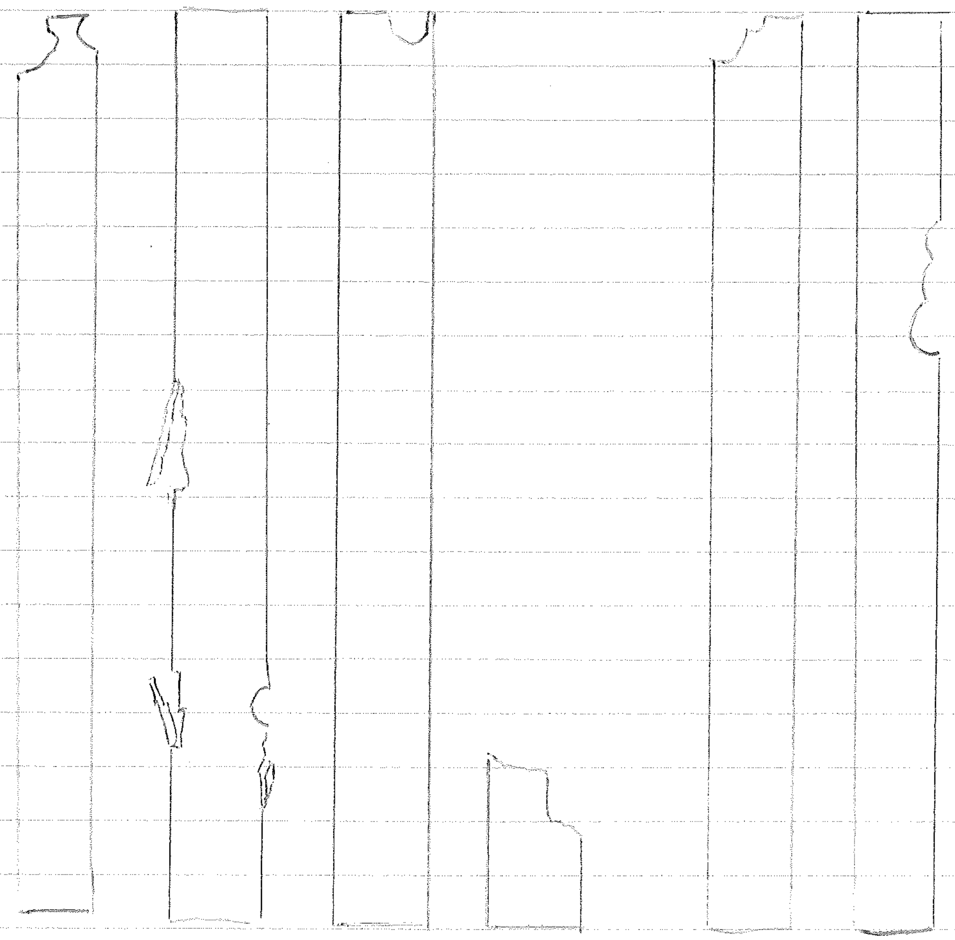
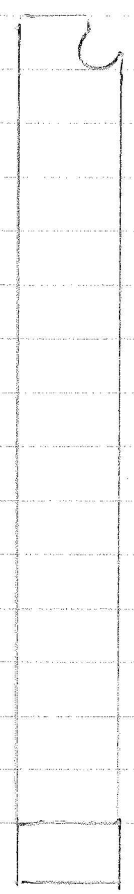
Figure # 1 encrusted (cont.)



unencrusted



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In Lab Tripnuestes Grazing

Table # 3 % Blades Damaged

encrusted type:	bitten	50
	unbitten	50
unencrusted type:	bitten	0
	unbitten	100

Figure # 2 Damaged Blades encrusted

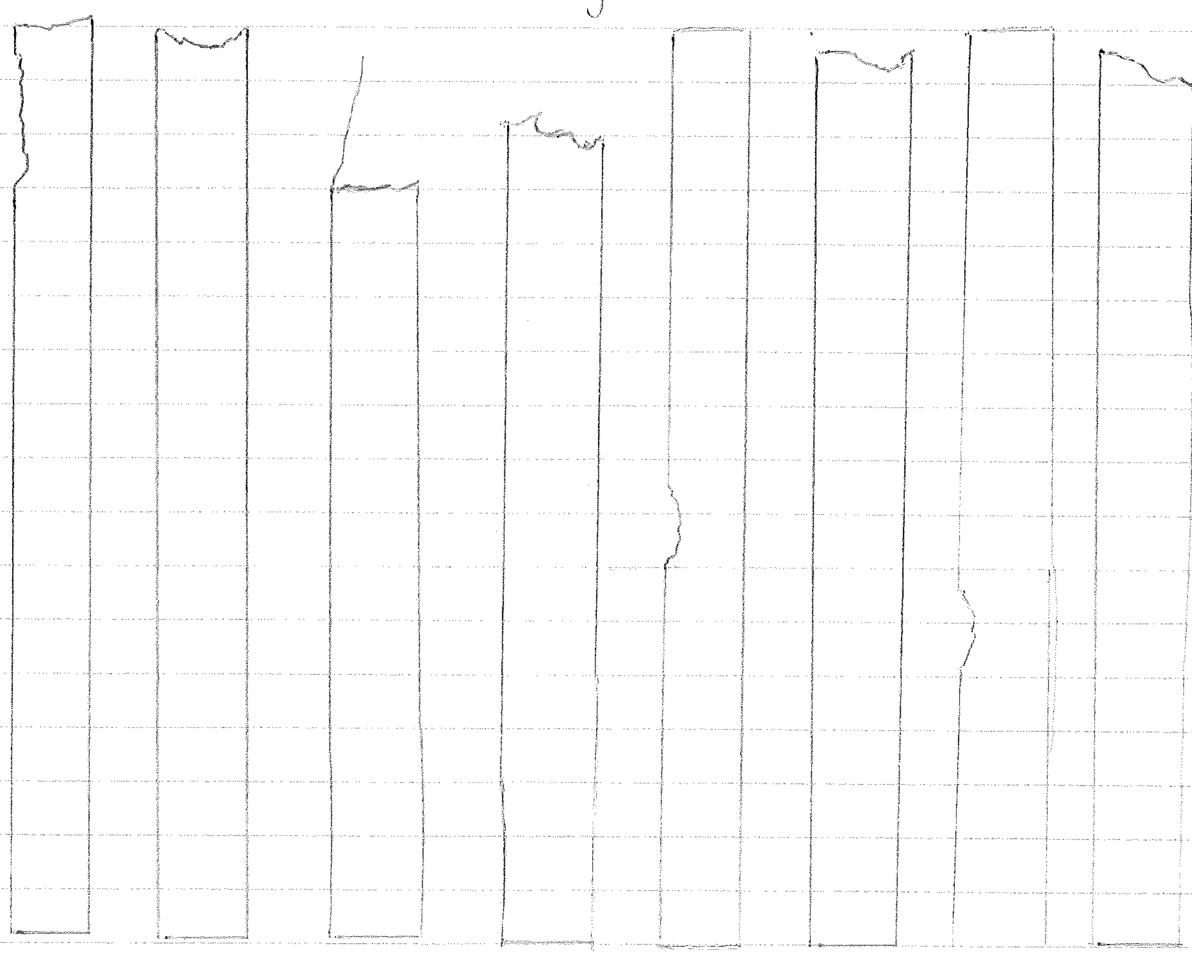

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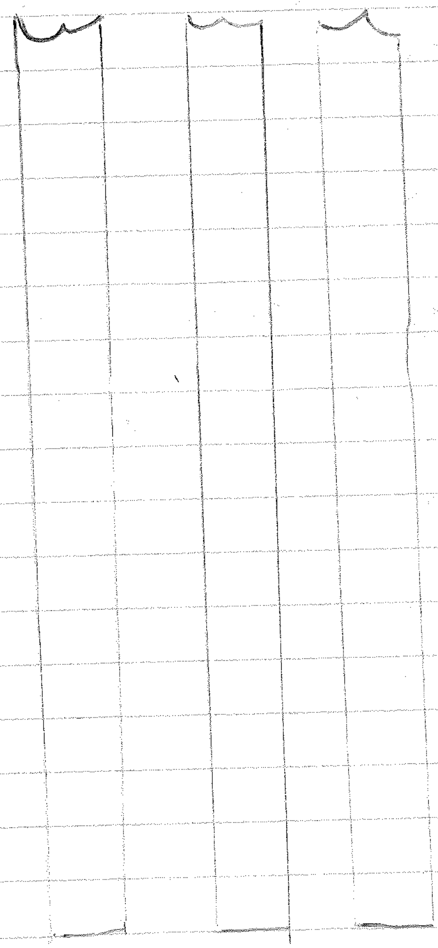
Figure # 3 "Questionable" Damaged Encrusted



Discussion

In situ colonization experiment:

It is worth noting initially that growth rates of new shoots in exclusion of grazers and in open environment are equal (1.09 cm/day). This is relative assurance that the exclosure is not shading the Thalassia and thereby skewing results.

Avg. percent cover for crustose red algae was 7.12% for control blades and 7.89% for experimental. That these means are significantly different can be stated with 96% confidence (student t-test). It appears that grazers are in fact depressing colonization rates of calcareous algae. But, the difference is not highly significant and considering encrusting reds reach as high as 95% cover (Fall work Bio FSP) the grazers effects are certainly not dramatic. A more interesting result is the difference in colonization success by filamentous forms in exclusion of grazers and in open environment. 77.8% of exper blades have filamentous forms present, 10% for control blades. Grazers appear to be quite successful in removing the filamentous forms and thereby affecting epifloral community. No % cover figures are listed for filamentous forms on either experimental or control blades because in both cases filamentous populations are exceedingly low. This may be due to the fact that filamentous forms in natural environment are low and therefore seed source not extensive. In any case, overall scantiness of filamentous forms precludes any definite conclusions on their importance in algal communities in presence vs. absence of grazers. For future study I would recommend longer period for colonization. Due to higher growth rate of filamentous forms I feel over a longer colonization period in exclusion of grazers the filamentous forms might even overtake crustose reds in epifloral dominance.

Serpulid polychaete worms are common inhabitants of both control and experimental blades. However, total counts per blade indicate greater average number per blade for exper than for control (17.8 vs 6.4). This difference is "very highly significant" according to Student t-test. I think this is a clear indication that the epiphyte grazers are limiting the population of these polychaete worms.

Another interesting distinction between the communities found on control vs. experimental blades is overall diversity. On all but two of the 10 ~~experimental~~ control blades the only organisms present were the crustose red algae and serpulid polychaetes. The exceptions were the presence of one annelid larvae on one blade and two sm (5mm) filamentous red algae on another. On the other hand the list of organisms found on the experimental blades is quite extensive. Included therein: filamentous reds, greens, various veligers, two hydroids (Hydractinia and Corynne), encrusting bryozoan colonies, an unidentified (juvenile) cnidarian polyp.

It seems quite plausible that the absence of this diverse group of organisms from the control blades, as well as the large decrease in serpulid polychaete pop., great decrease in filamentous algal forms in general, and slight decrease in crustose red pop. could be attributed to the successful grazing enterprises of a variety of echinoids, molluscs, asteroids, and fish.

There is ample evidence supporting the above postulation in the literature. Penhale '77 states that 1/4 to 1/3 of community metabolism of the overall Thalassia blade comes from epiphytic flora and that this flora is a significant food source for resident herbivores. Brook '75 discusses control of microalgal pop. by grazers. Clavijo '74 states that the queen conch and juvenile surgeonfish may exist exclusively on epiphytes.

Selection by Grazers of Scraped vs. Encrusted Blades:

The results of the in situ grazing experiment are quite clear cut: 87.5% of the encrusted blades received either urchin or fish bites or both. Of the 16 scraped blades, only one solitary fish bite was recognizable. The urchins and fish are selecting for the encrusted blades by a large margin. The in lab experiment is not nearly as dramatic. First of all, only urchins (Tripneustes) were used due to inability to catch striped parrotfish or other known sea grass feeding fish. Secondly, the presence of "classic" fish nips on three of the blades places the validity of the urchin damage noticed on other blades in question. The fish nips had to have occurred before the blades were placed in the artificial Thalassia bed. The question that naturally arises is whether some of the less obvious urchin damage was present before placement in aquaria as well? This is, of course, impossible to answer in retrospect. At various times Tripneustes were observed w/ blades tucked underneath in contact w/ oral surface. And certain blades were undeniably damaged during experiment. In any case, 100% of damage recognized was on encrusted blades.

That fish and urchins in the natural environment select for heavily encrusted blades receives support from lab work done by Bio (ASP (80). Work done on Thalassia bed in the lagoon behind the west reef indicated the following: % cover by encrusting reds considerably higher where fish and urchin bites occur

78.3 % cover - urchin bites
95 " - fish "
43.75 " - uneaten

A study by Jobel + Ogden (unpublished) concluded that when offered a choice Redtail parrotfish will select seagrass w/ epiphytes.

The fact that the fish and urchins select for the encrusted blades supports initial assumption of the importance of epiflora in diet. Most recent studies indicate that most seagrass consumers have no enzymes to digest structural carbohydrates (Lawrence '75) of the seagrass blade. This offers another reason to stress the relative importance of epiflora as a source of nutrition. However, exact proportion of nutrient demand derived from epiflora vs blade tissue is still unknown and would be fertile ground for future study.

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