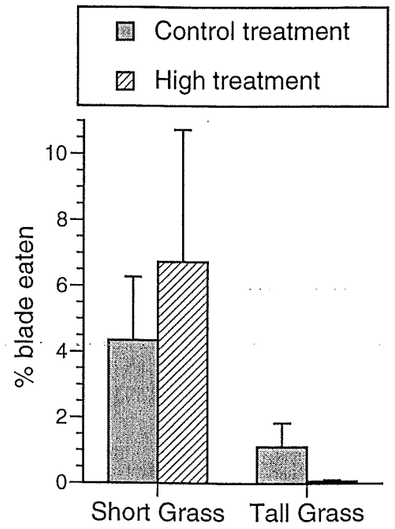

FIG. 1. Parrotfish herbivory of *Thalassia testudinum*blades of average patch height and blades raised ~ 15 cm above the average patch height in short and tall patches.

DISCUSSION

Since herbivorous fish fed more in areas with short turtle grass than tall grass, herbivory may influence blade height. Fish fed indiscriminately on blades the average height of grass beds and those placed above the average height, indicating that blade visibility does not attract fish. Location of a grass bed is likely an important factor in determining the extent to which it is eaten. In our treatments, the short bed of grass was closer to the reef than the taller bed. It has been shown that a halo effect occurs around Caribbean reefs (Randall 1965), because fish seek refuge in these patch reefs and only venture short distances to feed. Despite the 50 m distance, the turtle grass beds near the reef may experience more herbivory and are thus shorter than patches farther away from the reef which have less herbivory pressure, enabling them to grow taller. Factors such as sediment depth, sediment type, wave action, and water depth may also be important in influencing grass height.

The height of grass beds may affect the communities of fish and invertebrates that reside within them. Shorter beds offer less refuge from predators, and lower biomass of grass in the shorter beds may also limit the amount and the diversity of organisms residing there. Growth rates of grass between habitats could differ as well. Shorter grasses may regenerate faster to compensate for loss to herbivores, while longer grasses may become senescent without herbivory pressure. Future studies could examine the effect of grass bed height on both the diversity of grass dwelling organisms and turtle grass growth rate.

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THE EFFECT OF SEDIMENT ON HERBIVORY IN TURTLE GRASS BEDS

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Abstract. Epiphytes growing on blades of turtle grass, *Thalassia testudinum,* are a source of food for many marine organisms. The grass acts as a baffle and tends to trap sediment which accumulates in a white layer on the leaves. We hypothesized that high sediment accumulation would deter herbivory on grass blades. Instead, we found significantly higher percent herbivory on grasses with high sediment loads than on those without sediment in both experiments and field surveys. White, sediment-covered grasses may be preferred by herbivores because sediment may accumulate more on grasses with a high epiphyte load. Additionally, sediment may contain organic matter which is useful to herbivores or may have a neutral rather than detrimental affect on epiphyte digestion as originally predicted. Future study is needed to assess herbivore preference of different epiphyte types as well as to determine the relationship between disturbance and sediment accumulation on turtle grass.

Key Words: algae, epiphytes, sea grass, Thalassia testudinum

INTRODUCTION

Turtle grass beds *(Thalassia testudinum)* are productive marine communities found on sandy substrates from the surface to a depth of 8 m (Phillips, 1978). Turtle grass beds act as baffles, collecting varying levels of sediment stirred up by local disturbances and wave action. Accumulation of high sediment loads may impact both epiphyte growth and herbivory on turtle grass (Phillips, 1978). In most areas, grass blades have a high cover of epiphytes, including calcareous red algae, diatoms, and filamentous algae (Ogden, 1976). Numerous herbivores feed on turtle grass, digesting the epiphytic algae (J. Gilbert, pers. comm.). Some species graze on the epiphytes without damaging the turtle grass, but some fish and urchins bite off pieces of grass with the epiphytes.

High sediment cover may hinder epiphyte growth, making these grasses less attractive to herbivores. A thick layer of sediment may also be unpalatable to herbivores or hinder digestion. We hypothesized that a high load of sediment would deter herbivory on turtle grass.

METHODS

We conducted our study in Discovery Bay, Jamaica on February 25-26, 1998. We collected turtle grass blades with a highly visible thick white covering of sediment and blades with little or no apparent sediment but a high epiphyte cover. Blades were collected from patches of high and low sediment cover found throughout the backreef in depths less than 2 m. Though sediment load on turtle grass seemed to be unpredictably patchy in the backreef, we observed suspended sediment levels to be higher near the shore and in disturbed areas. All blades were cut to a length of 20 cm from the tip. We used a clothespin to clip together the bases of six blades of grass of the same sediment load, and attached a metal bolt to the clothespin to weigh it down. We had eight clothespin replicates for the sediment treatment and 10 replicates for the non-sediment treatment (2 of the original 10 sediment replicates were lost). We distributed the replicates in five turtle grass patches (each patch having at least one replicate of blades with and without sediment within a $1m^2$ area), separated by at least 10m, in shallow water approximately 20 m off the western shore of Discovery Bay. We collected our samples and assessed percent herbivory (how much of the blade area had been removed) on each blade of grass after 24 h. A one-way ANOVA was performed to test the effect of sediment on percent herbivory.

We also conducted field surveys to compare herbivory on grass blades with high and no sediment loads. From each of 5 patches within 10m from the shore and < 2m deep (where blades were heavily sedimented) and 6 patches in open areas about 20m from shore (where blades were

not sedimented), we haphazardly chose 10 blades and recorded the number of blades showing evidence of herbivory. We analyzed our data using a one-way ANOVA to compare the proportion of blades with herbivory in each patch type.

RESULTS

We found significantly more herbivory on turtle grass leaves with high sediment cover. We found 8.5 ± 2.4 % (mean ± SE) herbivory on blades with sediment cover, and 1.3 ± 2.2 % herbivory on blades without sediment cover ($F_{1,16} = 4.91$, $P = 0.042$; Fig. 1). Both fish bites and sea urchin bites were present on both types of leaves. In our field survey of herbivory, there was a significantly higher percentage of leaves with herbivory in patches where the leaves were heavily sedimented ($F_{1,9} = 5.76$, $P = 0.040$; Fig. 2).

DISCUSSION

Contrary to our prediction, we found more herbivory on turtle grass with high sediment cover. This was observed in our experimental treatments when blades with high and no sediment load were placed side by side. It also was observed in our field survey of herbivory in patches of grass with high sediment load and in those with low sediment load, indicating that fish and urchins are more concentrated in or migrate to patches of turtle grass with high sediment cover. The consistency of our experimental and survey results suggest that sediment covered leaves are preferred by herbivores.

It appears that sediment is in fact palatable or may be easier to digest or expel than originally predicted. Sediments could be palatable to herbivores if organic matter, such as detritus, is present in sediment. It is also possible that grasses with higher epiphyte loads are more likely to accumulate sediment. Thus, white sediment cover may act as a visual cue for herbivores to detect optimal food resources. Grazers may actively seek out high sediment patches for this reason, or possibly because the increased turbidity in sediment patches provides increased protection from predators.

It would be interesting to determine the effects of both human and climatic disturbance on sediment levels and herbivore distribution. Our data suggest that herbivores could be concentrated in sediment-rich patches of turtle grass, but more work is needed to distinguish the factors affecting their distribution. Future studies could also determine if sediment load increases with increased epiphyte load. It would also be useful to examine the types of epiphytes that are preferred by specific herbivores, and see if these epiphytes are associated more often with leaves with high sediment loads.

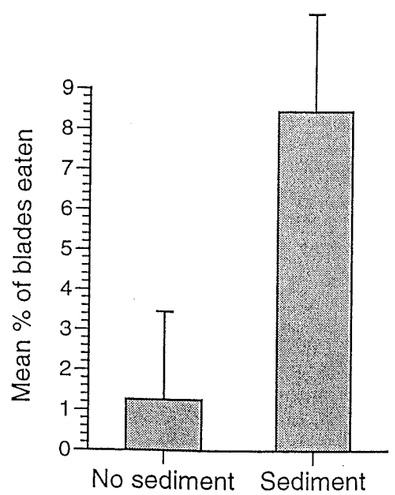

FIG. 1. Mean percent of blades eaten (area missing) for turtle grass leaves with and without sediment cover.

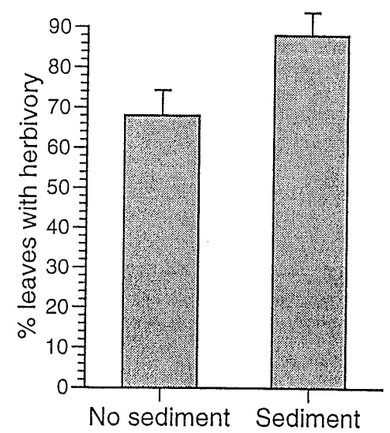

FIG. 2. Mean percent of leaves found with evidence of herbivory in patches where leaves had no and high sediment loads.

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