HALIMEDA SPECIES DISTRIBUTION AND SEDIMENT CONTRIBUTION IN SHALLOW-WATER MARINE ENVIRONMENTS OF SAN SALVADOR ISLAND, BAHAMAS

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Introduction

Halimeda is a branching, segmented, green, calcareous alga that is common in warm, marine waters throughout the tropics and subtropics. Because of its ability to produce aragonite in its segments, the plant is often preserved as white, corn-flake–shaped grains. These flakes are prominent in the sediment and rock record on San Salvador Island, which makes the island an excellent location to study the plant in three stages: 1) the living plant in the actual growth environment; 2) the recent sediment produced by the plant in and around the growth environment; and, 3) the ancient sediment preserved in Pleistocene delta deposits. By studying these various aspects of living plants and their preservation, correlations are revealed between environment and species distribution, environment and *Halimeda*-sediment content, and preservation and environment of deposition.

Study Areas and Procedures

Field research took place in three main study areas: 1) North Point, on the northeastern tip of the island; 2) Pigeon Creek, on the southwestern end of the island; and, 3) Quarry "E", on the western side of the island at the northern tip of Pigeon Creek. North Point's western side provides a shallow-water environment protected from the high wave action on the eastern side. The substratum ranges from a soft sand bottom to rocky hardgrounds, where little to no *Thalassia* grass grades into lush beds as one moves away from the shore. A relationship appears to exist between *Halimeda* species distribution and grass density; therefore, transects were set up from the shore to these grass beds. Field work included taking population counts using a 0.5-m square every 0.5 m, and recording information such as *Halimeda* species, grass density, substratum types, and associated algae. I used traits such as plant and segment size, segment shape, holdfast development, and degree of calcification to identify species (figs. 1, 2). I also recorded grass density, which ranged from absent to dense.

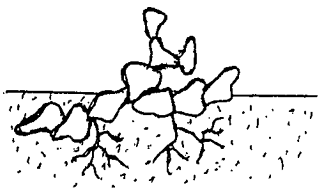
Pigeon Creek is a tidal inlet (with an associated delta) that is 9 km long and reaches a maximum width of 1.6 km (Mitchell, 1986). The sites used in this study were located just to the north of the delta, in a scour channel, and on the delta itself. Shallow-water *Thalassia* beds containing abundant *Halimeda* and shrimp burrows border the channel. *Halimeda* sediment occurs in both the grass beds and the channel. Sediment can also be seen saltating over the ripples of the delta, although little *Halimeda* sediment is visible. I took short sediment cores across two transects in the channel and one across the delta.

Teeter (1985) interpreted the section at Quarry "E" as a Pleistocene delta deposit, an ancient analog of the Pigeon Creek delta. He divided the section into three distinct beds; these deposits represent (in ascending order) a grass bed, an active delta, and a later grass bed. Samples were taken from each bed for thin section analysis.

Observations and Interpretations

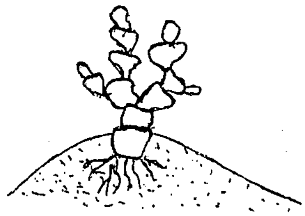
Halimeda tends to be patchy in distribution. Where *Halimeda* occurs within grass beds, I have documented a relationship between *Halimeda* species and grass density. The smaller plants, *H. tuna* and *H. simulans*, prefer an environment having low grass density; the taller plants, *H. favulosa* and *H. monile*, prefer a grassier environment. *H. monile* prefers sparse grass, whereas *H. favulosa* prefers a medium density of grass (fig. 3). One explanation is that the taller plants have a smaller holdfast-to-body ratio, thus resulting in a need for the more stable and protected environments that the grass beds provide. The *H. monile* and *H. favulosa* that did grow in the less protected areas tended to be smaller than the plants that grew in the grass beds, further supporting this explanation. Trends also exist between grain size and environment, with the delta having an unusually low amount of coarse material compared to what is available in the channel and the grass beds. This is a puzzle because the ancient analog, Quarry "E", contains several layers of coarse, unbroken *Halimeda*-rich material. This could reflect a lack in the amount of material available today as compared to the Pleistocene; or it could be that the delta is being fed by another arm of Pigeon Creek which has a smaller amount of *Halimeda* sediment; or, perhaps the coarse layers represent episodic storm deposits. The thin section analysis of the Quarry "E" material reveals a lack of *Halimeda* in the upper and lower beds which contain peloids and foraminifers as the dominant constituents, whereas the middle bed is rich in *Halimeda*, peloids, red algae, shell fragments, foraminifers, and some echinoid plates. *Halimeda* composes 85% of the middle bed, but contributes only 1% in the lower bed and up to 30% in the upper bed. Aragonite bundles typically fill pore spaces in the *Halimeda* flakes, and are the main cement in the rocks. Sparry calcite partially occludes some of the pore spaces; it may grow directly on bioclasts or on the aragonite bundles. Rock porosity ranges from 25%-35% in the non-*Halimeda*-rich areas of the rock, and decreases to 10%-15% in the *Halimeda*-rich areas.

A) SPRAWLER



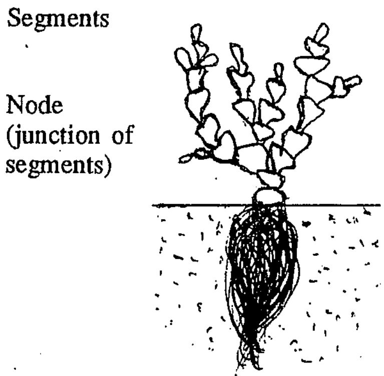
Holdfast composed of a few loose filaments appearing on various places on the plant.

B) ROCK-GROWER



Holdfast composed of filaments branching and forming a mat which fixes onto rocks.

C) SAND-GROWER



Holdfast composed of filaments branching and adhering to sand grains.

D) SEGMENT FEATURES

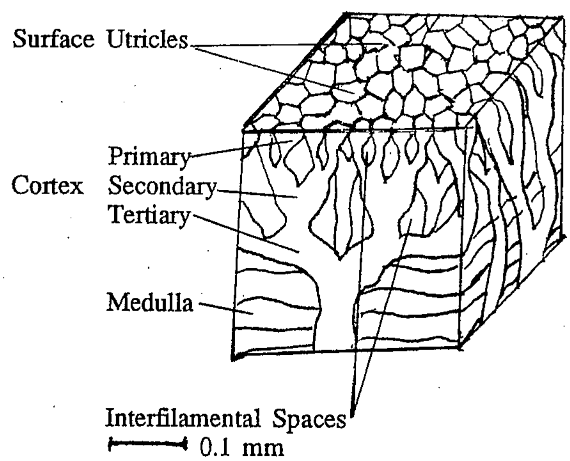


Fig. 1. A,B,C) Basic parts of *Halimeda*, and the three main types of holdfasts. D) Enlarged section of a segment showing both surface and interior features. Note the interfilamental spaces. It is here that calcification begins on the exterior of the utricles. (after Hillis-Colinvaux, 1980)

Species name	Plant height (cm)	Holdfast length (cm)	Segment size (mm)	Segment shape	Calci-fication
H. monile	16	4	3 x 8	cylindric/ trilobed	moderate
H. favulosa	22	4	9 x 13	varies in the plant	moderate
H. simulans	12	4	11 x 15	triangular/ kidney shape	moderate to heavy
H. incrassata	24	9	10 x 14	undulating/ deeply lobed	moderate to light
H. opuntia	7	diffuse	7 x 11	flat,ribbed/ contorted	moderate to heavy
H. tuna	15	incon-spicuous	13 x 19	discoid/ kidney shape	moderate to light

Fig. 2. Characteristic features of common *Halimeda* species of San Salvador Island, Bahamas. Given plant sizes are maximum lengths and heights (Hillis-Colinvaux, 1980).

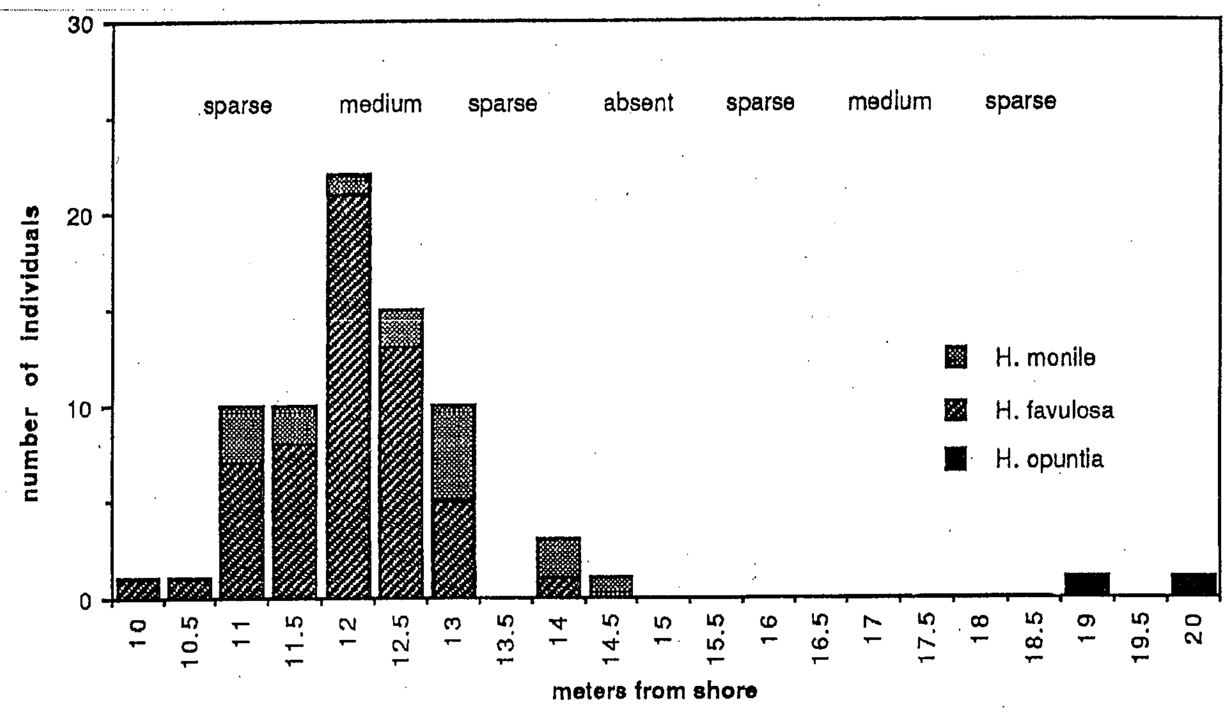


Fig. 3. Histogram of Transect A from North Point demonstrating the number of individual species vs. meters from shore. Grass density (across top) ranges from absent (0% coverage) to sparse (up to 25%) to medium (25-50%) to dense (50-100%).

References Cited

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