

A Preliminary Survey of Rubble Organisms at Two Disturbed Areas in Barbados

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Introduction

Coral reefs are home to a large diversity of species and provide important ecosystem services (Harborne et al. 2006; Hughes 2010). Coral reefs change and degrade due to naturally occurring environmental factors such as storm waves and high sea swells from tropical depressions, storms and hurricanes, as well as anthropogenic forces such as dynamiting (Harborne et al. 2006). Corals can be fragmented into small pieces as the force of the waves brings the coral pieces towards the shore. These fragments are then covered partially in sand, creating a rough surface and making an erosive product now termed coral rubble (Brewster and Mwansa 2000). Coral rubble is a niche that has not been studied thoroughly. The rubble habitat has been found to be colonized by algae and marine invertebrates including anemones, sponges, soft corals and sedentary polychaetes. Many juvenile marine organisms such as reef fish, gastropods, sea urchins and mollusks use the rubble as a nursery as there is reduced risk of predation (Lewis and Bray 1983; Brewster and Mwansa 2000; Harborne et al. 2006).

This study looks at environmental and anthropogenic stresses on the rubble habitat. We will examine the differences between a rubble intertidal zone and other rubble sites that are permanently submerged in water; this is termed environmental stress. Anthropogenic physical disturbance will be defined by: many tourists and locals walk along the intertidal zone: they directly step onto the coral rubble to observe tropical species and curiously flip over coral rubble to discover other hidden organisms (Brewster and Mwansa 2000).

Objectives

1. Create and develop a database to determine the importance of the rubble habitat as a niche and nursery.
2. Understand better the effects of human disturbances and environmental stress on the biota of the sites.
3. Identify the main stakeholders that benefit from the rubble habitat and propose

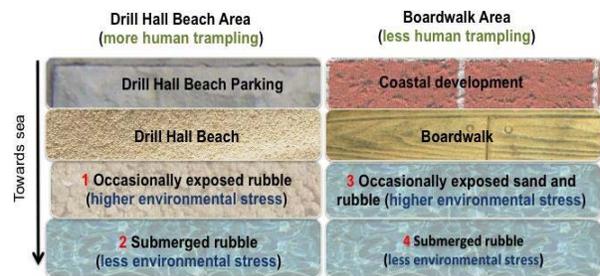
incentives to promote the conservation of this habitat.

Hypothesis

1. Differences in biodiversity will be seen on the fauna in sites with higher human trampling compared to sites with less human trampling.
2. Differences in biodiversity will be seen on the fauna in sites close to shore occasionally covered by water compared to fully submerged sites further away from shore.

Methods

Two areas in Barbados with rubble habitats have been chosen; with each area having two sites (as seen in Figure 1). The first area is in front of Drill Hall Beach, with the other at the beginning of a boardwalk further down the beach. Site 1 will be considered more affected by human disturbances, and more affected by environmental stress. Site 3 will be considered less affected by human disturbances and environmental stress. Sites 2 and 4 will be considered both less affected by environmental stress and human disturbance.



A preliminary survey of the two areas was done. This included: transects, random sampling, quadrats and ROCS. Two 20 meter transects were used to determine the ground cover for the habitat at each of the four sites. This will also used to determine rugosity of the sea floor. Random sampling, by arbitrarily flipping over ROCS, was done to get a basic idea of the organisms present. One meter cubed quadrats were used to get an idea of diversity and abundance. The data obtained was then analysed using Simpson's Index. Three ROCS

per site were used as another collection method, as a means of reducing the discrepancy created by cryptic and fast-moving organisms. The ROCS consisted of netting with freshwater cleaned rubble inside, creating a similar habitat to the surroundings. The transects, quadrats and ROCS were placed randomly based on a researcher throwing a rock behind their back to determine the starting location.

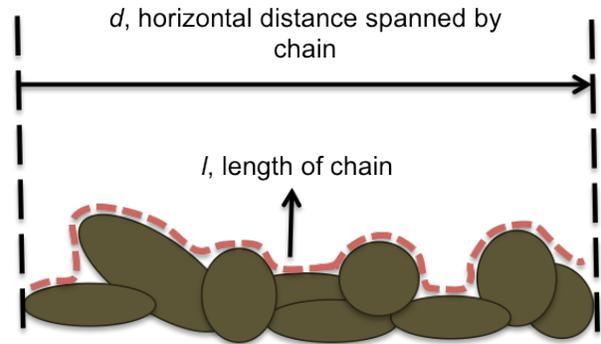
Results

The transects determined the main cover types consisted of sand, rubble, turf and macroalgae. For sites 1, 2, and 4, macroalgae and rubble were found to be the main cover types. Sand was the main cover type for site 3. Sites 2 and 4 had the highest rugosity indexes. During the preliminary survey of all the sites, 27 species were found. These species were entered into the database. Based on Sorensen's Coefficient Index, there was little similarity between sites, with sites 1 and 2, and sites 2 and 4 being the most similar. Species richness in descending order is site 1, 2, 4 and 3. Simpson's Diversity Index (λ) from highest to lowest was site 4, 2, 3 and 1. Species richness in descending order is site 4, 1, 2 and 3. The sufficient number of ROCS was not recovered thus no analysis could take place.

Conclusions

Species biodiversity of coral rubble habitats has been seen to affect by human disturbances in the form of human trampling and environmental stress in form of intertidal zones. More human trampling and environmental stress led to lower diversity. This has been seen in the quadrats, but not in the random sampling techniques.

Rugosity of the coral rubble and ground cover for all sites were measured to gain a better understanding of the surveyed sites, but in turn, they were useful in the discussion of species biodiversity. The ground cover composition was generally composed of rubble and macroalgae. Sites with larger rubble had more diversity, in part due to the increased difficulty in overturning the rocks as well as the increased depth. Sites with higher rubble ground cover had a higher rugosity. The presence of higher rugosity offers higher surface area available for organisms to colonize and, in turn, leads to a higher biodiversity.



In future research, organism capturing devices, such as ROCS, should undergo further research and development so that they can remain in location for the duration of the study. Additional research is required to further develop potential rubble habitat conservation strategies such as producing pamphlets available to tourists with rubble organisms present in all sites. These pamphlets could promote the conservation of the rubble habitat to tourists by increasing their awareness. Tourist presence could also lead to interest for hotels to conserve the habitat as a tourist attraction.

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A few of the organisms found...



Aplysia dactylomela – Spotted Sea Hare



Hermodice carunculata – Bearded Fireworm



Asterina folium – Blunt Armed Sea Star



Holothuria cubana – Grub Sea Cucumber



Carpilius corallines – Batwing Coral Crab



Linckia guildingii – Common Comet Star