Coral Richness in Relation to Depth and Water Quality at Champagne Reef

Lindsey George
Selyna Nunez
Katy Schumann
Rachel Williams

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Dr. Thomas Lacher
Dr. Jim Woolley

INTRODUCTION:

Corals are animals from the class Anthozoa that form communities called coral reefs. Each coral colony is made up of individual polyps that contain zooxanthellae, which is a type of photosynthetic algae. The coral and zooxanthellae exist in a symbiotic relationship. The coral provides shelter for the zooxanthellae and, in return, the zooxanthellae provide energy through photosynthesis (Humann, 1993; NOAA, 2008). This relationship is very crucial to the coral's survival. If there is even the slightest change in water quality, the zooxanthellae could leave the coral to die; which is known as coral bleaching. Therefore, corals must be located in a region with adequate water quality in order to thrive (Richmond, 1993; Turner, 2008). The purpose of this study was to analyze coral densities in relation to depth and water quality at Champagne Reef, Dominica. In order to conduct this study, we first looked at coral densities in relation to depth. Once we found the depth with the greatest coral mean, we tested the water quality to assess why the corals were located there in higher numbers. The water quality tests done in this study included dissolved oxygen, pH, temperature, nitrite nitrogen, alkalinity, ammonia and carbon dioxide. This data was then used to compare coral densities in three different depths: 1.5, 4.6 and 7.6 m. We hypothesized that a higher number of species of corals at a certain depth would correlate to variances in water quality tests.

METHODS AND MATERIALS:

In order to view the reef, we started by wearing the proper attire. Wet suits were worn along with snorkel gear: fins, mask, and a snorkel. Baby shampoo was used to keep our masks from fogging. We then tied a 30.5m rope to a 1x1m quadrat with holes drilled in it to allow it to sink. We gathered the excess rope and tied it off to 9m. The rope was

marked in 1.5m increments. On two separate days we all traveled to Champagne Reef around 14:00. Two people pulled the quadrat around to random sites at depths of 1.5, 4.6, and 7.6m. The other two people counted the different species of coral and marked it down on an underwater tablet with a pencil. We repeated this procedure three times until we had a total of nine samples. Water samples were taken at every site in order to conduct tests: pH, dissolved oxygen, ammonia nitrogen, nitrite nitrogen, alkalinity, carbon dioxide, and salinity. Due to faulty equipment, we were unable to calibrate the salinity test. The dissolved oxygen test was done at Champagne Reef to reduce error. The remaining tests were conducted at Archbold Tropical Research and Education Center (ATREC).

RESULTS:

Table 1 shows little variance in coral diversity, based on depth, between 1.5m and 7.6m. From the data collected there were more coral species at 4.6m. According to Table 2, there was a distinction in the Ammonia Nitrogen, Alkalinity and Carbon Dioxide water quality tests. There was little difference between the three depths in the calculated pH, Nitrite Nitrogen and Dissolved Oxygen levels.

Table 1: Number of Coral Species per Depth

	1.5m:	4.6m:	7.6m:
Day 1:	9	13	8
Day2:	9	9	9
Total:	18	22	17
Avg:	9	11	8.5

Table 2: Water Quality (ppm) per Depth

Depth (m):	pH:	Ammonia-Nitrogen:	Nitrite-Nitrogen:	Alkalinity:	Carbon Dioxide:	Dissolved Oxygen:
1.5	7.8	0.15	0.05	158.7	5.2	5.5
4.6	7.8	0.33	0.05	162	1.7	5.7
7.6	7.7	0.67	0.05	139.3	5.7	5.9

DISCUSSION:

The results from the data collected support our hypothesis. Based on the results found in Table 1, the 4.6m depth sustains a higher number of coral species. The variances in water quality shown in Table 2 may explain this efficiency. When comparing the results from the Ammonia-Nitrogen test, there is great variation between the three depths. Since the results from our coral analysis found that more coral species were located in the 4.6m depth, we can say that an Ammonia-Nitrogen reading of 0.33ppm may be best at supporting a higher coral species density. The results from the Alkalinity test in show that 162ppm is also highest at the 4.6m depth. The Carbon Dioxide reading varied the most throughout all three depths. Lower readings of Carbon Dioxide are associated with greater species diversity as shown in our results from Table 1. For the tests of pH, Nitrite- Nitrogen and Dissolved Oxygen there was little variation found so we can conclude that these tests likely have no effect on coral species diversity, at least at our site and selected depths. These results could have been subject to error. These errors could include measurement discrepancy, bias in site sampling and general human error. In addition, our study looked only at associations of coral species richness with water quality parameters. To determine if there is some mechanistic reason for this association would require careful experimental work.

There are still many tests that can be conducted in relation to coral species diversity. Some of these tests were unavailable or inconvenient in order for us to carry them out. Temperature and light could be main factors in deciding coral species diversity. These tests should be considered in future experiments. Our data may be used in future studies conducted at Champagne Reef and throughout the Caribbean.

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