Sea urchin density along a depth gradient at Rodney's Rock and Champagne Bay, Dominica

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Abstract

The density of sea urchins along a depth gradient down to 6 meters was analyzed at two sites off of the West coast of Dominica. There was a visible relationship between depth and urchin location, with the majority of the urchins residing closer to the surface. The study indicated that urchins may prefer to stay near the surface in order to be in close proximity to their algae food source.

Introduction

There are 100 species of sea urchin known to occupy the Caribbean and Gulf of Mexico, many of which live at shallow depths (Hendler 1995; 198). Residing in the class Echinoidea, sea urchins take on a variety of colors, shapes, and sizes but are most commonly described as spiny, round marine creatures (Hendler 1995; 198). This study focuses on four commonly encountered native sea urchins along the Western coast of Dominica, analyzing density along a depth gradient down to six meters. The most common species of urchin in this area is *Diadema antillarum* which is characterized by long black or white spines. The other less common species are *Echinometra lucunter lucunter*, having dark spines and a red center, *Tripneustes ventricosus*, having short white spines and a brown center, and *Eucidaris tribuloides*, having tan, cylindrical, thick spines (Hendler 1995; 206-223). The data were gathered at two separate sites: Rodney's Rock and Champagne Bay. It was expected that urchin species would be concentrated at certain depths rather than be randomly distributed.

Materials and methods

Rodney's Rock is a large, mostly submerged boulder located on the West coast of Dominica near Massacre. Its entire surface is reef suitable for sampling and it reaches depths of 12 meters. Champagne Bay is a beach area on the West coast, South of Roseau. The floor of the bay is sloping and mostly sandy and contains only scattered reef areas suitable for sampling. Eighty percent of the samples were taken at Rodney's Rock while only twenty percent were taken at Champagne Bay and none of the latter were deeper than 2-3 meters.

Measurements were taken using a square constructed from PVC pipe and measuring one meter inside. The square was suspended vertically from two marked ropes attached to a flotation device made from PVC and two 250mL plastic bottles. The float was held in place by 1-2 people and the square was dropped to the appropriate depth so that it rested approximately 20-40cm from the reef surface. One or two people surface dived to the depth of the square and counted the number present of each species of sea urchin. In cases of disagreement, another count was conducted or an average was used. The square was dropped to a lower depth or moved to a new location after each count, locations being determined mostly at random, but subject to some bias based on accessibility.

Results

Depth	*Diadema antillarum* counted
0-1 m	5, 1, 1, 1, 6, 3, 3, 3, 5, 1, 2, 1, 1, 2, 6, 3, 4, 6, 6, 9, 9, 1
1-2 m	1, 3, 3, 3, 3, 5, 2, 6, 4, 3, 0, 1, 0, 0, 1, 3, 8, 5, 2, 0, 4
2-3 m	0, 0, 0, 1, 0, 2, 1, 2, 5, 2, 1, 3, 4, 1, 7, 2, 1, 0
3-4 m	0, 1, 0, 2, 0, 1, 0, 0, 2, 2, 0, 2, 0, 0, 1
4-5 m	0, 1, 0, 2, 2, 0, 1, 0, 2, 0, 0, 2
5-6 m	2, 1, 0, 0, 0, 0, 0, 0, 2

Table 1 – *Diadema antillarum* counted in each square meter sampled at depths from 0 to 6 meters.

Depth	*Echinometra lucunter lucunter* counted
0-1 m	7, 4, 1, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0

Table 2 - *Echinometra lucunter lucunter* counted in each square meter sampled at depths from 0 to 6 meters. No specimens were counted below 1 meter.

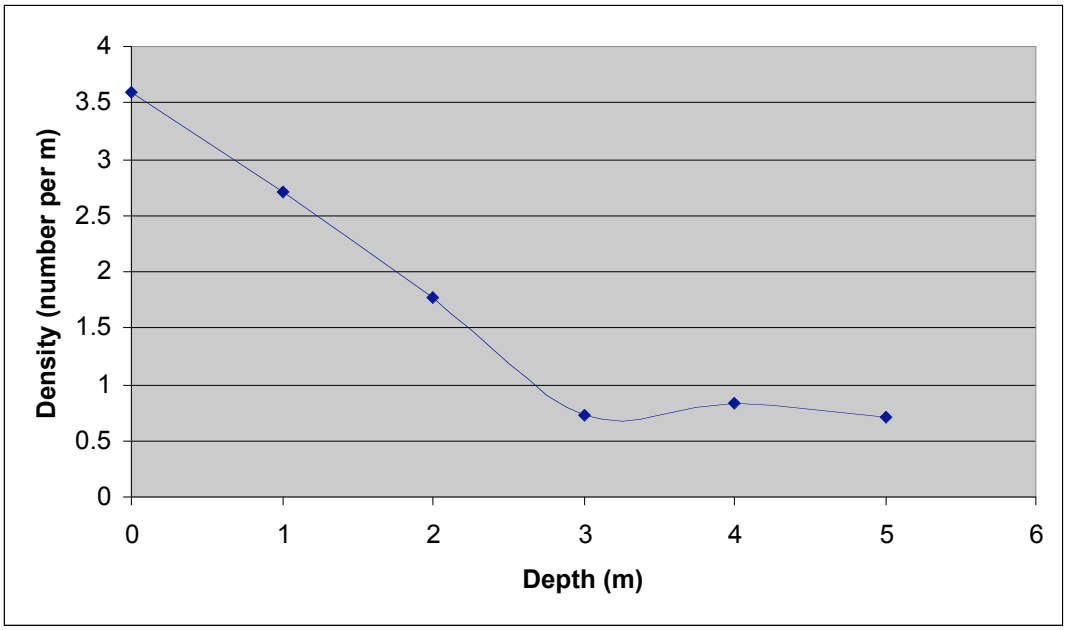

Figure 1 – Density of *Diadema antillarum* versus depth from 0 to 6 meters.

Discussion

Figure 1 illustrates that the average number of *Diadema* was inversely proportional to depth, decreasing by one urchin per one meter below the surface. This pattern continued up to a depth of four meters, at which point density was unchanged up to a depth of six meters. This trend may have been a result of the presence of algae, the primary food source of *Diadema*, closer to the surface of the water. Algae are more prevalent near the surface of the water due to their need for light to carry out photosynthesis (Lighthouse Foundation). Urchins have limited mobility, which requires them to rely upon staying close to their food source near the surface.

Table 2 shows that *Echinometra lucunter lucunter* were not as abundant as *Diadema* in the area sampled, and that they preferred to live within 1 meter of the surface. *Echinometra lucunter lucunter* were counted in clusters, possibly indicating a grouping behavior or a specific preference for habitat. Urchins may find certain coral types more suitable for boring holes, contributing to their clustering (Humann 1992; 288). The abundant *Diadema* may compete for a limited space near the surface, forcing some to have to reside at lower depths. The *Echinometra lucunter lucunter*, being small in size, may not have to face the issue of competition, since it can easily fit in the smaller crevices left uninhabited by the *Diadema*.

Some sources of error may have been the movement of the meter square due to waves, biased site selection, sampling during different times of the day, and over-counting due to the assumption that the reef surface was flat.

Conclusion

Analysis of the data, graphs, and figures presented above indicated that density patterns for *Diadema antillarum* and *Echinometra lucunter lucunter* did exist. Both urchins exhibited tendencies to reside at shallow depths and typically avoided the underside of reefs. One modification that could improve the measurement and data collecting process of the study would be to attach a small weight at the bottom of the meter square, giving greater stability during measurement. Another modification that would allow extended research would be access to scuba diving equipment, providing an opportunity to explore greater depths for more diverse data.

References

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