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Biodiversity of cryptofauna associated with reefs of the Los Roques Archipelago National Park, Venezuela

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Abstract. Cryptofauna associated with colonies of dead coral is important due to their role as bioeroding organisms that alter the physical structure of reefs. We studied dead colonies of *Montastraea annularis* to obtain information on the main groups present and their relative abundance at Los Roques Archipelago National Park (reefs of Dos Mosquises, Cayo La Pelona, and Cayo Sal). Dead corals were collected at 6-8 m and 9-13 m depth, (3 fragments at each location), and colony volume was estimated for density values standardization. Fragments were broken down in the laboratory and organisms were separated. In all, 1,499 individuals in 8 taxonomic groups were found. The most abundant were sipunculids (57.29%), followed by polychaetes (20.45%), crustaceans (14.76%), nematods, mollusks, and echinoderms. The fauna associated with reefs fragments is highly diverse, but consistently dominated by the same groups.

Key words: cryptofauna, *Montastraea annularis,* dead colonies

Introduction

Coral cryptofauna, initially defined by Klumpp et al. (1988) as mobile organisms using spaces available in coral rock, is made up mainly by a large number of invertebrates. This community of organisms, associated with the reef's calcareous skeleton, inhabits cracks and holes and is classified into borers and opportunists. Borers make cavities in the calcareous layer thus increasing the surface for colonization by organisms such as sponges, bivalves, crustaceans, sipunculans and polychaeta (Hutchings 1974, 1992). Opportunists are unable to bore but take advantage of cavities created by borers. Here one must also include fauna inhabiting the outer surface of the coral, such as fish, crustaceans, echinoderms, and algae. Cryptofauna is has been demonstrated to contribute to the breakdown of the carbonate reef structure in the long run. Few studies in the Caribbean deal with the biodiversity of cryptofauna and none at all concern the southern Caribbean (Ochoa-Rivera et al. 2000; Campos-Vasquez et al. 1999; Moreno-Forego et al. 1998).

The objectives of the present study were to study the biodiversity of crypto fauna associated with dead fragments of *Montastraea annularis*, the dominant species in the region (CARICOMP 1991, Bone et al. 2001), and to evaluate the spatial variations in the distribution of these organisms between various locations on the reef and at different depths.

Material and Methods

This study was executed at Los Roqués Archipelago, (11º 44´45″ - 11º 58´ 36″ N., and 66º 32´ 42″ - 66º 52´ 57″ W; Weil 2003).

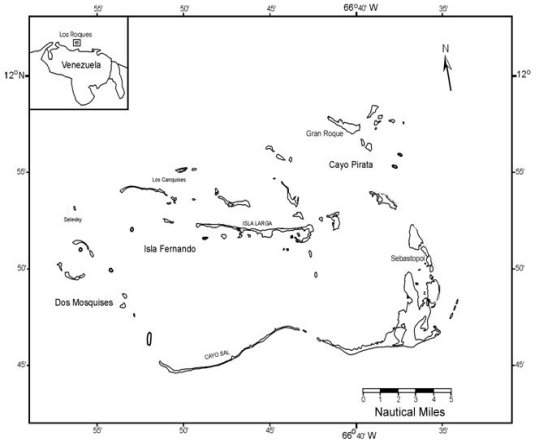

Figure l. Map of Los Roques Archipelago National Park indicating Cayo La Pelona (1), Dos Mosquises Sur (2), and Cayo Sal (3) (Modified from Villamizar et al. 2003). (Fig.1) at two depths (6-8 m and 9-14 m).

Dead fragments *of M. annularis* the second most important coral species in these reefs (14% of total cover; Villamizar et al. 2003) were used. The samples (3 fragments or pillars of *M. annularis*) were taken at Dos Mosquises, Cayo La Pelona, and Cayo Sal. The most exponed and deteriorated pillars were

taken, bringing the total to 18 samples. In the laboratory, coral fragments were broken into smaller pieces with chisel and hammer and organisms were extracted and separated in broad taxonomic groups. Results from the different locations and depths were compared by Kruskal-Wallis analyses ($p<0.05$).

Results

A total of 1.499 individuals were collected, belonging to 8 taxonomic groups, with a mean density of 116±132 ind/l. Sipunculans were dominant, with a relative abundance of 57.3% (mean density of 66±97 ind/l) followed by polychaetes 20.45% (24± 29 ind/l) and crustaceans 14.76% (17±18 ind/l). Chitons, echinoderms, bivalves, gastropods and nematods were also found, but their relative densities was always less than 5% (Table I). The greatest mean density of cryptofauna was found at Dos Mosquises, with 165±216 ind/l, followed by Pelona (131±55 ind/l) and Cayo Sal (51±39 ind/l). Sipunculans always dominated (55.9%, 60.6% and 53.4%), polychaetes were the second most important group in Dos Mosquises and Cayo Sal, with 21.7% and 35.3% respectively. In Pelona, crustaceans (15.6%) were the second group and polychaetes the third, representing 13.09% of the total.

	DMS		PELONA		CAYO SAL		TOTAL	
Invertebrate groups	S	D	S	D	S	D	S	D
Sipunculids	164	21	106	54	28	27	99	34
Polychaets	44	28	9	25	13	23	22	25
Crustaceans	38	14	23	18	3	7	21	13
Bivalves		1	1	2	1		1	1
Ophiuroids	4		1	4		0.2	1	1
Chitons	6	1	3				3	0.2
Nematodes	6	3.0	1.8	4.9		0.29	2.7	2.7
Gastropods	0.2	2	8	2		0.2	3	3
Total	262	69	153	110	44	57	153	79
Total/groups	7	7	8	7	4	6	8	8

Table 1:. Mean density for the invertebrate groups of the cryptofauna for the 3 reef locations (S= shallow, D= deep).

No significant differences were found among the three locations. The shallower zone showed higher density (153±176 ind/l vs. 78±55 ind/l). Sipunculids were more abundant in the shallower zones of all reefs (K-W p: 0.019, Table 1), whereas both groups were dominant in deeper zones.

Discussion

Except for the fact that sipunculids and polychaetes were the dominant cryptofauna at all reefs and all depths, no spatial patterns were noticeable in the distribution, composition, and abundance of cryptofauna. Other studies have also found sipunculids more abundant in the shallower zone (Perry 1998), which could be related to greater biomass, cover and complexity of algae that provide food, substrate and protection (Klumpp et al. 1988), or sipunculid distribution patterns may be more directly related to the degree of dead coral and reef degradation (Peyrot-Clausade and Brunel 1990; Capa 2003; Fonseca et al. 2005). Campos-Vasquez et al. (1999) and Ochoa-Rivera et al. (2000) reported greater polychaete density in the shallow zones of reefs located in Punta Nizuc and Cozumel and explained it by anthropogenic reef degradation. Thus, the lower polychaete densities at Los Roques may indicate good reef health there. Dead coral cover between 14 and 20% reached the maximum values in the shallow zone of La Pelona, where densities of sipunculids were high (Villamizar et al. 2003).

Densities of cryptofauna in this study are low compared to Moreno-Forero et al. (1998), who reported 328 ind/l for polychaetes and 213 ind/l for sipunculids in *Acropora palmata* samples from Colombia. These high values could be related to the state of degradation of the reefs at Isla Grande (Colombia), with <0.2% coral cover. Nonetheless, significant negative correlations were found between cryptofauna density and volume of coral fragments ($r=-0.54$ $p=0.02$), and between sipunculid density and fragment volume ($r=-0.52$ $p=0.029$). Thus more cryptofauna was found in smaller fragments. At Los Roques, high biodiversity of cryptofauna coincided with low abundante and an absence of spatial pattern. Cayo Sal exhibited the lowest diversity.

Studies of cryptofauna thus have the potential of acting as a useful indicador of reef health.

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