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ECOLOGICAL BASE LINE ESTABLISHMENT IN THE EL AEROLITO ANCHIALINE SYSTEM

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Quantification of community structure aids in management practices by enabling objective population estimates of biota, comparisons between systems, and long-term monitoring to detect variations. In the Aerolito System, echinoderm richness and abundance are both very high, making this system possibly unique worldwide.

Key words: Ecological monitoring, Echinoderms, Aerolito de Paraiso, Stygobite, Anchialine cave.

INTRODUCTION

The sink hole (locally called »Cenote«) El Aerolito (20°27'58'' N y 86°58'41''O) on Cozumel Island, Mexico, is the principal entrance to an approximately 18km long anchialine system, with an average depth of 12 m, and a maximum depth of 27 m. It is one of two systems in Cozumel with a sea connection (at 240 m of the length of Cenote). The sediment consists predominantly of mud and clay (MEJÍA-ORTÍZ *et al.*, 2007; SOLÍS-MARÍN & LAGUARDA-FIGUERAS, 2010). Biologically, the El Aerolito system is very interesting because it has crustaceans, sponges, polychaetes, and fish, as well as the first recorded troglobitic echinoderms (MEJÍA-ORTIZ *et al.*, 2005; SOLÍS-MARÍN & LAGUARDA-FIGUERAS, 2010; POMORY *et al.*, 2011). Despite the diversity, a quantitative study of the density has never been conducted, in part because of the complex nature of these habitats (ARKO-PIJEVAC *et al.*, 2001).

An ecological base line study provides a quantitative reference point of community structure, and is the first step for a long-term monitoring effort. Long-term monitoring would enable the detection of variations in the community and the identification of (natural or anthropogenic) disruptions causing them, thus providing a useful tool for ecosystem management (BLOSSEY, 1999; ABURTO-OROPEZA *et al.*, 2008).

MATERIAL & METHODS

A quantitative ecological base line was acquired in July 2011 and January 2012 by a belt transect technique of 15 x 1m (a total of 210 m^2) to the right of the permanent life line (a nylon rope used in cave dives to mark the route of divers), and the permanent life line was marked with duct tape to indicate the position of the transect for future monitoring. All conspicuous benthic macroinvertebrates were counted and measured. Temperature and depth were measured with a Mares Nemo Sport dive computer and were recorded, as were the types of substrata. Fieldwork was filmed with a Sony Handycam video camera.

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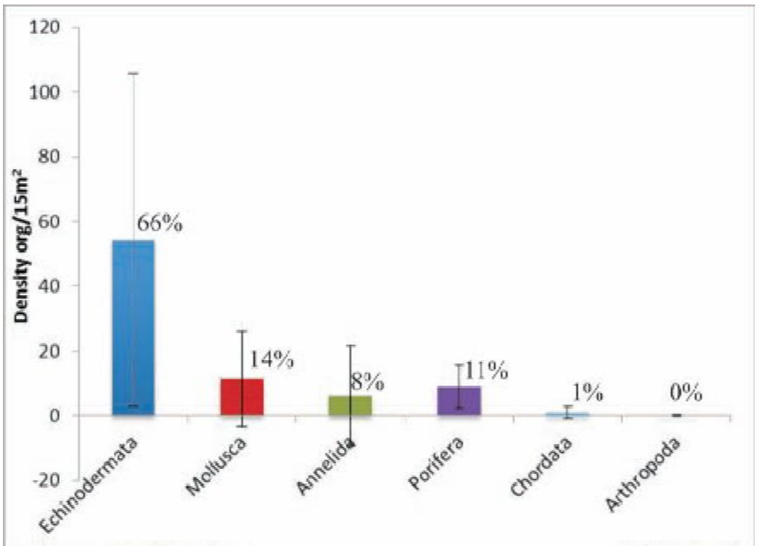

Copidaster cavernicola	Lima (Ctenoides) cf. scabra	Polychaeta sp.1	Porifera sp.1	Ascidiacea sp.1	*Farfantepenaeus sp.*
Asterina pompom	Hyalina (Volvarina) avena	Polychaeta sp.2	Porifera sp.2	Ascidiacea sp.2	
Mithrodia clavigera	Opisthobranchia	Polychaeta sp.3	Porifera sp.3		
Ofionereis reticulata		Polychaeta sp.4	Porifera sp.4		
Ophiothrix angulata		Polychaeta sp.5	Porifera sp.5		
Ophiothrix orstedii			Porifera sp.6		
Ophiocoma espinosa			Porifera sp.7		
Ophiothrix cf. suensonii			Porifera sp.8		
			Porifera sp.9		
			Porifera sp.10		

Fig. 1. Density and relative abundance of Phylla of conspicuos macroinvertebrates with the species of each taxa.

Olmstead-Tukey's test was used to determine the ecological status (dominant, common, occasional or rare) of each species by means of a graphic analysis between the average of density on natural logarithmic scale (organisms/10 m^2) against its relative frequency (GONZALEZ-ACOSTA *et al.* 2005).

RESULTS

El Aerolito system was characterized by 29 conspicuous benthic macroinvertebrates corresponding to six Phyla. Porifera and Echinodermata were the richest (10 Porifera, 8 Echinodermata, 5 Annelida, 3 Mollusca, 2 Chordata [Ascidiacea] and 1 Arthropoda species).

Echinodermata provided the most abundant taxa with 66%, followed by Mollusca (14%) and Porifera (11%) for a total of 91% of the organisms (Fig. 1). Two species were dominant (*Ofionereis cf. reticulata* with 65% and *Hyalina avena* with 14%), five common, one occasional, and twenty one rare. *Asterina pompom, Mithrodia clavigera,*

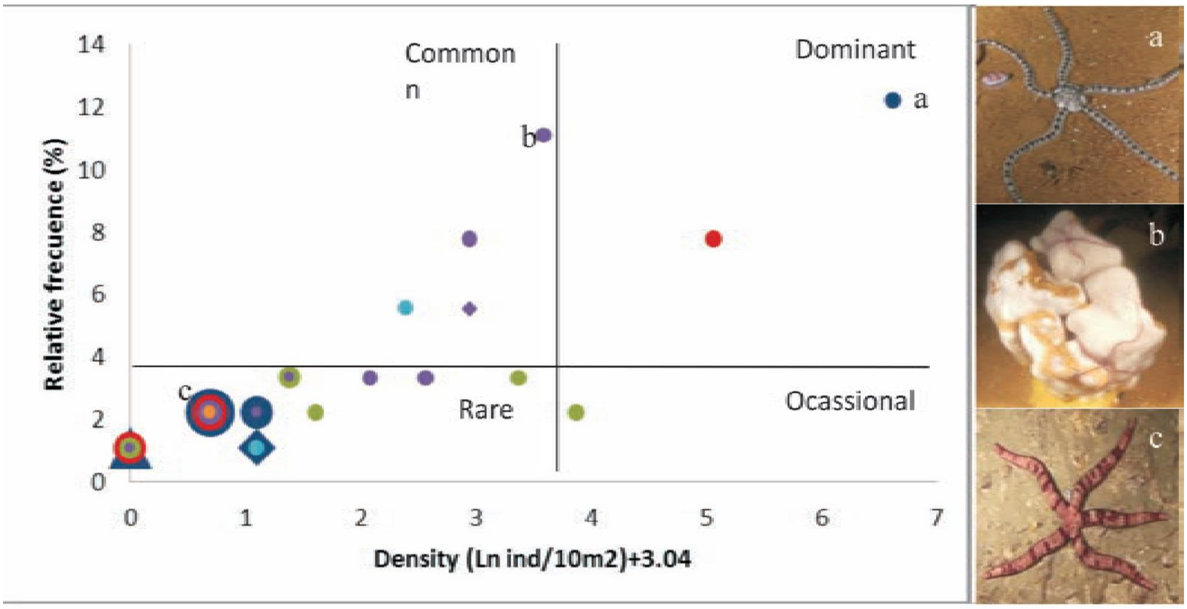

Fig. 2. Plot of the Olmstead-Tukey test. Each point represents one species, diamond two and triangle three three. Colors represent the Phylla (blue navy, Echinodermata; red, Mollusca; green, Annelida; purple, Porifera, blue sky, Chordata; and orange, Arthropoda). At the right, photographs of *Ofionereis cf. reticulata* (a), Porifera sp.1 (b) and *Copidaster cavernícola* (c) indicating its position in the diagram.

Ophiocoma wendtii, Lima cf. scabra, Annelida sp. and *Porifera sp*. 7 had the least density (5 org/100 m^2). This category includes the starfish *Copidaster cavernicola*, which is the only stygobitic echinoderm described in the system (Fig. 2).

DISCUSSION

A greater number of invertebrates were observed than reported before (11, not counting the 11 Annelida recorded by FRONTANA-URIBE & SOLÍS-WEISS (2011) since they were not collected inside of the system), including the first record of mollusks (3 spp.) and ascidians (2 spp.). Five previously reported species of crustaceans (*Procaris sp., Bahalana mayana, Mayawekelia sp., Speleonectes* and *Yagerocaris cozumel*) and sea cucumbers were not observed (MEJÍA-ORTÍZ *et al*., 2007). The biggest organisms were *Ophionereis cf. reticulata* (38 cm), *Mithrodia clavigera* (32 cm) and *Porifera* sp.*1* (22 cm).

In contrast to previous reports, crustaceans are in low densities, while echinoderms have greater richness and higher densities, up to 109 org/10 m^2. Because of the high densities of echinoderms, El Aerolito is the most important anchialine cave in the world for echinoderms (FRONTANA-URIBE & SOLÍS-WEISS, 2011).

CONCLUSIONS

The El Aerolito system should be protected because it could be biologically unique worldwide, and future variations detected by long-term monitoring could indicate the need for improved management strategies.

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