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New record of the basket star *Gorgonocephalus eucnemis* (Ophiuroidea: Gorgonocephalidae) at the Pacific coast of Mexico

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The basket star Gorgonocephalus eucnemis *is a common ophiuroid resident of rocky bottoms and artificial substrata at depths of 8 to 1,850 m, and in the eastern Pacific is distributed from the Bering Sea to San Diego, USA. This paper presents a new record of this species obtained with a submersible at Guadalupe Island, Mexico (29.10976°N, −118.25417°W), which extends its distribution range over 400 km, and corresponds to the southernmost site of occurrence of this ophiuroid in the eastern Pacific.*

Keywords: Baja California Peninsula, basket star, Guadalupe Island, submersible

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INTRODUCTION

The family Gorgonocephalidae comprises 34 genera and 95 valid species (Stöhr *et al.*, 2012), and it can be found worldwide and from shallow waters to the deep ocean (Hendler *et al.*, 1995; Rosenberg *et al.*, 2005). The species of the genus *Gorgonocephalus*, commonly called 'basket stars', are well recognized representatives of the family and can be distinguished by the following: disc and arms covered by stumps or tubercles but disc often naked interradially, arm spines present before the first arm fork, and the disc edge with a girdle of plates (Baker, 1980). The individuals live gregariously in rocky habitats swept by currents, clinging to octocorals, sea pens and sponges, or to one another forming a dense network with their dendritic arms (Mortensen, 1927).

There are 10 valid species of this genus distributed worldwide (Stöhr & O'Hara, 2012), three of which are present in the eastern Pacific: *Gorgonocephalus diomedeae* Lütken & Mortensen, 1899, only found in Panama (Lütken & Mortensen, 1899); *Gorgonocephalus chilensis* (Philippi, 1858) from Chile (Manso, 2010); and *Gorgonocephalus eucnemis* (Müller & Troschel, 1842). The latter is a boreal species resident of the Atlantic and Pacific Oceans; in the Pacific region it occurs in the East Siberian Sea, Laptev Sea, Chukchi Sea, Okhotsk Sea and Sea of Japan, and in the eastern margin it can be found from the Bering Sea to California, at depths from 8–1850 m (Hendler, 1996; Lambert & Austin, 2007). It is a large basket star (disc diameter up to 140 mm) with five complexly branching arms used for clinging to gorgonians and other substrata (Hendler, 1996). The disc is covered with scales and scattered granules, which are very numerous on the radial shields and along the edge of the genital scales. The teeth and oral papillae are spine-like and body colour is quite variable, including white, maroon, beige, cinnamon, salmon, pink or coral and bright orange-red. Often the arms and the disc differ in colour (May, 1924; Patent, 1970; Hendler, 1996).

This basket star can be found in areas of high current attached to octocorals (*Psammogorgia, Gersemia* and *Primnoa*), sea pens, sponges and crinoids (*Florometra* and *Heliometra*), or even on gas pipes (May, 1924; Mortensen, 1927; Clark A.H. & Clark A.M., 1967; Patent, 1970; Hendler, 1996; Krieger & Wing, 2002; Love & York, 2005). Juveniles of *G. eucnemis* are associated with the alcyonacean *Gersemia* sp., and as they grow, move towards the adults of their own species. Once there, they take food that was captured by adults until their arms are developed well enough to capture food and the juveniles become independent (Mortensen, 1927; Patent, 1970).

The basket star *G. eucnemis* is an opportunistic feeder; it positions its arms curved upwards with the branches extended facing the current, and with some of the arms attached to the substrate for support (Patent, 1970; Lambert & Austin, 2007). The numerous mucus glands in the tube feet immobilize its prey, consisting mostly of small bottom-dwelling crustaceans and macroscopic zooplankton (including chaetognaths), fish larvae and jellyfish

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(Patent, 1970). According to Patent (1970) *G. eucnemis* has an annual reproductive cycle and spawns for six months of the year, from June to November, and its gonads are parasitized by the polychaete *Protomyzostomum polynephris* Fedotov, 1912 which consumes the genital sacs leading to partial or full castration of the host (Fedotov, 1912).

In recent years, the use of effective sampling methods including photographic surveys and direct observations using deep-sea submersibles, have revealed highly diverse benthic communities in the deep sea. Taking advantage of this technology, the objective of this paper is to present a new record of *G. eucnemis* at Guadalupe Island, Mexico, which represents its southernmost occurrence in the eastern Pacific.

MATERIALS AND METHODS

The volcanic Guadalupe Island is a territory that belongs to Mexico and is located about 200 km west of the Baja California Peninsula. The area is isolated, surrounded by depths of 3,600 m or more, and practically lacks a shelf with the exception of the southern tip where a 4 km long platform joins the island to other smaller islets. Guadalupe Island has a number of underwater canyons on the east coast, one of the most prominent located in front of Campo Norte (29.15°N, −118.28°W; Gallo-Reynoso & Figueroa-Carranza, 2005).

The study was performed from 26 September to 3 October 2008, and the observation of *G. eucnemis* was opportunistic as the main objective of the visit was to gather information about the deep-water assemblages of the western side of the island, near the areas where white sharks (*Carcharodon carcharias* (Linnaeus, 1758)) occur during summer and autumn. Dives were conducted on-board the DeepSee submersible vessel (model Triumph, able to reach down to 457 m), which can carry a pilot and two passengers. A total of 18 surveys were done at four different locations (Campo Norte, Cañones Gemelos, Playa Palmas and Punta Pilar), each spanning an average of four hours of effective observation time. During the immersion, information about depth and temperature, and images of the most conspicuous specimens were recorded with HD video cameras and digital still cameras.

The identity of the specimens of *Gorgonocephalus eucnemis* was determined on the basis of photographs that highlighted its diagnostic characters (described in Hendler, 1996; Lambert & Austin, 2007). In addition, in order to confirm the geographical range of the species we consulted specialized literature and checked the information about observed or collected specimens in over 20 museums worldwide, available on the Global Biodiversity Information Facility webpage (http://data.gbif.org), the World Register of Marine Species (http://www.marinespecies.org), the Ocean Biogeographic Information System (http://www.iobis.org/), the Integrated Taxonomic Information System (http://www.itis.gov) and the Mexican Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (http://www.conabio.gob.mx/remib/).

RESULTS

One specimen of *Gorgonocephalus eucnemis* was found at Guadalupe Island, at 287.6 m deep (water temperature 9°C), during a survey (29 September 2008) of a locality known as Playa Palmas (29.10976°N, −118.25417°W). During the entire expedition, only one individual was seen resting over the remnant of a dead octocoral colony, and with some of its arms placed over the basaltic bottom (Figure 1). The specimen was not collected, but identification was done on the basis of diagnostic traits such as the dichotomously ramified arms having terminal portions with coiling branches, a disc covered with thick skin, small sharp stumps covering the disc and interradial area, and radial shields nearly meeting in the centre of the disc. The individual had a brownish colour on the disc as well as on the proximal portion of the arms, and tan colour in the distal portion of the arms. The basket star was feeding on suspended particles and had its arms spread out like a fan.

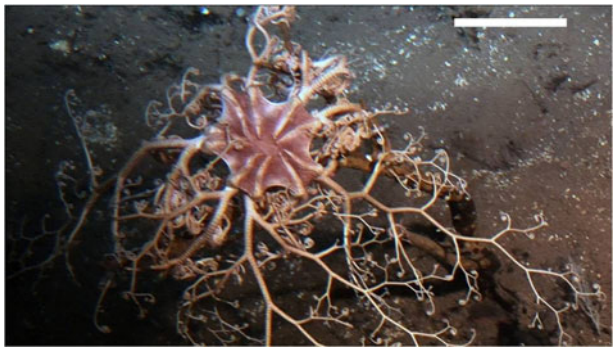

Fig. 1. *Gorgonocephalus eucnemis* specimen observed at Guadalupe Island (287.6 m deep). Scale bar = 10 cm (photograph by Manuel Lazcano).

The survey of literature and museum records indicated that the southernmost record of *G. eucnemis* in the eastern Pacific is off San Diego (32.7417°N, −117.3833°W), based on a specimen present in the Invertebrate Zoology Collections (Echinoderms) of the National Museum of Natural History, Washington (catalogue number USNM 39004), collected in April 1889 at 227 m depth by the steamer 'Albatross', under the name *Gorgonocephalus caryi* (Lyman, 1860) (subjective synonym of *G. eucnemis*; Hendler, 1996). The new record here presented for Guadalupe Island was located about 400 km south-west of this location.

DISCUSSION

The finding of *Gorgonocephalus eucnemis* at Guadalupe Island, several hundred kilometres south of the previously recognized southern limit, is important as it increases the number of known ophiuroids present at the western coast of Mexico to 64 species (Honey-Escandón *et al.*, 2008). The observed specimen (Figure 1) had a disc diameter of about 100 mm, probably being an adult (Patent, 1970), and the length of each arm may be about 300 mm. As the individual was not collected, we used its general morphology to make the taxonomic distinction; nevertheless there are specific characteristics that were not observed but should be considered in order to reliably identify *G. eucnemis*. They include a nearly naked dorsal and ventral interradial region of the disc, dorsal interradial region scattered with small granules, and edge of genital scale bearing large granules or spinelets (Hendler, 1996; Lambert & Austin, 2007). The species *G. eucnemis* is easily identified from *G. diomedae* by the short spines or stumps covering its disc (Hendler, 1996) and from *G. chilensis* because the latter basket star has a more developed radial shield (Barboza *et al.*, 2010). The depth of observation and the position of the body on the substratum were not

unusual for this species (Hendler, 1996). Some of the arms of the observed specimen were gripping a dead octocoral, while other arms were directly extended and placed over the bottom, an interesting feat considering that gorgonocephalids tend to use this position to suspension feed (Patent, 1970).

Recent surveys of the fish and invertebrate faunas of Guadalupe Island (Reyes Bonilla *et al.*, 2009, 2010), have shown that many species present at Guadalupe Island also occur near the Baja California Peninsula, at similar or even lower latitudes than Guadalupe. From these observations we suggest that it is feasible that *G. eucnemis* also follows the mentioned pattern and it may have resident populations in deep waters somewhere close to the mainland.

In conclusion, the results of this paper extend the accepted distribution range of the ophiuroid *Gorgonocephalus eucnemis* by about 400 km southward, and point out its presence in Guadalupe Island, off western Baja California, Mexico. This new information will be instrumental in future biogeographical analyses of this unusual echinoderm family.

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