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# Mass aggregation of the cushion starfish *Pentaceraster cumingi* in the southern Gulf of California

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The cushion starfish *Pentaceraster cumingi* (Gray, 1840) is a common asteroid resident in reefs and surrounding sandy areas in the tropical eastern Pacific region. In the Gulf of California, Mexico, the species reaches population densities of about 0.8 individuals/50 m<sup>2</sup> (Reyes Bonilla et al. 2005), while in Panama the average is 1 individual/m<sup>2</sup> (Alvarado et al. 2012). In both regions this starfish is considered as common, and probably its relatively high abundance is related to its diversified diet that includes from detritus to live urchins (Luna-Salguero and Reyes-Bonilla 2010; Dee et al. 2012). The species is not under significant commercial exploitation in Mexico, even when it is very similar to *Oreaster reticulatus*, an asteroid that is heavily fished in the Caribbean (Scheibling 1981).

In October 2015, five large aggregations of *P. cumingi* were found about 150–300 m southeast of El Cayo Island (24.87° N, –110.61° W), at depths of 6–8 m and over sandy bottom. The animals were adults (arm length from 50 to 90 mm), and were arranged in small clusters of 3 to over 40 individuals where the specimens were alongside

or even on top of their neighbors (Fig. 1). From four photographs and four videos we counted a total of 2,733 starfishes, of which 1,287 composed the largest group, and there were 486, 458, 259 and 243 in the others. Those figures are underestimations, as many organisms were overlooked as they were placed underneath others. The area in which the specimens appeared was less than 1,000 m<sup>2</sup>, and thus the population density was around 3 individuals/m<sup>2</sup>; this is, about 4 times higher than usual (Reyes-Bonilla et al. 2005; Luna-Salguero and Reyes-Bonilla 2010). Interestingly, other *P. cumingi* aggregations were found in the same month near La Lobera Islet (24.84° N, –110.61° W) at depths of 6–8 m with near 32 individuals (Fig. 2), and at El Gallo Island (24.46° N, –110.39° W) at depths of 11–13 m with at least 46 individuals (Fig. 3). At both locations *P. cumingi* were aggregated on sandy bottoms at the edge of rocky reefs.

The grouping behavior in *P. cumingi* is not unusual in the southwestern Gulf of California, as from July through September, similar congregations have been seen in different years by the authors at locations such as the entrance of San José Island estuary (24.88° N, –110.57° N), and east of La Gaviota Island (24.28° N, –110.33° W). The aggregations were short lived, as in 2015, the one at La Gaviota disappeared 2 days after it was observed. One possible cause of the grouping behavior is that the groups represent feeding aggregations, as the species apparently is sedimentivorous (Reyes-Bonilla et al. 2005). However, the evidence in favor is not strong as the characteristics of the sandy bottom do not seem to differ between the areas where the starfishes were seen, and others directly adjacent. Also, a similar species of the same family, *Oreaster reticulatus*, conducts itself very differently: instead of making groups, the individuals distribute uniformly over the bottom, probably to avoid competition for food (Scheibling 1981).

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**Fig. 1** A large aggregation of *P. cumingi* found southeast of El Cayo Island

We suggest instead that although no reproductive products were observed in the water around the individuals of *P. cumingi*, the aggregations might have a reproductive origin. We support this idea on the fact that *O. reticulatus* individuals have the habit to group during the reproductive season, probably because at a distance of just 12 m, the fertilization success is reduced to 50 % (Scheibling 1981; Metaxas et al. 2002). Also, if we consider that in 2015 the Gulf of California was under the influence of a very strong El Niño event that caused a temperature anomaly of over 2 °C (<http://www.ospo.noaa.gov/Products/ocean/sst/anomaly>), it is possible that the presence of warmer than usual conditions might have extended the gonad cycle of *P. cumingi* from summer (the usual season of starfish reproduction in the Gulf of California [Reyes-Bonilla et al. 2005]) to the fall. From these observations, and the fact that *P. cumingi* usually appears in relatively low population densities, we propose that the



**Fig. 2** An aggregation of *P. cumingi* found near La Lobera Islet



**Fig. 3** An aggregation of *P. cumingi* found near El Gallo Island

aggregating behavior conducted by this species reflects an effort to increase its reproductive success.

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## References

- Alvarado JJ, Guzmán HM, Breedy O (2012) Distribution and diversity of echinoderms (Asteroidea, Echinoidea, Holothuroidea) in the islands of the Gulf of Chiriqui, Panama. *Rev Biol Mar Oceanog* 47:13–22
- Dee LE, Witman JD, Brandt M (2012) Refugia and top-down control of the pencil urchin *Eucidaris galapagensis* in the Galápagos Marine Reserve. *J Exp Mar Biol Ecol* 416:135–143
- Luna-Salguero BM, Reyes-Bonilla H (2010) Estructura comunitaria y trófica de las estrellas de mar (Echinodermata: Asteroidea) en arrecifes rocosos de Loreto, Golfo de California, México. *Hidrobiol* 20:127–134
- Metaxas A, Scheibling RE, Young CM (2002) Estimating fertilization success in marine benthic invertebrates: a case study with the tropical sea star *Oreaster reticulatus*. *Mar Ecol Prog Ser* 226:87–101
- Reyes-Bonilla H, González-Azcárraga A, Rojas-Sierra A (2005) Estructura de las asociaciones de las estrellas de mar (Asteroidea) en arrecifes rocosos del Golfo de California, México. *Rev Biol Trop* 53:233–244
- Scheibling RE (1981) Abundance, spatial distribution, and size structure of populations of *Oreaster reticulatus* (Echinodermata: Asteroidea) on sand bottoms. *Mar Biol* 57:107–119
- Scheibling RE (1981) Optimal foraging movements of *Oreaster reticulatus* (L.) (Echinodermata: Asteroidea). *J Exp Mar Biol Ecol* 51:173–185