The Sea Anemone *Bunodosoma cangicum* as a Potential Sentinel Species for Microplastic Pollution on the Amazonian Coast

La Anémona de Mar *Bunodosoma cangicum* como una Especie Potencial de Centinela para la Contaminación por Microplásticos en la Costa Amazónica

L'Anémone de Mer *Bunodosoma cangicum* est une Espèce Sentinelle Potentielle contre la Pollution Microplastique sur la Côte Amazonienne

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EXTENDED ABSTRACT

Plastic pollution is a growing global concern. The production of plastic materials reached 348 million tons in 2017 (PlasticsEurope 2018), and between 1.7 to 4.6% of all this production ends up in the marine environment (Jambeck et al. 2015). Today, plastic is widespread in the world's oceans and coasts, making up to 80% of the marine debris (Barnes et al. 2009, Bellas et al, 2016). Once in the aquatic environment, plastic waste are continuously fragmented into meso- (5.1 - 25 mm) and microplastics (< 5 mm) (GESAMP 2019). Due to the small size, these contaminants can be ingested by organisms of all trophic levels, thus becoming one of the biggest threats to marine life in the present time (Browne et al. 2008, Thompson et al. 2009). Microplastic ingestion can result in physical damage, such as abrasions and internal blockages, and chemical contamination, through exposure to pollutants adsorbed to the surface of the particles (Gregory 2009). The sea anemone *Bunodosoma cangicum* Belém and Preslercravo 1973 (Hexacorallia: Actiniidae) is an endemic species of the South Atlantic (Fautin, 2013). The organism presents some attributes that can make it an excellent biomonitor of plastic contamination, such as a wide distribution, sessile habit, opportunistic feeding behavior, high abundance in the beachrocks of the region (*in situ* observation) and easy sampling. The Amazon coast occupies about one third of the Brazilian coast. The region is recently undergoing a rapid urbanization process (Becker 2005) which is directly related to the increment of pollution in the Amazon basin. Studies on contamination of aquatic fauna by microplastic are scarce for the Amazon, and restricted to fishes (Pegado et al. 2018, Andrade et al. 2019). Here we report for the first time the ingestion of meso- and microplastic particles by the predatory sea anemone *Bunodosoma cangicum* at the Amazon coast, wider Caribbean region (WCR). Field expeditions occurred during October 2018, when ninety specimens (30 at each local) were randomly sampled in three beachrocks of the intertidal zone of the Amazonian coast. Here, we present the results for a single sampling site, located at Maçarico beach (Salinópolis municipality, state of Pará, Brazil). The area is adjacent to the mouth of Sampaio River, being bordered by an urbanized beachfront, cliffs, dunes and coastal vegetation (Ranieri and El-Robrini 2016). The pedal disc diameter of the organisms was measured using a caliper (0.1 mm precision) before removal from the substrate using a metal spatula. The animals were individually stored in glass pots with 4% formaldehyde. In laboratory, the specimens were dissected and the contents of the gastrovascular cavity extracted. The obtained material was analyzed under stereoscope. The identified plastic particles were counted, classified, measured and photographed. Laboratory procedures were performed to prevent airborne fibers contamination (Torre *et al*., 2016). Polymer identification by Fourier Transform Infrared Spectroscopy (FTIR) method are in course and will be presented. The collected data were tested for normality and homoscedasticity for the appropriate selection of the statistical tests to be used. Linear regressions was performed to verify the relation between:

i) Pedal disc diameter and number of plastic particles, and
ii) Pedal disc diameter and plastics diameter.

On average, pedal disc diameter was 28.3 mm (± 8.4), ranging between 16.4 and 47.4 mm. Overall, 102 microplastics and 2 mesoplastics items were identified in 24 individuals (80%) among the 30 examined. On average, 4.3 (± 2.5) plastics per individual were found. Fibers comprised about 87% of the ingested plastics, followed by fragments (~ 9%) and films (~4 %). Linear regression analysis indicated a positive correlation between pedal disc diameter and number of plastic particles, with each additional millimeter of pedal disc diameter corresponding to an additional of 0.13 ingested plastic particles ($F(1,22) = 6.342$; $p = 0.01957$; $r^2 = 0.1885$; $y = 0.44583 + 0.13475x$) (Figure 1). The low R-square may be due to

the low number of samples in this preliminary study. No significant correlation was found between pedal disc diameter and plastics size (p = 0.2439). Our results provides the first evidence of microplastic contamination of marine invertebrates from the Amazon coast. Microfibers have been reported to be the prevailing plastic form in the digestive tract of diverse marine species (Possatto et al. 2011, Devriese et al. 2015, Bellas et al. 2016; Mizraji et al. 2017). Our data corroborate with these findings. Actiniarians have a diverse array of vertebrate and invertebrate predators (Ottaway 1977), therefore these organisms can transfer microplastic contamination to species of numerous trophic levels and possibly even to fish of commercial interest. Avian can also prey on sea anemones (Donoghue et al. 1986), thus representing another transfer route for microplastics in the biota. Microplastics are ingested most frequently by sessile generalist filter-feeding species that target abundant small prey (Romeo et al. 2015, Messinetti et al. 2018). *B. cangicum* exhibits similar attributes despite the predatory behavior, plus a high abundance and easy sampling. These characteristics make it an excellent biomonitor for microplastic contamination. Experimental research is necessary so that we can understand the effects and interaction of microplastics in this sea anemone, which has a great potential to be used to monitor plastic pollution in the entire Brazilian coast.

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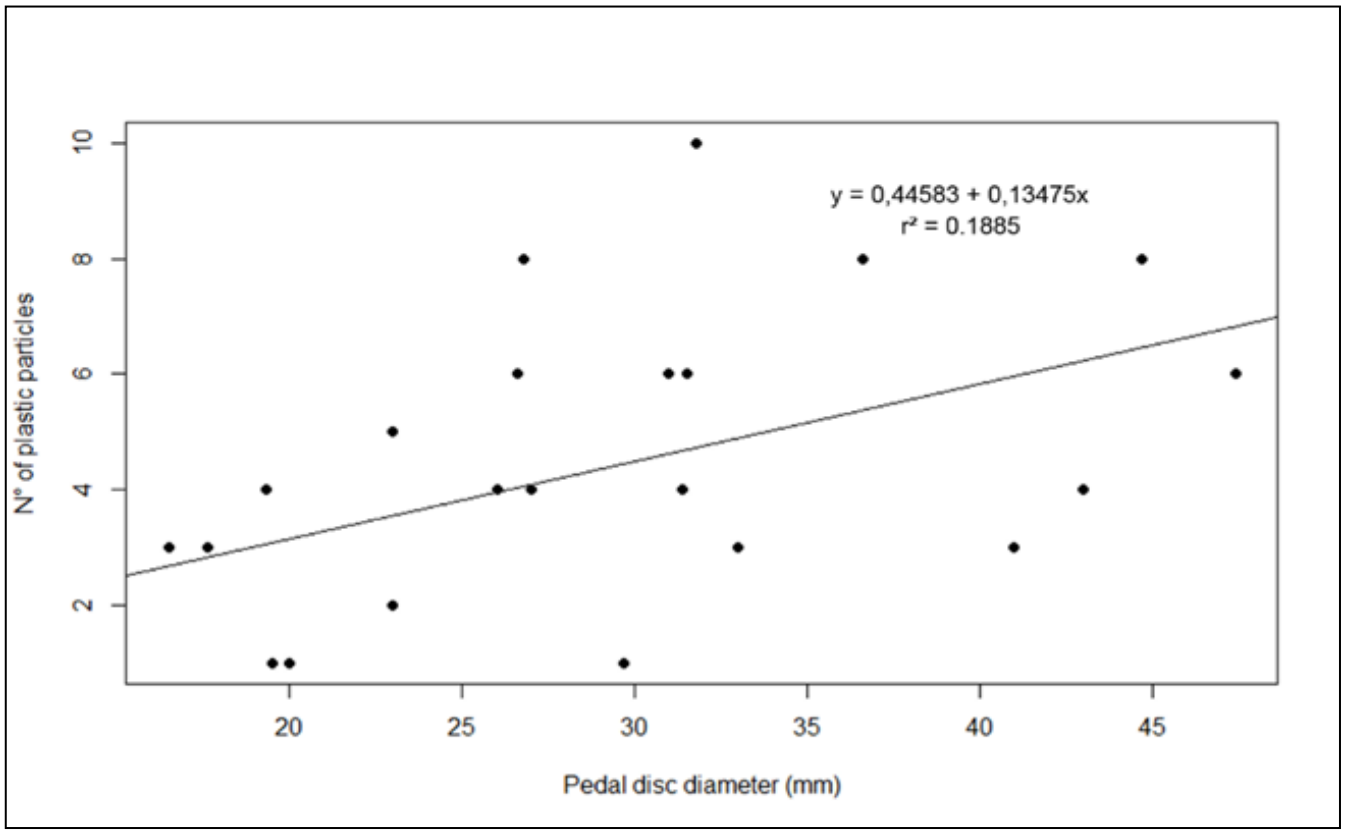

Figure 1. Scatter plot presenting the relationship between the number of ingested microplastic particles and sea anemone pedal disc diameter (n = 24).

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