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ROPE TO THE SEA: OBSERVATION OF THE FISHING ROPE ACTING AS ARTIFICIAL SUBSTRATA TO FIXATION OF CORAL Astrangia solitaria (Le SUEUR, 1817) COLLECTED IN THE GREAT AMAZON REEF SYSTEM (GARS)

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Abstract

Herein, we report the first observation of the coral *Astrangia solitaria* (Le Sueur, 1817) adhered on the polypropylene fishing rope (artificial substrate), collected in the areas of the Great Amazon Reef System (GARS). The specimens of *A. solitaria* were collected adhered on the fishing rope abandoned in bottom areas associated with the GARS, in the state of Amapá (Northern Brazil) (02°57'54"N; 048°27'50,4"W), during the commercial fishing operations of the red snapper - *Lutjanus purpureus* (Poey, 1866) - in May 2024. We observed 226 m of lost rope from the illegal lobster trap "caçoeira" adhered (wrapped) in the fish trap called "manzuá", where we accounted 63 colonies of *A. solitaria* covering 12.5 cm of this rope. This observation can be associated with a wide range of marine invertebrate adaptations for the use of these types of macroplastics in an anthropized environment.

Keywords: Marine litter. Ghost fishing. Amazon Reefs. Polypropylene rope. Environmental impact.

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1 Introduction

Pollution promoted by plastic debris is one of the main anthropogenic impacts carried out throughout the marine environment, with different emitting sources and present in several ecosystems, from continental waters to deep oceans (JAMBECK et al., 2015); these wastes are composed by different chemical and polymer structures and represented in the environment as femto, pico, nano, micro, meso and macroplastics (UURASJÄRVI et al., 2020; BERMÚDEZ; SWARZENSKI, 2021). Worldwide, the plastic is one of the main agents of degradation of wildlife, being present in all scales of the marine food chains, including its presence in humans (PRATA, 2023; LIU; YOU, 2023; JAGIELLO, DYLEWSKI; SZULKIN, 2024).

In Brazil, the fishing activity is widely practiced along the coastal and continental shelf regions, especially on the northern coast, where it is based one of the largest fishing fleets in the country (PRESTES et al., 2021; COSTA et al., 2022). However, despite the wide range of species targeted (e.g. fishes, lobsters, shrimps) and the different fishing gear used, this activity has a strong impact on the environment, especially due to the overfishing and the introduction of plastic materials, such as nets and lines, which end up impacting marine fauna even after fishing activities through ghost fishing (VITORINO et al., 2022).

Despite the extensive record of macroplastics in marine habitats, few studies report the behavioural interactions and use of the surface of plastic performed by invertebrates (ROSA, 2023).

In the northern region of Brazil, the Great Amazon Reef System (GARS) is composed by an extensive coral and rhodoliths beds (mesophotic reefs), occurring along the continental shelf between Brazil (Maranhão state) and French Guyana (MOURA et al., 2016; VALE et al., 2022), with a wide presence of coral species, being *Astrangia solitaria* (Le Sueur, 1817) one of the most representative in the region, occurring associated with hard substrata from coastal zones to depths of 573m (ALVES-JÚNIOR et al., 2023). Based on that, herein we report the coral *A. solitaria* attached to the polypropylene rope from the GARS.

2 Material and Methods

The rope of the illegal lobster trap "caçoeira" containing the coral specimens of *A. solitaria* was manually collected adhered (wrapped) in the fish trap called "manzuá", during the commercial fishing operations of the red snapper *Lutjanus purpureus* (Poey, 1866), performed in May 2024, between the depths of 70 and 100 m, in the GARS area (02°57'54"N; 048°27'50,4"W), associated with the Amapá state continental shelf (Figure 1), under the supervision of National Center for Research and Conservation of Northern Marine Biodiversity ("Centro Nacional de Pesquisa e Conservação da Biodiversidade Marinha do Norte – CEPNOR/ ICMBio") ("Autorização de Pesquisa nas Unidades de Conservação Federal" - SISBIO Number: 44915–3). The coral specimens adhered on the rope were identified, photographed, fixed/stored in ethanol 70% and all colonies were deposited, in the invertebrate collection of the Federal Rural University of the Amazon (UFRA), under voucher number LABCRUS.CNDR001.

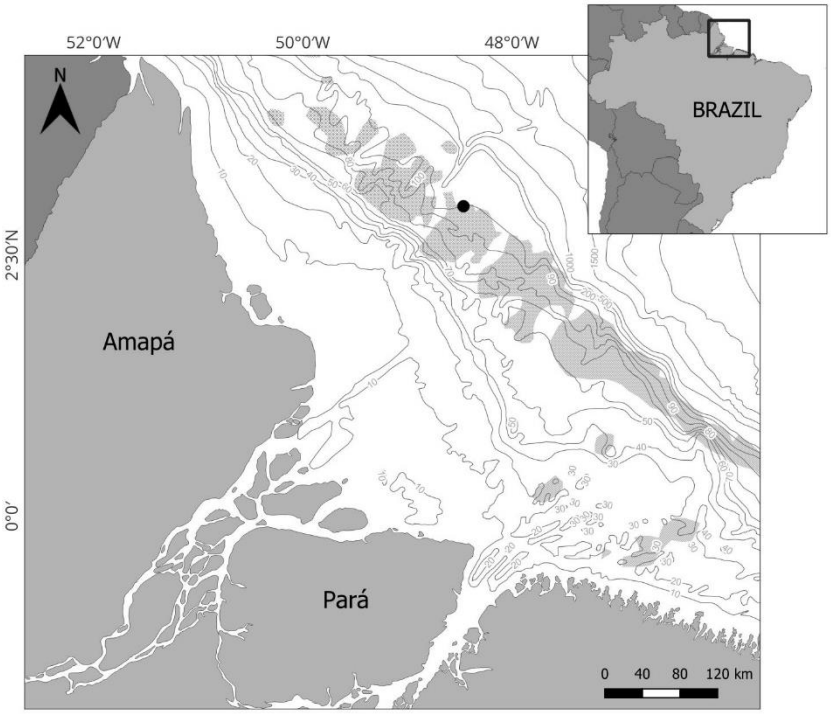

Figure 1. Map of the region where the lobster trap rope ("caçoeira") was collected acting as ghost fishing in GARS areas (Black circle).

3 Results and Discussion

A total of 226 m of the lost rope was recovered wrapped in the "manzuá" trap during the commercial fishing operations of the *L. purpureus*, where we observed 63 colonies of *A. solitaria* adhered on the fishing rope containing 12.5 cm (Figure 2). Adhesion to the rope may have probably taken place during the coral's larval stages, estimating from the size of the colonies, with the hypothesis of the time adrift at sea between 3 and 6 months. In this observation, the plastic rope can form an associated microbiota, serving as an attraction for other invertebrates, increasing colonization by overlapping specimens/species as well as attracting pelagic predators which can consume macro/microplastics during the predation.

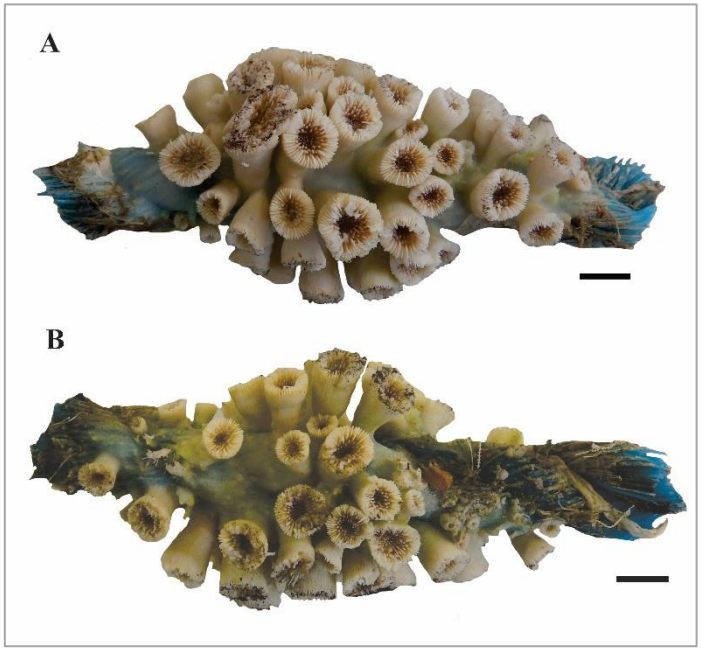

Figure 2. Lobster fishing rope ("caçoeira") composed of polypropylene A-B), found abandoned at sea containing colonization of the coral Astrangia solitaria in GARS areas (state of Amapá). Scale bar = 1 cm.

The rope collected belongs to the lobster trap called "caçoeira" (Figure 3a-c), which is illegally used along the north and northeast Brazilian coast, however, despite the prohibition, it is one of the main lobster fishing gears in the GARS areas (LIMA; MELO, SILVEIRA, 2013; SANTOS et al., 2020). This rope corresponds to the main part of the trap called "filame" (Figure 3a), which is composed of one rope (above 200 m), with one tip attached to the buoy (contain signal flags), and the other side with a bottom hook called "garateias" for fixing the trap to the hard substrata (Figure 3a) (more examples see SANTOS et al., 2020).

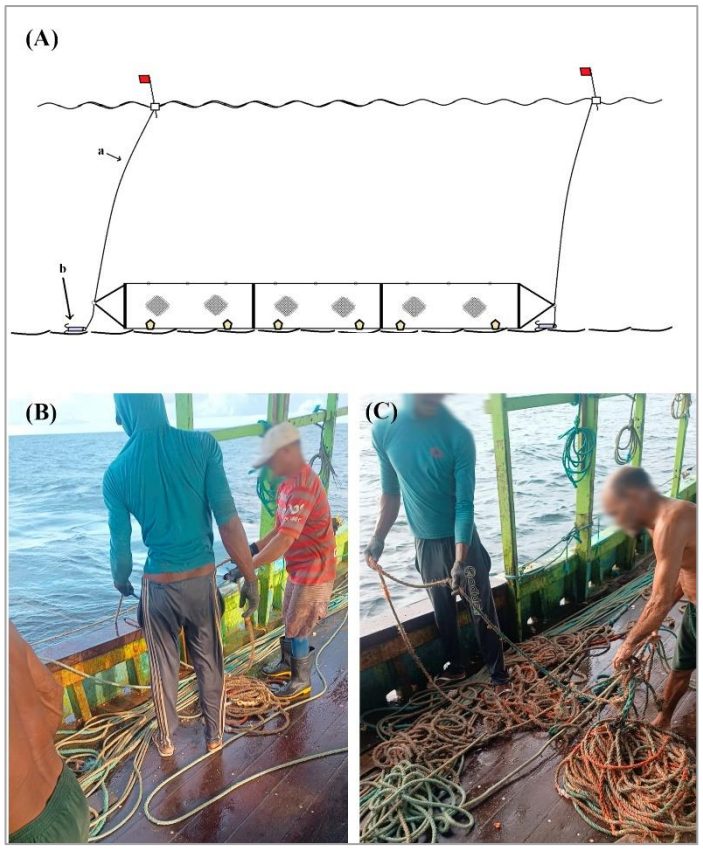

Figure 3. A) Schematic illustration of the illegal lobster trap called "caçoeira", contain the fishing rope indicated as: a = "filame" and b = "garateias" (modified from SANTOS et al., 2020); B - C) Fishermen collecting 226 m of rope from an abandoned lobster trap ("caçoeira") acting as ghost fishing in GARS areas (state of Amapá).

In coastal and oceanic areas, ghost fishing is one of the main problems for biodiversity security, once the gear released into the environment (abandoned or lost), continues to capture individuals, leading to the death of captured species by consumption of pieces of net, rope or hooks, strangulation or drowning when wrapped in nets (e.g. echinoderms, molluscs, crustaceans, fish, turtles, birds and marine mammals) (VITORINO et al., 2022). In addition, the deterioration of fishing gears (e.g. rope, buoys, nets, tires, styrofoam, plastic bottles), increase the input of micro- and macroplastic in all marine environments, acting as a strong polluting agent by the emission of the plastic fragments for a long time for the water column, including severe damage to biodiversity associated with the mesophotic reefs (Northern Brazil).

For marine invertebrates, the adhesion in hard substrata favours to carry out their biological activities (feeding, reproduction and growth) (ALVES-JÚNIOR et al., 2023).

However, the adhesion in artificial substrata and consumption of microplastics may change the animal's diet, as well as obstructing the alimentary and excretory tract, which can lead to the animal's death (REISSER et al., 2014; ROMAN et al., 2021). This case is widely observed in coastal zones, with hermit crabs as one of the main groups that use micro- and macroplastics in their biological behaviour; the presence of plastic in the environment affects negatively the biology and feeding of these species (CRUMP et al., 2020; JAGIELLO, DYLEWSKI; SZULKIN, 2024).

Studies performed by Morais et al. (2024), indicated that the large population growth and intense fishing activities are one of the main agents of degradation of the Amazon biome, acting as an emitter of micro- and macroplastics into the continental aquatic environments and the marine adjacent areas. The fishing gear abandoned in Amazon continental shelf areas, under the influence of marine currents, may act as a disperser of species into new biogeographical regions, promoting the introduction of invasive/exotic species to other regions, as observed by Soares et al. (2023), who indicated the wide distribution of the invasive corals *Tubastraea* spp. being transported by marine litter between the South Atlantic and Caribbean Sea.

Despite the deleterious effects of plastic on biodiversity, marine litter may act on the colonization of this artificial substrate by a wide range of sessile invertebrates (biofouling) such as corals, sponges, bryozoans, molluscs, crustaceans, as well as vertebrates such as ascidians and small fish (MANTELLATO et al., 2020; SOARES et al., 2023). This action may indicate the adaptive process (survival strategy) of the species to colonize new artificial substrates. This fact was related in studies performed by Rosa (2023), who observed the plastic utilization by the benthic tube-building polychaete *Diopatra cuprea* (Bosc, 1802), indicating the use of macroplastics in the dynamics and behaviour of invertebrate species.

4 Conclusions

Despite the severe impacts of plastic in the marine environment, the polypropylene rope can act as a substrate for the settlement and dispersion of fauna; which in this paper, we report the first observation of adhesion of the coral *A. solitaria* in polypropylene fishing rope (artificial substrata) in GARS areas.

Additionally, we warn about the presence and possible impacts of the fishing waste on Amazonian mesophotic reefs in the northern region of Brazil.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

FAAJ, DEGM, IHAC conceived the research ideas, designed the study and writing the manuscript; AGCMK and APBC performed the first draft of this manuscript and revisions along the main text.

DECLARATION OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence this study.

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