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The Coastal Ecosystem is Affected by Fishing in Gillnets

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Abstract

The purpose of this investigation is to comprehend how this high-quality fishing instruction is affecting the reef systems along the coast, reducing the amount of the target species Panulirus echinatus and its related fauna. A region without gillnet fishing was compared to a region with a lot of gillnet fishing in the study. During the night time visual census analysis of the target species, P. echinatus were found in significantly greater numbers at the location where gillnet use was virtually non-existent in all three of the sampled habitats the fringe, the cave, and the soft bottom. 4 lobster species and 10 crab species were found in bycatch species from distinct anglers' gillnet arrivals. As detritivores, herbivores, and first consumers in the reef ecosystem, these decapod species serve as natural prey for numerous reef fishes. The ecological function of Brazil's tropical coastal reefs is affected in an indirect way by this.

Keywords: Coastal ecosystem; Fishing; Gillnets; Reef systems; Fauna

Introduction

Palinuridae spiny lobsters exhibit evolutionary habitat differentiation, with some species spending the entirety of their benthic life cycle on shallow coastal reefs; whereas other species migrate to deep water during the ontogeny of their young and adults. This Palinuridae life cycle pattern has been observed worldwide; additionally, only two or three species are known to coexist in the same area. In Brazil, Panulirus argus and Panulirus laevicauda use the same shallow coastal reefs as nursery grounds during their juvenile stages. One of the most common lobsters found in Brazilian tropical coastal reef habitats, Panulirus echinatus Smith, 1869 also lives in the same places as its young and adults [1] (Figure 1).

The spiny lobster industry is one of the most lucrative in the world and a significant economic resource in Brazil. Throughout the course of recent years unfortunate fishery the board of spiked lobster stocks in the West Atlantic Sea has prompted an emotional decrease in arrivals. In Brazil, P. argus and P. laevicauda already have stock management measures in place, such as a minimum landing size and time limits for fishing. However, these measures have not been successful in preserving stock numbers. Additionally, P. echinatus is still exempt from any legislation regarding fishery management [2].

Along Brazil's coastal reefs, artisanal fishing methods using gillnets for P. echinatus have been used in large numbers. The strategy has proactively been restricted for different species in profound water checks yet it is as yet viewed as reasonable for the P. echinatus fishery. The contention for the continuation of the gillnet procedure depends on the way that the high quality technique involves non-motorized boats which in principle ought to introduce a low effect fishing exertion and a genuinely necessary monetary pay for the nearby networks included [3].

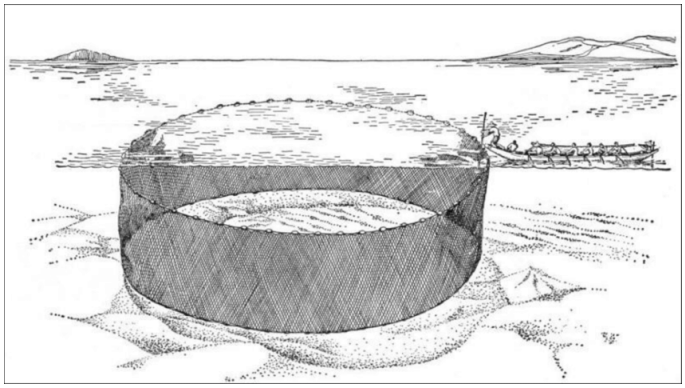

Figure 1: Fishes are affected by circle gillnet.

A long trap attached directly to the reef crests that are exposed at low tide is the caçoeira gillnet. Over the course of a nightly tidal cycle, the nets remain attached to the reef fringe and are collected the following morning. Wild stocks and associated low-trophic level species that are caught and discarded as bycatch may be directly affected by this unregulated harvesting practice [4].

To dissect the effect of gillnet fishing over a beach front reef environment we looked at two seaside regions roughly 30 km separated. Gillnet fishing was used heavily at one site, but it was not used at the second survey site. In both locations, a nocturnal visual census was used to assess the population of the target species P. echinatus, while in-situ landing counts from local fishermen's sailboats were used to assess the population of bycatch species [5].

Results

There were a total of 1136 bycatch samples in the caçoeira gillnet, with an average of 23.7 17.3 specimens per boat landing. A sum of 14 decapod species was caught, in addition to the objective species P. echinatus, which was kept in 100 percent of, gillnets recovered (Table 1). The largest herbivorous crab, Damithrax hispidus, was the most significant bycatch species, with landings sometimes exceeding those of the intended lobster, P. echinatus; It has no economic value, and fishermen only used the chelipeds of larger people for their own use. The rest of the body was thrown away on the beach, along with smaller people [6]. Parribacus antarcticus came in second place, with specimens much smaller than the 20 cm standard for larger specimens found in the majority of landings; the species is used as food for subsistence and

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Table 1: Impact on Coastal Ecosystem.

Aspect	Impact on Coastal Ecosystem
Biodiversity	Gillnets can catch non-targeted species, leading to a decrease in biodiversity
Habitats	Fishing in gillnets can damage sensitive habitats like coral reefs and sea grass beds
Food web	Overfishing with gillnets can disrupt the food web and cause imbalances
Marine litter	Discarded gillnets and fishing gear can become marine litter and cause harm to marine organisms
Water quality	Overfishing with gillnets can lead to an increase in harmful algal blooms through an imbalance in nutrient levels
Economic impact	Overfishing with gillnets can lead to the collapse of fisheries, affecting the livelihoods of coastal communities

Table 2: The design and structure of gillnets.

Design characteristics	Measurement and description	
	Mesh size 1	Mesh size 1
Mesh size	15mm	25mm
Length of net	100m	100m
Height of net	2.74m	2.74m
Net structure	Rectangular	Rectangular
Sinker material	Block	Block
Floater material	Rubber cock	Rubber cock
Type of mesh	Knotted	Knotted
Gear colour	White	White
Netting material	Polyester	Polyester
Hanging ratio	0.2-0.5	0.2-05

commands a high value in local markets.

In terms of dominance, the following species were all representative. Discarded items included Mithraculus forceps, Dromia erythropus, Damithrax brasiliensis, and Menippe nodifrons with no commercial value. Panulirus laevicauda and Panulirus argus arrivals were completely considered as adolescents and under the allowed get size and in this manner denied for exchange however utilized as means food by the anglers.

The remaining six bycatch species lacked dominance. While Plagusia depressa is traded in local markets, Microphrys antillensis, Damithrax hemphilli, and Chorinus heroes have no commercial value and are discarded as bycatch. Carpilius corallinus, the largest crab, is also highly sought after as zootherapy or traded locally as material for handicrafts [7]. Palinurellus gundlachi was landed as large adults and is a highly sought-after local gastronomic delicacy.

Discussion

The landings of 48 sailboats were looked at in this study. Every day, 50 artisanal fishermen in Tamandaré catch spiny lobsters using mostly gillnets. This compares to an impressive yearly weight of arrivals of P. echinatus. As a result, this study's findings are only a small portion of Brazil's annual catch, but they do show how much associated fauna is removed from the coastal biogenic reef environment each year [8] (Table 2).

The low wealth of P. echinatus at Tamandaré can be reflected in the diminishing weights contained in the arrival records. The differences between the target species in these two tropical reef areas strongly suggest that Tamandaré's intense fishing is also bad for bycatch lobsters and crabs. Since this is a non-specific method of fishing that also catches a lot of related fauna; additionally, this type of fishing has a significant impact on Brazil's entire coastal reef ecosystem as well as several other nations worldwide [9]. It is important to note that the anthropogenic disturbance brought on by the tourism industry at Porto de Galinhas is a significant factor in the reduction in the use of gillnets, which is beneficial to the lobster population and the bycatch decapods that accompany them. This is true regardless of how harmful tourism can be to the reef environment.

Melo and Pinheiro had previously reported that P. echinatus lives in predation-safe areas like deep rock cavities and is nocturnal; exhibiting night-time foraging behavior, particularly during reproductive times. The UVC information at the two locales in this concentrate emphatically features how P. echinatus utilizes cavern and cavern structures in waterfront reef regions as its principal territory in any event, during night [10]. When compared to the soft bottom, P. echinatus has a higher density on the reef's fringe, indicating that this is where it prefers to forage. This may help to explain why this method of fishing is so successful and why fishermen prefer to anchor gillnets there.

Crabs belonging to the subfamily Mithracinae made up 80% of all recorded bycatch landings, making them the most common species. Herbivorous Crabs at this subfamily are known as "green growth cleaning groups" in the aquaria business for their algal control capacities. They usually get caught in areas with algae beds because of their association with them. Studies have shown that the evacuation of crabs having a place with this gathering in a reef biological system can bring about critical algal development, arriving at a 75% increment in green growth where these crabs are taken out [11]. Ceccarelli emphasized that herbivores largely control the relationship between algae and corals in coral reefs. As a result, the removal of these keystone low-trophic level crabs increases the effects of ecological imbalance because algae is the primary competitor of coral species in the reef environment and its dominance can cause serious negative effects.

Similar to other coral reefs around the world, reef fish in Brazilian reefs are being overfished, reducing the number of predators for large decapods and increasing the number of non-traded species, the majority of which are invertebrates. This harming overexploitation of decapods with gillnets detailed here could be speeding up the breakdown of this environment particularly when most of bycatch species are at the foundation of trophic chain like the herbivorous crabs [12]. The loss of detritivores, also known as omnivorous decapods, in locations with substantial organic material deposits, such as anthropogenically impacted coastal areas, is yet another significant issue. As a result, nutrification can increase, resulting in excess ammonia, nitrite, and acidification of the water. Organic matter may not be utilized. This deterioration in the quality of the water renders it toxic to a number of delicate animals, resulting in their deaths-a situation that can be observed in aquarium systems [13]. Additionally, it is well documented that a number of decapods are in charge of cleaning corals, removing sediment, eating the dead tissues of benthic organisms, and maintaining the health of corals. As a result, removing these "cleaners" from the environment may result in an abundance of undesirable organisms, such as pathogenic animals. The trophic relationship of reef fish, the natural predators of reef decapods, is a further cause for concern given the extensive decapod removal [14]. Nearly half of the fish species in the studied ecosystem are mobile invertebrate feeders, and many of these fish species already face overexploitation. Therefore, fishermen's consistent

and indiscriminate removal of primary and secondary consumers in the trophic chain has the potential to cause a large-scale ecological imbalance in the coastal reef system and may be affecting trophic relationships that are not fully understood at the moment. This natural unevenness constrained by the ceaseless gillnet uses can bring about an irreversible change in the seaside reef biological system situated in the environmental outpouring hypothesis, and the termination overflow [15]. According to Neubauer, an overexploited marine population will not recover quickly, and ecosystems may collapse during prolonged periods of intense overexploitation.

Special attention should be paid to the study's documentation of the giant coral crab Carpilius corallinus as a bycatch. This crab is only found in Brazil, where it lives in areas with coral reefs. The species has a very low density, according to recent research. This species is primarily traded for crafts and zootherapy; it doesn't address a significant financial asset however it is easy to find this crab exchanged as trinkets in nearby art markets [16]. This species is in danger along Brazil's coastal reefs, and management measures should be put in place to limit its exploitation if it is to avoid extinction. Its capture would be discouraged if its use in crafts or as a fishery resource was prohibited in local markets.

The population of P. argus and P. laevicauda, the most important decapod resource on Brazil's northeast coast, experienced the most detrimental species-specific effects from the gillnet fishery. This was due to the placement of the nets in their nursery habitats, as evidenced by the small juvenile landings of both species that were observed during this study. The dismissal for fishery the executives and regulation shown by high quality anglers has placed extensive tension on lobster populaces and this might be one of the elements adding to the diminishing standing stocks at a considerable lot of the 20-50 m profound seaward locales [17]. The intensive gillnet fishing in the nursery habitat of these two lobsters' stops the continuation of their life cycle because the juvenile stage is removed prior to migration to the adult habitual niche, compromising the entire population stock. This is because these two lobsters present an ontogenetic migration for deeper habitat in their juvenile and adult phases. This negative effect on a fishing resource that is very important strongly suggests that management measures should be taken to keep the nursery habitat and their juvenile stages.

The P. echinatus population is showing all of the signs of a dying fishery, including dramatic stock declines over the past two decades, low recruitment, fewer fish in the catch, and an increase in Catch per Unit Effort. In this study, we show that artisanal gillnet fishing has a significant impact on P. echinatus populations, which is concerning when this shallow coastal reef ecosystem is the only habitat for the entire lifecycle [18]. According to the findings, this method of non-discriminatory fishing has a direct impact on populations of P. argus, P. laevicauda, and P. echinatus, as well as other significant bycatch species, which in turn has an indirect impact on the ecological function of Brazil's tropical coastal reefs [19]. Assuming that the lobster fishery is to keep away from the destiny of the much reported verifiable fishery breakdowns, similar to the North Atlantic cod and the Shellfish, it is vital that severe administration measures are acquainted at the earliest opportunity with forestall the on-going overexploitation situation. We suggest that the Brazilian government immediately establish several small no-take zones in the studied coastal reef ecosystem on the basis of these stock collapses that have already been documented [20]. No-take zones have been shown to reverse the trophic cascade effect and gradually restore the reef ecosystem if the environment is still intact. In the studied coastal reef ecosystem, these zones could serve as protected nurseries and sanctuaries for brood stock. This kind of action is the only one that might make it possible to restore reef fish and lobster stocks, which would be good for the environment and increase the likelihood that artisanal fishermen in Brazil will have a resource that can support themselves on their own.

Conclusion

We might also want to consider expanding the use of the night time UVC method for observing this species of decapods in order to collect biological data about its population. This is huge in light of the fact that there is an absence of natural information, which is the fundamental motivation behind why the IUCN doesn't yet order species like P. Argus as imperiled.

Conflict of Interest

The author has no conflict of interest.

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None

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