CLOSE ENCOUNTER OF THE FIRST KIND: REPORT ON A CLEANING SYMBIOSIS BEHAVIOUR OF LEATHERJACKETS (*Oligoplites saurus*) ASSOCIATED WITH A SPINETAIL DEVIL RAY (*Mobula mobular*) IN SOUTHEASTERN BRAZIL

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Scraping behavior in teleost species is often associated with epibiont, parasite and debris removal, primarily documented in interactions with sharks. This study provides the first documented evidence of leatherjackets (*Oligoplites* sp.) engaging in cleaning symbiosis with a Spinetail devil ray (*Mobula mobular*) off the coast of Ilhabela, southeastern Brazil. Drone footage captured on May 12 and May 24, 2024, revealed leatherjackets scraping their bodies against the devil ray's dorsal surface, targeting their heads and lateral surfaces, aligning with incidental cleaning behavior. This novel interspecies interaction occurred during an upwelling bloom, attracting numerous marine species to the area. Potential ecological

implications of declining elasmobranch populations due to climate change and human activities are also noted.

Keywords: Elasmobranch; incidental cleaning; teleost; São Paulo; biodiversity hotspot. Abbreviated title: Cleaning Symbiosis of Leatherjackets with Spinetail Devil Rays in SE Brazil

ENCONTROS PRÓXIMO DO PRIMEIRO TIPO: RELATO DE UM COMPORTAMENTO DE SIMBIOSE DE LIMPEZA DE GUAVIRAS (*Oligoplites saurus*) ASSOCIADOS A UMA RAIA MANTA (*Mobula mobular*) NO SUDESTE DO BRASIL

O comportamento de raspagem em espécies de teleósteos é frequentemente associado à remoção de epibiontes, parasitas e detritos, documentados principalmente em interações com tubarões. Este estudo fornece a primeira evidência documentada de jaquetas de couro (*Oligoplites* sp.) engajadas em simbiose de limpeza com uma arraia-diabo-rabo-espinhal (*Mobula mobular*) na costa de Ilhabela, sudeste do Brasil. Imagens de drone capturadas em 12 e 24 de maio de 2024 revelaram jaquetas de couro raspando seus corpos contra a superfície dorsal da arraia demoníaca, visando suas cabeças e superfícies laterais, alinhando-se com um comportamento de limpeza incidental. Esta nova interação interespécies ocorreu durante uma floração ascendente, atraindo inúmeras espécies marinhas para a área. Também são observadas potenciais implicações ecológicas do declínio das populações de elasmobrânquios devido às alterações climáticas e às atividades humanas.

Palavras-chave: Elasmobrânquios; limpeza incidental; teleósteo; São Paulo; hotspot de biodiversidade.

INTRODUCTION

Studies have suggested that scraping behavior of teleost species against surfaces or other animals is likely used to remove parasites (Arnal et al., 2001). Most assessments have reported scraping interactions specifically involving sharks (Thomson & Meeuwig, 2022). these include four Carangidae members, commonly termed jacks, in both the Atlantic, where *Caranx crysos* and *C. ruber* have been documented as displaying this behavior towards the shark *Carcharhinus galapagensis*, while *Elagatis bipinnulata* has been reported as rubbing against the latter and *C. falciformis* (Eibl-Eibesfeldt, 1955; Wicklund, 1969), and in the Pacific, where *Caranx melampygus* has been noted as scraping against *C. galapagensis*, and *E. bipinnulata* exhibits this behavior towards *Carcharhinus amblyrhynchos* (Papastamatiou et al., 2007). This specificity may be due to the format of shark dermal denticles, which usually present rough surfaces (Grossman et al., 2009). To the best of our knowledge, however, no documented records are available in this regard between teleosts and rays worldwide.

MATERIAL AND METHODS

Drone footage taken by RM on 12th of May 2024, 12:14 h, onboard the vessel Captain Hook (Fishing, 26.5 ft), taken during field trips from the Projects, Mantas de Ilhabela and ProBaV (Baleia a Vista Project) for the collaborative monitoring of cetaceans and elasmobranchs along the northern coast of São Paulo, Brazil, off Ilhabela, in Southeastern Brazil (23056.164'S, 45017.612'W). The footage is available on social media (Instagram: https://www.instagram.com/reel/C7ND0jypRu0/?igsh=MmR0a3FveWRxdTd0). A few days later, on the 24th of May, this behavior was observed again in Saco do Diogo, off Ilhabela, 23 56'S, 45 17'W.

RESULTS AND DISCUSSION

The drone footage revealed several leatherjackets (*Oligoplites* sp.) exhibiting cleaning symbiosis behaviour associated with a Spinetail devil ray (*Mobula mobular*) specimen (Figure 1). The Spinetail devil ray specimen was swimming at a leisurely pace about 50 cm to 1 m from the water surface, surrounded by a school of about 20 leatherjackets, all swimming in the same direction. The leatherjackets were noted on more than 10 occasions (sometimes by the same individual) as quickly scraping their bodies laterally on the dorsal surface of the Spinetail devil ray. During this behavioral sequence, no noticeable Spinetail devil ray behavior changes were observed, even though leatherjackets have sharp dorsal spines associated with the dorsal fin. Thomson & Meeuwig (2022) reported that the scrapers in their study preferred to target their head, eyes, gill covers, and lateral surfaces, which commonly harbor parasites and where damage would significantly impact fitness. This is similar to our observations, where leatherjackets mostly targeted their heads and lateral surfaces.

Figure 1. Cleaning symbiosis behaviour by leatherjackets (*Oligoplites sp.*) associated with a Spinetail devil ray (*Mobula mobular*) specimen off Ilhabela, northern São Paulo state coast, Southeastern Brazil. Note the three leatherjacket individuals scraping their heads and bodies on the Spinetail devil ray dorsum. Photo/Footage by Rafael Mesquita Ferreira.

This may comprise a case of incidental cleaning, a type of opportunistic mutualism with no apparent communication between organisms (Vaughan et al., 2016). This has been previously reported for leatherjackets on a redfin needlefish (*Strongylura notata*) (Lucas & Benkert, 1983). In that study, the authors noted both cleaning and scale-feeding behavior, by the leatherjackets, although they note that these animals were primarily feeding on zooplankton and that low proportions of ectoparasites and scales in their stomachs were noted, suggesting that this association comprised primarily neither a cleaning symbiosis nor a scale-feeding episode, but instead that the primary function of this association may be predator avoidance by leatherjackets (Lucas & Benkert, 1983). The authors go further and indicate that this may be, in fact, the primary factor involved in the association involving leatherjackets and larger fishes.

Incidental cleaning is defined by Côté (2000) as when one organism may employ another for the removal of epibionts, debris and, potentially, parasites lodged on its body surface as it might from any other suitable substrate. This definition, however, also usually encompasses feeding on the removed epibionts and debris (*e.g.*, scales), which was not observed herein, as the leatherjackets simply scraped their bodies and showed no sign of ingesting any debris. Furthermore, some authors (Grossman et al., 2009) indicate that the concept of cleaning symbiosis should not be applied to a scenario where a fish merely rubs itself against a shark or turtle, and that, instead, these animals are better seen as convenient coarse surfaces, similar to sandy or rocky bottoms, which fish use to remove external parasites, even though fish that do rub against other animals must adjust its speed and rubbing behavior to match the other animal's movements.

The present observation of a facultative cleaning symbiosis (*sensu* Lucas and Bankert, 1983) was made during an upwelling bloom, resulting in a plenitude of invertebrates, attracting thousands of rays, and even a whale shark and juvenile humpback whale to the area, observed for several days. The intrusion of these colder waters during the period can be verified at https://www.dropbox.com/scl/fi/cqia60cgaz3b1r498ycrg/sst_animation_90day_satlantic_930x580.gif?rlkey=4b2uriirmxdra77kp5e9zy732&e=1&dl=0.

Finally, it is important to note that, due to the current climate change scenario, overfishing, habitat destruction and pollution, elasmobranchs such as sharks and rays, are currently at heightened threat for extinction, and their worldwide population declines may limit interactions with other species such as those reported herein, as noted by other authors (Thomson & Meeuwig, 2022), with potentially negative ecological consequences.

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