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Parasites of Stranded Juvenile Green Turtles Chelonia Mydas (Testudines: Cheloniidae) in Rio de Janeiro, Brazil

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Abstract

Environmental pollution caused by human activities in marine ecosystems involve several contaminants that act as immunosuppressive agents to several species, favoring parasitic infections. Chelonia mydas is considered an endangered species whose populations are continually being reduced in size. Several factors contribute to this: overexploitation of eggs and adult females during nesting, capture of males and juveniles for food, habitat degradation, fungal and bacterial infections or gastrointestinal parasitic diseases. The aim of this study was to evaluate the ecto and endoparasites of stranded green turtles in Rio de Janeiro, Brazil. SIMBA database analysis reported a total of 1116 stranded green sea turtles, however only 109 carcasses were well preserved and only 53 of them were analyzed for parasite infection. Most of the samples (75%, n=40) tested positive for parasites and 64% (n=34) of them were composed of gastrointestinal parasites.. All the gastrointestinal parasites were represented by trematodes, but the most frequent one was Neoctagium travassosi, followed by Metacetabulum invaginatum and Deuterobaris intestinalis, suggesting those areas to present less anthropogenic changes, sheltering a variety of intermediate hosts. There are few Brazilian coast data available due to the country's vast extension and unviable stranded animals carcasses. Therefore, this study contributes to parasitological analysis of C. mydas in Southeast region of Brazil.

Keywords: Chelonia mydas; sea turtles; gastrointestinal parasites.

1. Introduction

Parasites are known as bioindicators of environmental health [1]. Environmental pollution caused by human activities in marine ecosystems involve several contaminants that act as immunosuppressive agents to several species, favoring parasitic infections [2]. They provide an increase in energetic cost to their host, by absorbing their nutrients and triggering stress and immune response, also affecting behavior and, eventually, death [3].

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Parasitism not only affects a single individual, but it may also influence a whole population, due to its impact on the host reproductive potential and survival [4]. Therefore, study on parasitic infection of endangered wild animals has drawn much attention [5].

Chelonia mydas, commonly known as green turtle, forages in coastal habitats occurring worldwide from tropical regions to temperate zones [6, 7]. They are considered an endangered species whose populations are continuously being reduced in size [8]. Many factors are involved: overexploitation of eggs and adult females during nesting, capture of males and juveniles in feeding areas, and habitat degradation [8], as well as gastrointestinal parasites [9-12], fungal and bacterial infections [13, 14] . In Brazil, they can be found among coast areas, mainly in Rio Grande do Norte, Pernambuco, Espírito Santo and Rio de Janeiro [15, 16]. Rio de Janeiro is considered a foraging area for the green turtle [17]. Additionally, the expansion of fishing operations and other anthropogenic activities are the main factors responsible for mortality or stranding of sea turtles [18 ,19]. However, one of main natural causes for the green turtle stranding in Rio de Janeiro are endoparasites [17]. Among gastrointestinal parasites, the most commonly found in sea turtles are helminths organisms [20, 21, 22], mainly the Spirorchiidae family [23]. It is composed by trematodes species that inhabit the circulatory system of several sea turtles species, like C. mydas, Eretmochelys imbricata and Caretta caretta [21]. There's few data concerning emerging diseases on sea turtles along the Brazilian coast due to difficulty to access carcasses available for parasitological analysis [20, 21, 24]. Therefore, the aim of this study was to evaluate the ecto and endoparasites of stranded green turtles in Rio de Janeiro, Brazil.

2. Material and Methods

Parasite data were obtained in the public domain of the Aquatic Biot's Information and Monitoring System (SIMBA). It is a platform for data sharing over the Beach Monitoring Project, that accomplishes a condition of the federal environmental licensing of Petrobras Entreprise' activities of production and flow of oil and natural gas from the Santos Basin Pre-Salt in Brazil, conducted by Ibama. Our study focused on the Rio de Janeiro state coast. The Rio de Janeiro state is located in the southeast region of Brazil, with an extension of 800km of coastline, which includes several coves and bays. It has a great diversity of ecosystems such as estuarine and lagoon systems, beaches, restingas and rocky shores [25] (Figure 1).

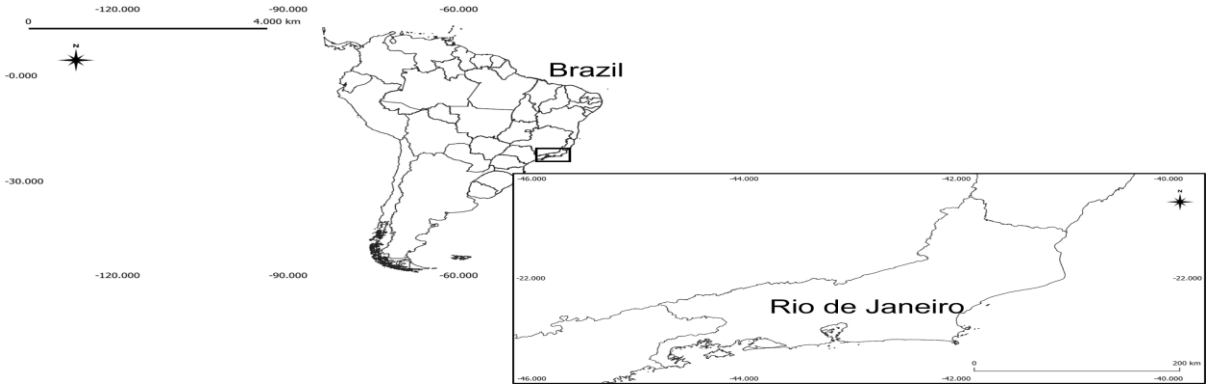

Figure 1: Data were collected on stranded green sea turtle Chelonia mydas in Rio de Janeiro state coast.

SIMBA database has several sorts of ecological information on stranded sea animals in the Brazilian coast. Data of the present study were filtered from 2019 to 2021, according to our taxonomic model, the green sea turtle C. mydas. Only the parasite and coproparasite exams of the stranded green sea turtle in the Rio de Janeiro state coast were considered. The exams were downloaded from database and results were analyzed in relation to individual sex and life stage.

3. Results

Database analysis reported a total of 1116 green sea turtles stranded in Rio de Janeiro state coast, however only 109 carcasses were well preserved and only 53 of them were analyzed for parasite infection (Figure 2). Most of the samples (75%, n=40) tested positive for parasites and 64% (n=34) of them were composed of gastrointestinal parasites, while 9% (n=5) were ectoparasite, 5% (n=3) were intracellular parasites and 2% (n=1) tested for both. Most of the samples (62%, n = 25) were represented by only one parasite infection, while 38% (n=15) presented mixed infection with at least two different parasites. The infection pattern in the stranded green sea turtles was different along the coast (Figure 3). Cluster analyses suggested a similarity in the parasite species infection of 22% between the south and the other areas, while similarity between Rio de Janeiro city and the north state was 59%. (Figure 4).

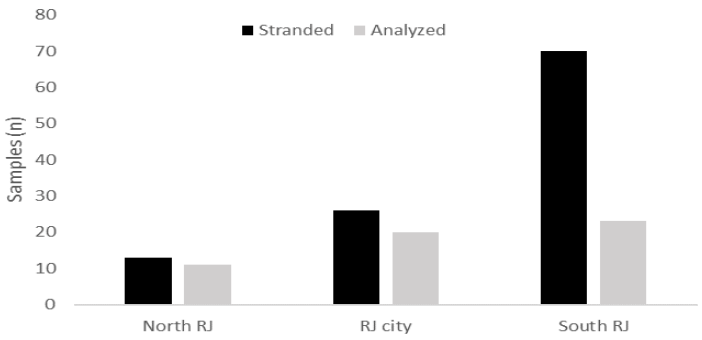

Figure 2: Number of stranded green sea turtles in Rio de Janeiro state coast and number of carcasses analyzed for parasite infection per region.

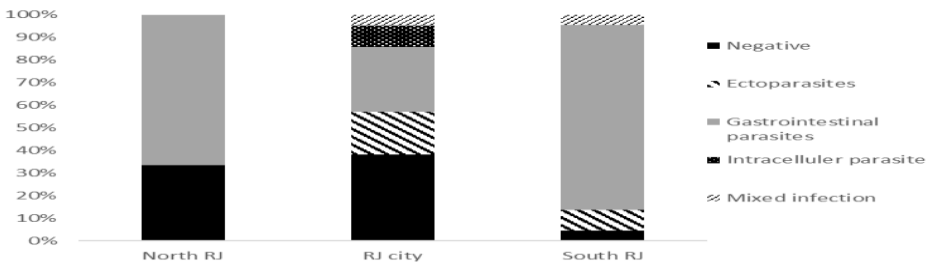

Figure 3: Parasite infection pattern of the green sea turtle Chelonia mydas along the Rio de Janeiro state coast.

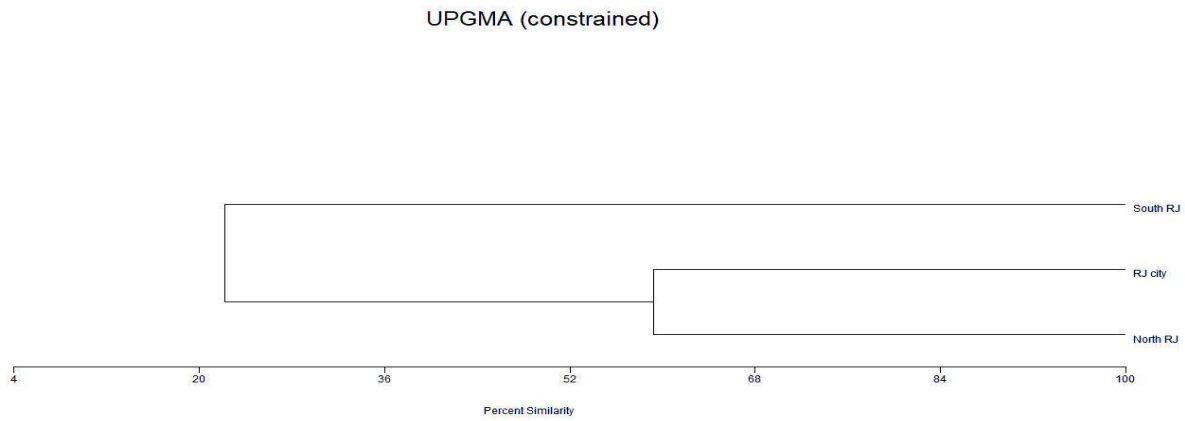

Figure 4: Cluster analyses comparing the parasite infection profile of the green sea turtle Chelonia mydas along the Rio de Janeiro state coast.

All the gastrointestinal parasites were represented by trematodes, but the most frequent one in the samples was Neoctagium travassosi with a frequency of 20% in the studied population, followed by Metacetabulum invaginatum with 16% and Deuterobaris intestinalis with 15% (Figure 5). On the other hand, the only ectoparasite species detected was Ozobranchus branchiatus with a frequency of 11% (n =6), on both adult and egg forms. The only intracellular parasites were represented by the Coccidian. Species were also different between the sampling areas, where the parasite N. travassosi was the most frequent species in the south Rio de Janeiro, while the gastrointestinal parasite Cricocephalus albus and the ectoparasite O. branchiatus were in the north and the ectoparasite O. branchiatus was the most frequent in Rio de Janeiro city (Figure 6).

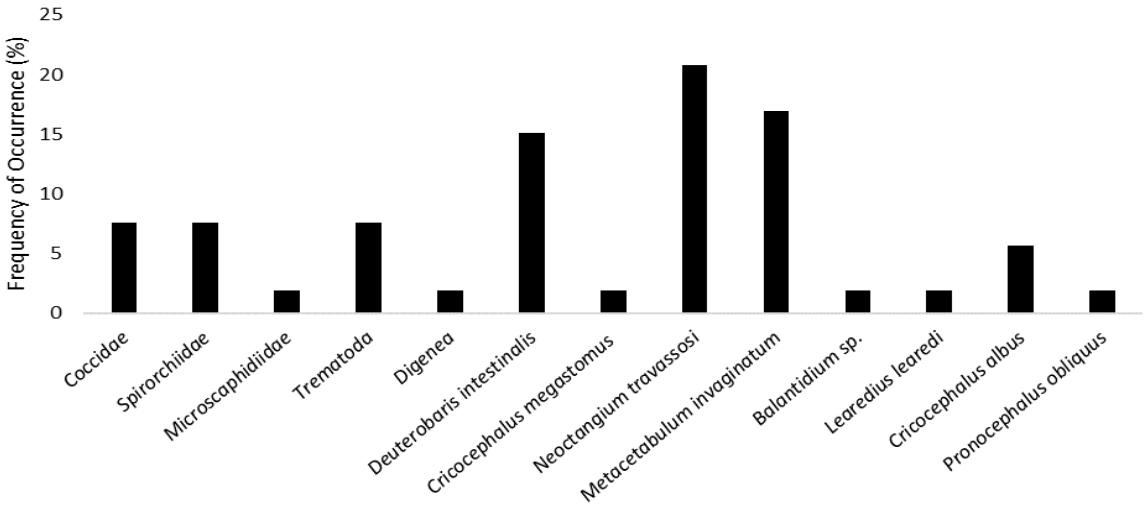

Figure 5: Frequency of occurrence of parasites in stranded green sea turtles along the Rio de Janeiro state coast.

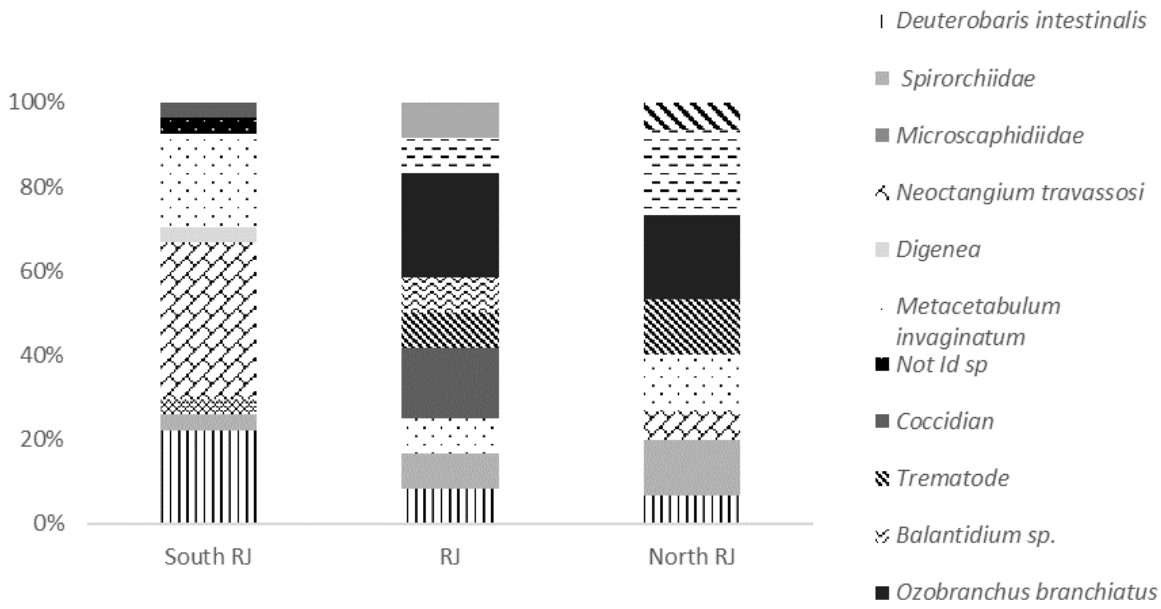

Figure 6: Parasite species occurrence in the three study sites along the Rio de Janeiro state coast.

4. Discussion

Currently, emerging infectious diseases are one of the main threats to global biodiversity of sea turtles [26-29]. Gastrointestinal parasites are considered one of the most adapted organisms to marine environments as well as their host, mainly due to sea turtles migratory habits [11]. This characteristic contributes to reduce the number of healthy sea animals. In the present study, 53 carcasses were analyzed for parasite infection, from a total of 1116 stranded sea turtles found in Rio de Janeiro state coast. The difficulty in accessing fresh carcasses of these sea animals are mainly due to the current lack of knowledge of the potential negative impact of anthropogenic factors and the recognition of emerging diseases [24]. Our data demonstrated that 75% were positive for parasites and 64% of them were gastrointestinal. Helminths are the main group of parasites detected on C. mydas carcasses along the Brazilian coast [20,21, 22, 30]. In our study, the most frequent parasites in the samples also belonged to the helminths group. The main species identified were N. travassosi with a frequency of 20% in the studied population, followed by M. invaginatum with 16% and Deuterobaris intestinalis with 15%. Gomes and his colleagues (2017) also observed these three species on the sea coast of Espírito Santo, Brazil, presenting 61,1%, 61,1% and 19,4% of prevalence, respectively [30]. The parasites N. travassosi and M. invaginatum can be usually found in the urinary bladder, esophagus, small and large intestine of infected sea turtles, mainly C. mydas. N. travassosi has been observed in Brazil, Trindad and Porto Rico [20, 21, 22]. D. intestinalis habits small and large intestines of Testudines and has been recently observed for the first time in Brazilian coast [22]. Other parasite groups were also observed after carcasses parasitological analysis. The Spirorchiidae family presented an almost 10% frequency of occurrence. They are classified as a blood flukes parasitizing sea turtles worldwide and may cause a wide range of inflammatory reactions in the vascular system frequently implicated with stranding and death [10,20,21,31]. Santoro and colleagues (2020) [32] also observed sea turtles infected with spirorchiid flukes. A total of 319 carcasses were screened along the Tyrrhenian coast

and the north-western Adriatic coast, 56 of them were infected with this group of parasites. In Brazil, a study in São Paulo and Rio de Janeiro coast, reported the occurrence of Amphiorchis indicus Mehrotra, 1973 (Digenea, Spirorchiidae), in C. mydas for the first time [23].This parasite was isolated on gastrointestinal tract and the liver of C. mydas carcasses after necropsy [23].There are few studies on the occurrence of parasites from the family Spirorchiidae in Brazil, the present work contributes to parasitological analysis on Brazilian coast. Gastrointestinal parasites usually depend on an intermediate host to complete their life cycle and get to the final host [33]. Trematodes, for example, which were the most frequent parasite group in the present study samples, have as their first host molluscs and for second host crustacean, molluscs and some vertebrates [34]. Therefore, any environmental changes that could reduce the intermediate host, could also reflect on the level of parasite infection on the sea turtle. The present study reported that the stranded sea turtles along the south and north coast of Rio de Janeiro were majorly infected by trematodes, suggesting those areas to present less anthropogenic changes, sheltering a variety of intermediate hosts. Indeed the south coast from Rio de Janeiro has one of the largest Conservation Unit named Estação Ecológica de Tamoios, which provides protection to the rocky reef and their biological components. Trematodes were also the most abundant parasite in green sea turtles from other countries, as for Costa Rica [35]. Other sea turtle species, also reported the prevalence of trematodes for the loggerhead sea turtle Caretta caretta of the Adriatic Sea [4,36], as well as for the leatherback turtle Dermochelys coriacea of the Mediterranean Sea, which was also infected by Digenea [37]. Digean parasite has also been reported for the hawksbill sea turtle Eretmochelys imbricata of Senegal [38]. Coccidiosis in chelonians is considered an emerging infectious disease [39, 40]. Since the 1970s the C. mydas mortality associated with a coccidia infection was reported, coccidiosis outbreak were observed in different areas such as: US, Hawaii and Australia [39,41]. Recent analysis points to an interoceanic spread of these parasites, which could be a potential risk to sea turtle communities [39]. Besides enterocolitis, this parasite can migrate to kidney and brain, leading to abnormal neurological signs attributed to meningoencephalitis [39]. Even with a low incidence of this parasite in Rio de Janeiro state, attention should be applied in order to follow a possible Green turtle coccidiosis outbreak in Brazil. On the other hand, the Rio de Janeiro city, had the least frequency of trematodes and the largest of ectoparasites, which also represents an environmental bioindicator. Ectoparasites usually have a direct life cycle, without an intermediate host [29], resulting in infection increase under polluted environments [42]. In the Rio de Janeiro city coast we can find Guanabara bay, a highly polluted site, with heavy metal contamination, wastewater discharge, floating garbage and other industrial pollutants [43]. Our results suggest an influence of environmental pollution on ectoparasite infection in this area. It is a high conservation concern, because Ozobranchus sp. is know to be the most likely vector of herpesvirus associated with the fibropapillomatosis in sea turtles [44], also causing erosion of soft tissues and death [45]. The present study contributes to parasitological data of sea turtles from the Brazilian coast, mainly, Rio de Janeiro state area, thus providing important information about helminth fauna in this region and broadening the geographical distribution of parasite species. However, further studies of the parasite influence on sea turtle ecology should be conducted.

4. Conclusion

Environmental pollution caused by human activities in marine ecosystems involves several contaminants that act as immunosuppressive agents to several species, favoring parasitic infections. Parasitological analysis of sea turtles carcasses are considered as bioindicators of environmental health. There are few Brazilian coast data available due to the country's vast extension and unviable stranded animals carcasses. Therefore, this study contributes to parasitological analysis of Chelonia mydas in the Southeast region of Brazil.

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