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Attitudes towards conservation and fishing interaction with sea turtles in the southeast coast of Brazil

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ABSTRACT

In Brazil populations of marine turtles are mainly threatened by fishing, they are accidentally captured in virtually all types of fishing. The rescue of fishing folk wisdom could help reduce these catches. The aim of this study was to discuss the interactions between fishing and sea turtles. From September 2012 to January 2014 44 fishermen and 7 gatherers were interviewed, in the southern state of Espírito Santo. Ten Questions to build the Index of Positive Attitudes towards the conservation of marine turtles were selected (IPA). The IPA was different between the three cities, indicating different types of interactions in the region, the highest rates were found in Guarapari and smallest in Anchieta, the most important factor being the type of contact with the animal where in Guarapari most respondents were gatherers, while in Anchieta they were net fishermen. There was no significant difference between the IPA for these and for respondents who already participate in environment-related matters. To assess the impacts of bycatch, fishermen using longlines and net gear that offer high risk were considered. More than half reported that marine turtles are frequently caught in nets and longlines, including in some cases the animal being tapped for consumption. Policies to mitigate bycatch and quantify the impact of fishing activities become necessary in the region, as the impact of these activities is threatening the population of sea turtles on site.

1. Introduction

Currently there are seven species of sea turtles in the world, and five of them are found on the Brazilian coast (Marcovaldi and Marcovaldi, 1999), they are: *Caretta caretta* (Linnaeus, 1758), *Chelonia mydas* (Linnaeus, 1758) and *Lepidochelys olivacea* (Eschscholtz, 1829), which are in the endangered category, and *Dermochelys coriacea* (Linnaeus, 1766) and *Eretmochelys imbricata* (Linnaeus, 1766), which are in the critically endangered category (IUCN, 2015). The other turtles that do not occur in Brazil are *Natator depressus* (Garman, 1880), endemic to Australia and *Lepidochelys kempii* (Garman, 1880), found in the Gulf of Mexico, both classified as threatened (IUCN, 2015). Our coastal region is a priority area for conservation of sea turtles globally (Wallace et al., 2011; Selig et al., 2014; Carvalho et al., 2015).

Threats to populations of marine turtles in Brazil include: landfills, vehicle traffic, human presence on the beaches, ports, harbors and piers, waterfront occupation (hotels and condos), and exploitation of oil and gas, lighting of beaches, diseases (Santos et al., 2011) and, especially, mortality in fishing nets (Almeida et al., 2011). Globally they also suffer impacts of pollution (Ragland et al., 2011; Stewart et al., 2011) and the effects of climate change on reproduction (Hulin et al., 2009).

In Brazil these animals are caught incidentally in virtually all types of fishing, with the highest mortality rates in driftnets (Almeida et al., 2011). It is extremely important to know the impacts of different fishing gear, not only in Brazil but in other neighboring countries, as evidenced by González-Carman et al.

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(2012), migratory species turtles having contact with different fleets during their displacement.

The rescue of the popular wisdom of fishermen on the biology of sea turtles can assist in the search for decreased bycatch. Known lethal fishing gear measures can be formulated to decrease the risk they represent, through scientific research on the subject, the recognition of local knowledge is important in the dialogue with scientific study for conservation of habitats (Bahia and Bondioli, 2010).

The complex of traditional ecological knowledge, practices and beliefs tends to be empirical and is closely related to the way of life of traditional communities (Berkes, 2003). It is crucial to make an inventory of the uses and practices of traditional societies, because these communities are custodians of a considerable part of mankind's knowledge of biodiversity (Diegues et al., 2000).

The traditional ecological knowledge accumulated through generations and interactions between people and nature and its application through the usual ecological management plans can be useful in modern conservation programs. Its use in conservation includes: folk taxonomy, knowledge of species and ecological interactions (Drew, 2005). Also according to this author, conservationists can make a fair exchange of knowledge and promote shared responsibility with local communities.

The aim of this study was to discuss the interactions between fishing and sea turtles in the southern state of Espírito Santo, southeastern Brazil.

2. Materials and methods

2.1. Study site

The study area is located in the southern state of Espírito Santo, in the cities of Anchieta and Piúma that are part of the Bay of Benevente. The Bay comprises the municipalities of Anchieta (20°S; 40°W) and the Balneario [group of beaches] of Iriri, Piúma and Itaoca (21°S; 40°W) (Fig. 1). The region is influenced by the Benevente rivers: Anchieta, Piúma, Itapemirim (between the municipalities of Itapemirim and Marataízes) and Itabapoana (bordering the state of Rio de Janeiro). The Guarapari stands out for having the second largest number of fishing vessels in the state and the fourth in number of fishermen and gatherers (Teixeira et al., 2012).

The shallow continental shelf south of Espírito Santo consists of distinct formations with submerged rocky reefs, an island complex formed of the islands of the region, banks of calcareous algae, truncated submerged reefs and biogenic bottoms (Pinheiro et al., 2010).

In 2010, in a search for an environmental diagnosis of the southern coast of the state of Espírito Santo, additional studies for the creation of a marine protected area were held in which the mapping was also carried out of marine habitats of the southern coast of Espírito Santo (Pinheiro et al., 2010). The area has one of the main spawning sites of *C. caretta* (Santos et al., 2011), and is an important feeding ground of *C. mydas* (Almeida et al., 2011).

2.2. Data collection

In the present study we carried out six field trips, lasting three to ten days, from September 2012 to January 2014 in the municipalities of Piúma, Anchieta and Guarapari, Espírito Santo, totaling 50 days of collection. Information related to local knowledge and interaction between fishermen and sea turtles was collected through interviews, using a semi-structured questionnaire with open and closed questions, with traditional fishermen living in Piúma belonging to the fishing colony of Zone-9 (20° 51′S, 40° 43′W), traditional fishermen living in Anchieta belonging to the fishing colony of Zone-4 (20° 48′S, 40° 39′W) and traditional fishermen living in the city of Guarapari belonging to the fishing colony of Zone-3 (20° 40′S, 40° 30′W), an identification board was used at the end of each interview for the recognition of turtle species mentioned during the interview.

Interviews were conducted with fishermen appointed by the president of the colony and by other fishermen and interviews were conducted in fishing villages and in locations near colonies such as ports and fish markets. The study was authorized by the presidents of the colonies and approved by the Research Ethics Committee of the Federal University of Juiz de Fora.

To assess the impacts of bycatch the respondents who use longline and net were considered, these being the predominant fishing gear in the scientific literature related to incidental catch of sea turtles (Almeida et al., 2011; Pupo et al., 2006). With regard to fishing gear, fishermen were divided into three types of fishing: Nets, longline and gatherers. The net category was widespread due to the similarity between the practices considered (trawl nets, and gillnets) that are the types of nets used in these locations (Netto and Di Beneditto, 2007).

2.3. Fishing profile

The State of Espírito Santo has 36 fishing ports distributed along the 10 Fishery Zones (centralized administrative headquarters of the colonies in the region) distributed on the coast of the Espírito Santo (Z-01 to Z-10) (Netto and Di Beneditto, 2007). Each Fishing Zone has a fishing colony, which has a legal president, and decisions are made before assemblies. The colony is responsible to the government agencies for issuing certificates and fishing licenses, and also can provide other services like health and job training.

2.3.1. Fishing colony zone – 3 "Almirante Noronha", County Guarapari

The Colony Almirante Noronha – Guarapari, was founded in 1926 in order to save the coast, through Federal Decree. At the headquarters there are a dental office and a doctor's office. There are approximately 1500 members who are residents in Guarapari. There are approximately 500 registered vessels in sizes ranging between 6 and 15 m, and most over 10 m. The average income of members varies between 2 and 3 minimum wages (Fundação Promar, 2005, Teixeira et al., 2012), The fishing area is between the northern coast of the state of Rio de Janeiro to the south of Bahia. Small and medium vessels fish at a distance of 30 miles from shore and the large boats up to 350 miles, fishing gear used includes: Trawl nets, Gillnets, Handline and Longline (CEPEMAR, 2011).

2.3.2. Fishing Colony zone – 4 "MarcílioDias", County Anchieta

The fishing category in Anchieta is manual and mid-size industrial. 600 fishermen are registered in the colony, in the seven fishing communities of Anchieta. The Second Fishing Census conducted in 2008 showed that 146 fishermen are active in the Anchieta headquarters. The fishing fleet is estimated at 200 motorboats.

Of these, about 70 work in shrimp fishing, 80 fish at sea and about 50 fish near shore and in the Anchieta and Benevente rivers. There are approximately eight rowing canoes fishing from the central beach of Anchieta. The fishing gear used include: a) Shrimp Trawl – balloons (trawl nets), b) Drift nets and bottom nets, c) Trolling, d) Cast nets and seines (beach seine) (CEPEMAR, 2011).

Created in order to save the coast, today the colonies operate with the legalization of the associated document. The fishing area is between Abrolhos – BA and Cabo de Santa Marta – SC, and the small boats use areas between Guarapari and Pontal in Marataízes at a distance of 15 miles from the coast at a depth of 60 m, while larger boats fish are at a distance of 50–60 miles offshore in depths