Influences of conservation action on attitudes and knowledge of fishermen towards sea turtles along the southeastern Brazil

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ABSTRACT

This study describes the local ecological knowledge (LEK) about the sea turtles of fishermen from the communities of São Francisco de Itabapoana (SFI), Atafona (ATF), Farol de São Tomé (FST) and Cabo Frio (CF), southeastern Brazil (~ 21–23°S). The influence of the National Program for the Conservation of Sea Turtles on the fishermen's perception of and attitudes towards sea turtles were also evaluated. The results based in 80 interviews showed that the green turtle (*Chelonia mydas*) is the species most frequently observed and incidentally captured in bottom trawl nets, gillnets and fishing lines along the region. In general, fishermen know about occurrence and preferential diet of the sea turtles along the study area. Fishing and pollution were the main threats. In SFI and FST (where the Program is present) and in CF (where the Program is absent), most interviewees reported that when the capture occurs and the sea turtle 'appears' to be dead, they release it immediately in the sea, which is bad for turtles as they may drown. In ATF (where the Program is absent), most interviewees reported that they attempt to resuscitate the sea turtle when it 'appears' to be dead. The 15+ year presence of the Program in the region (SFI and FST) and its local strategies have discrete influence about fishermen's perception of and attitudes towards sea turtles; instead, knowledge of sea turtles derives from regional fishing practices. This study proposes redirecting the Program's strategies so that the fishing communities act as local conservation agents.

1. Introduction

Sea turtles are protected by specific laws and conservation actions in many countries, but their populations continue to be threatened by factors such as incidental capture in fisheries, illegal egg collection, loss of feeding and breeding habitats and pollution [1–3]. Brazil is considered a priority area for the conservation of these animals due to the occurrence of five species: loggerhead (*Caretta caretta* Linnaeus, 1758), green (*Chelonia mydas* Linnaeus, 1758), olive ridley (*Lepidochelys olivacea* Eschscholtz, 1829), leatherback (*Dermochelys coriacea* Linnaeus, 1766) and hawksbill (*Eretmochelys imbricata* Linnaeus, 1766) [4]. However, these species are also threatened by the abovementioned factors in Brazilian waters [4–6].

Incidental capture in fisheries is primarily responsible for the decline of sea turtles populations worldwide with records involving various fishing gears such as trawl nets, gillnets and fishing lines [5,7,8], so fishing communities are directly involved in the conservation of these animals. The knowledge of the members of these communities about

the natural resources that are part of their economy or subsistence is termed traditional or local ecological knowledge (LEK). The LEK is acquired through personal experiences and transmitted between family members or from older to younger people in the community [9,10]. This knowledge is an important source of information for studies related to the environment and organisms of a given region [11–13]. Since the last decade, studies on the perception, knowledge and interaction of fishermen with the sea turtles have increased worldwide. They provide relevant data for the species conservation, especially regarding the impact of fishing on population declines [6,14–20].

Conservation actions or programs should integrate scientific and educational activities with the local communities to enable ecological, cultural, social, economic and political development [21]. Many programs around the world have shown positive results regarding behavioral changes of the fishermen and their engagement in conservation initiatives [22–26]. In contrast, there are situations with less engagement between communities' members and researchers/government institutions, with
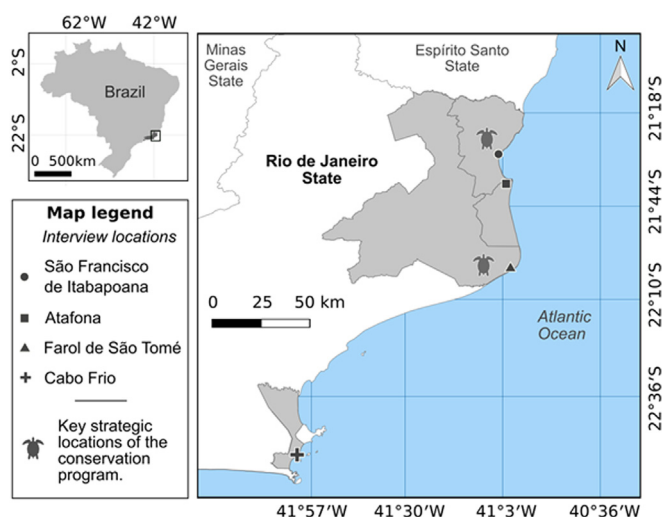

Fig. 1. Location of the study area in Rio de Janeiro state, southeastern Brazil, indicating the fishing communities and the physical facilities of the National Sea Turtle Conservation Program.

lack of confidence that harms the conservation programs and their effectiveness [27–29].

Many sea turtles conservation programs conduct research on the biology, migratory patterns, population genetics and incidental capture of species, but primarily report the results to the scientific community and environmental managers [30–33]. The lack of a return of research results to the fishing communities is common and interferes with local participation in animal conservation [34].

In Brazil, sea turtles have been protected since the 1980's, with the creation of the National Program for the Conservation of Sea Turtles (hereafter referred to as the Program), which became the main responsible for the protection and research activities of these animals [4]. Previously to the beginning of this Program there was no regular information about the sea turtles in Brazil. In 1998, the Brazilian Federal Law no. 9605 provided for sanctions and penalties for capture, killing, egg collection and habitat disturbance of wild fauna. In 1999, Brazil ratified the International Convention for the Protection and Conservation of Turtles (CIT).

The objectives of the study are as follows: i) to describe the LEK of fishermen about sea turtles in southeastern Brazil (~ 21°S) and ii) to evaluate the influence of the Program on fishermen's perceptions of and attitudes towards sea turtles. Fishermen working in areas under the direct influence of the Program are expected to demonstrate greater knowledge of the biology, ecology and conservation of sea turtles, with positive attitudes related to mitigating the impacts of fishing activities on these animals. In addition, this study proposes strategies to empower fishing communities to act as local conservation agents.

2. Materials and methods

2.1. Study area

This study was carried out in four fishing communities from Rio de Janeiro state, southeastern Brazil: São Francisco de Itabapoana (21°18'S, 40°57'W), Atafona (21°37'S, 41°03'W), Farol de São Tomé (21°45'S, 41°19'W) and Cabo Frio (22°52'S; 42°01′W) (Fig. 1). Artisanal coastal fishing is one of the main economic activities in this region. Considering the four communities, the fishing vessels (5–15 m) are made of wood, men predominantly carry out the fishing and the main fishing gear is bottom trawl net for shrimps capture, besides gillnets and fishing lines [35–37]. The Program has physical facilities in São Francisco de Itabapoana and Farol de São Tomé that have been continuously active since 2001 and 2002, respectively. Around the communities of Atafona and Cabo Frio the Program is absent.

2.2. Data collection

Between January and May 2016, 20 fishermen were interviewed in each community, totalling 80 ethnographic interviews. The number of interviews in Ethnoscience studies depends on the data saturation, which is the moment when the data reported tend to repeat themselves without adding new relevant information [38,39]. When the population of interest is homogeneous, as in the case of the present study (fishermen based in a given community), 12–20 interviews are sufficient to express representative results [40–42]. Here we use an approach combining the percentage frequencies of the responses to the questionnaire (quantitative information) and the description of LEK. This prevented us to be biased by the limitations of both techniques, especially because culture and symbolism cannot be measurable by means of quantitative measurements [40,43,44].

The choice of respondents was based on the following criteria: (i) to be fisherman in the region, (ii) to have fishing as the main economic activity and (iii) to use fishing gears which have the potential for incidental captures of sea turtles (bottom trawl nets, gillnets or fishing lines, according to the literature). In each community, the fishermen were approached at the landings areas and chosen opportunistically, checking the criteria indicated above and their availability to respond to the questionnaire.

The interviews were informal conversations based on a semi-structured questionnaire containing open and closed questions [45]. The questions were divided into four categories: (i) profile of the fisherman, (ii) characteristics of local fishing, (iii) LEK about the biology and ecology of sea turtles, considering general characteristics, and (iv) fisherman's interaction with and attitudes towards sea turtles, considering all species (Box 1). In category ii, although it is common to use more than one type of fishing gear, the answer refers to the most used gear by the interviewed fisherman. For category iv, we verify how the fisherman acts in relation to the captures, if he knows resuscitation mechanisms and mitigating actions, regardless the fishing gear used.

Box 1

Ethnographic questionnaire topics, information and number of questions asked of fishermen in Rio de Janeiro state, southeastern Brazil.

Topic	Information	Nº questions
Fisherman profile	Age, schooling, length of residence in the region, monthly income, number of dependents, housing characteristics and internet access	10
Characteristics of local artisanal fishing	Time of fishing activity, vessel characteristics, main fishing gear and target species	7
LEK – sea turtle biology and ecology, considering general characteristics	Presence and identification of species in the region; body size, feeding, reproduction and predation behaviour and local conservation	15
Fisherman's interaction with sea turtles, considering all species	Incidental capture while fishing, fisherman's behaviour during incidental captures, presence of the conservation Program and fisherman's knowledge of sea turtle conservation	19