



UNIVERSIDADE ESTADUAL DE SANTA CRUZ
PÓS-GRADUAÇÃO EM ECOLOGIA E CONSERVAÇÃO
DA BIODIVERSIDADE



**Atitudes de conservação e Conhecimento de
pescadores artesanais sobre tartarugas marinhas
(Reptilia: Testudines) no Sul da Bahia, Brasil**

Heitor de Oliveira Braga

Orientador: Dr. Alexandre Schiavetti

**Ilhéus-Bahia
2012**

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(Reptilia: Testudines) no Sul da Bahia, Brasil**

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Orientador: Dr. Alexandre Schiavetti

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pescadores artesanais sobre tartarugas marinhas
(Reptilia: Testudines) no Sul da Bahia, Brasil**

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**Ilhéus-Bahia
2012**

***Dedico à minha família, em
especial a minha querida avó
materna Gilma Alves de Oliveira.***

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Francisco Cândido Xavier

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RESUMO

Há registro de sete espécies de tartarugas marinhas no mundo. Dessas, cinco são encontradas na costa litorânea do Brasil. Numa esfera global todas essas espécies se encontram em algum grau de ameaça. Diversas são as causas da redução da população desse quelônio nos últimos anos. Não obstante, a interação com a pesca representa o maior fator de mortalidade desses táxons, com destaque a duas artes de pesca: rede de arrasto e rede de lagosta. Devido aos poucos estudos com comunidades pesqueiras tradicionais e tartarugas marinhas na região Sul da Bahia, o presente trabalho buscou identificar e avaliar o conhecimento ecológico e as possíveis atitudes tomadas pelos pescadores artesanais em relação à conservação e a captura accidental de tartarugas marinhas em Ilhéus, Sul da Bahia, Brasil. A pesquisa foi conduzida com 30 pescadores especialistas, reconhecidos como os detentores do conhecimento sobre a pesca na região. O conhecimento e as atitudes em relação à conservação de tartarugas marinhas foram respectivamente médio e moderado, segundo os parâmetros de classificação adotados (baseado na escala de likert e Alfa de Cronbach). As atitudes mediram o grau de consciência do entrevistado sobre o estado de conservação das tartarugas e as tendências em terem ações favoráveis ou/e desfavoráveis em relação à manutenção da população de tartarugas na região de estudo. Possíveis áreas de desovas foram relatadas pelos especialistas. Alguns comportamentos e dados ecológicos do quelônio em estudo foram corroborados com a literatura científica. A maioria dos pescadores mencionou ter capturado tartarugas durante alguma operação de pesca recentemente. As regiões costeiras de Ilhéus, Olivença e Acuípe foram destacadas como áreas de grande probabilidade de captura accidental. As últimas capturas foram atribuídas à linha de pesca. Entretanto, segundo especialistas, a rede de lagosta e a rede de camarão apresentam maior probabilidade de captura do animal. O conhecimento e as atitudes não mostraram relação com a idade, número de filhos e tempo de associação com a colônia de pescadores. Conhecimento e atitudes foram fracamente inversamente correlacionados ($r = -0.38$, $p = 0.04$). O nível educacional do entrevistado mostrou ter uma relação positiva com atitudes positivas em relação à conservação do recurso ($H = 8.33$; $p = 0.04$). Foram identificados crenças e tabus alimentares (tabus segmentares, tabus de história de vida, tabus de hábitat e tabu exógeno). A espécie *Lepidochelys olivacea* (Eschscholtz, 1829) foi o único registro de captura accidental na região e a CPUE para uma embarcação de rede de arrasto foi de 13.07 tartarugas por hora de arte de pesca no mar. Estudos etnoecológicos, continuação de projetos de educação ambiental,

monitoramento de áreas de desovas e a utilização de recursos pesqueiros moderadamente são recomendados para o Sul da Bahia.

Palavras-chave: Reptilia; Cheloniidae; Dermochelyidae, conhecimento ecológico tradicional, atitudes, captura acidental; conservação.

ABSTRACT

In the world are found seven species of sea turtles. Of these, five are found in the littoral coast of Brazil. In a global sphere all these species if find in some degree of threat. Several cause of declining population in recent years this turtle. Nevertheless, interaction with fishing is the biggest factor in degradation of these táxon, especially the two gears: trawl net and lobster. Due to few studies with traditional fishing communities and marine turtles in the southern region of Bahia, this study investigates fishermen's ecological knowledge about sea turtles and attitudes towards conservation and bycatch of sea turtles in Ilhéus, Southern of Bahia, Brazil. The research was conducted with 30 fishermen specialists, recognized as the holders of knowledge about fishing in the region. The knowledge and attitudes towards the conservation of sea turtles were respectively medium and moderate according to the classification parameters adopted (based on Likert scale and Cronbach's Alpha). The attitudes measured the degree of awareness of the respondent on the conservation status of turtles and trends were favorable and unfavorable actions in relation to the maintenance of the turtle population in the study region. Potential areas of spawning were reported by the interviewed experts. Some behaviors and ecological data of the turtle in the study were corroborated with scientific literature. Most fishers interviewed mentioned having captured turtle during a recent fishing operation. On the coast of Ilhéus, Olivença and Acuípe were pointed areas of high probability of bycatch. The latest catches were attributed to the fishing line, but according to the respondents, the network of lobster and shrimp are more likely to capture the animal. The knowledge and attitudes showed no relation with age, number of children and time associated with the colony of fishermen ($r = -0.38$, $p = 0.04$). The educational level of the respondent showed a positive relationship with positive attitudes towards the conservation of the resource ($H = 8.33$, $p = 0.04$). In 50% of the respondents were identified beliefs and taboos (segmental taboos, life history taboos, habitat taboos and exogenous taboos). *Lepidochelys olivacea* (Eschscholtz, 1829) was the only record of bycatch in the region and CPUE for to just one trawl fishing boat was 13.07 turtles per hour of fishing gear at sea. Ethno-ecological studies, continuing environmental education projects, monitoring of spawning areas and the use of fishery resources moderate strategies can assist in conservation of marine turtles.

Key-words: Reptilia; Cheloniidae; Dermochelyidae; traditional ecological knowledge; attitudes, bycatch, conservation.

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INTRODUÇÃO GERAL

Existem registros de sete espécies de tartarugas marinhas no mundo, agrupadas em duas famílias: Dermochelyidae e Cheloniidae. Dessas, cinco são encontradas na costa Brasileira (Marcovaldi e Laurent 1996; Marcovaldi e Marcovaldi 1999). Em uma escala global, todas essas espécies se encontram em algum grau de ameaça de extinção, segundo a União Internacional para a Conservação da Natureza (IUCN 2012), sendo a tartaruga-verde (*Chelonia mydas*; Linnaeus, 1758) e a tartaruga cabeçuda (*Caretta caretta*; Linnaeus, 1758), consideradas espécies em perigo de extinção, a tartaruga-oliva (*Lepidochelys olivacea*; Eschscholtz, 1829) vulnerável a extinção, a tartaruga-de-couro (*Dermochelys coriacea*; Vandelli, 1761) e a tartaruga-de-pente (*Eretmochelys imbricata*; Linnaeus, 1766), espécies criticamente ameaçadas.

O Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio) juntamente com o Tamar (Projeto Tartarugas marinhas) avaliou o risco de extinção das cinco espécies de tartarugas marinhas pertencentes a fauna marinha brasileira, relatando a tartaruga-verde *C. mydas* como espécie vulnerável (VU), *C. caretta* e *L. olivacea* em perigo (EM) e *E. imbricata* e a *D. coriacea* criticamente em perigo (CR), o que demonstra uma redução da população desses nos últimos anos na costa litorânea do Brasil (Almeida et al. 2011a; Almeida et al. 2011b; Castilhos et al. 2011; Marcovaldi et al. 2011; Santos et al. 2011).

Atividades humanas como o trânsito de veículos nas praias, poluição por plástico e petróleo, contaminação por patógenos, captura accidental pela pesca, encalhes, coleta de ovos e fêmeas nas praias, mudanças globais, colisões com embarcações e dragagem de portos e canais podem ser citadas como as principais causas da depredação da população de tartarugas marinhas em todo o mundo (National Research Council 1990; Marcovaldi e Thome 1999; Bugoni et al. 2001; Shanker e Pilcher 2003; Kotas et al. 2004; Tisdell e Wilson 2005; Mast et al. 2005; Coelho 2009; Tamar 2012).

Além disso, a interação com a pesca representa um grande fator de mortalidade de tartarugas marinhas (Crouse 1984; Epperly et al. 1996; Oravetz 1999; Poiner e Harris 1996; Cheng e Chen 1997; Spotila et al. 2000; Domingo

et al. 2006; Casale et al. 2004; Pinedo e Polacheck 2004; Carranza et al. 2006). Dentre diferentes artes de pesca, a rede de arrasto e a rede de lagosta se destacam pela maior probabilidade de acometer e gerar alguns transtornos leves, lesões e até o óbito de tartarugas marinhas (Shanker e Pitcher 2003; Casale et al. 2004; Gallo et al. 2006; Marcovaldi et al. 2009; Wallace et al. 2011; Moore et al. 2010).

No Brasil, os equipamentos artesanais são os mais usados na costa litorânea (MPA 2012). Porém, estudos sobre a pesca artesanal e a interação entre recursos naturais e comunidades pesqueiras tradicionais no Brasil ainda são pouco realizados e não apresentam uma estatística referencial apropriada sobre tal atividade (Pacheco 2003; Souto 2008). Uma lacuna importante diz respeito às informações sobre a captura acidental de tartarugas marinhas (Pupo et al. 2006).

Averiguar as possíveis atitudes de membros de comunidades tradicionais, referentes à conservação de um determinado recurso pode ter grande importância para a preservação do ecossistema (Alexander 2000). Essas atitudes oriundas da fauna são formadas por percepções, conhecimentos, crenças, mitos, valores e a integração dessas com o meio natural (Drews 2002).

A investigação dos saberes tradicionais, estratégias e as próprias atitudes através da etnoecologia representam uma ferramenta para auxiliar o manejo apropriado de recursos naturais, além de buscar valorizar esse mundo de diversas maneiras com participação integral dos atores locais dessas comunidades tradicionais (Toledo 1992; Nazarea 1999; Toledo e Barrera-Bassols 2010). Além disso, as informações a respeito do conhecimento do meio ambiente, coletadas através de comunidades podem contribuir para o conhecimento da biologia de diversos organismos e suas interações com o meio (Begossi et al. 2002), além de proporcionar dados importantes para decisões de formuladores de política e pesquisadores (Stave et al. 2007, Brook 2007, Brook e McLachlan 2008).

Os diversos impactos gerados ao meio ambiente provenientes dessa interação homem-meio são conhecidos por serem intermediados pelos

sentimentos, comportamentos, conhecimentos e crenças (Marques 2001). Entender e compreender a memória bio-cultural oriunda do saber local de uma determinada comunidade tradicional, além de buscar dar importância àqueles que a representam e colaboram com sua existência (Toledo e Barrera-Bassols 2010) está cada vez mais sendo utilizada e incorporada frente às mudanças ambientais e sociais (Davis e Wagner 2003).

Através de estudos ecológicos de comunidades tradicionais, pode-se avaliar rapidamente a perda da biodiversidade e a importância da conservação de recursos em esgotamento e do envolvimento sustentável para as presentes e futuras gerações. Pela escassez de estudos sobre tartarugas marinhas na região de Ilhéus, o estudo desses quelônios dentro de uma perspectiva etnoecológica representa um primeiro passo para a incorporação de políticas de gestão dos recursos naturais, possibilitando definir estratégias de conservação (manejo e co-manejo) juntamente com a comunidade envolvida.

Nessa perspectiva, o presente estudo tem como objetivo identificar e avaliar o conhecimento ecológico e as possíveis atitudes tomadas pelos pescadores artesanais em relação à conservação e a captura acidental de tartarugas marinhas na região de Ilhéus, Sul da Bahia, Brasil.

A dissertação foi desenvolvida através da colaboração do Programa de Ecologia e Conservação da Biodiversidade, da Universidade Estadual de Santa Cruz (UESC) e seguiu os padrões de publicação da revista *Chelonian Conservation and Biology*, cujo principal produto é o artigo intitulado: "Attitudes and traditional ecological knowledge of experts fishermen in relation to conservation and bycatch of sea turtles (Reptilia: Testudines), Southern Bahia, Brazil."

Esta pesquisa foi aprovada pelo Comitê de Ética em Pesquisa da Universidade Estadual de Santa Cruz (ANEXO 1) e autorizada pelo Instituto Brasileiro do Meio Ambiente e dos Recursos Renováveis - IBAMA e pelo Instituto Chico Mendes de Conservação da Biodiversidade - ICMBio (ANEXO 2).

OBJETIVO GERAL:

Analisar o conhecimento ecológico local e as possíveis atitudes tomadas pelos pescadores artesanais em relação à conservação e a captura acidental de tartarugas marinhas na região de Ilhéus, sul da Bahia, Brasil.

OBJETIVOS ESPECÍFICOS:

Verificar se existe relação entre o conhecimento ecológico dos pescadores e atitudes de conservação sobre as tartarugas marinhas;

Caso exista, determinar a relação entre conhecimentos/atitudes e algumas variáveis sócio-demográficas (idade, tempo de associado a colônia de pescadores, número de filhos e grau de escolaridade);

Verificar e justificar a presença de tabus alimentares, crenças ou usos medicinais das espécies de tartarugas existentes na região e suas implicações na conservação;

Calcular a captura por unidade de esforço (CPUE), média e área de pesca para rede de arrasto e linha para a frota pesqueira das colônias de pescadores de Ilhéus.

HIPÓTESE

O conhecimento ecológico tradicional de pescadores artesanais da região de Ilhéus está relacionado com as atitudes que possuem em relação à conservação das tartarugas marinhas, porém, algumas variáveis sócio-demográficas dos pescadores influenciam no nível de conhecimento e de atitude direcionados a esses quelônios.

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Attitudes and traditional ecological knowledge of experts fishermen in relation to conservation and bycatch of sea turtles (Reptilia: Testudines), Southern Bahia, Brazil.

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Abstract - This study investigates fishermen's ecological knowledge about sea turtles and their attitudes towards the conservation and bycatch these animals. The research was conducted with fishermen specialists, recognized as the holders of knowledge about fishing in the region. The traditional ecological knowledge and attitudes of fishermen towards the conservation of sea turtles were respectively medium and moderate according to specialists on fishermen (based on Likert scale and Cronbach's Alpha). Potential areas of spawning were reported. The most recent captures of turtles were attributed to fishing line, but according to the respondents, the network of lobster and shrimp traps is more likely to capture turtles. Knowledge and attitudes were weakly inversely correlated, and the education level of the respondent showed a positive relationship with positive attitudes towards turtle conservation. Taboos and beliefs were also reported in the study. *Lepidochelys olivacea* was the only species recorded as bycatch in the region according to data from fishing operations. Environmental education projects, monitoring of spawning areas and strategies to moderate the use of fishery resources can assist in the conservation of marine turtles.

Key Words - Reptilia; Cheloniidae; Dermochelyidae; traditional ecological knowledge; attitudes; bycatch; Atlantic Ocean; conservation

INTRODUCTION

Due to being migratory and occupying distinct geographical areas according to their stage of life (Carr et al. 1990; Bolten and Balazs 1995; Plotkin and Spotila 2002; Godley 2003), sea turtles are susceptible to damage through various interactions with humans. On a global scale, all species of sea turtles in Brazil are under some level of threat according to the International Union for the Conservation of Nature (IUCN) (2012), including the green turtle (*Chelonia mydas*) and loggerhead turtle (*Caretta caretta*), which are threatened with extinction; the olive turtle (*Lepidochelys olivacea*), which is vulnerable to extinction; and the leatherback turtle (*Dermochelys coriacea*) and hawksbill turtles (*Eretmochelys imbricata*), which are critically endangered species.

An assessment of the conservation statuses of turtles in Brazil performed by the Chico Mendes Institute for Biodiversity Conservation (ICMBio) together with the TAMAR (Sea turtles) Project, reported the green turtle *C. mydas* as vulnerable (VU), *C. caretta* and *L. olivacea* as in danger (EM) and *E. imbricata* and *D. coriacea* as critically endangered (CR), which indicates reductions in the populations of these taxa in recent years on the Brazilian coast (Almeida et al. 2011a; Almeida et al. 2011b; Castilhos et al. 2011; Marcovaldi et al. 2011; Santos et al. 2011).

There are several threats that these animals face in the sea or on the beaches where they nest (Marcovaldi and Thome 1999; Tisdell and Wilson 2005). Human activities and impacts such as vehicular traffic on beaches, plastic pollution, contamination with oil, the spreading of pathogens, the accidental capture of turtles by fishermen, the gathering of eggs and females on beaches, global climate changes, collisions of turtles with boats and the dredging of harbours and channels can be cited as the primary causes of the declines in turtle populations on a global scale (National Research Council 1990; Shanker and Pilcher 2003; Mast et al. 2005). In particular, turtle strandings may also be considered a major threat to the populations of these animals in coastal areas (Bugoni et al. 2001; Kotas et al. 2004; Coelho 2009, Tamar 2012).

Most importantly, according to Epperly et al. (1996) and Cheng and Chen (1997), the greatest impact on the survival of these animals is the use of fishing equipment, with emphasis on the fishing nets that are recognised as a major factor in the mortality of sea turtles across the world (Poiner and Harris 1996; Oravetz 1999; Spotila et al. 2000; Casale et al. 2004; Carranza et al. 2006). In Brazil, the homemade devices are commonly used on the coast (MPA 2012). Studies of the artisanal fisheries in Brazil are still few and there are no accurate statistics on such activity (Pacheco 2003; Souto 2008), representing a significant gap with regard to information on the bycatch of sea turtles (Pupo et al. 2006).

Studies investigating the attitudes of members of traditional communities regarding the conservation of a particular resource can have great importance for the preservation of the ecosystem (Alexander 2000). Furthermore, information derived from the community members' knowledge of the environment can assist in management and co-management efforts, contribute to the existing knowledge of the biology of various organisms and their interactions with the environment (Begossi et al. 2002) and provide important data to help shape the decisions of policy-makers and researchers (Stave et al. 2007, Brook and McLachlan 2008).

Most of the interactions between humans and their environment are known to be mediated by feelings, behaviours, knowledge and beliefs (Marques 2001). Understanding and comprehension of the bio-cultural memory associated with the local knowledge of a particular traditional community as well as efforts to represent those community members and collaborate with their existence (Barrera-Bassols and Toledo 2010) are increasingly being utilised and incorporated in the responses to environmental and social changes (Davis and Wagner 2003).

Furthermore, the use of ethnoecological tools to evaluate possible damage and loss of biodiversity animal related to the populations of species under some degree of threat may represent a first step towards integrating the political management of natural resources and conservation strategies with the behaviour of the local community so that fishery resources can be utilised

rationally, with a consequent decrease in the mortality of sea turtles. From this perspective, this study investigates fishermen's ecological knowledge about sea turtles and attitudes towards the conservation and bycatch of sea turtles (Reptilia: Testudines) in Ilhéus, Southern Bahia, Brazil.

METHODS

Study site – The present study was conducted in the municipality of Ilhéus (14°48'40.44"S, 39°1'42.97"O; Fig. 1), in the southern region of the state of Bahia, Brazil. This area has a population of 180,000 inhabitants and an area of 1,840,991 km² (IBGE 2010). The climate of the region, according to the Köppen classification scheme, is Af; warm and humid tropical, without a predictable dry season and with an average annual rainfall of 2000 mm (Mori et al. 1983; Martini et al. 2007).

The coastal region of Ilhéus is 80 km long and almost straight with few protrusions or recesses, bounded by the Sargi river to the north, the Acuípe river to the extreme south, and by the continental shelf, the edge of which passes between the 50 m and 60 m isobaths (França 1979; Caló et al. 2009). The hydrography of the region consists of two basins: the Cachoeira and the Almada. These basins are part of most of the routes of the fishermen of Ilhéus. The precipitation regime can cause large floods in periods of heavy rain (Andrade 2003). There are two colonies of fisherman in Ilhéus: Z-19 and Z-34 (Fig. 2). These were chosen for use in this study because of the ease of finding fishermen to facilitate data collection. Located on the edge of Pontal Bay, colony Z-19 was founded in 1921 and is currently managed by José Leonardo Oliveira dos Santos. It comprises 3,000 members, of whom only 700 are active fishermen. Colony Z-34, located in the Malhado neighbourhood, was founded in 1947, is currently managed by José Reynaldo Oliveira, and has approximately 3,000 active members, including individuals from neighbouring municipalities (Caló et al. 2009).

Interviews – Data collection took place from July 2010 to September 2011 in colonies Z-19 and Z-34. Interviews were performed using the snowball method (Bailey 1978) adapted by Alarcon (2006) and conducted interviews with fishermen specialists (Marques 1995). Field data were collected first through

semi-structured interviews (Viertler 2002) and later through well-designed questionnaires (Huntington 2000). The timing of the visits was adapted according to the forecasted arrival of the fishing boats. Constant contact with the research subject is observed as a necessary investment in studies of traditional ecological knowledge according to Brook (2007).

Initially, the names of three fishermen who had relevant knowledge about fishing in Ilhéus were collected from the presidents of each colony using the criterion “native expert(s)”, meaning individuals who are both self-acknowledged and recognised by the community as experts and who are culturally competent (Bailey 1978; Marques 1995; Alarcon 2006). The selected expert fishermen each indicated three additional fishermen and so forth, constituting an indication network (Fig. 3). The network terminated when a fisherman was cited more than once. A fisherman was considered an expert if he was indicated two or more times. The fisherman specialists were interviewed after being identified through the formation of the indication network. The interviews consisted of a series of questions (Table 1) relating to the fishermen’s profile, structure and work equipment, the traditional ecological knowledge (TEK) of fishermen about sea turtles and bycatch of sea turtles (It was considered local ecological knowledge of the fisherman on the ecology of the sea turtle and animal behaviour), a projective test (Costa-Neto et al. 2009), attitudes towards turtle conservation (This part of the interview was assessed by the awareness of the respondent regarding the conservation status of turtles and their tendency to have positive action in relation to maintenance of the population of turtles) and beliefs and taboos regarding turtles (It was considered food preferences and aversions of fishermen and their implications for conservation of sea turtles). The projective test was performed by presenting six sea turtle species to record the perceptions and knowledge of respondents. To avoid skewing the test, the turtle *Lepidochelys kempii* (Kemps Ridley or Lora) was not used in the questionnaire due to its similarity to *Lepidochelys olivacea* (Olive), which is recorded in Brazil. Interviews were recorded on paper. We considered the common names of all species of sea turtles to assess knowledge through projective test. The questionnaire was pre-tested using a pilot study conducted in colony Z-18 in

Itacaré, Bahia. Ten interviews were conducted in the pilot study. This procedure helped to adapt the questionnaire before applying it (White et al. 2005).

The fishermen were approached individually, with some interference from other fishermen present at the interview site. Despite this interference, the only responses recorded were those provided by the individual who was being interviewed. At the start of all interviews, the fishermen received a document entitled “Statement of Informed Consent (IC)” and agreed to participate in the research.

Fishing trips – Fishing trips were made from May to August 2011 in the coastal area of Bahia. The boat trips depended on weather conditions and navigation. Data were collected by fisherman trained using the standards of the National Sea Turtle Conservation in Brazil (Projeto TAMAR/ICMBio). Data files contained information about fishing locations, distance from shore, time of use of fishing gear at sea and data related to the biology of turtles if there was a capture. The morphometric data consisted of measurements of the length of the curved carapace (CCC) and curved carapace width (LCC) according to Bolten (1999).

Data Analysis –The interviews covered the emic approach with respect to the point of view of the research subjects (Posey 1986). All information obtained in the interviews was taken into account following the unity model of different individuals (Hays 1976 and Marques 1991). The taboos were classified into the following categories (life history, temporal, habitat, specific, segmental, method) proposed by Colding and Folke (2010) and the classification of fishing gear was based on the FAO (Food and Agriculture Organization of the United Nations).

For quantitative comparisons of the respondents in terms of their broad knowledge and attitudes towards the conservation of turtles, indicators were created based on the study by Nazario and Bitencourt (2003). Data were converted using a three-point Likert scale for both knowledge (correct answers = 1, partial answers = 0.5, wrong answers = 0) and attitudes (positive attitudes = 1, moderate attitudes = 0.5, negative attitudes = 0). This scale quantifies the attitudes of individuals based on an order of numerical qualitative importance, expressing agreement or disagreement with respect to variables and attitudes related to the study object (Dencker 1998). The indicators for traditional

ecological knowledge and attitudes towards conservation were created by summing the scores for each subject and dividing the total by the highest possible score (Ditt 2002; Nazario and Bitencourt 2003).

The reliability and internal consistency of these indicators was measured by Cronbach's alpha coefficient, which assesses the magnitude to which the items in a group are correlated (Pereira 1999; Oviedo and Campo-Arias 2005). Knowledge and attitude indicators were divided into three classes (0 - 0.33; 0.34 - 0.66; 0.67 - 1). Attitudes were classified as positive, moderate and negative, whereas knowledge was classified as low, medium and high.

Correlation analyses were made between indicators of knowledge and attitude, investigating the relationship between profile variables of the respondent (time associated with the fishing colony, age and number of children) and knowledge and attitudes as well as the relationship between education level and knowledge and attitudes. We investigated the relationship between indicators and level of education by classifying education level as follows: A = illiterate; B = Elementary School 1 (1 - 5 years); C = Elementary School 2 (6 - 9 years) and D = Secondary school and Higher Education. Kruskal-Wallis non-parametric tests, correlation analyses and Cronbach's alpha coefficient were conducted using R version 2.12.1. The ltm package for R was used to calculate Cronbach's alpha coefficient (Rizopoulos 2006). To construct the box plot was used PAST: Paleontological Statistics Software Package for Education and Data Analysis (Hammer et al. 2001).

Using the data from fishing trips, CPUE (catch per unit effort) was calculated. CPUE was calculated separately for each species of sea turtle to allow quantitative comparisons between species, using the ratio of the number of turtles captured (N) to the exposure time of the fishing gear in hours: $t = \text{CPUE} (N / t)$. All geographic data from the fishing locations, the nesting areas and the location of the study area were processed using the ArcGIS 9.2 software program (ESRI).

RESULTS

Profile of the fishermen - The indication network of colony Z-19 included 34 fishermen. Of these, 21 were considered experts. The network of colony Z-34 included 26 fishermen, of which only 13 were considered experts. Thirty specialists were interviewed for the study. Only 4 experts refused to participate in the work.

The ages of the respondents ranged from 40 to 86 years, and they were all male. The average fishing experience was 32 years, and the majority of respondents had a low level of education (Table 2). We interviewed 7 illiterate fishermen and 3 who had completed high school. The time associated with the fishing colony varied from 3 to 52 years with a mean of 24 years, and 87% of respondents lived only on their fishing income. The predominant types of fishing boat in Ilhéus were fibre and wood, and fishing trips averaged 4 crew members. The boats were generally small (4 - 6 m width; 7 - 14 m length), 66% of the specialists used the boats of other fishermen and the fishing gear most often used was fishing line and trawl nets. The average frequency of fishing trips was three to four times per month. The time at sea per fishing trip varied with the type of fishing gear used (trawl nets = 10 - 20 days; line = 7 - 8 days).

Local Ecological Knowledge about sea turtles - The indicator of ecological knowledge about sea turtles as measured by the Likert scale ranged from 0.26 to 0.77 with an average value of 0.43. In general, the ecological knowledge about sea turtles was average. None of the candidates obtained the minimum or maximum values of the indicator. According to the established classes, 27% of the fishermen had a low level of knowledge about sea turtles, 63% had medium knowledge and 10% had a high level of knowledge. The Cronbach's alpha coefficient for knowledge was approximately 0.7. The index of knowledge was not associated with the age of the fishermen ($r = 0.10$, $p = 0.62$), the number of children of the fishermen ($r = 0.08$, $p = 0.66$) or the time associated with the fishing colony ($r = -0.05$, $p = 0.80$).

All of the fishermen said they had seen turtles along the coast of Ilhéus. The experts cited 20 nesting areas from Barra Grande to Una covering the entire coast of Ilhéus. Of these, Olivença and Ponta do Ramo were most

frequently cited by experts as nesting areas for sea turtles (6 - 7 times). Ponta da Tulha and Acuípe were also remembered as spawning areas (4 - 5 times) and the remainder were cited by at least one respondent (1 - 3 times, Fig 4). In relation to nesting areas, all of the fishermen said that turtles spawn on desert beaches, and 38% said that spawning occurs mostly in the summer.

In the projective test, only one fisherman mentioned that *Natator depressus* occurs in the region. All others cited at least one species that occurs on the coast of Bahia. Of the experts interviewed, 45% correctly identified the species *E. imbricata*; 24%, *C. mydas*; 10%, *C. caretta*; (being all respondents belonging to the classes of medium or high knowledge) and 13%, *D. coriacea* (only one respondent belonged to the class of low knowledge and the rest belonging to the other two classes). No fisherman identified the species *L. olivacea*. Most experts identified the turtles based on their shell, colour, size and fins. It is important to note the record of *D. coriacea* made by a fisherman interviewed in the south of Ilhéus, specifically on the high seas in front of Comandatuba Island. This fisherman was one of the four respondents who recognised the leatherback turtle and described some details consistent with the literature.

The interviewed experts identified the various types of turtle by their common names, referring to *C. mydas* as the green turtle, *suranha* and *aruanã*. The species *E. imbricata* was identified as the hawksbill turtle and as *malhada*. *C. caretta* was identified as the common and the yellow turtle. *D. coriacea* was identified as the leathery, skin, and black turtle and as *Jamanta*. *L. olivacea* and *N. depressus* were not identified by the fishermen by their common names.

When asked to identify turtle foods, all experts cited at least one type of food correctly according to literature (Van Dam and Diez 1996; Bjorndal 1997; Hirth 1997; Sanches and Bellini 1999; Pemberton et al. 2000; León and Bjorndal 2002; Reich et al. 2007) and when asked about the predators of turtles, they cited men, sharks, some birds (albatrosses and black vultures) and fish (goliath grouper, common dolphinfish and shark). Responses provided regarding the turtles' dive time varied significantly between respondents and 53% mentioned a correct time interval with reference to some studies

(Hochscheid et al. 1999; Godley et al. 2002; Bentivegna et al. 2003, Hays et al. 2004; Eckert et al. 2006; Sale et al. 2006). According to the fishermen, the preferred habitats of the turtles are places with rocks, reefs, beaches and shallow and deep water. The fishermen reported that the turtles' diet consists of seaweed, small fish, crustaceans, limestone, shellfish and shrimp. Plastics and several wastes were also cited as parts of their diet. Although the overall level of knowledge was medium, some fishermen showed satisfactory knowledge compared with the literature on the ecology and behaviour with regard to the chelonians studied.

Knowledge about bycatch - Only 1 specialist had never accidentally caught a turtle during a fishing operation. During each respondent's last reported capture, 66% were using fishing line as their fishing gear and 94% of the captured turtles were alive and in a normal state without apparent injury. Their average weight was 31 kg and depth was 36 m at the last sighting. The coasts of Ilhéus, Olivença and Acuípe were cited as the localities with the highest numbers of records for turtle captures. In the interviews, most of the fishermen attributed their most recent turtle capture to fishing line, but all experts said that the fishing gear that picks up the most turtles in the region of Ilhéus is the nets (gill/lobster, $n = 27$; shrimp trawl, $n = 2$) and that turtles are rarely captured by lines (fund, submerged or half water; $n = 1$) or long-lines ($n = 1$).

Attitudes towards conservation - The indicator for attitudes towards conservation of sea turtles had an average value of 0.69. The study participants proved to be alerted before the causes of the decline of sea turtle population, tending to present awareness and actions more accurate than negative that can assist in the recovery of the conservation status of the species studied. This ranged from 0.35 to 1 and only 2 fishermen obtained the maximum value. Most of the interviewees (59%) had positive attitudes the maintenance of the sea turtles population in the study region and the other 41% held moderate attitudes. No negative attitudes were recorded. The Cronbach's alpha index calculated for attitudes was 0.43. The index of attitudes was not correlated with time associated with the fishing colony ($r = -0.18$, $p = 0.35$), the respondent's age ($r = -0.28$, $p\text{-value} = 0.15$) or the respondent's number of children ($r = -0.04$, $p = 0.83$).

Ninety percent of respondents thought it was important to conserve turtles and the environment where they live. Ninety-seven percent did not think that sea turtles affect fishing, but only 47% knew how to explain this fact. Only one interviewee did not approve of the law that has prohibited the capture and use of sea turtles in Brazil since 1986 (Decree of SUDEPE, paragraph 005 of January 31, 1986, IBAMA 2009) along with other complementary legislation. Seventy-three percent of the specialists had previously held unfavourable attitudes related to the consumption of sea turtle eggs, but all said that they no longer consumed the eggs in the present.

In a hypothetical encounter with a turtle, 3 fishermen said that they would consume it or use the shell for making hand-crafted products. When asked about how to avoid catching turtles, 27% said that they did not know how and 73% said that they avoid using fishing nets (shrimp and lobster) to reduce the catch.

Local ecological knowledge and attitudes towards conservation - In the present work, there was a tendency for attitudes towards turtles to be inversely related to knowledge about sea turtles. The correlation between these two indicators was negative and significant ($r = -0.38$, $p = 0.04$). The interviewed experts who exhibited a greater local ecological knowledge about sea turtles tended to have more unfavourable attitudes towards the conservation of chelonians (Fig. 5).

Relationship between level of education and the indicators - In this study, the fishermen's level of education did not influence the extent of their local ecological knowledge about sea turtles ($H = 1.27$ $p = 1.74$). Regarding attitudes towards conservation, there was a tendency for more highly educated fishermen to have more positive attitudes towards turtle conservation ($H = 8.33$; $p = 0.04$; Fig 6).

Fishing operation - There were 28 days of sampling effort and 411.75 hours of trawl net use at sea. The timespan over which the fishing gear was used at sea changed every day. Only 1 turtle was captured during the sample period by fishing expeditions using trawl nets. We monitored 100.33 hours of line fishing and no turtles were captured by that gear.

From the fishing logbooks, we determined the areas where line fishing and shrimp trawl nets were used. The area where trawl nets were used for fishing was 11.057,35 km² and the area used for line fishing was 21.243,98 km². There was a 11.057,35 km² area of overlap for the two types of fishing (Fig. 7).

One *L. olivacea* (olive tortoise, Fig 8) was captured during the monitored fishing operations. The CCC of the captured individual was 77 cm and the LLC was 70 cm. The turtle weighed 40 kg. The CPUE (Catch per unit effort) for trawl nets was calculated to be 2.4×10^{-3} turtles for hours. The estimated CPUE for one year would be 13.07 turtles to one fishing boat.

Beliefs and Taboos - In the study of the perceptions of the fishing communities of Ilhéus, sea turtles were mentioned as taboo by 48% of the interviewed experts. They were considered taboo as food due to their “strong” meat, for presenting leathery shell, and have the ability to cause disease when ingested. The turtles were locally referred to as “*remoso*” and “*carregado*”. The folk medicine of some of the fishermen included uses for sea turtles (21%). Therapeutic indications for human use that were mentioned by the experts included the use of turtle lard oil as a remedy for rheumatism, muscle aches, fatigue and back pain and for fighting bronchitis and asthma.

Specific taboos were recorded for situations in which individuals had dietary restrictions defined in relation to sea turtles. The situations comprised the following: post-operative periods for both sexes, some types of inflammation, chronic disease and pregnancy in women. Of the interviewed experts, 4 said that they did not consume turtles with external characteristics such as the presence of warts and lumps on the body of the animal or the presence of a jellyfish on the face. The justification was that consuming turtles with these characteristics may harm a person’s health.

Life history taboos were also observed, in which 45% of respondents said that they only eat adult and elderly turtles and restrict their use of the species at early stages of its development (young). Habitat taboos were also recorded for 24% of respondents. According to the interviewees, there are places where fishing access is limited due to the presence of turtles. Fishermen

cited the following locations: Pé de Serra, Ponta do Espigão, Pedra de Ilhéus and Abrolhos as places where they avoid fishing because of the large number of turtles found in these areas.

Among the 4 experts who said they have used the shells of sea turtles, primarily hawksbill turtles, to make glasses and other handcrafts, there were no food restrictions related to the consumption of eggs. The fishermen do not use the meat for commercial purposes. When a turtle is captured, they consume it at sea or take the meat home. Fifty-two percent of the respondents enjoy turtle meat compared to beef and chicken.

DISCUSSION

Knowledge about sea turtles and fishing trips – Keeping in mind that the survey was conducted only with fishermen specialists who had been recognised as knowledgeable about fishing in the region, one can say that we recorded as much information as possible and that no other local fishermen had different or deeper knowledge than what we recorded. The index we generated to measure ecological knowledge presented an acceptable degree of reliability. According to Gabriel and Tritapepe (2008), values of Cronbach's alpha above 0.6 are considered satisfactory for opinion polls.

It was assumed that the fishermen who were identified by the indication networks in the two colonies had a deeper knowledge of turtles. This assumption may be incorrect considering that fishing effort is directed towards species of fish and laws are currently in place in Brazil that restrict fishing for turtles, with the result that fishermen's contact with turtles is only casual. Most of the fishermen experts we interviewed also use a bottom line, which is considered a type of fishing gear that is less likely to catch turtles compared with other types of gear (Tamar 2012). Calo et al. (2009) concluded that the fishermen of the same study area possess considerable knowledge about "vermelhos", a group of large fish, knowledge which was possibly acquired by exploiting the fish with fishing gear, an activity which does not occur with the sea turtle.

Sea turtles are considered key species in coral reef communities (León and Bjorndal 2002; Bjorndal and Bolten 2003; Bjorndal and Jackson 2003). Many interviewed fishermen reported avoiding fishing in areas where there is a greater probability of interaction with the animal. Decree No. 037 regulating Municipal Law No. 3212 of 01/30/2006 was completed in 2011 for the realisation of the creation of Municipal Marine Park Ilhéus to protect some marine species, with an emphasis on *Epinephelus itajara* (the goliath grouper). Even while under construction, the existence of this initiative may explain the avoidance of this type of ecosystem by fishermen in the region, which in the future may have a positive effect on the population growth of sea turtles in the region. However, the regulations imposed on fishermen to reduce fishing should always be constantly monitored and revised because the survival of individuals in fishing areas may often depend on the attitudes of the fisherman, who in a given time can be influenced negatively, especially when there is an initial assessment appropriate to the likely impacts to coastal communities (Casale et al. 2004). Another reason for the low capture rate of turtles is that contact between fishermen and the animal may cause a decrease in fishing effort, generating financial and material losses, even if minimal. Marcovaldi et al. (2002) report that fishing-animal interactions can cause damage to the fishing target. Nevertheless, the fact that many interviewees said that turtles do not affect their fishing is not for the simple reason that turtles do not cause any equipment damage or reduction in effective fishing time, but because they have only occasional contact with turtles and consequently the probability of damage caused by turtles is low. This fact can also be a reflection of the continued work of the Tamar as in many parts of the Brazilian coast, through which many anglers may have absorbed a more conservationist discourse that is not necessarily (but can be) a reflection of realities in their day-to-day.

Despite the finding that the fishermen's ecological knowledge about sea turtles as communicated through interviews was not within the range that represents deep knowledge, the interviews with experts did identify areas of great importance for nesting turtles. In these sub-areas of Ilhéus on the southern coast of Bahia, there are no records of strandings of four species of sea turtles (Coelho 2009). The increased recognition of hawksbill turtles in the

projective test can be explained by the fact that hawksbill species have been recorded nesting on the southern coast of Bahia (Marcovaldi and Marcovaldi 1999). In relation to the projective still some limitations methodology as shown figures (drawings and pictures two-dimensional), the color variation of the hull according to the animal immersion in water may have been implicated in the recognition species.

In the municipalities of Itacaré and Uruçuca, there are reports of turtle nests on the beaches of Pompilho, Itacarezinho and Patizeiro (Camiilo et al. 2009). Due to the hawksbill turtle's peculiarities, for decades products have been extracted from the animals for export and sale to tourists (Hughes 1973). Among all species, the hawksbill turtle is the one that has suffered the greater depredation as a result of its shell (Anne and Donnelly 1999). The hawksbill turtle's shell holds more use than those of other species, and their greater contact with fishermen may have influenced the collaboration and greater recognition on the part of respondents.

There are few studies in the literature that address the history of the leatherback turtle in the state of Bahia. The current conservation status of the species is "in critical condition" (Almeida et al. 2011b; IUCN 2012). There are sporadic reports of spawning in the extreme south of Bahia (Marcovaldi et al. 2006; PATEcosmar 2012), and the shore in the state of Espírito do Santo is cited as the most important nesting area for this species in Brazil (Soto et al. 1997, Roach and Fabian 2002), with a population that is genetically differentiated from the rest of the country (Vargas et al. 2008). In the present study, some fishermen were able to identify the leatherback turtle, even if they had only fished in southern Bahia throughout their lives. Huntington (2000) emphasises the importance of incorporating this type of traditional ecological knowledge into research projects and management strategies and of integrating, analysing and incorporating this new knowledge. Thus, this type of initial information can be an important step for the conservation of potential new nesting areas of the species in southern Bahia, where studies on population structure and nest monitoring are nonexistent.

Even with a few catches to the bottom line in the study area, fishermen warned of the impact of the use of net fishing in the region. Trawling for lobster and the use of fishing nets have been identified as one of the main threats to sea turtle populations worldwide (Poiner et al. 1990; Poiner and Harris 1996; Shanker and Pitcher 2003; Casale et al. 2004; Wallace et al. 2011). In Brazil, the impact of lobster trawling in Bahia has already been observed (Marcovaldi et al. 2006). These methods can drive large decreases in sea turtle populations because forced apnea may further aggravate the state of captured turtles, which can lead to death (Lutcavage and Lutz 1997).

In relation to the monitored fishing trips, the record of only one captured individual can be explained by the fact that the region has fewer records of spawning events compared to other regions, such as the northern coast of Bahia and Espírito do Santo. It should also be considered that our calculations were based on only one boat shrimp trawling and line fishing. It is known that there are a greater number of such vessels in the region. Thus, the estimated value for CPUE should be restricted to just one vessel and a smaller fishing area. The limitations in the methods used in the study and low probability of capturing turtles with fishing artefacts used may also explain the low incidence of bycatch of sea turtle.

Estimating the CPUE for the total area of trawl fishing, the impact is greater. Magalhães and Rocha (2001) report the presence of 950 shrimp boats (70% of all shrimp fishing boats of the State of Bahia) in the following cities: Valença, Cairu, Camamu, Ilhéus, Canavieiras, Porto Seguro, Prado, Caravelas and Mucuri. It is estimated that the CPUE for the whole region in the analysed period was 2.28 individuals caught per hour of trawling and that the regional CPUE for one year of sampling effort was 48.51 individuals captured. Based on the number of trawl vessels, the regional estimate made for CPUE demonstrates that fishing gear can be detrimental and unfavourable to the population of *L. olivaceae* in the state of Bahia. .

Attitudes towards conservation and their relationship with other variables - The low Cronbach's alpha value suggests that the items analysed express different attributes and cannot be jointly adopted in the calculation of a one-dimensional

variable (Nazario and Bitencourt 2003). For Pereira (1999), there is a stipulated amount of alpha needed to determine the validity of an indicator. Values above 0.40 have been satisfactory for some studies (Drews 2002; Ditt 2002).

Fishermen experts demonstrated predominantly positive attitudes. Coastal communities with nesting areas in Sri Lanka exhibited similar attitudes (Rajakaruna et al. 2009). The influence of community attitudes towards conservation in traditional and some demographic variables has been almost nonexistent (Hill 1998, Allendorf et al. 2006). Negative attitudes were provided by fishermen with a greater number of children because it is expected that a family with a large number of members requires a greater amount of food energy for their sustenance. Baquete and Boer (1998) also found no relationship between number of children and attitudes around an elephant reserve in Mozambique. Even with environmental education activities and occasional lectures given to members of the local community, no trend was identified between attitudes and time associated with the fishing colony. As was observed in the fishing community in this study, the age of the respondents did not influence attitudes in two protected areas in Nepal (Baral and Heinen 2007). Mehta and Keller (1998) also documented the same trend. Thus, the profile variables of the respondents recorded in this study did not influence the attitudes of the respondents in relation to the conservation of sea turtles in the region of Ilhéus.

More unfavourable attitudes towards the conservation of sea turtles were held by those fishermen who know more about their behaviour and could best distinguish their habitat characteristics. It is expected that foraging and capture of turtles are easier for those fishermen who have a more enhanced level of knowledge about the resource. Bright and Tarrant (2002) reported that knowledge increases the ability to think, looking at all sides of the issue, but does not always influence the direction of the attitudes of an individual. In this case, the above knowledge about the rules of endangered species in the United States did not influence the perceptions and attitudes of students.

The education level of the fishermen was related to their attitudes. Fiallo and Jacobson (1995) found the same relationship between these two variables.

Positive attitudes were exhibited by those with a higher level of education, perhaps because the access to the information acquired during their studies, access to different types of media and greater contact with educated people could help in better assimilating the importance and need for conservation of resources that are threatened with depletion. According to Sah and Heinen (2001), attitudes towards the conservation of a resource are influenced by educational level. However, there were some fishermen with low education levels who had positive attitudes towards the conservation of sea turtles. The fear of fines and punishments meted to those who violate environmental laws (Ditt 2002) may help explain this finding. The attitudes of these fishermen may also be influenced by some kind local belief. Bright and Barro (2000) showed that beliefs can have influence over the attitudes of an individual in relation to natural resources in addition to just their knowledge.

Beliefs and Taboos - Food taboos may be considered informal institutions that define and limit the use of resources by human communities in ecosystems, accounting for rules that are not instituted but somehow regulate human behaviour (Colding and Folke 1997). In this study, the presence of food taboos can be considered a reason for the low consumption of sea turtles by fishermen of the macro-region of Ilhéus. These unwritten social rules can be a way to conserve a resource (Reichel-Dolmatoff 1976; Begossi et al. 2002). However, a decrease in adherence to traditional practices over time can cause a greater impact on some populations of animals (Pinto et al. 2006).

The specific taboos that were identified by interviewing experts of the two fishing colonies of Ilhéus are similar to those reported in studies from the Atlantic Forest and the Amazon (Begossi 1992; Begossi and Braga 1992; Pezutti et al. 2010; Hanazaki and Begossi 2006). Decreases in the exploitation of wild species can be aided by specific taboos (Colding and Folke 2000). Dietary restrictions related to the appearance and taste of meat were considered more a means of avoiding the consumption of the animal. The reasons attributed to the taboos by the fishermen were the same as those given by other fishermen in coastal communities in the southeast (Begossi 1992).

Exogenous taboos, in which laws are imposed on the population leading to a breakdown of the interaction between people and animals (Costa-Neto 2000), may in some cases assist in the conservation of a resource. Often, this kind of taboo cannot control all of the actions of the fishermen, as occurs in the fishing community of Ilhéus. The chelonians, especially sea turtles and turtles, are one of the most popular ingredients used in traditional medicine around the world (Alves et al. 2008). In northeastern Brazil there are several records of the use of animals and plants in alternative therapies (Costa-Neto 2002; Alves and Rosa 2005; Alves 2009; Ferreira et al. 2009). In Bahia, turtles are known to be highly utilised in zootherapy and alternative medicine (Costa Neto and Marques 2000) as well as in communities in the southeast of São Paulo (Begossi 1992; Begossi et al. 2004) and in Rio Tocantins (Begossi and Braga 1992). In the region of this study as well as in other traditional communities, turtle fat is used for the treatment of asthma, bronchitis and arthritis (Alinõ et al. 1990; Begossi 1992; Seixas and Begossi 2001; Begossi et al. 2006). On the north coast of Bahia as well as on the coast of Ilhéus in southern Bahia, fat is only used in this way when there is bycatch (Costa-Neto 2000).

Conservation Concerns - Among the species of sea turtles that are recorded in Brazil, all are under some degree of threat (Almeida et al. 2011a; Almeida et al. 2011b; Castilhos et al. 2011; Marcovaldi et al. 2011; Santos et al. 2011; IUCN 2012). The use of bycatch in nets by traditional coastal communities is a major factor in the declining populations of turtles (Gallo et al. 2006; Marcovaldi et al. 2009; Moore et al. 2010).

In relation to fisheries, lobster and shrimp trawling should be adapted and restricted in certain ecosystems due to the high probability of turtle capture. Fishing colonies should always be involved in any change in fishing regulations, and participation in key decisions should be interactive. Despite the fact that this type of fishing is not considered a major contributor to the problem of bycatch worldwide, this type of fishing should still be constantly monitored due to its large magnitude and its ability to generate deep local environmental effects (McLellan et al. 2009).

Data acquired from traditional ecological knowledge can assist in strategies and programs for sustainable conservation and management policies (Stave et al. 2007) and generate important discussions to strengthen the understanding of the resource under study (Turner et al. 2000). The preservation of traditional practices such as sustainable food taboos, beliefs and customs is necessary. In relation to the sustainable use of resources in zootherapies, there must be a local analysis and a thorough observation of the possible implications of the practice, as well as a check for immediate needs to provide appropriate management measures as it relates to the conservation of the species (Ferreira et al. 2009).

An individual with a higher knowledge rating did not have more positive attitudes towards turtles in our study. However, mitigation measures related to environmental education should not be discarded, but should be reviewed and explored in a more appropriate way. Recommendations are needed for effective communication strategies in cases where there is a propensity towards negative attitudes by fishermen with a greater degree of knowledge about the ecology of the animal. Even in the generally positive attitudes that prevail among the interviewed experts, there are still fishermen who occasionally use turtles which can be detrimental to the species, especially females who are more coastal and more likely to be predation.

Studies monitoring the nests, clutches and traditional ecological knowledge of sea turtles in southern Bahia are needed due to the scarcity of data in the existing scientific literature, especially for the leatherback and hawksbill turtles, which need urgent help because of their critical conservation status. Strategic conservation and mitigation measures must be developed and applied so that a significant portion of the existing diversity of turtles is not lost over the coming centuries (Buhlmann et al. 2009).

The involvement of the community in conservation activities and monitoring may, over the long term, contribute to increased knowledge and more favourable attitudes (Brewer 2002). Promoting beliefs and taboos conducive to sea turtles conservation could foster positive attitudes and behaviour. Government oversight and participatory measures to adjust and

reduce human activities to avoid bycatch, the continuing globalisation of scientific knowledge on the conservation status and bycatch of sea turtles, activities of university students involving the local community, public mobilisation with a educational approach that is appropriate and compatible with reality and the continuation and expansion of environmental education projects and monitoring such as the TAMAR / ICMBio, PAT Ecosmar (Projeto Tartaruga Amiga) and the plan for reducing the incidental catch of seabirds being conducted in Brazil (IBAMA and CEMAVE - Research Center for Conservation of Birds) can provide data to improve the conservation practices and management of sea turtles.

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Figure Legends

Fig. 1. Locations of fishermen's colonies Z-19 and Z-34, adjacent rivers and the continental shelf in Ilhéus, Bahia, Brazil.

Fig. 2. Locations of the fishermen's colonies in the city of Ilhéus, BA: a) Z-19 b) Z-34. (photo credit Heitor Braga).

Fig. 3. A model of the indication network used for the selection of expert fishermen in colonies Z-19 and Z-34 in Ilhéus, Bahia (N=60).

Fig. 4. Nesting areas in southern Bahia according to the interviewed specialists (N=30).

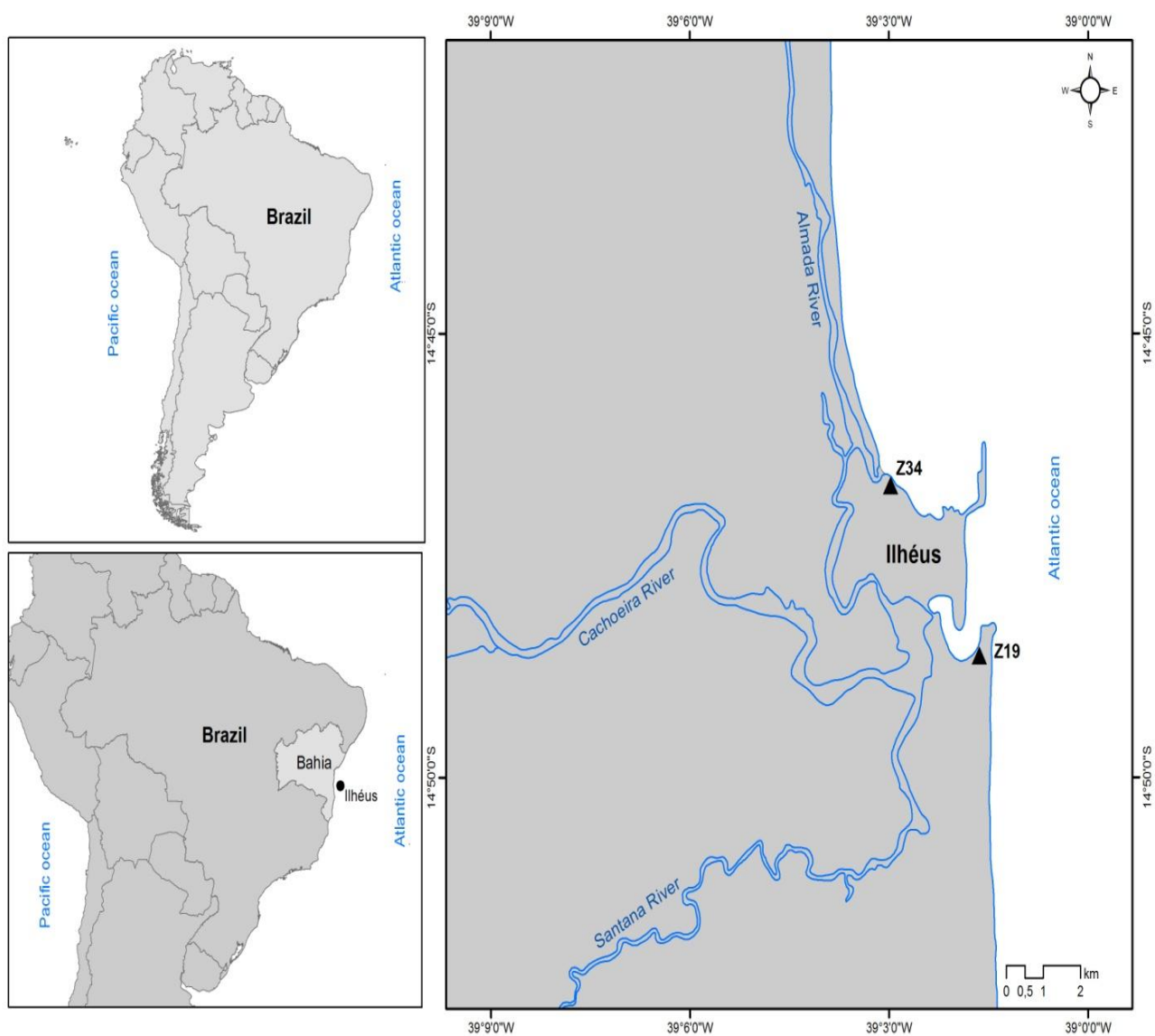
Fig. 5. The relationship between local ecological knowledge about sea turtles and attitudes towards their conservation ($p = 0.04$, N=30).

Fig. 6. The relationship between the level of favourable attitudes of the fisherman towards conservation (%) and education categories (A = illiterate, B = Elementary School 1, C = Elementary School 2, D = Secondary school and higher, N=30).

Fig. 7. Map of the line fishing and trawl net areas offshore from southern Bahia, Brazil.

Fig. 8. The turtle (*Lepidochelys olivacea*) captured by a trawl net. (N=1). (photo credit G. P. Neves).

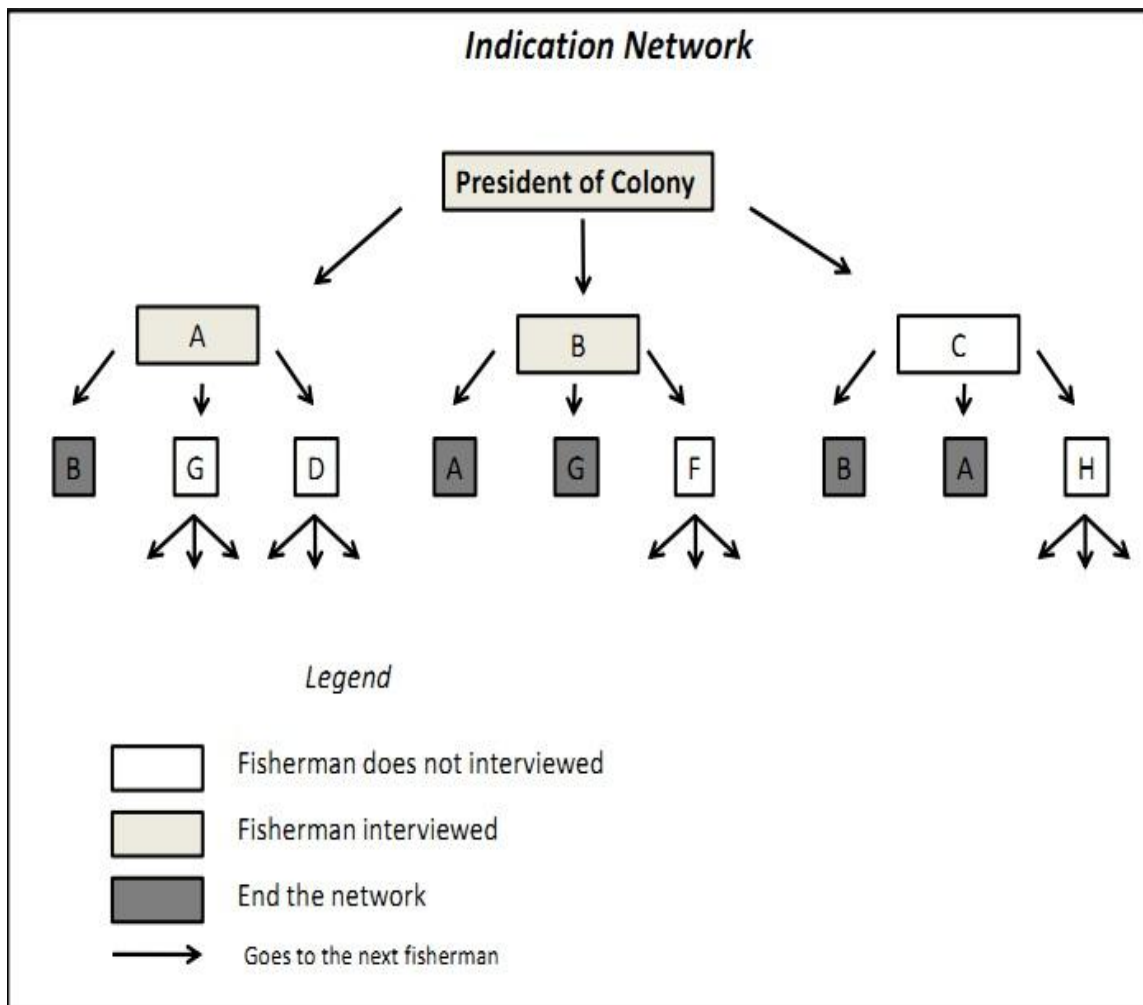
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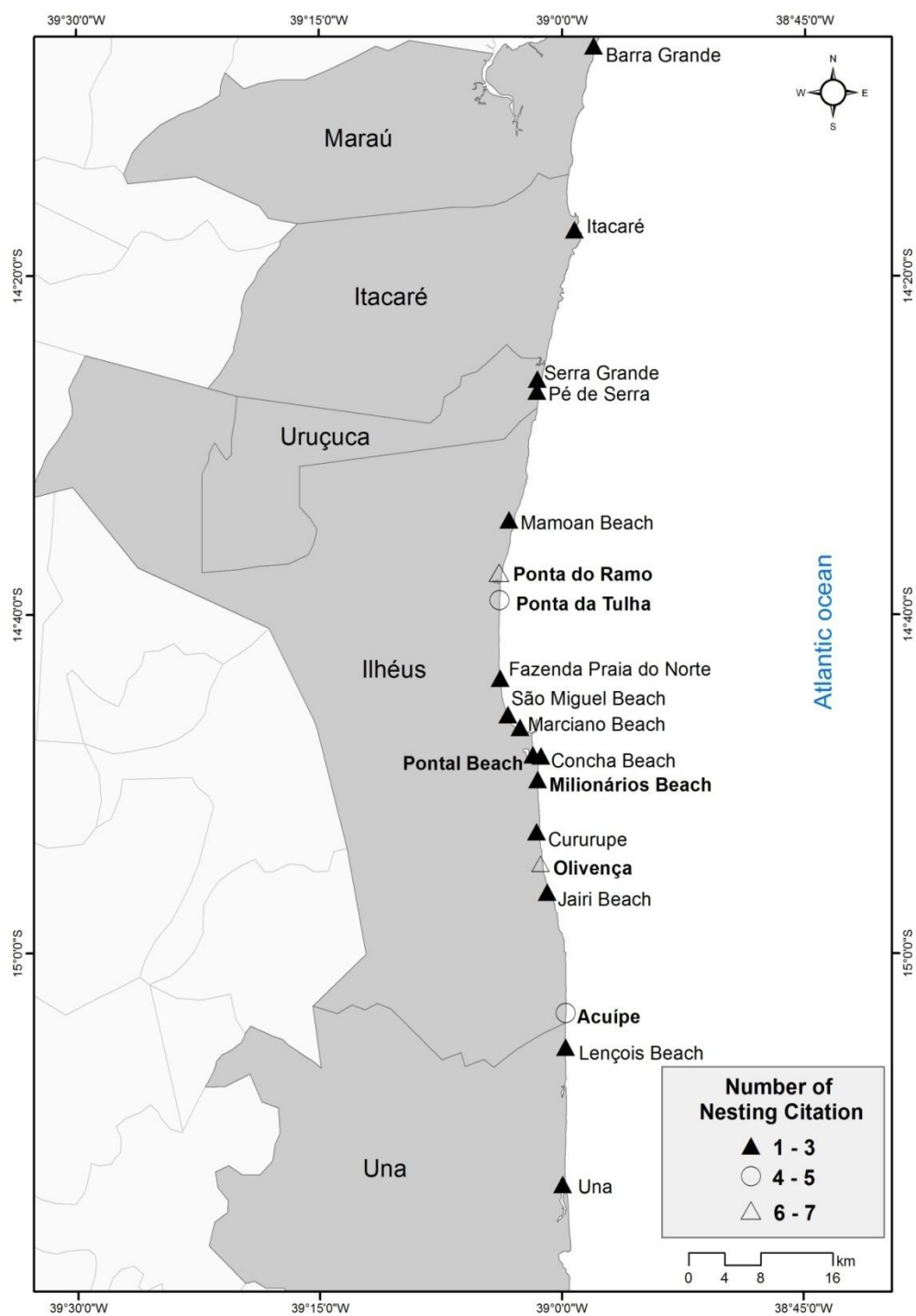
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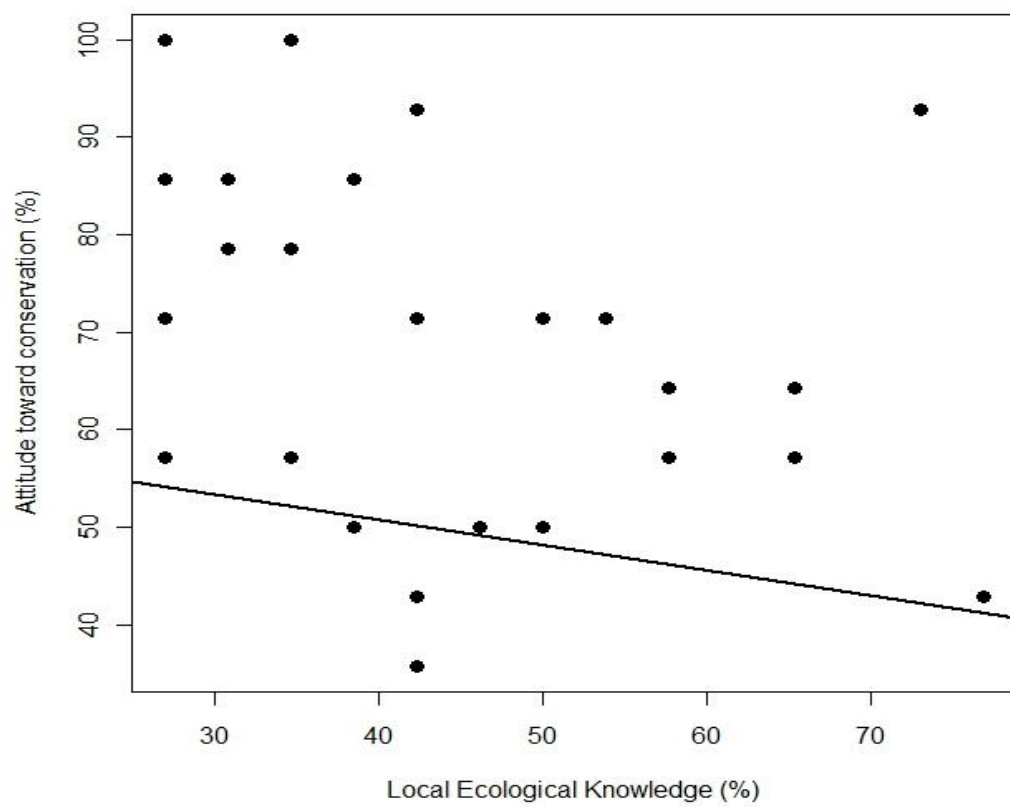
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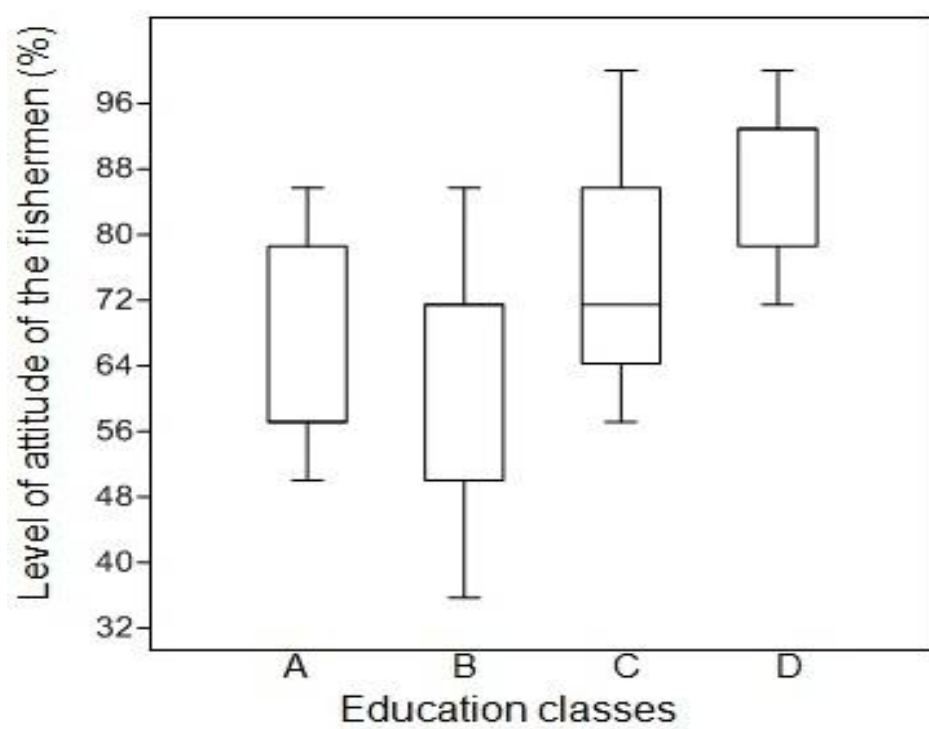
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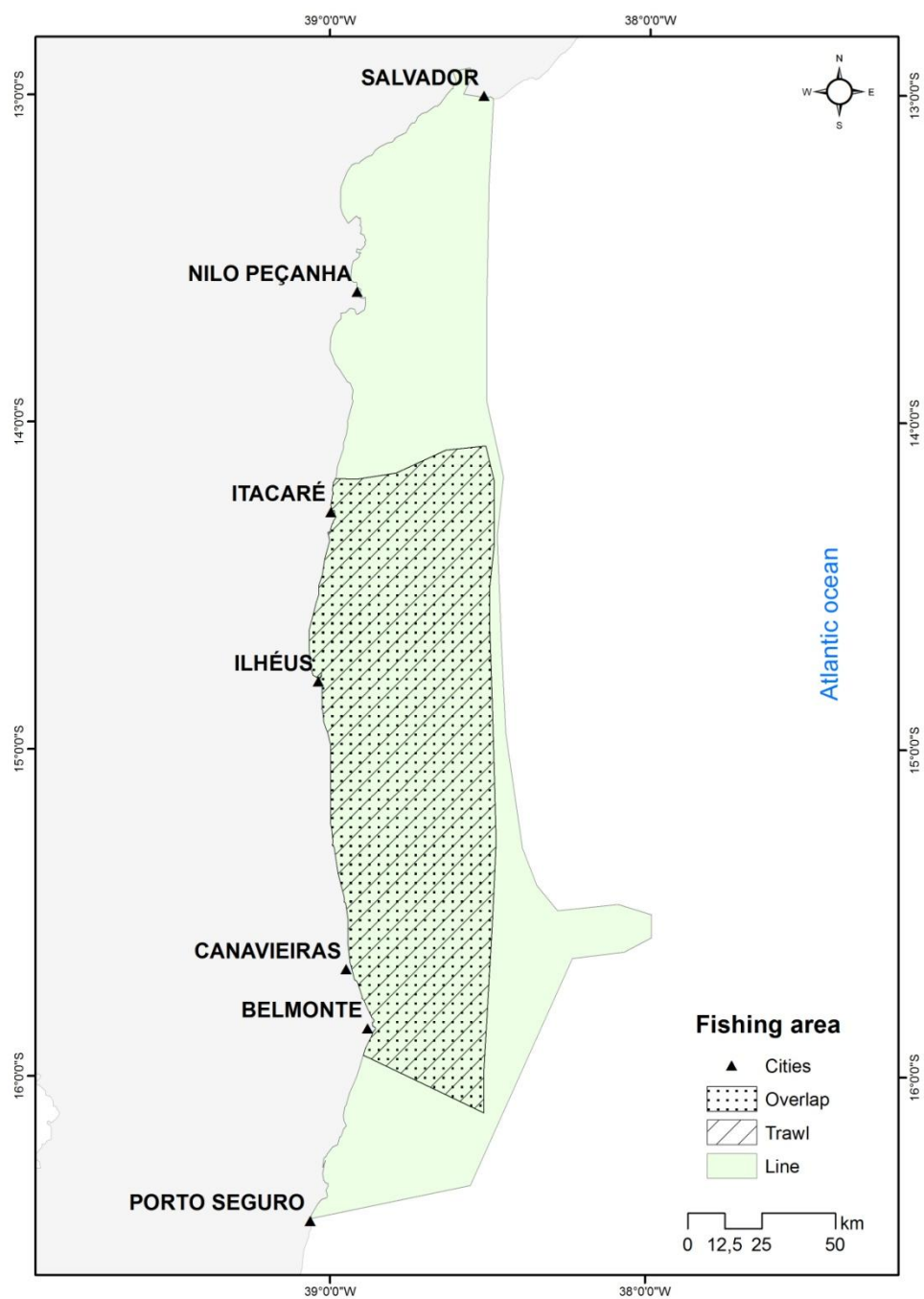
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6.



7.



8.



Tables

1.

Table 1. Characteristics of questionnaire applied to the experts (N=30).

Characteristics	Number of questions	Percentage of questionnaires
Fisherman profile	10	12
Structure and work equipment	19	23
Knowledge about turtles	13	16
Projective test	6	7
Knowledge bycatch	16	20
Attitudes towards conservation	8	10
Beliefs and Taboos	10	12
Total	82	100

2.

Table 2. Profile of the specialists interviewed in the colonies of fishermen Ilhéus, Bahia (N=30).

	Minimum	Mean	Maximum
Age (years)	40	54	86
Schooling (years)	0	5	14
Fishing time(years)	13	32	60
T associated the colony(years)	3	24	52
Time of residence in Ilhéus(years)	10	41	63
Nº of children	1	3	7
%			
Male:	100		
Ocuppation:			
Fishing only	87		
Others	13		

CONCLUSÕES GERAIS

Em geral, o conhecimento ecológico local dos pescadores das colônias de Ilhéus sobre tartarugas marinhas, segundo os padrões de classificação utilizados, foi médio. O perfil dos entrevistados se concentrou em indivíduos com média de 54 anos, de baixa escolaridade e com um tempo médio de 32 anos de pesca. Possíveis áreas de desovas foram relatadas pelos entrevistados especialistas, com destaque a possíveis locais de nidificação de tartaruga de couro, nos municípios ao sul de Ilhéus. Alguns comportamentos e dados ecológicos do quelônio em estudo foram corroborados com a literatura científica.

A maioria dos pescadores entrevistados mencionou ter capturado tartaruga durante alguma operação de pesca recentemente. A costa de Ilhéus, Olivença e Acuípe foram destacadas como áreas de grande probabilidade de captura accidental. As últimas capturas foram atribuídas à linha de pesca. Entretanto, segundo os entrevistados, a rede de lagosta e a rede de camarão apresentam maior probabilidade de captura do animal.

As atitudes mostraram ser predominantemente positivas e moderadas em relação à conservação do recurso natural estudado. Os pescadores, de uma forma geral, acham importante manter as tartarugas marinhas e o ambiente natural onde elas vivem. A tartaruga marinha não foi relatada como um recurso alimentar e artesanal pelos pescadores, apesar de, no passado apresentarem atitudes desfavoráveis em relação ao quelônio.

Conhecimentos e atitudes foram fracamente inversamente correlacionados. O nível educacional do entrevistado mostrou ter uma relação positiva com as atitudes, no que diz respeito à conservação do recurso. A presença de tabus alimentares foi verificada em metades dos especialistas entrevistados.

A redução da antropização acerca das tartarugas marinhas pelo homem, sensibilização pública com uma abordagem educativa adequada e compatível com a realidade da comunidade tradicional, programas de capacitação de agentes multiplicadores e a continuação de projetos de educação ambiental e de monitoramento do recurso natural estudado, e, podem colaborar com

informações adicionais para que seja possível avaliar o potencial impacto sobre as populações de tartarugas marinhas na região Sul da Bahia.

APÊNDICE 1
ROTEIRO PARA ENTREVISTA DE ESPECIALISTAS NAS COLÔNIAS DE
PESCADORES DE ILHÉUS, BAHIA.

Parte I. Dados gerais da entrevista:

- 1) Pesquisador:
- 2) Data:
- 3) Local:
- 4) Hora/início:
- 5) Hora/fim:
- 6) Colônia:

Parte II. Dados pessoais do entrevistado:

- Nome:
- Apelido:
- Sexo:
- Idade:
- Local de nascimento:
- Estudou:
- Atividade do cônjuge:
- N° de filhos:
- Tempo de associado (Colônia):
- Atividade dos filhos:
- Quanto tempo mora aqui?

Parte III. Conhecimento sobre a pesca, estrutura e equipamentos de trabalho.

- *Apetrecho mais utilizado:* _____

- Tempo de atividade de pesca:
- Vive só de pesca?
- Aprendeu a pescar com quem?
- Onde o senhor costuma pescar?
- Possui embarcação?
- Se não, usa de quem?
- Qual o tipo de embarcação?
- Tamanho da embarcação?
- Quantas pessoas acomodam?
- Qual (is) outro(s) apetrecho(s) o senhor usa para pescar?
- O que o senhor pesca?

- Quantas vezes embarcam? (diariamente/semanalmente/mensalmente)
- Quanto tempo costuma ficar em alto mar?
- Como era a pesca há 10,20 anos atrás? E hoje? Pescava o que nessa época?
- Se houve mudança? Por quê?

Parte IV. Conhecimento ecológico tradicional dos pescadores (CET) sobre tartarugas marinhas (áreas de alimentação / reprodução, tabus alimentares, fins medicinais e artesanais).

- Para o senhor o que é tartaruga?
- Na região encontra-se tartarugas?
- Qual local encontra-se mais tartarugas?
- Qual o tamanho delas? (Máximo e Mínimo)
- Qual a maior que você já avistou?
- Qual profundidade(m) máxima do local onde o senhor encontrou a última tartaruga que viu?
- Local onde se mais pega tartaruga? Por quê?
- Quem se alimenta de tartaruga?
- O que elas comem?
- Sabe o local onde elas desovam? Nomes das praias? Que época?
- Já comeu ovos de tartarugas? Todos podem consumir? Se não, quem?
- O senhor já consumiu a carne de tartaruga?
- Qual tipo de tartaruga o senhor já consumiu?
- O que o senhor achou?
- Como você chama os animais que não pode ser consumido por algum motivo?
- A tartaruga para o senhor é um pescado remoso ou não-remoso? Por quê?
- Todos podem consumir essa carne? Quem não pode? Por quê?
- Existe algum lugar específico que não se pesca por causa das tartarugas? Onde? Por quê?
- Existe alguma tartaruga que antigamente ou hoje não se pega(va) por causa de alguma característica do animal? Como cheiro, visual, ser agressivo?
- Existe alguma tartaruga que os pescador só pega(va) numa fase da vida do animal como filhote/adulto/velho ?
- Existe alguma tartaruga que pode ser usada para fins medicinais? Qual e como é utilizada?
- Já usou tartarugas para fins artesanais? Qual? Que parte da tartaruga?
- Conhece alguém que faz esse tipo de trabalho? Quem? Onde?
- O senhor acha que atualmente encontra-se o mesmo número de tartarugas como há 10,20 anos atrás? Se não, por quê?
- Se já viu cópula (com elas fazem filhotes)? Como que é? Descreva.

- Qual o tempo de mergulho delas?
- Para o senhor, qual a principal ameaça as tartarugas?

Parte V. Teste projetivo.

(Nesse momento o entrevistador apresentará ao pescador um guia com 6 espécies de tartarugas, sendo 5 registradas no Brasil para a identificação).

- Quantos tipos de tartarugas são encontrados na região?
- Dentre as fotos seguintes, o senhor sabe identificar quem é quem?
- Como o senhor as diferencia?
- Fale sobre elas.

Parte VI. Conhecimento do entrevistado sobre a captura acidental de tartarugas marinhas na região de Ilhéus-BA.

- O senhor já pescou ou encontrou alguma tartaruga durante a pesca?
- Qual *apetrecho* que o senhor usou nessa pesca?
- Qual (is) *apetrecho(s)* o senhor acha que pega mais fácil tartaruga?
- Qual foi a reação do senhor?
- Que profundidade e local ocorreu?
- Qual o estado da tartaruga encontrada?
- Qual o tamanho dessa tartaruga?
- Você sabe qual o tipo de tartaruga era? Alguma característica?
- Ela estava viva ou morta?
- No caso de encontrar a tartaruga aparentemente morta, o que o senhor fez?
- Tentou reanima - lá?
- Conhece alguém que sabe reanimar, cuidar e tratar de tartarugas machucadas?
- Conhece alguém que já pescou? Quem? Quantas o senhor pescou? Qual *apetrecho* usado?
- Para o senhor, qual ao artefato de pesca que mais pega tartaruga?
- Como é possível pescar e não capturar tartarugas? O que podemos fazer para não capturar?

Parte VII. Atitudes do entrevistado em relação à conservação.

- O que as tartarugas marinhas representam para você?
- Porque é importante manter as tartarugas marinhas e o ambiente onde estas vivem?
- Alguma das espécies de tartaruga marinha tem diminuído nos últimos anos? Em sua opinião qual/is é/são o/s motivo/s?

- Em sua opinião a presença das tartarugas marinhas prejudica a pesca? De que forma? Por quê?
- Quando foi proibida a pesca de tartarugas marinhas? O que senhor acha da proibição da pesca de tartarugas?
- Antes da proibição, era comum capturar tartarugas? Qual espécie?

Parte VIII. Indicação de especialista.

- Indique um indivíduo que tenha conhecimento aprofundado sobre tartarugas marinhas na região de Ilhéus.
- Qual o nome/apelido?
- Quantos anos ele tem?
- Onde posso encontrá-lo?
- O senhor sabe qual o melhor horário para conversar com ele?

APÊNDICE 2

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

Meu nome é Heitor de Oliveira Braga. Sou estudante da Universidade Estadual de Santa Cruz (UESC) e estou fazendo um estudo sobre a pesca accidental de algumas tartarugas aqui em Ilhéus. Tal pesquisa pretende saber como e quando ocorre esse tipo de pesca pela frota pesqueira, assim como buscar o conhecimento dos pescadores locais sobre as áreas em que as tartarugas aparecem mais, os locais onde elas provavelmente se reproduzem e onde seus ovos são encontrados com maior frequência.

Para a realização da pesquisa irei conversar com alguns pescadores como o senhor, nas colônias Z-19 e Z-34 localizadas nos Bairros Pontal e Malhado. Se sentir-se à vontade para colaborar com nossa pesquisa irei aplicar um questionário com perguntas relacionadas às tartarugas marinhas, algumas características da atividade pesqueira local, aos tipos e localização de aparelhos de pesca, além de questionamentos sobre as presas alvo, a possível utilização de iscas e outros fatores do meio que podem estar relacionados com a captura accidental. Caso o senhor não queira fornecer informações para o nosso estudo, será respeitada a sua decisão. Se o senhor permitir, as entrevistas poderão ser gravadas por meio de um gravador. Essas gravações com as informações registradas poderão ser repassadas para um cd e guardadas em meu local de trabalho na UESC. Caso seja autorizado, irei tirar algumas fotos dos artefatos de pesca e da espécie de animal estudada durante as embarcações. Essas imagens somente poderão ser divulgadas em revistas ou reuniões científicas, como imagens ilustrativas. Se no meio da entrevista o senhor desistir de colaborar com o nosso estudo não será prejudicado de forma alguma. A sua identidade será mantida em sigilo e apenas as informações serão registradas. Se quiser, seu nome será coletado e anotado nos roteiros de entrevistas. Sendo necessário entrevistar o senhor novamente para coletar outras informações, esses dados pessoais irão facilitar meu estudo. Assim sendo, seu nome e sua idade serão mantidos em absoluto sigilo. No fim dessa entrevista, se sentir-se à vontade para indicar algum outro pescador que já tenha capturado tartaruga acidentalmente, que conheça locais de reprodução, desova ou outras informações relevantes sobre as tartarugas marinhas em Ilhéus, ficarei muito grato. Se não for possível, já estarei satisfeito com a contribuição dada.

A sua opinião será muito importante para o nosso estudo, pois os dados coletados nas entrevistas poderão contribuir para a conservação do meio ambiente, para

o conhecimento ecológico local sobre as tartarugas e para que a cultura e tradição dos pescadores não se percam ao longo das gerações. As informações coletadas irão fazer parte de um trabalho que poderá ser publicado em revistas científicas e ser divulgado em encontros de pesquisadores que trabalham com tartarugas e populações humanas, além de constituir um relatório para ser entregue na UESC. Posteriormente essas informações serão divulgadas nas duas colônias de pescadores para o conhecimento de todos, através de banners auto-explicativos.

Caso o senhor concorde em participar da entrevista, deverá assinar este termo de consentimento, que também será assinado por mim, que sou o pesquisador responsável. Dessa forma, uma cópia ficará comigo e a outra com o senhor.

Em caso de dúvida, por favor, pergunte. Desde já agradeço. Meu endereço de trabalho é na Universidade Estadual Santa Cruz, Departamento de Ciências Biológicas, Universidade Estadual de Santa Cruz, Rodovia Ilhéus – Itabuna, Km 16, Ilhéus, BA, Programa de Pós-Graduação em Ecologia e Conservação da Biodiversidade, CEP: 45.650-000 Telefone e FAX: (73) 9199- 7149. E-mail: heitorob@gmail.com.

_____, ____ / ____ / ____	_____	
Local	dia mês ano	Assinatura do voluntário

A rogo do Sr (a)._____, assinam:

“marca do polegar”

Assinatura da Testemunha 1



Assinatura da Testemunha 2

APÊNDICE 3

FICHA DE EMBARQUE

- Mestre do barco: _____. Data: _____.
- Nome da embarcação: _____. Número de tripulantes: _____.
- Local da pesca: _____. Qual a distância da costa? : _____.
- Hora/início DA PESCA DO DIA: _____ Hora/fim: _____.
- Ponto de GPS dos locais de PESCA (se tiver GPS): 1- _____.
- 2 - _____. 3 - _____. 4 - _____. 5 - _____.
- 6 - _____.
- Hora que põe e tira a linha no mar (minutos ou horas):
 Põe: _____ Tira: _____
 Põe: _____ Tira: _____
 Põe: _____ Tira: _____
 Põe: _____ Tira: _____
- Tempo da linha total no mar (horas): _____
- Nº de tartarugas capturadas acidentais nesse dia: () 0 () 1 () 2 () 3 ou mais.
- O que eu fiz quando encontrei uma tartaruga na pesca?
- Local onde pego a tartaruga e distância da costa?

TARTARUGA CAPTURADA	PRIMEIRA	SEGUNDA
Maior medida (comprimento)		
Menor medida (largura)		
Peso (g ou kg)		
Número do anel na nadadeira (Se tiver)		
Ponto de GPS da captura		

- Como a tartaruga estava: **(MARQUE COM X A OPÇÃO)**:

PRIMEIRA:

- a. Viva e sem danos aparentes.
- b. Viva e com danos aparentes.
- c. Viva e com verrugas.
- d. Morta mas sem danos aparentes.
- e. Morta e com danos aparentes.
- f. Morta com verrugas.
- g. Outro: _____.

SEGUNDA:

- a. Viva e sem danos aparentes.
- b. Viva e com danos aparentes.
- c. Viva e com verrugas.
- d. Morta mas sem danos aparentes.
- e. Morta e com danos aparentes.
- f. Morta com verrugas.
- g. Outro: _____.

APÊNDICE 4**PRANCHA UTILIZADA NO TESTE PROJETIVO**

FONTE: <http://www.tartanet.it>

ANEXO 1

**UNIVERSIDADE ESTADUAL DE SANTA CRUZ**
COMITÊ DE ÉTICA EM PESQUISA - CEP/UESC**PARECER CONSUBSTANCIADO nº 602**

- Reunião Ordinária nº 118, 3/novembro/2010 -

Protocolo: 379/2010

Pesquisador responsável: HEITOR DE OLIVEIRA BRAGA

Título da Pesquisa: *"Captura acidental etnoconhecimento sobre tartarugas marinhas (Testudines Cheloniidae) em Ilhéus, Bahia".*

O Comitê de Ética em Pesquisa da Universidade Estadual de Santa Cruz analisou o projeto de pesquisa acima referenciado e constatou que o mesmo atende às exigências da Resolução CNS nº 196/1996.

Situação do Protocolo: Considerando a relação favorável 'benefícios/riscos', e não havendo, pois, nenhum elemento que se constitua em comprometimento ético na realização do projeto, ele foi considerado **APROVADO** por este Comitê.

Conforme a Resolução CNS 196/1996, relatórios parciais e final, bem como eventuais alterações metodológicas durante a execução do trabalho deverão ser comunicadas e enviados ao CEP-UESC para acompanhamento. *É importante ressaltar que a responsabilidade do(s) pesquisador(es) sobre as conseqüências da pesquisa não se encerra com a conclusão da etapa de coleta de dados, mas sim estende-se para além do término do projeto de pesquisa, até a fase de divulgação e aplicação dos resultados.*

Ilhéus, Campus Soane Nazaré de Andrade, 3 de novembro de 2010.

ANEXO 2



Ministério do Meio Ambiente - MMA
Instituto Chico Mendes de Conservação da Biodiversidade - ICMBio
Sistema de Autorização e Informação em Biodiversidade - SISBIO

Autorização para atividades com finalidade científica

Número: 24635-1	Data da Emissão: 18/08/2010 14:34
Dados do titular	
Nome: Alexandre Schiavetti	CPF: 123.522.798-79
Título do Projeto: Captura accidental e etnoconhecimento sobre tartarugas marinhas (Testudines Cheloniidae) em Ilhéus, Bahia	
Nome da Instituição : UESC - UNIVERSIDADE ESTADUAL DE SANTA CRUZ	CNPJ: 40.738.999/0001-95

Cronograma de atividades

#	Descrição da atividade	Início (mês/ano)	Fim (mês/ano)
1	embarques e entrevistas	08/2010	07/2011

De acordo com o art. 33 da IN 154/2009, esta autorização tem prazo de validade equivalente ao previsto no cronograma de atividades do projeto.

Observações e ressalvas

1	As atividades de campo exercidas por pessoa natural ou jurídica estrangeira, em todo o território nacional, que impliquem o deslocamento de recursos humanos e materiais, tendo por objeto coletar dados, materiais, espécimes biológicos e minerais, peças integrantes da cultura nativa e cultura popular, presente e passa da, obtidos por meio de recursos e técnicas que se destinem ao estudo, à difusão ou à pesquisa, estão sujeitas a autorização do Ministério de Ciência e Tecnologia.
2	Esta autorização não exime o titular e a sua equipe da necessidade de obter as anuências previstas em outros instrumentos legais, bem como do consentimento do responsável pela área, pública ou privada, onde será realizada a atividade.
3	Esta autorização não poderá ser utilizada para fins comerciais, industriais ou esportivos. O material biológico coletado deverá ser utilizado para atividades científicas ou didáticas no âmbito do ensino superior.
4	O titular da licença ou autorização e os membros da sua equipe deverão optar por métodos de coleta e instrumentos de captura direcionados, sempre que possível, ao grupo taxonômico de interesse, evitando a morte ou dano significativo a outros grupos; e empregar esforço de coleta ou captura que não comprometa a viabilidade de populações do grupo taxonômico de interesse em condição in situ.
5	Este documento não dispensa o cumprimento da legislação que dispõe sobre acesso a componente do patrimônio genético existente no território nacional, na plataforma continental e na zona econômica exclusiva, ou ao conhecimento tradicional associado ao patrimônio genético, para fins de pesquisa científica, bioprospecção e desenvolvimento tecnológico.
6	Em caso de pesquisa em UNIDADE DE CONSERVAÇÃO, o pesquisador titular desta autorização deverá contactar a administração da unidade a fim de CONFIRMAR AS DATAS das expedições, as condições para realização das coletas e de uso da infra-estrutura da unidade.
7	As atividades contempladas nesta autorização abrangem espécies brasileiras constantes de listas oficiais (de abrangência nacional, estadual ou municipal) de espécies ameaçadas de extinção, sobreexploradas ou ameaçadas de sobreexploração.

Locais onde as atividades de campo serão executadas

#	Município	UF	Descrição do local	Tipo
1		BA	Ilhéus	Fora da UC

Atividades X Táxons

#	Atividade	Táxons
1	Marcação de animais silvestres in situ	Cheloniidae
2	Observação e gravação de imagem ou som	Cheloniidae

Este documento (Autorização para atividades com finalidade científica) foi expedido com base na Instrução Normativa nº154/2007. Através do código de autenticação abaixo, qualquer cidadão poderá verificar a autenticidade ou regularidade deste documento, por meio da página do Sisbio/ICMBio na Internet (www.icmbio.gov.br/sisbio).

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