

The environmental conflicts and the estuarine dolphin (*Sotalia guianensis*) conservation from the Costeira da Armação's community point of view, in the Anhatomirim Environmental Protection Area, South of Brazil¹

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ABSTRACT

The Anhatomirim Environmental Protection Area, situated in Santa Catarina State, was created in 1992 with the main purpose to conserve the estuarine dolphin that lives in the region. However, the EPA creation has caused conflicts among the inhabitants and the bodies responsible for supervising the Protected Area, which aggrieves both the community and the dolphin conservation. By means of interviews with inhabitants of Costeira da Armação community, inserted in the Anhatomirim EPA, the environmental conflicts existing in the region, the local community's view about such conflicts and proposals for the estuarine dolphin conservation were evaluated. Seventy interviews were carried out based on a questions protocol, including open and closed questions, from August to October 2004. Different environmental conflicts were identified in the region, where the main ones are related to the inspection bodies, the limitations imposed by the EPA creation and to the dolphins watching tours. The community showed a positive view regarding the dolphin and thinks that it must be preserved. Thus, the conservationist efforts must involve local communities in conservation measures so that they become more effective and the existing conflicts can be mitigated.

Key words: Environmental Protection Area, Human community, fishermen, *Sotalia guianensis*.

INTRODUCTION

Nowadays, one of the main biodiversity conservation mechanisms has been the establishment of protected areas. However, about 20%

of the world population lives within the hotspots, priority areas for conservation (Cincotta et al., 2000). Besides, several of such regions are inhabited by indigenous and other native populations. In some cases, it may be contributed for the appearance of social and cultural conflicts, because some conservation models disregard the presence of human populations inside

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them and in their surroundings (Hanazaki, 2003). The ethnology seeks to understand the interaction among human populations and the natural resources, with special attention to the perception, knowledge and usage, thus contributing to elucidate cultural differences and analyze cultural diversity or heterogeneity (Beggossi et al., 2002). By studying a certain community, we can also understand better the environment in which it is inserted and look for solutions to preserve that place's biodiversity.

According to the *Sistema Nacional de Unidades de Conservação* – SNUC (National System of Protected Areas - SNUC) of 2000, an EPA is a Sustainable Use Protected Area and the basic purpose of such areas is to make nature conservation compatible with sustainable use.

The Anhatomirim Environmental Protection Area was created by the Federal Decree No. 528 of May 20 1992, with the purpose to preserve the remnants of Tropical Rainforest, the water sources to supply to the handmade fishing populations of the region and protect the feed, reproduction and rest areas of the resident estuarine dolphin population (Brazil, 1992). This region corresponds to the south limit of distribution of the estuarine dolphin, *Sotalia guianensis* (Simões-Lopes, 1988). Although it was created in 1992, the Anhatomirim EPA does not have a zoning law or a management plan yet, like a great part of the Protected Areas in the country (Wedekin et al., 2002; Zellhuber et al., 2002). According to Wedekin et al. (2002), the EPA was created and limited without a previous knowledge of the dolphin's behavior and ecology. Besides, there is not much diffusion and acceptance of EPA by the communities of the region (Zellhuber et al., 2002).

According to Zellhuber et al. (2002), the main environmental conflicts currently existing in the EPA are economic activities like fishing, shellfish farming, and tourism, among which we can highlight the dolphin-watching, which has been practiced since 1980, through vessels of various sizes. The number of vessels has increased every year, having as the main attraction the visit to Currais Bay (or Golfinhos Bay)

and also to the historical and architectonic sites of Santa Cruz and Santo Antônio Fortresses. The Currais Bay has already been identified as one of the main concentration areas of estuarine dolphins in the Norte Bay (Wedekin et al., in the press).

Nowadays, the touristic activities for dolphin-watching are practiced by 45 schooner-type vessels, registered with the *Capitania dos Portos* (Ports Captaincy) in Florianópolis (Mori, 2002). In addition to these, there are ten handmade fishing vessels that also practice the activity, operating mainly in the summer (Mori, 1998).

This study aims at carrying out a survey of the possible environmental conflicts existing in the Anhatomirim EPA, from *Costeira da Armação's* community point of view, such as the relationship of tourism, the local community and the dolphins; the relationship of the EPA and enforcement bodies with the community; and the population's level of commitment to such issues and in relation to the estuarine dolphin conservation.

STUDY AREA

The Anhatomirim EPA is situated northwest of the Santa Catarina Island. Its marine portion includes waters of the Norte Bay, between the coordinates 27°23'12" - 27°35'36" S and 48°33'48" - 48°30'12" W (FIGURE 1). The EPA's total area comprises 4,602.6 ha (Wedekin et al., 2002).

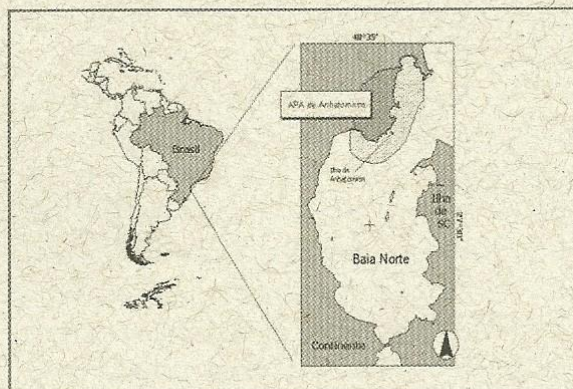


FIGURE 1. Localization of the study area in the Norte Bay, coast of Santa Catarina, south of Brazil.

(source: Wedekin, 2003)

The Anhatomirim EPA's marine area is composed of creeks and beaches, including the Anhatomirim Island, where the Santa Cruz Fortress is located, the Armação Creek and the Currais Bay. This bay has an area of approximately 0.7Km², with an average depth of 2.50m (Mori, 1998).

The human population that inhabits within the EPA is distributed into six locations: *Areias de Baixo*, *Caiera do Norte*, *Praia do Antenor*, *Costeira da Armação*, *Fazenda da Armação* (the largest) and *Armação da Piedade*. Most of the city's population is urban and young, with a higher density of people aged between 10 and 19 years old (Mori, 1998). The head of the family's education level shows a primary-education level, and only quite few heads of family have completed high school. The city's main source of income is the natural resources exploration (fishing and tourism). The communitarian associations existing within the EPA are: *Colônia de Pescadores Z10* (Fishermen's Union), *Associação dos Moradores do Balneário Caravelas* (Association of Inhabitants of Balneario Caravelas) and *Sociedade Balneário Praia do Antenor* (Balneário Praia do Antenor Association) (Mori, 1998).

METHODS

The data collection was carried out in the *Costeira da Armação* community (popular center next to the Golfinhos Bay), through interviews based on a protocol that included open and closed questions.

The questions had the purpose to assess the knowledge of inhabitants (fishermen and non-fishermen) about the estuarine dolphin's ecology, the main human impacts and the proposals for their conservation. All together, it was asked 34 questions divided into blocks related to the socioeconomic data, fishing activities, the species' ecology, environmental conflicts and the species' conservation.

The interviews were carried out in a non-probabilistic manner, at the beach, in the local commerce, in the restaurants, in the streets and in the inhabitants' houses, comprising 40% of the resident population and 100% of the fishermen. The estimation is that the number of constituents in the *Costeira da Armação* community is 280 people, according to local inhabitants.

For some questions, the answers were analyzed by comparison among the different groups, established according to the interviewee's economic activities and education level. Whenever possible, the percentages of the different answers were compared through chi-square tests (level of significance = 5%).

RESULTS

Characteristics of the sampled population

In the *Costeira da Armação*, 70 adult inhabitants of both genders were interviewed, being 38 men (54%) and 32 women (46%). Most of the interviewees are native (63%) and have not completed the elementary school.

Twenty-two fishermen (31%) whose main activity is fishing were interviewed. Twenty-seven per cent of the interviewees work in the local commerce or in tourism support activities (restaurants, grocery stores, tourism vessels), 21% are housewives and 21% have activities other than fishing, commerce or tourism. Retired people (6%) and unemployed people (3%) were also interviewed.

Fishermen

The fishermen from the *Costeira da Armação* community can be characterized as "hand-made fishermen". The source of knowledge about fishing is transmitted through oral tradition. Only two fishermen stated to have already worked inside large-sized fishing vessels.

Among the fishermen whose main activity is fishing (n=22), 40% perform other activities in parallel to fishing (n=9), like tourism, commerce and shellfish-farming operation, and three are retired fishermen. All the interviewees that work in tourism are fishermen.

The species most often caught in the place is the pink-shrimp (*Farfantepenaeus* spp.); 50% of the fishermen catch only shrimps and 32% catch shrimps and other species (the croaker - *Micropogonias furnieri* - was mentioned three times). Fishermen that catch other species total 18%.

The fishing technique most often used in the region was the rede de caceio (drift gillnet) that is suitable for catching shrimps. Another strategy used is the trawling or trap net. It was also mentioned the *espinhel* (long lines) and the rede *feiticeira* (trammel net), which consists of three meshes, two large outer meshes (*malhão*) and another smaller inner mesh. This technique catches various sea species (Caltabeoti, 2004).

Most of the fishermen fish all year long (78%). Others fish only in a certain period of the year: 7% in the winter, 11% from August to October and 4% from March to December.

It can be noted that the handmade fishing is an activity that is passed through the generations, because most of the fishermen also have fishermen parents (86%); however, the activity has progressively decreased. Only 22% of the fishermen's children pursue the fishing activity, while the others (78%) don't practice this activity.

Environmental conflicts and conservation

Tourism vessels

Forty-one per cent of the interviewees see the tourism vessels for dolphin-watching (schooners) from a positive view, considering that they don't cause any kind of problem (FIGURE 2). The positive aspects mentioned were that the boats bring money to the city, to res-

taurants, increase sales, generate jobs and foster tourism. The interviewees that see boats from a negative view total 34% and stated that they cause problems related to dolphins, pollution and noise. Some of the interviewed people stated that the boats run over the dolphins and that the noise frightens and chases them away. They also mentioned the lack of inspection, the fact that the schooners moor on the beach and enter the Currais Bay and upset the fishing due to the noise.

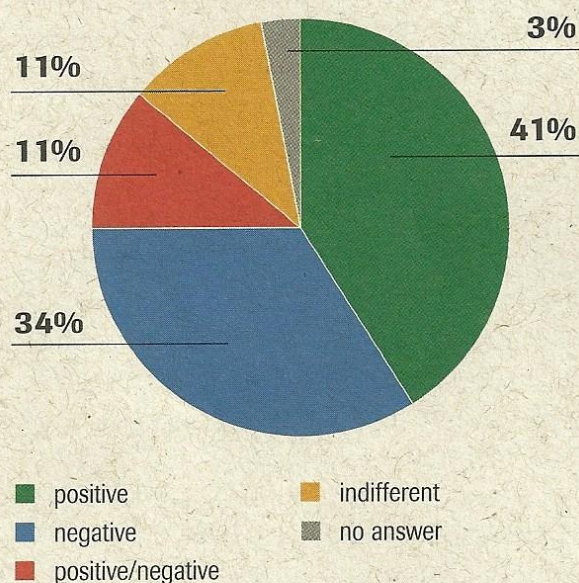


FIGURE 2. The view of the inhabitants of Costeira da Armação in relation to the tourism boats

Other interviewees have both a positive and a negative view in relation to the tourism boats. The positive aspects mentioned were related to people that work directly in the tourism and in restaurants, it means, the employment and income generation. The negative aspects of the tourism boats were once more related to dolphins, pollution, disorganization and lack of awareness. Some of the interviewees were indifferent about the tourism boats (11%), stating that they do not upset, disturb or harm. However, one of those people pointed the fact that boats cause pollution in the bay. As regards this issue, there was no significant difference among the answers of the inhabitants that work or are somehow related to the tourism (businessmen, restaurant or schooner owners) and inhabitants that do not

work in the tourism area (X^2 calculated = 0.52; g.l. 2; $p > 0.05$).

Most of the interviewed people said that the dolphins' reaction is negative (44%) when the tourism boats come near (FIGURE 3). Negative reactions were considered when the interviewees mentioned one of the following behaviors: they submerge, flee, become afraid, get stressed, hide, get annoyed by the noise, immerse. For 20% of the interviewed people, the dolphin presents a positive reaction when schooners come near. Positive reactions were considered when the following reactions were mentioned: they follow the boats, swim around, jump, frolic, and show off to tourists. Some interviewees mentioned both positive and negative reactions from the dolphins. It was considered answers like "it depends, they stay around; they flee, jump or frolic; when the boats turn the engine off, they stay around; they become calm or flee". Other answers were considered as indifferent regarding the dolphins' reaction, like "they keep on swimming; they keep still; they are used to that; they do not flee".

Accidental capture

Few interviewees stated that there are accidental captures of dolphins in fishing nets.

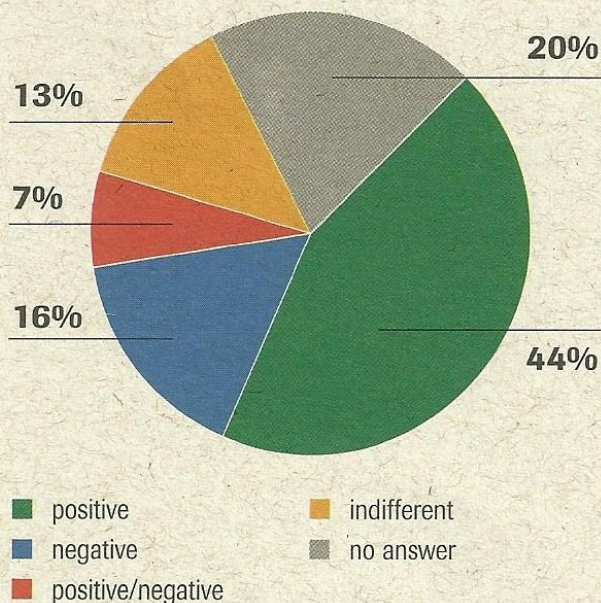


FIGURE 3. The dolphins' reaction to the approach of tourism boats according to the interviewees

Regarding this issue, there was no significant difference comparing the fishermen and not fishermen (X^2 calculated = 0.32; g.l. 1; $p > 0.05$). The number of people that affirmed that there are accidental captures in fishing nets was 24%, provided that some have mentioned that this fact is uncommon or only happened in the past when the nets were allowed in the Currais Bay (however, they are still used within the Bay). One of the interviewees pointed that sometime ago, in one of the fisheries in which there was an accidental capture, the fishermen ate the dolphin's meat. Another person mentioned that dolphins were hunted in the past. Seventy per cent of the interviewed people stated that there is no accidental capture of dolphins in fishing nets. The fishing nets associated with the accidental capture of dolphins were the trammel net and the whitefish net (FIGURE 4). Other types of fishing nets mentioned were: trawls, trap nets and bottom-set gillnets. Two interviewees informed that the dolphins are captured in traineiras (trawlers), 14-18-meter-long boats, which have a large purse seine to capture sardine, mullet, anchovy and *manjuba* (*Anchoviella lepidentostole*). The capture, according to the interviewed people, occurs in the Currais Bay and in São Miguel Bay, places where there is a great number of dolphins.

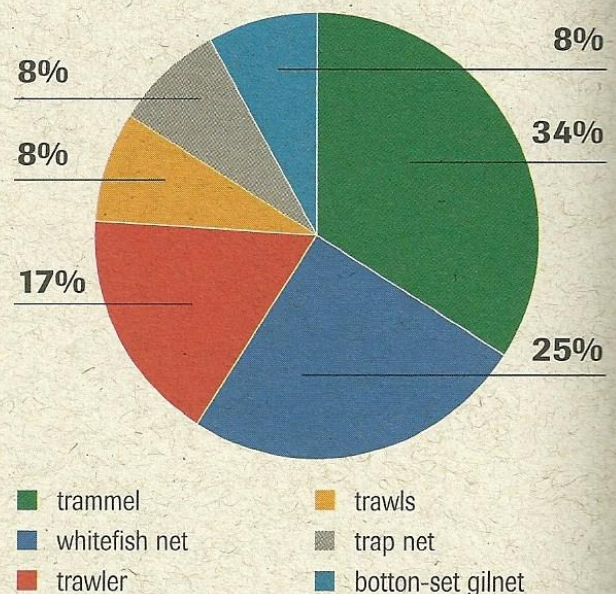


FIGURE 4. Fishing instruments mentioned by the interviewees in which accidental captures of dolphins occur in Costeira da Armação

When it was asked about having found any dead dolphin or a dolphin that had run aground, 57% of the interviewees answered no, but two of them mentioned that they had found them in the open sea. The interviewees that said to have found any dead dolphin or a dolphin that ran aground (43%) mentioned that this is an uncommon fact, having occurred twice or three times or sometime ago. They also said that the dolphin had fishing net marks (n=6) and a person affirmed it had been caused by a trammel-net. Other people stated to have seen cuts, where two people affirmed that the injuries had been caused by the schooner's propeller. Three people informed that the dolphins were killed by traineiras and two people asserted that the animal had no marks or injuries.

In relation to shellfish farming activities, 74% of the interviewed people asserted that there is no shellfish-farming operation in the region. The interviewed people that affirmed that there is a shellfish-farming operation were 36%, but the farming operations were said to be located on the northward beaches, which was confirmed through field observations. Two interviewees mentioned that the shellfish farming operation in the region is harmful to dolphins.

Social, Structural and Environmental Problems

The biggest problems existing in the region, pointed by most of the interviewed people (77%), were related to structural, social and environmental issues (TABLE 1). They mentioned that the fishing nets ban within the bay is a problem. Twenty-three per cent of the interviewed people asserted that there are no problems in the region.

TABLE 1: Social, structural and environmental problems in the Anhatomirim EPA

Social and structural problems	Environmental problems
Sanitation; access highway to the region; transportation, unemployment, health system, tourism infrastructure deficiency; education, fishermen abandonment.	Inspection; IBAMA; shellfish farming; fishing scarcity; pollution in the beach and sea; tourism; tourism boats within the bay; fishing boats and nets; lack of awareness from the inhabitants and the government bodies.

Most of the interviewees (60%) have a negative view in relation to the environmental enforcement bodies. Twenty-one per cent have a positive view and 19% point both a positive and a negative side. One of the negative points was regarding the prohibitions: "we can't plant; we can't build; we can't throw the net". Others mentioned as negative points the lack of attention of such bodies: "they are neglectful; they only come over in the close season". They also mentioned the lack of dialog with the community, the lack of knowledge and studies about fishing and the close season, and the fact that the inspection bodies aggrieve the fishermen: "the inspection only works for poor people".

Inhabitants Suggestions

As regards the inspection, many fishermen have asserted that the close season occurs in a wrong period, disrespecting the animals' reproductive cycle. They also mentioned that there should be a stricter inspection of the large fishing boats and the schooners within the Currais Bay. Many of the interviewees have suggested the creation of an area where the schooners should be forbidden (this area has already been established by the IBAMA Administrative Ruling No. 5-N, of January 20 1998, in which the Art. 1 establishes the creation of the "Dolphins Exclusive Zone", where tourism passenger, sports and leisure vessels

are forbidden to sail). In relation to IBAMA, it was suggested that there should be a better dialog with the community.

It was suggested the creation of an Association of Inhabitants, through which they could systematize themselves and enhance their participation. Another suggestion was the installation of more wastebins at the beach and in the streets.

In relation to the awareness of the Anhatomirim EPA, 27% of the interviewed people answered that they didn't know it and 16% had already heard about it. The ones who asserted to know the EPA were 57%; however, when they were asked about the reason why it had been created, many of them didn't know how to answer. Others gave answers not totally associated with the actual reasons for the creation of the EPA, like: "to avoid deforestation; to arrest people; to forbid constructions; to forbid fishing". Some people showed to know the actual reasons for the EPA creation: "to protect the environment; to protect dolphins, birds; to protect the fauna; to preserve the Atlantic Forest; to preserve the marine portion, vegetation and animals".

Forty-one per cent of the inhabitants who stated to know the EPA think that its creation is good for the region, mentioning that there must be environment protection and conservation. Eighteen per cent of the people have a negative view about the EPA: The EPA is only on paper; it is badly limited, it does not work out; they only forbid; it aggrieves fishermen, it does not help dolphins. They also mentioned that the community lacks information.

Most of the inhabitants think that the dolphin should be protected (91%); however, 9% of the interviewed people think that the dolphin should not be protected, pleading that the nature puts itself in charge of protecting them. A fisherman has mentioned that the otter upsets fishing, and therefore, it should not be protected.

In order to protect the dolphins, most of the people suggested the prohibition of schoo-

ners within the Currais Bay, and the organization and decrease in the number of schooners. Many people suggested increasing or enhancing the inspection both of schooners and the large fishing boats, like the trawlers, which decrease the fishing stocks. It was also mentioned the prohibition of fishing nets within the Bay and the prohibition of trawls in the sandbanks, which are mentioned as shrimps vivariums. Other suggestions were: there should be a better dialog between IBAMA and the community; awareness-raising of tourists, schooners, fishermen, inhabitants and governing authorities; creation of protection laws; to respect, take care, and not ill-treat the dolphin. Some of the interviewed people consider the dolphins as intelligent, clever animals, pleading that they do not fall into the fishing nets: "they pass over or aside the nets".

DISCUSSION

It could be verified that there is a serious environmental conflict in the Anhatomirim EPA area. The inhabitants are aggrieved as many limitations are imposed and people, mainly the fishermen community, are not provided with other subsistence alternatives.

The fact of some people suggesting the creation of an Association of Inhabitants shows that the community has the potential to organize itself and have an increased participation in the local issues.

Many inhabitants pointed social-type problems, like unemployment, educational system and fishermen abandonment. They pointed as environmental problems the inspection, IBAMA, the fishing scarcity and the tourism boats within the bay.

The environmental inspection bodies are seen from a negative view by a great part of the inhabitants, and this is due to the fact that they are very severe in some cases and neglectful in others. Many people mentioned

that there is no inspection or it is insufficient, in the case of the industrial fishing, but that they charge a lot from the handmade fishermen. It was also mentioned that the close season occurs in the wrong period. In a work about accidental capture of turtles in fishing nets, Pupo (2004) says that the biggest problem pointed by fishermen from the Santa Catarina Island is the industrial fishing and that there is a strict inspection over the handmade fisherman, when compared to the industrial fishing. According to Simões-Lopes & Paula (1997), the Protected Areas of Santa Catarina state offer only a symbolic protection to species they intend to protect, once there is no enforcement.

The lack of dialog between the environmental bodies and the community was also pointed as a problem and it reflects lack of awareness about the Anhatomirim EPA by the community, corroborating Zellhuber et al. (2002), who affirms that there is little diffusion and acceptance of EPA by the communities of the region. Few people are aware of the EPA and its actual reason for being created. Among them, some have a negative view of the EPA creation: "it is badly limited, it does not work out; it aggrieves fishermen; it does not help dolphins".

Wedekin et al. (2005) identified the main impacts that influence in the scene of the estuarine dolphin conservation in the Norte Bay, the area where the EPA is inserted. Among the impacts identified by these authors, local inhabitants also expressed their concerns about pollution, interference of tourism boats, shellfish farming and, more scarcely, the accidental gillnetting in fishing nets.

The tourism boats are seen both from a positive and a negative view by the community. Some positive aspects are the income and employment generation (for the people that work in the tourism area), and the negative aspects are related to the dolphins, pollution, disorganization and the lack of awareness of people who work with schooners. Simões-Lopes & Paula (1997) assert that the cetacean-watching

tourism may be an alternative for non-lethal exploration of resources and its development has been motivated by the increase in public awareness and economic opportunities that can be provided to the local communities, but for that, severe behavior rules must be adopted. In the region, this activity benefits only some restaurants' owners (who own the establishment on the seashore) and the few community people who work in the schooners. The enforcement also shows itself inefficient, provided that the local inhabitants themselves don't know the "Dolphins Exclusive Zone", where the boats are not allowed to sail.

A great part of the interviewed people (44%) has considered as negative the dolphins' reaction in relation to the tourism vessels. In a field study through the direct monitoring of the animals, a high percentage of negative behavioral reactions were noted in relation to vessels (64%) (Pereira, 2004). In the same study, positive reactions upon the vessels approach were noted in only 0.03%. Ribeiro et al. (2004), mention that there was a clear impact of the tourism vessels on dolphins *Stenella longirostris* in 73.4% of the cases of meetings with vessels in the Fernando de Noronha Archipelago.

Few people stated that there are accidental captures in the fishing instruments. Some affirmed that it rarely occurs. The most often mentioned fishing instruments were the trammel nets and the whitefish nets, and people also mentioned that the dolphins are captured by trawlers. As regards this issue, Simões-Lopes & Ximenez (1990) obtained answers from the region's local fishermen that denied the cetaceans capture, but it's known that the accidental capture in fishing nets is one of the main threats to cetaceans (Simões-Lopes & Paula, 1997) and that it occurs virtually throughout the area of distribution of the *Sotalia guianensis* in the western South Atlantic (Borobia & Rosas, 1991). The species that suffer the biggest impact in the State of Santa Catarina are *S. guianensis* and *Pontoporia blainvillei* (Simões-Lopes & Ximenez, 1993). In the case of the *S. guianensis*, the

mortality is mainly due to the floating gillnets used in the handmade fishing and occasionally to the trawling fishing by trawlers. Such occurrences are concentrated in internal waters of Norte and Sul Bays, between the Santa Catarina Island and the continent (Simões-Lopes & Paula, 1997). For Simões-Lopes & Ximenez (1990), the most impacting nets are the drift gillnets, used for catching shrimps, which are the nets most used by the interviewed fishermen. The fishermen from the north of Santa Catarina State mention the *miraguaia*, whitefish and trammel nets as the most impacting for cetaceans (Pinheiro & Cremer, 2003b).

The consumption of dolphin's meat was mentioned in one occasion, when there was an accidental capture. In some interviews, the meat was mentioned as a food taboo for being rather fatty. The fishermen from the north of Santa Catarina State (Pinheiro & Cremer, 2003a) avoid consuming this meat for the same reason; however, some occasions of cetacean meat consumption are mentioned in the literature (Simões-Lopes & Paula, 1997; Flores, 2002).

The strandings of dolphins were considered as uncommon facts by the interviewed people and, when they occurred, the animals presented fishing net marks or injuries supposedly caused by the boats' propeller. According to Wedekin et al. (in press), the stranding records for the Norte Bay region didn't correspond to the dolphins distribution, indicating that the animals' carcasses are carried by the maritime streams until stranding in another place. Animals were found in regions relatively close to the Currais Bay like Daniela Beach and Canasvieiras, both in the Santa Catarina Island (Simões-Lopes & Ximenez, 1990, 1993). Flores (1994) reports that, between 1991 and May 1994, four individuals were collected in the EPA, where two of them presented fishing net marks, and that, according to inhabitants and fishermen of the region, more than twenty animals were found dead, some presenting marks probably caused by propellers.

According to local inhabitants, the shellfish farming was prohibited in the Currais Creek. Mori (1998) and Wedekin (2003) have mentioned the shellfish as an activity that may be harmful to the dolphins' population of the region, because it reduces the area occupied by the animals, causing habitat loss.

The community's negative view about the inspection bodies and the EPA creation shows that the system currently adopted won't be effective while the community is not inserted and informed about it. The inhabitants of *Costa da Armação* showed to have a positive view regarding the dolphin and think that it must be protected. Thus, the conservationist efforts must actively involve the local communities in conservation measures so that these measures become more effective, attenuating the existing conflicts.



CONCLUSIONS

The community knowledge has shown itself to be homogeneous among the groups of fishermen and not fishermen, despite the closer contact and observation of dolphins by the formers. The inhabitants showed a positive view regarding the dolphin and think that it must be protected.

Conflicts were identified between the community and the environmental enforcement bodies and such conflicts are related to the limitations imposed by the EPA creation and to the tourism vessels. The dolphin-watching tourism has shown to benefit few people from the community, concentrating the benefits to the tourism companies established in the capital city, Florianópolis. So that the conservation measures adopted in the Anhatomirim EPA can become more effective, the community must be actively involved.

ACKNOWLEDGMENTS

We thank the Ecology and Zoology Department/CCB-UFSC and the FUNCITEC for the financial support; Leonardo Wedekin and Fernando Oliveira, for the comments in preliminary versions of this article; and the inhabitants of Costeira da Armação, for their collaboration.

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