# Payment for environmental services, fishers and cetaceans' conservation

**Shirley Pacheco de Souza**
Professor at the Federal Institution of Education, Science and Technology of São Paulo (IFSP); CAPESCA/PREAC – UNICAMP; Fisheries and Food Institute. Caraguatatuba [SP], Brazil. <shirleypacheco@yahoo.com>.

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## Abstract
The interactions between fisheries and cetaceans have been widely discussed by several authors. Bycatch of small cetaceans is frequent around the world, threatening several species. In Brazil, in two critical areas– Soure(Marajó Island) and São Sebastião - more than 70% of the local fishers (n= 40 and n=70, respectively) interviewed in a previous study reported bycatch of Guiana dolphin (*Sotalia guianensis*) or Franciscana dolphin (*Pontoporia blainvillei*) in gillnets. Other negative interaction involving fisheries and cetaceans is the entanglement of Southern right whales in fishing nets during their migration along the coast, as reported by 68% of the fishers interviewed in the South of Brazil (Pântano do Sul: n=25). On the other hand these interactions result in damage of the fishing gear and great economic losses to the fishers. To minimize these conflicts we suggest the adoption of strategies involving interested fishers in bycatch monitoring programs, where fishers could collect local data on the critical areas and frequency of dolphins' accidental catches, consequently increasing their awareness of the problem and providing a better baseline to support educational and regulatory measures related to cetaceans' bycatch. As a compensation for the time and energy spent in these programs, fishers could receive a "payment for environmental services" (PES), as an economic incentive to their participation, which would contribute to their economic stability as well as to cetaceans' conservation.

## Keywords
Payment for environmental services; fishers; cetaceans; conservation.

## Introduction

Fishing activities are affected by a wide range of large scales interactions, such as: disputes about territories and resources use, conflicts about conservation units' legal framework and decision making process on local fisheries management. Industrial and small-scale fishers also interact accidentally with cetaceans during fishing operations. These interactions can be considered negative when they involve competition between cetaceans and fishers for feeding resource, bycatch (accidental capture) of cetaceans by fishing gear, and their use by fishers for several purposes. On the other hand cooperation between cetaceans and fishers during the catch of fish schools is considered a positive interaction.

The accidental capture of non-target species in fishing gear, known as bycatch, is one of the major impacts on cetacean populations, causing the mortality of over than 300.000 individuals annually (WWF, 2004; REEVES et al., 2005). Cetaceans are quite vulnerable to mortality from bycatch and other anthropogenic causes due to their slow maturity and low reproductive rates. Not only the industrial fisheries, but also the small-scale fisheries cause great mortality to cetaceans due to bycatch, which is largely underreported by fishers, especially when they are not involved in conservation programs (SPENCER et al., 2000; KEMPER et al., 2005; SOYKAN et al., 2008; MOORE et al., 2009).

Both the industrial and small-scale fisheries cause high levels of bycatches, involving not only marine mammals but also sea turtles and seabirds (MOORE et al., 2009). As industrial fisheries are frequently monitored in relation to bycatches, there is a little more information on the species affected, the fishing gear involved and critical areas. In contrast, there is a lack of information about cetaceans' bycatches by small-scale fisheries, which is characterized by the use of a variety of small boats, fishing nets and main target species that are captured in several coastal environments. Such characteristics result in a diversity of fishing strategies, making difficult to assess data on these kinds of fisheries.

Generally, bycatches are underreported by the fisheries that are not under on-board observers' programs (SPENCER et al., 2000; KEMPER et al., 2005; SOYKAN et al., 2008). Moreover, there is not any global data bank with information on cetaceans' bycatch (READ, 2005).

A multi-specific and multi-gear approach has been suggested by many authors in order to improve bycatch management in critical areas around the world (SOYKAN et al., 2008; MOORE et al., 2010). Collaborative studies involving researchers and fishers may contribute to better understand the interactions between small-scale fisheries and the coastal environment as suggested by Silvano and Begossi (2010).

Small-scale fishers have been intensively surveyed concerning their Local Ecological Knowledge (LEK) about aquatic ecosystems and their interactions with the species they use (JOHANNES, 2003; SILVANO et al., 2009; BEGOSSI et al., 2010). The study of LEK is part of the Ethnobiology, a branch of Human Ecology.

Interviews about cetaceans' ethnobiology carried out in a previous study with 171 fishers, in four areas along the Brazilian coast, from 2007 to 2008: Soure (Marajó Island), Ponta Negra (Natal), São Sebastião and Pântano do Sul (Florianópolis), recorded important information on the interactions between fisheries and cetaceans. Bycatch of cetaceans was mention as the main interaction, among others (Figure 1) (SOUZA, 2011).

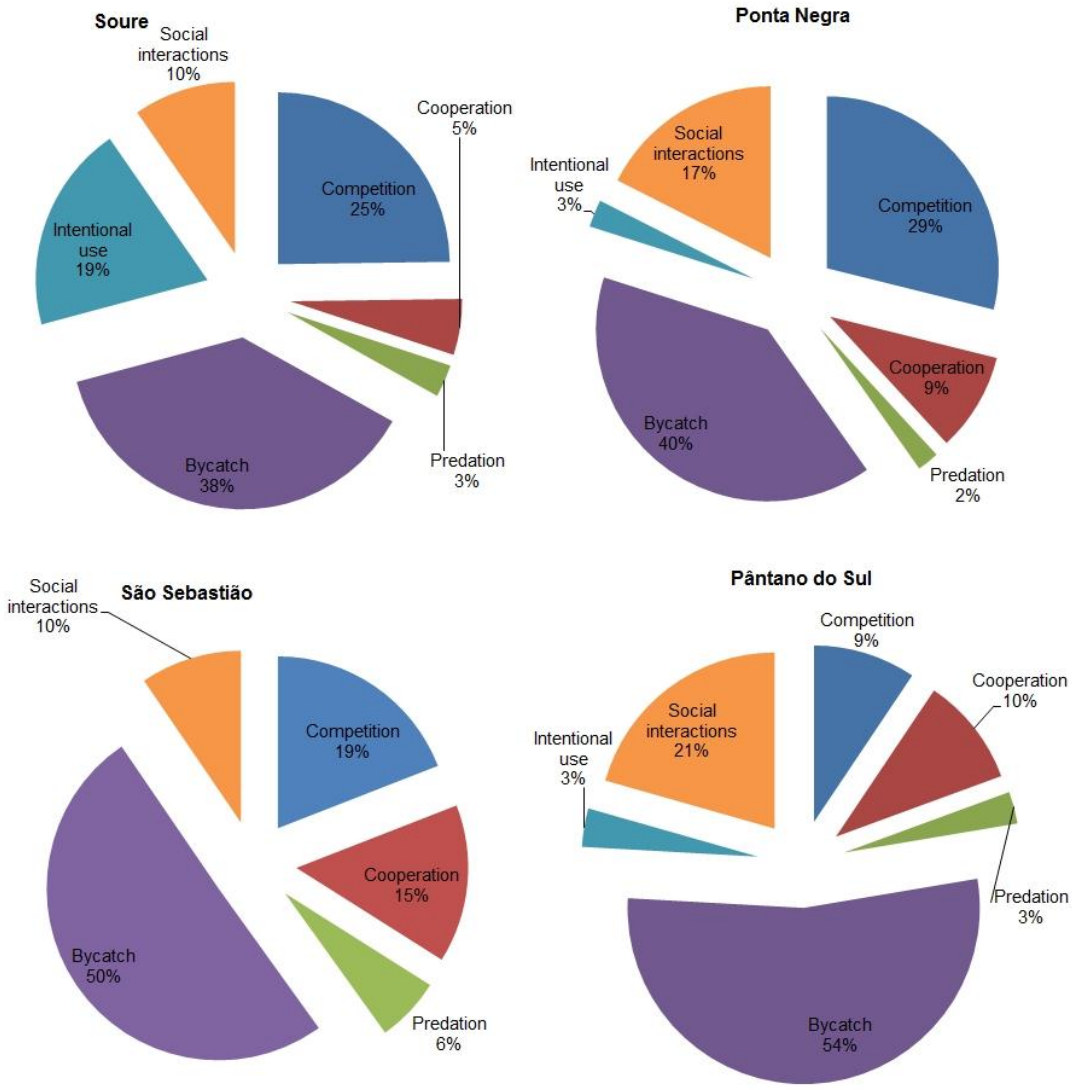


**Figure 1.** Categories of interactions between cetaceans and fisheries reported by Brazilian fishers.

Half of the 88 cetacean species currently recorded around the world occurs along the Brazilian coast, rivers and estuaries. Two of them are particularly affected by incidental catch: the small dolphin Franciscana, also known as Toninha (*Pontoporia blainvillei*) and the Guiana dolphin (*Sotalia guianensis*).These species are listed by IUCN, respectively, as "vulnerable" and "data deficient", and the literature has confirmed that they are the most caught in gillnets along the Brazilian coast (DI BENEDITTO et al., 2001, 2010; IUCN, 2010; OTT et al., 2002; SECCHI et al., 2004; DA SILVA; MARTIN, 2010).

According to Souza (2011), more than 70% of the interviewed fishers in two areas – Soure (Marajó Island) and São Sebastião – reported bycatch of *S. guianensis* and *P. blainvillei*, respectively, by surface and bottom gillnets (Figure 2) (SOUZA, 2011).

The extensive removal of top predators from their original ecosystems can cause a cascade effect, changing other species' composition and abundance and resulting in biological and economic losses. Additionally, in the case of *P. blainvillei* it represents the loss of the single species from the Pontoporiidae Family.



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## Review of some critical areas of bycatch or entanglements in the Brazilian coast

Recently, Siciliano et al. (2008) reported the occurrence of high rates of accidental catches of *S. guianensis* along the coast of Amapá and Pará States, Northern of Brazil. They reinforce the need to carry out a monitoring program to evaluate accidental catches and educative programs to the local communities.


**Figure 2.** *Pontoporia blainvillei* (A) and *Sotalia guianensis* (B) accidentally caught by gillnets in São Sebastião, Southeastern Brazilian coast.

Di Beneditto and Ramos (2001) recorded 181 accidental catches of *Pontoporia blainvillei* from 1986 to 1999, in the northern coast of Rio de Janeiro State (Southeastern Brazil). Most catches occurred in surface gillnets operating until 10 nautical miles from shore, in depths until 30 m. The authors suggest a continuous gillnet fleet monitoring to better evaluate the local risk for *P. blainvillei*. Moura et al. (2009) also analyzed cetaceans' strandings on the northern coast of Rio de Janeiro State, from 2001 to 2007, with special attention to *S. guianensis*. Over 32% of all *S. guianensis* stranded in that period showed evidence of entanglement in gillnets, and most strandings occurred during the spring and winter.

Souza and Winck (2005) monitoring gillnets fisheries, recorded the bycatch of 13 *P. blainvillei* and two *S. guianensis* in 12 months (jun 2004 – may 2005) in Caraguatatuba and São Sebastião, northern coast of São Paulo State.

Bertozzi and Zerbini (2001) reported the accidental catches of 31 individuals of *P. blainvillei*, by gillnets, in three years of monitoring at Praia Grande, central coast of São Paulo State. These catches also occurred in shallow waters, in depths until 20m, and suggest a high mortality of this species on a regional basis.

Ferreira et al. (2010) discussed the accidental catches of *P. blainvillei* by gillnets and seine nets on the coast of Rio Grande do Sul State and found higher rates of catches during the spring. The authors estimated that hundreds of *P. blainvillei* are caught annually in that area, threatening the species viability. They suggest the implementation of fisheries exclusion areas in shallower waters (until 30m) and the decrease in nets size and fishing effort.

## Economic losses

Generally when a cetacean is caught accidentally, there is some damage to the fishing gear involved in the catch. The most extreme case of damage recorded during the study on cetaceans' ethnobiology were found in Pântano do Sul (southern of Brazil), where 68% of the fishers (n=25) claimed that when the Southern Right whales (*Eubalaena australis)* entangles in fixed trap nets they carry the net, tearing it and causing great economic losses. Damage related to dolphin's entanglement were also reported, but in a small-scale. However, it is necessary to obtain quantitative information on the economic costs of the damage to fishing gear during cetaceans' accidental catches, to accurately dimension fishers' losses.

## The proposal of Payment for Environmental Services (PES)

Payment for environmental services has been defined by Wunder et al. (2008) as a voluntary transaction between buyers and providers of a well-defined environmental service, whose provision is guaranteed over time by contract. PES has been applied around the world in several situations: retention or capture of carbon, conservation of biodiversity, landscapes and water basins. One of the advantages of PES is that besides increasing the possibility of resource conservation, it can improve the life quality of providers and resource users and the local economic stability.

Begossi et al. (2011) suggested that PES could be used as a strategy to involve small-scale fishers in fisheries co-management of the protected areas of Ilha Grande and Paraty bays (Southeastern Brazilian coast). Fishers could be paid by restricting fishing activities and monitoring these protected areas against other prohibited uses, taking part in fisheries management and helping to solve conflicting situations.

Wunder et al. (2008) defined some categories of PES, and biodiversity conservation is one of them. In this case the benefits for which PES could be applicable are: biodiversity value for future use and the knowledge of its existence and importance. In this sense, cetaceans' conservation fits very well in this category.

Read (2005) emphasizes that fishers' participation in programs of reducing cetaceans' bycatch is logical and equitable, since fishers are the most familiar with fishing practices and may bring solutions to bycatch problems.

With this in mind, we suggest to propose the PES to fishers interested in participate of monitoring programs, especially in areas where small cetaceans' bycatch is frequent. Initially, they could collect data on: fishing boats and fishing methods involved in bycatch, critical areas, measures of local fishing effort, and the frequency of bycatches. As a first consequence, they could adapt their fishing strategies to avoid these critical areas, finding alternative locations to setting gillnets.

Involving local fishers in threatened species' conservation is one of the actions proposed in the Action Plan for the Conservation of the Toninha (*P. blainvillei*), the most vulnerable small cetacean of the South-Western Atlantic (DI BENEDITTO et al., 2010). Once participating in monitoring programs, fishers could receive a PES, as an incentive to their dedication to these activities.

The PES could be implemented through contracts between the interested fishers and governmental agencies of natural resources management. In this case, the costs for the PES could be transferred, as mitigation costs charged by these agencies, to big companies that are exploring commercially the local marine environment, in activities such as petroleum and gas production and harbor operations. The effectiveness of these PES schemes could be monitored and evaluated by the involved agencies, concerning to the fishers' participation, the payment by the companies, the data produced and the practical results obtained regarding to cetaceans' bycatch.

Our expectation is to increase fishers' awareness in relation to accidental catches, and to reach a significant local participation in the monitoring programs. As a result, the data produced through these programs could provide a better baseline about cetaceans' bycatch, supporting educational and regulatory measures on this issue.

## Conclusion

The implementation of PES for biodiversity conservation is a new tool that can be incorporated to natural resources management policies. However, it is necessary to define the rules and conditions in which PES would be a useful option, among them: the demand for the species' conservation, the engagement of the local resource users, the costs of PES implementation, and the practical results in terms of conservation.

Considering that a high percentage of fishers mentioned the bycatch of small cetaceans, we suggest a cetaceans' bycatch monitoring program involving interested in the most critical areas.

This suggestion could be a new strategy to deal with small cetaceans' bycatch, considering the situation of some species, such as *P. blainvillei* and *S. guianensis*, which are highly threatened by this kind of fishing interactions. Additionally, fishers' direct involvement in bycatch management, could be an efficient solution to minimize cetaceans' bycatch.

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