

Interactions between fisheries and cetaceans in Espírito Santo State coast, southeastern Brazil

Ricardo de Freitas Netto^{1, 2} & Ana Paula Madeira Di Benedetto¹

¹ Universidade Estadual do Norte Fluminense (UENF) Laboratório de Ciências Ambientais (LCA) – Av. Alberto Lamego 2000, CEP 28013-600, Campos dos Goytacazes, RJ, Brazil. E-mail: anapaula@uenf.br

² Centro de Estudos em Ecossistemas Marinhos e Costeiros do Espírito Santo (CEMARES) - Rua Celso Calmon 445 / 801, Praia do Canto, CEP 29055-590, Vitória, ES, Brazil. E-mail: ricardo@cemares.org.br

Abstract. Interactions between fisheries and cetaceans in Espírito Santo State coast, southeastern Brazil. The survey of fisheries and their interactions with cetaceans was carried out in 10 fishing Zones along Espírito Santo State coast, southeastern Brazil, between March 2002 and February 2003. Thirty-six harbours were visited and the information were taken through interviews with fishermen and direct observations. The species of cetaceans that outstand are: Franciscana (*Pontoporia blainvillei*) and boto-cinza (*Sotalia guianensis*). Seven kinds of interaction were identified on the study area: entanglement, collision, trappind, harpooning, stealing, ambush and cooperative fishery. It was reported interactions in 75% of harbours. The entanglement was registered in all of them. The sites that outstand as potential risk areas to the cetaceans are: (i) Regência, due to the variety of gillnets used, and (ii) Barra do Itapemirim and Piúma, due to the expressive number of boats.

Key words: by-catch, marine mammals, fishing tackle and entanglement.

Resumo. Interações entre a atividade pesqueira e os cetáceos na costa do Estado do Espírito Santo, sudeste do Brasil. O levantamento da atividade pesqueira, e das suas interações com cetáceos, foi conduzido em 10 zonas pesqueiras ao longo da costa do Espírito Santo, sudeste do Brasil, entre março de 2002 e fevereiro de 2003. Trinta e seis portos foram visitados sendo que as informações foram colhidas através de entrevistas e observações diretas. Dentre os cetáceos que interagem com a pesca (n= 11) podemos destacar a Franciscana (*Pontoporia blainvillei*) e o boto-cinza (*Sotalia guianensis*) como os mais susceptíveis a interação com a pesca devido a sua distribuição próxima a costa. Sete tipos de interações foram identificados na região de estudo: emalhe, colisão, emaranhamento, arpoamento, roubo, tocaia e pesca cooperativa. Em 75% dos portos (n= 27) foram registradas interações sendo que o emalhe foi reportado em todos os portos. Os portos que se destacam como potenciais áreas de risco para os cetáceos são: (i) Regência, devido à grande variedade de redes empregada, e (ii) Barra do Itapemirim e Piúma, devido o expressivo número de embarcações sediadas.

Palavras-chaves: captura acidental, mamíferos marinhos, aparelhos de pesca e emalhe.

INTRODUCTION

Conservation of marine resources has been neglected because of unsuccessful management procedures, usually focused on target species of fishery (MURAWSKI, 2000). Generally, fishes, mollusks and crustaceans are the main target species of fishery, however, other organisms, with no commercial value, are captured; such as marine mammals (NYBAKKEN,

1997; HALL *et al.*, 2000; MURAWSKI, 2000; YODZIS, 2001). According to McCAUGHAM (1992), those organisms may be classified as 'by-catch', defined by the portion of capture that is returned to the sea dead or injured, probably not surviving further. Direct impacts over top predators by mortality in fishing gears, as well indirect impacts by prey elimination, affect biodiversity, so it must be included in fishery management. In socio-economic terms, by-catches

may reduce fishery profits and contributes to a negative image on the activity. It also depreciates the explored stock due to mortality of juvenile fishes that haven't reached commercial size (HALL *et al.*, 2000).

About 80% of the marine mammals living species have already been reported from these interactions and it is estimated that about 100,000 specimens are caught each year in fishing gears all over the world (PERRIN *et al.*, 1994; OTT *et al.*, 2002; SECCHI *et al.*, 2004). Among the cetaceans occurring off Brazilian coast, Franciscana (*Pontoporia blainvillei* - Gervais & D'orbigny, 1844) and boto-cinza (*Sotalia guianensis* - Gervais, 1953) are considered the most vulnerable to interactions with fishery (IBAMA, 2001). The typical coastal distributions of these two species overlap gillnet fishing grounds, increasing the potential of by-catches (SICILIANO, 1994; DI BENEDITTO *et al.*, 1998; MONTEIRO-NETO *et al.*, 2000; OTT *et al.*, 2002; SECCHI *ET AL.*, 2004). Furthermore, these species are included in the "Official List of Fauna and Flora Threatened Species" (IBAMA, 1989), and the "Action Plan for Aquatic Mammals of Brazil" (IBAMA, 2001) recommends an intensification of studies about these species all over their range.

Studies about interactions with cetaceans and fisheries has been applied in several localities, mainly through interviews and questionnaires (LAL MOHAN, 1994; LIEN *et al.*, 1994; DI BENEDITTO *et al.*, 1998; DI BENEDITTO, 2001; DI BENEDITTO & RAMOS, 2001; OLIVEIRA *et al.*, 2002). According to LIEN *et al.* (1994), the monitoring of interactions between cetaceans and fisheries has been taken in Canada continually with questionnaires and the results are considered as "excellent".

MATERIAL AND METHODS

Espírito Santo State coast is situated in Brazilian southeastern region (18°24'S - 21°11'S), and it has about 521Km of coastline, in the western South Atlantic. Between March 2002 and February 2003 the survey of fishery activity was taken in 36 harbours distributed along the coast with a total of 1,963 interviews.

The information about interaction between cetaceans and fishery was obtained with local fishermen through questionnaires and semi-orientated

interviews. The first one intended to rise up the following information: fishing tackle used in the boat (type, dimensions, operation and target-species), boat characteristics (dimensions, crew and autonomy), fishing grounds and the presence of cetaceans during fishing operations as well the interactions between them. Results regarding to fishery characteristics can be found in FREITAS NETTO & DI BENEDITTO (2007).

The second type of interview was orientated by the interviewer once in a while to keep the interviewed in the subject of interest. This modality was made only with the head fishermen, who better express themselves and presents further knowledge on the fishery, in order to understand and confirm the interaction between cetaceans and the activity (QUEIROZ, 1991; OLIVEIRA *et al.*, 2002; FREITAS NETTO *et al.*, 2002). The interactions registered were considered positive, negative or null, for either cetaceans or fishery activity. At the same time, it was registered how fishermen could use dead animals involved in by-catches. The number of interviews applied was determined by the number of boats in each landing point, where the most experienced fishermen was taken as a sample. Species identification was made through JEFFERSON *et al.* (1993), showing images of the species to fishermen after the description, by them, of the cetacean that interact with their fishing tackle (OLIVEIRA *et al.*, 2002).

In the present study, the interviewers always identified a fisherman that had been considered a leader in the community, like a President of a Colony, Association or Cooperative fishery. The goals of the study were explained to him as well as the fact that we were only studying the interaction of marine mammal with fishery and we were not involved with regulatory agencies. After that fisherman understood our research, he cooperated with it helping us in the approach to the interviewed ones in their respective landing point. Inconsistent information from fishermen descriptions was never considered in this study.

RESULTS

Species registered

The interviews in the present work indicated that

four species of cetacean's interact with fishery along the fishing grounds of Espírito Santo State boats. The following species are:

Franciscana (*Pontoporia blainvillei*) – Gervais & d'Orbigny (1844)

Regionally known as "Manico" or "Cachimbo", this species is considered uncommon in the region. Its occurrence was reported only in Regência harbour (19°40'S, 39°50'W), Doce river mouth (Fig.1). The distribution of this species has always been associated to areas close to the coastline.

Boto (*Sotalia guianensis*) – Van Bénédén (1862)

Regionally known as "boto", this species is cited as the most common in the region; its occurrence was registered in all harbours. Its distribution is restricted to shallow waters in areas close to the coastline.

Humpback Whale (*Megaptera novaeangliae*) – Borowsky (1781)

It is a common species in Espírito Santo State coast, occurring until Largo dos Abrolhos (18°S – 19°45'S) (Fig.1). According to the interviews, the observations of humpback whales were done between May and December. Generally, these

animals dislocate far away from the coast during the migratory movements. In the harbours where boats had more autonomy then occurrences of this species happened frequently.

Southern Right Whale (*Eubalaena australis*) – Desmoulins (1822)

This species is commonly observed in Espírito Santo State coast. According to data surveyed, between May and November, the species reaches the central cost of the State (20°S) generally close to the coastline.

A group of species, that was impossible to separate from information of fishermen, is regionally denominated by "toninha/tuninha". This group is the second most common in the region and its occurrence covers the entire coast, far away from the coastline. Usually "toninha/tuninha" was described as bigger dolphins, and also distinguished from the "boto" (*S. guianensis*) by its dark colour. This species may include Rough-toothed dolphin (c.f. *Steno bredanensis* - Cuvier in Lesson, 1828), Bottlenose-dolphin (c.f. *Tursiops truncatus* - Montague, 1821), Pantropical spotted dolphin (c.f.



Figure 1. Espírito Santo State coast, southeastern Brazil (A - North region and B – south region).

Stenella attenuata - Gray, 1846), Atlantic spotted dolphin (c.f. *S. frontalis* - Cuvier, 1828), Spinner dolphin (c.f. *S. longirostris* - Gray, 1828), Striped dolphin (c.f. *S. coeruleoalba* - Meyen, 1833) and Clymene's dolphin (c.f. *S. clymene* - Gray, 1850). This information has been reported in the interviews conducted in harbours where the boats presented major fishery autonomy, matching with the oceanic distribution of the species mentioned above.

Interactions with fisheries

In the region, seven kinds of interaction between cetaceans and fisheries were described (Tab.1). Interactions between cetaceans and fisheries were registered in 75% of the harbours (n= 27). Entanglement was reported in 23 harbours and it is related to by-catch in gillnets. Cooperative fishery was the second kind of interaction most frequent in the region. It was registered in nine harbours, associated to beach seine nets (see Tab.1). Table 2 presents the percentage of fishermen that refers to the kind of interaction and the destination of the animal dead by fishing tackle. Interaction such as harpooning and bait destination in fishery activity was

less mentioned in the interviews probably because the fishermen were afraid of being exposed to environmental regulatory agencies. Collisions with whales have presented an average of 50% in the fishermen's referees probably due to the rarity of the interaction. Other interactions are much more mentioned in the interviews by over 80% of all fishermen interviewed.

DISCUSSION

Among the species reported in this study *P. blainvillei* does not present continuous distribution along Espírito Santo State coast, restricted to adjacent regions of Doce River mouth (FREITAS NETTO *et. al.*, 2005a; FREITAS NETTO *et. al.*, 2005b). DI BENEDITTO *et al.* (1990) and SICILIANO (1994) had already reported this species in the region and in northern areas (between 18°24'S and 18°42'S).

Strong evidences indicate that there are at least two gaps along the distribution of *P. blainvillei*'s populations in southeastern Brazil (SICILIANO *et al.*, 2002). In the South region of Brazil (25°S to 41°S)

Table 1. Descriptions of interactions between cetaceans and fisheries in Espírito Santo State coast, southeastern Brazil.

Kind of interaction	Description	Species	Fishing tackle	Interference	
				Fishery	Cetaceans
Entanglement	Animal collides with gillnets and, through its nose and / or fins, gets entangled in the fishing gear.	All species	Gillnets and <i>Double ring</i> bottom trawl net	-	-
Collision	Animal collides with gillnets, however, can break the net and it may get free.			-	-
Trapping	Animal gets trapped itself with the rope or lines of the fishing gear through its fins.	Whales	Long-lines and Hand-lines	-	-
Harpooning	Animal is harpooned while it approaches to the vessels. Their flesh is used as bait in long lines.	Boto and Tuninha/Toninha	Harpoon	+	-
Stealing	Animal approaches to the fishing tackle and steals fishes that is entangled.	Boto	Gillnets and Long- lines	-	+
Ambush	Animal follows the bottom trawl net during its operation and it captures fishes that try to escape from the fishing gear.	Boto	Bottom trawl nets	o	+
Cooperative fishery	A group of animals surrounds or it pushes a shoal toward a fishing gear.	Boto	Gillnets and beach seine nets	+	+

Legend: (-) negative; (+) positive and (o) null.

Table 2. Occurrence of the interactions between fishing tackles and cetaceans in Espírito Santo State coast, southeastern Brazil.

Region	Fishing harbour	Kind of interaction / destination of the animal	Species involved (common names)	% fishermen	
NORTH	Itaúnas	Entanglement / Bait for fishery	Boto and tuninha	100	
		Trappind / Bait for fishery	Boto and tuninha	100	
	Conceição da Barra	Entanglement / Bait for fishery	Boto and tuninha	82/56	
		Collision	Whales	65	
	Guriri	Entanglement		100	
		Stealing	Boto and tuninha	85	
		Ambush		100	
	Barra Nova	Cooperative fishery		100	
		Entanglement	Boto and tuninha	95	
	Barra Seca	Entanglement / Bait for fishery	Boto and tuninha	100/46	
		Ambush	Boto	86	
	Pontal do Ipiranga	Entanglement	Boto and tuninha	100	
	Povoação	Entanglement	Boto and tuninha	100	
	Regência	Entanglement / Bait for fishery and human consumption	Boto, franciscana and tuninha	100/100	
	SOUTH	Barra do Riacho	Entanglement / Bait for fishery	Boto and tuninha	80/44
		Barra do Sahy	Entanglement	Boto and tuninha	85
Santa Cruz		Entanglement	Boto and tuninha	100	
Nova Almeida		Entanglement	Boto	100	
		Trappind	Whales	60	
Manguinhos		Entanglement	Boto	100	
		Entanglement / Bait for fishery	Boto	86/40	
Praia do Suá		Collision	Whales	55	
		Harpooning / Bait for fishery	Boto and tuninha	34/34	
Prainha		Harpooning / Bait for fishery	Boto and tuninha	42/42	
Praia da Costa		Entanglement	Boto	100	
		Entanglement	Boto	100	
Praia de Itapoá		Cooperative fishery	Boto	100	
		Entanglement	Boto	100	
Barra do Jucú		Collision	Whales	25	
		Entanglement	Boto and tuninha	100	
Ponta da Fruta		Entanglement	Boto and tuninha	100	
Praia de Una		Entanglement	Boto and tuninha	100	
Praia de Ubú e Parati		Entanglement	Boto and tuninha	100	
		Cooperative fishery	Boto	100	
Anchieta	Cooperative fishery	Boto	100		
Piúma	Entanglement / Bait for fishery	Boto and tuninha	100/65		
	Cooperative fishery	Boto	100		
Itaoca	Entanglement	Boto and tuninha	100		
	Cooperative fishery	Boto	100		
Barra de Itapemirim	Entanglement / Bait for fishery	Boto and tuninha	100/35		
	Cooperative fishery	Boto	100		
Marataízes	Cooperative fishery	Boto	100		
Boa Vista	Cooperative fishery	Boto	100		

its distribution is continuous (SECCHI *et al.*, 2002). The population sited in Espírito Santo State stands in the Northern limit of the species distribution (SICILIANO, 1994), and it is probably the most threatened small cetacean in Brazil (IBAMA, 2001; OTT *et al.*, 2002).

Nowadays, the main problem related to the conservation of this species in Brazil is the lack of a constant monitoring of by-catches. Moreover, the insufficient information about fishing effort hinders good mortality estimates of these species in fishing operations (OTT *et al.*, 2002).

During the migration season (winter-spring), the humpback and southern right whales are sighted along Espírito Santo State coast, as well in other regions of Brazil (IBAMA, 2001), corroborating the informations raised in the present work. The occurrence of humpback whales in Brazilian waters is well known from Rio Grande do Sul State (32°S) until Pernambuco State (3°S) (IBAMA, 2001). The distribution of the Southern right whale ranges between Rio Grande do Sul State and Bahia State (18°S) (LODI *et al.*, 1996).

In Espírito Santo State, peculiarities about the common denomination of some species studied were identified. *P. blainvillei*, for instance, has a regional confuse denomination, like "manico" or "cachimbo", while in other regions it is denominated Toninha or Franciscana (IBAMA, 2001). These names were never mentioned in Regência, the only one locality that the species were registered by interviews. On the other hand, the term "toninha/tuninha", is used by the fishermen in Espírito Santo to denominate large oceanic dolphins (*Steno bredanensis*, *T. truncatus* and *Stenella* spp). This group was not possible to distinguish by fishermen offshore.

Common names of species have a great importance in approaches that involve traditional knowledge of communities that have their activities strongly related to wild fauna and flora species (MARQUES, 1995). In the present context, the knowledge of regional denomination has minimized possible mistakes related to the recognition of some species and their distribution patterns.

In Brazil, records about the interaction between cetaceans and fisheries were done all over the coast

(SICILIANO, 1994; MONTEIRO-FILHO, 1995; DI BENEDITTO *et al.*, 2001; OTT *et al.*, 2002; FREITAS NETTO & BARBOSA, 2003). In Espírito Santo State DI BENEDITTO *et al.* (1990), SICILIANO (1994) and FREITAS NETTO & BARBOSA (2003), had reported the relation between fisheries and cetaceans referring mainly to by-catches in gillnets.

Cooperative fishery, described in harbours sited in the South region of Espírito Santo State, was also reported by MONTEIRO-FILHO (1995) in São Paulo State (23°S - 25°S). In Laguna, Santa Catarina State (26°S - 29°S), the species *T. truncatus* interacts with fishermen indicating and pushing shoals to fishing gears (SIMÕES-LOPES, 1991). In regard to ambush interaction we found only one record in Australia with *Tursiops aduncus* in eastern Monterey Bay (CORKERON *et al.*, 1990).

Among kinds of interaction registered in the present study, entanglement through by-catches in gillnets was the most representative, promoting injures or death of the animals and expressive damage to fishing gears. All over the world these events promote impact over the cetaceans species, and are considered very important issues in the conservation of many species (HALL *et al.*, 2000).

Incidental catches in Southeast Brazil where studied in the Rio de Janeiro upstate, Atafona, by DI BENEDITTO (2003), that registered 55 entanglements of small cetaceans (22 *P. blainvillei* and 20 *S. guianensis*) in gill nets during a year period study. The author suggested to push gill net activity over 10n.miles due to the high rates of incidental captures in areas close to shore. In São Paulo State, BERTOZZI & ZERBINI (2002) registered 31 *P. blainvillei* between 1999 and 2001, while ROSAS *et al.* (2002) registered 40 specimens of *P. blainvillei* between 1997 and 1999. In all of these studies mesh sizes of gillnets have 8 to 12 cm and captured most juveniles specimens.

In Espírito Santo State the number of incidental captures from fishery monitoring was recorded by BADKE (2003) and FREITAS NETTO *et al.* (2005b). The first author registered five specimens (*S. guianensis*) in the South region - Piúma, while the last one registered six specimens (*P. blainvillei*) in the North region - Regência. Both studies presented lower incidental captures when compared to southern

regions despite have same characteristics regarding to fishery activity.

Higher numbers of incidental captures occur in the south of Brazil (OTT *et al.* 2002). SECCHI *et al.* (2000) estimated that over a thousand specimens of *P. blainvillei* are captured in the southern region of Rio Grande do Sul.

Considering aspects related to the occurrence of cetaceans in Espírito Santo State coast, some harbours stand out by the use of fishing gears that may represent potential risks to these species. Entanglement is the interaction that presents major risk, this way, the harbour of Regência deserves special attention due to the variety of gillnets used and the possible occurrence of an isolated population of *P. blainvillei* (SICILIANO *et al.*, 2002).

The harbours of Piúma (20°51'S, 40°43'W) and Barra de Itapemirim (21°01'S, 40°48'W), present considerable fishing effort with gillnets. The boats operate in a fishing ground where the continental shelf suffers a narrowing (FREITAS NETTO, 2003). These characteristics increase the chances of coastal cetaceans by-catch, for which depth is as limitation to their distribution (DI BENEDITTO *et al.*, 2001).

Interaction between cetaceans and fisheries occurs along the entire coast in many ways. Nevertheless, to understand these negative interactions other variables, as fishing effort and fishing areas must be taken into account. This study provides an overview about cetaceans in Espírito Santo State, a little studied area. In this way, constant monitoring of by-catches in the localities of Regência (North region), due to a presence of an endangered species, and Barra de Itapemirim (South region), due to the large vessel fleet operating with gillnets, might shed light on the real impact of fishery over cetacean's species in this area of the Brazilian coast.

ACKNOWLEDGMENTS

To Instituto Aracruz, Project AWARE and CNPq Proc. 300322/03-8, for financial support. To Mr. Oswaldo Viola Filho and the Institutions that collaborate in this project: laboratório de Ciências Ambientais of Universidade Estadual do Norte Fluminense (UENF), Departamento de Ecologia e

Recursos Naturais da Universidade Federal do Espírito Santo (UFES), Instituto Brasileiro do Meio Ambiente (IBAMA), Ministério da Agricultura, Instituto de Pesca e Atividade Náutica do Brasil (IPAN-BR), Instituto de Desenvolvimento Ambiental e Florestal (IDAF), Parque Estadual de Itaúnas (PEI-ES), Projeto TAMAR – Bases of Guriri and Regência, Projeto TAVIVAMAR of Anchieta, Escola de Pesca de Piúma (ESCOPECA), Fishing Zones (Z-01 a Z-10) and Fishery Cooperatives. To financial supporters: Aracruz Celulose S/A through Instituto Aracruz and Project AWARE.

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Recebido: 16/10/2006

Revisado: 10/12/2007

Aceito: 10/01/2007

