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Assessment of the fisheries characteristics
in southeastern Brazil: Moving towards a
monitoring program to assess Franciscana
bycatch in FMA 1b – northern Rio de
Janeiro

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INTERNATIONAL
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Final Report Project

Assessment of the fisheries characteristics in southeastern Brazil: Moving towards a monitoring program to assess Franciscana bycatch in FMA 1b – northern Rio de Janeiro

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Cover photo: A live stranded Franciscana dolphin calf (*Pontoporia blainvillei*) rescued at Farol de São Thomé, Campos do Goytacazes on 6 January 2011. Photo by Leandro Corrêa.

Brief Objectives of the Work

Incidental capture in fishing gear is the main source of anthropogenic mortality for small cetaceans worldwide (Reeves *et al.* 2003), involving a range of fishing gear such as gillnets, trawls and long-lines. The Franciscana dolphin (*Pontoporia blainvillei*) is a small odontocete inhabiting coastal waters of the Southwestern Atlantic Ocean. This species is considered the most threatened cetacean in South America. It is listed as Vulnerable in the IUCN Red List and is considered Critically Endangered in Brazil. The Franciscana range has been divided into four 'Franciscana Management Areas' (FMAs I to IV). FMA 1 corresponds to the northern portion of the species area of distribution and includes the coasts of the Brazilian states of Rio de Janeiro (RJ) and in Espírito Santo (ES). FMA 1 is geographically isolated from the remainder of the FMAs. Within FMA, two populations have been recently recognized; they are labeled FMA 1a and FMA 1b. Bycatch in gillnets is likely the greatest threat to Franciscanas of these two populations, but quantitative estimates of fishery-associated mortality are either not available (FMA 1a) or are older than 10 years (FMA 1b). Recent line transect aerial surveys sampled the range of the two populations (Danilewicz *et al.*, 2012), but were unable to compute estimates of abundance in FMA 1a because an insufficient number of sightings were observed. For FMA 1b, a population of less than 2000 individuals was computed. This estimate suggests that mortality in gillnets is unsustainable if bycatch rates today are similar to those observed 10 years ago. This proposal aims to (1) conduct surveys to identify fishing villages in FMAs 1a and 1b, (2) assess the characteristics of the fisheries in these regions and (2) evaluate whether incidental captures of Franciscana and other cetacean species occurs. We expect to provide a report containing a description of the fisheries and identification of areas of risk for Franciscanas given knowledge of their current and historical distribution. The information in the report will be used to establish a monitoring program to estimate bycatch of Franciscanas in FMA 1a and FMA 1b.

The objectives of this study are:

1. Perform an assessment of the characteristics of the fisheries operating along the range of the Franciscana FMA 1a and FMA 1b population.
2. Assess compliance of the fisheries with IN12.
3. Evaluate areas/fisheries of high-risk of Franciscanas.

Outcome:

1. This project will provide information to establish a long-term monitoring plan to estimate bycatch of Franciscanas in FMA 1a and 1b.

Description of the methods

The assessment of the characteristics of the fisheries was carried through visits to previously monitored and previously unsurveyed fishing villages in RJ (FMA 1b). Visits took place twice in each season to investigate potential seasonal changes in the fishing operations and to obtain information on fleet and gear characteristics (type of net, panel size, mesh size), fishing grounds, target and incidentally caught species, and social and economic status of the village. This information was collected using standardized methodology as recommended by the International

Whaling Commission (IWC, 1994) and the Cetacean Bycatch Resource Group (CBRS, www.cetaceanbycatch.org).

Interviews were conducted using standardized forms and data collected were stored in a database. An attempt to interview a minimum of 5 experienced fishermen (*i.e.* more than 5 years in activity) was made in each location. Information provided was complemented by additional interviews with other members of the fishing communities. Governmental enforcement agencies, fishermen unions or equivalent organizations were consulted during the project and access to their archives will be requested to assess historical fisheries data and potential temporal and spatial changes in fishing operations/gear. Gillnets and tangle nets are here defined according to Von Brandt (1959). There two main types of gillnets and tangle nets: single wall nets and multiwalled or trammel nets. They are operated either as drift nets or anchored to the bottom. These nets are fished close to the bottom, in midwater or at the surface (Figure 1).

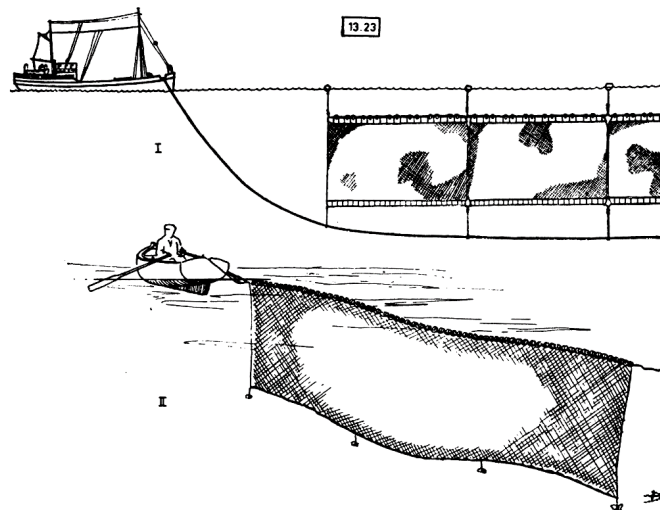


Figure 1. Figure 1. Illustration of gillnets operating off northern Rio de Janeiro state, Brazil, in accordance to Von Brandt, A. (1959). Classification of fishing gear. Section 9: Fishing Gear and Its Operation. Pp. 274-296 *In* Modern Fishing Gear of the World, Ed. By H. Krjstjonnson. Fishing News (Books) Ltd., London, England. (I) midwater gillnet and (II) surface gillnet.

Results

(1) Assessment of the characteristics of the fisheries operating along the range of the Franciscana FMA 1a and FMA 1b population.

In FMA 1b (RJ), the use of gillnets by local fishermen have been observed in 13 municipalities, as follows:

- (a) Saquarema: Praia do Dentinho;
- (b) Araruama: Pontal, Vargas and Pernambuco in Praia Seca;
- (c) Arraial do Cabo: Monte Alto, Figueira, Praia Grande and Praia do Pontal;
- (d) Cabo Frio: Praia do Foguete, Praia das Conchas, Però, Praia Rasa, Unamar and Tamoios;
- (e) Armação dos Búzios: Praia de Manguinhos, Centro, Praia Gorda and Praia Rasa;
- (f) Casimiro de Abreu: Barra de São João;
- (g) Rio das Ostras: Praia do Abricó, Praia da Tartaruga, Praia da Boca da Barra, Praia de Costa Azul and Praia do Mar do Norte;
- (h) Macaé: Barreto/Centro;
- (i) Carapebus: Balneário de Carapebus;
- (j) Quissamã: Praia de João Francisco, Praia da Lagoa Preta, Praia do Visgueiro, Praia de Flecheiras and Barra do Furado;
- (k) Campos dos Goytacazes: Farol de São Thomé;
- (l) São João da Barra: Atafona and Açú
- (m) São Francisco do Itabapoana: Praia de Manguinhos, Praia de Santa Clara, Praia de Buena and Praia de Barra de Itabapoana.

Of these, three fishing ports were identified as the major ones, with over 60 gillnet boats actively operating: Atafona (São João da Barra Municipality), Macaé (Barreto/Centro, Macaé Municipality) and Tamoios (Cabo Frio Municipality). Armação dos Búzios has around 60 boats operating but they are scattered in smaller ports within the municipality and operate locally; all other ports have fewer boats, usually between 2 to 10 boats, or less, by locality. These are the cases in Armação dos Búzios (Rasa), and Quissamã (Praia de João Francisco, Praia da Lagoa Preta and Praia do Visgueiro). Figure 2 illustrates the northern Rio de Janeiro state and the most representative fishing ports visited during this project.

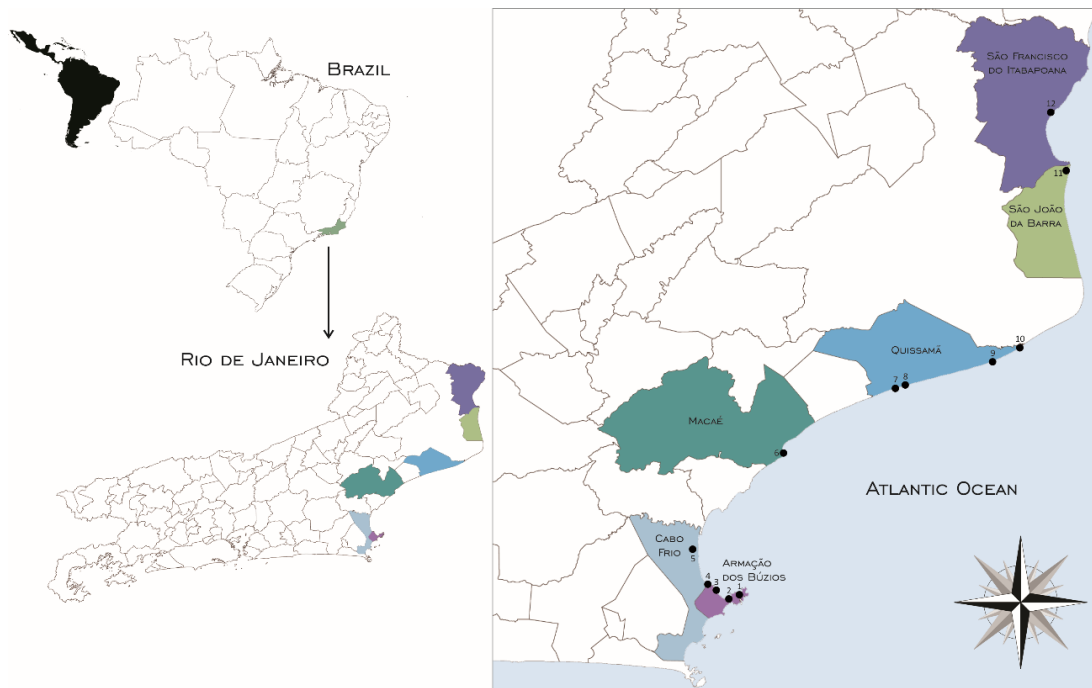


Figure 2. Northern Rio de Janeiro state and the most representative fishing ports visited during this project: (1) Armação dos Búzios: Praia de Manguinhos, (2) Armação dos Búzios: Centro, (3) Armação dos Búzios: Praia Gorda, (4) Armação dos Búzios: Praia Rasa, (5) Cabo Frio: Tamoios, (6) Macaé: Barreto/Centro, (7) Quissamã: Praia de João Francisco, (8) Quissamã: Praia da Lagoa Preta, (9) Quissamã: Praia do Visgueiro, (10) Quissamã: Praia de Flecheiras and Barra do Furado, (11) São João da Barra: Atafona, and (12) São Francisco do Itabapoana: Praia de Manguinhos.

Results of the survey on fish caught by artisanal gillnet fishery operating off the three main fishing ports along northern RJ state coast, SE Brazil (Atafona, Macaé and Tamoios) are described in Table 1. The characteristics of fishing gear and operation in the three major landing fishing ports in northern Rio de Janeiro state, Brazil are described in Table 2. It includes additional data from Di Benedetto *et al.* (1998), Di Benedetto (2001, 2003), Silva *et al.* (2012, 2016), Bau (2015), Calleja (2015), Oliveira *et al.* (2016), Bonfim *et al.* (2017), and Silva *et al.* (2017).

(2) Assess compliance of the fisheries with IN12

In Atafona, surface gillnets surface varies in length from 2,500 to 6,400 m length. in Macaé, gillnets set for weakfish varies from 1,900 to 3,000 m in length, and the ones used for croaker from 2,500 to 4,000m. In Tamoios bottom gillnets varies from 2,500 to 9,000 m in length, and surface gillnets from 2,500 to 10,400 m in length. Boats in all ports are usually smaller than 10 m in length. On this point, it seems that gillnets operating off Macaé are in accordance with IN12. On the other hand, Atafona and Tamoios are not. It has been noted that there is no enforcement. Therefore, as states before (Weir *et al.* 2011), gillnet restrictions are ineffective unless they are properly enforced.

(3) Evaluate areas/fisheries of high-risk of Franciscanas

Including all ports visited and data from interviewed fishermen, the Atafona fleet is largely the most relevant in the context of this project. The main fishing ground of gillnet boats from Atafona

is from Anchieta (board of Espírito Santo state with Rio de Janeiro state) to Macaé, usually around the 50m isobath. In Atafona, incidental captures of small cetaceans are reported as frequent in both types of gillnets (surface = *caída boiada* and bottom = *minjuada*, when using mesh size 25 to 70 mm). Fishing effort is higher around Cabo de São Thomé. In general, each interviewed fisherman in Atafona reported the number of 1 to 10 Franciscanas captured/year. Carcasses are discharged at sea, fishermen are aware of the inspection at the port and try to avoid any comment and documentation of the captures. Therefore, the area of elevated risk of entanglement of Franciscanas is from Atafona to Macaé, increasing the risk in the direction of up to the 50 m isobath, followed by direction of Atafona up to the 40 m isobath, and rarer along the coast of Macaé. In other words, the area from Atafona (São João da Barra) and Macaé, off Cabo de São Thomé, should be considered the main area of incidental captures of Franciscanas within FMA 1a (Figure 3).

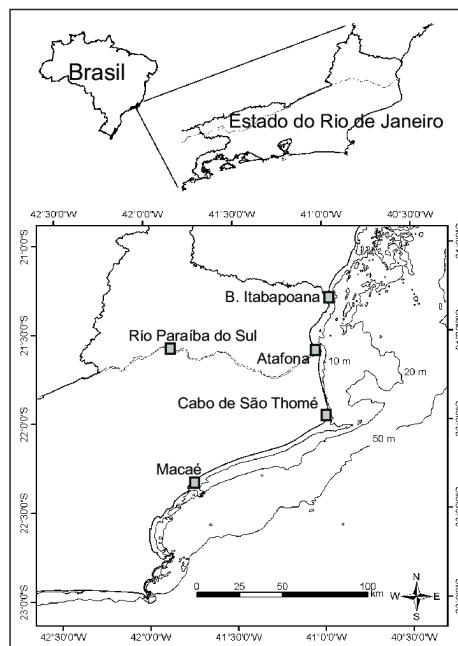


Figure 3. Area from Atafona (São João da Barra) and Macaé, off Cabo de São Thomé, considered the main area of incidental captures of Franciscanas along the northern coast of Rio de Janeiro state (FMA 1a) (Downloaded from Bittar *et al.* 2008 "Hábito alimentar do peixe-espada adulto, *Trichiurus lepturus*, na costa norte do Rio de Janeiro, sudeste do Brasil" <https://doi.org/10.5007/2175-7925.2008v21n2p83>).

Fisheries in Atafona has changed its characteristics since the beginning of the surveys in early 80's. Boats are better equipped, some have two winches, including the use of GPS and cell phones for positioning the nets. As described in Table 2, gillnets can be longer than the ones used in the 80's and 90's (Di Benedetto *et al.* 1998), but the general pattern of captures are the same of decades ago.

In the context of this project, other gillnet fisheries based and operating off Macaé, Cabo Frio, Armação dos Búzios, Quissamã and São Francisco do Itabapoana municipalities deserves more attention as there is potential risk of entanglement of small cetaceans, mainly Franciscanas and Guiana dolphins. Due to its magnitude, the Tamoios (Cabo Frio) fisheries needs more attention as it operates in an area with high diversity and abundance of whales, dolphins, sharks and rays, many of them included in some category of threat. The Cabo Frio upwelling system provides a

unique rich marine ecosystem, which favors the occurrence of large whales (e.g. Bryde's *Balaenoptera brydei*; dwarf minke *B. acutorostrata*) and other smaller cetaceans (bottlenose dolphins *Tursiops truncatus*, rough-toothed-dolphin *Steno bredanensis*, common dolphin *Delphinus delphis*, and Atlantic spotted dolphins *Stenella frontalis*). It is important to emphasize that this gillnet fishery has not been surveyed before and its impact on small cetaceans is quite unknown.

Other initiatives achieved during the course of this project

Stranding network within FMA 1a: records of stranded Franciscana dolphins with signs of interactions with fisheries

A citizen science initiative was launched to get back information of stranded Franciscana dolphins within FMA 1a in June 2017. Flyers, posters and stickers were produced for the stranding network campaign as of December 2017 and have been distributed in all fishing localities and cities in northern Rio de Janeiro state (see Annex 1). There have been three records of stranded Franciscanas along northern RJ coast: on 22 Jan 2016 in Manguinhos, São Francisco do Itabapoana, on 26 Sep 2017 in Praia de Costazul (Figure 4), Rio das Ostras and on 09 Oct 2017 in Praia do Abricó, Rio das Ostras. The stranded specimens had clear signs of interactions with fisheries including net marks, broken beaks and knife cuts.



Figure 4. Stranded Franciscana dolphin found in Praia de Costazul, Rio das Ostras on 26 September 2017. Photo available at: <https://g1.globo.com/rj/regiao-dos-lagos/noticia/golfinho-e-encontrado-morto-em-praia-de-rio-das-ostras-no-rj.ghtml>

Aerial survey along the northern coast of Rio de Janeiro state

An aircraft was used to survey the northern coast of Rio de Janeiro state on December 19, 2017. This was a unique opportunity to survey the Franciscana dolphin area and to obtain data on their occurrence and fisheries interactions. A helicopter Sikorsky (image available at <https://www.helis.com/database/cn/28570/> Sikorsky S-76C Serial 76-0658, Register PR-CHG by BHS Táxi Aéreo – Brazilian Helicopter Services Táxi Aéreo Ltda.) was used to fly over the coastline from Macaé to Campos dos Goytacazes. The aim of the aerial survey was to evaluate numbers of shore birds and their habitats along the coastline from Macaé to Barra do Furado, in Quissamã. The flight departed from Macaé airport at 07:40AM and ended at 09:20AM at the same location. We flew at an altitude of 150m over sea level covering the municipalities of Macaé, Carapebus,

Quissamã and the southern board of Campos dos Goytacazes, encircling Lagoa Feia and returning southwards. A team of six observers took part on the flight, including five trained ornithologists in search of shore birds. One of the observers (S. Siciliano) searched exclusively for cetaceans during the flight and was positioned on the right side of the aircraft, looking to the coastline. Once a group of dolphins was sighted the aircraft encircled the area to certify the species and estimate the number of specimens in the pod. In result, two groups of Franciscana dolphins were sighted off Barra do Furado, in Quissamã. In the same area, other five groups of Guiana dolphins (*Sotalia guianensis*) were also spotted. In addition, records of special relevance were made, including: two large manta rays (possibly *Manta birostris*, a bull shark (*Carcharhinus leucas*), and several sea turtles (*Chelonia mydas* and *Caretta caretta*). The first group of Franciscana dolphins, composed of two individuals, was milling and the second group, composed of at least 10 dolphins, was in apparent feeding behavior, diving repeatedly and encircling fish. Figure 5. illustrates the surveyed area and the approximate positions of Franciscana dolphin groups, including gillnet fishing boats operating in the area.

It is important to mention that several gillnet fishing boats were spotted in the same area where Franciscana and Guiana dolphins were found, thus indicating possible conflict in the use of space and resources. It should be emphasized the concentration of records of both Franciscana dolphins and Guiana dolphin in a narrow strip of area from Barra do Furado to Farol de São Thomé.

Franciscana dolphin as flag species for the proposed “Mosaic Jurubatiba” Whale Heritage Site

In October 2017, GEMM-Lagos team proposed the “Mosaic Jurubatiba” as a Whale Heritage Site (WHS) under supervision of the World Cetacean Alliance (WCA). WCA is a partnership of over 90 non-profit organizations, whale and dolphin watching tour operators and individuals in 40 countries worldwide working collaboratively to protect cetaceans and their habitats. A WHS is an outstanding example of a place where authentic and respectful interactions take place between wild cetaceans and people, and where this is also embraced in the cultural, economic, social, and political lives of associated communities. The license agreement for the candidate “Mosaic Jurubatiba” WHS was signed as of November 2017. The proposed geographical boundaries of the candidate “Mosaic Jurubatiba” WHS include the coastline from Búzios Peninsula to Barra do Furado, Quissamã, including the adjacent waters of Restinga de Jurubatiba National Park (PN Restinga de Jurubatiba) along the north-eastern coast of Rio de Janeiro state. Indeed, the area has an enormous potential for tourism and sustainable development of local human populations. A documentary on this area can be looked at here: <https://globoplay.globo.com/v/6605726/programa/> The marine waters adjacent to the PN Restinga de Jurubatiba are used by local artisanal fishermen, but the local fishery is already collapsing since fish landings are reducing during the decade and fishermen are getting even poorer, gaining incomes that are not enough to cover costs of living. The “Mosaic Jurubatiba” maritime area attracts fishing boats from several ports in the vicinities, mainly Atafona, Macaé and Tamoiós. The number of boats operating in the area can reach around 50 or more in a single day. Data from fishing monitoring since early 80s indicate from 1 to 10 Franciscanas incidentally caught by boat/year. Law enforcement is limited to wait fishing boats to arrive in the port and check if there is a dolphin or sea turtle onboard. No measures have been proposed to reduce bycatch or to educate people (and fishermen) on the importance of Franciscanas and Guiana dolphins for the environment. Previous awareness campaigns, conducted from 2003 to 2007, were successful in pointing out the existence of a population of Franciscanas exclusive in the area. Local people

and visitors were informed of the presence of an endangered species, its conservation threats and possible measures to reduce bycatch. Unfortunately, funds decreased, and the campaign stopped. For this reason, it is fundamental to conduct a long-term campaign for the protection of dolphins, whales, sea turtles, sharks and rays in the "Mosaic Jurubatiba" area. The establishment of a Whale Heritage Site will clearly help to combine efforts for long term conservation efforts for Franciscanas and Guiana dolphins. There is no formal whalewatching in the area. Tourism boats from the nearby cities of Búzios and Arraial do Cabo search for whales and dolphins and use them to lure more tourists. On the other hand, Guiana dolphins are particularly common in the "Mosaic Jurubatiba" and their presence is often noted by locals and tourists. As a National Park, Jurubatiba attracts people from many places for distinct reasons. People want to explore its beautiful scenery, camping, taking pictures and watch sea turtles and dolphins. This activity needs to be organized and better conducted in a long term. The accreditation as a Whale Heritage Site will help the area of Mosaic Jurubatiba to better improve and coordinate these activities. The candidate Whale Heritage Site is still being implemented. Indeed, local decision makers and the population recognize the importance of this area as crucial habitat of the Franciscana dolphin. Every year the staff of the Restinga de Jurubatiba National Park celebrate the establishment of this protected area, and the Franciscana dolphin is on the focus of the discussion during five days of celebration. The decision makers in the municipality of Quissamã also placed warning signs along the beaches to alert the population of the importance of the coastal waters as habitat of dolphin species, especially the Franciscana dolphin. The incidental bycatch of cetaceans by artisanal fishery needs urgent attention, as well as the development of four harbors just inside the Franciscana Management Area I – Rio de Janeiro, which constitutes the second smallest population in South America. The activities of a harbor on this area will increase substantially the number of vessels moving in the habitat of this dolphin species and the potential impacts including: collision, noisy disturbance and oil pollution.

In conclusion, the interaction between humans and cetaceans in the proposed area is marked by the incidental bycatch of Franciscana dolphins and Guiana dolphins in the artisanal fishery. Then, a candidate Whale Heritage Site in the proposed region can help to increase the chances of fishermen explore sustainable tourism in marine waters as an alternative source of income that can support the conservation of globally threatened dolphin species. The human communities associated with cetaceans, mainly composed by fishermen and tourism operators, will benefit of whale watching as an alternative economic activity to fishery, which is collapsing at local scale.

The National Plan for conservation of the Franciscana dolphin is the main initiative for the protection of dolphins in the proposed site. Several mitigation strategies are under discussion with policy makers at national level regarding the expansion of the Restinga de Jurubatiba National Park, which cover only terrestrial areas, to marine waters. Also, the implementation of a fishing exclusion zone in the proposed area could be set as a priority discussion by policy makers, but a critical issue is to establish untouchable areas without causing the collapse of the artisanal fishery as a socioeconomical and cultural activity in the region. The implementation of the proposed Whale Heritage Site by itself is a crucial step towards the increase of a sustainable way of living in the region.

Stablishing the proposed Whale Heritage Site is a unique opportunity for calling attention of both national and international scientific community to this relevant area for conserving globally threatened cetacean species. The research funding in Brazil is currently very scarce, and the proposed site will increase the chances of coordinated international efforts for research in the region. It is also crucial to disseminate the conservationist importance of the proposed site on media (e.g. newspapers, television and social networks) will also trigger the interest environmental

educators to helping to aware local populations on the profits they can make with tourism associated with the protection of marine waters and cetacean species in the region.

The number of domestic tourists in the candidate Whale Heritage Site was not yet surveyed. Indeed, in the best of our knowledge, there is an increase in international tourists visiting the area. The main purpose of establishing this Whale Heritage Site is to call attention of both public decision makers and population the potential of this area for touristic activities.

When accredited, the "Mosaic Jurubatiba" Whale Heritage Site will become a continuous driving force to promote cetacean awareness, to set up a controlled whalewatching industry, and protect dolphins, whales and sea turtles in a long term.

In a country with economic problems, social priorities including education and health, immediately drives conservation efforts to a second position. Indeed, protecting franciscanas in this area has been assigned as a 'problem' to solve the economic situation. The planning of two large ports near the Jurubatiba National Park are a clear threat to the long-term survival of dolphins and whales.

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When accredited, the "Mosaic Jurubatiba" Whale Heritage Site will become a continuous driving force to promote cetacean awareness, to set up a controlled whalewatching industry, and protect dolphins, whales and sea turtles in a long term. More information on this proposal can be seen at WHS website: <http://whaleheritagesites.org/candidate-site-jurubatiba/>

In the meanwhile, to create awareness, we developed a series of outreach material, including posters, flyers and stickers (Figure 8).

Conclusions and Recommendations

- (1) The area from Atafona (São João da Barra) to Macaé, off Cabo de São Tomé, should be considered the main area of incidental captures of Franciscanas within FMA 1a;**
- (2) The ports of Macaé, Tamoios (Cabo Frio) and Armação dos Búzios have been unsurveyed and they deserve more attention. The Tamoios fishery is of special concern as its operates in the area with higher diversity of marine megafauna;**
- (3) Compliance of the fisheries with IN12 is limited and poorly enforced in all areas visited;**
- (4) The results of the aerial survey indicate the importance of a narrow stretch of coast, from Barra do Furado (Quissamã) to Farol de São Thomé (Campos dos Goytacazes), as a relevant area for Franciscana and Guiana dolphins. This fishing ground is intensely used by gillnet boats and has the highest probability of incidental catches of Franciscanas;**

(5) The candidate Whale Heritage Site of Mosaic Jurubatiba is a crucial step towards increasing a sustainable way of living in the region.

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Table 1. Fish caught by artisanal gillnet fishery operating off the three main fishing ports along northern RJ state coast, SE Brazil: Atafona, Macaé and Tamoios

ORDER/Family	Scientific name	Local common name	Common name	Atafona	Macaé	Tamoios	IUCN (Global)	ICMBio (Regional)
CHONDRICHTHYES								
Carcharhiniformes								
Carcharhinidae	<i>Carcharhinus acronotus</i>	Cação-de-focinho-negro	Blacknose shark	1,2	6		NT	
	<i>Carcharhinus plumbeus</i>	Cação-corre-costa	Sandbar shark	1,2,4	6		VU	
	<i>Carcharhinus brevipinna</i>	Cação-galha-preta	Spinner shark	1,2	6		NT	
	<i>Carcharhinus limbatus</i>	Cação-galha-preta	Blacktip shark	1,2	6		NT	
	<i>Rhizoprionodon porosus</i>	Cação-troço-troço	Caribbean sharpnose shark	1,2,4	6	7+	LC	LC
Sphyrnidae								
	<i>Sphyrna zygaena</i>	Cação-martelo, Cação-panã	Smooth hammerhead		6	7	VU	DD
Squatiniiformes								
	<i>Squatina guggenheim</i>	Cação-anjo	Angular angel shark		6	7+	EN	CR
Rajiformes								
Rhinobatidae								
	<i>Pseudobatos horkelii</i>	Cação-viola, Raia-viola	Brazilian guitarfish		6	7+	CE	DD
	<i>Zapteryx brevirostris</i>	Raia-viola, Cação-viola	Lesser guitarfish		6	7+	VU	VU
Arhynchobatidae								
	<i>Atlantoraja castelnaui</i>	Raia-chita, Raia-pintada	Spotback skate		6	7+	EN	CR
	<i>Atlantoraja cyclophora</i>	Raia	Eyespot skate		6	7+	VU	EN
	<i>Atlantoraja platana</i>	Raia-emplastro	La Plata skate		6	7+	VU	LC
	<i>Psammobatis extenta</i>	Raia-emplastro	Zipper sand skate		6	7+	LC	LC
	<i>Psammobatis lentiginosa</i>	Raia	Freckled sand skate		6	7+	DD	NE
	<i>Rioraja agassizii</i>	Raia-santa	Rio skate		6	7+	VU	EN

	<i>Sympterygia acuta</i>	Raia-santa	Bignose fanskate	6	7+	VU	EN
	<i>Sympterygia bonapartii</i>	Raia-santa	Smallnose fanskate	6	7+	DD	EN
Myliobatiformes							
Myliobatidae							
	<i>Aetobatus narinari</i>	Raia-pintada, Raia-chita	Spotted eagle ray	6		NT	LC
	<i>Rhinoptera bonasus</i>	Raia	Cownose ray	6		NT	LC
Dasyatidae							
	<i>Dasyatis hypostigma</i>	Raia-manteiga, Raia-prego	Butter stingray	6	7+	DD	LC
Gymnuridae							
	<i>Gymnura altavela</i>	Raia-borboleta	Spiny butterfly ray	6	7+	VU	CR
	<i>Gymnura micrura</i>	Raia-borboleta	Smooth butterfly ray	6		DD	LC
TELEOSTEI							
Clupeiformes							
Clupeidae	<i>Sardinella brasiliensis</i>	Sardinha-verdadeira, Sardinha-maromba	Brazilian sardinella	6	7+	NE	LC
Siluriformes							
Ariidae	<i>Genidens</i> spp.	Bagre	Catfish	1,3	6		
	<i>Genidens barbatus</i>	Bagre	White sea catfish	1	6	NE	
Batrachoidiformes							
Batrachoididae							
	<i>Porichthys porosissimus</i>	Peixe-sapo	No name available	6	7*	NE	LC
Scombriformes							
Pomatomidae							
	<i>Pomatomus saltatrix</i>	Anchova, Enchova	Bluefish	1,2	6	VU	LC
Scombridae							

	<i>Euthynnus alleteratus</i>	Bonito, Bonito-pintado, Bonito-serra	Little tunny	1,2	6	7	NE	LC
	<i>Katsuwonus pelamis</i>	Bonito-riscado, Gaiado, Listrado, Serra	Skipjack tuna		6	7	LC	
	<i>Sarda sarda</i>	Sarda	Atlantic bonito		6	7	LC	
	<i>Scomber goliias</i>	Cavalinha	Atlantic chub mackerel		6	7	LC	
	<i>Scomberomorus cavalla</i>	Cavala	King mackerel		6	7	LC	
Trichiuridae								
	<i>Trichiurus lepturus</i>	Peixe-espada	Largehead hairtail		6	7+	LC	
Syngnathiformes								
Fistularidae								
	<i>Fistularia petimba</i>	Trombeta	Red cornetfish		6	7	LC	LC
Dactylopteridae								
	<i>Dactylopterus volitans</i>	Voador	Flying gurnard		6	7*	NE	LC
Carangiformes								
Carangidae								
	<i>Oligoplites saurus</i>	Goibira, Guaivira	Leatherjack	1,2	6	7	NE	
	<i>Oligoplites saliens</i>	Guaivira, Guaibira	Castin leatherjacket	1,2	6	7	LC	
	<i>Selene setapinnis</i>	Peixe-galo	Atlantic moonfish	1,2	6	7	LC	LC
Pleuronectiformes								
Paralichthyidae								
	<i>Syacium sp.</i>	Solha	Flounder		6	7**		
Mugiliformes								
Mugilidae								
	<i>Mugil curvidens</i>	Parati, tainha	Dwarf mullet		6	7	NE	DD
Pomadasyidae								
	<i>Anisotremus virgicunus</i>	Salema, Salemo	Porkfish	1,2,3	6			
Scianidae								
	<i>Cynoscion spp.</i>	Pescada	Weakfish	1,2,3	6	7		
	<i>Isopisthus parvipinnis</i>	Pescadinha, Faneca	Bigtooth corvina	3		7	NE	LC

<i>Macrodon atricauda</i>	Pescadinha	Southern King Weakfish	5,6			NE	DD
<i>Nebris microps</i>	Pescada-banana, Pescada-rolão, Olhuda, Pescadinha	Smalleye croaker	5			LC	LC
<i>Paralonchurus brasiliensis</i>	Maria-luisa, Mistura	Banded croaker	5				
<i>Cynoscion striatus</i>	Pescada-olhuda	Striped weakfish	6	7			
<i>Cynoscion acoupa</i>	Pescada-cascuda, Pescada-amarela	Acoupa weakfish	6	7			
<i>Cynoscion quatuorcupa</i>	Pescada-rolão, Banana, Olhuda, Pescadinha, Goete-maria-mole, Maria-mole	Stripped weakfish	5,6	7		NE	LC
<i>Cynoscion jamaicensis</i>	Goete, Goete-verdadeiro	Jamaica weakfish	5,6			LC	LC
<i>Micropogonias furnieri</i>	Corvina-branca, Corvina, Curvina, Corvinota	Whitemouth croaker	1,2,3,4	1,5,6	7	LC	LC
<i>Menticirrhus americanus</i>	Papa-terra	Southern kingcroaker	1,2,3	6	7	NE	LC
<i>Menticirrhus littoralis</i>	Papa-terra	Gulf kingcroaker	1,2,3	6	7	NE	DD
Lobotiformes							
Lobotidae							
<i>Lobotes surinamensis</i>	Pejereba, Prejereba	Tripletail	1,3	6	7	LC	LC
Priacanthiformes							
Priacanthidae							
<i>Priacanthus arenatus</i>	Olho-de-cão, Miraceu	Atlantic bigeye	6		7**	LC	LC
Triglidae							
<i>Prionotus punctatus</i>	Cabrinha, Voador-cabrinha	Bluewing searobin	6		7**	LC	LC

References: (1) Di Benedetto et al. 1998 (2) Di Benedetto 2001(3) Oliveira et al. 2016 (4) Bonfim et al. 2017; (5) Bau 2015 (6) Silva et al. 2017 (7) This report

(+) Very small ones, less than 15 cm, or damaged, are discarded

(*) bycatch: species of no commercial value and discarded

(**) Fish smaller than 10-12 cm are discarded

Table 2 Characteristics of fishing gear and operation in the three major landing fishing ports in northern Rio de Janeiro state, Brazil – Data collected from June 2017 to February 2018. Additional data from Di Benedetto et al. (1998), Di Benedetto (2001, 2003), Silva et al. (2012, 2016), Bau (2015), Calleja (2015), Oliveira et al. (2016), Bonfim et al. (2017), and Silva et al. (2017).

Gillnet characteristics	Atafona, São João da Barra	Macaé	Tamoios, Cabo Frio
Crew	2-4 fishermen	2-5 fishermen	2-3 fishermen
Boat	9,5-13,6m length, 2,5-4 m width, 2-12 tonnage range, 30-90 HP motor power	7,5-15m (mostly 9-11m) length, 2,5-3,5m width, 2-12 tonnage range, 30-90 HP motor power	3,5-12m length, 2,5-3,5m width, 1-10 tonnage range, 15-90 HP motor power
Onboard equipment	VHF communication, GPS, winch used to retrieve the net	VHF communication, GPS, winch used to retrieve the net	VHF communication, Cell phone used to locate the position of the net, winch used to retrieve the net
Gillnet information details	<p>"Pescadinha" (Weakfish): 1,900-3,000 m length, 2-3 m height, 30 mm mesh size;</p> <p>"Minjuada" (bottom gillnet): 2,500-4,000 m length, 3-6 m height, 30 mm mesh size;</p> <p>"Caída" (surface gillnet): 2,500-6,400 m length, 2,3-6 m height, 55 mm mesh size</p> <p>Corks used in the main cable, lead at the bottom</p>	<p>"Cabelinho" (Weakfish): 1,900-3,000 m length, 40-35 mm mesh size</p> <p>"Laça" (Croaker): 2,500-4,000, 60-70 mm mesh size</p>	<p>"Minjuada" (bottom gillnet): 2,500-9,000 m length, 3-6 m height, 30 mm mesh size;</p> <p>"Caída" (surface gillnet): 2,500-10,400 m length, 2,3-6 m height, 55 mm mesh size</p>
Operation mode of the gillnet	<p>Pescadinha: 2-3 casts/day, 3-4 h/soak time, 4-5 days/week;</p> <p>Minjuada: 2 casts/day, 8-20 h/soak time, 5-6 days/week;</p> <p>Caída: 1-2 casts day, 10-12 h/soak time, 5-7 days/week</p>	<p>Cabelinho: 1 cast/day, 10h/soak time, 4-5 days/week;</p> <p>Laça: 1 cast/day, 10-12 h/soak time, 5-6 days/week</p>	<p>Pescadinha: 1 cast/day, 8-10h/soak time, 4-5 days/week;</p> <p>Minjuada: 1 cast/day, 10-12 h/soak time, 5-6 days/week;</p> <p>Caída: 1 cast day, 10-12 h/soak time, 5-7 days/week</p>
Major fishing grounds	From Anchieta, following the 40m isobath to the south, heading to Cabo de São Tomé, operating	From Macaé heading to Cabo de São Tomé, operating at maximum 100m	From the mouth of River São João to SE and E heading to Búzios, operating at maximum

	at maximum 50m isobath, to Macaé. Off and around Cabo de São Tomé is the main incidental capture area for Franciscanas	isobath. Off and around Barra do Furado (Quissamã) is the main incidental capture area for Franciscanas	100m isobath. Off and around Búzios Peninsula is the main incidental capture area for Franciscanas
Commonly caught fish spp.	Whitemouth croaker, "Weakfish", Bluefish, Atlantic bonito and sharks	Whitemouth croaker, "Weakfish", Largehead hairtail, Leatherjack, Atlantic bonito and sharks	Whitemouth croaker, "Weakfish", Largehead hairtail, Leatherjack, Atlantic bonito, Atlantic bigeye, sharks and rays



Figure 5. (A) Aerial view of Barra do Furado, off Quissamã, northern coast of Rio de Janeiro state; (B & C) Gillnet fishing boats operating off Barra do Furado on December 19th, 2017; (D) Aerial view of the location of the two sighted groups of Franciscana dolphins (*Pontoporia blainvillei*) off Barra do Furado; (E & F) Views of Macaé, northern coast of Rio de Janeiro state. Photos by S. Siciliano.



Figure 6. (A & B) Gillnet fishing boats docked in Atafona harbor; northern coast of Rio de Janeiro (C) Details of the winch used to retrieve gillnets; (D) Several gillnet fishing boats docked in Atafona; (E) Detail of a gillnet used in Atafona, note the affixed pieces of cork to the rope which formed the upper edge of the net. Photos by A.P. M. Di Benedetto.



Figure 7. Fisherman mending gillnets in Cais São João, Tamoios Fishing Village, Cabo Frio, South-eastern Rio de Janeiro state, Brazil; (B) Fishermen preparing gillnets to depart fishing off Cabo Frio; (C) Fishing boat ready to depart off Tamoios, Cabo Frio; (D) Small-type gillnet fishing boat in Tamoios, Cabo Frio; (E) Large amount of rays captured in January, 2018 off Cabo Frio by Tamoios fishing boats; (F) Fishermen and family retrieves fish from a gillnet in Tamoios, Cabo Frio. Photos by S. Siciliano.



Figure 8. Outreach poster produced for the candidate "Mosaico Jurubatiba" Whale Heritage Site. Graph design by Walter Vasconcelos.



Annex 1: Outreach material, flyers and stickers, produced for the Franciscana dolphin stranding network and the Mosaic Jurubatiba Whale Heritage Site. Graph design by Walter Vasconcelos.