Biotemas, 32 (2): 87-96, junho de 2019
ISSNe 2175-7925
http://dx.doi.org/10.5007/2175-7925.2019v32n2p87

Franciscana dolphin (*Pontoporia blainvillei*) diet from Northern Espírito Santo State coast, Brazil

Gabriel M. Rupil [1, 2] *
Lupércio Barbosa [3]
Milton Cesar C. Marcondes [4]
Barbara Maichak de Carvalho [5]
Ana Paula Cazerta Farro [1, 6]

[1] Universidade Federal do Espírito Santo
Programa de Pós-graduação em Biodiversidade Tropical, Centro Universitário Norte do Espírito Santo
CEP 29.932-540, São Mateus – ES, Brazil
[2] Universidade Federal de Santa Catarina, Programa de Pós-graduação em Ecologia
CEP 88.040-900, Florianópolis – SC, Brazil
[3] Organização Consciência Ambiental – Instituto ORCA
CEP 29.101-300, Vila Velha – ES, Brazil
[4] Instituto Baleia Jubarte, CEP 45.900-000, Caravelas – BA, Brazil
[5] Universidade Federal do Paraná, Programa de Pós-graduação em Zoologia
Departamento de Zoologia, Caixa Postal 19.020, CEP 81.531-980, Curitiba – PR, Brazil
[6] Universidade Federal do Espírito Santo, Departamento de Ciências Agrárias e Biológicas
Centro Universitário Norte do Espírito Santo, CEP 29.932-540, São Mateus – ES, Brazil
* Corresponding author
gabrielrupil@gmail.com

Submetido em 14/05/2018
Aceito para publicação em 15/04/2019

Resumo

Dieta da toninha (*Pontoporia blainvillei*) na costa norte do Espírito Santo, Brasil. A toninha (*Pontoporia blainvillei*) é considerada a espécie de golfinho mais ameaçada da costa do Brasil. A população de toninhas que ocorre no litoral norte do estado do Espírito Santo constitui uma população isolada, separada por um hiato geográfico das demais populações. Da mesma forma, não há informações sobre hábitos alimentares de toninhas na área de estudo. O objetivo desta pesquisa é descrever a dieta da toninha na costa norte do Espírito Santo. Foram analisados 18 conteúdos estomacais de carcaças encalhadas no período de janeiro/2012 a março/2015. Foram contabilizados os itens da dieta identificados e calculadas a frequência de ocorrência e a abundância relativa das presas. São apresentados novos registros de presas para a espécie. A presa mais comum encontrada na dieta da toninha foi *Isopisthus parvipinnis*. Assim como em outras localidades, a família Sciaenidae foi o grupo mais importante na dieta de *Pontoporia blainvillei* no Espírito Santo, seguida por presas pelágicas da ordem Clupeiformes.

Palavras-chave: Cetáceos; Ecologia trófica; Odontocetos; Peixes

Abstract

The franciscana dolphin (*Pontoporia blainvillei*) is the most threatened dolphin species in the Brazilian coast. The study area is the northernmost distribution range of the species and the stock inhabiting the northern State of Espírito Santo is isolated from other populations. Likewise, there is no information on feeding habits of franciscana dolphins in the study area. Hence, the aim of this study was to describe the diet of franciscana dolphins from the Northern Espírito Santo State coast. Stomach contents of 18 individuals stranded in the study area between January 2012 and March 2015 were analyzed. We ranked each specific prey item found in stomach contents using the frequency of occurrence, the total count of prey items, and the relative abundance of prey. It was found novel records of prey species for the franciscana dolphin and we explored possible feeding strategy patterns. The fish *Isopisthus parvipinnis* was the most common prey consumed by the dolphins. Our report agrees with previous studies showing demersal fish species, mainly sciaenids, as the most common preys consumed by the franciscana dolphin followed by pelagic fish species.

Key words: Cetaceans; Fish; Feeding ecology; Odontoceti

Introduction

Pontoporia blainvillei (Gervais & D'Orbigny, 1844) is popularly known as "toninha" in Brazil, or as La Plata River dolphin and "Franciscana" in Uruguay and Argentina. Franciscana dolphin is the sole extant species in Pontoporiidae family. The species is distributed from Itaunas (18°25'S), on the Northern coast of Espírito Santo State, Brazil (SICILIANO, 1994), to the Northern coast of Golfo San Matías (42°35'S), Argentina (CRESPO et al., 1998). This dolphin species inhabits preferentially coastal and estuarine areas up to 50 m depth, even though the species is more abundant in shallow waters over soft-bottoms at 30 m depth (PINEDO et al., 1989; DI BENEDITTO; RAMOS, 2001; DANILEWICZ et al., 2009). The species distribution is not continuous along its entire geographic range. The northernmost population in the Espírito Santo State is geographically isolated and morphologically and genetically differentiated from all other southern populations (CUNHA et al., 2014). Since 2012, the franciscana dolphin has been categorized as "Vulnerable" by the International Union for Conservation of Nature (ZERBINI et al., 2017). The species is also considered the most threatened dolphin in Brazil (MMA, ICMBio – Portaria 444/2014).

Over the last few decades, several studies have described the diet of franciscana dolphins along the species' distribution range. In Brazil, Pinedo (1982; 1989) and Ott (1995) studied the feeding ecology of the franciscana dolphins inhabiting the northern Rio Grande do Sul State coast. Bassoi (2005) utterly explored the feeding ecology of the species, diet variation patterns and its relationship with oceanographic features along the coast of Rio Grande do Sul State. Cremer et al. (2012) and Paitach (2015) studied the diet of the franciscana dolphins inhabiting the Santa Catarina State coast. Bittar and DiBeneditto (2009) described the diet of the franciscana dolphins inhabiting the northern coast of Rio de Janeiro State. In Argentina, Bastida et al. (2000) and Rodríguez et al. (2002) described the diet of the franciscana dolphin along the northern Argentinian coast, while Paso-Viola et al. (2014) explored the diet of the franciscana dolphins along southern Buenos Aires Province. Praderi (1986) studied franciscana diet in Uruguayan coast. Danilewicz et al. (2002) presented an exhaustive review compiling previous reports and scientific studies on the diet and feeding ecology of the franciscana dolphin. However, no information is available about the feeding ecology of the northern stock of the franciscana dolphins.

The purpose of our study was to describe the diet of franciscana dolphin from the Franciscana Management Area I -FMA I- (DIBENEDITTO et al., 2010) through stomach remains examination using stranded carcasses. We ranked all prey items consumed by the dolphins and we described all predator-prey relationships to give insights about the feeding ecology of the species' northernmost stock.

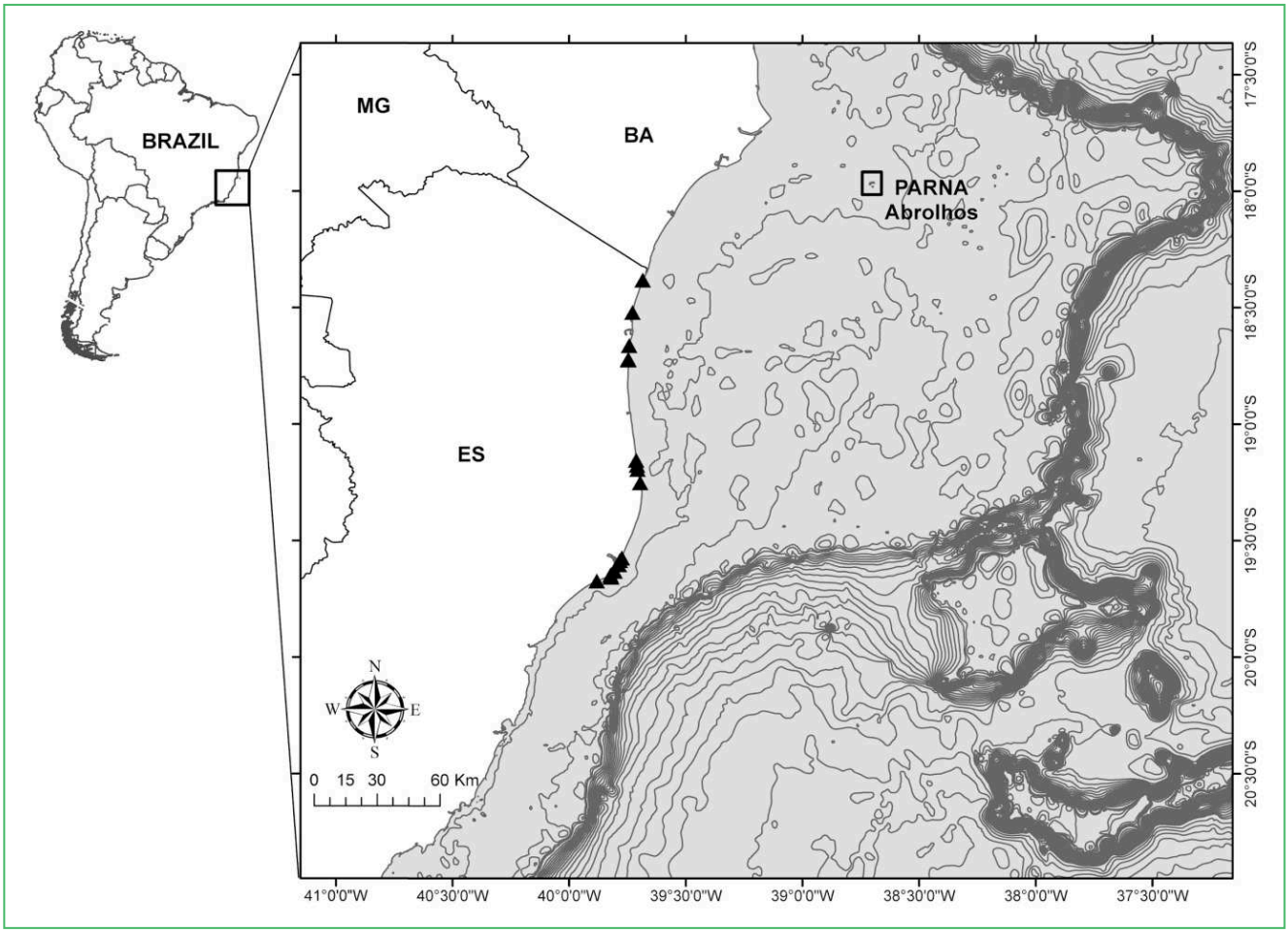
Materials and Methods

Study area and sampling

The carcasses of Franciscana dolphin were found from 18°22'S – 39°40'W to 19°40'S – 39°53'W along the northern Espírito Santo State coast (Figure 1). Our study area includes part of the Abrolhos Bank (Figure 1). The Abrolhos Bank (16°40' to 19°30'S, 37°25' to 39°45'W) is located on an extension of the Brazilian continental shelf, ranging from southern Bahia State towards the Rio Doce estuary (MUEHE, 2001). The Abrolhos Bank's sea floor comprises a highly heterogeneous environment featuring great diversity of habitats, including calcareous algae banks, soft-bottoms and both sandstone and coral reefs (MUEHE, 2001). Oceanographically, oligotrophic waters of the Brazilian Current govern the sea along our study area (SCHMID et al., 1995).

We examined the stomach content of 18 franciscana dolphins stranded between January 2012 and March 2015 along the northern coast of Espírito Santo State (Figure 1). Handling the stranded carcasses followed the recommendations of experts for stranded marine mammals in Brazil (Rede de Encalhes de Mamíferos Aquáticos do Brasil – REMAB). The carcasses were collected with the support of two nongovernmental organizations, the Instituto Baleia Jubarte (IBJ) and the Instituto ORCA.

FIGURE 1: Study area on the northern Espírito Santo State coast, Brazil, showing the sites of 18 *Pontoporia blainvillei* individuals stranded from January 2012 to March 2015.



Diet composition

We analyzed the diet based on stomach remains. The stomachs were dissected, and hard structures were retrieved using tap water and a set of graded sieves (200 µm, 400 µm and 1 mm). Fish prey was identified using the sagittal otoliths and catalogues and guides (e.g., CORRÊA; VIANNA, 1992; BAREMORE; BETHEA, 2010, ROSSI-WONGTSCHOWSKI et al., 2014). We considered the maximum right or left otolith counted and the size of otoliths found in the stomach content to estimate the relative abundance of fish prey species. Cephalopod abundance was estimated using the maximum number of either upper or lower beaks found. Crustacean abundance was estimated using the exoskeleton. Mollusk abundance was estimated using the shell. Throughout our study, cephalopod prey and shrimp could not be identified to a lower taxonomic level. Prey size and prey weight could not be estimated during the study. All prey items found in the franciscana dolphin stomachs were screened, labeled and identified to the lowest possible taxonomic level. All items found in the stomachs were archived in the Zoological Collection (Coleção Zoológica Norte Capixaba) at the Centro Universitário do Norte do Espírito Santo (CEUNES), Universidade Federal do Espírito Santo (UFES).

Data analysis

To rank all prey species, we used the frequency of occurrence (O) and the numerical importance (N) of prey items. These two measures are defined as (i) the proportion of stomachs containing a specific prey item and (ii) the proportion of all prey items for a certain type of prey to the total count of prey individuals found in all predators, respectively (CORTÉS, 1997). Additionally, we computed, considering fish families, the relative abundance of prey (P). The relative abundance of prey is defined as the proportion of the total count for a specific prey to the total count of prey items found in all stomachs in which a specific type of prey occurs. All measures are expressed as a percentage. We used the Costello (1990) graphical representation to show the importance of the prey species composing the diet of the franciscana dolphins. Cephalopods were not included in this analysis.

Results

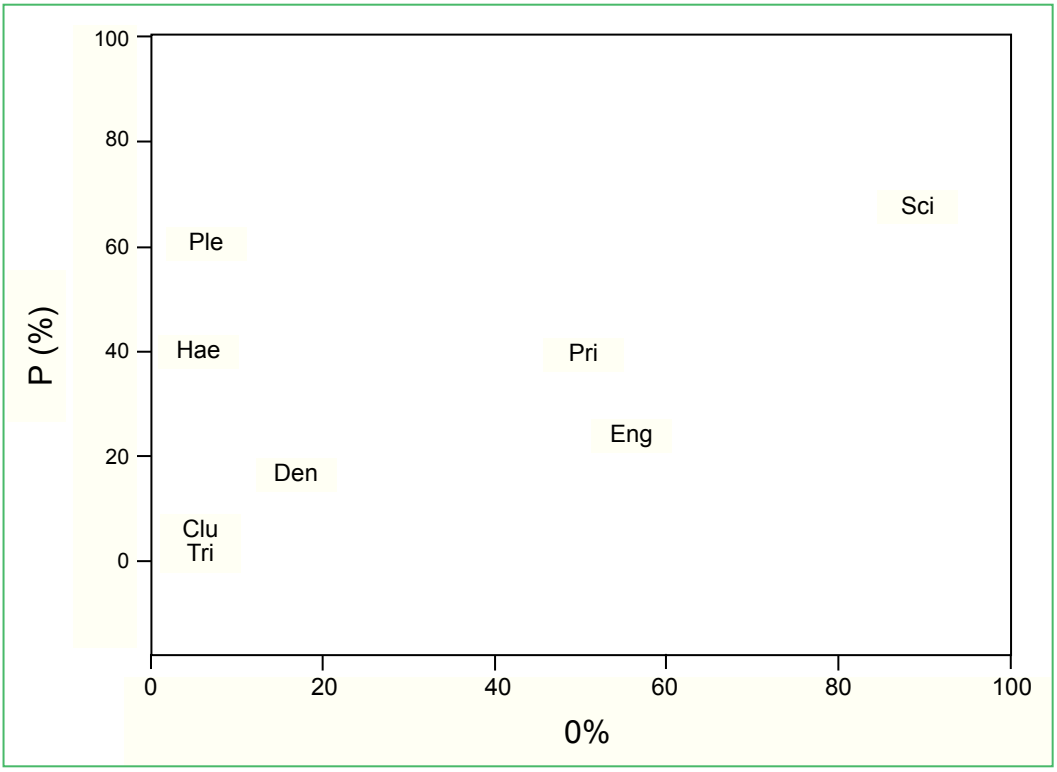
The prey found in the stomachs included fish, crustaceans, squid, and other mollusks. Dietary descriptors are presented in Table 1. We counted and identified 624 prey items, of which 611 were fish (N% = 97.91%, Table 1). Otolith features were occasionally eroded by stomach acids, so identification to species was not always possible. Cephalopod prey included nine individuals (N% = 1.44%, Table 1). We also found three crustaceans (N% = 0.48%, Table 1) and one bivalve shell (N% = 0.16%, Table 1). Fish prey remains were found in all stomachs examined (O% = 100.00%, Table 1). Crustaceans were found in three stomachs (O% = 16.67%, Table 1) and all of these samples were juveniles. Cephalopod prey were found in two stomachs (O% = 11.11%, Table 1) and bivalve prey were found in only one sample (O% = 5.56%, Table 1). Sciaenids (five species were identified in our study) are the predominant type of prey consumed by the franciscana dolphin (N% = 64.26, Table 1). *Isopisthus parvipinnis* (O% = 55.56%, Table 1) was the most frequent sciaenid prey species found in all stomachs. Pelagic prey in Clupeiformes (herrings) were also common items, such as *Chirocentrodon bleekerianus* and engraulid fish (Table 1). Drums (*Stellifer* sp.), which are sciaenids, were the most abundant fish prey identified (N% = 47.60%, Table 1). *Stellifer* sp. could be several species in the genus, namely: *Stellifer rastrifer* (Jordan, 1889), *Stellifer stellifer* (Bloch, 1790), *Stellifer naso* (Jordan, 1889) and *Stellifer* sp. *Chirocentrodon bleekerianus*, a pelagic fish, also appears to be a quite abundant fish prey consumed by the dolphins (N% = 20.67%, Table 1). Most *Stellifer* sp. items were found in only one sample, which is classified as a juvenile female in our records.

The graphical representation method (Figure 2) shows sciaenid fish as the most important prey consumed by the franciscana dolphins along the study area.

TABLE 1: Dietary descriptors of prey items consumed by franciscana dolphins (*Pontoporia blainvillei*) along the northern coast of Espírito Santo State, Brazil. Abbreviations: O = frequency of occurrence; N = numerical importance; P = relative abundance.

Prey items	O (%)	N (%)	P (%)
Teleostei	100	97.91	–
Clupeidae	5.56	0.32	6.25
Sardinella sp.	5.56	0.32	–
Engraulidae	55.6	11.70	24.75
Cetengraulis edentulus (Cuvier, 1829)	5.56	0.16	–
Lycengraulis grossidens (Agassiz, 1829)	5.56	0.80	–
Engraulidae (non-identified)	50.00	10.74	–
Haemulidae	5.56	0,32	40.00
Haemulopsis corvinaeformis (Steindachner, 1868)	5.56	0.16	–
Haemulon plumieri (Lacepède, 1802)	5.56	0.16	–
Pleuronectiformes	5.56	0.48	60.00
cf *Paralichthys* sp.	5.56	0.48	–
Pristigasteridae	50.00	20.67	39.81
Chirocentrodon bleekerianus (Poey, 1867)	50.00	20.67	–
Sciaenidae	88.89	64.26	67.74
Isopisthus parvipinnis (Cuvier, 1830)	55.56	11.38	–
Larimus breviceps Cuvier, 1830	11.11	0.32	–
Paralonchurus brasiliensis (Steindachner, 1875)	5.56	0.16	–
Stellifer brasiliensis (Schultz, 1945)	44.44	4.81	–
Stellifer sp.	38.89	47.60	–
Trichiuridae	5.56	0.16	1.92
Trichiurus lepturus Linnaeus, 1758	5.56	0.16	–
Crustacea	–	–	–
Dendrobranchiata	16.67	0.48	3.23
Dendrobranchiata (non-identified)	16.67	0.48	–
Mollusca	–	–	–
Cephalopoda (non-identified)	11.11	1.44	–
Bivalvia (non-identified)	5.56	0.16	–

FIGURE 2: Costello graphical representation showing the relative importance and dominance of prey. Axis X refers to the frequency of occurrence (O) and axis Y to the specific relative abundance of prey (P), both measures expressed as a percentage. Prey acronyms: Clu, Clupeidae; Den, Dendrobranchiata; Eng, Engraulidae; Hae, Haemulidae; Ple, Pleuronectiformes; Pri, Pristigasteridae; Sci, Sciaenidae; Tri, Trichiuridae.



Discussion

Diet and food habits define the position of a species within a food web. Studies about the diet composition of dolphins can increase our understanding of the ecological role these species play in aquatic ecosystems (PAULY et al., 1998). To analyze the diet, we gave special attention to frequency of occurrence, which expresses how often a certain type of prey was consumed by the predator (CAILLIET, 1977), enabling us to weight all specific predator-prey relationships from a bipartite perspective to the broadest extent.

Regarding the study area, the Abrolhos Bank features high biodiversity and has been categorized as a marine hotspot (DUTRA et al., 2006). From a conservation ecology perspective, our results exhibit the importance of dietary studies to reveal the ecological role of the franciscana dolphin along the study region (BOWEN, 1997). The franciscana dolphin could be a key species along the coast, given that the species may be influencing estuaries and reef areas through predation and energy flow means.

Our study agrees with previous reports (e.g., RODRÍGUEZ et al., 2002) and shows sciaenid fish are the most frequent type of prey consumed by the franciscana dolphin. In general, our research agrees with Bittar and DiBeneditto (2009), whose results show sciaenids (demersal fish) as the most frequent prey consumed by franciscana dolphins inhabiting the coast of Rio de Janeiro State, which is the closest geographical area to this study. We highlight sciaenids as a rich and abundant family of fish along the Southern Atlantic coast that are particularly associated with runoff (MENEZES; FIGUEIREDO, 1980). Furthermore, sciaenids are shoaling fish (CHAO et al., 2015) and are capable of emitting sounds, which in turn may influence the predatory behavior of dolphins (RAMCHARITAR et al., 2006).

We report *H. corvinaeformis* and *H. plumieri* as likely new records of prey species in the diet of the franciscana dolphin. It is noteworthy that both are haemulid fish. Like sciaenid fish, haemulids are capable of emitting sounds (MENEZES; FIGUEIREDO, 1980). Adults are typically quiescent during day, when they shelter near or under ledges, and spread out to feed on benthic invertebrates at night (NELSON et al., 2016). Based on these characteristics of haemulid fish, we can infer that some franciscana dolphins likely prey on these fish at night. Adult haemulids are usually found in Brazilian coastal reefs, whereas estuaries are used as nurseries for juveniles (MENEZES; FIGUEIREDO, 1980). In this sense, our results are consistent with those of Tellechea et al. (2007). The latter researchers showed that franciscana dolphins can prey on organisms in low visibility waters in Uruguay. Our results suggest that these dolphins use passive listening to prey.

Danilewicz et al. (2002) reported no significant difference in the diet of franciscana dolphins between males and females and between age classes. However, more recent and seminal studies exhibit diet variation within the population level (BASSOI 2005; HENNING et al., 2018). As to this particular issue, further efforts to increase the sample size to explore diet variation between groups within the franciscana dolphin stock from the coast of northern Espírito Santo State are needed. Our results also show that there can be a likely turnover in the occurrence of some specific prey along the franciscana dolphin distribution range. For example, while franciscana dolphins prey on haemulids (reef associated fish) along our study area, gerreid and gobiid fish are prey consumed by franciscana dolphins on the coast of Santa Catarina State, in southern Brazil (CREMER et al., 2012), suggesting a differentiation in the use of food resources among populations (BASSOI, 2005; HENNING et al., 2018). Although the small sample size in our study did not allow us to conduct any kind of analysis, we found it noteworthy that our findings support previous studies about likely preferential use of shrimp by juveniles (DANILEWICZ et al., 2002; BASSOI, 2005). In our study, shrimp were only found in stomachs of samples categorized as juveniles. We determined age class based on Kasuya and Brownell Jr (1979) and Brownell Jr (1984). However, further studies on growth patterns and age determination are needed for franciscana dolphins from the coast of northern Espírito Santo State. We also encourage future studies to use stable isotope techniques to reveal concealed trophic differentiation within the population level (DI BENEDITTO et al., 2013; DIBENEDITTO; MONTEIRO, 2016).

The franciscana dolphin stock from the northern coast of Espírito Santo State may be vulnerable because of two factors: i) the isolation of this dolphin stock; and ii) the possible effects of competition with other top predators, including the fisheries (RUPIL, 2016). Regarding the isolation of the stock, franciscana dolphins have been previously reported to show limited movement patterns and a small home range in Argentina (BORDINO et al., 1999). However, further studies are needed to determine movement patterns and the home range of the species in our study area. As for the likely effects of competition, some fish species consumed by the franciscana dolphin, such as *Sardinella* sp. and *I. parvipinnis*, are economically important in commercial fisheries (FROESE; PAULY, 2017). Different sciaenid species, including *I. parvipinnis*, are harvested by many fishing communities along the Brazilian coast under the name *pescadinha* (MENEZES; FIGUEIREDO, 1980). *Isopisthus parvipinnis* is also the most common species consumed by *Sotalia guianensis,* popularly known as the Guiana dolphin, along the central Brazilian coast (RUPIL et al., 2018). We also encourage future studies to consider prey size to get more accurate estimates of trophic overlap between top predators (BITTAR; DI BENEDITTO, 2009; PASO-VIOLA et al., 2014). However, we find it noteworthy to mention that the results from Rupil (2016) agree with those of Paitach (2015) about the likely relative feeding specialization trend of the franciscana dolphin, relative to other co-existing top predators, which may make the franciscana dolphin a more vulnerable species. We also find it noteworthy that Rupil (2016) concluded that *P. blainvillei* and *I. parvipinnis* are likely vulnerable species due to predatory pressure exerted by top predators (including fisheries) along the northern coast of Espírito Santo State.

Our study is the first description of the diet of franciscana dolphins along the species' northernmost

distribution range. Our main findings show the franciscana dolphins could prey on different functional prey species through the water column, although fish associated with estuaries appear to be the most important prey consumed by the franciscana dolphins in the study area. We conclude that the franciscana dolphins from northern Espírito Santo State are probably vulnerable due to isolation and the likely consumptive effect of competition with other sympatric top predators and fisheries. In addition, further studies are needed to provide insights about growth patterns and other biological aspects of the species in the study area.

Acknowledgements

We thank Professor Henry Louis Spach and Vitor Leonardo Amaral Rodrigues for their kind support. Olímpio Rafael Cardoso helped make the map. The cetacean rescue program was carried out by IBAMA, as required by the federal environmental licensing of the Terminal Marítimo de Belmonte-BA, conducted by IBAMA. Stranded cetaceans were collected through the license ICMBio 13306-6. Adriana Colosio conducted the necropsies and screened the samples. We thank two anonymous reviewers for their valuable contributions that improved the manuscript. This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de N vel Superior - Brazil (CAPES) - Finance Code 001. Barbara Maichak de Carvalho is supported by a CNPQ graduate scholarship (141267/2015-1). GMR is supported by a CAPES graduate scholarship (UFES registration number: 201700939; CAPES process number: 1690185).

References

BAREMORE, I.; BETHEA, D. A guide to otoliths from fishes of the Gulf of Mexico. **NOAA Technical Memorandum NMFS SEFSC**, Miami, v. 599, p. 1-106, 2010.

BASSOI, M. **Feeding ecology of franciscana dolphin, *Pontoporia blainvillei* (Cetacea: Pontoporiidae), and oceanographic processes on the Southern Brazilian coast.** 2005. 190 f. Thesis (Doctor of Philosophy) – University of Southampton, Southampton. 2005.

BASTIDA, R.; RIVERO, L.; RODRIGUEZ, D. Presencia inusual de elementos de origen antrópico en los contenidos estomacales de la franciscana (*Pontoporia blainvillei*). In: ENCONTRO DE TRABALHO SOBRE A COORDENAÇÃO DE PESQUISA E CONSERVAÇÃO DA FRANCISCANA, *Pontoporia blainvillei*, NO ATLÂNTICO SUL OCIDENTAL, 4. Relatório técnico, 05-09 de Novembro 2000, Porto Alegre, **Resumos**... Porto Alegre: UFRGS, 2000.

BITTAR, V.; DI BENEDITTO, A. P. M. Diet and potential feeding overlap between *Trichiurus lepturus* (Osteichthyes: Perciformes) and *Pontoporia blainvillei* (Mammalia: Cetacea) in Northern Rio de Janeiro, Brazil. **Zoologia**, Curitiba, v. 26, p. 374-378, 2009.

BORDINO, P.; THOMPSON, G.; IÑIGUEZ, M. Ecology and behaviour of the franciscana (*Pontoporia blainvillei*) in Bahía Anegada, Argentina. **Journal of Cetacean Research and Management**, Cambridge, v. 1, n. 2, p. 213-222, 1999.

BOWEN, W. D. Role of marine mammals in aquatic ecosystems. **Marine Ecology Progress Series**, Oldendorf, v. 158, p. 267-274, 1997.

BROWNELL JR, R. Review of reproduction in platanistid dolphins. **Report of the International Whaling Commission**, Cambridge, v. 6, p. 149-158, 1984.

CAILLIET, G. M. Several approaches to the feeding ecology of fishes. In: PACIFIC NORTHWEST TECHNICAL WORKSHOP, FISH FOOD HABITS STUDIES, 1, 1977, Sea Grant **Publ. WSG-WO-77-2**, 1977. p. 1-13.

CHAO, N. L.; FRÉDOU, F. L.; HAIMOVICI, M.; PERES, M. B.; POLIDORO, B.; RASEIRA, M.; SUBIRÁ, R.; CARPENTER, K. A popular and potentially sustainable fishery resource under pressure-extinction risk and conservation of Brazilian Sciaenidae (Teleostei: Perciformes). **Global Ecology Conservation**, Menglun, v. 4, p. 117-126, 2015.

CORRÊA, M. F. M.; VIANNA, M. S. Catálogo de otólitos de Sciaenidae (Osteichthyes-Perciformes) do litoral do estado do Paraná, Brasil. **Neritica**, Curitiba, v. 7, p. 13-41, 1992.

CORTÉS, E. A critical review of methods of studying fish feeding based on analysis of stomach contents: application to elasmobranch fishes. **Canadian Journal Fish Aquatic Science**, Ottawa, v. 54, p. 726-738, 1997.

COSTELLO, M. J. Predator feeding strategy and prey importance: a new graphical analysis. **Journal Fish Biology**, Liverpool, v. 36, p. 261-263, 1990.

CREMER, M. J.; PINHEIRO, P. C.; SIMÕES-LOPES, P. C. Prey consumed by Guiana dolphin *Sotalia guianensis* (Cetacea, Delphinidae) and franciscana dolphin *Pontoporia blainvillei* (Cetacea, Pontoporiidae) in an estuarine environment in southern Brazil**. Iheringia. Série Zoologia**, Porto Alegre, v. 102, p. 131-137, 2012.

CRESPO, E. A.; HARRIS, G.; GONZÁLEZ, R. Group size and distributional range of the franciscana, *Pontoporia blainvillei*. **Marine Mammal Science**, Lawrence, v. 14, n. 4, p. 845-849, 1998.

CUNHA, H. A.; MEDEIROS, B. V.; BARBOSA, L. A.; CREMER, M. J.; MARIGO, J.; LAILSON-BRITO, J.; SOLÉ-CAVA, A. M. Population structure of the endangered franciscana dolphin (*Pontoporia blainvillei*): reassessing management units. **Plos One**, Cambridge, v. 9, n. 1, p. 1-10, 2014.

DANILEWICZ, D.; ROSA, F.; BASTIDA, R.; MARIGO, J.; MUELBERT, M.; RODRIGUEZ, D.; LAILSON BRITO JR, J.; RUOPPOLO, V.; RAMOS, R.; BASSOI, M.; OTT, P. H.; CAON, G.; ROCHA, A. M.; CATÃO-DIAS, J. L.; SECCHI, E.

R. Report of the working group on biology and ecology. **Latin American Journal of Aquatic Mammals**, Rio de Janeiro, v. 1, n. 1, p. 25-42, 2002.

DANILEWICZ, D.; SECCHI, E. R.; OTT, P. H.; MORENO, I. B.; BASSOI, M.; BORGES-MARTINS, M. Habitat use patterns of franciscana dolphins (*Pontoporia blainvillei*) off southern Brazil in relation to water depth. **Journal Marine Biology Association of the United Kingdom**, Cambridge, v. 89, p. 943-949, 2009.

DI BENEDITTO, A. P. M.; MONTEIRO, L. R. Isotopic niche of two coastal dolphins in a tropical marine area: specific and age class comparisons. **Journal Marine Biology Association of the United Kingdom**, Cambridge, v. 96, p. 853-858, 2016.

DI BENEDITTO, A. P. M.; RAMOS, R. M. A. Biology and conservation of the franciscana (*Pontoporia blainvillei*) in the north of Rio de Janeiro State, Brazil. **Journal of Cetacean Research and Management**, Cambridge, v. 3, p. 185-192, 2001.

DI BENEDITTO, A. P. M.; REZENDE, C. E.; CAMARGO, P. B.; KEHRIG, H. A. Trophic niche comparison between two predators in northern Rio de Janeiro State, Brazil: a stable isotopes approach. **Biota Neotropica**, Campinas, v. 13, n. 3, 2013.

DI BENEDITTO, A. P. M.; ROCHA-CAMPOS, C. C.; DANILEWICZ, D.; SECCHI, E. R.; MORENO, I. B.; HASSEL, L. B.; TAVARES, M.; OTT, P. H.; SICILIANO, S.; SOUZA, S. P. **Plano de ação nacional para a conservação do pequeno cetáceo toninha:** *Pontoporia blainvillei*. Brasília Instituto Chico Mendes de Conservação da Biodiversidade, 2010. 25 p.

DUTRA, G. F.; ALLEN, G. R.; WERNER, T.; MCKENNA, S. A. **A rapid marine biodiversity assessment of the Abrolhos Bank, Bahia, Brazil.** RAP Bulletin of Biological Assessment, 38, Washington: Conservation International, 2006. 160 p.

FROESE, R.; PAULY, D. **FishBase.** World Wide Web electronic publication. 2018. Disponível em: <www.fishbase.org>. Acesso em: 2 mar. 2018.

HENNING, B.; DE SA CARVALHO, B.; PIRES, M. M.; BASSOI, M.; MARIGO, J.; BERTOZZI, C.; ARAÚJO, M. S. Geographical and intrapopulation variation in the diet of a threatened marine predator, Pontoporia blainvillei (Cetacea). **Biotropica**, Malden, v. 50, n. 1, p. 157-168, 2018.

KASUYA, T.; BROWNELL JR., R. L. Age determination, reproduction, and growth of the franciscana dolphin, *Pontoporia blainvillei*. **Scientific Reports of the Whales Research Institute**, Tokyo, v. 31, p. 45-67, 1979.

MENEZES, N. A.; FIGUEIREDO, J. L. Manual de peixes marinhos do sudeste do Brasil. Vol. IV, Teleostei (3). São Paulo: Universidade de São Paulo, Museu de Zoologia, 1980. 90 p.

MUEHE, D. O litoral brasileiro e sua compartimentação. In: CUNHA, S. B.; GUERRA, A. J. T. (Ed.). **Geomorfologia do Brasil.** 2. ed. Rio de Janeiro: Editora Bertrand Brasil, 2001. p. 273-349.

NELSON, J. S.; GRANDE, T. C.; WILSON, M. V. **Fishes of the World.** New Jersey: John Wiley & Sons, 2016. 752 p.

OTT, P. H. **Estudo da ecologia alimentar de *Pontoporia blainvillei* (Gervais & D'Orbigny, 1844) (Cetacea, Pontoporiidae) no litoral norte do Rio Grande do Sul, Sul do Brasil**. 1995. 69 f. Trabalho de Conclusão de Curso (Graduação em Ciências Biológicas) – Universidade Federal do Rio Grande do Sul, Porto Alegre. 1995.

PAITACH, R. L. **Ecologia alimentar e espacial da toninha (*Pontoporia blainvillei*) e do boto-cinza (*Sotalia guianensis*) na Baía de Babitonga, sul do Brasil**. 2015. 142 f. Dissertação (Mestrado em Ecologia) – Universidade Federal de Santa Catarina, Florianópolis. 2015.

PASO-VIOLA, M. N.; DENUNCIO, P.; NEGRI, M. F.; RODRÍGUEZ, D.; BASTIDA, R.; CAPPOZZO, H. L. Diet composition of franciscana dolphin *Pontoporia blainvillei* from southern Buenos Aires, Argentina. **Revista de Biología Marina y Oceanografía**, Valparaiso, v. 49, p. 393-400, 2014.

PAULY, D.; TRITES, A. W.; CAPULI, E. Diet composition and trophic levels of marine mammals. ICES. **Journal of Marine Sciences**, v. 55, p. 467-481, 1998.

PINEDO, M. C. **Análise dos conteúdos estomacais de *Pontoporia blainvillei* (Gervais & d'Orbigny) e *Tursiops gephyreus* (Lahille, 1908) (Cetacea, Platanistidae e Delphinidae) na zona estuarial e costeira do Rio Grande, RS, Brasil.** 1982. 95 f. Dissertação (Mestrado em Oceanografia) – Fundação Universidade do Rio Grande, Rio Grande. 1982.

PINEDO, M. C.; PRADERI, R.; BROWNELL JR., R. L. Review of the biology and status of the franciscana *Pontoporia blainvillei*. Biology and conservation of the river dolphins. **Occasional Paper of the IUCN Species Survival Commission**, London, v. 3, p. 46-51, 1989.

PRADERI, R. Comentarios sobre la distribución de Pontoporia blainvillei en aguas del Rio de la Plata. In: 1ª REUNIÓN DE TRABAJO DE ESPECIALISTAS EN MAMÍFEROS ACUÁTICOS DE AMÉRICA DEL SUR, 206-214, 1986, Buenos Aires, **Resumos**...Buenos Aires: RTEMAAS, 1986.

RAMCHARITAR, J.; GANNON, D. P.; POPPER, A. N. Bioacoustics of fishes of the family Sciaenidae (croakers and drums). **Transactions of the American Fisheries Society**, Oxford, v. 135, p. 1409-1431, 2006.

RODRIGUEZ, D.; RIVERO, L.; BASTIDA, R. Feeding ecology of the franciscana (*Pontoporia blainvillei*) in marine and estuarine waters of Argentina. **Latin American Journal of Aquatic Mammals**, Rio de Janeiro, v. 1, p. 77-94, 2002.

ROSSI-WONGTSCHOWSKI, C. L. D. B.; SILIPRANDI, C. C.; BRENHA, M. R.; GONSALES, S. D. A.; SANTIFICETUR, C.; VAZ-DOS-SANTOS, A. M. Atlas of marine bony fish otoliths (sagittae) of southeastern-southern Brazil Part I: Gadiformes (Macrouridae, Moridae, Bregmacerotidae, Phycidae and Merlucciidae); Part II: Perciformes (Carangidae, Sciaenidae, Scombridae and Serranidae). **Brazilian Journal of Oceanography**, São Paulo, v. 62, p. 1-103, 2014.

RUPIL, G. M. **Dieta de golfinhos e sobreposição trófica com a pesca de arrasto na costa central do Brasil.** 2016. 51 f. Dissertação (Mestrado em Biodiversidade Tropical) – Universidade Federal do Espírito Santo, São Mateus. 2016.

RUPIL, G. M.; BOGONI, J. A.; BARBOSA, L.; MARCONDES, M. C. C.; FARRO, A. P. C. Climate influences on Guiana dolphin diet along the Brazilian coast. **Scientia Marina**, Barcelona, v. 82, n. 3, 159-168, 2018.

SCHMID, C.; SCHÄFER, H.; ZENK, W.; PODESTÁ, G. The Vitória eddyand its relation to the Brazil Current. **Journal of Physical Oceanography**, Boston, v. 25, p. 2532-2546, 1995.

SICILIANO, S. Review of small cetaceans and fishery interactions in coastal waters of Brazil. **Reports of the International Whaling Commission** (special issue), Cambridge, v. 15, p. 241-250, 1994.

TELLECHEA, J. S.; PEREZ, W.; OLSSON, D.; LIMA, M.; NORBIS, W. feeding habits of franciscana dolphins (*Pontoporia blainvillei*): echolocation or passive listening? **Aquatic Mammals**, Old Mystic, v. 43, n. 4, p. 440-448, 2017.

ZERBINI, A. N.; SECCHI, E.; CRESPO, E.; DANILEWICZ, D.; REEVES, R. ***Pontoporia blainvillei*.** The IUCN red list of threatened species. 2017. Disponível em: <http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T17978A50371075.en>. Acesso em: 8 fev. 2018.