UNIVERSIDADE ESTADUAL PAULISTA
"JÚLIO DE MESQUITA FILHO"
Instituto de Biociências
Campus do Litoral Paulista

GABRIEL MENDONÇA GRELLET

Análise temporal da dieta de toninha (Cetartiodactyla: *Pontoporia blainvillei)* na FMA IIb, sudeste do Brasil

São Vicente - SP
2023

UNIVERSIDADE ESTADUAL PAULISTA
“JÚLIO DE MESQUITA FILHO”
Instituto de Biociências
Campus do Litoral Paulista

GABRIEL MENDONÇA GRELLET

Análise temporal da dieta de toninha (Cetartiodactyla: *Pontoporia blainvillei)* na FMA IIb, sudeste do Brasil.

Trabalho de conclusão de curso apresentado ao Instituto de Biociências da UNESP – Campus do Litoral Paulista, como parte dos requisitos para obtenção do título bacharel em Ciências Biológicas, com habilitação em Biologia Marinha.

Orientador(a): Carolina Pacheco Bertozzi
Coorientador(a): Teodoro Vaske-Junior

São Vicente - SP
2023

G825a

Grellet, Gabriel Mendonça

Análise temporal da dieta de toninha (Cetartiodactyla: Pontoporia blainvillei) na FMA IIb, sudeste do Brasil / Gabriel Mendonça Grellet. -- São Vicente, 2023

67 p. : il., tabs.

Trabalho de conclusão de curso (Bacharelado - Ciências Biológicas) - Universidade Estadual Paulista (Unesp), Instituto de Biociências, São Vicente

Orientadora: Carolina Pacheco Bertozzi

Coorientadora: Teodoro Vaske-Junior

1. Ecologia Trófica. 2. Hábitos Alimentares. 3. Cetáceo Costeiro. 4. Conteúdo Estomacal. 5. Pequeno Golfinho. I. Título.

Sistema de geração automática de fichas catalográficas da Unesp. Biblioteca do Instituto de Biociências, São Vicente. Dados fornecidos pelo autor(a).

Essa ficha não pode ser modificada.

SUMÁRIO

LISTA DE TABELAS

LISTA DE FIGURAS

INTRODUÇÃO GERAL

A transferência de energia e acúmulo de matéria ocorrem ao logo da cadeia e interações tróficas (Odum, 2000; Tilley, 2004). A ecologia trófica nada mais é que uma ferramenta que permite através de sua ótica uma melhor compreensão sobre estes processos. Definida por Garvey & Whiles (2016) como a ecologia da derivação nutricional, em outras palavras, seria equivalente ao estudo e avaliação de hábitos alimentares, uma subdisciplina relativa a ecologia quanto ao forrageamento. Conceito este que passou ser popularizado por Elton (1927) com os conceitos de pirâmides de produção tróficas e guildas tróficas.

Perturbações nas populações de consumidores de topo podem ter consequências diretas ou indiretas sobre a abundância e diversidade de espécies em níveis tróficos inferiores, através do controle “topo-base” (Hairston et al., 1960; Estes et al., 2011; Ripple et al., 2016). Logo, o desaparecimento de predadores topo podem originar fenômenos denominados de “cascatas tróficas” (Paine, 1980; Estes & Duggins, 1995; Heithaus et al., 2008; Estes et al., 2011). Dado o atual contexto de depredação das redes tróficas a nível global, sobretudo pela remoção destes consumidores topo em decorrência de atividades antropogênicas (Estes et al., 2011), torna o estudo sobre os seus hábitos alimentares, ainda que uma ciência de base, imprescindível visando o mapeamento e das interações ecológicas entre os organismos.

Uma melhor compreensão da dieta de predadores ameaçados, a partir de metodologias que possibilitem a identificação de suas presas, são um primeiro passo que nos permitem inferir de maneira mais acurada seus respectivos papéis ecológicos e quais as consequências do seu desaparecimento em suas respectivas comunidades. Assim, é possível utilizar-se deste tipo de estudo como base para pesquisas ecológicas mais aplicadas que visam responder questões quanto a nicho, uso de habitat, e diretrizes para a conservação, sempre de modo integrar como o impacto gerado pelas atividades antrópicas têm afetado na mortandade destes grandes predadores e na disponibilidade dos diferentes níveis de consumidores ao longo da cadeia (Heithaus et al., 2008; Henning, 2018).

Mapear a dieta e estudar hábitos alimentares de predadores nos permite compreender melhor o nicho ecológico que desempenham e quais as consequências de seus desaparecimentos para as redes tróficas, fenômenos denominados "cascadas tróficas" (Paine, 1980; Estes et al., 1995, 2011). Assim é possível utilizar-se deste tipo de estudo para observar como o impacto gerado pelas atividades antrópicas têm afetado na disponibilidade de presas consumidas, ou seja, observar o quanto essas atividades têm afetado na diversidade biológica de consumidores de diferentes ecossistemas (Heithaus et al., 2008), uma vez que atividades antrópicas podem levar tanto à diminuição das populações de predadores quanto de presas (Pauly et al., 1998).

A depredação das redes tróficas é ainda mais visível no ambiente marinho, onde a continuidade da atividade pesqueira em larga escala nos permite inferir um declínio global nos níveis tróficos capturados como relatado por Pauly et al. (1998), o que indica mudanças nas estruturas das teias alimentares marinhas de maneira generalizada. Logo, consumidores de topo nestes ambientes acabam sendo os grupos de organismos com as populações mais afetadas por este mesmo tipo de atividade exploratória. Isso inclui o grupo dos mamíferos marinhos, os quais, mesmo que não sendo alvos da atividade pesqueira, acabam sendo capturados de maneira acidental (Heithaus et al., 2008; Brownell et al., 2019).

Os cetáceos por atuarem como consumidores de topo, são organismos com grande potencial para serem utilizados como possíveis indicadores de saúde oceânica

(Fossi et al. 2020). Por desempenharem uma série de papéis importantes em seus ecossistemas golfinhos (odontocetos), tem a capacidade de atuar na ressuspensão de sedimento, transporte de nutrientes horizontal e verticalmente, e são essenciais na manutenção da diversidade da teia através da influência que exercem pela predação (Katona & Whitehead, 1988; Santos et al., 2002; Heithaus et al., 2008; Roman et al. 2014; Campos et al., 2020). Contudo, pouco se sabe sobre o papel funcional e a real importância dos pequenos cetáceos nos ecossistemas aquáticos, tanto marinhos como de água doce (Kiszka et al. 2022).

No Brasil, conhecida popularmente como toninha, a *Pontoporia blainvillei* (Gervais & d'Orbigny, 1884), é a espécie de odontoceto mais ameaçada de extinção no Atlântico Sul Ocidental, endêmica das águas costeiras e estuarinas da América do Sul (Sechi et a*l*., 2003a). Classificada como "Vulnerável" pela IUCN (Zerbini et al., 2018), no Brasil a espécie é classificada como "Criticamente em Perigo de Extinção" (Ministério do Meio Ambiente, 2014). Essa alta taxa de mortalidade se deve principalmente a atividade pesqueira que, há pelo menos 50 anos, tem impactado negativamente as populações de *P. blainvillei*, devido a captura acidental em redes de emalhe (Ott et al., 2002; Secchi et al., 2003a). No entanto, esta não é a única ameaça que a espécie enfrenta. A ingestão de resíduos de origem antrópica, a poluição acústica e química de seu habitat e a diminuição dos estoques pesqueiros, são alguns exemplos das pressões sofridas direta e indiretamente pela espécie, todas relacionadas à impactos gerados pela atividade humana (Zerbini et al., 2018).

Sua distribuição vai desde o estado do Espírito Santo, em Itaúnas (18°25'S 30°42'W) (Siciliano, 1994), até o Golfo de São Matias na Argentina (42°35'S 64°48'W) (Crespo et al., 1998). No entanto, estudos demonstraram que a distribuição de *P. blainvillei* não é contínua em sua área de ocorrência no Brasil (Siciliano et al., 2002), havendo duas lacunas em sua distribuição. A primeira se encontra de Regência (ES) até a Barra do Itabapoana (RJ), e a segunda de Macaé (RJ) à Ilha Grande (RJ) (Azevedo et al., 2002; Danilewicz et al., 2012). Se utilizando de estudos prévios em genética, morfologia e estrutura geográfica populacional, foram propostas por Secchi et al. (2003b), quatro áreas de manejo, a fim de direcionar e organizar as ações para a conservação da *P. blainvillei*, as chamadas FMA (*Franciscana Management Areas*), organizadas a partir da área de ocorrência da espécie (FMA I, II, III e IV). A FMA I está localizada na costa dos estados do Espírito Santo e Rio de Janeiro; enquanto a FMA II engloba o litoral dos estados de São Paulo, Paraná e Santa Catarina; sendo essas duas áreas de manejo restritas ao território brasileiro. Já a FMA III abrange o estado do Rio Grande do Sul e o Uruguai. E por fim, a FMA IV restringe-se à porção mais ao sul da distribuição, localizada na Argentina. Posteriormente, novos estudos revisaram a proposta das FMAs, e propuseram novas subdivisões (Cunha et al., 2014; do Amaral et al., 2018).

Estudos sugerem que a espécie seja generalista e prede de maneira oportunista, ainda que seus hábitos alimentares sejam essencialmente piscívoros e teutófagos (Cremer et al., 2012; Henning et al., 2018; Campos et al., 2020; Bassoi et al., 2021), sobretudo espécies sem valor comercial, também alvos de captura acidental. Tendo em vista que a disponibilidade e diversidade de presas tende a variar geograficamente, a extensa área de ocorrência de *P. blainvillei*, implica em variações sobre a composição de sua dieta ao longo de sua distribuição (Rodríguez et al., 2002; Bittar & DiBeneditto, 2009; Cremer et al., 2012; Henning et al., 2018).

A prevalência de otólitos *sagitta* e bicos de cefalópodes no conteúdo estomacal de carcaças de *P. blainvillei* permite a investigação e avaliação dos táxons predados pela espécie (Fitch & Brownell 1968; Pierce & Boyle 1991; Cremer et al., 2012).

Contudo, mesmo este sendo uma metodologia considerada de baixo custo, são poucos os estudos publicados, especialmente na porção norte de sua distribuição. Existem apenas três publicações que tratam sobre a temática no que corresponde a região da FMA II (Cremer et al., 2012; Henning et al., 2018; Campos et al., 2020), dentre essas publicações, apenas duas são sobre o litoral paulista (Henning et al., 2018; Campos et al., 2020), a mais recente tem seus dados referentes a 7 anos atrás (Campos et al., 2020).

Tendo em vista a carência de estudos de ecologia alimentar e a necessidade de melhor descrever os hábitos alimentares ao longo de toda a distribuição da espécie, buscamos através deste estudo avaliar a composição da dieta de *Pontoporia blainvillei* no litoral centro-sul de São Paulo ao longo de 7 anos de amostragem e assim analisar possíveis tendências e preferências a partir dos fatores estruturantes propostos por Henning et al. (2018): sexo, estágio de desenvolvimento e sazonalidade. Com o acréscimo de mais um fator, a anualidade, uma vez que a temporalidade poderia interferir sobre a relevância dos táxons amostradas, já que a crescente atividade pesqueira e a depredação dos estoques podem ter influência direta sobre a dieta da espécie (Heithaus et al., 2008; Henning et al., 2018; Campos et al., 2020).

Temporal Analyses over franciscanas (Cetartiodactyla: *Pontoporia blainvillei)* feeding habits, on Franciscana Management Area IIb, southeast Brazil.

Gabriel M. Grellet[1]; Victor S. Luiz[2].; Márcio Marcio Hidekazu Ohkawara[2]; Teodoro Vaske-Junior[1]; Carolina P. Bertozzi[1]

[1]Laboratório de Biologia e Conservação de Organismos Pelágicos (LABCOP), Instituto de Biociências, Campus do Litoral Paulista da Universidade Estadual Paulista, IB/CLP, UNESP (São Vicente, SP- Brazil);

[2]Instituto Biopesca (Praia Grande, SP- Brazil).

Correspondence:

E-mail: gabriel.grellet@unesp.br

[1]ABSTRACT

In the Western South Atlantic, the franciscana (*Pontoporia blainvillei*) is a species of small coastal dolphin, threatened by indcidental catch in fishing gillnets. Information about the species' feeding habits is still scarce in the northern portion of its distribution (FMAs I and II). This study aimed to describe and evaluate the importance its feeding habits by analyzing the stomach contents of 206 carcasses from strandings and incidental captures between the years 2015 and 2021, on the south-central coast of São Paulo. We identified 6932 otoliths and 1126 cephalopod beaks, totaling 20 prey taxa identified: 17 teleosts and 3 cephalopods. The species that presented the highest index of relative importance (∑IRI > 90%) were respectively *Stellifer rastrifer*; *Pellona harroweri*; *Doryteuthis plei*; *Lolliguncula brevis*; and *Paralonchurus brasiliensis*. Thus franciscanas presented piscivorous and teutophagous habits. The greater contribution of *S. rastrifer* to the diet differs from previous studies conducted in the same region. We did not record significant differences between the importance of these species for sexes, ages and seasons. The temporal analysis of the diet showed a significant difference between the years studied.

KEYWORDS

Trophic ecology; feeding habits; small dolphin; coastal cetacean; stomach content.

[1]***O manuscrito foi formatado segundo a revista: Marine Mammal Science***

1. INTRODUCTION

The continuity of large-scale fisheries has been responsible for the depletion of food webs on marine environments, under which it has been possible to infer a global decline in captured trophic levels (Pauly et al., 1998), indicating widespread changes on marine food webs. Therefore, higher trophic level consumers in these environments end up being the most affected groups of organisms by this same exploitation economic activity. This includes marine mammals, which, even if they are not targeted by fisheries, end up being accidentally caught, which potentially can result in their mortality due to bycatch (Heithaus et al., 2008; Brownell et al., 2019).

Because of their role as marine predators, cetaceans are great candidates as ocean health indicators (Fossi et al. 2020). Thus, dolphins play a series of key roles in their ecosystems and are essential on maintaining the diversity and health of food webs through the influence they exert through predation (Katona & Whitehead, 1988; Santos et al., 2002; Heithaus et al., 2008; Campos et al., 2020). However, little is known about the functional role and ecological processes in which small cetaceans are involved in aquatic ecosystems (Kiszka et al. 2022). Therefore, studies regarding their feeding ecology can contribute to a more accurate comprehension of marine trophic structures, their functioning and energy flow (Bisi et al., 2012)

The franciscana dolphin, *Pontoporia blainvillei* (Gervais & d'Orbigny, 1884), is considered the most endangered species of small cetacean in the entire Western South Atlantic. It is classified as "Vulnerable" by the IUCN (Zerbini et al., 2017), and as "Criticaly Endangered" by Brazilian Red List (ICMBio, 2022), mainly for its high mortality rate caused due to bycatch in gillnets. This harmful interaction between the species and fisheries has been recorded for at least 60 years (Ott et al., 2002; Secchi et al., 2022). Other threats such as waste ingestion, acoustic and chemical pollution of its habitat and the reduction of fish stocks also contribute directly and indirectly to the conservation of the species (Zerbini et al., 2018).

The species is endemic to the South American Eastern coast, occurring from Itaúnas, in the state of Espírito Santo, Brazil (18°25'S 30°42'W) (Siciliano, 1994) until the Gulf of São Matias in Argentina (42°35'S 64°48' W) (Crespo et al., 1998). Where four management areas are recognized, throughout its distribution, called Franciscana's Management Areas (FMA); FMA I: from Espírito Santo to Rio de Janeiro, Brazil; FMA II: from São Paulo to Santa Catarina, Brazil, FMA III: Rio Grande do Sul, Brazil to Uruguay and FMA IV: Argentina. More recent studies have proposed subdivisions on the FMAs taking into account new populational data on the species, based on its genetics and distribution (Cunha et al., 2014; do Amaral et al., 2018). It is suggested that FMA II, which includes the states along southeastern and southern Brazil and represents one of the least known units, to be subdivided into two large areas based on ecotoxicological data: FMA IIa from Rio de Janeiro the south coast, to the north coast of São Paulo's state; and FMA IIb, from the central coast of São Paulo to the central coast of Santa Catarina (Cunha et al., 2014; Sucunza et al., 2020).

Studies suggest that franciscanas present generalistic feeding habits, preying opportunistically over different species throughout the water column, even though the species presents essentially piscivorous, teutophagous and ocasionally carcinophagus habits, feeding mainly on species with little or no commercial value (Cremer et al., 2012; Henning et al., 2018; Campos et al., 2020; Bassoi et al., 2021). However, variations of its diet composition throughout its distribution are notable (Rodríguez et al., 2002; Bittar & DiBeneditto, 2009; Cremer et al., 2012; Henning et al., 2018). Such variations in diet can be attributed to intrapopulation factors, such as sexual dimorphism and ontogenetic development stages (Rodriguez et al., 2002;

Henning et al., 2018; Campos et al., 2020; Bassoi et al., 2021) and spatio-temporal factors, such as territoriality or seasonality (Rodriguez et al., 2002; Santos & Haimovici 2001; Henning et al., 2018; Campos et al., 2020; Bassoi et al., 2021). Considering that the availability and diversity of prey tends to vary geographically over the occurrence area of *P. blainvillei*, studies characterizing its diet are therefore impelled throughout its distribution. However, most published studies containing statistical analyzes on the species' diet, rather than punctual descriptions, refer to the southern portion of its distribution, in FMAs III and IV (Rodriguez et al., 2002; Paso-Viola et al., 2014; Denuncio et al., 2017; Franco-Trecu et al. 2017; Tellechea et al. 2017; Bassoi et al., 2021), while for the northern portion, these publications are scarcer, in FMA I (Bittar & Di Beneditto, 2009) and FMA II (Henning et al., 2018; Campos et al., 2020). However, none of these studies have previously sought to infer differences in the species' diet inbetween each year sampled, which may have occured due to methodological limitations. Though, now this information can be retrived throughout the continuous stranding survelance campaings launched in Brazil as environmental conditions for the oil and gas exploitation. Incorporating the annual temporal factor into the analysis of feeding habits could help on understanding if the depletion and fluctuation of stocks could have an influence on the species' diet through time (Rodriguez, et al. 2002; Heithaus et al., 2008; Henning et al., 2018; Campos et al., 2020).

Therefore on this study we sought to describe the diet and evaluate the importance of *Pontoporia blainvillei* preyed species through stomach content analysis of carcasses derived from strandings and accidental captures on the south-central coast of São Paulo (FMA IIb) over seven years of sampling. Analizing possible trends and preferences based on intrapopulation (sex and developmental stages) and temporal (seasons and years) structuring factors of the diet.

2. METHODS

2.1. DATA COLLECTION

Pontoporia blainvillei carcasses were collected through a ongoing continuous sampling effort, consisting on daily beach surveys along approximately 75 km of coastline on the central coast of the state of São Paulo, Southeast Brazil, between 24°01’07’’S, 46°23’56’’W – 24°22’43’’S, 47°01’02’’W. We analyzed the stomach contents of 206 franciscanas found stranded (*n* = 150) or accidentally captured (*n* = 56), from 2015 to 2021 (2015 = 27; 2016 = 37; 2017 = 32; 2018 = 48; 2019 = 31; 2020 = 12; 2021 = 19) (Table 2).

We classified the dolphins (n = 206) based on their food content and size, into: “Suckling Calves”, for animals with only the presence of milk in their gastric tract; “Weaned Calves”, for animals that had a total length <90 cm; Juvenile females, >90 cm and <119 cm; and Adult Females, >119 cm; Juvenile males, >90 cm and <107 cm; Adult males were >107 cm (Rodríguez et al., 2002; Ramos & Di Beneditto 2005; Bertozzi et al., 2010). We found 14 Suckling Calves, 18 dolphins with no sign of food content, and 174 franciscanas presenting food items, of which: 88 were males and 83 females; 10 weaned calves, 77 juveniles and 87 adults.

TABLE 1: Number of franciscanas collected for each sex and development stage.

Sex	Suckling Calves	Weaned Calves	Juveniles	Adults	Total
Males	6	11	41	41	99
Females	8	16	34	46	104
Undetermined	-	-	3	-	3
Total	14	27	78	87	206

TABLE 2: Number of franciscanas collected for each year and season.

Years	Summer	Fall	Winter	Spring	Total
2015	2	4	6	15	27
2016	10	5	13	9	37
2017	10	3	7	12	32
2018	13	1	12	22	48
2019	8	4	3	16	31
2020	2	0	4	6	12
2021	7	1	4	7	19
Total	52	18	49	87	206

The esophagus and stomach, including all their chambers, were sectioned and the contents were washed under running water using a 200 μm fine mesh sieve. Items found partially degraded and crustaceans cephalothorax were stored in 70% alcohol, otoliths were preserved dry, and cephalopod beaks in a solution of 70% alcohol and glycerin (1:1) (Lopes et al., 2012; Campos et al., 2020).

2.2. IDENTIFICATION OF THE FOOD ITEMS

We identified fish otoliths and cephalopod beaks, to the lowest taxonomic level possible, via comparison with a reference collection of Otoliths of Teleost Fishes from the Southeast-South Region of Brazil (COSS-Brasil, Instituto Oceanográfico da Universidade de São Paulo, 2022) as also with the use of specific bibliographies (Corrêa & Viana, 1993; Vaske-Júnior, 2006; Xavier & Cherel, 2009; Fischer et al., 2011; Di Beneditto, 2021). We based the count of the prey number in each stomach through the separation of the sagittal otoliths into right and left sides and the cephalopod beaks into upper and lower pieces, the highest value counted was used as the number of ingested prey (Campos et al., 2020). Decapods (shrimps) were not identified due to their advanced stage of digestion.

2.3. ESTIMATING PREY SIZE AND WEIGHT

We estimated the total length or the length mantle and the biomass of prey through the use of regression equations present in the literature (Suplementary Table 1) (Santos, 1999; Di Beneditto & Ramos, 2001; Di Beneditto & Lima, 2003; Lopes et al., 2012; Henning et al., 2018; Campos et al., 2020). We performed the measurements from obtained images under a stereomicroscope coupled to a camera with use of TCapture software (5.1.1.0(N)) to the nearest 0.01 (µm) for all otoliths and beaks that were unworned. Otolith length (OL) as also upper and lower rostral lengths for cephalopods (UHL and LHL) were considered from the anterior tip to the most posterior projection (Clarke, 1986; Dehghani et al., 2016).

2.4. INDEX OF RELATIVE IMPORTANCE

We estimated the importance of each prey taxa in franciscana's diet, based on the Relative Importance Index (*IRI*) (Pinkas et al. (1971):

$$IRI = [(\%\,FN\ +\ \%W)\ *\ \%FO]$$

Where *FN* is the percentage of numerical abundance of prey*; W* is the percentage of prey estimated biomass, and *FO* is the percentage of stomach content samples in which a prey taxon occurred. For comparative analyzes of sex, development sateges, seasons, and years, we calculated index values considering the percentage of stomachs in relation to the total stomachs in each category.

2.5. STATISTICAL ANALYSIS

In order to verify possible statistically significant differences in the diet, we carried out a series of One-Way Analysis of Variance (ANOVA), using the SigmaPlot program (12.5v) between the five most relevant species according to their respective values of importance for each sex, stages of development, seasons and years. Due to the non-parametric nature of the used data, we performed the Kruskall-Wallis test for sets that did not pass the normality and Shapiro-Wilk tests ($p < 0.05$) or the equality of variances test (F-test) ($p < 0.05$).

3. RESULTS

3.1. FEEDING COMPOSITION

We identified 8058 food items (otoliths and beaks) at species level, of which 6932 were otoliths and 1126 cephalopod beaks. Decapod exoesqueletons had a low prevalence ($n = 33$) presenting an occurrence of 3.44%. Thus, in this study, we quantified and analyzed approximately 4112 preyed individuals, present in the digestive contente of franciscanas.

We identified a total of 20 prey taxa present in the food content of *P. blainvillei*. Teleost fishes represented 17 taxa, belonging to 6 families: Sciaenidae, Pristigasteridae, Engraulidae, Trichiuridae, Mugilidae and Dorosomatidae (Table 3). Among the cephalopods, two species belong to the Loliginidae family and one from the Argonautidae family.

We noted that the size of the suckling calves varied from 60.5 cm to 82.9 cm. While for weaned calves, showed a minimal total length size of 79 cm. We also observed the inverse sexual dimorphism in the size difference between males and females. The size of the females varied between 85.4 cm and 114.8 cm, therefore with an average size of 119.8 cm. The males, measured 79 cm to 126.9 cm, had an average size of 106.5 cm. Individuals without the presence of food content were mostly calves (94.4%), and measured from 55.5 cm to 83.7 cm.

TABLE 3: Identified franciscana's prey species and each respective taxonomy.

	Family	Taxa (Species)
Teleostei	Engraulidae	*Anchoa sp.*
		Engraulis anchoita
		Lycengraulis grossidens
	Dorosomatidae	*Harengula clupeola*
	Scianidae	*Ctenosciaena gracilicihrrus*
		Cynoscion jamaicensis
		Isopisthus parvipinnis
		Larimus breviceps
		Macrodon atricauda
		Menticirrhus americanus
		Micropogonias furnieri
		Paralonchurus brasiliensis
		Stellifer brasiliensis
		Stellifer rastrifer
	Mugilidae	*Mugil curema*
	Pristigasteridae	*Pellona harroweri*
	Trichiuridae	*Trichiurus lepturus*
Cephalopoda	Argonautidae	*Argonauta nodosa*
	Loliginidae	*Doryteuthis pleii*
		Lolliguncula brevis

3.2. ESTIMATES OF PREY SIZE AND WEIGHTS

The total average length for otoliths was 2.53 mm (SD ± 1.12) and 1.83 (SD ± 1.24) for cephalopod beaks. While the average prey size of a teleost fish was about 5.7 cm (SD ± 2.01), and 5.57 cm (SD ± 3.18) for a cephalopod (Table 4). The largest estimated specimen of fish was a representative of *Engraulis anchoita* (14.59 cm), and for cephalopods a *Doryteuthis plei* (25.64 cm) (Table 4). The smallest estimated specimens were *Macrodon atricauda* for fish and *Argonauta nodosa* for cephalopods, both measuring < 2 cm in length. The average weight was estimated at 6.22 g (SD ± 5.81) for teleosts, and 12.61 g (SD ± 7.98) for cephalopods (Table 4). The specimen with the highest estimated weight for teleost fishes was a representative of the species *Trichiurus lepturus* (18.84 g), and for cephalopods it was a specimen of *D. plei* (169.2 g) (Table 4).

TABLE 4: Estimated lenght and weight for each preyed taxa.

	Taxa	Lenght (cm)			Weight (g)			N
		Mean ± SD	Max	Min	Mean ± SD	Max	Min	
Teleostei	***Anchoa sp.***	5.14 ± 0.60	6.63	4.15	1.66 ± 0.69	3.64	0.75	70
	Ctenosciaena gracilicihrrus	9.72 ± 0.17	9.90	9.46	7.4 ± 0.15	7.56	7.16	16
	Cynoscion jamaicensis	9 ± 0.2	9.43	8.61	16.5 ± 0.66	17.87	15.23	15
	Engraulis anchoita	7.73 ± 4.81	14.59	2.36	5.41 ± 7.72	18.78	0.1	5
	Harengula clupeola	-	-	-	-	-	-	-
	Isopisthus parvipinnis	4.7 ± 0.34	5.56	3.93	2.6 ± 1.1	5.45	0.1	66
	Larimus breviceps	4.78 ± 0.62	5.5	3.25	3.35 ± 2.06	5.71	1.71	35
	Lycengraulis grossidens	8.31 ± 1.68	10.57	6.60	7.92 ± 6.25	16.92	2.71	4
	Macrodon atricauda	5.82 ± 3.84	10.67	1.8	6.24 ± 7.64	18.83	0.1	5
	Menticirrhus americanus	4.77 ± 0.18	4.93	4.51	17.26 ± 0.7	17.86	16.27	4
	Micropogonias furnieri	4.35 ± 0.12	4.63	4.14	1.35 ± 0.4	2.28	0.66	44
	Mugil curema	1.9	1.9	1.9	0.11	0.11	0.11	1
	Paralonchurus brasiliensis	5.22 ± 0.5	6.01	3.54	4 ± 1.65	6.65	1.60	75
	Pellona harroweri	4.4 ± 0.22	4.81	3.95	1.65 ± 0.67	2.91	0.32	97
	Stellifer brasiliensis	4.9 ± 0.33	5.49	3.97	3.31 ± 1.02	5.15	0.48	135
	Stellifer rastrifer	4.8 ± 0.22	5.56	4.32	3.18 ± 0.69	5.47	1.58	150
	Trichiurus lepturus	5.72 ± 0.23	6.17	5.38	17.5 ± 0.66	18.84	16.51	17
Cephalopoda	***Argonauta nodosa***	3.47 ± 2.42	5.2	1.76	10.96 ± 13.83	20.74	1.18	2
	Doryteuthis pleii	9.23 ± 3.53	25.64	2.17	21.29 ± 18.44	169.2	0.72	226
	Lolliguncula brevis	4 ± 1.33	8.08	1.87	5.58 ± 5.4	28.54	0.53	155

3.3. FREQUENCIES AND INDEX OF RELATIVE IMPORTANCE

The fish species that showed the highest occurrence in stomachs were *Pellona harroweri* (*%FO* 50.57), *Stellifer rastrifer* (*%FO* 39.66) and *Paralonchurus brasiliensis* (*%FO* 36.78), respectively, while for cephalopods they were *Doryteuthis plei* (*%FO* 32.76) and *Lolliguncula brevis* (*%FO* 32.18) (Table 5). These same five species also presented the highest recorded numerical frequencies, only in a different order for the teleosts: *Stellifer rastrifer* (*%FN* 32.54), *Pellona harroweri* (*%FN* 24.66) and *Paralonchurus brasiliensis* (*%FN* 6.42) (Table 5). The fish families that presented the highest frequencies were Sciaenidae, Pristigasteridae and the Loliginidae family for cephalopods, which corroborates other previous publications in the same FMA (Cremer et al., 2012; Henning et al., 2018; Campos et al., 2020)

We observed that *Stellifer rastrifer*, the species with the highest recorded numerical frequency, had the highest Importance value among the taxa *(%IRI* 30.79; *%FN* 32.54). *Pellona harroweri*, the second taxon in order of importance, was the species with the highest frequency of occurrence *(%IRI* 24.15; *%FO* 50.57). And *Doryteuthis plei*, the third most important taxon, was the one that presented the greatest contribution in terms of biomass *(%IRI* 22.63; *%W* 38.59).

The most relevant species (IRI) to franciscanas feeding habits were: 1. *Stellifer rastrifer*; 2. *Pellona harroweri*; 3. *Doryteuthis plei*; 4. *Lolliguncula brevis*; and 5. *Paralonchurus brasiliensis* (Table 5). It is important to highlight that these five species combined hold more than 90% of the relative importance in the composition of the diet, just as the top three ranking species hold more than 75%. Fish presented higher values of importance in contributing to the diet than cephalopods, this is also reflected by the frequency of occurrence of these two groups. Sagitta otoliths were present in 90.23%

of the stomachs examined while cephalopod beaks were only present in 46.55% of the total.

TABLE 5: Index Relative Importance (*IRI*) for each taxon in descending order.

Taxa	*FO%*	*FN%*	*W%*	*IRI*	*IRI%*	RANK
Stellifer rastrifer	39.66	32.54	20.90	2119.32	30.79	1
Pellona harroweri	50.57	24.66	8.22	1662.83	24.15	2
Doryteuthis plei	32.76	8.97	38.59	1558.15	22.63	3
Lolliguncula brevis	32.18	6.64	7.48	454.57	6.60	4
Paralonchurus brasiliensis	36.78	6.42	5.18	426.70	6.20	5
Stellifer brasiliensis	26.44	4.73	3.16	208.59	3.03	6
Isopisthus parvipinnis	22.41	5.96	3.13	203.65	2.96	7
Larimus breviceps	20.11	3.35	2.27	113.01	1.64	8
Trichiurus lepturus	10.92	0.98	3.47	48.55	0.71	9
Ctenosciaena gracilicirrhus	5.75	3.25	4.86	46.62	0.68	10
Anchoa sp.	10.34	2.27	0.77	31.40	0.46	11
Cynoscion jamaicensis	3.45	0.31	1.03	4.64	0.07	12
Micropogonias furnieri	2.30	1.51	0.41	4.43	0.06	13
Macrodon atricauda	2.30	0.12	0.16	0.64	0.01	15
Lycengraulis grossidens	1.72	0.11	0.18	0.50	0.01	14
Engraulis anchoita	1.15	0.10	0.11	0.24	0.00	16
Menticirrhus americanus	0.57	0.05	0.17	0.13	0.00	17
Argonauta nodosa	1.15	0.02	0.05	0.09	0.00	18
Mugil curema	0.57	0.04	0.00	0.02	0.00	19
Harengula clupeola	0.57	0.02	0.00	0.01	0.00	20

3.3.1. INTRAPOPULATIONAL FACTORS

TABLE 6: Percentages of Numerical Frequencies (*FN*), Occurance Frequencies (*FO*), Biomass (*W*) and Relative Imporance (*IRI*) for each taxa between sexes (Male and Female).

		Males					Females				
	Taxa	***FN%***	***FO%***	***W%***	***IRI***	***IRI%***	***FN%***	***FO%***	***W%***	***IRI***	***IRI%***
Teleostei	*Anchoa sp.*	2.03	9.09	0.73	25.05	0.35	2.59	12.05	0.88	41.89	0.62
	C. gracilicirrhus	2.20	4.55	3.53	26.04	0.36	4.74	7.23	7.21	86.42	1.28
	C. jamaicensis	0.37	3.41	1.32	5.78	0.08	0.24	3.61	0.80	3.74	0.06
	E. anchoita	0.02	1.14	0.03	0.05	0.00	0.21	1.20	0.23	0.52	0.01
	H. clupeola	0.04	1.14	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00
	I. parvipinnis	5.21	22.73	2.93	185.01	2.58	7.10	22.89	3.79	249.37	3.71
	L. breviceps	2.96	21.59	2.15	110.40	1.54	0.00	0.00	0.00	0.00	0.00
	L. grossidens	0.20	3.41	0.34	1.82	0.03	3.95	19.28	2.72	128.49	1.91
	M. atricauda	0.13	2.27	0.18	0.70	0.01	0.12	2.41	0.15	0.65	0.01
	M. americanus	0.00	0.00	0.00	0.00	0.00	0.12	1.20	0.42	0.65	0.01
	M. furnieri	0.11	1.14	0.03	0.16	0.00	3.33	3.61	0.92	15.37	0.23
	M. curema	0.07	1.14	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00
	P. brasiliensis	3.18	22.73	2.76	134.94	1.88	10.87	53.01	8.93	1049.97	15.60
	P. harroweri	24.25	51.14	8.67	1683.38	23.44	23.95	49.40	8.12	1584.37	23.55
	S. brasiliensis	5.25	26.14	3.76	235.64	3.28	4.01	27.71	2.72	186.55	2.77
	S. rastrifer	41.21	43.18	28.38	3004.72	41.84	21.07	37.35	13.76	1300.85	19.33
	T. lepturus	0.78	6.82	2.97	25.62	0.36	1.06	14.46	3.81	70.47	1.05
Cephalopoda	*A. nodosa*	0.02	1.14	0.05	0.08	0.00	0.00	0.00	0.00	0.00	0.00
	D. plei	8.15	31.82	37.57	1454.82	20.26	8.19	33.73	35.83	1484.88	22.07
	L. brevis	3.81	34.09	4.61	287.09	4.00	8.46	28.92	9.69	524.81	7.80

Between the sexes, we observed that males preyed upon more prey species than the females (M = 19; F = 16) (Table 6), and demonstrated greater values for the two main preyed species, especially for *S. rastrifer* (≅ x 2.31 for males). However, females presented higher relative importance values for some specific species, such as *L. brevis* (≅ 1.83x) and mainly for *P. brasiliensis* (≅ x 7.7 for females).

TABLE 7: Percentages of Numerical Frequencies (*FN*), Occurance Frequencies (*FO*), Biomass (*W*) and Relative Imporance (*IRI*) for each taxa between development stages (Weaned Calves, Juveniles and Adults).

		Weaned Calves					**Juveniles**					**Adults**				
	Taxa	***FN%***	***FO%***	***W%***	***IRI***	***IRI%***	***FN%***	***FO%***	***W%***	***IRI***	***IRI%***	***FN%***	***FO%***	***W%***	***IRI***	***IRI%***
Teleostei	*Anchoa sp.*	3.21	10.00	2.28	54.93	0.54	2.88	11.69	1.17	47.29	0.78	1.73	9.20	0.54	20.88	0.27
	C. gracilicihrrus	0.00	0.00	0.00	0.00	0.00	5.80	9.09	10.45	147.68	2.45	2.02	3.45	2.78	16.54	0.22
	C. jamaicensis	0.00	0.00	0.00	0.00	0.00	0.31	5.19	1.24	8.05	0.13	0.35	2.30	1.07	3.25	0.04
	E. anchoita	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	2.30	0.17	0.80	0.01
	H. clupeola	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	1.15	0.00	0.05	0.00
	I. parvipinnis	2.84	30.00	3.15	179.56	1.76	3.36	15.58	2.13	85.55	1.42	7.96	27.59	3.86	325.86	4.26
	L. breviceps	1.89	10.00	2.71	45.96	0.45	5.38	23.38	4.39	228.59	3.79	2.23	18.39	1.39	66.71	0.87
	L. grossidens	0.00	0.00	0.00	0.00	0.00	0.31	3.90	0.60	3.52	0.06	0.00	0.00	0.00	0.00	0.00
	M. atricauda	0.00	0.00	0.00	0.00	0.00	0.07	1.30	0.10	0.22	0.00	0.17	3.45	0.20	1.29	0.02
	M. americanus	0.00	0.00	0.00	0.00	0.00	0.14	1.30	0.58	0.93	0.02	0.00	0.00	0.00	0.00	0.00
	M. furnieri	0.00	0.00	0.00	0.00	0.00	2.37	3.90	0.78	12.25	0.20	1.06	1.15	0.27	1.53	0.02
	M. curema	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	1.15	0.00	0.08	0.00
	P. brasiliensis	0.00	0.00	0.00	0.00	0.00	4.97	31.17	4.85	306.04	5.08	8.02	45.98	5.98	643.80	8.42
	P. harroweri	54.44	60.00	38.38	5569.31	54.63	23.53	51.95	9.46	1713.39	28.44	21.96	48.28	6.76	1386.25	18.14
	S. brasiliensis	1.13	20.00	1.60	54.76	0.54	4.87	27.27	3.93	239.91	3.98	4.96	26.44	3.06	212.23	2.78
	S. rastrifer	36.11	50.00	49.06	4258.05	41.77	34.67	32.47	26.86	1997.82	33.16	30.44	44.83	18.05	2173.29	28.44
	T. lepturus	0.38	10.00	2.83	32.05	0.31	1.03	11.69	4.39	63.30	1.05	0.93	10.34	3.04	41.11	0.54
Cephalopo	*A. nodosa*	0.00	0.00	0.00	0.00	0.00	0.07	2.60	0.18	0.65	0.01	0.00	0.00	0.00	0.00	0.00
	D. pleii	0.00	0.00	0.00	0.00	0.00	3.91	29.87	20.28	722.51	11.99	11.68	39.08	46.38	2269.19	29.69
	L. brevis	0.00	0.00	0.00	0.00	0.00	6.34	29.87	8.63	447.14	7.42	6.20	37.93	6.45	479.83	6.28

The weaned calves showed a greater dependence on a few species of teleost fish (*n* = 7), mainly *P. harroweri* and *S. rastrifer* (Table 7), differing from the adults and juveniles that presented more diverse feeding habits (*n* = 17), with different orders of importance, including cephalopod species. Juveniles a showed lesser importance values for squid consumption, especially for *D. plei*, for which adults showed more than the triple of importance (≅ 3.14x). This consequently demonstrates a greater consumption of fish species by juveniles, as is the case for species such as *P. harroweri*, *L. breviceps,* and *C. gracilicirrhus*.

3.3.2. TEMPORAL FACTORS

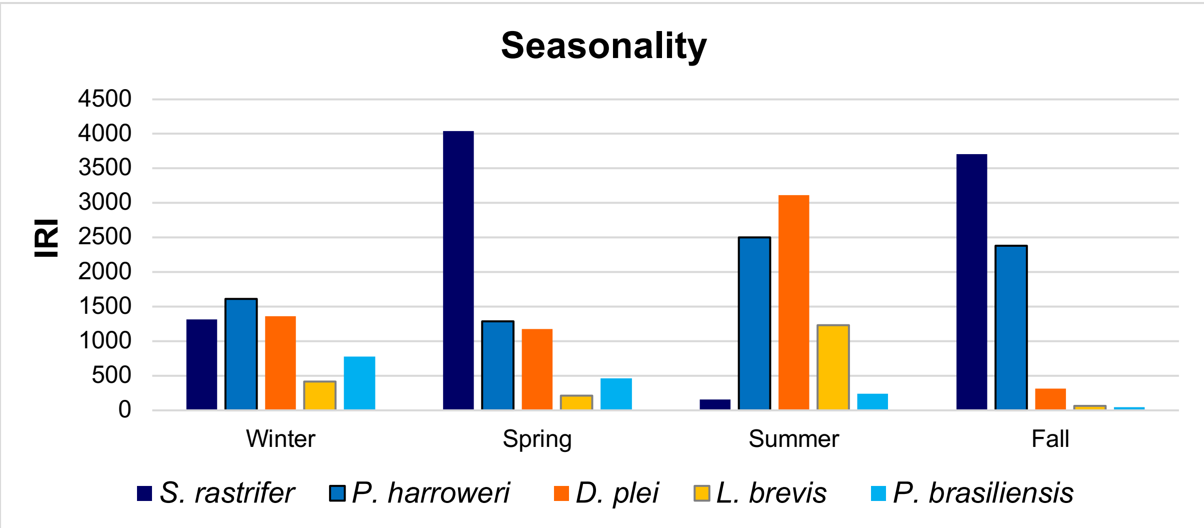

FIGURE 1: Index of Relative Importance (*IRI*) values of the five most important species over different seasons (winter, spring, summer and fall).

Based on the importance of the five main preyed species, we observed an apparent contrast between seasons. This may indicate alternating trends in the main prey species, which corroborates the thesis that *P. blainvillei* are generalist and opportunistic predators (Cremer et al., 2012; Campos et al. 2020; Bassoi et al., 2021). *S. rastrifer* has its peak of importance in the autumn and spring month (Figure 1). *P. harroweri* presented higher values in summer, with a gradual decrease in the following months (Figure 1). And another well marked trend in different seasons was the higher rates of consumption of cephalopods in the summer (Figure 1).

As for possible trends in the importance between years (Figure 2) over preyed fish species, we found an annual alternation in the importance of *S. rastrifer* and *P. harroweri*, occurring from 2017 onwards, when *S. rastrifer* starts to reach higher levels IRI values (> 4000). It was also observed that from 2018 onwards, there was a certain stability in the consumption of *P. brasiliensis*, which could indicate a certain pattern of constancy in its predation. In relation to cephalopods, there was a notable drop in the consumption of *D. plei*, starting in 2018. In relation to *L. brevis*, fluctuations were observed within expectations.

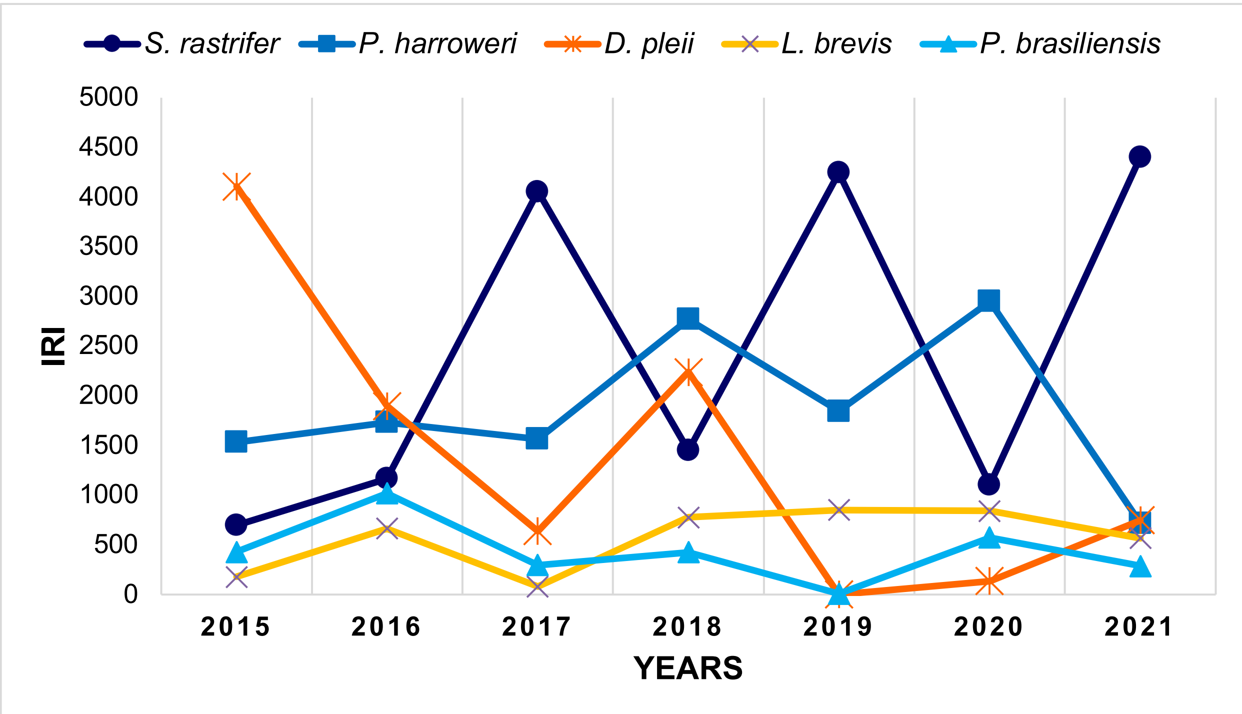

FIGURE 2: Index of Relative Importance (*IRI*) values of the five most important species over 7 different sampled years.

3.4. FEEDING VARIANCE

From the variance tests used, we found that there were no significant differences in the median importance values between the five most relevant prey species, for the different sexes (p_{sexes} = 0.137), developmental stages (p_{stages} = 0.075) and seasons ($p_{seasons}$ = 0.070). The differences between treatments were not large enough to exclude the possibility that they were due to random sampling variability. Therefore, we can state that the diet of *Pontoporia blainvillei* did not differ in terms of the importance of preyed upon prey according to sex, stage of development and seasonality.

However, when comparing the importance for the seven years sampled, we found that the differences in median values between species are greater than expected by chance, with a significant statistical difference (p_{years} = 0.004). In order to isolate the groups that differ from the others, we used the Tukey statistical test, a multiple paired

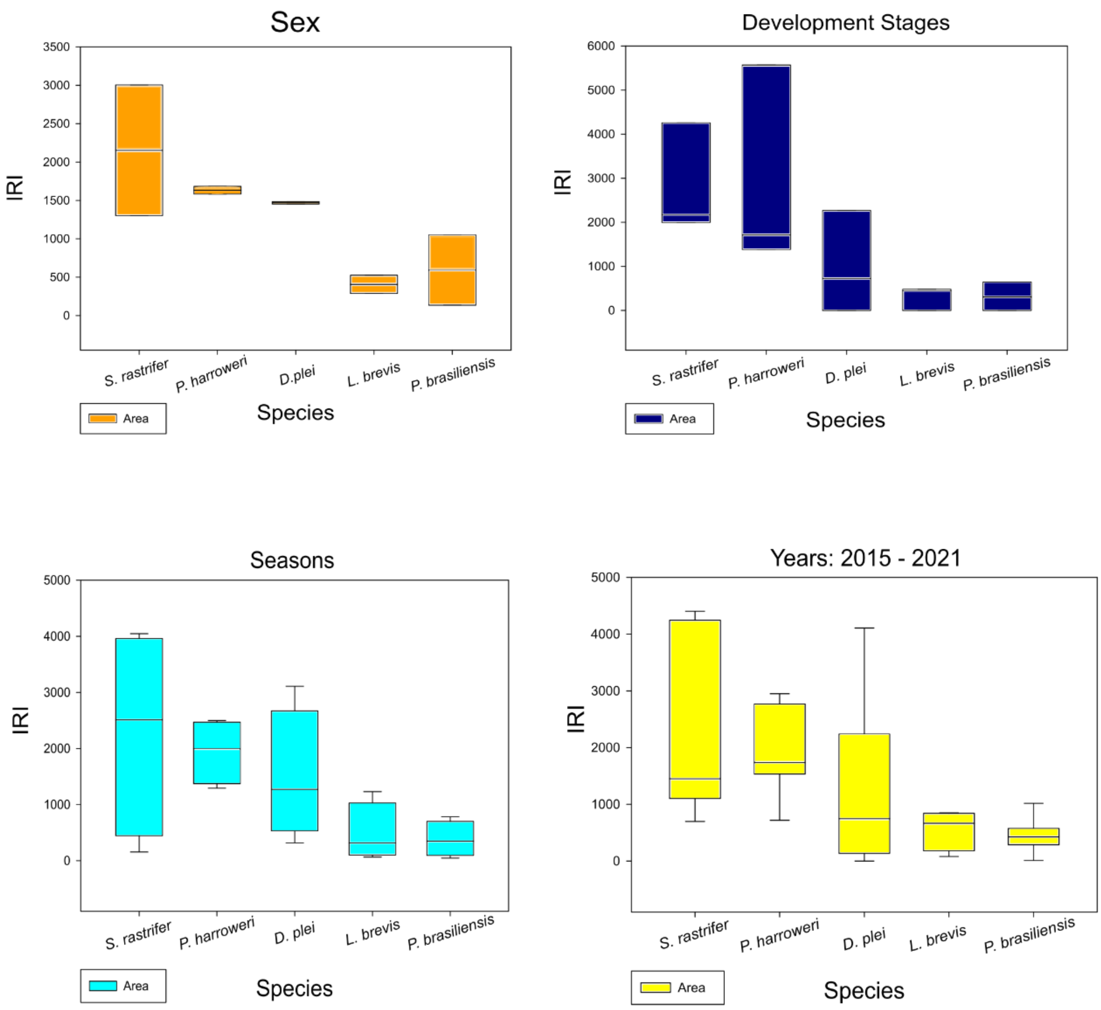

FIGURE 3: Boxplot graphs of the relative importance values (y-axis) from the five most important species (x-axis) for each structuring factor (sex, development stages, seasons and years).

comparison procedure, thus indicating significant differences ($p < 0.05$) between the species "*P. brasiliensis* vs. *S. rastrifer*" and "*P. brasiliensis* vs. *P. harroweri*". Therefore, this may be an indication of possible food preferences over the years among these three main species of teleost fish in the FMA IIb population.

4. DISCUSSION

The present study updates the information on francicana's feeding habits in FMA IIb, identifies significant temporal differences on the importance of its preyed species and demonstrates the great potential for the usage data originating from both incidental captures and strandings in studies for marine mammals feeding ecology. This potential is expressed by the large *n*-samples of franciscanas collected (n = 206) and analyzed (n = 174), being the study with the largest *n*-samples for FMAs I and II (DiBeneditto & Ramos, 2001; Bittar & DiBeneditto, 2009; Cremer et al., 2012; Henning et al., 2018; Rupil et al., 2019; Campos et al., 2020; DiBeneditto & Siciliano, 2021), which has also directly reflected in our analyzed number of food items (n = 8058). As already proven by Rodriguez et al. (2002) there are no differences in feeding depending on the origin of franciscana's collected individuals.

However, it is interesting to note the presence of a considerable number of franciscanas without any presence of food content (n = 18), we believe this occurred because they were mostly calves due to their short total length, and may not have had the chance to suckle and/or would have suffered from been split apart from their mothers, so they may have died due to starvation. It is also worth highlighting the need for further investigations into the weaning transition period for *P. blainvillei* calves in the region (FMA II), given the record of individuals with lengths close to those of juveniles (82.9 cm), which only contained milk in the gastric tract, as of smaller calves (79 cm), which already had the presence of food items.

Comparing the composition of taxonomic groups identified within works the of Henning et al. (2018) and Campos et al. (2020), of which were also conducted throughout the state of São Paulo, our present results presented the smallest number of taxonomic groups recorded. We registered a total of 20 preyed taxa, while both studies by Henning et al. (2018) and Campos et al. (2020) recorded 29 taxa. Both previous works totaled 12 different taxonomic groups from those identified in our study (the same genera in these works were considered as equivalents). Henning et al. (2018) presented 4 more families than those observed in our study: Serranidae, Sparidae, Carangidae and Haemulidae. While Campos et al. (2020) presented other 3 families: Clupeidae, Paralichthyidae and Phycidae. However, the taxonomic groups of these families in their respective studies did not present significant frequencies or relative importance, which indicates an occasional consumption of these taxa without any great representation in *Pontoporia* sp.'s feeding (*%FO* 1.15; *%FN* 0.02). We also recorded for the first time, even if only occasionally (*%FO* 1.15; *%FN* 0.02), the predation of the Argonautidae family on FMAs I and II (DiBeneditto & Ramos, 2001; Bittar & DiBeneditto, 2009; Cremer et al., 2012; Henning et al., 2018; Rupil et al., 2019; Campos et al., 2020; DiBeneditto & Siciliano, 2021). This species of octopus had only been previously recorded in the diet of franciscanas in studies further south in its distribution (Santos & Haimovici, 2001; Bassoi et al., 2021).

Regarding the relative importance of predated taxa, both studies previously conducted in the state of São Paulo showed similarities regarding the main species and their order of importance. Henning et al. (2018) recorded the five most relevant species being: 1. *P. harroweri*; 2. *D. plei*; 3. *P. brasiliensis*; 4. *I. parvipinnis*; and 5. *S. rastrifer*. While Campos et al. (2020), having divided their analysis of the main species into teleosts and cephalopods, recorded their most relevant taxa being: 1. *P. harroweri*; 2. *I. Parvipinnis* and 3. *Stellifer* sp.; 1. *D. plei* and 2. *L. brevis*. We also obtained a very similar order to that presented in both works. However, our results demonstrated that *S. rastrifer* was proven to be our most relevant species in our study area, which differs the from previous studies, especially that of Henning et al. (2018), who had also sampled at the same study area, and had recorded the species *P. harroweri* and *D. plei* in this most prominent position in the importance order. We can interpret this result as a possible indication of fluctuations in the availability of these prey species, which is similar to what was observed regarding the Importance Indices (IRI) of the species over the years studied. And it demonstrates the greater need to carry out studies that seek to investigate and evaluate the species' diet in the long term.

It is also interesting to note how the greater importance values of the main preyed species during different seasons seems to match their seasonal ecological patterns, e.g., *S. rastrifer* has its peak of importance in the autumn and spring months, which probably correspond to its period of recruitment and reproduction (Almeida & Branco, 2002; Souza & Chaves, 2007; Pina & Chaves, 2009; Pombo et al., 2012) (Figure 1). *P. harroweri* presented higher values on summer, probably due to the greater presence of copepods on the coast during this period, a planktonik group of great relevance for *P. harroweri* feeding (Vega-Pérez, 1993; Muto et al., 2008), as well as the high rate of reproductive activity that the species presents during the period (Souza & Chaves, 2007; Pina & Chaves, 2009). The higher importance of cephalopods during the summer (Figure 1), corroborates on Vaske-Júnior (2014) reports, of an increase in the abundance of the species *Lolliguncula brevis* in the coastal ecosystems from the

Baixada Santista region, during the summer months, even though it is a species that occurres throughout the year, this most likely happens due to the reproductive activity of the species during this period, as already recorded by Coelho et al. (2010), as it is also known that the occurrence of squid paralarvae from the Loliginidae family is related to the summer months on the coast of São Paulo (Postuma & Gasalla, 2010; Martins et al., 2014).

We observed a low difference in the richness of species preyed upon by males and females. This was reflected in the statistical differences between the importance of the main prey species, where we did not record them for both sexes, developmental stages and even seasonality. This differs from the results of Henning et al. (2018) who recorded sexual, ontogenetic and seasonal differences, and Campos et al. (2020) who also found significant differences regarding seasonality in the feeding habits. However, our study proposed to infer the variance of the importance values of the observed species, while other studies sought, through dissimilarity tests, to infer differences regarding the composition of the diet on these same factors. That said, our study was both the first to evaluate the diet of *P. blainvillei* based on an annual factor, and also the first to infer and record significant differences in the importance of preyed fish species over years, which may demonstrate some degree of preference or dependence between groups over time. This diverges from the thesis that *P. blainvillei* are essentially generalist and opportunistic predators (Cremer et al., 2012; Henning et al., 2018; Campos et al., 2020; Bassoi et al., 2021). This could be a first clue for future studies to better investigate predator-prey relationships that populations of the species' exert on their local communities, regarding a possible degree of specialization, considering the accentuated consumption of species belonging to the Sciaenidae family. Being one of Sciaenidae's main characteristics, a sound-emitting swim bladder, which may allow them to be located underwater, but is also believed to influence the incidental capture of these dolphins (Tellechea et al., 2017; Campos et al., 2020).

Pontoporia blainvillei presented piscivorous and teutophagous habits. Its target species are known to inhabit coastal and estuarine environments, and are known to have demersal, pelagic-demersal and pelagic lifestyle, which corroborates with feeding throughout the water column (Campos et al., 2020) and demonstrates the fundamental role of the species in influencing coastal communities. However, their prey, as they are species with coastal habits, are direct and indirect targets of fisheries, whether as primary targets, secondary targets, or as accidental capture. As for Campos et al. (2020), we observed that most fish species, especially the three most relevant (*S. rastrifer*, *P. harroweri* and *P. brasiliensis*) to franciscanas, do not have high commercial value, but are potential secondary fishing targets, used as a byproduct because they are accidentally caught in shrimp trawling (Coelho et al., 2002; Fischer et al., 2011; Santos et al., 2016; Campos et al. 2020). This demonstrates how fisheries are direct and indirect competitors for marine resources, showing an overlap with the feeding behavior of franciscana dolphins, and leading to high bycatch rates that threaten the species' (Campos, 2020).

Admitting that diet description studies based on stomach content analysis methodology have biases, whether in obtaining samples due to the different digestion time rates for different feeding items present, secondary contamination, or because they are the last instant feeding representations (Fitch & Brownell, 1968; Clarke, 1996; Bisi et al., 2012; Campos et al., 2020), and even due to information loss provided by ecological indices, such as the relative importance index (Brown et al., 2012 ; Cunha & Cunha, 2016). This is still valid methodology for determining the feeding habits of coastal cetacean populations, presenting good consistency when compared to molecular methodologies, regarding the composition of prey species and their relative quantities (Dunshea et al., 2013). Becoming essential to understanding the ecological role of cryptic species and the influence they exert on communities. Above all, in the study of threatened predators, helping to aim and design better environmental governance guidelines in favor of their conservation and the maintenance of their ecosystemic services.

Therefore, understanding the ecological impacts of small cetaceans is important, from a perspective of the increasing decline of species, threatened mainly due to bycatch (Brownell et al., 2019; Kiszka et al. 2022). And given the variety of coastal species preyed upon by *P. blainvillei*, throughout its area of occurrence (Rodríguez et al., 2002; Bittar & Di Beneditto 2009; Cremer et al., 2012; Henning et al., 2018; Bassoi et al., 2021). And in order to better comprehend its ecological role and realized niche of the franciscana dolphin in its entirety, there is need for more studies aiming the analysis of the feeding ecology of the species throughout its distribution, especially through its northern portion.

Finally, we believe that the main contribution of our study to the conservation of the smallest and most threatened cetacean in the Western Atlantic was in updating the description of the FMA IIb population feeding habits, and demonstrating that the importance of fish species consumed by *Pontoporia blainvillei* is affected by time, presenting a significant variation between years, which could be an indicative of fluctuations in the availability of these prey species and a clue to some degree of preference or dependence. This information is relevant for addressing regulatory measures on fisheries and for better designing further management plans for the species. In order to better understand the relationship between local fisheries and their real impact on prey communities. And so, we open the way for future studies that shall delve deeper into the ecology and behavior of the species and so that responsible managers can now better establish guidelines for the conservation of the species.

ACKNOWLEDGMENTS

We thank the Biopesca Institute and the collaborating fishermen for the samples from accidental captures and Stranding Monitoring Program “PMP-BS” (Projeto de Monitoramento de Praias da Bacia de Santos), which is subject to environmental constraints under the federal environmental license granted by IBAMA (RET No 1169/2019 - ABIO No 1169/2019 - 1st renewal) for the stranding samples. We are grateful to São Paulo Research Foundation - FAPESP for the fellowship granted to G. Grellet (Grant #2021/01314-5).

REFERENCES

Almeida, L. R. D., & Branco, J. O. (2002). Aspectos biológicos de *Stellifer stellifer* (Bloch) na pesca artesanal do camarão sete-barbas, Armação do Itapocoroy, Penha, Santa Catarina, Brasil. *Revista brasileira de Zoologia*, *19*, 601-610.

do Amaral, K. B., Danilewicz, D., Zerbini, A., Di Beneditto, A. P., Andriolo, A., Alvares, D. J., Secchi, E., Ferreira, E., Sucunza, F., Borges-Martins, M., de Oliveira Santos, M. C., Cremer, M., Denuncio, P., Ott, P. H., & Moreno, I. B. (2018). Reassessment of the franciscana *Pontoporia blainvillei* (Gervais & d’Orbigny, 1844) distribution and niche characteristics in Brazil. *Journal of Experimental Marine Biology and Ecology*, *508*(August), 1–12. https://doi.org/10.1016/j.jembe.2018.07.010

Azevedo, A. F., Fragoso, A. B. L., Lailson-Brito Jr, J., & Cunha, H. A. (2002). Records of the franciscana *(Pontoporia blainvillei*) in the southwestern Rio de Janeiro and northernmost São Paulo State coasts-Brazil. *Latin American Journal of Aquatic Mammals*, 191-192.

Bassoi, M., Secchi, E. R., Danilewicz, D., Moreno, I. B., Santos, R. A., & Shepherd, J. G. (2021). Intrapopulation variation in the diet of franciscana dolphin (*Pontoporia blainvillei*) off southern Brazil. *Journal of the Marine Biological Association of the United Kingdom*, *101*(3), 621-637.

Bertozzi, C. P., Marigo, J., Botta S., Alonso, M.B., Henning, B., Ribeiro, J., Viotto, J., Marcatto, F., Souza, S. P., & Dias, J. F. (2010). Idade e comprimento sexual para machos e fêmeas de toninha, *Pontoporia blainvillei* acidentalmente capturadas no estado de São Paulo. XIV Reunião de Trabalho de Especialistas em Mamíferos Aquáticos da América do Sul.

Bisi, T. L., Lailson-Brito, J., & Malm, O. (2012). Feeding Ecology of Marine Mammals: Methods of Study. *Oecologia Australis*, *16*(2), 210-234.

Bittar, V. T., & Di Beneditto, A. P. M. (2009). Diet and potential feeding overlap between *Trichiurus lepturus* (Osteichthyes: Perciformes) and *Pontoporia blainvillei* (Mammalia: Cetacea) in northern Rio de Janeiro, Brazil. *Zoologia (Curitiba)*, *26*, 374-378.

Brown, S. C., Bizzarro, J. J., Cailliet, G. M., & Ebert, D. A. (2012). Breaking with tradition: redefining measures for diet description with a case study of the Aleutian skate Bathyraja aleutica (Gilbert 1896). *Environmental Biology of Fishes*, *95*, 3-20.

Brownell, R. L., Reeves, R. R., Read, A. J., Smith, B. D., Thomas, P. O., Ralls, K., Amano, M., Berggren, P., Chit, A. M., Collins, T., Currey, R., Dolar, M. L. L., Genov, T., Hobbs, R. C., Kreb, D., Marsh, H., Zhigang, M., Perrin, W. F., Phay, S., … Wang, J. Y. (2019). Bycatch in gillnet fisheries threatens critically endangered small cetaceans and other aquatic megafauna. *Endangered Species Research*, *40*, 285–296. https://doi.org/10.3354/ESR00994

Campos, L. B., César, M., & Santos, D. O. (2020). Feeding habits of the franciscana dolphin (*Pontoporia blainvillei*) in south-eastern Brazil. *Journal of the Marine Biological Association of the United Kingdom,* 1-13. https://doi.org/10.1017/S0025315420000120

Clarke, M. R. (1996). Cephalopods as prey. III. Cetaceans. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences*, *351*(1343), 1053-1065.

Coelho, J. A. P., Puzzi, A., da Graça Lopes, R., Rodrigues, E. S., & Pietrojr, O. (1986). Análise da Rejeição de Peixes na Pesca Artesanal Dirigida ao Camarão Sete-Barbas (Xiphopenaeus Kroyeri) no Litoral do Estado de São Paulo. *Boletim do Instituto de Pesca*, *13*(2), 51-61.

Coelho, L. I., Muto, E. Y., Marian, J. E. A. R., & Soares, L. S. H. (2010). Contribuição ao conhecimento da dieta, atividade alimentar e reprodução de *Lolliguncula brevis* (Blainville, 1823) na região costeira de Santos (Estado de São Paulo). Bol. Inst. Pesca, São Paulo, v. 36, n. 3; p. 225-236.

Corrêa, M. F. M., & Vianna M.S. (1993). Catálogo de otólitos de Sciaenidae (Osteichthyes - Perciformes) do litoral do Estado do Paraná, Brasil. Nerítica 7, 13–41.

Cremer, M. J., Pinheiro, P. C., Simões-Lopes, P. C. (2012). 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*, 102(2) Junho, 131–137. https://doi.org/10.1590/s0073-47212012000200003

Crespo, E. A., Harris, G., & Gonzalez, R. (1998). Group size and distributional range of the franciscana *Pontoporia blainvillei*. *Marine Mammal Science* 14 (4), 845–849.

Cunha, H. A., Medeiros B. V., Barbosa L. A., Cremer M. J., Marigo J., Lailson-Brito J., Azevedo, A. F., Solé-Cava, A. M. (2014). Population Structure of the Endangered Franciscana Dolphin (*Pontoporia blainvillei*): Reassessing Management Units. PLoS ONE 9(1): e85633. https://doi.org/10.1371/journal.pone.0085633

Cunha, P. L. & Cunha, M. A. (2016). Index of Relative Importance; a new perspective. *Frontiers in Marine Science. Conference Abstract: XIX Iberian Symposium on Marine Biology Studies.* doi: 10.3389/conf.FMARS.2016.05.00038

Danilewicz, D., Claver, J. A., Pérez Carrera, A. L., Secchi, E. R., & Fontoura, N. F. (2004). Reproductive biology of male franciscanas (*Pontoporia blainvillei*) (Mammalia: Cetacea) from Rio Grande do Sul, southern Brazil. *Fish. Bull.* 102, 581–592.

Danilewicz, D., Zerbini, A. N., Andriolo, A., Secchi, E. R., Sucunza, F., Ferreira, E., Denuncio, P., & Flores, P. A. C. (2012). Abundance and distribution of an isolated population of franciscana dolphins (*Pontoporia blainvillei*) in southeastern Brazil: Red alert for FMA I. *International Whaling Commission, Scientific Committee Paper SC/64/SM17*.

Dehghani, M., Kamrani, E., Salarpouri, A., & Sharifian, S. (2016). Otolith dimensions (length, width), otolith weight and fish length of *Sardinella sindensis* (Day, 1878), as index for environmental studies, Persian Gulf, Iran. *Marine Biodiversity Records*, *9*, 1-6. https://doi.org/10.1186/s41200-016-0039-0

Di Beneditto, A. P. M. & Ramos, R. M. A. (2001). Biology and conservation of the franciscana (*Pontoporia blainvillei*) in the north of Rio de Janeiro State, Brazil*. The*

Journal of Cetacean Research and Management, Cambridge, v. 3, n. 2, p. 185-192. https://doi.org/10.47536/jcrm.v3i2.889

Di Beneditto, A. P. M., & Siciliano, S. (2021). Hábitos alimentares da toninha (*Pontoporia blainvillei*) na costa norte do Estado do Rio de Janeiro, Brasil. *Revista Ibero-Americana de Ciências Ambientais*, *12*(1), 745-749.

Di Beneditto, A.P.M. & Lima, N. R. W. (2003). Biometria de teleósteos da Costa Norte do estado do Rio de Janeiro para estudos sobre piscivoria. *Biotemas*, 16 (1): 135 – 144.

Di Beneditto, A.P.M. (2021). Guia de identificação visual de otólitos de peixes do norte do Rio de Janeiro. 1ª Edição. Campos dos Goytacazes, RJ: LCA – Laboratório de Ciências Ambientais. ISBN: 978 – 65 – 00 – 32785 – 4.

Dunshea, G., Barros, N. B., Berens McCabe, E. J., Gales, N. J., Hindell, M. A., Jarman, S. N., & Wells, R. S. (2013). Stranded dolphin stomach contents represent the free-ranging population's diet. *Biology letters*, *9*(3), 20121036. https://doi.org/10.1098/rsbl.2012.1036

Elton, C. S. (1927) Animal Ecology. University of Chicago Press, Chicago

Estes, J. A., & Duggins, D. O. (1995). Sea Otters and Kelp Forests in Alaska: Generality and Variation in a Community Ecological Paradigm. *Ecological Monographs*, *65*(1), 75–100. https://doi.org/10.2307/2937159

Estes, J. A., Terborgh, J., Brashares, J. S., Power, M. E., Berger, J., Bond, W. J., Carpenter, S. R., Essington, T. E., Holt, R. D., Jackson, J. B. C., Marquis, R. J., Oksanen, L., Oksanen, T., Paine, R. T., Pikitch, E. K., Ripple, W. J., Sandin, S. A., Scheffer, M., Schoener, T. W., … Wardle, D. A. (2011). Trophic downgrading of planet earth. *Science*, *333*(6040), 301–306. https://doi.org/10.1126/science.1205106

Fischer, L. G., Pereira, L. E. D., & Vieira, J. P. (2011). *Peixes estuarinos e costeiros*. Rio Grande: Luciano Gomes Fischer.

Fitch, J. E., & Brownell, R. L. (1968). Fish otoliths in cetacean stomachs and their importance in interpreting feeding habits. *Journal of the Fisheries Board of Canada*, *25*(12), 2561-2574.

Fossi, M. C., Baini, M., & Simmonds, M. P. (2020). Cetaceans as ocean health indicators of marine litter impact at global scale. *Frontiers in Environmental Science*, *8*, 586627.

Garvey, J. E., & Whiles, M. (2016). Trophic Ecology (1st ed.). CRC Press. https://doi.org/10.1201/9781315367804

Hairston, N. G., Smith, F. E., & Slobodkin, L. B. (1960). Community structure, population control, and competition. The American Naturalist, 94, 421–425.

Heithaus, M. R., Frid, A., Wirsing, A. J., & Worm, B. (2008). Predicting ecological consequences of marine top predator declines. *Trends in ecology & evolution*, *23*(4), 202–210. https://doi.org/10.1016/j.tree.2008.01.003

Henning, B., Carvalho B. S., Pires, M. M., Bassoi M., Marigo, J., Bertozzi C., and Araújo, M. S. (2018). Geographical and intrapopulation variation in the diet of a threatened marine predator, *Pontoporia blainvillei* (Cetacea). *Biotropica,* 50(1), 157–168. https://doi.org/10.1111/btp.12503

ICMBio (2022). Atualização da Lista Oficial das Espécies Ameaçadas de Extinção. Portaria MMA Nº 148. Ministério do Meio Ambiente, Brasília.

Katona, S., & Whitehead, H. (1988). Are cetacea ecologically important. *Oceanogr Mar Biol Annu Rev*, *26*, 553-568.

Kiszka, J. J., Woodstock, M. S., & Heithaus, M. R. (2022). Functional roles and ecological importance of small cetaceans in aquatic ecosystems. *Frontiers in Marine Science*, *9*, 803173.

Lopes, X. M., da Silva, E., Bassoi, M., dos Santos, R. A., & de Oliveira Santos, M. C. (2012). Feeding habits of Guiana dolphins, *Sotalia guianensis*, from south-eastern Brazil: new items and a knowledge review*. Journal of the Marine Biological Association of the United Kingdom, 92(08), 1723–1733.* doi:10.1017/s0025315412000495

Martins, R. S., de Camargo, R. & Gasalla, M. A. (2014). The São Paulo shelf (SE Brazil) as a nursery ground for *Doryteuthis plei* (Blainville, 1823) (Cephalopoda, Loliginidae) paralarvae: a Lagrangian particle-tracking Individual-Based Model approach. *Hydrobiologia* 725, 57–68. https://doi.org/10.1007/s10750-013-1519-4

Muto, E.Y., Malfara, D.T., Coelho, L.I.; Soares, L.S.H. (2008). Alimentação das sardinhas *Pellona harroweri* (Fowler, 1919) e *Chirocentrodon bleekerianus* (Poey, 1867), na região costeira de Santos, estado de São Paulo. In: Braga ES (Org.). Oceanografia e mudanças globais. São Paulo: Instituto Oceanográfico, 287-302.

Odum, H. T. (2000). An energy hierarchy law for biogeochemical cycles. *Emergy Synthesis: Theory and Applications of the Emergy Methodology. Gainesville, Florida*, 235-48.

Ott, P. H., Secchi, E. R., Moreno, I. B., Danilewicz, D., Crespo, E. A., Bordino, P., Ramos, R., Di Beneditto, A. P., Bertozzi, C., Bastida, R., Zanelatto, R., Perez, J. E., & Kinas, P. G. (2002). Report of the Working Group on Fishery Interactions. Latin American Journal of Aquatic Mammals, 1 (special issue 1), 55–64. https://doi.org/10.5597/lajam00008

Paine, R. T. (1980). Food Webs: Linkage, Interaction Strength and Community Infrastructure. *Journal of Animal Ecology*, *49*(3), 667–685. https://doi.org/10.2307/4220

Pauly, D., Christensen, V., Dalsgaard, J., Froese, R., & Torres Jr, F. (1998). Fishing down marine food webs. *Science*, *279*(5352), 860-863.

Pierce, G. J., & Boyle, P. R. (1991). A review of methods for diet analysis in piscivorous marine mammals. *Oceanogr. Mar. Biol. Annu. Rev*, *29*, 409-486.

Pina, J. V., & Chaves, P.T. (2009). Incidência da pesca de arrasto camaroeiro sobre peixes em atividade reprodutiva: Uma avaliação no litoral norte de Santa Catarina, Brasil. *Atlântica (Rio Grande)*, *31*(1), 99-106.

Pinkas, L., Oliphant, M.S. & Iverson, I.L.K. (1971) Food Habits of Albacore, Blue Fin Tuna and Bonito in Californian Waters. *California Department of Fish and Game*, 152, 1-105.

Pombo, M., Denadai, M. R., & Turra, A. (2012). Population biology of Stellifer rastrifer, S. brasiliensis and S. stellifer in Caraguatatuba Bay, northern coast of São Paulo, Brazil. *Brazilian Journal of Oceanography*, *60*, 271-282.

Postuma, F. A., & Gasalla, M. A. (2010). On the relationship between squid and the environment: artisanal jigging for Loligo plei at São Sebastião Island (24 S), southeastern Brazil. *ICES Journal of Marine Science*, *67*(7), 1353-1362.

Ramos, R. M. A.,.Di Beneditto, A. P. M, Rezende, C.E., & Monteiro, L.R.(2005). Guia para estudo de cetáceos: métodos para determinação de idade em cetáceos odontocetos. Editora UENF.

Ripple, W. J., Estes, J. A., Schmitz, O. J., Constant, V., Kaylor, M. J., Lenz, A., Motley, J. L., Self, K. E., Taylor, D. S., & Wolf, C. (2016). What is a Trophic Cascade?. *Trends in ecology & evolution*, *31*(11), 842–849. https://doi.org/10.1016/j.tree.2016.08.010

Rodríguez, D., Rivero, L., & Bastida, R. (2002). Feeding ecology of the franciscana (*Pontoporia blainvillei*) in marine and estuarine waters of Argentina. *The Latin American Journal of Aquatic Mammals* Special Issue 1, 77-94.

Rupil, G. M., Barbosa, L., Marcondes, M. C. C., de Carvalho, B. M., & Farro, A. P. C. (2019). Franciscana dolphin (*Pontoporia blainvillei*) diet from northern Espírito Santo state coast, Brazil. *Revista Biotemas*, *32*(2).

Santos, L. O., Cattani, A. P., & Spach, H. L. (2016). Ictiofauna acompanhante da pesca de arrasto para embarcações acima de 45 HP no litoral do Paraná, Brasil. *Boletim do Instituto de Pesca*, *42*(4), 816-830.

Santos, M. C. O., Rosso, S., dos Santos, R. A., Lucato, S. H. B., & Bassoi, M. (2002). Insights on small cetacean feeding habits in southeastern Brazil. *Aquatic Mammals*, *28*(1), 38-45.

Santos, R. A. (1999). Cefalópodes nas relações tróficas do sul do Brasil. PhD thesis. Fundação Universidade do Rio Grande, Rio Grande, Brazil.

Santos, R. A., & Haimovici, M. (2001). Cephalopods in the diet of marine mammals stranded or incidentally caught along southeastern and southern Brazil. *Fisheries Research* 52, 99-112.

Secchi, E. R., Ott, P. H., & Danilewicz, D. (2003) a. Effects of fishing by-catch and conservation status of the franciscana dolphin, Pontoporia blainvillei. *Marine mammals: Fisheries, tourism and management issues*, 174-191.

Secchi, E. R., Danilewicz, D., & Ott, P. H. (2003) b. Applying the phylogeographic concept to identify franciscana dolphin stocks: implications to meet management objectives. *Journal of Cetacean Research and Management*, 5(1), 61–68.

Siciliano, S., Di Beneditto, A. P. M., & Ramos, R. M. A. A. (2002). A toninha Pontoporia blainvillei nos Estados do Rio de Janeiro e Espírito Santo, costa sudeste do Brasil: caracterização dos hábitats e fatores de isolamento das populações. *Boletim do Museu Nacional, NS, Zoologia*, *476*, 1-15.

Souza, L. M. & Chaves, P. T. (2007). Reproductive activity of fish (Teleostei) and closed season to shrimp trawling off the northern coast of Santa Catarina, Brazil. Revista Brasileira de Zoologia [online]. 2007, v. 24, n. 4.

Sucunza, F., Danilewicz, D., Andriolo, A., Azevedo, A. F., Secchi, E. R., & Zerbini, A. N. (2020). Distribution, habitat use, and abundance of the endangered franciscana in southeastern and southern Brazil. *Marine Mammal Science*, *36*(2), 421-435. https://doi.org/10.1111/mms.12650

Tellechea, J. S., Perez, W., Olsson, D., Lima, M., & Norbis, W. (2017). Feeding habits of franciscana dolphins (*Pontoporia blainvillei*): echolocation or passive listening?. *Aquatic Mammals*, *43*(4), 430.

Tilley, D. R. (2004). Howard T. Odum's contribution to the laws of energy. *Ecological Modelling*, *178*(1-2), 121-125.

Vaske-Júnior, T. (2006). Guia de identificação de cefalópodes costeiros e oceânicos do Atlântico sudoeste equatorial através das mandíbulas (bicos). Olinda: Ecológica-Livro Rápido.

Vaske-Júnior, T., Knoeller, J. M. D., & Viliod, M. C. L. (2014). Occurrence and biological aspects of the Atlantic brief squid Lolliguncula brevis in the estuary of São Vicente-SP , southeastern Brazil. UNISANTA BioScience, 3(April 2010), 66–77.

Véga-Perez, L. A. (1993). Estudo do zooplâncton da região de Ubatuba, Estado de São Paulo. Publicação esp. Inst. Oceanogr., São Paulo, (10):65-84.

Xavier, J. C., & Cherel, Y. (2009). *Cephalopod beak guide for the Southern Ocean*. Jose Xavier.

SUPPLEMENTARY

SUPPLEMENTARY TABLE 1: Regression equations “food item length-length” and “food item length-weight” of prey species present in the literature

Taxa	Equations - Lenght	Equations - Weight	References
Anchoa sp.	SL=1,831 x OL + 1,297	W=0,244 x OL^2,527	Lopes et al., 2012
C. gracilicirrhus	TL= 3,286 + 0,877 x ln(OL)	W=1,636 + 0,785 x ln(OL)	Henning et al., 2018
C. jamaicensis	TL= 3,738 + 0,660 x ln(OL)	W=-0,53 + 2,135 x LN(OL)	Henning et al., 2018
E. anchoita	SL= (32,803 x OL^1,088)/10	W= 0,1748 x OL^3,4088	Bassoi, 2005
H. clupeola	-	-	-
I. parvipinnis	TL= 3,642 + 1,045 x ln(OL)	W= -0,853 + 3,433 x LN(OL)	Henning et al., 2018
L. breviceps	TL= 3,383 + 1,073 x ln(OL)	W= -1,256 + 3,553 x ln(OL)	Henning et al., 2018
L. grossidens	TL= (2,549 x OL)+ 1,646	W= 0,344 x OL^3,108	Di Beneditto, 2001
M. atricauda	CP=0,924 x CO^1,2447	P= 0,0158 x CP^2,9913	Di Beneditto & Lima, 2003
M. americanus	TL= 3,665 + 1,223 x ln(OL)	W= -0,791 + 3,78 x ln(OL)	Henning et al., 2018
M. furnieri	TL= 3,986 + 0,667 x ln(OL)	W= 0,157 + 2,207 x ln(OL)	Henning et al., 2018
M. curema	SL= 0,6505 x OL^1,69	W= 0,00412 x OL^5,16	Lopes et al., 2012
P. brasiliensis	TL= 3,556 + 1,191 x ln(OL)	W= -1,551 + 3,979 x ln(OL)	Henning et al., 2018
P. harroweri	TL= 4,029 + 0.608 x ln(OL)	W= 0,552 + 1,842 x ln(OL)	Henning et al., 2018
S. brasiliensis	TL= 3,568 + 1,213 x ln(OL)	W= -0,746 + 3,719 x ln(OL)	Henning et al., 2018
S. rastrifer	TL= 3,730 + 1,127 x ln(OL)	W= -0,292 + 3,555 x ln(OL)	Henning et al., 2018
T. lepturus	TL= 5,193 + 0,898 x ln(OL)	W= 0,627 + 2,952 x ln(OL)	Henning et al., 2018
A. nodosa	ML= (4,9237 x UHL^1,2933)/10 ML= (9,5338 x LHL^1,2314)/10	W= 0,0377 x UHL^3,4949 W= 0,2593 x LHL^3,1856	Santos, 1999
D. plei	ML= (67,431 x URL^1,2908)/10 ML= (64,303 x LRL^1,3143)/10	W= 8,8096 x URL^2,8564 W= 7,9418 x LRL^2,908	Santos, 1999
L. brevis	ML= (41,3751 x URL + 3,3180)/10 ML= (42,8967 x LRL + 1,8382)/10	W= 6,0749 x URL^2,4677 W= 5,9731 x LRL^2,5789	Campos et al., 2020 /CEPSUL

NORMAS

Guide for Authors

Marine Mammal Science publishes significant new findings on marine mammals resulting from original research on their form and function, evolution, systematics, physiology, biochemistry, behavior, population biology, life history, genetics, ecology and conservation. Range extensions, unusual observations of behavior, and preliminary studies of a few individuals are published only where there is sufficient new information to render the manuscript of general interest. Low priority will be given to confirmatory investigations of local or regional interest. The Journal endorses the principle that experiments using live animals should be undertaken only for the purpose of advancing knowledge. Consideration should be given to the appropriateness of experimental procedures, species of animals used, and number of animals required. All animal experimentation reported in Marine Mammal Science must be conducted in conformity with the relevant animal care codes of the country of origin. The Editor will refuse manuscripts in which evidence of adherence to such codes is not apparent. Marine Mammal Science publishes

1. Articles: important original research;
2. Review Articles: critical appraisals which place recent research in a new conceptual framework;
3. Notes: short communications on current research, important preliminary findings or new techniques;
4. Opinions: invited contributions on selected topics;

5. Letters: a forum for communications in response to papers previously published in Marine Mammal Science, opinion, interpretation, and new information about all topics of interest to marine mammalogists;

6. Obituaries and In Memoriam Notices: Obituaries are short announcements of recent deaths of Society for Marine Mammalogy members and In Memoriam notices are longer descriptions of the career and accomplishments of recently deceased members who have made major contributions to the field of marine mammal science and the Society.

Articles, Review Articles and Notes are subject to peer review. Any Letter challenging published results or interpretations is transmitted to the author of the published work with an invitation to respond. The Letter and its response are published simultaneously. Letters are judged by the Editor on appropriateness of the subject and interest to readers. Obituaries and In Memoriam Notices require contacting the Editor before submitting material. Brief Obituaries and In Memoriam Notices will be published after review by the Editor.

Manuscript Preparation

The manuscript should be concise, logical, and unequivocal. Publication is facilitated if authors double-check for typographical and other errors and ensure that manuscripts and figures meet the requirements outlined below. Manuscripts that do not conform will be returned for correction before consideration. If in doubt, consult the Editorial Office. Authors are charged for excessive changes in proof.

The Society for Marine Mammalogy has created a pilot program to cover the cost of editing for the quality of English for authors for which English is not their primary language (ESL – English as a secondary Language). For an author who meets this condition, and whose paper is likely to become acceptable for publication as determined by the Editor-in-Chief, he/she will be notified of the opportunity to request that their paper be edited for quality of English and clarity. If requested and approved, once the paper is at the stage of minor revision, the EIC will have an English editor, proofread the paper and provide a Word file edited for English and clarity. The English editor will provide the file within a reasonable period of receiving the paper (usually 6-10 days). In editing the paper, if any editing, inadvertently changes the meaning of something, the author can correct the edit and let the EIC know. The cost for this editing will be covered by the Society for Marine Mammalogy and will be managed by the EIC. It is possible that papers for which the English is sufficiently poor to understand content upon initial submission might be returned to the author for improvement to a level where content is sufficiently clear for reviewers to follow. Reviewers will be instructed to ignore quality of English in their review as long as it does not impede their ability to understand the substance of the paper. If you have any questions about the program, contact the Editor-in-Chief.

Manuscripts must be submitted as a Microsoft Word document or in a document format that can be imported into Microsoft Word. The submission should not be in Adobe PDF format.

A full-length Article includes a title page, abstract, keywords, text, acknowledgments, literature citations, tables, figure captions, and figures. Notes and Letters do not have an abstract and are prepared in narrative form without headings, except for “Literature Cited.” All parts of the manuscript, including footnotes, tables, and figure captions, should be typewritten, double-spaced with margins at least 2.5 cm wide. Number all pages of the manuscript beginning with the title page and include line numbers on each page. Underline only when the material is to be set in italics or italicize directly. Use capital letters only when the letters or words are to be capitalized. Do not end a line of text with a hyphen.

Title Page

The first page should contain only the title, the name(s), and affiliation(s), (plus current affiliation, if different) of the author(s). The title should be brief and contain words useful for indexing and information retrieval.

- Do not use “and” or “&” between last two authors.
- Forenames are spelled out; initials are spaced out.
- Use superscript numerals to indicate affiliation and place below author name(s).
- Street names, PO box number, and ZIP (postal) code are not allowed.
- List department, institution, city, state (if US), or country (outside USA)
- USA state names are spelled out; include province for Canada and state for Australia

Corresponding Author

- The heading “Correspondence” should be set in bold and roman.
- Complete mailing address with email ID is required. Phone and fax numbers not needed.
- Provide country names other than USA.
- Email starts on a new line. Use “Email” without a hyphen.

English Abstract and Key Words

The abstract, of not more than 200 words typed on a separate page, should precisely reflect the contents of the paper, and focus attention on the purpose of the study, principal results, conclusions and their significance. Below the abstract, provide and identify as such three to ten key words or short phrases that will assist in cross-indexing your article. The heading “KEYWORDS” should be set in all caps, bold, and roman. The key words should be set in lowercase (except for proper nouns, etc.); alphabetical order; separated by commas; no end period Wiley has compiled guidelines to enable you to optimize the discoverability on the web of the most public part of your article (the title and the article abstract).

Article discoverability is increasingly important as researchers are finding content through more specific search criteria and less through browsing the literature. Optimizing your article for search engines will greatly increase its chance of being viewed and/or cited in another work.

In addition to enhancing specific author metrics (individual article downloads and citations) creating an article that gets high returns through search engines helps Marine

Mammal Science. Just as relevance is crucial to career advancement for you, it is also integral to library renewal decisions for the journal.

Wiley has compiled guidelines to enable you to optimize the discoverability on the web of the most public part of your article (the title and the article abstract).

Non-English Abstract

The English abstract may be translated into a foreign language and provided as a second abstract, following the English abstract in the paper. The language to which the abstract is translated may be chosen by the author. It is recommended that the language be the primary language of the author or the language of the country in which the work was conducted, if applicable. A non-English abstract is not required but optional.

Text

The Publication Manual of the American Psychological Association (7th Edition) must be followed. Spelling should be standard U.S. (not British) to conform to Webster's Third New International Dictionary. Units should conform to the Système International d'Unités (SI). Non-standard abbreviations must be defined the first time they appear. Mathematical symbols, Greek letters, and unusual symbols should be identified clearly; superscripts and subscripts should be legible and carefully placed.

Standard Abbreviations

General

ns (nanosecond), ms (millisecond), s (second), min (minute), hr (hour); do not abbreviate day, week, month, year

g (gram), mg, kg, Hz, kHz, MHz, km, m (meter), mm, cm, cc, mi (mile), ft, in. (note period), kn (knot), ha, gal, ml, L (liter, spell out when used alone).

Statistics

p (probability), $\bar{x}$ (mean, x-bar above), *SD, SE, CV, SEM, N* (total sample size), *n* (subsample size), *df, r* (correlation coefficient), *t, F, U, Z* (statistical tests); letters (except Greek) in equations are italicized.

$t(177) = 3.52$, $p < .001$, 95% CI [0.35, 0.95]

When using a statistical term in narrative text, use the term, not the symbol.

Latin words and phrases

i.e., (note comma); e.g., (note comma); ca. (only used with dates); c.f.; in vivo; in situ; vs.; etc.; per se; et al.; via; sensu; sensu faro; sensu stricto; a priori. These common ones are not set in italics.

Acknowledgments

List all acknowledgments briefly under a single heading at the end of the text on a separate page. If applicable, give the permit number(s) under which the work was conducted.

Reference List

References should be cited in the text in the following form:

- One author: Smith (2000) and (Smith, 2000).
- Two authors: (Smith & Jones, 2004) and Smith and Jones (2004).
- Three or more authors: Smith et al. (1993) and (Smith et al., 1993).
- References are cited alphabetically, not chronologically in the text.

References should be double-spaced and listed alphabetically as “REFERENCES” in the following standard form, giving the journal titles in full and each author’s last name starting with a full capital followed by lowercase for the rest of the name. Include a DOI for all works that have a DOI, regardless of whether you used the online version or the printed version.

References with 21 or more authors: include the first 19 authors’ names, insert an ellipse (…) (but not an ampersand), and then add the final author’s name.

Akaike, H. (1974). A new look at the statistical model identification. IEEE Transactions on Automatic Control, 19(6), 716–723. https://doi.org/10.1109/TAC.1974.1100705

Delarue, J. (2008). Northwest Atlantic fin whale vocalizations: Geographic variations and implications for stock assessments [Unpublished master's thesis]. College of the Atlantic.

Dugan, P. J., Rice, A. N., Urazghildiiev, I. R., & Clark, C. W. (2010, May 7). North Atlantic right whale acoustic signal processing: Part I. Comparison of machine learning recognition algorithms [Paper presentation]. IEEE Long Island Systems, Applications and Technology Conference, Farmingdale, NY.

Laake, J., Punt, A., Hobbs, R., Ferguson, M., Rugh, D., & Breiwick, J. (2009). Re-analysis of gray whale migration surveys 1967-2006 (NOAA Technical Report NMFS-AFSC-203). U.S. Department of Commerce.

Leatherwood, S., & Reeves, R. R . (1983). The Sierra Club handbook of whales and dolphins. Sierra Club Books.

Murchison, A. E. (1980). Detection range and range resolution of echolocating bottlenose porpoise (Tursiops truncatus). In R.-G. Busnel & J. F. Fish (Eds.), Animal sonar systems (pp. 43–70). Plenum Press.

U.S. Federal Register. 1997. Endangered and threatened wildlife and plants; change in listening status of western population of Steller sea lion as endangered. FR 62(108):30772– 30773 (5 June 1997). National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Department of Commerce.

Reference list order:

- General: arranged alphabetically by author surname.

- Several works of same first author:

” Single author: arranged chronologically.

” Single author, same year: arrange alphabetically by title of the work (excluding A, An, The); exception: works part of series, then arrange in series order (Part 1 and Part 2); indicate by placing lowercase letters immediately after year to help differentiate in-text citation.

- Multiple author works: single author first, followed by multiple author works.
- Only multiple author works: follow alphabetical order for second author and then the third author and so on.
- Several works of two or more authors in same order: arrange chronologically.
- Several works of two authors or more authors in same order, same year: see single author, same year.
- Several works of authors with same surname: arrange alphabetically by first initial.
- Alphabetize the prefixes M’, Mc, and Mac literally, not as if they were all spelled Mac. Disregard the apostrophe: MacArthur precedes McAllister, and MacNeil precedes M’Carthy.
- Group authors (Agency, Association or Institution): alphabetize using first significant word of name; full name to be used; a parent body precedes a subdivision (University of Michigan, Department of Marine Biology).
- Author designated as anonymous: alphabetize as if anonymous were a true name.
- No author: title moves to author position, alphabetize by first significant word of title.

Citation of personal communications and unpublished data are not to be included under ‘Literature Cited’ but should be referenced as footnotes that include the complete name and address of the source and the month and year of the communication or notification of the unpublished data. If the unpublished data citation is from the author or a coauthor, a footnote with details is not required. Meeting abstracts should not be cited as such or included in the Literature Cited Section. If information from an abstract is the only source of support for a point being made, it must be treated as a personal communication or unpublished data and have received prior approval from the author of the abstract before being cited. Such citations should be used minimally and shall not comprise a critical component of a major point being made in the manuscript because the validity or reliability of such data cannot be evaluated properly by readers. A paper may be cited ‘in press’ only if it has been accepted in final form by a journal. Papers ‘submitted’ or ‘in preparation’ may not be cited as such, but information in them may be cited as ‘personal communication.’ Any citation of information based on a manuscript submitted or in preparation, must be with the explicit permission of the lead author or person who provided the information. Citations of non-refereed documents (e.g., contract reports, environmental impact statements, meeting working papers) and gray literature is discouraged and should not be used as “one more example” of a point when primary peer-reviewed literature is cited to support the point. However, if there is no primary peer-reviewed literature to support important findings or the interpretation of those findings presented in the manuscript, they may be cited. Such citations should only be referenced in the Literature Cited section if the reference is readily available to the reader. The source for the reference must be given, including if necessary the address where it can be obtained. Any document bearing a ‘Do not cite without permission’ statement may be cited only with the explicit permission of the lead author.

A statement that all necessary permissions have been obtained must be included in the cover material accompanying the submitted manuscript. Authors must double-check all literature cited; they are solely responsible for its accuracy.

Tables

Authors using Word or WordPerfect must use those programs' table editors to create tables. Each table should be included in the text of the paper approximately where you would like it to be located (at first mention of it) but it should also be submitted as a separate file.

Do not create tables by typing single lines of text followed by a hard return, with spaces or tabs used to align columns. Such tables will have to be rekeyed by the copy editor, causing a possible delay in publication and an increased probability of error in the rekeyed data.

Do not embed tables from other applications into word-processing files unless the tables are converted to the word processor's native format. If the embedded table cannot be edited using the word processor's table editing and formatting commands, it will have to be rekeyed.

Do not break large tables into smaller ones merely to accommodate page breaks or to create subsections.

In a table, each row of data must be in a separate row of table cells.

Figures

Please read this information carefully to avoid publication delays. All figures will be reproduced exactly as transmitted, so authors must take special care to prepare high-quality files. Check with your technology support personnel if you need help with producing the proper files.

Filename is Ms#_Fig#.ext, e.g., 2271_Fig1.pdf or 2271_Fig2.tif. If there are several parts to a figure, label them as 3(a), 3(b), 3(c), etc. (note use of lowercase letters).

Each figure should be included in the text of the paper approximately where you would like it located (after the first mention of it) but also provide it as a separate file. If you have a multipart figure, the Press prefers to receive these as a single file, with panels labeled within the image, rather than as multiple files. However, if necessary you may transmit each part of the figure separately along with a document that shows how they should be laid out (including white space). Figures consisting of more than one panel should include lowercase panel designations (“a,” “b,” “c,” etc.).

Line art (charts, graphs, line drawings) should be prepared using a vector drawing program such as Adobe Illustrator or CorelDraw and the files submitted in EPS, AI, or CRD format. The minimum resolution is 600 dpi. Photographs should be in TIFF format with a minimum resolution of 300 dpi. Combination photograph and line illustrations should be in TIFF or EPS format with a minimum resolution of 600 dpi. Do not embed photographs in Word, PowerPoint, or PDF files.

Check that figures are well labeled, e.g., units on the x- and y-axes are marked.

Ensure that spellings and abbreviations on the figures are consistent with those used in the text (and journal style).

Fonts and line thickness should be large enough to still be legible but not excessively large after reduction to fit the maximum size of figures in Marine Mammal Science (11.7 x 17.5 cm).

Font styles and sizes should be consistent within and between figures. Use standard fonts such as Times, Arial, Helvetica, or Symbol. Sans serif fonts such as Arial and Helvetica are ideal and should be used whenever possible.

Keys and scale bars should be placed inside the figure whenever possible.

Avoid placing labels over shaded areas of a figure. Best results are obtained from black lettering on a white background. If the area requiring a label contains shading, it is best to create a white box and place the black label within.

Omit any extraneous information, such as page numbers, figure numbers, author names, or manuscript number, from the figure. Figures themselves should not contain a title or text that is duplicated in the figure legend. Figure legends should be included separately with the manuscript text.

More detailed information on the submission of electronic artwork can be found at: http://authorservices.wiley.com/bauthor/illustration.asp.

Equations

To produce display equations—equations that sit by themselves on a line—use the Equation Editor included with Microsoft Word or WordPerfect.

To produce in-line math—small equations or single characters that appear within a line of regular text— you can insert the necessary characters like other normal text. If the desired math is too complex or not available as individual characters, then use Equation Editor.

Statistics

Most papers require statistical analyses to support interpretation of the data. Use of appropriate statistical analyses is critical. Not all scientists are proficient at determining the correct or most appropriate analyses to be used for the nature of the data or design of the study. If none of the authors is a statistician or quantitative biologist, it is important for the authors to consult with someone who has the appropriate expertise to provide guidance on statistical analyses. There has been frequent inappropriate use of lack of statistical significance being stated as “no significant differences” and interpreting this to mean things are not different or are similar. Such statements will no longer be allowed in MMS papers. See Armhein et al. 2019 in Nature 567: 305-307 for discussion of the problems with how statistical significance is being used inappropriately.

Registration of Nucleotide and Amino Acid Sequences

Newly reported DNA or amino acid sequences must be deposited in the appropriate public databases (GenBank/EMBL/DNA Data Bank of Japan or UniProtKB/Swiss-Prot). Accession numbers must be included in the final version of the manuscript prior to publication.

Taxonomic Usage Policy

Taxonomic usage in Marine Mammal Science should follow the List of Marine Mammal Species and Subspecies on the Society for Marine Mammalogy website. This list will periodically be updated as appropriate. Authors wishing to use a different nomenclature should explain the departure in a footnote. The Editor may seek input from the Society's Committee on Taxonomy before accepting a departure.

Authorship Policy

Everyone listed as an author on a paper in Marine Mammal Science is expected to have made substantial contributions to the conception or design of the work; OR to the acquisition, analysis, or interpretation of data; OR creation of new software used in the work; AND have contributed to drafting the work or substantially revising it for content; AND agrees to be accountable for their own contributions and for ensuring that the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, are appropriately investigated and resolved.

Corresponding Author

There can only be one corresponding author and this person is solely responsible for (i) communicating with the journal and managing communication between co-authors; (ii) including all qualifying authors in the author list and getting their approval for submission of the manuscript and the order in which the authors are listed; (iii) distributing the proofs to all co-authors and returning all proof corrections to the journal office; (iv) responding to any queries regarding the published paper.

Author Contributions

As of March 2020, the corresponding author is required to indicate the contribution role for each author using the CRediT Contributor Role Taxonomy at submission of a manuscript. This information will be included in the publication as the author contribution statement. The corresponding author is responsible for ensuring that the descriptions are accurate and agreed by all co-authors prior to submission.

To comply with CRediT:

• The role(s) of all authors should be listed, using the categories defined by CRediT; for more information, visit CRediT's website here.

• Authors may have contributed in multiple roles.

• CRediT in no way changes the journal's criteria to qualify for authorship.

• If there are contributors whose input does not rise to the level of authorship, ensure that proper acknowledgements are included in the manuscript.

ORCID iD

As of March 2019, authors are required to use an ORCID iD in order to create an account in Marine Mammal Science's ScholarOne site and submit to the journal. ORCID iD is a unique and persistent identifier that distinguishes you from every other researcher and follows you throughout your career, regardless of changes to your institution or location.

Your author iD will be deposited to Crossref where the ORCID record will be automatically updated upon article publication. (Please note you must give permission for Crossref to do so.) Learn more about ORCID and Crossref's automatic update functionality here.

Additional Resources (PDFs):

• How to associate your iD with your ScholarOne account;

• How to provide your iD during manuscript submission.

PRE-PUBLICATION, DATA SHARING AND ARCHIVING, AND DATA CITATION POLICIES

This journal will consider for review articles previously available as preprints on non-commercial servers such as ArXiv, bioRxiv, psyArXiv, SocArXiv, engrXiv, etc. Authors may also post the submitted version of their manuscript to non-commercial servers at any time. Authors are requested to update any pre-publication versions with a link to the final published article.

Marine Mammal Science encourages authors to share their data and other artefacts supporting the results in their paper by archiving them in an appropriate public repository. Authors should include a data accessibility statement, including a link to the repository they have used, in order that this statement can be published alongside their paper. For example:

The data that support the findings of this study are openly available in [repository name] http://doi.org/[doi], [reference number].

For more examples of data availability statements, please visit Wiley Author Services' data sharing and citation resources page.

To find an appropriate public repository, visit re3data.org or fairsharing.org to find registered and certified data repositories relevant to your subject area. Please contact the editorial office if you have any questions.

In recognition of the significance of data as an output of research effort, Wiley has endorsed the FORCE11 Data Citation Principles and is implementing a mandatory data citation policy. Hence, Marine Mammal Science requires data to be cited in the same way as article, book, and web citations and authors must include data citations as part of their reference list. Data citation is appropriate for data held within institutional, subject focused, or more general data repositories. It is not intended to take the place of community standards such as in-line citation of GenBank accession codes.

When citing or making claims based on data, authors must refer to the data at the relevant place in the manuscript text and in addition provide a formal citation in the reference list. We recommend the format proposed by the Joint Declaration of Data Citation Principles:

Authors; Year; Dataset title; Data repository or archive; Version (if any); Persistent identifier (e.g. DOI)

Policy for Papers Based on Samples Obtained Lethally

• Researchers should use alternative non-lethal procedures when they are available and satisfy the objectives of the research.

• Animals should be killed in the most humane and rapid method available.

• Any population or stock-scale impacts should be minimized through prudent selection of animals (e.g. avoidance of reproductive females if possible) and sample size.

• Where possible on-going activities outside the research community (e.g., hunting, bycatches, whaling, strandings) should be utilized as a source of material for scientific studies of marine mammals.

The journal's current policy is to allow publication of papers that include data from lethal sampling as long as the sampling has been done legally in the country from which the samples were obtained. If research is conducted outside of territorial waters, legal documentation requirements fall to the principal investigator's country of residence and the sampling must have been done legally for that country. Samples obtained from directed lethal take exclusively for the purposes of scientific research may be used only if the sampling is legal in the researchers' home/host countries and the appropriate permits have been received.

Policy Regarding Plagiarism and Self-Plagiarism

Marine Mammal Science believes that repeating text (full sentences or paragraphs) verbatim or nearly verbatim from previously published papers without giving proper attribution is not acceptable, whether the paper from which the text has been taken was by another author (plagiarism) or the same author (self-plagiarism). When such an issue is raised by a reviewer or Editor for a paper, and it is for plagiarism, the paper will likely be rejected without the ability for resubmission, although cases deemed minor may be given the opportunity to be remedied. Major cases may also be brought to the attention of the author's institution. If it is for self-plagiarism, the nature and extent of the overlap in text will be examined through software that cross references published material, and a determination of the course of action that should be taken will be made by the Editor in consultation with Wiley publication ethics advisors. It is recognized that methodology often follows previously developed methods, and thus descriptions may be the same or similar. This is fine but be sure you acknowledge the source of previously published methodology. If it is large amounts of text verbatim use quotation marks along with the source, but if it is paraphrased, providing the source is sufficient. A first case of self-plagiarism being considered for an individual author will likely not result in a rejection or retraction, but the author will be notified in writing and be required to revise the paper appropriately. The author will be cautioned that a second offense would likely result in rejection/retraction of the paper and future submissions by the author would be checked by the cross-referencing software before being considered. Please see the following for discussions of self-plagiarism: http://www.ithenticate.com/plagiarism-detection-blog/bid/65061/What-Is-Self-Plagiarism-and-How-to-Avoid-It#.WL1TsoWcGwc

https://ori.hhs.gov/avoiding-plagiarism-self-plagiarism-and-other-questionable-writing-practices-guide-ethical-writing

unesp
UNIVERSIDADE ESTADUAL PAULISTA
"JÚLIO DE MESQUITA FILHO"
Instituto de Biociências
Câmpus do Litoral Paulista

unesp IB-CLP

PARECER FINAL DO TRABALHO DE CONCLUSÃO DE CURSO

Discente: **Gabriel Mendonça Grellet**

Título: *"Análise temporal da dieta de franciscana, Pontoporia blainvillei na FMA IIb, sudeste do Brasil."*

Orientador: Profa. Dra. Carolina Pacheco Bertozzi

Curso/Habilitação: Bacharelado em Ciências Biológicas/Biologia Marinha

COMISSÃO EXAMINADORA	CONCEITO
Profa. Dra. Carolina Pacheco Bertozzi	APROVADO.
Dr. Renan Lopes Paitach	APROVADO.

PARECER:
TRABALHO DE ÓTIMA QUALIDADE, COM AJUSTES NECESSÁRIOS DE FORMATAÇÃO.

CONCEITO FINAL:

A Comissão Examinadora abaixo assinada conclui que o discente **Gabriel Mendonça Grellet** obteve o seguinte conceito:

[X] APROVADO   [ ] REPROVADO

São Vicente, 07 de dezembro de 2023.

Carolina P. Bertozzi
Profa. Dra. Carolina Pacheco Bertozzi

p/ Carolina P. Bertozzi
Dr. Renan Lopes Paitach