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Feeding habits of bluefish *Pomatomus saltatrix* (Linnaeus, 1766) (Actinopterygii, Pomatomidae) off the Brazilian Southwestern Atlantic

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Abstract: The stomach contents of 507 bluefish *Pomatomus saltatrix* from the Southwestern Atlantic were examined (61.9% contained some food). The diet was dominated by bony fish (84.6% by Prey Specific of Importance Relative Index - PSIRI). The main prey were *Dactylopterus volitans* (27.8%), Fish remains (13.0%), Mysidacea (12.5%) and *Sardinella brasiliensis* (11.9%). The average trophic level was estimated at 4.8, confirming its status as a top predator. Analyses based on the PSIRI contributions of different prey revealed variations in dietary composition in terms of size classes and seasons. Juvenile individuals occupy the lowest trophic level, present a lower diversity of prey and concentrate their consumption on Mysidacea. Sub-adults and adults consume mainly fish and occupying higher trophic levels. *D. volitans* was the most important prey during summer and autumn. Squids were consumed in greater proportion in spring. The differences observed for sub-adult and adult fish between seasons were mainly related to variations in the percentage of different fish in their diets whereas differences observed for small fish were mainly related to an increase in consumption of Mysidaceae in spring. We confirm that Southwestern Atlantic *P. saltarix* is a highly mobile pelagic predator, that feeds predominantly on small pelagic fish.

Key words: Diet composition, ontogeny, trophic level.

Hábitos alimentares da anchova *Pomatomus saltatrix* (Linnaeus, 1766) (Actinopterygii, Pomatomidae), no Atlântico Sudoeste brasileiro. Resumo: O conteúdo estomacal de 507 anchovas, *Pomatomus saltatrix*, do Atlântico Sudoeste foi examinado (61,9% com algum conteúdo). A dieta foi dominada por peixes ósseos (84,6% Indíce Relativo de Importância por Presa Específica - PSIRI). As principais presas foram *Dactylopterus volitans* (27,8%), Restos de peixe (13,0%), Mysidacea (12,5%) e *Sardinella brasiliensis* (11,9%). O nível trófico médio foi estimado em 4,8, confirmando seu status de predador de topo. Análises baseadas nas contribuições do PSIRI de diferentes presas revelaram variações na composição da dieta em termos de classes de tamanhos e estações do ano. Indivíduos menores ocupam o nível trófico mais baixo, apresentam menor diversidade de presas e concentram seu consumo sobre Mysidaceae. Sub-adultos e adultos consomem principalmente peixes e ocupam níveis tróficos mais elevados. *D. volitans* foi a presa mais importante durante o verão e outono. Lulas foram consumidas em maior proporção na primavera. As diferenças observadas para peixes sub-adultos e adultos entre as estações foram principalmente relacionadas a variações na porcentagem de peixes diferentes nas suas dietas enaquanto as diferenças observadas para peixes pequenos foram relacionadas principalmente a um aumento no consumo de Mysidaceae na primavera. Confirmamos que *P. saltarix* do Atlântico Sudoeste é um predador pelágico altamente móvel, que se alimenta predominantemente de pequenos peixes pelágicos.

Palavras-chave: composição da dieta, ontogenia, nível trófico.

Introduction

The bluefish, *Pomatomus saltatrix* (Linnaeus, 1766), is a coastal pelagic species with migratory behavior and a cosmopolitan distribution. It occurs preferentially in continental shelf waters in temperate and tropical regions (Briggs 1960, Champagnat 1983, Juanes *et al*. 1996, Haimovici & Krug 1996). It is an active piscivorous fish (Haimovici & Krug 1992, McHenry *et al*. 2019), preyed upon by top predators, including sharks (Wood *et al*. 2009) and dolphins (Milmann *et al*. 2016), constituting an important link within coastal trophic web. The bluefish is also an important fishery resource throughout its distribution range, being captured by industrial, artisanal, and recreational fisheries, especially in the south and southwestern Atlantic, off the Brazilian coast to Argentina (Krug & Haimovici 1989, Haimovici & Krug 1992, 1996, Begossi 1996, Lucena *et al*. 2002, Lucena & O'Brien 2005, Souza *et al*. 2021). It is also captured in the North Atlantic along the coast of the United States (Buckel & Conover 1997, Buckel *et al*. 1999, Juanes *et al*. 2002, Wilson & Degnbol 2002), in the Mediterranean (Dhieb *et al*. 2005), and in Eastern Australia (Kailola *et al*. 1993, Zeller *et al*. 1996, Schilling *et al*. 2019). In Brazil, it has commercial importance, mainly for the industrial and artisanal fisheries, and is also the target of recreational fisheries. The main area of commercial exploitation extends from the south to the southeast, especially in the states of Rio Grande do Sul and Rio de Janeiro (Lucena *et al*. 2000). Two molecular units found in Brazilian coast and the region around the Rio de Janeiro and São Paulo states (south-eastern Brazil) seems to be the possible location of a phylogeographic break (Queiroz-Brito *et al*. 2022).

Studies on the food habits of fish are fundamental to understand the structure and functioning of marine ecosystems (Díaz-Ruiz *et al*. 2004, Freitas *et al*. 2015), as they allow us to understand ecological aspects of species such as trophic interactions, their role in the food chain, and the energy flow through ecosystems (Brown *et al*. 2012). Information on the use of food resources and the use of habitat by different population strata (*e.g.* recruits, juveniles and adults) allows to broaden and deepen the knowledge of the species. In this perspective, this study aims to identify the composition of the bluefish diet on the southeastern coast of Brazil and analyze the ontogenetic and seasonal variations.

Materials and methods

Sample collection, processing, and data analysis: The examined stomachs were obtained in two different research projects. The first one aimed captured of bluefish *P. saltatrix* by commercial purse seine and gillnet fleets operating along the southeastern coast of Brazil (24º00'S and 22º25'S), between March 2014 and October 2016, in the fishing ports of Niterói and Cabo Frio. The second project aimed the captured of bluefish juveniles by beach seine, carried out on sandy beaches located in the outer sector of Guanabara Bay (Itaipu and Adão beaches, municipality of Niterói) in 2018 (Fig. 1). In both projects the collections were monthly.

The fishes obtained were refrigerated and examed in the Fishery Ecology and Necton Biology Laboratory (ECOPESCA) of Fluminense Federal University (UFF), where they were measured (total length, cm) and weighed (total weight, g). After dissection of the abdominal cavity, the stomach was removed in each individual for analysis of their contents under a stereomicroscope. Contents were identified to the lowest possible taxon, either macroscopically or with a stereomicroscope, using the most relevant regional taxonomic keys (Figueiredo & Menezes 1978, 1980, 2000, Menezes & Figueiredo 1980, 1985, Mclaughlin 1980) and individual prey taxa were counted. Then, each food item was weighed separately using a balance (precision of 0.1 g).

Feeding habits: To evaluate the contribution of each specific prey to the bluefish diet, the Prey Specific of Importance Relative Index (%PSIRI) (Brown *et al*. 2012) was applied through the equation: %PSIRI = %FO (%PN + %PW)/2, where %FO corresponds to the frequency of occurrence (number of stomachs that contain the given prey divided by the total number of stomachs), %PN and %PW refers, respectively, to the specific abundance of each prey in number and weight. Stomachs that contained only digested organic matter were not included in the analyzes to avoid increasing uncertainties.

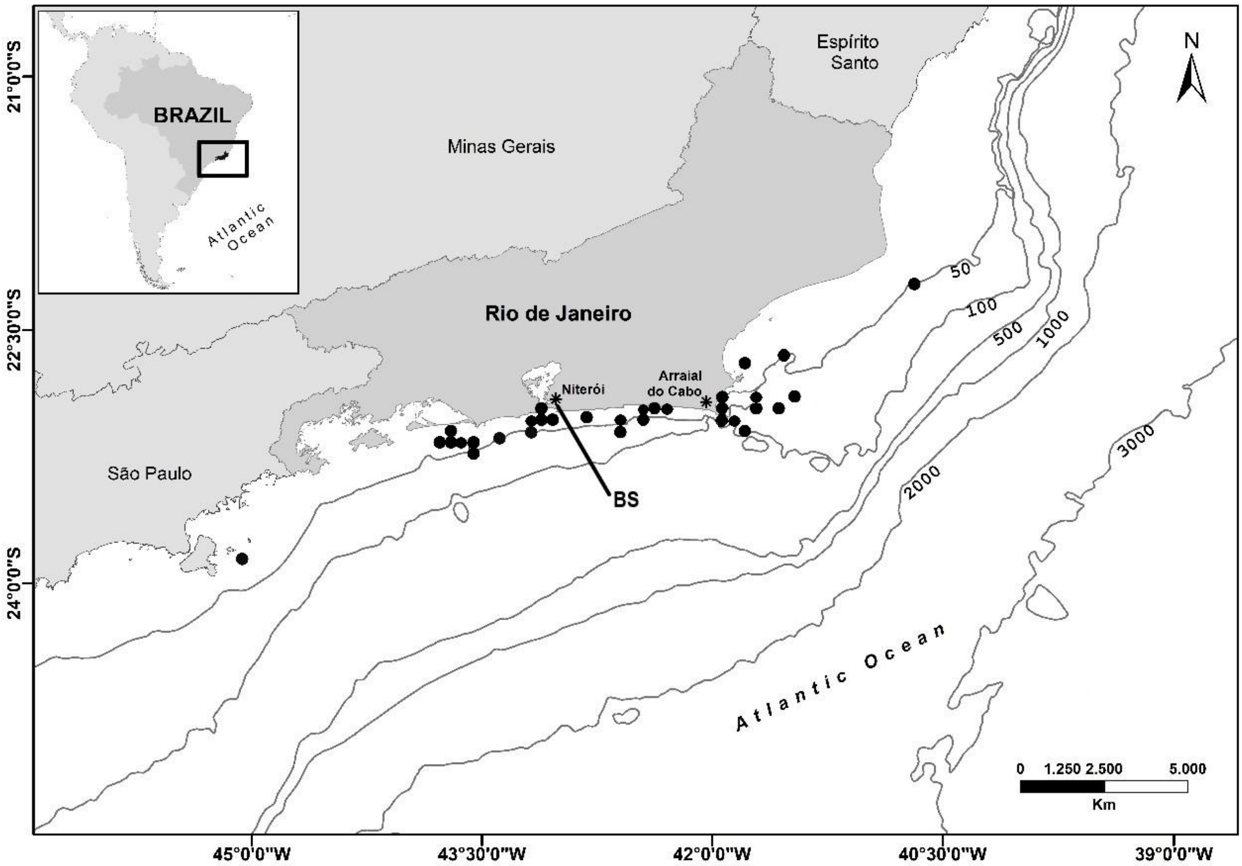

Figure 1. Map of the study area and distribution of *Pomatomus saltatrix* capture points (black dots). Location of the beaches where juveniles were captured by beach seine (BS).

For the identification of ontogenetic and seasonal feeding patterns, individuals were separated in total length classes: class I (≤ 15.0 cm) representing juveniles, class II (15.1 to 37.4 cm) sub-adults and class III (≥ 37.5) adults. We considered the length at first sexual maturation (37.4 cm) as a reference to separate the last two size classes (Souza *et al*. 2021). To verify possible seasonal variations in the diet, the data were separated by seasons, considering: summer (January to March), autumn (April to June), winter (July to September) and spring (October to December).

The dietary strategy of *P. saltatrix* was analyzed with the aid of the Costello diagram modified by Amundsen *et al*. (1996). This diagram considers the specific abundance and frequency of occurrence of each prey consumed, thus estimating its degree of importance in the diet. In this method, information on predatory food ecology is obtained by means of a graphical relationship between the specific abundance of prey ($\%A_i$) and the frequency of occurrence ($\%F_i$), calculated from the formula: $\%A_i = 100S_i * St_i - 1$ $\%F_i = 100N_i \cdot N\text{-}1$ where, S_i is the number of stomachs containing only prey i, St_i is the total number of stomachs in which prey i occurs, N_i is the number of predators with prey i found in the stomach, and N is the total number of predators with content stomach. Analyzes were performed considering the total number of stomachs and each size class (I, II and III). Levin's standardized index (Krebs 1999) were used to estimate the size of food niches for the total set of individuals and for each size class.

To describe more fully the ecological role of *P. saltatrix* in the study area, the prey composition was used to estimate the trophic levels (TL) and the niche amplitudes. The trophic levels was calculated using the formula proposed by Cortés (1999). This equation took into account the type of prey found in stomach contents:

$$TL = 1 + \left(\sum_{J=1}^{n} P_{j\ *TL} \right)$$

Where TL = trophic level of *P. saltatrix*, TLj = trophic level of each prey category consumed, *Pj* = proportion of each prey category in the diet of the predator, and n = number of prey items. The trophic levels of prey were obtained from FishBase (Froese & Pauly 2022) and the Sea Around Us Project DataBase (Pauly *et al*. 2020).

Data analysis: A Permutational Multivariate Analysis of Variance (PERMANOVA) was used to evaluated potential differences in the prey composition among the size classes (fixed, with three levels - classes I, II and III) and seasons (fixed, with four levels - Summer, Autumn, Winter, Spring). PERMANOVA was performed on a Bray–Curtis similarity matrix whith data of weight of food items previously transfomed by log (x+1). Statistical significance ($P < 0.05$) was tested using 9999 permutations of residuals under a reduced model of sum of type I (sequential) squares. When significant differences were detected ($P < 0.05$), pairwise comparisons between groups were conducted. Percentage similarity analyzes (SIMPER) was performed to infer which prey contributed to the similarity/dissimilarity between the factors. These analyses were perfomed using the statistical package PRIMER 6.0 with PERMANOVA+ (Anderson *et al*. 2008, Clarke & Gorley 2015).

Results

General diet: A total of 507 stomachs were analyzed (491 from commercial captures and 16 from experimental captures carried out on sandy beaches). Of this total, 193 (38.1%) stomachs were empty. The total length of the 314 individuals ranged from 4.5 to 81.0 cm.

A total of 823 food items were recorded in the analyzed stomachs, of which 87.5% were in the initial stage of digestion or intact, enabling the prey identification. The trophic spectrum of *P. saltatrix* is composed by bony fish, crustaceans and cephalopods. Among bony fish, *Dactylopterus volitans* was the most important prey, followed by fish remains, *Sardinella brasiliensis* and *Caranx crysos*. However, Mysidacea crustaceans was the third most important prey in the diet (Table I, Supplementary material).

Diet by size: Differences were found in the composition and relative importance of food items between the size classes. Fish of the Clupeidae family constituted the only common food item in the three size classes. Mysidacean crustaceans were recorded in classes I and III, but showed outstanding importance in the smallest size class (62.9 %PSIRI). *D. volitans* was in classes II and III, but only in class III (adults) it was the most important food item. The diet of sub-adults (class II) showed an exclusively piscivorous habit, while in class III (adults), in addition to fish and crustaceans, cephalopods (squid and nautilus) were recorded. It is possible to notice differences between juveniles and adults. The greatest diversity of prey and the greatest breadth of trophic niche were recorded for adults (Table 1).

The graphical analysis of the Amundsen diagram for all analyzed individuals, based on the specific abundance of the prey in relation to its occurrence (Fig. 2), suggests that the bluefish have a specialist-opportunist feeding strategy – some individuals are specialized in Fish remains, *S. brasiliensis* and *D. volitans* and when they are smaller (Classes I and II) consumed items as Mysidacea and Fish remains in high frequency and specific abundance.

Diet by season: Seasonal analysis showed that *D. volitans*, *S. brasiliensis* and cephalopods (Loliginidae) occurred as prey in all seasons. *D. volitans* was the main prey consumed during summer and autumn, but was less important in winter and spring, when squids were the most consumed prey (Fig. 3). Autumn was the season with the greatest variety of prey items and spring was the one with lowest diversity of prey.

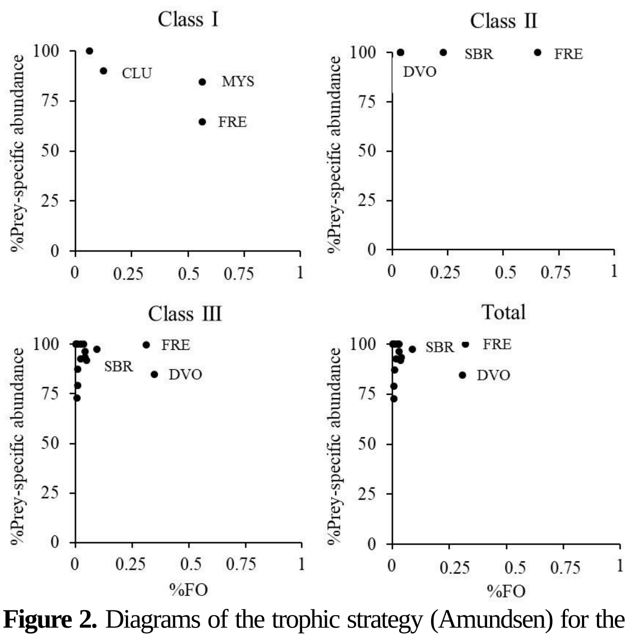

Figure 2. Diagrams of the trophic strategy (Amundsen) for the main food items in diet of bluefish *Pomatomus saltatrix*. As a function of the Frequency of occurrence (%) and Prey-specific abundance (%), for the different size classes of *P. saltatrix* in the southeastern coast of Brazil. Legend: FRE = Fish remains, DVO = *Dactylopterus volitans*, SBR = *Sardinella brasiliensis*, CLU = Clupeidae remains e MYS = Mysidacea.

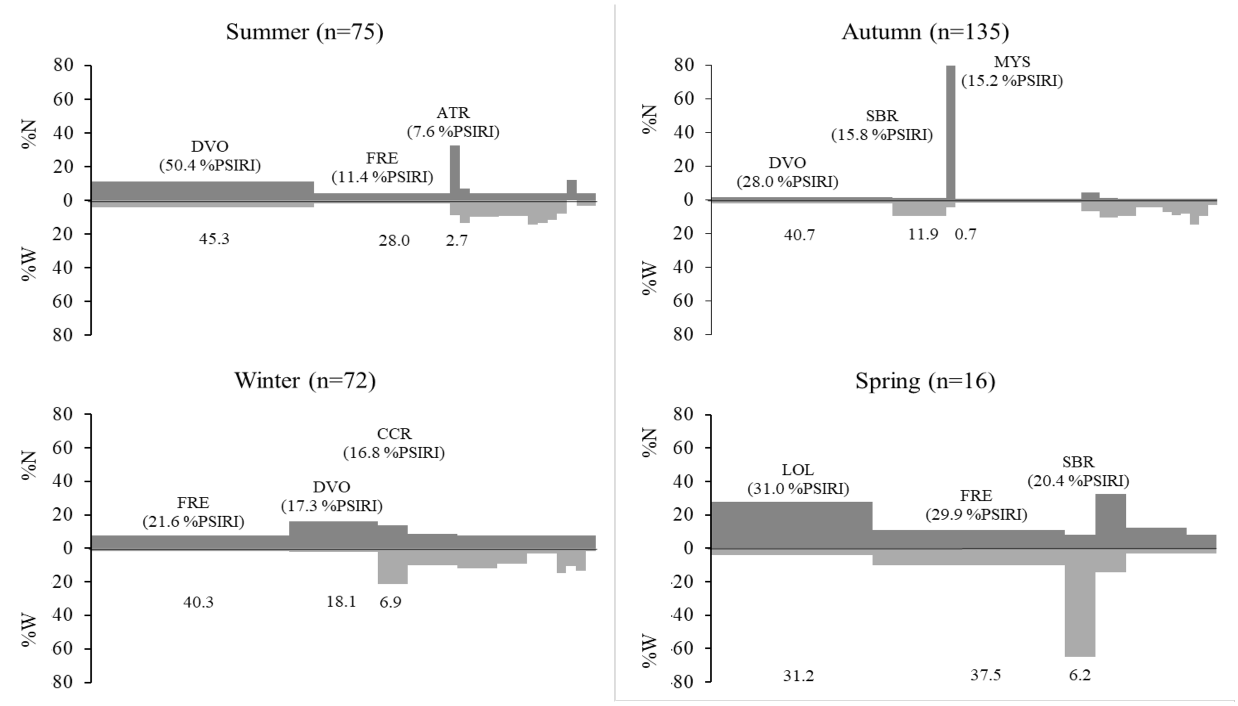

Figure 3. Prey-Specific Index of Relative Importance (%PSIRI) for the main food items in diet of bluefish *Pomatomus saltatrix* in southeastern coast of Brazil. %N, percentage of number; %W, percent of weight; and %FO, frequency of occurrence (bold). %PSIRI values are indicated in parentheses. Legend: FRE = Fish remains, DVO = *Dactylopterus volitans*, SBR = *Sardinella brasiliensis*, ATR = *Anchoa tricolor*, MYS = Mysidacea, CCR = *Caranx crysos*, and LOL = Loliginidae.

Table II. Results of the Permutational Multivariate Analysis of Variance (PERMANOVA) analysis of the *Pomatomus saltatrix* diet between size classes (I, II, III), and seasons (Su, summer; Au, autumn; Wi, winter; Sp, spring) in Southwestern Atlantic. ECV: estimated component of the variance. The symbol > corresponds to the greatest similarity within each group.

Source	df	MS	Pseudo-F	P(perm)	ECV	Pair-wise test	
Cl	2	20011	5.1499	0.0001	23.2		
Se	3	6749	1.7369	0.0271	7.8		
						I	Sp
Cl x Se	1	8484,2	2.1835	0.0370	14.5	II	Au > Wi
						III	Su, Au > Wi, Sp
Res	307	3885,7			62.3		
Total	313						

The largest estimated component of the variance (ECV), which represents how important each term is at explaining the overall variation in the model was 23.2% for size, 7.8% for season and 14.5% for the interaction between the factors (Table II). Significant interactions between the factors were recorded (F = 2.1835, P = 0.037), pairwise comparisons among all size classes in all seasons showing that during autumn and winter the diet of fish in size class II showed differences in relation to class III (t = 2.4631; P = 0.0002/ t = 1.4578; P = 0.0332). The differences observed for sub-adults and adults among seasons were mostly due to fluctuations in the percentage of their diets constituted by different fish. During spring, the diet of fish belonging to class I was significantly different from class III (t = 2.2533; P = 0.0001), since in this season the juveniles had a high consumption of Mysidaceae.

The SIMPER analysis showed that the items Mysidacea, Fish remains and *D. volitans* were the preys that most contributed to the diet of *P. saltatrix*, respectively for classes I, II and III (Table III). Size class III was the one with the lowest mean similarity, indicating the greatest variation in the diet. It was also possible to verify high mean dissimilarity

Table III. Average abundance (AAb) and Average similarity (ASim%) of most typical feed items from SIMPER analysis for size classes of the *Pomatomus saltatrix* in Southwestern Atlantic.

Size Classes	Class I		Class II		Class III	
Average similarity	26.2%		24.3%		15.4%	
Feed items	AAb	ASim	AAb	ASim	AAb	ASim
Dactylopterus volitans					0.9	9.3
Sardinella brasiliensis			0.8	4.2		
Fish remains	0.1	8.6	0.9	20.1	0.6	4.9
Mysidacea	0.1	17.4				

values between all size classes. The greatest dissimilarity was recorded between classes I and III (98.3%) where prey *D. volitans* and Fish remains had the greatest contributions. The smallest mean dissimilarity was found between classes II and III (87.5%), where Fish remains, *D. volitans* and *Sardinella brasiliensis* contributed significantly.

Discussion

The overall dietary description in the current study indicates that, like other populations globally, Southwestern Atlantic *P. saltatrix* feed predominantly on small pelagic prey, especially fish, highlighting the importance of this prey type for this species (Haimovici & Krug 1992, Silvano & Begossi 2009, Potts *et al*. 2016, Juanes *et al*. 2016). The dominance of bony fish as prey indicates that bluefish has a typically carnivorous-piscivorous behavior, occupying the high trophic level (TL = 4.8), common for a predator at the top of the food chain. Our results revealed that the diet of *P. saltatrix* shows changes related to seasonal variations in prey availability for different population strata. Thus, individuals of different classes must approach or move away from shallower areas depending on the seasonal availability of preferential prey. On the southeastern Brazilian coast, bluefish can be classified as a generically piscivorous predator with an specialist-opportunist feeding strategy.

The ontogenetic differences observed between the different size strata were relevant, especially between juveniles (Class I) and the other length classes. The greater variety of prey, especially in the diet of adults, indicates a widening of the food spectrum. Despite the differences in the number of stomachs analyzed between the size classes, other studies show an ontogenetic pattern similar to that found by us. This pattern, where juveniles have a diet composed of fish and crustaceans and adults with a diet predominantly focused on fish consumption, corroborates the results described in works carried out in other regions (Buckel *et al.* 1998, Szczebak & Taylor 2011, Schilling *et al*. 2017).

The greater importance of planktonic crustaceans in the diet of young individuals may be related to their frequent availability in shallow environments (Abble *et al*. 2002, Maggi *et al*. 2009) and to morphological limitations that prevent the capture of larger prey with greater mobility like pelagic fish (Scharf *et al*. 1998). Smaller bluefish, inhabiting shallow environments, are more likely to encounter small pelagic prey, notably crustaceans. Bluefish locates its prey visually and its ability to capture fast prey increases with size (Olla *et al*. 1970). This may explain the predominance of fish and squid in the stomachs of larger fish.

Mysids tend to be more common in coastal and estuarine areas (Murano 1999), where they can reach high densities and biomass, dominating zooplankton in the surf zone of sandy beaches (Ávila *et al*. 2009). Studies in Australia (Schilling *et al*. 2017) show that juveniles *P. saltatrix* have a foraging habit close to the substrate are found mysids in swarms near the benthos, consistent with the high consumption of mysids recorded in this study. The presence of these crustaceans in the stomachs of adults suggests a vertical foraging behavior, which corroborates the opportunistic strategy of the species. Studies carried out on the south coast of Brazil (Haimovici & Krug 1991, Lucena *et al*. 2000), on the east coast of the USA (Juanes *et al*. 1993, Scharf *et al*. 2000) and Australia (Schilling *et al*. 2017) comparing the diet of juveniles and adults showed the same dietary pattern described in this study. The presence of small pelagic prey in the diet of adult individuals may be related to greater abundance and vulnerability to predation compared to larger prey (Juanes *et al*. 2016), reinforcing their opportunistic behaviour. Juanes and Conover (1994) suggested that the energy obtained from highly nutritious small pelagic prey is necessary to maintain the very fast growth rate of *P. saltatrix*.

Despite the high relative importance of fish from the Clupeidae family in the diet of juveniles and adults, the marked presence of *D. volitans* (flying gurnard), especially in the diet of adults, should be highlighted. The high consumption of flying gurnard during summer and autumn coincides with the period of greater abundance of this species in the southeastern shelf of Brazil (Netto & Gaelzer 1991) and greater reproductive activity (Machado *et al*. 2002), factors that can increase their vulnerability and the possibility of interacting with predators. The nearshore coastal ocean is important to marine fishes in providing refugia and food for developing juveniles during critical early life stages (Lasiak 1986, Robertson & Lenanton 1984), including bluefish in the southeast in late spring and summer (Souza *et al*. 2021).

The higher consumption of flying gurnard by adults during summer and autumn, of *S. brasiliensis* by subadults in autumn and of mysidids in spring suggests that *P. saltatrix* presents an opportunistic behavior linked to the availability of high-energy or easily accessible prey, indicating that seasonal variation is being influenced by size classes.

These findings are important because they call attention to the link between *P. saltatrix* and the availability of small pelagic prey. Large changes in the abundance of these prey can impact distribution, energy intake, growth and reproduction of bluefish. Furthermore, changes in the distribution of prey populations can result in co-migration behavior by predators such as bluefish, helping to explain possible interannual variations in fisheries production in traditional capture areas.

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Ethical statement

Collection of fish and biological samples were conducted following all applicable ethical regulations regarding experimentation with animal. The investigation was performed under license SISBIO #15787-1.

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Feeding habits of bluefish *Pomatomus saltatrix* (Linnaeus, 1766) (Actinopterygii, Pomatomidae) off the Brazilian Southwestern Atlantic

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Supplementary material

Table I Supplementary material. Diet composition of bluefish *Pomatomus saltatrix* by frequency of occurrence (%FO), per cent number (%N), per cent weight (%W), prey-specific index of relative importance (%PSIRI), and importance ranking (R). Total length classes: Class I (≤15.0 cm), Class II (15.1 to 37.4 cm) and Class III (> 37.4 cm).

Food items		Total length classes																Total				
		Class I					Class II					Class III									
Higher taxa	Prey	%FO	%N	%P	%PSIRI	R	%FO	%N	%P	%PSIRI	R	%FO	%N	%P	%PSIRI	R	%FO	%N	%P	%PSIRI	R
Teleostei		**68.7**	**17.8**	**69.6**	**35.6**		**96.1**	**100**	**100**	**100**		**98.5**	**21.1**	**95.7**	**88.1**		**97.1**	**57**	**98.1**	**84.6**	
Dactylopteridae	*Dactylopterus volitans*						3.8	33.3	7.2	4.8		37.9	1.8	1.8	31.4	**1**	33.1	4.8	1.9	27.8	**1**
Carangidae	*Caranx crysos*											4.8	1.2	9.3	8.8		4.1	3.2	9.7	8.2	
	Decapterus punctatus											4.0	0.8	6.3	**5.0**		3.5	2.0	6.6	4.7	
	Trachurus lathami											0.4	0.8	1.9	0.2		0.3	2.0	2.0	0.2	
Clupeidae	*Sardinella brasiliensis*						23.1	16.7	31.7	38.6	**2**	8.1	0.9	6.8	11.0	**3**	8.9	2.3	6.4	11.9	
	Brevoortia aurea											1.1	0.8	5.5	1.2		1.0	2.0	5.8	1.1	
	Harengula clupeola											0.7	0.8	7.4	1.0		0.6	2.0	7.8	1.0	
	Remains	12.5	8.9	48.2	10.9	**3**											0.6	2.0	0.0	0.1	

Food items		Total length classes															Total				
		Class I					Class II					Class III									
Higher taxa	**Prey**	**%FO**	**%N**	**%P**	**%PSIRI**	**R**	**%FO**	**%N**	**%P**	**%PSIRI**	**R**	**%FO**	**%N**	**%P**	**%PSIRI**	**R**	**%FO**	**%N**	**%P**	**%PSIRI**	**R**
Engraulidae	*Anchoa tricolor*											2.6	4.8	4.8	5.7		2.2	12.6	5.1	5.0	
Chlorophthalmidae	*Parasudis truculenta*											0.4	3.1	2.0	0.5		0.3	8.0	2.1	0.4	
Priancanthidae	*Heteropriacanthus cruentatus*						3.8	16.7	47.3	8.7	**3**	5.1	0.8	4.3	4.7		4.8	2.0	4.6	4.7	
	Priacanthus arenatus						3.8	16.7	8.4	3.1		0.7	0.8	5.2	0.8		1.0	2.0	4.0	0.8	
Sciaenidae	*Isopisthus parvipinnis*											0.7	0.8	7.4	1.0		0.6	2.0	7.8	1.0	
Trichiuridae	*Trichiurus lepturus*											0.7	0.8	8.2	1.1		0.6	2.0	8.5	1.1	
Percophidae	*Percophis brasiliensis*											0.4	0.8	9.4	0.6		0.3	2.0	9.8	0.6	
Ophichthidae	*Ophichthus gomesii*											0.4	0.8	9.6	0.6		0.3	2.0	10.0	0.6	
Scombridae												2.6	0.8	4.6	2.5		2.2	2.0	4.9	2.3	
Fish remains		56.3	8.9	21.4	24.7	**2**	65.4	16.7	5.4	44.9	**1**	27.9	0.8	1.2	11.8	**2**	32.5	2.0	1.0	13.0	**2**
Crustacea		**62.5**	**82.2**	**30.4**	**64.4**		**0.0**	**0.0**	**0.0**	**0.0**		**0.4**	**76.6**	**2.7**	**8.6**		**3.5**	**36.9**	**0.3**	**12.6**	
Mysidacea		56.3	73.3	21.9	62.9	**1**						0.4	76.6	2.7	8.6		3.2	34.9	0.3	12.5	**3**
Copepoda		6.3	8.9	8.6	1.5												0.3	2.0	0.0	0.1	
Cephalopoda		**0.0**	**0.0**	**0.0**	**0.0**		**0.0**	**0.0**	**0.0**	**0.0**		**5.1**	**2.4**	**1.6**	**3.3**		**4.5**	**6.2**	**1.6**	**2.9**	
Loliginidae												4.8	1.6	1.2	3.2		4.1	4.2	1.2	2.8	
Argonautidae	*Argonauta* sp.											0.4	0.8	0.4	0.1		0.3	2.0	0.4	0.1	
Total stomachs					16					26					272					314	
Trophic level					3.5					4.5					4.7					4.8	
Niche breadth					0.1					0.1					0.6					0.6	