ZOOLOGIA 26 (2): 374–378, June, 2009

SHORT COMMUNICATION

Diet and potential feeding overlap between *Trichiurus lepturus* (Osteichthyes: Perciformes) and *Pontoporia blainvillei* (Mammalia: Cetacea) in northern Rio de Janeiro, Brazil

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ABSTRACT. This study describes the diet and assesses potential overlap in the feeding habits of *Trichiurus lepturus* Linnaeus, 1758 and *Pontoporia blainvillei*Gervais & D'Orbigny, 1844 in northern Rio de Janeiro, southeastern Brazil. Fishes were numerically dominant in both diets, followed by cephalopods for *P. blainvillei* and crustaceans for *T. lepturus*. Both predators move along similar coastal feeding areas in northern Rio de Janeiro, but our results indicate differences in their resource exploitation, what allows for their coexistence.

KEY WORDS. Cannibalism; diet; feeding; food habits; predators.

Trichiurus lepturus Linnaeus, 1758 (Perciformes: Trichiuriidae) and *Pontoporia blainvillei* Gervais & D'Orbigny, 1844 (Cetacea: Pontoporiidae) are carnivore species that coexist along the Brazilian coast (Di Beneditto *et al.* 2001, Bittar *et al.* 2008). There are no comparatives studies on the feeding habits of these species, but their diet has been studied separately (Shuozeng 1995, Di Beneditto & Ramos 2001, Di Beneditto *et al.* 2001, Danilewicz *et al.* 2002, Rodriguez *et al.* 2002, Martins *et al.* 2005, Chiou *et al.* 2006, Bittar *et al.* 2008).

This study compares the feeding habits of these predator species, since both coexist in northern Rio de Janeiro and could be trophic competitors. We endavour to contribute to a better understanding of the marine food chain along the Brazilian coastal waters.

All specimens analyzed were collected in northern Rio de Janeiro through gillnet fisheries carried out at Atafona fishing village, between 21°18'S and 22°25'S, from 0.02 to 42.1 nautical miles from shore and in waters 5-70 m deep. Between August 2004 and July 2006, 350 individuals of *T. lepturus* were collected, and 343 were included in the diet analysis. Only adult specimens, measuring between 100 and 163 cm of total length, were analyzed, due to their hightest likelyood of being potential trophic competitors of *P. blainvillei* (Di Beneditto *et al.* 2001). Ninety-nine specimens of *P. blainvillei* collected from September 1989 to December 2005 were analyzed. The total length of the P. blainvillei specimens ranged from 78.2 to 148.0 cm.

Stomachs were separated and their contents rinsed in a sieve of 400 µm to recover the contents. Undigested prey were measured and weighted. The Index of Relative Importance (IRI) (Pinkas *et al.* 1971) was applied to determine the representative prey species and considered teleosts, cephalopods, and crustaceans as independent prey to reduce under or overestimation of their importance (Clarke 1986). A non-parametric descriptive statistic, with the median as a central tendency measure, was used for the size, biomass and density (number of individuals) comparison considering the main teleost and cephalopod items consumed by both carnivores. The crustaceans were not considered in our comparisons due to their scarcity in the diet of *P. blainvillei*. The diets of *T. lepturus* and *P. blainvillei* were also compared through the diversity and dominance indexes of Simpson and the Jaccard (qualitative), and Morisita-Horn (quantitative) similarity indexes, described in Magurran (1988).

Trichiurus lepturus and *P. blainvillei* prey upon neritic species, both pelagic and demersal (Tabs I and II). Teleosts species of Scianidae, Engraulidae and Clupeidae are the most representative items in the diet of both species (Tabs I and II). Cephalopods are more frequent in the diet of *P. blainvillei*, while the crustaceans dominate in stomach contents of *T. lepturus*. All favoured fish (Di Beneditto *et al.* 2001), cephalopod (Roper *et al.* 1984) and crustacean (Di Beneditto *et al.* 1998, Costa *et al.* 2003) species occur all year round in northern Rio de Janeiro.

Results from the non-parametric descriptive statistics are presented on table III. In general, prey species ingested by *T. lepturus* are larger than those ingested by *P. blainvillei*. However, the total biomass and density recorded in the stomach contents are lower in *T. lepturus*. The greater prey selectivity by *T. lepturus* is possibly associated with its voracity, as reported

Table I. Prey species consumed by *T. lepturus* in northern Rio de Janeiro, with the Index of Relative Importance (IRI), numeric frequency (%FN), biomass (%W) and occurrence (%FO).

Order	Prey	IRI	%FN	%W	%FO
	Fishes				
1	*Trichiurus lepturus* Linnaeus, 1758	356.5	4.4	40.2	8.0
2	*Pellona harroweri* Fowler, 1917	290.6	12.3	8.5	14.0
3	*Chirocentrodon bleekerianus* Poly,1867	146.9	6.5	9.8	9.0
4	*Lycengraulis grossidens* Agassiz, 1829	73.4	3.3	9.0	6.0
5	*Peprilus paru* Linnaeus, 1758	67.0	6.0	2.4	8.0
6	*Chloroscombrus chrysurus* Linnaeus, 1766	25.6	2.2	4.2	4.0
7	*Odontognathus mucronatus* Lacepède, 1800	20.5	2.7	1.8	4.5
8	*Stellifer brasiliensis* Schultz, 1945	12.8	2.7	1.6	3.0
9	*Isopisthus parvipinnis* Cuvier, 1830	9.5	1.4	2.4	2.5
10	*Paralonchurus brasiliensis* Steindachner, 1875	6.9	0.8	6.1	1.0
11	*Bagre bagre* Linnaeus, 1766	6.8	1.1	3.5	1.5
12	*Anchoa filifera* Fowler, 1915	5.4	1.6	0.5	2.5
13	*Cynoscion jamaicensis* Vaillant & Bocourt, 1883	4.5	0.5	3.9	1.0
14	*Anchoviella lepidentostole* Fowler, 1911	4.1	1.4	0.3	2.5
15	*Arius spixii* Agassiz, 1829	4.0	1.9	0.1	2.0
16	*Orthopristis rubber* Cuvier, 1830	2.2	0.5	1.7	1.0
17	*Stellifer* sp.	1.9	1.6	0.3	1.0
18	*Pagrus pagrus* Linnaeus, 1758	1.4	0.3	2.5	0.5
19	*Trachurus lathami* Nichols, 1920	0.9	0.5	0.4	1.0
20	*Prionotus punctatus* Bloch, 1797	0.6	0.5	0.1	1.0
21	*Porichthys porosissimus* Cuvier, 1829	0.6	0.3	0.9	0.5
22	*Anchoa* sp.	0.1	0.3	0.0	0.5
23	*Macrodon ancylodon* Bloch & Schneider, 1801	0.1	0.3	0.0	0.5
–	*Ctenosciaena gracilicirrhus* Metzelaar, 1919	–	–	–	–
–	*Cynoscion virescens* Cuvier, 1830	–	–	–	–
–	*Larimus breviceps* Cuvier, 1830	–	–	–	–
–	*Micropogonias furnieri* Desmarest, 1823	–	–	–	–
–	*Sardinella brasiliensis* Steidachner, 1879	–	–	–	–
–	*Stellifer rastrifer* Jordan, 1889	–	–	–	–
	Cephalopods				
1	*Loligo plei* Blainville, 1823	13,173.7	59.1	99.0	83.3
2	*Loligo sanpaulensis* Brakoniecki, 1984	608.7	22.7	1.6	25.0
–	*Lolliguncula brevis* Blainville	–	–	–	–
	Crustaceans				
1	*Pleoticus muelleri* Bate, 1888	8,222.9	96.3	95.5	42.9
2	*Artemesia longinaris* Bate, 1888	30.6	3.1	0.5	8.6
3	*Xiphopenaeus kroyeri* Heller, 1862	7.3	0.3	0.6	8.6

IRI = [(%FN+%W) x FO] (Pinkas *et al.* 1971); nc: not calculated.

Table II. Prey species consumed by *P. blainvillei* in northern Rio de Janeiro, with the Index of Relative Importance (IRI), numeric frequency (%FN), biomass (%W) and occurrence (%FO).

Order	Prey	IRI	%FN	%W	%FO
	Fishes				
1	*Stellifer* sp.	1,438.5	24.9	8.9	42.6
2	*Anchoa filifera* Fowler, 1915	1,086.8	9.9	16.3	41.5
3	*Pellona harroweri* Fowler, 1917	973.3	12.1	12.6	39.4
4	*Isopisthus parvipinnis* Cuvier, 1830	835.6	10.8	9.8	40.4
5	*Cynoscion jamaicensis* Vaillant & Bocourt, 1883	349.3	8.0	5.1	26.6
6	*Chirocentrodon bleekerianus* poly,1867	339.4	5.5	13.3	18.1
7	*Stellifer brasiliensis* Schultz, 1945	249.2	4.7	3.7	29.8
8	*Sardinella brasiliensis* Steidachner, 1879	127.0	2.8	12.1	8.5
9	*Peprilus paru* Linnaeus, 1758	96.7	1.1	6.5	12.8
10	*Stellifer rastrifer* Jordan, 1889	51.8	2.3	3.2	9.6
11	*Odontognathus mucronatus* Lacepède, 1800	35.9	1.1	3.1	8.5
12	*Micropogonias furnieri* Desmarest, 1823	19.8	0.9	1.1	9.6
13	*Trichiurus lepturus* Linnaeus, 1758	16.4	0.3	1.4	9.6
14	*Ctenosciaena gracilicirrhus* Metzelaar,1919	13.2	0.5	1.3	7.5
15	*Anchoviella lepidentostole* Fowler, 1911	10.0	1.1	2.1	3.2
16	*Paralonchurus brasiliensis* Steindachner, 1875	1.4	0.2	0.1	4.3
17	*Orthopristis ruber* Cuvier, 1830	1.0	0.4	0.1	2.1
18	*Cynoscion virescens* Cuvier, 1830	0.3	0.2	0.1	1.1
19	*Lycengraulis grossidens* Agassiz, 1829	0.2	0.1	0.1	1.1
20	*Porichthys porosissimus* Cuvier, 1829	0.2	0.1	0.1	1.1
21	*Larimus breviceps* Cuvier, 1830	0.1	0.0	0.1	1.1
22	*Macrodon ancylodon* Bloch & Schneider, 1801	0.1	0.0	0.0	1.1
23	*Anchoa* sp.	–	–	–	–
–	*Arius spixii* Agassiz, 1829	–	–	–	–
–	*Bagre bagre* Linnaeus, 1766	–	–	–	–
–	*Chloroscombrus chrysurus* Linnaeus, 1766	–	–	–	–
–	*Pagrus pagrus* Linnaeus, 1758	–	–	–	–
–	*Prionotus punctatus* Bloch, 1797	–	–	–	–
–	*Trachurus lathami* Nichols, 1920	–	–	–	–
	Cephalopods				
1	*Loligo plei* Blainville, 1823	6,227.8	68.3	25.2	66.7
2	*Loligo sanpaulensis* Brakoniecki, 1984	4,640.0	25.2	7 2.3	47.6
–	*Lolliguncula brevis* Blainville	261.2	6.6	2.6	28.6
	Crustaceans				
1	*Artemesia longinaris* Bate, 1888	nc	–	–	–
2	*Pleoticus muelleri* Bate 1888	–	–	–	–
3	*Xiphopenaeus kroyeri* Heller, 1862	nc	–	–	–

IRI = [(%FN+%W) x FO] (Pinkas *et al.* 1971); nc: not calculated.

Table II. Size, biomass and density (number of individuals) of fishes and cephalopods consumed by *T. lepturus* and *P. blainvillei* in northern Rio de Janeiro. Total biomass and density (number of individuals) per stomach.

	T. lepturus			*P. blainvillei*		
Prey	Size (cm)	Biomass (g)	Density	Size (cm)	Biomass (g)	Density
Fishes						
Minimum values	1.1	0.2	1.0	0.1	0.1	1.0
Median	7.5	10.0	1.0	4.7	57.9	31.0
Maximum values	100.8	914.3	11.0	36.7	338.7	201.0
Cephalopods						
Minimum values	1.3	0.4	1.0	2.3	1.1	1.0
Median	6.2	16.8	1.0	5.6	122.1	10.0
Maximum values	23.9	193.4	4.0	23.0	1,495.0	75.0

by Martins *et al*. (2005) and Chiou *et al*. (2006). The values of biomass and density (number of individuals), in turn, may reflect differences in the digestion rate, the ability to fill the stomach and/or the nutritional needs of the predators.

The diet of *P. blainvillei* is more diverse than that of *T. lepturus*. Although prey richness is similar, the high abundance of prey consumed for *P. blainvillei* may be responsible for this difference. The prey diversity is influenced by the equitable distribution of the fishes consumed by *P. blainvillei*, resulting in a lower dominance value. For *T. lepturus*, the opposite pattern is recorded. The two e species show 60% of similarity in their diet. However, the quantitative comparison (abundance) indicates a low diet similarity between them (Tab. IV).

Table III. Comparison between the diet of *T. lepturus* and *P. blainvillei* in northern Rio de Janeiro through ecological indexes (indexes values range from 0 to 1).

	T. lepturus	*P. blainvillei*
Number of prey species	28	27
Index of diversity of Simpson	0.36	0.89
Index of dominance by Simpson	0.64	0.11
Index of similarity of Jaccard (qualitative)	0.60	
Index of similarity of Morisita (quantitative)	0.02	

Diet overlap is expected between sympatric species of carnivores that have similar sizes and food preferences (Zavala-Camin 1996). In this study, the lower diversity of prey and the higher dominance may indicate that the diet of *T. lepturus* is more selective than the diet of *P. blainvillei*. However, we need to be careful when applying such ecological indexes to diet studies. Differences in food assimilation rates between the predators, for instance, can under or over estimate their food preferences.

In northern Rio de Janeiro, the adult specimens of *T. lepturus* and *P. blainvillei* exploit coastal waters to obtain their food resources. However, the former feeds preferentially on pelagic species, while the latter feeds along the water column. In general, the prey consumed by both species in northern Rio de Janeiro have low commercial value or are treated as by-catch by the local fisheries. When the preys are commercially valuable, as *I. parvipinnis* and *L. plei*, the fisheries targets larger specimens than those consumed by the species studied (Costa & Haimovici 1990, Di Beneditto *et al*. 1998). This indicates that the prey species can be at pre-recruitment sizes of the fishery grounds.

Despite some overlap in their feeding habits, quantitative variations in size, biomass and density of prey consumed indicate differences in their exploitation of resources, allowing for the coexistence of *T. lepturus* and *P. blainvillei* in the region. However, additional studies on their feeding habits are still needed in the areas where both species are sympatric in order to confirm this pattern.

ACKNOWLEDGEMENTS

The authors would like to thank to Marcos C. de O. Santos, Ilana R. Zalmon, Leandro R. Monteiro and Carlos E.V. de Carvalho for reviewing the early draft of this manuscript. We also thank the fishermen from Atafona fishing village that provided us with the studied specimens and Silvana R. Gomes for helping the collection of specimens. This study was supported by FAPERJ (E-26/170670/2004) and A.P.M. Di Beneditto was supported by CNPq (305160/2006-0).

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Submitted: 03.IX.2008; Accepted: 16.VI.2009.
Editorial responsability: Paulo da Cunha Lana