Contribution of the polychaetous annelids to the diet of some brazilian fishes

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ABSTRACT

Otter trawls for fish were taken between the three offshore islands, Anchieta, Vitória and Couves off the southeast coast of Brazil in order to determine their food habits. The stomachs of 2834 specimens of fish belonging to 77 species were examined; 1076 were found to be empty and 595 contained polychaetes. Sixty-five species of polychaetes were identified, with the most frequent ones belonging to the genera *Notomastus, Onuphis, Anaitides, Pherusa, Laonice, Diopatra* and *Euclymene*. The polychaete families were grouped according to their habitat, that is, the bottom, in subsurface sessile, subsurface mobile, surface sessile and surface mobile. The subsurface mobiles had the highest percentage (42.8 %) in the stomach contents with food present.

RÉSUMÉ

Le rôle des annélides polychètes dans le régime alimentaire de certains poissons brésiliens

Dans le but d'estimer la part des polychètes dans le régime alimentaire des poissons benthiques et "démersaux" de la côte Sud-Est du Brésil, une série de prélèvements a été réalisée à l'aide d'un chalut à panneaux du type "otter trawl" dans la région comprise entre les îles Anchieta, Vitória et Couves à des profondeurs comprises entre 10 et 50 m. Le contenu stomacal de 2834 individus de poissons appartenant à 77 espèces a été examiné : 1076 estomacs étaient vides et 595, soit 33,8 % des autres, contenaient des polychètes. Environ 65 espèces de polychètes ont été identifiées, les plus fréquentes appartenant, par ordre décroissant d'importance numérique, aux genres *Notomastus, Onuphis, Anaitides, Pherusa, Laonice, Diopatra* et *Euclymene*. Les familles de Polychètes ont été groupées suivant la position qu'elles occupent sur le fond, soit : sub-surface sessile, sub-surface mobile, surface sessile et surface mobile. Les sub-surfaces mobiles sont les plus fréquentes (42,8 %) dans le contenu des estomacs examinés.

AMARAL, A.C.Z., NONATO, E.F. & M.A.V. PETTI, 1994. — Contribution of the polychaetous annelids to the diet of some brazilian fishes. *In*: J.-C. DAUVIN, L. LAUBIER & D.J. REISH (Eds), Actes de la 4ème Conférence internationale des Polychètes. *Mém. Mus. natn. Hist. nat.*, **162** : 331-337. Paris ISBN 2-85653-214-4.

INTRODUCTION

The role of polychaetes as food for fish has been limited to such authors as KAWAKAMI & AMARAL (1976, 1983), AMARAL & MIGOTTO (1980), BEN-ELIAHU, GOLANI & BEN-TUVIA (1983), BADALAMONTI & RIGGIO (1989) and BEN-ELIAHU & GOLANI (1990). Their objective was to determine the position polychaetes occupy among the prey eaten by fish.

Since earlier studies off the coast of Brazil had indicated a high incidence of polychaetes as food for fish, our primary objective was to determine in greater detail their role as a major food element. We also attempted to clarify those factors conditioning the apparent selectivity of certain species of fish when catching food as related to the ecological position occupied by the polychaetes.

STUDY AREA

The samples were taken from the northern coast of the State of São Paulo between the islands of Anchieta, Vitória and Couves (23°31' - 23°45' S and 44°58' - 45°06' W, Fig. 1) from 10 to 50 m in depth. The bottom sediments consist of sandy mud with occasional patches of sand or shell fragments near the islands. Off Vitória Island in 40 and 50 m depth the sediment is muddy with sporadic presence of lime plates. Throughout the area low temperature water (<18 °C) (the so called South Atlantic Central Water - SACA) occurs near the bottom during the summer months (CASTRO FILHO *et al.*, 1987).

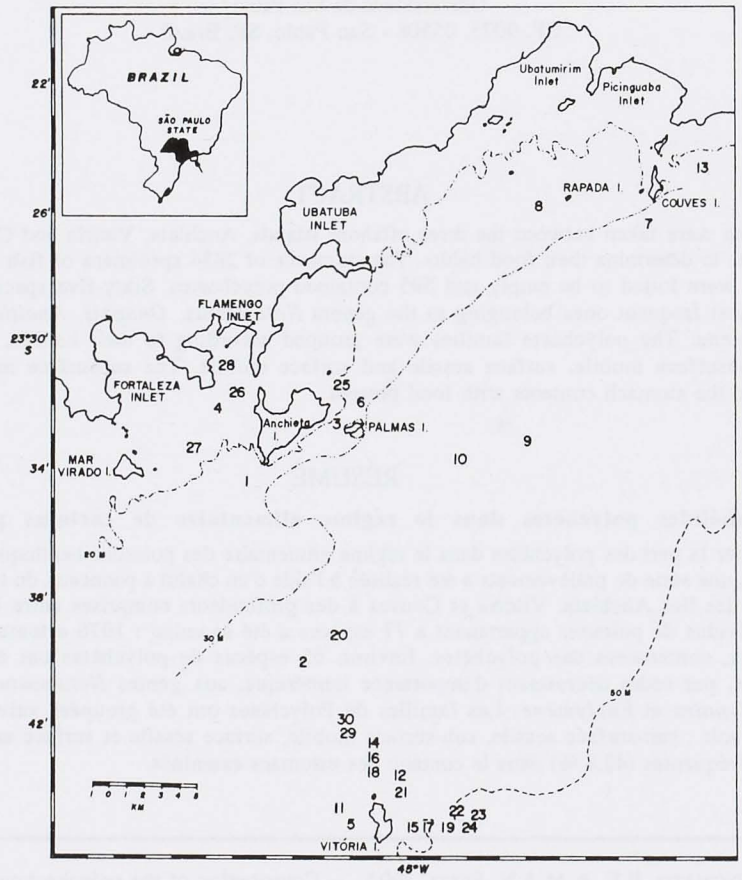

FIG. 1. — Location of catches between the islands Anchieta, Vitória and Couves.

MATERIAL AND METHODS

The samples comprised 30 trawl net hauls taken August 1978 through May 1979 and September 1982 through May 1985. The organisms caught in the net were sorted and packed on ice for future analyses of the digestive tract. Seventy percent of the specimens of the more abundant species were kept; whereas, all specimens were retained for those species with fewer numbers. In the laboratory the stomachs were removed and preserved individually with 10 % formaldehyde. The contents of each fish was analyzed individually under a dissecting microscope, and the food items recorded.

The polychaetes were separated and identified to the lowest possible taxon. The numerical frequency was used to analyze the results, each fragment possessing a head was counted. The polychaetes were grouped according to life habits, following the criteria proposed by FAUCHALD & JUMARS (1979) and GASTON (1987).

The families of polychaetes were distributed into four groups on the basis of their spatial location on the substrate or mobility as subsurface sessile, subsurface mobile, surface sessile and surface mobile.

RESULTS AND DISCUSSION

Of the 2834 stomachs examined from 77 species of fish, 1076 (38 %) were empty and not included in further analyses. A total of 1398 polychaetes were encountered from 595 fishes (34 %) of which 1134 could be identified at least family.

The examination of the Polychaeta present in the stomachs of the fish permitted the identification of 28 families, 42 genera and 65 species (Table 1). Those species which were numerically the most abundant are indicated with an asterisk in Table 1.

TABLE 1. — Polychaete occurrence, number of individuals and numerical frequency found on stomach contents of demersal and benthic fishes.

Species	#occur.	#inds.	Num. freq.(%)	Species	#occur.	#inds.	Num. freq.(%)
ONUPHIDAE	10	225	19.8	GONIADIDAE	130	20	1.8
Diopatra sp.	6	7	0.6	*Glycinde* sp.	3	6	0.5
**Diopatra cuprea*	3	5	0.4	*Glycinde multidens*	6	1	1.2
**Diopatra spiribranchis*	5	57	5.0	*Goniada maculata*	1	19	0.1
Diopatra splendidissima	11	22	1.9	EUNICIDAE	18	3	1.7
Diopatra tridentata	1	2	0.2	*Eunice* sp.	2	16	0.3
Mooreonuphis sp.	1	2	0.2	Unidentified	16	19	1.4
Mooreonuphis fragilis	2	6	0.5	AMPHARETIDAE	13	7	1.7
**Mooreonuphis nebulosa*	8	15	1.3	*Amphicteis sp.*	4	2	0.6
Mooreonuphis stigmatis	2	5	0.4	*Amphicteis latibranchiata*	1	6	0.2
Onuphis sp.	31	36	3.2	*Isolda pulchella*	4	4	0.5
Onuphis eremita	5	11	1.0	Unidentified	4	14	0.4
Onuphis vexillaria	1	3	0.3	LUMBRINERIDAE	9	3	1.2
Unidentified	54	54	4.8	*Lumbrineris* sp.	2	10	0.3
CAPITELLIDAE	102	222	*19.6*	*Lumbrineris tetraura*	6	1	0.9
Notomastus sp.	10	17	1.5	Unidentified	1	14	0.1
Notomastus lobatus	88	201	17.7	SIGALIONIDAE	8	3	1.2
Unidentified	4	4	0.4	*Sthenelais* sp.	2	6	0.3
CIRRATULIDAE	13	105	9.3	*Sthenelais oculata*	3	2	0.5
Audouinia tentaculata	3	5	0.4	*Thalenessa lewisii*	1	3	0.2
**Cirratulus filiformis*	5	94	8.3	Unidentified	2	14	0.3
Unidentified	5	6	0.5	TRICHOBRANCHIDAE	5	8	1.2
MALDANIDAE	80	97	8.6	*Terebellides* sp.	3	4	0.7
Euclymene sp.	6	12	1.1	*Terebellides anguicomus*	1	2	0.4

TABLE 1 (continued). — Polychaete occurrence, number of individuals and numerical frequency found on stomach contents of demersal and benthic fishes.

Euclymene dalesi	7	16	1.4	*Terebellides stroemi*	1	12	0.2
Unidentified	67	69	6.1	PILARGIDAE	8	11	1.1
OPHELIIDAE	18	89	7.9	*Loandalia americana*	7	1	0.1
Ammotrypane aulogaster	5	57	5.0	*Sigambra grubii*	1	9	0.1
Armandia sp.	1	1	0.1	NEPHTYDAE	6	7	0.8
Armandia agilis	6	18	1.6	*Nephtys* sp.	5	2	0.6
Travisia forbesii	6	13	1.2	*Nephtys paradoxa*	1	8	0.2
TEREBELLIDAE	42	62	5.8	AMPHINOMIDAE	6	4	0.7
Artacama benedeni	4	10	0.9	*Pseudeurythoe* sp.	2	4	0.4
Loimia medusa	3	4	0.4	Unidentified	4	7	0.4
Pista sp.	2	2	0.2	ORBINIIDAE	5	4	0.6
Streblosoma bairdi	6	14	1.2	*Naineris setosa*	2	3	0.4
Thelepus sp.	2	4	0.4	Unidentified	3	5	0.3
Thelepus setosus	6	9	0.8	NEREIDAE	3	1	0.4
Unidentified	19	19	1.7	*Neanthes bruaca*	1	4	0.1
FLABELLIGERIDAE	38	59	5.2	Unidentified	2	4	0.4
Pherusa laevis	17	27	2.4	SABELLIDAE	3	1	0.4
Pherusa parmata	8	17	1.5	*Chone* sp.	1	3	0.1
Piromis arenosus	5	7	0.6	Unidentified	2	4	0.3
Unidentified	8	8	0.7	DORVILLEIDAE	2	4	0.4
SPIONIDAE	24	44	3.9	*Dorvillea rudolphi*	2	4	0.4
Laonice branchiata	13	31	2.7	MAGELONIDAE	2	4	0.4
Paraprionospio pinnata	1	3	0.3	*Magelona nonatoi*	2	4	0.4
Unidentified	10	10	0.9	EUPHROSINIDAE	1	4	0.4
PHYLLODOCIDAE	21	43	3.8	*Euphrosine* sp.	1	3	0.4
Anaitides sp.	1	2	0.2	HESIONIDAE	2	3	0.3
Anaitides tamoya	20	41	3.6	Unidentified	2	2	0.3
GLYCERIDAE	14	25	2.2	PECTINARIIDAE	1	2	0.2
Glycera sp.	2	2	0.2	*Pectinaria laelia*	1	1	0.2
Glycera americana	7	15	1.3	POLYNOIDAE	1	1	0.1
Hemipodus rotundus	1	4	0.4	Unidentified	1	1	0.1
Unidentified	4	4	0.4				

* Indicates most frequently occurring polychaetes in the stomach of fish.

Table 2 lists the 10 most frequently caught species of fish with the number of stomachs containing food in their stomach and the percent occurrence of polychaetes.

The feeding habits of the 10 species listed in Table 2 characterize as benthic feeders and fed specially on crustaceans, polychaetes, ophiuroids, molluscs and fish. Polychaetes were present in 38.5 % to 88.0 % of the stomachs analyzed.

Other fish, among which *Dasyatis americana* HILDEBRAND & SCHROEDER, 1828 and *Narcine brasiliensis* (OLFERS, 1831), fed upon polychaetes regularly but were not included herein due to the small number collected.

The above results confirm the observations of KAWAKAMI & AMARAL (1983), who showed that up to 86.0 % of the total volume of organisms present in the stomach of two species of flat-fishes, *Etropus longimanus* and *Symphurus jenynsi* were polychaetes. AMARAL & MIGOTTO (1980) also observed a high incidence of polychaetes in the stomachs of *Paralonchurus brasiliensis* (77.3 %), *Micropogonias furnieri* (68.5 %) and *Orthopristis ruber* (39.9 %) in Ubatuba region of Brazil.

The grouping of polychaete families as a function of habits constitutes an effective way to clarify why they are preferred by certain fishes. As discussed by CHAO & MUSIK (1977) for young Sciaenidae, the search for food

TABLE 2. — List of the most frequently caught fish species, number of stomachs with food and percent occurrence of polychaetes in the stomach contents.

Species	Stomach with contents	Frequence polychaete
RHINOBATIDAE		
Zapteryx brevirostris (Muller & Henle, 1941)	41	56.1 %
ARIIDAE		
Genidens genidens (Valenciennes, 1839)	24	87.5 %
SERRANIDAE		
Dules auriga Cuvier, 1829	26	38.5 %
GERREIDAE		
Eucinostomus gula (Cuvier, 1830)	22	63.6 %
POMADASYIDAE		
Conodon nobilis (Linnaeus, 1758)	39	53.8 %
Orthopristis ruber (Cuvier, 1830)	38	57.9 %
SCIANIDAE		
Micropogonias furnieri (Desmarest, 1823)	108	73.1 %
Paralonchurus brasiliensis (Steindachner, 1815)	336	71.7 %
Umbrina canosai Berg, 1895	68	42.6 %
BOTHIDAE		
Etropus crossotus Jordan & Gilbert, 1891	27	51.9 %

depends more on the habits of the prey than on selective preference. We grouped the families of polychaeta in accordance to the position they occupy in the bottom and their presumed ability to escape the predator. The polychaete families were distributed in four groups as indicated in Table 3.

TABLE 3. — Polychaete families distributed according to the position they occupy in the sediment.

1. SUB-SURFACE SESSILE	3. SURFACE SESSILE
Flabelligeridae	Ampharetidae
Mageloniidae	Cirratulidae
Maldanidae	Sabellidae
Pectinariidae	Terebellidae
	Trichobranchidae
2. SUB-SURFACE MOBILE	4. SURFACE MOBILE
Capitellidae	Amphinomidae
Glyceridae	Eunicidae
Goniadidae	Dorvilleidae
Lumbrineridae	Euphrosinidae
Nephyidae	Hesionidae
Orbiniidae	Onuphidae
Phyllodocidae	Polynoidae
Pilargidae	Sigalionidae
Spionidae	

The 10 most frequently caught fish species were placed into three groups on the basis of their feeding behaviour (Fig. 2). One group of species feed mainly on subsurface mobile polychaetes; these were: *Eucinostomus gula, Genidens genidens, Micropogonias furnieri, Zapteryx brevirostris* and *Umbrina canosai*. A second fed on subsurface mobile ones; these were: *Etropus crossotus* and *Conodon nobilis*. The third group

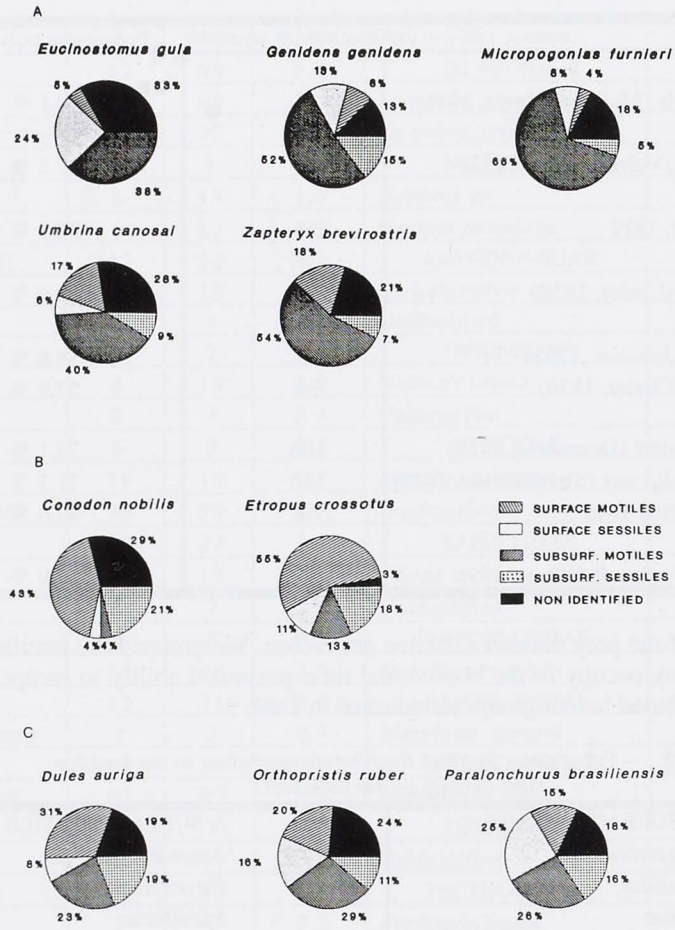

FIG. 2. — Species of fish grouped in function of preferences on polychaetes position and mobility. A, those eating mainly surface mobile forms. B, those feeding on subsurface mobile ones. C, those revealing no definite preference.

showed no defined preferential habit to the position on the substrate or mobility of the polychaetes they caught; these were: *Orthopristis ruber, Paralonchurus brasiliensis* and *Dules auriga.*

The results of the study on the distribution of the polychaetes in the same area carried out by MORGADO (1988), when analyzed under the same criterion, showed values very similar to those corresponding to the stomach contents.

This comparison between the polychaetes found in the area and the polychaetes ingested indicates that these animals are being preyed upon by members of the fish community in accordance to their availability. However, when one analyses the data species by species, it becomes obvious that the preference for one or another group of polychaetes by a determined species of fish can occur. This indicates the influence of other factors, such as morphological adaptations or the capacity to explore the substract in a different way.

The group of fish which feed mainly on subsurface mobile polychaetes have the capacity to churn up the sediment in the search for food and frequently uses this manner to capture their prey. On the other hand, *Etropus*

crossatus and *Conodon nobilis* present certain limitations concerning this capacity, restricting themselves more to the capture of a group less available in the environment, the surface mobiles.

CATEGORIES	POLYCHAETES	
	in the area (MORGADO, 1988)	in the stomach analysis
Surface mobile	27.7 %	25.0 %
Surface sessile	15.1 %	18.0 %
Sub-surface mobile	42.0 %	42.8 %
Sub-surface sessile	15.3 %	14.3 %

The criterion of accessibility herein adapted may contribute to a better evaluation of the role of polychaetes as more frequent or preferential prey of different marine organisms, and also to clarify the existence of specific food selection processes on the part of their habitual predators.

ACKNOWLEDGEMENTS

We are particularly indebted to the Instituto Oceanográfico (IO-USP) for the logistics support. Special thanks should be given to Dr. Claudia ALVES MAGALHÃES and Jacques VIELLIARD for their suggestions. We are also grateful to Dr. Donald REISH and two anonymous reviewers who improved earlier versions of this work. This research was supported by funds from the "Conselho Nacional de Pesquisa (CNPq)", "Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP)" and "Comissão Interministerial de Recursos do Mar (CIRM)".

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