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POLYCHAETES TROPHIC STRUCTURE IN TODOS OS SANTOS BAY (BA-BRAZIL) ⁽¹⁾

(With 5 figures)

RÔMULO BARROSO ⁽²⁾⁽³⁾

PAULO C. PAIVA ⁽²⁾⁽⁴⁾

ORANE F. S. ALVES ⁽⁵⁾

ABSTRACT: The trophic structure of polychaetes was studied between March 1997 and May 1997 in Todos os Santos Bay. Thirty two survey stations were sampled with a van-Veen grab. A total of 1802 individuals (39 families) was recorded and grouped into 5 trophic groups. Deposit-feeders (represented by surface deposit-feeders and subsurface deposit-feeders) were the dominant group, followed by carnivores. Suspension-feeders and omnivores were less frequent. The dependence of trophic groups on environmental variables was estimated by means of a stepwise multiple regression analysis. The trophic groups were related to sediment type and depth. Carnivores were positively correlated to coarse sediments, being more abundant in the southwestern region of the bay. Suspension-feeders were positively correlated to gravel and depth. This correlation seems to be associated to the fixation of these animals in such substrate, since most suspension-feeders are tubicolous species, and to the lower hydrodynamism of greater depths that facilitates the feeding process of such species.

Key-words: Polychaeta, trophic groups, trophic structure, Todos os Santos Bay, Brazil.

RESUMO: Estrutura trófica dos anelídeos poliquetas da Baía de Todos os Santos (BA-Brasil).

A estrutura trófica dos anelídeos poliquetas da Baía de Todos os Santos foi estudada no período de março a maio de 1997. As coletas foram feitas com um busca fundo do tipo van-Veen em 32 estações oceanográficas. Um total de 1802 indivíduos pertencentes a 39 famílias foram identificados. Os grupos tróficos mais abundantes foram os depositívoros, representados pelos de superfície e pelos de subsuperfície, seguido pelos carnívoros. Os onívoros e suspensívoros foram pouco comuns. A relação de dependência entre os grupos tróficos e as variáveis ambientais foi avaliada através de uma análise de regressão múltipla passo a passo. Houve correlação significativa dos grupos tróficos com os tipos de sedimento e com a profundidade. Os carnívoros ocorreram preferencialmente em sedimentos grossos e foram mais abundantes na região sudoeste da baía e os suspensívoros foram relacionados positivamente com a porcentagem de cascalho e com a profundidade. A relação dos suspensívoros com a porcentagem de cascalho possivelmente se deve ao fato da maior parte desses animais serem tubícolas, necessitando deste substrato para a fixação, e a relação com a profundidade pode ser explicada pelo baixo hidrodinamismo de profundidades maiores, o qual quando muito intenso, inviabiliza a captura de alimento por esses organismos.

Palavras-chave: Polychaeta, grupos tróficos, estrutura trófica, Baía de Todos os Santos, Brasil.

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² Universidade Federal do Rio de Janeiro, Departamento de Zoologia, IB, CCS, Bl. A, Ilha do Fundão, 21941-590, Rio de Janeiro, RJ, Brasil.

³ Research Fellow of Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq).

⁴ Programa de Pós-Graduação em Ciências Biológicas/Zoologia, Museu Nacional/UFRJ, Quinta da Boa Vista, São Cristóvão, 20940-040, Rio de Janeiro, RJ, Brasil.

⁵ Research Fellow of PICDT, Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES).

INTRODUCTION

Structural analysis of benthic community is an important tool to describe changes in space, with applications on point source pollution monitoring, and in time, including the descriptions of changes in system health. (HEIP, 1992). Moreover, such analysis is one of the most parsimonious ways to evaluate energy flow in marine ecosystems (PAIVA, 1994).

Polychaete worms play a critical role in the macrobenthic productivity of continental shelves (KNOX, 1977) and their multiple feeding types allow for an evaluation of the macrobenthic trophic structure using only this taxon (GAMBI, GIANGRANDE & FRESI, 1982; BIANCHI & MORRI, 1985). Distributional patterns of polychaetes trophic groups have been proved to be sensitive to several factors including environmental disturbances, food supply, sediment type, anthropogenic effects and hydrodynamic conditions (SANDERS, 1958; LEVINTON, 1972; PROBERT, 1984; GASTON, 1987; GASTON & NASCI, 1988; PAIVA, 1994; MUNIZ & PIRES-VANIN, 1999; RUTA, 2001).

This trophic group approach was improved for the polychaetes with the establishment of the "feeding guild" concept by FAUCHALD & JUMARS (1979). Afterwards, DAUER, MAYBURY & EWING (1981) and GASTON (1987) amended this classification for some families, however the general pattern was maintained.

The aim of this paper is to describe the spatial distribution patterns of polychaete trophic groups in Todos os Santos Bay, and their dependence to some environmental variables.

STUDY AREA

Todos os Santos Bay is a depositional marine system, with many estuarine areas close to the rivers mouths (SOUZA, 1996). This Bay is the largest in Brazil, located in the northeastern coast in the State of Bahia (12°35'30"-13°07'30"S and 38°29'00"-38°40'00"W). It has an area of ca. 1.100km² and is surrounded by a coastline of ca. 200km reaching 32km in width. In most parts of the bay, the bottom is relatively flat, with depths ranging from 2 to 10 meters. The deepest region of the bay reaching approximately 50 meters, is in the Itaparica-Salvador channel (MACEDO, 1977). Geomorphology, geology, climate, vegetation and hydrographical condition aspects have also been studied by MACEDO (op. cit). A detailed study about sedimentation on the bay has been conducted by BITTENCOURT, FERREIRA & NAPOLI (1976), the oceanography by WOLGEMUTH *et al.* (1981) and the effects of petroleum and its derivatives in benthic communities by PESO-AGUIAR *et al.* (2000).

This important water body has been subjected to strong human actions such as, fishing activities, tourism, the use for navigation for commercial and industrial production transport (SILVA *et al.* 1996), urban sewage disposal, portuarie activities, bottom mining and channel dredging. These activities can cause different impacts on marine communities (GERMEN/UFBA - NIMA, 1997).

MATERIAL AND METHODS

Samples were taken between March and May 1997 in 32 survey stations, with 3 replicates for faunistic analysis and 1 for sedimentary analysis. The study region was divided in 6 regions according to its geomorphological characteristics. The stations location were: 5 stations in northwestern region (N1, N2,...), 6 in central region (C1, C2, ...), 4 in northeastern region, between the Madre de Deus and Mare Islands (M1, M2,...), 5 in southwestern region, between Itaparica Island and western coast (I1,I2,...), 7 in southeastern region, between Itaparica Island and Salvador city (S1,S2,...) and 5 in the adjacent shelf (P1, P2,...) (Fig.1).

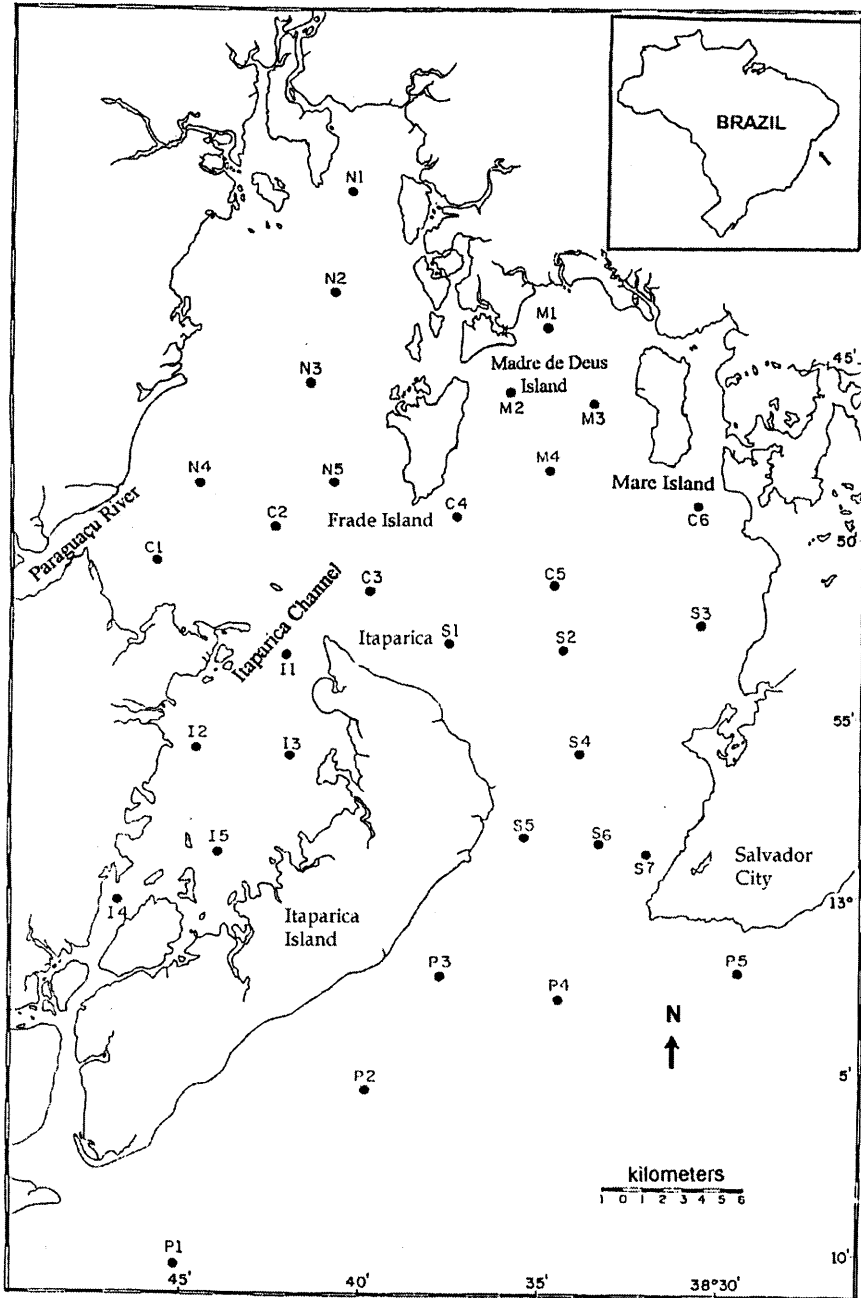


Fig.1- Map of the study area with the 6 regions and 32 sampling stations.

All replicate samples were taken with a 0.1m² van-Veen grab. The sediment collected was washed through a 1.0mm mesh sieve and the material retained was preserved in a 5% buffered formalin solution before sorting and identification, at family level, in the laboratory.

Hydrographic data were obtained using Nansen bottles with reversing thermometers. The salinity was measured using an refratometer and the dissolved oxygen content was determined by the Winkler titration method. The sediment was submitted to the standard dry-sieve pipette method described in SUGUIO (1973).

Families classification into feeding guilds was based on FAUCHALD & JUMARS (1979) and GASTON (1987). Five trophic groups were considered: carnivores, surface deposit-feeders, subsurface deposit-feeders, suspension-feeders and omnivores. Families classified into two trophic groups were included in both.

The ecological importance of each trophic group in the sampling stations was evaluated using a Trophic Importance Index, adapted from PAIVA (1994).

$$TII = \sum_{i=1}^s \ln n_i + 1 \quad \text{where,}$$

s = number of families of the trophic group in the sample.
 n_i = number of individuals of the ith family in the sample.
 ln = natural logarithm.

The dependence of trophic groups on environmental variables was estimated by means of a stepwise multiple regression analysis (LEGENDRE & LEGENDRE, 1983), with a significance level of 0.05.

Differences of Importance Index of each trophic group (carnivores, surface deposit-feeders, subsurface deposit-feeders, suspension-feeders and omnivores) among regions in the bay were assessed by means of an Analysis of Variance (ANOVA) with unequal replication and a post-hoc Tukey test (ZAR, 1996).

RESULTS AND DISCUSSION

Classification of families in trophic groups is presented in table 1, as well as their density in each sampling station. The most abundant trophic groups at Todos os Santos Bay were the deposit-feeders, represented by surface and subsurface deposit-feeders. For the surface-deposit feeders, Spionidae was the most abundant family. Some authors consider this family as an interface-feeder, owing to its capability of changing its feeding behavior according to hydrodynamic conditions (DAUER, MAYBURY & EWING, 1981). For the subsurface-deposit feeders group, the most abundant species were *Notomastus lobatus* Hartman, 1947 (Capitellidae) and *Sternaspis capillata* Nonato, 1966 (Sternaspidae). The second most abundant trophic group was the carnivores, represented mainly by Syllidae and Polynoidae species. The omnivores and suspension feeders were not abundant in the samples. The fact that the deposit feeders were the most important group was also found by PAIVA, (1994); MUNIZ, SUMIDA & PIRES-VANIN (1998) and RUTA (2001), thus, this seems to be a common pattern in studies of polychaetes trophic structure in the southern Brazilian continental shelf.

TABLE 1
Density (ind./ 0.3 m²) of polychaete families in each station and their trophic groups

Families/stations	N1	N2	N3	N4	N5	M1	M2	M3	M4	C1	C2	C3	C4	C5	C6	I1	I2	I3	I4	I5	S1	S2	S3	S4	S5	S6	S7	P1	P2	P3	P4	P5	T.G.					
Polynoidae	2	1	2	2	2	20	3	2	1	2	2	4	3	7	7	4	2	1	1																C			
Polydoridae														1	2																			C				
Pholoididae																																			C			
Sigalionidae	1	1		3	2		2	4	1	1	1	1	1	2	1	1																		1	C			
Chrysopetalidae																																		1	C			
Eulepethidae																																		3	2	C		
Amphinomidae																																			C			
Phyllodoctidae	1						1	2	4	3	3	1	1	1	1																			1	C/B			
Hesionidae																																			C			
Pilargidae																																			C			
Syllidae	1						3		2	26	13	34																							C			
Nereitidae							4	5	1	2	1	3	5	4	1																			1	14	5	6	O
Nephtyidae																																			1	1	C/B	
Goniadidae							2		2																											C		
Glyceridae																																				1	C/B	
Onuphidae							1	1	1	27		2	3																						13	9	C/S	
Eunicidae							1			1	2	4	5																						8	1	C	
Lumbrineridae							3		1	37	1	1																							4	4	3	C/B
Lysaretidae							3																												7	1	C/S	
Dorvilleidae																																			8	1	C/S	

continued

Families/station:																conclusion																	
	N1	N2	N3	N4	N5	M1	M2	M3	M4	C1	C2	C3	C4	C5	C6		I1	I2	I3	I4	I5	S1	S2	S3	S4	S5	S6	S7	P1	P2	P3	P4	P5
Orbiniidae	1					1	5	1			1	2			4	7	7	4	3	3							1		3	7	B		
Paraonidae						2	1								1	4	1	1														1	S
Spionidae	14	2				8	1		4	2	10			9	37	5	18	2	13	5	6			4	1		2	6	28	S/F			
Magelonidae	2					2	1		1	1	1			2	7		1	2					1	2	5		2	1	9	S			
Poecilocheatidae	1					6	2				2					1	2	1											1	1	S		
Cirratulidae	1					16	1		1	5	1			4		1	18	15	1									6	4	S			
Fiabelligeridae											2					2		4	3										1	S			
Cossuridae																	1	1														B	
Ophelidae						3	7		7	2				3	41		2	1	1				1	1	1				1	1	5	B	
Sternaspidae	65	3				2			49	1	2			1	59		23	1												2	B		
Caprellidae	5	6	5	6	12	1	2	25	4	16	15			2	8	2	6	3	5	3	5	7	7	4	4		1		6	B			
Arenicolidae																							1								F/S		
Maldanidae									9					11	44													12	12	B			
Owenidae																											3		S/F				
Pectinariidae						1				1	1			3	1							2					1		B				
Ampharetidae						1								3										1				7	4	S			
Terebellidae						4								16	2		1	2					4	10		4	3	2	S				
Trichobranchida						1				1	1	2	7	1	2		1	2											2	S			
Sabellidae										1				1		1							3	1					1	F			
Serpulidae																	1											2	1	1	F		

(C) carnivores, (S) surface deposit-feeders, (B) subsurface deposit-feeders, (F) suspension-feeders and (O) omnivores.

The spatial distribution of trophic groups at different regions of the bay is presented in figure 2. Table 2 shows the differences trophic groups importance among regions assessed by the ANOVA and Tukey Test post-hoc. The omnivores were significantly more abundant in the shelf adjacent to the bay (region P) in relation to northwestern and southeastern regions (stations N and S), and the carnivores were significantly more abundant in southwestern region (region I) in relation to the bay's northwestern region (region N). The positive correlation between carnivores importance and coarse sediments is the probable explanation for the greatest abundance of this group in region I. The low abundance of carnivores in region N was probably due to the fact that the muddy sediments dominated this depositional region (mainly clay), and the carnivores showed a preference by coarse sediments as will be seen below.

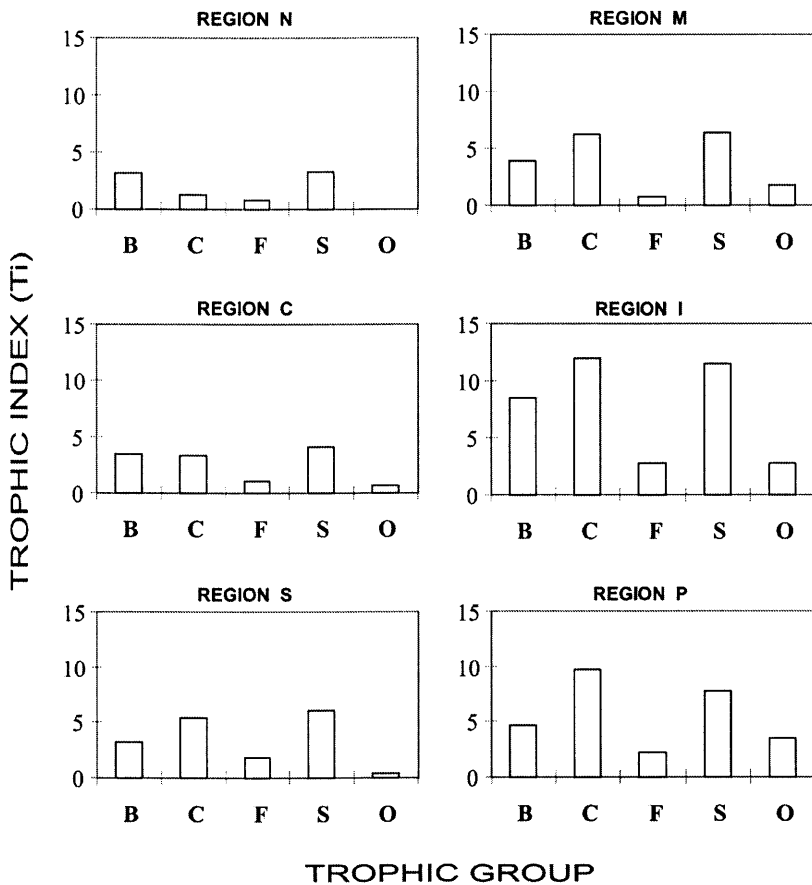


Fig.2- Trophic Importance Index of each trophic group for regions at Todos os Santos Bay. (C) carnivores, (S) surface deposit-feeders, (B) subsurface deposit-feeders, (F) suspension-feeders, (O) omnivores.