Polychaeta in the estuary of the Piauí River, Sergipe, Brazil

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ABSTRACT

The distribution of infaunal polychaetes was examined in order to discriminate polychaete assemblages in the estuary. In March 1987, 4,398 specimens were collected in 123 samples from 15 areas. A cluster and ordination analysis was used to define benthic polychaete assemblages. Two associations were present which were related to the high and low energy depositional environments and hydrological gradients. The first group, restricted to the upper reaches of the estuary, was composed of *Laeonereis acuta*, *Amphicteis gunneri*, *Heteromastus similis*, *Neanthes succinea* and *Scolelepis texana*. The second group, present in the middle section of the estuary, was dominated by *Prionospio (P.)* cf. *dubia*, *Scoloplos* sp., *Euclymene* sp., *Isolda pulchella* and *Magelona papillicornis*.

RÉSUMÉ

Polychètes de l'estuaire de la rivière Piauí, Sergipe, Brésil

Cette étude porte sur la distribution de la faune des Polychètes de l'estuaire du fleuve Piauí. 4 398 spécimens furent récoltés en mars 1987, en 123 échantillons de 15 régions. L'analyse en composantes principales et la classification hiérarchique permettent de définir les assemblages des Polychètes benthiques. Deux groupes ont été identifiés: le premier est restreint à la partie amont de l'estuaire du Piauí; il est formé de *Laeonereis acuta*, *Amphicteis gunneri*, *Heteromastus similis*, *Neanthes succinea* et *Scolelepis texana*. Le deuxième groupe est présent dans la partie moyenne de l'estuaire, avec les espèces dominantes *Prionospio (P.)* cf. *dubia*, *Scoloplos* sp., *Euclymene* sp., *Isolda pulchella* et *Magelona papillicornis*.

INTRODUCTION

The estuary of the Piauí River is located in the state of Sergipe, Brazil. A qualitative study of polychaetes was made off-shore (NONATO & LUNA, 1970 a, b) and in the Sergipe River Estuary (SANTOS, 1979) which provided information on the distribution of polychaetes and other animals. Studies were made in the Piauí-Fundo-Real system to characterize the region, according to physicochemical variations (ALVES, 1989), zooplankton (ARAUJO, 1989), sediment and Foraminifera distribution (ZUCON, 1989) and phytoplankton (FRANCO, 1991). Macrobenthic

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fauna studies in other estuarine regions of the Brazilian Coast have been made by BEMVENUT (1987), LANA (1986) and LANA *et al.* (1989). The objective of this paper is to describe the distribution and diversity of subtidal polychaetes in a tropical estuary located in northeast Brazil.

STUDY AREA

The Piauí River is part of the estuarine complex, located in Sergipe, Brazil (11°22'30" S / 32°22'33" W) (Fig. 1). It is approximately 40 km long and 50-5,000 m in width. The depth ranges from 1-27 m (FRANCO, 1991). The water temperature ranged from 24 to 29.5 °C in 1986/87 (ALVES, 1989). The region is characterized by dry and wet periods. The rainfall ranges from 241.5 mm/month in July to 46.1 mm/month in December (ALVES, 1989). The sediment of the Piauí River varies from coarse sand poorly selected in the upper estuary to fine sand well selected at the mouth. The total granulometrical distribution has a median value of 2.5 (± 1.1) and varies from coarse sand to clay. The highest percentage of fine sand was 43.6 (ZUCON, 1989). The selection varies from 1.16 % well selected sediment to 53.18 poorly selected sediment. The areas 7 to 10 (Fig. 1) are characterized by biodetritus.

The salinity varies as a result of seasonal fluctuations of rainfall, river run-off, and tidal amplitude (FRANCO, 1991). These waters can be divided into three categories: 1) limnetic water from river flow in the upper part of the estuary, 2) mixohaline waters from the mixture of river and coastal water and 3) mixoeuhaline waters at the mouth of the river (ALVES, 1989).

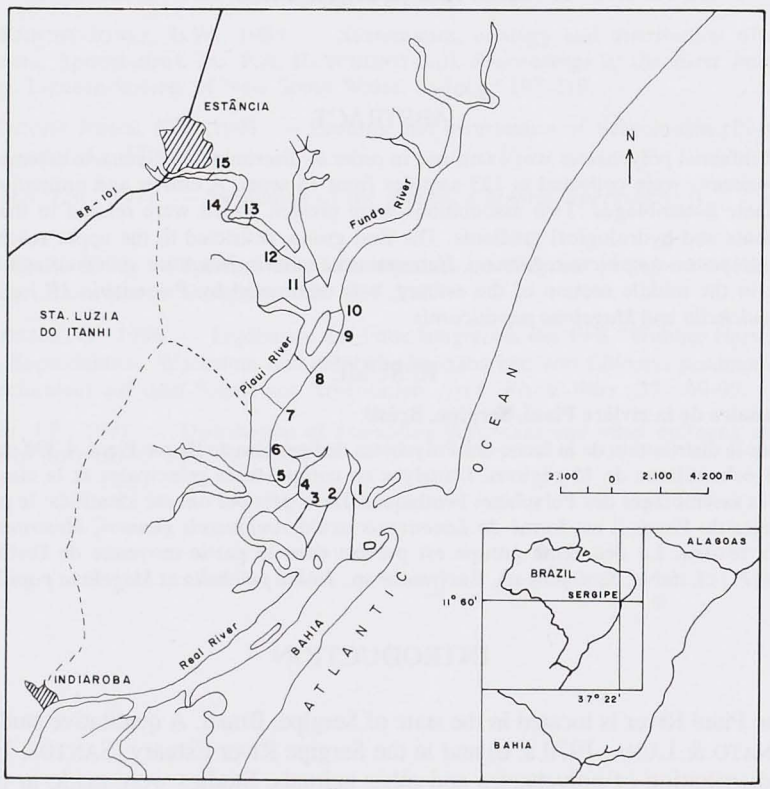

FIG. 1 — Piaui River, showing the position of the samplings areas.

Dissolved oxygen generally ranged from 2.2 to 6.8 mg. l^{-1} (ALVES, 1989). The median estuarine region showed the highest level of nutrients, diatom density and zooplankton (ALVES, 1989; FRANCO, 1991; ARAUJO, 1989). The changes in nutrients are probably a consequence of the annual climatological and hydrographical pattern.

MATERIAL AND METHODS

Samples were taken in March 1987. Fifteen areas were sampled along 35 km of the estuary (Fig. 1). A total of 123 samples were taken using a 10 liter Van Veen grab. Three stations were sampled in each area, and four replicates were taken at each station, one for sediment analysis and three for biological analysis. Only two stations were sampled in areas 12 - 15. Each biological sample was washed through a 0.5 mm sieve. Larger animals were picked from the sieve. Remaining material was stained with Bengal Rose and fixed in formalin. Samples were transferred to 70 % alcohol prior to identification. Environmental parameters and other biological aspects of the Piauí estuarine system were studied concurrently (ALVES, 1989; ARAUJO, 1989; FONTES, 1989; ZUCON, 1989; FRANCO, 1991).

The species were ranked according to occurrence, abundance and percentage of total number of specimens. The Shannon-Wiener diversity index and evenness indices were used (GRAY, 1981). A matrix data with the abundance of 80 species and 41 samples was used for the data analysis. The replicates were summed up by area for cluster and ordination analysis. The variables indicating abundance were logarithmically transformed using the expression $Y_{ij} = \log (x_{ij} + 1)$ (GREEN, 1979).

The matrix was subjected to a cluster analysis (WPGMA), employing the Czekanowski Coefficient of similarity. The multivariate similarity patterns were also studied with a Q-mode Principal Component Analysis (PCA). The analysis in Q mode was done because of the large number of species. A computer program ACOMP written by J. L. VALENTIN (IEAPM - MM) was used.

RESULTS

A total of 4,398 specimens was collected which belonged to 81 taxa in 32 families. The dominant taxa were identified by occurrence and abundance. The most abundant species were *Prionospio (P.)* cf. *dubia*, *Laeonereis acuta*, *Euclymene* sp. and *Isolda pulchella* (Table 1). The diversity ranged from 0.01 to 2.8 and was higher from areas 2 to 10. The lowest value was found at areas 11 to 15 (Table 2).

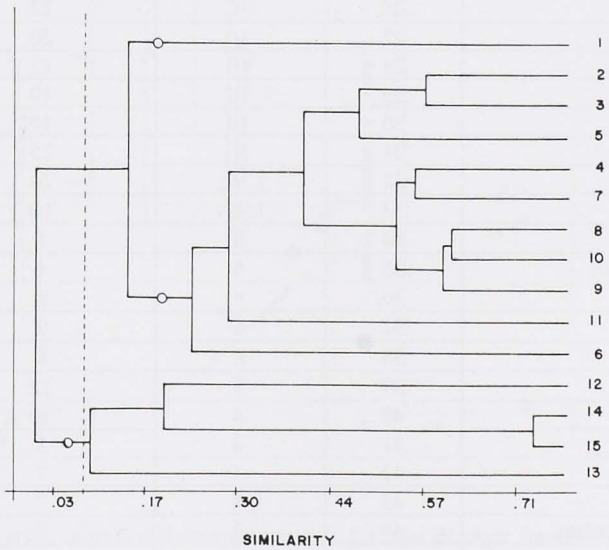

FIG. 2. — Dendrogram for 80 species of polychaetes, considering 15 areas. The abundance of the species was summed up in each area.

Cluster analysis indicated: 1) Area 1 at the mouth of the river is euhaline and is separated from the others. The salinity was about 35,0 ‰, and the sediment was principally well sorted fine sand. 2) Areas 2 to 11 were clustered together with two groups: areas 2, 3, 5 and 4, 7, 8, 9, 10, 11. The salinity ranged from 18-30, P.S.U. and the

TABLE 1. — Rank and abundance of the most common polychaetes taxas collected in the Piauí River, Sergipe.

Species	Rank	Occurrence (n°)	Numbers for survey (Total)	% of total
Scoloplos sp.	1	51	207	4.70
Prionospio (P.) cf. dubia	2	45	593	13.48
Isolda pulchella	3	36	352	8.00
Tharyx sp.	4	35	63	1.43
Ceratocephala crosslandi	5	35	134	3.04
Euclymene sp.	6	27	447	10.16
Poecilochaetus australis	7	26	173	3.93
Goniada maculata	8	23	47	1.00
Magelona papillicornis	9	23	278	6.32
Laeonereis acuta	10	23	1168	26.55
Sigambra grubii	11	22	32	0.72
Polycirrus cf. *plumosus*	12	21	74	1.68
Magelona nonatoi	13	18	29	0.65
Neanthes succinea	14	16	43	0.24
Stauronereis rudolphi senso	15	16	24	0.54
Cabira cf. *incerta*	16	15	35	0.79
Trochochaeta sp.	17	15	156	3.54
Diopatra A	18	15	41	0.93
Diopatra B	19	13	22	0.50
Glycera sp. A	20	12	14	0.31
Pista corrientis	21	12	15	0.34
Magelona variolamellata	22	12	33	0.75
Pectinaria catharinensis	23	12	13	0.29
Sternaspis capillata	24	11	24	0.54
Malacoceros vanderhorsti	25	11	17	0.38
Parandalia tricuspis	26	10	22	0.50
Amphicteis gunneri	27	10	26	0.59
Pectinaria catharinensis	28	10	13	0.29
Marphysa sp.	29	10	10	0.22
Kinbergonuphis spp.	30	10	10	0.22
Scolelepis sp.	31	9	15	0.34
Hemipodus B	32	9	24	0.54
Glycera americana	33	8	10	0.22
Glycinde multidens	34	8	9	0.20
Magelona posterolongata	35	6	6	0.13
Laonice sp.	36	6	8	0.18
Heteromastus similis	37	6	9	0.20
Owenia fusiformis	38	6	8	0.18
Chone sp.	39	5	12	0.27
Spiophanes sp.	40	4	30	0.68
Loimia medusae	41	4	5	0.11
Eunoe sp.	42	4	7	0.15
Lysidice sp.	43	4	7	0.15
Branchiomma nigromaculata	44	3	7	0.15
Pectinaria laelia	45	3	3	0.06
Sthenolepis grubei	46	3	5	0.11
Others	50	-	118	2.68
TOTAL			4.398	

sediment ranged from sand to silt and clay and was characterized for biodetritus in areas 7 to11. 3) Areas 12 to 15 were characterized by salinity ranging from 1 to 15 P.S.U., going from mesohaline to oligohaline zones. The sediment was mostly coarse sand.

TABLE 2. — Diversity and evenness values

Areas	Diversity	Evenness	Areas	Diversity	Evenness
1	2.14395	0.97575	9	2.46250	0.70427
2	2.67771	0.85400	10	2.16672	0.60005
3	2.44909	0.70044	11	2.47467	0.84045
4	2.88888	0.75890	12	1.04351	0.75274
5	2.00215	0.66833	13	0.66225	0.47771
6	2.52725	0.75843	14	0.24756	0.17858
7	2.39059	0.63959	15	0.01851	0.02670
8	2.18262	0.60002	TOTAL	2.79627	0.63812

These groups of areas, clustered together, were partially influenced by changes in polychaete density. However, these results divided the Piauí River in 3 regions: the mouth, area 1, the lower estuary, area 2 to 11 and the upper estuary, area 12 to 15.

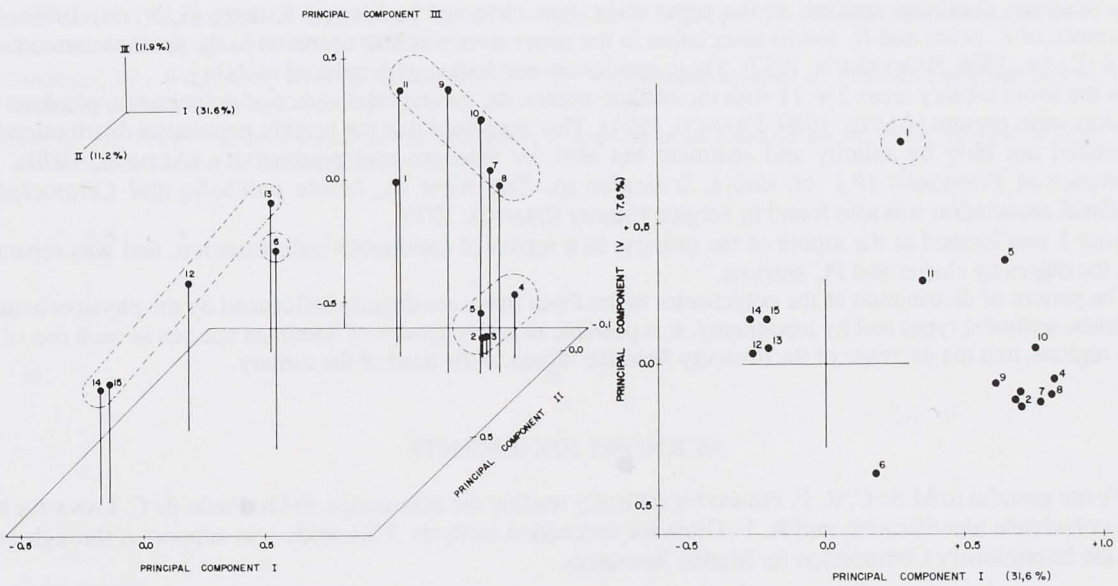

FIG. 3. — Position of 15 areas on principal components: left, I, II and III; right, I and IV showing principally area 1.

By projecting the scores in the orthogonal space of the first three principal components (Fig. 3A), it was possible to see that groups of stations were perfectly discriminated. The first axis was related to the abundance of *Prionospio (P.)* cf. *dubia*, *Scoloplos* sp., *Euclymene* sp., *Isolda pulchella* and *Ceratocephala crosslandi*, indicating the most similar areas from 2 to 11 divided into two groups: 2 to 5 and 7 to 11. The second axis was

related to the abundance of *Laeonereis acuta*, *Amphicteis gunneri*, *Scolelepis texana*, *Hemipodus* sp. in areas 12 to 15. The fourth axis was probably related to the negative abundance of species (Fig. 3B). Almost the same groups were obtained by cluster analysis: area 1 isolated, areas from 2 to 11 clustered together and areas 12 to 15 clustered together (Fig. 2).

DISCUSSION

Tropical estuaries are influenced by the seasonal rain pattern and the resulting effects due to sedimentation, erosion, dissolved oxygen and nutrients. Nearly all the benthic surveys of tropical estuaries have been taken along the east and west coast of India, (ALONGI, 1990). The most extensive investigations of subtropical estuarine macrobenthos were near Brisbane in Queensland, Australia (STEPHENSON *et al.*, 1972; STEPHENSON *et al.*, 1977). STEPHENSON *et al.* (1972) stated that workers in the subtropics and tropics failed to find communities with only a few dominant species.

MAURER & VARGAS (1984) found a depauperated infauna in the soft bottom benthos in the Gulf of Nicoya, Costa Rica. They concluded that tropical estuarine communities were generally low in density and biomass. The mean Shannon-Wiener diversity for polychaetes was of 1.91, range = 0 to 3.09 (MAURER *et al.* 1988).

In the Piaui River the diversity was similar to the values found in Costa Rica (MAURER*et al*, 1988). The influence of industrial wastes in the Piauí River estuary could be considered as a factor causing the low diversity. Comparison of the polychaetes obtained in the Piauí River estuary and the Sergipe estuary in the northeastern region of Brazil (SANTOS, 1979) showed the same pattern of species composition and species abundance.

Zones of changes occurred in the Piauí River, and it was possible to divide the river in three region, the mouth, the lower estuary and the upper estuary. Similar regions were found in foraminiferan studies of Piaui River (ZUCON, 1989) and macrobenthic studies of Sergipe River (SANTOS, 1979).

The upper part of the Piauí Estuary, areas 12 to 15, was dominated by *L. acuta* and *A. gunneri*. The occurrence of *L. acuta* as dominant species, in the upper river, was observed in Sergipe Estuary (SANTOS, 1979). The occurrence of *L. acuta* and *H. similis* association in the upper river was also observed in the southeastern coast of Brazil (LANA, 1986; BEMVENUTI, 1987). These species are euryhaline with reduced mobility.

In the lower estuary areas 2 to 11 with mixohaline waters, the greatest abundance of polychaetes, plankton and nutrients were present (ALVES, 1989; FRANCO, 1991). This suggested that the benthic population distribution was influenced not only by salinity and sediment but also for nutrients and productivity (ALONGI, 1990). The occurrence of *Prionospio (P.)* cf. *dubia*, *Scoloplos* sp., *Euclymene* sp., *Isolda pulchella* and *Ceratocephala crosslandi* association was also found in Sergipe Estuary (SANTOS, 1979).

Area 1 was located at the mouth of the estuary, in a region of continuous sedimentation, and was separated from the others by cluster and PC analysis.

The pattern of distribution of the polychaetes in the Piauí River are directly influenced by the physicochemical gradients, sediment types and by topography. It is possible to notice groups of dominant species in each one of the three regions, and the decrease of the diversity from the mouth to the head of the estuary.

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