ON ZOOPLANKTON OF A MANGROVE ECOSYSTEM CLOSE TO MACAU, RIO GRANDE DO NORTE, BRAZIL

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ABSTRACT

The data from a diagnostic survey of zooplankton of a mangrove area close to the city of Macau, Rio Grande do Norte, Brazil conducted between May 1996 and March 1997 are presented here. The proximity of large salinas to the area of study reflected in the high salinity values obtained at all stations studied. The seasonal fluctuations of zooplankton production with a distinct peak in May at all stations is attributed to the natural process of enrichment of the ecosystem rather than to eutophication.
Key words: Zooplankton, mangrove, Macal RN

RESUMO

Zopoplankton de um Ecossistema de Manguezal Próximo à Macau, Rio Grande do Norte, Brasil

Os dados do levantamento do zooplâncton de uma área de manguezal próximo à cidade de Macau, Rio Grande do Norte, Brasil, realizado entre maio de 1996 e março de 1997, são apresentados. Nas proximidades de grandes salinas a área de estudo apresentou altos valores de salinidade em todas as estações estudadas. As flutuações sazonais da produção do zooplâncton com picos distintos em maio em todas as estações é atribuído ao processo natural de enriquecimento do ecossistema e não devido à eutrofização.
Palavras chave: Zooplâncton, manguezal, Macau RN

INTRODUCTION

The city of Macau situated about 225 km to the west of Natal, Rio Grande do Norte, Brazil, has witnessed impressive expansion of salt industry which caters to the needs of internal market as well as for exportation. Taking advantage of suitable environmental conditions, attempts were also made to culture *Artemia* and penaeid shrimps, which in spite of the initial promise as a viable economic proposition, has suffered serious set backs due to the spread of infections.

The development of large scale salinas was not achieved without serious environmental damages, reducing the area of mangrove forest and bringing about environmental changes which are not conducive to the survival of the mangrove trees.

Another concern from the point of view of environmentalists is the possible environmental impact due to the large number of oil producing wells operating in the close vicinity of these mangrove areas. Recognizing the need to monitor the region for possible environmental damages, PETROBRÁS, supported the present diagnostic survey of zooplankton which is expected to serve as a basis for future long-term monitoring.

Since a number of investigations were carried out on zooplankton of Potengi estuary (SANKARANKUTTY *et al.*, 1984, 1991, 1995; ESNAL & SANKARANKUTTY, 1985; SANKARANKUTTY & MEDEIROS, 1985; NAIR & SANKARANKUTTY, 1988 and SANKARANKUTTY, 1991), where the ecosystem is recognized as highly polluted, a comparison of the data from the two regions can indicate incidence of environmental deterioration in the Macau region. A comparison with zooplankton of the inshore region is also possible since a study was conducted during 1988-1989 (SANKARANKUTTY *et al.*, 1991) utilizing one of the platforms of PETROBRÁS located close to Macau.

MATERIAL AND METHODS

Five stations were chosen for sampling (Fig. 1), as required by PETROBRÁS, within the mangrove creeks, and the sampling was done at approximately bi-monthly intervals from May 1996 to March 1997, except at stations 1 and 2 where no data are available for the months of July (Station 1 and 2) and March (Station 2). The sampling of zooplankton was done with a conical net having a mouth diameter of 48 cm. The samples were collected by vertical hauls from close to the bottom to the surface and three samples were obtained at each sampling from each station. Temperature and salinity values of surface water were recorded utilizing a thermometer and refractometer respectively.

RESULTS

Among the environmental parameters studied (Table 1), temperature varied marginally between 27.5° C in July at stations 3, 4 and 5 and in December at Station 1 and 2 and the maximum temperature observed was 31° C in May at Station 4. On the other hand, the salinity remained relatively high throughout the year between 31‰ in May and July at Station 5 and the exceptionally high value of 43.5‰, in December at Station 5.

Analysing the data on the seasonal fluctuation of zooplankton (Fig. 2), it is obvious that there is a clear peak of production in the month of May at all stations, Station 3 registering the largest peak of 56,698 org.m^{-3} and Station 2 presenting the smallest peak with 10,696 org.m^{-3}. A second peak of zooplankton abundance was also evident in the month of March, the number ranging between 4296 org.m^{-3} at Station 3 and 5753 org.m^{-3} at Station 2. Considering all the stations together, it is clear that the ecosystem investigated did not present any marked variation from station to station in zooplankton production.

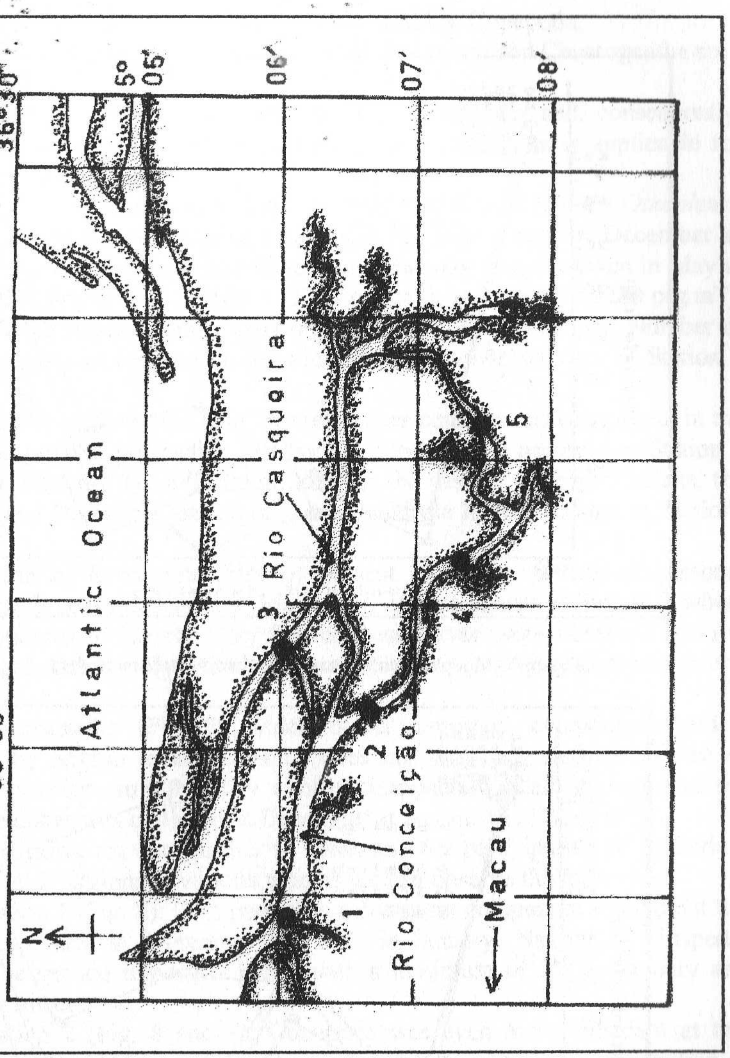

Figure 1 - Map of Macau area, indicating the sampling stations.

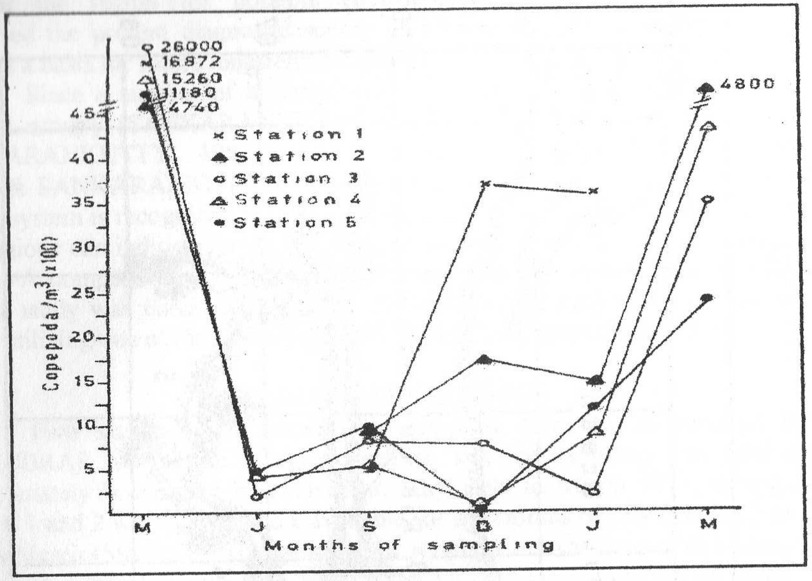

Figure 2 - Zooplankton fluctuation at the five stations studied.

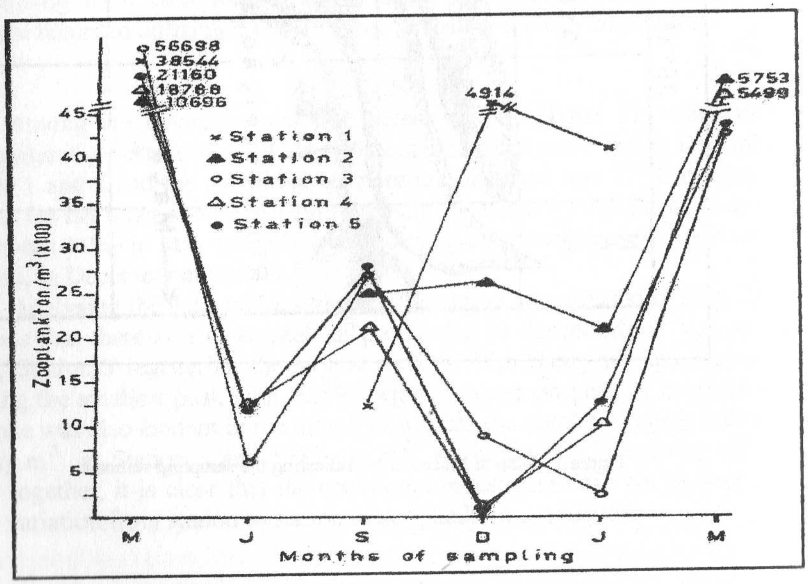

Figure 3 - Fluctuation of Copepod population at the five stations studied.

Among the components of zooplankton in the samples, Copepoda, Appendicularia, nauplii of Cirripedia, zoeae of Brachyura and Chaetognatha are well represented.

Copepoda (Fig. 3) is normally the most numerous, and, consequently, the pattern of seasonal abundance observed for zooplankton is applicable for Copepoda as well.

Appendicularia (Fig. 4) is also represented (mostly *Oikopleura dioica* Fol) in the samples almost throughout the year except in December at Station 4. The number of appendicularians is high in the samples taken in May at Station 1 (1008 org.m^{-3}), at Station 5 (1744 org.m^{-3}), at Station 3 (2280 org.m^{-3}). At Station 4 the largest number (709 org.m^{-3}) was collected in July. Number of appendicularians was reduced during the period December/January at Station 3 to 5.

Nauplii of Cirripedia (Fig. 5) are another conspicuous component in the samples, yhe peak of production in May (21,336 org.m^{-3}) occurred at Station 3 followed by Station 1 (13,840 org.m^{-3}). As in the case of appendicularians, the period between December and January presented the lowest number at Stations 3, 4 and 5.

Zoeae of Brachyura (Fig. 6) present a similar pattern of seasonal fluctuation with peaks observed in May at all stations except at Station 2 where the peak appeared in March. Very few of these larvae were observed in July, December and January. By March, they were once again quite common in the samples.

Chaetognatha (Fig. 7) which is na important component (mostly represented by *Sagitta tenuis* Conant), does not show any definite pattern of seasonal fluctuation. In July, they almost disappeared at all stations and the maximum number was collected in December at Station 1 (112 org.m^{-3}).

Analyzing the data further to determine the participation of individual component at all stations in various months we can observe the following:

Station 1 (Fig. 8): Copepoda was a dominant component throughout the year, between 40% in September and 81% in January. Nauplii of Cirripedia constitute the second important group with a minimum of 3% in January and 40% in September.

Station 2 (Fig. 8 and 9): Copepoda was even more abundant at this station representing 39% in September and up to 83% in March. Contribution of the larvae of Cirripedia was relatively small, varying between 3% in January and March and 41% in September when they were even more abundant than Copepoda.

Station 3 (Fig. 9): We have a diffent picture altogether at this station. While Copepoda dominated between December and March (87% in December, 85% in January and 82% in March), nauplii of Cirripedia were conspicuous in September (53%) and May (38%). In July, Appendicularia dominated with a participation of 52%.

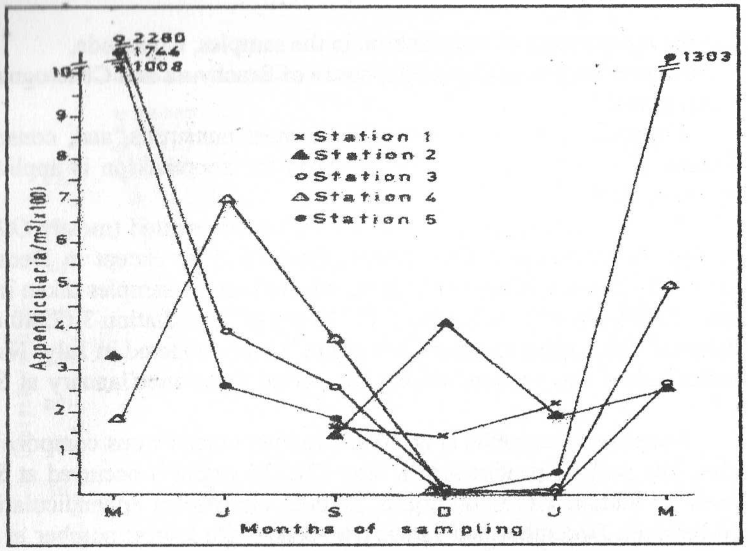

Figure 4 - Fluctuation of appendicularia population at the five stations studied.

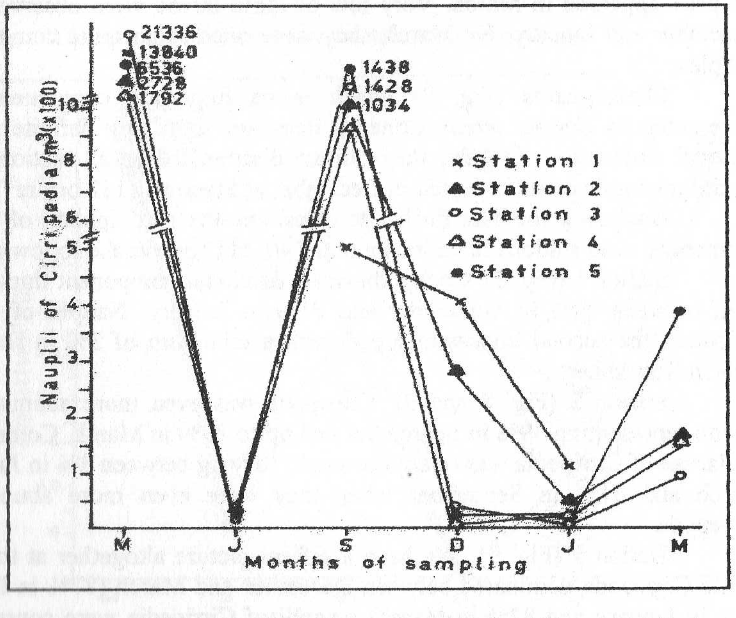

Figure 5 - Fluctuation in the number of larvae of Cirripedia at the five stations studied.

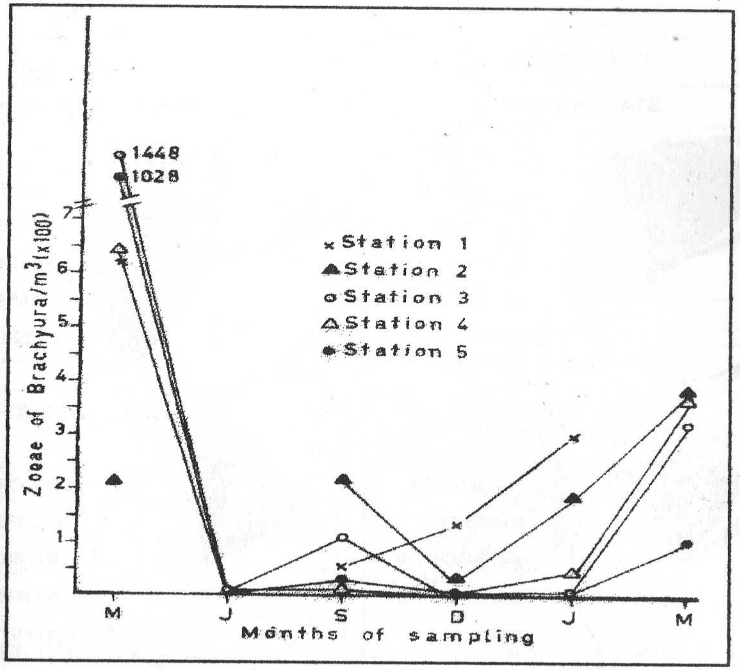

Figure 6 - Fluctuation in the number of larvae of Brachyura at the five stations studied.

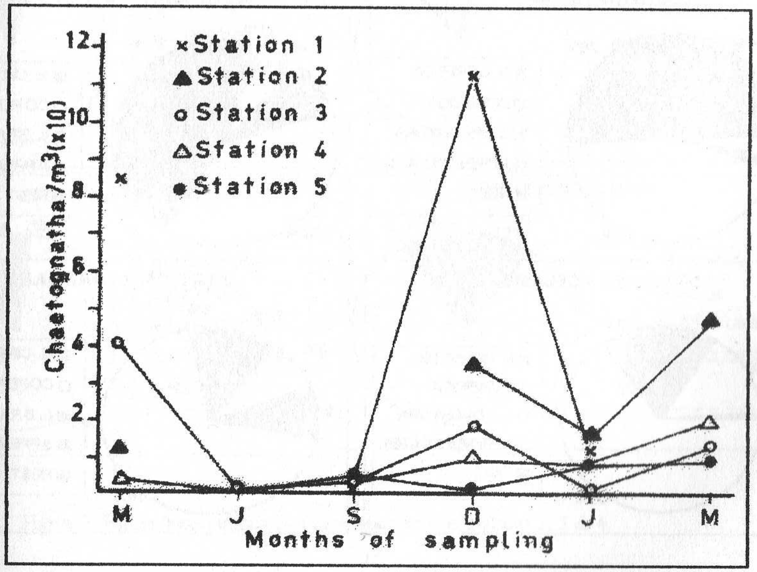

Figure 7 - Fluctuation in chaetognath population at the five stations studied.

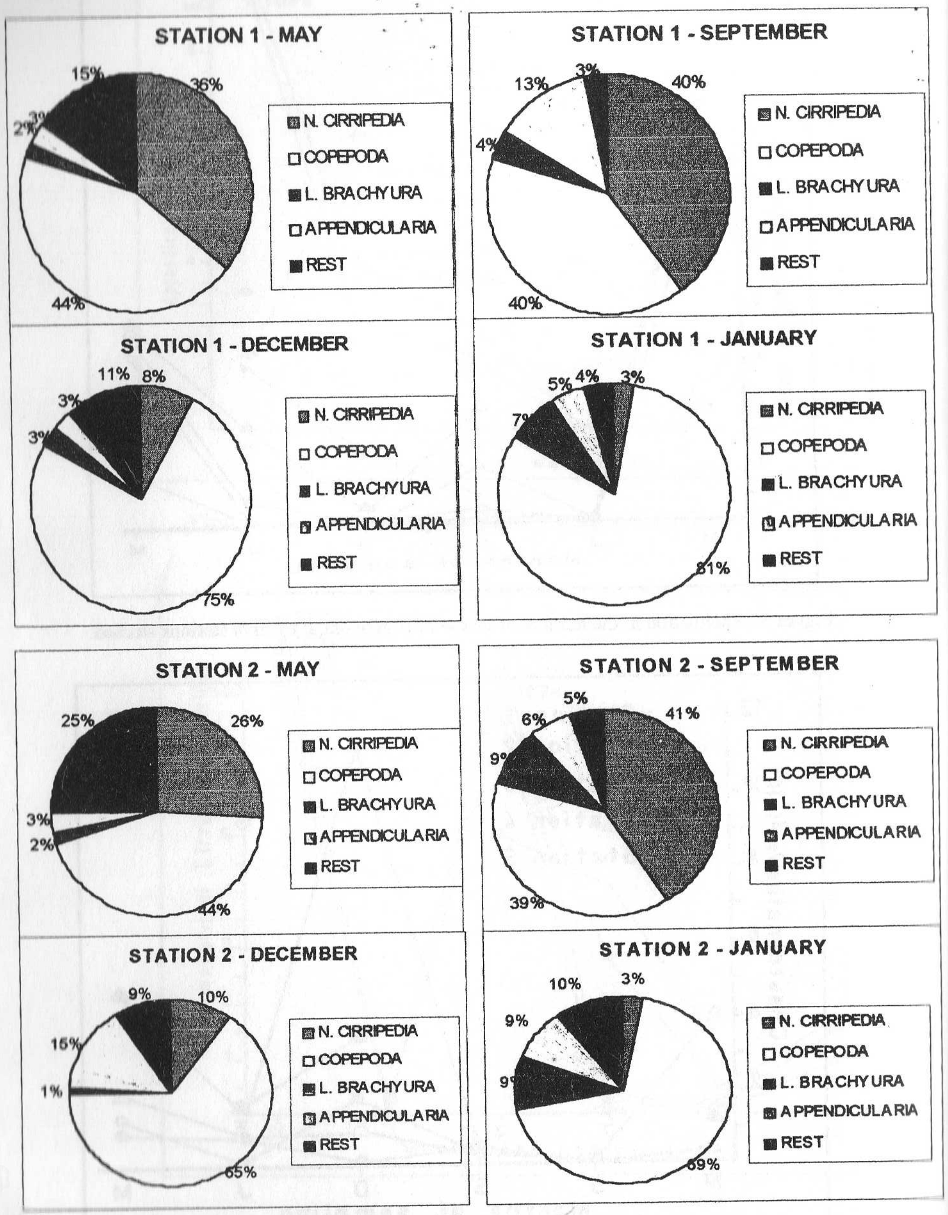

Figure 8 - Percentage composition of zooplankton at stations 1 and 2.

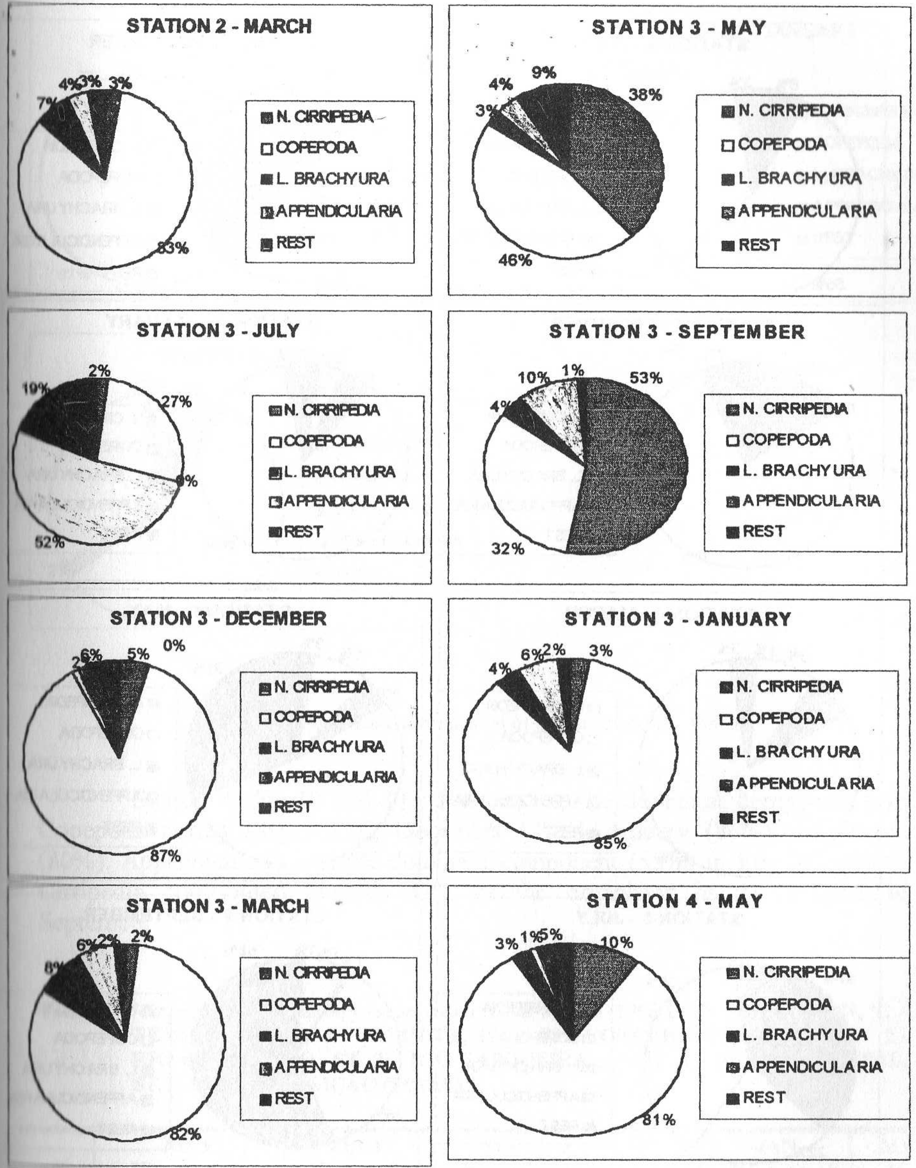

Figure 9. Percentage composition of zooplankton at stations 2, 3 & 4.

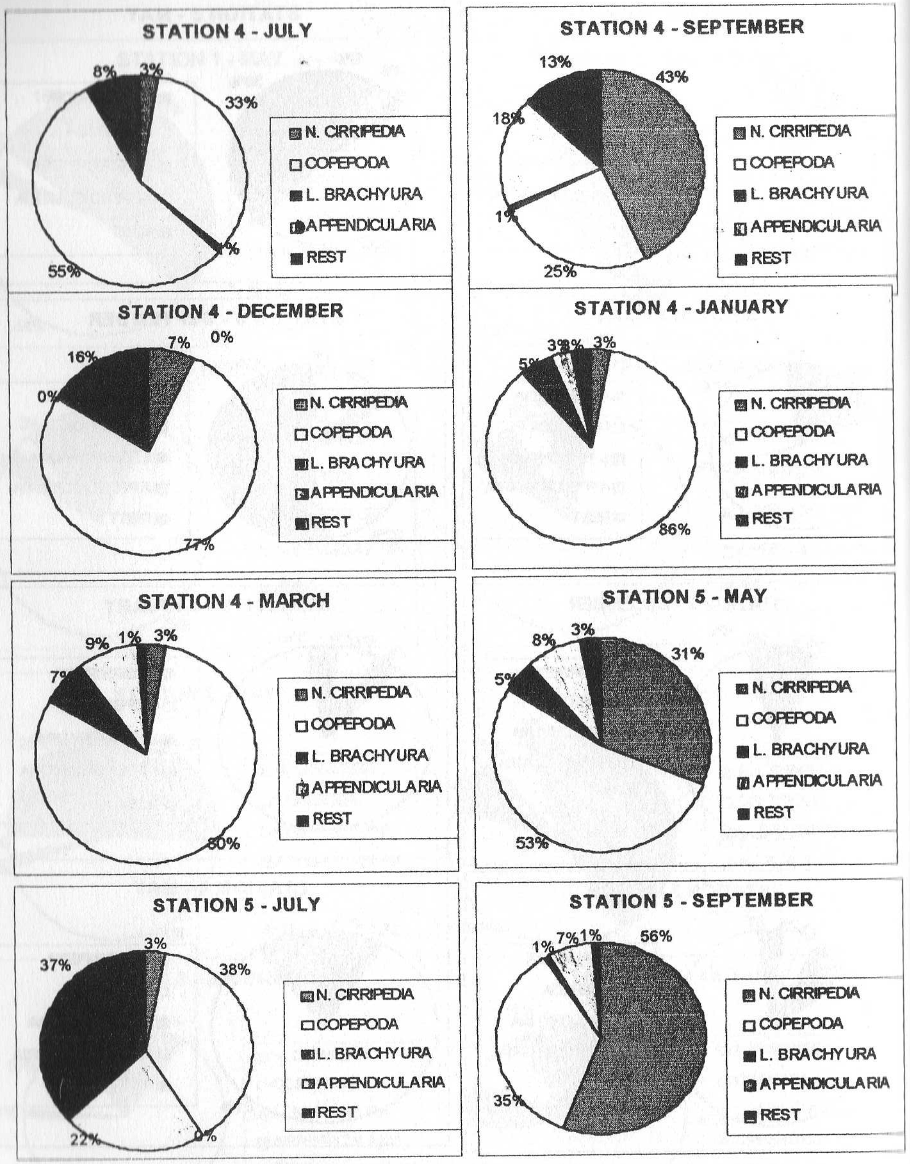

Figure 10 - Percentage composition of zooplankton at stations 4 & 5.

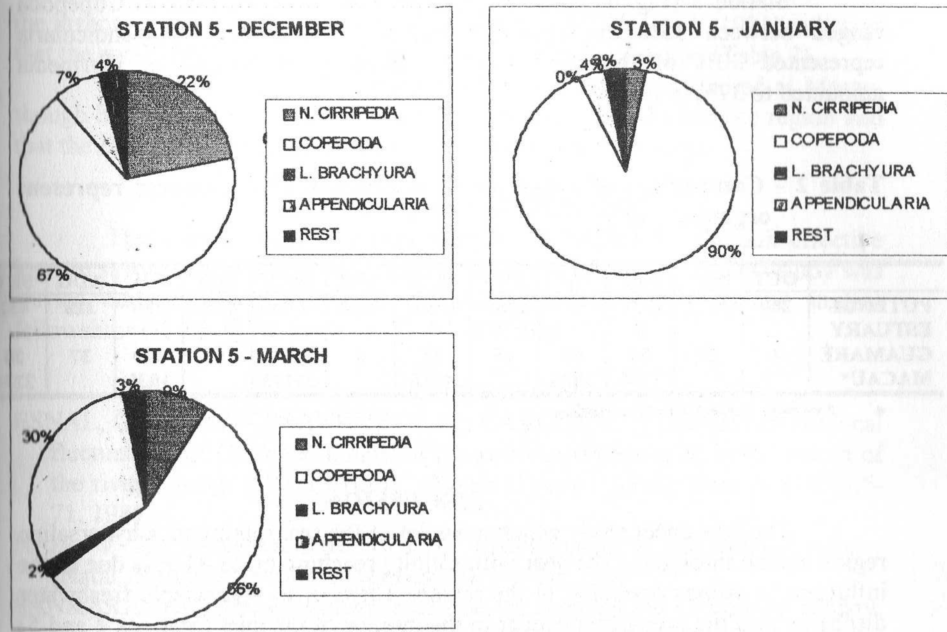

Figure 11 - Percentage composition of zooplankton at station 5.

Station 4 (Fig.10 and 11): Here again, the dominant component was Copepoda during May (81%), December (77%), January (86%) and March (80%). Appendicularia was the dominant component (55%) in July. Nauplii of Cirripedia contributed towards 43% of the organisms in the samples in September.

Table 1 - Temperature and salinity values observed at Macau (1996-1997) ST-STATION, °C – TEMPERATURE , S – SALINITY, ST. 1 - RIO CONCEIÇÃO (BARRA), ST. 2 - RIO CONCEIÇÃO ST. 3 - RIO CASQUEIRA , ST. 4 - SALINA CRISTAL, ST. 5 - RIO CONCEIÇÃO (FINAL)

	MAY		JULY		SEP		DEC		JAN		MARCH	
ST	°C	S	°C	S	°C	S	°C	S	°C	S	°C	S
1	29.5	34.5			29	38	27.5	40	29.5	38		
2	29.5	34			28	35.5	27.5	42	30.5	37	29.5	40
3	30	34	27.5	40	28	39	28.5	42	29	42	29.5	41
4	31	31.5	27.5	38	28	39.5	28	42	29	42	29	40
5	30.5	31	27.5	31	28	42	28	43.5	29	39	29	40

Station 5 (Fig. 11 and 12): The percentage contribution of Copepoda ranged between 35% in September and 90% in January. Appendicularia represented 30% of the organisms in March while nauplii of Cirripedia amounted to 37% in July.

Table 2 - Comparison of zooplankton production (the numbers represent organisms/m^3)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SET
POTENGI ESTUARY	287	5622	12738	-	37527	13137	7204	7754	4770	586	326	452
GUAMARÉ	4	17	54	68	15	11	3	21	14	190	37	28
MACAU*			1756	1834		4985		29173		1036		2234

- **Average value from five stations**

DISCUSSION

The area under study which is an ilet of the sea, represents a hypersaline region almost throughout the year with salinity reaching up to 43.5‰ due to the influence of salinas operating in the region. There is no appreciable freshwater discharge into the ecosystem except in the interior of the inlet (Stations 4 and 5) where a modest drop in salinity was observed in May (31.5 and 31‰ respectively).

In spite of the relatively stable condition of the ecosystem, a certain level of enrichment of the ecosystem is evident in May when there was a clear and proeminent rise in zooplankton production. During this period there is an overall increase in the number of all planktonic organisms, especially Copepoda and nauplii of Cirripedia. Since there is a relatively efficient flushing of the ecosystem due to the semidiurnal tide and an almost total lack of freshwater discharge into the system, no significant variation in the composition and production of zooplankton was seen among the five stations.

Table 2 presents the data collected from elsewhere for comparison with the present study. The zooplankton production is significantly high in the estuary of Potengi (the data from the intermediate station is utilized here for comparison, SANKARANKUTTY *et al.*, 1995) where all three stations studied showed not only a larger production but also a shift in the production peak (February) compared to the peak observed in May at Macau. While the seasonal fluctuation observed at Macau can be recognized as a consequence of enrichment of the ecosystem due to rainfall, in Potengi estuary such flutuation is also due to large scale discharge of domestic as well as industrial products. This assumption can be substantiated by the fact that the zooplankton peak normally occurs following the raining season under natural conditions while in Ptengi such peaks were observed during the dry season when there is a concentration of nutrients of domestic and industrial origin, resulting in the eutrophication of the ecosystem.

A comparison of data obtained during the present study with those from the inshore region close to Macau (SANKARANKUTTY *et al.*, 1991) indicates that the zooplankton production is very low in the inshore region (Table 2).

In summary, it can be mentioned that the ecosystem studied at Macau, though hypersaline in character, is more productive than the inshore region and that the enrichment of the ecosystem is through a natural process.

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