

# A COMPARISON OF THE MARINE AND ESTUARINE BENTHIC FAUNA OF THE NEARSHORE REGIONS OF THE ARABIAN SEA

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The distribution and abundance of the benthic fauna of the Arabian sea were studied in the nearshore region at a depth of 10 fathoms, about 7 miles off Cochin. The results showed that the macrofauna was more abundant than the meiofauna. The foraminiferans and the nematodes formed the dominant groups of the meiofauna. The larger foraminiferans such as *Rotalia beccarii* occurred in fair numbers in the macrofauna as well. The macrofauna was mostly represented by gastropods, bivalves and a few small bottom-dwelling fishes. A comparison of the benthic fauna of this area with that of the backwater revealed that although the main groups of the fauna were the same in both the areas, the species composition was different. The benthic biomass in the nearshore area was higher than those regions of the backwater which had similar substrata. The values obtained were 6.37 gm/m<sup>2</sup> in the nearshore region as compared to 2.44 gm/m<sup>2</sup> and 3.36 gm/m<sup>2</sup> in the estuarine region. However, the benthic biomass at the mouth of the backwater as has been reported earlier was considerably higher than that of the nearshore region. In the backwater the variations in the salinity and the nature of substrata were thought to be the main factors controlling the distribution and abundance of the benthic fauna; but in the nearshore region, since salinity is less variable, it seems that the nature of the substratum is the primary factor governing the abundance of the bottom fauna. The substratum in the nearshore region was predominantly clayey-silty and this may account for the absence of larger macrofauna.

## INTRODUCTION

A preliminary report on the bottom fauna of Cochin backwater has dealt with the distribution and abundance of the macro and meiofauna (Desai and Krishnan Kutty 1966). As a continuation of this work the benthic fauna in the nearshore region of the Arabian sea, off Cochin was studied and this paper presents a comparison of the benthic biomass of the nearshore region and the backwater.

## MATERIAL AND METHOD

Samples of the bottom fauna were collected by two types of grabs namely Peterson and Van veen as described earlier (Desai and Krishnan Kutty 1966). The former sampled an area of 0.044 m<sup>2</sup> and the latter 0.048 m<sup>2</sup>. Both these grabs were found to work efficiently on the muddy bottom of nearshore regions. The macrofauna was collected by washing the samples through a 0.5 mm sieve as described earlier except that the samples were sieved on board after mixing thoroughly with water. The meiofauna samples were obtained by inserting a plastic tube, 1.85 cm in diameter and 5 cm in length, from the top surface into the mud collected by the grab. This sample was first washed through 0.5 mm sieve and then through

0.062 mm sieve. The organisms of the macro and meiofauna thus collected were preserved in 4-5% formalin. The forms were then identified, counted and weighed after drying.

#### SAMPLING AREA AND ITS HYDROGRAPHY

The sampling station fixed was at a depth of 10 fathoms, just about seven miles off Cochin (Fig. 1). This station being somewhat away from the backwater is characterised by more stable hydrographic conditions than the backwater. Ramamirtham and Jayaraman (1960) and Sastry and Myrland (1960) studied the hydrographical features of the continental shelf off Cochin and along the south Kerala Coast respectively. These authors have reported upwelling in this area during the monsoon months which is followed by sinking during the post-monsoon period. These changes result in the fluctuations of temperature, salinity and oxygen along the vertical profile. The bottom temperature at a depth of 10 fathoms varied between 24°C and 28.5°C during November-January period, salinity between 33.5 and 35‰ and dissolved oxygen from 4.5 to 5 ml/L.

#### SUBSTRATUM

The grain size analysis of the substratum showed that it was predominantly muddy. Coarse or medium fraction of the sediment was totally absent. The composition of the sediment was as follows :

- Fine sand—7.0%
- Silt—60.5%
- Clay—32.5%

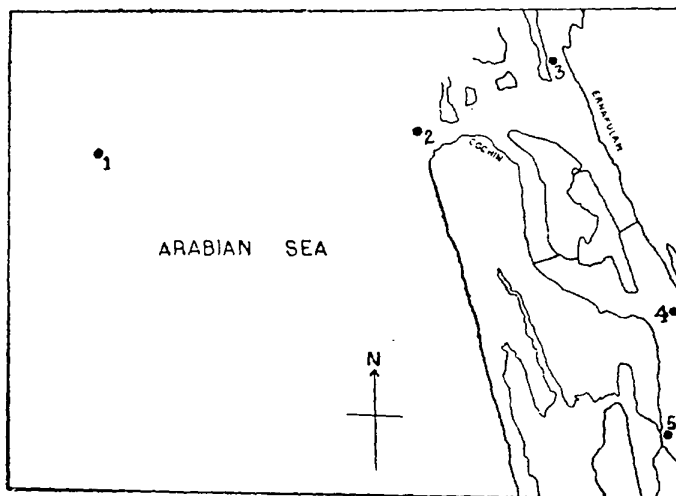


FIG. 1. Map of the nearshore region around Cochin.

## RESULTS

The results of the qualitative and quantitative examination of the twenty samples both for the macro and meiofauna collected during December 1966, have been given in Tables I and II. It can be seen from the tables that the macrofauna is more dominant than the meiofauna. The macrofauna was represented mostly by bivalves, gastropods and a few bottom-dwelling fishes. Only one species of bivalve, *Meretrix ovum* was fairly abundant in all the samples, average number in the total sample being 158/m<sup>2</sup>. Only the young bivalves of about 1.5 to 2 mm in size were present in the sample, the adults being completely absent. This probably indicates a heavy settlement of larvae here. The gastropods were represented by three forms, *Canculus clanguloides*, *Nassa* sp. and *Conus* sp. of which *C. clanguloides* was most abundant. The average number per square metre for *C. clanguloides* was 146, for *Conus* sp. 149 and for *Nassa* sp. 74.

Among fishes only the mud dwelling forms such as *Oligolepis acutipinnes* and *Bregmaceros maclellandi* were seen and their average abundance was 4/m<sup>2</sup>.

Polychaetes and the gastropods, *Dentalium* and *Cavelinea* occurred occasionally and these gastropods were represented by empty shells.

The larger foraminiferan, *Rotalia beccarii* though a member of the meiofauna was also collected along with other macrofauna. Its average abundance was 12675/m<sup>2</sup>.

The foraminiferans and the nematodes were the dominant groups of the meiofauna. These occurred in almost all the samples. Their number per square metre averaged 114722 and 220520 respectively. Among the foraminiferans, *R. beccarii* was the predominant form. The other species recorded were *R. calcar*, *Globigerina bulloides*, *Trochammina* sp., *Nonion* sp. and *Textularia* sp. The nematodes were largely represented by *Anticoma* sp., *Chromadora* sp., *Desmodora* sp., *Trichoma* sp. and some other unidentified nematodes.

The other forms occurring occasionally were Sarcodina (*Diffugia* sp. ?), polychaetes of the families Spionidae and Sternaspidae, post-veliger stages of gastropods, ostracods and some unidentified crustaceans.

*Average biomass*

Average values of the dry weight of macro and meiofauna are summarised in Table II. The total biomass was 6.37 gm/m<sup>2</sup>, of which the major portion was contributed by the macrofauna such as the gastropods which gave a value of 3.897 gm/m<sup>2</sup> and the foraminiferans which were 1.25 gm/m<sup>2</sup> and the rest was made up of nematodes, bivalves and fish.

## COMPARISON OF THE MARINE AND ESTUARINE FAUNA

Desai and Krishnan Kutty (1966) while studying the bottom fauna of the Cochin backwater reported that due to the influx of large quantities of fresh water during the monsoon months, the hydrographic conditions in the backwater, especially the salinity showed wide fluctuations. The salinity changes were more marked

TABLE I  
Number/m<sup>2</sup> of benthic fauna in different samples collected from the nearshore region of Cochin

Sample No.	1	2	3	4	5	6	7	8	9	10
<i>Meiofauna</i>										
Sarcodina	—	—	—	—	—	—	—	—	—	—
Foraminiferans	669,368	1037,520	14,875	55,781	11,156	26,031	18,594	63,218	—	29,750
Nematodes	156,186	368,152	208,248	308,653	282,622	632,180	122,717	81,812	215,685	56,937
Polychaetes	—	—	—	—	3,719	—	—	—	—	—
Gastropods- Post veliger stages	14,875	—	—	3,719	—	—	—	—	—	—
Unidentified Crustacea	—	—	—	—	—	—	—	—	—	—
Ostracod	—	—	—	—	—	—	—	—	—	—
<i>Macrofauna</i>										
Foraminiferans	45,895	250	16,250	1,137	6,250	659	22,396	250	20,625	2,523
Polychaetes	46	—	—	—	22	—	—	—	—	—
Bivalves	—	22	105	188	312	479	125	646	42	250
Gastropods	—	—	—	—	—	—	—	—	—	—
<i>Canculus</i> sp.	125	750	354	—	42	188	125	105	—	625
<i>Conus</i> sp.	604	—	437	167	250	—	63	—	—	105
<i>Nassa</i> sp.	—	229	146	—	—	—	—	—	—	63
Fish	22	—	—	—	22	—	—	—	42	—

TABLE I (Contd)

Sample No.	11	12	13	14	15	16	17	18	19	20
<i>Meiofauna</i>										
Sarcodina	—	—	—	—	—	—	—	—	—	3,719
Foraminiferans	3,719	100,405	—	29,750	14,875	14,875	7,437	133,874	11,156	52,062
Nematodes	14,875	237,997	29,750	126,436	178,498	509,463	137,592	174,779	100,405	457,401
Polychaetes	—	—	—	—	—	—	—	—	—	—
Gastropods- Post veliger stages	—	—	—	—	—	—	—	—	—	—
Unidentified Crustacea	—	—	—	3,719	—	—	—	—	—	—
Ostracod	—	—	3,719	—	—	—	—	—	—	—
<i>Macrofauna</i>										
Foraminiferans	18,637	14,067	22,479	8,021	9,542	8,563	24,562	10,979	2,047	12,675
Polychaetes	—	—	—	—	—	—	—	—	—	—
Bivalves	105	188	105	208	42	105	83	63	42	63
Gastropods	—	—	—	—	—	—	—	—	—	—
<i>Canculus</i> sp.	—	146	22	22	84	84	42	42	63	105
<i>Conus</i> sp.	167	250	250	105	125	63	188	—	—	271
<i>Nassa</i> sp.	—	125	63	42	42	271	105	125	105	125
Fish	—	—	—	—	—	—	—	—	43	—

TABLE II

Average weight in gm/m<sup>2</sup> of the benthic fauna in the nearshore region and in the backwater near Cochin. The value of the biomass in different stations of the backwater are calculated from Desai and Krishnan Kutty (1966). Station 1—nearshore region, Station 2—Barmouth, Stations 3, 4 and 5—estuarine region of the backwater (see Fig. 1)

Faunal groups	Stations				
	1	2	3	4	5
Foraminiferans	1.254	Not collected	3.170	0.600	0.021
Nematodes	0.661	7.816	0.100	0.827	0.188
Polychaetes	—	386.508	0.010	0.037	0.030
Bivalves	0.032	0.102	0.020	0.601	10.418
Gastropods	3.897	—	0.057	0.377	0.017
Fish	0.524	—	—	—	—
Total	6.368	394.426	3.357	2.442	10.674

in the southern region of the backwater (Stations 3-5, Fig. 1) than in the region near the sea (Station 2, Fig. 1). The substrata were also not found to be uniform in the areas studied. From the foregoing account on the nearshore region it can be seen that unlike the backwater, the salinity conditions and substrata are less variable in the nearshore region and hence the faunal composition and abundance here were different from that of the backwater.

A comparison of the benthic fauna of the two regions indicates that although the main groups of fauna were represented in both the areas, their faunal composition was different. The foraminiferans, nematodes, polychaetes, bivalves and gastropods were all found in both the regions but in the backwater the bivalves and the polychaetes were represented by more species. The greater diversity of species in the backwater may be due to different types of substrata. Three species of bivalve, *Meretrix ovum*, *Modiola striatus* and *Nuculana mauritiana* were collected from the backwater while only the younger forms of *M. ovum* occurred in the nearshore region. The polychaetes were abundant in the backwater and were represented at least by four genera while they were scarcely present in the nearshore region. The gastropod, *C. clanguloides* was common in both the areas. *Nassa* sp. and *Conus* sp. were abundant in the nearshore region although a small number of the former was also collected from the backwater. The settling stages of gastropods which were observed in considerable numbers in the estuarine region were almost absent in the nearshore region.

Among the foraminiferans *R. beccarii*, *G. bulloides*, *Textularia* sp. and *Nonion* sp. were found in both the areas, although in the backwater they were more common in the areas close to the sea.

The benthic biomass of the nearshore region was found to be much less than that of the upper reaches of the estuary which are close to the sea. It was, however, higher than the two stations in the backwater (Stations 3 & 4, Table II, Fig. 2) with substrata like that of the nearshore region containing a good percentage of silt and clay but the biomass was less than the southernmost station in the backwater (Station 5, Table II) which had a sandy substratum.

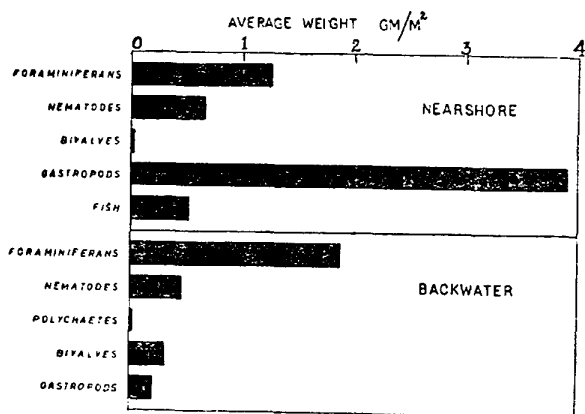


Fig. 2. Comparison of the average biomass gm/m<sup>2</sup> of different faunal groups in the nearshore region and backwater near Cochin with similar substrata.

From the above comparison it becomes evident that the nature of substrata and fluctuations in salinity are the two important factors determining the abundance of biomass. In the backwater marine conditions are only found in the region adjacent to the sea while typically estuarine conditions prevail in the lower reaches of the estuary. The biomass was found to be higher in the regions where the salinity changes were less marked (Station 2, Table II). One would therefore, expect a high biomass value in the nearshore region also where the salinity is more uniform. But the biomass here was relatively less, presumably because of a muddy substratum. This feature has also been noticed in the backwater where the substratum was largely composed of silt and clay. The biomass was generally higher where the substratum was largely composed of sand (Station 5, Table II) despite wide changes in salinity. The importance of the nature of substratum in controlling the abundance of marine organisms was also emphasised by Holme (1954) and Southward (1957). Panikkar and Aiyar (1937) observed absence of animals on substrata of thick clay and their abundance on sandy substratum. Seshappa (1953) while analysing the bottom fauna of the inshore region along the Malabar coast observed that both salinity and nature of substrata are important in determining the abundance of bottom fauna.

The very high biomass in the backwater close to the sea is only partly explained by the favourable substrata and salinity conditions. Rich supply of nutrients and high primary production in a particular area might also govern the abundance of animals. Thorson (1934) and McIntyre (1961) observed that greater nutrient supply and higher chlorophyll content of the surface water supports a greater population of benthic animals. Qasim and Reddy (1967) have found high pigment concentrations in the backwater close to the sea which indicates high primary production in this area.

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