

Quantitative Studies on Benthic Macrofauna of North-Eastern Arabian Sea Shelf

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Quantitative distribution of macrobenthos of the north-eastern Arabian Sea shelf (between lat. 24° and 16°N and long. 74° and 66°E) has been studied. Mean value of benthic biomass in this region is 7 gm⁻². Distribution of biomass shows a gradual decrease with depth. A decline in benthic biomass is also noticed in a north-south direction. Nine different faunal elements of macrobenthos exhibit patchy distribution in relation to depth and area. Polychaetes followed by bivalves form an important faunal assemblage. Dominance of sestonophages on the inner shelf and of detritophages along the middle and the outer shelf indicates a greater abundance of food. Some environmental factors such as nature of substratum, dissolved oxygen and suspended organic matter, seem to play an important role in the distribution of macrobenthos.

THE north-eastern Arabian Sea, which is a very productive area in the Indian Ocean¹, is not adequately studied^{2,3} for its benthic fauna. A survey on the benthos of the continental shelf of this region was undertaken between December 1973 and May 1974. The area covered, is approximately 276000 sq. km, lying between latitudes 24° and 16° N and longitudes 74° and 66°E and extends in the depth range of 20-140 m.

Materials and Methods

Samples were obtained using a snapper, a grab and a dredge. The samples were sieved through a 0.5 mm mesh screen and hence the results mainly pertain to macrobenthos. Standing crop in terms of biomass was estimated on a dry weight basis⁴. For determining the trophic structure, from each sample, dry weight of organisms with a similar mode of feeding was determined to find out the ratio of weight of representatives of 3 main trophic groups (deposit-feeders, suspension feeders and carnivores). Collection and analysis of suspended organic matter from bottom waters was done by following the procedure of Rao⁵.

Results and Discussion

Environmental characteristics — Bottom environment along the continental shelf of the north-eastern Arabian Sea is characterized by the following ecological factors, from December to May.

Bottom salinity fluctuated within a narrow range of 35.15 to 37.11‰. High values were observed at depths greater than 70 m and also towards the north.

Dissolved oxygen concentration in bottom waters varied from 0.67 to 5.26 ml/litre. Higher values were observed north of Bombay. In the region, south of Bombay, average lower values of 2.41 ml/litre were encountered at most of the stations.

Primary and secondary maxima of bottom temperatures were recorded in April and November

respectively. July/August and December/January periods were marked for primary and secondary minima respectively. The range in temperatures in the Arabian Sea is reported⁶ to be maximum at about 100 m depth.

Suspended organic matter which forms an important source of food for benthic organisms, ranged from 0.5 to 13 mg/litre in quantity along the shelf of the north-eastern Arabian Sea. The concentration decreased with the distance from the shore.

Benthic biomass — Benthic biomass, as determined on a dry weight basis showed a wide variation of 0.02 to 153 gm⁻² with an average of 7 gm⁻². Biomass was high (Fig. 1) and remained uniform in the region north of the Gulf of Cambay. This area showed average values of 10 gm⁻². Average biomass decreased to 5 gm⁻² in between 20° and 17°N latitudes. The area especially off Bombay was marked as a zone of low benthic production, wherein the biomass values did not exceed 1 gm⁻².

On the basis of observations on benthic biomass, the continental shelf of the north-eastern Arabian Sea can be demarcated into two distinct zones: zone I — area extending south of Indo-Pakistan border (approximately along lat. 23°N) up to lat. 20°N; and zone II — south of lat. 20°N and up to lat. 17°N. The variations (Fig. 1) within the zone and also between the adjacent stations were large, and the biomass varied considerably.

In the overall analysis, the biomass distribution showed a decreasing trend towards the south. Thus, from the average value of 33 gm⁻², between latitudes 24° and 23°N, the lowest value of 0.5 gm⁻² was recorded between 18° and 17°N latitudes. The intervening region showed a gradual decrease except for an increase close to 19°N. Humphrey¹ has attributed these differences in the benthic biomass of the Arabian Sea to higher phosphate content and higher primary production in the northern region as compared to the southern region. On the basis

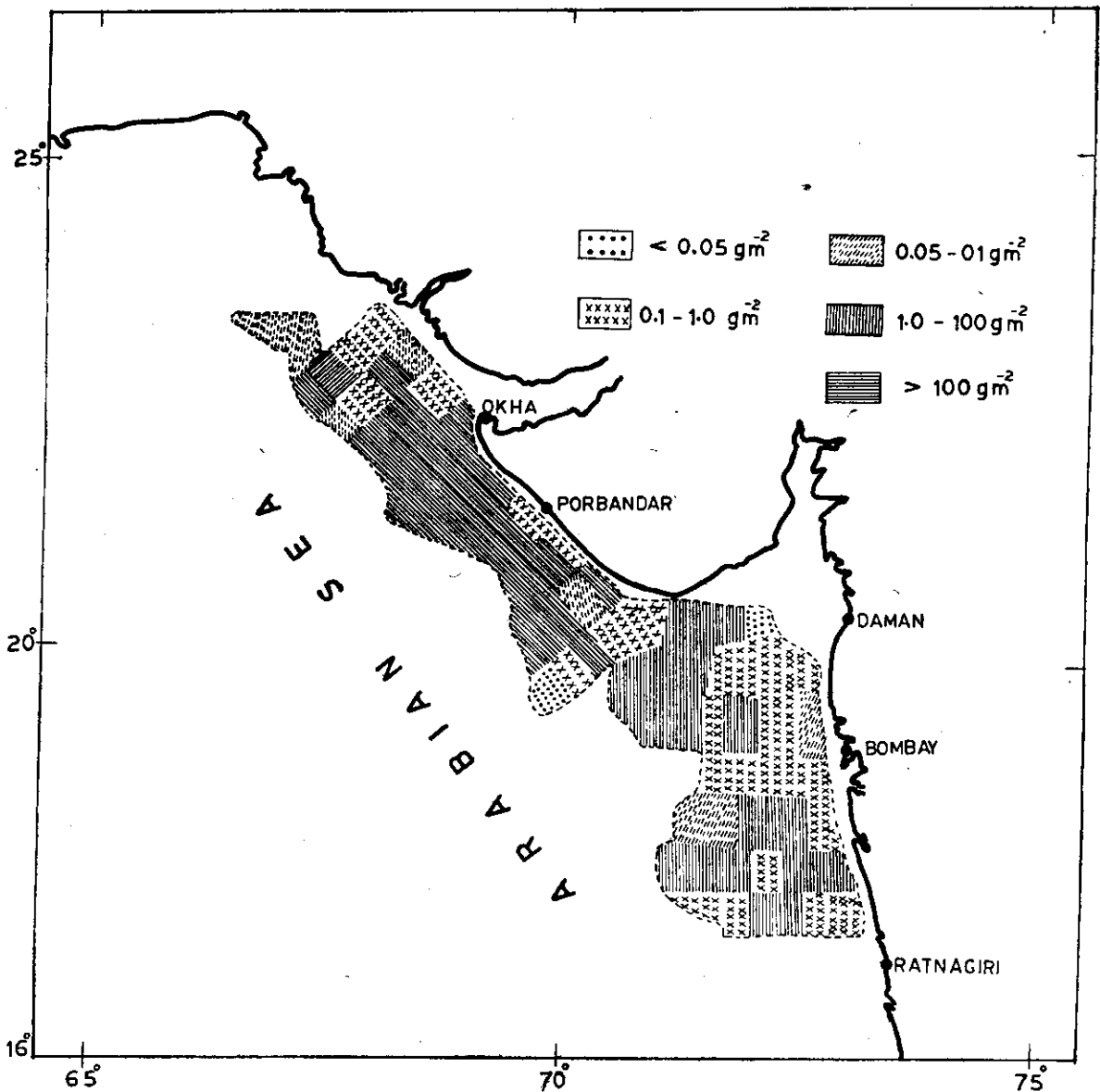


Fig. 1 — Benthic biomass distribution in north-eastern Arabian Sea shelf

of biomass values, Neymann⁷ has proposed the division of the West Indian Ocean into 2 regions. The boundaries between these regions lie at approximately 15°N latitude, i.e. in the vicinity of Goa⁴.

An analysis of data on the distribution of benthic biomass in relation to different depths (Table 1) revealed that with increasing depth, there is a gradual decrease in the biomass. Thus, in the nearshore regions of 20-40 m depth, the highest average biomass of 10.2 gm⁻² was obtained. Thereafter, the value followed a decreasing trend with the increasing depth except for a substantial rise in 60-80 m depth zone. This finding agrees with the biomass values of the other regions of the Indian Ocean^{4,7-9}.

Benthic fauna—In accordance with the high biomass values, the benthic fauna in this part of the Arabian Sea, is rich and varied. A total number

of 9 different faunal groups constituted the macro benthic population (Table 1). Polychaetes formed the dominant faunal group (43.09% of biomass and 74.56% of the population) followed by bivalves (26.96%), sipunculids (12.09%), echinoids (7.36%), cirripedia (4.80%) and scaphopoda (2.95%). Other faunal groups, amphipods, ophiuroidea and bryozoa, were represented in 0.9 to 2.11% in biomass and 0.17 to 1.12% by population.

Distribution of benthic fauna along the north-eastern Arabian Sea shelf is patchy and showed wide variations especially in relation to depth. At various depth zones (Table 1), polychaetes were the dominant faunal group, forming a biomass value of 24.22% (120-140 m) to 71.33% (40-60 m) and from 42.86% (120-140 m) to 84.81% (20-40 m) in population density. Bivalves were represented at all the depths except at 120-140 m depth zone. Sipunculids were absent only from 100-120 m depth zone, whereas

TABLE 1 — BIOMASS AND POPULATION DENSITY OF DIFFERENT FAUNAL GROUPS (DEPTHWISE) ON THE SHELF OF THE NORTH-EASTERN ARABIAN SEA

Depth zone (m)	No. of observations (n)	Total biomass (gm ⁻²)	Population density (nm ⁻²)	Biomass (gm ⁻²)-faunal groupwise/Population count (nm ⁻²)-faunal groupwise								
				Polychaetes	Sipunculids	Cirripedis	Amphipoda	Scaphopoda	Bivalves	Echinoidea	Ophiuroids	Bryozoa
20-40	28	285.76	12553	122.64	54.68	—	—	3.76	99.65	0.35	1.79	2.89
40-60	12	53.20	6578	10647	344	—	—	658	698	59	88	59
60-80	10	87.97	57.23	37.94	0.23	—	—	0.56	8.99	5.48	—	—
80-100	17	82.66	8645	5339	118	—	—	236	649	236	—	—
100-120	2	6.65	706	31.23	4.48	24.97	—	—	18.03	9.26	—	—
120-140	1	3.88	413	4012	118	236	—	—	767	590	—	—
				29.57	1.06	—	0.05	10.84	11.20	20.75	9.19	—
				5274	54	—	6	1182	767	1062	300	—
				1.82	—	—	—	—	2.36	2.47	—	—
				352	—	—	—	—	177	177	—	—
				0.94	2.47	—	0.47	—	—	—	—	—
				177	118	—	118	—	—	—	—	—

echinoids were not represented at 120-140 m depth. Bryozoans were observed only at the shallow depth of 20-40 m, whereas cirripeds, amphipods, scaphopods and ophiuroids showed wide variations (Table 1).

Quantitative distribution of different faunal groups, when considered in relation to geographical limits, displayed very few variations. The notable exceptions were bryozoans and cirripeds. The former were restricted in the region north of 21°N lat., whereas the latter were prevalent in the region south of 21°N lat. The observations on the distributional limitations of cirripeds in the Arabian Sea confirms the earlier observations¹⁰.

Trophism—Trophic structure of macrobenthos was determined by taking the weight of animals, from each sample, having a similar mode of feeding to determine the percentage composition of 3 main feeding graphs. All the 3 main trophic groups were represented at most depths and also in most areas. With increasing depth, the ratio of suspension feeders to detritus feeders increased. Thus at the maximum depth, detritus feeders dominated the benthic fauna indicating the abundance of labile or digestible organic matter.

The Arabian Sea is characterized by rich bottom fauna^{1,3,4,8,9} which is attributed to the inflow of equatorial waters of low salinity, causing stratifications in the water column². Low benthic biomass at higher depths along the shelf of the Arabian Sea is probably because of an inflow of subsurface water with low oxygen content⁹.

The present investigation being seasonal in nature, it is rather difficult to single out an environmental parameter which may be acting as an ecological master factor. But as seen from the data on trophism, it may be inferred that suspended organic

matter plays an important role in the distribution of bottom fauna. The substratum affects the faunal distribution in different environments⁴. The bottom deposits of sand with a mixture of clay or silt form an ideal substrate for polychaetes and bivalves, which together, contribute for more than 80% of of bottom fauna. The compact substratum of clay and sand, favours the growth of detritus feeders such as sipunculids, ophiuroids and echinoids. Thus it may be inferred that alongwith suspended organic matter, the substratum acts as an important ecological factor in the distribution of bottom fauna along the north-eastern Arabian Sea shelf.

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