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Sub-Littoral Meiobenthos of the Northeastern Bay of Bengal

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Of the 11 taxonomic groups represented, Nematoda followed by Foraminifera and Harpacticoida were dominant. Meiofaunal abundance was more related to the texture of the sediment than variation in depth. Population density varied from nil to $534.65 \times 10^3 m^{-2}$ (median = 31.45×10^3). Distribution was contagious with varied fauna in the nearshore region. On the basis of metabolic index, the food requirement of the benthic community (macro + meio) in the Bay of Bengal was found to be lower than that of the Arabian Sea and the Andaman Sea.

Studies on the sub-littoral meiofauna of the Bay of Bengal are scarce[1,2]. The present paper deals with the distribution, population density and standing crop of meiobenthos in relation to substrata and depth, based on data collected during 76th and 77th cruises of *R V Gaveshani* in June 1980. The macro-meio fauna relationships are also discussed and their food requirements highlighted.

Materials and Methods

The area surveyed lies between lat. 15°45' to 21°6.2'N and long. 81°12.5' to 88°11.2'E within the depth range of 18 to 230 m. Sampling was carried out at 150 locations[3] using a 0.18 m^2 Peterson grab and meiobenthic samples were collected by the methods described elsewhere[4]. Median values are given as the frequency distribution of meiofauna, which is highly contagious. Biomass is expressed as wet weights. Morisita's index of dispersion[5] was calculated for the spatial distribution of different meiofaunal groups. Departures from randomness were found significant ($P < 0.05$) when I_δ (Σx-1) + n-Σx was outside the appropriate 5% significance of χ^2 for n-1 degrees of freedom.

Results and Discussion

In the present investigation both temporary and permanent meiobenthos were observed as classed by Coull and Bell[6]. The former consisted of larval forms of Polychaeta, Gastropoda, Bivalvia and some Amphipoda while the latter comprised of Foraminifera, Nematoda, Turbellaria, Harpacticoida, Ostracoda, Kinorhynca and Gastrotricha (Table 1).

Table 1—Sediment-wise Faunal Abundance [No. ($\times 10^3$) m^{-2}]*, Composition, Prevalence and Index of Dispersion

Faunal group	Textural class						% Composition	% Prevalence	Morisita's index†
	Sand	Clayey sand	Silty sand	Sandy clay	Silty clay	Clay			
Foraminifera	45.6	64.01	22.64	14.15	10.22	6.05	25.06	28.67	6.02
Nematoda	93.17	62.16	33.97	28.83	24.37	15.09	42.5	46.67	3.43
Turbellaria	4.32	7.77	—	1.44	3.93	1.42	3.36	9.33	21.4
Polychaeta	9.04	6.66	7.55	4.19	3.93	0.82	4.36	13.33	9.11
Gastropoda	—	0.37	—	—	—	—	0.06	0.67	15.0
Bivalvia	16.9	0.74	15.1	5.77	9.44	0.76	5.59	14	10.52
Harpacticoida	10.22	7.96	23.9	7.21	—	2.62	7.57	5.99	18.58
Amphipoda	17.69	11.1	3.15	2.62	—	1.77	6.11	9.99	28.58
Ostracoda	7.86	1.85	15.1	—	3.93	1.89	3.39	9.33	15.04
Kinorhyncha	1.18	0.37	2.52	—	3.15	—	0.33	2.67	55.21
Gastrotricha	1.97	—	7.55	—	—	0.71	1.11	4.67	23.25
Unidentified	—	1.48	—	0.26	—	0.39	0.56	2	62.99
Population‡, No.($\times 10^3$) m^{-2}	207.95	164.48	131.48	64.47	58.97	31.52			
Biomass‡ (g m^{-2})	3.46	2.25	3.25	0.84	1.43	0.59			
Population ratio (macro:meio)	1:171	1:113	1:53	1:65	1:34	1:82			
Biomass ratio (macro:meio)	5:1	18:1	6:1	8:1	7:1	6:1			
No. of observations	16	17	5	24	8	80			

*Mean values; †Significant at 5% level of χ^2 for 149 degrees of freedom; ‡Mean total

Numerically, population abundance varied from total absence of fauna at as many as 28 stations to a maximum population density of 534×10^3 m^{-2} recorded at st 29 (median = 31.45×10^3 m^{-2}). Similarly biomass values varied from nil to a maximum value of 10.35 g m^{-2} at st 108 (median = 0.35 g m^{-2}). Of the 11 taxonomic groups present, the most dominant as well as prevalent group was Nematoda followed by Foraminifera (Table 1). This suggests their competancy of survival and magnitude of horizontal distribution. A previous report[1] indicated Foraminifera, Nematoda and Polychaeta in the order of prevalence and the maximum population observed was 963×10^4 m^{-2}. The discrepancy may be probably attributed to temporal variation and sampling locations.

Meiofaunal abundance in relation to sediment type is given in Table 1. Distribution of the sediment types has been discussed earlier[3]. Coarse sediments harbour rich fauna while the finer were relatively impoverished. High population counts and biomass values were obtained in sandy sediments while low values for these were obtained in clay deposits. Kinorhynchs preferred fine substrata while other groups had an affinity towards coarser sediments. This observation corroborates that of Wieser[7], Tietjen[8] and Coull[9]. The sand fauna tends to be slender as it must maneuver through the narrow interstitial openings, whereas the mud fauna is not restricted to a particular morphology but is generally larger[6]. Though the number of taxa in different sediments did not decrease as the grain size decreased, their abundance did. Nearshore regions had high meiobenthic biomass (Fig 1) whereas offshore areas sustained lower meiobenthic biomass. High benthic biomass in the nearshore region is mainly attributed to the enrichment of coastal waters due to riverine flow and land runoff[10].

The faunal groups were generally contagious in

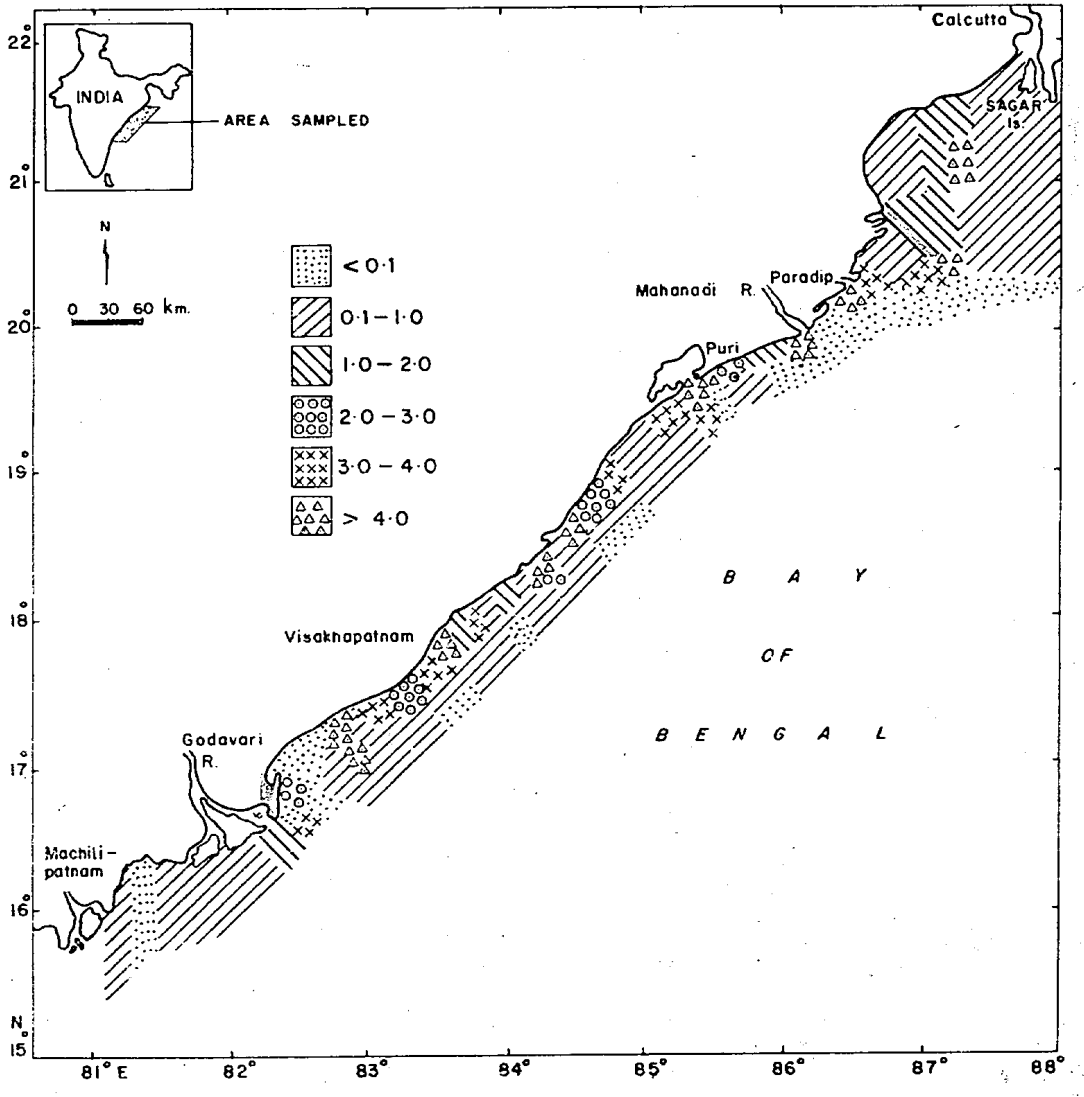

Fig. 1—Biomass (g m^{-2}) distribution

distribution (Table 1). Gastropods showed maximum value of contagiousness as it was present at only 1 station. Nematodes, foraminiferans and harpacticoids showed lower values of contagiousness as they were both dominant and prevalent. Meiofauna has been generally found to exhibit a clumped distribution[11]. This is largely because of variations in the physical parameters of the environment (such as temperature, salinity and currents) which though minor are nevertheless significant[6]. Several other explanations have been put forth to explain the patchy distribution of meiofauna. Gerlach[12] has suggested attraction of meiofauna to an organic rich food source while others have suggested patchy distribution of the food of meiofauna (bacteria, microflora)[13]. Selective predation on meiofauna could also cause patchiness. A predator feeding on a particular class and size of fauna will give rise to a discordant distribution[14]. It is also to be noted that the frequency distribution of an assemblage alone cannot explain the mechanisms underlying it.

Table 2 indicates the abundance of meiofauna at different depths. It is observed that shallow stations (<60 m) had more varied fauna than deeper stations. Though the faunal abundance generally decreases with depth[2,15], no such inference could be drawn in the present study. High abundance in the 100-120 m zone was probably due to the predominance of sand in the substrata at these depths.

Population ratio of macro:meio fauna was 1:91 while the biomass ratio was 9:1. The correlation between macro:meio fauna abundance ($r=0.36$) and biomass ($r=0.19$) was not significant. The hypothesis put forth by Elmgrem[16] regarding the prey-predator type relationship between macro and meiofauna seems to be not valied in the present study as no significant correlation was obtained between macro and meiofauna population and biomass. Comparison of macro-meiofauna ratios can indicate genuine differences in the utilization of particular habitats by the fauna. The abundance of meiofauna is generally between 30 to 190 times that of macrofauna and high ratios are generally observed in deep waters[17]. From Table 1, it is seen that the ratios tend to be high in sandy substrata and low in clay substrata. Similar observations have been reported by Wigley and McIntyre[15].

Production estimates were based on the method of McIntyre[17]. Data for the shelf region of the Arabian Sea and the Andaman Sea were obtained from Parulekar *et al.*[2]. The benthic production (macro + meio) of the Bay of Bengal based on the present data and the previous report[3] was 5.5 g dry weight $m^{-2}y^{-1}$ while that of the Arabian Sea and the Andaman Sea were 16.04 g dry wt $m^{-2}y^{-1}$ and 10.58 g dry wt $m^{-2}y^{-1}$ respectively. The figures reveal that the Bay of Bengal is less productive than the Arabian Sea or the Andaman Sea. This inference gains support from the existing literature[18,19]. The contribution of macrofauna and meiofauna to the total benthic production shows that the macrofauna play an important role in the Bay of Bengal while in the

Table 2—Depth-wise Faunal Abundance [No.($\times 10^3$) m^{-2}]* and Biomass*

Faunal group	Depth (m)											
	<20	20-40	40-60	60-80	80-100	100-120	120-140	140-160	160-180	180-200	200-220	>220
Foraminifera	1.97	34.46	20.49	26.21	8.39	48.75	—	2.52	—	6.29	3.15	—
Nematoda	35.38	50.03	22.25	15.75	11.88	48.12	6.29	15.1	19.44	9.53	31.45	34.39
Turbellaria	4.32	4.19	2.03	0.52	3.49	—	—	—	—	—	1.26	—
Polychaeta	11.01	4.32	2.84	—	—	0.63	—	—	—	2.7	—	—
Gastropoda	—	0.13	—	—	—	—	—	—	—	—	—	—
Bivalvia	2.36	7.21	2.92	—	10.48	8.18	—	—	—	—	3.15	—
Harpacticoida	5.16	7.74	6.09	11.01	8.39	8.81	—	2.52	0.76	—	1.89	—
Amphipoda	—	12.78	1.32	—	—	—	—	—	1.89	2.7	—	—
Ostracoda	—	4.06	3.25	—	—	6.29	—	—	—	—	0.63	—
Kinorhyncha	0.39	0.52	0.2	—	—	—	—	—	—	—	—	—
Gastrotricha	—	1.05	1.22	—	—	—	—	—	3.77	—	—	—
Unidentified	1.57	—	1.02	—	0.7	—	—	—	—	—	—	—
Population† No. ($\times 10^3$) m^{-2}	62.16	126.49	63.63	53.47	43.33	120.78	6.29	20.14	25.86	21.22	41.53	34.39
Biomass† (g m^{-2})	1.05	2	1.15	0.53	0.7	2	0.06	0.2	0.22	0.26	0.57	0.34
Population ratio (macro:meio)	1:80	1:105	1:109	1:82	1:26	1:117	1:5	1:29	1:41	1:256	1:176	1:573
Biomass ratio (macro:meio)	9:1	10:1	4:1	2:1	5:1	13:1	35:1	21:1	7:1	26:1	7:1	14:1
No. of observations	16	48	31	6	9	4	1	5	10	7	10	3

*Mean values; †Mean total

Table 3—Benthic Metabolic Index and Primary Productivity

Area	Biomass g m^{-2} (dry wt)		Metabolic index			Ratio over Bay of Bengal	Column primary productivity (g $C/m^2/yr$)
	Meio	Macro	5 × Meio biomass	1 × Macro biomass	Σ		
Arabian Sea	1.42	0.92	7.2	0.92	8.12	2.9	173.57
Andaman Sea	0.9	0.79	4.5	0.79	5.29	1.9	157.31
Bay of Bengal	0.19	1.8	0.95	1.8	2.75	1	107.6

Arabian Sea and the Andaman Sea, it is the meiofauna which contributes significantly to benthic production.

In order to get an idea of the food requirements for both macro and meiobenthos, a metabolic index (Table 3) was calculated as suggested by Gerlach[20]. It is observed that the food requirements of the Arabian Sea benthic fauna (macro + meio) is 3 times more than that of the Bay of Bengal while the benthic fauna of the Andaman Sea require twice as much as that of the Bay of Bengal. Food requirements of the benthos mainly come from the over-lying water column[21]. Available data on the primary productivity[22-25] were recalculated into annual production (m^{-2}). It is clear from Table 3 that the productivity over the shelf regions of the Arabian Sea, Andaman Sea and the Bay of Bengal are of decreasing magnitude though not in the same ratio. This clearly indicates that the benthos is not solely governed by the primary productivity of the water column but also by other food sources such as detritus and micro-organisms from the sediments.

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