

Meiofauna of the Andaman Sea

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Total meiofauna of the Andaman Sea, in the depth range 30-2150 m was between 68 and 438/10 cm² (\bar{X} = 247.8). The biomass was within the range 3.57 and 32.8 mg/10 cm² (\bar{X} = 14.46). Faunal components were maximum in sandy sediments which contained little silt and clay. The fauna diminished in coarse coralline sand and clayey sediments. Faunal density showed unusually low values at intermediate depths (200-500 m). At all the depths fauna was mostly present in the upper 2 cm of the sediments and only nematodes and foraminiferans were found below 4 cm of the sediments. Differences in the population density appear to be related to changes in hydrographic condition and sediment characteristics.

Earlier studies on bottom fauna from the Andaman Sea are mainly on macrobenthos^{1,2}. Meiofauna, which constitutes an important part of benthos, has not been investigated. This paper gives the quantitative aspects of meiofauna studied during the 51, 52, 67 and 68 cruises of *R V Gaveshani*.

Materials and Methods

Forty one stations were worked in Jan.-Feb. 1979 but due to insufficient quantity of sediments obtained at some stations only 22 samples were considered adequate for quantitative study. During the following year (Jan.-Feb. 1980) some of the stations of the earlier year (51 and 52 cruises of 1979) were repeated. Locations of sampling stations are given in Fig. 1. Samples were taken either with a La Fond Dietz snapper (0.017 m² area, 15 cm penetration) or a Petersen grab (0.1 m² area, 25 cm penetration) in the depth range 30 to 2150 m. From the grab samples sub-samples were obtained by pushing a plexiglass core (45 cm inner diam., 10 cm length) and these were divided into 0-2, 2-4, 4-6, 6-8 and 8-10 cm deep fractions. The method for the analysis of meiofauna was the same as described elsewhere³.

Results

Hydrography—Details of sediment characteristics and physico-chemical parameters of the area are given by Parulekar and Ansari⁴. Sediments in the shallow region (<200 m) were sandy, having little silt and clay, followed by coarse coralline sand and shell and gravel up to 800 m and clayey beyond 1000 m. A steady decrease in temperature from shallow to a depth of 500 m was observed. Changes in temperature were more pronounced between 200 and 300 m depth range. Salinity did not show much change and the values ranged from 31.88‰ at 30 m to 35‰ at 500 m. Dissolved oxygen was low at the bottom level at most

of the stations. The values ranged from 0.45 ml/litre at 300 m (st 1189) to 4.82 ml/litre at 50 m (st 1185).

Faunal composition and biomass—Table 1 gives the density of various taxa (10 cm⁻² surface area) and their wet weight (biomass) enumerated in the samples. Seven taxonomic groups and nauplii were identified. Nematodes were most dominant at all stations except st 1208 where benthic foraminiferans dominated. Foraminiferans ranked 2nd in abundance. These two

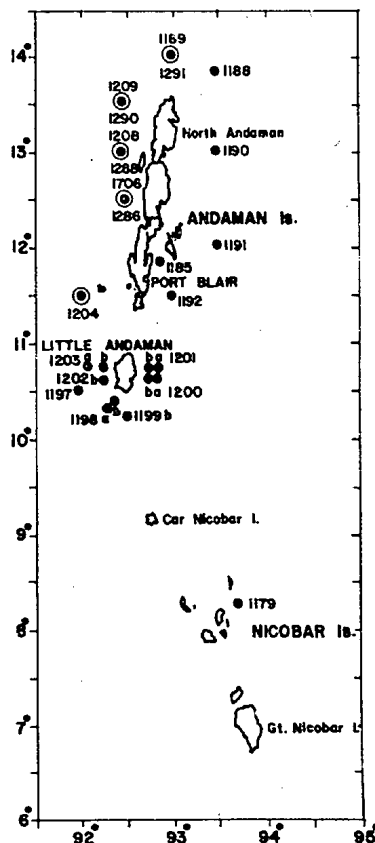


Fig. 1—Location of sampling stations [⊙, repeat stations of 1979 and 1980]

Table 1—Meiofauna Density per 10cm²
[Values in parenthesis are biomass in mg wet weight/10cm²]

Taxonomic group	Stations										
	1179	1185	1188	1189	1190	1191	1192	1197	1198a	1198b	1199b
Nematoda	102 (10.2)	152 (15.2)	152 (15.2)	—	68 (6.8)	102 (10.2)	232 (23.2)	68 (6.8)	34 (3.4)	34 (3.4)	152 (15.2)
Foraminifera	68 (2.02)	102 (3.06)	136 (4.08)	—	—	102 (3.06)	34 (1.02)	102 (3.06)	—	—	—
Copepoda	—	—	34 (0.24)	—	—	—	68 (0.47)	—	—	34 (0.24)	34 (0.24)
Polychaeta	—	34 (1.12)	—	—	—	—	102 (3.36)	34 (1.12)	—	—	—
Turbellaria	34 (0.17)	34 (0.17)	—	—	—	—	—	34 (0.17)	34 (0.17)	—	34 (0.17)
Lamelli-branchiata	—	34 (0.85)	—	—	—	34 (0.85)	—	—	—	—	—
Kinorhyncha	—	34 (0.14)	—	—	—	—	—	—	—	—	34 (0.14)
Nauplii	—	—	—	—	—	—	—	—	—	—	—
Total	204 (12.41)	390 (21.39)	322 (19.52)	—	68 (6.8)	238 (14.96)	436 (28.25)	238 (11.15)	68 (3.57)	68 (3.64)	254 (15.75)

Taxonomic group	Stations										
	1200a	1200b	1201a	1201b	1202b	1203a	1203b	1204	1206	1208	1209
Nematoda	302 (30.2)	102 (10.2)	152 (15.2)	34 (3.4)	68 (6.8)	204 (20.4)	102 (10.2)	68 (6.8)	68 (6.8)	136 (13.6)	102 (10.2)
Foraminifera	34 (1.02)	—	—	—	34 (1.02)	34 (1.02)	68 (2.04)	—	68 (2.04)	186 (5.58)	34 (1.02)
Copepoda	68 (0.47)	—	34 (0.24)	—	34 (0.24)	34 (0.24)	34 (0.24)	—	34 (0.24)	34 (0.24)	34 (0.24)
Polychaeta	34 (1.12)	—	—	34 (1.12)	34 (1.12)	68 (2.24)	34 (1.12)	34 (1.12)	34 (1.12)	—	34 (1.12)
Turbellaria	—	—	68 (0.34)	34 (0.17)	—	—	34 (0.17)	34 (0.17)	—	—	—
Lamelli-branchiata	—	—	—	34 (0.85)	—	—	34 (0.85)	—	34 (0.85)	—	—
Kinorhyncha	—	34 (0.14)	—	—	—	—	—	34 (0.14)	—	—	—
Nauplii	—	34 (0.06)	—	—	34 (0.06)	—	34 (0.06)	—	34 (0.06)	34 (0.06)	—
Total	438 (32.81)	170 (10.41)	254 (15.78)	136 (6.39)	204 (9.25)	340 (23.9)	340 (15.53)	170 (8.23)	272 (11.96)	390 (19.48)	204 (12.58)

Population \bar{X} = 247.8/10cm² and Biomass \bar{X} = 14.46mg/10cm²

taxa together represented about 75% of the meiofauna assemblage. Among other groups Harpacticoida, Polychaeta and Turbellaria were important. Their average biomass in the Andaman Sea was 14.46mg/10cm².

Changes in population density of meiofauna in relation to depth is given in Table 2. In the shallow region (0-100 m) the fauna was highest and decreased with increasing depth up to 500 m. Beyond 500 m and up to 1500 m the faunal density increased again at the highest depths (>2000 m) decreased to a minimum—both in quantity and quality.

Vertical distribution—Fig. 2 gives the vertical distribution of meiofauna. About 68% of the total fauna was found in the upper 0-2 cm of the sediments,

Table 2—Distribution of Fauna in Relation to Depth

Depth range m	No. of observation	Av. density/ 10cm ²
0-100	6	288
101-200	3	176
201-500	4	136
501-1000	3	236
1001-1500	3	220
1501-2000	2	134
>2000	1	68

regardless of sediment type. The fauna progressively decreased with increasing depth and no animals were found below 6 cm in the sediment.

Fig. 3 illustrates the vertical distribution of the major taxa (Nematoda, Foraminifera and other

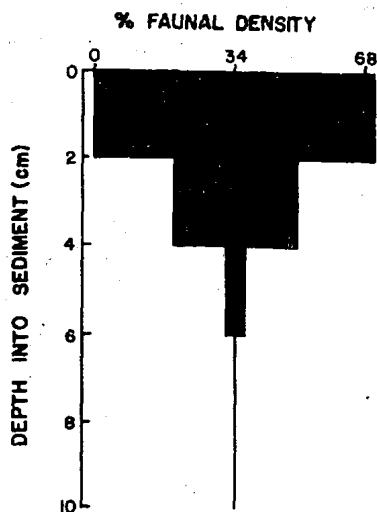


Fig. 2—Vertical distribution of meiofauna

 Table 3—Number of Total Meiofauna and Dominant Group per 10 cm² of Sediment Reported Earlier

Locality	Depth m	Total meiofauna	Dominant group and its density/10 cm ²
Off Massachusetts, USA ⁹	40-58	127-988	N 50-924
-do-	69-179	235-537	N 202-507
-do-	366-567	117-127	N 110-117
Off East Africa ⁵	1045-5030	15-170	N 14-128
Off North Carolina, USA ¹³	250-500	1 3 8	1174* N 60-1026
-do-	800-2500	40-149*	N 32-134
Bay of Bengal ¹¹	100-500	260-1630	F —
-do-	500-1000	122-1050	F —
Buzzards Bay ¹⁰	18	276-1861	N 250-1860
Loch Nevis Scotland ⁸	101	541-2224	N 405-2072
Bermuda coast ²⁰	2-13	123-1333	N 88-958
Kerala coast ²²	4-12	78-1455	N 42-1146
Andaman sea ^f	100-500	68-340	N 34-102
-do-	501-2000	68-438	N 34-302

* Foraminiferans not included; ^f Present study.

N = Nematoda and F = Foraminifera

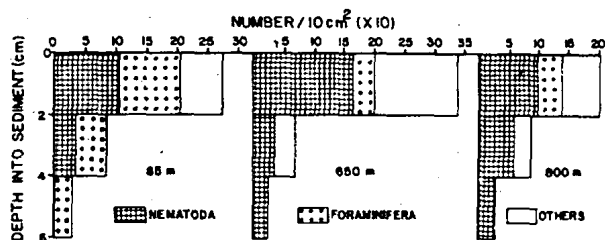


Fig. 3—Vertical distribution of dominant meiofaunal groups

groups) in the sediment at 85, 680 and 800 m depth. All taxa decreased both qualitatively and quantitatively with the increasing depth. Only nematodes and the foraminiferans were the groups encountered in the entire 6 cm deep sediment. Among other groups only the polychaetes and turbellarians were seen below 2 cm in the sediment.

Discussion

Comparison of the data of 1979 with those of 1980 did not show any significant difference in meiofauna. A partial list of meiofauna densities from other areas is given in Table 3 for comparison with the present study. Although some variations were found in meiofauna densities particularly in the shallow region (due partially to variations in techniques used by different authors), the fauna decreased with increasing depth and the nematodes formed the most dominant group in all except in the Bay of Bengal where foraminiferans dominated the fauna. In general, the density of meiofauna in the Andaman Sea falls below the range reported for the other areas, except for the values given by Thiel⁵.

The influence of sediment types on benthic fauna is well documented⁶⁻⁸. In the present study, faunal changes coincided with the changes in substratum and

hydrographic condition. The shallow (0-200 m) region characterised by sandy bottom had the maximum fauna (Table 2). Beyond 200 m the sediments changed to coarse coralline sand which was associated with a decrease in population density. With increasing depth there was further change in the sediment (muddy) which led to marked changes in faunal density and at deeper depths (>2000 m), as expected, the fauna reduced to only 1 taxonomic group the Nematoda. Similar results were obtained in the macrofauna³. The disappearance of some of the meiobenthic groups with increasing depth, as is the case in the present study, has also been observed by Wigley and McIntyre⁹ which has been reported to be due to changes in the type of sediments. The interesting feature of the study is the considerable increase in the total fauna between 500 and 1500 m (Table 2). This was probably due to changes in the sediment type from coarse to muddy deposit where high detrital deposition might be occurring. Wieser¹⁰ said that greater densities in meiobenthic animals are found in the finer mud deposit where presumably more food is available. Ansari *et al.*¹¹ have observed high meiobenthic population in the Bay of Bengal in muddy deposits. This certainly suggests that changes in the type of sediments may be important for meiofauna.

Both temperature and oxygen show sharp changes in the region between 100 and 500 m and a steady trend between 500 and 1200 m³. Thus in the region of maximal faunal change (between 200 and 500 m), at least 3 ecological factors; temperature, dissolved

oxygen and sediment composition seem to be responsible. Tietjen⁷ has correlated changes in meiofauna with the changes in bottom temperature, sediment composition associated with the availability of food. The effect of oxygen deficiency can be seen at the 1189, where fauna was nil. Numerous studies have shown that the absence of oxygen is an important factor affecting the distribution of bottom organisms¹²⁻¹⁴. The abundance of fauna at the sediment surface is correlated with the availability of oxygen, food supply and living space^{8,13,15}.

Two main sources of food namely, detritus and bacteria are important for deep sea benthos. The former is either derived from the euphotic zone or formed *in situ* and the latter exists there as reported by Tietjan¹³. The available information suggests large quantities of detritus present in the water column and heterotrophic bacteria in the sediments of this region^{16,17}. However, the amount of detritus that reaches the bottom is not known. Similarly, the mode of feeding of meiofauna especially nematodes, which will give better idea of the utilization of detritus in this region, is also not known. The productivity of the water column which form the main source of food for deep water benthos is reported to be low. This probably reflects the low benthic productivity of the Andaman Sea.

Organic matter in the sediment may act as a source of food supply for the invertebrates (benthos) which ingest mud directly. However, a distinction must be made between dead (organic) matter (debris) in the sediments and that associated with organisms particularly bacteria. Because much of the total organic matter in the sediments occurs as refractory compound such as lignin or cellulose which are not digestible by most invertebrates. Determination of organic matter in the sediment of Andaman Sea ranged between 0.45 and 1.50%¹⁷.

While it appears that main ecological role of meiofauna is one of mineralizing organic matter and releasing nutrients to the overlying water^{19,20}, the recent study by Bell and Coull²¹ suggests that meiofauna may serve as food at higher trophic level

and/or their density is controlled by macrofauna community. Low benthic production in the Andaman Sea can be the result of limited mixing due to stratification of the water and low productivity of the water column.

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