

## Benthic Macrofauna of the Andaman Sea

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Macrobenthic fauna in the depth range 11 to 2150 m comprised 22 faunal taxa. Of these, the polychaetes were the most dominant group and contributed 76.8%. Distribution of macrofauna was substrate specific with maximum ( $410\text{ m}^{-2}$ ) population on clayey deposits and minimum ( $266\text{ m}^{-2}$ ) in coralline sand areas. Mean standing stock was relatively low ( $6\text{ gm}^{-2}$ ) and varied from 0.3 to  $74.4\text{ gm}^{-2}$ . Biomass of infauna was considerably lower than those of the epifauna or onfauna and the production decreased rapidly with increasing depth. Qualitative and quantitative impoverishment of the benthic macrofauna in relation to oceanographic characteristics of the Andaman Sea are discussed.

Bottom fauna of the Andaman Sea is inadequately known. Earlier reports<sup>1-3</sup> are based on scanty data and mainly relate to trophic structure. During the cruises of *R V Gargeshani* in Feb. 1979 (51 and 52) and Jan. 1980 (67 and 68) an extensive area ( $90,000\text{ km}^2$ ) lying between lat. 6-15°N and long. 91-97°E, in the depth range 11 to 2150 m has been surveyed (Fig. 1) for qualitative and quantitative distribution of benthic fauna. The present communication deals with the distribution, abundance, faunal composition, prevalence and standing stock measurements of macrobenthos in relation to environmental and biotic conditions in the Andaman Sea.

### Materials and Methods

In all 68 stations, including 7 repeat observations for year to year changes if any, were worked (Fig. 1) and from each, samples were collected using either a Petersen Grab ( $0.1\text{ m}^{-2}$ ) or a La Fond Dietz Snapper ( $0.017\text{ m}^{-2}$ ). All the samples were washed through 0.5 mm stainless steel mesh and preserved in 1:500 Rose Bengal seawater formalin. Processing and analysis of the samples were done according to the procedure reported elsewhere<sup>4</sup>. Biomass values were presented on wet weight measurements and these exclude skeletal parts. Bottom sediments were described by visual examination of the sediments and from the echo sounding records.

### Results and Discussion

Out of 68 samples, only 40 standard samples (when the sampling gear came full with sediments) were taken for the study of quantitative aspects.

Benthic macrofauna was represented by 22 taxa in varying proportions (Fig. 2). Crustaceans, as represented by 9 taxonomic groups, were qualitatively important. Polychaetes formed the most dominant group followed by amphipods, harpacticoids and cirripeds. The remaining taxa were present in very

small proportions (<1%). The prevalence of each (Fig. 2) was found to be in accordance with the observed percentage composition of different faunal taxa.

Distribution of macrobenthos in different parts of the Andaman Sea showed a well demarcated depth

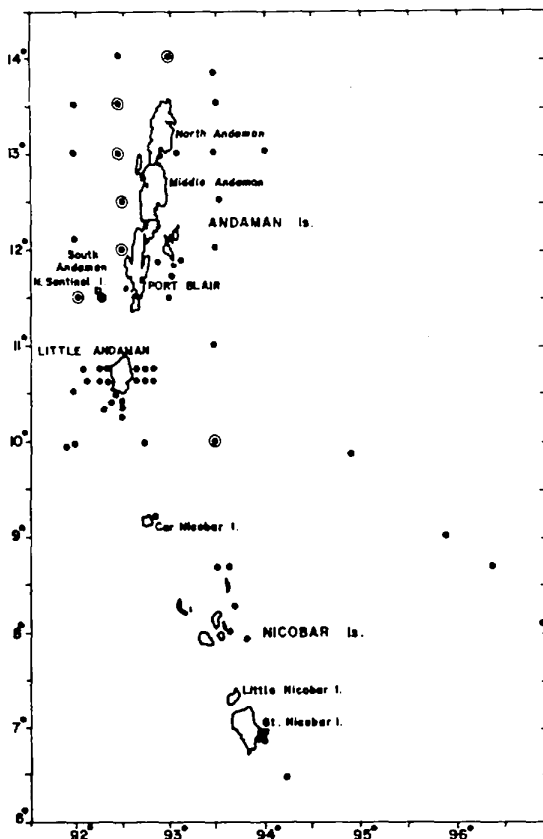


Fig. 1—Macrobenthos sampling sites (●) in the Andaman Sea [⊗, repeat stations of 1979 and 1980, ⊕, unscheduled station off North Sentinel Island]

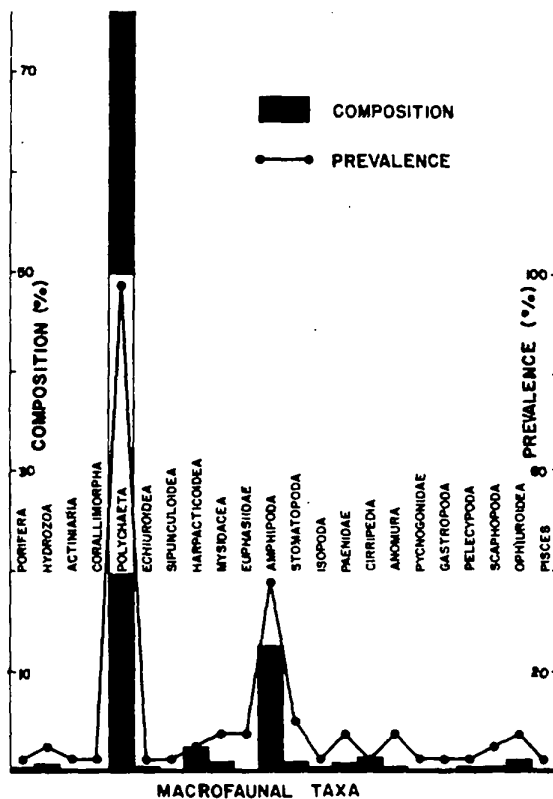


Fig. 2—Benthic macrofauna of Andaman Sea

zation (Table 1). Seventeen taxa, in varying proportions (0.14-69.11%) were observed up to 200m depth, whereas in deeper waters (> 2000m) only 1 taxon was encountered. In the intermediate depth zones of 200-1000 and 1000-2000m, 9 and 6 taxa respectively were observed. Except for polychaetes which were present (Table 1) in increasing proportions from shallow to deeper waters, only a few of the other taxa were found in more than 1 depth zone and whenever they occurred, as in the case of amphipods and stomatopods (Table 1) their abundance decreased with depth.

Abundance of macrofauna varied from 80 to 998 animals  $m^{-2}$  with a fairly high average of 406  $m^{-2}$ , and displayed a distinct substrate specificity. As observed from Fig. 3, a large part of the bottom deposits of the Andaman Sea contained hard rock<sup>5</sup>. Coral reef, coral debris and coralline sand formed the next important type of bottom deposits (Fig. 3) but these were mainly restricted to shallower depth of <200m. The mid depths of 200-1000m were either characterized by sandy mud or clay and were rarely rocky whereas the greater depths (>1000m) had mostly clay or hard rocky substratum. In clay deposits and their admixture

Table 1—Per Cent Composition and Prevalence (in parentheses) of Benthic Macrofauna at Different Depths in the Andaman Sea

Macrofaunal taxa	Depth (m)			
	0-200	200-1000	1000-2000	>2000
Porifera	0.82 (7.7)	—	—	—
Hydrozoa	0.14 (7.7)	—	—	—
Actinaria	—	0.27 (8.3)	—	—
Corallimorpha	0.14 (7.7)	—	—	—
Polychaeta	69.61 (94.1)	89.25 (100)	75.66 (100)	100 (100)
Echiuroidea	—	1.60 (8.3)	—	—
Sipunculoidea	0.14 (7.7)	—	—	—
Harpacticoidea	4.12 (7.7)	—	2.69 (11.1)	—
Mysidacea	1.80 (23)	—	—	—
Euphasiidae	0.29 (15.4)	0.30 (8.3)	—	—
Amphipoda	16.32 (69.2)	4.84 (25)	13.55 (22.2)	—
Stomatopoda	0.29 (15.4)	1.61 (8.3)	1.33 (11.1)	—
Isopoda	0.92 (7.7)	—	—	—
Paenidae	1.66 (23)	—	—	—
Cirripectida	—	—	5.41 (11.1)	—
Anomura	0.98 (15.4)	—	—	—
Pycnogonidae	0.14 (7.7)	—	—	—
Gastropoda	—	0.27 (8.3)	—	—
Pelcecyoda	—	—	1.35 (11.1)	—
Scaphopoda	0.82 (7.7)	0.24 (8.3)	—	—
Ophiuroidea	1.66 (15.4)	1.61 (8.3)	—	—
Pisces	0.14 (7.7)	—	—	—

with sand and silt, the fauna was richer (410  $m^{-2}$ ) than in the sandy deposits or the coralline areas (266  $m^{-2}$ ). Animal distribution in relation to depth showed that the mean population count was 460  $m^{-2}$  (80-998  $m^{-2}$ ) up to 200m depth zone which decreased to 241  $m^{-2}$  (90-470  $m^{-2}$ ) in the 200-1000m depth range followed by a sudden rise up to 468  $m^{-2}$  (179-882  $m^{-2}$ ) in the depth zone 1000-2000m. The highest value of 764  $m^{-2}$  was found in deeper waters of >2000m. Depths > 1000m were characterized by clayey deposits which

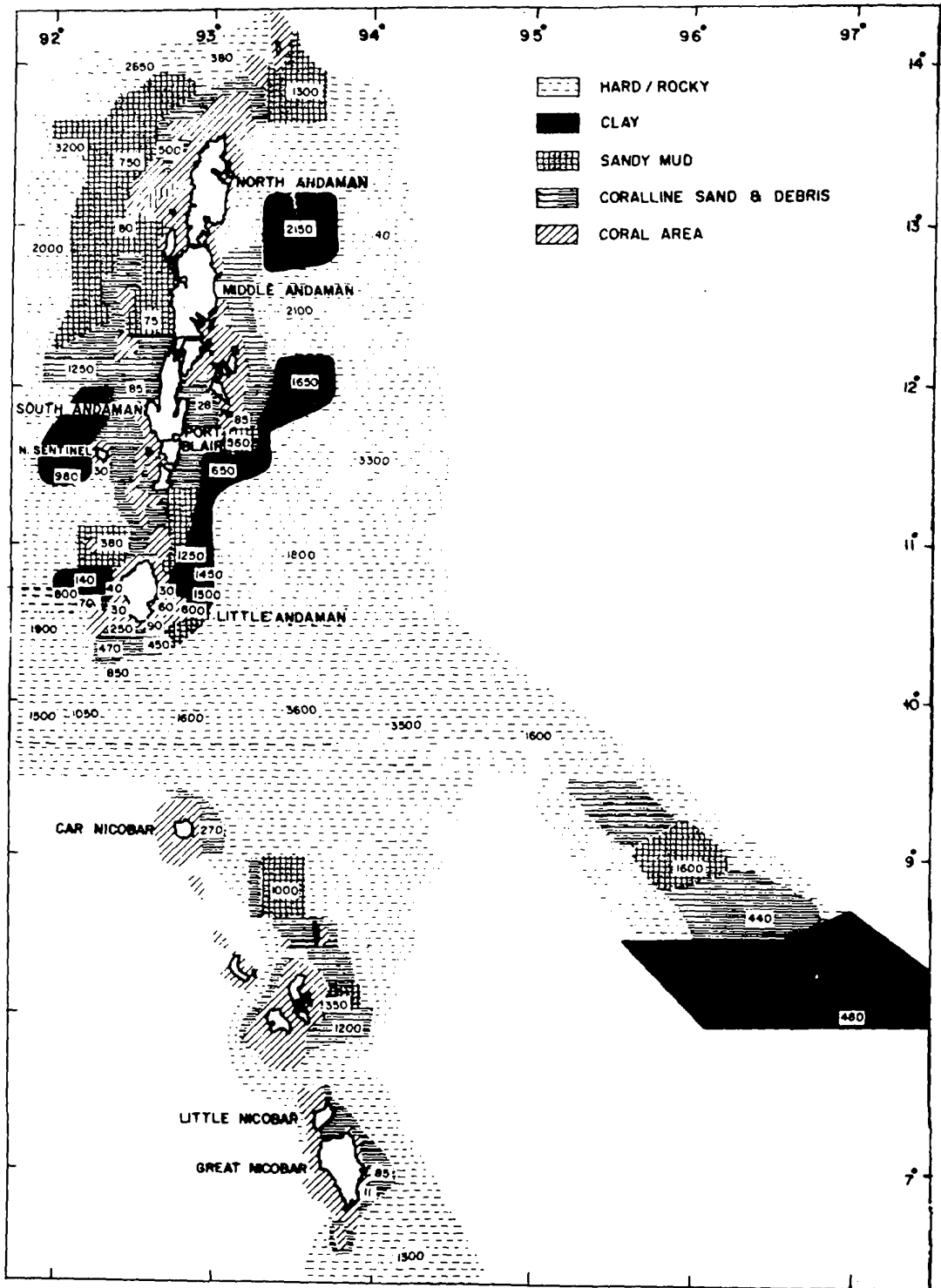


Fig. 3 Bottom sediments in the Andaman Sea [Numbers indicate the depth (m) distribution]

was in contrast to sandy deposits found at depths < 1000 m (Fig. 3) and hence this would account for the observed disparity in the population density. No significant qualitative or quantitative changes were observed in the distribution, occurrence and abundance of macrofauna from the collections of 1979 with those of 1980.

The standing stock of the benthic macrofauna varied from 0.3 to 74.4 gm<sup>-2</sup> with a mean value of 6 gm<sup>-2</sup>. At 2 of the shallow (< 40 m) stations close to the Little Andaman Island (Fig. 1) high biomass values of 36.7 and 74.4 gm<sup>-2</sup> were encountered mainly due to the presence of large epifaunal animals like prawns and fishes and the onfaunal animals like sponges, corallimorphs and hydrozoans. However, at most of the sampling stations, the biomass never exceeded greater than 8 gm<sup>-2</sup> nor was there any marked variations between the samples of 1979 and 1980.

Biomass distribution in relation to depth showed high mean values (11.3 gm<sup>-2</sup>; 0.7-74.4 gm<sup>-2</sup>) in shallow waters (< 200 m). A sharp decline in the biomass of about 70% was found in the next depth zone of 200-1000 m (2.7 gm<sup>-2</sup>; 0.3-6.5 gm<sup>-2</sup>). There was a slight increase of about 8% in the 1000-2000 m depth (2.9 gm<sup>-2</sup>; 1.3-7.8 gm<sup>-2</sup>), followed by about 190% decrease in deeper waters > 2000 m (1 gm<sup>-2</sup>). Biomass production (mean value) was relatively greater (5.8 gm<sup>-2</sup>) in sandy deposits than in clayey substrata (2.4 gm<sup>-2</sup>) and thus showed an inverse relationship with the abundance of fauna.

Macrobenthic biomass of Andaman Sea was compared with earlier observations from other areas of the Indian Ocean and this has been shown in Table 2.

Neiman<sup>2</sup> has reported that the macrobenthos of the shelf region of Burma, which forms the northern and eastern part of the Andaman Sea, varies from 0.4 to 10 gm<sup>-2</sup>. Similarly, Ansari *et al.*<sup>6</sup> have studied the macro and meiobenthos up to 1750 m depth off the southeast and central east coast of India (Bay of

Bengal), which forms the western and to a certain extent the southern limits of the Andaman Sea.

There are no comparable data from depths > 200 m from the eastern Andaman Sea (Table 2). Present observations on the macrobenthic biomass up to 200 m depth, indicate a fairly high mean value (10.2 gm<sup>-2</sup>) as compared to the reported<sup>2</sup> value of 1.5 gm<sup>-2</sup> from the Burma coast. Even the standing crop in deeper waters above 200 m as observed in the present investigation was reasonably high (3 gm<sup>-2</sup>).

Comparison of present data (Table 2) of the western Andaman Sea with the corresponding areas in the Bay of Bengal reveals that the mean and the range values from depths < 200 m are greater in the Andaman Sea whereas the values both range and mean for depths > 200 m are higher in the Bay of Bengal. Even a comparison between the macrobenthic biomass up to 2000 m depth of the corresponding areas (between lat. 6 and 15° N) in the Arabian Sea, Bay of Bengal and the Andaman Sea, respectively, clearly indicate that mean biomass is highest (12 gm<sup>-2</sup>) in the Arabian Sea<sup>7</sup>, lowest (6 gm<sup>-2</sup>) in the Andaman Sea and fairly high (9.5 gm<sup>-2</sup>) in the Bay of Bengal<sup>6</sup>.

The observed low macrobenthic biomass production in the Andaman Sea, may probably be due to the influence of environmental and biotic factors on benthic production. As shown in Fig. 4, the most striking features about the variations in the environmental factors are the sharp decrease in bottom temperature and consistently low (< 2 ml/l) oxygen content at the bottom, especially below 200 m depth.

The sharp fall of about 17°C in the bottom temperature from 30 to 380 m depth (Fig. 4) and further up to 2150 m probably has an important role in the distribution and production of macrobenthos. Sanders and Hessler<sup>8</sup> have reported the water temperature as the factor responsible for pronounced changes in the macrofaunal composition at depths 100-300 m along the Gay Head-Bermuda transect and

Table 2—Comparison of Macrobenthic Biomass Production in Andaman Sea and Bay of Bengal

Area	Position	Depth (m)	No. of observations	Biomass range (mean) gm <sup>-2</sup>
Andaman Sea <sup>2</sup> (Off Burma Coast)	lat. 7 to lat. 15° N	0-200	7	0.4-10 (1.5)
Bay of Bengal <sup>6</sup>	lat. 9 to lat. 15° N	0-200	17	0.5-43.3 (11.6)
		> 200	8	0.8-14.2 (4.6)
Andaman Sea*	lat. 6 to lat. 15° N	Eastern Andaman Sea	6	1-36.7 (10.2)
		(long. 93 to long. 97° E)	10	0.4-7.8 (3.0)
	Western Andaman Sea	0-200	11	0.7-74.4 (12.4)
		(long. 91 to long. 93° E)	13	0.3-7.3 (1.4)

\*Present study

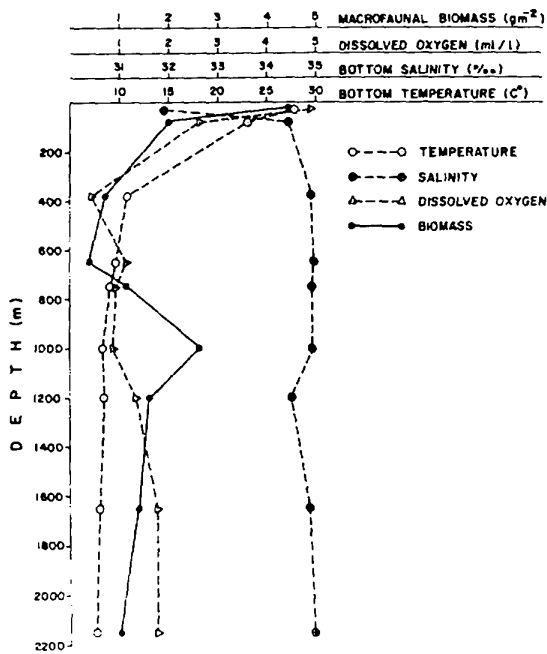


Fig. 4- Environmental factors and macrobenthic biomass production at different depths in the Andaman Sea

they have inferred that this depth range represents the upper boundary of the deep sea macrobenthos.

Dissolved oxygen content also has an interesting pattern of distribution (Fig. 4). Oxygen value was 4.82 ml/litre at 30m which decreased sharply to 2.52 ml/litre at 80m and went on decreasing till a near depletion (0.43 ml/litre) was observed at 380m. A gradual recovery up to 1.75 ml/litre was observed at 2150m. As compared to the distribution of dissolved oxygen in the Arabian Sea and Bay of Bengal<sup>9</sup>, the bottom waters of Andaman Sea have an oxygen deficient environment. Rosenberg<sup>10</sup> has reported that low oxygen content causes a high physiological stress resulting in considerable impoverishment in benthic production.

Sharp stratification of the water is a characteristic feature of the Andaman Sea<sup>11</sup>. The very stable stratification, except for the shelf region, impedes the influx of nutrients to the surface and oxygen to the subsurface layers<sup>12</sup>. The limited mixing<sup>13</sup> between

surface, subsurface and bottom waters probably has resulted in making the Andaman Sea an area of low biological productivity. The primary productivity of the overlying waters which is an important source of food to benthic organisms<sup>14</sup> varies from 120 to 615  $mgC/m^2/day$  (av. 273  $mgC/m^2/day$ ) and is considerably lower<sup>15</sup> than in most of the other regions of the Indian Ocean. Accordingly, organic carbon in the sediment<sup>16</sup> is low (0.87%) and similar is the case with the meiobenthos<sup>17</sup>. Though the detrital energy is reported to be high<sup>18</sup>, a large part of it is non-labile and therefore, of little use as a direct source of food to the benthic macrofauna. Thus the Andaman Sea, because of its peculiar hydrographic conditions and unique food chain, becomes a region of low benthic production.

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