

## Zooplankton Abundance of the Andaman Sea

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Zooplankton biomass and abundance of major groups from the Andaman Sea in February 1979 are presented. Average zooplankton biomass is  $5.6 \text{ ml}/100 \text{ m}^3$  and is generally poor compared to reported values from east and west coasts of India. Copepoda forms the dominant component followed by Chaetognatha and Tunicata. Estimates of zooplankton biomass to dry weight and to organic carbon content are made. The average standing crop of zooplankton is  $288.8 \text{ mg C}/\text{m}^2$  for the upper 200 m column.

Very little is known about the oceanographic and biological aspects of the Andaman Sea ( $91^\circ\text{-}94^\circ\text{E}$ ,  $6^\circ\text{-}14^\circ\text{N}$ ). During the International Indian Ocean Expedition (IIOE-1960-65) also this area has been scantily studied. The northeastern part of this area receives considerable amount of river runoff and on the eastern side it is connected to the Pacific Ocean through the straits of Malacca, thus maintaining the gene flow of the Indo-Pacific elements. The 51 and 52 cruises of *RV Gaveshani* were conducted in February 1979 to study the oceanographic features around the Andaman and Nicobar islands. The paper presents detailed survey of the zooplankton of the area.

### Materials and Methods

Zooplankton samples were collected from 34 stations, 29 of them being around the Andaman-Nicobar islands (Fig. 1), with a Heron-Tranter (HT) net (mesh size  $500 \mu\text{m}$ ) with a flow meter attached in vertical hauls from the upper 200 m depth. At a few shallow stations (sts 1185, 1187, 1206 and 1208) collections were made from depths varying from 30 to 100 m. Zooplankton biomass was estimated as displacement volume. Additional samples were taken at some of the stations to study the biomass-dry weight relationship and organic carbon content of zooplankton. For this purpose biomass (displacement volume) of several fresh samples were estimated on board and dried at constant temperature until constant dry weight was obtained. Later, these samples were analysed to estimate the organic carbon content of zooplankton.

### Results and Discussion

**Zooplankton biomass**—Biomass ranged from  $1.8 \text{ ml}/100 \text{ m}^3$  at st 1179 to  $14.4 \text{ ml}/100 \text{ m}^3$  at st 1185. It could be seen (Fig. 2) that the area on the eastern side

of the islands was generally poor in zooplankton standing crop (av.  $3.6 \text{ ml}/100 \text{ m}^3$ ). However, a patch of fairly high standing crop (av.  $11.8 \text{ ml}/100 \text{ m}^3$ ) was observed around the Andaman island. The biomass was moderate in the other areas (av.  $6.3 \text{ ml}/100 \text{ m}^3$ ) except for a few isolated patches of poor biomass. The average biomass values reported from the east coast of India range from  $7.8$  to  $8.4 \text{ ml}/100 \text{ m}^3$  during southwest monsoon period<sup>1</sup>,  $2.5$  to  $15.4 \text{ ml}/100 \text{ m}^3$  during late southwest monsoon period<sup>2</sup>,  $8.9$  to  $32.2 \text{ ml}/100 \text{ m}^3$  in June<sup>3</sup> and  $8.9$  to  $10 \text{ ml}/100 \text{ m}^3$  from the west coast of India during the post monsoon period<sup>4</sup>. In comparison, the average zooplankton biomass from the entire area studied was generally poor ( $5.6 \text{ ml}/100 \text{ m}^3$ ). The biomass in this area sampled in Feb.-March 1963 (IIOE) by *INS Kistna*<sup>5</sup> showed poor biomass ( $0.5$  to  $5.5 \text{ ml}/\text{haul}$ ; Organdi net). The ranges in the biomass values obtained from *Anton Brunn* cruises in March ( $1$  to  $13.5 \text{ ml}/100 \text{ m}^3$ ) and *Pioneer* cruises in April ( $3.8$  to

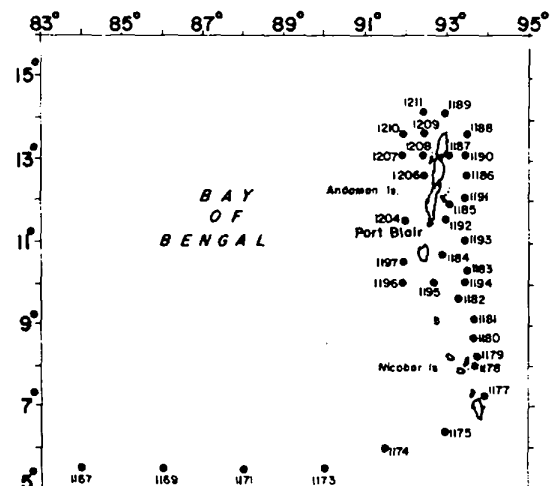


Fig. 1 - Zooplankton stations during the 51 and 52 cruises of *RV Gaveshani*

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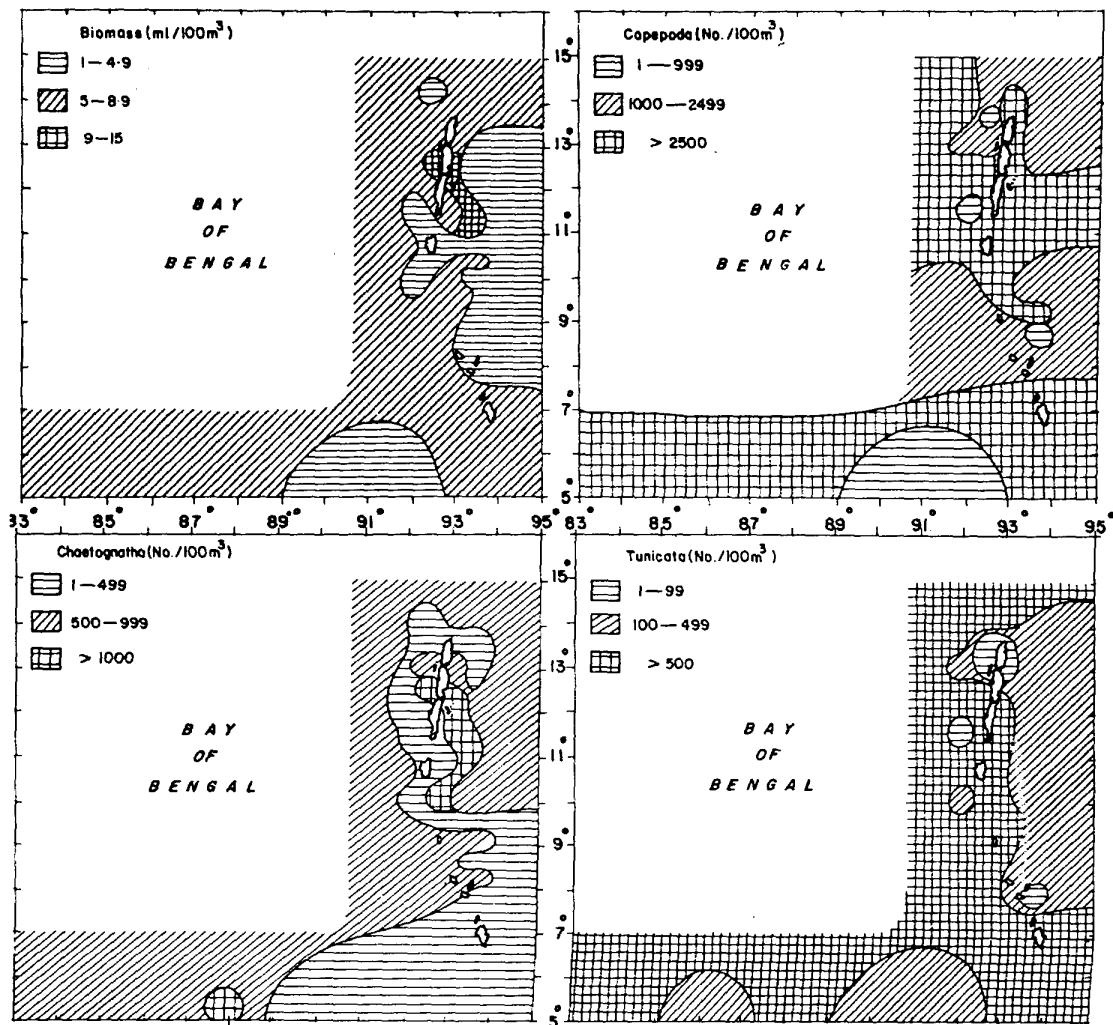


Fig. 2—Distribution of zooplankton biomass, Copepoda, Chaetognatha and Tunicata in the Andaman Sea

12.4 ml/100 m<sup>3</sup>) from the Andaman Sea are comparable to the values obtained in the present study. The total zooplankton counts ranged between 760/100 m<sup>3</sup> at st 1204 and 13900/100 m<sup>3</sup> at st 1206.

**Zooplankton components—Copepoda:** Copepoda formed the dominant component of zooplankton forming 53.9% of the total counts. Higher density of copepods was observed around the Andaman and Nicobar islands (Fig. 2). Highest numbers of them (7150/100 m<sup>3</sup>) were recorded at st 1206 but their counts in general were far less compared to reported values<sup>1-4,6</sup> from east and west coasts of India and the Laccadive Sea.

**Chaetognatha:** Chaetognaths formed the next abundant group (12.9%). They were poorly represented in the area around the islands (Fig. 2) except

for a patch of higher density in the eastern side of the Middle, South and Little Andamans and at st 1206. Their highest density (1959/100 m<sup>3</sup>) was observed at st 1185. The density of chaetognaths was relatively low compared to IIOE data available<sup>7</sup> for the seas around Andaman island.

**Tunicata:** Pelagic tunicatarians formed 8% of the total counts with peak density (1290/100 m<sup>3</sup>) at st 1210. Thaliacea represented by both salps and doliolids formed a less abundant component (1.8%) and their maximum density was observed at st 1185 (530/100 m<sup>3</sup>).

**Ostracoda:** Ostracods were fairly abundant around the Andaman and Nicobar islands (Fig. 3). They formed about 4.7% of the total counts and their

maximum abundance (2100/100 m<sup>3</sup>) was observed at st 1206. Their total distribution in the surveyed area was similar to IOE data<sup>8</sup>. Maximum population range was scattered between 92° and 94°E longitude.

**Euphasiacea:** Euphasiids occurred at all stations in small numbers (Fig. 3), forming 4.1% of the total counts. Their maximum density (1700/100 m<sup>3</sup>) was observed at st 1207.

**Decapoda:** Decapod larvae and adult decapods were in general poorly represented around the islands (Fig. 3). They contributed to 2.5% of the total zooplankton counts with maximum density (540/100 m<sup>3</sup>) at st 1206.

**Fish eggs and larvae:** Fish eggs and fish larvae together formed only 1.4% of the zooplankton counts. Fish eggs were represented only at 39% of the stations (maximum density 250/100 m<sup>3</sup> at st 1187). Fish larvae

were better represented around the Andaman islands (Fig. 3), their highest density being 250/100 m<sup>3</sup> at st 1206.

Apart from these, other groups such as Hydromedusae, Scyphomedusae, Siphonophora, Pteropoda (both Thecosomata and Gymnosomata), Heteropoda, Cladocera, Amphipoda, Mysidacea and larvae of Polychaeta, Echinodermata, Cirripedia, Bryozoa, Stomatopoda and Cephalopoda were encountered at several stations but contributed only a small percentage of the total counts.

**Secondary production**—Data on the zooplankton standing crop, estimated as displacement volume, are available from the Indian Ocean. Several attempts have also been made to relate these to other trophic levels to project the quantum of energy transfer. It is felt desirable to conduct some observations so as to facilitate more direct methods for these calculations.

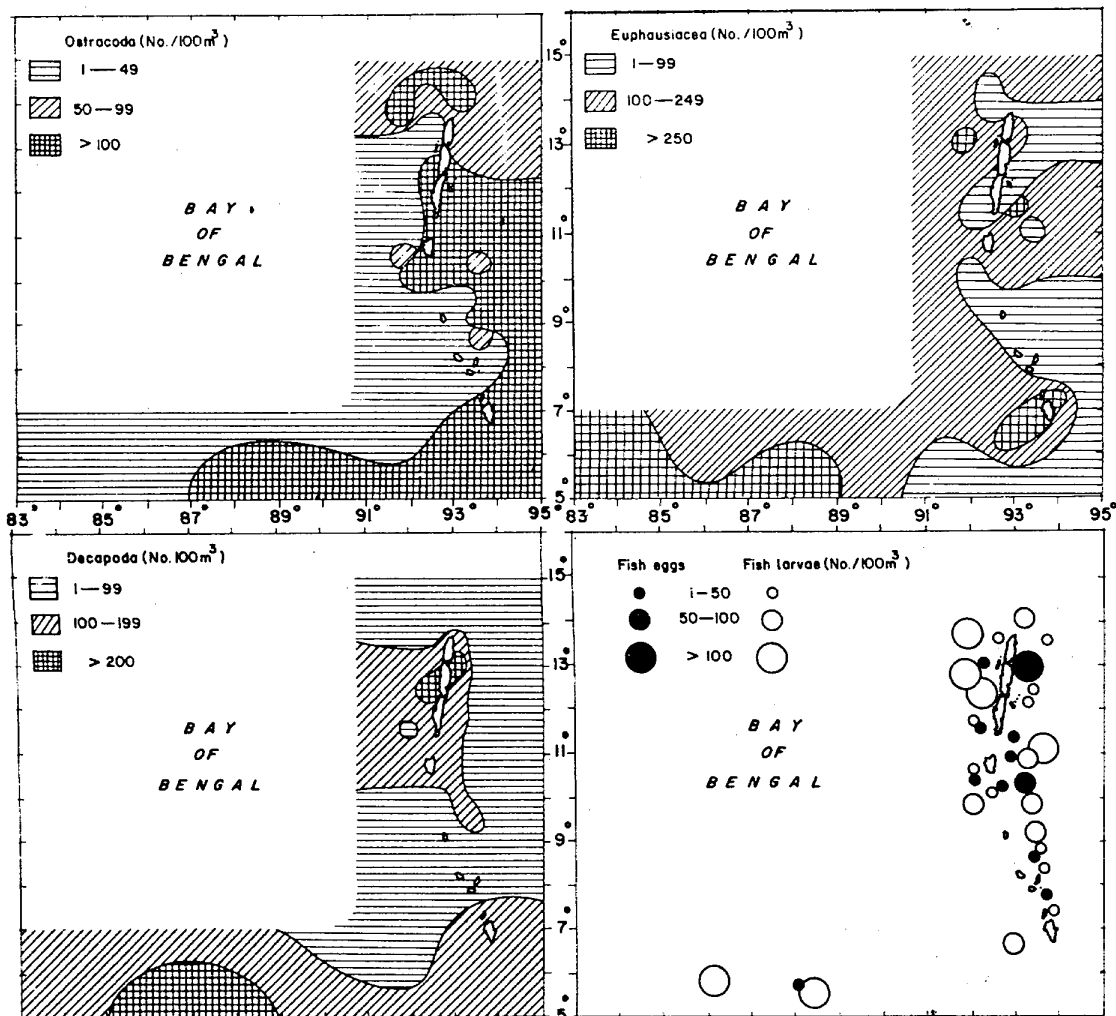


Fig. 3—Distribution of Ostracoda, Euphasiacea, Decapoda, fish eggs and larvae in the Andaman Sea

Large variations are possible in the percentage of water content and organic carbon content depending on the composition of zooplankton and presence of gelatinous organisms. Earlier estimates<sup>9</sup> from estuarine and offshore waters of Goa had yielded values ranging from 61.9 mg to 81.7 mg dry weight/ml of zooplankton biomass. In the present study it varied between 68.7 and 82.2 mg dry weight/ml, an average of 75.4 mg dry weight/ml zooplankton biomass was used for further estimates. Organic carbon for mixed zooplankton from estuarine and offshore regions of Goa ranged from 30.4 to 41% of dry weight<sup>9</sup>. Studies from Cochin backwaters<sup>10</sup> had yielded the organic carbon content of non-gelatinous zooplankton as 33.1%, which in the present estimate ranged from 27% to 38.4% of dry weight with a mean value of 34.2%.

Using these mean values the average zooplankton standing crop in the Andaman Sea was calculated which varied from 185.6 mg C/m<sup>2</sup> in areas having low biomass (Fig. 2), 324.9 mg C/m<sup>2</sup> in areas having moderate biomass values and 608.6 mg C/m<sup>2</sup> in regions of high biomass for the upper 200 m column depth. The average for the entire area obtained was 288.8 mg C/m<sup>2</sup> for the 200 m column depth.

The fish landings of the Andaman Area show that it sustains rich pelagic fishery resources comprising both planktonivorous (shoals of sardine and mackerel) and carnivorous (shark, tuna, barracuda) fishes. At present, the fish landings in the Andaman and Nicobar islands are only about 1500 tonnes/year. The projected fishery potential of these waters estimated from the data collected during the present cruises<sup>11</sup> shows sufficient scope to expand the fishery. Although the zooplankton biomass was lower compared to coastal waters of Indian peninsula it is comparable to data available<sup>6,12</sup> from Laccadive waters. The eastern side of the islands showed poor biomass values, but this

area sustained high density of copepods. The lower biomass in this area is apparently due to relatively poorer abundance of decapods, tunicates and euphysiids. Compared to the IIOE data for the northeast monsoon period fish eggs and larvae, decapods and euphysiids were more in the present collections. Chaetognatha, Copepoda and Ostracoda on the other hand showed comparatively lower density. However, a seasonal coverage of these waters is highly desirable to draw more definite conclusions regarding faunal abundance, composition and productivity.

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#### References

- 1 Nair V R, Peter G & Paulinose V T, *Mahasagar - Bull natn Inst Oceanogr*, **10** (1977) 45.
- 2 Achuthankutty C T, Madhupratap M, Nair V R, Nair S R S & Rao T S S, *Indian J mar Sci*, **9** (1980) 201.
- 3 Nair S R S, Nair V R, Achuthankutty C T & Madhupratap M, *J Plankton Res* (in press).
- 4 Nair V R, Peter G & Paulinose V T, *Mahasagar - Bull natn Inst Oceanogr*, **11** (1978) 35.
- 5 Indian Ocean Biological Centre, *Handbook to the International zooplankton collections*, **1** (1969).
- 6 Goswami S C, *Indian J mar Sci*, **8** (1979) 232.
- 7 Indian Ocean Biological Centre, *International Indian Ocean plankton atlas*, **4** (1973), Fasc. 2.
- 8 Indian Ocean Biological Centre, *International Indian Ocean plankton atlas*, **3** (1972), Fasc. 1.
- 9 Nair V R, *Indian J mar Sci*, **9** (1980), 114.
- 10 Madhupratap M, Venugopal P & Haridas P, *Indian J mar Sci*, **8** (1979) 155.
- 11 Qasim S Z & Ansari Z A, *Indian J mar Sci*, **10** (1981) 276.
- 12 Madhupratap M, Wafar M V M, Haridas P, Narayanan B, Menon P G & Sivadas P, *Indian J mar Sci*, **6** (1977) 138.