

# ZOOPLANKTON ABUNDANCE OFF THE KERALA COAST DURING FEBRUARY AND APRIL 1970

K. S. PURUSHAN, T. BALACHANDRAN AND M. SAKTHIVEL,

*Regional Centre, National Institute of Oceanography, Cochin - 18.*

## ABSTRACT

The standing stock of zooplankton was relatively high in the outer neritic zone with the highest volume in the area off Cochin and Alleppey. Foraminifers, chaetognaths, amphipods and gonostomid fish larvae were more densely populated in the area off Cochin; meroplanktonic larvae such as pilidium, tornaria, cirripede nauplius and pluteus in the inshore waters off Alleppey and gelatinous groups such as medusae and salps and fish larvae like myctophids, carangids, serranids and sciaenids in the area off Quilon. Euphausiids, ostracods and a few species of pteropods were more abundant in the high saline water mass of the offshore waters while *Penilia* and *Evadne* species of cladocerans and many meroplanktonic groups reached their maximum density in the low saline water mass of the inshore waters. The dense population of many groups observed in the inshore waters in February is found to be drifting to off shore waters in April.

## INTRODUCTION

A considerable amount of work on various groups of zooplankton has been done along the Kerala coast by Menon (1945), Chidambaram and Menon (1945), George (1953), Saraswathy (1967), Silas (1968) and Silas and George (1969). While the area off Trivandrum and Calicut has received more attention, not much work has been done on the central part of the coast. Therefore, the present programme was organised to fill up this gap by studying in detail the faunal composition of zooplankton and their seasonal changes during the northeast and intermonsoon period in between Cochin and Quilon.

## MATERIALS AND METHODS

Under NIO-CIFO joint research programme, two cruises were undertaken along three transects in the area off Cochin, Alleppey and Quilon with 4-5 stations in each transect (Fig. 1). The first cruise was held during 24th to 26th February, 1970 and the second cruise during 8th to 10th April on the same track. The stations were fixed from inshore to offshore at the interval of 8 to 10 nautical miles. In the first cruise only one deep water station was worked in the Quilon transect. In the second cruise one deep water station in each transect was covered. Observations were made for zooplankton, hydrography and

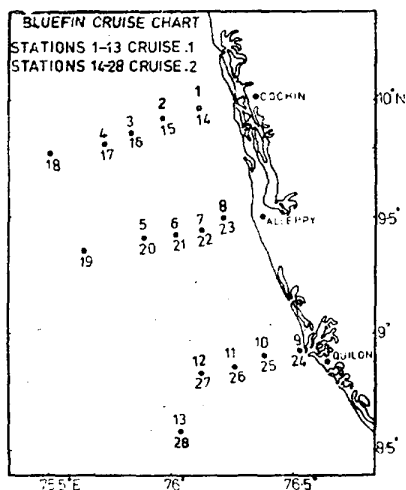


Fig. 1. Cruise chart of 'Blue Fin' Cr. 1 and 2, Cr. 1, February, Cr. 2, April

sediments. A detailed report on hydrography has been published by Purushan and Rao (1974).

Zooplankton samples were collected by means of vertical hauls with HT square net (mouth area 0.25 m<sup>2</sup>, length 2.8 m, mesh width 200  $\mu$ ). Normally the hauls were taken from bottom to surface. In stations where marked thermocline was observed, two hauls were taken, one from bottom to surface and the other from the top level of the thermocline to the surface. The samples were treated uniformly following the procedure devised by Hansen (1966). The total number of each taxonomic group present in the sample was converted into logarithms and distribution charts were prepared showing the different grades of density.

## General hydrography

The Kerala coast is influenced by two watermasses, a low saline coastal water-mass and a high saline oceanic watermass (Wyrtki, 1973). The presence of high saline water at the subsurface level in the continental shelf is evident (Banse, 1968, Purushan and Rao, 1974). During February–April this water is traceable upto 40 m depth. The low saline water-mass has 34.29 to 34.50 ‰, 4 to 5 ml/l oxygen and 28.4 to 30.2 °C surface temperature. This watermass is found to occupy the inshore waters of the coastal belt from surface to bottom and spreads at the surface level upto the offshore areas. The high saline watermass has 35.40 to 36.40 ‰, 0.28 to 1.1 ml/l oxygen at the subsurface level and 29.0 to 29.6 °C surface temperature.

## RESULTS

The distribution of standing stock of zooplankton shows that the outer neritic zone is twice richer than the inner neritic zone (Fig. 2). However, two inshore stations in the area off Cochin and off Quilon in the first cruise are equally rich like offshore stations. The highest standing stock is recorded in the outer neritic zone off Cochin and Alleppey. Similar offshore richness of plankton has been observed by Sakthivel (1972) in the area off Cochin and Calicut. This is attributed to the phenomenon of offshore upwelling which commences in February at a deeper level with a tilt in thermocline in April (Sharma, 1968).

Foraminifers were found in large numbers in February with the density of the population gradually declining from Cochin to Quilon transect and in April

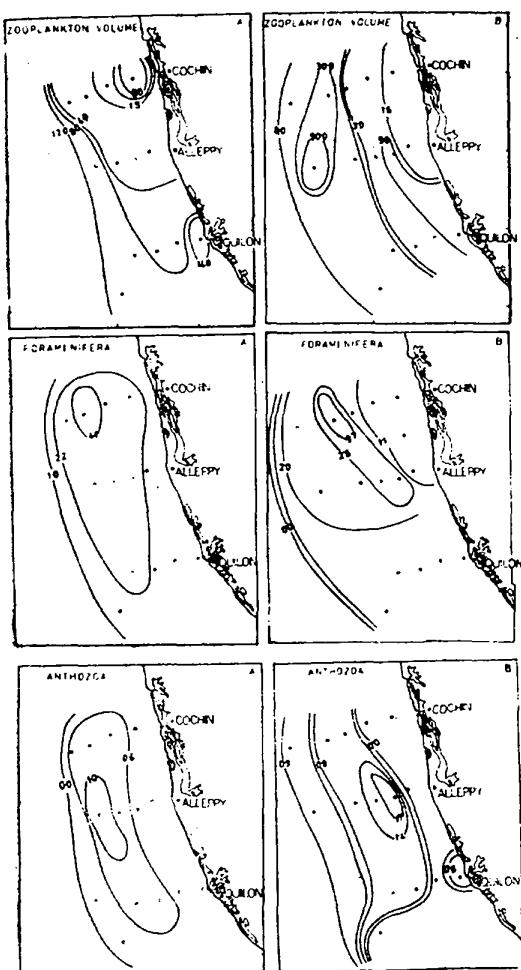


Fig. 2. The displacement volume of zooplankton and the distribution and relative abundance of Foraminifera and and Anthozoa. A, February. B, April.

the entire population from south gets drifted to the north reaching heavy density. Twenty six species of planktonic Foraminifera have been reported in the

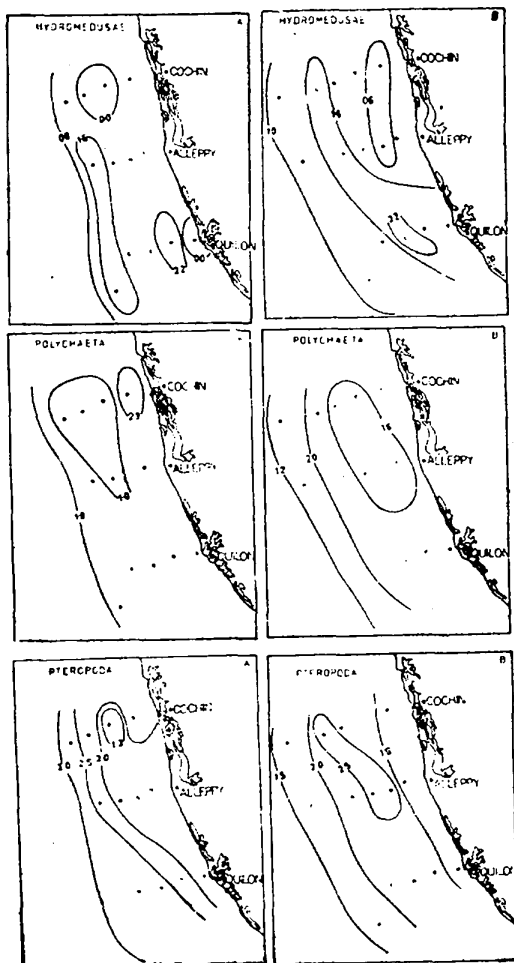


Fig. 3. The distribution and relative abundance of Hydromedusae, Polychaeta and Pteropoda. A, February. B, April.

plankton and sediments (Kameswara Rao, 1973) in the area off Cochin, Pelagic anthozoans (including actinia, arachnates, zoanthea and zoanthina) were

abundant in the area off Alleppey during both cruises. Hydromedusae were very common in the area off Quilon. Of a total of 51 species recognised, 14 species were new to the Arabian Sea (Vannucci & Santhakumari, 1969). *Pleurobrachia*

sp. and *Beroe* sp. of ctenophores were found in few numbers in the Quilon and Alleppey transects. Pelagic polychaetes were abundant off Cochin with maximum concentration in the in-shore waters off Cochin in February (Fig. 3.)

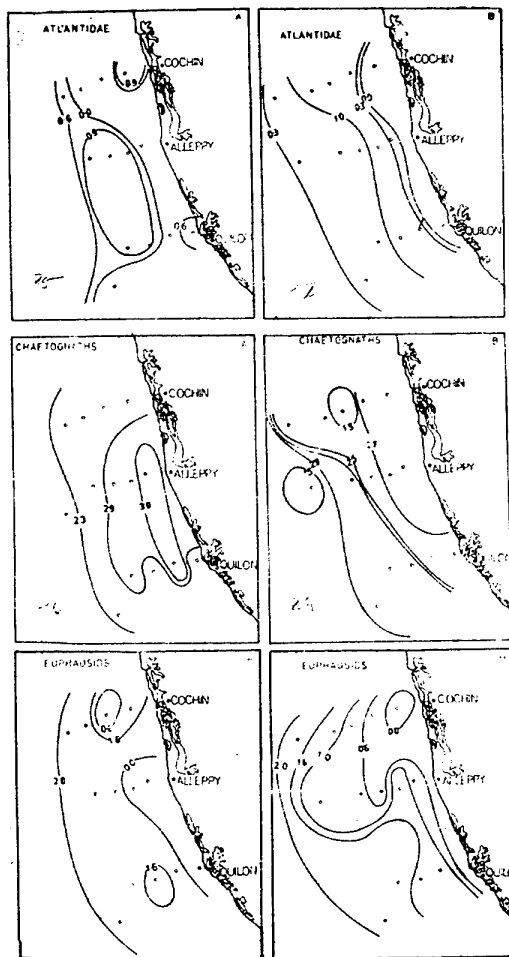


Fig. 4. The distribution and relative abundance of Atlantidae, Chaetognaths and Euphausiids. A. February. B. April.

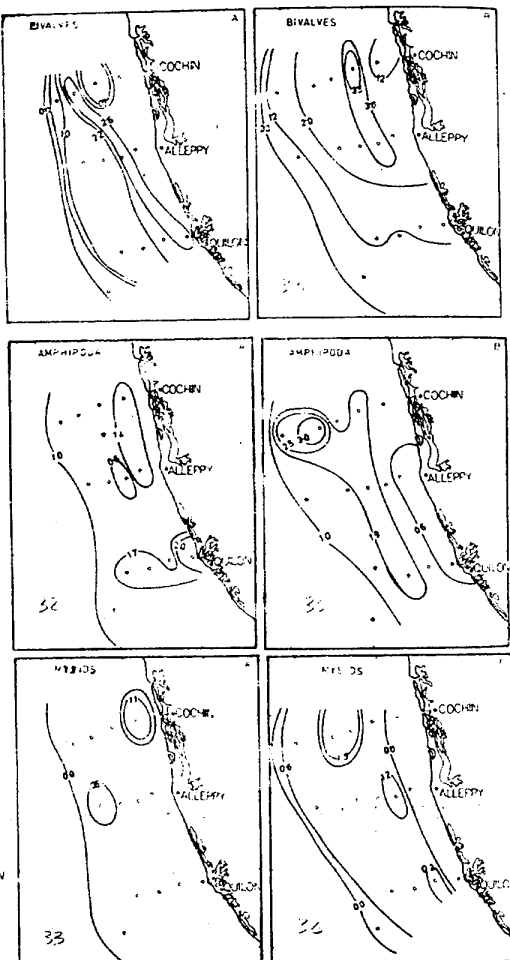


Fig. 5. The distribution and relative abundance of Bivalves, Amphipoda and Mysids. A. February. B. April.

The thecosomatous pteropods such as *Limacina inflata* d'orbigny, *L. trochiformis* d'orbigny, *Creseis acicula* Rang, *C. virgula* Rang, *C. conica* Eschscholtz, *Clio pyramidata convexa* (Boas,) *Cavolinia longirostris* (Lesueur, Blainville) and

*Desmopterus papilio* Chun were present. Of all these species *L. trochiformis* and *C. acicula* were abundant in the near-shore waters and the rest of the species in the offshore waters. Atlantids and *Firolloida* sp. of Heteropods were less

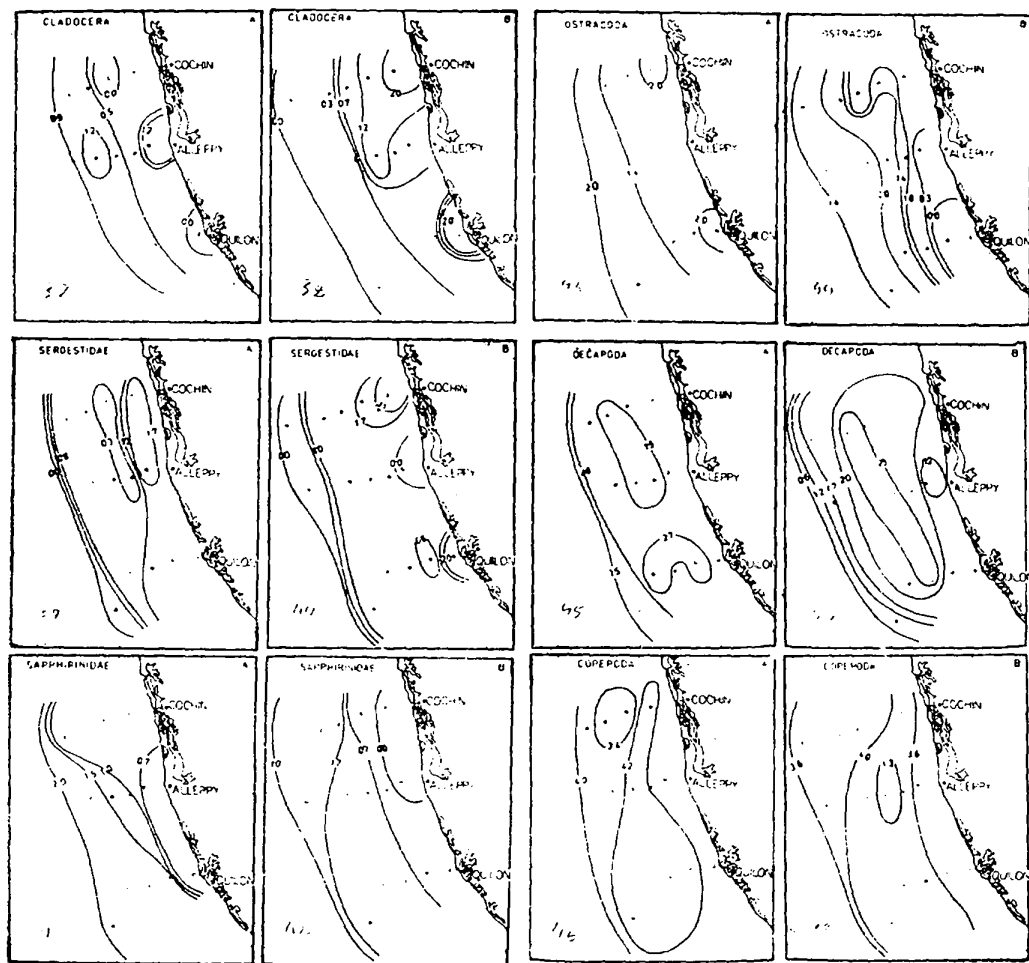


Fig. 6. The distribution and relative abundance of Cladocera, Sergestidae and Sapphirinidae. A. February. B. April.

Fig. 7. The distribution and relative abundance of Ostracoda, Decapoda and Copepoda. A. February. B. April.

numerous. Meroplanktonic gastropods, gymnosomes and phylliroids and cephalopod juveniles were found in a few numbers. The veligers of bivalves were found numerous in all the shelf stations with maximum concentration around 40-50 m depth line in the area off Cochin in April. The population of chaetognaths, found in dense concentration in the shelf waters off Quilon and Alleppey in February move towards north reaching heavy density in the area off Cochin (Fig. 4.)

Hyperiid were the dominant component of amphipods. A dense patch, observed in the nearshore waters off Quilon in February gets drifted towards north reaching swarms in the off shore areas off Cochin (Fig. 5). The entire swarm was constituted by a single species *Hyperia sibaginis* (Nair, 1972). A gradual increase in the population of euphausiids was observed from inshore to offshore waters. Mysids, found only in two stations in February were very common in April. Cladocerans constituted by *Evadne* sp. and *Penilia* sp. were very abundant in the inshore waters (Fig. 6). *Cypridina* sp. was the dominant component of ostracods and found numerous in the offshore waters. The population of sergestids is more widespread in April with high concentration in the inshore waters off Cochin and Quilon in February. A dense patch of decapod larvae (excl. sergestids) observed off Quilon in February spreads to other transects in April. Phyllosoma larva was present only in two stations in the area off Cochin and Alleppey even though the lobster *Puerulus severi* was caught here in several tons in the same cruises

(Fig. 7). A gradual increase in the density of sapphirinids was found from inshore to offshore waters. Other copepods were found uniformly abundant in all the transects in February. In April the density was slightly reduced and the highest concentration was found to be restricted to a patch in the area off Alleppey.

Two dense patches of salps were observed in the inshore waters off Cochin and Quilon with offshore increase in February (Fig. 8). In April this dense patch drifted towards the outer shelf with reduction in the population in other areas. Doliolids were found in few numbers. Copelates were uniformly abundant in the shelf waters in February and patchy in April.

Fish eggs were very few in both the cruises. Fish larvae were less abundant in February than in April (Fig. 9). Myctophids were the dominant group of fish larvae with the highest density (50/haul) in two stations off Cochin and off Alleppey. Nellen (1973) has also recorded the highest concentration (528/m<sup>2</sup>) of myctophid larvae along the west coast of India. Larvae of *Gonostomidae* were more common in February with the maximum number in the Cochin transect. Larvae of *Engraulidae* were found only in two stations in the Alleppey and Quilon transects in February. *Carangid* larvae were more common in April in the Quilon transect. Out of a total of seven records of *serranid* larvae, four were found in Quilon transect. Larvae of *Gobiidae* were present in Cochin and Quilon transects. There were three records of *sciaenid*

Fig. 8. The distribution and relative abundance of Salps and Copepata, A. February, B. April.

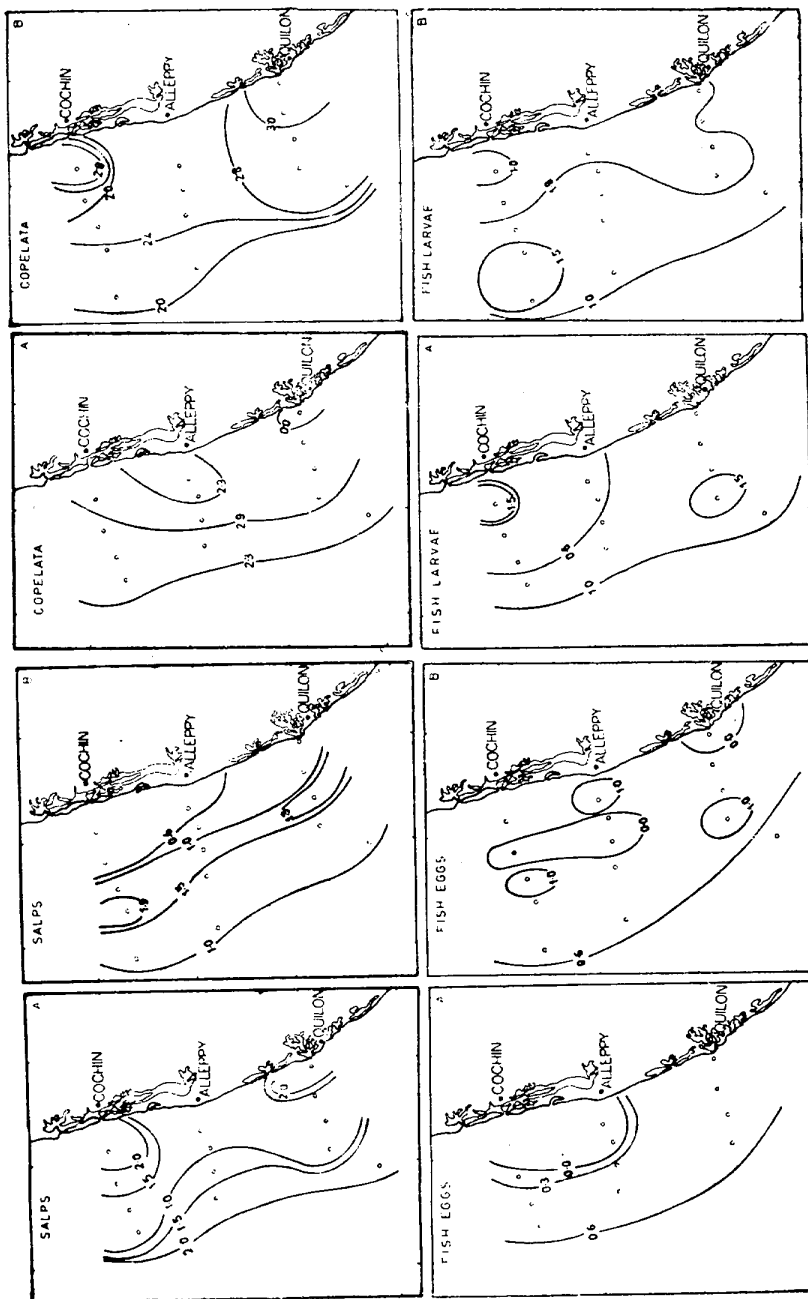


Fig. 9. The distribution and relative abundance of Fish eggs and Fish larvae, A. February, B. April:

larvae in the area off Quilon. *Bothid* and *Cynoglossus* larvae were present only in one or two stations. The rare groups such as *Bregmaceros*, *Synodontidae*, *Sphyaenidae*, *Dactylopteridae*, *Tetradontidae* and *Mugilidae* were represented in one or two samples.

Pilidium larvae of Nemertines were abundantly found in the inshore waters of all the transects in February with peak density in the area off Alleppey (Fig. 10 a & b). This population is much reduced in April and almost absent in the offshore waters. Bipinnaria and

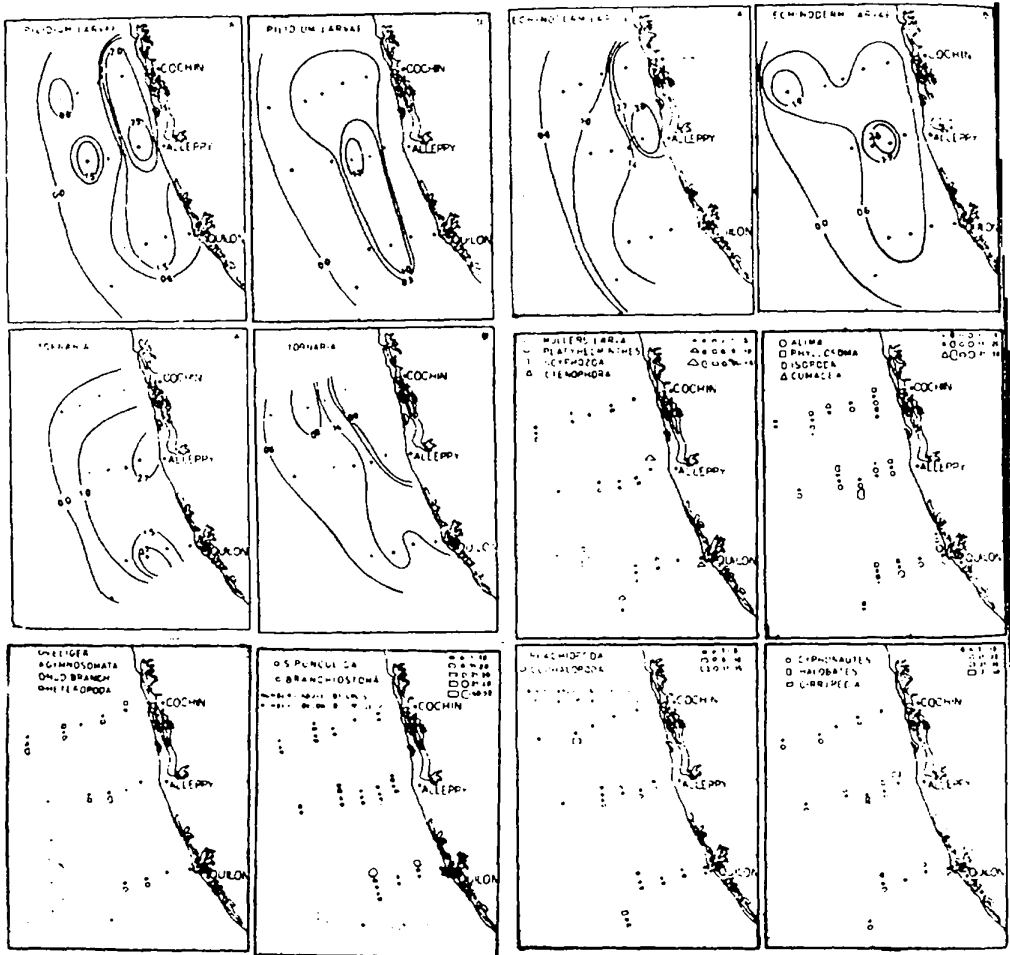


Fig. 10. a. The distribution and relative abundance of Larval and other groups, A. February B. April.

Fig. 10. b. The distribution and relative abundance of Larval and other groups, A. February, B. April.



pluteus larvae of echinoderms had similar pattern of distribution reaching swarms in the area off Alleppey. Tornaria larvae of phoronids were also found numerous in February in the nearshore waters off Alleppey and Quilon and absent off Cochin. There were a few records of muller's larvae and Turbellarians. Brachiopod larvae were found only in April in Alleppey and Quilon transects. The occurrence of these larvae in the area off Cochin and Calicut has already been reported by Sakthivel (1972). With these new records in the area off Alleppey and Quilon it has been observed that these larvae are found all along the west coast of India from Trivandrum to Bombay. Sipunculids and Branchiostoma larvae were present in all transects.

#### DISCUSSION

From the over all distribution it is clearly observed that the meroplanktonic forms (such as bivalve larvae, pilidium, tornaria, echinoderm larvae) and cladocerans reach peak abundance in the low saline watermass of the nearshore waters. Such larval abundance is also observed in the east coast around Mandapam and Krusadai island during the northeast monsoon period (Chacko, 1950, Prasad, 1954). Della Croce and Venugopal (1972) have reported the highest density of *Evadne tergestina* ( $16,935/m^3$ ) in the inshore waters off Quilon and sudden decrease ( $20/10 m^3$ ) towards the offshore stations. A swarm of *Penilia avirostris* along with *Creseis acicula*

has also been reported in the inshore waters off Cochin (Sakthivel & Haridas, 1974). Therefore the low saline environment of the west coast forms a separate ecological niche where only certain groups of animals flourish better. Even though the west coast has a broad continental shelf providing favourable substratum for the settlement of larvae, it appears that the intrusion of high saline offshore watermass into the continental shelf arrests the distribution of many larval forms.

Of all the stations explored, station No. 12 and 18 are found to be populated by a variety of fish larvae and about 8 to 9 families are represented there. *Myctophids*, *Gonostomids* and *Bregmacerotids* are the three common groups of fish larvae in the west coast. As Nellen (1973) reports, the west coast of India stands second in abundance of myctophid larvae next to the Gulf of Oman in the Arabian Sea. February appears to be more productive period than April.

#### ACKNOWLEDGEMENTS

We are indebted to Dr. S. Z. Qasim, Director, National Institute of Oceanography and Mr. M. C. Perumal, Director, Central Institute of Fisheries Operatives for the facilities and encouragement. The Skipper Mr. Balan and crew of "Blue Fin" are thanked for their excellent co-operation on board. We are grateful to Dr. T. S. S. Rao for going through the manuscript.

#### REFERENCES

- Banse, K. 1968. Hydrography of the Arabian Sea, shelf of India and Pakistan and effects on demersal fishes. *Deep Sea Res.*, 15 (1) : 45-80.

- Chacko, P. I. 1950. Marine plankton from waters around Krusadai Island. *Proc. Ind. Acad. Sci.*, **31** (3B) : 162-174.
- Chidambaram, K. and M. D. Menon. 1945 The correlation of the west coast (Malabar and S. Kanara) fisheries with plankton and certain oceanographical facts. *Proc. Ind. Acad. Sci.*, **22** (6B) : 355-367.
- Della Croce, N. and P. Venugopal. 1972 Distribution of marine cladocerans in the Indian Ocean. *Mar. Biol.*, **15** : 132-138.
- George, P. C. 1953 The marine plankton of the coastal waters off Calicut with observations on the hydrological conditions. *J. Zool. Soc. India*, **51** (1) : 76-107.
- Hansen, V. Kr. 1966 The Indian Ocean Biological Centre : The Centre for sorting plankton samples of the International Indian Ocean Expedition. *Deep. Sea Res.*, **13** (2) : 229-234.
- Kameswara Rao, K. 1973 Quantitative distribution of planktonic foraminifera in the south-west coast of India. *Indian J. mar. sci.*, **2** (1) : 54-61.
- Menon, M. A. S. 1945 Observations on the seasonal distribution of the plankton of the Travancore coast. *Proc. Ind. Acad. Sci.*, **22** (2 B) : 31-62.
- Nair, K. K. C. 1972 A note on an amphipod swarm along the south-west coast of India. *Curr. Sci.*, **41** (5) : 185-186.
- Nellen, W. 1973 Kinds and abundance of fish larvae in the Arabian Sea and Persian Gulf. In *The Biology of the Indian Ocean. Ecol. Studies* **3**, **5** (1) : Zeitzschel (Ed.), Springer-Verlag, Berlin. 415-430.
- Prasad, R. R. 1954. Observations on the distribution and fluctuations of planktonic larvae off Mandapam. *Symp. Marine & Freshw. Plankton in the Indo-Pacific* : 21-34.
- Purushan, K. S. and T. S. S. Rao. 1974 Studies on upwelling off the south-west coast of India. *Indian J. mar. Sci.*, **3** (1) : 81-83.
- Sakthivel, M. 1972 Simple underway sampler and its performance. *Handbook to the Internat. zoopl. Coll. 3, Proc. Workshop on plankton methods IOBC, Cochin* : 8-17.
- Sakthivel, M. and P. Haridas. 1974 Synchronization in the occurrence of a *Trichodesmium* bloom and swarming of *Creseis acicula* Rang (Pteropods) and *Penilia avirostris* Dana (Cladocera) in the area off Cochin. *Mahasagar - Bull. nat. Inst. Oceanogr.*, **7** (1 & 2) : 61-67.
- Saraswathy, M. 1967 Pelagic copepods from the inshore waters off Trivandrum coast. *Proc. Symp. Crustacea, Mar. biol. Ass. India*, **1** : 74-106.

- Sharma, G. S. 1968 Seasonal variation of some hydrographic properties of the shelf waters off the west coast of India, *Bull. nat. Inst. Sci. India*, **38** : 263-276.
- Silas, E. G. 1968 Cephalopods of the west coast of India collected during the cruises of the Research Vessel *Varuna* with a catalogue of the species known from the Indian Ocean. *Proc. Symp. Mollusca, Mar. biol. Ass. India*, **3** (3) : 277-359.
- Silas, E. G. and K. C. George. 1969 On the larval and postlarval development and distribution of the mesopelagic fish *Vinciguerria nimbaria* (Jordan and Williams) (Family Gonostomidae) off the west coast of India and the Laccadive Sea. *J. mar. biol. Ass. India*, **11** : 218-250.
- Vannucci, M. and V. Santhakumari. 1969 New records of Hydromedusae from the shelf waters off the Kerala coast. *J. mar. biol. Ass. India*, **11** (122) : 40-43.
- Wyrtki, K. 1973 Physical Oceanography of the Indian Ocean. In : *The Biology of the Indian Ocean, Ecol. Studies* 3, **1** (3) : 18-36. Zeitzschel (Ed.), Springer-Verlag, Berlin.