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Distribution of Zooplankton from Arabian Sea, along Southern Kerala (Southwest Coast of India) During the Cruise

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Abstract: Among different groups of zooplankton copepods contributed maximum numerical abundance contributed up to (31.93%). 26 species of copepods constituted by 20 species of calanoida, 3 species of harpatocoida and 3 species of cyclopoida. The predominant species of copepods were *Acartia spinicuda, Calanus finmarchicus, Paracalanus parvus, Acrocalanus gracilis,* and *Euterpina acutiferons*. Less number of Ichthyoplankton encountered during present study is an indication of anthropogenic hydrographical changes in coastal waters and its adverse impact on fishery potential of these transects. Salinity showed a significant positive correlation with zooplankton density. Relatively low zooplankton density in the near shore stations compared to offshore may be attributed to salinity variations and marginal stress from the fresh water input. Thus the present attempt is made to study the distribution of zooplankton recorded in Arabian Sea along Southern Kerala. Among the stations, the highest zooplankton population of 366 Nom^{-3} was recorded at Neendakara 5km offshore and Veli near shore (EDP) recorded the lowest density of 60 Nom^{-3}. The minimum zooplankton density encountered at Veli transect might be due to constant exposure to precipitate, severe drop in pH, low dissolved oxygen leading to asphyxiation and death of large population.

Key words: Zooplankton, population density and Arabian Sea.

INTRODUCTION

Zooplankton plays an important role in the marine food chain as intermediate link between phytoplankton and fish. Some fishes are exclusively zooplankton feeders and therefore their abundance is directly linked to the presence of zooplankton. The rate of zooplankton production can be used to estimate the exploitable fish stock Tiwari and Nair (1991). Among the zooplankton community, hydromedusae form a significant part of carnivore in the estuarine habitat. The group often serves as an index to industrial pollution Santhakumari *et al.,* (1999). The present study accounts deals with aspect of zooplankton distribution, density and diversity along the southern Kerala coast.

MATERIALS AND METHODS

Zooplankton samples were collected from the subsurface waters along each station by horizontal subsurface towing of plankton net (mouth area 0.25m^2, mesh size 300µm) for 5 min which was employed in southern Kerala coast between (Lat 9º 57′N and 8º 29′N and Long 76º 14′E and 76º 53′E) stretch from north to south during 2004. A digital flow meter was used to determine the volume of water filtered UNESCO (1968). Samples were collected in 250ml plastic bottles and preserved in 4% buffered formaldehyde and used for qualitative and quantitative analysis following Gowsami and Padmavathi (1996). The keys employed include the works of Wilson (1932), Davis (1955), Kasthuriranagn (1963), Krishnapillai (1986) and Wickstead (1965). The biomass is found out by the volume displacement method and expressed in ml m^3. The numerical analysis was carried out using Utermohls inverted plankton microscope.

RESULT

Zooplankton includes members of percentage shows that copepods formed dominant groups Copepod (31.93%), Foraminifera (6.19%), Acantharia (3.74%), Radiolaria (2.48%), Ciliata(5.67%), Anthomedusae (2.41%), Leptomedusae (0.22%), Siphonophores (2.46%), Ctenophores (1.34%), Salps (0.71%), Doliolids (0.33%), Chaetognatha (3.85%), Decapoda (1.6%), Larvae (19.01%), Cladocera (9.08%), Cumacea (0.25%), Isopods (0.44%), Ostracoda (0.35%), Copepod (31.93%), Amphipoda (3.24%), Pteropoda (1.71%), Appendicularia (3.24%), and Ichthyoplanktons (2.83%) (Fig. 1). Species composition of zooplankton recorded at different transects (Table 1). A total of 120 species of zooplankton were recorded, which include 26 species of copepod, 10 species of foraminifera, 10 species of ciliate , 6 species of

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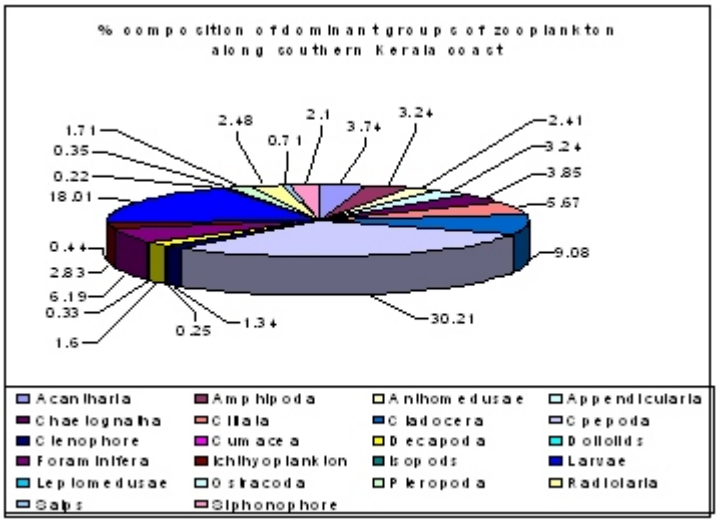

Fig 1: Percentage composition of dominant groups of zooplankton along southern Kerala coast

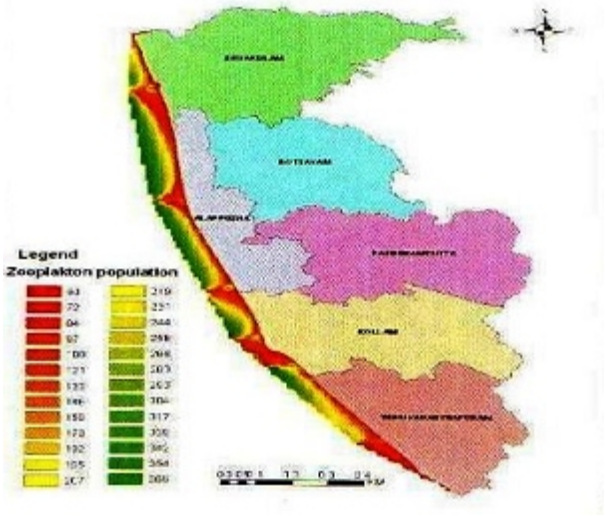

Fig 2: Variation of zooplankton population (Nom^{-3}) along the transects

Table 1: List of zooplankton species recorded along the southern Kerala coast during October 2004.

S.No	Name of the species	Transect I	TransectII	Transect III	Transect IV	Transect V	Transect VI
Foraminifera							
1	*Ammonia beccari*	+	+	+	+	+	+
2	*Rosalina bertheloti*	+	+	+	+	+	+
3	*Eponides repandus*	-	+	-	+	-	-
4	*Elphidium crispum*	+	+	+	-	+	+
5	*Loxostomum limbatum*	-	+	+	+	+	+
6	*Amphistegina radiata*	-	+	+	+	+	+
7	*Textularia candeiana*	-	+	+	+	+	+
8	*Textularia agglutnans*	-	+	+	+	+	+
9	*Bolivinitia quadrilatera*	+	+	+	+	++	++
10	*Globigerina sp.*	+	++	++	++	++	++
Acantharia							
11	*Acanthochiasma sp.*	-	+	-	++	++	+
Radiolarians							
12	*Thalassicolla sp.*	-	-	+	++	+	+
Ciliata							
13	*Codonellopsis ostenfeldii*	-	+	+	+	+	+
14	*Favella brevis*	-	+	+	+	+	+
15	*Favella phillippensis*	-	+	+	+	+	+
16	*Favella erenbergii*	-	+	+	+	+	+

Table 1: Continued

17	*Codonellopsis ecaudata*	+	+	+	+	+	+
18	*T. beroidea*	-	+	+	+	+	+
19	*Coxiella ampla*	+	+	-	+	+	+
20	*T. cylindrical*	+	+	+	+	+	+
21	*T. directa*	+	+	+	+	+	+
22	*T. tubulosa*	+	+	+	+	+	+
Anthomedusae							
23	*Laodicea undulata*	+	+	+	+	+	+
24	*Sarsia eximia*	+	+	+	+	+	+
25	*Bougainvillea sp.*	+	-	+	+	+	+
26	*Phialella quadrata*	+	+	+	+	+	+
Leptomedusae							
27	*Obelia sp.*	+	+	-	+	-	-
Siphonophores							
28	*Muggiaea kochi*	+	+	+	+	+	+
29	*Lensia conoidea*	+	+	+	+	+	+
Ctenophore							
30	*Pleurobranchia pileus*	-	+	+	+	-	+
31	*Beroe cumis*	+	+	+	+	+	+
Salps							
32	*Salpa fusiformis*	+	+	+	+	+	+
Doliolids							
33	*Doliolum gegenbauri*	-	+	-	+	+	+
Chaetognatha							
34	*Sagitta enflata*	++	+	++	++	+	++
35	*Krohnitta subtilis*	-	+	+	+	+	-
36	*S. serratodentata*	+	+	+	-	-	+
37	*S. zetesios*	-	+	+	+	+	+
38	S. setosa	+	+	+	+	+	+
39	*S. elegans*	+	++	+	+	++	+
Cladocera							
40	*Penilia avirostris*	-	+	+	+	+	-
41	*Podon lecarti*	-	+	+	+	+	++
42	*P. intermedius*	++	++	++	+	+++	+++
43	*Evadna normani*	+++	+++	+++	+++	+++	+++
44	*E.tergestina*	+	+	+	-	+	+
Cumacea							
45	*Diastylis sp.*	0	+	-	-	+	+
Isopods							
46	Sphaeroma sp.	-	-	+	+	+	+
47	Idotea sp.	-	+	-	-	-	+
Ostracoda							
48	*Conchoecia sp.*	0	+	+	+	+	+
Copepoda							
(a)Calonoidia							
49	*Acartia danae*	-	+	+	+		++
50	*A. spinicuda*	++	+++	+++	+++	+++	+++
51	*Calanus finmarchicus*	++	++++	+++	+++	+++	+++
52	*Temora discaudata*	-	+	+	+	-	+
53	*T. longicornis*	-	+	-	+	+	+
54	*T. turbinata*	-	-	+	+	+	-
55	*Centeropages furcatus*	+					
56	*Acrocalanus gibber*	+	+	+	+	-	+
57	*Labidocera detruncata*	+	+	+	-	+	+
58	*Paracalanus parvus*	-	++	++	++	++	+
59	*Pseudocalanus elongatus*	+	+	+	+	+	+
60	*Pontella danae*	-	++	+	+	++	+
61	*Pontellopsis herdmani*	-	-	-	+	-	+
62	*Euterpinna acutifrons*	+	+	+	+	+	+
63	*Eucalanus crassus*	+	+	+	+	+	+
64	*Acrocalanus gracilis*	+	++	++	++	+	++
65	*Labidocera acuta*	+	+	+	+	+	+
66	*Eucalanus attenuatus*	-	+	+	+	+	+
67	*Paracalanus parvus*	+	+	+	+	+	+
68	*Temora stylifera*	+	+	+	+	+	+
(b)Harpacticoida							
69	*Euterpina acutiferons*	+	++	+	++	++	+
70	*Microsetella rosea*	+	-	+	-	-	-
71	*M. gracilis*	+	+	+	+	+	+
C) Cyclopodia							
72	*Corycaeus nana*	-	+	-	+	+	+

Table 1: Continued

73	*Oithona rigida*	-	+	+	+	+	+
74	*O. similis*	+	+	+	+	+	+
Amphipoda							
75	*Gammarus sp.*	+	+	+	+	+	+
76	*Corophium sp.*	-	+	-	+	+	+
77	*Metaprotella sp.*	-	-	+	-	-	+
Pteropods							
78	*Creseis acicula*	+	+	+	+	+	+
79	*Cliona limacina*	-	+	-	-	-	-
80	*Cavolina sp.*	-	-	-	-	+	-
Appendicularians							
81	*Oikopleura diocia*	+	+	+	++	++	+++
82	*O. fusiformis*	+	+	+	++	+	++
Decapoda							
83	*Lulcifer hanseni*	+	++	++	++	++	++
Larvae							
84	*Copepod nauplius*	++	++	++	++	++	++
85	*Cypris larvae*	-	-	+	-	-	+
86	*Cirripede nauplius*	-	-	+	-	+	+
87	*Gastropod veliger*	+	++	++	++	++	+
88	*Bipinaria larvae*	+	+	+	+	+	+
89	*Echinopluteus larvae*	-	+	+	+	+	+
90	*Bivalve viliger*	+	+	+	+	+	+
91	*Cyphonatues larvae*	-	-	+	-	-	-
92	*Lamellibranch larvae*	+	++	+++	+++	++	++
93	*Nereid larvae*	-	-	-	-	+	-
s94	*I zoea of crab*	+	+	+	+	+	+
95	*Decapod zoea*	+	+	+	+	+	+
96	*Megalopa of crab*	-	-	+	-	+	-
97	*Mysis larvae*	+	+	+	+	+	+
98	*Penaed nauplius*	+	+	+	+	+	+
99	*Alima larvae*	-	-	+	+	+	-
100	*P. protozoea*	+	+	+	++	++	+
Ichthyoplanktons							
101	*Post larvae of stoleophorus sp.*	+	+	+	+	+	+
102	*Post larvae of Ambassis sp.*	-	+	+	-	-	+
103	*Egg of sardinella sp.*	+	+	++	+	+	+
104	*Egg of stolephorus sp*	+	+	+	+	+	-
105	*Leiognathidae daura*	-	+	+	+	+	+
106	*Sardinella fimbriatta*	-	+	-	+	-	+s

* Transect. I (Cochin), *Transect. II (Alleppey), *Transect. III (Kayamkulamm), *Transect. IV (Neendakara), *Transect. V (paravur), *Transect. VI (Veli).“+” Denotes presence, “++” Denotes less abundant, “+++” Denotes Abundant, “–” Denotes absence.

Chaetognatha, 5 species of Cladocera, 4 species of Anthomeusae, 3 species of Amphipoda, 3 species of Pteropoda, 2 species each of Siphionophore, Ctenophore and Appendicularians. Accantharia, Radiolaraia, Leptomedusae, Salps, Doliolids, Cumacia, Isopods, Ostracoda, and Dacapoda were represented by one species each. Whereas, 17 larval forms and 6 Ichthyoplanktons also were recorded and its biomass varied from 0.02 ml m^{-3} at Veli near shore to 0.23 ml m^{-3}at Neendakara 5 km offshore. The population density recorded as highest of 366 Nom^{-3} at Neendakara 5 km offshore and the lowest density of 60 Nom^{-3} in Veli near shore (EDP). Variations of zooplankton population at different stations were illustrated in Fig. 2.

DISCUSSION

Zooplankton community of a marine ecosystem comprises of heterogeneous assemblage of many animals covering taxonomic groups. The distribution of zooplankton varies with the state of tide population dynamics is related to the physico-chemical factors. The zooplankton occupies a single position between the autotrophs and other heterotrophs and forms an important link in marine food web. Zooplankton is a good indicator of changes in water quality, because it is strongly affected by the environmental conditions and it is quickly responded to changes in environmental quality Gannon and Stemberger (1978). Saldeek (1983) reported that among zooplanktons crustaceans, cladocerans and copepods can used as the indicator of aquatic environment. Among the stations zooplankton density ranged from 60 No m^{-3} at Veli near shore (EDP) to 366 m^{-3}at Neendakara 5 km offshore. Among different groups of zooplankton copepods contributed to the maximum numerical abundance contributed up to (31.93%). In present survey a total of 22 group of zooplankton comprise of 106 species of zooplankton species were recorded and the order. The most common species of copepods were *Acartia spinicuda, Calanus finmarchicus, Paracalanus gracilis,* and *Euterpina acutiferons*. Such types of numerical abundance of copepods in various waters were studied by (Gowsami, 1985a, b and Vijayalakshmi *et al.,* 1983). The high zooplankton density at Neendakara waters might be due to relatively stable environmental conditions like optimal salinity, temperature, and good standing crop of phytoplankton prevailed in that region. And also at Neendakara, salinity showed a significant positive correlation with zooplankton density. Relatively low

zooplankton density in the near shore stations compared to offshore may attributed to earlier works of Asha *et al.,(*2002); Robin *et al.,*(2003). The minimum zooplankton density encountered at Veli transect might be due to constant exposure to suspended precipitate, severe change in pH, low dissolved oxygen will cause prolonged sub lethal effects such as chocking of respiratory asphyxiation and consequently leads to the death of large population of zooplankton community. This observation is similar to he findings of Abdul azis and Balakrishnan Nair (1981); Bijumon *et al.* (1998, 2000); Prijilal, (2003). In coastal waters tide can influence the qualitative and quantitative distributions of zooplankton. There was a shoreward increase in zooplankton during food period and reverse trend experienced. Copepods and decapods were the higher forms substantiate higher population during ebb period. While, Chaetognaths and Appendicularians caught appreciable number during the flood period. This conclusion is in agreement with earlier observations at Maharashtra coastal waters by Gajbhiye *et al.,* (1983). At Veli transect, very high numerical abundance of siphonophores was noticed indicating that the pollution thriving nature of that species especially low pH and high water temperature. Kamaeswara Rao *et al.,* (1979) revealed that no foraminifera species were present in the beneath the acidic flacks and species diversity of foraminifera very low at vicinity of EDP area. Gajbhiye *et al.,* (1991) has reported that *Acartia spinicuda* can thrive well in polluted environment and appears to be an indicator of marine pollution. Present study reveals that zooplankton density of southern Kerala coasts was affected by anthropogenic activities together with the industrial effluent discharge. This will lead ecological imbalance and there by corresponding fishery potential of these area.

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