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Zooplankton Abundance and Diversity from Pointcalimere to Manamelkudi, South East Coast of India

Varadharajan D* and Soundarapandian P

Centre of Advance study in Marine Biology, Faculty of Marine Sciences, Annamalai University, Parangipettai, Tamil Nadu, India

Abstract

The play an important role to study is the faunal biodiversity of an aquatic ecosystem. The zooplankton recorded with the present study belonged to some taxa including, Foraminifera, Calanoida, Cheatognatha, Appendicularia, Polychaeta, Hydrozoa, Echinodermata, fish eggs and larvae. Rotifers were found in all stations. Fish eggs and larvae occurred throughout the year, but had peak abundance in summer. Larval forms of all groups were more evenly distributed in all the stations except *O.dioica*, *Mysis* and *Ehinopluteus* During the study period maximum salinity was recorded in the month of May 34.5 ppt and minimum was in the month of November 26.5. The maximum water temperature was recorded (34.5°C) in June and minimum (25.5°C) was recorded in the month of November, In general, pH was low during the monsoon season that is 7.6 in the month of December and maximum was recorded in April, 8.2. Dissolved oxygen concentration was low during the summer season could be attributed to the lesser input of freshwater into the study areas. High dissolved oxygen was observed in all the stations.

Keywords: Zooplankton; Foraminifera; Calanoida; Abundance; Diversity

Introduction

Zooplankton is economically and ecologically vital group of aquatic organisms so as to occupy a wide range of habitats extending from the pleuston to benthos. It is the primary consumers of the ocean and grazes on the phytoplankton. It is an important food sources for large animals [1] can be important in the remineralization and transport of nutrients [2]. Zooplankton is necessary to assess the potential fishery resource of a place [3]. Species composition, abundance and diversity of zooplankton have been well studied from some tropical estuaries of India [4-6], Vellar estuary [7], Palk Bay [8] South east coast of India. In the present study an attempt has been made to investigate the zooplankton species abundance and diversity from Pointcalimere to Manamelkudi south east coast of India.

Materials and Methods

The distribution of zooplankton was investigated from four stations for one year from August 2008 to July 2009. The four stations were (Station-1) Pointcalimere (or) Kodikkarai (Latitude, 10°18' N; Longitude, 79°51' E), (Station-2) Mallipattinam (Latitude, 10°16'35N"; Longitude, 79°19'12" E), (Station-3) Sethubavachathiram, (Station-4) and Manamelkudi (Latitude, 10°25'13" N, Longitude 79°18'51"E), south east coast of India. Zooplankton samples were collected at monthly intervals from the surface waters of the study area. In all the four stations, samples were collected by horizontal towing of plankton net (0.35m mouth diameter) made up of bolting silk (No.10, mesh size 158um) for half an hour. These samples were preserved in 5% formalin [9] and used for qualitative analysis. The major taxonomic groups of zooplankton were determined under the light microscope with a magnification of 10x10. Samples were analyzed for determination of zooplankton abundance and diversity [10-12] and for identification of zooplankton standard works of [13,14] were used. The species evenness, richness, diversity and index were calculated by using computer statistical software package, 'ECOSTAT'. Standard methods were followed for the estimation of the different physico-chemical features of the water samples.

Results and Discussion

Zooplankton recorded in the present study consisted of 73 species at four stations from August 2008 to July 2009. The zooplankton recorded with the present study belonged to some taxa including, Foraminifera, Calanoida, Cheatognatha, Appendicularia, Polychaeta, Hydrozoa, Echinodermata, fish eggs and larvae were identified and their occurrence patterns are summarized. The zooplankton species are maximum in station (3) when compared to other stations (Table 1). The most dominant copepod species were *Acartia* spp., *Paracalanus* spp and *Temora turbinata.* Such types of numerical abundance of copepods in different waters were studied by [15,16]. In general, copepod species flourished at different seasons of the year [17]. Cyclopoida was represented by *Oithona* spp. *Oncaea venusta* and *Corycaeus catus*. The distribution of some *Acartia* species is known to be affected by temperature and salinity regimes [18]. Numeriacal abundance of copepods was also recorded by different coastal system of India [4,5]. Further the important factors that controlled the distribution of copepods were rainfall, river discharge and salinity as opined by [19].

Rotifers were found in all stations. Larval forms of all groups were more evenly distributed in all the stations except *O.dioica*, *Mysis* and *Ehinopluteus*. Foraminifera were common in all the stations and present throughout the year. Peak abundance occurred in February and March, during the dry season, represented mainly by *Globigerina* spp. These species have often been considered to be sensitive to sea-surface temperature, and therefore their assemblage can be used to estimate past sea-surface temperatures. Cyclic changes in the flux of planktonic foraminifera are powerfully prejudiced by environmental factors, such as sea-surface temperature, the structure of the water

***Corresponding author:** D.Varadharajan, Faculty of Marine Sciences, Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai-608 502, Tamil Nadu, India, Tel: +04144-243223; Fax: +04144-243553; E-mail: heartvaradhan@gmail.com

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S.No	Foraminifera	Stations			
		1	2	3	4
1	*Globigerina rubescense*	-	+	+	+
2	*G.bulloides*	+	-	+	+
3	*G.opima*	+	+	+	-
4	*Tintinnopsis bermudensis*	+	+	+	+
5	*T.butschlii*	+	+	-	+
6	*T .cylindrica*	+	+	+	+
7	*T.rubulosa*	+	+	+	+
8	*T.minuta*	+	+	+	-
9	*T.mortensenii*	+	+	+	+
10	*T.butschii*	+	+	+	+
11	*T. tocantinensis*	-	+	+	+
12	*Eutintinnus tennuis*	+	+	+	+
13	*Favella philipiensis*	+	+	+	+
14	*F.brevis*	+	+	+	+
15	*Dictyocysta seshayai*	+	+	+	+
16	*Acanthomentron sp*	+	+	+	-
	Hydroida				
1	*Obelia sp*	+	+	+	+
	Rotatoria				
1	*Brachionus calvciflorus*	+	+	+	+
2	*B.rubens*	+	+	+	+
3	*B.plicatilis*	+	+	+	+
	Pteropoda				
1	*Cresis sp*	+	+	+	+
	Cirripedia				
1	Molt of barnacle	+	+	+	+
	Calanoida				
1	*Rhicalanus sp*	+	+	+	-
2	*Nanaocalanus minor*	+	+	+	+
3	*Metacalanus sp*	+	+	+	+
4	*Paracalanus parvus*	+	+	+	+
5	*Acrocalanus gracilis*	-	+	+	+
6	*A.gibber*	+	-	+	+
7	*Pontella sp*	+	+	+	+
8	*P.danae*	+	+	+	+
9	*Temora turbinata*	-	+	+	+
10	*T. stylifera*	+	+	+	+
11	*T. discaudata*	-	+	-	+
12	*Tartanus barbatus*	+	+	+	+
13	*P. aurivilli*	+	+	+	+
14	*Labidocera pavo*	+	+	+	+
15	*L.acuta*	+	+	+	+
16	*L.pectinata*	+	+	+	+
17	*Acartia spinicaude*	+	+	+	+
18	*A.danae*	+	+	+	-
19	*A.centrura*	+	+	-	+
20	*A. southwelli*	+	+	+	-
21	*A.erythraea*	+	+	+	+
	Cyclopoida				
1	*Oithona rigida*	+	+	+	+
2	*O.similis*	+	+	+	+
3	*O.spinirostris*	+	+	+	+
4	*Oncaea venusta*	-	+	+	+
5	*Corycaeus catus*	+	+	+	+
6	*Bomolochus sp*	+	+	+	+
7	*Euterpina actiferons*	+	+	+	+
8	*Microsetella sp*	+	+	+	+
9	*Macrosetella sp*	+	+	+	+
	Doliolida				
1	*Salpa sp*	+	+	+	+
2	*Doliolum sp*	+	+	+	+
	Sagittoidea				
1	*Sagitta sp*	+	+	+	+
2	*S.enflata*	+	+	+	+
3	*S.bifunctata*	+	+	+	+
	Appendicularia				
1	*Oikopleura sp*	+	+	+	+
2	*O. parva*	+	+	+	+
3	*O.dioica*	+	-	+	+
4	*Crustacean nauplii*	+	+	+	+
5	*Copepod nauplii*	+	+	+	+
6	*Barnacle nauplii*	+	+	+	+
7	*Shrimp zoea*	+	+	+	+
8	*Mysis zoea*	+	+	+	-
9	*Crab zoea*	+	+	+	+
10	*Polychaete larvae*	+	+	+	+
11	*Ophioplutes larvae*	+	+	+	+
12	*Gastropod veliger*	+	+	+	+
13	*Bivalve veliger*	+	+	+	+
14	*Ehinopluteus larvae*	+	+	+	-
15	*Fish egg*	+	+	+	+
16	*Fish larvae*	+	+	+	+
	Total	67	69	70	66

(+denotes presence, - denotes absence)

Table 1: Checklist of zooplankton species recorded from four stations.

column, and the food supply [20]. Temperature has also a role in the vertical movement of zooplankton species, but to a limited extent. Many species were reported more abundant in the upper layer in cloudy winter days like *Euterpina acutifrons* and *Oithona species*. Light variation was suggested to be the trigger signal, controlling the vertical movement of zooplankton populations.

The 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 [21,22]. Salinity is the major problem of the coastal environment [22]. During the study period maximum salinity was recorded in the month of May 34.5 ppt and minimum was in month of November 26.5.During the monsoon season, all the stations received bulk rainfall and fresh water from land run off, which in turn greatly reduced the salinity values [23,24]. The maximum water temperature recorded in 34.5°C in June, minimum was recorded in month of November, 25.5°C. In general, pH was low during the monsoon season that is 7.6 in the month of December and maximum were recorded April, 8.2. Dissolved oxygen concentration was low during the summer season could be attributed to the lesser input of freshwater into the study areas. High dissolved oxygen was observed during by all the stations (Table 2). Therefore, zooplankton is considered to be best indicators of water quality.

In the present study zooplankton diversity was inversely linked to abundance, which was generally higher during the south east monsoon period as compared to the north east monsoon [25,26].

Parameters	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Jul
Salinity(ppt)	26.5	27	28	26.5	27	29.5	30	31	35	34.5	33.5	33
Temperature (0°C)	29.5	27.5	28.5	25.5	26.5	31.5	32	31.5	32	34	34.5	31.5
pH	7.9	8	7.8	7.9	8.3	8.1	8.2	8	8.2	7.7	8.2	8.3
Do(Mg/l)	4.1	4.2	4.3	4	4.5	4.3	4.1	4.2	3.7	3.3	3.9	4.1

Table 2: Water quality parameters in all stations.

Index	Stations			
	1	2	3	4
Pielou's evenness J	0.9099	0.8953	0.928	0.919
Shannon -Wienner's diversity(H)	5.5201	5.4886	5.688	5.535
Margalef's(D)iversity index	5.5022	5.4709	5.567	5.176
Margalef's(D) Species Richness(SR)	6.7124	6.9725	6.986	6.522
Simpson's Index(D)	0.969	0.9642	0.974	0.971

Table 3: Zooplankton evenness, diversity, richness and index.

The lower diversity in the north east monsoon period was caused by high abundance of zooplankton species such as *Acartia* spp. and other dominant groups that emerged during this period. Similar trends were reported by [27,28] from Bay of Bengal and Cochin backwaters. The food web relationship closely followed the seasonal pattern of zooplankton species abundance. Higher diversity of zooplankton in station 3 reflects the diversity of the sea grass, mangrove and reef environment. Nutrients are considered to be one of the most important parameters in the coastal environment influencing growth, reproduction and metabolic activities zooplankton. The area from Pointcalimere to Manamelkudi is rich with the nutrients such as Nitrate, Nitrite, Ammonium, and phosphate as reported by [8]. So the zooplankton species is rich in Pointcalimere to Manamelkudi.

For the data analysis Margalef's species richness (*d'*), Shannon-Weiner diversity function (*H'*), Pielou's evenness (*J'*) and Simpson's dominance (*1-λ'*) was used to reflect the underlying changes in physical, chemical and biological properties of zooplankton species [12,29]. The species richness and diversity of zooplankton at four sampling stations were determined by using Pielous evenness shown that highest at the station-3 (0.9278) and lowest at the station1 (0.9099). Both Shannon and Simpson indices were highest at the station S3 (5.6875 and 0.9739). In general among the four stations, station 3 had the high density, abundance and diversity (Table 3). Peaks of the zooplankton species recorded in summer seasons could be due to stable environment [9,12,30,31]. Many copepod species during monsoon seasons disappear and species composition also changed [32]. This is due to non-availability of food and low values of temperature and salinity [33]. The turbulence of the food web and minimum production of plankton during the monsoon season also reason for low abundance and distribution of zooplankton [34]. The salinity is the key factor that drastically affects the plankton abundance during monsoon seasons [35]. The zooplankton production during the periods of high salinity was documented by [36].

In the present investigation, the increase or decrease of salinity in the water column exerts either a direct or an indirect effect in the appearance or disappearance of some forms and replacement by others. Another effect is probably due to the movement of some species from one station to another to avoid either variations of temperature and salinity. The indirect effect could be due to the scarcity of food caused by the fluctuations of salinity in the waters eventually affecting the inhabitant's abundance of zooplankton. The present information of the zooplankton abundance and distribution would form a useful device for further ecological appraisal and monitoring of these coastal ecosystems.

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