

Short Communication

Diel variations in zooplankton and their biochemical composition from Vengurla to Ratnagiri, west coast of India

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Diel variations in zooplankton biomass, common groups and proximate composition zooplankton at stations between Vengurla to Ratnagiri, along west coast of India were studied. Higher biomass values were obtained for the night samples (av =80 ml /100 m³) as compared to the day collections (av =65 ml/ 100 m³). Copepods contributed maximum at all stations (58.4 to 73.9%).

Zooplankton constitute the largest ecological group organisms in the sea and play an important role in marine food chain. They feed on phytoplankton and in turn form the food for animals at higher trophic level. Unlike phytoplankton, zooplankton possess feeble swimming ability and exhibit vertical migration. Diel variations in the distribution of estuarine zooplankton¹⁻⁵ and the biochemical composition of zooplankton from the oceanic waters have been reported^{6,7}. However information on the diel variations of zooplankton population and their biochemical constituents from coastal areas is scanty. The present communication deals with diel variability of common groups including economically important fish and decapod larvae and their biochemical composition in the coastal waters from Vengurla to Ratnagiri, west coast of India.

Horizontal zooplankton samples were collected from 4 stations (Fig. 1) during *R V Gaveshani* cruise 239 using a Heron-Tranter net (mouth area 0.25 m², mesh size 330 µm). At each station the net was towed for 10 mins. at every 3 hr interval covering the entire diel cycle. Zooplankton samples were preserved in 5% formaldehyde. The samples were analysed for estimation of biomass and occurrence of major groups/species. A separate set of zooplankton sample was taken simultaneously for estimation of biochemical components. The samples were cleared of debris, washed with distilled water and dried at 60°C till constant weight. Proetins⁸, carbohydrates⁹ and lipids¹⁰ were estimated in triplicate. For diel variation study, the zooplankton samples collected during 0600 to 1800 hrs and 1800 to 0600 hrs were considered arbitrarily as day and night samples

respectively. The values were averaged for day and night collections at each stations.

Zooplankton biomass (ml/100m³) values (Table 1) varied from 16 to 139 ml /100³ (av. =72ml / 100 m³). Higher values were obtained during night (av. =80ml /100 m³) compared to day time (av. =65ml /100 m³). Such nocturnal abundance of zooplankton in surface layers in the estuaries along east and west coasts of India have been reported earlier "

Twenty five zooplankton groups were identified in the samples collected over the diel cycle at different stations (Table 2). The Copepods were the dominant group (59.89%) followed by chaetognaths (9.99%),

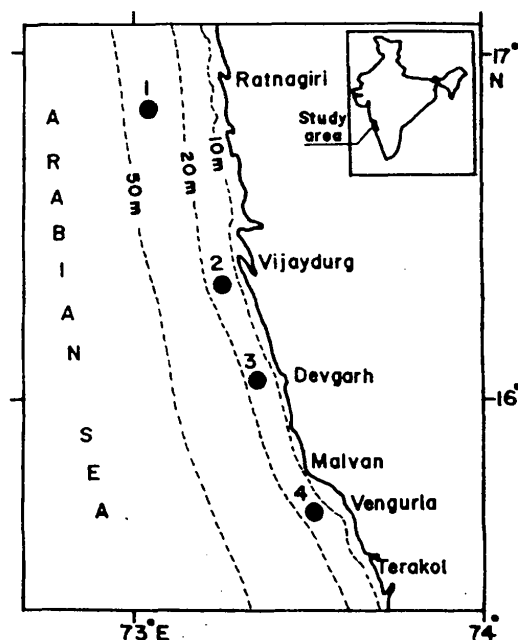


Fig. 1— Station locations

siphonophores (7%), decapods (4.1%), amphipods (3.29%), hydromedusae (2.79%), appendicularians (1.93%), fish eggs and larvae (1.79%), invertebrate eggs (1.75%) and Polychaetes (1.7%). The remaining groups constituted < 1% of the total counts. Copepods were represented by 42 species belonging to 17 families. Of the 42 species 31 belong to calanoids, 9 to cyclopoids and 2 to harpacticoids. Nine species belonging to 3 genera represented the chaetognaths.

Sagitta enflata was more common (84.38%) followed by *S.bedoti* (12.21%) and *S.robusta* (2.08%). The cladocerans were represented by 2 species viz. *Evadne tergestina* and *Penilia avirostris*. *Lucifer hansenii*, *Acetes* sp., larval stages of *Metapenaeus dobsoni*, *M.monoceros*, *Penaeus merguensis*, *Parapeneopsis stylifera*, and brachyuran larvae were the common decapods in the samples. The other groups were represented only by larval forms.

Table 1—Diel variations in zooplankton biomass (ml /100m³) at 4 stations from Vengurla to Ratnagiri, west coast of India

St. No	Time (hrs)							
	Day				Night			
	0700	1000	1300	1600	1900	2200	0100	0400
1	43	22	22	16	36	42	54	47
2	60	72	54	60	72	78	68	62
3	89	99	99	89	104	94	139	94
4	93	64	58	94	97	98	105	88

Table 2—Distribution and abundance (no/100m³) of common groups at 4 stations from Vengurla to Ratnagiri- west coast of India

Groups	STATIONS							
	1		2		3		4	
	Day	Night	Day	Night	Day	Night	Day	Night
Protozoa	00	86	95	00	132	00	186	93
Hydromedusae	521	530	3497	3952	1592	1333	00	116
Siphonophora	2789	1978	2994	2215	5751	8438	1953	2884
Ctenophora	54	86	72	144	259	239	186	326
Polychaeta larvae	238	454	527	1760	1214	2344	140	349
Mollusca larvae	130	216	216	192	597	398	419	325
Brachipod larvae	43	43	191	96	00	80	209	93
Pteropoda	65	97	383	142	1042	1050	512	139
Heteropoda	65	173	216	132	301	2867	93	70
Cladocera	43	54	96	00	2603	1154	00	00
Ostracoda	22	162	96	72	159	00	70	46
Copepoda	32685	16589	25598	35326	33303	35870	38858	29818
Mysidacea	00	1730	00	00	00	00	93	00
Cumacea	00	00	96	96	00	00	00	00
Amphipoda	108	1093	719	1353	1254	7144	791	1163
Euphausiacea	00	43	96	120	00	00	00	93
Decapoda+	108	357	503	2850	4686	7144	849	488
Decapoda larvae								
Stomatopoda larvae	00	43	96	00	00	00	00	00
Chaetognatha	5010	3137	6683	6509	5114	6054	4360	4534
Appendicularia	2315	400	695	778	637	701	1744	674
Thalacia	65	22	168	00	418	796	70	116
Invertebrate eggs	789	573	216	299	1174	915	1410	1884
Halobates	00	00	00	00	239	00	93	00
Cyphonaute larvae	259	260	168	144	239	80	163	325
Fish eggs+larvae	2795	260	288	264	1157	2309	93	232
Others	00	00	96	96	100	80	93	232

Average values (%) for proteins, carbohydrates and lipid for day and night samples are given in Fig.2. Protein ranged from 14.82 to 45.55% at st 1, 13.44 to 40.29% at st.2, 22.26 to 31.17% at st 3 and 22.81 to 41.13% at st 4. Protein was high in samples collected during night at sts 1 and 2 as compared to those obtained for day samples from the respective stations.. However, such a difference was not noticed at sts 3 and 4. The values recorded in the present study are comparable to the values reported for the northern part of central Arabian Sea¹¹ and lower than those reported earlier for Andaman Sea⁶, northwest bay of Bengal⁷, north eastern Arabian Sea¹², Arabian Sea of the south central west coast of India¹³ and east coast of India. Greater occurrence of certain groups such as Copepods, decapods, euphausid and fish eggs polychaetes, salps and doliolids might have probably

influenced the high protein content in zooplankton during the night collections at sts 1 and 2. However, noticeable difference in protein content was not observed between day and night samples at sts 3 and 4.

Lipid values were in the range of 12.02 to 33.81% at st 1, 14.06 to 20.66 % at st 2, 9.92 to 26.68 % at st 3 and 13.58 to 35.67 % at st 4. On an average the lipid content ranged from 15.93 to 22.47% in day samples and 17.5 to 20.94% in night samples. The values recorded in the present study agree with the earlier report¹⁴ but are lower than those reported for zooplankton from the north eastern Arabian Sea¹². The amount of lipid was more in zooplankton collections made during the day at sts 1 and 4. The reverse was true for sts 2 and 3.. Higher percentage of lipids during the day at the above mentioned stations could therefore be due to greater occurrence of high lipid containing groups¹⁵ like Copepods, chaetognaths, invertebrate eggs and fish eggs and larvae. Though there was difference in protein and lipid content between day and night samples, it was not highly significant (Anova).

Carbohydrate ranged from 1.38 to 8.42 % at st 1, 0.66 to 4.84 % at st 2, 1.46 to 2.46 % at st 3 and 1.13 % at st 4. No appreciable difference was observed in carbohydrate content between day and night samples. On an average the night samples showed 2.06% while the day samples as 1.96%. The values recorded in the present study are comparable with the earlier reports^{6,7,12-15}. In general, carbohydrate content is very low in zooplankton as compared to proteins and lipids^{7,12} as was observed in the present study.

It may be said that the differences in the zooplanktonic population and their biochemical components observed during the present study could be due to the changes in species composition as a result of the vertical migration of zooplankton.

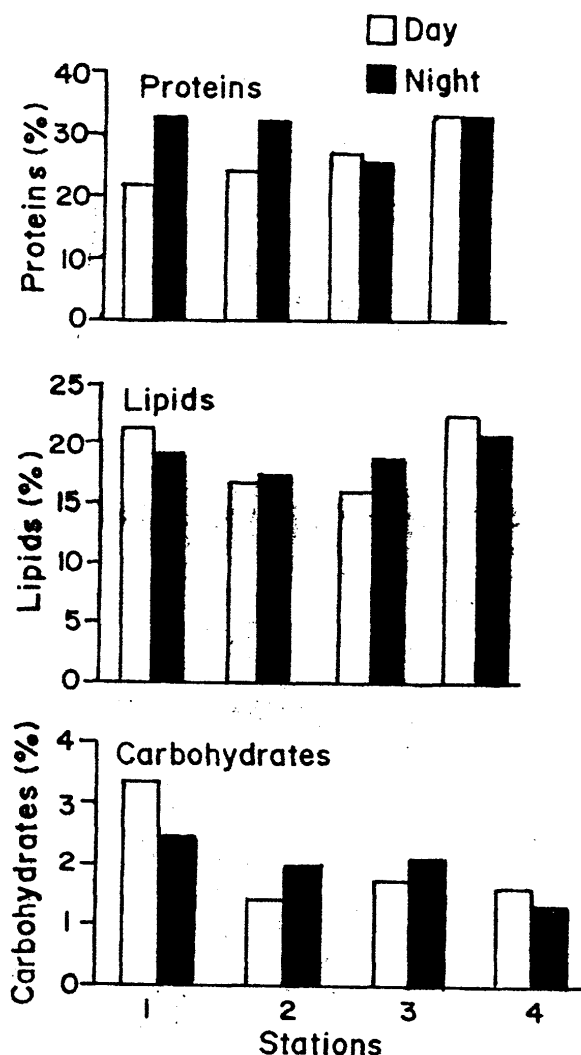


Fig.2—Proximate composition of zooplankton (average values) in day and night samples

References

- 1 Chandramohan P & Rao T S S, Tidal cycle studies in relation to zooplankton distribution in the Godavari estuary, *Proc Indian Acad Sci*, 75(1972) 23-31.
- 2 Pillai P P & Pillai A M, Tidal influence on the diel variations of zooplankton with special reference to Copepods, *J Mar Biol Ass India*, 15 (1973) 411-417.
- 3 Madhupratap M & Rao T S S, Tidal and diurnal influence on estuarine zooplankton, *Indian J Mar Sci*, 8 (1979) 9-11
- 4 Goswami S C, Selvakumar R A & Goswami U, Diel and tidal variations in zooplanktonic populations in the Zuari estuary, Goa, *Mahasagar-Bull Natn Inst Oceanogr*, 12 (1979) 247-258.
- 5 Selvakumar R A, Goswami S C & Goswami U, Tidal and diel influence on zooplankton occurrence in the Mandovi estuary, Goa, *Indian J Fish Ass Bombay*, 16 & 17 (1987) 34-49.

- 6 Goswami S C, Rao T S S & Matondkar S G P, Biochemical composition of zooplankton from the Andaman Sea, *Indian J Mar Sci*, 10 (1981)296-300.
- 7 Kumari L K & Goswami S C, Biomass and biochemical composition of zooplankton from northwest Bay of Bengal, *Indian J Mar Sci*, 22 (1993) 143-145.
- 8 Raymont J E G, Austin J & Linford E, Biochemical studies on marine zooplankton I. The biochemical composition of *Neomysis integr*, *J Cons Perm Int Explor Mer*, 28 (1964) 354-363.
- 9 Dubois M, Gillis K A, Hamilton J K, Rbus R A & Smith F, Calorimetric method for determination of sugars and related substances, *Anal Chem*, 28 (1956)350-356.
- 10 Folch J, Lees M & Solane-Stanley G H, A simple method for the isolation and purification of total lipid from animal tissues, *J Biol Chem*, 226 (1957)497-509.
- 11 Nandakumar K, Bhat L K & Wagh A B, Biochemical composition and calorific value of zooplankton from Northern part of Central Arabian Sea, *Indian J MarSci*, 17(1988)48-50.
- 12 Kumari L K & Achuthankutty C T, Standing stock and biochemical composition of zooplankton in the northeastern Arabian Sea, *Indian J Mar Sci*, 18 (L989) 103-105.
- 13 Sumitra-Vijayaraghavan, Selvakumar R A & Rao T S S, Studies on zooplankton from the Arabian Sea off the South Central West Coast of India *Indian J Mar Sci*, 1(1982) 70-74.
- 14 Goswami S C, Rao T S S & Matondkar S G P, Biochemical studies on some zooplankton off the west coast of India, *Ma-hasagar-Bull Natn Inst Oceanogr*, 14 (1981) 313-316.
- 15 Kumari L K, Nair V R & Gajbhiye S N, Biochemical composition of zooplankton from the offshore oil fields of Bombay, *Proc Nact Acad Sci India*, 63(B) II (1993)161-167.