

Organic Carbon Content of Zooplankton from the Nearshore Waters of Bombay

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Organic carbon content of zooplankton in the Versova creek and Thana creek (polluted areas), off Versova and off Mahim (relatively unpolluted areas) varied respectively from 21.4-30, 13.2-38.4, 21.6-30 and 25.8-39.6% dry weight. The carbon content of zooplankton was dependent on the constituent organisms and hence high biomass was not always associated with concomitant increase in organic carbon content. The polluted areas were characterised by wide fluctuation in the rate of secondary production with maximum during premonsoon period. The relatively unpolluted areas showed comparable rate of production, limited variations and peak production during the postmonsoon period.

Studies on the ecology of zooplankton from the nearshore waters of Bombay¹⁻⁴ substantiate the effect of pollution on the abundance and diversity of zooplankton population. Often the polluted areas around Bombay sustain high biomass of zooplankton due to congregation of gelatinous organisms. Very high biomass obtained from a particular sample need not necessarily give rise to concomitant high percentage of carbon values⁵. Organic matter present in zooplankton can theoretically yield information about the energy of the secondary producers and hence is a reliable measure for the assessment of secondary production. However, there are only a few reports on the carbon content of tropical zooplankton^{5,6,7} and these studies indicate some amount of fluctuations. The present study pertains to seasonal variation of organic carbon in zooplankton collected from the polluted and relatively unpolluted areas around Bombay.

Two sets of stations were selected for the present investigation (Fig. 1). Versova creek (Vc) and Thana creek (Tc) are representative of polluted areas, the former by sewage and the latter by industrial effluents. The creek stations were characterised by low levels of dissolved oxygen and higher nutrient values (Table 1). During ebb tide recorded DO values at Vc often reached zero level in April-May period. The stations off Versova (V) and off Mahim (M) are relatively unpolluted. In general, at sts V and M comparatively high dissolved oxygen content, high salinity and low nutrient values were recorded (Table 1). At these stations intensity of pollution gradually decreased due to dilution and mixing processes in the sea.

Monthly zooplankton samples were collected from all stations from Jan. to Dec. 1980. All were oblique hauls using HT net (mouth area of 0.25 m²; mesh size 0.3 mm) with an attached flow meter. In June, due to

rough weather, sampling could not be done at Vc, V and M. Duplicate samples were obtained from all stations. One sample was preserved in 5% formalin for detailed qualitative analyses and the other sample

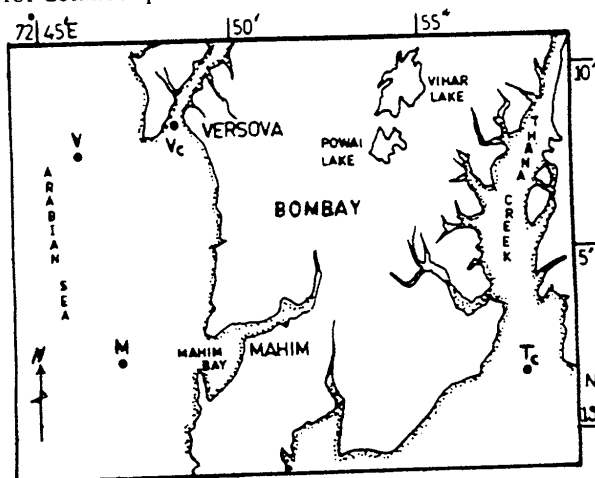


Fig. 1—Location of stations

Table 1—Range and Mean Value of Different Parameters at the Four Stations during January to December 1980
[Mean values are given in parentheses]

Parameters	Stations			
	Vc	Tc	V	M
Temp. (°C)	23.0-30.5 (27.7)	23.0-33.0 (27.9)	23.5-30.75 (27.5)	23.25-34.0 (27.4)
Sal. (x10 ⁻³)	20.0-36.26 (31.14)	8.34-36.93 (29.40)	21.83-36.65 (33.38)	22.73-35.69 (32.57)
Dissolved oxygen (mg.l ⁻¹)	0.0-7.13 (3.30)	2.06-6.7 (4.06)	2.30-8.72 (5.95)	2.20-7.56 (5.60)
Nitrate (µg-at.l ⁻¹)	0.62-65.16 (11.2)	4.70-48.0 (19.41)	0.70-37.53 (5.03)	0.1-49.98 (7.78)
Phosphate (µg-at.l ⁻¹)	1.64-30.43 (4.72)	2.27-5.52 (4.10)	0.66-2.99 (1.57)	1.38-4.71 (2.29)

was immediately frozen. Each frozen sample was washed thoroughly with distilled water and dried in an oven at 70°C until a constant weight was obtained. Organic carbon in a 10 mg sample was estimated by the wet oxidation method⁸.

Organic carbon content—At st Vc percentage carbon values fluctuated from 21.4 to 30.6 with maximum in April (Fig.2) while at st Tc they varied from 13.2-38.4% with maximum in Aug. At both the stations stable values were observed during postmonsoon period (Oct.-Dec.). The observed range in carbon values at st M was 25.8-39.6% and the peak was in Aug. At st V variation in organic carbon was 21.6 to 30% with maximum in Sept. Almost constant values were obtained at sts M and V during premonsoon period (Feb. to April).

Annual variation in zooplankton biomass (dry weight) indicated wide variations in the polluted stations (Vc and Tc) with peaks in April/May and Oct. High values of zooplankton biomass were not always associated with simultaneous increase in the organic carbon content. In the relatively unpolluted sts M and V fluctuations in zooplankton biomass were not well marked except for a very conspicuous peak in Oct./Nov.

Rate of secondary production—Organic carbon content of zooplankton for different months were utilised to estimate the rate of production⁵ at different stations and the values are given in Table 2. Maximum rate of secondary production at sts Vc, Tc, V and M were respectively 13.36 (April), 11.94 (May), 8.32 (Oct.) and 9.91 (Nov.) mg C.m⁻³.d⁻¹.

In the present samples mostly herbivores and omnivores predominated with a relatively low percentage of predators. Percentage incidence of

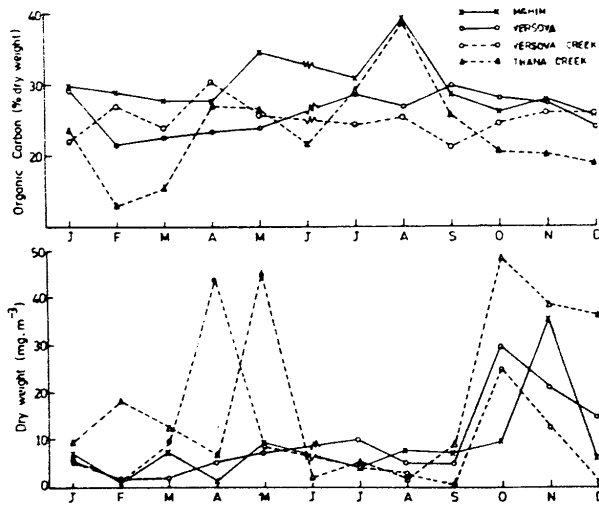


Fig. 2—Variations in organic carbon content of zooplankton and biomass at polluted (Tc and Vc) and relatively unpolluted (V and M) stations.

Table 2—Rate of Production and Contribution of Different Groups to Total Zooplankton Population at Polluted and Relatively Unpolluted Stations

Month	Rate of production (mgC.m ⁻³ .d ⁻¹)	Crustaceans, molluscs etc. (%)	Chaetognaths & coelenterates (%)
Thana Creek			
Jan.	2.26	96.0	4.0
Feb.	2.41	93.5	6.5
March	1.24	86.3	13.7
April	1.88	85.6	14.4
May	11.94	83.0	17.0
June	0.42	83.5	16.5
July	1.51	85.0	15.0
Aug.	0.88	98.0	2.0
Sept.	2.37	93.6	6.4
Oct.	9.88	94.7	5.3
Nov.	7.67	89.5	10.5
Dec.	6.69	90.5	9.5
Versova Creek			
Jan.	1.15	98.0	2.0
Feb.	0.48	93.0	7.0
March	2.28	96.3	3.7
April	13.36	100.0	0.0
May	2.23	98.5	1.5
June	—	—	—
July	0.97	100.0	0.0
Aug.	0.82	99.8	0.2
Sept.	0.20	96.0	4.0
Oct.	6.00	81.0	19.0
Nov.	3.29	93.0	7.0
Dec.	0.34	99.8	0.2
Mahim			
Jan.	2.06	99.6	0
Feb.	0.35	97.1	2.9
March	2.11	98.4	1.6
April	0.41	99.7	0.3
May	3.35	99.0	1.0
June	—	—	—
July	1.20	99.2	0.8
Aug.	3.03	98.0	2.0
Sept.	2.07	61.0	39.0
Oct.	2.60	91.0	9.0
Nov.	9.91	94.8	5.2
Dec.	1.54	90.9	9.1
Versova			
Jan.	1.70	96.8	3.2
Feb.	0.34	88.7	11.3
March	0.41	98.9	1.1
April	1.21	99.7	0.3
May	1.71	96.0	4.0
June	—	—	—
July	2.93	99.6	0.4
Aug.	1.44	99.1	0.9
Sept.	1.53	88.0	12.0
Oct.	8.32	79.9	20.1
Nov.	5.90	96.9	3.1
Dec.	3.57	76.0	24.0

different groups indicated that the crustaceans, molluscs and polychaetes formed the major fraction of zooplankton population (Table 2). The predator community represented mainly by chaetognaths, medusae and ctenophores, occasionally contributed to high biomass. The percentage incidence of gelatinous groups was relatively more at st Tc.

At st Tc high values of organic carbon was obtained in July/Aug. (Fig. 2) when the zooplankton contained appreciable quantity of *Acetes* spp. and fish larvae. Low values of carbon recorded at Tc in Feb./March and Oct./Nov. were associated with low percentage incidence of copepods. In st Vc high carbon values were related to the dominance of copepods, mysids and decapods while low values to an increase in the density of gastropods and chaetognaths. At sts V and M percentage organic carbon content of zooplankton was high when the copepods and other crustaceans contributed at least 95% of the total population. Decrease in the crustacean population was often followed by concomitant increase in chaetognath population probably leading to low percentage of organic carbon.

In general, there was well marked variations in the rate of secondary production with maximum values either during premonsoon or postmonsoon period. Average values of carbon content of zooplankton at sts Vc, Tc, V and M were respectively 25.2, 23.4, 26.1 and 29.9% of dry weight. The mean rates of secondary production for the above stations were respectively 2.83, 4.1, 2.64 and 2.60 mgC.m⁻³.d⁻¹. Eventhough the percentage carbon content of zooplankton was relatively low in the polluted area than the relatively less polluted area, unusually high biomass obtained at

occasional intervals gave rise to higher average rate of secondary production. The polluted stations were identical with major peak in zooplankton production in April/March and a secondary peak in Oct./Nov. while in relatively unpolluted stations a single peak was observed in Oct./Nov. with comparable rate of secondary production.

The overall range in percentage carbon is comparable with that reported from the nearshore waters off Cochin⁷ but lower than that recorded off Goa⁵. In general, when decapods, mysids and fish larvae were very abundant the estimated organic carbon content of zooplankton was always high while the predominance of coelenterates and chaetognaths gave lower percent of carbon values. The carbon content of zooplankton is reported to vary depending on the constituent organism⁵ and the present study once again substantiates the above contention.

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