ZOOPLANKTON POPULATION IN THE POLLUTED ENVIRONMENT OF THANA CREEK & BOMBAY HARBOUR

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ABSTRACT

Hydrographical and biological parameters of Thana Creek & Bombay Harbour were studied to assess the prevailing water quality. Zooplankton samples were collected from various stations during January 1975 to July 1975. The qualitative distribution of zooplankton was found to be very irregular and fluctuating. Copepods were the dominant taxa followed by lucifers, chaetognaths, decapod larvae, ctenophores, hydromedusae, fish larvae & polychaetes. To a certain extent the distribution of zooplankton is affected by variation in salinity during different seasons, also along the length of the creek. Pronounced effect of pollution on zooplankton biomass was also observed.

INTRODUCTION

Much concern has been shown in recent years on the growing problem of marine environmental pollution particularly of coastal areas which are becoming more useful to man's growing activities. The changes on the ecology of marine environment on the coastal areas of India is increasingly felt in recent years. Bombay is an apt example of this. It has a population of about 8.2 million and is the largest metropolitan city on the west coast of India. Almost 30% of the country's industries are located in this city & near by area. Discharge of large quantity of domestic and industrial waste is believed to be changing the ecological balance of the coast: (Desai 1971, Gajbhiye 1979). It was therefore, considered desirable to investigate the hydrobiological parameters and to study the water quality around Bobmay specially Thana creek & Harbour complex. Zooplankton was taken as an indicative parameter to assess the intensity of pollution

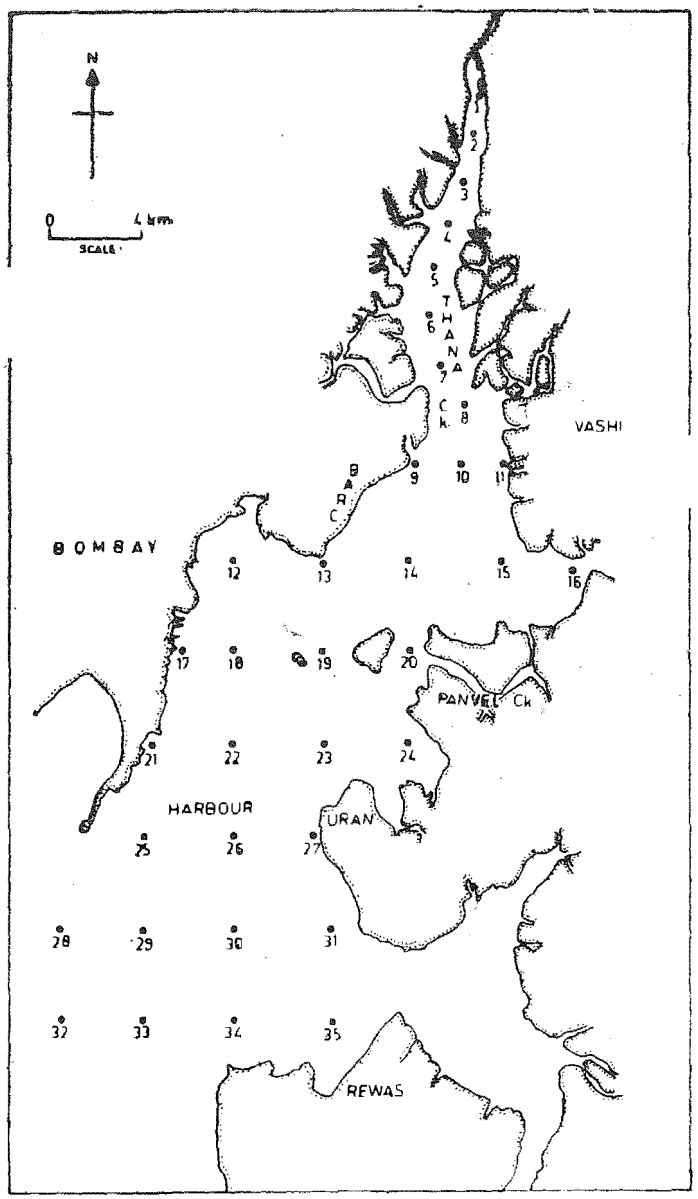

Fig. 1 Map showing the location of stations.

DESCRIPTION AND HYDROGRAPHY OF THE AREA

Bombay located at 18°55N lat. and 72°49 E long is the largest city on the central west coast of India. The Thana creek region extends over a distance of 40 km in length and coveres an area of 340 km^2. The creek is 16km long and very narrow and shallow compared to the Bombay harbour region (Fig. 1). The Thana creek is connected to the Ulhas river on one side and Bombay harbour to the other side. Numerous inlets joint the Thana creek. During the monsoon these inlets discharge drainage water from different

Table — 1. VARIATION OF ENVIRONMENTAL FACTORS IN THE THANA CREEK AND BOMBAY HARBOUR DURING PREMONSOON PERIOD JANUARY TO APRIL 1975

Stn. No.	Water Temp °C	Salinity 0%	Dissolved oxygen (ml/1)	PO_4 ug at/1	NO_3 ug at/1
1.	23.6-30.5	37.03-37.21	2.51-4.80	0.73-05.67	16.76-49.23
2.	24.0-30.0	37.03-37.15	3.63-4.00	1.11-05.67	06.40-49.63
3.	24.0-30.5	37.15-37.36	3.65-4.05	1.11-05.77	05.82-45.34
4.	24.4-28.0	37.06-37.13	4.16-4.57	1.11-03.58	06.99-57.79
5.	23.5-27.1	36.10-37.12	5.02-9.14	1.11-05.58	13.09-57.44
6.	23.3-27.0	36.47-36.95	3.20-5.12	0.33-03.67	15.13-57.97
7.	23.5-27.3	35.76-36.90	3.43-5.01	1.11-12.77	12.51-57.40
8.	24.0-26.6	35.59-38.95	4.57-10.8	0.73-04.00	05.24-57.97
9.	24.1-27.7	35.70-37.20	2.74-2.77	0.73-03.58	16.25-58.20
10.	23.4-28.0	35.95-36.70	4.61.5.12	0.33-02.44	15.71-29.65
11.	24.1-28.5	35.60-36.60	3.58-5.71	0.33-02.44	08.44-28.52
12.	23.6-28.0	35. 0-36.60	2.74-5.49	1.11-05.67	08.15-46.69
13.	24.5-27.5	36.13-37.63	4.11-4.27	0.33-04.80	05.29-66.09
14.	23.2-27.4	35.95-37.03	4.57-5.49	0.23-02.78	05.05-38.41
15.	23.5-26.8	35.89-36.26	1.17.3.38	1.11-01.56	07.57-28.10
16.	24.0-27.1	35.77-36.88	3.66-6.67	0.73-03.35	15.71-28.87
17.	24.8-28.5	36.13-37.03	4.39-5.71	0.33-03.58	05.53-34.92
18.	24.0-27.7	36.17-36.70	3.20-7.25	0.73-2.16	14.08-36.38
19.	24.1-27.9	35.59-37.40	4.48-4.80	1.11-3.22	10.47-22.95
20.	24.0-27.0	35.05-36.13	3.84-7.62	0.34-3.18	04.07-38.70
21.	24.0-27.0	35.37-37.00	1.11-6.37	0.73-2.78	05.09-23.86
22.	23.6-28.0	34.69-37.30	4.81-5.59	0.34-2.44	05.06-24.61
23.	23.5-27.5	36.60-37.21	4.0-12.00	0.73-1.93	06.69-19.60
24.	24.0-27.9	35.95-36.38	2.97-5.23	0.73-1.93	02.74-15.86
25.	24.0-27.3	35.98-37.40	4.80-8.74	0.34-1.56	05.09-23.86
26.	24.1-28.3	35.95-37.00	4.27-5.71	0.33-1.93	03.01-13.86
27.	24.0-27.0	35.95-37.30	1.00-5.94	0.33-2.36	03.78-25.72
28.	23.5-28.0	35.95-37.10	4.69-10.37	0.33-2.78	02.17-21.55

area of the city but also used as a convenient source of drainage for disposal of effluent by the industries clustered around.

The tides in this region are of semidiurnal type with an average tidal range of 3.7 m. The currents in the creek are 2 knots. During the cold months December to February the water temperature is relatively low ranging from 21.°C to23.°C and in summer it goes up to 28.°C—30.°C (Table — 1). During the premonsoon months variation in salinity values are of very small range (34‰ — 38‰). High salinity values were normally observed along the shallow region close to the mud flats and mangroves which may be sweeping out high saline water. However, during the monsoon the large amount of fresrwater from Ulhas river and from numerous inlets lower the salinity of the creek water to about 9.60‰ near the Thane b idge. The D. O. values varied from 0.17 to 12m/1. Phosphate value was around 5 ug at/1. A higher concentration of PO4 — P was observed in the area where a low D.O. was noticed. High concentration of nitrate in the head of the creek ranging from 23.28 — 34.92 ug at/1 was reported (NIO Reports 1975).

MATERIAL AND METHODS

The survey was planned for a period of two years commencing from December 1974. This paper presents the data during the premonsoon season which is the most impo.tant from the point of view of the effect of undiluted pollutant on environmental ecology. Sampling stations were fixed on a closer gr.d of 2 kms. Collections were made at alternate spring and neap conditions in each month. Samples for hydrographical parameters were collected either with reversing bottles or Van Dorn sampler. The surface temperature was measured with ordinary thermometer and bottom temperature with reversing thermometers.

Plankton samples were collected with H.T. net of a mouth area of .25 m^2 and mesh size 0.2 mm. Horizontal hauls of 10 minutes duration were taken for all collections. The samples were preserved in 5% neutral formalin. The total volume of zooplankton from each haul was determined by displacement method and biomass was calculated per 100 m^3. Samples

were fractioned by plankton splitter and the number and percentage composition of the organisms were determined.

RESULTS

Total zooplankton biomass varied from 1.5 ml/100 m^3 to 25.0 ml/100 m^3 at different stations. The lowest value was recorded at st. 18(1.5ml/100 m^3.) Taxawise distribution was also not regular. Average biomass of zooplankton and percentage composition are given in Fig. 2 and Fig 3 A & B Copepods were dominant in the majority of samples.

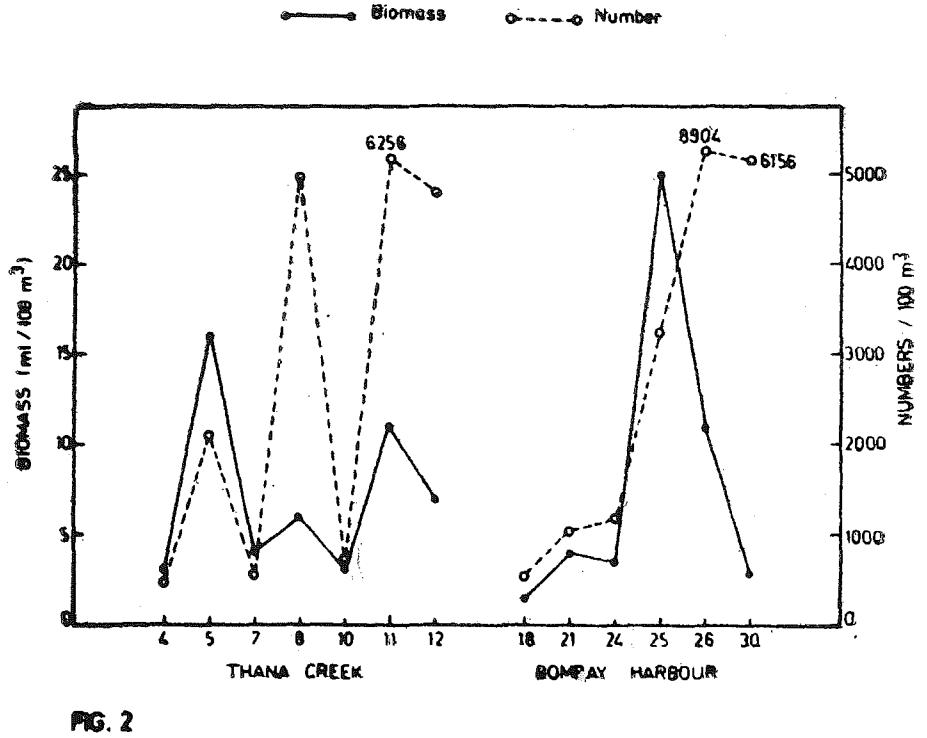

FIG. 2

Fig. 2 Variation in the mean values of total population and biomass of zooplankton in the thana creek & bombay Harbour.

Different groups observed in the zooplankton samples collected from various stations were flagellates, medusae, siphnophores, ctenophores, polychates, chaetognaths, copepods, decapods larvae, amphipods, lucifers, mysids fish eggs and fish larvae. Besides these ostracods and gastropods, appeared in a few numbers.

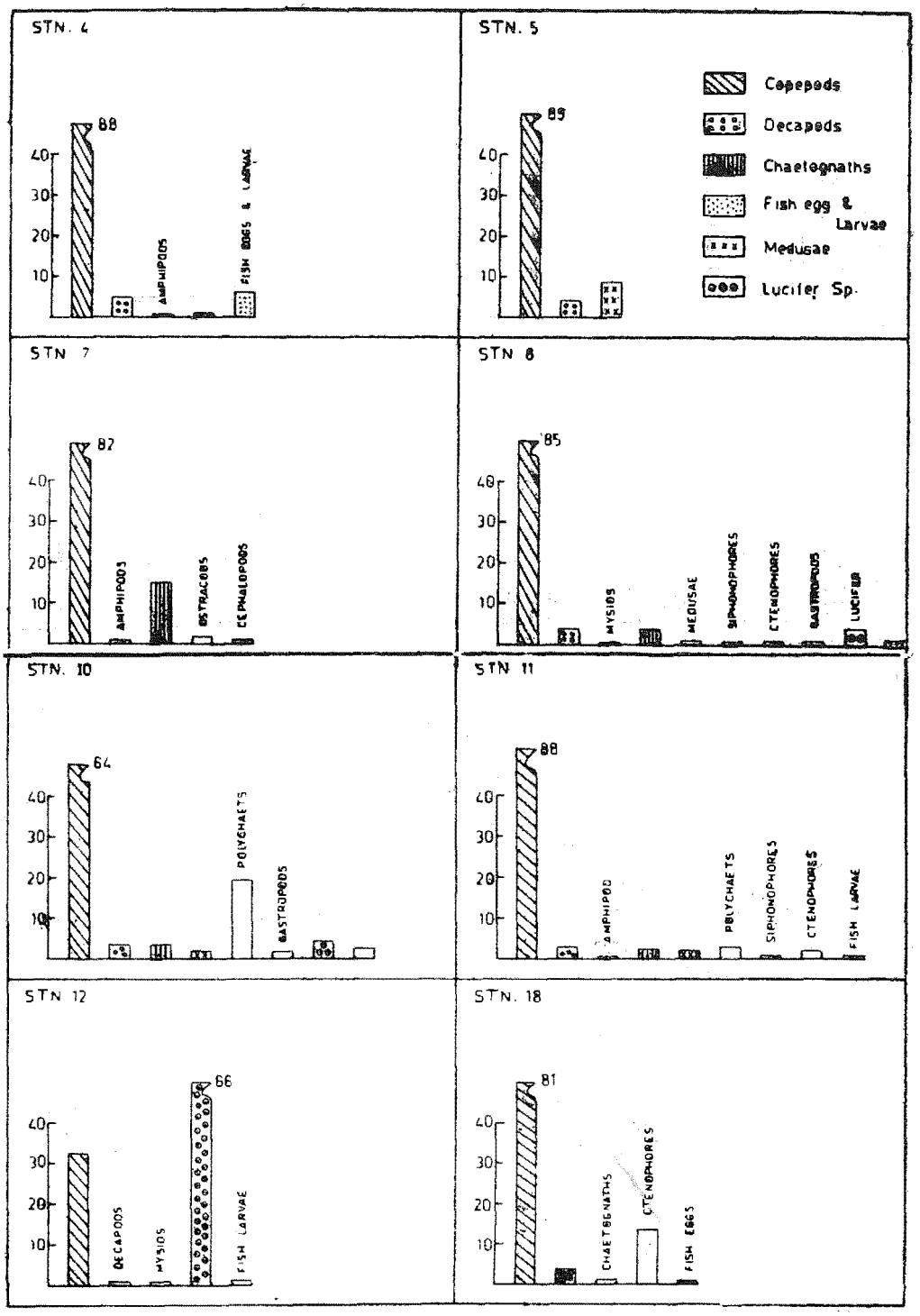

Fig. 3a Percentage composition of different groups of zooplankton at selected stations.

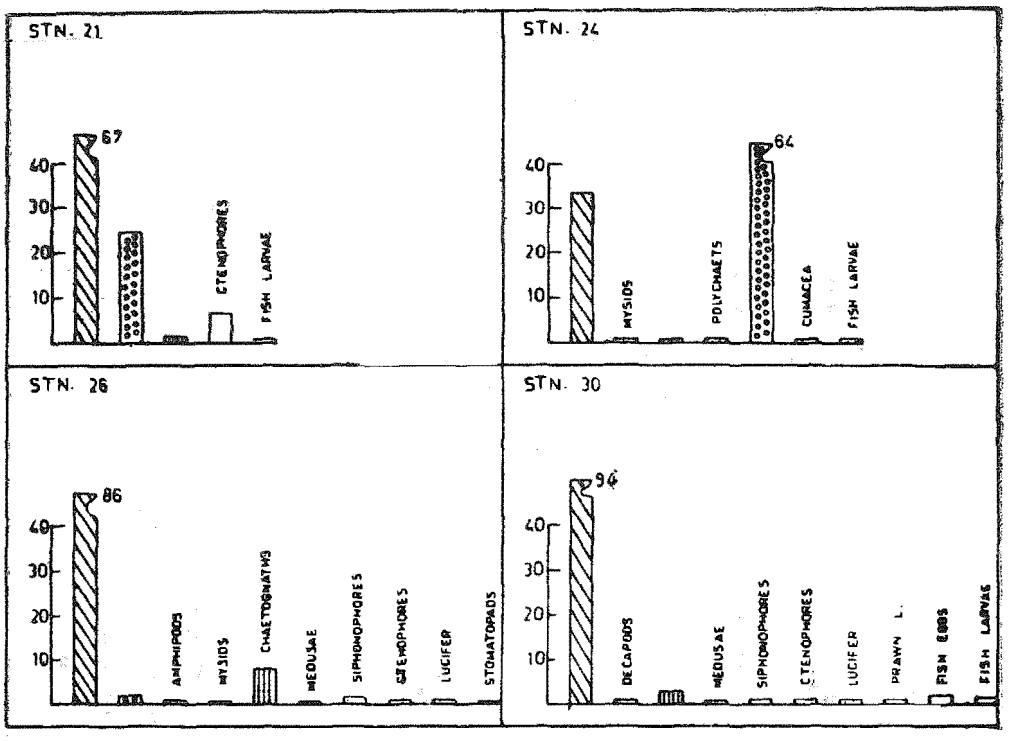

FIG. 3 B

Percentage composition of different groups of zooplankton at selected stations.

Medusae

The highest number of medusae were observed at St. 5 (7.52%) and the lowest density was recorded at St. 20 (0.08%). They were not noticed at stations 4, 7, 12, 18, 21, 24 and 26. The dominant species belonged to the genera *Phialidium, Eirene, and Blackfordia.*

Siphonophores

They were observed rarely at a few stations. The highest number of siphonophores were observed at st. 26 (1.12%) in the month of March.

Ctenophores

They were observed at six different stations in large number with the *dominant SP. of Pleurobrachia* The highest number of ctenophores were observed at St. 18 (13.21%) in the month of February and lowest were observed at St. 30 (0.07%).

Polychaetes

Large number of polychaetes were observed in the sample collected at st. 10 in January. The lowest number of polychaetes were found at st. 25 in March. At St. 4, 5, 7, 8, 12, 18; 21 and 26 they were not observed. The recorded species belong to the genus *Tompopetris.*

Chatetognaths

Chaetognaths were observed in almost all samples excepting st. 5 and 12. Maximum population (14.99%) was observed in January. The lowest number of chaetognaths were found at St. 25 in March. The dominant species were *S. bedoti* and *S. enflata.*

Copepods

They were dominant in the majority of samples except in the samples collected from St. 12, 24 & 25 where lucifers and flagellates were dominant. The number of copepods in the harbour area was higher than that of the creek area. The highest number of copepods were observed at St. 26 in March 8160/100 m^3 and the lowest found at st. 25 (1.33%) where the *Noctiluca* bloom was observed. The copepods were represented by species of genus *Acartia, Paracalanus, Acrocalanus, Oithona, Centrophages* & *Eucalanus*.

DECAPODS LARVAE

Except St. 7 and 24, they were observed in all samples and their incidence varied between 0.04% to 29.5%. At st. 21 they formed the second abundant group in March (about 29.5%). The decapods were represented mainly by zoea, protozoea and other stages of larvae.

Lucifers dominated the sample at station 18 and 24 in February 1975 with a value of about 66.46% and 44.03% respectively. The lowest number of lucifers were observed at st. 25 (0.15%) in March.

More fish eggs and larvae were observed in the creek area. The highest number of fish eggs were observed at st. 10 in January and the fish larvae were observed at st. 11 in February. The lowest number of fish eggs and larvae were observed in the harbour area i.e. 0.005% at station 25 and 0.16% at station 24.

DISCUSSION

The results have indicated that the average production of zooplankton is very irregular & fluctuating in Thana creek and harbour complex. The Thana creek is connected to the Ulhas river on one side and Bombay Harbour on the other side. It is also characterised by high saline water during the dry months between October to May and very low saline water between June to October. (Zingde et al 1979) & (NIO Report 1975). It exhibits salinity gradient along its length from the harbour mouth to the Ulhas on the other side.

Almost 1/3 of the country s industries are located in this region which discharge effluents in the upper reaches of the Thana creek. Domestic sewage is also discharged from Bombay, Thana and other adjoining suburbs. Desai (1971) has reported marine pollution and disposal of sewage around Bombay.

Zooplankton like any other living population, are generally affected by the environmental conditions like temperature, salinity, dissolved oxygen etc. Also, the changes brought about by the introduction of various type of waste may bring about significant differences in zooplankton population. The average biomass is ranging from 1.5 to 25.0 ml/100 m^3 which is considerably low compared to the unpolluted regions of the west coast of India. (Paulinose & Aravindakshan 1977, Menon and George 1977). Although some stations represent normal values. Stations along the length of the creek where the industrial effluents are discharged i.e. the stations 7, 10 and 18 have been adversely affected. Zooplankton production is however, higher in the station near the head of the creek and the harbour on the other side (Fig 2). The average maximum values were recorded in the month of March & April coinciding with one of the peak periods of

zooplankton production. A bimodal peak in zooplankton abundance in Bombay waters has been reported by Pillai (1968), and Gajbhiye (1979). The predominance of copepods was noticed many times during the highest population density peak recorded at sts. 26, 11, 30 & 8. *Acartia & Paracalanus* were the deminant genera in these samples. The common copepods of Bombay have already been reported by many previous workers in different periods. (Sreenivasan 1942 & Pillai 1968). The chaetognaths were represented by *S. bedoti* at Thana creek and *S. bedoti* & *S. bombayensis* at Harbour. The other common group was hydromedusae which was represented by the genera *phialidium, Eirene and Blackfordia* at Thana and *Phialidium, Blackfordia, Eutima and Solumundella* in the harbour. The dominance of medusae and ctenophores in Thana is significant. Chopra (1960) noticed a sudden outburst of ctenophores along with medusae in Bombay water. Lucifers, polychat larvae, were also present in good numbers whereas fish larvae & gastropods were very poor.

Parameters like low DO, high BOD and very high nutrient values as revealed can be very well attributed to the pollutional conditions due to discharge of large amount of industrial effluent from Thana. Comparison of the result obtained during the present study on the distribution and abundance of zooplankton with those of Gae (1934), Bal & Pradhan (1945, 1952) and Pillai (1968) clearly indicated the changes brought about by the adverse effect of indiscriminate discharge of pollutant in to the creek.

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