

## Ecology of hydromedusae from Bombay Harbour—Thana and Bassein Creek estuarine complex

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Species composition, abundance, seasonal variation and distribution of Hydromedusae were carried out during October 1985 to September 1986. Thirty four species belonging to twenty two genera were recorded from this region. *Blackfordia virginica* and *Phialidium brunescens* were found from all stations at least during certain period. The present study shows a general decrease in species diversity in the interior stations which receive large quantities of sewage and industrial effluents and this signifies the sensitive nature of these species. Density of dominant species such as *Blackfordia virginica*, *Eirene ceylonensis*, *Phialidium brunescens* and *Eutima commensalis* occurring in swarms at times constitute high standing stock. Maximum density was observed at st. 4 which is interior and closer to the industrial estates of Thana District. Abnormalities like occurrence of specimens having 3,5, and 6 radial canals instead of its usual 4 radial canals were observed in *Blackfordia virginica* and *Eutima commensalis* were found to be crumbled, distorted and brownish in colour. This indicates the adaptation of these hardy species to the prevailing water quality. Station 5 was found to be very poor in density as well as in species diversity of hydromedusae. This suggestive of the fact that some environmental factor or combination of several factors inhibit the growth and activity of these animals of this area. *Ostromovia inkermanica* is a new record to Arabian Sea.

Hydromedusae contribute substantially to the total zooplankton standing stock in the estuarine and nearshore waters. Occasionally these forms occur in dense swarms and thus the entire zooplankton appear to be nothing but a soup of medusae. Ecologically this group is important as they are exclusively carnivores and form an important link in the trophic web of the marine environment. Tropical estuaries experience only limited fluctuations of temperature. However, the environment remains rigorous due to extreme change in salinity. Species composition in these systems is fairly distinct from their counterparts of temperate region. Several authors have studied the hydromedusae from west coast of India<sup>1-5</sup>. While detailed studies on this group are available from limited estuaries<sup>6-11</sup>, hydromedusae from Bombay harbour estuarine complex has not been studied in detail and hence an attempt was made to study the species compo-

sition, abundance and distribution of hydromedusae from the entire system of Bombay harbour - Thana and Bassein Creek complex.

### Materials and Methods

Zooplankton samples were collected by oblique hauls of Heron-Tranter net (mesh size 0.33 mm) equipped with a calibrated flowmeter. Monthly sampling was done for a period of one year from October 1985 - September 1986 from eight stations covering intermediate phases of the tide to avoid tidal effect if any, (Fig. 1). Thana and Bassein Creeks form an estuarine creek systems of Bombay and join the Arabian Sea. Due to industrial growth along the Thana Belapur industrial belt the interior segment of the creek gets polluted by waste water input. The depth at the stations varied between 6 to 10 m. Stations 1 and 8 from coastal nearshore waters; 2,3 and 7 are from creek regions and stations 4 and 5 are interior and closer to the industrial estates of Thana District. Station 6 is in an area where extensive dredging of sand is being carried out. The interior stations are mangrove populated area, having limited tidal influence and

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receive discharge of industrial effluents (>180 mld) and domestic wastes (350 mld)<sup>12</sup>. Water samples were taken using a Niskin water sampler for the estimation of physico-chemical parameters like temperature, salinity, pH, dissolved oxygen (DO), biological oxygen demand (BOD) and nutrients like phosphate, nitrite and nitrate. Analyses were carried out following standard procedures<sup>13,14</sup>, Zooplankton samples were preserved in 5% formalin and biomass (ml/100m<sup>3</sup>) was estimated adopting volume displacement method while population density (no/100m<sup>3</sup>) was determined by analysing aliquots of 50-100% of the

samples for the study of hydromedusae. Hydromedusae were separated and identified.

### Results and Discussion

The estuarine complex opens into Arabian Sea in the north at Bassein and in the south at Bombay harbour. Since there is a pronounced tidal exchange, the sewage and other industrial effluents discharged into it are continuously flushed out. Table 1 indicates the range of values of various physico-chemical parameters like temperature, salinity, DO, BOD and nutrients like phosphate, nitrite and nitrate which are more or less in the normal range except for the higher values of nitrite and nitrate in the interior stations. The pH of water does not vary much (7.5 to 8.2) over the period of study. These high values of nutrients can be attributed to the incoming sewage and effluent load.

Monthly variations in the standing stock of zooplankton and density of hydromedusae population at different stations are depicted in Fig. 2. Data from different months are clubbed into three distinct seasons viz. premonsoon (February -May), monsoon (June-September) and post-monsoon (October-January). Zooplankton biomass (ml/100m<sup>3</sup>) during these seasons ranged from 12 to 49, 6 to 132 and 10 to 740ml/100m<sup>3</sup>; while the population density (no/100m<sup>3</sup>) of hydromedusae fluctuated between 3 and 1838; 0 and 1120; 13 and 7096/100 m<sup>3</sup> in the premonsoon, monsoon and postmonsoon respectively. It appears that the postmonsoon season seemed to be favourable for hydromedusae and their contribution to the total zooplankton biomass was fairly high.

Thirty four species belonging to twenty two genera of hydromedusae were recorded during the present investigation. List of species are given in

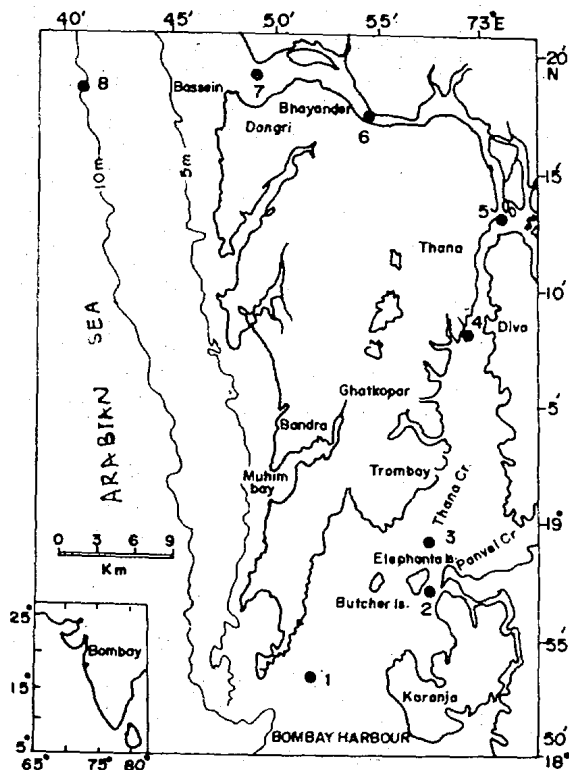


Fig. 1—Location of Stations

Table 1—Variation in hydrographic parameters and density of hydromedusae at different stations of Bombay harbour-Thana and Bassein creek estuarine complex during Oct. 1985 to Sep. 1986. (Values in ranges).

St. no.	Temp. (°C)	Sal. ( $\times 10^{-3}$ )	DO (mg/l)	BOD (mg/l)	PO <sub>4</sub> ( $\mu\text{g at/l}$ ),	NO <sub>2</sub> ( $\mu\text{g. at/l}$ )	NO <sub>3</sub> ( $\mu\text{g. at/l}$ )	no/100 m <sup>3</sup> ,	
								Minimum	Maximum
1	25.0-30.0	26.9-37.9	4.1-8.7	0.8-2.6	0.3-4.9	1.0-4.7	1.0-29.2	3	240
2	25.0-30.0	22.9-37.5	2.6-8.8	0.4-3.0	1.6-9.2	0.9-12.2	5.2-52.8	80	2410
3	24.0-31.2	22.7-37.6	2.8-8.8	0.1-4.3	1.3-8.8	0.3-8.0	6.6-41.0	22	1818
4	24.0-32.0	6.7-37.6	2.1-6.9	0.8-4.1	2.3-15.9	2.0-34.5	6.8-65.8	26	7926
5	24.0-33.0	1.1-28.0	2.4-7.2	0.2-4.6	1.0-9.9	0.3-22.8	12.2-71.8	26	106
6	24.5-32.0	2.0-32.9	5.3-9.0	0.2-4.7	0.7-5.7	0.1-4.4	13.4-78.2	13	144
7	24.0-31.5	18.1-36.1	4.1-8.7	0.2-5.0	1.2-5.6	0.1-2.4	11.5-72.1	7	516
8	24.0-32.0	15.4-36.7	4.4-9.3	0.6-4.3	1.2-2.3	0.1-1.0	4.5-22.6	12	1521

Table 2. Some of these species are residents of the backwaters, others are temporary visitors coming from the sea.

Figure 3 represents the distribution of some dominant species like *Blackfordia virginica*, *Ostroumovia inkermanica*, *Phialidium brunescens*,

*Eutima commensalis* and *Eirene ceylonensis*. The range in pH value was not significant and hence it is not included.

*B. virginica*—A euryhaline species present in all stations at least during certain periods of the year. Highest density, 4196/100<sup>3</sup>m was observed during

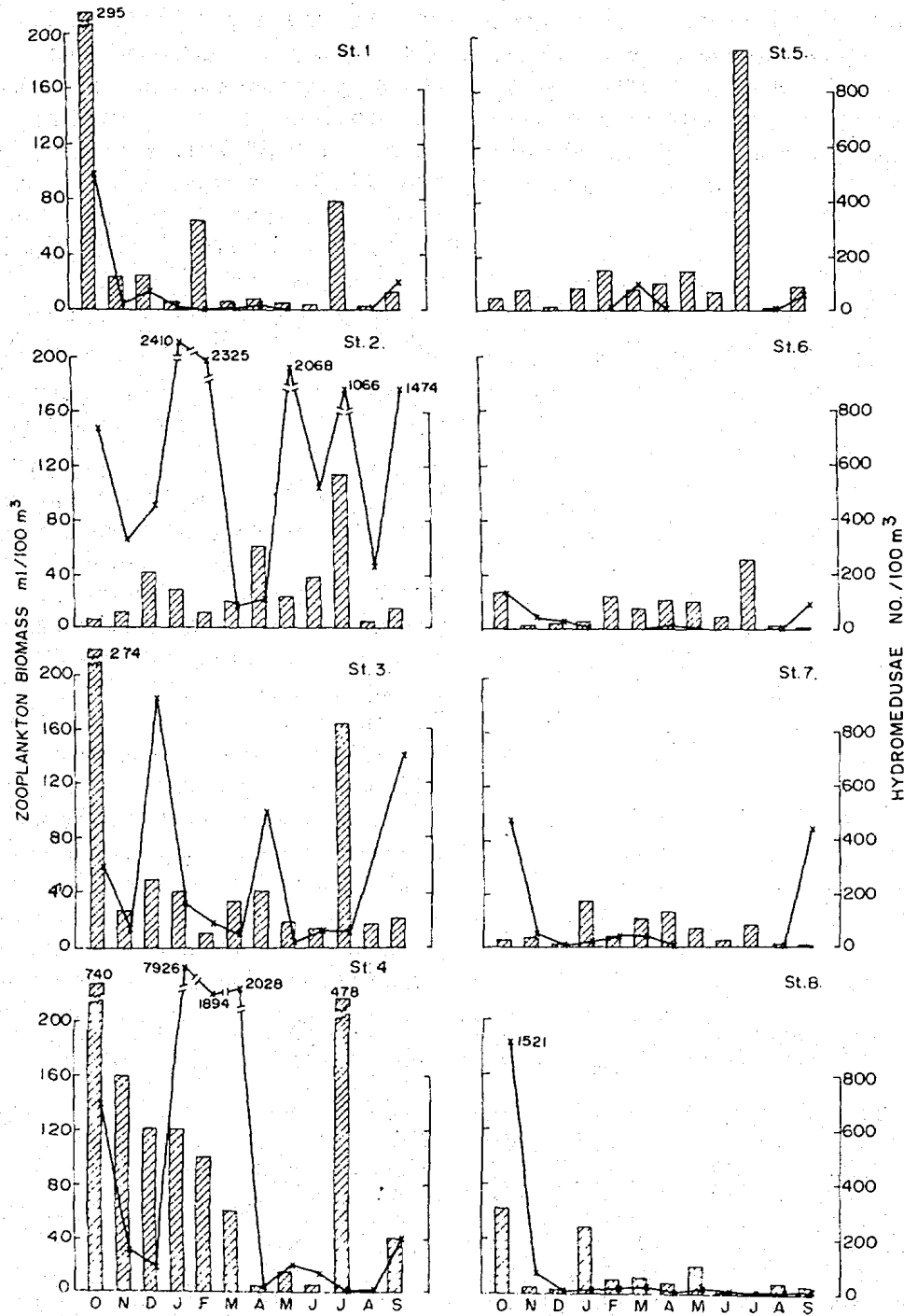


Fig. 2—Monthly variation in the zooplankton biomass and population density of hydromedusae at sts 1-8



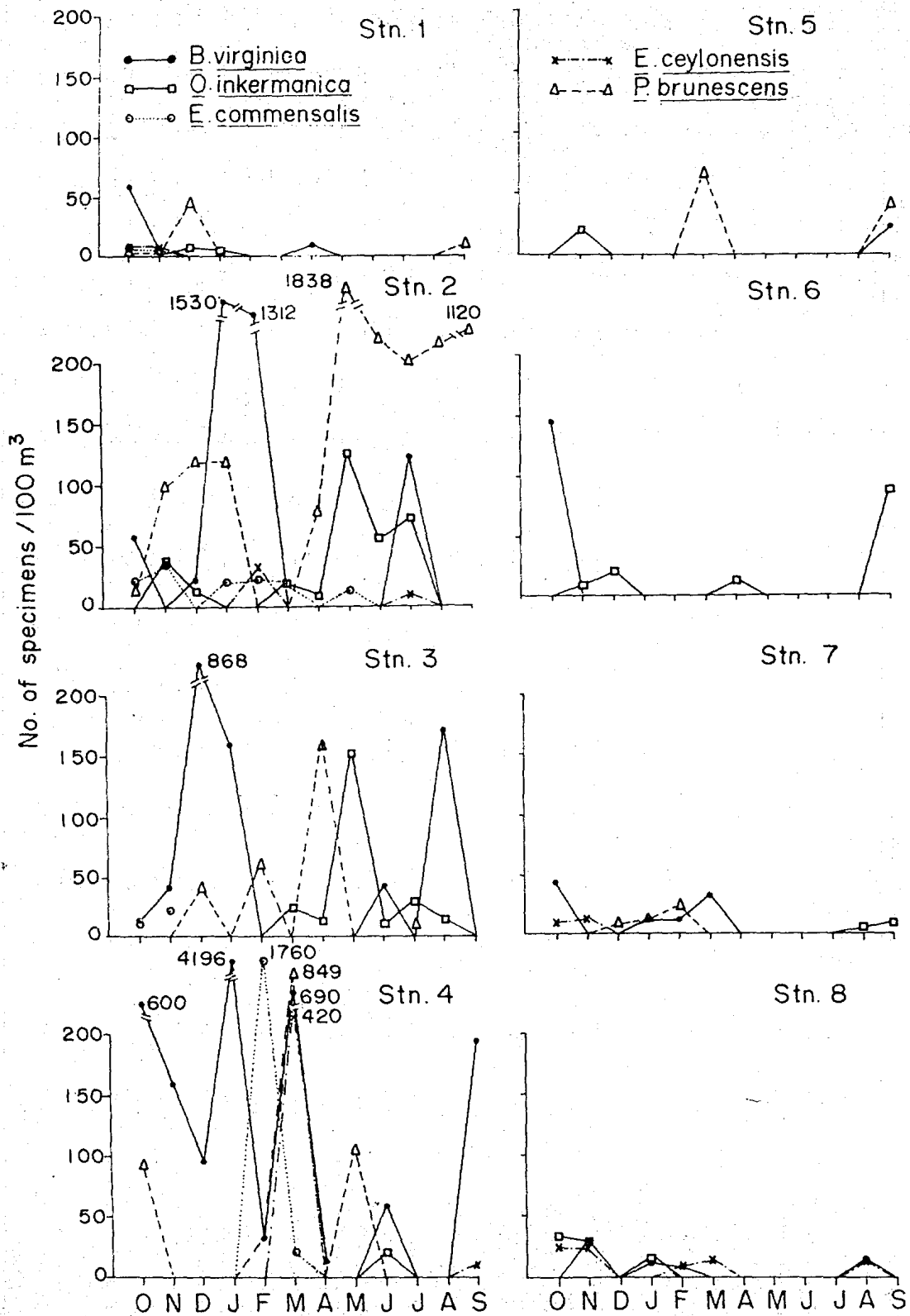


Fig. 3—Monthly variation of different species of hydromedusae at sts 1-8

January at st. 4. The temperature ranged from 24 to 25.5°C, the salinity varied from 33.5 to 33.6×10<sup>-3</sup> and the dissolved oxygen content changed from 2.6 to 2.9 ml/l. This species is considered as a backwater form but it may occasionally be found from coastal waters also.

*O. inkermanica*—This species was also recorded from all stations and the highest density, 152/100m<sup>3</sup> was noticed in May from third station. It occurred in abundance during high saline period from interior stations. This species is a new record to Arabian Sea. Earlier it was reported from Visakhapatnam coast, Bay of Bengal<sup>15</sup>.

*P. brunescens*—The maximum density (1838/100<sup>3</sup> m) was found from st. 2 in May when the temperature varied from 29 to 30°C, the salinity ranged from 37.1 to 37.5×10<sup>-3</sup> and the dissolved oxygen content varied from 6.3 to 7.2 ml/l.

*E. commensalis*—This species was considered as an endemic species to Cochin backwaters and is recorded from Bombay waters for the first time. The maximum density was found to be 1760/100 m<sup>3</sup> from st. 4 during February when the temperature ranged between 26.5 and 28.5°C, the salinity value varied from 34.5 to 34.7×10<sup>-3</sup> and the dissolved oxygen value ranged from 3.9 to 4.9 ml/l.

*E. ceylonensis*—Its abundance was less when compared with the above mentioned species in this area. Earlier it was recorded from Trivandrum coast, Bombay waters and from Aroor<sup>10,17</sup>. It is eurythermic and euryhaline preferring high temperature and salinity.

*Liriope tetraphylla*, *Aglaura hemistoma* and *Solmundella bitentaculata* were found from five stations in few numbers and they were totally absent at sts 4,5. They are holoplanktonic species widely distributed and occurrence of these species indicates the presence of offshore waters; and are absent in the interior stations. Earlier, these species were reported from cochin backwaters<sup>7</sup>.

Species like *Ectopleura sacculifera*, *E. dumortieri*, *Zanclaea costata*, *Hybocodon forbesi*, *H. unicus*, *Meliceratum octocostatum*, *Phialidium bicophorum*, *Eucheilota menoni*, *Eirene menoni*, *Helgicirrho malayensis*, *Tiaropsidium japonicum*, *Phialucium multitentaculatum*, *P. condensum*, *Octophialucium indicum*, *Aequorea tenuis* and *Cunina duplicata* were rare from this area during the present investigation. Other species were found

occasionally at this region. Maximum species diversity was observed at st. 1 and a downward trend was observed up to st. 5 and then again at st. 6 onward on upward trend to st. 8 was noticeable.

In species diversity station 1 ranked first with occurrence of 19 species, followed st. 2 with 18 species and st. 8 with 16 species. Station 5 was found to be the poorest with two species. The dominant species namely *B. virginica*, *P. brunescens*, *E. ceylonensis* and *E. commensalis* had their peak occurrence at st. 4. In density of the population of hydromedusae, st. 4 ranked first while in species diversity it was poor.

The most dominant and abundantly occurring species were found at st. 4 indicating its tolerance to varying hydrographic conditions including those induced by the addition of industrial effluents and domestic sewage. Abnormalities were observed in *B. virginica* from samples collected at st. 4. Frequent occurrence of specimens having 3,5 and 6 radial canals instead of its usual 4 radial canals were noticed. Most of the specimens of *E. commensalis* were found to be crumbled and brownish in colour. Nair observed abnormalities in chaetognaths from this region<sup>18</sup>. The shape of curve and period suggest that population explosion of one species is followed by that of another species; two different species were usually found to explode in their peaks at different times except for March at st. 4 (Fig. 3). This also suggests that conditions triggering medusae bud release are different for different species, thus the species will occupy different ecological niches.

Dwindling of species diversity at interior stations during the period of study is an important indication of its sensitivity to the changing environmental conditions. This may be due to the changing environment of this area.

It could be assumed that a decline in species diversity and density of hydromedusae in general indicates the deteriorating water quality. The existing species appear to have adapted themselves to the prevailing conditions, with more food available as is reflected by an increase in density of population (Fig. 3). The present study gives further evidence to its decline presumably under the influence of increasing pollution of the area with industrial effluents and domestic wastes. The drastic decline of these species in the interior station (st.

5) throughout the period of study is an important indication of its sensitivity to the changing environmental conditions.

Hydromedusae at interior stations were absent or rare during low saline monsoon period (Fig.3). This suggests that low salinity is not favourable for the liberation of medusae from the hydroid. During postmonsoon and premonsoon periods hydromedusae were well represented in density with regard to species like *B. virginica*, *E. ceylonensis* and *E. commensalis*, whereas at st. 5 except for March and September medusae were totally absent. Salinity was found to be the limiting factor for the growth and activity of hydromedusae from Cochin backwaters<sup>7,9</sup>. In the present study even during high saline premonsoon period medusae were absent at sts 5 and 6. Salinity range at st. 5 was not very low while the high values of nitrate and nitrite were noticeable (Table 2). It appears that the low level of DO in the polluted environment coupled with BOD might be adversely affected the survival of these organisms. Station 6 is an area where extensive dredging for sand is being carried out and hence there is every chance of removal of hydroid colonies with the sand and only the newly forming colonies may be there to produce medusae. The increasing of polluting of the area with the industrial effluents and domestic wastes inhibits the growth and activity of hydromedusae. The distorted body shape of *E. commensalis* is also significant in this context.

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