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# Distribution and Seasonal Abundance of Macro Benthos of Gangavali Estuary, Uttar Kannada, West Coast of India

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***Abstract***

Distribution and seasonal abundance of Gangavali estuary was studied for one year from September 2007 to August 2008. The diversity, abundance and biomass of macro-benthos were observed selecting four stations along the Gangavali estuary and eleven benthic organisms were encountered in the present study. Polycheates were observed at all four stations with maximum faunal distribution. The diversity of macro benthos was at maximum numbers towards lower reaches of the estuary. The benthic faunal components exhibit bimodal pattern of distribution with monsoon as a period of minimum density and post-monsoon and early pre-mansion with maximum density.

## 1. Introduction

Karnataka coast on western boundary of India has nine major rivers that meet Arabian Sea and Gangavli is one of them. This river geographically lies between $74^0$18' to $74^0$42' N longitude and $14^0$29' to $14^0$48' E latitude.

Estuaries are coastal ecological niche, receiving importance in recent years due to industrialization, urbanization, and construction of harbors along the banks of estuaries. The estuaries have gained importance and attracted the attention of scientists and other agencies in view of their importance of coastal biodiversity. Most of the estuarine areas are put in to various uses, such as constant source of fish supply for coastal population with high agriculture potential, important habitat for birds, recreation like navigation bird watching, domestic use disposal of industrial waste and sewage. Estuaries are ideal grounds for aquaculture. The estuarine environment is recognized as a complex ecosystem with widely varying physico-chemical influences and characteristic biota. Benthic community is often used as indicator of ecological status of an estuary (Swartz, 1978). Duda *et al.,* (1982) has established. Hence the benthic macro fauna provides the most accurate and reproducible information of the fertility of water while. Remani *et al,* (1983) and Schafer *et al.,* (1985) have suggested the use of certain macro benthos as bioindicators of change in the environment. Benthic fauna have a great potential to indirectly control the fate and subsequent bioavailability of sedimentary contaminants in their immediate environment (Sandens *et al.,* 2000), the information gained from monitoring benthic macron invertebrate communities has been used widely to measure the status and trends in the ecological condition of estuaries. Estimation of benthic abundance is necessary for the assessment of demersal fishery resources as benthos form an important source of food for demersal fishes. Macro benthos has been extensively used for pollution studies. Earlier work on benthos give information on the quantitative and qualitative distribution from deferent regions of West Coast of India.

## 2. Materials and Methods

The preliminary survey of the estuary was made in the beginning and four sampling stations were selected for macrobenthos studies which represent different zones of estuarine water, i.e. i) lower reaches, ii) lower middle reaches, iii) upper middle reaches and iv) upper reaches.

The water samples were collected monthly from September 2007 to August 2008 during high tide and low tide. The physico- chemical parameters of water were studied using standard methods (APHA AWW and WPCF, 1971). The sediment samples were collected by Pyrex transparent hand core at different stations. These samples were treated with 5% of rose bengal and formaldehyde solution and preserved for further analysis. The grain size analysis of sediment was carried out with the help of different sized sieves. Silt and Clay fractions of dried sediment were determined by pipette analysis as described by Holme and Mc Intyre (1971). The sediment was sieved using a 500µ sieve and residue obtained on the sieve was preserved for analysis of macrobenthos, later the samples were studied under microscope to identify up to taxa level as per Gosner (1971) and the density of the macro fauna is estimated for per square meter of sediment. The

animals of each variety were gently blotted and weighed to obtained biomass (gm./m²).

## 3. Result and Discussion

### Hydrological and sediment parameters

The station wise average values of water and sediment parameters were recorded in Table 1. The environmental characteristics of the estuary were found to fluctuate periodically during monsoon, post- monsoon and pre-monsoon. High temperature and high salinity occurred during pre-monsoons season while monsoon is characterized by heavy rain fall leads to heavy reverine discharges and dilute the estuarine water. The pH range of water generally remained on alkaline side. The estuarine sediment was generally composed of sand and silt. The percentage of clay is more at lower reaches. The concentration of organic carbon is closely related the clay fraction. The average carbon content was low at station 4 because of higher percentage of sand and low percentage of clay, similar observation was made by Parulakar *et al.,* (1980) in Bombay water and stated that the clay and silt-clay had high organic matter than sand and clayey-sand in general.

Table 1. Average Hydrological and Sedimental parameters of Gangavali estuary

| Parameters | Stations | | | |
|---|---|---|---|---|
| | I | II | III | IV |
| Air Tem o$^c$ | 29.17 | 28.67 | 29.25 | 28.8 |
| Temp o$^c$ | 28.79 | 28.21 | 28.10 | 28.9 |
| pH % | 7.60 | 7.40 | 7.39 | 7.30 |
| Salinity% | 13.06 | 8.94 | 4.39 | 1.37 |
| D.O ml/lit. | 5.13 | 4.94 | 5.23 | 5.46 |
| Susp.Load | 0.29 | 0.28 | 0.23 | 0.23 |
| Org.Carbo % | 2.41 | 2.55 | 2.12 | 1.61 |
| Sand % | 24.91 | 23.1 | 32.43 | 53.00 |
| Silt % | 57.18 | 60.61 | 51.49 | 34.48 |
| Clay % | 14.08 | 16.00 | 14.10 | 13.05 |

### Population density and Biomass

The data on population density and biomass of the macrobenthos collected from four stations of Gangavali estuary is presented in Table 2 & 3 and Figure 1. Among the species community a few are abundant but some are rare. A critical analysis of this data revealed the following facts.

Fig. 1: Population density of Macrobenthos (no/m²) of Gangavali estuary (%)

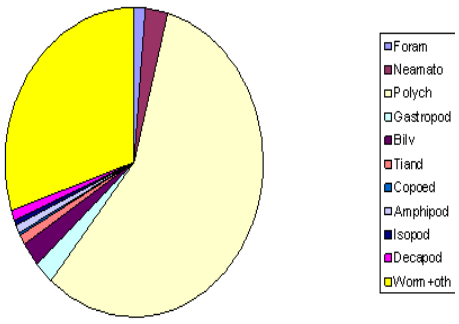


Fig. 2: Seasonal abundance of Macrobenthos of Gangavali estuary

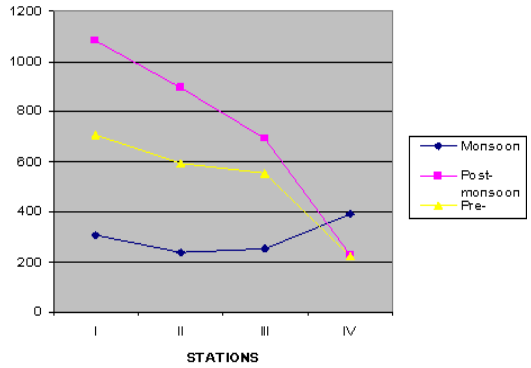

Table 2. Density of Macrobenthos (no/m²) of Gangavali estuary

| Group | Station | | | | Total | % |
|---|---|---|---|---|---|---|
| | I | II | III | IV | | |
| Foraminifera | 207 | 130 | 0 | 0 | 337 | 1.38 |
| Neamatoda | 332 | 260 | 64 | 34 | 690 | 2.82 |
| Polycheata | 4340 | 4170 | 3664 | 1684 | 13858 | 56.76 |
| Gastropoda | 448 | 178 | 12 | 0 | 638 | 2.61 |
| Bivalvia | 250 | 282 | 88 | 0 | 620 | 2.53 |
| Tanaidacea | 76 | 128 | 86 | 0 | 290 | 1.18 |
| Copepoda | 20 | 10 | 4 | 0 | 34 | 0.13 |
| Amphipoda | 20 | 134 | 62 | 26 | 242 | 0.99 |
| Isopoda | 0 | 98 | 0 | 0 | 98 | 0.4 |
| Decapoda | 142 | 120 | 38 | 12 | 312 | 1.27 |
| Worm+others | 2340 | 1770 | 1960 | 1226 | 7296 | 29.88 |
| Average | 743.18 | 661.81 | 543.45 | 271.09 | 2219.53 | |

Table 3. Station wise Variation in Biomass of Macrobenthos (gm/m²) of Gangavali estuary

| Group | Station | | | | Average |
|---|---|---|---|---|---|
| | I | II | III | IV | |
| Foraminifera | 0.023391 | 0.01469 | 0 | 0 | 0.00952 |
| Neamatoda | 0.083 | 0.065 | 0.016 | 0.0085 | 0.043125 |
| Polycheata | 32.5066 | 31.2333 | 27.4433 | 12.6131 | 25.94075 |
| Gastropoda | 340.0365 | 135.1037 | 9.10812 | 0 | 121.06210 |
| Bivalvia | 189.75 | 214.038 | 66.792 | 0 | 117.6450 |
| Tanaidacea | 0.01482 | 0.02496 | 0.01677 | 0 | 0.014138 |
| Copepoda | 0.0072 | 0.0036 | 0.00144 | 0 | 0.00306 |
| Amphipoda | 0.012 | 0.0804 | 0.0372 | 0.0156 | 0.0363 |
| Isopoda | 0 | 1.028 | 0 | 0 | 0.2570 |
| Decapoda | 15.0236 | 12.696 | 4.0204 | 1.2696 | 8.2524 |
| Worm+others | 14.742 | 11.151 | 12.348 | 7.7238 | 11.4912 |

Table: 4. Distribution of Macrobenthic fauna in Gangavali estuary

| Sl No. | Species | Stations | | | |
|---|---|---|---|---|---|
| | | I | II | III | IV |
| 1 | Foramenifera | + | + | - | - |
| 2 | Nematoda | + | + | + | + |
| 3 | Neries | + | + | - | - |
| 4 | P.pinnata | - | - | + | + |
| 5 | G.alba | + | + | + | + |
| 6 | L.leteropoda | + | + | + | + |
| 7 | T.attenuata | + | + | + | - |
| 8 | N.tigrina | + | + | + | - |
| 9 | N.rumphi | + | + | - | - |
| 10 | E.fluviatilis | + | + | + | - |
| 11 | M.meritrix | + | + | + | - |
| 12 | M.casta | + | + | - | - |
| 13 | P.malabarica | + | + | - | - |
| 14 | Black calm | + | + | - | - |
| 15 | Villorita | + | - | - | - |
| 16 | Cyprinoids | + | - | - | - |
| 17 | Tanaidacea | + | + | + | - |
| 18 | Copepoda | + | + | + | + |
| 19 | Ampelisca sp. | + | + | - | - |
| 20 | Melita sp. | - | + | - | - |
| 21 | Corophium sp. | + | - | - | - |
| 22 | Cyathura sp. | - | + | - | - |
| 23 | Chiridotea sp. | - | + | - | - |
| 24 | P.indica | + | + | + | + |
| 25 | M.dobsoni | + | + | + | + |
| 26 | M.monoceroc | + | + | + | + |
| 27 | C.caridina | + | + | + | + |
| 28 | Sylla serrata | + | + | + | + |
| 29 | Matuta lunaris | + | + | - | - |
| 30 | Charybdis sp. | - | + | - | - |
| | Station wise Total Types | 25 | 26 | 15 | 10 |

Eleven benthic groups were encountered in Gangavali estuary at all four stations during the study period. These are Foramenifera, Nematoda, Polycheata,Gastropoda, Bivalvia, Tanaidacea, Copepoda, Amphipoda, Isopoda, Decapoda and Worms and others. The over all macro faunal density and biomass varied from 34no./$m^2$ to 13858no./$m^2$ (av. 2219no./$m^2$) and 0.0036gm./$m^2$ to 340.0365gm./$m^2$ (av.25.88gm./$m^2$) respectively. The important group in terms of number and species were Polycheata (13858no./$m^2$) followed by Nematoda (690no./$m^2$) and the highest biomass 484.24gm./$m^2$ contributed by gastropoda to the benthic populatiogn.

The groups occurred in the following order of abundance were Polycheata (56.76%)> Worms and others (29.88%)> Nematoda (2.82%)> Gastropoda (2.61%)> Bivalvia (2.53%)>Foraminifera (1.38)> Decapoda (1.27%)> Tanaidacea (1.18%)> Amphipoda (0.99)> Isopoda (0.40) and Copepoda 0.13no./m2. During the period of study tenure, Copepoda has low density with biomass of 0.01224gm./m2 and their distribution was seasonal and found only during post-monsoon period and not noticed during pre-monsoon and monsoon. During the study period, station 1 had shown large biomass values due to presence of gastropoda. The station 4 had shown the lowest of biomass values. It is because of gastropoda, bivlvia and other groups like foraminifera, tanaidacea, copepoda, isopoda not noticed at the upper reaches.

The maximum population density was found during post-monsoon. A substantial decrease in benthic fauna during monsoon has been reported by Chandramohan(1987), Srinivas rao and Rama sarma(1983). The species diversity increases towards the sea with decreasing organic enrichment (Mishra, 2002). But in the present study the highest population density shown towards lower reaches and lowest population density was observed at station 4. This is clearly showed that increase in organic enrichment had shown increased population density towards the sea. Ansari *et al.,*(1986) made the similer observation in Goa estuary that the benthic population and biomass was significantly higher at the site of organic enrichment.

The type of sediment factor determines the macro benthic community (Muniz and Piers, 2000) and deferent functional groups have been defined in association with deferent substrate type. Debasish *et al.,* (2009) described the impact of monsoon is not drastic up on the macrobenthic organisms. The hydro-chemical parameters have more influence on distribution of population density, species richness and diversity. Other than hydro-chemical and sediment factor, environmental characteristics are another factor determining the community of macrobenthos. Bhat and Neelakantan (1988) described the environmental characteristics of an estuary fluctuate periodically depending on three seasons i.e. pre-monsoon, monsoon and post-monsoon. The post-monsoon is known for stable environmental condition and increasing benthic production. In present study, the seasonal variations in abundance and biomass followed a similar pattern with low values in monsoon and pre-monsoon.

## 4. Conclusion

The present study revealed higher benthic density and biomass during post-monsoon towards the river mouth and decreased towards upper reaches. The environmental patterns of Gangavli estuary fluctuates periodically. The pH range of Gangavali estuary generally remained on alkaline side which suggests that the estuary water is not polluted during the period of present work. The stable environmental condition of post-monsoon season which favors the growth of benthic population. The benthic faunal components exhibited bimodal pattern of distribution with post-monsoon and early pre-monsoon as a period of maximum density and monsoon with minimum density.

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