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Macrobenthic Composition and Diversity in the Coastal Belt of Thondi, Southeast Coast of India

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Abstract: Macro fauna reside beneath the sediment surface in burrows and tubes. They assist in the breakdown of particulate organic material by exposing them to microbes and their faeces contain rich nutrients, forming food for other consumers and can potentially support off-shore communities. Nearly half of the world's commercial fish catch consists of shellfish and demersal fish, whose main food items come from benthic animals. They retain on 0.5 mm sieve. The estimation of benthic production would serve as a useful index for assessing the fishery potentials, interaction, pollution and intertidal ecology. The present study on macro benthic fauna was carried out in Thondi coastal area. Two sampling points were fixed by GPS. Fifty four species were identified of this 24 species belonged to gastropods, 15 species to bivalves, 5 species to amphipods, 6 species to decapods and 4 species to echinoderms. The monthly variation of species composition, percentage composition, population density, species diversity, richness, evenness on macrobenthic faunal assemblage were investicated for a period of six months from September 2005 to February 2006.

Key words: Macrobenthic · Species diversity · Richness · Evenness

INTRODUCTION

Macro benthos are grater than 0.5 mm size, resides in sea bottom sediment, performing varieties of ecological function. They exhibit variety of body shapes, feeding styles and reproductive modes and comprise the critical link in the marine food web. Macro benthos consumes all kinds of organic matter (bacteria, planktonic and benthic organisms, detritus etc.,) and in turn act as a food for many fishes, birds and other marine invertebrates. They act as a connecting link between the biotopes of substratum and water column in the aquatic systems. They take part in breakdown of particulate organic material and export energy to higher trophic level and can potentially support off-shore and pelagic communities [1, 2]. The developmental stages of many macro benthic organisms are pelagic, forming important components of plankton community, that in turn is consumed by fish and thus having high influence on pelagic fisheries. Thus the estimation of benthic production is useful to assess the fishery production of a particular area [3]. Its distribution highly depends on physical nature of the substratum, nutritive content, degree of stability, oxygen content and level of hydrogen sulphide. The small changes in the environment will have considerable response on the benthic community and it avails to measure the degree of pollution. [4, 5]. Hence, it is regarded as indicator organisms hinting the condition, nature and characteristics of the ecosystem. An assessment on health of a particular ecosystem can be achieved only through a careful analysis of benthic fauna. The estuarine and coastal water benthic communities on West and East coast of India were studied [6-13]. As there is no study on macrobenthos in Thondi Coastal waters, hence the present study has been undertaken to understand the community structure, density and diversity of macrobenthic fauna in relation to environmental parameters.

MATERIALS AND METHODS

The present study was carried out for six months from September 2005 to December 2006 from Thondi Coastal waters, Palk Bay (Lat 9° 43' and 10° 2' N; Long 77° 47' and 78° 49' E) (Fig.1). Station I is fixed at the mouth and station II is about 1 km away from the station I in the up streams of the river. The water and sediment samples were collected in every month at all stations.

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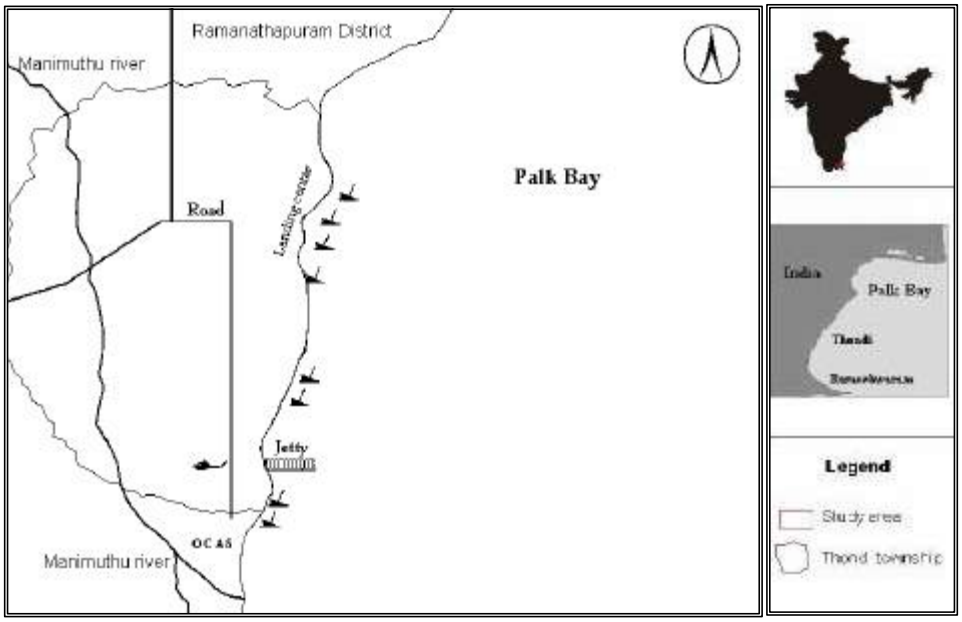

Fig. 1: Showing the study area

For benthos, after retrival of sediment from Peterson's grab (0.08m^2), sieved and retained through 0.5 mm screen and preserved in 5% formalin. The animals were separated, counted, identified up to species level using standard references and expressed in No/m^2. The temperature, salinity, dissolved oxygen, nitrate, nitrite, phosphate and silicate in water were estimated by following method of [14]. The total organic carbon (TOC) in sediment was estimated by following method of [15].

RESULTS

Salinity: The salinity of the surface water ranged from 25.5% (November) to 29% (September) at Station I and from 26% (November) to 29.5% (September) at Station II. (Fig.2).

Temperature: The surface temperature varied between 27°C to 29°C at Station I and 26.5°C to 29.5°C at Station II (Fig.3). The maximum temperature was observed in premonsoon (September) at Stations I and II and the minimum temperature was found to occur in monsoon (November) at Stations I and II.

Dissolved Oxygen: The surface water dissolved oxygen content was ranging from 3.9 02 ml/l to 4.8 02 ml/l at Station I and 3.7 to 4.9 at Station II (Fig.4). The maximum values of dissolved oxygen content 4.8 and 4.9 were recorded in monsoon (December) at Station I and premonsoon (January) at Station II. The minimum values of dissolved oxygen content 3.9 and 3.7 were recorded in premonsoon (September) at Station I and II.

Total Organic Carbon: The organic carbon content in the sediment ranged from 0.71%(November 2005) to 3.28% (January) at station I and 0.42% (October) to 2.89% (January) at station II. (Fig.5).

Population Density: Monthly occurrence and abundance of macrobenthos at two different stations are given (Fig.6). In general, macrobenthos population was more during post monsoon. The population density at Station I and II was found to be varied from 3818 to 6396, 3372 to 6205 no/ m2 respectively (Fig.7).

Patterns of diversity indices such as Shannon and Wieners diversity index (H!), Simpson index (D), Pielous evenness index (J). In general, the species diversity varied from 0.531 to 1.175. The results revealed that there was no specific pattern of diversity in between the stations. High species diversity indices was observed during postmonsoon followed by premonsoon and monsoon seasons. The species richness varied from 0.36 to 0.48, 0.47 to 0.62 (Fig.8). Species richness was more during monsoon followed by premonsoon and post monsoon seasons. Species evenness varied from 0.38 to 0.73, 0.34 to 0.71 (Fig.9). Species evenness didn't shown

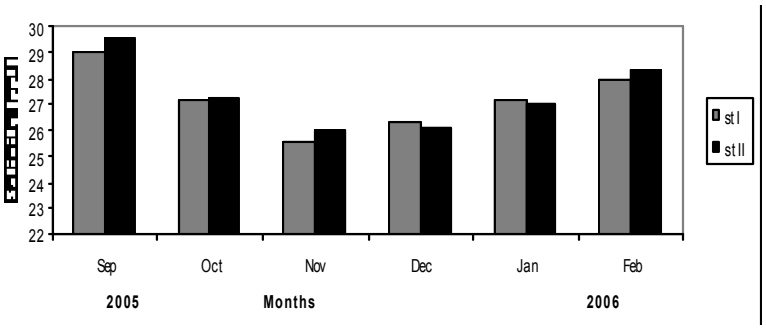

Fig. 2: Seasonal variation of salinity

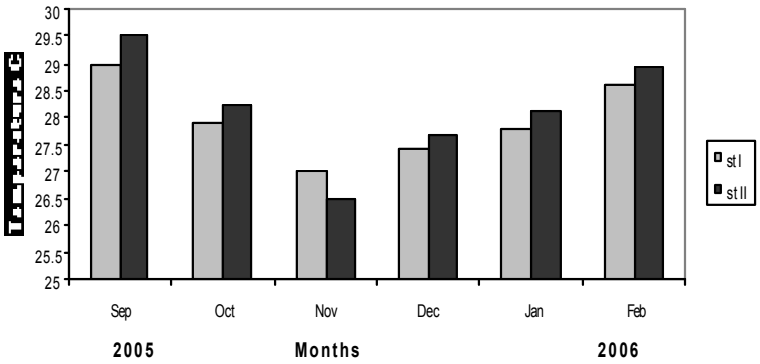

Fig. 3: Seasonal variation of Temperature

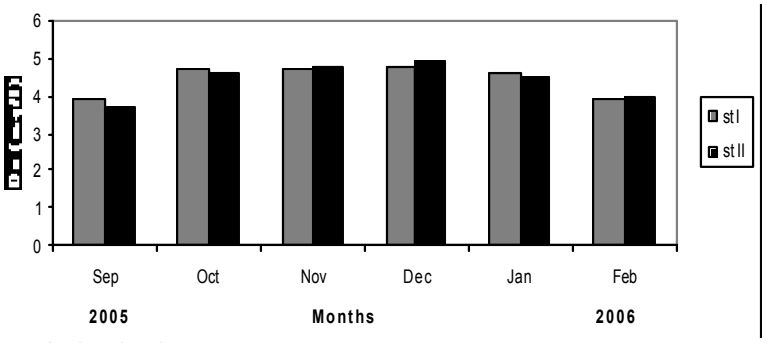

Fig. 4: Seasonal variation of Dissolved oxygen

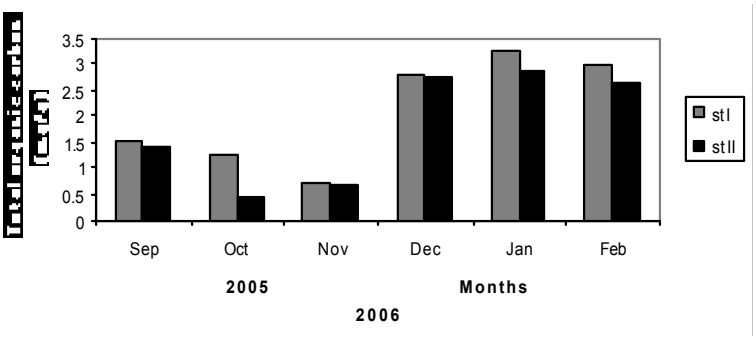

Fig. 5: Seasonal variation of Total organic carbon

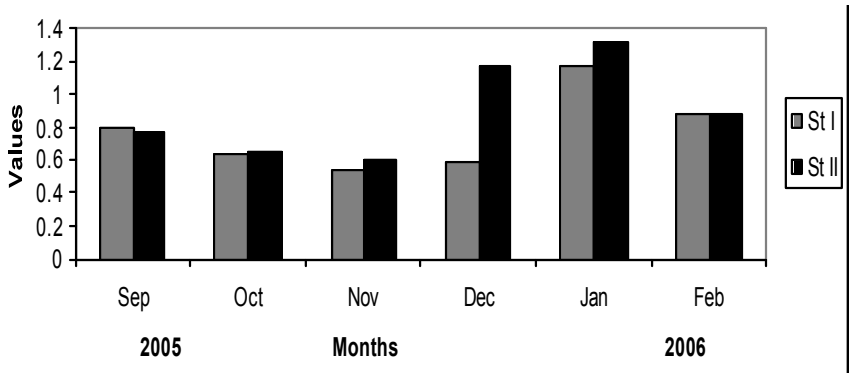

Fig. 6: Seasonal variation-macrofaunal Diversity

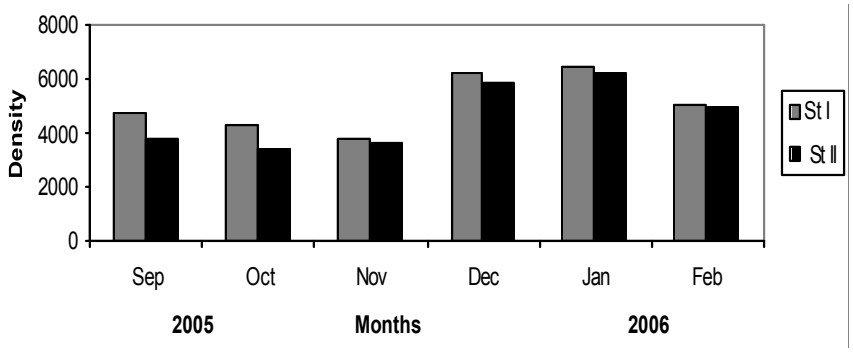

Fig. 7: Seasonal variation-macrofaunal density

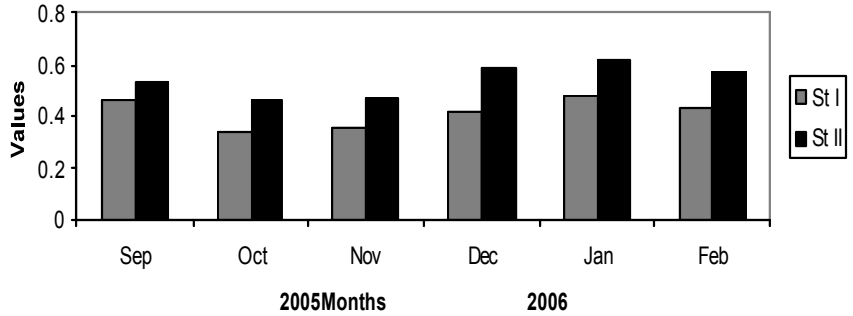

Fig. 8: Seasonalvariation-macrofaunal Richness

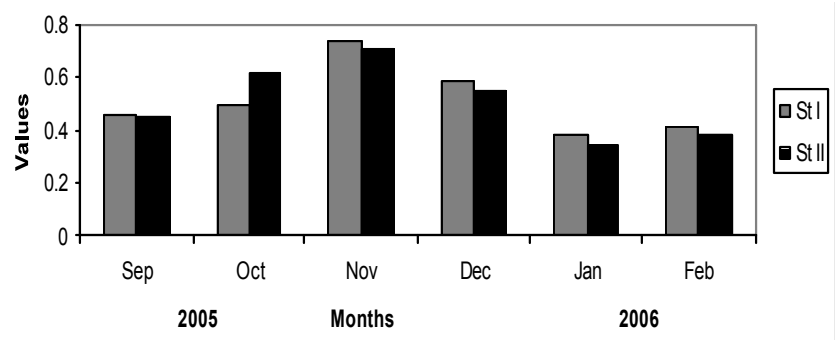

Fig. 9: Seasonalvariation-macrofaunal Evenness

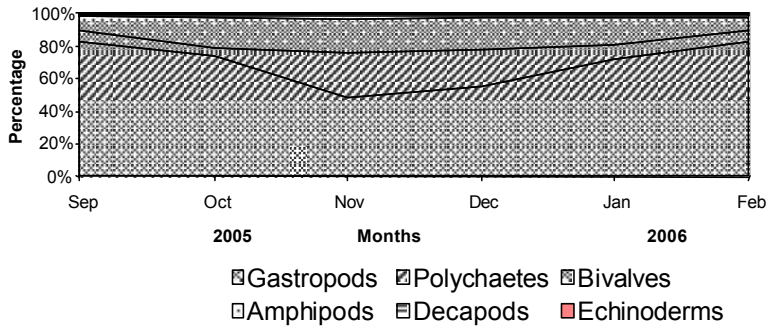

Fig. 10: Percentage contribution of macrobenthic faunal group at station I

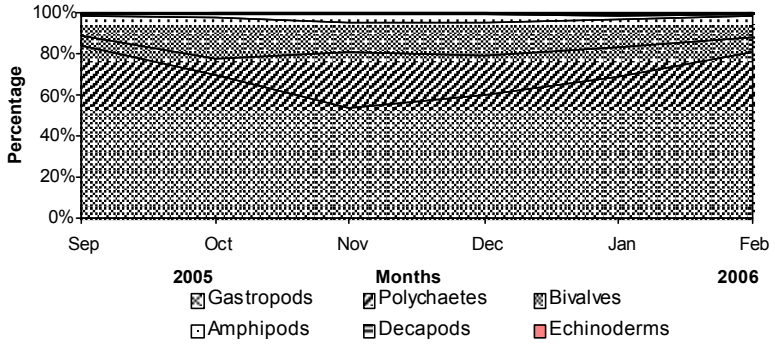

Fig. 11: Percentage contribution of macrobenthic faunal group at station II

Table 1: List of macrobenthos observed in Station I and Station II

S.No	Species	Station I	StationII
Gastropods			
1	*Cerethidea cingulata*	*	*
2	*Potamides cingulata*	*	*
3	*Cerithium rubus*	*	*
4	*Cerithium oblicus*	*	*
5	*Telescopium telescopium*	*	*
6	*Cerithidea fluviatilus*	*	*
7	*Umbonium vestiarium*	*	*
8	*Cyprea arabica*	*	*
9	*Marginella angutata*	*	*
10	*Drupa tuberculata*	*	
11	*Drupa margariticola*		*
12	*Cantharius erythrostomus*	*	*
13	*Nassarius arcularius plicata*	*	*
14	*Strombus canarium*	*	*
15	*Strombus urgeus*	*	
16	*Natiga tigerina*	*	*
17	*Nassa hepatica*		*
18	*Nassa jacksoniana*	*	*
19	*Murex tribulus*	*	*
20	*Chicoreus ramosus*	*	*
21	*Bursa* sp.	*	*
22	*Trochus sterllatus*	*	
23	*Murex haustellam*	*	*
24	*Chicoreus brunneus*	*	*

Table 1: Continued

Polychaetes			
1	*Antistrosyllis constricta*	*	*
2	*Dentronereis aestuarina*	*	*
3	*Perinereis capensis*	*	*
4	*Ceratonereis coastae*	*	*
5	*Capitella capitata*	*	*
6	*Ophlina acuminata*	*	*
7	*Lumbricinereis Latereilli*	*	*
8	*Cossura delta*	*	*
9	*Eunice tubifex*		*
10	*Prinospio pinnata*	*	*
11	*Nephtys Polybranchia*		*
12	*Glycera alba*	*	*
13	*Cirratulus cirrtus*	*	*
14	*Pisionidens indica*		*
15	*Syllis cornuta*	*	*
16	*Branchiomaldane vincenti*	*	*
17	*Terebella ehrenbergi*	*	
Bivalves			
1	*Lucina ovum*	*	*
2	*Meretrix casta*	*	*
3	*Vepricardium asiaticum*	*	*
4	*Anadora granosa*	*	*
5	*Gafrarium* sp.		*
6	*Lunulicardia retusa*	*	*
7	*Gafrarium tumidum*	*	*
8	*Mactra cuneata*	*	*

Table 1: Continued

9	*Katalysia opmia*	*	*
10	*Paphia textile*		*
11	*Mesodesma trigonum*	*	*
12	*Tellina bruguieri*	*	*
13	*Modiolus tulipa*	*	*
14	*Crassostrea madrasensis*	*	
15	*Donax cuneatus*	*	*
Amphipods			
1	*Grandidierella gilesi*	*	*
2	*Corophium triaenonyx*	*	*
3	*Urothoe platydactyla*	*	*
4	*Ampelisca scabripes*	*	*
5	*Ampithoe ramondi*	*	*
6	*Eripisella* sp.		*
Decapods			
1	*Portunus sanguinolentus*		*
2	*Portunus pelagicus*	*	*
3	*Scylla serrata*	*	*
4	*Metapenaeus dopsoni*	*	
5	*Penaeus indicus*		*
Echinoderms			
1	*Pentaceraster regulus*	*	*
2	*Coniodiscaster scaber*	*	*

any distinct variation between stations and found to be more during premonsoon period followed by monsoon and postmonsoon period. Benthic macrofauna at all stations were represented by six groups viz., Gastropods, Bivalves or pelycypods, Polychaetes, Amphipods, Decapods and Echinoderms.

Species Composition and Percentage Composition: Totally 61 species were found at Station I and that was 60 at Station II. The benthic faunal species numbering 8 (Gastropods 2, Bivalves 2, Decapods 2, Polychaetes 1, Ambipods 1) were restricted to Station I. Species numbering 7 (Gastropods 3, Polychaetes 2, Bivalves 1, Decapods 2) were restricted to Station II. Species numbering 58 (21 species of Gastropods, 15 species of Polychaetes, 13 species of Bivalves, 4 species of each Amphipods and Decapods and single species of Echinoderm) were recorded in all the stations are given in the (Table.1). At Station I percentage composition of gastropods, polychaetes, bivalves, amphipods, decapods and echinoderms were ranged between 48.97 and 85.21, 5.28 and 26.76, 8.9 and 20.17, 1.32 and 3.14, 0.34 and 1.30, 0.24 and 0.34 (Fig. 10). At Station II, percentage composition of gastropods, polychaetes, bivalves, amphipods, decapods and echinoderms were ranged between 53.45 and 83.55, 5.76 and 26.91, 9.42 and 20.16, 0.41 and 3.81, 0.43 and 1.32, 0.25 and 0.41. (Fig. 11).

DISCUSSION

In the present study it could be seen that there are characteristics seem to have influenced by physico-chemical, biological characteristics prevailing in the environment. The species composition of the macrofauna in the present study showed the dominants of gastropods followed by polychaetes, bivalves, amphipods, decapods and echinoderms.

Similar studies were carried east and west coast of India, showed the polychaetes were the dominant species. It is strengthen by [16] in Cochin backwater, [17] coleroon estuary. But the present study dominated by the single species of gastropod *Cerethidea cingulata.* It shows the substratum favours the high proliferation of *Cerethidea cingulata.* Apart from organic conversion might be more by *Cerethidea cingulata* rather by polychaetes in the present observation.

Polychaetes were the second dominant group observed in the present study. Most of the benthic Studies explored that *Glycera* is the dominant species in the polychaete communities [17, 18]. The dominances of polychaetes might be due to firm substrate provided by seaweed deposition. Polychaetes have a mucos secreting device, which is used to protect themselves in adverse conditions [19] in estuarine habitat.

Among the bivale species *Gafrarium* spp., *Mactra cuneata, Lunulicardia retusa, Vepricardium asiaticum, Meritrix casta* And *Anadora granosa* were found to be common during the present study. The same species were observed coleroon estuary and vellar estuary [20, 21]. Amphipods, decapods and echinoderms contributed minimum percentage occurrence in the present study.

Temperature is an important ecological factor, which influence distribution of benthic organisms. High temperature (29.5) recorded in premonsoon season influence the distribution of macrobenthic organisms. Low temperature recorded in December and January months influence higher faunal density. Low density recorded in November due to heavy downpour, which caused drastic fluctuations in the sampling stations. Positive relationship between the abundance of benthic fauna and concentration of organic carbon in sediments had been documented by many workers [22, 23]. Although positive relationship between organic carbon and benthic population was recorded in the present study, the relationship was not however significant. Salinity is also considered to be a dominant limiting factor, in the distribution of benthic fauna of the present study. The salinity determines the distribution of benthic fauna in

Damman cornice and half moon Bay of Arabian Gulf [24]. Similarly, the salinity level was drastically changed and caused low density in the benthic fauna in November. P^H and DO didn't play any considerable role in benthic faunal assemblage of present study. The similar founding's was also projected by [20]. Macro faunal density in the study area was high in late monsoon and early post monsoon. This high faunal density associated with faunal diversity and richness. But evenness observed to be high in October and November months. It was strengthened by [12] studied in Kachchh mangroves. From that it was concluded diversity correlated with density and it might be same in east and west coast of India.

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