Temporal Variations in the Distribution of Interstitial Meiob fauna along the Southwest Coast of India

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Introduction

Studies on benthic populations have been widely accepted as a tool for assessing the health of the environment because of certain unique qualities displayed by benthic invertebrates. Being an important link in the food chain between bacteria and macro fauna of sediments, meio fauna populations are probably suitable indicators of the benthic ecosystem balance. High sensitivity, rapid turnover rate, quick response, life cycles entirely spent in sediments and relative pollution stability makes meio fauna a valid tool to assess the impact of environmental stress. Monitoring of coastal environment is one of the key tools in scientific management of coastal resources.

Studies on interstitial meio fauna assemblages in relation to environmental variables from the Indian beaches are scanty. Initial meio fauna studies reported from the Indian coast were from the mud bank region of Kerala coast [1]. Following those a few more studies on the distribution and abundance of meio fauna have been made off the Indian coast [2-8]. Thiruvananthapuram, the capital district of Kerala on the southwest coast of India, is the southernmost district of the state. Considering the role of meio fauna as key indicators of environmental stress, the present paper explores the distribution of meio fauna and its temporal variation in Thiruvananthapuram coast of Kerala in relation to the prevailing environmental parameters as structuring factors of interstitial meio fauna in the sandy beaches.

Materials and Methods

The study was carried out along the Thiruvananthapuram coast of Kerala at two selected beaches, station I, located at Poonthura coast and station II, at Adimalathura coast, lying between latitudes 8020'-8030; North and longitudes 76055'-77003' east. Samples were taken monthly from the 2 stations up to a depth of 25 cm using a graduated steel cover having a length of 25 cm and diameter 5.5 cm. The sediment core was then divided into 5 cm and each segment was immediately removed intact into separate polythene bags. The samples were anaesthetized with 7% MgCl and preserved in 4% buffered formalin 0.1% Rose Bengal added to the sample for efficient extraction of the fauna and was separated by suspension decantation method [9]. Separated benthic sample were then processed through a set of two sieves with 500 mm and 42 mm mesh sizes for the separation of meio fauna. Meiob fauna was then counted on a higher taxonomic level using a binocular microscope.

Observations of physic-chemical characteristic of sea water were made according to standard methods [10,11]. Bottom sediment was subjected to the analysis of geochemical variables temperature, pH, organic carbon and texture [12]. Monthly values of all parameters analysed were pooled to obtain the seasonal values as pre monsoon (Feb-May), monsoon (June-Sep) and post monsoon (Oct-Jan).

Results and Discussion

The interstices of sandy beaches are profusely inhabited by meio benthic invertebrates which are of great ecological significance. The taxonomic composition, density and distribution of meio benthic fauna vary considerably from space to space depending on a wide variety of factors. Exposure, predation, competition, grain size, organic matter and oxygen largely determine the distribution of meio fauna in Indian beaches [13]. Numerically meio benthic abundance varied slightly in the two beaches. The overall density variation was from 1288 to 8386/100 cm² at the Poonthura coast and from 1151 to 10795/100 cm² at the Adimalathura coast (Table 1).

Faunal composition of meio fauna obtained from the two sandy beaches of Thiruvananthapuram coast consisted of 11 taxa coprising foraminifera, Turbellaria, Kinorhyncha, Nematoda, oligochaeta, Polychaeta, Archiannelida, Ostracoda, Copepoda, Amphipoda and Arachnida. Over all abundance of meio fauna has been in the order Nematoda, Copepoda, Foraminifera, Oligochaeta and Ostracoda at the Poonthura coast and in the order Nematoda, Foraminifera, Copepoda, Archiannelida and Oligochaeta at the Adimalathura coast (Figure 1). In general nematodes dominated the meio benthic community of Thiruvananthapuram coast. Nematodes are the most abundant
meiofaunal community of Indian beaches which often represents more than 80% of benthic meiofauna [5,14-18].

<table>
<thead>
<tr>
<th>Season</th>
<th>Poonthura coast</th>
<th>Adimalathura coast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre monsoon</td>
<td>Range 3465-6073</td>
<td>Range 2579-4631</td>
</tr>
<tr>
<td></td>
<td>Mean 4945</td>
<td>Mean 3592</td>
</tr>
<tr>
<td>Monsoon</td>
<td>Range 1288-4590</td>
<td>Range 1511-5877</td>
</tr>
<tr>
<td></td>
<td>Mean 2511</td>
<td>Mean 2508</td>
</tr>
<tr>
<td>Post monsoon</td>
<td>Range 1559-8386</td>
<td>Range 4540-10795</td>
</tr>
<tr>
<td></td>
<td>Mean 6617</td>
<td>Mean 7884</td>
</tr>
</tbody>
</table>

Table 1: Temporal variations (No/100 cm²) in meiofaunal density along Thiruvananthapuram coast, Kerala.

The study revealed distinct temporal variation in the interstitial meiofaunal components along the coast of Thiruvananthapuram (Figure 2). Faunal abundance was higher during the post monsoon period followed by pre monsoon. A distinct feature of the Indian beaches is the influence of monsoon rains that adversely affect the density of the fauna. During the monsoon period (June-Sept) the beach configuration changes drastically at short term intervals due to severe erosion or heavy deposition. Strong wave action during the monsoon has the capacity to completely remove or deposit the substratum. During the high turbulence period sediment particles get rearranged affecting the interstitial spaces and the living space available for the organisms that get shifted continuously. This phenomenon might uproot the benthic fauna and expose them to the risk of predation [19,20].

The ambient physico-chemical conditions and the physical change in the sediments are responsible for the temporal distribution of meiofauna. There were considerable fluctuations in the density of all taxa from month to month. Increased temperature, high salinity, stable beach conditions and the probable greater food availability favored the rich post and pre monsoon populations. Seasonal variations in the hydrobiological and geological variables are presented in Tables 2 and 3 respectively. The periods of high density of interstitial meiobenthic community in the present study is coincided with increased water and sediment temperature, pH, dissolved oxygen and increased organic carbon in the sediment together with higher proportion of silt and clay. Seasonal breeding is characteristic of meiofauna [21] and the increased meiobenthic density is coinciding with intense breeding activities of meiofauna during the high temperature period [22,23]. Temperature may also influence population increase indirectly by controlling supply of bacterial and diatom food. Size of sand grains was reported to be a major factor influencing meiofaunal abundance [5,13,24-27]. Interstitial fauna develop best in sands with medium diameter [9] and moderate organic enrichment [21]. Sandy beaches of Kerala in general have extremely low organic matter in sediment. Faunal abundance was higher during the post and pre monsoon months (Figure 2) with nematodes recording maximum abundance followed by copepods in the Poonthura beach and foraminifers at the Adimalathura beach. On average nematode contributed 57.96% (pre-monsoon), 47.4% (monsoon) and 49.25% (post monsoon) of the total meiobenthic fauna. Prevalence of nematode fauna in meiofaunal community of Indian beaches was reported earlier [15,16,28]. Abundance of foraminifera in sandy substrata was also reported from Indian beaches [1,15].
Vertically, the majority of meiobenthic organisms are confined to the upper 10 cm depth (Figure 3). Mostly nematodes are found to penetrate the deep layers and found in the entire 25 cm depth. Foraminifera are the other group in the deeper layers of the sediment. 21% of foraminifera and 25% nematoda penetrate the deeper (more than 10 cm) layer. Of all the other groups only oligochaeta and archinannelida were recorded from the deepest (20-25 cm) layer. Decrease in faunal density in the deeper layers has been attributed to the reduction in interstitial space, oxygen content and food material [29]. One of the reasons for the successful penetration of nematodes into deeper layers could be attributed to their capacity of anaerobic existence [1]. Seasonal variations were evident in the vertical distribution meiobenthos with highest density in the surface section (0-5 cm) during the monsoon period at both the beaches and maximum density in the 5-10 cm layer during other seasons (Figures 4 and 5). Meiobrana in sandy sediments generally appear to be concentrated at the levels where desiccation is not too severe and oxygen availability is not too low [30,31]. Because of better drainage of sand and higher temperature at the surface layer the fauna found penetrated to the deeper layer during pre and post monsoon seasons.

The study revealed distinct seasonal variation in interstitial meiofaunal along the coast of Thiruvananthapuram, Kerala on the southwest coast of India. The meiobenthic abundance in general was widely distributed.
found in accordance with sediment granulometry and physicochemical characteristics of water prevailing along the coast. Temperature, pH, salinity, dissolved oxygen, sediment composition and % of organic carbon in the sediment are proved to be important descriptive parameters related to the abundance and distribution of meiobenthos. Different meiofaunal components showed difference in vertical movement. A downward migration of meiofauna has been observed in the study area due to better drainage, high temperature and exposure.

References