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Research Article

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Distribution of Meiofauna in the Poonthura Estuary, Thiruvananthapuram, Kerala

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ABSTRACT

Meiofauna, which constitutes an important part of benthos facilitates biomineralization of organic matter and enhances nutrient regeneration. The present investigation reveals the spatio-temporal variations in the meiofaunal structure of the Poonthura estuary (latitude 8^0 25' – 8^0 30'N and longitude 76^0 55' – 77^0 00' E) on the southwest coast of India, lying in the outskirts of Thiruvananthapuram city. The data presented in the paper is based on 108 core samples collected during three consecutive seasons (pre-monsoon, monsoon and post monsoon) from three selected stations in the Poonthura estuary. Meofauna in the estuary was represented by 12 taxa in varying proportions. Nematodes, foraminifers, copepods and oligochaetes were the most abundant and most widely distributed groups. Nematodes alone contributed more than 60% of total meiofauna in the estuary and represented in high abundance during all seasons and all stations. A decrease in meiofaunal abundance from the mouth towards the head of the estuary was evident. All the meiofaunal groups exhibited seasonality in their abundance with relatively high density during the pre monsoon season.

Key words: *Meiofauna, Distribution, Abundance, Estuary*

INTRODUCTION

Benthos represents a major component of the coastal ecosystems and plays a vital role in the food chain. Meiobenthic production is equal to or higher than macro benthos in shallow waters[7,11,15,26] and facilitates biomineralization of organic matter and enhances nutrient regeneration in shallow water ecosystems[8,22,23]. Meiobenthic assemblages are sensitive indicators that reflect the general health of benthic habitats and are used as effective tools in biomonitoring programmes. There have been many meiobenthic studies from the Indian coastal waters[1,2,4,6,8,19,21,28,29,31] while a perusal of literature reveals that information available on meiobenthos from the coastal ecosystems of Kerala is scanty. The objective of the present study is to describe the spatio-temporal distribution pattern of meiobenthic community in the Poonthura estuary and to assess the role of abiotic factors in structuring the meiobenthic community.

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MATERIALS AND METHODS

The study was carried out in the Poonthura estuary along the south-west coast of India (latitude $8^0$25'- $8^0$30' N latitude and 76^0 55'- $77^0$00'E longitude) lying in the outskirts of Thiruvananthapuram city. The tidal reaches of Karamana River is designated as Poonthura estuary which is separated from Arabian sea by a sand bar at Poonthura which opens during the monsoon period following heavy discharge of water from the Karamana River. The total length of the estuary is 4.35 km and enclosing a small island called Edayar. Parvathy Puthanar canal, the most polluted canal of the city by the sewage spilled from the city sewage farm at Muttathara joins the estuary. Poonthura estuarine system also serves as coconut retting ground.

Sediment samples were collected during three consecutive seasons(pre-monsoon, monsoon and post monsoon) from three selected stations in the Poonthura estuary located in the upper(station I), middle(station II) and lower reaches(station III). Meiofaunal estimations were carried out on 108 core samples (5.5 cm diameter and 25 cm long).The undisturbed sediment samples collected were transferred to polythene bags and preserved in 5% formalin. The isolation and extraction of the benthic organisms were carried out by flotation decantation method[16]. The decanted benthic samples were then passed through a set of two sieves with 500 µm and 42 µm mesh size. The residue retained on 42 µm sieve was stored in glass container and preserved in 5% buffered formaldehyde with 1% Rose Bengal as stain prior to sorting and enumeration of meiobenthos. All meiofaunal individuals contained in 25cm long core samples under the surface of 5.5 cm were counted and expressed in conventional units (m^{-2}) to facilitate comparison with the distribution pattern reported elsewhere.

Bottom water and sediment samples were collected and analyzed for different physic-chemical characteristics temperature, pH, salinity, dissolved oxygen, nutrients, organic carbon and sediment texture following standard procedures[10,12,18,32].

RESULTS AND DISCUSSION

Table I illustrates the abundance of meiofauna in the Poonthura estuary recorded during different seasons. Among the different stations, station located in the lower reaches supported greater abundance than the stations in the middle and upper reaches. The decrease in meiofaunal abundance from mouth towards the head of the estuary is coincided with the distribution of salinity and sediment particle size (Table II).Hydrodynamic factors were found greatly regulating the density of benthos, particularly the intensity of influx and efflux of the sea[2,4,14,28]. Significant positive correlation ($P< .01$) was observed between salinity and meiofaunal density at all stations. In general high numerical abundance of meiobenthos was coincided with high and stable salinity during the pre monsoon season (Feb-May) and the low abundance with low and fluctuating salinity of the southwest monsoon. Size of sand grains was also reported to be a major factor influencing meiofaunal abundance in diverse settings[2,5,13,24,25,29]. The meiofaunal density in the Poonthura estuary increases from the silty zone to the sandy zone. The upstream stations characterized by weak tidal currents, heavy land drainage and sewage mixing had greater deposition of silt fraction while the downstream was characterized by major textural class of sand.

Faunal composition of meiobenthos obtained from the estuary consisted of 12 taxa in varying proportions (Fig.1). Nematodes, foraminifers, copepods and oligochaetes were the most abundant and most widely distributed taxa. Nematodes alone contributed 62.74 % of the total meiofauna and represented in high abundance during all seasons at all stations. The prevalence of nematodes in meiofaunal communities in the Indian estuaries and beaches is indicated by many workers[1,3,4,6,9,17,28,31,33]. Nematodes showed a clear seasonality in their occurrence with minimum abundance during the monsoon season at all stations and fairly good abundance during the pre and post monsoon periods. Similar temporal variations with

nematode dominancy in meiobenthic communities have been reported from different geographical regions[20,21,27,30].

Like nematodes foraminifers and copepods were also extensively represented but in moderate abundance at all stations. Foraminifera contributed about 12.87% and copepods about 8.83% of the total meiofauna (Fig. 1). Foraminifers were more abundant at the upstream stations than in the downstream section of the estuary. Highest abundance of copepods was during the pre monsoon period while that of foraminifers were during the post monsoon period (Fig.2). Oligochaetes were totally absent during the pre monsoon period at all stations while it was represented at all stations from September to January and contributes about 6.65% of the total meiofaunna. Unlike other meiofaunal groups the abundance of ostracods was during the monsoon months and it contributed 6.36% of the total meiofauna. Other meiofaunal groups embodies turbellarians (0.86%), Kinorhynchs (0.05%), polychaetes (0.58%), archiannelids (0.14%), amphipods (0.21%), arachnids (0.19%) and bivalves (0.55%). Incidences of these taxa were occasional with low densities. The sensitive groups like Kinorhynchs were recorded only from the pollution free waters at station III.

The observations reveal that the spatial and temporal distribution of meiobenthos in the Poonthura estuary is principally governed by the seasonal monsoons. There was steep decline of faunal abundance during the south west monsoon months along with steep decline in salinity, scouring of bed banks of the estuary and cessation of tidal inputs and consequent arrest in the recruitment of meiofauna from the neritic end of the estuary. Post monsoon was a period of recolonization and establishment of meiofauna as indicated by progressive increase in faunal density. Meiofaunal density compared by ANOVA related significant differences between seasons ($P < 0.05$). Seasonal temperature changes also have a major effect on the reproduction of meiobenthos[30]. The meiobenthic forms are known to feed actively on diatoms, bacteria, protozoans, detritus and dissolved organic carbon. The less availability of these food items also seemed an important limiting factor in controlling their abundance during the south west monsoon period. Such detrimental effect of monsoon on meiobenthos has been reported earlier from the Indian coast[3,4,6,8,28]. The meiofaunal population density, in general was poor in the estuary compared to that reported from other Indian estuaries. The state and composition of meiobenthic assemblages reflect the general health of the estuary and pressure on the natural habitat associated with sewage mixing. The minimum tidal flushing at the interior part of the estuary reduced the faunal density and reveals considerable pollution of the habitat which is further confirmed by the abundance of nematodes, the most common bio indicator taxa among meiobenthos.

Table I: Abundance of total meiofauna in the Poonthura estuary during different seasons

Stations	Pre monsoon		Monsoon		Post monsoon		Annual
	Range	Mean	Range	Mean	Range	Mean	Mean
I	535-1101	790	312-815	504	394-717	598	630
II	1165- 3535	1860	356-1297	739	571-1880	1011	1203
III	2343-6054	3780	414-4275	1847	1659-6199	3420	3017

Table II Seasonal and annual values (mean) of physico-chemical parameters of water and soil in the Poonthura estuary

Station	Season	Water	Salinity	DO(mg/l)	Sand (%)	Silt (%)	Clay (%)	Organic
		temperature (^{0}C)	(ppt)					Carbon (%)
I	Premonsoon	31.50	1.60	3.10	32.70	62.10	5.20	1.86
	Monsoon	27.50	0.58	4.61	36.69	54.65	6.82	1.29
	Postmonsoon	30.00	0.68	4.61	41.15	51.99	7.16	1.28
	Annual	29.50	1.13	4.11	36.94	56.15	6.39	1.46
II	Premonsoon	30.50	3.74	2.76	51.24	37.33	11.43	6.24
	Monsoon	28.00	1.44	2.89	61.96	32.97	5.07	3.58
	Postmonsoon	29.10	1.08	3.10	51.12	43.74	5.13	2.01
	Annual	28.98	2.09	2.92	54.78	38.01	7.21	3.94
III	Premonsoon	31.70	5.09	3.92	63.33	32.37	4.30	2.41
	Monsoon	28.70	1.99	4.31	88.75	8.60	2.66	1.75
	Postmonsoon	31.13	1.69	5.16	58.61	38.47	2.92	0.96
	Annual	30.51	2.97	4.46	70.23	26.48	3.29	1.71

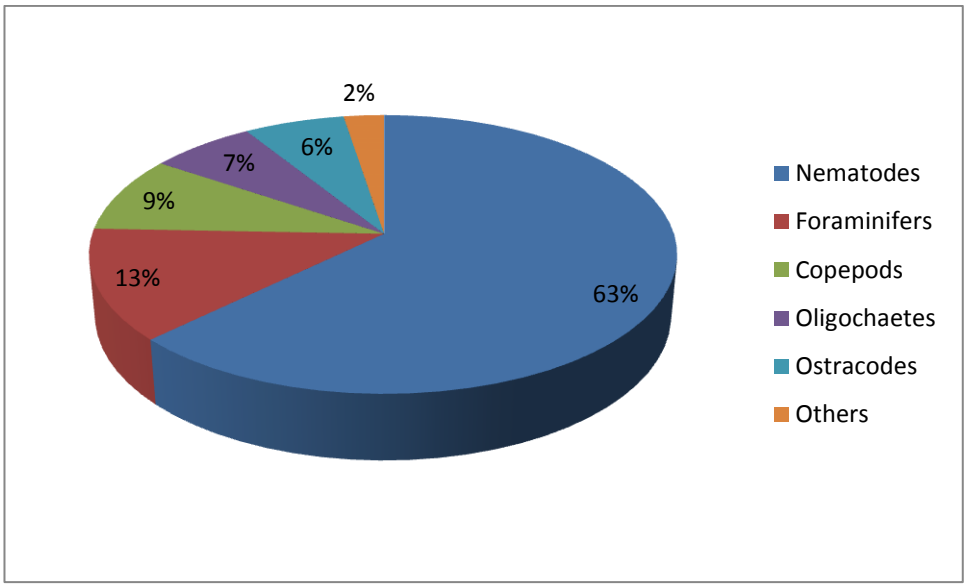

Fig. 1: Composition of meiofauna in the Poonthura estuary

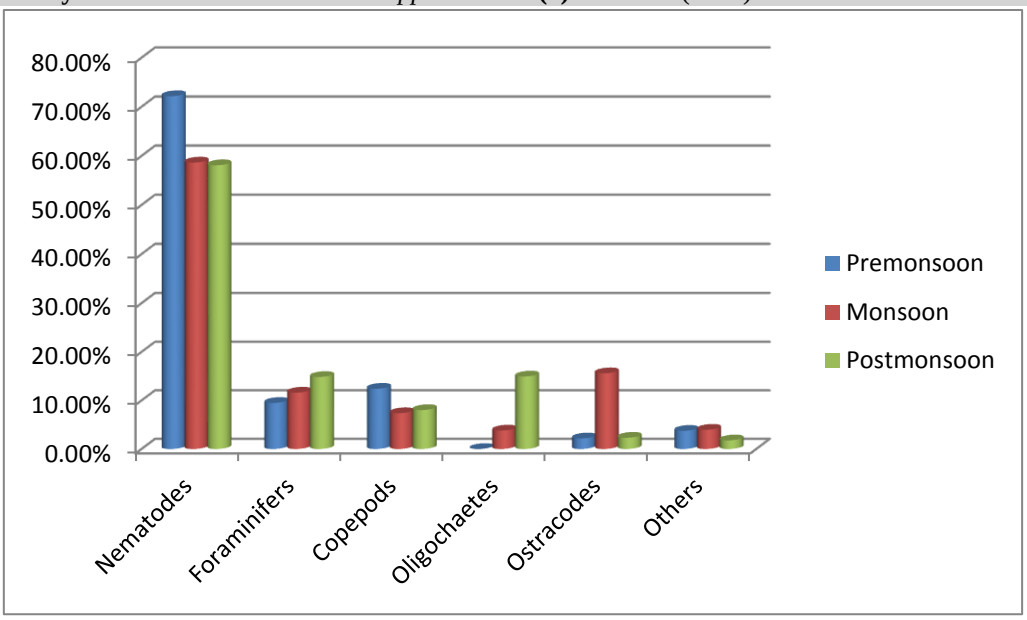

Fig. 2: Seasonal variations in the abundance of various meiofaunal taxa in the estuary

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