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ECOLOGY OF MEIOBENTHOS OF RAMBHA BAY IN CHILKA LAGOON, BAY OF BENGAL

D. G. RAO

Department of Life Sciences, Regional College of Education, Bhubaneswar-751 007

ABSTRACT

During 1978-80, the meiobenthos of the soft sediments of Rambha Bay in Chilka Lagoon was sampled. Apart from several qualitative samples, a total of as many as 26 quantitative samples (in triplicate) were analysed to study the relative abundance, density, composition and seasonal fluctuations of sedimentary meiofauna. The sediment nature and physico-chemical parameters of the ambient milieu was also studied to explain the spatial and temporal variations of the meiobenthos. The bottom sediment of Rambha Bay comprised of muddy sand and silty sand.

As many as 14 meiofaunal taxa were encountered. Of which nematodes, copepods, oligochaetes, ostracods, kinorhynchs and polychaetes were the dominant groups in the order of their abundance. The systematic study revealed as many as 76 species belonging to Foraminifera (7 species,), Polychaeta (10 species), Copepoda (34 species), Amphipoda (6 species), Isopoda (6 species), Tanaidacea (1 species), Cumaceae (2 species) and Mollusca (7 species). The kinorhynch species of undetermined identity viz. *Echinoderes* sp. and *Pycnophyes* sp. were discovered in the Rambha sediments for the first time.

The density of meiofauna ranged between 1128/10 cm^3 and 1583/10 cm^3 and the biomass range between 7.719 mg/10 cm^3 and 10.528 mg/10 cm^3 in the Rambha Bay. Studies on the vertical distribution revealed that an average 71.67% of the total meiofauna were restricted to 0-5 cm of the sediment deposit; 21.56% to 6.10 cm and 6.74% to 11-15 cm depths respectively. In Rambha Bay, the macro-meiofaunal ratio was 1 : 129.

The significance of meiofauna as the food organisms to the higher tropic levels was also discussed.

INTRODUCTION

ALTHOUGH the littoral sedimentary meiofauna is extensively investigated from different parts of the World Seas, vast stretches of brackish-water lagoons, bays, estuaries and marine biota still remain unexplored all along the Indian Coasts. A perusal of literature on the meiobenthos of the Indian Seas makes it abundantly clear that very few quantitative ecological researches are available and they are of a preliminary nature (McIntyre, 1969; Damodaran, 1973; Ganapati and Sarma, 1973; Sarma and Ganapati, 1975; Ansari and Parulekar, 1981). The reports available on meiofauna of Indian brackishwater lagoons are those of Sarma and Rao (1980) and Sarma *et al.* (1981).

The meiofauna of Chilka Lagoon, the largest giant brackishwater body (1165 km^2 area) of the peninsular India between latitudes 19°25′ and 19°54′N and langitudes 85°67′ and 85°35′E in Puri and Ganjam districts of Orissa State (Fig. 1) on the east coast of India is least studied.

In an attempt to gain as comprehensive understanding of the productive propensitive of the littoral sediments of the lagoon, the ecobiology of the meiofauna of Chilka Lagoon sediments was studied during October, 1978 — January, 1980. The qualitative and quantitative data obtained on the meiofauna of Rambha Bay located in the southern sector of the lagoon are reported and discussed in the present paper.

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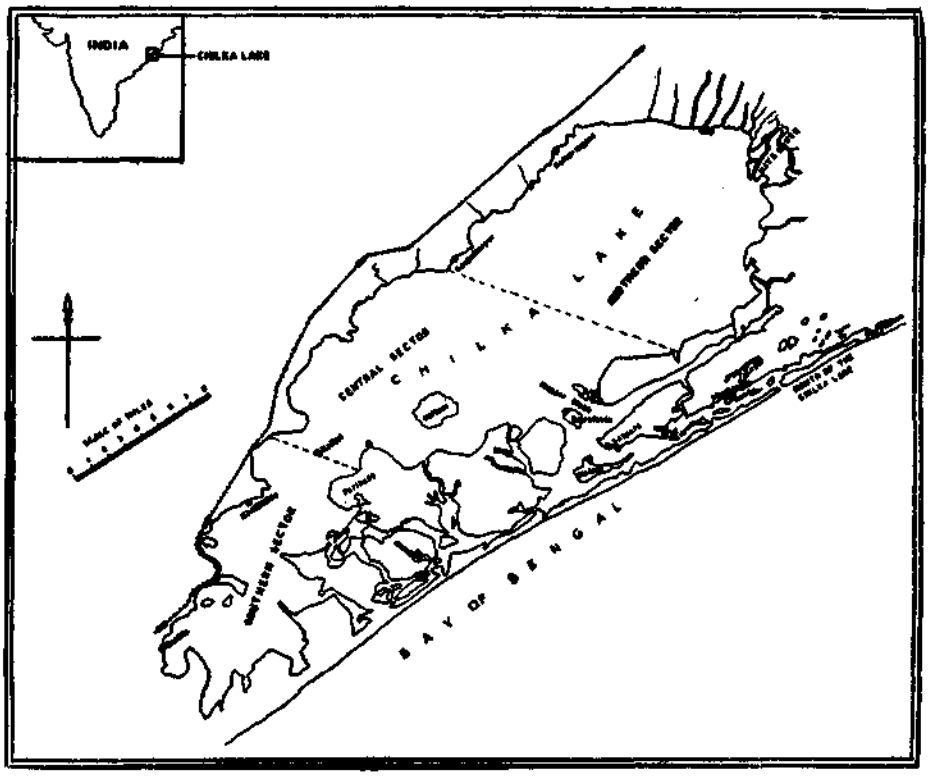

FIG. 1. Chilka Lake showing station positions.

MATERIAL AND METHODS

In the extreme southwest of the Chilka Lagoon is the Rambha Bay surrounded by rocky hills. Silty sand and muddy sand form the sedimentary environment. The bottom of the littoral region is covered with *H. ovata* mats. In Rambha true lagoonal conditions are observed.

Apart from several qualitative samples, a total of as many as 36 quantitative samples (in triplicate) of core samples of sediment of Rambha were collected during October, 1978 to January, 1980 for meiofaunal studies. Meiofaunal sampling and estimation of physico-chemical parameters were carried out once in three months.

The physico chemical parameters of the water were analysed by using standard methods (Barnes, 1959). The organic matter of the sediment was estimated by the Walkley-Black method modified by Jackson (1967). The particle size analysis of the sediment was analysed following the method of Krumbein and Pettiohn (1938).

For collecting the sediment samples, a hand operated ' ring lined corer ' made after Jonsson

(1967) with little modification was made use of (Sarma and Rao, 1980). A 40 cm long core sampler with the inner lining of the corer consists of 5 cm long pvc tubing with an inner diameter of 3.8 cm. The samples thus collected in the field were brought to the laboratory and were sieved through a 500μ and 62μ standard sieves to separate the macrofauna, and meiofauna. The organisms left over the 500μ sieve was analysed for macrofauna and that of 62μ for meiofauna after transferring them into finger bowls. The materials in the finger bowls were fixed in 5% neutral formalin solution to which Rose Bengal stain was added to facilitate easy sorting of meiofauna. The quantitative data was expressed in terms of numbers per 10 cm^2.

Biomass values of meiofauna were given as dry weights and expressed in terms of mg/10 cm^2. The average dry weight values of a single specimen recorded for different meiofaunal taxa were as follows. Foraminifera, 7.69 μg; Nematoda, 2.86 μg; Oligochaeta, 20 μg; Polychaeta 20 μg, Copepoda 11.1 μg; Amphipoda 20 μg; Isopoda 30 μg; Ostracoda 12.5 μg; Chironomid larvae 18.8 μg; Kinorhyncha 6.7 μg and Mollusca 33 μg.

Results

During the present studies data were collected from Rambha on water temperature, salinity, dissolved oxygen, pH, and water depth fluctuations in the littoral zone and the results are given in Table 1.

The Rambha Bay experiences little salinity fluctuations due to the restricted nature of the area as it is surrounded by islands and also it is far away from the lagoonal mouth. The summer evaporation plays a vital role in raising the salinity in general.

Table 1. *Trimonthly values of environmental parameters of Rambha Bay during October, 1978 to January, 1980*

		Oct.' 78	Jan.' 79	Apr.' 79	July' 79	Oct.' 79	Jan.' 80
Surface water							
Temperature (°C)	..	29.5	22.0	30.0	30.0	30.0	26.5
pH	..	8.09	8.03	7.95	7.91	8.10	8.79
Salinity (‰)	..	10.12	9.94	9.58	15.26	12.97	14.34
Dissolved oxygen (ml/l)	..	9.50	7.15	6.50	7.70	8.60	6.90
Depth (m)	..	1.5	1.1	0.91	1.1	1.4	0.91
Sediment							
Organic matter (%)	..	..	1.69	1.23	0.84	1.58	1.39
Sand (%)	..	..	77.00	73.80	74.00	77.00	76.90
Silt (%)	..	..	12.00	16.20	17.00	15.90	14.00
Clay (%)	..	..	11.00	10.00	8.98	7.10	9.10

Sediments of Rambha comprised of mostly muddy sand except in October, 1979 during which silty sand was noticed. Brownish sediments comprising coarse sand blanketed with *Halophyla* weed was common here.

The organic matter content ranged between

0.84% (July, 1979) and 1.69% (January, 1979) in Rambha. No definite seasonal trend was noticed.

Qualitative composition of meiofauna

The systematic study revealed as many as 117 species in the lagoon. Of which 76 species belonging to Foraminifera (7 Species), Polychaeta (10 species), Copepoda (34 species) Amphipoda (6 species), Isopoda (6 species), Tanaidacea (1 species), Cumacea (2 species), Insect larvae (1 species), Kinorhyncha (2 species) and Mollusca (7 species) were present in Rambha (Table 2).

TABLE 2. *Qualitative composition of meiofauna in Rambha Bay*

List of species
PROTOZOA
Quinqueloculina sp.
Q. lamarckiana
Elphidium crispum (linne) Cushman & Grant
Rotalia calcar Hofker
R. beccarii Linnaeus
Globigerina bulloides d' Orbigny
Globigerinoides conglobata H. B. Brady
NEMATODA
Undetermined
Kinorhyncha
Echinoderes sp.
Pycnophyes sp.
ANNELIDA
Ancistrosyllis constricta Southern
Dendronereis aestuarina Southern
Nereis chilkaensis Southern
Perinereis mariorii Southern
Nephtys polybranchia Southern
Lubriconereis polydesma Southern
L. simplex Southern
Glycinde sp.
Myriochele picta Southern
Barantolla sp.
ARTHROPODA
Culicoides sp.
Longipedia coronata Claus
L. rosea Sars
Sunaristes sp.
Canuella furcigera Sars
Ectinosoma melaniceps Boeck
E. normani T. et A. Scott
Microsetella norvegica (Boeck)
Enterpina acutifrons (Dana)
Harpacticus littorallis Sars
H. nipponicus Ito
Harpacticus sp.
Perissocope sp.
T. ensifer Fisher
Parategastes sphaericus (Claus)
Eudactylopus sp.
Idomene sp.
Parastenhelia sp.
Stenhelia sp.
Diossaccus sp.
Amphiascus sp.
Nitocra spinipes Boock
N. spinipes var *orientalis* Sewell
Phyllopodopsyllus sp.
Laophontella armata var *indica* Sewell
Laophontella sp.
Mesochra sp.
Enhydrosoma sp.
Laophonte cornuta Philippi
Heterolaophonte quinquespinosa (Sewell)
Heterolaophonte sp.
Onychocamptus chathamensis
Laophontopsis sp.
Halicyclops tenuispina Sewell
Saphirella indica Sewell
Iphinoe sp.
Paradiastylis culicoides Kemp
Apseudus chilkensis Chilton
Apanthura sandalensis Stebbing
Cirolana sp.
Exosphaeroma parva Chilton
Synidotea variegata Collinge
Munna sp.
Ligia exotica Roux
Ampelisca pusilla Sars
Paracalliope sp.
Grrandidierlla bonnieri Stebbing
Maera othonides Walker
Quadrivisio bengalensis Stebbing
Talorchestia martensii Ruffo
MOLLUSCA
Modiola undulata Dunker
M. striatula Hanley
Stenothyra miliacea (Navill)
S. minima (Sowerby)
Fenella virgata (Philippi)
Pygmaeonassa orissaensis (Preston)
Acteocina townsendi (Melvill)

Copepod systematic studies proved to be quite rewarding in the lagoon. The species identified in Rambha belonged to 17 families, 27 genera and 34 species in Rambha. The family Laophontidae was represented by the maximum species (6).

Quantitative composition

Minimum and maximum total meiofaunal densities ranged from 1128/10 cm² (October, 1979) to 1583/10 cm² (January, 1979) and averaged 1390/10 cm². Biomass values ranged between 7.7191 mg/10 cm² (October, 1979) and 10.5281 mg/10 cm² (July 1979). The biomass averaged 9.3003 mg/10 cm² (Table 3).

Fairly high densities and biomass values were noted throughout the study period. The faunal densities were very high particularly in January

TABLE 3 A. *Seasonal distribution of total numerical density (No./10 cm²) and biomass (mg/10 cm²) values of meiofaunal taxa of Rambha Bay*

Groups		Oct. '78	Jan. '79	Apr. '79	July '79	Oct. '79	Jan. '80
Foraminifera	A	276	41	22	..	51	..
	B	2.1224	0.3153	0.1692	..	0.3922	..
Nematoda	A	647	1160	843	966	748	1049
	B	1.8504	3.3176	2.4110	2.7628	2.1393	3.0001
Oligochaeta	A	63	72	121	83	113	138
	B	1.2600	1.4400	2.4200	1.6600	2.2600	2.7600
Polychaeta	A	27	19	22	18	19	16
	B	0.5400	0.3800	0.4400	0.3600	0.3800	0.3200
Copepoda	A	110	152	204	286	122	161
	B	1.2210	1.6872	2.2644	3.1746	1.3542	1.7871
Ostracoda	A	135	57	60	103	48	21
	B	1.6875	0.7125	0.7500	1.2875	0.6000	0.2625
Amphipoda	A	..	..	8	10	..	1
	B	..	..	0.1600	0.2000	..	0.0200
Isopoda	A	..	3	17	16	..	8
	B	..	0.0900	0.5100	0.4800	..	0.2400
Tanaidacea	A	..	2	9	..	..	3
	B	..	0.0400	0.1800	..	..	0.0600
Insect larvae	A	..	12	4	..	..	4
	B	..	0.2184	0.0728	..	..	0.0728
Halacaridae	A	..	3	..	..	3	..
	B	..	0.0381	..	..	0.0381	..
Kinorhyncha	A	13	50	41	26	9	44
	B	0.0871	0.3350	0.2747	0.1742	0.0603	0.2948
Gastropoda	A	..	2	3	3	14	..
	B	..	0.0660	0.0990	0.0990	0.4620	..
Pelecypoda	A	20	10	17	10	1	..
	B	0.6600	0.3300	0.5610	0.3300	0.0330	..
Others	A	..	..	2	..	..	..
	B	..	..	0.0264	..	..	..
Total	A	1291	1583	1373	1521	1128	1445
	B	9.4284	8.8701	10.3385	10.5281	7.7191	8.8173

A=Density B=Biomass

to July. However, the biomass was low in January during which period the light bodied nematodes were more prolific.

The seasonal vertical distribution of the faunal densities ranged as follows :—

Depth	*Density (per 10 cm²) range*		
0— 5 cm	832 (October, 1979)	to	1117 (January, 1979)
6—10 cm	220 (October, 1979)	to	368 (January, 1979)
11—15 cm	62 (April, 1979)	to	124 (July, 1979)

On an average 71.67%, 21.56% and 6.74% of the total meiofauna were present respectively in the three corresponding depths cited above.

The seasonal fluctuations found in the vertical distribution of meiofaunal densities coincided with that of the total meiofaunal densities.

Seasonal changes of the meiofauna

As many as 14 meiofaunal taxa were encountered in this station. Of which nematodes, copepods, oligochaetes, ostracods, kinorhynchs and polychaetes were the dominant

TABLE 3 B. *Seasonal distribution of numerical density (No./10 cm²) and biomass values (mg/10 cm²) of meiofaunal taxa in 0-5 cm depth in Rambha Bay*

Groups		Oct. '78	Jan. '79	Apr. '79	July '79	Oct. '79	Jan. '80
Foraminifera	A	176	29	22	..	51	..
	B	1.3534	0.2230	0.1692	..	0.3922	..
Nematoda	A	477	785	616	660	535	719
	B	1.3642	2.2451	1.7618	1.8876	1.5301	2.0563
Oligochaeta	A	44	44	70	47	66	88
	B	0.8800	0.8800	1.4000	0.4900	1.3200	1.7600
Polychaeta	A	21	16	16	18	16	16
	B	0.4200	0.3200	0.3200	0.3600	0.3200	0.3200
Copepoda	A	72	117	161	213	95	117
	B	0.7992	1.2987	1.7871	2.3643	1.0545	1.2987
Ostracoda	A	81	46	49	85	44	18
	B	1.0125	0.5750	0.6125	1.0625	0.5500	0.2250
Amphipoda	A	..	..	4	8	..	..
	B	..	..	0.0800	0.1600	..	..
Isopoda	A	..	3	17	14	..	7
	B	..	0.0900	0.5100	0.4800	..	0.2100
Tanaidacea	A	..	2	7	..	..	3
	B	..	0.0400	0.1400	..	..	0.0600
Insect larvae	A	..	12	2	..	..	4
	B	..	0.2184	0.0364	..	..	0.0728
Halacaridae	A	..	3	..	..	3	..
	B	..	0.0381	..	..	0.0381	..
Kinorhyncha	A	13	48	41	24	9	44
	B	0.0871	0.3216	0.2747	0.1608	0.0603	0.2944
Gastropoda	A	..	2	3	3	13	..
	B	..	0.0660	0.0990	0.0990	0.4290	..
Pelecypoda	A	17	10	13	10	..	
	B	0.5610	0.3300	0.4290	0.3300	..	..
Others	A	..	..	2	..	..	..
	B	..	..	0.0660	..	..	..
Total	A	901	1117	1023	1082	832	1016
	B	6.4774	6.6459	7.6857	7.7842	5.6942	6.2976

A=Density B=Biomass

TABLE 3 C. *Seasonal distribution of numerical density (No./10 cm²) and biomass (mg/10 cm²) values of meiofaunal taxa in 6-10 cm depth in Rambha Bay*

Groups		Oct.' 78	Jan.' 79	Apr.' 79	July' 79	Oct.' 79	Jan.' 80
Foraminifera	A	62	12	..	..	..	..
	B	0.4768	0.0923	..	..	..	..
Nematoda	A	132	293	191	211	154	264
	B	0.3775	0.8380	0.5463	0.6035	0.4404	0.7550
Oligochaeta	A	13	19	35	25	31	34
	B	0.2600	0.3800	0.7000	0.5000	0.6050	0.6800
Polychaeta	A	3	2	4	..	3	..
	B	0.0600	0.0400	0.0800	..	0.0600	..
Copepoda	A	29	29	37	57	26	37
	B	0.3219	0.3219	0.4107	0.6327	0.2886	0.4107
Ostracoda	A	35	11	9	16	4	3
	B	0.4375	0.1375	0.1125	0.2000	0.0500	0.0375
Amphipoda	A	..	..	4	2	..	1
	B	..	..	0.0800	0.0400	..	0.0200
Isopoda	A	..	..	..	2	..	1
	B	..	..	..	0.0600	..	0.0300
Tanaidacea	A	..	..	2	..	..	..
	B	..	..	0.0400	..	..	..
Insect larvae	A	..	..	2	..	..	..
	B	..	..	0.0364	..	..	..
Kinorhyncha	A	..	2	..	2	..	..
	B	..	0.0134	..	0.0134	..	..
Gastropoda	A	..	..	..	..	1	..
	B	..	..	..	..	0.0330	..
Pelecypoda	A	3	..	4	..	1	..
	B	0.0990	..	0.1320	..	0.0330	..
Total	A	277	368	288	315	220	340
	B	2.0327	1.8231	2.1379	2.0496	1.5100	1.9232

A=Density B=Biomass

TABLE 3 D. *Seasonal distribution of numerical density (No./10 cm²) and biomass values (mg/10 cm²) of meiofaunal taxa in 11-15 cm depth in Rambha Bay*

Groups		Oct.' 78	Jan.' 79	Apr.' 79	July' 79	Oct.' 79	Jan.' 80
Foraminifera	A	38	..	..	..	..	..
	B	0.2922	..	..	..	..	..
Nematoda	A	38	82	36	95	59	66
	B	0.1087	0.2345	0.1030	0.2717	0.1687	0.1888
Oligochaeta	A	6	9	16	11	16	16
	B	0.1200	0.1800	0.3200	0.2200	0.3200	0.3200
Polychaeta	A	3	1	2	..	..	..
	B	0.0600	0.0200	0.0400	..	..	..
Copepoda	A	9	6	6	16	1	7
	B	0.0999	0.0666	0.0666	0.1776	0.0111	0.0777
Ostracoda	A	19	..	2	2	..	..
	B	0.2375	..	0.0250	0.0250	..	..
Total	A	113	98	62	124	76	89
	B	0.9188	0.5011	0.5546	0.6943	0.4998	0.5865

A=Density B=Biomass

groups in the order of their abundance and their temporal and vertical distribution is given below.

Nematoda

Nematoda was the dominant taxa and contributed on an average 64.54% of the total meiofaunal density. The minimum and maximum densities ranged from 647/10 cm² October, 1978) to 1160/10 cm² (January, 1979) and averaged 902/10 cm². Nematode densities were very high in January and relatively low in October.

Biomass values ranged between 1.8504 mg/10 cm² (October, 1978) and 3.3176 mg/10 cm² (January, 1979). The density and biomass cycles synchronised.

The seasonal vertical distribution of the nematode densities ranged as follows :

Depth	*Density (per 10 cm²) range*	
0— 5 cm	477 (October, 1978)	to 785 (January, 1979)
6—10 cm	132 (October, 1978)	to 293 (January, 1979)
11—15 cm	36 (April, 1979)	to 95 (July, 1979)

On an average 70.47%, 22.64% and 6.86% of the total nematodes were distributed respectively in the three corresponding depths cited above.

The seasonal fluctuation found in the vertical distribution of nematode densities closely followed that of the total nematode fauna.

Copepoda

Copepoda contributed on an average 12.29% of the total meiofaunal density. The minimum and maximum densities ranged from 110/10 cm² (October, 1978) to 286/10 cm² (July, 1979) and averaged 173/10 cm². The copepod densities were high during April-July and low during October.

The biomass values ranged between 1.2210 mg/10 cm² (October, 1978) and 3.1746 mg/10 cm² (July, 1979). The density and biomass cycles of copepoda synchronised.

The seasonal vertical distribution pattern of copepods ranged as follows :

Depth	*Density (per 10 cm²) range*	
0— 5 cm	72 (October, 1978)	to 213 (July, 1979)
6—10 cm	26 (October, 1979)	to 57 (July, 1979)
11—15 cm	1 (October, 1979)	to 16 (July, 1979)

On an average 74.39%, 21.29% and 4.3% of the total copepods were present respectively in the three corresponding depths cited above.

The seasonal fluctuations found in the vertical distribution of copepod densities coincided with that of the total copepod fauna.

Remarks

Longipedia coronata, L. rosea, Canuella furcigera, Ectinosoma melaniceps Harpacticus littoralis, Nitocra spinipes, N. spinipes var *orientalis* and *Heterolaophonte quinquespinosa* were the common species.

Oligochaeta

Oligochaeta comprised on an average 7.21% of the total meiofaunal density. The minimum and maximum densities ranged from 63/10 cm² (October, 1978) and 138/10 cm² (January, 1980) and averaged 98/10 cm². Oligochaetes were fairly well represented throughout the study period and their densities were relatively high during January and April, 1979.

The biomass values ranged between 1.26 mg/10 cm² (October, 1978) and 2.760 mg/10 cm² (January, 1980). The density and biomass cycles synchronised.

The seasonal vertical distribution of oligochaete densities ranged as follows :

Depth	*Density (per 10 cm²) range*	
0— 5 cm	44 (October, 1978 and January, 1979)	to 88 (January, 1980)
6—10 cm	13 (October, 1978)	to 35 (April, 1979)
11—15 cm	6 (October, 1978)	to 16 (April, October, 1979 and January, 1980)

On an average 61.26%, 26.35% and 12.37% of the total oligochaetes were present respectively in the three corresponding depths cited above.

The seasonal changes found in the vertical distribution of the oligochaete coincided with that of the total oligochaete density.

Ostracoda

Ostracoda on an average constituted 5.15% of the total meiofaunal density. The minimum and maximum total ostracod density ranged from 21/10 cm² (January, 1980) to 135/10 cm² (October, 1978) and averaged 71/10 cm². The seasonal changes in the ostracod populations were irregular.

Biomass values ranged between 0.2625 mg/10 cm² (January, 1980) and 1.6875 mg/10 cm² (October, 1978). The density and biomass cycles synchronised.

The seasonal vertical distribution of ostracod densities ranged as follows :

Depth	*Density (per 10 cm²) range*	
0— 5 cm	18 (January, 1980)	to 85 (July, 1979)
6—10 cm	3 (January, 1980)	to 35 (October, 1978)
11—15 cm	0 (January, October, 1979 and January, 1980)	to 19 (October, 1978)

On an average 80.37%, 16.39% and 3.22% of the total ostracods were present respectively in the three corresponding depths cited above.

The seasonal fluctuations found in the vertical distribution of ostracod densities closely followed that of the total ostracods.

Kinorhyncha

Kinorhyncha comprised on an average 2.1% of the total meiofaunal density. The minimum and maximum density ranged from 9/10 cm² (October, 1979) to 50/10 cm² (January, 1979) and average 31/10 cm². Kinorhynchs were well represented in January to July.

The biomass values ranged between 0.0603 mg/10 cm² (October, 1979) and 0.3350 mg/10 cm² (January, 1979). The density and biomass cycles synchronised. On an average about 98.05% of the kinorhynchs was present in 0-5 cm.

Remarks

Pycnophyes sp., *Echinoderes* sp. were the two species found in this station of which *Pycnophyes* sp. constituted 80-90% of the total kinorhynch population.

Other taxa

Among the other taxa, Foraminifera and Polychaeta were the dominant groups.

Foraminifera comprised on an average 5.01% of the total meiofaunal density. A maximum density and biomass of 276/10 cm² and 2.1224 mg/10 cm² (October, 1978) respectively.

Rotalia beccarii, *Globigerina bulloides*, *Globigerinoides conglobatis*, *Elphidium crispum* were the common species.

Polychaeta contributed on an average 1.48% of the total meiofaunal density. The minimum

and maximum density ranged from 16/10 cm^2 (January, 1980) to 27/10 cm^2 (October, 1978). The biomass values ranged between 0.320 mg/10 cm^2 (January, 1980) and 0.540 mg/10 cm^2 (October, 1978). On an average polychaetes contributed 4.38% of the total meiofaunal biomass. The biomass and density cycles synchronised.

On an average 86.48%, 9.26% and 4.24% of the total polychaetes were present in 0-5 cm, 6-10 cm and 11-15 cm depths respectively.

Juveniles, subadults and just metamorphosed specimens of *Nereis chilkensis*, *Lubriconereis polyderma*, *Lycastis indica*, *Ancistrosyllis constricta* were commonly observed.

Bivalvia comprised on an average 0.69% of the total meiofaunal density and 3.28% of the total meiofaunal biomass. Bivalves were mostly observed in 0-5 cm and rarely further below. Juveniles of *Modiola undulata* and *M. striatula* were the common forms.

Isopods comprised on an average 0.5% of the total meiofaunal density and 2.2% of the total meiofaunal biomass. Isopods were frequently observed in 0-5 cm and sporadically further below. Adults of *Munna* sp. and juveniles of *Exophaeroma parva*, *Synidotea variegata* and *Cirolana* sp. were frequently observed.

Gastropods formed on an average 0.3% of the total meiofaunal density and 1.44% of the total meiofaunal biomass. They were encountered frequently in 0-5 cm and sporadically further below. Juveniles of *Stenothyra minima*, *S. miliacea* and *Pygmaeonassa orissaensis* were frequently encountered.

Amphipoda (Juveniles of *Ampelisca pusilla*, *Telorchestia martensii*, *Quadrivisio bengalensis* and *Paracalliope indica*), Tanasidacea (*Apseudes chilkensis*), insects (Chironomid larvae, *Culicoides* sp.), halacarines and miscellaneous groups were encountered sporadically.

Discussion

Temporal distribution of total meiofauna

The ambient physico-chemical conditions and the physical changes in the sediment are responsible for the temporal distribution of meiofauna (Perkins, 1958; Coull, 1970; McIntyre and Murison, 1973; Damodaran, 1973; Sarma and Ganapati, 1975). In the present investigation the temperature, salinity and the benthic vegetation cover appear to be the pertinent parameters determining the temporal distribution of the meiofauna. The minimum and maximum abundance of total meiofauna in Rambha occurred in October and January respectively. The maximum meiofaunal density occurred in January in which nematoda populations conspicuously formed the bulk of the meiofauna. In general, the meiofaunal densities were stable throughout the sampling period.

Copepoda

Maximum copepods were recorded in Rambha during July. This finds explanation in the fact that the flood effect of river Daya - Mahanadi system is felt in the southern part during late October to November period (Sewell and Annandale, 1922; Patanaik, 1971). Sarma and Ganapati (1975) and Marcotte (1977) observed high copepod densities during winter. Perkins (1958), Coull (1970) and Gray (1976) observed the maximum copepod densities during the periods of high temperature and salinity. The high copepod densities noted during winter and summer months in the present study are in agreement with the above findings.

Nematode

Maximum nematode densities were recorded during winter months. An inverse relationship between the temperature and nematode density is recorded by several authors (Hopper and Mayers, 1967; Coull, 1970; Damodaran, 1973). Capstick (1959) opined that salinity does bear little impact on the nematode density changes. The nemic populations of winter substantially

contributed to the total meiofaunal density recorded during January.

Oligochaeta

The seasonal trend of the oligochaeta densities cannot be satisfactorily explained in relation to any of the parameters studied. The seasonal sequence was erratic. In Rambha they were fairly abundant in October-January period. The sandy nature of the Rambha sediments appears to be favourable for the establishment of the oligochaeta populations.

Other taxa

Among other taxa, ostracods were observed as consistent demizens in Rambha with maximum during October where the temperature and salinity registered maximum values. Smidt (1951) observed the ostracod maxima in late summer and winter in shallow areas. The changes in the numbers were attributed to the amount of organic detritus present. Otherwise little is known about the ostracod temporal distribution. Moderate to high values of organic matter were found during the periods of maximal occurrence of ostracods in the present locality.

Kinorhynchs were relatively more conspicuous numerically during January to April, when the ambient salinity and temperature were fairly stable. Kinorhynchs are known to occur in high densities when temperature and salinities are relatively high (Higgins, 1971 ; Higgins and Rao, 1979 ; Higgins and Pleeger, 1980).

Polychaetes though consistently occurred were numerically not the dominant group and did not show any seasonal sequence. Rest of the taxa were only sporadic in this occurrence.

Vertical distribution

The density of total meiofauna and varied meiofaunal components declined with increasing depth. This is in agreement with the observations of the earlier workers (Mare, 1942 ; Smidt, 1951 ; McIntyre, 1968, 1969 ; Tietjen, 1969 ; Coull, 1970 ; Sarma and Ganapati, 1975 ; Ansari and Parulekar, 1981).

In Rambha on an average 71.677 of the total meiofauna was found in 0-5 cm layer of the sediment ; 21.56% in the 6-10 cm and 4-11% in the 11-15 cm depths respectively.

The causative factors for such decline in the densities were often sought in the vertical pH changes, vertical decrease in O_2, vertical decrease in interstitial water and vertical decrease in organic content (food) (Tietjen, 1969 ; McIntyre, 1969).

Nematodes and oligochaetes are having capability to penetrate into the deeper layers of the sediments. They are used as biological indicators of pollution. 73-85% of the copepods were observed in the upper 5 cm sediment. The susceptability of the copepods for the anoxic conditions prevailing in the deeper depths is well known (Tietjen, 1966 ; McIntyre, 1969 ; Coull, 1970 ; Sarma *et al.*, 1974).

The macro meiofaunal ratios (1 : 129) observed in Rambha agree with the ratios observed by wigley and McIntyre (1964).

Ecological significance

In the present instance, the meiofaunal populations are either deposit feeders or browsers and are preyed upon by carnivorous meiofauna and by the larger metazoans. McIntyre (1969) states that in the organically rich environments the meiofauna mainly assist in the recycling of nutrients at a low trophic level. Damodaran (1973) states that a part of the meiofaunal production is utilised by non-selective deposit feeders, but bulk of it is available for bottom feeding fishes and crustaceans. The hypothesis developed by Coull and Bell (1979) regarding the meiofaunal significance in the ecosystem states that the mud/detrital meiofauna does serve as a significant source of food for higher tropic level (primarily natant browsers), whereas in sandy substrates the numbers of the meiofauna primarily serve as metazoan nutrient regenerators.

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