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SURVEY OF MEIOFAUNA IN THE GAUTAMI-GODAVARI ESTUARY

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ABSTRACT

The survey of meiofauna in the Gautami-Godavari Estuary yielded 12 groups of meiobenthic organisms. Nematoda (90.5%) was the most dominant group followed by harpacticoid copepoda (3.7%). Maximum and minimum (2,292 and 267 Nos./10cm³) densities were recorded in the lower and upper reaches of the estuary respectively. Significant positive correlation was observed between salinity and meiofauna density from mouth to head end of the estuary. 27 species of harpacticoid copepods belonging to 11 families and 22 genera were recorded. An attempt has been made to recognize ecologically equivalent meiobenthic harpacticoid copepod species in the estuarine systems.

INTRODUCTION

THE MEIOFAUNA have attracted the awareness and attention of the researchers all over the world and their significance in the biogeocoenosis has been well documented. As more attention has been paid to the studies on non-estuarine meiofauna (McIntyre, 1969 ; Coull, 1972 ; Sarma and Ganapati, 1975 ; Ansari, *et al.*, 1980), inadequate information is available on estuarine meiofauna (Coull, 1973 ; Bell, 1979 ; Ali *et al.*, 1983). Hence the present paper is an attempt to study the distribution of meiofauna in the Gautami-Godavari Estuary, situated on the east coast of India.

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MATERIAL AND METHODS

3.6 cm diameter and 20 cm long core samples were collected from four stations located in the lower (Stations 1 and 2), middle (Station 3) and upper (Station 4) reaches of the estuary (Fig. 1). The samples were passed through a set of two sieves (0.500 and 0.062 mm) to separate the meiofauna. The melofauna were identified to groups level and harpacticoid

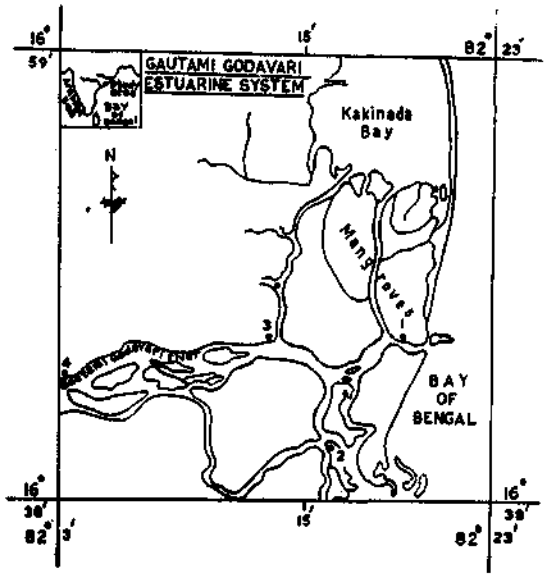

Fig. 1. Station positions in the Gautami-Godavari Estuarine system.

Copepoda to species level. Data on salinity, temperature, dissolved oxygen, grain size (Folk and Ward, 1957), organic matter (Gaudette *et al.*, 1974) were collected. Pearson product moment correlation coefficients were calculated.

Results and Discussion

The sediment was composed of fine sands with silt and clay at Stations 1, 2 and 3 and coarse sands with silt and clay at Station 4. Seasonal fluctuations in the median sizes of grains were significant at Station 4 ranging from 0.14 in June 1979 to 0.77 mm in March 1978, while they ranged from 0.11 to 0.19 mm at other stations. The average median grain sizes for Stations 1-4 were 0.16, 0.14, 0.15 and 0.45 mm respectively. The average values of silt content for Stations 1-4 were 44.2, 50.2, 24.2 and 8.5% respectively. The average values of organic matter for Stations 1-4 were 1.2, 1.1, 0.9 and 0.8% respectively. The other physico-chemical parameters and the quantitative abundance of meiofauna of Stations 1-4 are given in Tables 1-4 respectively. Distribution of harpacticoid copepod is presented in Table 5.

The survey of meiofauna in the estuary comprised of the following 12 groups: Nematoda, harpacticoid Copepoda, Ostracoda, Kinorhyncha, Turbellaria, Mollusca, Halacarina, Oligochaeta, Tardigrada, Crustacean larvae, Insect larvae and Amphipoda). Nematoda (90.5%) was the most dominant group followed by harpacticoid Copepoda (3.7%) and Ostracoda (3.6%). The spatial and temporal variations of the meiofauna in the Gautami-Godavari Estuary are principally governed by the physico-chemical parameters in the environment, which are profoundly influenced by the monsoons. The major peaks and high abundance of meiofauna generally coincided with the high and stable salinity conditions udrngi the summer period (Feb.-Jun.) and low abundance with low and fluctuatingsalinity conditions during flood (July-Sep.) and post-flood (oct.-Jan.) periods. Earlier information on meiofauna in estuarine habitats of India (Sarma and Ganapati, 1975; Ali *et al.*, 1983) confirm the present observations. Besides major groups, a decrease in the density of harpacticoid copepods like *Halectinosoma curticorne*, *Tachidius discipes*, *Stenhelia (Delavalia) longifurca*, *Pseudostenhelia secunda*, *Nitocra spinipes*, *Enhydrosoma buccholtzi* and *Nannopus palustris*, was also observed during the period of low salinity at all stations; many species had totally disappeared from the estuary during flood period (Table 5). A perusal of the meiofaunal abundance at different stations in the estuary reveals that the stations located in the lower reaches supported greater abundance than the stations present in middle and upper reaches of the estuary. A decrease in meiofaunal abundance from the mouth towards the head of the estuary coincided with distribution of salinity in the estuary. Significant ($p=0.05$) positive correlation ($r=0.9979$) was observed between salinity and mean animal density among stations located in the lower, middle and upper reaches (Stations 2, 3 and 4) of the estuary. Capstick (1959) recorded low densities of nematode fauna in the head end of the Blyth Estuary and indicated the negative influence of low salinities on the benthic populations. Further, an analysis of correlation between salinity and meiofauna density shows a positive correlation at all stations.

Hicks and Coull (1983) have pointed out the world wide distribution of ecologically equivalent copepod species in the shallow water sedimentary habitats. The meiobenthic harpacticoid species *Halectinosoma curticorne*, *H. gothiceps*, *Tachidius discipes*, *Microarthridion littorale*, *Stenhelia (Delavalia) madrasensis*, *Pseudostenhelia secunda*, *Nannopus palustris* and *Limnocletodes behningi* and the genus *Mesochra* were recorded from Vellar Estuary (Wells, 1971) and in the present estuary,

TABLE 1. *Monthly averages of salinity, temperature, dissolved oxygen (interstitial water) and densities (Nos./10 cm²) of meiofauna at Station* 1

Month	Salinity (‰)	Temperature (°C)	Dissolved oxygen (ml/L)	Total meiofauna	Nematoda	Ostracoda	Copepoda	*(S.D.) longifurca*	*R. propinqua*	*H. curticorne*
1978										
Feb.	33.0	32.5	2.74	2590	1806	587	89	19	16	10
Mar.	31.4	30.9	2.66	4199	3546	324	162	19	..	30
Apr.	33.6	31.5	2.14	3165	2833	229	12	4	..	4
May	33.1	32.1	2.22	2028	1500	334	54	18	..	..
Jun	20.0	28.5	2.32	68	501	125	46	6	7	13
Jul.	2.0	28.5	2.34	1483	1366	98	4	..	..	2
Aug.	no	no	no	no	no	no	no	no	no	no
Sep.	2.1	30.8	3.37	1062	941	72	22	22	..	..
Oct.	6.0	29.2	2.94	1300	1192	42	9	..	..	..
Nov.	11.6	31.1	2.42	446	335	77	21	..	..	16
Dec.	20.0	25.5	2.58	769	722	13	4	4	..	..
1979										
Jan.	27.4	27.5	2.60	596	539	40	4	..	..	2
Feb.	18.9	28.5	2.48	1535	1409	42	76	3	73	..
Mar.	29.8	28.9	2.22	321	292	8	4	..	4	..
Apr.	38.3	31.1	2.09	279	275	..	4	..	..	1
May	29.4	30.8	2.17	1010	905	59	9	..	..	..
Jun.	31.1	28.9	2.48	467	446	17	..	..	..	..
Jul.	15.3	29.2	2.62	801	763	38	..	..	..	..
Aug.	no	no	no	no	no	no	no	no	no	no
Sep.	10.8	32.5	3.57	323	313	..	10	..	..	..
Oct.	6.5	28.7	3.23	435	388	42	5	2	..	1
Nov.	18.8	29.3	2.65	640	563	71	6	..	..	2
Dec.	18.3	28.3	2.09	567	475	66	17	1	..	7
1980										
Jan.	22.8	27.8	2.50	363	243	43	34	14	..	7
Mean	20.9	29.6	2.60	1139	971	106	27	5	4	4

no = no observations

TABLE 2. *Monthly averages of salinity, temperature, dissolved oxygen (interstitial water) and densities (Nos./10 cm³) of meiofauna at Station 2*

Month	Salinity (‰)	Temperature (°C)	Dissolved oxygen (ml/L)	Total meiofauna	Nematoda	Ostracoda	Copepoda	*E. buncholzi*	(*S.D.*) *longifurca*	*P. secunda*	*T. discipes*	*N. palustris*	*H. curticorne*
1978													
Feb.	26.9	32.5	3.51	6002	4558	729	300	81	67	..	13	54	54
Mar.	32.7	31.0	2.52	1352	1295	33	20	..	..	..	..	10	7
Apr.	35.5	31.4	3.52	5775	5509	145	58	19	..	..	..	..	19
May	36.0	30.7	3.20	5042	4958	54	4	..	..	2	..	..	..
Jun.	11.5	27.4	3.49	1364	1342	13	4	..	..	..	..	4	..
Jul.	0.0	28.9	2.96	2921	2854	66	1	..	..	..	..	..	1
Aug.	no	no	no	no	no	no	no	no	no	no	no	no	no
Sep.	0.5	28.0	3.66	387	362	4	20	..	..	..	..	20	..
Oct.	3.8	29.8	3.22	6298	6160	17	121	..	3	..	80	..	..
Nov.	7.5	30.5	3.17	3358	3031	193	17	..	..	..	..	..	8
Dec.	8.4	25.3	3.38	2432	2375	21	4	..	..	..	2	..	2
1979													
Jan.	18.9	27.3]	2.94	1226	1108	34	83	..	..	..	..	2	..
Feb.	17.6	29.9	3.14	2510	2288	50	46	29	8	1	..	..	7
Mar.	33.8	29.4	2.61	729	662	17	42	3	..	6	..	6	6
Apr.	39.7	32.6	3.59	1642	1596	13	29	..	..	16	..	..	4
May	29.5	31.7	3.36	1961	1792	17	143	..	47	79	..	..	..
Jun.	36.8	31.9	3.53	1096	1067	..	13	..	6	7	..	..	..
Jul.	16.8	28.8	3.62	2025	1983	13	29	..	8	8	..	..	..
Aug.	no	no	no	no	no	no	no	no	no	no	no	no	no
Sep.	10.3	32.8	3.57	2780	2723	..	38	16	4	..	4	2	..
Oct.	7.6	28.1	3.55	509	484	..	17	..	..	..	..	17	..
Nov.	12.0	27.5	3.32	1329	1241	5	50	..	5	6	16	14	3
Dec.	12.7	28.6	3.25	488	450	29	8	..	2	..	4	..	1
1980													
Jan.	22.2	26.3	3.12	1425	1263	22	76	4	..	17	11	..	8
Mean	19.1	29.5	3.30	2293	2233	67	51	7	7	6	6	6	5

no — no observations

TABLE 3. *Monthly averages of salinity, temperature, dissolved oxygen (interstitial water) and densities (Nos./10 cm²) of meiofauna at Station 3*

Month	Salinity (‰)	Temperature (°C)	Dissolved oxygen (ml/L)	Total meiofauna	Nematoda	Ostracoda	Copepoda	*M. pygmaea*	*E. buccholtzi*	*S. (D). madrasensis*
1978										
Feb.	16.0	29.0	3.62	1735	1309	328	39	..	17	..
Mar.	20.5	31.5	2.51	3868	3182	156	418	123	85	114
Apr.	22.9	29.3	2.18	1178	1033	45	45	..	30	..
May	24.5	29.6	3.03	1251	1175	4	34	30	..	..
Jun.	2.7	25.1	2.89	417	351	..	58	19	3	..
Jul.	0.5	27.7	2.70	1440	1411	25	4	3	..	..
Aug.	no	no	no	no	no	no	no	no	no	no
Sep.	0.0	26.3	3.91	..	..	..	..	..	..	..
Oct.	0.5	25.1	3.22	72	64	..	8	..	..	..
Nov.	0.5	27.7	3.23	139	139	..	..	..	..	..
Dec.	4.1	23.7	2.24	303	300	..	3	2	..	..
1979										
Jan.	3.4	23.3	2.43	568	545	..	2	..	..	..
Feb.	3.4	27.9	3.45	1076	1034	..	42	..	..	..
Mar.	17.4	27.0	1.79	663	637	4	21	..	..	..
Apr.	14.8	29.2	2.16	996	954	4	2	1	..	..
May	13.1	32.9	3.29	2025	1898	4	25	6	6	..
Jun.	14.8	29.7	2.32	383	379	..	4	4	..	..
Jul.	3.6	26.8	2.41	137	137	..	..	..	..	..
Aug.	no	no	no	no	no	no	no	no	no	no
Sep.	0.3	33.9	4.16	2	2	..	..	..	..	..
Oct.	0.5	27.8	3.52	..	..	..	..	..	..	..
Nov.	3.5	29.2	3.68	119	119	..	..	..	..	..
Dec.	3.3	24.3	1.88	222	221	..	1	..	..	..
1980										
Jan.	9.5	25.3	2.48	694	646	..	40	12	..	..
Mean	8.2	27.8	2.91	786	706	26	34	9	6	5

no = no observations

TABLE 4. *Monthly averages of salinity, temperature, dissolved oxygen (interstitial water) and densities (Nos./10 cm²) of meiofauna at Station 4*

Month	Salinity (‰)	Temperature (°C)	Dissolved oxygen (ml/L)	Total meiofauna	Nematoda	Ostracoda	Copepoda	*N. spinipes*	*M. pygmaea*
1978									
Feb.	0.5	25.8	2.71	242	182	26	25	6	12
Mar.	7.6	27.7	2.48	2070	1043	119	575	288	287
Apr.	17.5	30.1	2.91	1222	581	145	390	390	..
May	0.5	29.5	2.76	1243	979	110	151	120	..
Jun.	0.5	27.4	3.10	56	52	..	1	..	1
July.	0.0	27.5	3.12	13	9	1	2	..	2
Aug.	no	no	no	no	no	no	no	no	no
Sept.	0.0	27.6	3.72	19	19	..	..	..	..
Oct.	0.3	27.2	3.21	20	16	4	..	..	..
Nov.	0.5	26.8	2.69	45	45	..	..	..	..
Dec.	0.5	22.4	3.06	11	11	..	..	..	..
1979									
Jan.	2.4	23.0	3.06	8	8	..	..	..	..
Feb.	0.4	23.3	2.61	66	66	..	..	..	..
Mar.	0.5	27.2	2.45	6	6	..	..	..	..
Apr.	4.2	29.5	2.49	..	..	..	..	..	..
May	0.5	29.5	2.64	597	597	..	..	..	..
Jun.	1.6	30.2	2.96	162	162	..	..	..	..
Jul.	0.5	28.0	3.39	..	..	..	..	..	..
Aug.	no	no	no	no	no	no	no	no	no
Sep.	0.5	28.7	3.33	..	..	..	..	..	..
Oct.	1.3	26.6	3.15	19	19	..	..	..	..
Nov.	0.9	25.1	2.99	37	37	..	..	..	..
Dec.	2.4	25.1	2.95	26	25	..	..	..	..
1980									
Jan.	1.2	22.3	3.04	11	6	..	..	..	..
Mean	2.0	26.8	2.90	267	176	18	52	36	14

no = no observations

TABLE 5. *Distribution of meiobenthic harpacticoid copepod species at Stations 1-4*

Family/Species	St. 1	St. 2	St. 3	St. 4
Longipediidae Sars, Lang				
Longipedia weberi A. Scott, 1909	—	+	+	—
Canuellidae Lang				
Sunaristes sp.	+	+	—	—
Canuella perplexa T et A Scott, 1893	—	+	—	—
Ectinosomatidae Sars, Olofsson				
Halectinosoma curticorne (Boeck, 1872)	+	+	+	—
H. gothiceps (Giesbrecht, 1881)	+	+	—	—
H. herdmani (T et A Scott, 1874)	+	—	—	—
Tachidiidae Sars, Lang				
Tachidius discipes (Giesbrecht, 1881)	+	+	+	—
Microarthridion littorale (Poppe, 1881)	+	+	—	—
Thalestridae Sars, Lang				
Paradactylopodia brevicornis (Claus, 1866)	—	+	—	—
Diosaccidae Sars				
Stenhelia (Delavalia) longifurca Sewell, 1934	+	+	+	+
S. (D). madrasensis Wells, 1971	+	+	+	+
Robertsonia propinqua (T. Scott, 1893)	+	+	+	—
Haloschizopera sp.	+	—	+	—
Schizopera consimilis Sars, 1909	—	—	—	+
Pseudostenhelia secunda Wells, 1971	+	+	+	+
Ameiridae Monard, Lang				
Nitocra spinipes var. *orientalis* Sewell, 1924	+	+	+	+
N. mediterranea (Brian, 1928)	—	+	—	—
Canthocamptidae Sars, Monard, Lang				
Mesochra pygmaea (Claus, 1863)	—	+	+	+
Cylindropsyllidae Sars Lang				
Leptastacus sp.	—	—	+	—
Cletodidae T. Scott				
Enhydrosoma curvirostre (T. Scott, 1894)	—	+	—	—
E. buccholtzi (Boeck, 1872)	+	+	+	—
E. longifurcatum Sars, 1909	+	+	+	—
Cletocamptus confluens (Schmeil, 1874)	+	—	—	—
Nannopus palustris Brady, 1880	+	+	+	—
Limnocletodes behningi Borutzky, 1926	—	+	—	—
Laophontidae T. Scott				
Paralaophonte congenera Sars, 1908	—	+	+	—
Laophontopsis secunda (Sewell, 1924)	+	—	+	—
Total species	17	21	16	6

Similarly copepod species *Microarthridion littorale, Robertsonia propinqua, Nannopus palustris and* the closely related species of *Halectinosoma, Schizopera, Nitocra, Mesochra, Enhydrosoma, Paralaophonte and Pseudostenhelia* were recorded from North Inlet estuary (Coull *et al.*, 1979) and in the present estuary. In general, the harpacticoid species *Microarthridion littorale, Nannopus palustris* and the genera *Halectinosoma, Stenhelia* (*Delavalia*) and *Mesochra* were recorded from Vellar, North Inlet and Gautami-Godavari estuaries. Similarities in physico-chemical environment (sediment composition and salinity regime), probably, paved the way for the existence/establishment of taxonomically/ecologically equivalent copepod species in estuarine systems. Thus the occurrence of similar estuarine meiobenthic copepod assemblages in different parts of the world indicate the long standing adaptation of these species to the estuarine environment in their physiology and behaviour without developing morphological features suitable for taxonomic differenciation.

In the present investigation an estuarine, coarse sand meiobenthic copepod assemblage characterized by *Nitocra spinipes* and *Mesochra pygmaea* was recognized in the upper reaches of the Gautami-Godavari Estuary.

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