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Sediment - ostracode relationship in the gulf of Mannar, off Tuticorin, east coast of India

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ABSTRACT

An attempt has been made to establish the sediment-ostracode relationship, in the gulf of Mannar, off Tuticorin, south east coast of India. 48 sediment samples were collected from 12 sampling stations. Twelve bottom sediment samples were collected once in three months, for a period of one year, so as to represent the four seasons (winter, summer, southwest Monsoon and northeast Monsoon). Calcium carbonate and organic matter content of each sample were correlated against the ostracode population recovered in the respective sample. An increase in the $CaCO_3$ percentage and a decrease in the organic matter content generally favour a higher population size.

INTRODUCTION

There are only a few published papers on the taxonomical studies of recent ostracodes from the east coast (Jain, 1976; Misra and Shrivastava, 1979; Sreenivas et al., 1991; Varma et al., 1993; Shyam Sunder et al., 1995) and west coast of India (Jain, 1978; Bhatia and Kumar, 1979; Guha, 1980; Jain, 1981; Khosla et al., 1982; Vaidya and Mannikeri, 1994). However, there is no comprehensive work on the ecology of ostracodes of this region except an introductory work from the marine marginal waterbodies by Annapurna (1981), Annapurna and Rama Sarma (1982), Khosla et al. (1982) and casual reference on the ecology of ostracodes can be made in Vaidya and Mannikeri (1994). Hussain et al. (1996) have presented the distribution and ecology of widespread and abundantly occurring species in the gulf of Mannar, off Tuticorin, southeast coast of India.

AREA OF STUDY

The area under investigation is off the coast of Tuticorin ($8^{o}47'$ N and $78^{o}10'$ E to $78^{o}25'$ E) in the gulf of Mannar, southeast coast of India, which forms a part of toposheet numbers 58 L/1 and L/5 of the survey of India. This region is influenced by the northeast monsoon (September - November) and the southwest monsoon (June - August).

The bay depressions generally occur during the months of October - December, and frequently cross the coast near Tuticorin and during those times, causing heavy downpour. The climate and temperature are tropical. In the gulf of Mannar, pearl and chank beds occur roughly in line parallel with and at a distance of 11 km from the land (Freda Chandrasekaran et al., 1968). Numerous patches of these pearl and chank beds are found at a depth range around 14 m. The surface of these beds consists of sediments formed by the consolidation of sand and dead corals in situ. Locally, isolated colonies of corals exist. These coral colonies afford shelter and support a large variety of marine organisms such as protozoans, sponges, coelenterates, molluscs, crustaceans etc. In the shallow surf beaten area between high tide and low tide levels, different varieties of marine algae flourish.

MATERIALS AND METHODS

In order to understand the sediment-ostracode relationship, a total of 48 sediment samples were collected. Collections were made from the innershelf of gulf of Mannar at 12 stations, off Tuticorin,

ranging in depth between less than a metre to about 20 m (Fig.1), once in three months for a period of one year representing the four seasons. The sediment samples were collected making use of a Petersen grab.

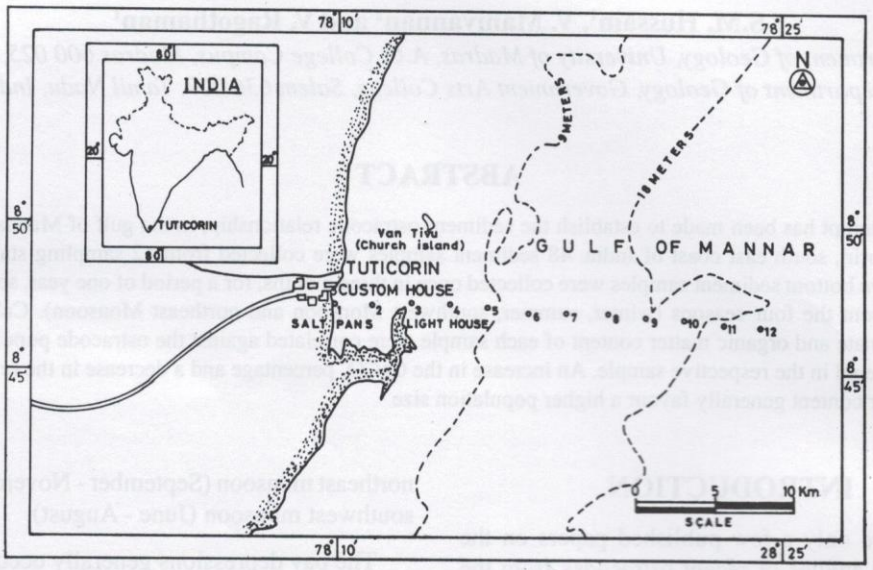

Fig. 1: Location of sampling stations. Legend: o = sample location point.

In the present study, calcium carbonate was determined by rapid titration method (Piper, 1947). Walkely and Black method as detailed out by Jackson (1967) was employed in determining the organic matter content of the sediments. Sand, silt and clay fractions in the sediment were estimated by the pipette method in accordance with the procedure adopted by Krumbein and Pettijohn (1938). Trefethen's (1950) textural nomenclature has been used to describe the sediments.

A unit volume of 25 ml wet sediment sample taken from the top layer was preserved immediately in 10% neutralised formaldehyde solution for the study of living ostracodes. The sediment sample preserved in neutralised formalin was subjected to laboratory treatment by adopting the technique of Walton (1952). The preserved sediment sample was washed over an ASTM 230 mesh sieve (opening 0.063 mm) to remove the finer particles. The sieve with residue was kept for about 1 hour in a tray containing an aqueous solution of Rose Bengal. Care is taken to ensure that the residue on the sieve mesh was fully covered by the solution. The material on the sieve was then washed to remove excess stain and dried. The ostracode specimens were separated from this residue, under a stereomicroscope and counted. The specimen which takes the stain was considered as living at the time of collection.

RESULTS AND DISCUSSION

The content of $CaCO_3$% and organic matter along with the living and total (living + dead) population of ostracodes are presented in Table 1, 2, 3 and 4. In the study area, the organic matter content in the sediments is found to be generally low, ranging from 0.302 to 2.213% by weight, the lowest value is recorded in station 1 of April and the highest is at station 2 of October. The low values of organic matter content of the sediments in the gulf of Mannar may be attributed to the lack of inflow through streams from the nearby areas. The organic matter may, therefore be of authigenic nature chiefly contributed by algae, corals and molluscs. The lower values of organic matter and the maximum value of the standing crop are recorded during April collection.

Table 1: January (Winter)

Stations	Depth (m)	Sand %	Silt %	Clay %	$CaCO_3$%	Organic Matter %	Living Population per unit volume	Total population per unit volume
1	< 1.0	96.95	2.38	0.67	22.0	0.465	5	70
2	1.8	20.60	39.40	40.00	18.0	2.190	14	123
3	2.8	81.64	8.16	10.20	24.5	1.600	6	47
4	4.5	88.22	3.63	8.15	26.0	0.580	4	22
5	5.6	83.19	7.57	9.24	32.0	0.550	73	310
6	7.2	80.91	8..64	10.45	31.5	0.515	99	439
7	10.9	82.47	7.66	9.87	31.0	0.680	28	442
8	12.7	83.90	8.72	7.38	29.0	0.545	18	207
9	13.4	88.66	6.04	5.30	28.5	0.685	15	280
10	14.5	94.76	2.74	2.50	25.5	0.715	18	232
11	16.3	94.02	2.66	3.32	23.0	0.750	27	257
12	19.0	95.04	2.16	2.80	22.5	0.750	27	285
Mean value		82.53	8.31	9.16	26.13	0.835	28	226

Table 2: April (Summer)

Stations	Depth (m)	Sand %	Silt %	Clay %	$CaCO_3$%	Organic Matter %	Living Population per unit volume	Total population per unit volume
1	< 1.0	95.71	2.79	1.50	21.0	0.302	6	38
2	2.2	67.45	19.55	13.00	29.5	0.480	6	61
3	3.3	78.36	13.64	8.00	30.0	0.474	5	59
4	4.8	76.12	12.38	11.50	30.0	0.515	22	228
5	6.6	79.03	14.82	6.15	32.0	0.324	184	1295
6	9.5	79.35	12.05	8.60	31.0	0.357	105	934
7	11.9	78.58	12.01	9.41	30.5	0.436	96	668
8	14.0	77.97	11.48	10.55	31.0	0.462	17	220
9	15.4	82.22	10.73	7.05	30.0	0.418	8	81
10	16.8	91.75	5.52	2.73	29.0	0.349	20	167
11	18.9	95.43	2.87	1.70	27.0	0.335	20	116
12	19.9	95.62	3.08	1.30	26.0	0.480	19	115
Mean value		83.13	10.08	6.79	28.92	0.411	42	341

Table 3: July (South West Monsoon)

Station	Depth (m)	Sand %	Silt %	Clay %	$CaCO_3$%	Organic Matter %	Living Population per unit volume	Total population per unit volume
1	< 1.0	95.55	1.45	3.00	20.5	0.358	8	111
2	2.1	22.88	33.02	44.10	21.5	2.114	9	124
3	3.7	33.72	27.10	39.18	25.5	1.531	12	166
4	4.8	77.68	7.32	15.00	27.5	0.964	32	352
5	6.9	70.16	16.69	13.15	29.0	0.743	30	418
6	9.5	69.21	17.29	13.50	32.5	0.408	27	431
7	11.2	78.36	12.50	9.14	31.0	0.410	18	283
8	13.1	76.54	14.13	9.33	32.0	0.572	34	415
9	14.6	94.64	2.84	2.52	28.0	0.405	16	208
10	15.4	97.23	0.07	2.70	26.5	0.387	25	369
11	17.4	95.18	1.70	3.12	25.5	0.454	32	334
12	18.7	95.80	0.20	4.00	26.0	0.325	19	179
Mean value		75.58	11.19	13.23	27.13	0.723	20	283

Table 4: October (North East Monsoon)

Stations	Depth (m)	Sand %	Silt %	Clay %	$CaCO_3$%	Organic Matter %	Living Population per unit volume	Total population per unit volume
1	< 1.0	96.26	2.64	1.10	21.5	0.500	5	49
2	2.7	23.76	29.06	47.18	22.5	2.213	2	12
3	4.3	68.70	14.14	17.16	29.0	1.060	9	79
4	5.4	76.39	12.66	10.95	29.5	0.542	12	98
5	7.2	75.93	12.57	11.50	30.5	0.560	22	273
6	10.3	79.14	11.86	9.00	30.0	0.412	45	469
7	12.8	79.81	11.19	9.00	31.5	0.453	8	95
8	13.9	83.35	9.10	7.55	32.5	0.432	24	245
9	14.8	84.39	7.11	8.50	30.0	0.471	10	64
10	16.5	98.80	1.20	-	27.0	0.332	7	130
11	18.3	98.92	0.58	0.50	26.5	0.567	9	66
12	19.3	95.25	3.30	1.45	26.0	0.475	9	146
Mean value		80.06	9.62	10.32	28.04	0.668	14	148

In the present area of study, the calcium carbonate percentage in the sediments varies from 18.0 to 32.5%, the minimum in station 2 in January and the maximum at station 6 in July. Spatial distribution of the calcium carbonate content reveals that the samples collected from the intermediate segment of the transect record higher values, irrespective of the season. This may be due to the occurrence of numerous patches of pearl and chank beds and also the presence of coral reefs in this region. In the same region (station 5 to 8) both the living and total population of ostracodes were encountered comparatively more. From the above observation, it may be inferred that the calcium carbonate content of the sediments is an important factor which governs the population of ostracodes, especially its spatial distribution. The calcium carbonate content is found to be directly proportional to the population size, in the study area.

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