

## Meiobenthos of Saphala Salt Marsh, West Coast of India

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Benthic fauna of the salt marsh comprised 10 taxonomic groups, dominated by nematodes (63.9%), harpacticoids (18.5%), turbellaria (5.6%), crustacean nauplii (5.4%) and polychaetes (4.1%). The population density varied from 282 to 17300.(10 cm)<sup>-2</sup> with a mean value of 3435.(10 cm)<sup>-2</sup>. More than 60% fauna occurred in the top 5 cm sediment layer and the major groups showed clumped distribution. Meiofaunal distribution and abundance was influenced by salinity, dissolved oxygen and the availability of food.

Salt marshes (locally known as 'khar' or 'Khazan' land), which are extended estuarine wet lands or mud flats lined by fringing mangrove, have high biological productivity potential and also serve as nursery for some of the commercially important fishes and prawns<sup>1</sup>. The present investigation forms a part of the study undertaken to assess the suitability of a salt marsh for mariculture of prawns and fin fishes.

### Materials and Methods

Saphala salt marsh (lat. 19°40'N, long. 72°37'E) is about 130 km north of the metropolis of Bombay. It covers a total area of about 1907 hectares, out of which about 280 hectares are under salt production. The salt marsh falls under the backwaters of river Vaiterna and two bifurcating creeks, Sarwar and Mande. Both creeks have mangrove vegetation of *Avicennia officinalis* A. marina and *Ceriops tagal*.

For the present study 5 stations were chosen. Sts 1 and 3 are situated in the area of mud flat which is not utilized. St 4 is in the salt production area and st 5 in the canal which supplies the salt water to the area. All stations were sampled only during Aug.-Oct. 1984. Meiofauna samples up to a depth of 15 cm were collected using a hand operated plastic corer (4 cm inner diam; 15 cm length). Replicate samples were taken from each station, at low tide when the mud was exposed. Each core sample was sliced into three 5 cm layer subsamples and preserved in 5% formalin solution to which Rose Bengal was added. Water sample for salinity, was collected alongwith meiofauna sample. Dissolved oxygen and pH of the overlying water were measured in the field using Horizon oxygen meter and digital pH meter. Temperature

of overlying water and sediment was also recorded. Mud samples were collected separately for sediment characteristics and organic content.

Meiofauna samples were analysed<sup>2</sup> and biomass was determined according to Crisp<sup>3</sup>. Organic content of the sediment was determined by the method of El Wakeel and Riley<sup>4</sup>.

### Results and Discussion

*Environmental feature*—Environmental data are given in Table 1. Water temperature ranged from

Table 1—Environmental Parameters

Station	Temp. °C		Salinity (× 10 <sup>-3</sup> )	Dissolved oxygen (ppm)	pH
	Air	Surface water			
August					
1	30.0	26.5	3.0	1.5	8.5
2	30.0	28.2	3.4	2.0	8.0
3	28.5	28.5	3.7	2.4	8.0
4	28.5	28.0	8.0	3.6	7.5
5	28.0	28.2	5.4	4.8	8.0
Av.	29.00	27.88	4.70	2.86	8.00
September					
1	27.5	28.0	4.8	2.9	7.75
2	28.0	29.0	3.4	3.0	7.75
3	29.0	30.0	4.6	3.3	7.00
4	29.0	30.0	12.1	2.9	7.50
5	30.0	32.0	4.8	2.8	7.50
Av.	28.70	29.80	5.94	2.98	7.50
October					
1	31.2	29.9	29.8	3.0	7.5
2	29.5	31.0	28.7	2.6	7.5
3	30.5	30.0	28.7	3.8	7.5
4	31.0	30.8	30.8	4.0	7.5
5	30.0	31.0	28.6	3.7	7.0
Av.	30.44	30.54	29.32	3.42	7.40

26.5 °C at st 1 in Aug. to 32°C at st 5 in Sept. with a mean value of 28.5°C in the study area. Air temperature did not show any major change (27.5-31.5°C). Salinity showed wide fluctuation ( $3 \times 10^{-3}$  in Aug. to  $30.8 \times 10^{-3}$  in Oct.). During Aug. and Sept. the salinity values were very low mainly due to heavy precipitation and high land runoff. October marks the end of southwest monsoon resulting in salinity changes, as observed in the present study. Comparatively high salinity values were observed at st 4. Dissolved oxygen values were rather low.

**Sediment character**—The mud at Saphala salt marsh appeared to be loose and well mixed. The sediment was characterised by high percentage of silt-clay fractions (Table 2). In general, silt-clay fraction varied from 74.5% at st 4 to 97.8% at st 2. Sediment temperature although, did not show much variation between stations during different months was relatively high in Oct. (32.2°C) suggesting that during fair season a relatively high temperature could be maintained. High percentage of silt-clay followed the general trend of high faunal density except at st 4.

The dead organic matter in the sediment provide information on the availability of food for meiobenthos<sup>5</sup>. Sediment organic matter in the present study varied between 0.88% at st 4 and 1.18% at st 2. A positive correlation between organic matter and meiofauna population density was observed. Biomass values were low [0.18 to  $3.09 \text{ mg } (10 \text{ cm})^{-2}$ ]. However, low value of biomass does not give the true picture of the total annual turnover of meiofauna<sup>5</sup>.

**Faunal density and composition**—The salt marsh fauna was characterised by high population density [ $\text{no } (10 \text{ cm})^{-2}$ ] during Aug.–Oct. (Table 3). Maximum meiofaunal density (17300) was observed at st 2 in Oct. and minimum (282) at st 4 in Aug. Average counts for all stations was 3435. An interesting feature of the study was that in the area where salt is being produced (st 4), the faunal density was significantly lower as compared to the other stations. The population, in general was poor in Aug. but increased in subsequent months.

Fig. 1 gives the average value (all months combined) of percentage composition and percent prevalence of all taxa in this study. The meiofau-

Table 2 – Comparison of Meiofaunal Density and Biomass with Sediment Characteristics

Station	Sediment temp. (°C)	Silt-clay (%)	Organic matter (%)	Density [ $\text{no.}(10\text{cm})^{-2}$ ]	Biomass [ $\text{mg.}(10\text{cm})^{-2}$ ]
1	29.0	94.1	0.97	4048	1.822
2	28.9	97.8	1.18	6868	3.091
3	28.9	86.1	1.14	4056	1.825
4	29.5	74.5	0.88	0402	0.181
5	29.9	84.5	0.92	2009	0.904

Table 3 – Meiofaunal Density

[Values  $\text{no.}(10\text{cm})^{-2}$ , are mean of 2 replicates]

St No.	Nematoda	Harpacticoida	Turbellaria	Crustacean nauplii	Polychaeta	Gastrotrich	Oligochaeta	Tardigrada	Decapoda	Ostracoda	Total
August											
1	1061	105	89	114	76	—	102	26	26	—	1599
2	575	76	26	—	89	—	26	—	—	—	789
3	635	51	38	26	26	13	—	—	—	—	814
4	178	64	20	—	20	—	—	—	—	—	282
5	572	38	38	—	38	—	13	26	—	—	725
September											
1	1143	102	165	13	81	—	—	—	—	—	1564
2	800	1003	203	143	245	89	—	—	13	13	2509
3	1346	405	267	127	241	76	102	—	—	—	2564
4	229	26	31	—	64	—	—	—	—	—	350
5	432	13	114	—	13	—	—	—	—	89	661
October											
1	4699	3645	229	356	152	—	—	—	15	—	9096
2	9296	4039	381	2516	305	534	229	—	—	—	17300
3	5588	1651	559	381	432	76	—	51	—	51	8789
4	502	38	18	13	—	—	—	—	—	—	571
5	3302	381	330	254	51	153	—	—	—	203	4675

na was represented by 10 taxa in varying proportions. Nematodes were numerically the most dominant group (63.9%). Harpacticoids (18.5%) were next in abundance followed by turbellarians (5.6%) and crustacean nauplii (5.4%). Other groups include polychaete (4.06%), gastrotrich (1.04%), oligochaete (0.39%), tardigrada (0.25%) and decapoda (0.08%). The prevalence of dominant taxa was found to be in accordance with the observed percentage composition. Accordingly, nematodes, harpacticoids and turbellarians were prevalent over other groups at all the stations.

**Vertical distribution**—Depth distribution of meiofauna is given in Fig. 2. More than 60% of the fauna was in the top 5 cm layer of the sediment. The fauna progressively decreased with increasing sediment depth. All major groups were in the deeper layer except harpacticoids, which were confined only up to the top 10 cm layer. The downward movement of a significant number of taxa reflects favourable conditions prevailing there in the sediment. Added to this was the favourable nature of the substratum (loose silt-clay) which allows movement of pore water and easy penetration of fauna.

Mean meiofaunal density was compared by two way Anova (Table 4). There were significant differences between mean population density at different stations and in different months. Differences among months, as seen from F ratio were more pronounced than among stations which indicate the impact of environment on meiofauna.

To delineate the meiofaunal distribution, analysis for Morisita's index ( $I\delta$ ) of dispersion for the most dominant and numerically abundant faunal group was carried out (Table 5). All values of  $I\delta$  were significant, indicating an aggregated or contagious dispersion ( $\chi^2$ ,  $p < 0.05$ ,  $n-1$  degree of freedom). The high  $I\delta$  value for crustacean nauplii indicated their clumped distribution which was further confirmed from the dominance of zoea larvae in the zooplankton samples of the same area<sup>6</sup>. Such meiofaunal distribution is attributed to changes in the microhabitat<sup>7</sup>.

Food supply and oxygen availability are 2 important factors limiting the distribution and abundance of meiofauna in the salt marsh<sup>7</sup>. Normally the oxygen reduces with sediment depth accompanied by reduction in the meiofaunal density down in the sediment. The oxygen values recorded in the present study are also low. Meiofauna are adapted to living under reduced oxygen tension<sup>8</sup>. Availability of food may therefore be the chief factor in the distribution and abundance of meiofauna in the salt marsh. The population

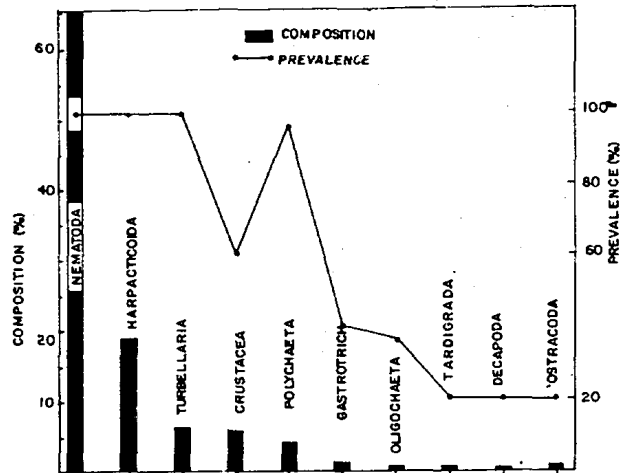


Fig. 1 — Percentage composition and prevalence of meiofaunal taxa

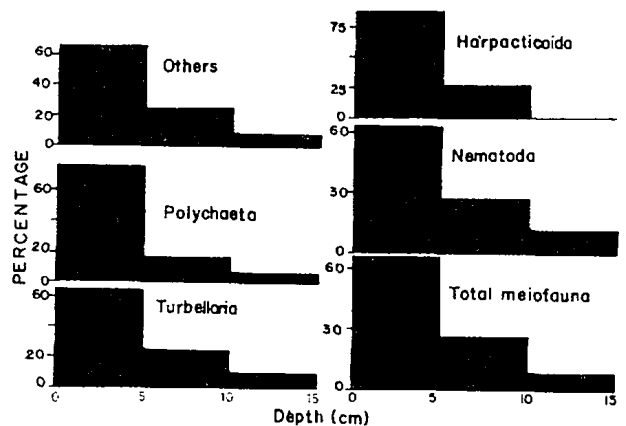


Fig. 2 — Vertical distribution of meiofauna

Table 4 — Two way Anova of Stations vs Months [after log(x + 1) transformation]

Source of variation	SS	df	MS	F ratio
Between stations	1.7848	4	0.4462	9.18*
Between months	1.95698	2	0.9784	20.13*
Error (interaction)	0.38893	8	0.0486	

\*  $F < 0.01$

Table 5 — Morisita's Index ( $I\delta$ ) for Most Abundant Meiofauna

Taxon	$I\delta$
Total fauna	1.3921*
Nematoda	1.0696*
Harpacticoida	1.6847*
Turbellaria	1.2582*
Crustacean nauplii	2.4553*
Polychaeta	1.508*

\*contagious

density recorded is very high and is comparable to that ( $10 \times 10^6 \text{m}^{-2}$ ) in the mud flats<sup>9</sup>, and is much higher than that either from seagrass bed<sup>10</sup> or from intertidal sand<sup>11</sup>. This indicates that mud flats of salt marsh may favour high meiofaunal population because of the availability of detritus which provide main food for the development of meiofauna population<sup>12</sup>. Although the present study covers only 3 months data, the effect of salinity on meiofaunal population was evident.

That the density of meiofauna decreases with depth in natural sediment is known<sup>7,13</sup> and it is true in the present study also. The reason given for such distribution is decreasing food and increasing oxygen tension associated with increase in sediment depth. In the present study however, a significant number of animals were found deep in the sediment.

The distribution of most of the taxa in the present study reflects the patchiness in distribution of such ecosystem<sup>14</sup>. Significantly low population density at st 4 may be the result of the sediment and the brine soaked into it. High density values of nematodes and harpacticoids, which form the main food for most of the prawns and fish larvae<sup>15</sup>, indicate that the study area is suitable for mariculture.

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