

## Faunal composition of metazoan meiofauna from the southeast continental shelf of India

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Analysis of the faunal composition of meiobenthos in the sediments of the southeast continental shelf of India showed nine taxonomic groups. Among these, nematoda, copepod and foraminifera were dominant. As many as 192 species of free-living marine nematodes, 39 species of harpacticoid copepods and 39 species of foraminiferans were identified. Other groups of metazoans encountered were polychaetes, ostracods, isopods, cumaceans, tanaidacea and tardigarda. Free-living marine nematodes constituted 57.63% of the total meiofaunal organisms. Harpacticoid copepods, foraminiferans and others constituted 14.77%, 13.89% and 13.71% respectively. Xyalidae, Desmodoridae, Comesomatidae and Linhomoeidae were the most dominant families of nematodes. These families were represented in all the depths. The abundance of nematodes showed a decrease with increase in depth (207.7±19.2 no. of ind. /10 cm<sup>2</sup> at 30-50 m depth to 34.6±6.5 no. of ind. /10cm<sup>2</sup> at >175 m depth). Similarly the number species also decreased with increase in depth (from 151 species at 30-50 m depth to 58 species at >175 m depth). More number of species were found in the Southern part of the study area than the Northern part.

**[Keywords:** Faunal composition, Metazoan meiobenthos, Nematodes, Copepods, Foraminiferans, Continental shelf]

### Introduction

Meiofauna has been regarded as a major metazoan component in the benthic ecosystem due to high abundance and fast turnover rates. Its production is equal or higher than macrofauna in shallow waters to deep sea<sup>1,4</sup>. It constitutes a high quality food source for fishes, shrimps and larvae of molluscs. Thus it is an important component in benthic food chain<sup>5-8</sup>. Compared to macrofauna, meiofauna is highly useful in environmental impact assessment and ecosystem health monitoring in view of its higher species richness, shorter life-cycles (3–5 generations per year) and lack of larval stages<sup>9-11</sup>. In particular, they respond rapidly to changes in sediment grain size and food availability<sup>12,13</sup>. While many studies have been carried out on meiobenthos in and around the Indian waters, meiofaunal communities of the Indian shelf sediments received cursory attention. More over the meiofaunal studies done in the Indian subcontinent covered mostly the continental shelf<sup>14-17</sup>, shallow coastal waters<sup>18-23</sup> and estuarine waters<sup>24,25</sup>. There is no work on the distribution and species level composition of meiobenthos from the Southeast coast of India. In the shelf region of other countries also only few works have been carried out<sup>26-28</sup>. Therefore the present investigation was undertaken from this region.

### Materials and Methods

The study area extends from 10° 34.03' to 15° 14.48' N and from 79° 52.13' to 80° 53.87'E in the continental shelf region of the Southeast coast of India (Fig. 1). Totally 35 sediment samples were collected along 6 transects (off Karaikkal, Parangipettai, Cheyyur, Chennai, Tammenapatanam and Singarayakonda) at the depths of 30-50 m, 50-75 m, 75-100 m, 100-150 m, 150-175 m and above 175 m. In addition, due to the presence of an industrial cluster in Cuddalore- SIPCOT (State Industries Promotion Corporation of Tamil Nadu), sampling was done at 30-50 m and above 175 m depths. Karaikkal, a part of Puducherry Union Territory is on the extreme South of the study area and Singarayakonda located in Andhra Pradesh is on the Northern most part of the study area. Samples could not be collected due to the hard nature of the bottom in Karaikkal at 75-100 m depth, in Parangipettai at 150-175 m depth and in Tammenapatanam at 50-75 m depth. Among the various transects covered, Singarayakonda, Tammenapatanam and Chennai were considered as Northern sector of the study area and the rest Southern. The study area map was drawn with the help of SURFER 8.0.

Meiofaunal samples for the present study were collected onboard FORV (Fishery and Oceanographic

Research Vessel) “*Sagar Sampada*” during Cruise No. 260. Two samples were collected using a Smith McIntyre grab (having a bite area of 0.2 m<sup>2</sup>) from each depth. Immediately after the grab was hauled to the deck and sub-samples were taken from undisturbed grab samples using a glass corer (with an internal diameter of 2.5 cm and a length of 15 cm) from the middle of grab sample<sup>29</sup>. The samples were fixed in buffered formalin at a concentration of 4%. The replicate core samples were processed separately in the laboratory and data were pooled for analyses. In the laboratory, samples were washed through a set of 0.5 mm and 0.063 mm sieves. The sediment retained in the 0.063 mm sieve was decanted to extract

meiofauna following the method<sup>30</sup>. Sorting of meiofauna from sediment was done by flotation technique. The efficiency of this technique is around 95%<sup>31</sup>. The meiofaunal organisms were stained with Rose Bengal prior to extraction and were sorted and enumerated under a stereomicroscope (Meiji, Japan). All the nematodes and harpacticoid copepods were mounted onto glass slides, using the formalin-ethanol-glycerol technique<sup>32</sup>. Identification of nematodes was carried out to the highest taxonomic level possible using the compound microscope (Olympus CX 41 under higher magnification of 1000x) following the standard pictorial keys of Platt and Warwick<sup>29,33</sup>, Warwick *et al.*<sup>34</sup> and the NeMys Database<sup>35</sup>. The other

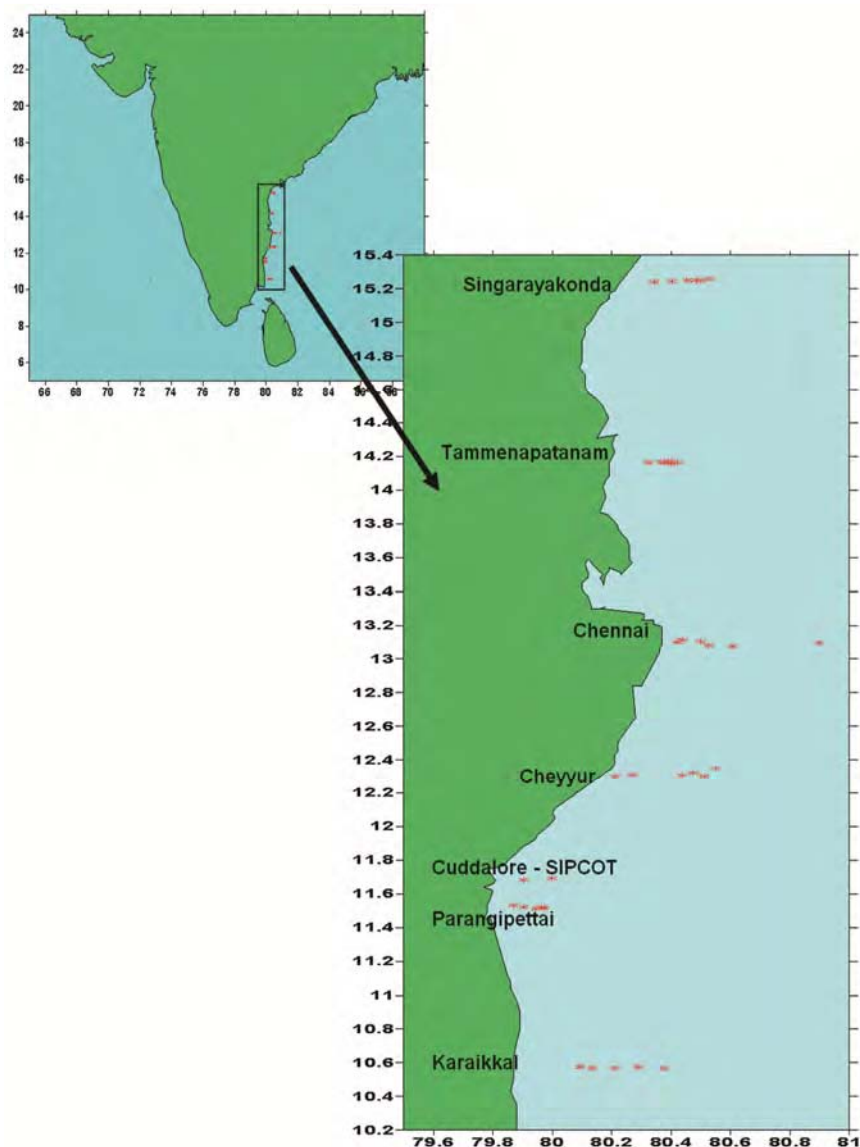


Fig. 1—Depths sampled at various transects

meiobenthic organisms were identified to genus level using standard taxonomic keys<sup>36,37</sup>.

Hydrographical parameters (temperature, salinity, dissolved oxygen (DO) and pressure) of bottom waters were measured at each sampling station using Seabird 911 plus CTD (Conductivity Temperature Depth) instrument. Sediment textural analysis was done using GRADISTAT 4.0 package<sup>38</sup> and the results obtained were processed statistically using Logarithmic (original) Folk and Ward<sup>39</sup> method to obtain median particle diameter and nomenclature. Total Organic Carbon content (TOC) was estimated using Walkley–Black method as modified by Gaudette *et al.*<sup>40</sup>. From the values of TOC, Total Organic Matter (TOM) was calculated using a conversion factor of 1.724 method<sup>41</sup>.

## Results

### Environmental parameters

Sediment surface temperature and dissolved oxygen content showed decrease with increase in depth. Temperature ranged between (mean and standard error)  $27.62 \pm 0.08^\circ\text{C}$  (30-50 m depth) and  $13.17 \pm 3.41^\circ\text{C}$  (150-175m depth). The dissolved oxygen content was in the range of  $4.17 \pm 0.03$  ml/l (30-50m depth) to  $0.11 \pm 0.009$  ml/l (>175 m depth). Sediment surface salinity and bottom water pressure observed increase with increase in depth. Salinity varied from  $34.96 \pm 0.01$  PSU (>175 m depth) to  $23.7 \pm 6.12$  PSU (75-100 m depth). Bottom water pressure recorded from  $188.01 \pm 7.0$  bar at >175 m depth to  $27.1 \pm 0.73$  bar at 30-50m depth. Between the median particle diameter and total organic matter showed opposite trend to each other, increasing with decrease in depth *viz.* Median particle diameter (MPD) varied from  $0.49 \pm 0.08$  mm (30-50 m depth) to

$0.1 \pm 0.06$  mm (>175 m depth). Total organic matter content ranged between  $4.98 \pm 0.91\%$  at 100-150 m depth and  $2.5 \pm 0.6\%$  at 30-50 m depth.

### Percentage composition of meiobenthos

Totally nine taxonomic groups were found in the meiobenthic samples. Among these, nematoda (57.63%), harpacticoida (14.77%) and foraminifera (13.89%) were dominant in all the depths. The other groups which were found in less numbers included polychaeta, ostracoda, isopoda, cumacea, tanaidacea and tardigarda which constituted together 13.71% (Fig. 2a). These groups showed a patchy distribution in the shelf sediments. Nematodes, harpacticoid copepods, foraminiferans and others were represented respectively by 192, 39, 39 and 88 species (Fig. 2b).

### Nematodes

The 192 species of nematodes identified belonged to 96 genera and 33 families. Xyalidae, Desmodoridae, Comesomatidae and Linhomoeidae were the most dominant families having more than 15 species each. Families such as Microlaimidae, Axonolaimidae, Cyatholaimidae and Leptolaimidae were represented by more than 10 species each.

The abundance (mean $\pm$ SE) of nematodes decreased with increase in depth. The maximum abundance of  $207.7 \pm 19.2$  no. of ind. /10 cm<sup>2</sup> was noticed in 30-50 m depth and the minimum in >175m depth ( $34.6 \pm 6.5$  no. of ind. /10 cm<sup>2</sup>) (Fig. 3a). Highest number of species was recorded in 30-50m depth (151 species) followed by 100-150 m depth (120 species), 75-100 m depth (100 species), 50-75 m depth (95 species), 150-175m depth (80 species) and >175 m depth (58 species) (Fig. 3b). The most dominant free-living marine nematode genera in the Southeast continental

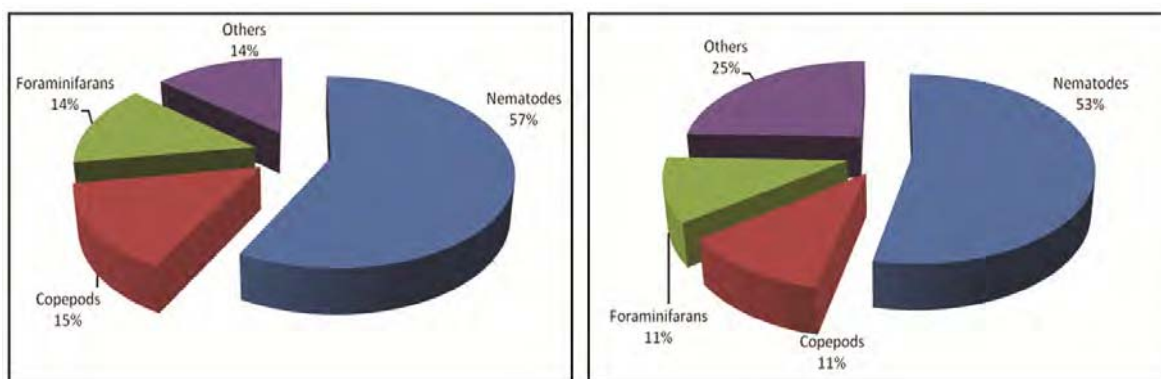


Fig. 2—Percentage contribution of metazoan meiobenthos in the southeast continental shelf of India (a) in terms of number of organisms and (b) number of species

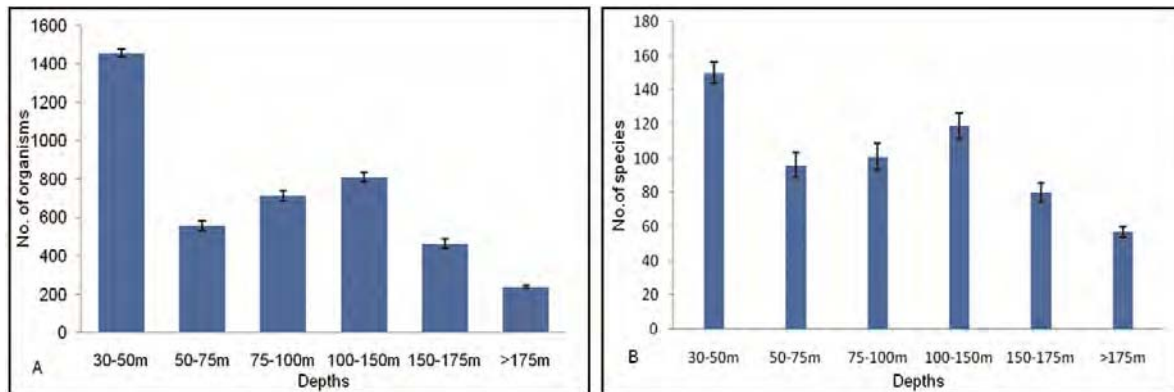


Fig. 3—Variations in the abundance (a) and number of species (b) of nematodes in relation to depths sampled

shelf of India were *Viscosia*, *Halalaimus*, *Sabatieria*, *Paralongicyatholaimus* and *Daptonema*.

Seventeen families such as Anoplostomatidae, Oxystominidae, Oncholaimidae, Trefusiidae, Chromadoridae, Comesomatidae, Cyatholaimidae, Desmodoridae, Microlaimidae, Leptolaimidae, Ceramonematidae, Desmoscolecidae, Monhysteridae, Xyalidae, Sphaerolaimidae, Linhomidae and Axonolaimidae were found in the entire study area. Some families were found to be depth specific—Enchelidiidae and Epsilonematidae were restricted only in 30-50 m depth range, Meyliidae in 50-75 m depth and Enoplidae in 75-100m depth. Totally 30 out of 33 nematode families were recorded in 30-50 m depth followed by 28 families in 50-75 m and 100-150 m depths. While behind 100m depth all the 33 nematode families were found and beyond 100m depth 29 families were recorded. However Enoplidae, Enchelidiidae, Epsilonematidae and Meyliidae were not recorded. At the edge of the shelf (beyond 175 m) only 18 families were recorded. Ironidae, Leptosomatidae and Draconematidae were present in all the depth ranges except > 175 m depth (Table 1).

The abundance of nematodes varied between the transects. While the maximum abundance was found in Chennai transect  $168.5 \pm 30.99$  no. of ind. /10cm<sup>2</sup>, the minimum was in noticed in Tammenapatanam transect  $88.67 \pm 25.60$  no. of ind. /10cm<sup>2</sup> (Fig. 4a). More number of species was found in the Southern part than the Northern part (Fig. 4b). Higher number of species (95) was recorded in the Parangipettai transect followed by Karaikkal (90), Cheyyur (84), Chennai (77), Tammenapatanam (64) and Singarayakonda (57). Only 49 species were collected from the two depths ((30 m and 200 m) sampled in Cuddalore-SIPCOT transect.

The most common species in the study were *Viscosia* spp., *Halalaimus* spp. and *Sabatieria* spp. In

Karaikkal transect, the dominant species were *Viscosia* spp., *Siplophorella* sp. and *Odontophora* spp. In Parangipettai transect the dominant ones were *Siplophorella* spp., *Viscosia* spp. and *Halalaimus* spp. In Cheyyur transect, *Viscosia* spp., *Daptonema* spp. and *Halalaimus* spp. were dominant. *Viscosia* spp., *Halalaimus* spp. and *Sabatieria* spp. were dominant in Chennai, Tammenapatanam and Singarayakonda transects. In Cuddalore-SIPCOT transect, *Viscosia* spp. and *Siplophorella* sp. were dominant and other species were evenly distributed (Table 3). *Viscosia* spp. were abundant in all the transects, *Metachromadora* spp. and *Siplophorella* sp. were found only in the southern part (Karaikkal, Parangipettai and Cuddalore-SIPCOT).

#### Harpacticoid copepods

Harpacticoid copepods constituted the second dominant group among the meiobenthos. All the harpacticoid copepods are typically benthic. They were found in almost all the depths. During the present study 39 species of harpacticoid copepods belonging to 30 genera and 17 families were recorded. Among these Ectinosomatidae, Laophontidae, Dactylopusiidae and Miraciidae were the most dominant families with more than 3 species each.

The mean abundance of harpacticoid copepods showed the maximum in 30-50 m depth ( $54 \pm 9.74$  no. of ind. /10cm<sup>2</sup>) and the minimum in 75-100m depth ( $11.57 \pm 3.94$  no. of ind. /10cm<sup>2</sup>) (Fig. 5a). However, the highest number of species was recorded in >175 m depth (39 species) followed by 30-50 m (36 species), 100-150 m (30 species), 100-150 m (29 species) and 50-75 m depths (22 species). Only 18 species were recorded from 75-100 m depth. The most dominant harpacticoid copepods were *Microsetella* spp., *Macrosetella* sp., *Cervinia* sp. and *Canuella* sp. (Table 2).

Table 1—Free-living marine nematodes recorded from the southeast continental shelf of India

Families	30-50m			50-75m			75-100m			100-150m			150-175m			>175m		
	Family	Genus	Species	Family	Genus	Species	Family	Genus	Species	Family	Genus	Species	Family	Genus	Species	Family	Genus	Species
Enoplidae	A	0	0	A	0	0	P	1	1	A	0	0	A	0	0	A	0	0
Thraucostomopsidae	P	2	2	P	1	1	A	0	0	P	2	2	P	1	1	A	0	0
Enchelidiidae	P	1	1	P	1	1	A	0	0	P	1	1	P	1	1	A	0	0
Anoplostomatidae	P	2	2	P	1	2	P	1	2	P	1	2	P	1	2	P	1	2
Anticomidae	P	1	1	P	1	1	P	1	1	P	1	2	A	0	0	A	0	0
Ironidae	P	2	2	P	1	1	P	1	1	P	2	2	P	1	1	A	0	0
Leptosomatidae	P	3	3	P	1	1	P	1	1	P	1	1	P	1	1	A	0	0
Oxystominae	P	2	7	P	3	7	P	2	6	P	2	6	P	2	6	P	3	6
Oncholaimidae	P	2	7	P	2	5	P	1	5	P	2	7	P	2	6	P	2	5
Enchelidiidae	P	1	1	A	0	0	A	0	0	A	0	0	A	0	0	A	0	0
Tripyloididae	P	1	2	A	0	0	A	0	0	P	1	1	A	0	0	A	0	0
Trefusiidae	P	2	4	P	2	4	P	2	3	P	2	4	P	1	1	P	1	1
Chromadoridae	P	3	3	P	2	2	P	2	2	P	1	1	P	1	1	P	1	1
Comesomatidae	P	6	15	P	5	13	P	3	12	P	4	10	P	3	10	P	4	5
Ethmolaimidae	P	2	2	A	0	0	P	1	1	P	1	1	A	0	0	A	0	0
Cyatholaimidae	P	5	8	P	4	5	P	3	4	P	6	8	P	2	3	P	3	4
Selachinematidae	P	0	0	P	2	2	A	0	0	P	1	1	A	0	0	P	1	1
Desmodoridae	P	9	12	P	5	5	P	5	6	P	8	10	P	4	5	P	1	1
Draconematidae	P	1	1	P	0	0	P	1	1	P	0	0	P	0	0	A	0	0
Epsilonematidae	P	1	1	A	0	0	A	0	0	A	0	0	A	0	0	A	0	0
Microaimidae	P	4	9	P	3	6	P	2	4	P	4	8	P	1	2	P	1	1
Leptolaimidae	P	4	9	P	2	2	P	1	1	P	2	4	P	2	3	P	1	1
Ceramoniematidae	P	3	4	P	1	2	P	2	2	P	2	3	P	2	3	P	1	1
Meyliidae	A	0	0	P	1	1	A	0	0	A	0	0	A	0	0	A	0	0
Desmoscolecidae	P	3	6	P	1	3	P	2	4	P	1	3	P	1	3	P	1	3
Aegialoaimidae	A	0	0	P	1	1	P	1	1	P	1	1	A	0	0	A	0	0
Morbysteridae	P	3	5	P	2	3	P	2	7	P	2	5	P	2	4	P	2	6
Xyalidae	P	4	10	P	2	9	P	3	14	P	3	9	P	1	7	P	1	5
Sphaerolaimidae	P	1	3	P	1	3	P	1	1	P	1	3	P	1	3	P	1	1
Siphonolaimidae	P	2	3	P	1	1	P	2	3	P	1	1	A	0	0	A	0	0
Linhomoeidae	P	6	15	P	4	8	P	4	9	P	5	13	P	3	7	P	3	8
Axonolaimidae	P	3	10	P	2	3	P	3	7	P	3	9	P	3	8	P	2	5
Diplopetidae	P	1	3	P	1	3	P	1	2	P	1	2	P	1	2	A	0	0
<b>Total</b>	<b>30</b>	<b>80</b>	<b>151</b>	<b>28</b>	<b>53</b>	<b>95</b>	<b>25</b>	<b>48</b>	<b>100</b>	<b>28</b>	<b>62</b>	<b>120</b>	<b>22</b>	<b>37</b>	<b>80</b>	<b>18</b>	<b>30</b>	<b>57</b>

P – present; A – absent

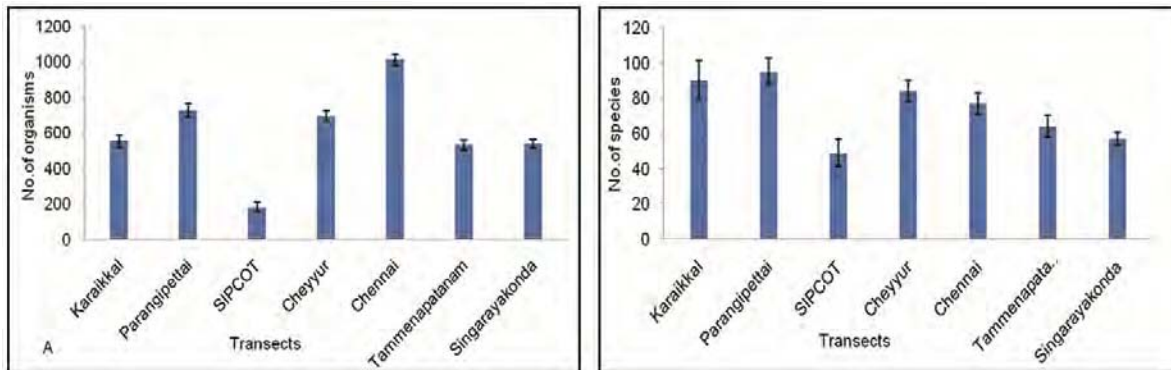


Fig. 4—Variations in the abundance (a) and number of species (b) of nematodes in relation to transects covered

Table 2—Dominant meiofaunal genera at various depths in the southeast continental shelf of India

Depths sampled(m)	Meiofaunal Groups	Dominant genera
30-50m	Nematodes	<i>Viscosia, Halalaimus, Siplophorella, Sabatieria and Anoplostoma</i>
	Copepods	<i>Microsetella, Cervinia and Macrosetella</i>
	Foraminiferans	<i>Rosalina, Ammonia and Quinqueloculina</i>
50-75m	Nematodes	<i>Halalaimus, Viscosia, Sabatieria, Anoplostoma and Siplophorella</i>
	Copepods	<i>Microsetella, Cervinia and Macrosetella</i>
	Foraminiferans	<i>Rosalina, Quinqueloculina and Spiroloculina</i>
75m-100m	Nematodes	<i>Viscosia, Daptonema, Halalaimus, Sabatieria and Paralongicyatholaimus</i>
	Copepods	<i>Microsetella, Macrosetella and Tisbe</i>
	Foraminiferans	<i>Rosalina, Pararotalia and Ammonia</i>
100-150m	Nematodes	<i>Viscosia, Halalaimus, Paralongicyatholaimus, Sabatieria and Terschellingia</i>
	Copepods	<i>Microsetella, Harpacticus and Canuella</i>
	Foraminiferans	<i>Rosalina, Pararotalia and Ammonia</i>
150-175m	Nematodes	<i>Halalaimus, Viscosia, Sabatieria, Paralongicyatholaimus and Daptonema</i>
	Copepods	<i>Harpacticus, Macrosetella and Microsetella</i>
	Foraminiferans	<i>Rosalina, Nonion and Ammonia</i>
>175m	Nematodes	<i>Viscosia, Daptonema, Halalaimus and Tricoma</i>
	Copepods	<i>Microsetella, Harpacticus and Cervinia</i>
	Foraminiferans	<i>Rosalina, Pararotalia and Ammonia</i>

The abundance of Harpacticoid copepods was comparatively higher ( $171.33 \pm 61.70$  no. of individuals) in the Northern sector (Chennai, Tammenapatanam and Singarayakonda) compared to the ( $138.33 \pm 32.67$  no. of individuals) Southern sector (Karaikkal, Parangipettai and Cheyyur) (Fig. 5b). The number of species was more or less similar in the various transects covered. Karaikkal and Tammenapatanam transects showed higher number of species (30) followed by Singarayakonda (27) and Parangipettai, Cheyyur and Chennai (23). In Cuddalore-SIPCOT transect 24 species were recorded. The most dominant harpacticoid copepod genera were *Microsetella*, *Macrosetella*, *Harpacticus* and *Cervinia* (Table 3).

#### Foraminiferans

Foraminiferans formed the only protozoan group in the meiobenthic samples. They were found in almost

all the depths. During the present study 39 species of foraminiferans belonging to 19 genera and 15 families were recorded. Among these Rosalinidae, Rotaliidae and Hauerinidae were the most dominant families with more than 4 species each.

The mean abundance of foraminiferans was maximum in 30-50m depth ( $47.29 \pm 10.38$  no. of ind./ $10\text{cm}^2$ ) and minimum in 75-100 m depth ( $16 \pm 4.60$  no. of ind./ $10\text{cm}^2$ ) (Fig.6a). The highest number of species was recorded in 30-50 m depth (30 species) followed by 100-150 m and >175 m (29 species), 75-100 m (24 species), 150-175m (23 species) and 50-75 m depths (22 species). The most dominant genera were *Rosalina* spp., *Ammonia* sp., *Pararotalia* sp. and *Quinqueloculina* spp. (Table 2).

The mean abundance of foraminiferans was comparatively high ( $174.67 \pm 29.49$  no. of individuals) in the Northern sector (Chennai, Tammenapatanam

Table 3—Dominant meiofaunal genera recorded in different transects of the southeast continental shelf of India

Transects	Meiofaunal Groups	Dominant genera
Karaikkal	Nematodes	<i>Viscosia</i> , <i>Siplophorella</i> and <i>Odontophora</i>
	Copepods	<i>Microsetella</i> , <i>Canuella</i> and <i>Cervinia</i>
	Foraminiferans	<i>Rosalina</i> , <i>Ammonia</i> and <i>Triloculina</i>
Parangipettai	Nematodes	<i>Siplophorella</i> , <i>Viscosia</i> and <i>Halalaimus</i>
	Copepods	<i>Microsetella</i> , <i>Cervinia</i> and <i>Macrosetella</i>
	Foraminiferans	<i>Rosalina</i> , <i>Ammonia</i> and <i>Quinqueloculina</i>
Cheyyur	Nematodes	<i>Viscosia</i> , <i>Daptonema</i> and <i>Halalaimus</i>
	Copepods	<i>Microsetella</i> , <i>Macrosetella</i> and <i>Canuella</i>
	Foraminiferans	<i>Rosalina</i> , <i>Triloculina</i> and <i>Pararotalia</i>
Chennai	Nematodes	<i>Viscosia</i> , <i>Halalaimus</i> and <i>Sabatieria</i>
	Copepods	<i>Macrosetella</i> , <i>Microsetella</i> and <i>Cervinia</i>
	Foraminiferans	<i>Rosalina</i> , <i>Nonion</i> and <i>Ammonia</i>
Tammenapatnam	Nematodes	<i>Viscosia</i> , <i>Halalaimus</i> and <i>Sabatieria</i>
	Copepods	<i>Microsetella</i> , <i>Canuella</i> and <i>Zosime</i>
	Foraminiferans	<i>Rosalina</i> , <i>Pararotalia</i> and <i>Ammonia</i>
Singarayakonda	Nematodes	<i>Halalaimus</i> , <i>Viscosia</i> and <i>Sabatieria</i>
	Copepods	<i>Harpacticus</i> , <i>Canuella</i> and <i>Microsetella</i>
	Foraminiferans	<i>Rosalina</i> , <i>Pararotalia</i> and <i>Ammonia</i>
Cuddalore-SIPCOT	Nematodes	<i>Viscosia</i> and <i>Siplophorella</i>
	Copepods	<i>Microsetella</i> , <i>Cervinia</i> and <i>Macrosetella</i>
	Foraminiferans	<i>Rosalina</i> , <i>Ammonia</i> and <i>Pararotalia</i>

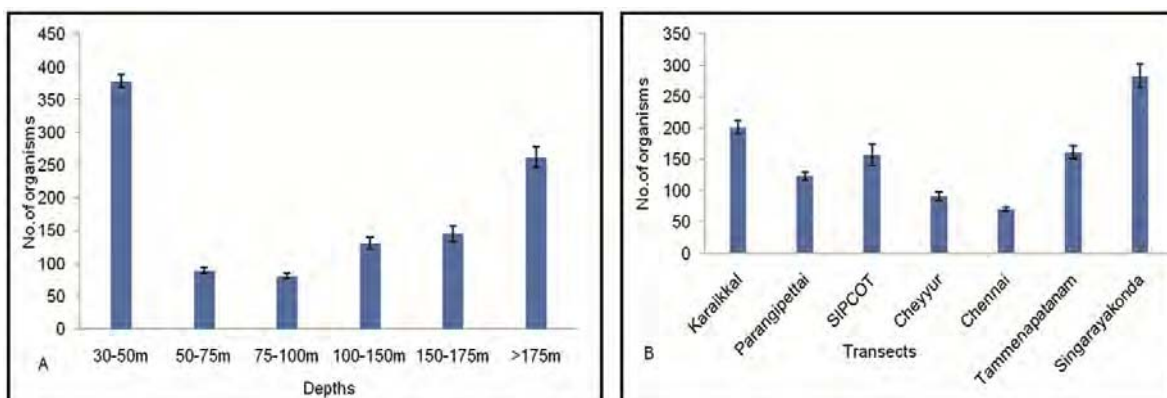


Fig. 5—Variations among the harpacticoid copepods in relation to depths sampled (a) and transects covered (b)

and Singarayakonda) than the Southern sector ( $114.67 \pm 9.24$  no. of individuals-Fig. 6b). The number of species was more or less similar in all the transects (Karaikkal–25 species, Tammenapatnam and Singarayakonda–24 species each, Parangipettai, Cheyyur and Chennai–22 species each). In Cuddalore-SIPCOT transect only 17 species of foraminiferans were observed. The most dominant foraminiferan genera were *Rosalina*, *Ammonia* and *Pararotalia* (Table 3).

#### Polychaetes and Ostracods

Polychaetes are mainly temporary meiobenthos. They were found in all the depths sampled. They were identified only up to genus level. Totally 40 genera were identified belonging to 19 families. The

dominant genera identified were *Prinospio* spp., *Amphicteis* sp., *Capitella* spp., *Lumberineris* sp. and *Magelona* spp. The abundance of ostracods was relatively poorer and they were not found in all the depths. In the present study only 12 genera were identified. The dominant *ostrocods* genera were *Tanella*, *Keijiella* and *Basslerites*.

#### Isopods, Cumaceans, Tanaidacea and Tardigrada

Isopods were found in very less density and were present in all the transects particularly in Singarayakonda transect. Cumaceans did not occur in all transects and depths. They were found only in shallower depths (30 m depth). Tanaidacea (1 species) and Tardigrada (2 species) were found only in Singarayakonda transect.

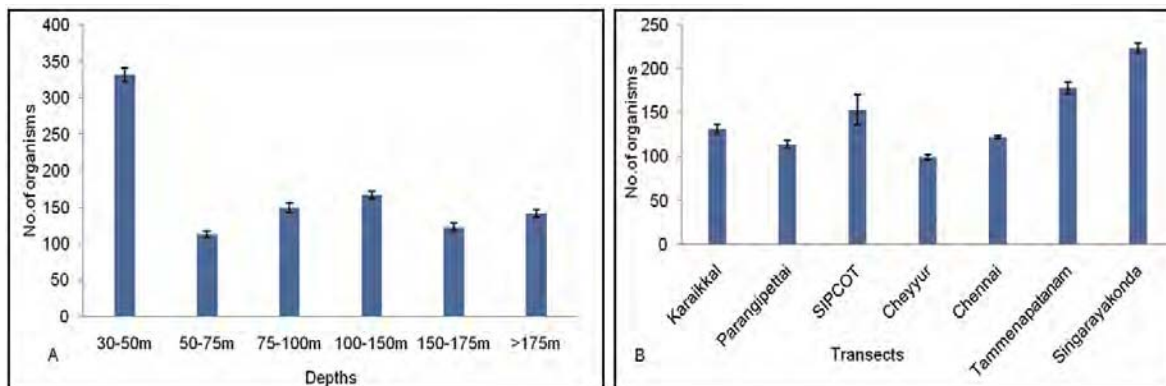


Fig. 6—Variations among the foraminifera in relation to depths sampled (a) and transects covered (b)

## Discussion

The meiobenthic fauna of the Southeast continental shelf of India included nine taxa namely free-living marine nematodes, harpacticoid copepods, foraminiferans, polychaetes, *ostracods*, isopods, cumaceans, tanaidacea and tardigarda. Among these the most dominant group was free-living marine nematodes followed by harpacticoid copepods. Similar observation was made earlier<sup>15,22-25</sup> from Indian shelf and elsewhere<sup>26-28,42-45</sup>. Apart from the polychaetes, all other groups (*ostracods*, isopods, cumaceans, tanaidacea and tardigarda) were represented irregularly in the shelf region<sup>16</sup>.

In the present study, all the meiobenthic taxa showed a decline in abundance with increase in depth. However the decline with increase in depth was not steady as noticed in the case of nematodes (depth range 100-150 m showed an increase from that of 50-75 m and 75-100 m to decline again in 150-175m and >175m) as reported earlier by many investigators<sup>15,21,26</sup>. The vertical zonation of the surface and subsurface assemblages of meiobenthos and nematodes in particular were controlled by the vertical profile of environmental factors. An important feature of nematode populations is the presence of a large number of species present in a single habitat<sup>28</sup>. Differences in food availability both quantitative and qualitative appear to be an important factor controlling total abundance and the faunal composition of the metazoan meiobenthos at the taxonomic level<sup>15,28,46,47</sup>. Physico-chemical factors and competition, both among the individuals within a species as well as among the species, can also play a major role in limiting the faunal abundance and distribution<sup>16,26</sup>.

Nematodes were represented by 192 species belonging to 96 genera and 33 families in the present

investigation. About 154 species of nematodes have been reported from the Western continental shelf of India<sup>15</sup>. The dominant families in the present study were Xyalidae, Desmodoridae, Comesomatidae, Linhomoeidae, Microlaimidae and Axonolaimidae. Similar results have been reported by Sajan and Damodaran<sup>16</sup> in Western continental shelf of India. As observed in the present study, decline in abundance, number of species and families with increase in depth was reported by Soltwedel<sup>26</sup> and Sajan and Damodaran<sup>16</sup>. Transect-wise variation was less distinct in the faunal composition. However, such a variation was noticed in the abundance of nematodes in the entire shelf. Southern sector showed higher number of species than the Northern sector. The hypothesis that low oxygen level (0.07mL/l) does not affect the abundance of nematodes<sup>16,17</sup> is found to be true in the present study also.

Harpacticoid copepods are generally the second most abundant metazoan meiobenthos<sup>15-26</sup>. Investigation on their distribution patterns is necessary to have complete understanding of continental shelf meiofaunal composition<sup>48,49</sup>. Our knowledge of the harpacticoid copepods distribution and diversity in the Indian shelf is limited. In the present study, 39 species of harpacticoid copepods belonging to 30 genera and 17 families were found. Most abundant genera recorded in the present investigation were *Microsetella*, *Macrosetella*, *Cervinia* and *Canuella*. Similar observations were made by Sajan and Damodaran<sup>16</sup> in the shelf region and Eldose<sup>50</sup> in the slope region.

The only protozoan group found in the meiobenthic assemblage is foraminiferans. It ranked third in terms of abundance in the present investigation. Depth-wise variation in abundance and number of species was noticed. Similar findings were made by Pascual

*et al.*<sup>51</sup> and Bouchet *et al.*<sup>52</sup>. Higher mean abundance of foraminiferans was recorded in shallower depths in the study area, as reported earlier by Sajan and Damodaran<sup>16</sup> in the Western continental shelf of India. The most common genera observed in the present investigation were *Rosalina*, *Ammonia*, *Pararotalia* and *Quinqueloculina*. Similar observation was also reported earlier by Sajan and Damodaran<sup>16</sup> Eldose<sup>50</sup> and Pascual *et al.*<sup>51</sup>.

Other groups of the meiobenthos such as polychaetes (temporary meiobenthos) were poorly represented in meiobenthic community at various depths<sup>16</sup>. Ostracods were poorly represented, as they prefer sandy sediments of the shallower depths<sup>53</sup>. Isopods, cumaceans, tanaidacea and tardigarda were scarce in the shelf region. Thus the composition of the meiobenthos in the shelf of Southeast coast of India to that of other shelf displays a similar taxonomic grouping. The number of species of nematode found in the present study is found to be higher than those reported by Sajan *et al.*<sup>15</sup> (154 species) in the West coast of India, Netto *et al.*<sup>54</sup> (157 species) in Southeast Brazil and Liu *et al.*<sup>55</sup> (101 species) in Hong Kong.

The three hydrographical parameters which showed significant positive correlation with abundance of nematodes, foraminiferans and others in the present study were dissolved oxygen, temperature and median particle diameter. These three parameters showed progressive decrease with increase in depth and were very low in the deeper depths covered in the present study (>175 m depth) particularly the dissolved oxygen was lower than 0.1mL/l indicating the presence of oxygen minimum layer in the study area as reported earlier in other parts of the Indian waters<sup>56,57</sup>. The results also indicated that the abundance of nematode was not affected by the low oxygen levels at deeper depths. Earlier studies have indicated that meiofauna in general and nematodes in particular tend to be more tolerant than macrofauna to anoxia<sup>53,58</sup>. The low oxygen level did not affect the abundance of nematodes<sup>17</sup> but the foraminiferans and soft-shelled taxa (polychaetes, turbellarians, ostracods etc.) were found to be rare or absent in most oxygen-depleted regions<sup>59</sup>. The abundance of harpacticoid copepods also did not show much decrease with increase in depth. Thistle<sup>60</sup> pointed out that harpacticoid copepods are successful in the deeper waters and their abundance decreases less rapidly with increase in depth.

In the present study, the shallower depths were sandy in nature and the deeper depths silty in nature.

Sediment nature is an important factor which determines the distribution of meiofauna in particular the nematodes<sup>16, 17</sup>. The trend noticed in the distribution of two dominant groups of meiofauna namely nematodes and harpacticoid copepod in the study area was strikingly different (more of harpacticoid copepods in the northern region and nematodes in the southern region). While the nature of sediment nature was silty in the northern region, it was sandy in the southern region. It is attributed to the high sedimentary load brought to the northern region by the freshwater flow from Krishna River<sup>61</sup> and comparatively less sediment load to the southern region due to lack of such large rivers. The present study is an one time study carried out in few transects along the Southeast coast of India. Therefore, the intensity of sampling has to be increased covering various seasons and more number of transects to confirm the trends noticed in the present study on the faunal composition of metazoan meiofauna in the Southeast coast of India.

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