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Diversity of amphipods in the continental shelf sediments of southeast coast of India

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Original Article

Abstract

The diversity of amphipods in the continental shelf sediments of the southeast coast of India is dealt in the paper. Samples for the study were collected onboard FORV *Sagar Sampada* during Cruise Nos. 260, 275 and 290 conducted in December 2008, May 2010 and October 2011 respectively. Samples were collected at various depths (30 m, 50 m, 75 m, 100 m, 150 m and 200 m) along 6 transects namely Singarayakonda, Tammenapatanam, Chennai, Cheyyur, Cudallore-Parangipettai and Karaikkal besides Cuddalore-SIPCOT using Smith-McIntyre grab having a bite area of 0.2 m^2. The total number of species of amphipods recorded was 44 belonging to 29 genera and 17 families. The number of species and abundance decreased from the shallower depths to the deeper depths. The abundance varied from 1 to 467 nos./0.2 m^2. The maximum was found in Cheyyur transect at 30 m depth and the minimum in Cheyyur at 150 m and in Cuddalore-SIPCOT at 200 m depth. The number of species at various depths ranged from 1 to 17. While the maximum number of species was found in Cheyyur at 30 m depth, the minimum was found in Cheyyur at 150 m, Cuddalore-SIPCOT at 200 m and Cuddalore-Parangipettai at 150 m depths. *Ampelisca* spp. was found to be dominant in the study area. Species estimators, especially Chao1 showed the chances of recording as many as 142 species of amphipods in the study area with intensive sampling. In view of this fact, further sampling in the study area will throw more light on the amphipod diversity.

Keywords: *Amphipod, diversity, continental shelf, southeast coast, sediment.*

Introduction

The Amphipoda comprises a group of small to medium-sized peracarid crustaceans that are widely distributed world over in marine, brackishwater, freshwater and terrestrial environments. Amphipods form an important food item for fishes and other organisms (Nair *et al.,* 1973). The amphipods come under four suborders namely Gammaridea, Hyperiidea, Caprellidea and Ingolfiellidea, among which Gammaridea is the most dominant group including 5700 species embraced in 1060 genera (Barnard and Karaman, 1991).

In Indian waters Gravely (1927) and Raj (1927) studied the amphipod fauna of Krusadai Islands in the Gulf of Mannar, the former dealt with gammarids and the latter with caprellids. Their studies however were brief mentioning the occurrence of about 17 species. Barnard's (1935) contribution on the brackish water gammarid amphipods based on the collections made by the Zoological Survey of India from Tamil Nadu, Andhra Pradesh and Bengal besides others is commendable. Investigations by Walker (1905), Stebbing (1907), Tattersall (1912, 1925), Chilton (1920, 1921), Stephensen (1931), Nayar (1950, 1956, 1959), Pillai (1954, 1957, 1961) and John (1955) dealt with the amphipods collected from the coastal areas of Bengal, Chilka lake, Visakhapatnam and Madras.

Venkataraman and Wafer (2005) reported the occurrence of 139 species of amphipods in the Indian seas. Several works are available on the diversity of amphipods (117 species) from the shallower waters in the east coast of India. However not much is known about the diversity of amphipods from the deeper depths i.e. from the continental edges (up to 200 m), slope (200-1000 m) and further down in the bathybenthic (up to 4000 m) and abyssobenthic regions (up to 6000 m depth). In view of the above fact, the present study was undertaken to study their diversity in the continental shelf area up to the shelf break (30-200 m) of the southeast coast of India.

Material and methods

The study area extends from Lat. 10° 34.03′ to 15° 14.48′ N and from Long. 79° 52.13′ to 80° 53.87′ E in the continental shelf region of southeast coast of India. Totally 84 samples were collected along 7 transects off Karaikkal, Cuddalore-Parangipettai, Cuddalore-SIPCOT (State Industries Promotion Corporation of Tamil Nadu), Cheyyur, Chennai, Tammenapatanam and Singarayakonda at the depths of 30 m, 50 m, 75 m, 100 m, 150 m and 200 m.

Benthic samples for the present study were collected onboard the FORV *Sagar Sampada* through Cruise Nos. 260, 275 and 290 conducted in December 2008, May 2010 and October 2011 respectively along the shelf region. The Smith - McIntyre grab having a bite area of 0.2 m^2 was used for collecting the samples from each depth.

The sediment samples were passed through 0.5 mm sieve with copious sea water. After sieving, the amphipods were carefully separated together with residual sediment if any, preserved in 5-7% formaldehyde, labeled and stored for further examination. In the laboratory the samples were washed again under tap water, added 5-7% formaldehyde containing Rose Bengal. Identification of amphipods was done following Lincoln (1979), Barnard and Karaman (1991) and Lyla *et al.* (1998) as far as possible up to the species/ generic level under a binocular microscope.

Results

Forty four species of amphipods belonging to 29 genera and 17 families were identified from the sediment samples collected from the continental shelf area. Family Ampeliscidae was represented by 9 species, followed by Isaeidae with 6 species, families Lysianassidae and Aoridae with 4 species each and Gammaridae with 3 species (Table 1).

Table 1. List of amphipod species identified from the sediment of continental shelf area of southeast coast.

Families and amphipod species		
I.	**Family – Lysianassidae**	
	1.	*Ichnopus spinicornis*
	2.	*Lysianassa certaina*
	3.	*Lysianassa* sp.
	4.	*Nannonyx* sp.
II.	**Family – Ampeliscidae**	
	5.	*Ampelisca typica*
	6.	*Ampelisca brevicornis*
	7.	*Ampelisca diadema*
	8.	*Ampelisca spinifer*
	9.	*Ampelisca* sp. 1
	10.	*Ampelisca* sp. 2
	11.	*Ampelisca* sp. 3
	12.	*Byblis* sp.
	13.	*Haploops* sp.
III.	**Family – Hyalidae**	
	14.	*Hyale perieri*
	15.	*Hyale* sp.
IV.	**Family- Gammaridae**	
	16.	*Gammarus locusta*
	17.	*Gammarus salinus*
	18.	*Gammarus* sp.
V.	**Family- Melitidae**	
	19.	*Maera* sp.
	20.	*Melita* sp.
VI.	**Family- Haustoriidae**	
	21.	*Bathyporeia* sp.
	22.	*Urothoe* sp.
VII.	**Family- Oedicerotidae**	
	23.	*Oedicerotidae* sp.
VIII.	**Family- Phoxocephalidae**	
	24.	*Phoxocephalus* sp.
IX.	**Family- Liljeborgiidae**	
	25.	*Liljeborgia* sp.
X.	**Family- Calliopidae**	
	26.	*Calliopius* sp.
XI.	**Family- Dexaminidae**	
	27.	*Dexamine* sp.
XII.	**Family- Ampithoidae**	
	28.	*Ampithoe rubricata*
	29.	*Ampithoe* sp.
XIII.	**Family- Aoridae**	
	30.	*Aora typical*
	31.	*Aora* sp.
	32.	*Leptocheirus* sp.
	33.	*Microdeutopus* sp.
XIV.	**Family- Isaeidae**	
	34.	*Gammaropsis maculata*
	35.	*Gammaropsis* sp.
	36.	*Isaea elmhirsti*
	37.	*Isaea montagui*
	38.	*Isaea* sp.
	39.	*Photis* sp.
XV.	**Family- Corophiidae**	
	40.	*Corophium* sp.
XVI.	**Family- Iscryoceridae**	
	41.	*Ericthonius* sp.
	42.	*Ischryocerus* sp.
	43.	*Jassa* sp.
XVII.	**Family-Caprellidae**	
	44.	*Caprella* sp.

Species composition

Among the 44 species of amphipods identified, the most dominant species was *Ampelisca* sp.1 which constituted 20.9% of the total number of amphipods collected followed by *Isaea* sp. and *Ampelisca* sp.3 with percentage contributions of 8.89% and 7.95% respectively. *Gammarus* sp., *Ampithoe sp.,Hyale* sp.and *Leptocheirus* sp. constituted 5.89%, 5.89%, 5.5%, and 5.5%, respectively. The lowest contribution was by *Aora typica* which constituted 3.72% (Table 2).

Distribution

Species number

Transect-wise, the no. of species ranged from 16 to 23. While the maximum number of species was recorded in Tammenapatanam transect and Cheyyur transects, the minimum was in Cuddalore-Parangipettai transect.

The number of species decreased from the shallower depths to the deeper depths. The average number of species varied

Table 2. Top 10 species of amphipods in continental shelf area of southeast coast

Sl. No	Species name	Percentage contribution (%)
1	*Ampelisca* sp.1	20.9
2	*Isaea* sp.	8.89
3	*Ampelisca* sp.3	7.95
4	*Gammarus* sp.	5.89
5	*Ampithoe* sp.	5.89
6	*Hyale* sp.	5.50
7	*Leptocheirus* sp.	5.50
8	*Gammaropsis* sp.	5.45
9	*Ampelisca* sp.2	3.72
10	*Aora typica*	3.72

from 3.14±3.71 to 12.71±4.57. While the maximum number of species was found at 30m depth, the minimum was found at 150m depth.

Abundance

The total number of amphipods collected from the study area was 1798. Among the various transects covered Singarayakonda constituted 35.35% of the total number of amphipods collected followed by Cheyyur (28.21%). The lowest contribution was from Chennai (4.18%). Depth-wise, 30 m contributed 45.3% of the total followed by 75 m (20.17%), the contribution was the lowest at 200 m (2.99%). The abundance decreased from the shallower to the deeper depths. The average abundance varied from 0 to 156 nos./0.2 m^2 (Table 3). While the maximum was found in Cheyyur at 30 m depth, the minimum was found in Cuddalore- SIPCOT at 150 m depth.

The total number of amphipods collected during Cruise No. 260 was 438. Depth-wise the abundance ranged between 1 and 160nos./0.2 m^2. While the maximum was observed in Singarayakonda at 150 m depth, the minimum was observed in Karaikkal at 50 m,Cheyyur at 75m, Chennai at 150 m and Tammenapatanam at 150 m depth. In many samples collected from various depths no amphipod species was recorded. Transect-wise the abundance varied from 3 to 203. The maximum was recorded in Singarayakonda transect and the minimum in Cuddalore-SIPCOT transect.

During Cruise No. 275, the total number of amphipods collected from the study area was 477. Depth-wise, the abundance ranged between 1 and 192 nos./0.2 m^2. While the maximum was in Cheyyur at 30m depth, the minimum was in Cuddalore-SIPCOT at 200m depth. From depths such as Cheyyur 75 m, Cuddalore-SIPCOT 50 m, Parangipettai 75 m & 200 m and Karaikkal 150 m & 200 m no amphipod was recorded. Transect-wise the abundance varied from 27 to 254. The maximum was in Cheyyur transect and the minimum in Karaikkal transect.

During Cruise No. 290, the total number of amphipods collected from the study area was 913. The abundance ranged between 1 and 230 nos./0.2 m^2. While the maximum was in Cheyyur at 30 m depth, the minimum was in Cheyyur at 75 m & 150 m depths. In Chennai 75 m and Cuddalore- SIPCOT 150 m & 200 m depths no amphipod species was recorded. Transect-wise the abundance varied between 39 and 278. The maximum was in Cheyyur transect and the minimum in Cuddalore-SIPCOT transect.

Percentage composition - cruise-wise

During Cruise No. 260, the percentage contribution of 30m depth to the total number of amphipods collected was more (37.21%). It was followed by 150m depth with the contribution of 28.99%. Other depths such as 50, 75 and 100m contributed 12.55%, 10.95% and 5.93% respectively. The 200m depth contributed only 4.33%. Transect-wise, Singarayakonda contributed as much as 46.34% of the total number of amphipods collected. Tammenapatanam came next with the percentage contribution of 19.4% followed by Cheyyur, Chennai, Karaikkal, Cuddalore-Parangipettai and Cuddalore- SIPCOT (13.92%, 9.8%, 5.47%, 4.33% and 0.68% respectively).

Table 3. Depth-wise variation in the abundance of amphipods (nos/0.2m^2)of the continental shelf of southeast of India.

	30m	50m	75m	100m	150m	200m
Singarayakonda	48±57	19.33±18.55	11±10.53	14.33±21.45	47±64.86	6±6
Tammenampatanam	22.33±29.67	25.33±43.87	10±14.79	7±10.44	1.66±2.88	4.33±7.50
Chennai	10.66±12.22	5.33±6.11	2.33±4.04	5.33±7.57	2.33±2.51	3.33±5.77
Cheyyur	155.66±97.70	32.33±23.75	1±1	4.66±4.16	0.33±0.57	3.66±2.08
Cuddalore-SIPCOT	18.66±21.36	7.33±12.70	7.66±10.01	2±1.73	0±0	0.33±0.57
Cuddalore-Parangipettai	37.66±51.22	11.33±8.14	0.66±1.15	23.33±35.34	2.66±3.05	2.33±2.08
Karaikkal	24.33±15.50	4.66±3.05	6.66±6.50	2.33±2.08	2.33±2.08	1±1.73

During Cruise No. 275, the percentage contribution of 30m depth to the total number of amphipods collected was more (59.28%). It was followed by 100m depth with the contribution of 17.44%. Other depths such as 50, 75 and 200m contributed 15.43%, 5.81% and 1.56% respectively. The 150m depth contributed only 0.44%. Transect-wise, Cheyyur contributed as much as 56.82% to the number of amphipods collected. Cuddalore-Parangipettai came next with the percentage contribution of 23.37% followed by Cuddalore-SIPCOT and Karaikkal (14.76% and 6.04% respectively).

During Cruise No. 290, the percentage contribution of 30 m depth to the total number of amphipods collected was more (57.61%). It was followed by 50 m depth with the contribution of 21.13%. Other depths such as 100, 75 and 150m contributed 7.99%, 4.81% and 4.38% respectively. The 200 m depth contributed only 4.05%. Transect-wise, Cheyyur contributed as much as 30.44% to the number of amphipods collected. Singarayakonda came next with the percentage contribution of 25.62% followed by Tammenapatanam, Cuddalore-Parangipettai, Karaikkal, Chennai and Cuddalore-SIPCOT (13.91%, 12.59%, 7.99%, 5.14% and 4.27% respectively).

Diversity

The diversity values are given in Table 4. The diversity decreased with increase in depth. Margalef richness (d) index varied between 1.93 and 3.88. The higher value was observed at 30 m depth and the lower at 100 m depth. The Pielou's evenness (J') was in the range of 0.96- 0.99. While the maximum was found at 150 m & 200 m depths, the minimum was at 30 m &100 m depths. The Shannon-Wiener index (H'log2) ranged from 1.14 to 3.39. While the maximum was recorded at 30m depth, the minimum was at 150m depth. The values of Taxonomic diversity index (Delta) varied from 56.47 to 96.59. The higher value was recorded at 50 m depth and the lower at 150 m depth. The total taxonomic distinctness index (sDelta+) varied from 278.09 to 1219.6. While the maximum was recorded at 30 m depth, the minimum was at 150 m depth. Total phylogenetic diversity (sPhi+) index also showed the above trend and was in the range of 71.90 - 1033.33.

Discussion

In the present study, 44 species of amphipods were recorded in the southeast continental shelf of India. This is low compared to 113 species of amphipods reported by Marques and Santini (1993) from the Portuguese continental shelf region. However they covered the entire shelf region and collected samples up to the depth of 545 m. Brandt (1997) recorded 148 species of amphipods from the shelf down to deep Arctic Ocean (North East Polynya, Greenland sea and Iceland). Bryazgin (1997) who studied the distribution and ecology of benthic amphipods in Barents sea recorded 154 species. The depth sampled extended up to 550 m. Stransky and Brandt (2010) recorded 136 species of amphipods from the southern shelf of Greenland. The depth extended up to 260 m. Stransky and Svavarsson (2010) who sampled up to 170 m again from the same area reported the occurrence of 134 species. Richness (number of species) recorded in a particular area is a function of effort, sample size and area of coverage (Magurran, 2004). In the present study only the southeast continental shelf area was covered over three cruises. If the sampling is intensified then there are chances for recording more number of amphipod species as revealed by Chao1 which predicted the occurrence of 142 species (Table 5). As this measure is based on the abundance data (quantitative) and not presence/absence (qualitative) data, it is more reliable (Magurran, 2004).

Presently, the average abundance recorded was in the range of 0 - 156 nos./0.2 m^2. Varghese *et al.* (1996) found the average abundance to be 672/1000 m^2 in Andaman and Nicobar islands. Gasca and Morales (2004) reported an abundance of 240/1000 m^2 in the Mexican Carribbean Sea. The abundance recorded in the present study is thus found to be more than that of the above studies. However the abundance recorded presently was found to be lower than that of Freitas *et al.* (2010) in the continental shelf of Brazil (659/0.025-0.042 m^2). In the present study the amphipod abundance was found

Table 4. Diversity of amphipods in continental shelf area of southeast coast

Depths	S	N	d	J'	H'(log2)	Delta	sDelta+	sPhi+
30m	12.71±4.57	49.85±53.20	3.88±1.14	0.96± 0.02	3.39±0.82	95.25±3.83	1219.60±432.65	1033.33±341.56
50m	9.28±3.90	23.14±16.25	3.18±0.93	0.97±0.01	3.02±0.64	96.59±2.75	896.01±368.66	809.52±300.44
75m	4.28±2.69	9.57±7.52	2.09±0.52	0.97±0.01	1.82±1.02	82±36.32	410.15±254.16	633
100m	4.71±1.49	12.71±9.30	1.93±0.53	0.96±0.04	2.07±0.55	91.97±11.66	448.25±165.64	438.09±148.35
150m	3.14±3.71	12.57±27.14	1.94±0.81	0.99±0.009	1.14±1.30	56.47±52.85	278.09±375.08	280.95±291.13
200m	3.71±2.05	5±3.82	2.06±0.49	0.99±0.008	1.62±0.97	85.79±37.41	350.95±223.52	71.90±190.23

S=Number of species; N=Total number of organisms;d=Margalef richness; J'=Pielou's evenness; H'(log2)=Shannon diversity calculated using logarithmic base 2; Delta=Taxonomic diversity; sDelta+=Total taxonomic distinctness index; sPhi+=Total phylogenetic diversity index

Table 5. Species estimators for amphipods sampled from the continental shelf region of southeast coast of India

Samples	Sobs	Chao1	Chao2	Jacknife1	Jacknife2	Bootstrap	MM	UGE
1	6.19	9.65	6.19	6.19	6.19	6.19	5.55	6.31
2	10.59	17.12	29.55	14.92	14.92	10.59	9.98	10.70
3	13.94	21.85	33.71	20.50	23.23	13.94	13.59	14.00
4	16.56	25.23	35.25	24.34	28.15	16.56	16.59	16.62
5	18.87	28.42	38.19	27.62	32.20	18.88	19.13	18.80
6	20.82	31.34	40.28	30.22	35.27	20.83	21.30	20.66
7	22.45	33.25	42.70	32.36	37.79	22.47	23.18	22.28
8	23.86	34.72	43.13	34.01	39.46	23.90	24.82	23.72
9	25.23	36.68	43.09	35.71	41.27	25.32	26.27	25.02
10	26.32	37.93	43.79	36.94	42.46	26.47	27.56	26.20
11	27.42	39.85	44.61	38.19	43.78	27.64	28.71	27.28
12	28.29	41.60	45.45	39.13	44.75	28.59	29.74	28.28
13	29.17	43.41	47.24	40.12	45.81	29.58	30.67	29.20
14	30.05	44.80	47.79	41.14	46.86	30.59	31.52	30.07
15	30.86	46.21	48.35	42.09	47.91	31.54	32.30	30.88
16	31.62	48.20	49.73	43.00	48.98	32.45	33.01	31.64
17	32.37	50.62	49.90	43.82	49.83	33.35	33.66	32.36
18	33.09	53.20	50.91	44.68	50.84	34.24	34.26	33.05
19	33.78	54.68	52.03	45.48	51.80	35.11	34.82	33.70
20	34.42	57.01	52.77	46.27	52.76	35.93	35.34	34.33
21	34.99	59.04	54.08	46.98	53.67	36.70	35.82	34.93
22	35.53	61.05	54.67	47.53	54.24	37.42	36.27	35.50
23	36.07	63.07	54.94	48.14	54.89	38.15	36.69	36.06
24	36.61	65.37	55.69	48.79	55.65	38.89	37.08	36.59
25	37.08	66.55	56.61	49.35	56.35	39.56	37.45	37.11
26	37.61	69.09	57.08	50.00	57.12	40.30	37.80	37.60
27	38.07	71.16	57.59	50.58	57.79	40.98	38.13	38.09
28	38.52	73.02	57.81	51.12	58.41	41.64	38.44	38.56
29	38.95	74.59	58.02	51.64	59.01	42.28	38.73	39.01
30	39.41	77.09	58.64	52.22	59.69	42.95	39.01	39.46
31	39.89	79.68	58.92	52.80	60.32	43.64	39.27	39.89
32	40.32	81.73	59.38	53.35	60.92	44.30	39.52	40.31
33	40.70	85.00	59.11	53.75	61.27	44.87	39.76	40.72
34	41.13	87.51	59.26	54.28	61.83	45.53	39.99	41.12
35	41.49	90.28	59.32	54.69	62.24	46.09	40.20	41.51
36	41.87	94.60	59.45	55.14	62.72	46.68	40.41	41.89
37	42.29	99.40	59.59	55.65	63.26	47.32	40.61	42.26
38	42.69	106.26	59.84	56.14	63.78	47.94	40.79	42.62
39	43.05	111.84	59.78	56.54	64.16	48.51	40.98	42.98
40	43.37	121.10	59.87	56.91	64.53	49.03	41.15	43.33
41	43.72	130.33	60.18	57.35	65.06	49.60	41.31	43.67
42	44.00	142.00	60.33	57.67	65.43	50.07	41.47	44.00

low in the Chennai and Cuddalore-SIPCOT. It is attributed to disturbance to biota in these areas. In the Cuddalore-Parangipettai region, the industrial development is fast. The SIPCOT (State Industries Promotion Council of India) has 45 odd chemical and pharmaceutical industries which discharge treated and untreated effluents which are finding their place to the shelf waters. This may be the reason for the low abundance of amphipods here. Previous study done (Ajmal Khan *et al.,* 2010) in Cuddalore-Parangipettai area on the epifauna showed low number of species in the SIPCOT

region which was indicative of the stress here. Due to stress, Simpson dominance index was found high and other diversity indices (Shannon, Margalef etc.) were low.

Shanmugam *et al*. (2007) who assessed the levels of coastal marine pollution of Chennai waters reported high levels of pollution there. The major activities that are responsible for coastal pollution in Chennai are discharge and disposal of untreated and industrial wastes, discharges of coolant waters, harbours activities such as dredging, cargo handling, dumping of ship wastes, spilling of cargo's chemicals and metal ores, fishing activities etc. (Anon, 2005). There are 14 major industries located in the Ennore-Manali areas. The industries at Manali and Ennore are mostly chemical based, manufacturing petro chemicals, fertilizers, pharamaceuticals, paints etc. There are two power plants at Ennore, namely Ennore Thermal Power Plant with a production capacity of 200 MW and North Chennai Thermal Power Plant with a production capacity of 600 MW. The fly ash is continuously deposited in the sea. The industries at Ennore - Manali are using a wide variety of raw materials and discharge waste products into air, water or land as gaseous emissions, liquid effluents and sludge, respectively. Impairment of the coastal habitats here is attributed as the reason for low amphipod abundance (the lowest contribution of 4.18% to the total number of amphipods collected was from this transect).

Marques and Bellan-Santini (1993) reported that out of 113 amphipod species, 46 species were found in medium to fine sand bottom. Marques and Bellan Santini (1993), Bellan Santini and Dauvin (1997) and Conlan *et al*. (2008) also found more number of species in medium to fine sand bottom. In the present study also more number of amphipod species was found in Cheyyur where the bottom is sandy.

Marques and Santini (1993) who recorded 113 species from Portuguese continental shelf, found *Ampelisca* spp. to be dominant. In the present study also *Ampelisca* sp. was found dominant. Brandt (1997) who recorded 288 species in the shelf of East Greenland and Ingole *et al*. (2009) who recorded 16 species of amphipods along the central west coast of India also made similar observations.

Amphipods constitute an important food source for fishes. Although demersal fishes are able to adapt their diet to the available prey, they feed primarily on macrobenthic fauna, especially amphipods, with polychaetes and bivalves being taken as secondary prey items. At least in the shelf sediments, they could be expected to play a vital role in the diet of many secondary consumers. The importance of amphipods as a nutritional resource appears to be due to the combined secondary production of several co-inhabiting species (Bellan-Santini and Dauvin, 1988), although inter specific interaction seems to be relatively limited.

In the present study, the abundance, number of species and diversity decreased, with increase in depth. Sanders *et al*. (1965) stated that in the deep sea peracarid crustaceans become proportionally more common and the amphipod become rarer. The present study has been made in the southeast shelf region of India only. Such studies carried out in the entire continental shelf of both the coasts of India besides the Andaman and Nicorbar islands so also Lakshadweep will help us to get comprehensive information on the diversity of amphipods in the continental shelf area of India.

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