Available online at www.pelagiaresearchlibrary.com

Pelagia Research Library

Advances in Applied Science Research, 2013, 4(6):249-255

Pelagia Research Library

ISSN: 0976-8610
CODEN (USA): AASRFC

Diversity of Invertebrate trawl by catch off Mallipattinam, Sathubavasatherum, Memesal, southeast coast of India

P. Prabhu, U. Balasubramanian and S. Purushothaman

PG and Research Department of Zoology and Biotechnology, A. V. V. M. Sri Pushpam College, (Autonomous) Poondi, Thanjavur District, Tamil nadu

---

ABSTRACT

Invertebrate by-catch diversity was studied in the inshore waters of (5- 35m depth) of Mallipattinam, Sathubavasamuthrum and Memesal during Feb 2010 – Jan 2011. In the present study, brachyuran crabs, shrimps, stomatopods, cephalopods, gastropods, bivalves, echinoderms and jellyfish were recorded. Altogether 67 species of invertebrates in Mallipattinam, Sathubavasathrum and 76 in Memesal were recorded during the study period. The percentage compositions of invertebrates were calculated. Diversity indices calculated showed variation of the different station. Shannon-Weiner diversity index ranged from 2.035 to 4.776; Margalef's richness index was ranged from 2.306 to 6.782; Pielou's evenness index varied from 0.488 to 0; taxonomic diversity varied from 0.488 to 0.957 and total phylogenetic diversity ranged from 733.33 to 1716.8, indicated different level of ecological state of the different station and different months.

Keywords*:* Invertebrates, Trawl by-catch, Diversity, Origin

INTRODUCTION

India has a vast extent of coast line of about 8,000 km spanning 13 maritime states and Union Territories, which are home to a variety of coastal and marine ecosystems, comprising nationally and globally significant biodiversity (Venkataraman and Wafar, 2005). It also supports almost 30% of its human population being dependent on the rich exploitable coastal and marine resources.

The incidental catch of non-target species (bycatch) represents 40.4% of the total marine catch (Davies *et al*., 2009). Kelleher (2005) estimated the fishery discards at more than 7 million tonnes, of which 27% contributed by shrimp trawl fisheries. The bottom trawl fisheries, particularly those of crustaceans, are characterized by selectivity problems due to the diversity of species affected. Although the by catches are generally unavoidable it is possible to quantify the by catch and identify marine by catch species for effective reduction of fishery discards (Kennelly and Broadhurst, 2002).

In recent years there has been increasing interest in potentially wider impacts of commercial fishing including changes to habitats and effects on non-target species (Parsons, 1992; Alverson *et al*., 1994; Dayton *et al*., 1995). Particular concerns have been raised with regard to bottom trawling where intensive fishing may result in significant alterations to the benthic environment and associated communities (De Groot, 1984; Hutchings, 1990; Messiah *et al*., 1991; Jonnes, 1992).

Macro invertebrates especially molluscs, crustaceans, echinoderms play an important ecological role in interacting actively with other species and therefore influencing benthic community structure (Venkataraman and Wafar, 2005; Bijukumar, 2008; Wafer *et al*., 2011). Species assemblages depend greatly on resource availability and on the distance to other populations (Woodward and Kelly 2002; Mark Zimmermann, 2006).

Most of these previous studies focused on the specific groups such as molluscs (Victor and Lazarus, 2000; Appukuttan, 2008; Babu *et al*., 2010; Venkatesan *et al*., 2010), decapod crustaceans (Ajmalkhan *et al*., 2005; Ravichandran *et al*., 2007; Bijukumar, 2007), echinoderms (Balaji *et al*., 2007; James, 2008).

Considering the problems associated with commercial trawl fishing on marine benthic biota and the lacunae exist in this line, the present survey was made to study the diversity of invertebrates caught in trawls at selected landing centers along the three stations.

MATERIALS AND METHODS

Samples were collected by monthly intervals from the trawl by catch operated in inshore waters of (5 – 35m depth) Mallipattinam, Sathubavasathrum and memesal, Southeast coast of India during October 2011 to September 2012. The samples were collected visual census method. The invertebrates collected were preserved in 5-8% neutralized formalin. Later the specimens were examined using various morphological characters for identification. Each invertebrate species in the trawl bycatch was identified up to species level using field guide and standard books (Antony Fernando and Oliva Fernando, 2002 and Chhapgar, 2005). The data were approached to various diversity indices such as Shannon-Weiner index, Margalef richness, Piolou's evenness, taxonomic diversity and total phylogenetic diversity using PRIMER (version 6.1.5) and ORIGIN 6.0 statistical software.

RESULTS AND DISCUSSION

In the present study, nine invertebrate taxa namely cnidarians (scyphozoa), crustaceans (shrimps, brachyuran crabs, stomatopods), molluscs (gastropods, bivalves, cephalopods), and echinoderms (echinoidea, asteroidea) were recorded in the trawl bycatch altogether 84 species were recorded in three areas. Of 84 species, 36 species were gastropods, 17 were bivalves, 6 cephalopods, 13 crabs, 5 shrimps, 2 species each were stomatopods, echinoids, asteroids and 1 scyphozoans. In Mallipattinam coastal waters 66 species were recorded. Among 66, 29 species belonged to gastropods, 14 to bivalves, 5 to cephalopods, 7 to brachyuran crabs, 5 to shrimps, 2 each to stomatopods, echinoidea, 1 each to asteroideas, and 1 scyphozoans were recorded. In Sathubavasathram coastal waters 75 species were found. Of 75, 30 were gastropods, 16 were bivalves, 6 were cephalopods, and 12 were brachyuran crabs, 5 shrimps, 2 echinoides, 2 asteroides, and 1 scyphozoans. At Memesal 76 species were enumerated, which consisted 33 species of gastropods, 17 bivalves, 6 cephalopods, 9 brachyuran crabs, 5 shrimps, 1 stomatopod, 2 echinoids, 2 asteroids, 1 scyphozoan. Numerically, 66 species belonging to 32 families and 44 genera, 74 species belonging to 40 families and 51 genera and 75 species belonging to 38 families and 49 genera were recorded from Mallipattinam , Sathubavasathram and Memesal coastal waters respectively (Table 1). In the present study gastropods were recorded dominant group in three coastal waters. Such a preponderance of gastropods in invertebrate samples was reported earlier by Venkataraman, (2005; Tissot, 2006; Daminnidis *et al*., 2007). A variation in number of species and their composition was noticed among all the three sites.

Bijukumar (2008) recorded 534 species of invertebrates, among them higher number was contributed by molluscs (134 species). Similarly in the present study, among 84 species of invertebrates recorded, 53 species belong to molluscs.

Architectonica perspectiva, Babylonia spirata spirata, B. zeylanica, Bursa spinosa, Chicoreus ramosus, Conus amadis, Ficus ficus, Harpa conoidalis, Hemifusus cochlidium, H. pugilinus, Murex tribulus, M. trapa, Natica didyma, Tonna dolium, Turritella attenuata, T. acutangula and *Umbonium vestiarium,* in gastropods; *Anadara inequivalvis, A. rhombea, Meretrix casta, M. meretrix, Paphia malabarica, P. textile, Perna indica, P. viridis, Placenta placenta* and *Saccostrea cuculata,* in bivalves; *Loligo duvauceli, Octopus areolatus, Sepia aculata, Sepiella enermis* in cephalopods; *Calappa lophos, Podophthalamus vigil, Portunus sanguinolentus, Charybdis feriatus, C. hablites,* in brachyuran crabs; *Penaeus indicus, P. monodon, Metapenaeus affinis, M. dobsoni,* in shrimps and *Salmasis bicolor, Astropecten indicus,* in echinoderms were found to be common in three stations during the study period.

Table – 1. Invertebrates recorded in three stations

Family/Species	Mallipattinam	Sathubasathram	Memesal
Cnidaria			
Ulmaridae			
Aurilia solida	17	14	8
Shrimps			
Penaeidae			
Penaeus indicus	235	48	80
P. monodon	27	20	53
Metapenaeus affinis	46	29	31
M. monoceros	35	20	12
M. dobsoni	49	27	68
Brachyuran crabs			
Calappidae			
Calappa lophos	103	61	38
Portunidae			
Charybdis feriatus	22	6	17
C. granulata	-	10	-
C. hablites	4	9	1
C. lucifera	17	-	27
C. truncata	-	3	4
Podophthalmus vigil	-	31	31
Portunus pelagicus	25	18	-
P. sanguinolentus	52	25	37
Thalamita creneta	10	2	-
Dorippidae			
Dorippe facchino	-	4	9
Leucosiidae			
Philyra scabriuscula	-	2	1
Stomatopods			
Squillidae			
Harpiosquilla indica	15	27	53
Squilla mantis	5	-	-
Gastropods			
Architectonicidae			
Architectonica perspectiva	1	1	5
Buccinidae			
Babylonia spirata spirata	9	13	17
B. zeylanica	16	14	15
Bursa rana	-	5	5
B.spinosa	26	13	3
Muricidae			
Chicoreus ramosus	26	13	3
Conidae			
Conus amadis	1	5	5
C. inscriptus	-	4	1
C. betulinus	1	-	3
Ficidae			
Ficus ficus	13	13	25
F. gracilis	1	-	10
F. subintermedius	-	3	-
Fasciolaridae			
Fusinus longicaudatus	2	2	1
Harpidae			
Harpa conoidalis	5	4	6
Melongenidae			
Hemifusus cochlidium	19	25	21
H. pugilinus	16	10	15
Turridae			
Lophiotoma indica	2	10	2
Turricula javana	3	3	8
Muricidae			
Murex ternispina	4	3	2
M. trapa	4	5	7
M. tribulus	16	10	25

M. virgineus	4	-	2
Nassaridae			
Nassarius dorsatus	3	7	2
Natica didyma	1	6	17
N. macrochiensis	-	2	-
N. tigrina	4	6	11
Fasciolaridae			
Pleuroploca trapezium	14	7	3
Cassidae			
Phalium canaliculatum	-	-	5
Naticidae			
Rapana bulbosa	-	1	6
Tonnidae			
Tonna dolium	12	6	6
T. sulcosa	-	1	3
Turbinellinae			
Turbinella pyrum	-	-	4
Turritellidae			
Turritella turitella	6	-	-
T. acutangula	23	9	8
T. attenuata	15	8	28
Trochidae			
Umbonium vestiarium	2	12	7
Bivalves			
Arcidae			
Anadara inequivalvis	38	19	21
A. granosa	5	16	1
A. rhombea	17	-	2
Cardiidae			
Cardium setosum	7	9	13
Cucullaeidae			
Cucullaea cucullata	-	3	3
Ostreidae			
Crassostrea madrasensis	-	10	5
Donacidae			
Donax cuneatus	-	3	5
Veneridae			
Katelysia opima	19	6	6
Meretrix casta	10	6	1
M. meretrix	16	2	4
Paphia malabarica	4	1	12
P. textile	3	3	12
Pectinidae			
Pecten tranquebaricus	2	1	2
Mytilidae			
Perna indica	2	8	4
P. viridis	5	7	3
Placunidae			
Placenta placenta	15	11	8
Ostreidae			
Saccostrea cucullata	3	3	7
Cephalopods			
Octopodidae			
Hapalochlaena fasciata	-	7	11
Octopus areolatus	144	78	20
Loligonidae			
Loligo duvauceli	154	244	35
Sepiidae			
Sepia aculeata	18	11	3
S. pharonis	3	2	14
Sepiella enermis	3	3	11
Echinoderms			
Astropectinidae			
Astropecten indicus	3	4	3
Goniasteridae			
Stellaster incei	2	3	16

Temnopleuridae			
Salmasis bicolor	5	9	12
Salmasis virgulata	-	2	8

The percentage composition of invertebrates recorded in three stations is shown in Figs. 2-4. In Mallipattinam, brachyuran crabs were found to be the dominant group by constituting 37% of the total invertebrates recorded. Cephalopods formed second dominant group with a percentage of 35%; shrimps formed third dominant group with 10%; gastropods, echinoderms, bivalves, stomatopods and cnidarians came next in the order with a percentage contributions of 6%, 5%, 3%, 3%, 1% respectively

In Mallipattinam in Sathubavasathram, brachyuran crabs topped the list with a percentage of 46%; cephalopods ranked second with 31%; gastropods formed third dominant group with 7%; shrimps, echinoderms, bivalves, stomatopods and cnidarians came next in the order with 6%, 4%, 3%, 2%, 1% respectively to the total invertebrates
With respect to Memesal, as in Mallipattinam, gastropods were dominant group with a percentage of 29%. Shrimps were found to be the second dominant group with a percentage contribution of 24%. Brachyuran crabs formed third dominant group with a percentage of 17%. Bivalves, cephalopods, stomatopods, echinoderms, and cnidaria came next in the order with a percentage contribution of 11%, 9%, 5%, 4%, 1%, respectively to the total Invertebrates bycatch

Species composition of invertebrate organisms in the present observation showed numerical dominance in the order of molluscs (gastropods, bivalves and cephalopods), crustacean (brachyuran crabs, shrimps and stomatopods) and others, as was observed earlier by Bastida *et al*, (1992), Bremec and Roux, (1997), Klein *et al*, (2001).

Mallipattinam, the no of species ranged from 12 to 28 with minimum during June and maximum during December; number of organisms was ranged from 74 to 281 with minimum during the month February and maximum during the month March. The Shannon – Weiner index ranged between 2.691 to 4.277 with minimum during March and maximum during June; the evenness index varied from 0.594 to 0.943 with minimum during March and maximum during August. The species richness was ranged from 2.306 to 5.802 with minimum during December and maximum during June; the taxonomic diversity varied from 59.44 to 81.78 during June and maximum during March; total phylogenetic diversity ranged from 733.3 to 1783.3 during December and maximum during June.

In Sathubavasathram, the no of species ranged from 13 to 28 with minimum during July and maximum during January; number of organisms ranged from 39 to 195 with minimum during April and maximum during January; the Shannon – Weiner index ranged from 2.035 to 4.216 with minimum during October and maximum during February. The evenness index varied from 0.488 to 0.955 with minimum during February and maximum during July. The species richness was ranged from 3.175 to 5.120 with minimum during November and maximum during January. The taxonomic diversity varied from 45.08 to 81.68 with minimum during January and maximum during October and total phylogenetic diversity ranged from 883.3 to 1516.7 with minimum during July and maximum during January.

In Memesal, the no of species ranged from 16 to 32 with minimum June and maximum during February; number of oranisms varied from 41 to 148 with minimum during June and maximum during December. The Shannon – Weiner index ranged from 3.501 to 4.776 with minimum during June and maximum during February; the evenness index varied from 0.827 to 0.957 with minimum during December and maximum during October. The species richness ranged from 4.039 and 6.782 with minimum during June and maximum during April; the taxonomic diversity varied from 69.34 to 83.53 with minimum during December and maximum during July and total phylogenetic diversity ranged from 1033.3 to 1716.7 with minimum during June and maximum during February.

Among the regions, the species count (Fig. 2a) was at the maximum (33) in Memesal during April and minimum (12) in Mallipattinam during December. The maximum number of organisms (Fig. 2b) was 281 (Mallipattinam, March) and the minimum was 41 (Memesal, June). The Shannon–Wiener index (Fig. 2c) ranged between 2.035 (Sathubavasathram, March) and 4.776 (Memesal, February). The species richness (Margalef's d) (Fig. 2d) was ranged between 2.306 (Mallipattinam, December) and 6.782 (Memesal, April). The evenness component (J') (Figs. 2e) varied from 0.488 (Sathubavasathram, February) to 0.957 in (Memesal, October). The taxonomic diversity (Fig. 2f) varied from 45.08 (Sathubasathram, February) to 83.53 in (Memesal, June). The total phylogenetic diversity (Fig. 2g) ranged between 733.33 (Mallipattinam, December) and 1716.8 (Memesal, February).

Generally, in a healthy environment margalef richness index is higher in the range of 2.5 – 3.5 (Khan *et al*., 2004). In the present study, Margalef richness index ranged from 2.3 – 6.7 from different sites indicating the rich diversity in these organisms areas. The maximum evenness index was recorded in Pazhayar coastal water. Among the stations, maximum (4.776) diversity was recorded in Memesal coastal waters compared to Mallipattinam and Sathubasathram. This might be due to more number of trawlers operated and also nature of the substratum, which favors colonization of more benthic invertebrates in that region. Similar findings were reported earlier by Gustavo Riestra *et al*. (2006) and Tonks *et al*. (2008) in Northwestern Australia.

In conclusion, the present study compared to the three stations, Sathubavasathram and Memesal showed more invertebrate diversity than Mallipattinam. Brachyuran crab was the dominant class in Mallipattinam and Sathubavasathram, and with respect to Memesal, as oddity gastropods were dominant class and cnidarians was the least class in all the stations. The community structure is varied along the study areas it seems that habitat type has a strong influence on the distribution, abundance and diversity of all the invertebrates.

REFERENCES

[1] Ajmal khan, S., Raffi, S. M. and Lyla, P. S. **2005**. *Curr. Sci*, 88(8): 1316-1324.
[2] Alverson, D. L., Freeberg, M. H., Murawski, S. A. and Pope, J. G. **1994**. *Fish. Tech. Pap*, 233-339.
[3] Antony Fernando, S. and Olivia J. Fernando. **2002**. A field guide to the common invertebrates of the East coast of India. Annamalai University, India, 258 pp.
[4] Appukuttan, K. K. **2008**. Molluscan biodiversity and resource conservation. Glimpses of aquatic biodiversity- *Rajiv Gandhi chair spl. Pub*., 7: 103-110.
[5] Babu, A., Kesavan, K., Annadurai, A. and Rajagopal, S. **2010**. *J. Mar. biol. assoc. UK*, 3 e61; 1-5.
[6] Balaji, K., Thirumaran, G., Arumugam, R., Kumaraguruvasagam, K. P. and Anantharaman, P. **2007**. *J. Fish. Aqua. sci*, 328-336.
[7] Bastida, R., Roux, A. and Martinez, D. **1992**. *Oceanologica Acta*, 15 (6): 687 - 698.
[8] Bijukumar, A. **2008**. Biodiversity of trawl bycatch in Kerala coast, south Indian. *In:* Natarajan, P., Jayachandran, K. V., Kannaiyan, S., Ambat, B. and Augustine, A. (Eds.) *Glimpses of Aquatic Biodiversity, Rajiv Ganthi Chair Spec. Publ*. 7, Cochin University of Science and Technology, Kochi, 236-243.
[9] Bijukumar, A., Sushil kumar, M., Raffi, S. M. and Ajmal khan, S. **2007**. *Indian J. Fish.*, 54(3): 283-290.
[10] Bremec, C. and Roux, A. **1997**. *Fish. Res. and Develop. Jour*, 11: 153 - 166.
[11] Chhapgar, B. F. **2005**. Marine life in India. Oxford University Press. India. P 337.
[12] Damianidis, P., Fryganiotis, K. and Chintiroglou, C. **2007**. *Rapp. Comm. Int. Mer. Medit*, 38.
[13] Davies, R. W. D., Cripps, S. J., Nickson, A. and Porter, G. **2009**. *Mar. Pol*, 33. 661-672.
[14] Dayton, P. K., Thrush, S. F., Agardy, M. T. and Hofman, R. J. **1995**. *Mar. Fresh. Wat. Ecosys*, 5: 205-232.
[15] De Groot, S. J. **1984**. *Oce. Manag*, 9: 177-190.
[16] Gustavo Riestra., Juan Pablo Lozoya., Graciela Fabiano., Orlando Santana, and Daniel Carrizo. **2006**. *Pan-Ameri. J. Aqua. Sci*, 1 (2): 104-113.
[17] Hutchings, P. **1990**. *Aust. J. Mari. Fresh. Res*, 41: 111-120.
[18] James, D. B. **2008**. Indian echinoderms: Their resources, biodiversity, zoogeography and conservation. Glimpses aquatic biodiversity – *Rajiv Ganthi chair. spl. pub*, 7: 120 – 132.
[19] Jones, J. B. **1992**. *J. Mar. Fresh. Res*, 26, 59-67.
[20] Kelleher, K. **2005**. *FAO Fish. Tech. Pap*, 470, 131pp.
[21] Kennelly, S. J. and Broadhrust, M. K. **2002**. *Fish. Fish*, 3,340-355.
[22] Khan, S. A., Murugesan, P., Lyla, P. S. and Jayanathan, S. **2004**. *Curr. Sci*, 87, 1508-1510.
[23] Klein, J., Borzone, C. and Pezzuto, P. **2001**. *Amer. J. Aqua. Sci*, 23: 17- 26.
[24] Mark Zimmermann, **2006**. *Contine. Shelf. Res*, 26.
[25] Messieh, S. N., Rowell, T. W., Peer, D. L. and Cranford, P. J. **1991**. *Contine. Shelf. Res*, 11: 1237-1263.
[26] Parsons, T. R. **1992**. *Mar. Pollu. Bullet*, 25: 51-53.
[27] Ravichandiran, S., Anthonisamy, S., Kannupandi, and Balasubramanian, T. **2007**. *J. Fish. Aqua. Sci*, 2(1): 47-55.
[28] Tissot, N., Yoklavich, M., Milton Love S., York, K. and Amend, M. **2006**. *Scientific Editor. Fish. Bull*, 104:167–181.
[29] Tonks, M. L., Griffiths, S. P., Heales, D. S., Brewer, D. T. and Dell, Q. **2008**. *Fish. Res*, 89: 276–293.
[30] Venkataraman, K. and Mohideen Wafar. **2005**. *Ind. J. mar. sci*, 34(1): 57-75.
[31] Venkatesan, V., Kalidas, C., Zach aria, P. U. and Raj agopal, S. **2010**. *AES. B.FLUX*, 2(2) 113-119.

[32] Victor, A. C. C. and Lazarus, S. **2000**. *Proc. Not. Sem. Mor. Inr. Biodive*, No. 3:42-50.
[33] Wafar, M., Venkataraman, K., Ingole, B., Ajmal Khan, S. and LokaBharathi, P. **2011**. *PLoS ONE,*6(1): e14613.
[34] Woodward, F. I. and Kelly, C. K, **2002**. Why species are not more widely distributed. Physiological and environmental limits. in: Blackbourn T. M. and Gaston K. J. (Eds) Macroecology: Concepts and Consequences. *Blackwell Publishing, pp* 239-255.