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Marine Ornamental Invertebrate Resources of Parangipettai Coastal Waters (South East Coast of India)

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Abstract: The present study was carried out an marine ornamental invertebrate's resources of Parangipettai coastal waters during the month of March-August 2006, which revealed the occurrence of 28 species of marine ornamental invertebrates belonging to 4 phyla. From this the species diversity was high during the month of April and May and it was decreased in March. The most abundant species recorded during the study period was fiddler crab *Uca annulipes*, while sea star *Ludia maculata* was very least in their abundance.

Key words: Marine ornamental invertebrates, resources, diversity indices, species richness, evenness

INTRODUCTION

India is consecrated with a rich biodiversity and a high degree of endemism in hot spot areas (Anna Mercy, 2002). India has a long coastline of about 8129 km with varieties of commercially important marine ornamental fishes. The Gulf of Mannar, Gulf of Kutch, Andaman, Nicobar and Lakshadweep Islands are very potential areas with highly valuable marine ornamental fishery resources for the collection and utilization. The marine fish and invertebrate resources from the Andaman and Nicobar Islands and Lakshadweep are reported to be the richest in Asia. More than 500 species of invertebrates are available in these islands (Ramachandran, 2002).

In recent years, researchers, traders, collectors and hobbyist have began a world wide effort minimize the growing pressure on natural populations of marine ornamental species and to promote the sustainable use of these highly valued resources (Corbin, 2001). The tropical species of the genus *Lysmata*, *Periclimenes*, *Hymenocera* and *Stenopus* have received special attention, mainly due to their growing demand in the aquarium trade industry (Fiedler, 1994; Fletcher *et al*., 1995; Palmtag and Holt, 2001; Lin *et al*., 2001).

Apart from fin fishes, a wide range of invertebrates are found good to be kept in captivity. These include shrimps, sea anemones, starfishes and tubeworms that make their home on and around the rocks and corals alternatively, we can keep invertebrates alone in an aquarium so as to protect them from the unwelcome attentions of predatory fishes, which allow us to study their lifestyles more easily. Most tropical invertebrates are magnanimously beautiful and attract the viewer's attention with fascinating behavior patterns (Mills, 1987).

Majority of marine invertebrate resources encountered in the warm seas of the world are more colourful. Information on marine ornamental invertebrate resources is important for an aquarist who wishes to establish an effective invertebrate aquarium. Studies on ornamental invertebrate's resources

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are not available globally. Calado *et al.* (2003) studied only the resources of marine ornamental decapods and its popularity, in global ornamental trade. Information about ornamental invertebrate resources is helpful to biologist, aquarium traders and hobbyists. In this backdrop, this study explores the marine ornamental invertebrate resources of Parangipettai coastal waters, southeast coast of India.

MATERIALS AND METHODS

Description of the Study Area

In the present study, an extensive survey of ornamental invertebrates has been made from the Parangipettai coastal waters and Vellar estuary (Latitude 11°29' N, Longitude 79°46' E), Southeast coast of India (Fig. 1). The Vellar estuary viz., located at Parangipettai which is one of the fertile estuary in Tamil Nadu. Nearly 1.5 km upstream from the mouth at the tidal zone and in the northern bank of the estuary, a mangrove plantation covering an area of 10 ha was planted some 10 years back, by the Center of Advanced Study in Marine Biology. Being a tidal and bar built estuary, Vellar estuary has semi diurnal tides and the tidal flushing extends to a distance of about 10 km. The estuary is an open type with tidal the amplitude ranged from 1 to 1.5 m. The specimens were collected and recorded from the Annankoil landing center (Station I) and Vellar estuary (Station II) which was opposite to the Marine Biological Station.

The craft used for venturing to fishing grounds of Parangipettai coast are mostly indigenous, such as catamarans, fiber launches with lambardini engines, which are operated in sea and dugout canoes, which are employed in Vellar estuary. The gears employed are also mostly indigenous such as gillnets, trawlers, hooks, lines etc. in sea and mainly cast nets etc. in Vellar estuary. In Station I Annankoil landing center is a major landing center of the Parangipettai coastal regions. Fibre launches, catamarans and less number of dugout canoes catches are landed in this center. Many dugout canoes and less number of fiber launches catches are landed in Station II (Vellar estuary).

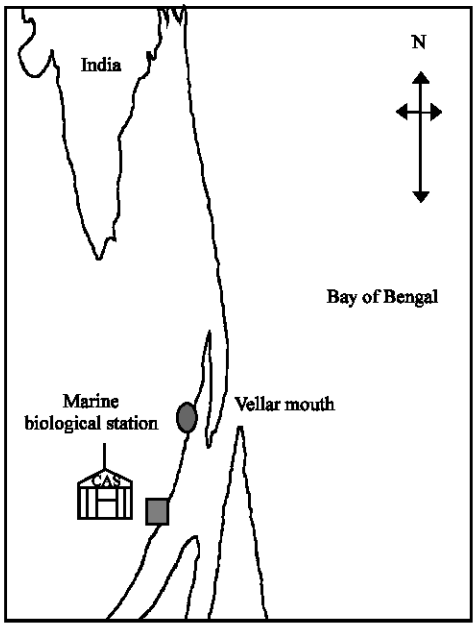

Fig. 1: The study area of Vellar estuary

Collection Procedure

The ornamental invertebrates were collected (5 collections/month) with the help of local fisher folk by the operation of trawl net in open sea through mechanized boat and by soft nylon cast net from canoes. Lobsters were collected by bottom gill net and hand picking method with the help of fishers (which was attached with the launches) (adopted from Jackman, 1974).

Good quality specimens of jellyfishes were collected by surface watching over open sea and estuary from the boat. On sighting a live jellyfish, plastic bucket WAS dipped under the jellyfish with some quantity of water and lifted up, this type of collection provided undamaged specimen (adopted from Jackman, 1974). Lepas were collected from different kinds of hard and soft floating substratum associated with by catches and entangled with the net. Green mussel *Perna viridis* attached with the hard substratum, were entangled with the net from Vellar estuary were also collected. *Uca* crabs and land hermit crabs were collected from intertidal regions of Vellar estuary through handpicking. Its abundance was recorded by Line transect method (English *et al*., 1975).

Preservation

The invertebrates were characterized and segregated from consumable fishes, their numbers were recorded and each individual species was preserved (Lincoln and Sheals, 1979) in 5% neutralized formalin for further identification.

Identification and Classification

For the identification, classification was carried out with the help previous research by Russell (1970), Sethuramalingam and Ajmal Khan (1991), Ajmal Khan (1992), Lyla *et al*. (1997), Zeiller (1974) and Clark and Rowe (1971).

Diversity Indices, Richness and Evenness

From the obtained data the various indices like species diversity, richness and evenness were calculated by using the standard formulae as given below:

Shannon-Wiener Diversity (H')

Species diversity was calculated using the following formula of Shannon and Wiener (1949).

$H' = -\Sigma^{s}pi \log pi$

$I = 1$

Which can be rewritten as:

$$H' = \frac{3.3219 (N \log N - - \Sigma ni \log ni)}{N}$$

Where,

H' = Species diversity

Ni = No. of individuals of the ith species

N = Total No. of the individuals in the collection and

Σ = Sum

Simpson Index (D')

Species richness (D) was calculated using the following formula given by Simpson (1949).

$$D = 1 - C$$

Where,

C = $\Sigma P^i 2$
D = 1-C
Pi = ni/N
ni = No. of individuals of i_1, i_2, etc.
N = Total No. of individuals

Pielou's Evenness (J')

Evenness or equitability (S) was calculated using the formula of Pielou (1966).

$$J' = H'/Jn^s \text{ or } H'/\log 2^5$$

Where,

J' = Evenness
H' = Species diversity and
S = Total No. of species.

RESULTS

Marine ornamental invertebrate resources of Parangipettai are shown in Table 1 and 2. In this present study 28 species of marine ornamental invertebrates belonging to 4 phyla were recorded

Table 1: Marine ornamental invertebrate resources of Parangipettai

Marine ornamental invertebrate resources	Common name
Jelly fish	Sea nettle
Chrysaora quinquecirrha	
Rhizostoma sp.	-
Sea anemone	-
Anthopleura sp.	
Lepas	Short stalked goose barnacle
Lepas anserifera	
Lobster	Indian spiny lobster
Panulirus homarus	
P. versicolor	Painted spiny lobster
Thenus orientalis	Sand lobster/Flat-head lobster
Crabs	Sponge crab
Dromia Dehanni	
Dorippe dorcipes	Masking crab
Calappa lophos	Shame face crab
Matuta lunaris	Box crab
Philyra globosa	Purse crab
Doclea ovis	Spider crab
Charybdis feriatus	Angel crab, Cross crab
Uca crab	Fiddler crab, Dobby crab
Uca annulipes	
Uca triangularis	Fiddler crab, Dobby crab
Hermit crabs	-
Clibanarius longitarsus	
C. clibanarius	-
Land hermit crab	Land hermit crab
Coenobita cavipes	
Squilla	Mantis shrimp
Harpiosquilla melanoura	
Aplysia	Ragged sea hare
Bursetella leachii	
Mussel	Asian green mussel
Perna viridis	

Table 1: Continued

Marine ornamental invertebrate resources	Common name
Sea urchin	Sea urchin
Salmasis virgulata	
Temnopleurus toreumaticus	Sea urchin
Sea star	Fringed sea star
Astropecten indicus	
Stellaster incei	-
Luidia maculate	-
Brittle star	Brittle star
Ophiocnemus marmorata	

Table 2: Marine ornamental invertebrate resources from two different landing centers of Parangipettai

Species	Annankoil landing center	Vellar estuary landing center
Chrysaora quinquecirrha	✓	✓
Rhizostoma sp.	✓	✓
Anthopleura sp.	✓	✓
Charybdis feriata	✓	✓
Matuta lunaris	✓	✓
Doclea ovis	✓	✓
Dromia dehanni	✓	✓
Philyra globosa	✓	✓
Calappa lophos	✓	✓
Dorippe dorcipes	✓	✓
Uca annulipes	-	-
Uca triangularis	-	-
Lepas anserifera	✓	✓
Harpiosquilla melanoura	✓	✓
Thenus orientalis	✓	✓
Panulirus homarus	✓	✓
P. versicolor	✓	-
Clibanarius longitarsus	-	-
Clibanarius clibanarius	✓	✓
Coenobita cavipes	-	✓
Perna viridis	-	✓
Bursetella leachii	-	✓
Temnopleurus toreumaticus	✓	✓
Salmasis virgulata	✓	✓
Stellaster incei	✓	✓
Astropecten indicus	✓	✓
Luidia maculata	✓	✓
Ophiocnemus marmorata	✓	✓

✓: Present, -: Absent

from Parangipettai coastal waters and Vellar estuary during the period of 6 months from March 2006 to August 2006. The most abundant species recorded during the study period was fiddler crab *Uca annulipes*, where as sea star *Ludia maculata* was found least in its abundance.

Month among the 28 species recorded during the study period only 19 were recorded in the month of March, in which short stalked goose barnacle *Lepas anserifera* was recorded top in their abundance, where as species like spider crab *Doclea ovis*, sand lobster *Thenus orientalis*, hermit crab *Clibanarius longitarsus*, land hermit *Coenobita cavipes* and sea urchin *Temnopleurus toreumaticus* were very least in their number (Table 3). Nine species were not found. In the month of April 23 species were recorded, in which *Thenus orientalis* was maximum in their number and sea urchin *Salmasis virgulata* was minimum and six species were not found. In the month of May most of the species (25 species) have shown their presence and only three were not found. During this month the most abundant species were *Uca annulipes* and jellyfish *Chrysaora quinquecirrha,* where as brittle star *Ophiocnemus marmorata* was least in its count. From the month of June to August, 23 individual species were recorded in respective months, among which *Uca annulipes* stands

Table 3: The month wise abundance of marine ornamental invertebrates of Parangipettai coast during March 2005-August 2005 (numbers/month)

	Months					
Species	March	April	May	June	July	August
Chrysaora quinquecirrha	47	12	3	0	0	7
Rhizostoma sp.	6	15	0	0	0	0
Anthopleura sp.	4	12	5	18	3	4
Charybdis feriatus	2	9	7	2	3	6
Matuta lunaris	6	4	6	5	3	3
Doclea ovis	1	5	8	11	13	15
Dromia dehanni	4	9	12	10	7	4
Philyra globosa	14	11	13	19	16	7
Calappa lophos	0	3	7	13	8	6
Dorippe dorcipes	6	3	4	8	13	11
Uca annulipes	0	0	90	81	75	63
Uca triangularis	0	0	22	19	23	16
Lepas anserifera	65	16	15	0	0	0
Harpiosquilla melanoura	6	10	14	3	2	0
Thenus orientalis	1	32	20	3	4	2
Panulirus homarus	0	0	0	4	2	3
P. versicolor	0	2	4	0	0	0
Clibanarius longitarsus	1	2	4	3	5	2
Clibanarius clibanarius	2	9	18	4	0	0
Coenobita cavipes	1	3	9	34	26	23
Perna viridis	0	0	8	15	5	7
Bursetella leachii	8	7	33	1	3	6
Temnopleurus toreumaticus	1	18	28	20	22	30
Salmasis virgulata	2	1	7	8	6	11
Stellaster incei	0	4	8	9	21	16
Astropecten indicus	0	0	10	5	9	2
Luidia maculata	0	0	0	3	1	1
Ophiocnemus marmorata	18	22	3	0	2	17

Table 4: The species diversity indices, species richness and species evenness of the marine ornamental invertebrates for the study period (March-August 2005)

	Months					
Parameters	March	April	May	June	July	August
Species diversity (H')	3.0491	4.0513	4.0113	3.7760	3.7205	3.8468
Species richness (D')	3.4136	3.9309	4.0813	3.8616	3.9245	3.9509
Species evenness (J')	0.7177	0.9084	0.8637	0.8347	0.8224	0.8503

a top. Ragged sea hare *Bursetella leachii* was the minimum in their number during June where as sea star *Luidia maculata* was least in their count during the month of July and August, respectively.

The ornamental invertebrate diversity varied from 3.0491 to 4.0513 (Table 4). The minimum diversity was observed during the month of March (3.0491) and the maximum was found during the month of April (4.0513). The richness values varied from 3.4136 to 4.0813. The minimum was observed during the month of March (3.4136) and the maximum was found during the month of May (4.0813). The evenness varied from 0.7177 to 0.9084. The minimum evenness was observed during the month of March (0.7177) and the maximum was found during the month of April (0.9084).

DISCUSSION

Balasubrahmanyan (1966) investigated the distribution of crabs in the intertidal regions of Vellar estuary (1959-1961). Nineteen species of brachyuran crabs were recorded so far from the intertidal areas of the Vellar estuary till date. *Uca annulipes* occurs as one of the dominant species between high water spring to low water neap. Due to the massive populations of *U. annulipes* and *U. triangularis*

were lodged to a distance of more than 100 m to inhabit the uninundated places. *U. triangularis* is present in random between high and low tide levels. *U. annulipes* occurs extensively in the intertidal level in firm muddy and sandy mud places. A large area of mud flats near this station bears *Uca* as the dominant species. Ajmal Khan *et al*. (2005) studied the brachyuran crab diversity in four stations of Pitchavaram mangroves and three stations of Vellar mangroves. In stations, *U. triangularis* and *U. annulipes* were highly abundant. Among which *U. annulipes* where is higher number. In the present study the result which obtained was similar with *U. annulipes* is the most prevalent and dominant species.

Brachyuran crab landings along the Parangipettai coast was reported by Radhakrishnan (1979) who recorded a total of five species, viz., *Scylla serrata*, *Portunus pelagicus*, *P. sanguinolentus*, *Podophthalmus vigil* and *Charybdis feriatus* and their annual landings were estimated as 28507 kg (28.5 tons). In this study seven crab species recorded which are suitable for ornamental purpose. Reddi (1935) has described hermit crabs from Portonovo. Thomas (1989) shows the taxonomic position of Indian water hermit crabs with remarks on their distinctive characters, colour patterns and distribution. In the present study, three species of hermit crabs were reported, which had ornamental fantasy. Land hermit crab *Coenobita cavipes* showed the highest abundance in the months of June, July and August.

Kizhakudan *et al*. (2004) summarizes the fishery of the sand lobster *T. orientalis* (Lund) by bottom set gillnets along the Tamil Nadu coast during September 2003 to February 2004. Sand lobsters are generally landed as by catch during shrimp and cephalopod trawl net operation. The resource is most abundant off the northwest and southeast coasts. In Tamil Nadu the trawlers land about 15-30 ton per annum. During this study *T. orientalis* was caught by by-catches. In the month of April and May their abundance was very high.

Vijayanand (2001) was carried out for a period of one year from January to December 2000, along the Kanyakumari District where a regular fishery of lobsters. Such as *Panulirus ornatus*, *P. versicolor*, *P. homarus*, *P. sewelli*, *P. longipes*, *Thenus orientalius* and *Scyllarides elisabethae* were recorded in the 38 lobster landing centers (Kanyakumari District) in during this study period. High species diversity, richness and evenness index was observed during the post monsoon and monsoon season. *T. orientalius*, *P. homarus*, *P. versicolor* was also recorded in the present study. Among these three species *T. orientalius* had shown its highest abundance. The diversity indices of marine ornamental invertebrate resources are descending in post monsoon and summer seasons when compared with the pre monsoon and monsoon. The invertebrate resource minimum diversity (3.0491) was observed during the post monsoon in March and maximum (4.0513) was found during the summer season in April. The ornamental invertebrates minimum richness (3.4136) was observed during the post monsoon in March and the maximum (4.0813) was found during the summer season in May. The ornamental invertebrate resources minimum evenness (0.7177) was observed during the post monsoon in March and maximum (0.9084) was found during the summer season in April.

Most of the recorded marine ornamental invertebrates are not palatable and are thrown on shore as by catch. Indian spiny lobster *Panulirus homarus*, large size of sand lobster *Thenus orientalis*, angle crab *Charybdis feriataus* and green mussel *Perna viridis* are edible ones, which are also fascinating the aquarium. *Perna viridis* are recently added in reef aquarium (Toonen, 2003). The discarded invertebrates from the by-catches should be treated as valuable ornamental species, which will give additional livelihood to the fisher folks.

The coral reefs and lagoons in the Gulf of Mannar, Andaman and Nicobar, Lakshadweep Islands provides rich wealth of aquarium fishes, which can be collected in a sustainable way without damaging the coral reefs and can be exported to earn considerable amount of foreign exchange (Sakthivel, 2002). Those reef zones have more attractive marine ornamental invertebrates (sponges, anemones, live corals, flatworms, polychaetes, shrimps, prawns, lobsters, hermit crabs, true crabs, mollusks, sea lilies, feather stars, sea stars, sea urchins and sea cucumbers) when compared to the present study area. So

this preliminary investigation from Parangipettai waters will trigger further detailed studies on that wealthy zone. The complete classified data of marine ornamental invertebrate are not available globally and for Indian waters. So a detailed investigation will be needed to improve the ornamental industry.

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