



DIVERSITY OF MARINE SHRIMP SPECIES ALONG THE COAST OF NAGAPATTINAM, TAMIL NADU, INDIA

U. Sathiya and V. Valarmathi*

PG and Research Department of Zoology, A.D.M. College, Nagapattinam-611001, Tamil Nadu, India.

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ABSTRACT

The assessment of species diversity in a particular region is very important in formulating conservation strategies. In the present study, the diversity of marine shrimp species along the coast of Nagapattinam, Tamil Nadu has been assessed on the basis of landing of variety of shrimp species. Penaeidae species were recorded from four landing sites viz. Akkaraipettai (Station 1), Keechankuppam (Station 2), Samandanpettai (Station 3) and Nagore (Station 4) for the period of three months (Dec'2016- Feb'17). Totally 10 shrimp species viz., *Penaeus monodon*, *Penaeus indicus*, *Penaeus semisulcatus*, *Penaeus merguensis*, *Penaeus (Litopenaeus) vannamei*, *Penaeus affinis*, *Metapenaeus dobsonii*, *Metapenaeus monoceros*, *Metapenaeus brevicornis* and *Parapenaeopsis stylifera* belonging to family Penaeidae were identified. All the species were available in all four stations during the study period except *Penaeus (Litopenaeus) vannamei*, *Metapenaeus monoceros* and *parapenaeopsis stylifera* were not found regularly. The occurrence of different species in different stations were presented in the following order: Akkaraipettai > Keechankuppam > Samandanpettai and > Nagore. The maximum and minimum number of shrimp species (6 and 4 species) recorded in all the months. *Parapenaeopsis stylifera* was minimum catch in all the months. December 2016 was ideal month for the maximum shrimps catches. Shrimp diversity is good in Nagapattinam and abundance of shrimp species are greatly influenced by environmental changes and destructive human activities.

Keywords: Penaeidae, Diversity, Nagapattinam coast, Abundance.

INTRODUCTION

Biodiversity performs a number of ecological services for mankind that have commercial and recreational or resources management purpose. India's marine and coastal ecosystem constitutes an important natural resource, since millions of people dependent on them for their livelihoods. This rich biodiversity has a significant role in the maintenance of the ecosystem. Crustacean fishery is one of the major resources of India that includes the commercially important shrimps, prawns, lobsters and crabs which are important in the tropical food chain of marine ecosystem. There are approximately 50,000 - 67,000 crustaceans have been estimated worldwide. They show an enormous diversity and different range of sizes. Generally, more than 10 million tons of crustaceans are produced annually for human consumption. The Indian decapods crustaceans reveal that 117 species of prawns inhabit the marine areas which fall under the domain of commercial fishing and the

number of penaeoid species now found in Indian waters is 122, which forms 34.9% of the world species showing high diversity of species (Jayalakshmi & Santhanam, 2013). The shrimps and prawns have great economical value as they earn valuable foreign exchange.

Penaeidae, a family of marine crustacean in the suborder Dendrobranchiata, often referred to as penaeid shrimp or penaeid prawn with 48 recognized genera, 23 of them is known only from the fossil record. Total average Penaeidae catching at world level was 1.21 million tons per annum for the year 2008 - 10. The Penaeidae shrimp constitute the backbone of Indian seafood export industry as the major foreign exchange earner as well as source of livelihood for millions of fishermen in the country.

The "Shrimp" stands for members of the family Crangonidae (Crangon crangon being the "Common Shrimp"), while the term "Prawn" is used for species of

*Corresponding Author: Dr. V. Valarmathi, Associate Professor, PG and Research Department of Zoology A.D.M. College, Nagapattinam-611001, Tamil Nadu, India, Email: mathivalar.k@gmail.com

Palaemonidae (*Palaemon serratus* being the “Common Prawn”). The term prawn is then usually employed for the larger forms (often those that are more laterally compressed and have a well-developed rostrum). The term “shrimp” is commonly used for the smaller forms (often dorsoventrally depressed and with a poorly developed rostrum).

Prawn in general form the most economically important constituent in the marine fish landings in India, accounting for an average of over 75,000 metric tons which comes to about 10 percent of the total landing of marine species. The annual production of marine prawn in the country could therefore be reasonably estimated at about 1,00,000 tons a year. Information on the prawn fisheries of India and on the biology of the economically important species is available in a number of contributions of which the most important ones of a general nature are those by (Aravindakshan & Karbhari, 1994; Rao, 1964). About 80 percent of the marine prawn catches come from the west coast of India, while the east coast accounts for about 20 percent. Along the west coast, the catches are higher in the northern sector, but the southern sector supports the fishery for the larger species, resulting in a concentration of prawn processing industry in this area.

The shrimps constitute a large group of crustaceans varying in size from microscopic to about 35 cm long. Although nearly 2500 species are known, only slightly less than 300 are of economic interest, and of these about 100 comprise most of the annual world shrimp catches (about 16,00,000 tons 1978 -79- 80). The body of the shrimps is almost always laterally compressed, the rostrum usually compressed and toothed, and the abdomen long, longer than the carapace or head. The antennules, or first pair of feelers, in most species bear a small scale or spine, the stylocerite, at their bases, and the antennal scales of the second pair of feelers, the antennae, are generally large and plate-like. The pereopods or legs are usually slender, but in some a single leg or pair of legs may be stout and some pereopods (the chelipeds) end in pincers or chelae. The pleopods or abdominal appendages used for swimming, are well developed and except in a few species, are present on all five anterior abdominal segments.

The economically important prawns constituting the major portion of the catches are the penaeids belonging to the genera *Penaeus*, *Metapenaeus*, *Parapenaeopsis* and *Solenocera*. In addition to the above, non-penaeid species belonging to the genera *Palaemon*, *Hippolytina* and *Acetes* are also caught. Commercial important species of shrimps in India therefore *Penaeus indicus*, *Penaeus monodon*, *Penaeus semisulcatus*, *Penaeus merguensis*, *Penaeus canaliculatus*, *Metapenaeus dobsoni*, *Metapenaeus affinis*, *Metapenaeus monoceros*, *Metapenaeus brevicornis*, *Metapenaeus kutchensis*, *Parapenaeopsis stylifera*, *Parapenaeopsis sculptilis*, *Parapenaeopsis hardwickii*, *Solenocera indica*. The maintenance and management of our rich biodiversity requires accurate and continuous updating of data,

Identification of biological organism and documentation of biological diversity is a primary step towards any research work, management and conservation. The assessment of marine shrimp species diversity in a particular region is very important in formulating conservation strategies. Hence, the present investigation is carried out to study the diversity of marine shrimp species along the coast of Nagapattinam, Tamil Nadu.

Description of the study area

Nagapattinam coastal town is one of the most booming harbours of India. It is the head quarter of Nagapattinam coastal district of Tamil Nadu. This district has a long coastal line of 188 km and has good fishing potential in view of its rich coastal area. It is a part of the Cauvery river basin and delta. Nagapattinam lies between 10° 15' to 11°30' North latitudes and 79° 30' to 79° 55' East longitude on the shore of the Bay of Bengal. The climate is sub tropical humid with higher rainfall. Most of the rainfall is received between October and December under the influence of Northeast monsoon. Fishery is the economic backbone of this coastal district provides mankind with food, medicines, industrial products etc. The coastal fish production is more than the inland fish production and the production has seen fluctuations. In Nagapattinam coast zone there are notable fishing hamlets, namely Akkaraipettai, Keechankuppam, Samandanpettai and Nagore. It has been assessed on the basis of landing of variety of species from various main landing centres of Nagapattinam coast

MATERIALS AND METHODS

Present study was carried out for three months from December 2016 to February 2017 in Nagapattinam. Four different stations were selected for present work viz Akkaraipettai (Station 1), Keechankuppam (Station 2), Samandanpettai (Station 3) and Nagore (Station 4). Regular visit was made every fortnight to different landing sites. Different species of shrimps were recorded, collected and brought to the laboratory. Collected shrimps are preserved in 10% formalin for further study. The body colour with strip, rostral structure, rostral teeth, antenna colouration and appendages of the shrimps are noted for identification. The species of the shrimps were identified and grouped up to species level according to the published literature, FAO and taxonomic keys.

RESULTS

About 10 species were recorded from Akkaraipettai (Station 1), Keechankuppam (Station 2), Samandanpettai (Station 3) and Nagore (Station 4) during study period (December 2016 to February 2017) and all the shrimp species were identified based on FAO and taxonomic keys. The systematic position and the distinctive morphological characteristics were tabulated (Table 1).

In the present study totally 10 shrimp species were recorded belonging to the family Penaeidae and represented by *Penaeus* genera and consists of species namely

Penaeus monodon, *Penaeus indicus*, *Penaeus semisulcatus*, *Penaeus merguensis* and *Penaeus vannamei*. *Metapenaeus* genera consists of *Metapenaeus affinis*, *Metapenaeus monocer*, *Metapenaeus dobsoni*, and *Metapenaeus brevicornis*. *Parapenaeopsis* genus includes *Parapenaeopsis stylifera* species (Table 2 and Figure 1).

Table 1. List of Marine Shrimp species identified in Nagapattinam.

Family	Genus	Species	Common name
Penaecidae	Penaeus	<i>Penaeus monodon</i> (Fabricius 1798)	Giant Tiger prawn
		<i>Penaeus indicus</i> (Milne Edwards, 1837)	Indian prawn
		<i>Penaeus semisulcatus</i> (De Haan, 1844)	Green Tiger shrimp
		<i>Penaeus merguensis</i> (De Man, 1888)	Banana prawn
		<i>Penaeus vannamei</i> (Boone, 1931)	Whiteleg shrimp
	Metapenaeus	<i>Metapenaeus affinis</i> (Milne Edwards, 1837)	Jinga prawn
		<i>Metapenaeus monoceros</i> (Fabricius, 1798)	Speckled shrimp
		<i>Metapenaeus dobsoni</i> (Miers, 1878)	Kadal shrimp
		<i>Metapenaeus brevicornis</i> (Milne Edwards, 1837)	Yellow shrimp
	Parapenaeopsis	<i>Parapenaeopsis stylifera</i> (Milne Edwards, 1837)	Karikkadi shrimp

Table 2. Distinctive characters of Shrimp Species in Nagapattinam.

S.No.	Shrimp species	Key characters
1	<i>Penaeus monodon</i>	Rostrum generally armed with 6 to 8 upper teeth (including those on carapace) and 3 lower teeth; postrostral crest well developed and reaching nearly to posterior margin of carapace, with or without a feeble median groove; adrostral crest extending to just before last postrostral tooth; gastrofrontal crest absent; hepatic crest almost horizontal and extending far behind antennal crest. Fifth pereopod without exopod.
2	<i>Penaeus indicus</i>	Carapace rather smooth, lacking gastrofrontal and hepatic crests; adrostral crest extending as far as or just before epigastric tooth; rostrum slightly curved at tip and sigmoidal-shaped, usually bearing 7 to 9 upper teeth (including those on carapace) and 3 to 6 lower teeth. Postrostral crest extending near to posterior margin of carapace.
3	<i>Penaeus semisulcatus</i>	Rostrum generally armed with 6 to 8 upper teeth (including those on carapace) and 3 lower teeth; postrostral crest well developed and reaching nearly to posterior margin of carapace, with a distinct median groove; adrostral crest extending beyond last postrostral tooth; gastrofrontal crest absent; hepatic crest long and extending behind antennal crest, straight but distinctly sloping antero-ventrally. Fifth leg with exopod (somewhat hidden beneath carapace).
4	<i>Penaeus merguensis</i>	Carapace rather smooth, lacking gastrofrontal and hepatic crests; adrostral crest extending to, or just before, epigastric tooth; tip of rostrum horizontally straight, and rostral crest becoming very high and broadly triangular in large specimens (even stronger in females), generally bearing 6 to 9 upper teeth (including those on carapace) and mostly 3 to 5 lower teeth; postrostral rest extending near to posterior margin of carapace.
5	<i>Penaeus vannamei</i>	The rostrum is moderately long with 7-10 dorsal and 2-4 (occasionally 5-8) ventral teeth. The tip of the rostrum in adults reaches the mid-length of the 2nd rostral segment. The lateral rostral groove ends near the posterior rostral tooth. The post-rostral keel is variable in length, and sometimes almost reaches the posterior edge of the carapace. Color is translucent, bluish or olive with dusky bands, reddish-brown on the antennules, but distinguished by white legs.
6	<i>Metapenaeus affinis</i>	Body pubescent, rarely partly or completely hairless; rostrum armed with 8 to 11 teeth along entire dorsal margin, slightly sinuous and reaching from proximal to distal margin of third antennular article, postrostral ridge ending near posterior

		margin of carapace; adrostral crest ending behind second rostral tooth, and adrostral groove a little behind epigastric tooth; branchiocardiac ridge slightly sinuous and reaching posterior extension of hepatic spine; telson armed only with spinules; Colour: body pale greenish to pale pinkish, with green or red-brown specks. pleopods reddish to whitish; distal half of uropods translucent green or rust coloured, telson armed only with ventral view spinules
7	<i>Metapenaeus monoceros</i>	Entire body hairless; rostrum armed with 5 to 7 dorsal teeth, toothless on little less than its distal half, reaching from proximal margin of second, to distal margin of third antennular article, rostral crest high; postrostral ridge not reaching posterior margin of carapace; adrostral crest and groove reaching as far as second rostral tooth ; branchiocardiac ridge feeble, not reaching middle of carapace; telson armed only with spinules.
8	<i>Metapenaeus dobsoni</i>	Body pubescent, but pubescence can be restricted to a few patches; rostrum long, extending beyond antennular peduncle, slightly sinuous, armed with 7 to 9 dorsal teeth, but toothless on its distal half; postrostral ridge ending near posterior margin of carapace; adrostral crest reaching as far as epigastric tooth , adrostral groove a little beyond; branchiocardiac groove almost reaching to middle of carapace; telson armed only with spinules; no ischial spine on first pereopod.. Colour: body pale yellow to brownish with red, brownish or greenish specks .
9	<i>Metapenaeus brevicornis</i>	Entire body pubescent, rostrum armed with 9 to 12 teeth along entire dorsal margin, straight, reaching as far as, or beyond, tip of antennular peduncle; postrostral crest reaching posterior margin of carapace or nearly so; adrostral crest ending behind second rostral tooth, adrostralgroove behind epigastric tooth; branchiocardiac ridge sinuous, reaching posterior extension of hepatic spine; telson armed only with spinules.Body pink, green-greyish or whitish with brown specks; rostral and middorsal abdominal crests brown; antennae red.
10	<i>Parapenaeopsis stylifera</i>	Rostrum reaches the middle of the eyestalks. It is long narrow and straight. Two dorsal spines are present of which the posterior one is at the level of frontal margin of the carapace. Colouration light brownish on antennular peduncles, abdomen yellowish, mid-carapace with a few chromatophores, yellowish eyestalks and telson tinged with brown.

In the present finding it was also observed that the maximum number of shrimp species *Penaeus monodon*, *Penaeus indicus*, *Penaeus semisulcatus*, *Metapenaeus affinis* and *Metapenaeus dobsoni* were recorded in all stations. *Penaeus merguensis* was recorded moderately in all stations while *Penaeus vannamei* was moderate in station 1 and 2 and totally absent in station 3 and 4. *Metapenaeus monoceros* was moderate from (Station 1 to 3 and absent in (station 4). *Metapenaeus brevicornis* was low amount in all stations and *Parapenaeopsis stylifera* landing was low in all stations except station 3. Thus Akkaraipettai (1), Keechankuppam(2), Samandanpettai (3) and Nagore(4) are major fishing and landing centres of Nagapattinam. The occurrence of different species in different stations were

presented in the following order: Akkaraipettai > Keechankuppam > Samandanpettai and >Nagore.

Abundance of Shrimp species during the study period (December 2016 - February 2017) in Nagapattinam was presented in (Table 2). The maximum number of shrimp species (6 species) recorded in all 3 months and minimum number was recorded (4species) in all months. Over all *Parapenaeopsis stylifera* was in minimum catch from December 2016 to February 2017. It also inferred that the December 2016 was recorded the maximum catch. Distinctive characters of different shrimp species recorded in Nagapattinam was presented in (Table 3).during study period.



Penaeus monodon



Penaeus indicus



Penaeus merguensis



Penaeus semisulcatus



Penaeus vannamei



Metapenaeus affinis



Metapenaeus dobsoni



Metapenaeus monoceros



Metapenaeus brevicornis



Parapenaeopsis stylifera

Plate 1. List of Marine species recorded in Nagapattinam.

Table 2. Shrimp species recorded during the study in different stations.

S.No.	Name of the Species	Family	Station				Remarks
			1	2	3	4	
1	<i>Penaeus monodon</i>	Penaeidae	+++	+++	+++	+++	High
2	<i>Penaeus indicus</i>		+++	+++	+++	+++	High
3	<i>Penaeus semisulcatus</i>		+++	+++	+++	+++	High
4	<i>Penaeus merguensis</i>		++	++	++	++	Moderate
5	<i>Penaeus vannamei</i>		++	++	-	-	Moderate
6	<i>Metapenaeus affinis</i>		+++	+++	+++	+++	High
7	<i>Metapenaeus monoceros</i>		++	++	++	-	Moderate
8	<i>Metapenaeus dobsoni</i>		+++	+++	+++	+++	High
9	<i>Metapenaeus brevicornis</i>		+	+	+	+	Low
10	<i>Parapenaeopsis stylifera</i>		+	+	-	+	Low

Akkaraipettai(1), Keechankuppam (2), Samandanpettai (3) and Nagore(4). +++ High ,++ Moderate ,+ Low, - Absent.

Table 3. Abundance of Shrimp species during the study period in Nagapattinam (December 2016 - February 2017).

S.No.	Name of the Species	Month		
		Dec'16	Jan'17	Feb'17
1	<i>Penaeus monodon</i>	+++	+++	+++
2	<i>Penaeus indicus</i>	+++	+++	+++
3	<i>Penaeus semisulcatus</i>	++	+++	+++
4	<i>Penaeus merguensis</i>	+++	+++	++
5	<i>Penaeus vannamei</i>	++	+	+
6	<i>Metapenaeus affinis</i>	++	++	++
7	<i>Metapenaeus monoceros</i>	+++	+++	+++
8	<i>Metapenaeus dobsoni</i>	++	+++	+++
9	<i>Metapenaeus brevicornis</i>	+++	+	++
10	<i>Parapenaeopsis stylifera</i>	+	+	+

+++ High ,++ Moderate ,+ Low.

DISCUSSION

Shrimps and prawns constitute a large group of crustaceans varying in size and are widely distributed in marine, brackish and freshwater regions from the equator to the Polar Regions. Although the majority of the commercial

marine species occupy shallow or moderately deep water areas along the continental shelves at depths of less than 100 m, some are found at depths of nearly 5700 m. Many shrimps are pelagic but the majority by far is benthic, living on a large variety of bottoms such as rock, mud, peat, and sand, fragments of shells or mixtures of these materials.

Although there are about 4048 species of prawns are recorded. Most of the commercial prawns belong to the Penaeoidea; at present, only less than 300 species of prawns are of economic interest worldwide and of these only about 100 comprise the principal share of the annual world catch (Chan, 1998; De & Franssen, 2011). Penaeoids are known to occur in 5 families, 23 genera and 121 species along the Indian coast (Radhakrishnan *et al.*, 2012).

Shrimps are one of the fascinating group of decapoda. They have developed a successful relationship between the environment and biological mechanism involved in the evolutionary process. They are partially swimmer and bottom dwellers and exhibits variety of feeding habits. They are well established in all kinds of marine ecosystem which forms the nursery ground of penaeid species. Morphologically shrimps are indicating different structure and colouration.

According to Suseelan (1987) and (Suseelan & Pillai, 1993), predominant Penaeidae species in the Indian coast are *F. indicus*, *P. monodon*, *P. semisulcatus*, *F. merguensis*, *F. penicillatus*, *M. dobsoni*, *M. monoceros*, *M. affinis*, *M. brevicornis*, *P. stylifera*, *Metapenaeus moyebi*, *Metapenaeus kutchensis*, *P. hardwickii*, and *P. sculptilis*. In the present study, *F. indicus*, *P. monodon*, *P. semisulcatus*, *F. merguensis*, *F. penicillatus*, *M. dobsoni*, *M. monoceros*, *M. affinis*, *M. brevicornis*, *P. stylifera*, *Metapenaeus moyebi*, *P. sculptilis* were landed. *P. semisulcatus*, *P. monodon* and *P. indicus* were obtained mostly all landing centre of southern region. All shrimp species are almost available and abundant in all stations of the present study. Furthermore, all shrimps were recorded not only in all seasons but throughout the year in all stations except 3 and 4 stations of the present study. Maximum was in December 2016 and minimum was in February 2017. However, the commercially important shrimp species catches are affected by multifarious human activities and environmental changes. The present study inferred that the penaeid shrimp species are available along the coast of Nagapattinam.

In the present study high number of species availability shows that the good environmental, oceanographic conditions and hydrographic features influences for living of these species in south east coast of India. However the fishing intensity can affect the distribution and abundance of marine species such effect on the species diversity, species abundance and species richness. The present report would give the novel insight on Penaeidae diversity in Nagapattinam along the east coast of India.

CONCLUSION

Totally 10 shrimp species viz., *Penaeus monodon*, *Penaeus indicus*, *Penaeus semisulcatus*, *Penaeus merguensis*, *Penaeus (Litopenaeus) vannamei*, *Penaeus affinis*, *Metapenaeus dobsonii*, *Metapenaeus monoceros*, *Metapenaeus brevicornis* and *parapenaeopsis stylifera* belonging to family Penaeidae were identified in

the present work. All the species were available in all four stations during the study period except *Penaeus (Litopenaeus) vannamei*, *Metapenaeus monoceros* and *parapenaeopsis stylifera* were not found regularly. The maximum number of shrimp species (6 species) recorded in all 3 months in Akkaraipetai and minimum number was recorded (4 species) in all months in Nagore. Over all *Parapenaeopsis stylifera* was in minimum catch from December 2016 to February 2017. It also inferred that the December 2016 was recorded the maximum shrimps catches. Abundance of shrimp species are greatly influenced by environmental changes and destructive human activities.

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