

## Chapter 8

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**Deep sea prawns****Rekhadevi Chakraborty**

Shellfish systematics is the most unique one in Fisheries Science in view of its importance and implications in diversity. The systematic zoology is the science that discovers names, determines relationships, classifies and studies the evolution of living organisms. It is an important branch in biology and is considered to be one of the major subdivisions of biology having a broader base than genetics, biochemistry and physiology. The shellfish includes two highly diversified phyla i.e. phylum *Arthropoda* and phylum *Mollusca*. These two groups are named as shellfishes because of the presence of *exoskeleton made of chitin in arthropods* and *shells made of calcium in molluscs*. These two major phyla are *invertebrates*. They show enormous diversity in their morphology, in the habitats they occupy and in their biology. Phylum Arthropoda includes economically important groups such as lobsters, shrimps, crabs. Taxonomical study reveals numerous interesting phenomena in shellfish phylogeny and the study is most indispensable for the correct identification of candidate species for conservation and management of our fishery resources and aquaculture practices. On the whole taxonomic study on shellfishes furnishes the urgently needed information about species and it cultivates a way of thinking and approaching of all biological problems, which are much needed for the balance and well being of shellfish biology as a whole.

Shrimp resources are available both from inshore and from offshore waters. As the fish resource from inshore waters remained static during the last two decades, fishing pattern underwent several changes in the previous decade, leading to the exploitation of deep sea resources either with deployment of large sized vessels or modified medium/small sized vessels. Deepwater shrimps appear to have a world-wide distribution in tropical waters. They have been caught in surveys using baited traps in depths between 200 m and 800 m off continents and at 200- 500 m depth in the Indian Ocean.

Deep sea decapod crustaceans constitute one of the dominant high price groups of invertebrates in the marine fishery sector of Kerala although the structure and organization of their community are not well known as that of coastal penaeid prawns. In view of the

increasingly prominent role played by deep sea prawns and prawn products in the economy of the country, the taxonomic identity of various species exploited from the deep sea fishing grounds off Kerala is an essential prerequisite for the sustainable development and management of deep sea prawn wealth of Kerala. The deep sea prawns landed at various harbours of Kerala is an assemblage of wide array of species representing various families, the prominent being *Pandalidae*, *Aristeidae*, *Solenoceridae* and *Penaeidae* while family *Oplophoridae* contributes to only a minor portion of the deep sea trawl catches in Kerala.

### **Deep-sea prawn fishery**

#### **Sakthikulangara**

During the first season (1999-2000) the fishing which started in November 1999 extended till June 2000. However, in the following seasons the fishing started earlier in September itself. The duration of deep-sea prawn fishery was between September and May during the next three seasons and between September and April during 2003-04 and 2004-05 seasons. During 2005-12 the fishing was carried out between September and June. The trawler units operated for deep-sea prawns varied between 5896 (2005-06) and 28,434 (1999-2000) with an average amounting to 12,009 units per season. The average annual trawling hours was 225,899 with minimum fishing hours (111,519) during 2004-05 and maximum (357,102) during 1999-2000.

About 72.8% of the deep-sea prawn catch from 'Quilon Bank' was landed at Sakthikulangara during 1999-2003. In the next three seasons during 2003-06 the contribution of Sakthikulangara was 84.2%. For the entire seven seasons between 1999 and 2006, an estimated catch of 83436 t deep-sea prawns was landed at Sakthikulangara (11919 t per season) which constituted 77.3% of entire prawn catch of 'Quilon Bank'. The trawler units operated for deep-sea prawns varied between 5896 (2005-06) and 28,434 (1999-2000) with an average amounting to 12,009 units per season.

The average annual trawling hours was 225,899 with minimum fishing hours (111,519) during 2004-05 and maximum (357,102) during 1999-2000. Trawling hours/boat which was only 12.6 at the beginning of fishery (1999-2000) increased steadily to 23 hrs in 2001-02 but declined slowly to reach 17.4 hrs in 2004-05. However, during 2005-06 the trawling hours/unit

increased to 36.1 hr mainly to have an extended fishery in order to save fuel. Maximum quantity of deep-sea prawns (18,129 t) was recorded during 2003-04 followed by a sharp decline during 2001-01 (6626 t) and 5978 t during 2009-2012. Maximum CPH (77 kg) was recorded during 2003-04 followed by (42.5 Kg) 2006-08, and 35 kg in 2000-01 while minimum (11%) was observed during 2009-12 season.

The deep-sea prawns contributing to the fishery in order of abundance during 1999-2006 based on average annual landings at Sakthikulangara were *H. woodmasoni* (3291 t; 27.6%), *M. andamanensis* (2884 t; 24.2%), *H. gibbosus* (2071 t; 17.4%), *P. spinipes* (1993 t; 16.7%), *A. alcocki* (1442 t; 12.1%), *S. hextii* (112 t; 0.9%), *P. martia* (89 t; 0.7 %) and *P. jerryi* (37 t; 0.3%). While the average estimated deep sea catch during 2006-2008 was 8571 t. The fishery was chiefly supported by seven species constituted by 4 non-penaeid and 3 penaeid. Among the non-penaeid species *Plesionika spinipes* (2402 t, 28%) forms the major catch followed by *Heterocarpus gibbosus* (1425 t, 17%) while the prime species in penaeid shrimp catch was contributed by *Metapenaeopsis andamanensis* (1987 t, 23%) followed by *Aristeus alcocki* (17%). During 2009-2012 further decline in the catch was observed 5978 t with a catch rate of 11.3 Kg/hr. The biological studies carried out with the samples collected from Sakthikulangara fishing harbour on three major samples indicated that females dominated the catch in case of *Heterocarpus gibbosus* (63% with a mean size of 103 mm, size range 66-135 mm, mode 101-105 mm), *P. spinipes* (36% with a mean size of 96.3 mm, size range 61-140 mm, mode 96-100 mm), *H. woodmasoni* (22% with a mean size of 104.7 mm, size range 111-115 mm, mode 111-115 mm).

### **Cochin Fisheries Harbour**

The first season of deep-sea prawn fishery (1999-2000) started from November 1999 and extended till May, 2000, as in the case of Sakthikulangara Centre. In the subsequent seasons till 2003, the fishery started in September itself and continued till April of the following year during 2000-01 and 2001-02; till February during 2002-03 and up to March during 2003-04. In the following two seasons viz. 2004-05 and 2005-06 the deep-sea prawn fishery started, still earlier, in August itself and continued till March 2005 and April 2006, respectively. During 2007-2012 the deepsea fishing was observed during September to April with an estimated average landings

of 1345 t during 2006-2008 while an estimated landings of 1012 t during 2009-2012. The common species of prawns constituted the deep-sea catch were *P. spinipes* (27-33%), *H. woodmasoni*, (6%), *H. gibbosus* (6%), *P. martia* (11%), *A. alcocki* (14%), *S. hextii* (0.6%), *P. jerryi* (9%) and *M. andamanensis* (25%).

### Size range in the fishery

#### *Heterocarpus woodmasoni*

Size range of *H. woodmasoni* along the Kerala coast was noticed as 46-100 mm (male) and 51-120 mm (female).

#### *Heterocarpus gibbosus*

Size range of *Heterocarpus gibbosus* along the Kerala coast was noticed as 46-100 mm (male) and 51-120 mm (female).

#### *Aristeus alcocki*

Size range of *Aristeus alcocki* along the Kerala coast was noticed as 83-100 mm (male) and 75-140 mm (female). In *Aristeus antennatus* carapace length ranged from 12-62 mm for females and 9-45 mm for males and natural mortality rates ranged from 0.55 to 0.70 for females and from 0.62 to 0.79 for males.

### Size Range of other deep Sea Shrimps

*Plesionika martia* : Males: 80 – 106 mm, Females : 87 – 106 mm

*M. andamanensis* : Males: 62 – 110 mm, Females : 62 – 140 mm

*S. hextii* : Males : 68 – 138 mm, Females : 62 – 140 mm

*P. jerryi* : Males : 72 – 96 mm, Females : 82 – 111 mm

### Biology

According to George (1969), the morphological variation shown by a species are basically used as taxonomic tool in the crustacean systematics and the characters generally often given due importance are nature of rostrum and its spines, carapace, carinae and sulcii, carination of abdomen, telson and appendages. Johnson (1973) expressed the view that changes in the shape and armature of 2<sup>nd</sup> cheliped due to simple allometric growth process may serve as a unique character in differentiation of closely related species. The linear measurement and function of different body parts, sexual dimorphism, sexual maturity, fecundity and changes in

the weightlength relationship etc. are a few of the processes that are studied through morphometric analysis (Hartnoll, 1985). Both conceptual and empirical aspects on various linear body measurements in crustaceans have been studied by a number of workers notably by Hartnoll (1974, 1978), Finney and Abele (1981), Huber (1985) and Blackstone (1986). Morphometric studies on the commercially important deep water shrimps are restricted to temperate waters by a few researchers based on very few number of morphometric characters of *H. reedi* and *A. antennatus* (Arana, 1970; Sarda *et al.*, 1995; Bas & Sarda, 1998). Whereas, no published information on the morphometric analysis of deep sea prawns have been made so far.

In the genus *Heterocarpus*, 24 morphometric parameters were observed since the 2<sup>nd</sup> pair of pereopods are unequal in total length. The parameters so examined are total length, carapace length, rostral length, 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> cheliped lengths, length of podomeres in the second cheliped viz. ischium, merus, carpus, propodus and dactylus, 2<sup>nd</sup> pleural length, depth and breadth and length of telson and Uropod as indicated in the above figure. For the species belonging to the genus *Heterocarpus*, the measurements of both short and long 2<sup>nd</sup> chelipeds were recorded. Total length was taken as the length between tip of the rostrum to tip of the telson whereas carapace length and rostral length were measured from posterior margin of orbit to the posterior most margin of the carapace and tip of the rostrum to the base of the last rostral spine respectively. Telson was measured from its proximal margin to the distal tip and the pleural width was measured at the widest part of the pleural wall of the 2<sup>nd</sup> abdominal segment. Total length of the chelipeds and walking legs were taken along their extended length from the proximal base of the ischium to the distal end of the dactylus.

### **Food and Feeding:**

The study of food and feeding habits of an animal is very essential in understanding the various aspects of biology namely growth, development, reproduction, migration and seasonal variation in the body condition. Further, knowledge on natural diet of an animal is important in fundamental community analysis for studies of food webs, trophodynamics resource partitioning and ecological energetic (Ivlev, 1961; Landenberger, 1968). An understanding of the relationship between animals and food organism especially the favorite food items and their seasonal distribution may help to locate the potential feeding grounds provide clue for the prediction and

exploitation of the resources (Muthiah, 1994). As food being the major factor regulating the abundance, growth and movement of animals, any information in this regard will add to the existing knowledge needed for better management of prawn stock. Many authors have discussed the food and feeding habits of deep sea prawns in many parts of the world ever since exploratory commercial fishing began for these crustaceans. One of the earliest works on feeding habits of deep sea prawns was by Murie (1903) on the Pink shrimp *Pandalus montagui*. The most significant contributions in the food and feeding on the pandalid prawn *Pandalus borealis* Kroyer the principal species supporting the cold-water fisheries of Northern Atlantic and Northern Pacific waters were that of Alien (1959).

Notable contribution on the food and feeding habits were made by Bullis (1956), Bullis and Rathjen (1959), Bullis and Thompson (1959), Thompson (1967), Klima (1969) and Anderson and Lindner (1971) on the Royal red shrimp *Hymenopenaeus robustus* Smith from the south east coast of United States and of Burukovsky (1978) on *Aristeus varidens* Holthuis from the west coast of Africa.

Nevertheless in the Indian Ocean, only very little is known on the food and feeding habits of deep sea prawns, though similar information on coastal Penaeid prawns are aplenty (Gopalakrishnan, 1952; Panikkar, 1952; George, 1959; Kuttyamma, 1974; Kunju, 1967). Suseelan (1985) conducted a preliminary study on the gut contents of *Heterocarpus gibbosus* and *H. woodmasoni* collected during the exploratory surveys off south west coast of India.

Suseelan (1985) reported that 73% of the stomachs of *H. woodmasoni* are empty while the crustacean remnants predominated followed by foraminifers, fish remnants and sand particles in the remaining 27%. Whereas in *H. gibbosus*, crustaceans constituted the major element (54%) and foraminifers (37%) appeared as the second major component. From the nature of food consumed and the presence of high proportion of detritus and crustacean remnants though in varying quantities, it can well be inferred that both the species are typical bottom feeders.

## **Reproductive Biology**

A thorough knowledge of the reproductive biology of any given species is an essential prerequisite for stock assessment of wild populations, sustainable exploitation and successful fishery management. The reproductive traits include aspects such as size at first maturity, size dependent fecundity, sex ratio, and nature of gonads, frequency and season of spawning

(Wootton, 1984). Information on these aspects is essential for sustainable exploitation and management of fish stocks.

The patterns of deep-sea reproductive biology length of breeding period, brood size, egg size-have been studied in the last 2 decades, mainly with reference to seasonality (Tyler 1988, Gage & Tyler 1991). Based on the hypothesis that the deep-sea is a physically seasonless environment Orton (1920) hypothesised that the breeding period of deep-sea species ought to be continuous throughout the year. Depth represents multicomponent factor related one of the major biotic and abiotic gradients found the oceans. Light, temperature, pressure, food ability and predator density are some of the factors which influence species distribution and life-histories. Three stages of egg development were defined based on ovigerous females: eggs of recent spawning with intense colour and no embryo or pigmentation visible, early stage (1) pale egg colour with slight embryo eye pigmentation, middle stage (2) total loss of egg colour with embryo eye pigmentation well visible and embryo well developed, late stage(3).

### **Description of maturity stages**

There were glaring differences in the colour and shape of the ovaries, though the variation in gonad Structure was not prominent in males. In females, seven stages of maturity were identified of which four stages (immature, maturing, head roe, spent) were defined according to the relative intensity of color and dimension of ovary in the cephalothorax while the later three stages of maturity were defined on the basis of the color of embryo and ovigerous females. In males also, the maturity stages could be assigned to three stages based on external macroscopic examination.

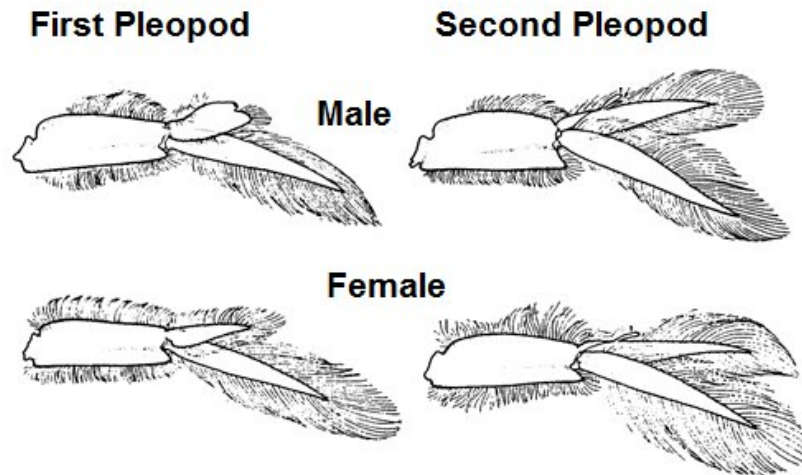


***Plesionika spinipes* egg**

One of the most important aspects of the reproductive biology of penaeid shrimps is the study of the histological basis of ovarian maturity and the spawning seasons, which is required

for the management of the stock as well as for aquaculture. It is well-established fact that most of the penaeid shrimp species migrate to offshore when they attain sexual maturity.

Tropical caridean shrimp were originally thought to be protandrous hermaphrodites (Clarke, 1972; Wilder, 1977), as are temperate-water pandalids which change from males to females after the first few years of life. Subsequent studies revealed that tropical deepwater carideans have separate sexes (King and Moffitt, 1984; Moffitt and Polovina, 1987). The sex of caridean shrimps can be determined by an examination of the shape of the endopods of the first pleopods (swimming legs); the endopod in males is broader and more leaf-shaped than in females. A mature male also possesses an appendix masculina situated between the appendix interna and the endopod of the second pleopod. Eggs are carried externally on the pleopods of ovigerous females, and brood sizes (the number of eggs carried) may exceed 30,000 on the larger *Heterocarpus* species (King and Butler, 1985). The mean sizes of reaching sexual maturity in females (defined as the size where 50 per cent of the female population is ovigerous) are given for several species in King (1986). Female *Heterocarpus laevigatus* reach sexual maturity between 40 and 43 mm carapace length which corresponds to a relative age of 4 to 4.6 years (King, 1983; Dailey and Ralston, 1986; Moffitt and Polovina, 1987)



### Key to the deepsea prawns of Penaeidae, Pandalidae and Oplophoridae

#### Penaeidae

1. Inner border of the antennular peduncle with a setose scale; Podaobranchiae absent.....2



No setose scale on the inner border of the antennular peduncle; podobranchiae present; pleurobranchia on 10-13 segments reduced to mere papillae.....*Aristeus alcocki*

2. Exopodite of the external maxillipeds large, absence of a brachio-cardiac sulcus in the branchiostegal region .....3
3. Symmetrical petasma; no basal spine at 3<sup>rd</sup> maxilliped .....4
4. A long fissure on either side of the carapace throughout the entire length; rostrum not glabrous and less than 1/3<sup>rd</sup> the length of carapace.....*Parapenaeus investigatoris*  
No fissure on carapace wall; rostrum glabrous, as long as carapace....*Penaeopsis jerryi*

### Pandalidae

1. Carapace hard and rigid with longitudinal carinae; 2<sup>nd</sup> pair of pereopods unequal.....*Heterocarpus*.....3  
Carapace smooth without a longitudinal carinae; 2<sup>nd</sup> pair of pereopods Carapace equal...2
2. 3<sup>rd</sup> abdominal somite unarmed or with fixed postero-medial tooth; terminal segment of 2<sup>nd</sup> maxilliped broader than long, attached strip like to penultimate segment with its longer side.....*Plesionika*.....5
3. 3<sup>rd</sup> abdominal tergum without spines, length of 6<sup>th</sup> abdominal segment less than 5<sup>th</sup>...4  
3<sup>rd</sup> abdominal tergum ends in a sharp spine dorsally; 6<sup>th</sup> segment more than double the length 5<sup>th</sup>.....*Heterocarpus woodmasoni*
4. Only one tooth present anterior to orbit; dorsal carapaceal ridge not prominent  
.....*Heterocarpus laevigatus*  
More than two teeth anterior to the orbit; dorsal carapaceal ridge very prominent  
.....*Heterocarpus gibbosus*
5. Posterior 10 ventral rostral teeth corresponding to 8 or fewer dorsal teeth, penultimate segment of 3<sup>rd</sup> maxilliped usually less than 1.5 times as long as terminal segment.....*Plesionika quasigrandis*  
Posterior 10 ventral rostral teeth corresponding to more than 8 dorsal teeth, penultimate segment of 3<sup>rd</sup> maxilliped more than 1.5 times as long as terminal segment.....6
6. Dactylus of 3<sup>rd</sup> pereopod less than 1/7 times, as long as propodus, posterior 10 ventral rostral teeth usually corresponding to more than 13 dorsal teeth.....*Plesionika spinipes*  
Dactylus of 3<sup>rd</sup> pereopod more than 1/7 times, as long as propodus, posterior 10 ventral rostral teeth usually corresponding to 13 or fewer dorsal teeth.....*Plesionika grandis*
7. Rostrum armed with a series of closely packed spines ventrally; distinct ocellus.....8  
Rostrum armed with distantly placed spines; ocellus absent.....*Plesionika alcocki*
8. 3<sup>rd</sup> abdominal tergum posteriorly protrudes as a sharp dorsal spine....*Plesionika ensis*  
3<sup>rd</sup> abdominal tergum without spines but protrudes as a wavy margin...*Plesionika martia*

## Oplophoridae

1. Rostrum with atleast as many dorsal as ventral teeth; abdomen with 4<sup>th</sup> and 5<sup>th</sup> somites usually armed with posteromesial tooth; left mandible with incisor process not tapering sharply toward opposable margin, armed with 9-14 subacute teeth ..... *AcanthePHYra*
2. Abdomen with 6<sup>th</sup> somite shorter than 5<sup>th</sup> (not including posteromesial spine); telson simply pointed posteriorly, not terminating in spinose endpiece; 3<sup>rd</sup> maxilliped and 1<sup>st</sup> pereiopod with broadly compressed rigid exopods..... *Oplophorus*
3. Carapace without carina supporting branchiostegal spine; abdomen with posterior margin of 3<sup>rd</sup> somite distinctly excavate either side of posteriomedian tooth..... *AcanthePHYra armata*  
Carapace with strong carina extending from branchiostegal spine to branchial region; abdomen with posterior margin of 3<sup>rd</sup> somite not distinctly excavate either side of posteromedian tooth.... *AcanthePHYra fimbriata*
4. Abdomen with posteriomedian tooth on 4<sup>th</sup> and 5<sup>th</sup> somites; telson armed with four pairs of dorsolateral spines..... *AcanthePHYra sanguine*
5. Rostrum distinctly overreaching antennal scale; posterior extension of upper lateral rostral carinae on carapace subparallel in dorsal aspect; pleuron of 1<sup>st</sup> abdominal somite armed with small tooth on ventral margin; antennal scale unarmed on only distal 1/6 of lateral margin.. *Oplophorus gracilirostris*  
Rostrum rarely overreaching antenna scale; posterior extension of upper lateral rostral carinae on carapace converging posteriorly in dorsal aspect; pleuron of 1<sup>st</sup> abdominal somite unarmed; antennal scale with distal ¼ of lateral margin unarmed..... *Oplophorus typus*

## Penaeid shrimps

*Aristeus alcocki* Ramadan 1938 (Red ring)

Family Aristeidae



**Diagnostic characters:** Large size red abdominal rings. Rostrum in female long and slender upper margin curved downwards till distal end of 2<sup>nd</sup> segment of antennular peduncle. Rostrum in males much shorter and seldom surpassing tip of antennular peduncle, armed with three teeth above orbit; **and no teeth on ventral side, lacks hepatic spine, upper antennular flagellum very short, Eyestalk with a tubercle.** Petasma simple, membranous, right and left halves united with each other along the whole length of dorsomedian with a papilla-like projection directed posteromedially. Thelycum represented by a shield shaped plate directed anteroventrally bordered by an oblique ridge on either side.

**Colour:** Pink with reddish bands on the posterior border of all abdominal segments.

**Fishery & Biology:** The catches were mainly composed of females and their size ranged from 78 mm to 188 mm in total length. The size distribution showed unimodal pattern with majority in size groups 146-165 mm. The males, which were very poorly represented in the catches were relatively smaller in size and their total length varied from 67 mm to 110 mm.

**Distribution:** Indian Ocean; Arabian Sea and Bay of Bengal, at depth of 350-450 m off Quillon and Alleppey.

***Plesiopenaeus edwardsianus* Johnson, 1868** (Scarlet shrimp)

**Family:** Aristeidae



**Diagnostic characters:** Rostrum very long in females and young males but becoming considerably short in adult males, with three or more dorsal teeth; carapace without postorbital spine; eye stalks with a tubercle on inner border; upper antennular flagella very short and flattened almost throughout their length; endopods of second pair of pleopods in males bearing

appendix masculine and appendix interna; third and fourth pairs of pleopods biramous; telson armed with 1 or 4 movable spines on each side; two well developed arthrobranchs on penultimate thoracic segment.

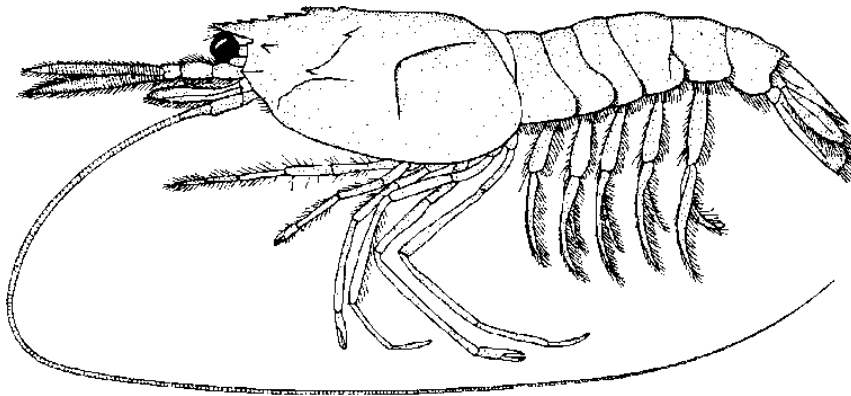
**Colour:** Deep pink

**Fishery & Biology:** Three female specimens ranging in total length from 207 to 245 mm (rostrum partly broken in all specimens) and carapace length from 79 to 96 mm obtained in Bobbin Trawl at 876-976 m depth.

**Distribution:** During one of the deep-sea trawling operations of FORV *Sagar Sampada* a few specimens of prawns, which were unusually large in size, were taken from about 900 m depth off Trivandrum on the southwest coast.

***Solenocera hextii* Wood-Mason & Alcock, 1891** (Deep sea mud shrimp)

**Family:** Solenoceridae



**Diagnostic characters:** Flattened rostrum with 7 teeth on dorsal side and no teeth on ventral side of the rostrum. Postrostral carina sharp but not laminose. Antennular flagella with red and white bands. The spines on the cervical groove situated ventral to the posteriormost rostral tooth which is well developed. The characteristic 'L' shaped groove on either side of the branchiostegal region is also clearly defined.

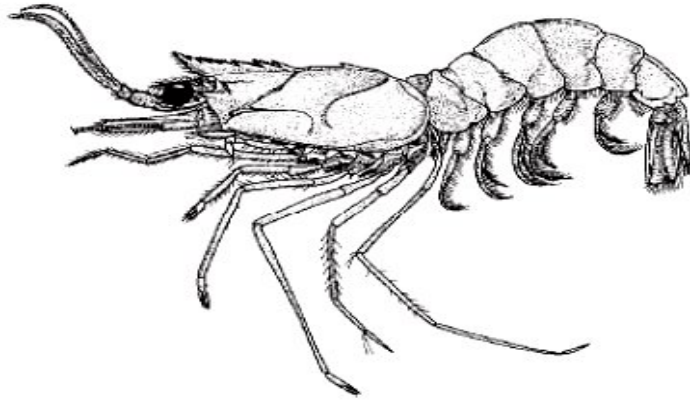
**Colour:** Pink to red

**Distribution:** Found all along the east and west coast of India at depths between 250 to 547 m.

***Solenocera alfonso* Perez Farfante, 1981**  
(Deep water mud shrimp)

**Diagnostic characters:** Antennular flagella flattened and tube like, rostrum horizontal, exopod of uropod without distolateral spine (family character). Telson armed with lateral spines; post

rostral crest elevated but not plate like. The postrostral crest is not separated from postrostral teeth by a distinct notch but postrostral crest behind cervical groove sometimes with an upper



tooth. Posterior part of hepatic groove and anterior part of branchiocardiac groove both very distinct and strongly curving downward; median part of first abdominal segment very narrow and dorsal crest of second abdominal segment distinct.

**Colour:** Pink to red

**Distribution:** Found at depths between 176 to 547 m. Though an Indo-West Pacific species, earlier records were only from Philippines, Indonesia and Northwestern Australia. In 2011, the species was recorded from Tuticorin, southeast coast of India from a depth of 250 to 350 m.

***Metapenaeopsis andamanensis* (Wood-Mason, 1891)**

(Rice velvet shrimp)

**Family: Penaeidae**



**Diagnostic characters:** Rostrum more or less horizontal and straight with 6 to 7 teeth on dorsal side and no teeth on the ventral side. Lower antennular flagellum longer than the upper, much longer than the entire antennular peduncle but 0.7 times the carapace length. 3<sup>rd</sup> pereopod surpass the rostrum by the length of the entire chela. Assymetrical petasma. 3rd maxilliped and 1st pereopod with a basal spine, distal fixed pair of spines on telson.

**Colour:** Pale pink to red

**Fishery & Biology:** The total length of males varied from 67 mm to 115 mm and that of females from 68 mm to 130 mm.

**Distribution:** A penaeid prawn commonly encountered in the trawl catches at all depths ranges upto 400 m and was obtained from all areas.

*Penaeopsis jeryii* ( Dagger shrimp)

**Family:** Penaeidae



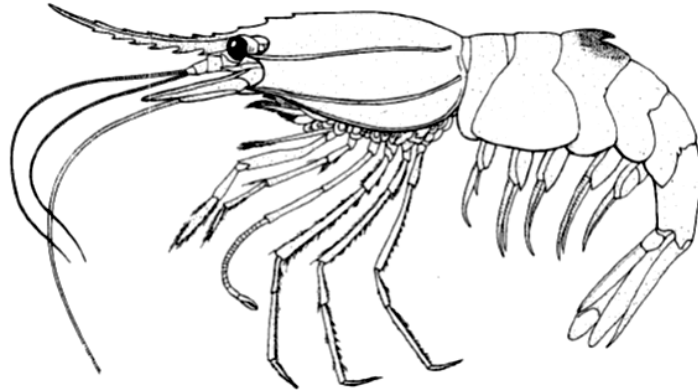
**Diagnostic characters:** Dagger shaped rostrum with teeth on dorsal side of the rostrum. Specimen appears to be pale red in color with white bands on the body. Cervical groove very prominent, antennal scale as long as rostrum. Thelycum trilobed and sub elliptical in structure.

**Fishery & Biology:** Size range of female specimens ranged from 74-115 mm and males ranged from 70-110 mm.

**Distribution:** All along the southwest coast of India particularly off Cochin, Quillon and Alleppey at depth of 275-350 m

*Heterocarpus woodmasoni* Alcock, 1901 (Indian Nylon Shrimp)

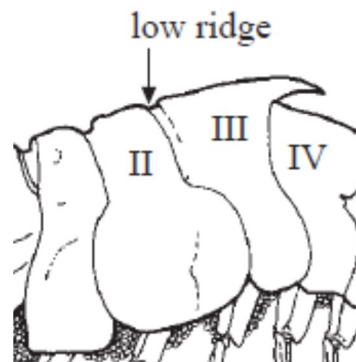
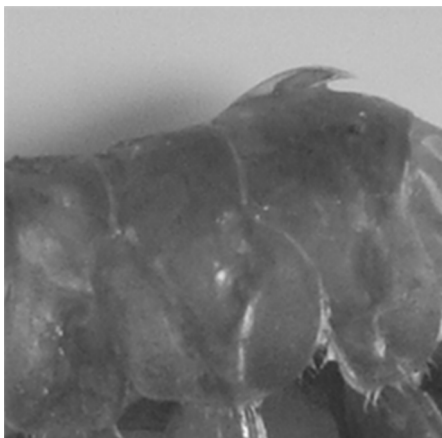
Family : Pandalidae



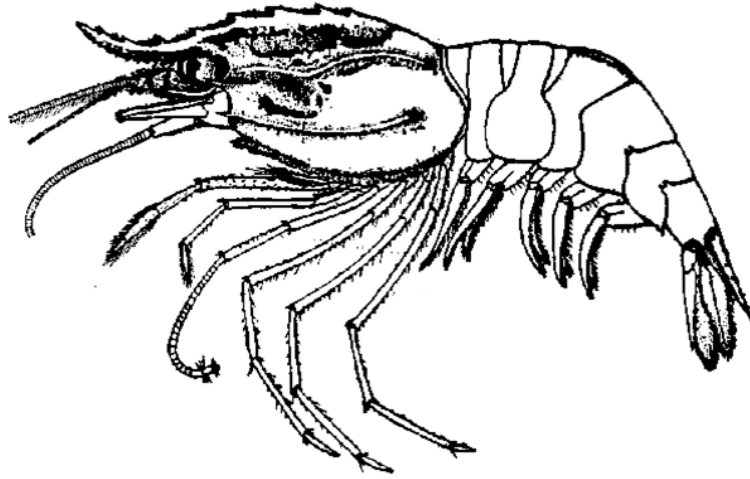
**Diagnostic characters:** Carapace with 2 longitudinal crests on each side, extending over full length of carapace – post antennal crest and branchiostegal crest. A conspicuous elevated, sharp tooth at middle of dorsal crest of 3rd abdominal segment, telson bears 5 pairs of dorsolateral spinules besides those at the tip.

**Fishery & biology:** Size in the catches ranged from 72 to 135 mm in total length but dominated by 111-120 mm size groups in both the sexes. The fertilized eggs on the pleopods and the head-roe are light orange and this colour stands out in contrast with the pink colour of the prawn. The berry becomes greyish in advanced stages of development.

**Distribution:** Andamans, Southwest of India off Cochin and Alleppey at depths of 250-400 m



*Heterocarpus gibbosus* Bate, 1888  
(Humpback nylon shrimp)



**Diagnostic characters:** The teeth on the dorsal crest and the rostrum together vary from 8 to 10. Teeth on the rostrum proper varying from 2 to 4 and 13-15 on ventral side. The dactyli of the 3 posterior legs short, median carination of the 3<sup>rd</sup> abdominal tergum is quite prominent. Carapace with 2 longitudinal crests on each side, extending over full length of carapace- post-ocular crest and branchiostegal crest. Post antennal crest very short.

**Fishery & biology:** The size of the individual prawn varied from 67 to 140 mm in total length and the catches were represented by all groups of the females. Males are mostly in 90-100 mm size groups. The colour of the berry is light **orange** and turns dirty grey as embryo develops.

**Distribution:** Southeast and Southwest coast off Cochin, off Alleppey at depths of 250-400 m. immature specimens were found in greater numbers in shallow waters while the bigger prawns seemed to prefer deeper grounds beyond 350 m.

*Heterocarpus sibogae* de Man, 1917

**Diagnostic characters:** Integument tomentose formed by lanceolate scalelike spines, rostrum about 2/3 as long as carapace, gradually recurved upwards, armed dorsally with 8 teeth followed by 6 on postrostral crest of which the first one placed behind middle of two small ones situated closely on distal part; a dark reddish spot covering almost the entire width of 3rd abdominal



somite on either side appears to be characteristic; tip of rostrum, orbital margin, carinae of 1st and 2nd abdominal terga, distal portion of spines on 3rd and 4th terga, tip of dorsal antennular flagellum and pereopods and the entire pleopods reddish; telson long, nearly as long as uropods, armed with 5 small dorsolateral movable spines on right side and 4 on left side in addition to 3 pairs at distal end; antennular flagella about the same length of carapace, stylocerite pointed and reaching middle of second segment of antennular peduncle; scaphocerite narrower distally, reaching 3/4 of rostrum; distolateral spine projecting well beyond anterior margin.

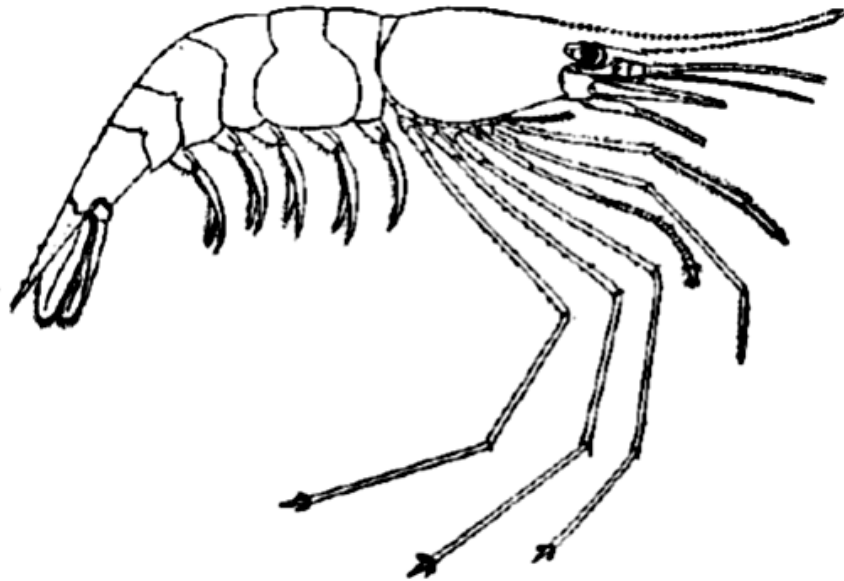
**Colour:** Fresh specimen appears pink

**Fishery:** One female, total length 114 mm, carapace length 34 mm; off Quilon at 310 320 m.

**Distribution:** Southeast and Southwest coast of India

*Plesionika spinipes* (Bate, 1888) (Oriental Narwal Shrimp)

**Family-** Pandalidae



**Diagnostic characters:** Rostrum upturned at the tip. Rostrum is armed with 46 teeth on the dorsal side and 31 teeth on the ventral side., very long slender legs, Telson is double the length of the 5<sup>th</sup> abdominal somite. Lower antennular flagellum longer than the upper and about 5.4 times the carapace length. 3<sup>rd</sup> maxilliped extends beyond the antennal scale by the length of its dactylus. Second pereopod exceeds the tip of antennal scale by its chela and 1/8 length of carpus. Minute tubercle on the dorsal surface of the carapace at about 1/6<sup>th</sup> of its length from the hinder

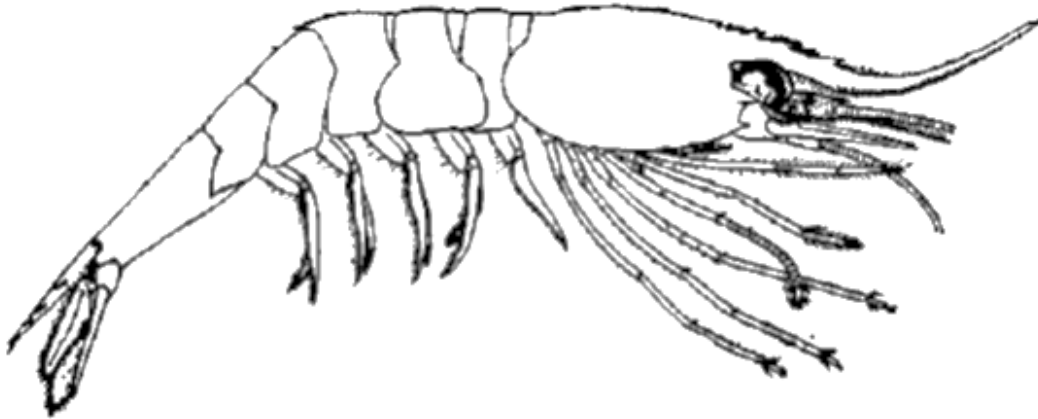
edge which corresponds in position to the small blunt median spine which is present in all the specimens.

**Colour:** Body pale red in colour

**Fishery & biology:** The size of this prawn in the catches ranged from 63 to 125 mm but the size groups 95-110 mm in both sexes predominated. Berry is greenish-blue in colour with ovoid shape of fertilized eggs.

**Distribution:** In Indian waters this species is known to occur in south-east and south-west coast of India abundantly noticed from Quilon and Mangalore regions from the depth of 250-400 m.

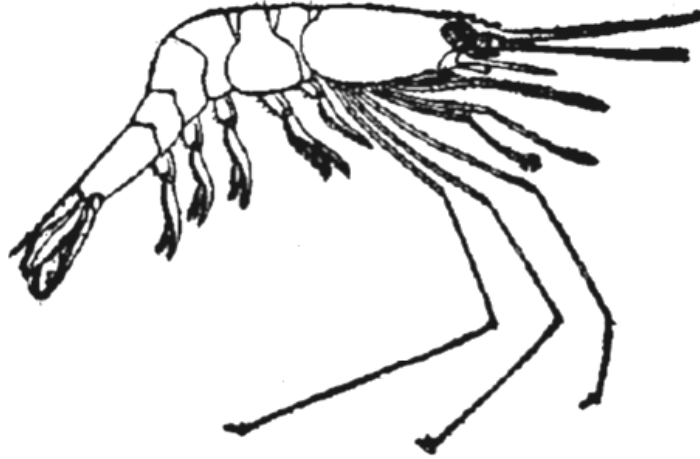
***Plesionika martia* (A. Milne-Edwards, 1883)**  
(Golden Shrimp)



**Diagnostic characters:** Rostrum very long pointed with 7-9 dorsal teeth including 2-5 teeth on carapace posterior to the level of orbital margin while ventral margin of the rostrum is armed with 34-56 teeth.

**Fishery & biology:** The size of this prawn in the catches ranged from 71 to 120 mm in males and 80 to 130 mm in females. The modal lengths for males and females were at 90-95 mm and 96-100 mm respectively. Berry is deep blue in colour in the early stages and to light grey in advances stages of development.

**Distribution:** In Indian waters this species is known to occur along the south-west coast particularly through out the Kerala coast abundantly noticed from Quilon and Alleppey regions from the depth of 200-450 m.

*Plesionika ensis* (A. Milne-Edwards, 1881)

**Diagnostic characters:** Rostrum long, moderately slender, having a double curve with the apex pointing upwards and reaching a good deal above the level of the dorsal surface of the carapace. It surpasses the scaphocerite by half or more its length in young specimens and less than half in adults. In both the sexes there are 5 to 6 (usually 6) proximally placed teeth on its upper margin ; the first 4 of which are placed close together above the orbit while the succeeding ones are isolated. The first tooth is movable and very small, hardly visible to naked eye. The sizes of the succeeding teeth show gradual increase until the fifth which is the largest of all. The fifth or the sixth tooth may be occasionally wanting. The ventral margin of the rostrum carries a row of 34-46 fixed teeth which are relatively smaller and sharp. The telson 9/11 length of 6<sup>th</sup> somite and is armed with 3 pairs of terminal spines and an equal number of small movable spines dorso-laterally. The 1<sup>st</sup> and 2<sup>nd</sup> pereopods are almost equal in length reaching the end of scaphocerite. The number of carpal joints in the 2<sup>nd</sup> pereopods varied between 15 and 17 in both the sexes. The last three pairs of pereopods are longer than the first two. The third pereopod, which is the longest of all, is a little more than 1.25 times the first and surpasses the end of scaphocerite.

**Colour:** body is pinkish throughout.

**Fishery & biology:** The individual size varied from 58-120 mm in total length and the size groups 91-110 mm dominated in the catches. The eggs on the pleopods are deep blue but colour fades gradually as the embryos develop.

**Distribution:** Reported from many parts of the world but its distribution in Indian Ocean was hitherto known from only 2 specimens collected by Alcock (1901) from the Andaman Sea.

Suseelan and Mohamed (1969) reported its occurrence in large numbers from off Quilon and Alleppey at 250-400 m.

***Plesionika adensameri***: A new distributional record of *Plesionika adensameri* (Balss, 1914) was recorded from southwest coast of India (Shanis et al., 2012).

***Plesionika williamsi* Forest, 1963**

**Diagnostic characters**: Body covered with lanceolate scales implanted in small pits; rostrum long, extending far beyond scaphocerite, about 1.5 times as long as carapace, curved downwards upto middle of antennular peduncle and thereafter gradually ascending, armed with 11 dorsal teeth arranged closely on basal crest, proximal 3 or 4 placed behind orbit, first tooth microscopic and movable, next 2 or 3 of medium size and remaining ones larger and of uniform size, telson as long as 6<sup>th</sup> somite, armed with 4 pairs of small movable spines dorsolaterally and 3 pairs on distal extremity; eyes large with distinct ocellus; stylocerite reaching near to distal border of basal segment of antennular peduncle, 3<sup>rd</sup> - 5<sup>th</sup> pereopods excessively long surpassing beyond scaphocerite by whole or greater part of carpus; propodus of 4th leg slightly longer than carpus and 15 -16 times as long as dactylus; 5<sup>th</sup> leg longest, about 4.5 times the length of carapace; appendix interna with small coupling hooks on distomedian surface; endopod of uropods reaching tip of telson.

**Fishery and biology**: 2 berried females, total length 144 and 145 mm, carapace length 28.5 and 30.0 mm; Off Quilon at 335 - 357 m, November, 1970. 1 berried female, total length 115 mm, carapace length 23 mm; off Quilon at 320 m, March, 1979.

**Distribution**: Arabian sea, Andamans off Quilon and Alleppey at 250-400 m

**Family : Ophlophoridae**

Antennal scale sharply serrated; exopod of 1st pair of pereopods foliaceous....*Ophlophorus typus*

Antennal scale smooth without any serrations. Exopod of 1st pereopods not foliaceous.....*Acanthephyra*

***Ophlophorus gracilirostris* Alcock, 1901**

**Diagnostic characters**: Carapace with dorsal carina extending to the posterior margin. Rostrum very long almost equal in length to the carapace. Branchiostegal spine quite distinct, with a well-

defined keel, spine on the 3<sup>rd</sup> abdominal tergum very much longer than those on the 4<sup>th</sup> and 5<sup>th</sup>. In the male the anterior border of the first abdominal somite is bilobed with the posterior lobe more pronounced and angular.

**Distribution:** Arabian Sea, Bay of Bengal, Andaman Sea and Hawaii Islands, Southwest of Cochin, off Alleppey 300-450 m

***AcanthePHYra armata* A. Milne-Edwards, 1881**



**Diagnostic Characters:** The carapace is without a straight ridge or carina running on the entire length of the lateral surface i.e., from the hind margin of the orbit to the posterior edge of the carapace. Rostrum long, upcurved with 5 to 6 teeth on the dorsal side and only one tooth on the ventral side of rostrum. Dorsal carina of 3<sup>rd</sup> to 6<sup>th</sup> abdominal somites ending in pointed spines. Sometimes the posterior spine on the sixth somite may be absent. Telson generally more or less truncated at the tip and laterally it is armed with spines. Eyes are well pigmented. Incisor process of the mandible is provided with teeth throughout the entire length of its cutting edge. Pereopods are not abnormally broad and flattened. Exopods of the third maxilliped and all pereopods are neither foliaceous nor rigid.

**Distribution:** Southeast and Southwest coast of India

*AcanthePHYra sanguinea Wood-Mason, 1892*

**Diagnostic Characters:** Rostrum longer than carapace with 7 dorsal and 5 ventral teeth, extending much beyond the tip of the antennal scale. Branchiostegal spine small, forming a small projection on frontal border of carapace and without a carina. Surface of carapace finely pitted as in all the species of the purpurea group. Dorsal carinae of 3<sup>rd</sup> to 6<sup>th</sup> abdominal somites ending in pointed spines, that of 3<sup>rd</sup> somite the longest and of 4<sup>th</sup> and 5<sup>th</sup> of equal size and smallest. Four pairs of dorsolateral spines present on the telson.

**Distribution:** Southeast and Southwest coast of India

*List of Deep sea shrimps from Indian waters*

	Species	Common name (English)	Distribution
<b>Family</b>	<b>Sicyoniidae Ortmann, 1898</b> 1 Genus, 4 Species <i>Sicyonia</i> H. Milne Edwards, 1830 <i>Sicyonia fallax</i> De Man, 1907a* <i>Sicyonia lancifer</i> (Olivier, 1811)* <i>Sicyonia longicauda</i> Rathbun, 1906* <i>Sicyonia parajaponica</i> Crosnier, 2003*	Rock shrimps  Knight rock shrimp	India Southwest & Southeast India Southwest & Southeast
<b>Family</b>	<b>Pandalidae Haworth, 1825</b> <i>Heterocarpus</i> A. Milne-Edwards, 1881b		
<b>Genus</b>	<i>Heterocarpus ensifer</i> A. Milne		

	Edwards,1881b* <i>Heterocarpus gibbosus</i> Spence Bate,1888 <i>Heterocarpus laevigatus</i> Spence Bate,1888* <i>Heterocarpus longirostris</i> Macgilchrist,1905 <i>Heterocarpus tricarinatus</i> Alcock &Anderson,1894* <i>Heterocarpus woodmasoni</i> Alcock,1901 <i>Heterocarpus sibogae</i> De Man,1917	Armed Nylon shrimp  Smooth Nylon shrimp  Scarred Nylon shrimp Indian Nylon shrimp Mino Nylon shrimp	Southeast & west coast Southeast & west coast A & N Islands Arabian sea Bay of Bengal Arabian Sea, Lakshadweep Southeast & West coast, Andaman Southeast & West coast, Andaman's
Genus	<b>Plesionika Bate, 1888</b> <i>Plesionika martia</i> (A.Milne-Edwards, 1883) <i>Plesionika spinipes</i> Spence Bate, 1888	Golden Shrimp Oriental Narwal	East & West coast West & south east coast, India
Family	Aristeidae Wood-mason, 1891 Aristeus Duvernoy, 1840	Aristeid shrimps	
Genus	<i>Aristeus alcocki</i> Ramadan, 1938	Arabian Red shrimp	Southeast, southwest, lakshadweep sea
Family	<b>Solenoceridae</b> Wood-Mason, 1891	Solenocerid shrimps	
Genus	<b>Solenocera</b> Lucas, 1849 <i>Solenocera alfonso</i> perez farfante, 1981* <i>Solenocera hextii</i> Wood-Mason and Alcock, 1891b	Deepwater Mud shrimp Deepwater Mud shrimp	Off Tuticorin East & West coast
Family	<b>Penaeidae</b> Rafinesque, 1815	Penaeid Prawns	
Genus	<b>Metapenaeopsis</b> Bouvier, 1905 <i>Metapenaeopsis andamanensis</i> (Wood-Mason in Wood-Mason & Alcock, 1891a)*	Rice velvet shrimp	Southwest, Southeast & Andamans
Genus	<b>Parapenaeus</b> Smith, 1885b <i>Parapenaeus investigatoris</i> Alcock &	Explorer Rose Shrimp	Southwest, SE & A &

	Anderson, 1899		NIslands
Genus	<b>Penaeopsis</b> spence Bate, 1881 <i>Penaeopsis jerryi</i> Perez Farfante, 1979	Gondwana Shrimp	Southwest, SE & A & N Islands
Family	<b>Oplophoridae</b> Dana, 1852a		
Genus	<b>Acanthephyra</b> A. Milne-Edwards, 1881b <i>Acanthephyra sanguinea</i> Wood-Mason in Wood-mason & Alcock, 1892* <i>Acanthephyra armata</i> A. Milne-Edwards, 1881		Off kerala, West coast  Off kerala, West coast

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