

# 10

## Taxonomy, Biology and Distribution of Deep Sea Shrimps

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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.

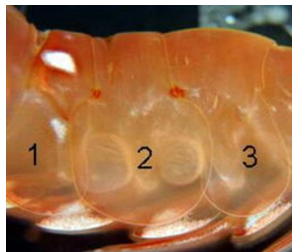
### **Difference between penaeid and non penaeid shrimps**

#### **Penaeid shrimp**

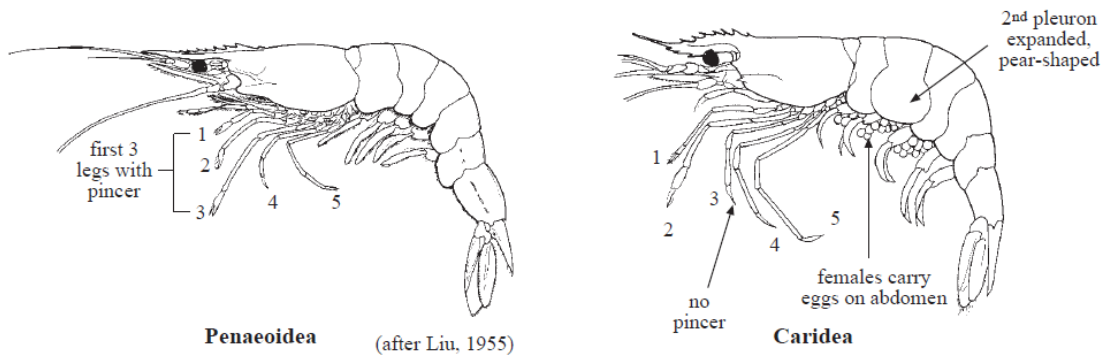
- Abdomen with posterior part of pleura covering anterior part of succeeding pleura
- Thelycum and petasma present, eggs are released directly into water and not attached to the female

#### **Caridean shrimp**

- 2<sup>nd</sup> abdominal pleuron greatly expanded, pear shaped and overlapping posterior part of 1<sup>st</sup> pleuron and anterior part of 3<sup>rd</sup> pleuron

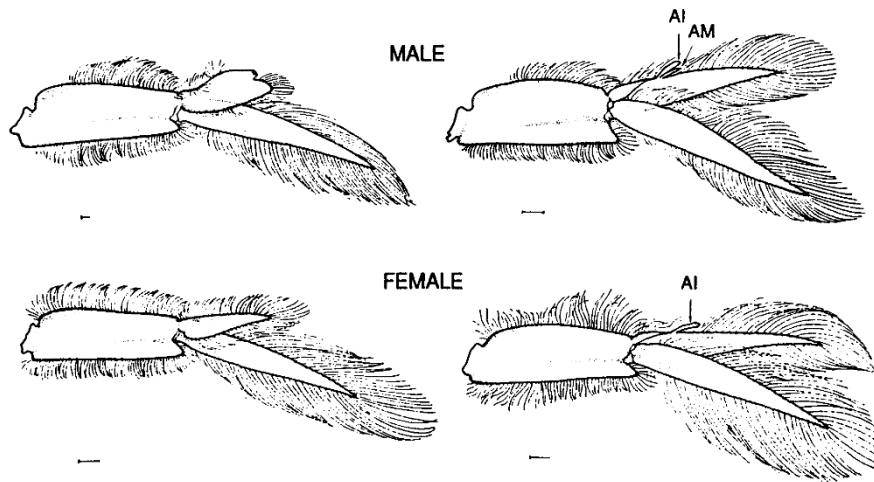


- No specific copulatory organs, females carry eggs on the abdomen until hatching



FIRST PLEOPOD

SECOND PLEOPOD



**Key to the deep sea prawns of Penaeidae, Pandalidae and Oplophotidae**

**Penaeidae**

- 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***
- Exopodite of the external maxillipeds large, absence of a brachio-cardiac sulcus in the branchiostegal region.....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  $1/3^{\text{rd}}$  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
2. Carapace smooth without a longitudinal carinae; 2<sup>nd</sup> pair of pereopods carapace equal.....2
3. 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
4. 3<sup>rd</sup> abdominal tergum without spines, length of 6<sup>th</sup> abdominal segment less than 5<sup>th</sup>.....4
5. 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***
6. 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***
7. Posterior 10 ventral rostral teeth corresponding to 8 or fewer dorsal teeth, penultimate segment on 3<sup>rd</sup> maxilliped usually less than 1.5 times as long as terminal segment.....***Plesionika quasigrandis***
8. 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
9. 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***
10. 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***
11. Rostrum armed with a series of closely packed spines ventrally; distinct ocellus.....8
12. Rostrum armed with distantly placed spines; ocellus absent.....***Plesionika alcocki***

13. 3<sup>rd</sup> abdominal tergum posteriorly protrudes as a sharp dorsal spine....***Plesionika ensis***
14. 3<sup>rd</sup> abdominal tergum without spines but protrudes as a wavy margin.....***Plesionika martia***

### Oplophoridae

1. Rostrum with at least 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> pereopod 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 posteriomedian 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***
6. 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***

**SCIENTIFIC CLASSIFICATION**

<b>Kingdom</b>	Animalia
<b>Phylum</b>	Arthropoda
<b>Subphylum</b>	Crustacea
<b>Class</b>	Malacostraca
<b>Subclass</b>	Eumalacostraca
<b>Superorder</b>	Eucarida
<b>Order</b>	Decapoda
<b>Suborder</b>	Dendrobranchiata
<b>Superfamily</b>	Penaeoidea

**Penaeid shrimps**

***Aristeus alcocki* (Ramadan 1938)**

Common name: 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**



**Petasma (Male)**

**Thelycum (Female)**

**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 Sampadaa* 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.



**Petasma (Male)**



**Thelycum (Female)**

**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. 3<sup>rd</sup> maxilliped and 1<sup>st</sup> pereopod with a basal spine, distal fixed pair of spines on telson.



**Petasma (Male)**



**Thelycum (Female)**

**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***

Common name: 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, Quilon and Alleppey at depth of 275-350 m.

### SCIENTIFIC CLASSIFICATION

<b>Kingdom</b>	Animalia
<b>Phylum</b>	Arthropoda
<b>Subphylum</b>	Crustacea
<b>Class</b>	Malacostraca
<b>Subclass</b>	Eumalacostraca
<b>Superorder</b>	Eucarida
<b>Order</b>	Decapoda
<b>Suborder</b>	Pleocyemata
<b>Infraorder</b>	Caridea

### Non-Penaeid shrimps

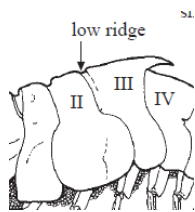
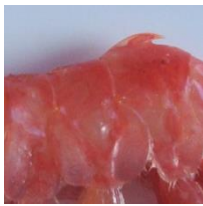
#### ***Heterocarpus woodmasoni* (Alcock, 1901)**

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 3<sup>rd</sup> 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.



Male



Female

**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.



Male



Female

**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 sibogaede* (Man, 1917)**

**Diagnostic characters:** Integument tomentose formed by lanceolate scale-like 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 3<sup>rd</sup> abdominal somite on either side appears to be characteristic; tip of rostrum, orbital margin, carinae of 1<sup>st</sup> and 2<sup>nd</sup> abdominal terga, distal portion of spines on 3<sup>rd</sup> and 4<sup>th</sup> 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 depth.

**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 and 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



Male

Female

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.

**Family : Ophlophoridae**

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

Antennal scale smooth without any serrations. Exopod of 1<sup>st</sup> 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 depth.

***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.



**Male**



**Female**

**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**

	<b>Species</b>	<b>Common name (English)</b>	<b>Distribution</b>
Family	<b>Sicyoniidae</b> (Ortmann,1898)	<b>Rock shrimps</b>	India (Southwest & Southeast)
	1 Genus, 4 Species		
Genus	<b>Sicyonia</b> (H. Milne Edwards,1830)		
	<i>Sicyonia fallax</i> (De Man,1907)		
	<i>Sicyonia lancifer</i> (Olivier,1811)		
	<i>Sicyonia longicauda</i> (Rathbun, 1906)		
	<i>Sicyonia parajaponica</i> (Crosnier, 2003)	Knight rock shrimp	
Family	<b>Pandalidae</b> (Haworth,1825)	Armed nylon shrimp	Southeast & west coast A & N Islands
Genus	<b>Heterocarpus</b> (A. Milne-Edwards,1881)		
	<i>Heterocarpus ensifer</i> (A. Milne Edwards,1881)		
	<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)	Indian nylon shrimp	
		Mino nylon shrimp	Arabian sea Bay of Bengal
		Smooth nylon shrimp	Arabian Sea, Lakshadweep
		Scarred nylon shrimp	Southeast & West coast, Andaman
			Southeast & West coast, Andaman's

## Training Manual on Species Identification

Genus	<b>Plesionika</b> (Bate, 1888) <i>Plesionika martia</i> (A. Milne-Edwards, 1883) <i>Plesionika spinipes</i> (Spence Bate, 1888)	Golden Shrimp  Oriental Narwal Shrimp	East & West coast  West & south east coast, India
Family Genus	<b>Aristeidae</b> (Wood-mason, 1891) <b>Aristeus</b> (Duvernoy, 1840) <i>Aristeus alcocki</i> (Ramadan, 1938)	Aristeid shrimps  Arabian Red shrimp	Southeast, Southwest, Lakshadweep sea
Family Genus	<b>Solenoceridae</b> (Wood-Mason, 1891) <b>Solenocera</b> (Lucas, 1849) <i>Solenocera alfonso</i> (Perez farfante, 1981) <i>Solenocera hextii</i> (Wood-Mason and Alcock, 1891)	Solenocerid shrimps  Deep water Mud shrimp  Deep sea Mud shrimp	Off Tuticorin East & West coast
Family Genus	<b>Penaeidae</b> (Rafinesque, 1815) <b>Metapenaeopsis</b> (Bouvier, 1905) <i>Metapenaeopsis andamanensis</i> (Wood-Mason in Wood-Mason & Alcock, 1891)	Penaeid Prawns  Rice velvet shrimp	Southwest, Southeast & Andaman
Genus	<b>Parapenaeus</b> (Smith, 1885) <i>Parapenaeus investigatoris</i> (Alcock & Anderson, 1899)	Explorer Rose Shrimp	Southwest, SE & A & N Islands
Genus	<b>Penaeopsis</b> spence (Bate, 1881) <i>Penaeopsis jerryi</i> (Perez Farfante, 1979)	Gondwana Shrimp	Southwest, SE & A & N Islands
Family Genus	<b>Oplophoridae</b> (Dana, 1852) <b>AcanthePHYra</b> (A. Milne-Edwards, 1881) <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



**References**

- Alcock. A. 1901. *A descriptive catalogue of the Indian deep-sea crustacea: Decapoda, Macrura and Anomala in the Indian Museum, Being a revised account of the Deep-sea species collected by the Royal Marine Survey Ship 'INVESTIGATOR'*, Calcutta, India, 286 pp.
- Alcock. A. 1906. *Catalogue of the Indian Decapod Crustacea in the Collections of the Indian Museum*. Part III. Macrura (*Penaeus*) Indian Museum, Calcutta, 55 pp.
- Calman, W. T. 1939. Crustacea: Caridea. *John Murray Exped., 1933-34, Scientific Reports* 6(4): 183-224.
- Chace, F. A., Jr. 1985. The caridean shrimps (Crustacea: Decapoda) of the *Albatross Philippine Expedition, 1907-1910*, Part 3; Families Thalassocarididae and Pandalidae. *Smithsonian contributions to Zoology*, No. 411: 143 p.
- De Man, J. G. 1911. The Decapoda of the Siboga Expedition – Part I. Family Penaeidae. *Siboga Exped. Monogr.*, 39a: 1-131.
- George, M. J. and George, K. C. 1964. *On the occurrence of the caridean prawn Thalassocaris lucida (Dana) in the stomach of Neothunnus macropterus (Temminck and Schlegel) from the Arabian Sea*. *Journal of the Marine Biological Association of India*, 6 (1). pp. 171-172.
- Holthuis, L. B. 1980. *FAO species catalogue. Vol.1 Shrimps and prawns of the world. An annotated catalogue of species of interest to fisheries. FAO Fish. Synop., (125) Vol.1: 1-271.*
- John, C. C. and C. V. Kurian. 1959. A preliminary note on the occurrence of deep-water prawn and spiny lobster off the Kerala coast. *Bull. Cent. Res. Inst. Trivandrum, Ser. C.*, 7(1): 155-162.
- Lalitha Devi, S. 1980. Notes on three caridean prawns from Kakinada. *J. Mar. Biol. Ass. India*, 22 (1&2): 169-173.
- Mohamed, K. H. and C. Suseelan. 1973. Deep-sea prawn resources off the South-West Coast of India. *Proc. Symp. Living Resources of the Seas around India*, CMFRI, India, pp. 614-633.
- Nandakumar, G., K. N. Rajan and K. Chellappan. 2001. Is the deep-sea prawn fishery of Kerala sustainable? *Mar. Fish. Infor. Serv., T & E Ser.*, No. 170: 5-9.
- Oomen P. Varghese. 1980. Results of the exploratory fishing in Quilon Bank and Gulf of Mannar IFP. *Bulletin*, 4: 1-49.
- Rajan, K. N., Nandakumar, G. and Chellapan, K. 2001. Innovative exploitation of deepsea crustaceans along the Kerala coast. *Mar. Fish. Infor. Serv., T & E Ser.*, No. 168.
- Silas, E. G. 1969. Exploratory fishing by R. V. *Varuna*. *Bull. Cent. Mar. Fish. Res. Inst.*, No. 12: 1-86.
- Silas, E. G. 1969. Exploratory fishing by R.V. *Varuna*. *Bull. Cent. Mar. Fish. Res. Inst.*, No. 12: 1-86.

- Sulochanan, P., K. N. V. Nair and D. Sudarsan, 1991. Deep-sea crustacean resources of the Indian Exclusive Economic Zone. *Proc. National Workshop on Fisheries Resources Data and Fishing Industry*: 98-107.
- Suseelan, 1974. Observations on the Deep sea prawn fishery off the south-west coast of India with special reference to Pandalids. *J. Mar. Biol. Ass. India*. 16(2): 491-511.
- Suseelan, C and K. H. Mohamed. 1968. On the occurrence of *Plesionikaensis* (A.M. Edw.) (Pandalidae, Crustacea) in the Arabian Sea with notes on its biology and fishery potentialities. *J. Mar. Biol. Ass. India*, 10(1): 88-94.
- Thomas, M. M. 1979. On a collection of deep sea decapod crustaceans from the Gulf of Mannar. *J. Mar. Biol. Ass. India*, 21: (1-2)