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**S**hellfish 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, and 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.

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. 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. The deep water penaeid shrimp is an important commercial crustacean resource along the Indian coast. In recent times, the deep sea shrimps emerged as the valuable resources as high health food items both in domestic and international markets due to the presence of various essential nutrients, particularly long chain omega -3 polyunsaturated fatty acids ( $\omega$ 3-PUFAs) viz., eicosapentaenoic acid (EPA, 20:5 $\omega$ 3) and docosahexaenoic acid (DHA, 22:6 $\omega$ 3) along with essential amino acids although the structure and organization of their community are not well known as that of coastal penaeid shrimps. The pioneering works of Alcock (1901, 1906) are one of the systematic of inshore penaeid shrimps of Indian origin. Identification of these deep sea shrimps to species level by conventional taxonomy is a herculean task because of their complex morphological characters.

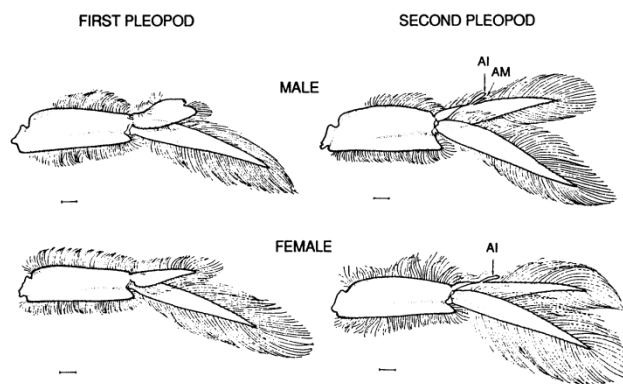
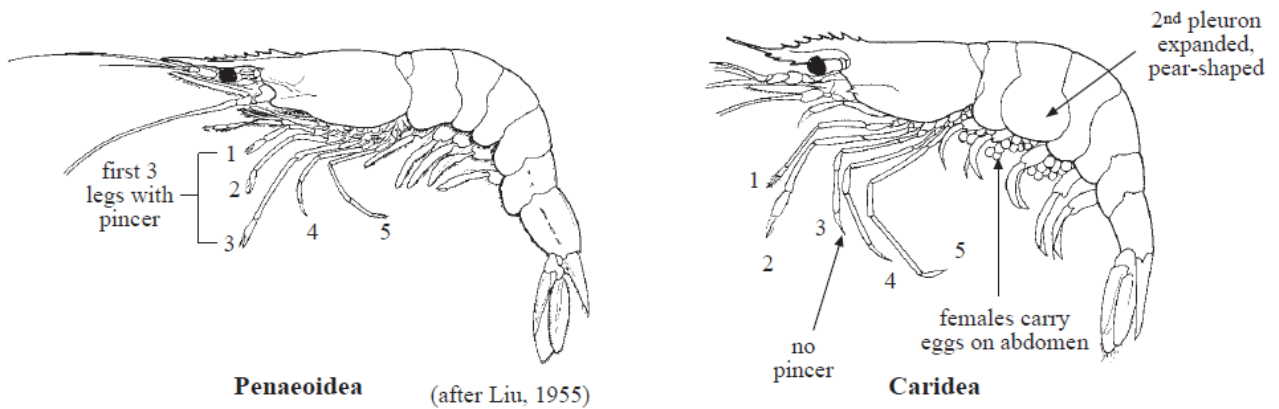
## **Difference between penaeid and non penaeid shrimps**

### **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**

- 2nd abdominal pleuron greatly expanded, pear shaped and overlapping posterior part of 1st pleuron and anterior part of 3rd pleuron.
- No specific copulatory organs, females carry eggs on the abdomen until hatching



## 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 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.

***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. Post rostral carina sharp but not laminose. Antennular flagella with red and white bands. The spines on the cervical groove situated ventral to the posterior most 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 547m.

***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. Asymmetrical 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 up to 400 m and was obtained from all areas.

### **Caridean 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 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-roes 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 coast 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.

### ***Plesionika quasigrandis* (Chace, 1985)**

**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.

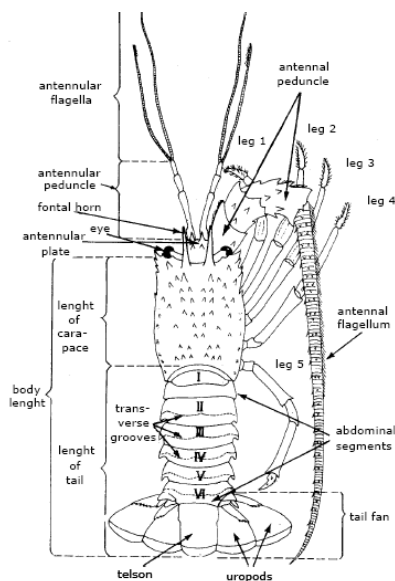
**Colour:** Body pale red in colour

**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.

## Lobsters

Lobsters are among the most prized of fisheries resources and of significant commercial interest in many countries. Because of their high value and esteemed culinary worth, much attention has been paid to lobsters in biological, fisheries, and systematic literature. They have a great demand in the domestic market as a delicacy and is a foreign exchange earner for the country.



The suborder Macrura Reptantia consists of three infraorders: Astacidea (Marine lobsters and freshwater crayfishes), Palinuridea (Spiny lobsters and slipper lobsters) and Thalassinidea (mud lobsters). The infraorder Astacidea contains three super families of which only one (the Nephropoidea) is considered here. The remaining two super families (Astacoidea and parastacoidea) contain the freshwater crayfishes. The superfamily Nephropoidea (40 species) consists almost entirely of commercial or potentially commercial species.

The infraorder Palinuridea also contains three super families (Eryonoidea, Glypheoidea and Palinuroidea) all of which are marine. The Eryonoidea are deepwater species of insignificant commercial interest. The Glypheoidea includes an almost exclusively fossil group. About 120 species are included in the superfamily Palinuroidea.

The third infraorder, the Thalassinidea, contains a single superfamily, the Thalassinidea which contains around 100 species. Only few representatives of this superfamily are known to be used as food and bait.

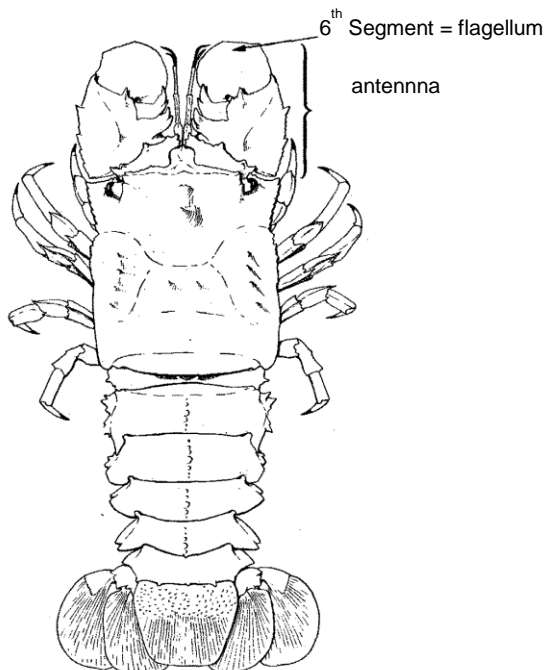
**SUPERFAMILY PALINUROIDEA** Latreille, 1802

Three families make up this superfamily, namely the Palinuridae (spiny lobsters), Synaxidae (furry lobsters) and Scyllaridae (slipper lobsters).

**Key to families**

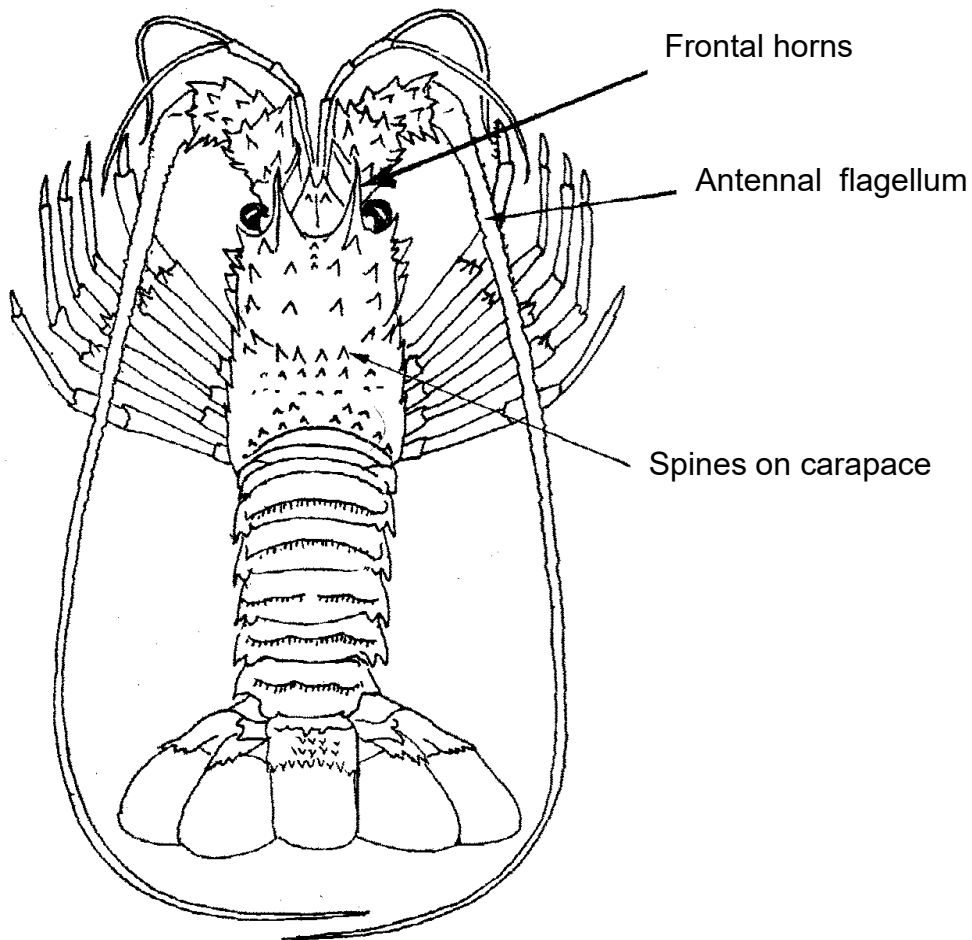
1a. Antennal flagellum reduced to a single, flat, plate which forms the sixth and final segment of the antenna. The shovel-like appearance of the antennae is responsible for the names shovel-nose lobster and bulldozer lobster also used for the animals of this group

..... **Scyllaridae**



1b. Antennal flagellum long and consisting of numerous small articles, whip-like or spear-like





***Panulirus homarus homarus* (Linnaeus, 1758)**

**Diagnosis:** Abdominal segments 2-5 with transverse grooves interrupted in the middle; minute squamae on the upper margin of the groove; antennular plate with four spines; exopod of third maxilliped absent; second maxilliped with no flagellum; olive green in specimens with minute squamae.

**Distribution:** The *P. homarus homarus* subspecies has a broad geographic range extending from East Africa to Japan including Indonesia, Australia, New Caledonia and the Marquesas Archipelago (Holthius, 1991). Northwest, southwest, southeast coast of India, A& N Islands and Lakshadweep Islands. Forms fishery along southwest and southeast coast; promising species for aquaculture

**Habitat and ecology:** The species is commonly found in very shallow water (1-15m), although can be found to depths of 90m. It inhabits rocky reefs for shelter (Holthius, 1991).

**Biology:** Maximum total length 31cm, carapace length 12cm. Average total length 20 to 25cm Major fisheries are on the southeast and southwest coast of India. The commercial fishery at Muttom, Kanyakumari district was found to be largely supported by 1<sup>st</sup> and 2<sup>nd</sup> year animals. At a given carapace length females are heavier than males. Females attain functional maturity at a carapace length (CL) of 55mm. Males attain maturity at 63mm CL on the basis of allometric growth of III walking leg. Peak breeding season is from November to December.

***Panulirus ornatus*** (Fabricius, 1798)

**Diagnosis:** Abdominal somites smooth and naked; colour of abdomen brownish or greenish-grey with utmost minute indistinct speckles. The usually large eyespot in the anterior half near the base of the pleura is accompanied by an oblique pale streak placed somewhat median of the eyespot. Legs not streaked, but with very sharply defined irregular dark spots.



**Distribution:** Tropical Indo-Pacific; It ranges from Natal in South Africa, along the coast of East Africa and the Red sea to southern Japan, the Solomon island, Papu New Guinea, Australia, New Caledonia and Fiji (Holthius, 1991). Forms fishery along the southeast coast of India.

**Habitat and ecology:** In shallow, sometimes slightly turbid coastal waters; from 1 to 8m depth, with a few records from depths as great as 50m; on sandy and muddy substrates and sometimes on rocky bottom often near the mouth of rivers, but also on coral reefs. The species has been reported as solitary or as a living in pairs, but has also been found in larger concentrations.

**Biology:** This is the largest of the *Panulirus* species and can attain a total body length of about 50cm, but usually is much smaller (25-30cm). Mainly form fishery along the southeast coast of India. *P.ornatus* is caught both by trawlers and gillnets. *P.ornatus* forms major component of the trawler catch. *P.ornatus* appears throughout the year, but highest catch is in May at Tuticorin. The size of lobsters in the fishery ranges from 113 to 233mm TL in males and 128-452mm TL in females with 41% falling in the size range of 181-190mm TL, which are

juveniles. At Tuticorin the inshore fishery for juveniles *P.ornatus* is detrimental to the stock. Occasionally found along the west coast of Kanyakumari district and form a small fishery at Tikkoti, Calicut. Occurrence of adult and egg bearing population at 40-60m depth indicated that the species breed probably at relatively deeper areas. This is a fast growing spiny lobster among the tropical species. Females mature at 90mm CL. The Fecundity in specimens caught along the Chennai coast (104.4mm to 145.1mm CL) ranges from 5,18,181 to 19,79,522 eggs.

### ***Panulirus versicolor*** (Latreille, 1804)

**Diagnosis:** Antennular plate with 4 strong spines arranged in a quadrangle. Carapace whitish with well-defined, sharply delimited area of bluish black; antennal peduncles pink; antennal flagella white; abdominal somites 2 to 5 with white transverse bands; legs with streaks of white lines.

**Distribution:** This species known throughout Indian ocean (east coast of Africa and the Red sea) east to Japan, Micronesia, Melanesia, Polynesia, and northern Australia (Holthius, 1991). Along the Indian coast the species has been reported from southeast, southwest, A&N Islands and Lakshadweep.

**Habitat and ecology:** This species is found in areas of coral reef, most often on the seaward edge of the reef plateau, where it utilizes the reef and rocks for shelter. It is found in shallow waters to a maximum depth of 15m (Holthius, 1991). Furthermore, they are nocturnal and they only aggregate in very small numbers.

**Biology:** Fishery of lower magnitude reported along the Chennai, Mandapam, Trivandrum coasts. In A& N Islands, *P.versicolor* formed 26% of total landings (0.12t) in 1999-2000 (Kumar et al., 2010). The fecundity of *P.versicolor* (66.0 to 95mm CL) from Chennai coast was estimated to range from 1, 70, 212 to 7, 33, 752

### ***Puerulus sewelli*** Ramadan, 1938

**Diagnosis:** Median keel of carapace with 5 post-cervical and 2 or 3 intestinal teeth. Fifth pereopod of male not chelate



**Distribution:** Western Indian Ocean; Somalia, Gulf of Eden, off Pakistan, southwest (Quilon Bank, Mangalore) and southeast (off Mandapam and Tuticorin, Gulf of Mannar) of India and A&N Islands.



**Habitat and ecology:** Known from depth between 180 and 300m on a substrate of coarse sand hard mud and shells (Holthius, 1991).

**Biology:** Maximum total body length 20cm, maximum carapace length about 8cm. Average total length about 15 cm. The species was commercially exploited along the southwest and southeast coast of India. A catch rate of 200-300kg/hr was reported from vessels opening off Mandapam. January to April is the peak period of abundance. During 1998-2000, 524t were landed at Sakthikulangara, Kollam, and Kerala. The sizes of *P.sewelli* ranged from 76-80mm to 176-180 TL in Males and from 81-85mm to 176-180mm in females. 26% of females were found in mature/berried stage. Due to coincidence of peak breeding and the fishery, the breeding population has been heavily exploited. The species has been overexploited and the current landing is around 2 tonnes/annum from Quilon Bank.

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