

Diversity of Commercially Important Crustaceans

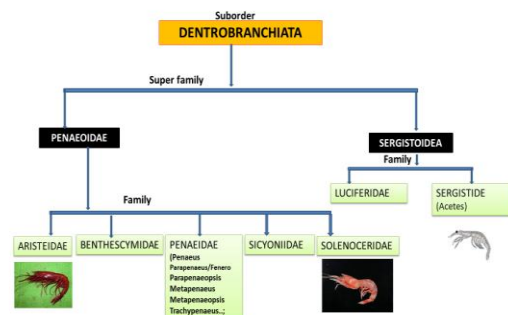
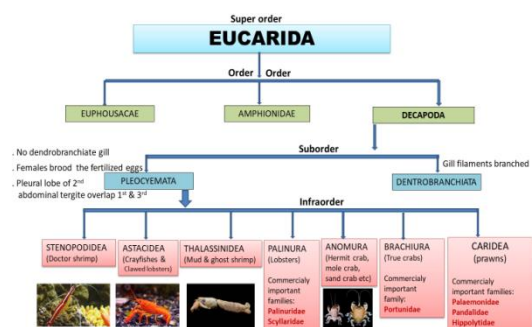
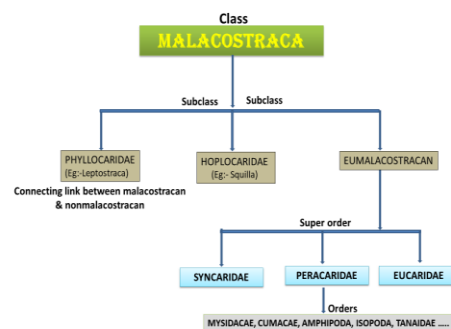
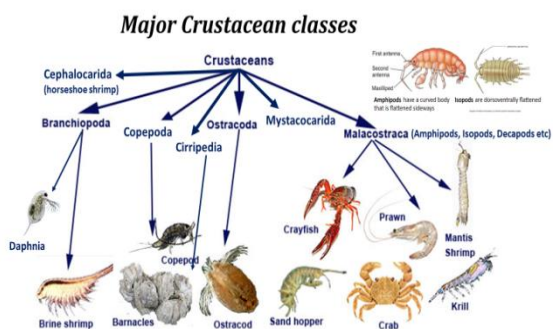
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Crustaceans are a diverse group of arthropods found in nearly all aquatic environments, with some even venturing onto land. They consist of more than 65,000 species distributed worldwide. Crustaceans show a great range of sizes from microscopic species measuring as little as a tenth of a millimeter to giant crabs, lobsters, and isopods with a body size of up to 4 meters in length, and weighing up to 20 kilograms. Thus they are a very diverse group of invertebrate animals that includes active animals such as crabs, lobsters, shrimp, krill, copepods, amphipods, and more sessile creatures like barnacles. Like other arthropods, crustaceans have an exoskeleton composed of chitin, which they molt when they grow.

General characteristics of crustaceans:

- They have a hard, but flexible exoskeleton or shell
- Two pairs of antennae
- A pair of mandibles (which are appendages used for eating)
- Two pairs of maxillae on their heads (additional mouth parts)
- Two compound eyes, often on stalks
- Segmented bodies (3 regions – cephalic, thoracic & abdominal) with appendages on each body segment

Crustacean Classification:



The decapod crustaceans belonging to the class Malacostraca are the most popular invertebrates due to their commercial value, of which the most important are shrimp species belonging to the five penaeidean families Solenoceridae, Aristeidae, Penaeidae, Sicyoniidae and Sergestidae and three caridean families - Pandalidae, Crangonidae and Palaemonidae. Among these, the families Penaeidae and Palaemonidae contain species of capture and culture importance. The features which are generally used for taxonomic analysis include the rostrum, carapace with its spines and carina,

carina of the abdomen, pleurae, telson appendages, petasma, appendix masculine, and thelycum. Shrimps/Prawns come under the order Decapoda Latrille, 1980, an order which derives the name from the presence of five pairs (10 numbers) of walking legs (deca = ten).

The order Decapoda is characterized by –

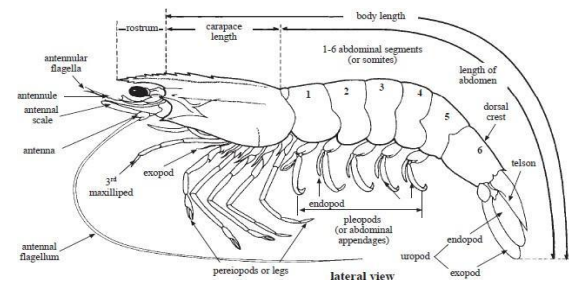
- The body can be divided into three broad regions – cephalic, thoracic, and abdominal regions with five, eight, and six segments respectively.
- The last five pairs (10 nos.) of appendages are pereiopod and are walking legs.
- Gills are of three different types, namely, dendrobranchs, trichobranch and phyllobranch.

Morphology of prawn/shrimp

The body of a shrimp/prawn is elongated, and segmented with three broad divisions – cephalothorax, abdomen, and telson. The cephalothorax represents the 'head' and is generally sub-cylindrical in cross-section. The abdomen is laterally compressed with six segments. Telson is dorso-ventrally flattened. The body consists of 19 segments and in addition there is a pre-oral region and post-anal region (telson). Each of the 19 segments bears a pair of appendages. These appendages are – the antennule, antenna, mandible, maxillula, maxilla, first maxilliped, second maxilliped, third maxilliped, first pereiopod, second pereiopod, third pereiopod, fourth pereiopod, first pleopod, second pleopod, third pleopod, fourth pleopod, fifth pleopod, and uropod.

The body is covered by a chitinous exoskeleton. The exoskeleton of the cephalothoracic region is coalesced to form the carapace. The anterior extension of the carapace is the rostrum. The rostrum is laterally compressed and bears teeth on both margins. Several spines, grooves, and ridges mark the surface of the carapace. The cephalothoracic region consists of 13 segments (five cephalic and eight thoracic). The exoskeleton of abdominal segments is distinct. The dorsal plate is known as the tergum, and the ventral plate is known as the sternum. Both the tergum and sternum together form a box-like structure that covers the body. Into the sternum, the appendages are attached. The tergum extends below the level of

the sternum and is called the pleuron. Telson is a conical structure with a broad basal part and a pointed distal end. It is not a segment and it does not contain any internal organs and hemocoel.

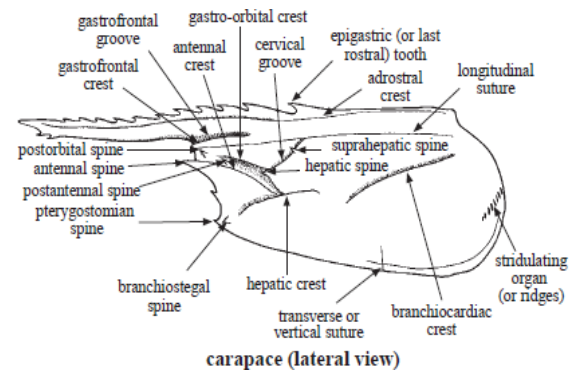


Appendages of a shrimp/prawn

There are 19 pairs of appendages and these are classified as follows –

1. **Cephalic** (5 pairs): antennule, antenna, mandible, maxillula, maxilla
2. **Thoracic** (8 pairs): first maxilliped, second maxilliped, third maxilliped, first pereiopod, second pereiopod, third pereiopod, fourth pereiopod, fifth pereiopod
3. **Abdominal** (6 pairs): first pleopod, second pleopod, third pleopod, fourth pleopod, fifth pleopod and uropod.

Technical terms:



Key for the identification of the commercially important families of prawns

1.	Pleura of 2 nd abdominal segment overlapping those of the proceeding (1 st) and succeeding (3 rd) segments; no chela on 3 rd pereopods; gills phyllobranchiate.....	2
	Pleura of 2 nd abdominal segment overlapping that of the succeeding (3 rd) but not of the preceding (1 st) segment; 3 rd pereopod chelate.....	3
2.	Carpus of second pair of pereopods entire; epipodites absent; upper antennular flagellum bifid; 3 rd maxilliped normal..... Palaemonidae	
	Carpus of second pair of pereopods divided into two or more articles; 1 st pair of pereopods non chelate or with a microscopic chela..... Pandalidae	
3	Last two pairs of walking legs well developed, gills many dendrobranchiate..... Penaeidae	
	Last one or two pairs of walking legs reduced or absent; gills few or wanting Sergastidae	

Classification of the Family Penaeidae

Subphylum **Crustace** Brunnich, 1772
 Class **Malacostraca** Latreille, 1802
 Subclass **Eumalacostraca** Grobben, 1892
 Order **Decapoda** Latreille, 1802
 Suborder **Dendrobranchiata** Bate, 1888
 Superfamily **Penaeoidea** Rafinesque, 1815
 Family **Penaeidae** Rafinesque, 1815

Key to Genera under Family Penaeidae From Indian waters

1.	Rostrum serrated only on the dorsal margin.....	5
	Rostrum serrated on the dorsal and ventral margins.....	2
2.	Adrostral carina and sulcus extends as far as the level of epigastric tooth, gastro frontal carina absent.....	3
	Adrostral carina and sulcus extends behind epigastric tooth; gastro frontal carina present.....	4
3.	Hepatic carina generally absent, if present, only feeble..... Fenneropenaeus	
	Hepatic carina present and prominent..... Penaeus	

4.	<p>Gastro-frontal sulcus not markedly bifid posteriorly; thelycum with pair of lateral plate on sternite XIV shielding sac like seminal receptacle opening along midline.....<i>Melicertus</i></p> <p>Gastro-frontal sulcus markedly bifid posteriorly; thelycum with a ventral undivided plate on sternite XIV infolded laterally, forming pouch opening anteriorly.....<i>Marsupenaeus</i></p>	
5.	<p>Telson with a pair of fixed subapical spines preceded by one to three pairs of movable spines; antennal peduncle usually bearing parapenaeid spine.....</p> <p>Telson generally without fixed subapical spine, but usually with movable lateral spines; antennular peduncle lacking parapenaeid spine.....</p>	<p>6</p> <p>8</p>
6.	<p>Carapace with longitudinal sutures (extending from post orbital region to almost posterior margin of carapace) and transverse sutures; telson with only one pair of minute lateral spines anterior to subapical spines<i>Parapenaeus</i></p> <p>Carapace without longitudinal sutures; telson with two or more pair of conspicuous spines anterior to subapical spines.....</p>	7
7.	<p>Third maxilliped and second peraeopod with basal spine; petasma asymmetrical.....<i>Metapenaepsis</i></p> <p>Third maxilliped and second peraeopod without basal spine; petasma symmetrical.....<i>Penaepsis</i></p>	
8	<p>Pleurobranch present on somite XIII; exopods on maxillipeds and anterior four pairs of pereopods; fifth pereopod without exopod.....<i>Metapenaeus</i></p> <p>- Pleurobranch absent on somite XIII; exopod present on all pereopods.....</p>	9
9	<p>Carapace without longitudinal and transverse sutures; telson with subapical pair of lateral movable spines mounted on elongated shoulder; epipods not furcated; petasma with ventro-lateral lobule produced into three flaps; anterior plate of thelycum as long as wide.....<i>Trachypenaepsis</i></p> <p>- Carapace with either longitudinal and / or transverse sutures ;telson without lateral spines or with movable ones not mounted on elongate shoulders; petasma with ventro-lateral lobule not produced into distal flaps.....</p>	10

10	Carapace without longitudinal sutures; second pereopod with ischial spine; hepatic spine present; petasma not constricted distally; anterior plate of thelycum rounded posteriorly..... <i>Atypopenaeus</i>	
-	Carapace with longitudinal sutures; second pereopod without ischial spine	11
11	Third pereopod without epipod body slender, integument thin ... <i>Parapenaeopsis</i>	
-	Third pereopod with epipod; body thick set; third maxilliped lacking basalspine.	12
12	Thelycum with plate on sternite XIV very short medially, deeply excavate, embracing extremely long caudal extension of median protuberance. Petasma with disto-lateral projections either moderately broad to rather narrow basally and extending laterally tomesially or forward directed hook like tip or extremely broad basally but narrowing rapidly, ending in forward directed tip <i>Megokris</i>	
-	Thelycum with plate on sternite XIV shallowly emarginated or occasionally produced in small median prominence, not continuous with medial protuberance; petasma with disto lateral projections tapering gently from relatively narrow base, extending almost straight laterally or curving slightly backwards <i>Trachysalambria</i>	

Key to species under the genus *Fenneropenaeus*

1.	Gastro-orbital carina absent or not reaching hepatic spine and occupying the middle 1/3 rd distance between hepatic spine and orbital angle.....	2
	Gastro- orbital carina occupying the posterior 2/3 distance between hepatic spine and orbital angle; dactyle of third maxilliped about as long as propodus; rostral crest may be elevated but not triangular in profile <i>indicus</i>	
2.	Dactyl of third maxilliped of adult male 0.5-0.6 times propodus; adrostral carina not reaching as far as epigastric tooth; rostrum broad basally, directed anteriorwards, basal part much elevated into a triangular in profile <i>merguiensis</i>	
	Dactyl of third maxilliped of adult male much longer than propodus; adrostral carina reaching just beyond epigastric tooth; rostrum slender, sharply directed downwards, basal part not much elevated <i>penicillatus</i>	

Key to species under the genus *Melicertus*

Adrostral carina and groove long, extending almost posterior region of carapace, groove wide, anterior plate of thelycum forming two subaccuminate, posterior process triangular; telson without movable spines; body with cross bands.....	<i>canaliculatus</i>
Adrostral carina and groove extending almost to posterior region of carapace; anterior plate of thelycum forming two subtriangular processes at the distal end at the apex ; telson with 3 pairs of movable spines; body without cross bands.....	<i>latisulcatus</i>

Key to species under the genus *Metapenaeus*

1.	Disto-medianpetasml projection with fully developed or vestigial apical filament; impregnated thelycum usually with white conjoined pads.....	2
-	Disto-medianpetasml projection without apical filament; thelycum of impregnated females without white conjoined pads	3
2	Posterior part of rostrum with distinctly elevated crest; basal spine on male third pereopod simple, disto median projection of petasma with a long and slender apical filament; thelycum with a large square and grooved anterior plate and lateral plates boomerang shaped, enclosing two pear shaped plates	<i>brevicornis</i>
-	Posterior part of rostrum without distinctly elevated crest ; basal spine on male third pereopod long and barbed; disto median projection of petasma with short filament on dorsal and ventral sides; anterior thelycal plates tongue like, lateral plates horse shoe shaped	<i>dobsoni</i>
3.	Ischial spine on first pereopod distinct	4
-	Ischial spine on first pereopod small or absent	6
4.	Disto-medianpetasml projections directed forwards convoluted, greatly swollen and lateral thelycal plates with raised lateral ridges, each with a posterior inwardly curved triangular plate, anterior plate of thelycum long a deeply groove	
	Disto-median petasml projections directed antero-ventrally anterior thelycal plate tongue like.....	5
5.	Lateral thelycal plates with salient and parallel ear shaped lateral ridges; disto median petasml projections hood-like.....	<i>monoceros</i>
	Lateral thelycal plates without lateral ridges; disto-median petasmlprojections not hood-like	<i>kutchensis</i>

6.	<p>Branchio-cardiac carina feeble or ill-defined, anterior end not exceeding posterior third of carapace; distal margin of anterior thelycal plate convex to indistinctly triangular; petasma with laminose and strongly diverging disto-median projections, disto lateral projections directed antero-ventrally; anterior thelycal plate flask-shaped, distal end with three tubercles of subequal size, lateral plates kidney shaped.....<i>moyebi</i></p> <p>Branchio-cardiac carina distinct, extending from posterior margin of carapace almost to hepatic spine; anterior thelycal plate longitudinally grooved, wider posteriorly than anteriorly; disto median petasmal projections crescent shaped, leaning on disto lateral projections and concealing them partly or completely.....<i>affinis</i></p>	
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Key to species under the genus *Parapenaepsis*

1	<p>Epipods present on first and second pereopods.....</p> <p>Epipods absent on first and second pereopods.....</p>	2 3
2	<p>Telson with pair of fixed apical spines; atleast distal half free portion of rostrum unarmed.....</p> <p>Telson without fixed subapical spines, with or without lateral movable spines; distal third or less part of rostrum edentulous.....<i>hardwickii</i></p>	3
3	<p>Petasma long with disto lateral projections slender, horn like, slightly curved directed anterior ventrally with ventro external openings; telson 4 pairs of fixed distal spines.....<i>stylifera</i></p> <p>Petasma long with disto lateral projections slender, horn like, slightly curved directed laterally with external openings; telson with one or two pairs of fixed spines.....<i>coromandelica</i></p>	

Key to species under the genus *Penaeus*

<p>Adrostral carina and groove do not extend up to epigastric tooth; antennal crest very prominent ending above middle of hepatic carina, hepatic carina horizontally straight; fifth pereopod without exopodite.....<i>monodon</i></p>
<p>Adrostral carina and groove beyond epigastric tooth; antennal crest very prominent ending above posterior third of hepatic carina, hepatic carina inclined antero ventrally; fifth pereopod with small exopodite.....<i>semisulcatus</i></p>

Identification of the family Palaemonidae

Classification of the Family Palaemonidae

Subphylum	Crustace	Palaemonids are commonly called as freshwater prawns. The important genera under this family are
Class	Malacostraca	<i>Palaemon</i> and <i>Macrobrachium</i> . Many species of
Subclass	Eumalacostraca	prawns under the genera complete their life cycle in
Order	Decapoda	estuaries. The two genera could be identified based
Suborder	Pleocyemata	on the key below
Superfamily	Palaemonoidea	

Carapace with antennal and Branchiostegal spines; mandible with palp, eyes pigmented; propodus of pereopod 5 with transverse rows of setae on the distal part of posterior margin; dactylus of last three pereopods simple Genus <i>Palaemon</i> Weber
Carapace with antennal and hepatic spines; eyes pigmented, propodus of pereopod 5 without transverse rows of setae on the distal part of posterior margin; dactylus of last three pereopods simple Genus <i>Macrobrachium</i> Bate

Key to species under the genus *Macrobrachium* Bate

1.	Carpus of pereopod 2 longer than merus.....	2
	Carpus of pereopod 2 subequal to or shorter than merus.....	8
2.	Rostrum with a distinct basal crest.....	3
	Rostrum without distinct basal crest.....	6
3.	Tip of telson reaching beyond tip of longer posterior spines.....	5
	Posterior spines over reaching tip of telson; distal part of rostrum without dorsal teeth	
4.	Carpus of pereopod 2 in male longer than ½ length of chela, its dactylus nearly as long as palm..... <i>M. rosenbergii</i> (de Man)	
	Carpus of pereopod 2 in male variable in length and proportion to chela, its dactylus shorter than ½ length of palm..... <i>M. villosimanus</i> (Tiwari)	
5.	Basal crest of rostrum shallow; palm of pereopod 2 normal, its dactylus shorter than palm <i>M. lamarreilamarrei</i> (Milne Edwards)	
	Basal crest of rostrum elevated; palm of pereopod 2 aollen, its dactylus longer than palm	

6.	Cutting edges of male 2 nd pereopod with two proximal tubercles and all joints of this appendage pubescent..... <i>M. rude</i> Cutting edges of male 2 nd pereopod with two proximal tubercles and all joints of this appendage non-pubescent.....	7
7.	Rostrum nearly straight with 9-12 dorsal teeth, two of which behind orbit; carpus of male pereopod 2 longer than chela..... <i>M. idella</i> (Hilgendorf) Rostrum curved with 9-12 dorsal teeth, three of which behind orbit; carpus of pereopod 2 shorter than chela..... <i>M. equidens</i> (Dana)	
8.	Pereopod 5 longer than 4; dorsal rostrum with many teeth closely arranged..... <i>M. mirabile</i> (Kemp) Pereopods 4 & 5 subequal in length	9
9.	Dactylus of male pereopod 2 with 4 or more tubercles at regular interval..... <i>M. scabriculum</i> (Heller) Dactylus of male pereopod with 1-2 tubercles..... <i>M. javanicum</i> (Heller)	

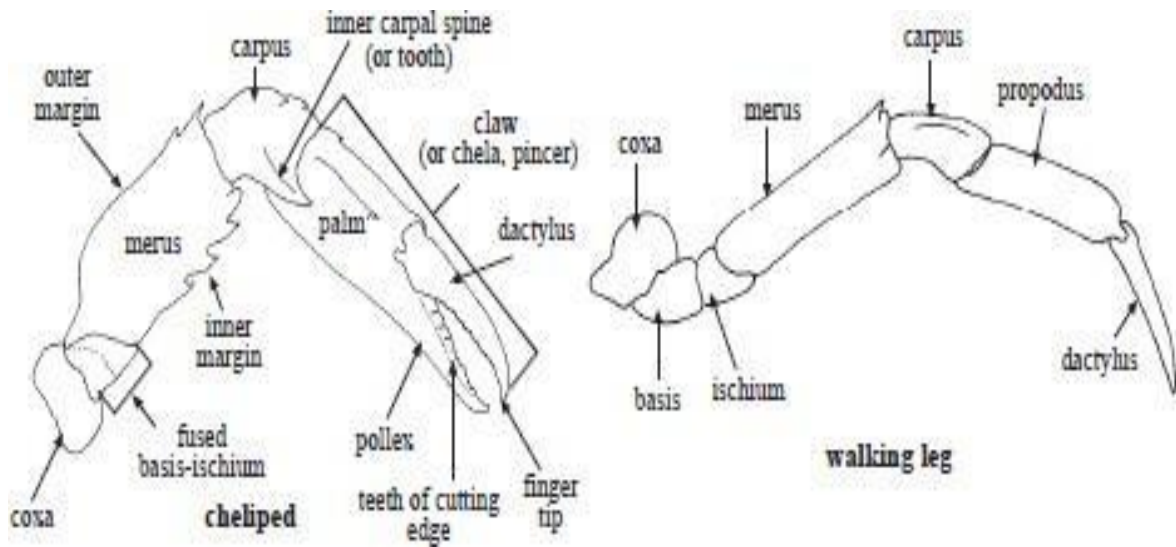
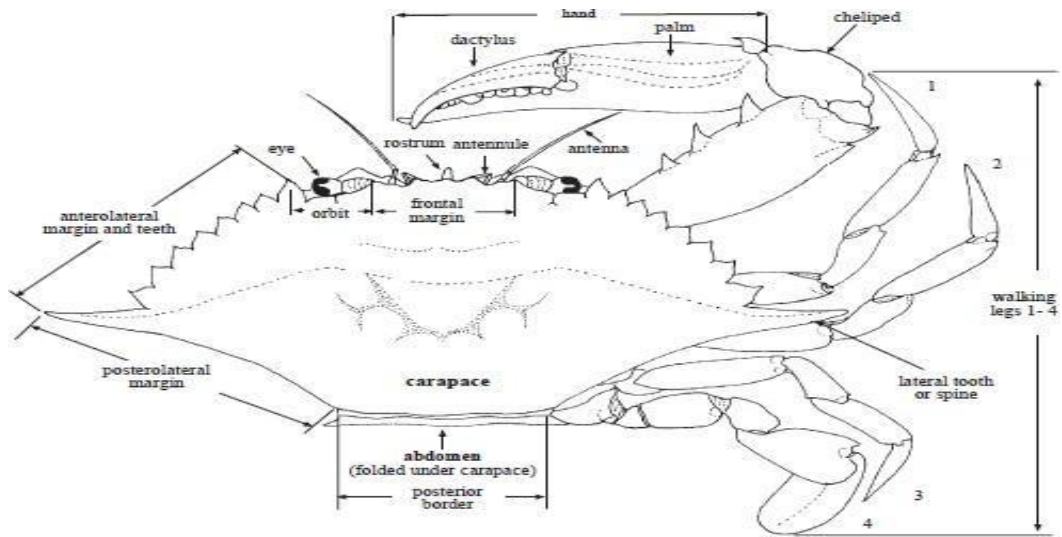
Crabs of commercial importance

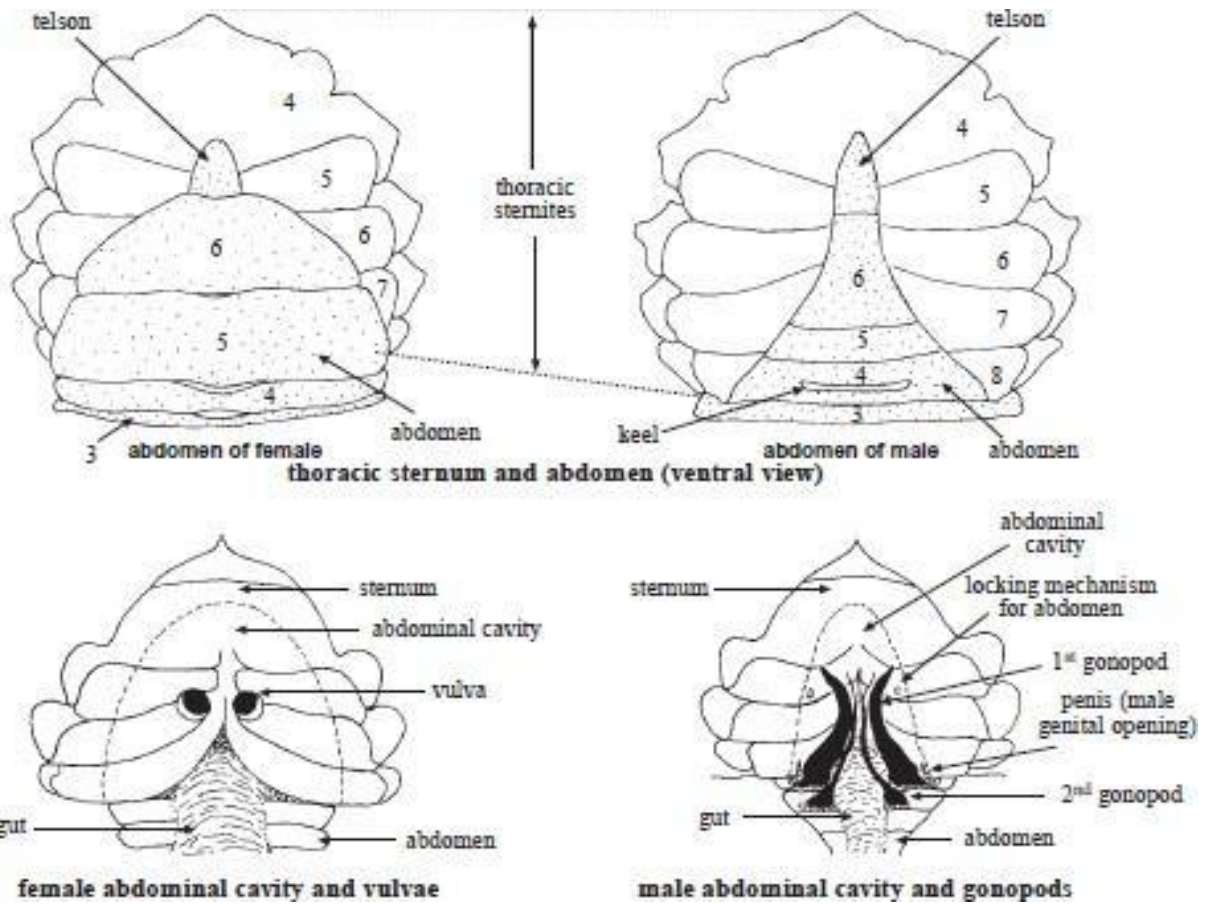
More than 600 species of crabs have been reported from India, of which a few species are commercially important. Many have been confined to sea and a few have invaded into the estuaries, but migrate to sea for breeding. The carapace is high, flattened with the antero lateral margins serrated. Abdomen is highly reduced and this structure is highly dimorphic. Abdominal appendages are also modified sex-wise. (two pairs in males and four pairs in females).

Classification of family Portunidae

Subphylum	Crustacea
Class	Malacostraca
Subclass	Eumalacostraca
Superorder	Eucarida
Order	Decapoda
Suborder	Pleocyemata
Superfamily	Portunoidea
Family	Portunidae

Technical terms: Structure of Carapace and cheliped of a crab





Key for the identification of some of the common species are given below

1.	Antero lateral borders of carapace cut into nine teeth.....	2
-	Antero lateral borders of carapace cut into six teeth..... <i>Charybdis</i>	4
2	Teeth on the antero lateral borders equal sized, green in colour.... <i>Scylla serrata</i>	3
-	Last tooth on the antero lateral borders enlarged in the form of a prominent large long spine..... <i>Neptunus</i>	
3	No spines on the posterior border of the arm of the chelipeds, carapace with three blood red spots..... <i>Neptunussanguinolentus</i>	
	A spine at the far end of the posterior border of the arm of the chelipeds <i>Neptunuspelagicus</i>	
4	First tooth on the antero- lateral borders anteriorly truncated and notched. Sixth abdominal tergum of male with curved and gradually convergent sides. One or two inconspicuous denticles near the far end of the posterior border of the protopodites of the last pair of legs. A brown cross marking on the carapace..... <i>Charybdis cruciata</i>	
-	First tooth on the antero- lateral borders acute, Sixth abdominal tergum of male with its sides parallel or even slightly divergent. Posterior border of the protopodites of the last pair of legs strongly serrated through out. 4 whitish spots on the carapace..... <i>Charybdis lucifera</i>	
	First tooth on the antero- lateral borders acute, Sixth abdominal tergum of male with	

	its sides parallel. Posterior border of the protopodites of the last pair of legs serrated in a larger part of its extent. Legs with annular bands. <i>Charybdis annulata</i>	
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Commercially important lobsters of India

The importance of lobsters in our marine products export trade is only second to that of prawns. The increasing demand of 'frozen lobster tails' has brought the Indian lobster to the limelight. About half a dozen species of spiny lobsters are recorded from the Indian region, belonging to the genera – *Panulirus*, *Palinustus* and *Peurulus*.

Diagnosis of Families

Palinuridae: Moderate to large-sized crustacean. The carapace is rounded (sub-cylindrical) in section, without a distinct median rostrum, ornamented with spines and granules of various sizes: each eye is protected by a strong, spiny frontal projection of carapace (frontal horns). Antennae are long and whip-like, antennules slender each consisting of a segmented peduncle.

Synaxidae: Carapace covered with small rounded granules but without enlarged spines; a small median triangular rostrum present; first pair of legs at least twice as thick as the second; entire body hairy and bright orange or red.

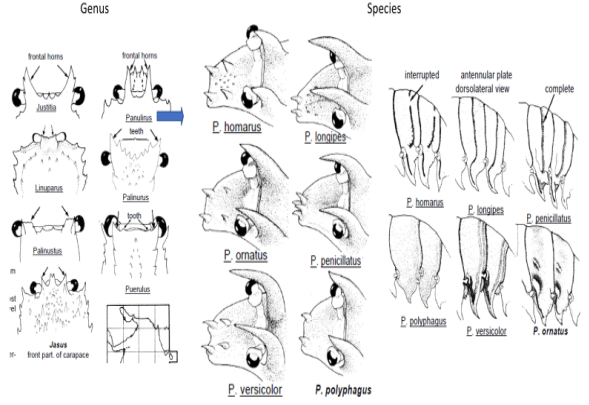
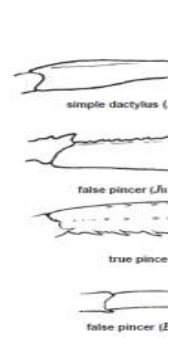
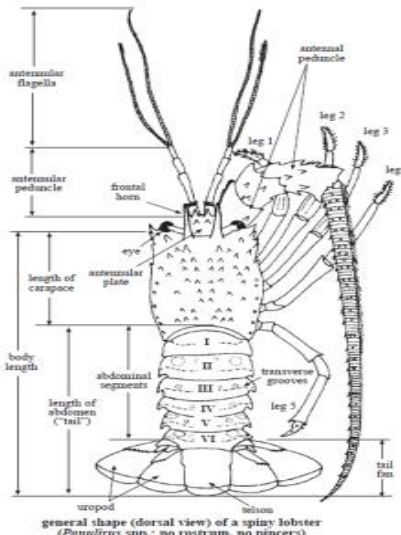
Nephripidae: Body tubular, a well-developed rostrum present; first 3 pairs of legs ending in true pincers, first pair much larger than the others.

Scyllaridae: Body flattened, firm: rostrum rudimentary or absent; first 4 pairs of legs without pincers, antennae plate-like, without pincers, antennae plate-like, without flagellum.

Polychelidae: Body flattened, soft: rostrum absent or rudimentary: first 4 pairs of legs with pincers; the first greatly elongated; antennal whip-like. Deep sea inhabitants.

Classification of family Palinuridae

- Subphylum **Crustacea** Brunnich, 1772
- Class **Malacostraca** Latreille, 1802
- Subclass **Eumalacostraca** Grobben, 1892
- Superorder **Eucarida** Calman, 1904
- Order **Decapoda** Latreille, 1802
- Suborder **Pleocyemata** Burkenroad, 1963
- Superfamily **Palinuroidea** Latreille, 1802



Key for the identification of 6 species of Lobsters under the genus *Panulirus*

1	Each abdominal segment with transverse groove.....	2
.	Abdominal segments without transverse groove.....	4
-		

2	Anterior margin of abdominal grooves scalloped..... <i>P. homarus</i> (Linnaeus) · Anterior margin of abdominal grooves not scalloped..... -	3
3	Antennular plate with 4 equal principal spines fused at base ... <i>P. penicillatus</i> (Olivier) · Antennular plate with 2 principal spines and some smaller spines behind <i>P. longipes</i> (Milne Edwards) -	
4	Flagellum of exopod of 2 nd maxilliped small or absent..... · Flagellum of exopod of 2 nd maxilliped well developed ,multiarticular <i>P. polyphagus</i> (Herbst) -	5
5	Conspicuous transverse white band posteriorly on each abdominal segment, legs with · longitudinal white lines..... <i>P. versicolor</i> (Latreille) No transverse white band on abdominal segments, but a conspicuous white spot on lateral portion, legs with alternative yellow and black mottling ... <i>P. ornatus</i> (Fabricius) -	