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Classification, Biodiversity and Conservation of Marine Commercial Crabs of India

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One of the best known and most intensely studied groups is the true crabs of the infraorder Brachyura. Brachyuran crabs belong to the Order Decapoda, the most diverse group of crustaceans alive today (Ng *et al.*, 2008). The known size of crabs now ranges from a maximum leg span of approximately 4 m in the giant Japanese spider crab *Macrocheira kaempferi* and a maximum carapace width of 46 cm in the giant Tasmanian crab *Pseudocarcinus gigas* to a minimum of 1.5 mm across the carapace for a mature ovigerous female pinnotherid, *Nannothers moorei*, the smallest known species of crab. Every living thing is classified into one of the three domains. Archaea, Bacteria, and Eukarya are the three domains. The eight levels of classification are domain, kingdom, phylum, class, order, family, genus, and species. True crabs are classified as follows:

Phylum: Arthropoda

Subphylum: Crustacea

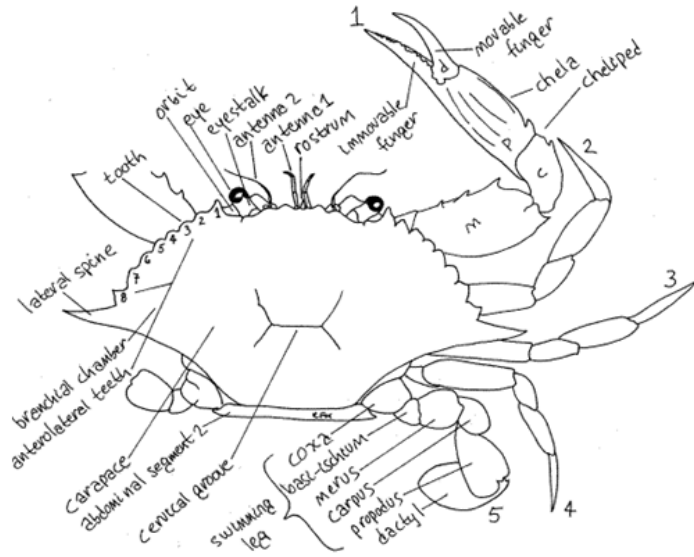
Class: Malacostraca

Order: Decapoda

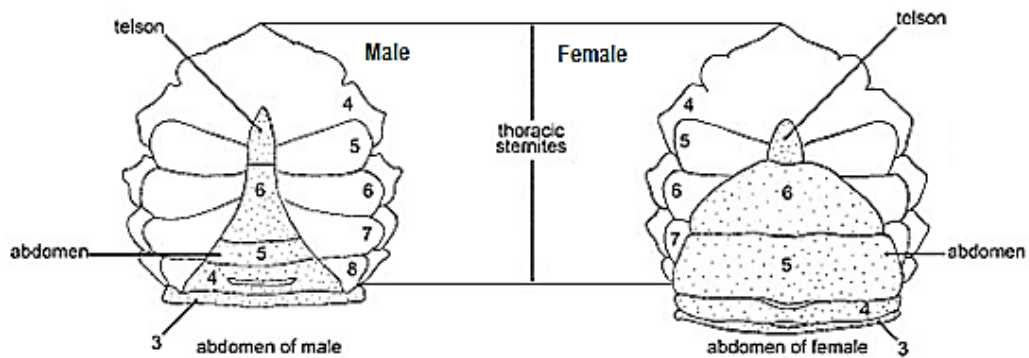
Suborder: Pleocyemata

Infraorder: Brachyura Linnaeus, 1758

The basic crab design consists of an expanded carapace (formed by a fusion of the head and some thoracic somites), and a strongly reduced abdomen that is tightly tucked underneath the thorax. In addition, the first pereopods of brachyurans are fully chelate, and the walking legs are placed at the sides of the body. True brachyuran crabs are often confused with hermit and porcelain crabs belonging to the infraorder Anomura. In general, most anomuran crabs have only three pairs of walking legs clearly visible, with the last pair being very small and normally positioned under the abdomen and not visible externally.



General shape of a Brachyuran Crab (Dorsal view)-Portunidae



Thoracic sternum and abdomen ventral view

Fishery Resources and their distribution

In India, most of the edible crabs caught from marine and brackish water environments belong to the family Portunidae. In the Indian Ocean, the crab fauna of Portunidae family is included under sub families, Podophthalmidae (Borradaile), Catoptrinae (Sakai), Portuninae (Rafinesque), Caphyrinae (Alcock), Carcininae (Macleay) and Polybiinae (Ortmann). Most of the edible crabs caught from marine and brackishwater environments belong to the sub family Portuninae. In the seas around India, five genera of Portuninae have been reported by various authors. They are *Scylla*, *Portunus*, *Charybdis*, *Lupocyclus* and *Thalamita*. Among them the first three genera contribute to

the commercial crab fishery Commercially important species are *Scylla* spp. (Mud crabs), *Portunus pelagicus* (blue swimmer crab), *P. sanguinolentus* (three spotted crab), *Charybdis feriatus* (crucifix crab), *C. lucifera* (Yellowish brown crab), *C. natator* (line crab) and *Podophthalmus vigil* (long eye-stalk crab; sub fly., Podophthalmidae).

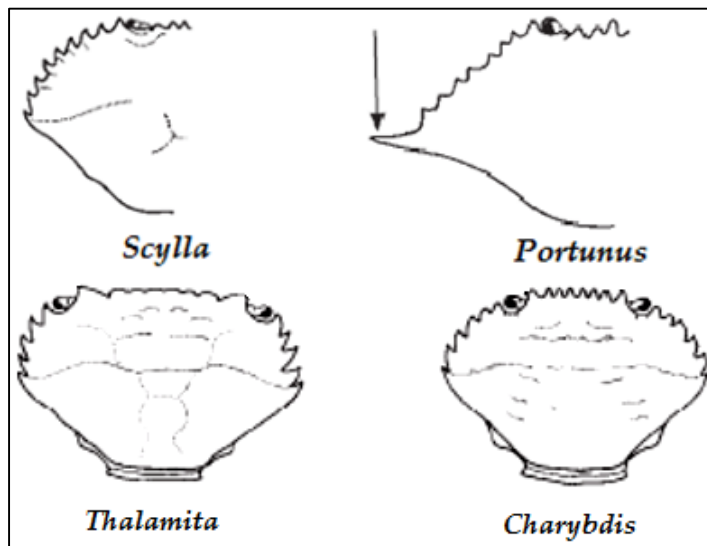
Distribution of commercially important species along the Indian Coast

<p>Gujarat</p> <ul style="list-style-type: none"> • <i>Portunus sanguinolentus</i> • <i>Charybdis feriatus</i> • <i>P. pelagicus</i> 	<p>Maharashtra</p> <ul style="list-style-type: none"> • <i>C. feriatus</i> • <i>P. sanguinolentus</i> • <i>P. pelagicus</i> 	<p>Karnataka</p> <ul style="list-style-type: none"> • <i>C. feriatus</i> • <i>P. sanguinolentus</i> • <i>P. pelagicus</i>
<p>Andhra Pradesh</p> <ul style="list-style-type: none"> • <i>P. pelagicus</i> • <i>P. sanguinolentus</i> • <i>C. feriatus</i> • <i>Scylla serrata</i> • <i>S. olivacea</i> 	<p>Odisha</p> <ul style="list-style-type: none"> • <i>P. pelagicus</i> • <i>P. sanguinolentus</i> • <i>C. feriatus</i> • <i>S. serrata</i> • <i>S. olivacea</i> 	<p>West Bengal</p> <ul style="list-style-type: none"> • <i>S. olivacea</i> • <i>S. serrata</i>
<p>Tamil Nadu</p> <ul style="list-style-type: none"> • <i>P. pelagicus</i> • <i>P. sanguinolentus</i> • <i>C. feriatus</i> • <i>C. natator</i> • <i>C. smithi</i> • <i>C. annulata</i> • <i>C. lucifera</i> • <i>C. helleri</i> • <i>Podophthalmus vigil</i> • <i>P. gladiator</i> • <i>S. serrata</i> 		

Portunidae

Carapace hexagonal, transversely ovate to transversely hexagonal, sometimes circular; dorsal surface relatively flat to gently convex, usually ridged or granulose; front broad, margin usually multidentate; usually 5 to 9 teeth on each anterolateral margin, posterolateral margins usually distinctly

converging. Endopodite of second maxillipeds with strongly developed lobe on inner margin. Legs laterally flattened to varying degrees, last 2 segments of last pair paddle-like. Male abdominal segments 3 to 5 completely fused, immovable.



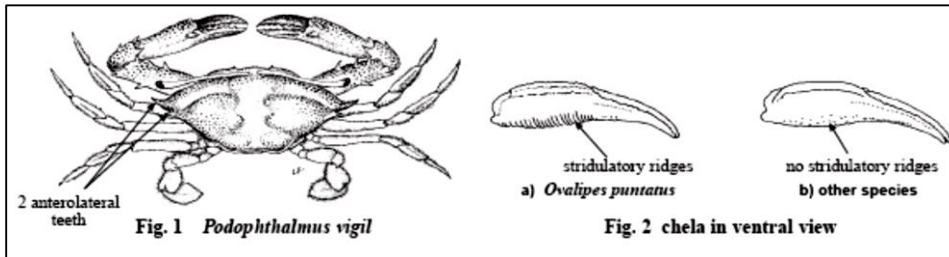
Key to species of interest to fisheries occurring in the area

1a. Carapace with 2 anterolateral teeth; eyes very long, reaching lateral edge of carapace (Fig. 1) ***Podophthalmus vigil***

1b. Carapace with more than 2 anterolateral teeth; eyes normal in size **2**

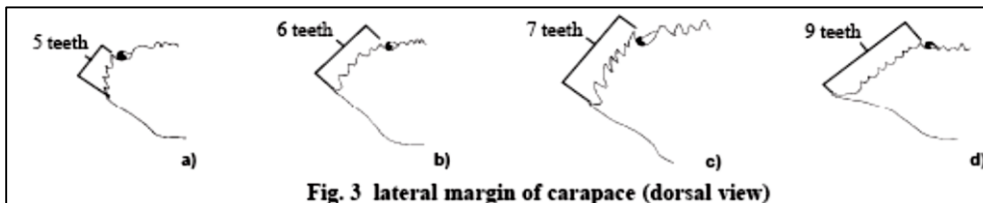
2a. Carapace rounded; ventral surface of palm with stridulatory (sound-producing) ridges (Fig. 2a) ***Ovalipes punctatus***

2b. Carapace transversely ovate; palm without any stridulatory (sound-producing) ridges (Fig. 2b) **3**



3a. Five to 7 teeth on each anterolateral margin (Fig. 3a-c) **4**

3b. Nine teeth on each anterolateral margin (Fig. 3d) **12**

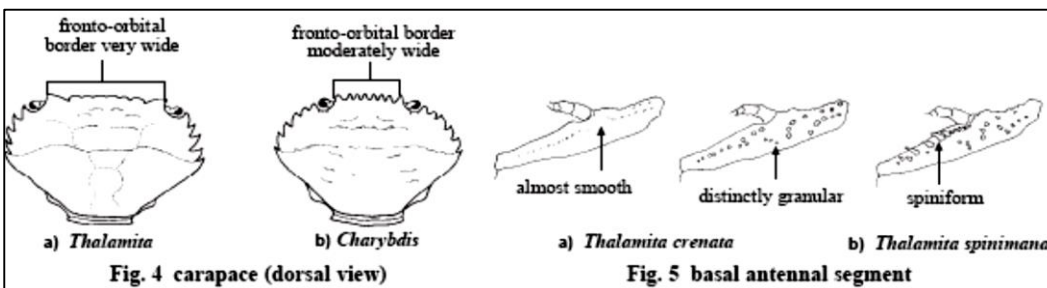


4a. Width of fronto-orbital border not much less than greatest width of carapace; 5 teeth on each anterolateral margin (first tooth sometimes with accessory denticle) (Fig. 4a) **5**

4b. Width of fronto-orbital border distinctly less than greatest width of carapace; 6 or 7 teeth on each anterolateral margin (Fig. 4b) **6**

5a. Basal antennal segment with a smooth or granulated ridge (Fig. 5a) ***Thalamita crenata***

5b. Basal antennal segment with several sharp spines (Fig. 5b) . . . ***Thalamita spinimana***

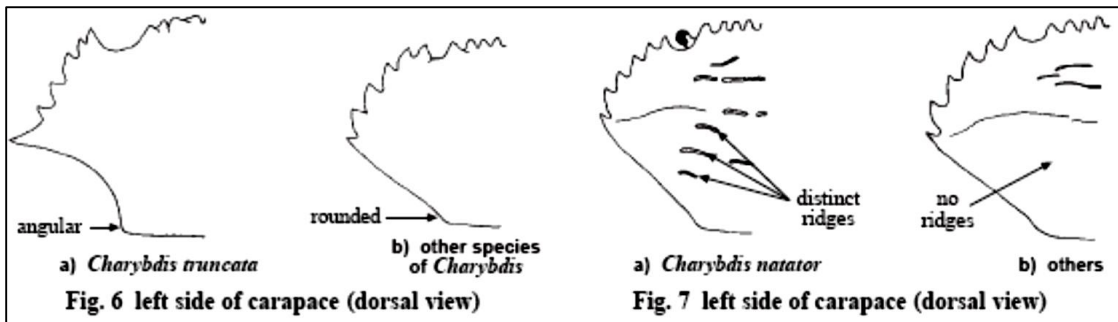


6a. Posterior border of carapace forming an angular junction with posterolateral border (Fig. 6a); merus of cheliped without distal spine on posterior border ***Charybdis truncate***

6b. Posterior border of carapace forming a curve with posterolateral border (Fig. 6b); Merus of cheliped with distal spine on posterior border **7**

7a. Carapace with distinct ridges or granular patches behind level of last pair of anterolateral teeth (Fig. 7a) ***Charybdis natator***

7b. Carapace without distinct ridges or granular patches behind level of last pair of anterolateral teeth (Fig. 7b) **8**

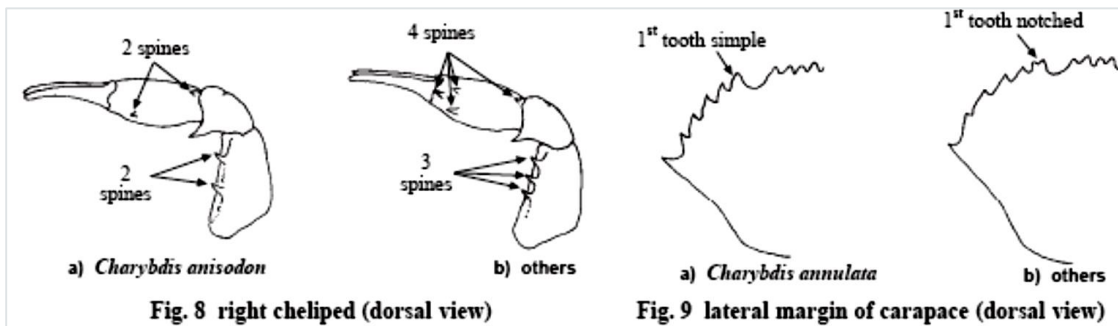


8a. Merus of cheliped with 2 spines on anterior border; palm with 2 spines on upper surface (Fig. 8a) ***Charybdis anisodon***

8b. Merus of cheliped with 3 or 4 spines on anterior border; palm with more than 2 spines on upper surface (Fig. 8b) **9**

9a. First anterolateral tooth not truncate or notched (Fig. 9a) ***Charybdis annulata***

9b. First anterolateral tooth truncate or notched (Fig. 9b) **10**



10a. Palm of cheliped with 4 spines on upper surface (Fig. 10a); male abdominal segment 4 keeled (Fig. 11a) ***Charybdis feriatus***

10b. Palm of cheliped with 5 spines on upper surface (Fig. 10b); male abdominal segment 4 not keeled (Fig. 11b) **11**

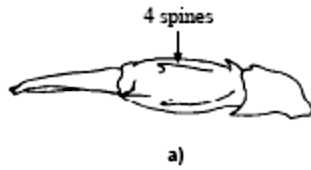


Fig. 10 right cheliped (dorsal view)

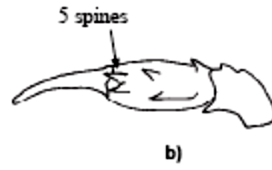
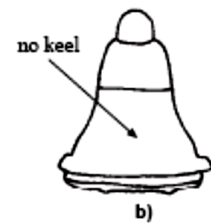


Fig. 11 male abdomen

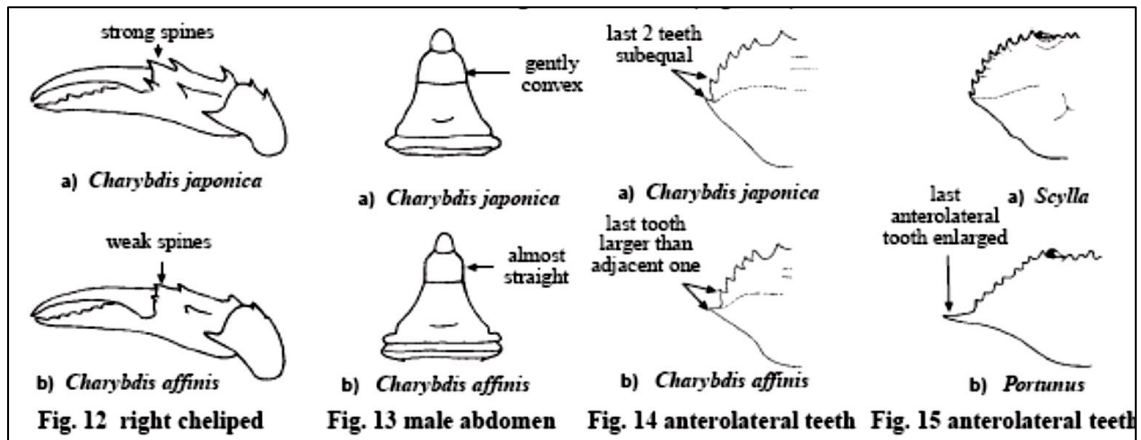


11a. Palm with well-developed spines (Fig. 12a); male abdominal segment 6 with convex lateral borders (Fig. 13a); last anterolateral tooth smallest and spiniform, not projecting beyond preceding tooth (Fig. 14a) ***Charybdis japonica***

11b. Palm with poorly developed spines (Fig. 12b); male abdominal segment 6 with lateral borders parallel in proximal half (Fig. 13b); last anterolateral tooth elongate, projecting laterally beyond preceding tooth (Fig. 14b) ***Charybdis affinis***

12a. Last anterolateral tooth subequal in size to others (Fig. 15a) **13**

12b. Last anterolateral tooth at least 2 times larger than others (Fig. 15b) **16**



13a. Carpus of cheliped with only 1 low to very low granule on outer surface, never spiniform (Fig. 16a); colour of palm usually with at least some patches of orange or yellow in life **14**

13b. Carpus of cheliped with 2 distinct spiniform or sharp granules or spines on outer surface (Fig. 16b); colour of palm in life green to purple **15**

14a. Frontal margin usually with sharp teeth (Fig. 17a); palm usually with distinct, sharp spines (Fig. 18a) ***Scylla paramamosain***

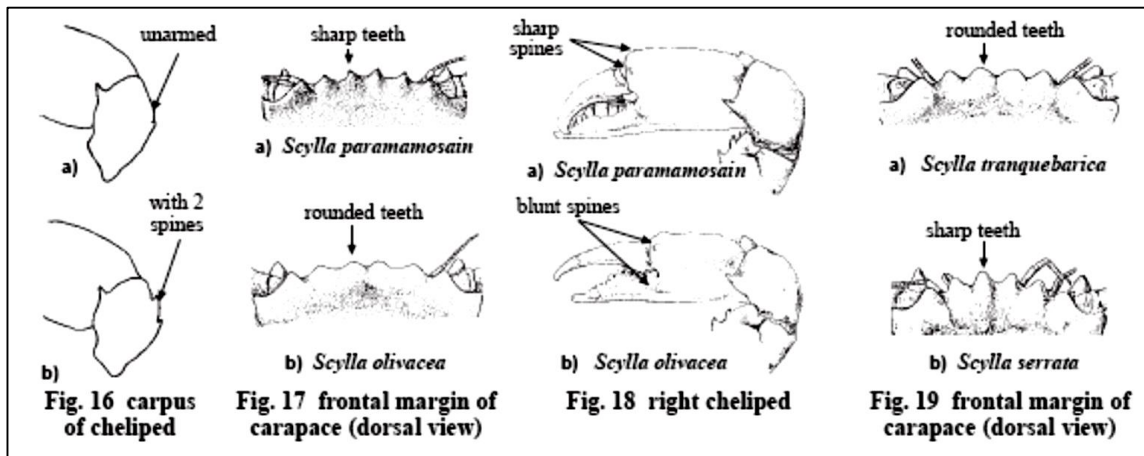
14b. Frontal margin usually with rounded teeth (Fig. 17b); palm usually with reduced, blunt spines (Fig. 18b) ***Scylla olivacea***

15a. Frontal margin usually with rounded teeth (Fig. 19a); sharp granules on palm and carpus never spiniform; colour in life: carapace usually very dark green to black, outer surface of palm purple and never with marbled pattern, last legs marbled only in males

..... ***Scylla tranquebarica***

15b. Frontal margin usually with sharp teeth (Fig. 19b); sharp granules on palm and carpus often spiniform; colour in life: carapace usually green to olive-green, outer surface of palm green and often with marbled pattern, last legs marbled both in males and females

..... ***Scylla serrata***

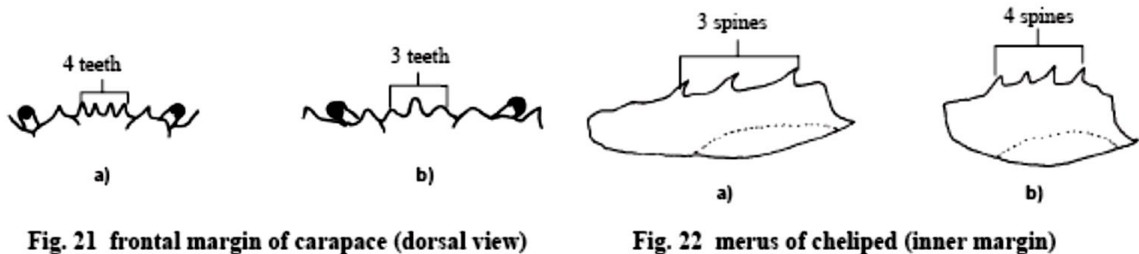


16a. Carapace with 3 purple to red spots on posterior half ***Portunus sanguinolentus***

16b. Carapace marbled or with uniform coloration **17**

17a. Front with 4 teeth (Fig. 21a); inner margin of merus of cheliped with 3 spines (Fig. 22a) ***Portunus pelagicus***

17b. Front with 3 teeth (Fig. 21b); inner margin of merus of cheliped with 4 spines (Fig. 22b) ***Portunus trituberculatus***



Species identification guide for fishery purposes – Crabs –Portunidae

Portunus pelagicus (Linnaeus, 1758) (Flower crab)

Carapace rough to granulose, front with 4 acutely triangular teeth; 9 teeth on each anterolateral margin, the last tooth 2 to 4 times larger than preceding teeth. Chelae elongate in males; larger chela with conical tooth at base of fingers.

Colour: Males with blue markings, females dull green/greenish brown.

Portunus Sanguinolentus (Herbst, 1783)(Three-spot swimming crab)

Carapace finely granulose, regions just discernible; 9 teeth on each anterolateral margin, the last tooth 2 to 3 times larger than preceding teeth. Chelae elongated in males; larger chela with conical tooth at base of fingers; pollex ridged.

Colour: Olive to dark green, with 3 prominent maroon to red spots on posterior 1/3 of carapace.

Charybdis feriatus (Linnaeus, 1758) (Crucifix crab)

Carapace ovate; 5 distinct teeth on each anterolateral margin.

Colour: Distinctive pattern of longitudinal stripes of maroon and white, usually with distinct white cross on median part of gastric region; legs and pincers with numerous scattered white spots.

Charybdis natator (Herbst, 1789) (Ridged swimming crab)

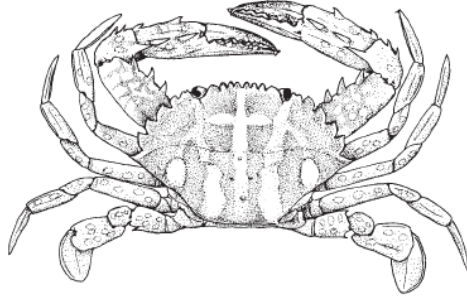
Carapace with densely covered with very short pubescence which is absent on several distinct transverse granulated ridges in anterior half.

Colour: Orangish red overall, with ridges on carapace and legs dark reddish brown.

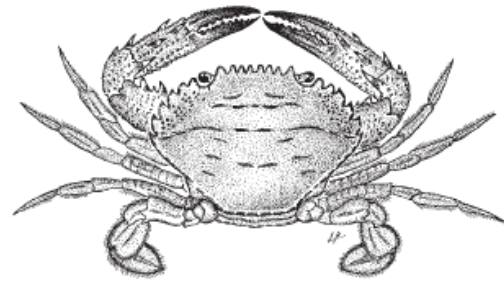
Podophthalmus vigil (Fabricius, 1798)

Carapace distinctly broader than long; anterior margin much broader than posterior margin, with posterolateral margins converging strongly towards narrow posterior carapace margin; orbits very broad. Eyes very long, reaching to or extending beyond edge of carapace.

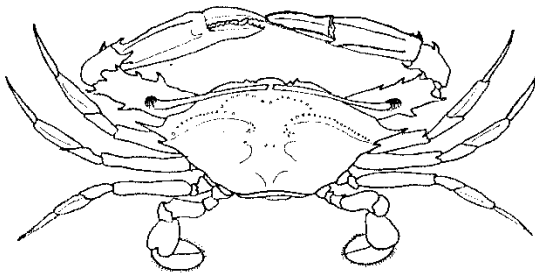
Colour: Carapace green; chelipeds and parts of legs violet to maroon in adults.



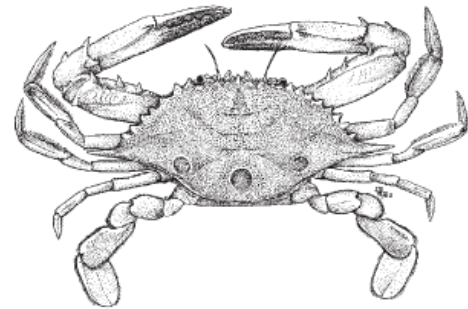
Charybdis feriatus (Linnaeus, 1758)



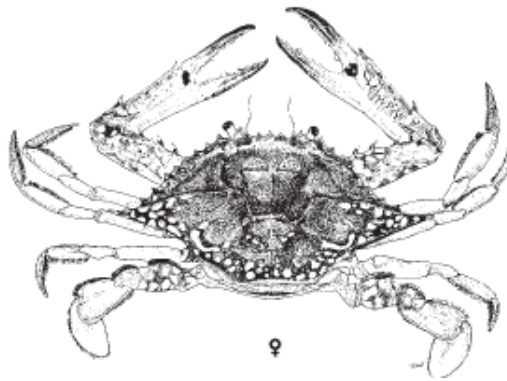
Charybdis natator (Herbst, 1789)



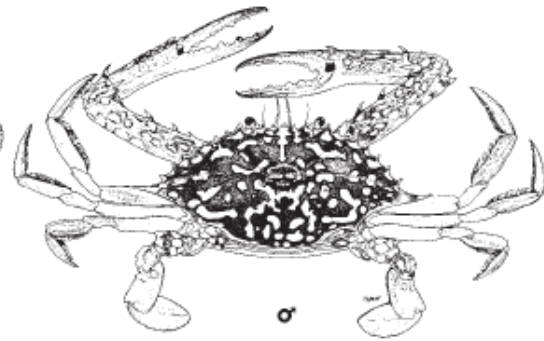
Podophthalmus vigil (Fabricius, 1798)



Portunus Sanguinolentus (Herbst, 1783)



Portunus pelagicus (Linnaeus, 1758)



***Scylla* spp.**

The taxonomy of the genus *Scylla* has been terribly confused and is still difficult. Recent research in Australia (Keenan *et al.*, 1998) has clearly shown, using morphological, DNA, and allozyme data, that there are 4 species of *Scylla*.

Scylla serrata (Forsskål, 1775) (Giant mud crab)

Carapace smooth, with strong transverse ridges; H-shaped gastric groove deep; relatively broad frontal lobes, all more or less in line with each other; broad anterolateral teeth, projecting obliquely outwards, colour green to greenish black; legs may be marbled.

Well-developed spines present on outer surface of chelipedal carpus and anterior and posterior dorsal parts of palm.

Scylla tranquebarica (Fabricius, 1798) (Purple mud crab)

Colour varies from brown to almost black in coloration, and has very well-developed spines on the outer surfaces of the chelipedal carpus and the palm (as seen in *S. serrata*). It differs from *S. serrata*, however, by having the frontal teeth more acutely triangular, the median pair projecting slightly forwards of the lateral pair, and the anterolateral teeth gently curving anteriorly, giving the carapace a less transverse appearance.

Scylla olivacea (Herbst, 1796) (Orange mud crab)

Carapace brownish to brownish green in colour (sometimes orangish), palm orange to yellow. It has a smoother, more evenly convex carapace with very low transverse ridges, a shallow H-shaped gastric groove, the median pair of the frontal lobes more rounded and projecting slightly forwards of the lateral ones, the anterolateral teeth gently curving anteriorly, giving the carapace a less transverse appearance. It also has very low spines on both the outer surface of the chelipedal carpus and the dorsal surface of palm.

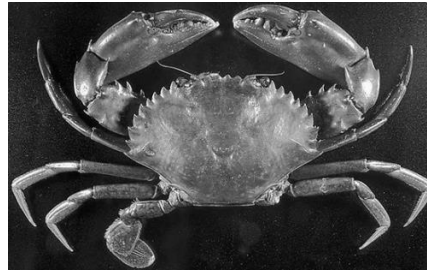
Scylla paramamosain Estampador, 1949 (Green mud crab)

Carapace usually green to light green, palm green to greenish blue with lower surface and base of fingers usually pale yellow to yellowish orange. Frontal margin usually with sharp teeth, palm usually with distinct, sharp spines.

Scylla serrata (Forsskål, 1775)



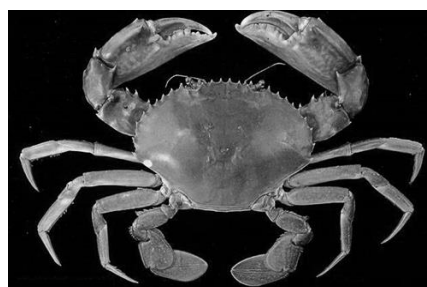
Scylla tranquebarica (Fabricius, 1798)



Scylla olivacea (Herbst, 1796)



Scylla paramamosain (Estampador, 1949)



Diversity of species along west coast

A total of 226 species of brachyuran crabs belonging to 130 genera and 39 families have been recorded from the different maritime states of the west coast of India. Highest species diversity recorded in Kerala (93 species) followed by Maharashtra (92 species). However, genetic diversity is more in Maharashtra (64 genera) than in Kerala (63 genera). Of the 39 families, Mathildellidae and Geryonidae are found exclusively in Kerala while two families namely, Pseudoziidae and Trapeziidae, known only from Maharashtra and the family Gecarcinidae from Goa. Among the states in the west coast of India, three brachyuran families, viz., Homolodromiidae, Atelecyclidae and Goneplacidae are recorded only from the state of Kerala; their representatives do not occur in the east coast but are found only in the Andaman and Nicobar Islands and Lakshadweep within Indian territorial waters. Among the 39 families, the family Portunidae contains the maximum number of species (28) followed by Xanthidae (23 species) and Leucosiidae (22 species). The genus *Charybdis* supports the maximum number of species (11) in the west coast (Dev Roy, 2013).

Conservation

At present, there is no ban on fishing immature and the berried crabs and the minimum size at capture is not implemented in India. As a conservation measure, only possibility is to educate fishermen to release the juvenile, berried and soft crabs to the sea while they are alive. The governments should take steps to implement ban during peak spawning seasons to prevent indiscriminate fishing. The best method to ensure a sustainable fishery throughout the year as well as to improve the quality of the yield is to ban fishing and marketing of undersized and berried crabs (Josileen, 2007). Recently CMFRI has suggested minimum legal size (MLS) at fishing for important fishery resources for Kerala state (Mohammed *et al.*, 2014).

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