CHAPTER 31

Overview of Crustacean Fisheries & Crab Taxonomy in India

Introduction

Crustaceans are one of the most valuable resources in the marine fishery in India and contributed an overall average of 14.9 % to the total landings during 1996-2019. Marine commercial crustacean resources mainly comprised of penaeid prawns, non-penaeid prawns, crabs, lobsters and stomatopods. Many species are exploited along the east and west coasts of India, mainly in trawls, seines and gill nets. The state of Gujarat was leading in overall Crustacean production contributing 30.2% of all India landings, followed by States of Maharashtra (22.5%) and Kerala (12.9%). The overall trend of the fishery (1981-2020) showed increase at national level, recording a maximum landing of 532851 tonnes during 2011 and the lowest, 192324 tonnes during 1981 with an overall average of 390063 tonnes. Resource-wise trend also, showed increase except for lobsters and stomatopods. The details are presented in the figures (Figs. 1- 5).

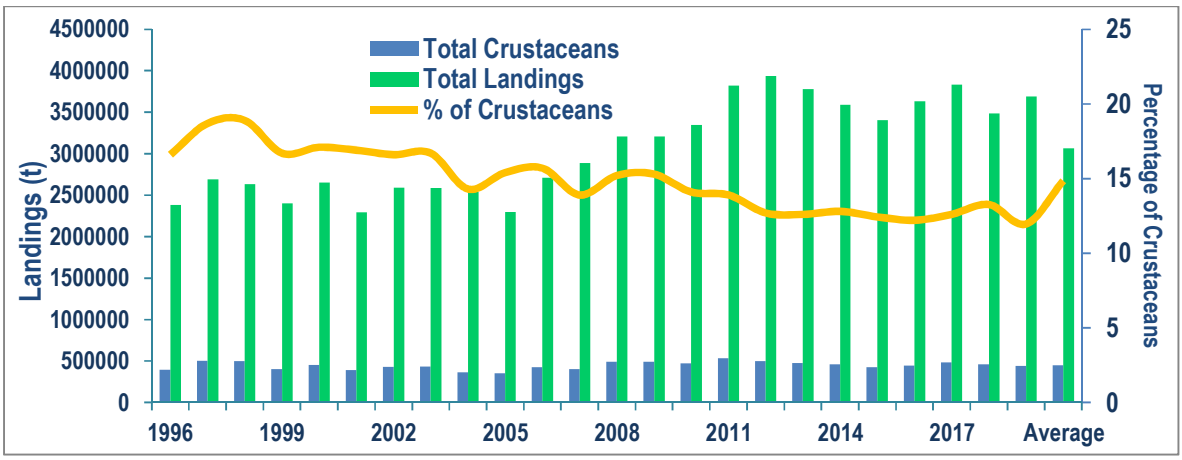

Fig. 1. Total marine fish and crustacean landings (t) in India during 1996-2019.

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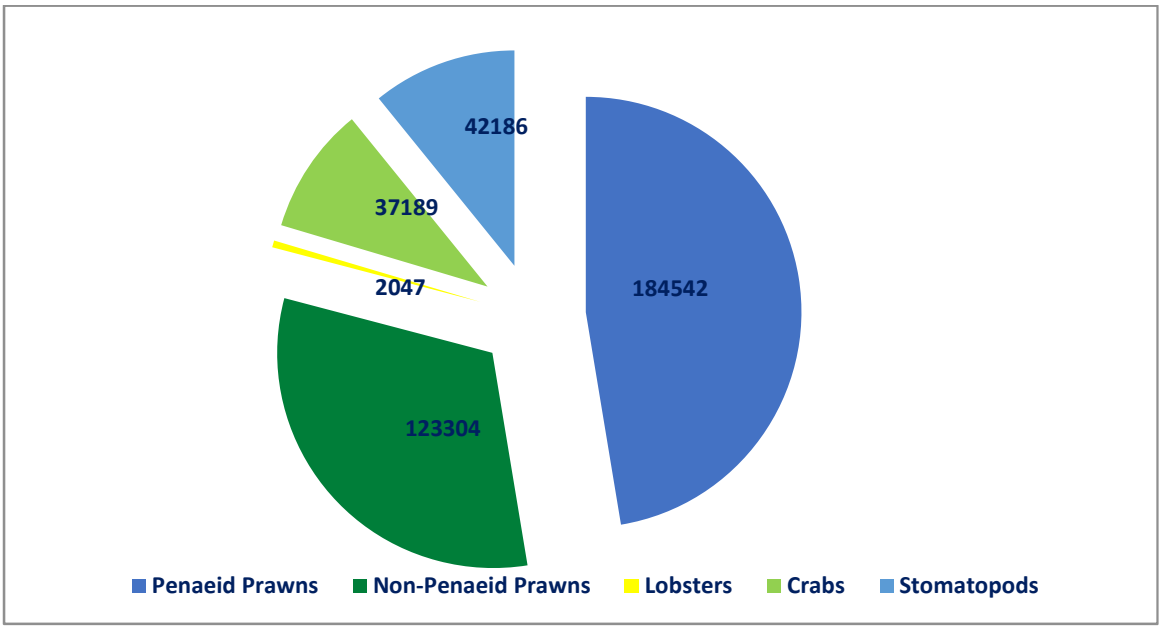


Fig. 2. Average production (t) of crustacean resources in India during 1981-2020.

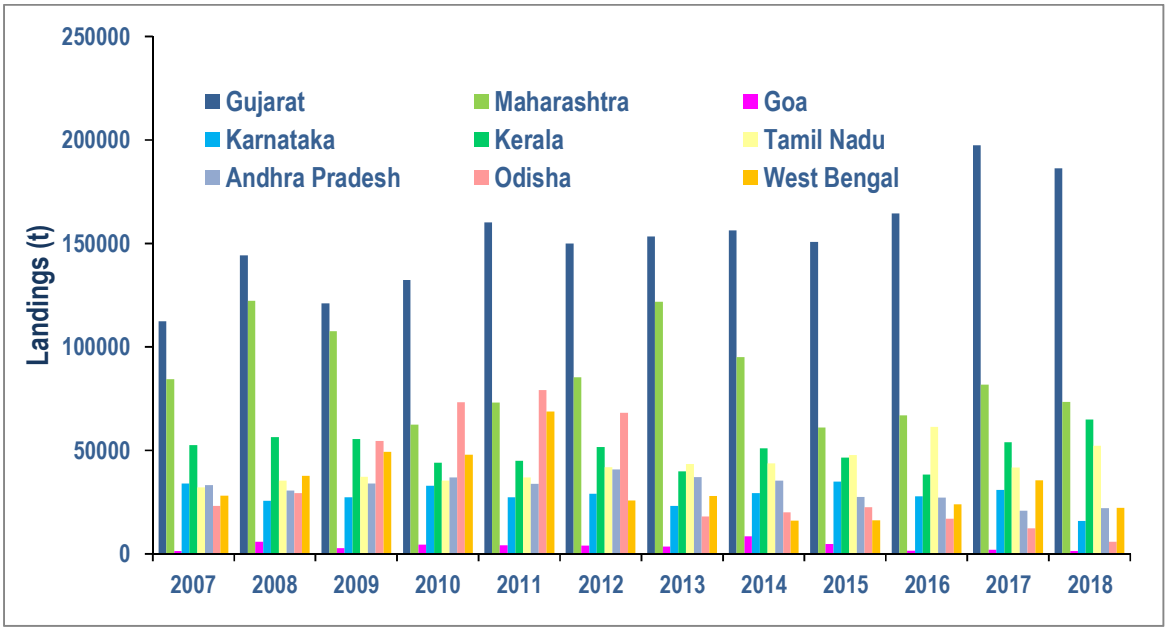


Fig. 3. State-wise Crustacean landings (t) in India during 2007-2018.

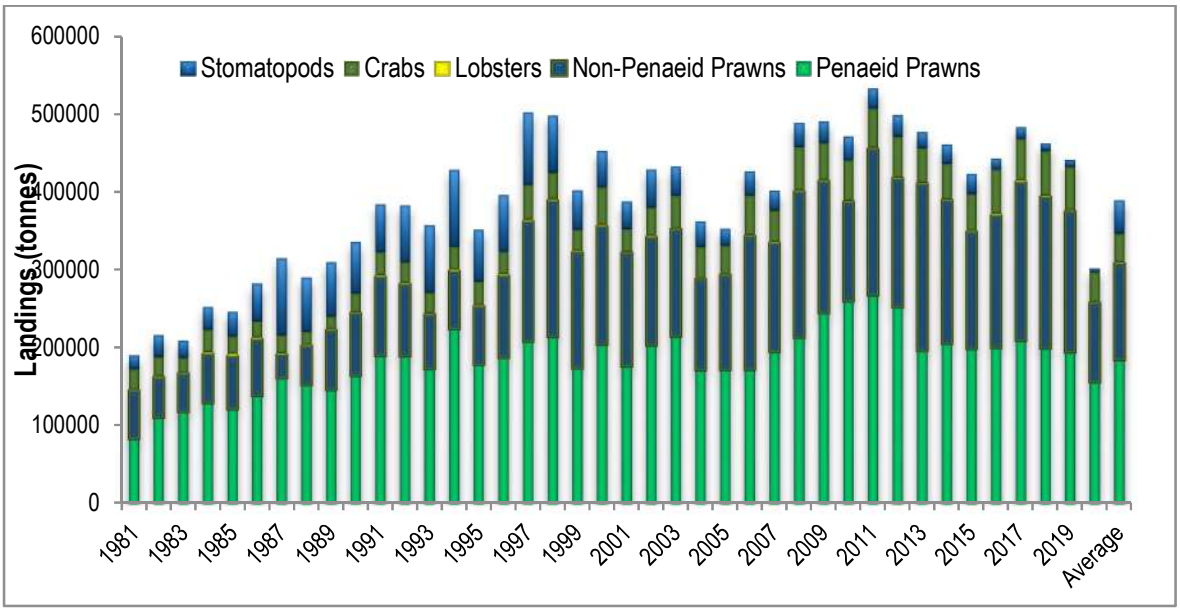


Fig.4. Annual production (t) of crustacean resources in India during 1981-2020.

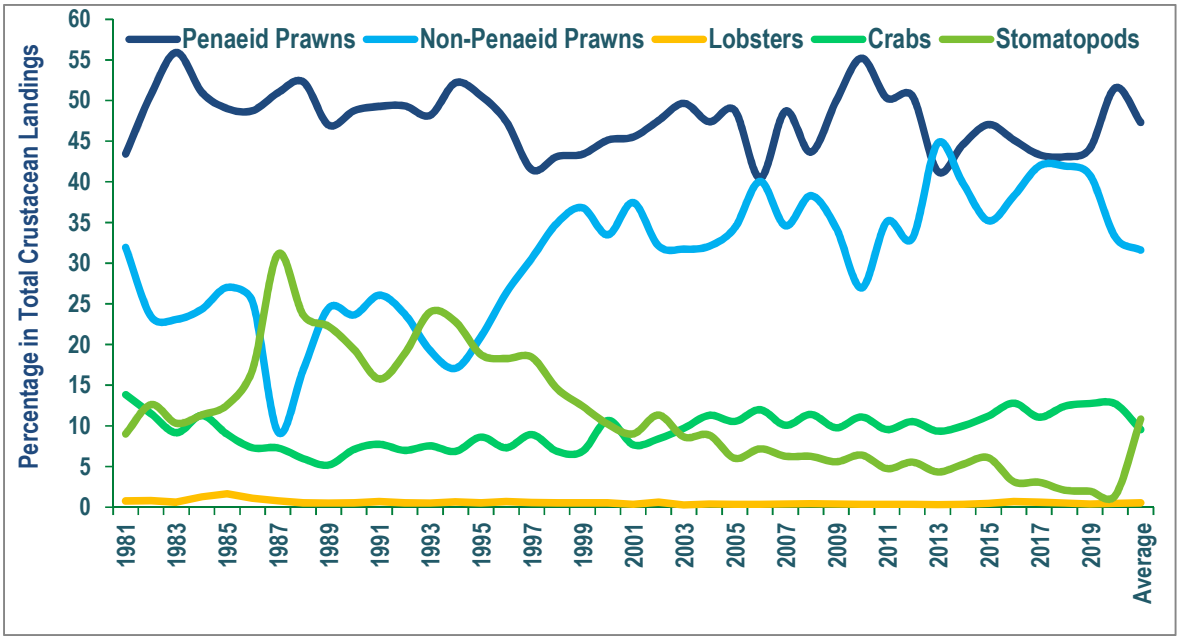


Fig.5. Percentage of various crustacean resources in India during 1981-2020.

Prawn Fisheries of India

Most of the commercial species of prawns* belong to the penaeoidea. Studies on penaeoids are more comprehensive and at present 5 families, 23 genera and 121 species (including the introduced species) are known to occur along the Indian coast including the Lakshadweep and Andaman and Nicobar Islands, with the penaeidae being the most important family (Radhakrishnan et al., 2011). As species of penaeidae are generally of moderate to large in

size occupying large quantities in shallow waters along the continental shelf in trawlable bottoms, they are fished extensively by trawls, gillnets and seines.

About 16 genera and 73 species of penaeids are known to occur along the Indian coast and adjoining seas. Among these, the genus *Penaeus* is of great economic importance followed by *Metapenaeus, Parapenaeopsis* and *Kishinouyepenaeopsis*. The other genus seems to be less abundant, although *Metapenaeopsis* and *Trachysalambria* are frequently found among prawn landings and have some commercial value (Radhakrishnan and Josileen, 2013). Total penaeid prawn landings during 1981-2020 and major commercial species are presented in the figure 6 and table 1.

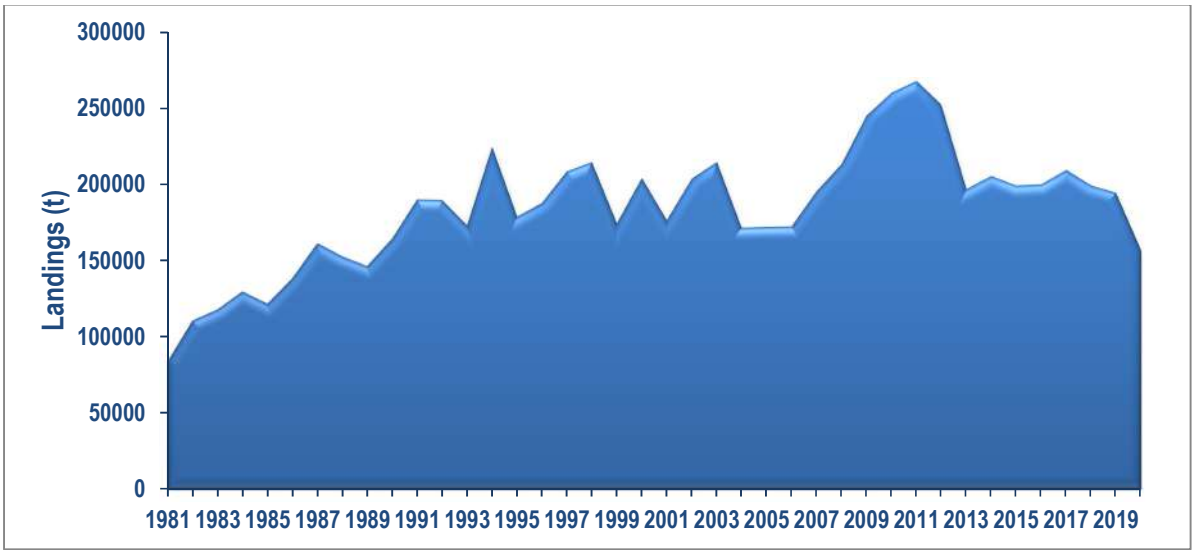


Fig. 6. Total penaeid prawn landings (t) in India during 1981-2020.

[*The terms 'shrimp' and 'prawn' are not related to any known taxonomic group. Although the term 'shrimp' is applied to smaller species, and 'prawn' to large forms, there is no clear distinction between both terms and their usage is often confused or reverse in different countries or regions (Chan, 1998)].

Non-penaeids contributed 31.6% of the total crustacean production in India during 1981-2020. Although non-penaeid prawns are found all along the coastline, they form fisheries of commercial importance only along the northwest and the northeast coasts contributed mainly by states of Maharashtra, Gujarat, Andhra Pradesh and West Bengal. The non-penaeid prawns are generally caught by the fixed bag nets, called 'dol' nets, in Maharashtra and Gujarat and by a variety of gears, such as stake nets, scoop nets, shore seines, boat seines and drag nets in other states. Besides these gears, they are occasionally caught in the trawls also. The total non-penaeid landings during 1981-2020 is presented in the figure 7.

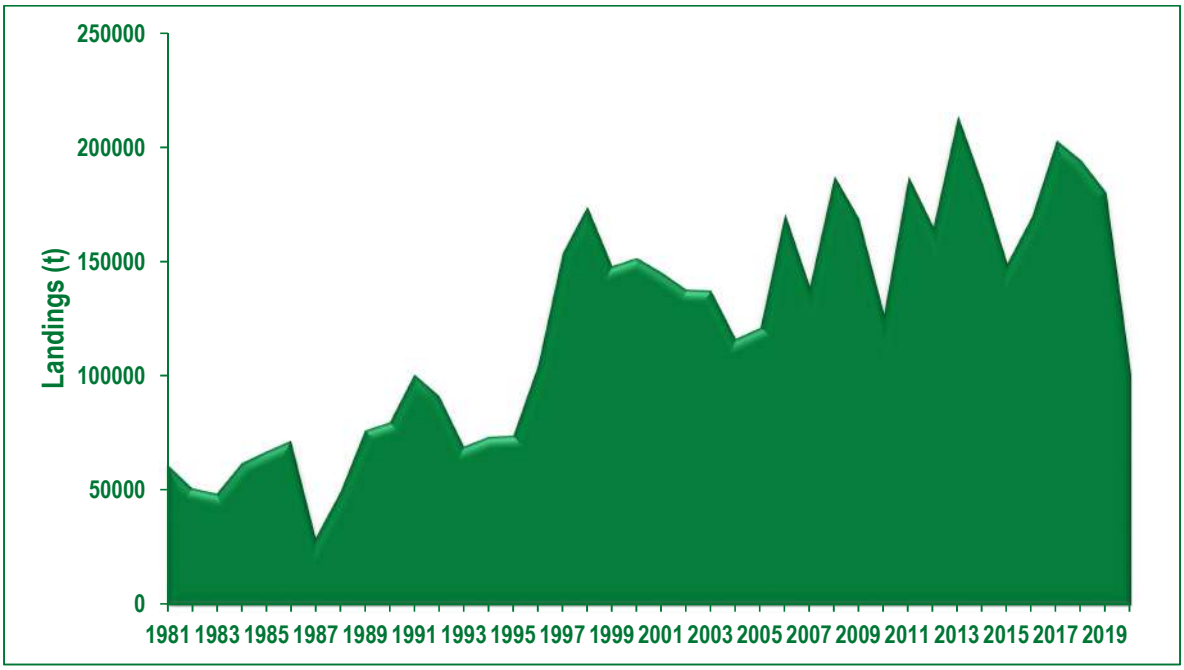


Fig. 7. Total non-penaeid prawn landings (t) in India during 1981-2020.

Deep-sea prawn fishery

In Indian waters, deep sea fishery is seasonal and major species is known to occur in south-east and southwest coast of India. The main fishing ground occurs off Kollam in Kerala and less abundant area off Mangalore, in Karnataka. Along east coast main fishing ground is off Toothukudi in Tamil Nadu. The depth of fishing occurring is mainly between 250 - 400 m. The details of species and landings are presented in table-2 and figures 8-9.

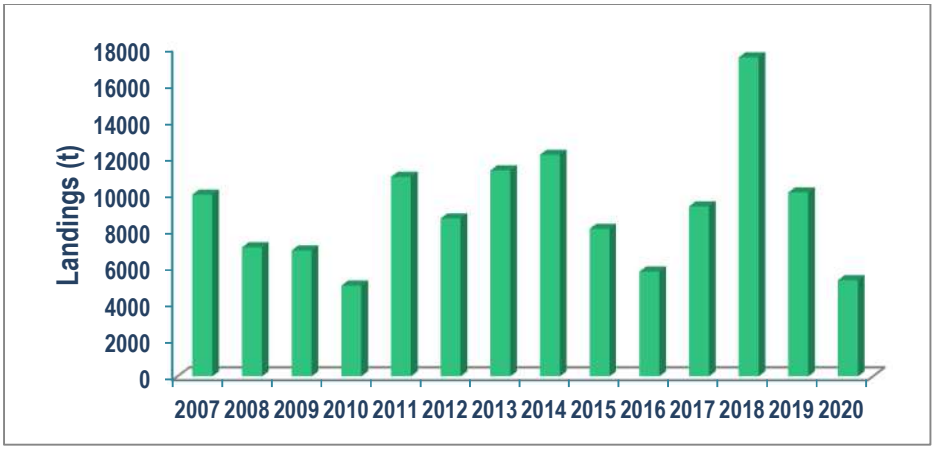


Fig. 8. Total deep-sea prawn landings (t) in India during 2007-2020.

Table -1. Commercially important prawns of India.

Penaeid Prawns
Penaeus canaliculatus (Olivier, 1811)
Penaeus indicus H.Milne Edwards, 1837
Penaeus japonicus Bate, 1888
Penaeus latisulcatus Kishinouye, 1896
Penaeus merguiensis De Man, 1888
Penaeus monodon Fabricius, 1798
Penaeus pencillatus Alcock, 1905
Penaeus semisulcatus De Haan, 1844
Metapenaeus affinis (H.Milne Edwards, 1837)
Metapenaeus brevicornis (H.Milne Edwards, 1837)
Metapenaeus dobsoni (Miers, 1878)
Metapenaeus kutchensis George, George and Rao, 1963
Metapenaeus monoceros (Fabricius, 1798)
Metapenaeus moyebi (Kishinouye, 1896)
Ganjampenaeopsis uncta (Alcock,1905) [*Parapenaeopsis uncta*]
Kishinouyepenaeopsis cornuta (Kishinouye, 1900) [*Parapenaeopsis cornuta*]
Kishinouyepenaeopsis maxillipedo (Alcock,1905) [*Parapenaeopsis maxillipedo*]
Mierspenaeopsis hardwickii (Miers,1878) [*Parapenaeopsis hardwickii*]
Mierspenaeopsis sculptilis (Heller,1862) [*Parapenaeopsis sculptilis*]
Parapenaeopsis stylifera (H.Milne Edwards, 1837)
Metapenaeopsis barbata (De Haan, 1844)
Metapenaeopsis stridulans (Alcock, 1905)
Megokris granulosus (Haswell, 1879) [*Trachypenaeus granulosus*]
Megokris sedili (Hall, 1961) [*Trachypenaeus sedili*]
Solenocera choprai (Nataraj, 1945)
Solenocera crassicornis (H.Milne Edwards, 1837)
Trachysalambria aspera (Alcock, 1905) [*Trachypenaeus asper*]
Non-penaeid
Acetes indicus H. Milne Edwards, 1830
Nematopalaemon tenuipes (Henderson, 1893)
Palaemon styliferus H. Milne Edwards, 1840 (in H. Milne Edwards, 1840) [*Exopalaemon styliferus*]
Exhippolysmata ensirostris (Kemp, 1914) [*Exhippolysmata ensirostris ensirostris*]
Lysmata vittata (Stimpson, 1860) [*Hippoysmata vittata*]

*Note: Species names are provided as following the **World Register of Marine Species** (WoRMS) and old names in [ ].

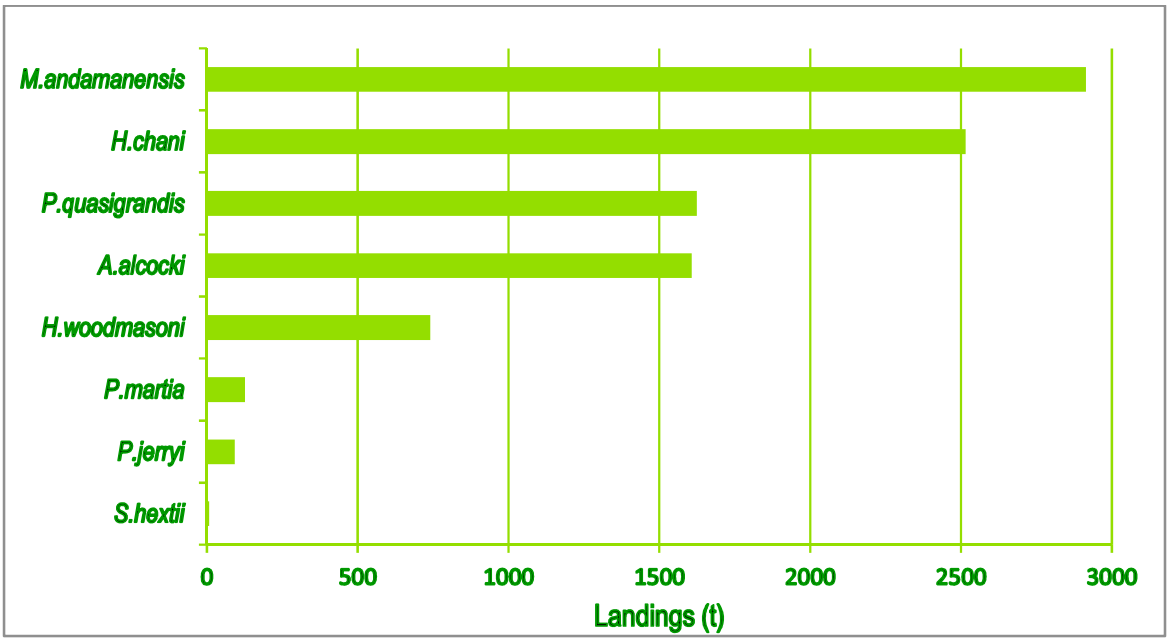


Fig. 9. Species composition of deep-sea prawn landings (t) in Kerala during 2013-2020.

Table-2. Major deep-sea prawns of India

Deep-sea prawns
Acanthephyra armata (A. Milne-Edwards, 1881)
Acanthephyra sanguinea (Wood-Mason in Wood-mason & Alcock, 1892)
Aristeus alcocki Ramadan, 1938
Heterocarpus chani Bate, 1888
Heterocarpus ensifer (A. Milne Edwards,1881)
Heterocarpus laevigatus (Spence Bate,1888)
Heterocarpus longirostris (Macgilchrist,1905)
Heterocarpus sibogae (De Man,1917)
Heterocarpus tricarinatus (Alcock &Anderson,1894)
Heterocarpus woodmasoni Alcock, 1901
Metapenaeopsis andamanensis (Wood-Mason, 1891)
Parapenaeus investigatoris Alcock and Anderson, 1899
Penaeopsis jerryi Pérez Farfante, 1979
Plesionika martia (A.Milne Edwards, 1883)
Plesionika quasigrantis (Bate, 1888)
Sicyonia fallax (De Man,1907)
Sicyonia lancifer (Olivier,1811)
Sicyonia longicauda (Rathbun, 1906)
Sicyonia parajaponica (Crosnier, 2003)
Solenocera alfonso (Perez farfante, 1981)
Solenocera hextii (Wood-Mason & Alcock, 1891)

Crab Fishery and Species composition

Edible crabs landed in India belong to the family Portunidae and around 61% of the landings were recorded by three species of marine crabs *Portunus sanguinolentus* (28.2%), *Portunus pelagicus* (25%) and *Charybdis feriata* (7.7%). The overall trend of the fishery indicated an increase at the national level, recording a maximum landing of 57354 tonnes (t) during 2018 and the lowest record of 14202 t during 1978 and the bulk of the estimated landings (59%) were from Tamil Nadu and Gujarat. The dominant species recorded in different states during 2018-2020 overall landings are presented in table 3 and all India (1981-2020) & state-wise estimates of marine crab landings during 2007-2020 are presented in figures 10 & 11. The other important edible species included in the fishery in appreciable quantities were *Charybdis lucifera*, *Charybdis natator*, *Charybdis smithii*, *Charybdis annulata*, *Portunus gladiator* (revised as *Monomia gladiator*), *Podophthalmus vigil*, *Scylla serrata* and *Scylla olivacea*.

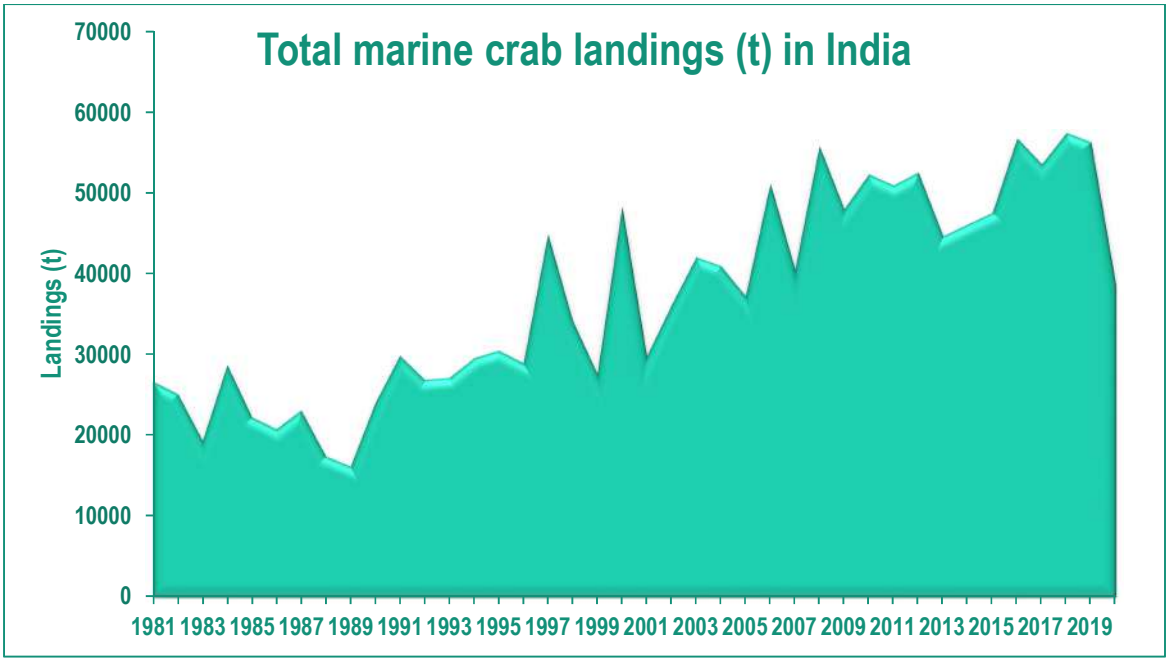


Fig. 10. Total marine crab landings (t) in India during 1981-2020.

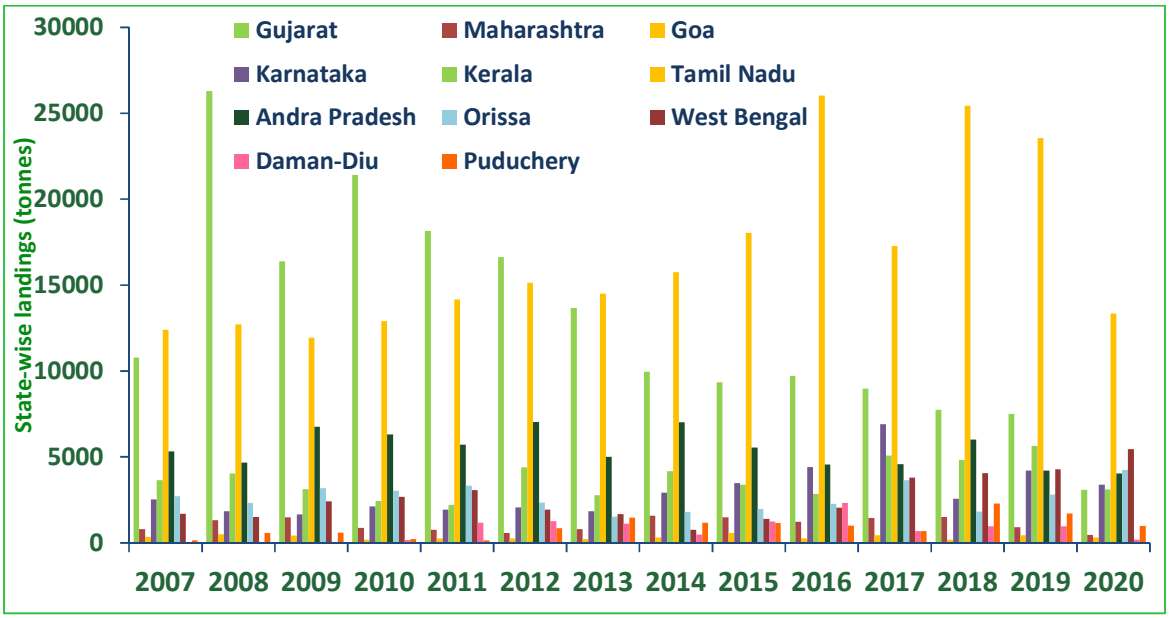


Fig. 11. State-wise estimates of marine crab landings during 2007-2020

Table-3. The dominant species recorded in the marine crab landings of different maritime states during 2018-2020.

State	**Dominant species (2018-20)**
Gujarat	*P. sanguinolentus*
Maharashtra	*P. sanguinolentus*
Goa	*P. sanguinolentus*
Karnataka	*P. pelagicus*
Kerala	*P. sanguinolentus*
Tamil Nadu	*P. sanguinolentus & P.pelagicus*
Andhra Pradesh	*P. sanguinolentus*
Odisha	*P. sanguinolentus*
West Bengal	*P. sanguinolentus*
Daman-Diu	*C. feriata*
Puducherry	*P. sanguinolentus*

Lobster fishery

In India, lobster landings recorded an average estimate of 2047 tonnes while for the last forty years (1981-2020). The overall trend of the lobster fishery in India indicated a decrease at the national level, recording a maximum landing of 4074 tonnes (t) during 1985 and the lowest record of 1201 t during 2005. The bulk of the estimated landings in recent years contributed by four states, Gujarat, Tamil Nadu, West Bengal and Maharashtra. The lobsters are mainly landed in trawlers, gillnet and traps. The lobsters are categorised into spiny or rock lobsters, sand lobsters and deep sea lobsters. The most important spiny lobsters are *Panulirus homarus, P. polyphagus, P. ornatus, P. penicillatus* and *P. versicolor. Thenus unimaculatus* forms the fishery of sand lobster and *Puerulus sewelli* is the major species among the deep sea lobsters. The details of all India landings during 1981-2020 is given in figure 12.

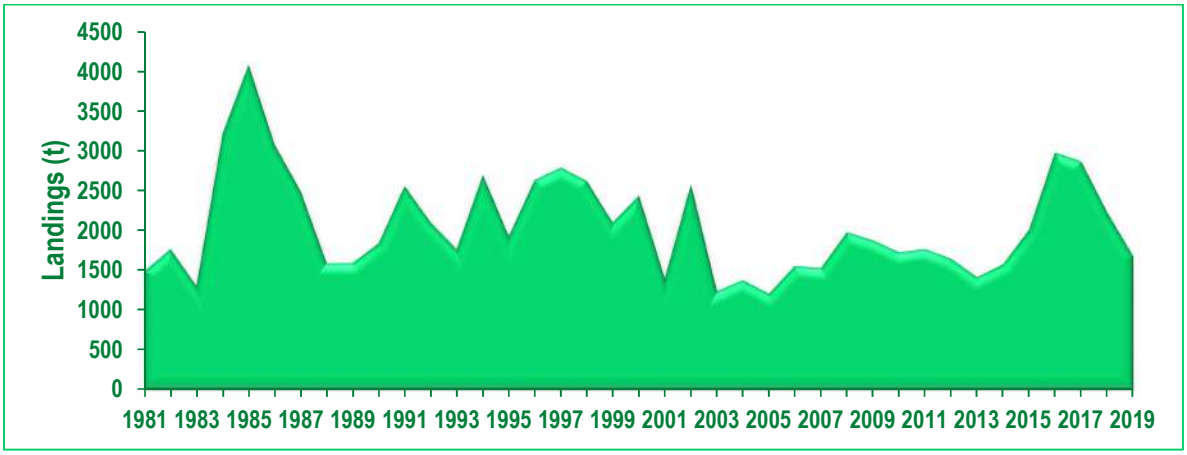


Fig. 12. Total lobster landings (t) in India during 1981-2020.

Taxonomy of Commercially Important Marine crabs of India

Introduction

Kathirvel (2008) reported 990 species of marine brachyuran crabs belonging to 281 genera and 36 families from Indian waters. Trivedi et al., (2018) published an annotated checklist of the marine brachyuran crabs occurring in Indian waters, with a total of 910 species belonging to 361 genera and 62 families. which has 446 species (218 genera and 51 families). Highest species diversity recorded in Kerala (183 species, 117 genera and 35 families) followed by Maharashtra (92 species). However, genetic diversity is more in Maharashtra (64 genera) than in Kerala (63 genera).

Classification

Crabs belong to the order Decapoda and they can be can be classified into two main groups, brachyuran crabs (infraorder Brachyura) and anomuran crabs (infraorder Anomura). Most species of Brachyura, or true crabs, can easily be separated from the so-called "false crabs" belonging to the infraorder Anomura by having five pairs of locomotory appendages of a crab (the pereiopods) are made up of a pair of usually powerful chelipeds (legs carrying a chela or pincer) and normally of four pairs of walking (or ambulatory) legs. The first appendage is referred to as the cheliped and the last four appendages (walking legs) as legs. The claw (or chela) itself consists of a palm (or manus) and two fingers, one of which is movable (the dactylus or movable finger), whereas the other one (Propodus/pollex) is fixed. The tips or edges of the fingers may be pectinated. In some families the last pair or all walking legs are modified for swimming or burrowing, as seen in the Portunidae (Carpenter and Niem, 1998).

Most of the edible crabs caught from marine and brackish water environments belong to the family Portunidae, Rafinesque, 1815. This family includes seven subfamilies; Caphyrinae Paul'son, 1875, Carcininae MacLeay, 1838, Carupinae Paul'son,1875, Podophthalminae Dana, 1851, Polybiinae, Ortmann, 1893, Portuninae Rafinesque, 1815, Thalamitinae Paul'son, 1875. In the seas around India, five genera of Portuninae have been reported by

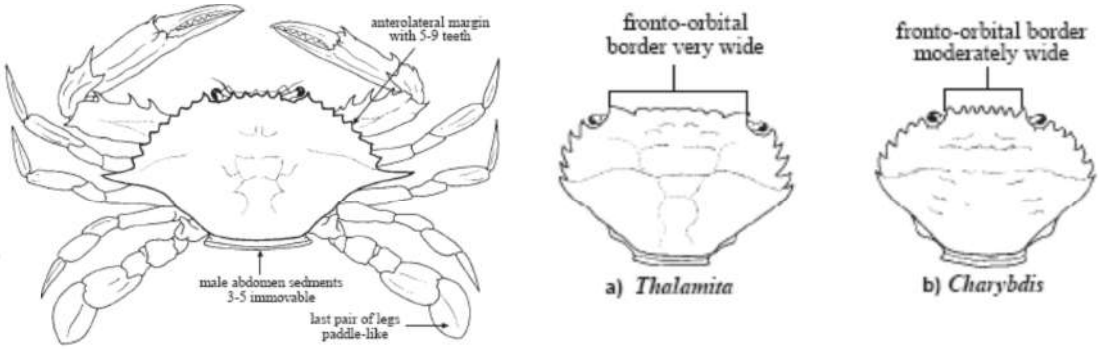
various authors. They are *Scylla, Portunus*, *Charybdis, Lupocyclus* and *Thalamita*. Among them the first three genera mainly contribute to the commercial crab fishery.

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.

Sexuality

In crabs, sexes are separate and sexes can be distinguished from the shape of the abdomen. In males the abdomen is narrow, inverted 'T' shaped and in addition mature males have larger and broader chelae. The first and second abdominal appendages (pleopods) are highly modified to form an intromittant copulatory organ. Females possess a broad abdomen, conical/oval in shape (according to the stage of maturity) and bear four pairs of pleopods.



Shape of abdomen in male and female (different stages) crabs

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***

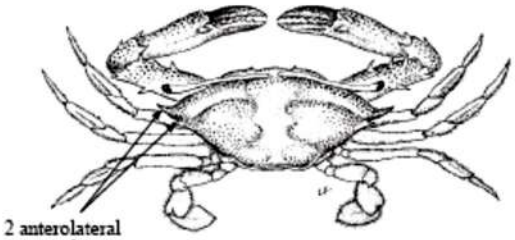


Fig. 1 ***Podophthalmus vigil***

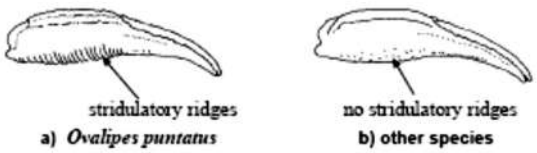


Fig. 2 chela in ventral view

3a. Five to 7 teeth on each anterolateral margin (Fig. 3a-c) ***4***
3b. Nine teeth on each anterolateral margin (Fig. 3d) ***12***

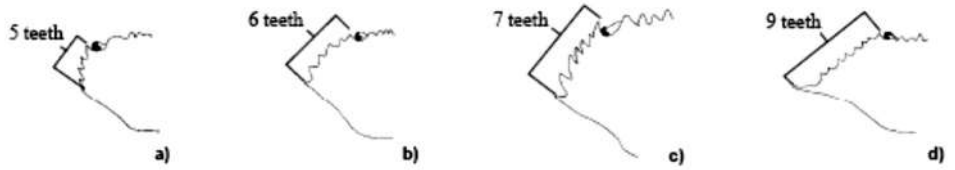


Fig. 3 lateral margin of carapace (dorsal view)

4a. Width of frontal-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 frontal-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***

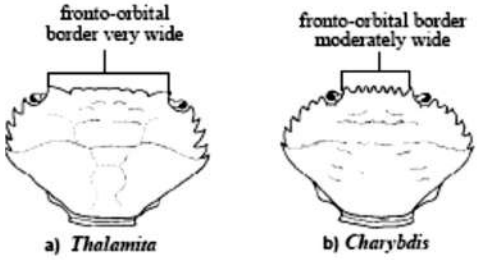


Fig. 4 carapace (dorsal view)

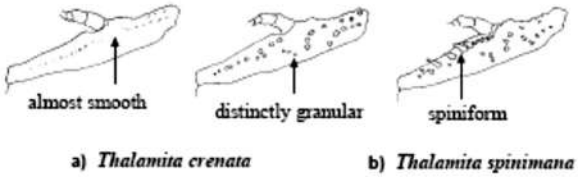


Fig. 5 basal antennal segment

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***

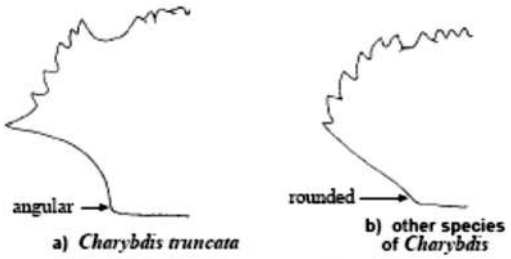


Fig. 6 left side of carapace (dorsal view)

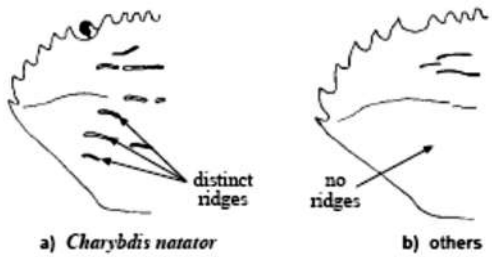


Fig. 7 left side of carapace (dorsal view)

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***

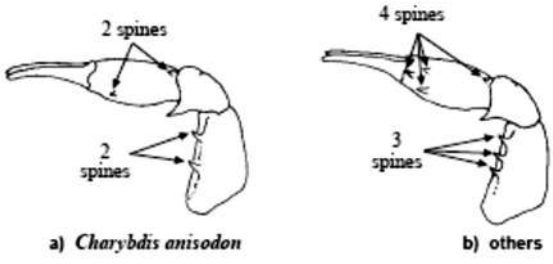


Fig. 8 right cheliped (dorsal view)

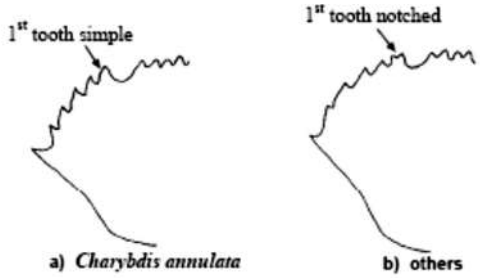


Fig. 9 lateral margin of carapace (dorsal view)

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

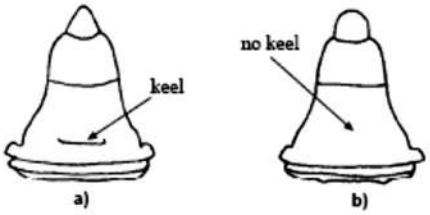
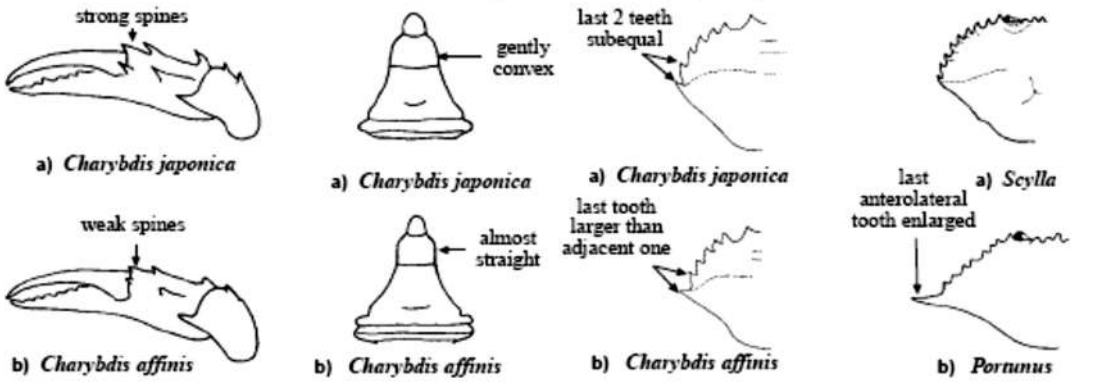


Fig. 11 male abdomen

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) ***3***
12b. Last anterolateral tooth at least 2 times larger than others (Fig. 15b) ***16***



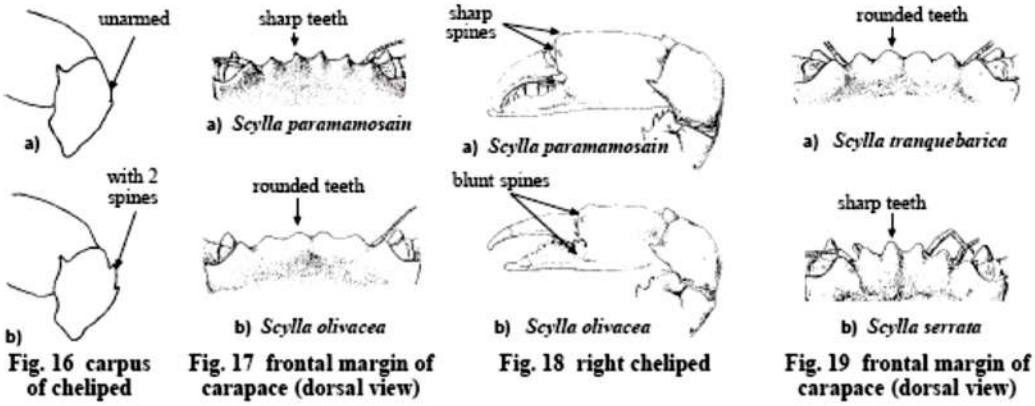
13a. Carpus of cheliped with only 1 low to very low granule on outer surface, never spiniform (Fig. 16a); colour of palm usually with at least some patches of orange or yellow in life ***14***

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***

Fig. 21 frontal margin of carapace (dorsal view)

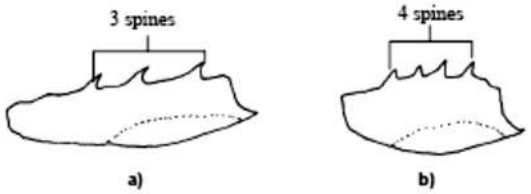


Fig. 22 merus of cheliped (inner margin)

Key – P.K.L.Ng .1998. FAO species identification guide for fishery purposes – Crabs – Portunidae .

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 feriata (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.

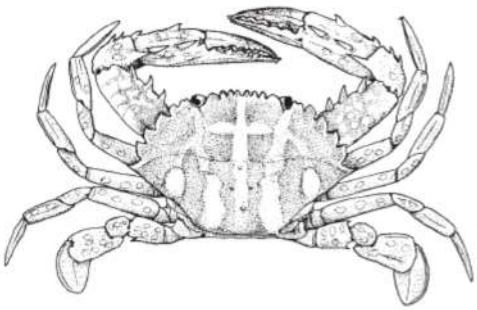
Charybdis natator (Herbst, 1789) (Ridged swimmimg crab)

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.

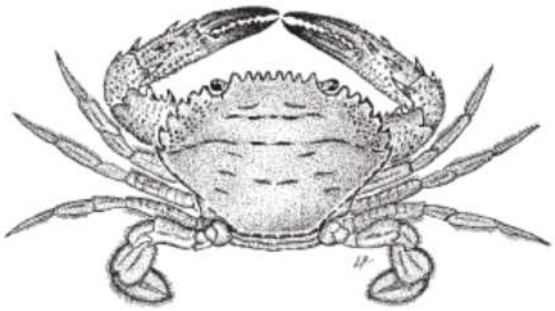
Podophthalmus vigil (Fabricius, 1798)

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.

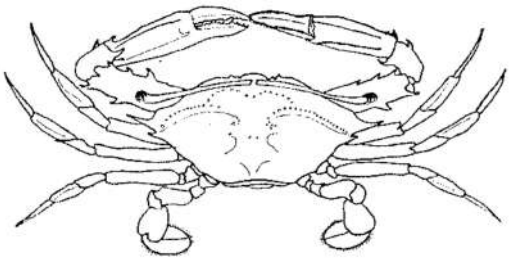
Charybdis feriatus (Linnaeus, 1758)



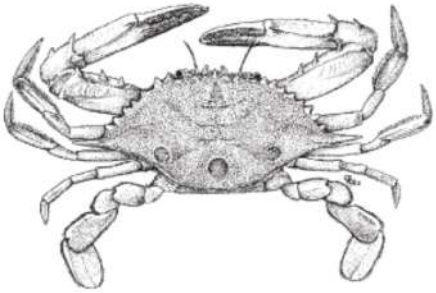
Charybdis natator (Herbst, 1789)



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)

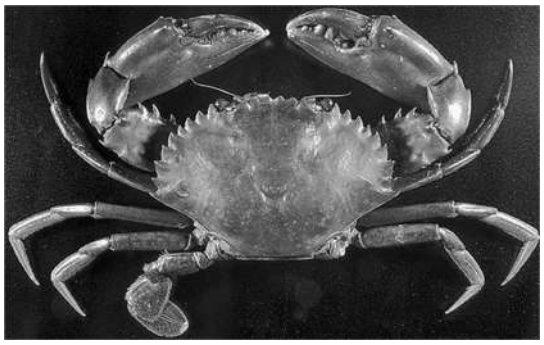
Carapace brownish to brownish green in colour (sometimes orangish), palm orange to yellow. It has a smoother, more evenly convex carapace with very low transverse ridges, a shallow H-shaped gastric groove, the median pair of the frontal lobes more rounded and projecting slightly forwards of the lateral 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

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