Chapter 2

Deep-sea decapod crustacean fauna in the fishery

2.1 Introduction

The order decapoda is the most species rich group of crustaceans, with various economically important and morphologically diverse species leading to a large amount of research (Toon et al., 2009). The largest group of decapoda are the brachyura crabs with 6559 species and followed by shrimps (3877 species), in which majority are caridean shrimps with 3268 species (De Grave et al., 2009). Radhakrishnan et al. (2012) provided a checklist of Penaeoid, Sergestoid, Stenopodid and Caridean shrimp fauna of India, which included 142 species under 43 genera of the suborder Dendrobranchiata and 295 species under 88 genera of the suborder Pleocyemata.

Glyphocrangon investigatoris from east coast of India. Rajool Shanis et al., (2014) reported misidentification of deep-sea pandalid shrimp *P. quasigrandis* from Indian waters. Chakraborty et al. (2014) confirmed the occurrence of deep-sea shrimp *Oplophorus gracilirostris* from India waters on the basis of morphological as well as molecular studies.

This chapter deals with the taxonomic account of deep-sea decapod crustaceans in the fishery with emphasis on the most dominant species, *P. quasigrandis* and newly recorded/described species.

**2.2. Materials and methods**

Commercial deep-sea shrimp trawl landing centers such as Sakthikulangara, Vypin and Cochin Fisheries Harbour were visited to collect decapods samples for a period of three years from January 2009 to December 2011. Additional samples of *P. quasigrandis* were also collected from Tuticorin Fisheries Harbour (Tamilnadu) for comparative study. The samples were preserved in the 5% formalin. Measurements were taken using a digital caliper to the nearest 0.01 mm and the total length (TL) measured from the tip of rostrum to tip of telson and carapace length (CL) from the orbital margin to the posterior dorsal edge of the carapace. The identification and description of species in the present study are in accordance to Alcock (1901), Chace (1985), Suseelan *et al.*, (1989), Suseelan (1990), Chan and Crosnier (1991), Chan (1998), Poupin (2003), Komai (2004), Fransen (2006), Chan and Ng (2008). Specimens examined in the present study were deposited in the collection of National Marine Biodiversity Museum at Central Marine Fisheries Research Institute (CMFRI), Natural History Museum and Institute (CBM) Chiba, National Bureau of Fish Genetic Resources, Cochin Unit, Cochin, (NBFGRC CH)
and Pelagic Fisheries Division in Central Marine Fisheries Research Institute (CMFRI, PFD), Cochin, India.

2.3 Results

Twenty six decapod crustacean species were identified during the study and the details are presented in the Table 2.1. Shrimps were the most diverse group with nineteen species recorded followed by lobsters (3), crabs (2) and squat lobsters (2). Among shrimps, Penaeoidea were represented by five species in three families and caridea by fourteen species in seven families. Crabs consisted of two species in two families and lobster included three species in three families. The squat lobsters were represented by two families Galatheidae and Chirostylidae. The family with the highest number of species observed was Pandalidae (7) followed by Acanthephyridae (2), Penaeidae (2) and Solenoceridae (2).

2.3.1 Taxonomic status of *Plesionika quasigrandis* Chace, 1985

Infraorder: Caridea

Superfamily: Pandaloidea Haworth, 1825

Family: Pandalidae Haworth, 1825

Genus: *Plesionika* Spence Bate, 1888

**Materials examined**

*Plesionika quasigrandis*, NBFGR CH 1142, ovigerous female, CL 22.92 mm, CMFRI PFD CR 133–140, eight specimens, five female, CL 17.2–24.8 mm (three ovigerous and two non-ovigerous) three male, CL 18.9–23.2 mm, off Kollam, Kerala coast, India, 220–300 m depth, CMFRI PFD CR 141–146, six specimens, four female, CL 18.3–23.8 mm (three ovigerous and one non-ovigerous) two male, CL 119.1–23.6 mm, off Tuticorin, Tamil Nadu 200–280 m depth.
Table 2.1. List of decapod crustaceans recorded in the deep-sea shrimp fishery of Kerala

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shrimp</strong></td>
<td></td>
</tr>
<tr>
<td>Aristeida</td>
<td><em>Aristeus alcocki</em> Ramadan, 1938</td>
</tr>
<tr>
<td>Glyphocrangonidae</td>
<td><em>Glyphocrangon investigatoris</em> Wood-Mason &amp; Alcock, 1891</td>
</tr>
<tr>
<td>Nematocarcinidae</td>
<td><em>Nematocarcinus gracilis</em> Spence Bate, 1888</td>
</tr>
<tr>
<td>Acanthephyridae</td>
<td><em>Acanthephyra fimbriata</em> Alcock &amp; Anderson, 1894</td>
</tr>
<tr>
<td></td>
<td><em>Acanthephyra sanguinea</em> Wood-Mason &amp; Alcock, 1892</td>
</tr>
<tr>
<td>Oplophoridae</td>
<td><em>Oplophorus gracilirostris</em> A. Milne-Edwards, 1881</td>
</tr>
<tr>
<td>Pandalida</td>
<td><em>Heterocarpus gibbosus</em> Spence Bate, 1888</td>
</tr>
<tr>
<td></td>
<td><em>Heterocarpus woodmasoni</em> Alcock, 1901</td>
</tr>
<tr>
<td></td>
<td><em>Plesionika adensameri</em> (Balss, 1914)</td>
</tr>
<tr>
<td></td>
<td><em>Plesionika alcocki</em> (Anderson, 1896)</td>
</tr>
<tr>
<td></td>
<td><em>Plesionika quasigrandis</em> Chace, 1985</td>
</tr>
<tr>
<td></td>
<td><em>Plesionika martia</em> (A. Milne-Edwards, 1883)</td>
</tr>
<tr>
<td></td>
<td><em>Plesionika williamsi</em> Forest, 1964</td>
</tr>
<tr>
<td>Pasiphaeidae</td>
<td><em>Pasiphaea sp.</em></td>
</tr>
<tr>
<td>Penaeidae</td>
<td><em>Metapenaeopsis andamanensis</em> (Wood-Mason in Wood-Mason &amp; Alcock, 1891)</td>
</tr>
<tr>
<td></td>
<td><em>Penaeopsis jerryi</em> Pérez Farfante, 1979</td>
</tr>
<tr>
<td>Solenoceridae</td>
<td><em>Hymenopenaeus equalis</em> (Spence Bate, 1888)</td>
</tr>
<tr>
<td></td>
<td><em>Solenocera hextii</em> Wood-Mason &amp; Alcock, 1891</td>
</tr>
<tr>
<td>Stylodactylidae</td>
<td><em>Parastylopectus sulcatus</em> Komai &amp; Rajool Shanis, 2011</td>
</tr>
<tr>
<td><strong>Crab</strong></td>
<td></td>
</tr>
<tr>
<td>Lithodidae</td>
<td><em>Paralomis investigatoris</em> Alcock &amp; Anderson, 1899</td>
</tr>
<tr>
<td>Portunidae</td>
<td><em>Charybdis (Goniohellenus) smithii</em> MacLeay, 1838</td>
</tr>
<tr>
<td>Enoplometopidae</td>
<td><em>Enoplometopus macrodontus</em> Chan &amp; Ng, 2008</td>
</tr>
<tr>
<td><strong>Lobster</strong></td>
<td></td>
</tr>
<tr>
<td>Nephropidae</td>
<td><em>Nephropsis stewarti</em> Wood-Mason, 1872</td>
</tr>
<tr>
<td>Palinuridae</td>
<td><em>Puerulus sewelli</em> Ramadan, 1938</td>
</tr>
<tr>
<td><strong>Squat lobster</strong></td>
<td></td>
</tr>
<tr>
<td>Galatheidae</td>
<td><em>Munidopsis sp.</em> Whiteaves, 1874</td>
</tr>
<tr>
<td>Eumunididae</td>
<td><em>Eumunida funambulus</em> Gordon, 1930</td>
</tr>
</tbody>
</table>

**Diagnosis**

Rostrum overreaching well beyond scaphocerite, armed with 40–49 dorsal
teeth, including 4–7 teeth on carapace above or posterior to orbital margin and armed with 31–40 ventral teeth. Posterior ten ventral rostral teeth corresponding to 6–8 dorsal teeth abdomen without posteromesial tooth or median dorsal carina on third somite, 4th and 5th somites with pleura tapering posteroventrally to strong tooth. Telson 1.2–1.4 times longer than sixth abdominal somite, with four pairs of dorsolateral spinules. Stylocerite sharply acute and with outer margin barely curving upward. Scaphocerite 4–5 times as long as wide. Third maxilliped without epipod, Penultimate segment 1.2–1.4 times longer than terminal segment. Pereiopods without epipods, carpus of first pereiopod 0.85–0.90 times as long as carapace. Second pereiopod sub equal with 19–32 articles. Dactylus of third pereiopod rather paddle shape and 0.33–0.14 times as long as propodus.

**Misidentification of *Plesionika quasigrandis* as *Plesionika spinipes***

*Plesionika narval* group is generally considered to be a taxonomically complex species cluster. According to Chan and Crosnier (1991), *P. spinipes*, *P. grandis* and *P. quasigrandis* belongs to the *P. spinipes* subgroup within the *P. narval* group. The species in this subgroup possess the fourth abdominal pleuron pointed. These three species bear strong morphological similarity and this led to misidentification of *P. quasigrandis* in India as *P. spinipes*. The important morphological differences among the *P. spinipes*, *P. grandis* and *P. quasigrandis* are given in the Table 2.2.

*Plesionika quasigrandis* was originally described by Chace (1985) from Philippine waters based on materials from 245–320 m depths. *Plesionika quasigrandis* is nearly similar to *P. grandis* and Chace (1985) observed the variations barely in the number of rostral teeth on ventral part and the proportional length of the
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distal two segments of third maxillipeds (Table 2.2).

**Table 2.2.** Comparisons of morphological characters of *Plesionika spinipes*, *P. grandis* and *P. quasigrandis*.

<table>
<thead>
<tr>
<th><strong>Plesionika spinipes</strong> Spence Bate, 1888*</th>
<th><strong>Plesionika grandis</strong> Doflein,1902*</th>
<th><strong>Plesionika</strong> quasigrandis Chace, 1985 (Present study)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior 10 ventral rostral teeth usually corresponding to dorsal teeth.</td>
<td>Posterior 10 ventral rostral teeth usually corresponding to 9–14 dorsal teeth.</td>
<td>Posterior 10 ventral rostral teeth corresponding to 6–8 dorsal teeth.</td>
</tr>
<tr>
<td>Stylocerite sharply acute and with outer margin not curved upwards.</td>
<td>Stylocerite sharply acute and with outer margin not curved upwards.</td>
<td>Stylocerite sharply acute and with outer margin barely curving upward.</td>
</tr>
<tr>
<td>Penultimate segment of third maxilliped 1.6–2times longer than terminal segment.</td>
<td>Penultimate segment of third maxilliped 1.55–1.85times longer than terminal segment.</td>
<td>Penultimate segment of third maxilliped 1.2–1.4 times longer than terminal segment.</td>
</tr>
<tr>
<td>Penultimate segment of third maxilliped 1.6–2times longer than terminal segment.</td>
<td>Penultimate segment of third maxilliped 1.55–1.85times longer than terminal segment.</td>
<td>Penultimate segment of third maxilliped 1.2–1.4 times longer than terminal segment.</td>
</tr>
<tr>
<td>Carpus of first pereiopod 0.85–05 times as long as carapace.</td>
<td>Carpus of first pereiopod 0.9–1 times as long as carapace.</td>
<td>Carpus of first pereiopod 0.85–0.90 times as long as carapace.</td>
</tr>
<tr>
<td>Dactylus of third pereiopod elongated and conical and 1/7–1/13 times as long as propodus.</td>
<td>Dactylus of third pereiopod elongated and conical or somewhat paddle shape and 1/4–1/7 times as long as propodus.</td>
<td>Dactylus of third pereiopod rather paddle shape and 1/3–1/7 times as long as propodus.</td>
</tr>
<tr>
<td>Telson 1.1–1.3 times longer than sixth abdominal somite.</td>
<td>Telson 1.1–1.4 times longer than sixth abdominal somite.</td>
<td>Telson 1.2–1.4 times longer than sixth abdominal somite.</td>
</tr>
<tr>
<td>Wider longitudinal red strips present on each side of abdomen.</td>
<td>Narrow longitudinal red strips on each side of abdomen.</td>
<td>No strips on the abdomen.</td>
</tr>
</tbody>
</table>

*Modified from Chan and Crosnier (1991)
In *P. quasigrandis*, the ventral teeth are distinctly more closely packed than those on the dorsal border, while the dorsal teeth are usually more closely set in *P. grandis*. *P. quasigrandis* differs from *P. spinipes* in several characters including morphometry, colour pattern and its geographical distribution. The pattern and range of rostral teeth is different in the two species. In *P. spinipes* the range of rostral teeth on the ventral side is between 24–36 and the posterior ten ventral rostral teeth usually corresponds to more than thirteen dorsal teeth, while in *P. quasigrandis* these are 31–40 and eight or less, respectively. A deep notch is present in the distal margin of the endopod of the first male pleopod of *P. spinipes*, which is absent in the same pleopod of *P. quasigrandis*. The body of *P. quasigrandis* is pale pinkish in color with no stripes on the abdomen (Plate 2.1), whereas *P. spinipes* has longitudinal stripes on each side of the abdomen. The stripes present in *P. spinipes* are slightly wider than those of *P. grandis* (Figure 21 and 22 in Chan and Crosnier, 1991).

**Distribution**

The shrimp species *P. quasigrandis* and *P. grandis* have a wide distribution in the Indo-west Pacific region. *Plesionika spinipes* is reported from Eastern Australia, Kai islands, north of New Guinea, New Britain, Chesterfield islands, New Caledonia, Loyal islands and French Polynesia; however its distribution is not extended to Indian waters.

**2.3.2 New records from Indian waters**

**2.3.2.1 Plesionika adensameri (Balss, 1914)**

Infraorder: Caridea

Superfamily: Pandaloidea Haworth, 1825
Family: Pandalidae Haworth, 1825

Genus: *Plesionika* Spence Bate, 1888

**Material examined:**

*Plesionika adensameri*, CMFRI ED. 2.4.3.3, one male (TL 9.8 cm, CL 1.9 cm), two female (TL 8.2–10.3 cm; CL 1.6–2.2 cm), Cochin Fisheries Harbour, Kerala (India), Arabian Sea, 2009, 200–300 m depth.

**Diagnosis**

Eye broadly subpyriform and ocellus longitudinally oval. Rostrum double curved with dorsal teeth distributed entire length, antennal spine well developed and reaching distal margin of basicerite; pterygostomain tooth distinct, smaller than antennal spine; stylocerite sharp, overreaching dorsal margin of first antennular segment. Third maxilliped long and slender, reaching beyond scaphocerite. Scaphocerite long and slender, 4.5 times as longer than maximal width.

Basal segment of antennular peduncle with small ventromesial tooth. First pereiopod reaching with chela and half of carpus beyond scaphocerite; second pereiopod reaching distal margin of first pereiopod; third, fourth, and fifth periopods similar, very long and slender. Second thoracic sternite unarmed; sixth thoracic sternites with prominent median elevation; seventh thoracic sternite broader than sixth, with prominent median elevation, larger than that of sixth. Abdomen without posteromesial tooth or median dorsal carina on third somite. Sixth abdominal somite less than twice as long as high. Exopod of third pleopod less than 0.66 as long as carapace. Telson as long as sixth somite, ending in distinct acute distal protruding tip. Uropods as long as telson, slender, exopod with movable distolateral spine.
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Distribution

Red sea (Depth: 732–1308 m) Gulf of Aden (Depth: 457–549 m), Maldives (Depth: 494 m) and India (Depth: 200–300 m).

1.3.2.2 Enoplometopus macrodontus Chan and Ng, 2008

Infraorder: Astacidea

Superfamily: Enoplometopidae Saint Laurent, 1988

Family: Enoplometopidae Saint Laurent, 1988

Genus: Enoplometopus A. Milne-Edwards, 1862

Material examined

Enoplometopus macrodontus, CMFRI PFD CR 148, female, CL 70.4 mm, CMFRI ED 3.4.1.1, off Chavakkad (10°30’, 75°24’), Kerala, South West coast of India, Arabian Sea, September 2009, 320 m depth.

Diagnosis

Body is cylindrical, carapace pubescent with numerous long stiff setae on the chelipeds, pereiopods, abdomen and telson. The rostrum is elongated which overreaches beyond the base of the antennular peduncle, armed with four spines laterally. The carapace is with five median and one postcervical spine. There are two lateral spines, one intermediate spine and one supra-ocular spine on the carapace. The intermediate tooth as large as the supra-ocular spine extends nearly to the margin of the eye. The median spines are almost equal but with anterior most spines slightly smaller. The postcervical tooth smaller than median teeth and is well defined and extends beyond the cervical groove. Abdomen and telson with long stiff setae. Telson rectangular, slightly longer than wide bearing two pair of movable lateral spine and two pairs of movable postero-lateral spines. Uropod with
protopodite divided into two lobes, endopod shorter than telson and bearing a postero-lateral spine.

Carpus and merus of first cheliped almost completely covered with large and small teeth along the margins except posterior 0.5–0.33 of dorsal margin of merus which is finely denticulate or smooth. Pereiopod 2nd to 5th sub-chelate. The cervical groove is inconspicuous and shallow, antennal spine large. Branchiostegal spine is present and small. The first pereiopod is long chelate and dorsoventrally compressed. The inner face of the chela is with four spines and the outer face is with tubercles. Outer margin of the propodus has 9–10 teeth and the inner margin 8 teeth, rest are tubercles. The pleura of the 2nd to 5th abdominal somites is bluntly pointed.

**Distribution**

Balicasag Island, Philippines (90–200 m depth), Sri Lanka and Arabian Sea, India (320 m depth).

**2.3.3 New species of deep-sea shrimp**

**2.3.3.1 Parastylodactylus sulcatus**

Infraorder: Caridea

Superfamily: Stylodactyloidea Spence Bate, 1888

Family: Stylodactylidae Spence Bate, 1888

Genus: Parastylodactylus Figueira, 1971

**Material examined**

*Parastylodactylus sulcatus*, Holotype: male (CL 9.3 mm), Southern Arabian Sea, offshore between Kollam and Cochin, south west coast of India, 09°04.5’N, 75°52.4’E, 350 m, 21 February 2010, CBM-ZC 10536. Paratypes: 1 male (CL 7.7
mm), same data as holotype, CBM-ZC 10537; 1 male (CL 7.9 mm), same data as holotype, CMFRI-E.D.1.7.1.1.

**Description**

Body moderately slender; integument moderately firm, glabrous on surfaces. Rostrum (Fig. 2.1A and Fig. 2.3A) elongate, slender, 2.2 times longer than carapace, slightly to somewhat curving dorsally in distal half; dorsal margin armed with 18–20 rather widely spaced, moderately small spines, including 6–7 on carapace, ventral margin with 6–8 moderately small spines. Carapace with low, but distinct postrostral ridge extending to mid length; dorsal margin in lateral view slightly sinuous; supraorbital tooth absent; infraorbital lobe prominent, far exceeding beyond antennal tooth, rounded distally, constricted at base, sharply buttressed on lateral face; antennal tooth moderately strong, directed forward; anterolateral margin between antennal and branchiostegal teeth strongly sinuous with deep concavity just inferior to antennal tooth; branchiostegal tooth relatively strong, overreaching antennal tooth; hepatic groove very deep.

Abdomen (Fig. 2.1 B) dorsally rounded on every somite; posterodorsal margin of third somite somewhat produced posteriorly. First to fourth pleura rounded, fifth pleuron with small posteroverentral tooth. Sixth somite 1.6 times longer than high and 1.9 times longer than fifth somite, posteroverentral angle bluntly pointed, posterolateral process moderately strong, terminating in acute tooth. Telson (Fig. 2.3 B and C) tapering posteriorly to acute tip, bearing five pairs of dorsolateral spines and three pairs of terminal spines. Eye (Fig. 2.1 C) subpyliform; cornea relatively small, distinctly shorter than and slightly wider than eyestalk; ocellus absent. Antennular peduncle (Fig. 2.1 A and D) moderately stout, not reaching mid
length of antennal scale. First segment longer than distal two segments combined; stylocerite strongly compressed laterally, reaching distal one-fourth of first segment, abruptly tapering to slender spiniform tooth; small, forwardly directed process proximal to base of stylocerite. Second and third segments unarmed. Outer flagellum with thickened aesthetasc-bearing portion reaching distal lamella of antennal scale; inner flagellum falling short of tip of rostrum. Antennal peduncle (Fig. 2.1A, C and D) moderately stout. Basicerite with moderately strong distolateral tooth.

Antennal scale (Fig. 2.1 E) 1.1 times longer than carapace, very narrow (8.7 times longer than wide), curving laterally in proximal half; lateral margin concave, unarmed; distolateral tooth strong, wider than distal lamella at base, far overreaching distal lamella; distal lamella clearly defined, narrowly rounded. Mandible (Fig.2.2 A and B) without palp; incisor and molar processes not clearly separated, incisor process bearing eight acute, unequal teeth on mesial margin; molar process with uneven mesial face; cluster of numerous minute spinules on mesial margin between incisor and molar processes. Maxillule (Fig. 2.2 C) with subovate coxalendite; basialendite subovate, somewhat narrowing basally, mesial margin with double row of slender spines and stiff setae; endopod with subtruncate terminal margin bearing one long spiniform seta at mesial angle and one short, curved sub marginal seta.

Maxilla (Fig. 2.2 D) with coxalendite consisting of single lobe; basialendite divided in 2 lobes, proximal lobe subrectangular, distal lobe subtriangular; endopod slightly curved mesially, reaching nearly to distal margin of basialendite, bearing one seta on mesial margin and three apical setae; scaphognathite moderately broad,
posterior lobe sub triangular, bearing long, flexed setae terminally.

First maxilliped (Fig. 2.2 E) with thickened coxalendite; basialendite narrowly subovate; endopod falling short of distal margin of basialendite; exopod moderately narrow, flagellum arising at midlength of mesial margin of caridean lobe; epipods large, distinctly bilobed. Second maxilliped (Fig. 2.2 F) with two terminal segments articulated at distal margin of propodus, ventral segment longer than dorsal segment; propodus elongate, slightly widened distally; carpus very short, cup-shaped; merus and ischium fused, subequal in length to propodus, bearing row of stiff setulose setae on ventral margin; exopod flagellum-like, slightly overreaching distal margin of merus; coxa with rounded, membranous epipod and large podobranch consisting of lamellae of various size (Fig. 2.2 G and H).

Third maxilliped (Fig. 2.3D) slender, overreaching distal end of antennal scale by about 0.7 length of ultimate segment; ultimate segment gradually tapering distally, subequal in length to penultimate segment, bearing two rows of long setulose setae on ventral margin; ultimate segment with one minute spine distolaterally and with two row of long setulose setae on ventral margin; articulation between ischium and basis clearly delimited; coxa (Fig. 2.3 E) with flattened, subcircular epipodonlateral face, without strap-like process; exopod absent. Pereopods moderately long and slender (Fig. 2.3 F,G and H), only left third pereopod of holotype preserved.

Third pereopod (Fig. 3 F–H) slightly falling short of tip of antennal scale; dactylus 0.27 times as long as propodus, terminating in strong, clearly demarcated unguis, armed with seven accessory spinules noticeably increasing in length, distalmost spinule arising somewhat proximal to base of unguis, only slightly
shorter than unguis; propodus about 12.0 times longer than wide, with two rows of slender spinules and tufts of short stiff setae on flexor margin; carpus 0.4 times as long as propodus, bearing 3 slender spines on lateral face ventrally; merus and ischium completely fused, bearing five spines in distal half, these spines increasing in size distally.

First pleopod with exopod distinctly longer than endopod; endopod (Fig. 2.2 I) strongly modified, tapering distally, mesial part folded ventrally, bearing thick covering of stiff setae and prominent slender spur arising at mid length of dorsomesial margin, lateral margin sinuous with sparse long stiff setae, appendix interna very short, located subterminally, bearing cluster of adhesive hooks. Second pleopod with appendix masculine sub equal in length to appendix interna (Fig. 2.2 J and K), bearing row of stiff setae on almost over entire length of mesial margin and one subterminal seta on lateral margin, both appendices arising at proximal 0.2 of endopod and reaching to mid length of endopod. Uropod (Fig.2.3 I) with moderately stout protopod terminating posterolaterally in acute tooth; endopod slightly shorter than exopod, gradually tapering distally; exopod with slightly sinuous lateral margin, bearing one stout spine just mesial to minute posterolateral tooth.

**Etymology**

From the Latin *sulcatus* (grooved), in reference to the characteristic very deep hepatic groove seen in this new species.

**Distribution**

Known only from the type locality in the southern Arabian Sea, off Kollam, Southwestern India, 350 m.
2.4 Discussion

Among the 26 decapod species observed in the fishery during the study period, only seven species of shrimps, *A. alcocki*, *H. gibbosus*, *H. woodmasoni*, *P. quasigrandis*, *P. martia*, *M. andamanensis*, *S. hextii* and one species of lobster, *Puerulus sewelli* were observed regularly in fishery. Other species were observed to be very less and rare in commercial deep-sea shrimp landings. The details of catch and species composition are discussed in the Chapter 3.

The present observation on the deep-sea decapods crustacean in fishery agreed with the results of earlier investigations conducted by both exploratory surveys and in commercial landings of south west coast of India (George and Rao, 1966; Mohamed and Suseelan, 1973; Suseelan, 1974; Thomas, 1979; Oommen, 1980; Suseelan *et al.*, 1989; Suseelan, 1990; Ninan *et al.*, 1992; Dineeshbabu *et al.*, 2001; Rajan *et al.*, 2001; Radhika, 2004; Jayaprakash *et al.*, 2006; Kurup *et al.*, 2008). Despite extensive sampling, no specimens of the two earlier reported species, *P. ensis* and *Heterocarpus laevigatus* from the deep-sea shrimp fishery off Kerala (Radhika, 2004) could be observed during the study. There is no report on the occurrence of deep-sea shrimp *P. williamsi* from Indian waters after their first reports (Suseelan, 1990), this is the second documented report of this species from India.

Pandalid shrimps were the most diverse group in the deep-sea shrimps during the study. Twenty four pandalid shrimp species belonging to six genera was reported from India (Rajool shanis *et al.*, 2012). Species such as *Plesionika ocellus*, *P.bifurca*, *P.unidens*, *Chlorotocus crassicornis*, *Dorodotes reflexus* and *H. tricarinatus* from Indian waters were reported about hundred years back and there
are no further reports of these species. *Heterocarpus ensifer* described based on collections of the RIMS ‘Investigator’ from Andaman Sea by Alcock (1901) was later re-identified as *H. sibogae* De Man, 1917 by Suseelan (1990).

Shrimps of the family Aristeidae consist of one of the most valuable deep-sea shrimp resources. Even though aristeid shrimp such as *Aristeus semidentatus*, *A. alcocki*, *Aristaeomorpha woodmasoni*, *A. foliacea* and *Aristaeopsis edwardsiana* was reported from the south west coast of India during deep-sea exploratory surveys (Radhakrishnan et al., 2012; Ganga et al.), only one species, *A. alcocki* was observed in the fishery during the study. Generally most species of the family Aristeidae inhabited at depth zone of above 500 m (Alcock, 1901; Paulo et al., 2006), this may be the reason for absence of these species in the fishery. Recently, Ganga et al. (2012) reported the high catch rate of aristeid shrimp, *A. edwardsiana* off Trivandrum at depth of 950 m during exploratory survey.

On close examination of the morphological characters and colour pattern of *P. quasigrandis* collected during the study, it is confirmed that the species occurring in Indian water is *P. quasigrandis* and not *P. spinipes*. The dorsal and ventral rostral teeth count of *P. quasigrandis* in the present study differs from the description provided by Chace (1985), Chan and Crosnier (1991), Hanamura and Evans (1996) and Fransen (2006). The taxonomic position of *P. grandis* has been disputed in relationship to *P. spinipes* (De Man, 1920; Chace, 1985). However the study conducted by Chan and Crosnier (1991) and Li and Komai (2003) observed that the two species are specifically distinct. The major difference between the two species is in the relative length of the dactylus of third pereiopod and the spacing of the rostral teeth. Chan and Crosnier (1991) and Fransen (2006) doubted the validity of
Chapter 2 Deep-sea decapod crustacean fauna in the fishery

*Pandalus (Parapandalus) spinipes* reported by Alcock (1901) from Kanyakumari and the taxonomic description of the species provided by George and Rao (1966) from the southwest coast of India and suggested that the species in Indian waters may be *P. grandis* or *P. quasigrandis*.

The stylodactylid shrimp genus *Parastylodactylus* was established by Figueira (1971) to accommodate *Stylodactylus bimaxillaris* Bate, 1888. The genus is characterized by the absence of a palp on the mandible and the presence of arthrobranchs above the bases of the first to fourth pereopods in both males and females. New species, *Parastylodactylus sulcatus* appears closest to *P. bimaxillaris*, sharing the following diagnostic characters: carapace with eight or fewer postrostral spines; fifth abdominal pleuron at least occasionally with posteroventral tooth; sixth abdominal somite 1.6–2.0 times longer than high; telson with five pairs of dorsolateral spines; dactylus of third pereopod with strong distal accessory spinule, making dactylus clearly biunguiculate; and merus ischium of third pereopod lacking proximoventral spine. However, the new species can be readily distinguished from *P. bimaxillaris* by the longer rostrum exceeding twice the carapace length (versus usually less than 1.8 times as long), the absence of a supraorbital tooth, and the very deep hepatic groove and the markedly inflated hepatic region inferior to the hepatic groove on the carapace. Furthermore, in *P. sulcatus*, the branchiostegal tooth over reaches the antennal tooth, while in *P. bimaxillaris*, it extends as far as the antennal tooth. The third pereopod is relatively longer and more slender in *P. sulcatus* than in *P. bimaxillaris*. There are no previous records of species of *Parastylodactylus* from waters around India and the present record thus constituting the first of the genus for Indian waters.
The reef lobster *Enoplometopus macrodontus* and pandalid shrimp *Plesionika adensameri* were recorded for the first time from Indian waters. Lobster *E. macrodontus* was originally described from Philippine (Chan and Ng, 2008). *E. macrodontus* can be mistaken with the other Indo-West Pacific species *E. occidentalis* in certain colour patterns. Both have only one spot on the carapace, many white spots on tergites and pleura and plain antennular flagella. They can be distinguished from each other by the presence of only one white band on the large chelae and banded basal segments on the 2nd to 5th pereiopods in *E. macrodontus*. This species also closely resembles the Atlantic *E. callistus* in having two lateral teeth, one intermediate tooth, five median teeth and one post cervical tooth on the carapace, presence of disto-ventral spine on the Ischium of the third maxilliped and two lateral spines on the telson. Chan and Ng (2008) reported *E. macrodontus* having two pairs of lateral spines on the telson. The present specimen also has two pairs of lateral spines and two pairs of postero-lateral spines. Fransen (2006) suggested that report of *P. adensameri* from Gulf of Aden and Maldives need confirmation, since this species is a possible endemic of Red Sea. The present record from the southern Arabian Sea confirmed the occurrence of this species in Indian waters. The present specimens collected from west coast of India agree well with the descriptions provided by Chace (1985) and Fransen (2006).

Diversity of deep-sea decapod crustacean of Indian waters is largely unexplored. The newly described deep-sea shrimp *Parastylodactylus sulcatus* from off Kollam is the latest new deep-sea shrimp reported from Indian waters during the last few decades. Majority of the deep-sea shrimp species were described hundred years back based on the surveys of the RIMS *Investigator* and there are no further
reports and description of many of these species. Detailed systematic studies coupled with molecular markers on this group from Indian waters are required to unravel their taxonomic status, species richness and geographical distribution.
Figure 2.1. *Parastylodactylus sulcatus*, holotype, male. A, carapace and cephalic appendages, lateral view (left antennal flagellum missing); B, abdomen and pleopods, lateral view (telson and uropods broken off); C, anterior part of carapace, eye, and basal part of antennule and antennal peduncles, lateral view; D, anterior part of carapace and left cephalic appendages, dorsal view (setae omitted); E, left antennal scale, dorsal view
Figure 2.2. Parastylodactylus sulcatus, A–H, paratype, male; I–K, holotype, male. A, left mandible, outer view; B, same, inner view; C, left maxillule, outer view; D, left maxilla, outer view; E, left first maxilliped, outer view; F, left second maxilliped, lateral view; G, basal part of left second maxilliped, showing structure of epipod and podobranch, dorsal view; H, epipod and podobranch of left second maxilliped, ventral view; I, endopod of right first pleopod, ventral view; J, endopod of left second pleopod, ventral view; K, appendix masculina of left second pleopod, ventral view
Figure 2.3. *Parastylopectylus sulcatus*, A–C, I, paratype, male; D–H, holotype, male. A, carapace and cephalic appendages, lateral view (antennule damaged, left antennal flagellum missing); B, telson, dorsal view (damaged); C, posterior part of telson, dorsal view; D, left third maxilliped, lateral view; E, same, basis and coxa, dorsal view; F, left third pereopod, lateral view; G, same, dactylus, lateral view; H, same, dactylus to carpus, lateral view; I, posterior part of sixth abdominal somite, telson and left uropod, lateral view
Plate 2.1

Aristeus alcocki

Glyphocrangon investigatoris

Nematocarcinus gracilis

Acanthephyra fimbriata

Acanthephyra sanguinea

Oplophorus gracilirostris

Heterocarpus gibbosus

Heterocarpus woodmasoni

Plesionika adensameri

Plesionika alcocki
Plate 2.2

Plesionika martia

Plesionika quasigrandis

Plesionika williamsi

Metapenaeopsis andamanensis

Hymenopenaeus equalis

Penaeopsis jerryi

Solenocera hextii

Parastylodactylus sulcatus

Pasiphaea sp.
Plate 2.3

*Paralomis investigatoris*  
*Charybdis (Goniohellenus) smithii*

*Enoplometopus macrodontus*  
*Nephropsis stewarti*

*Puerulus sewelli*  
*Eumunida funambulus*  
*Munidopsis sp*