

A Study on Penaeid Prawns of Subarnarekha Estuary

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Abstract

Present studies revealed the existence of 17 species under 6 genera belonging to Family Penaeidae Rafinesque, 1815 from Subarnarekha estuary in Odisha. Main aim of the study is to reduce the confusion to identify some of the common species of genera like *Helleropenaeopsis*, *Metapenaeus*, *Parapenaeopsis* and *Penaeus*. During the taxonomic identification some remarkable morphometric traits are observed in subadult stage of Penaeid prawns is highlighted in the work which confused the researchers to identify the species. Here, these characters are considered to be the subadult characters of the species. This work will be helpful to other future researchers to reduce the confusion regarding the morphometric identification of those species.

Key words: Morphometric trait, Penaeidae, Subarnarekha estuary, Taxonomy

Estuary is the transitional zone between sea face and end of the river. Subarnarekha is the longest river in east India covers three interstates- Jharkhand, West Bengal and Odisha but the Subarnarekha estuary confined in Odisha in Baleswar district which covers 50 km [1] length in Odisha. This estuary is a source of enormous amount of fish and other aquatic organisms, both fresh and brackish water possesses diversified mixed ecosystem from high tidal zone towards the coastal region. Among aquatic organisms' prawns are highly demandable diversified nutritive edible species. Prawns are decapods crustacean organisms of marine, estuarine and freshwater ecosystems in India. Various kinds of shrimp and prawns are considered excellent sources of protein and rich in essential minerals, making them highly beneficial for human consumption. Prawns are belonging to Phylum Arthropoda, Order Decapoda Latreille, 1803, Suborder Dendrobranchiata Bate [2], distribute worldwide of tropical and subtropical area a nature gifted diversified aquatic organisms. Aim of this study is to identify the Penaeid prawns belonging to Family- Penaeidae on that way find few remarkable morphometric traits on some common species in the sub-adult stage. Additionally, the study seeks to examine a few notable morphometric traits in some common species at the sub-adult stage. Understanding these traits can provide insights into the biology and ecology of these species, which is essential for effective management and conservation strategies.

Perez Farfante and Kensley [3] documented 26 genera belonging to family Penaeidae in the world. Alcock [4] reported the name of this Family penaeidae first time from Indian water. Family Penaeidae is comprising of 25 genera in which 17 genera and 78 species has been recorded by Chanda [5] from Indian water. Chanda [6] worked on penaeid prawns and revised *Parapenaeopsis* into five genera like *Alcockpenaeopsis*, *Batepenaeopsis*, *Helleropenaeopsis*, *Kishinouyepenaeopsis* and *Parapenaeopsis*. In West Bengal, Goswami [7] work on Penaeid

prawn of Digha coast of West Bengal and listed 21 species of penaeidae. Chanda and Bhattacharya [8] have been reported 22 species under 10 genera and two families of penaeoid shrimps from Digha and its adjacent coast. Reddy [9] reported five species of Family Penaeidae from Chilka Lake. Rath & Roy, [10] recorded 8 penaeid prawns from Bahuda estuary. Chanda [11], reported 25 species under 9 genera from Odisha coast and 27 species by Pati *et al.* [12]. Present studies (July, 2022- June, 2023) revealed 17 species under 6 genera (Table 1) in associated with appearance of some remarkable morphometric traits observed on some common Penaeid prawns such as two kinds of rostrum of species *Metapenaeus affinis* [13], different appearance of petasma on 1st pair of pleopods of *Parapenaeopsis Stylifera coromandelica*, Alcock [14], different body pigmentation of *P. merguensis* De Man [15] and *M. ensis* [16], different rostrum pattern of *H. sculptilis* [17].

MATERIALS AND METHODS

Study site

Samples were collected from different sites of the Subarnarekha estuary from high to lower zones of estuarine region like Jaleswar (21°46' 07"N, 87°09' 36"E), Baliapal (21°42'21"N – 87°13'48"E), Kakrapal near Chaumukh (21°33'56"N, 87°20' 57" E) at every month in the year July 2022 to 2023.

Preservation and identification

Collected specimen were preserved on the spot with 2% formalin solution & carried them into the lab for permanent preserve with rectified spirit to further research. Identification of specimen done on the basis of their morphological characteristics with the help of related literature, books of Holthuis [18], Chanda [11] and FAO identification sheet fishing area 51 (1983), Laxmi Pillai note book on penaeid (2013).

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Structure of appendages and genitalia are clear to shown with the help of stereoscopic binocular microscope & measured with sliding caliper.

diagnostic features of the Family, Genera and species has been given below:

Family Penaeidae Rafinesque-Schmaltz, 1815

Diagnosis

Body bilaterally symmetrical and somewhat laterally compressed. Presence of dorsal margin carination along last 3-4 abdominal segment. Presence of three pairs of pincers from 1st- 3rd pereopods. Rostrum having armed at dorsal or dorso-ventral position extends more or less antennular peduncle. Mostly having postrostral carination towards the end of carapace ridge. Postorbital and post antennal spine absence. Presence of cervical groove and sulcus confined at gastric region. Presence of adrostral carination, longitudinal line, cervical carina, hepatic spine and post antennal spine and some with pterygostomial spine and sulcus. Presence of thelycum at the ventral side of cephalothorax around last two pereopods basal region and petasma with 1st pleopod on ventral side of abdomen. Telson with distolateral spine or not.

Genus-Alcockpenaeopsis Chanda 2016

Diagnosis

Orbital spine absent, antennular flagella short and equal, semicircular anterior thelycal plate possesses lateral line, fused with square shaped posterior plate. Petasma with longer distolateral projection tappers at the distal end.

A. uncta Alcock, 1905

A. uncta was described by Alcock [14] from Orissa coast, East coast of India.

Diagnosis

Rostrum with 7-9+1 dorsal tooth, slightly upcurved at apex in female with toothless distal 1/3 part and curved downward in male rostrum. Epigastric tooth spaced from penultimate tooth. Post rostral carina extending up to posterior margin of carapace whereas ad rostral carina and sulcus extending up to epigastric tooth. Presence of longitudinal suture, cervical sulcus, hepatic sulcus and hepatic spine, Petasma with small distomedian projection but distolateral projection is long tappers at the tip. Thelycum with curved anterior plate and quadrate posterior plate with row of hairs.

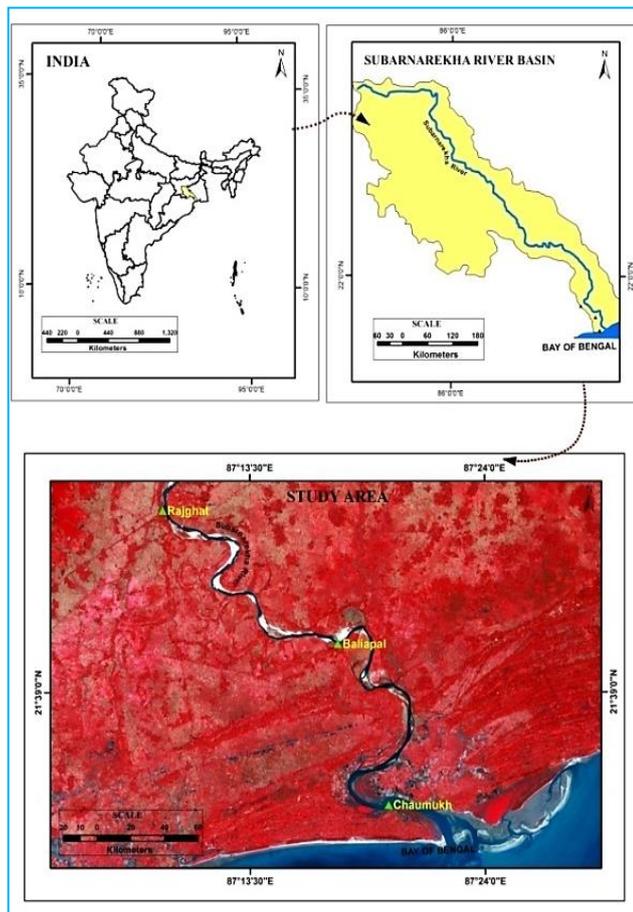


Fig 1 Map showing the study area

RESULTS AND DISCUSSION

During present study 17 species under 6 genera of Family- Penaeidae Rafinesque-Schmaltz, [19] were identified from Subarnarekha estuary (Table 1). The most important

Table 1 List of Species with their systematic position under Family Penaeidae and their distribution (LZ- Lower zone, MZ- Middle zone, NUZ- Near upper zone)

| Family | Genus | Species name | Distribution | |
|-----------|---------------------|--|--|--------|
| Penaeidae | Alcockpenaeopsis | <i>A. uncta</i> (Alcock 1905) | LZ, MZ | |
| | | Helleropenaeopsis | <i>H. hardwickii</i> (Miers 1878) | LZ, MZ |
| | | | <i>H. sculptilis</i> (Heller 1862)* | LZ, MZ |
| | Kishinouyepeneopsis | <i>K. cornuta</i> (Kishinouye 1900) | LZ | |
| | Metapeneaus | <i>M. affinis</i> (H. Milne Edwards 1837*) | LZ | |
| | | <i>M. brevicornis</i> (Milne Edwards 1837) | LZ, MZ, NUZ | |
| | | <i>M. dobsoni</i> (Miers 1878) | LZ | |
| | | <i>M. elegans</i> (De Man 1907) | MZ | |
| | | <i>M. ensis</i> (De Haan 1850)* | LZ, MZ, NUZ | |
| | | <i>M. lysianassa</i> (De Man 1888) | LZ, MZ, NUZ | |
| | | Parapeneopsis | <i>P. stylifera coromandelica</i> (Alcock 1906*) | LZ, MZ |
| | | | <i>P. stylifera stylifera</i> (Milne Edwards 1837) | LZ, MZ |
| | Penaeus | <i>P. japonicas</i> (Bate 1888) | MZ | |
| | | <i>P. merguensis</i> (De Man 1888*) | LZ, MZ, NUZ | |
| | | <i>P. monodon</i> (Fabricius 1798) | LZ, MZ | |
| | | <i>P. semisulcatus</i> (De Haan 1844) | LZ | |
| | | <i>P. indicus</i> (H. Milne Edwards 1837) | LZ | |

* indicates the species with morphometric variation

Genus-Helleropenaeopsis Chanda 2016

Diagnosis

Distomedian projections projected anteriorly and longer than distolateral projections, semicircular or triangular anterior plate of thelycum merged with posterior plate.

H. hardwickii (Miers 1878)

From Maharashtra coast and Arabian sea, Miers [20] first described the species as a *Penaeus hardwickii*.

Diagnosis

Rostrum having 8-9+1 dorsal armed, sigmoid distal half toothless and upcurved extending beyond antennular peduncle, adrostral carina ends before epigastric tooth, sulcus extends towards epigastric tooth, a space occurs between epigastric tooth and penultimate tooth, post rostral carina extending up to edge of carapace, short orbital spine, presence of longitudinal suture, cervical sulcus, hepatic sulcus, hepatic and antennal spine, telson armed with 3-5 pairs of lateral movable spine, distomedian projections of petasma wing like broad lie over the lateral lobe and its rough dorsal edge at the base distolateral projection with tapering ends. Thelycum with broad anterior and posterior plate possess a pair of anterolateral teeth.

H. sculptilis (Heller 1862)*

From Java Sea, Indonesia Heller [17] first described the species as *Penaeus sculptilis*. Alcock first identified this species from both coast of India in 1906.

Diagnosis

In female rostrum sigmoidal with 7-9+1 dorsal tooth, distal portion toothless, exceeding antennular peduncle whereas male rostrum short curve downward, tooth entirely on it, not exceeding third segment of antennular peduncle, epigastric tooth spaceous from penultimate tooth. Presence of transverse line at the branchial region. Distomedian projections projected anteriorly and longer than distolateral projections, triangular anterior plate of thelycum merged with posterior plate.

Remark- Rostrum of male species straight possess 3 armed at mid dorsal, toothless distal half but not exceeding anterior peduncle (Fig 2c).

Genus-Kishinouyepenaeopsis Chanda 2016

Diagnosis

Rostrum is medium size than other congenera, long slender curving apex of distolateral projection of petasma, anterior plate long rectangular shape with marginal groove, presence of short globular post-lateral plates.

K. cornuta (Kishinouye [21])

Kishinouye [21] from Ariake-Wan, Japan first described the species as *Penaeus cornutus*. From Andhra Pradesh, east coast of India first recorded it by Muthu [22].

Diagnosis

Presence of 5+1 dorsal tooth, not expand up to third antennular peduncle, Small distally toothless slightly upcurved portion presence. A gap between epigastric and penultimate tooth. Postrostral crest extend towards carapace edge, presence of orbital, hepatic and antennal spine, hepatic sulcus. Short longitudinal and transverse suture presence. Only female species is observed which possess long tongue like anterior plate with joined two small post-lateral plate.

Genus-Metapenaeus Wood-Mason 1891

Diagnosis

Body rounded laterally compressed. Rostrum dorsally armed most of species possesses full length except *M. brevicornis* and *M. dobsoni*. A large space between epigastric tooth and Penultimate teeth. Presence of postorbital sulcus, cervical sulcus, hepatic sulcus, hepatic carina, branchiocardiac carina and adrostral carina. Carapace with orbital, antennal and hepatic spine. Pterygostomian spine absent. They are generally transparent ash with brown, blue and red spots all over the body, uniformly arranged and few species are creamson white such as *M. lysianssa*, *M. brevicornis* & *M. dobsoni* of estuarine mouth area.

M. affinis (H. Milne Edwards [13])*

Penaeus affinis was named first by Edwards [13] from Malabar coast & South- West coast in India and it was shifted to the present genus as *M. affinis* by Alcock [14].

Diagnosis

Rostrum armed with 8-9+1, intraarmed with hairy appearance, proximo-ventral 1/3 part with series of hairs, extends upto 3rd antennular segment. Antennular peduncle with short antennules. Presence of adrostral groove and carina, postrostral carina ends 0.5-0.6 part of carapace length. Presence of hepatic spine, antennal spine no pterygostomian spine. Presence of branchiostegal suture toward hepatic spine below its presence of hepatic carina and sulcus towards the pterygostomian region. 1-3 pair of pereopods bear basal spine. Telson with no spine. Upper part of Anterior plate on thelycum narrow in appearance having marginal groove at center that encircles & base wider whereas posterior plate with lateral projection, Petasma with crescent shaped distomedian projection.

Remark- During present investigation in Subarnarekha estuary two types of *Metapenaeus affinis* are found of which one is similar in morphometry as described by Perez Farfente and Kensly [3] and another one is morphometrically similar as described by Fischer and Bianchi [23]. According to present investigation, both are occurring at low tidal zone of estuary and the rostrum of 2nd one is slightly more curved at the apex in comparison with 1st one.

Body colour of the species show some differences like 1st one (Fig 2a) carapace and each pleuron edge bear yellow semicircular line, basal part of pleopod and rest of the part of abdomen is translucent greyish appearance, pereopods, flagella and antennules light orange, biramous of pleopods and ridge of telson and uropods are brown in colour. 2nd one (Fig 2b) is creamy white body except biramous of pleopods deep orange and ridge of uropod brownish.

M. brevicornis (Milne Edwards [13])

From Ganjam, Odisha, east coast of India *M. brevicornis* at first described by Edwards [13] as *Penaeus brevicornis*.

Diagnosis

Rostrum having basal crest, short, armed number 1+ 5-7 and distal less than half is toothless and straight. Post rostral carination end before edge of carapace, adrostral carina reach at the penultimate tooth, absence of longitudinal line, presence of antennal spine, hepatic spine, cervical sulcus, hepatic sulcus. Pereopods are gradually increase in size. Telson with one pair spinules. Petasma with distolateral projection and narrow distomedian projection. Lower estuarine species are large and cream white colour, middle estuarine species having blue and brown spots all over the body.

M. dobsoni (Miers [20])

Metapenaeus dobsoni was originally described as *Mangalura dobsoni* by Miers [20] from Mangalore, Karnataka, West Coast of India.

Diagnosis

Rostrum elongated sinusoid distal toothless having 1+7 armed. Adrostral carina and groove extend up to last penultimate tooth. Presence of antennal and hepatic spine, cervical and hepatic sulcus, branchio-cardiac carina, only male species is found at near lower zone having slender petasma with distolateral and bulging distomedian projection.

M. elegans De Man, 1907

M. elegans was described by De Man [15] from Menado, Celebes during "Siboga Expedition". The species was first recorded from India by Silas and Muthu [24].

Diagnosis

Rostrum armed with 9+1 along entire dorsal margin, nearly straight, reaching from proximal margin to distal margin of third antennular peduncle or exceeding it. Adrostral crest reaching behind epigastric tooth. Epigastric tooth separates from penultimate tooth. Antennular flagella equal and short. Post ocular sulcus oblique, cervical sulcus present, hepatic sulcus downward towards the pterygostomian angle. hepatic spine prominent, Presence of branchio-cardiac line, Telson with spinules. Thelycum: Tongue like anterior wider to narrow posterior joined with kidney shaped post-lateral part.

M. ensis (De Haan [16])*

De Haan [16] first discussed *M. ensis* as *Penaeus Monoceros ensis* from North Japan Sea. Alcock [14] reported it from India first time and named as *Metapenaeus ensis*.

Diagnosis

Rostrum armed with 1+8-10, ventral surface with hairy appearance, post dorsal carination ends at the edge of carapace, adrostral carina ends before epigastric tooth, rostrum extends up to 2nd antennular peduncle segment. Short antennules. Presence of antennal and hepatic spine, cervical carination, hepatic sulcus, branchiocardiac carina. Anterior plate of thelycum elongated and wing like lateral plate at the base of it, slender petasma in juvenile stage.

Remark: Two types of body pigmentation were observed in *M. ensis* [16], at near lower to near upper zone of the estuary. Species of middle to near upper zone have body colour with deep ash spots, uropod and antennae are orange in colour, whereas species of near lower zone have reddish pigmentation (Fig 2g-h).

M. lysianassa (De Man [15])

M. lysanasa was first described as *Penaeus lysanasa* by De Man [15] from Margui Archipelago, Myanmar. It was first recorded from India (Orissa and Hoogly Delta) by Alcock [14] as *Metapenaeus lysianassa*.

Diagnosis

Rostrum very short having crest, reaching almost middle of the first antennular peduncle armed with 5-7+1teeth along entire dorsal margin, adrostral carina and sulcus extending to the second rostral tooth. Post rostral carina extending towards near posterior margin of carapace. Epigastric tooth closes toward the penultimate tooth, orbital spine absent, hepatic and antennal spine prominent. Petasma having bifurcated

distolateral projection with folded dorsal margin of distomedian projection. Thelycum with three distinct plate and subequal in appearance whereas tongue like anterior plate and grooved middle of the posterior plate which are oval in shape. Impregnated females are bearing conjoined pad over female genitalia.

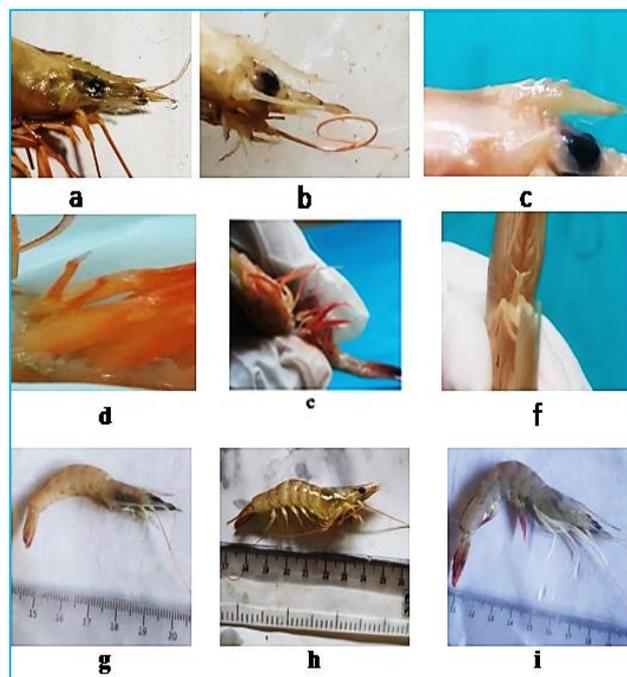


Fig 2 *M. affinis* [13] according to Parez Farfante [3] (a) Fischer and Bianchi [23], (b). Rostrum of male *H. sculptilis* Heller [17] (c), Petasma of *Parapenaeopsis stylifera coromandelica* Alcock [14] (d-f), two type pigmented body of *M. ensis* [16]. *P. merguensis* De Man [15] (i)

Genus- Parapenaeopsis Alcock [4]

Diagnosis

Generally long sigmoid rostrum except small in case of *P. cornuta*. Presence of longitudinal line, antennal spine, hepatic spine, carina & sulcus, cervical carina & sulcus.

P. stylifera coromandelica Alcock [14]*

From Cromondal Coast Alcock 1906 first reported the above species, Cat. Indian. Dec. Crust. Part-III Mac. Fas. I: 1-55.

Diagnosis

Rostrum having 1+5-6 armed, sinusoid long more than half distal toothless, inter armed with hairy appearance, extends up to middle of antennules, post rostral carination ends before the carapace edge, adrostral groove and carina ends before the epigastric tooth. Eye ball large black buried into the optic cup of antennular peduncle. Presence of gastro frontal groove, longitudinal line, cervical carina, antennal and hepatic spine, hepatic sulcus and carina. Thelycum looks like in FAO book description but three different appearance of Petasma.

Remark- Petasma of this species have generally long distolateral projection bulge at the base and meet together closely with median tube, some have no bulge at the base rather short distolateral projection and some portion of median tube with conjoined lateral plate not jointed & some species have totally separated lateral plate with small distolateral projection of this species. Generally, found from low to middle part of the estuarine region of Subarnarekha River (Fig 2d-f).

Body ash colour with orange appendages without scaphocerite, all over pleurons and some portion of carapace, two types of pods possess ash colour spots which give colour to the body. Translucent body with orange appendages, all over pleuron and some portion of the carapace and two types of pods possess ash colour spots, pleuron with white apex and black base. These color patterns and morphological features are crucial for distinguishing this prawn species from others in the estuary.

P. stylifera stylifera (Milne Edwards [13])

From Mumbai Coast first Edwards [13] reported the above species at Hist. Nat. Crust., II: 418.

Diagnosis

Rostrum long sigmoid having 6+1 teeth extends to the middle of antennules, inter armed with hairs, distal half toothless, postrostral carina ends before the carapace edge, adrostral groove ends beyond epigastric tooth, presence of longitudinal suture, gastro frontal groove, antennal and hepatic spine, hepatic sulcus and carination, petasma with telson with one pair of spinnules, thelycum have square shaped anterior plate hairy appearance at apex posterior median stalk joined with the middle groove of posterior plate is bifurcated anteriorly placed at the base of anterior plate a pair of iris like structure present at the post posterior plate. Pale yellow combined with ash and orange appendages with brown uropods.

Genus- *Penaeus* Fabricius 1798

Diagnosis

Rostrum possesses both side arm less number on ventral in comparison to dorsal. Presence of first 3 pairs of chelated pereopods. Presence of antennal spine, hepatic spine, post antennal carination, hepatic sulcus, gastro frontal carina.

P. indicus H. Milne Edwards [13]

H. Milne Edwards [13] first reported it as a new species from Coromandal coast, east coast of India.

Diagnosis

Body pubescent, rostrum triangular elongated from the proximal to distal having 1+7/5 armed, adrostral carina and groove ends before the epigastric tooth, presence of gastro-orbital groove, presence of hepatic and antennal spine, medium antennules, long antenna, pale yellow body, brownish dorsal margin, creamson white pereopods, pale yellow to reddish pleopod and uropods pink in appearance.

P. japonicas Bate 1888

Bate (1888) reported the species is the sub-species of *Penaeus canaliculatus*. Alcock [4] recorded it for the first time from India.

Diagnosis

Rostral formula is 8+1/1, presence of postrostral carina, gastrofrontal, gastroorbital, antennal, cervical and hepatic carina. Midrostral carina on 4-6th abdominal somite. Carapace bear adrostral sulcus, gastrofrontal, gastroorbital, cervical and hepatic sulcus. well-marked hepatic spine and also presence of three movable spine on telson. Petasma semiclosed, distomedian projection reached to the ventral costae, anteriorly hood like appearance. Thelycum closed, pouch like and elongated anterior plate.

P. merguensis De Man [15]*

From India first reported by Alcock [4] as a *Peneus indicus merguensis* De Man [15].

Diagnosis

Rostrum elongated, straight, firm, armed having 1+6-8/4-6 teeth, extend beyond third segment of antennular peduncle, adrostral carina extend beyond epigastric tooth, postrostral carina goes beyond more than half, medium antennules, presence of antennal groove, antennal and hepatic spine, presence of branchiostegal line.

Remark- Species of middle zone possesses translucent body with violet and orange spots all over the body, pleopods and pereopods with blue spots, pereopods are whitish and pleopods are pale yellowish to reddish, uropods are reddish more than half of the length (Fig 2i).

P. monodon Fabricius 1798

From India it was first discovered but neither existence of type species as it was destroyed now neotype species was remained from Jakarta, Indonesia by Holthuis 1949.

Diagnosis

Rostrum armed with 1+7-8/2-3 extends upto antennal scale, adrostral groove and carina extends beyond the epigastric tooth. Antennular peduncle with short antennules. Prominent antennal crest ends at the middle of hepatic crest, no gastrofrontal crest, no pterygostomian spine. Adult genitalia of the species same appearance as described in FAO.

P. semisulcatus De Haan [16]

From India by Alcock 1906 the above species was first recorded, at Cat. Indian Dec. Crust. Part-III, Mac. Fas. I : 1- 55.

Diagnosis

5 + 1/2 rostral formula. Presence of adrostral, postrostral, gastroorbital, gastrofrontal and hepatic carina. Carination present on abdominal somite. Cervical sulcus and gastroorbital sulcus present, absence of gastrofrontal sulcus. Distomedian projection of petasma reaching up to ventral costae. Thelycum open type.

CONCLUSION

Subarnarekha estuary has penaeid prawns source. During identification of collected species *Penaeus merguensis* which observed at lower zone to middle zone are large and small size respectively. Small size species generally mixed with other small prawns and locally called them *Gnagnua chingri*. *Metapenaeus ensis* locally called tania is more abundant species from near lower to near upper zone of the estuary. Though the estuary represents 17 species of Penaeid prawns but the most taxonomic diversified species of the estuary and their abundance are given in descending order like *Metapenaeus ensis* > *Parapenaeopsis sylifera coromandelica* > *Penaeus merguensis* > *Metapenaeus affinis* > *H. sculptilis*. During the identification of collected species, it was observed that *Penaeus merguensis* is present in varying sizes, with larger individuals found in the lower zone of the estuary and smaller ones in the middle zone. Therefore, present studies reveal the present status of penaeid prawn diversity of the estuary will certainly be enhance the knowledge on penaeid resource of study sites to the policy planners and researchers on the topic.

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