

Short Communications

Zoogeographic Distribution of Indian Penaeidae*

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During a detailed study of the systematics of Indian penaeid prawns, based on collections made from commercial catches as well as plankton samples of different regions, the distribution of several littoral species occurring in the different parts of the Indian coasts has been examined. Out of 52 species nearly 12 have wide distribution over the coastal regions of India. *Penaeus monodon*, *P. japonicus*, *P. indicus* and *Trachypenaeus curvirostris* occur in all the regions of the coastline, including the Andaman Sea. *Metapenaeus monoceros*, *M. affinis*, *M. dobsoni*, *Parapenaeopsis stylifera*, *Penaeus semisulcatus*, *P. merguensis* and *Solenocera pectinata* are also represented in most of the regions. Several of the species such as *Sicyonia lancifer*, *Metapenaeopsis barbata*, *Parapenaeopsis cornuta*, *Solenocera crassicornis*, *Metapenaeus ensis* and *Parapenaeus fissurus* occur in particular regions only. A study of the Indo-West Pacific distribution made it clear that more of the Indian species have an eastern distribution in the Indonesian waters than a Western distribution in East African waters, indicating that the Indian species are probably an eastern extension of the Indonesian fauna.

DURING a detailed study of the systematics of the penaeid prawns of the Indian coasts¹ the zoogeographic distribution of these species both in the Indian as well as Indo-West Pacific areas was examined. Attempts were made to study their distribution in the light of some of the results reported recently²⁻⁵ concerning the existence of certain barriers in the Indian Ocean region. Although there is lack of collection of prawns from certain areas along the Indian coast as well as other regions of the Indo-West Pacific, it is possible to get some idea about the zoogeography of the penaeid prawns by a study of the distribution of different species.

Indian distribution — Out of the 52 species considered in this report only 4, *Penaeus monodon*, *P. japonicus*, *P. indicus* and *Trachypenaeus curvirostris*, are found to occur in all the regions of the coastline of India, including the Andaman Sea (Table 1). There being no samples from the Andaman Sea in the present collection, it is probable that further investigations in this region will reveal a similar distribution for the widely distributed *Penaeus semisulcatus*, *P. merguensis*, *Metapenaeus monoceros*, *M. affinis* and *Parapenaeopsis stylifera* which are

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so far reported from all areas except the Andaman Sea. These 9 species are having the widest distribution among the Indian penaeids. Two species of *Solenocerinae*, *Solenocera pectinata* and *S. hextii* also may be added to these, being distributed in all the regions, except on the south-east coast. *Metapenaeus dobsoni*, *M. lysianassa* and *Parapenaeopsis sculptilis* are other species with wide distribution in the coasts, being found in most of the regions. Species like *Solenocera crassicornis*, *Penaeus penicillatus*, *Metapenaeus brevicornis* and *Parapenaeopsis hardwickii* are distributed from the middle regions of the coastline northwards while others like *Metapenaeopsis mogiensis*, *Metapenaeus burkenroadi*, *Trachypenaeus pescadorensis* and *Sicyonia lancifer* are distributed in the southern region of both the coasts. Quite a number of species occur only in a particular region; for example *Solenocera koelbeli*, *S. alticarinata*, *Penaeus canaliculatus*, *P. latisulcatus*, *Metapenaeopsis philippi* and *Parapenaeopsis cornuta* are recorded only from south-west coast, *Solenocera choprai* and *Metapenaeus stebbingi* occur in north-west coast, *Parapenaeopsis tenella* is found in south-east coast and *Metapenaeus ensis*, *Metapenaeopsis barbata* and *Parapenaeus fissurus* are found to occur in the middle region of the east coast and Andaman Sea. A few species like *Penaeopsis relectata*, *Parapenaeus longipes*, *Parapenaeopsis uncta*, *Trachypenaeus sedili* and *Solenocera melantho* are distributed in the south-west coast as well as the middle region of the east coast. *Parapenaeopsis maxillipedo* and *P. acclivirostris* are mainly found on the west coast with the distribution extending to the south-east coast also. Several other species have distribution in one or two regions. On the whole it may be said that nearly 12 species have wide distribution over the entire coast of India. It is very likely that further intensive collection from different areas might reveal the distribution of some more of the species in all the regions.

Indo-West Pacific distribution — Dall⁶ has discussed the Indo-West Pacific distribution of 17 Australian Penaeinae. In several of these species, which are distributed along Indian coasts also, the present study as well as other recent investigations from different parts of this region^{2,7-10} show that the distribution has been considerably extended. A number of species have been reported from the regions which Dall⁶ suggested as regions of probable occurrence at that time. In the case of *Penaeus latisulcatus* it has been found that the species occurs in all the areas like Indian waters, Malaysia and Northern Australia which Dall mentioned as areas of probable occurrence. In addition the species was reported from both south and east African waters, rendering it one of the widely distributed species. In other species like *Penaeus semisulcatus*, *Trachypenaeus curvirostris*, *Parapenaeopsis cornuta*, *P. sculptilis* and *P. tenella* also

TABLE 1 - DISTRIBUTION OF PENAEIDS ALONG THE INDIAN COAST

Species	North-west coast	South-west coast	South-east coast	East coast middle	North-east coast	Andaman Sea
<i>Solenocera crassicornis</i>	+	-	-	+	+	-
<i>S. wallairensis</i>	-	-	-	+	-	-
<i>S. pectinata</i>	+	+	-	+	+	+
<i>S. hextii</i>	+	+	-	+	+	-
<i>S. alticarinata</i>	-	+	-	+	-	-
<i>S. melantho</i>	-	+	-	+	-	-
<i>S. hoelbeli</i>	-	+	-	+	-	-
<i>S. choprai</i>	+	-	-	-	-	-
<i>Hymenopenaeus aequalis</i>	-	+	+	-	-	+
<i>Sicyonia lancifer</i>	-	+	+	-	-	+
<i>Aristeus semidentatus</i>	-	+	-	-	+	-
<i>A. alcocki</i>	+	+	-	-	+	-
<i>A. virilis</i>	-	-	-	-	-	+
<i>Aristaeomorpha woodmasoni</i>	-	+	-	-	-	+
<i>Penaeus canaliculatus</i>	-	+	-	-	-	+
<i>P. monodon</i>	+	+	+	+	+	+
<i>P. semisulcatus</i>	+	+	+	+	+	+
<i>P. japonicus</i>	+	+	+	+	+	+
<i>P. latisulcatus</i>	-	+	+	+	+	+
<i>P. indicus</i>	+	+	+	+	+	+
<i>P. merguensis</i>	+	+	+	+	+	+
<i>P. penicillatus</i>	+	+	+	+	+	-
<i>Metapenaeopsis stridulans</i>	+	-	+	+	-	+
<i>M. baybata</i>	-	-	+	+	-	+
<i>M. mogiensis</i>	-	+	+	+	-	+
<i>M. varuni</i>	-	+	+	+	-	+
<i>M. coniger</i>	+	+	+	+	-	+
<i>M. andamanensis</i>	-	+	+	+	-	+
<i>M. philippi</i>	-	+	+	+	-	+
<i>Parapenaeus longipes</i>	-	+	+	+	+	-
<i>P. fissurus</i>	-	+	+	+	+	+
<i>P. investigatoris</i>	-	+	+	+	+	+
<i>Penaeopsis rectacuta</i>	-	+	+	+	+	+
<i>Metapenaeus lysianassa</i>	-	+	+	+	+	+
<i>M. brevicornis</i>	+	-	+	+	+	-
<i>M. dobsoni</i>	+	+	+	+	+	-
<i>M. siebdingi</i>	+	+	+	+	+	-
<i>M. ensis</i>	-	-	+	+	-	+
<i>M. monoceros</i>	+	+	+	+	+	-
<i>M. alcocki</i>	+	-	-	-	-	-
<i>M. kutchensis</i>	+	-	-	-	-	-
<i>M. affinis</i>	+	+	+	+	+	-
<i>M. burkenroadi</i>	-	+	+	+	+	-
<i>Atypopenaeus stenodactylus</i>	+	+	+	-	-	-
<i>Trachypenaeus cuvivostvis</i>	+	+	+	+	+	+
<i>T. sedili</i>	-	+	+	+	+	-
<i>T. pescadoreensis</i>	-	+	+	+	+	-
<i>Parapenaeopsis uncta</i>	-	+	+	+	+	-
<i>P. stylifeva</i>	-	+	+	+	+	-
<i>P. stylifera cochinensis</i>	+	+	+	+	+	-
<i>P. maxillipedo</i>	+	+	+	-	-	-
<i>P. covnuta</i>	-	+	+	-	-	-
<i>P. nana</i>	-	+	+	+	-	-
<i>P. sculptilis</i>	+	-	+	+	+	-
<i>P. hardwickii</i>	+	-	+	+	+	-
<i>P. tenella</i>	-	-	+	+	-	-
<i>P. acclivivrostris</i>	+	+	+	+	-	-

in addition to their occurrence in areas which were suggested as areas of probable occurrence by Dall⁶ they have been reported from other areas too.

Among all the species considered here *Penaeus monodon* is the most widely distributed. *P. japonicus*, *P. latisulcatus*, *P. semisulcatus* and *P. indicus* are having equally wide distribution excepting for one or two particular regions. There are 3 species endemic to Indian waters, *Solenocera hextii* occurring on both the coasts of India, *Solenocera choprai* on the west coast and *Parapenaeopsis nana* on the east coast. It is seen (Fig. 1) that most of the species have a wide distribution in the Indonesian, Indo-China and Indian waters. It is also clear that

more of the Indian species have an eastern distribution in the Indonesian waters than a western distribution in East African waters. From these it would appear that the Indian species are an eastern extension of the Indonesian fauna. If so the barrier at the Malaya Peninsula/Sumatra land-mass restricting the distribution of Penaeidae, suggested by Hall^{2,11} does not seem to exist. De Bruin⁹ already expressed considerable doubt on the validity of Hall's hypothesis, based on the distribution of Ceylon species. Chhappgar¹² did not find any barriers between interconnecting oceans restricting the distribution of Brachyuran fauna of the Indo-Pacific region. The present report of *Metapenaeus ensis* from the east coast of India in fairly good numbers

(the distribution of which along with that of *Metapenaeus monoceros* was the basis of Hall's hypothesis) points to the absence of such a barrier. However, Johnson⁸ studying the biogeography of Malaysian marine decapoda, and disagreeing with Hall's hypothesis suggests that there is an indication of a sub-regional boundary between the western Indian Ocean and the Central Indo-West Pacific with the west coast of India forming a transition zone between the two. According to Klausewitz⁴, the ichthyofauna of the Indian Ocean shows "the eastern part till India and the Maldives is different from the western part". Jones and Kumaran studying the ichthyofaunistic zoogeographic division of the Indian Ocean came to the same conclusion. Although the establishment of the existence of any boundary in the region of the west coast of India is difficult in the absence of a more detailed knowledge of water movements than we have at present, it is interesting to point out that the distribution pattern of the Indian Penaeidae also indicate the possibility of the presence of such a barrier along the west coast of India as envisaged by Johnson⁸.

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Analysis of Morphometric Characters of *Selar kalla* (Cuvier)

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Relationships between different morphometric characters of *S. kalla* are studied. The total length is found to vary linearly with other characters. Variations in different characters are proportional to the size of the characters.

THE relationship in the length of different parts of the body of a fish varies much in different species. So a separate investigation of such relationship is necessary for each species. Except for a study of the morphometric characters in *Selaroides leptolepis* (C & V), collected from different

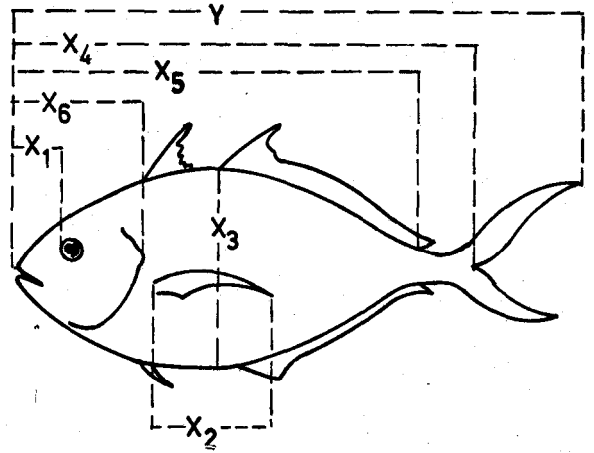


Fig. 1 — Morphometric characters of *S. kalla* [Details of characters are given in text]

stations along the west coast of India¹ no such effort is made on any species of Carangids which occur in the Indian waters. The present paper includes part of the results of an investigation to study the racial differences of *Selar kalla* (Cuvier) collected from different stations along the coast of Kerala.

Specimens of *S. kalla* collected from the catches of the Indo-Norwegian Project, Cochin, were preserved in 5% formalin. Using dividers the measurements were taken in centimetres correct to first decimal place. Those characters which showed conspicuous variations were utilized for this study. These included the total length (y), the lengths of snout (x_1), pectoral fin (x_2), and head (x_3), depth (x_4), fork length (x_5), and the distance between the tip of the snout and the base of the caudal peduncle (x_6) (Fig. 1).

These characters were defined following Pillai² except the distance between the tip of snout and base of the caudal peduncle which he has not considered. The total length is the distance between the tip of the snout when the mouth is kept closed and the tip of the longest ray of the caudal fin when stretched out. The distance between the tip of the upper jaw and the anterior border of the orbit is the length of the snout. The head length is the distance between the tip of the upper jaw when the mouth is closed to the posterior limit of the operculum. The maximum height of the body is taken to be its depth. The fork length is the distance between the caudal fork and the tip of the snout when the mouth is closed.

The total length is considered as the dependent variable and the remaining measurements as the independent variables. The relationships of the different independent variables with the dependent variable within a certain range (Table 1) were studied. A preliminary plot showed that the relationship between total length and other characters could very well be expressed by a straight line. Therefore for each relationship a linear regression represented by the equation $y = a + bx$ was fitted where y is the dependent variable, x is the independent variable, a and b are constants. The values of a and b were calculated using the least square methods. The regression values were tested for their significance using analysis of variance methods.