

The Distribution of Penaeid Prawns in Ceylon Waters

By

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Introduction

Thirty one species of penaeid prawns have been discovered in Ceylon waters. A taxonomic study of these species was carried out and their distribution in relation to hypothetical oceanographical barriers was discussed. (De Bruin 1965.) As penaeid prawns are of important commercial value a study was made of their distribution and relative abundance in the estuaries and seas round the Island. The results of this study are reported in this publication.

DISTRIBUTION OF PRAWNS IN ESTUARIES

Methods of Capture

Trawling in the estuarine waters of Ceylon was found to be impracticable on account of the presence of submerged logs and stakes. However local fishermen fish for penaeid prawns round the Island using simple types of gear. A study of the distribution of penaeid prawns in estuaries was therefore based on samples collected from catches made by local fishermen.

The method of fishing for prawns varies in different parts of Ceylon. In estuaries on the south-west coast between Panadura and Galle the common method of capture is the kraal or ja-kottu. This consists of bamboo tats placed across the length of the estuary. At some points there are gaps in the bamboo tats which lead into traps. Prawns entering these traps cannot find their way out and are thus captured. In more recent times this method of capture has spread to Puttalam and Jaffna. In Negombo and Chilaw prawns are captured at night by stake-seine nets set against the direction of the current. The most common method of capture in other parts of Ceylon is the cast net which is operated at night. This is the most popular and wide-spread method of capture in estuaries lying between Arugam Bay and Trincomalee. Details of these fishing appliances are described in a previous publication (Pearson 1923).

Sampling

Weekly samples from catches made by local fishermen were collected from the estuaries at Moratuwa/Panadura and Negombo over a period of three years. In the Panadura/Moratuwa estuary 98 samples were collected from a kraal operating at Diggalla—situated 6 miles from the mouth, 55 samples were collected from a kraal operating at Horetuduwa—4 miles from the mouth and 13 samples from a kraal operating at the mouth itself at Egoda Uyana. In the Negombo estuarine system—71 samples were collected at random from the stake-seine net catches over a period of three years. Ten samples were collected at Chilaw, 4 from Udappuwa, 4 from Puttalam and Kalpitiya, 3 from Pookulam Lake, 8 from Mannar, 36 from different parts of the Jaffna lagoon, 4 from Mullaitivu, 4 from Kokkilai, 4 from Nilaveli, 5 from Muttur, 4 from Batticaloa, 2 from Komari, 4 from Koggala, 4 from Ambalangoda and 12 from the Balapitiya estuarine system. (See Fig. 1.)

Distribution

Every sample collected at the respective collecting centres was then analysed for its species composition. The species composition of the total number of samples collected at each sampling station are given in Table I.

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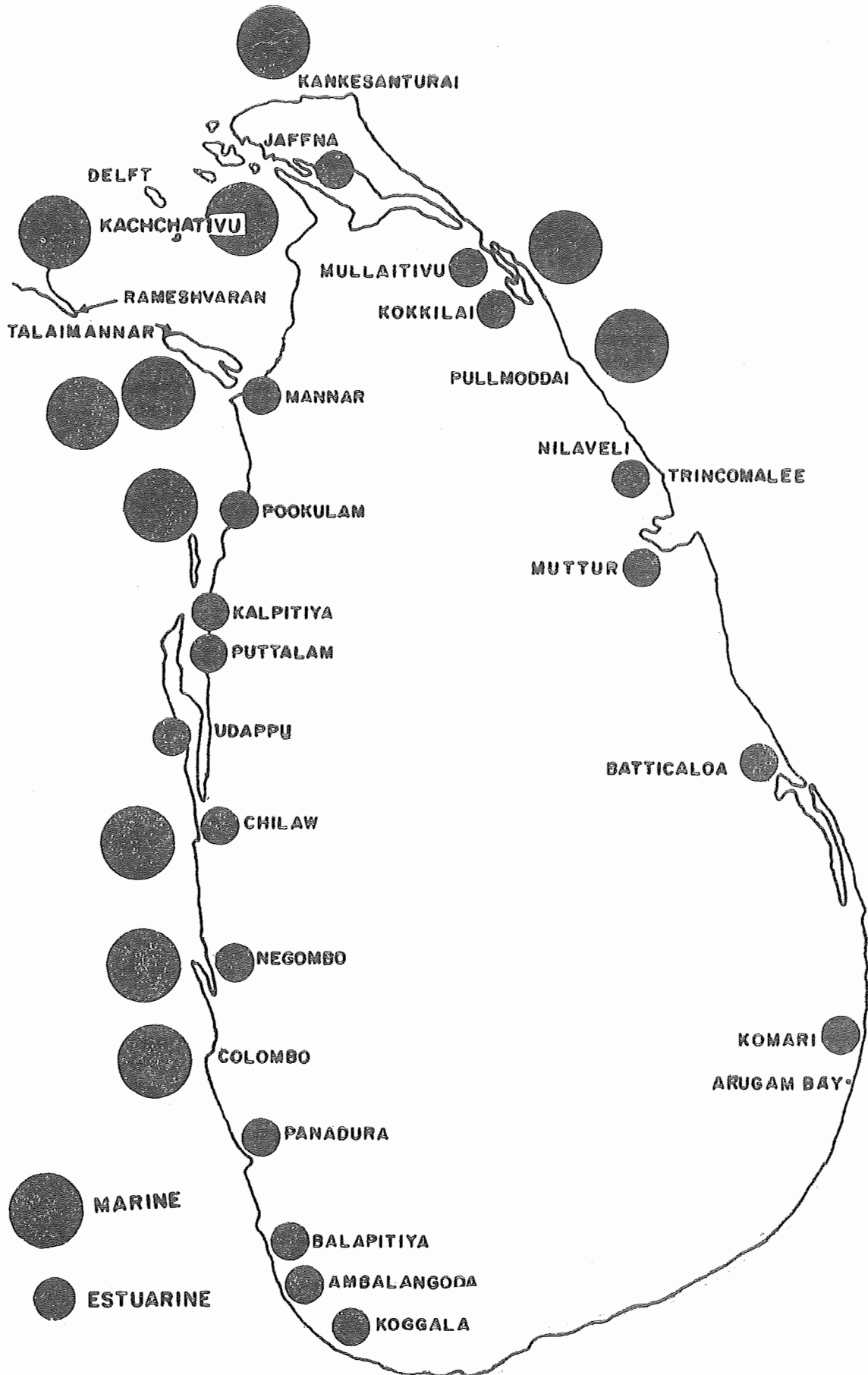


FIG. 1—MAP OF CEYLON SHOWING PRAWN SAMPLING STATIONS.

It is clear from Table I that some species are dominant to others and that there is discontinuity in the distribution of the majority of species. This discontinuity in distribution and species dominance is not attributable to the method of capture as each species was found to be vulnerable to all methods of capture.

Table I shows that the most abundant species is *Metapenaeus dobsoni*. However, it is not as commercially important as the other abundant species such as *Metapenaeus elegans*, *Penaeus indicus* and *Penaeus semisulcatus*, as it is one of the smallest in size.

TABLE I
Species composition of samples of penaeid prawns from estuaries round Ceylon

| LOCALITY | SPECIES COMPOSITION | | | | | | | | | | | | |
|--------------------------|------------------------|------------------------|-------------------|------------------------|----------------------------|------------------|-----------------------|-----------------|---|----------------------|------------------------------|---------------------------|----------------|
| | <i>Penaeus indicus</i> | <i>P. semisulcatus</i> | <i>P. monodon</i> | <i>P. latisulcatus</i> | <i>Metapenaeus elegans</i> | <i>M. dobson</i> | <i>M. burkenroadi</i> | <i>M. ensis</i> | <i>M. affinis</i> & <i>M. monoceros</i> | <i>M. lysianassa</i> | <i>Parapeneopsis cornuta</i> | <i>Parapeneopsis nana</i> | No. of Samples |
| Negombo .. | 15,587 | 7,020 | 507 | 268 | 6,110 | 73,168 | 138 | — | 45 | — | 765 | — | 71 |
| Chilaw .. | 700 | 55 | 21 | — | — | 200 | — | — | — | — | — | — | 10 |
| Udappu .. | 70 | — | — | — | — | 1,320 | — | — | — | — | — | — | 4 |
| Puttalam & Kalpitiya .. | 471 | 925 | — | 5 | — | — | 18 | — | — | — | — | — | 4 |
| Pookulam .. | 1,767 | — | — | — | — | 3,002 | — | — | — | — | — | — | 2 |
| Mannar .. | 1,815 | — | 12 | — | — | — | 250 | — | — | — | — | — | 8 |
| Jaffna .. | 449 | 1,421 | 241 | 177 | — | — | 2,801 | — | — | 1 | — | — | 36 |
| Mullaitivu .. | 591 | — | 315 | 1 | — | — | — | 2,698 | — | — | — | — | 4 |
| Kokkilai .. | 150 | 40 | 45 | — | — | — | — | — | — | — | — | — | 4 |
| Nilaveli .. | 1,850 | 150 | — | — | — | — | — | — | — | — | — | — | 4 |
| Muttur .. | 2,500 | — | — | — | — | — | — | — | — | — | — | — | 5 |
| Batticaloa .. | 6,667 | 1,429 | 80 | — | — | — | — | — | — | — | — | — | 4 |
| Komari .. | 450 | — | 150 | — | — | — | — | — | — | — | — | — | 2 |
| Koggala .. | 10 | — | 3 | 1 | 36 | — | — | — | — | — | — | — | 4 |
| Ambalangoda .. | 133 | — | 10 | — | 67 | 350 | — | — | — | — | — | — | 4 |
| Balapitiya .. | 696 | — | 2 | — | 486 | 6 | — | — | — | — | — | — | 12 |
| Egoda Uyana, Panadura .. | 282 | — | 5 | 67 | — | 408 | — | — | 903 | — | — | — | 13 |
| Horetuduwa, Moratuwa .. | 3,251 | — | 32 | — | 11,310 | 11,101 | — | — | — | — | — | — | 55 |
| Diggala, Panadura | 3,339 | — | 253 | — | 22,956 | 4,942 | — | — | — | — | — | — | 98 |

Penaeus monodon is the largest of penaeid species but is found only in very small numbers.

Penaeus indicus and *Penaeus monodon* were found uniformly distributed in the estuaries round the Island, but *P. semisulcatus*, *P. latisulcatus*, *Metapenaeus burkenroadi*, *M. monoceros*, *M. affinis*,* *M. ensis*, *Parapeneopsis cornuta* and *P. nana* were found restricted to the high salinity lagoons of the northern and eastern regions or to the relatively more saline mouths of low salinity lagoons of the south-west and southern sectors. *Metapenaeus elegans* and *Metapenaeus dobsoni* were either absent or rare in the north and east but were abundant in the low salinity lagoons of the south-western and southern regions.

This discontinuity in distribution is apparently determined by the differing salinity tolerances of the different species.

DISTRIBUTION OF PENAEID PRAWNS IN THE SEA

Methods of Capture

Fishing for prawns in the sea takes place on the mud banks off Mutwal, Colombo, Negombo and Chilaw at depths of 3–7 fathoms. In early days the gear used consisted of a miniature trawl operated off outrigger canoes or orus and a miniature Danish seine operated off two log-rafts or teppams. In recent times the miniature trawl is used off 26' mechanized boats.

In other areas there is no recognized fishery for prawns in the sea and, moreover, such a resource was unknown to local fishermen in the north-west, north and east coasts of Ceylon. Surveys conducted off the m.f.v. "North Star" and "Canadian" revealed the existence of prawn resources in these areas. The gear used in the surveys were small 26 ft. head-line try-nets. Recently the 40ft. head-line balloon trawl and the 40 ft. headline "Yankee Doodle" trawl were used during the surveys.

Sampling

Nineteen samples were collected during otter trawling operations NW of the Mutwal Fisheries Harbour at depths of 5–7 fathoms, 2 from otter trawling operations opposite the Drunken Sailor Buoy off Colombo at a depth of 9–10 fathoms, 4 from otter trawling operations conducted at depths of 10–11 fathoms west of Galle Face and Wellawatte Railway Station, 18 from commercial catches obtained by local fishermen off Kammal Moya, Negombo, 2 from local fishermen operating off Karukupone, Chilaw, 2 from beach-seine catches at depths of 0–3 fathoms off Pookulam, 3 from otter trawling operations conducted opposite the old Pier, Talaimannar, 10 from otter trawling operations conducted at depths of 6–7 fathoms between Rameshwaran Temple and Kachchitivu Island, 2 each from otter trawling operations conducted at depths of 6–7 fathoms off Delft Island and off Kankasanturai respectively, and 38 samples from otter trawling operations conducted at depths of 10–13 fathoms SE of the Mullaitivu Light House. (See Fig. I.) The species composition of the total number of samples obtained at each sampling station are given in Table 2.

Geographical Distribution

Some species of penaeid prawns found in estuaries were also present in the sea. They were *P. indicus*, *P. semisulcatus*, *P. monodon*, *P. latisulcatus*, *Metapenaeus dobsoni*, *M. monoceros*, *M. affinis*, *M. ensis*, *Parapeneopsis cornuta* and *P. nana*.

Two species which were abundant in estuaries were never met with in the sea. They were *Metapenaeus elegans* and *Metapenaeus burkenroadi*.

Some species were found only in the sea, namely *Solenocera subnuda*, *S. bedokensis*, all species of *Metapenaeopsis*, *Trachypeneus*, *Parapenaeus*, *Atypopenaeus* and *Parapeneopsis maxillipedo*, *P. coromandelica*, *P. uncta* and *P. tenella*.

* *M. affinis*. (H. Milne-Edwards)=*M. mutatus* (Lanchester, 1901; Hall, 1962). (See Dall & Racek, 1965, p. 68.)

TABLE II

Species composition of samples of penaeid prawns from seas round Ceylon

| SPECIES | LOCALITY | | | | | | | | | | |
|---------------------------------------|----------------|-----------------------------|--------------------|---------|--------|----------|--------|-------------|----------------------|-----|------------|
| | Colombo Mutwal | Colombo-Drunken Sailor Buoy | Colombo Galle Face | Negombo | Chilaw | Pookulam | Mannar | Talaimannar | Kachchitivu Palk Bay | KKS | Mullaitivu |
| <i>Solenocera subnuda</i> .. | 50 | — | — | — | — | — | — | — | — | — | 50 |
| <i>Solenocera bedokensis</i> .. | — | — | — | — | — | — | — | — | — | — | 30 |
| <i>Penaeus indicus</i> .. | 380 | 250 | — | 3 | 49 | 60 | 48 | 30 | — | — | 35 |
| <i>Penaeus merguensis</i> .. | 5 | — | — | — | 3 | — | 6 | 8 | 12 | — | 10 |
| <i>Penaeus semisulcatus</i> .. | 2 | — | — | — | 24 | — | 18 | 410 | 248 | 11 | 1,050 |
| <i>Penaeus monodon</i> .. | 46 | 50 | — | — | 1 | — | 8 | — | — | — | 44 |
| <i>Penaeus latisulcatus</i> .. | — | — | — | — | — | — | — | — | — | — | 1 |
| <i>Metapenaeus dobsoni</i> .. | 3,625 | — | — | 11,165 | 1,245 | 1,250 | — | — | — | — | — |
| <i>Metapenaeus monoceros</i> .. | 2 | 50 | 2 | — | — | — | 10 | — | — | 22 | 59 |
| <i>Metapenaeus affinis</i> .. | 48 | 125 | — | — | — | — | 6 | 23 | — | 13 | 365 |
| <i>Metapenaeus ensis</i> .. | — | — | 13 | — | — | — | — | 15 | — | — | 211 |
| <i>Metapenaeopsis hilarulus</i> .. | — | — | 13 | — | — | — | 7 | — | — | — | 1 |
| <i>Metapenaeopsis mogiensis</i> .. | — | — | 651 | — | — | — | 25 | — | — | 18 | 168 |
| <i>Metapenaeopsis stridulans</i> .. | — | — | 84 | — | — | — | — | — | — | 54 | 3,1448 |
| <i>Metapenaeopsis toloensis</i> .. | — | — | 12 | — | — | — | — | — | — | 220 | 30 |
| <i>Metapenaeopsis mannarensis</i> .. | — | — | — | — | — | — | 10 | — | — | — | — |
| <i>Trachypeneus salaco</i> .. | — | — | 65 | — | — | — | — | — | — | 65 | 1,933 |
| <i>Trachypeneus sedili</i> .. | — | — | 575 | — | — | — | — | — | — | 2 | 182 |
| <i>Trachypeneus curvirostris</i> .. | — | — | 119 | — | — | — | — | — | — | 2 | 307 |
| <i>Atypopeneus stenodactylus</i> .. | — | — | 345 | — | — | — | — | — | — | — | 44 |
| <i>Parapeneopsis cornuta</i> .. | 2 | — | — | — | — | — | — | — | — | — | — |
| <i>Parapeneopsis uncta</i> .. | 131 | — | 58 | — | — | — | — | — | — | — | 47 |
| <i>Parapeneopsis tenella</i> .. | — | — | — | — | — | — | — | — | — | — | — |
| <i>Parapeneopsis coromandelica</i> .. | 1,183 | — | — | 2,897 | 54 | — | — | — | — | — | — |
| <i>Parapeneopsis nana</i> .. | 31 | — | — | — | — | — | — | — | — | — | — |
| <i>Parapenaeus longipes</i> .. | — | — | — | — | — | — | — | — | — | — | 28 |
| No. of Samples .. | 19 | 2 | 4 | 18 | 2 | 2 | 2 | 3 | 10 | 2 | 3 |

Most species of penaeid prawns were found on both the west and east coasts of Ceylon, whether they were purely marine forms or whether they were forms found in both marine and estuarine environments. However, two species were found only in the south-west and west sectors of Ceylon where they form the basis of flourishing fisheries in the seas off Mutwal, Negombo and Chilaw. They were *Metapenaeus dobsoni* and *Parapeneopsis coromandelica*.

Sub-Strata Distribution

Species of penaeid prawns were found in a variety of sub-strata in the sea, such as mud, mud and sand, sand and shingle, sand and shell and coral and shingle and the majority of species displayed sub-strate specificity.

In the Palk Bay, prawns are not uniformly distributed but are restricted to certain areas composed of very soft green mud. The species present on the soft mud were *P. semisulcatus*, *P. merguensis*, *Metapenaeus monoceros* and *M. affinis*, but *P. semisulcatus* constituted nearly 95% of the population. In other areas of the Palk Bay, where the sea bottom consists of mud and sand or fine sand, these species were absent or scarce but small numbers of the species *P. indicus* were present.

A mud bank on the east coast stretches from Mullaitivu to Shoulder Point. Here too, there are different types of sub-strata such as soft green mud, more compact mud and mud and sand. *P. semisulcatus* preferred the patches of soft green mud while some species were found in great abundance in areas of more compact mud. They were *Metapenaeopsis stridulans*, *Metapenaeopsis toloensis*, *Trachypeneus salaco* and *Atypopeneus stenodactylus*. *P. indicus* was not present on this bank but very large numbers of this species have been captured during beach-seine operations on sand bottom closer inshore off the Mullaitivu Light House.

Off Mutwal, Colombo, *Metapenaeus dobsoni*, *Parapeneopsis coromandelica* and *Metapenaeus monoceros* were found on a mud and sand sub-stratum. Further off-shore between Galle Face and Mount Lavinia is a bank composed of sand and shingle, sand and patches of mud. The species abundant on sand and shingle were *Metapenaeopsos mogiensis* and *Trachypeneus sedili*.

All species were found to avoid hard bottom such as granite, sand-stone and live coral, but small numbers of *Metapenaeopsos mogiensis* were present on a mixture of dead coral and shingle.

The type of sub-stratum thus plays a major role in the segregation of different species of prawns in the sea, and this appears true for species in other parts of the world as well. Williams (1958) has verified experimentally that in the American forms "*Penaeus duorarum* occurred most often on shell-sand, *P. aztecus* and *P. setiferus* were found most frequently on the soft muddier sub-strata such as loose peat, sandy mud and muddy sand. Food content in the bottom materials may have been a confounding factor, but the results indicate attraction to sub-strate aside from the possible attraction to food".

Depth Distribution

There was no evidence of the influence of depth of water on the distribution of penaeid prawns in estuaries. In the sea, however, depth seems to exert some influence independent of the influence of the type of sub-stratum. On the east coast off Mullaitivu, for instance, species such as *Trachypeneus salaco*, *Metapenaeopsis stridulans*, *Metapenaeopsis toloensis* and *Atypopenaeus stenodactylus* were found in their greatest abundance at depths of 10–13 fathoms although sub-strata similar to that on which they were living were also present at greater depths. They also avoid depths less than 10 fathoms.

On the south-west coast between Colombo and Chilaw the species *Metapenaeopsos dobsoni*, and *Parapeneopsos coromandelica* were found in great abundance at depths of 4–7 fathoms on a sub-stratum of mud and sand. Although similar sub-strata are present on the banks lying west of Galle Face and Mount Lavinia at depths of 10–11 fathoms, these two species were absent. These banks were populated by large numbers of *Trachypeneus sedili*, *Metapenaeopsis mogiensis* and *Parapeneopsis maxillipedo*, forms which were absent at depths less than 10 fathoms.

Summary

A study of the distribution of 31 species of penaeid prawns in the estuaries and seas round Ceylon shows that some species are found in both estuaries and the sea while others are purely marine. To the former category belong *Penaeus indicus*, *P. semisulcatus*, *P. latisulcatus*, *P. monodon*, *P. merguensis*, *Metapenaeus dobsoni*, *M. monoceros*, *M. affinis*, *M. ensis*, *Parapeneopsis cornuta* and *P. nana*. The purely marine types are *Solenocera subnuda*, *S. bedokensis*, *Metapenaeopsis hilarulus*, *M. mogiensis*, *M. stridulans*, *M. toloensis*, *M. mannarensis*, *Trachypeneus salaco*, *T. sedili*, *T. curvirostris*, *Atypopeneus stenodactylus*, *Parapeneopsis maxillipedo*, *P. uncta*, *P. tenella*, *P. coromandelica* and *Parapeneus longipes*.

Two species were found only in estuaries—*Metapenaeus elegans* and *M. burkenroadi*.

Of the species found in both estuarine and marine environments, *M. dobsoni* is the most abundant in estuaries round Ceylon, but it is not as commercially important as the next most abundant species such as *Penaeus indicus*, *Metapenaeus elegans* and *Penaeus semisulcatus* since it is one of the smallest in size. *P. monodon* is the largest in size but the least abundant.

P. indicus and *P. monodon* were found distributed in estuaries right round the island but *P. semisulcatus*, *P. latisulcatus*, *Metapenaeus burkenroadi*, *M. monoceros*, *M. affinis*, *M. ensis*, *Parapeneopsis cornuta* and *P. nana* were found restricted to the high salinity lagoons of the northern and eastern regions or to the relatively more saline mouths of estuaries of low salinity lagoons of the south-west and southern regions. *Metapenaeus elegans* and *M. dobsoni* were either absent or scarce in the north and east but abundant in the south-west and southern regions.

Salinity thus plays a major role in the observed discontinuity in distribution of penaeid prawns in estuaries round the Island.

In the sea most species seemed to avoid hard-bottom such as coral, granite and sand-stone except *M. mogiensis* which was seen in fair numbers on a sub-stratum of coral and shingle. *Penaeus semisulcatus* was abundant on very soft green mud and avoided mud and sand. This type of sub-stratum it seemed to share with *Penaeus merguensis*, *Metapenaeus monoceros*, *M. affinis* and *M. ensis*. *P. indicus*, however, was abundant on very soft sand and was also present on a bottom of mud and sand. Some species preferred more compact mud. They were *Metapeneopsis stridulans*, *Metapeneopsis toloensis*, *Trachypeneus salaco* and *Atypopeneus stenodactylus*. Some were abundant on sand and shingle—they were *Metapeneopsos mogiensis* and *Trachypeneus sedili*. The type of sub-stratum thus appears to play a part in determining the segregation of penaeid species in the sea.

Although *Metapenaeus dobsoni* and *Parapeneopsis coromandelica* were found in mud and sand their distribution is also affected by depth since they were not found on patches of mud and sand beyond 7 fathoms. *Trachypeneus salaco*, *Metapeneopsos stridulans*, *M. toloensis*, *Atypopeneus stenodactylus* were restricted to depths varying from 10–13 fathoms. So were *Trachypeneus sedili*, *Metapeneopsos mogiensis* and *Parapeneopsis maxillipedo*.

Salinity, sub-strata and depth thus play their respective roles in segregating species of penaeid prawns in estuaries and in the sea.

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