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A review of the Brackish Water Prawns of Malaya

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INTRODUCTION

The purpose of this note is to bring together in one place, published and unpublished data accumulated in recent years on the occurrence of prawns in Malayan brackish waters. In addition to low salinity, i.e., oligohaline, brackish areas, there are in Malaya extensive areas of mangrove swamps with creeks and ponds which are polyhaline. This mangrove environment is characterized, in addition to its relatively high salinity, by a rich supply of organic matter, contained especially in the bottom sediments. Available evidence indicates that the prawn faunas of these oligohaline and polyhaline zones are quite distinct.

PENAEIDAE

Many members of this family occur in abundance in mangrove swamps. They form the basis of a profitable prawn pond industry at Singapore and in adjoining areas of South Johore. The prawns enter the swamps as juveniles and return to the sea to breed. Hall (1956, 1961 & 1962) has given a rather comprehensive account of these prawns and their biology in Singapore prawn ponds. Though his conclusions are based almost entirely on a single pond in the Jurong swamps, collecting in other ponds confirms their general validity. Hall (1962) has also given some information on the prawns of the Merbok estuary in Perak.

Hall (1962) records a single individual of *Parapenaeopsis affinis* (H. Milne Edwards) from the Merbok estuary and a single individual of *Trachypenaeus fulvus* Dall from the Jurong prawn pond. Both should be regarded as accidental occurrences in brackish waters. The truly brackish water penaeids all belong to the genera *Penaeus* and *Metapenaeus*.

Hall (1962) lists the following species as occurring in Singapore prawn ponds:

Penaeus indicus H. Milne Edwards
P. merguiensis de Man
P. monodon Fabricius
P. semisulcatus de Haan
Metapenaeus ensis (de Haan)
M. intermedius (Kishinouye)
M. lysianassa (de Man)
M. mastersii (H. Milne Edwards)
M. mutatus (Lanchester)
M. spinulatus Kubo
M. brevicornis (H. Milne Edwards)

In 1956 he had also recorded *P. penicillatus* Alcock; but he corrected this record in 1962.

Of these species *Metapenaeus ensis*, *M. mastersii*, and *P. indicus* are by far the most abundant. It is difficult to distinguish juveniles of *P. merguiensis* from *P. indicus;* but the available evidence indicates that *P. merguiensis* is comparatively rare.

Of these species Hall reports the following: *Metapenaeus brevicornis*, *M. mastersii*, and *M. mutatus*, from an apparently polyhaline location in the Merbok estuary. In addition he records *M. dobsoni* (Miers) from this locality. *M. dobsoni* is an Indian species for which the Merbok estuary forms the most south-easterly known locality.

According to the data given by Hall the salinity of the pond which he investigated varied considerably; but, except in the months of November and December, it remained above 20 parts per thousand. Even then it rarely fell below 10 parts per thousand. In casual collecting in Singapore and Johore, both in ponds and in estuaries, I have encountered this prawn association in salinities in the region of 18–20 parts per thousand. The list thus represents the Penaeidae of polyhaline habitats. In such habitats the penaeids are the dominant prawns.

By contrast penaeids are relatively rare in mesohaline and oligohaline habitats. The young of two species are fairly frequent in waters with salinities down to about 5 parts per thousand in Singapore and southern Johore. These are *M. brevicornis* and *M. lysianassa*. I have never encountered the more important prawn pond species in such waters. Both *M. brevicornis* and *M. lysianassa* have occurred in waters which, whilst tidal, showed no detectable salinity at the time of collection; but such occurrences are infrequent.

SERGESTIDAE

Acetes vulgaris Hansen is abundant in polyhaline waters around Malayan coasts. Hall (1962) notes it as occurring in prawn ponds in Singapore and I have seen it in prawn ponds in Johore. In certain areas, as around Kukup in South Johore and at Penang, it is sufficiently abundant to support an important prawn fishery. Like most penaeids it does not penetrate into oligohaline waters.

ATYIDAE

Certain species of *Caridina* are characteristic of oligohaline waters in Malaya and may occur there in great abundance. Species which I have found as adults in such waters include:

Caridina gracilirostris de Man

C. propinqua de Man

C. tonkinensis Bouvier

C. thambipillaii Johnson

The first three of these are especially characteristic of waters with salinities between 0–3 parts per thousand. All are common in suitable localities in southern and western Malaya, at least as far north as Penang. All have been found in habitats which, whilst tidal, had no detectable salinity. Only *C. propinqua*, the commonest of the three has been found in habitats unconnected with the sea, though *C. tonkinensis* has occurred in pools in the Paya Lebar area which are only very intermittently so connected. None of these species has been found in freshwater habitats at any great distance from the sea. *C. gracilirostris* has also occurred in the Sungei Seletar in polyhaline waters with salinities in the region of 18–20 parts per thousand. *C. thambipillaii* was described from two Malayan localities (Johnson, 1961a), one of which was a brackish ditch with a salinity of 2.77 parts per thousand. I have recently examined specimens from a presumed brackish pond near Rangoon.

Of the other Malayan species, I have taken *C. simoni peninsularis* Kemp in tidal but non-saline waters. *C. typus* H. Milne Edwards is confined as an adult to freshwaters; but very small stages are not found there. Such stages are so far unknown from Malaya; but I have seen specimens from other parts of the species range which were collected in marine and brackish habitats. *Atya spinipes* Newport has a similar life history.

Thus only three Malayan species appear to be purely freshwater organisms in Malaya: *Caridina excavatoides* Johnson; *C.* cf. *babaulti* Bouvier; and *C. weberi sumatrensis* de Man.

ALPHEIDAE

Alpheus microrhynchus de Man is an inhabitant of polyhaline waters and is not uncommon in mangrove creeks and prawn ponds.

A. paludosus Kemp is comparatively rare. It has been found in salinities as high as 20 parts per thousand; but is more frequently taken in lower salinities. I have several times taken it in freshwaters above the limit of tidal influence in the Sedili basin of South Johore. Tweedie (1938) reports an alpheid prawn, presumably the same species, from a tidal but non-saline habitat in the same area.

PALAEMONIDAE

The following species of the subfamily Palaemoninae are characteristic, and often abundant, inhabitants of polyhaline waters, including mangrove creeks and prawn ponds:

Leandrites deschampsi (Nobili)

Palaemon (Palaeander) semmelinkii (de Man)

Macrobrachium equidens (Dana)

Leptocarpus potamiscus (Kemp)

Of these the first is common in Singapore island, but has not so far been reported from elsewhere (Johnson, 1962a). *Palaemon (Palaeander) semmelinkii* was not mentioned by Hall; but it is a common inhabitant of mangrove creeks and it has been found in prawn ponds. *Macrobrachium equidens* is sometimes very abundant, as has been previously noted by Hall (1962); but it is seldom as abundant as the penaeids. *Leptocarpus potamiscus* is a northern species which was reported from Penang by Kemp (1917) and Holthuis (1950). I have seen specimens from Penang and Prai and also from mangroves at Port Swettenham, which is its most southerly known locality. *Macrobrachium equidens* occurs in marine habitats, though relatively rare there (Holthuis, 1950; Johnson, 1962a). *Palaemon (Palaeander) semmelinkii* is also known from marine habitats (Johnson, 1962a).

Most other Malayan members of the Palaemoninae are either entirely marine or entirely freshwater. *M. rosenbergii* (de Man) lives in freshwater for most of its life; but the adults return to saline waters to breed. Ling and Merican (1962) and Ling (1962) have shown that the larvae cannot survive in freshwater; but the post-larval juveniles are euryhaline and migrate upstream into freshwater areas. General distributional information indicates that this species has a similar life-cycle in other parts of its range, though Mendis and Fernando (1962) list it as being a brackish water species in Ceylon. From its distribution (Johnson, 1962b) it seems probable that *M. palawanense* Johnson has a similar life cycle. The localities from which I have collected specimens in Malaya have all been close to the tidal zone.

Only one species of the subfamily Pontoniinae has been found in Malayan brackish waters. This is *Periclimenes calmani* Tattersall. This species is common in brackish waters of the Suez Canal (Holthuis, 1956) where it is the only pontoniine found. It thus appears to be a truly brackish water species. It has not been found in fully euhaline waters in Malaya.

GENERAL COMMENTS

Brackish water prawns in Malaya appear to fall into three groups: (*a*) species in which the adult is an inhabitant of freshwaters but the larval stages are passed through in salt water; (*b*) species which are characteristic of oligohaline waters; (*c*) species which are characteristic of polyhaline waters. Many, but not all, of the latter have only their juvenile stages in brackish waters, reproduction occurring in marine habitats.

Group (*a*) includes *Caridina typus*, *Atya spinipes*, *Macrobrachium rosenbergii*, and possibly *M. palawanense*. Group (*b*) includes *Caridina gracilirostris*, *C. propinqua*, *C. tonkinensis*, *C. thambipillaii*, and *Alpheus paludosus*. Group (*c*) includes *Alpheus microrhynchus*, *Leandrites deschampsi*, *Palaemon* (*Palaeander*) *semmelinkii*, *Periclimenes calmani*, and the brackish water Penaeidea.

Taken as a whole the brackish water prawn fauna of Malaya is noticeably rich. One striking absentee is the genus *Palaemonetes*, characteristics of brackish waters in most parts of the world. *Palaemonetes* barely penetrates into the Oriental Region, although it reappears in Australia (Johnson, 1961b). This absence is somewhat surprising since according to the list given by Holthuis (1950), species of the genus occur in tropical South America and tropical West Africa. A partial explanation may be the presence in the Oriental Region of several small species of *Macrobrachium* such as *M. lamarrei* and *M. lanchesteri* which occupy much the same ecological niche as that in which freshwater species of *Palaemonetes* are found. The South American species of *Palaemonetes* are true freshwater forms, and the account given by Holthuis (1959) of the habitat of *P. carteri* Gordon in Surinname is very suggestive of the habitats of these small oriental species of *Macrobrachium*. The problem still remains as to why no species of the genus has been found in oligohaline waters in the Oriental Region, at least beyond its northernmost fringe. In northern temperate regions *Palaemonetes* is a very characteristic inhabitant of this oligohaline zone. In Malaya oligohaline waters are characterized by the almost complete absence of members of the family Palaemonidae, a phenomenon which is especially striking in view of the abundance of members of this family in local freshwaters and polyhaline waters.

Workers on the brackish waters of temperate regions usually only recognize a single brackish fauna as distinct from euryhaline species of freshwater or marine origin which spread into the brackish zone (Remane, 1958). The distribution of Malayan brackish water prawns would indicate that there are two such associations in Malaya, one characteristic of oligohaline and one of polyhaline waters.

Other groups of organisms are less well worked out; but the information available on them lends support to this conclusion. Amongst the crabs, the common edible crab, *Scylla serrata* (Forskal) is a characteristic inhabitant of mangrove creeks. Adults are never found in oligohaline waters and young individuals are rare there. Certain species of *Sesarma* have a similar distribution. *Varuna litterata* (Fabricius) occasionally occurs in low salinity waters with salinities in the region of 5 parts per thousand or even less. On the other hand several species of *Sesarma* are characteristic of the oligohaline zone (see Tweedie, 1940). *Potamocypoda pugil* Tweedie probably also belongs to this group. Tweedie (1938) described it from a non-saline tidal stream and I have seen specimens from a neighbouring stream with similar characteristics. In both it was associated with the oligohaline prawn, *Alpheus paludosus*. A considerable number of fishes, including the peculiar family Phallostethidae, seem to have their headquarters in the polyhaline zone. They either do not extend into the sea or oligohaline waters, or are much rarer there. The cyprinodont, *Oryzias javanicus* (Bleeker), though it extends into polyhaline and freshwaters seems to have its headquarters in the oligohaline zone. Many molluscs are characteristic of polyhaline waters. These include members of the genera *Cerithidea* and *Terebralia*, and *Syncera brevicula* (Pfeiffer) and *Telescopium telescopium*

(Linnaeus), amongst the snails, and the bivalve *Geloina ceylonica* (Lamarck). By contrast the snails, *Neritina violacea* (Gmelin), *Faunus ater* (Linnaeus), and *Melanoides ricqueti* (Grateloup) appear to be centred on the oligohaline zone.

There is thus sufficient evidence to postulate that, at least in the south-east Asian tropics, there are two brackish water faunal groups. A larger group with many species is centred on the polyhaline zone, whilst a smaller group characterizes the oligohaline zone. The simple picture postulated for brackish water faunas in temperate regions would thus be inapplicable to this area of the tropics.

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