

NOTES ON SOME SPECIES OF THE GENUS *MACROBRACHIUM*
(Crustacea: Decapoda: Caridea: Palaemonidae)

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The work of Holthuis (1950; 1952; 1959) has laid a sound basis for the understanding of the Indo-Pacific species of the genus *Macrobrachium* (= *Palaemon* auct.); but there are still several outstanding problems. In an attempt to deal with some of these I have examined collections preserved in the following institutions: British Museum (Natural History); Cambridge University Zoology Museum; the Zoological Museum, Amsterdam; and the Rijksmuseum van Natuurlijke Historie, Leiden. Where possible these have been supplemented by collections made by myself and my colleagues in Malaysia and Singapore.

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Some of the results of the present investigation have already been published elsewhere (Johnson, 1960 a, 1960 b, 1962 a, 1962 b, 1963). The present paper is concerned with two groups of closely related species: the *M.rosenbergii* group and the *M.equidens* - *rude* complex.

THE *M.ROSENBERGII* GROUP

Though it has not been possible to subdivide the large genus *Macrobrachium* as a whole, certain natural groups of species can be recognized. One of these centres round the familiar species *M.rosenbergii* (de Man). The members of this group are large to very large species. The rostrum is long and its dorsal margin bears a pronounced basal crest formed from closely approximated teeth. Distally the dorsal margin bears comparatively few, widely spaced teeth or is unarmed. The ventral rostral teeth are rather numerous to numerous, the number varying from 4 to 16. The 2nd legs of adult males are very long and comparatively slender. They are cylindrical in form and the carpus is long. They are spinulose and at least the dactylus is pubescent. The 2nd legs are often equal in size. When unequal they resemble each other in form and armature. The posterior legs are rather long and slender. The carapace usually remains smooth until the individual reaches a considerable size but in fullgrown adults it is commonly spinulose. The telson is produced into a well

developed median posterior point, which is much better developed than is usual in the genus *Macrobrachium*. The posterior marginal setae are comparatively few in number. Young individuals retain juvenile characters until they have attained a considerable size. In this phase they resemble in general appearance members of the genus *Leptocarpus* and of the sub-genus *Exopalaemon* of the genus *Palaemon* (= *Leander* auct.).

Despite their large size members of this group appear to be more primitive in many ways than the majority of species of the genus *Macrobrachium*. In my opinion they have probably originated independently of other species of the genus from prawns closely similar to the present members of the subgenus *Exopalaemon*. *Macrobrachium mirabile* (Kemp), 1917 is probably to be regarded as a less highly differentiated offshoot of the same stock, which also gave rise to the genus *Leptocarpus*.

Holthuis (1950 a) deals with 3 Indo-Pacific species which fall into this group: *M.rosenbergii* (de Man); *M.malcolmsonii* (Henderson and Mathai); and *M.weberi* (de Man). Each of these three species, as understood by Holthuis, really represents a complex of forms. These forms constitute a series of geographical subspecies of the first two species. *M.weberi*, as understood by Holthuis, probably comprises more than one species. Tiwari (1949 a) described the new species *M.choprai* and (1949 b) the new species *M.villosimanus*. Holthuis mentions both in an addendum to his Siboga monograph but was unable to incorporate them into his main treatment. *M.choprai* appears to be a subspecies of *M.malcolmsonii*. *M.villosimanus* is undoubtedly a valid species. Johnson (1962 b) has described the new species *M.palawanense*.

Holthuis had not seen specimens of *M.malcolmsonii* and was misled as to its characters by the published descriptions. In these circumstances there is a definite need for a more up to date review of this group.

The group contains the following valid Indo-Pacific species:— *M.rosenbergii* de Man; *M.malcolmsonii* (Henderson and Mathai); *M.villosimanus* (Tiwari); *M.palawanense* Johnson; *M.weberi* (de Man); and *M.sp. aff. weberi* (de Man). It is possible that *M.Jamarrei* (H.M. Edwards) also belongs to the group. This is a small species, never exceeding 60 mm in overall length which closely resembles juveniles of more typical members of group. Certain features, however, cast doubt on this relationship: the rostral crest is very ill-defined and the outer margin of the exopodite of the uropod has only a single tooth, lacking the internal spine which

is usually found in species of *Macrobrachium*. For these reasons I have excluded it from the group. A further species which may be related to the *M.rosenbergii* group, but which I have not treated further here, is *M.mirabile* (Kemp). Amongst non Indo-Pacific species the S. American *M.amazonicum* (Heller), a species which shows features reminiscent of both *M.villosimanus* and *M.weberi*, belongs here, as does *M.panamense* Rathbun.

The following key should serve to distinguish the Indo-Pacific species of the *M.rosenbergii* group from each other and from *M.lamarrei*:—

- 1. Small species (less than 60 mm *M.lamarrei* long when fully grown) in which the rostral crest is very low and ill-defined and in which there is no inner accessory spine to the tooth on the outer margin of the exopodite of the uropod.
 - Larger species in which the rostral crest is better developed (with rare exceptions) and in which the inner accessory spine to the tooth on the outer margin of the exopodite of the uropod is present. 2.
- 2. Comparatively small species not exceeding 120 mm. in overall length, in which both fingers of the second legs of the adult male have dense setation. 3.
 - Larger species exceeding 120 mm. overall length when fully grown, in which only the dactylus of the second legs of the adult male has dense setation. 6.
- 3. Rostrum with 8 to 9 ventral teeth; *M.villosimanus* all legs armed with very large and prominent spines.
 - Rostrum with 4 to 6 ventral teeth; spines on all legs, including the second legs, small to minute and tending to be directed along the limb. 4.
- 4. Inner spines of telson stout, not or only just attaining the tip of the telson; rostrum greatly over-reaching the antennal scale and usually markedly upturned. *M.sp. aff. weberi*
 - Inner spines of telson slender and over-reaching the tip of the telson; rostrum, if longer than the antennal scale, usually not markedly upturned. 5.
- 5. Rostrum of the adult rarely over-reaching the antennal scale; rostral crest high to very high; carpus of

the second legs of the adult male less than 1 3/4 times the length of the palm and only slightly longer than the combined length of the merus and the ischium. Posterior margin of the telson with only one pair of setae in addition to the terminal spines.

Rostrum of the adult distinctly *M.palawanense* over-reaching the antennal scale; rostral crest very low; carpus of the second legs of the adult male about twice as long as the palm and considerably longer than the combined length of the merus and the ischium; posterior margin of the telson with several pairs of setae in addition to the terminal spines.

- 6. Rostrum with 4 to 6 ventral teeth and with 0 to 4 dorsal teeth distal to the crest. *M.malcolmsoni* 7.
 - Rostrum with 8 to 15 ventral teeth and with 3 to 7 dorsal teeth distal to the crest. *M.rosenbergii* 9.
- 7. Palm of second legs of adult male normally shorter than the merus. (*M.m.choprai* Rostral crest high to very high).
 - Palm of second legs of adult male longer than the merus. 8.
- 8. Rostral crest moderate to high; rostrum short, not exceeding antennal scale. *M.m.malcolmsoni*
 - Rostral crest very low; rostrum longer and often exceeding the antennal scale. *M.m.kotreeanum*
- 9. Rostrum comparatively short, rarely exceeding the antennal scale by as much as 1/3rd. of its length and often shorter than that scale; ventral rostral teeth 8 to 12 (usually 10) in number; Carpus, even in large males, not or scarcely longer than the palm. *M.r.rosenbergii*
 - Rostrum long, almost as long as the carapace and usually exceeding the antennal scale by more than 1/3rd. of its length; ventral rostral teeth 11 to 15 in number; carpus distinctly longer than the palm. *M.r.schenkeli*

M.rosenbergii (de Man)

= *Palaemon carcinus* Indo-Pacific records (non *Cancer carcinus* Linnaeus, 1758).

Palaemon Rosenbergii de Man, 1879, p. 167.

Palaemon whitei (Guerin Ms) Sharp, 1893, p. 122, (not validly published, see Holthuis 1950).

Palaemon spinipes Schenkel, 1902, p. 501, pl. 9 fig. 7 (non Desmarest, 1817).

Macrobrachium carcinus Pearse, 1933, p. 189.

Macrobrachium rosenbergii Holthuis, 1950a, p. 111, fig. 25 (gives full synonymy), 1950b, p. 2.

Macrobrachium rosenbergii Johnson 1960 a, p. 179, fig. 4, 1960 b, p. 260, fig. 1; Ling and Merican, 1961, p. 55, figs. 1 to 8 (larval stages); Johnson, 1962 a, p. 56; Ling, 1962, p. 1; Mendis and Fernando, 1962, p. 69, fig. 2, p. 71; Johnson, 1963 a, p. 32.

Holthuis (1950) has explained why the name *M. carcinus* cannot be used for this species.

MATERIAL EXAMINED:

British Museum: Locality unknown, 56.34 from Zoological Society collection, 1 male of 281 mm; India, Ganjam, 89.6.17. 162-172, 13 individuals of 32 to 142 mm; India, Bombay, 89.6.17.218-223, coll. F. Day, 2 juveniles of 72 and 104 mm; India, Ratnagiri, coast about 100 mls. S. of Bombay, prestd. Lt. Col. K.R. Kirtikar, I.U.S., 1 male of 200 mm; India; Calcutta, 89.6.17., coll. F. Day, 2 juveniles of 61 and 104 mm; India, Sunderbunds, 89.6.17.224, coll. F. Day, 1 non-ovigerous female of 203 mm; Ceylon, 25a, 1 male of 235 mm; Burma, 89.6.17.160-161, 2 males of 210 and 268 mm; Burma, Tungoo, 91.11.20.1-4, prestd. E.W. Oates, 4 males of 184 to 226 mm; Burma, Pegu, 3 juveniles of 74 to 99 mm; Burma, Sittoung, 89.6.17.178-179, coll. F. Day, 3 juveniles of 81 to 89 mm; Burma, Gulf of Martaban, coll. Oates, 1 juvenile of 108 mm; Burma, Tavoy, 89.6.17.159, coll. F. Day, 1 male of 250 mm and 1 non-ovigerous female of 148 mm; Siam, 60.42, coll. Cole, 1 juvenile of 68 mm; Siam, Tah Kamen, 97.10.7.1., coll. S. Flower, 18.3.97, 1 male of 178 mm; Malaya, Penang, 83.24, Commissioners for Straits Settlements, International Fisheries Exhibition, 1883, 1 male of 200 mm; Singapore fishmarket, Feb. 1934, don. Raffles Museum, 1 ovigerous female of 197 mm; Singapore, freshwater Tanglin, Bedford-Lanchester coll., ref. II. 14.181, 5 juveniles of 25.5 to 60 mm; Borneo, Marabah River, 93.3.26.1-2, coll. A. Everett, Dec. 1892, 1 male of 206 mm and 1 bopyrized juvenile of 103 mm; Java, purchased off E. Gerrard Jnr., 1 male of 208 mm; Bali, purchased off E. Gerrard Jnr., 1 male of 208 mm; New Guinea, Lake Sentani, prestd. by L.E. Cheesman, 1 male of 248 mm; Australia, coll. Cole, 3 fragmented individuals; N.W. Australia, 92.3.26.403, 1 non-ovigerous female of 151 mm.

Cambridge: Siam, Singora, Skeat coll., 12 individuals of 111 to 171 mm; Siam, Tale Sap, Skeat coll., 1 medium-sized individual; Malaya, Skeat coll., 1 juvenile of 64 mm; Malaya, Kelantan, Skeat coll., 2 individuals of 90 to 120 mm.

Liverpool University: Singapore, 4 large specimens, possibly those on which Walker based his record.

Leiden: Java, Tandjong Priok, 1907, and November 1927, leg. P. Buitendijk, 4 of 101 to 165 mm, including ovigerous female. Locality unknown, from Zoological Museum, Utrecht, 1 individual; New Guinea, Tami River near Humboldt Bay, N.E. Netherlands New Guinea, from Hollandia Fisheries Department, 24.6.1955, 1 male of 287 mm; New Guinea, Andai, type specimen of *Palaemon rosenbergii*, an ovigerous female of 250 mm; New Guinea, Merauke River, near Koepruk above Merauke, S.W. Netherlands New Guinea, coll. Holthuis, 8.4.55., 1 male of 170 mm, 1 non-ovigerous female of 124 mm, and 2 ovigerous females of 147 and 153 mm; New Guinea, Ocean Pier, Merauke, coll. Holthuis, 3.4.55., 1 female of 142 mm; New Guinea, Pioneer's Bivouac, Mamberamo R., New Exped. 1920, Dec. 1920, 3 males of 128 to 206.7 mm., 3 non-ovigerous females of 135.5 to 160 mm., and 4 ovigerous females of 155 to 182 mm., also fragments of 2nd leg of a very large individual; New Guinea, Kampong Poe, S.E. portion of Lake Sentani, Netherlands New Guinea, 13.11.54, coll. L.B. Holthuis, 1 male of 199 mm; New Guinea, Diguel R., above Tanah Merah, S.W. Dutch New Guinea, 13th April 1955, coll. L.D. Brongersma and M. Boeseman, 1 non-ovigerous female of 170.8 mm; New Guinea, between Tanah Merah and Tanjong Okiba, 14th April 1955, coll. L.D. Brongersma, 1 ovigerous female of 168.5 mm. Specimens have also been seen in the collections of this museum and the Amsterdam museum from all the localities recorded in the Siboga report.

University of Singapore: Thailand, Bangkok, coll. A.G. Searle, November 1957, 1 male of about 160 mm with damaged rostrum; Pahang, mouth of Tahan R. in fishtrap, 10.3.57, coll. J.R. Hedrickson and D.S. Johnson, 1 medium-sized individual; Pahang, Kuala Tahan, Tahan and Tembeling rivers, 20 to 23.3.56., coll. E.R. Alfred, 2 males of 133 and 162 mm, and 1 non-ovigerous female of 129 mm; Kedah, P. Langkawi, S. Kisap 200 yds upstream from S. Raya estate H.Q., 6.8.57., coll. D.S. Johnson, 1 juvenile; Negri Sembilan, Muar R., just east of Kuala Pilah, 1.2.57, coll. D.S. Johnson, several juveniles; Johore, large stream in rubber country about 10 mls. east of Kota Tinggi, 22.2.57, coll. D.S. Johnson, 1 juvenile of 89 mm; Singapore, inflow tanks of Woodleigh Filter Beds, coll. Chief Water Engineer, Singapore, 1955, 1 male of 192 mm; Singapore, fishmarket, coll. Kwek, 19.12.56., 1 male of about 184 mm, rostrum damaged; Singapore, coll. Hassan, no definite locality or date, 2 males of 244 and 245 mm. Individuals of this species have also been seen from the following Malayan localities; Alor Star, Kedah; Penang I.; Kuala Lumpur, Selangor; Malacca, Malacca; Tangkak, Johore; Kota Bharu, Kelantan; Johore R., Kota Tinggi, Johore.

NOTES:

This species is probably the most distinctive of its genus in the Indo-Pacific region. The only species with which it is likely to be confused is *M. malcolmsonii*. Care must be taken in identifications within the range

of the latter species. The following characters are most useful in distinguishing *M.rosenbergii* from related species:—

a) the very large size of mature individuals, exceeding that of all other Indo-Pacific species;

b) the characteristic, deep Sistine blue colouration of the large 2nd legs of the adult male and the equally characteristic, transverse red band on the distal part of the chela of the same leg in juveniles (the first character at least is shared with *M.malcolmsonii*, though the colouration appears to be less intense in that species);

c) the form and armature of the rostrum, which is distinctly sigmoid with the dorsal crest low to very low and containing 7 to 10 but usually 8 or 9 teeth, with 3 to 7 dorsal teeth distal to the crest, and with 8 to 15 ventral teeth.

d) the comparatively massive 2nd legs of the adult male, which are less elongate in proportion to individual size than in other members of this species group, and in which the carpus, even in large males, attains less than half of the total body length.

e) the relative size of the carpus of the 2nd legs, which is considerably shorter than the chela and may or may not be longer than the palm.

f) the palm of the 2nd legs, which is of uniform width throughout, and which has a well defined sub-longitudinal groove on both the outer and the inner faces.

g) the comparatively long fingers of the 2nd legs, which in the typical race are 2/3rds of the length of the palm, and in the western race may exceed ¾ of the length of the palm.

h) the setation of the fingers of the adult male which is confined to the dactylus and stops well short of the tip of that finger.

i) the replacement of the cutting edge of the fingers of the 2nd leg of very large males by a row of numerous small teeth.

j) the large size of the spines borne by the 2nd legs, which are nonetheless smaller than those found in *M.malcolmsonii* and *M.villosimanus*.

k) the comparatively smooth carapace which only becomes moderately to very scabrous in very large males, and even in these is normally less scabrous than is usual in *M.malcolmsonii*.

l) the relatively stout posterior legs which are spine-scent, though less so, in all save the very largest males, than is usual in *M.malcolmsonii* and *M.villosimanus*.

m) the posterior margin of the telson which bears many pairs of setae and in which the telson tip greatly over-reaches the inner spines.

n) the comparatively poorly developed sexual dimorphism with females usually showing the specific characters in a well developed form.

Very large individuals seem to be prone to accidents causing damage to projecting portions of the

body, especially the rostrum and telson. Subsequent regeneration may result in very unusual rostral and telsonal forms. Such abnormalities include: shortening of the rostrum accompanied by loss of and/or re-duplication of teeth, and rounding off of the end of the telson accompanied by the partial or complete loss of spines and setae. The type female shows such damage.

In males, and to a lesser degree in females, the second legs of this species increase rapidly in relative length with increasing overall individual size. This increase becomes apparent at a larger initial size and is relatively less marked than in other species of the group. There is some development of high-low dimorphism in respect to the 2nd legs of the males; but this phenomenon is less marked than it is in the related *M.malcolmsonii*.

Young individuals differ strikingly from adults; but, with the exception of very small individuals, they can always be recognized by the characteristic rostrum. In very small individuals the rostrum is less elongate and less upturned towards the tip than it is in the adult. The number of rostral teeth is fewer and the terminal portion may be styliform and unarmed dorsally. They thus resemble the young of related species more closely than the adults do.

DISTRIBUTION AND ECOLOGY:

M.rosenbergii is by far the most widely distributed Indo-Pacific species of its group. It ranges from the Indus through to Hong Kong, the Philippines, New Guinea, N.W. Australia, Northern Queensland, and the Indian Ocean Christmas Island. It has also been recorded from the Tokyo region; but this record is doubtful. The distribution has been figured by Johnson (1960 a, p. 178 fig. 4), who, however, omits the localities from the Fly River in eastern New Guinea and the Archer River in Queensland, given by Holthuis (1950 b). The distribution is predominantly coastal, though there are some localities well removed from the sea along the course of large rivers.

In true freshwater *M.rosenbergii* is characteristic of rivers and lakes, extending up to the beginning of the torrent zone in the relatively short rivers of Malaysia and Indonesia. Here it may be collected alongside such torrent-dwelling species as *M.pilimanus* and *Atya spinipes*.

Young individuals may occur in large streams. Individuals 'trapped' in small water bodies, as in the Woodleigh Filter Beds, may grow to a large size; but large individuals normally migrate out of such habitats. *M.rosenbergii* is rather commonly collected in brackish waters and both adult and young individuals have been taken in fully marine coastal waters. Oviparous females are seldom collected from fully freshwater habitats in Malaysia and this seems to be true throughout the range of the species. Nonetheless they do occasionally

occur indicating that mating can take place in freshwater. The evidence indicates that all post-larval stages are euryhaline. Ling and Merican (1961) and Ling (1962, 1963) have shown that larval development cannot proceed in pure freshwater. From these facts the normal life cycle would seem to be that breeding takes place in the estuarine stretches of rivers and perhaps sometimes in the sea. Here the larval stages are passed through. The young prawns migrate into freshwater where they grow to maturity, returning to brackish water to breed. Judging by the considerable size range shown by breeding individuals there is a return to freshwaters after breeding and the whole process is repeated several times. Certain features, especially as to the biology of the males and the place where fertilization normally occurs remain to be worked out *M.rosenbergii* whilst not completely adapted to a freshwater life is more completely freshwater than such species as *M.mirabile* and *M.equidens*.

SUBSPECIES:

Examination of this series has convinced me that *M.rosenbergii* is represented by at least two subspecies. A preliminary comment on this situation has already appeared (Johnson, 1960 b). One of these is found in New Guinea and Australia including the type-locality of the species. The other occurs on the Asiatic mainland and in Malaysia. Owing to lack of material from Wallacea I have not been able to determine the exact boundaries between the two subspecies. The single specimen from Bali in the British Museum collections seems to be somewhat intermediate between the two. This suggests that possibly the whole of Wallacea will fall within the range of the eastern subspecies; but this conclusion must await confirmation on the basis of more adequate material.

The name of the western subspecies presents some difficulty. Since *Palaeomon whitei* is apparently not validly published, the oldest available name is *spinipes* Schenkel; but this name is pre-occupied. There is no other valid available name. I am therefore proposing the name *schenkeli*. I am designating as type the large male of 250 mm overall length in the British Museum collection from Tavoy, Burma, which thus becomes the type locality.

The differences between the two subspecies are best shown in tabular form.

<i>M.r.schenkeli</i> subsp.n.	<i>M.r.rosenbergii</i> (de Man)
Adult males comparatively slender.	Adult males comparatively stout.
Carapace of adult male comparatively smooth, with the spinulation usually restricted to the mid-dorsal region.	Carapace of adult male comparatively scabrous, with the spinulation usually generally distributed.
Carapace of adult male not pubescent.	Carapace of adult male commonly with a short,

velvety pubescence.

Rostrum (where not damaged) always long, often as long as the carapace, and usually exceeding the antennal scale by more than 1/3rd of its length.

Rostral crest moderate to low, almost always with 8 teeth but sometimes with 7 or 9 teeth. Distal portion of rostrum usually with 5 or 6 teeth more rarely with 4 or 7 teeth on the dorsal margin.

Ventral margin of rostrum with 11 to 15 teeth.

2nd legs of adult male comparatively slender.

Fingers of 2nd legs in adult male usually $\frac{3}{4}$ as the palm or even longer.

Carpus of 2nd legs of adult male always distinctly longer than the palm.

Rostrum comparatively short, rarely exceeding the antennal scale by as much as 1/3rd of its length, and often failing to reach the tip of the antennal scale.

Rostral crest low to very low, usually with 8 or 9 teeth, sometimes with 7 or 10 teeth. Distal portion of rostrum usually with 4 teeth, more rarely with 3 or 5 teeth on the dorsal margin.

Ventral margin of rostrum usually with 10 teeth but sometimes with as few as 8 teeth or as many as 12 teeth.

2nd legs of adult male comparatively stout.

Fingers of 2nd legs in adult male shorter, in large males only attaining 2/3rds of the length of the palm or even less.

Carpus of 2nd legs of adults of both sexes only very slightly longer than the palm and sometimes actually shorter than the palm.

It should perhaps be noted that not all of these characters can be observed in juveniles or small females. The most easily used of these differences are probably those concerning the rostral dentition and the length of the carpus of the 2nd legs. The general stoutness of *M.rosenbergii rosenbergii* as compared with *M.r.schenkeli* is very obvious when similar sized individuals are compared.

M.malcolmsonii (H.Milne Edwards)

= *Palaemon Malcolmsonii* H. Milne Edwards, 1844, p. 8, atlas, pl. 21.

Palaemon spinipes birmanicus Schenkel, 1902, p. 503, pl. 9 fig. 8.

Palaemon malcolmsonii Henderson and Mathai, 1910, p. 283, pl. 15 fig. 2; Kemp, 1915, p. 266; Balss, 1930, p. 318; Patwarden, 1937, p. 1, figs. 1-65; Chopra, 1939, p. 223, pl. 2 fig. 3; Chopra, 1943, p. 5; Chopra and Tiwari, 1949, p. 214.

Palaemon choprai Tiwari, 1949 a, p. 333, figs.

Macrobrachium malcolmsonii Holthuis, 1950 a, p. 121; Mendis and Fernando, 1962, p. 71.

MATERIAL EXAMINED:

British Museum: Pakistan, Kotree, Indus R., received from Karachi Museum, 3 males of 114 to 151 mm and 3 non-ovigerous females of 116 to 128 mm; Pakistan, Khetty, received from Karachi Museum, 1 male of 81.5 mm and 4 non-ovigerous females of 106 to 140 mm; Pakistan, Sind, 89.6.17.247., 1 female of 134 mm, India, Ganjam, with individuals of *M. rosenbergii* in jar 89.6.17.162-172, 2 badly damaged individuals of *M. rosenbergii*, 3 males of 89.5 to 156 mm; India, Madras, coll. F. Day, with individuals of *M. rude*, the whole collection labelled *Palaemon carcinus*, 2 males of 95 and 110 mm, and 2 ovigerous females of 84.2 and 114.5 mm; East Indies, 2 males of 133 and 146 mm, and 1 ovigerous female of 115 mm (this locality, being well outside the known range of the species, must be surely be erroneous).

Leiden Museum: India, Madras, J. Hornell, Zoological Survey of India, 16.8.22., 1 male of 143.5 mm and 1 ovigerous female of 92.5 mm; India, Rajmahal, Patna, coll. B.L. Chaushai, Zoological Survey of India, 9.5.1912, received from Tiwari as specimens of *P. choprai*, 1 male of about 118 mm and 1 non-ovigerous female of 101.8 mm; Ceylon, river near Polonnarawa, N. Central Province, coll. C.H. Fernando, 1951, 1 male of 137 mm.

NOTES:

When he prepared his Siboga monograph, Holthuis had not seen specimens of the present species and, in consequence, his conception of its characters was somewhat erroneous. In his key he associates it with *M. weberi*; but it is very clear that its real affinities are with *M. rosenbergii*. Indeed *M. malcolmsonii* and *M. rosenbergii* are so similar as to be easily confused by experts as is evidenced by the numerous misidentifications in the material which I have examined.

Holthuis states that in *M. malcolmsonii* the distal portion of the dorsal margin of the rostrum is unarmed; and that the inner terminal spines of the telson over-reach the telson tip. The first statement is seldom correct. The distal dorsal portion of the rostrum may be unarmed but more usually it bears from 1 to 4 teeth. The second statement is definitely incorrect. The posterior margin of the telson in *M. malcolmsonii* is as in *M. rosenbergii*, with the telson tip over-reaching the inner spines, as indeed is stated by Henderson and Mathai.

M. malcolmsonii is principally distinguished from *M. rosenbergii* by: its smaller size; its relatively long and slender 2nd legs; its greater spinosity; and its shorter rostrum with fewer ventral teeth. Its principal characters are as follows:

a) the comparatively large size at maturity, which exceeds that of other Indo-Pacific species with the exception of *M. jar* which attains about the same size

and *M. rosenbergii* which is considerably larger.

b) the very short to moderately long rostrum, which does not exceed the antennal scale or only slightly exceeds it, except in some individuals of the subspecies *kotreeanum*.

c) the rostral crest which is low to very high and includes from 7 to 11 but most usually 9 or 10 teeth.

d) the distal, dorsal margin of the rostrum, which usually bears 1 or 2 teeth, but which may be unarmed or bear as many as 3 or 4 teeth.

e) the presence of only 4 to 6 teeth on the ventral margin of the rostrum.

f) the 2nd legs of the adult male, which are fairly massive, but more slender than those of *M. rosenbergii*; in high males these are very elongate and have the carpus greatly exceeding $\frac{1}{2}$ of the overall body length whilst in low males they are comparatively short with the carpus attaining at most $\frac{1}{3}$ rd of the overall body length.

g) the length of the carpus of these legs which is always considerably greater than that of the palm though never quite attaining the total length of the chela.

h) the palm of these legs which is slender and of uniform width throughout and, as in *M. rosenbergii*, bears well marked sub-longitudinal grooves on both outer and inner faces.

i) the fingers which are comparatively long, attaining from $\frac{3}{5}$ ths to $\frac{3}{4}$ of the length of the palm, and thus being comparable in relative length to those of *M. rosenbergii rosenbergii*, but relatively shorter than those of *M. r. schenkeli*.

j) the setation of the fingers of the adult male, which is confined to the dactylus as in *M. rosenbergii* and as in that species, leaves the tip of the dactylus uncovered.

k) the very well developed spinescence of the 2nd legs, the spines usually being relatively longer than those of *M. rosenbergii* but shorter than those of *M. villosimanus*.

l) the very scabrous carapace of old males.

m) the posterior thoracic legs which are somewhat more slender than those of *M. rosenbergii* and, in fullgrown males are relatively more spinose than those of *M. rosenbergii* but less so than those of *M. villosimanus*.

n) the form of the posterior margin of the telson which is as in *M. rosenbergii* with the telson tip over-reaching the inner spines and with numerous terminal setae.

o) the moderately developed sexual dimorphism, the females retaining more juvenile characters than do those of *M. rosenbergii*, but approaching the adult males more closely than do the females of other species of the group.

It can be seen from the above synopsis that *M. malcolmsonii* is in many features intermediate between *M. rosenbergii* and *M. villosimanus*, though probably more closely related to the former.

An interesting feature of this species is the apparent occurrence of a pronounced high-low dimorphism in adult males, manifested particularly by the development of the 2nd legs. Similar dimorphism has been claimed previously for other species of the genus but Holthuis (1950 a, p. 104) does not accept these claims. The present data show clearly that there is such a dimorphism in *M.malcolmsonii*, the two groups being revealed by regression lines plotted against absolute size so that factors such as size and maturity are allowed for. It is of some interest that, whereas in 'low' males the two 2nd legs are of equal size, in 'high' males one 2nd leg is often much longer than the other. The 2nd legs of 'high' males must be distinctly unwieldy so that it is difficult to think what advantage this phenomenon can have for the species. Investigation of its biological significance might well prove a productive line of research for a worker in India with access to living material. (See Table 1)

Holthuis suggested that Schenkel's *Palaemon spineps birmanicus* should be assigned here. I hesitate to accept this synonymy because of the existence of *M.villosimanus* which might conceivably have been the basis of Schenkel's species. Until Schenkel's specimens are re-examined or specimens of *M.malcolmsonii* are again discovered in Burma the occurrence of *M.malcolmsonii* east of the Arakan hill tracts must remain doubtful.

Tiwari (1949) described as new the species *Palaemon choprai* which he considered to be the common river prawn of the Gangetic plain. From his short description it is clear that his species is at least very closely allied to *Macrobrachium malcolmsonii*. I have been able to examine 2 specimens of *P.choprai* determined by Tiwari and I am convinced that they are conspecific with *M.malcolmsonii*. Tiwari states that his species is distinguished from *M.malcolmsonii*, "by the keeled rostrum and by the dimensions of the 2nd pereopods; in *P.choprai* the palm is usually shorter than the merus; but in *P.malcolmsonii* it is always longer". The first difference just does not exist. The basal crest of *P.choprai* individuals is admittedly much higher and more conspicuous than the average for typical specimens of *M.malcolmsonii* but it merely forms one extreme of a continuous series, in which the basal crest is always present and is often moderately high to high. In this connection it may be noted that Henderson and Mathai state of *M.malcolmsonii*, "its upper margin consists of a highly convex proximal part ———". The second distinction is of very doubtful value. In the male specimen of *P.choprai* which I examined the palm is admittedly shorter than the merus, whereas in full-grown males of typical *M.malcolmsonii* the palm is longer than the merus; but in both the differences in length are very slight. Furthermore it is apparent from Tiwari's own description that exceptional full-grown males of *M.choprai* may have the palm longer than the merus. In the females of the typical form which I have examined the palm is shorter than the merus, whilst the table given by Henderson

and Mathai shows that this is the usual condition in juvenile males. A very slight difference in relative growth rates could account for the observed distinctions between full-grown males of *M.malcolmsonii* and *M.choprai*. As far as I can ascertain these are the only differences between these two so-called species. I do not think that these can be given specific value, the more so as the two forms occupy distinct geographical areas. On the other hand the differences, though slight, are population differences and not individual variations. Thus it seems justifiable to accept *M.choprai* as representing a geographical subspecies of *M.malcolmsonii*.

In the north-western portion of the species' range there is another, rather more distinctive, geographical variant. Specimens from Bombay, though somewhat intermediate can be assigned to the typical race. The north-western race is distinguished by the rather long rostrum, which may exceed the antennal scale, and which has a long and very low crest. There are also average differences in the dentition of the rostrum between this race and the typical race. I propose to recognize this form as a subspecies under the name of *M.malcolmsonii kotreeanum* after the town of Kotree, which is the type locality.

The three subspecies can be recognized by the following synopsis of characters:

M.malcolmsonii malcolmsonii (H.Milne Edwards)

In full grown males, but not in young males or in females, the palm of the 2nd leg is longer than the merus. The rostrum does not exceed the antennal scale. The rostral crest is moderate to high and contains 7 to 10 but usually 9 teeth. The ventral rostral teeth number 4 or 5 or more rarely 6. Distribution: Peninsular India and Ceylon.

M.malcolmsonii choprai (Tiwari)

Save for a few exceptional males individuals always have the palm of the 2nd leg shorter than the merus. The rostrum either does not exceed the antennal scale or scarcely exceeds it. The rostral crest is high to very high and contains 7 to 10, but usually 9 teeth. The ventral rostral teeth number 4 or 5 and more rarely 6. Distribution; Gangetic plain, Assam.

M.malcolmsonii kotreeanum subsp. nov.

Type: the large male of 151 mm from Kotree in the collections of the British Museum.

Type locality: Kotree, Indus River, Pakistan.

The palm of the 2nd legs is longer than the merus in both full-grown males and full-grown females. The rostrum is almost as long as or longer than the antennal scale. The rostral crest is very low. The teeth in the rostral crest number 9 to 11. The ventral rostral teeth number 5 or 6. Other features are as in *M.*

malcolmsonii malcolmsonii. Distribution: Indus Valley and Sind.

DISTRIBUTION AND ECOLOGY:

M.malcolmsonii appears to be the common river prawn of India. It is also known from a single locality in Ceylon. Whether or no it occurs in Burma remains doubtful.

Little seems to be known of the ecology of this species. It appears to replace *M.rosenbergii* to a great extent in the more inland areas of India; but the distribution of its sub-species strongly suggests dispersion through saline waters along the coasts.

M.villosimanus (Tiwari)

= *Palaemon villosimanus* Tiwari, 1949 b, p. 329.

Macrobrachium villosimanus Holthuis, 1950, p. 261.

MATERIAL EXAMINED:

Leiden: India, Hughly, Pulta Survey Party, Zoological Survey of India, 25.9.36., received from Tiwari, 2 males of 80 and 110 mm.

NOTES:

This species superficially resembles *M.rosenbergii* but it is at once distinguished by the much more slender 2nd legs, the extreme spinescence of all the legs, and the fact that both the dactylus and the fixed finger of the 2nd legs are setose. It is also a much smaller species, being intermediate in size between *M.weberi* and *M.malcolmsonii*, and showing full specific characters at a size at which individuals of *M.rosenbergii* are still juvenile.

The following combination of characters will serve to distinguish *M.villosimanus* from related species:

a) the comparatively small size at maturity which is less than that of related species with the exception of *M.weberi* and its near allies.

b) the form and armature of the rostrum, which is shaped much as in *M.rosenbergii*, considerably over-reaches the antennal scale, has a very low crest with some 8 to 10 teeth, has 4 teeth on the dorsal margin distal to the crest, and has 7 to 10 ventral teeth.

c) the 2nd legs of adult males which are very long and slender, though less so than in *M.weberi* and *M.palawanensis*, and in which the carpus exceeds $\frac{1}{2}$ of the overall length of the individual.

d) the long carpus of the 2nd legs of the adult male which is considerably longer than the palm, and which may be almost as long as the entire chela.

e) the slender palm of the 2nd legs, which is somewhat 'inflated' at the base of the fingers, and on which the longitudinal grooves, characteristic of *M.rosenbergii* and

M.malcolmsonii, are absent or very feebly developed.

f) the setation of the fingers of the 2nd leg which involves all save the tip of the dactylus and in addition, the median and lateral faces of the fixed finger.

g) the short fingers of the 2nd legs, which are between $\frac{1}{2}$ and $\frac{2}{3}$ of the length of the palm.

h) the extreme spinescence of the 2nd legs, which are armed with very large and prominent spines.

i) the posterior legs, which are very slender though less so than in *M.weberi*, and which are thickly set with large prominent spines.

j) the scabrous carapace, 6th abdominal segment, and telson of old individuals.

k) the absence of specialized spines along the ventral margin of the basal uropodial process, in contrast to the condition found in *M.weberi* and *M.palawanese*.

l) the posterior margin of the telson, which bears several pairs of setae, and in which the telson tip is over-reached by the inner terminal spines.

m) the well-marked sexual dimorphism, with the females not showing adult characters.

In size and in the relative length of the 2nd legs this species is intermediate between *M.malcolmsonii* and *M.weberi*. The type of setation of the fingers of the 2nd leg; the form of the posterior margin of the telson; and the pronounced sexual dimorphism would suggest close relationship with *M.weberi*. By contrast, the general appearance; the form and armature of the rostrum; and the spinulation of the 2nd legs, would suggest relationship with *M.rosenbergii*. Tentatively I regard *M.villosimanus* as a somewhat aberrant derivative of the *M.rosenbergii* stock showing convergent resemblances to *M.weberi*. Distribution: The species seems to have a restricted distribution around the head of the Bay of Bengal from Calcutta through the Chittagong hill tracts to Rangoon. It is just possible that Schenkel's *M.spinipes birmanicus* is the same species, in which event Schenkel's name will have to be adopted.

M.weberi (de Man)

= *Palaemon (Eupalaemon) weberi* de Man, 1892, p. 421, pl. 25 fig. 33.

Macrobrachium weberi Holthuis, 1950 a, p. 122, fig. 26 in part.

The species *M.weberi* as previously understood represents a complex of forms, which are best treated as separate species. Only the above references refer to *M.weberi* s.s.

MATERIAL EXAMINED:

Leiden: Celebes, lake Sidenreng, coll. M.Weber, paratype, from coll. J.G. de Man, 26.4.1930, 2 juvenile males of 49.2 mm; Celebes, Minralang R., coll. M.Weber, paratype, from coll. J.G. de Man, 26.4.1930, 1 juvenile

of 58 mm, and 1 non-ovigerous female of 70 mm; Celebes, Lake Tempe, from J.K. de Jong, Djakarta, 19.7.1947, topotypical material, 3 males of 76.5 to 98.5 mm and 2 ovigerous females of 91.5 and 94.5 mm; Celebes, Ugi, Lake Tempe, don. Lab. Onderz. Zee, Djakarta, 21.7.47., 1 male of 94.0 mm and 2 ovigerous females of 94.5 and 96.8 mm; Celebes, Tjenrana R., Kampong Oelot, Singkang, don. Lab. Onderz. Zee, Djakarta, 1 ovigerous female of 82.5 mm and 6 juveniles of 38.0 to 41.8 mm; Celebes, Tjenrana R., Singkang, don. Lab. Onderz. Zee, Djakarta, 7.8.47., 1 ovigerous female of 69.5 mm and 1 ex-ovigerous female of 67 mm; Celebes, Tjenrana R., Kampong Kamae, Singkang, don. Lab. Onderz. Zee, Djakarta, 19.7.47, 12 males of 48.5 to 95.5 mm, 2 non-ovigerous females of 71.4 and 87.5 mm, and 3 ovigerous females of 85.8 to 90.3 mm; Celebes, Walanaie R., nr. Singkang, don. Lab. Onderz. Zee, Djakarta, 22.7.1941, 1 male of 61 mm and 5 juveniles of 42.0 to 47.6 mm; 'Fishmarket', Djakarta, don. Lab. Onderz. Zee, 1940, 3 large damaged individuals.

The provenance of the last set of specimens is obscure but they certainly did not originally come from Java. All the evidence indicates a Celebean origin.

NOTES:

M. weberi is a member of a group of small species of the *rosenbergii* group which are set apart by: their comparatively small adult size; the great length and slenderness of the 2nd legs of large males; and the peculiar general spination consisting of small, blunt, adpressed spines. It can be distinguished by the following combination of characters:

- a) the small size at maturity, individuals seldom if ever exceeding 100 mm in total length.
- b) the form and armature of the rostrum, which in adults seldom exceeds the antennal scale and is often much shorter; and which possesses a low to high dorsal crest comprising usually 11 but sometimes as few as 9 or as many as 12 teeth; and which has 0 to 2 teeth on the dorsal margin distal to the crest and 3 to 5 ventral teeth.
- c) the 2nd legs of the adult male which are extremely long and slender, the carpus of large males being considerably longer than $\frac{1}{2}$ of the overall body length, and normally equal or sub-equal in size.
- d) the length of the carpus of the 2nd leg which in females and juveniles is considerably longer than the entire chela and in adult males is distinctly longer than the entire chela; in adult males it is less than twice as long as the palm and only slightly longer than the combined length of the merus and ischium.
- e) the palm of the 2nd legs which is short and inflated in juveniles but long and slender in adult males, and which does not possess longitudinal grooves.
- f) the fingers of the 2nd legs which are much longer than the palm in juveniles but much shorter in full-

grown males and in which the setation in adult males involves both fingers, covering both to the tips.

- g) the spinulation of the 2nd legs, which consists of minute to small, blunt, adpressed spines.
- h) the posterior thoracic legs which are long and slender and armed only with minute, adpressed spines.
- i) the general scabrosity of adult males, involving not only the carapace but also most of the abdomen and especially the 6th abdominal segment and the telson and which consists of blunt, adpressed spines.
- j) the presence of a characteristic row of peculiar blunt spines along the ventral margin of the basal uropodial process of adult males.
- k) the form and armature of the posterior margin of the telson, which bears only a single pair of terminal setae and in which the inner terminal spines greatly over-reach the telson tip whilst the outer spines are very short.
- l) the very pronounced sexual dimorphism which results in the female never showing any adult characters.

In addition the constitution of the exoskeleton seems to differ from that which is normal in the genus. In preservative most members of this genus are rather pale in colour and the exoskeleton is rigid and brittle. In *M. weberi* preserved individuals are usually dark coloured. The exoskeleton, especially of the 2nd legs is highly flexible, so that it is perfectly possible to tie the carpus into a loose knot and unite it without damage. What the advantage of this condition may be in a matter of speculation. It may help to reduce the likelihood of damage to these long and slender limbs.

There appears to be some regional variation in the form of the rostrum but the material available is not sufficient for the establishment of subspecies. In specimens from Lake Tempe the rostrum is shorter than the antennal scale and the crest is high. Specimens from the Minralang rivers are similar but the crest is somewhat lower. The adult specimens from Tandjung, Singkang resemble these. The specimens from the Tjenrana river have a rather low crest and the rostrum is almost as long as the antennal scale or even slightly longer than this. In juveniles the rostrum is proportionately longer than in adults, sometimes considerably exceeding the antennal scale, and the crest is lower. These changes in rostral form between juvenile and adult are the reverse of those occurring in *M. rosenbergii*. In both species the juvenile rostral form tends to approximate to that found in the subgenus *Palaeomon* (*Exopalaeomon*). Holthuis implies that in *M. weberi* the terminal portion of the rostrum is styliform and unarmed dorsally. This is sometimes true; more usually it bears 1 or 2 teeth.

Heterogonic growth of the 2nd legs of the male commences at a smaller individual size than in other species of this group and the heterogony is more marked.

An unusual feature of this species which has not been noted by previous workers is a row of peculiar spines situated along the ventral border of the uropodial process of large males. These spines are rather large and are blunt. A similar spine row is found in *M. palawanese*; but not, so far as I can determine in other species of the genus.

DISTRIBUTION AND ECOLOGY:

M. weberi is confined to Celebes, where it appears to be a common species of lakes and rivers. The high percentage of ovigerous females in these freshwater collections indicates that it is a freshwater breeder.

M. palawanese Johnson

= *Macrobrachium palawanese* Johnson, 1962 b, p. 307, fig. 1.

NOTES:

I have nothing to add to the description I have already given of this new species, which is closely allied to *M. weberi*. This is an even smaller species than *M. weberi*, adult characters being already well developed in individuals of less than 70 mm overall length. The 2nd legs of the adult male are relatively even more elongate and provide the easiest distinction between the two species.

The following features serve to distinguish *M. palawanese* from other species, including *M. weberi*:

- a) the rostrum which distinctly over-reaches the antennal scale and in which the crest is very low.
- b) the 2nd legs of the adult male which are very elongate and markedly unequal in size with the carpus considerably longer than the combined length of the merus and ischium and about twice as long as the palm.
- c) the distal portion of the antennal scale which is more rectangular than in *M. weberi*.
- d) the posterior margin of the telson which is similar to that of *M. weberi* but has several pairs of setae in addition to the terminal spines.
- e) the very small size.

In other features *M. palawanese* resembles *M. weberi*. Like that species it has a well-developed spination of small, adpressed spines; both fingers of the 2nd leg of the adult male are setose; the ventral margin of the uropod bears a peculiar row of blunt spines; and the integument of preserved specimens is usually dark-coloured and highly flexible.

DISTRIBUTION AND ECOLOGY:

The only specimens known are those mentioned by Johnson from Palawan and the east coast of Malaya. All the habitats in eastern Malaya are in slow streams, very close to the sea, and just above the tidal zone.

Macrobrachium sp. aff. *weberi* de Man

= *Palaemon weberi* Borradaile, 1899, p. 410.

Palaemon (Eupalaemon) weberi de Man, 1915, p. 420, pl. 28, fig. 7 and pl. 29, fig. 7; J. Roux, 1917, p. 600 and 1927, p. 322.

MATERIAL EXAMINED:

Leiden: Dutch New Guinea, R. Gjellerup, N. New Guinea Exped. 1910-11, 3 males of 79.5 to 90.5 mm and 4 smaller individuals of 55 to 75 mm (unfortunately the largest specimen is damaged and devoid of both 2nd legs); Dutch New Guinea, Hollandia, R. Gjellerup, 5.4.1911, New Guinea Exped. 1910-11, 10 individuals of both sexes from 65.8 to 74 mm; Dutch New Guinea, Zouthron, N. New Guinea Exped. 1910-11, 1 male of 84.2 mm; Dutch New Guinea, Mosso R., 9/12 May 1903, New Guinea Exped. 1903, 1 damaged female of 87 mm.

Amsterdam: Dutch New Guinea, Mosso R., 9/12 May 1903, New Guinea Exped. 1903, 1 male of 75.3 mm and 3 females of 65 to 78 mm; Dutch New Guinea, Hollandia, 5.4.1911, de Man collection 2 bopyrized females of 73.5 mm; Dutch New Guinea, Wassedoe, 9.8.1903, New Guinea Exped. 1903, fragmented male of over 70 mm; New Guinea, Tawarin, 20.6.1903, New Guinea Exped., 1903, 2 juveniles of about 37 mm.

NOTES:

These specimens are all part of the material which de Man assigned to *M. weberi*. They differ so considerably from the typical form of that species as to suggest that they really represent a new species. Unfortunately none appears to be full-grown and most of the larger specimens are damaged. Thus it is not possible to get a clear picture of the species characters and the form is best left without a name until more material is obtained.

These specimens differ from *M. weberi* in the form of the rostrum and in the form and armature of the posterior margin of the telson. In the absence of full-grown males it is not possible to tell whether the 2nd legs show any differences. The juvenile and female characters of these agree with those found in *M. weberi*.

In these New Guinea specimens the rostral crest is low to very low and contains 10 to 12 teeth. The terminal portion of the rostrum is always very long and over-reaches the antennal scale, often by 1/3rd, sometimes by as much as 4/5ths of its total length. This portion of the rostrum may be straight, in which event there is a strong resemblance to the rostrum of *Palaemon stylirostris*; alternatively, it may be considerably upturned so that the general shape of the rostrum resembles that of *Macrobrachium villosimanus*. The ventral rostral teeth are 4 to 6 in number. There are 2 or 3 post-orbital teeth as in *M. palawanese*. The very low rostral crest again resembles that of *M.*

palawanese.

The posterior margin of the telson bears several rows of setae in addition to the terminal spines, agreeing once more with *M.palawanese* rather than *M.weberi*. The relative lengths of the terminal spines show considerable variation. The inner spines are usually stouter than they are in *M.weberi* and *M.palawanese* and they may be very stout. Sometimes they over-reach the telson tip; more commonly they barely attain the telson tip or fall short of it. The outer spines are variable in size but almost always better developed than in *M.weberi* or *M.palawanese*. They vary between ¼ and 2/3rds of the length of the inner spines.

Males of about 80 mm overall length still show juvenile characters with an inflated palm on the 2nd leg. Thus the present form would seem to be a larger species than *M.weberi*. Preserved individuals are pale in colour and the cuticle is not flexible.

DISTRIBUTION:

This form seems to be not uncommon in West Irian. What is apparently the same form has been reported from New Britain by Borradaile.

Distribution of Indo-Pacific species of the *M.rosenbergii* group:

M.rosenbergii is probably the least specialized of these. It has retained the necessity for breeding in saline water, and it has by far the widest distribution, occurring from Pakistan through to Australia. The distribution is less extensive than that of *M.Jar* in which the young appear to be better adapted for life in the sea. *M.malcolmsonii* appears to have originated in the Indian sub-continent and to have been prevented from spreading eastwards by the parallel north-south mountain ranges of the Burma-Thailand area. *M.villosimanus* seems to be a more specialized derivative especially adapted to the condition in the lower stretches of the great rivers flowing into the head of the Bay of Bengal. The *M.weberi* subgroup appears to have originated in Wallacea and to have split up into several distinct geographically localized forms. Somewhat surprisingly it has apparently not been able to establish itself in Malaysia, except in the region immediately bordering on the S. China sea. *M.latidactylus* (Thalwitzer) shows a somewhat similar distribution and Tweedie (1950, p. 339; 1954, p. 118) has noted some other instances in grapsoid crabs. Possibly all of these have spread through a brackish water coastal zone when the southern portion of the S.China was dry land.

The *M.equidens* group:

Less closely knit and less easily defined than the *M.rosenbergii* group is a group of medium sized species centering around *M.equidens* (= *Palaeon sundaicus* auct.). These species have a long, often somewhat

sigmoid, rostrum, with fairly numerous ventral teeth. The 2nd legs of the adult male are long and cylindrical and the essential armament of the fingers consists of 2 moderately large teeth at the base of the dactylus associated with a single such tooth at the base of the fixed finger. Subsidiary teeth may be developed distally but the essential arrangement remains quite distinct from the many-toothed fingers of such species as *M.australe*. The carpus of full-grown males is always distinctly longer than the merus. The species which most probably belong here are: *M.equidens* (Dana); *M.rude* (Heller); *M.sintangense* (de Man); *M.idae* (Heller); *M.idella* (Hilgendorf); and *M.mami llodactylus* (Thalwitzer). These species, especially the first three, have constantly been confused with each other. Much of the confusion has been removed as a result of the work of Holthuis (1950). Unfortunately Holthuis had not seen *M.rude* and in consequence, he himself confused that species with *M.equidens*. In this paper I shall treat only these two species and their synonyms.

M.equidens and *M.rude* are very similar species. Full-grown males are readily distinguished; but the differences between juveniles and females, though easily appreciated when one has specimens in hand, are both difficult to describe and to figure. Probably the most useful distinguishing feature is the overall shape, as opposed to the detailed armament, of the rostrum.

M.equidens (Dana)

= *Palaeon equidens* Dana, 1852 a, p. 26, 1852 b, p. 591; Weitenweber, 1854, p. 62; Dana, 1955, p. 12, pl. 39, fig. 2; de Man, 1888 a, p. 283; Ortmann, 1891, p. 718.

non *Palaeon equidens* Heller, 1862, p. 418, pl. 2, fig. 44; Lanchester, 1901, p. 565, pl. 34, fig. 4.

Palaeon aequidens von Martens, 1868, p. 40.

non *Palaeon (Eupalaemon) equidens* de Man, 1892, p. 453, p. 26, fig. 36.

Palaeon (Eupalaemon) sundaicus? de Man, 1892, p. 437, pl. 26, fig. 35.

Palaeon (Eupalaemon) sundaicus de Man, 1897, p. 779, 1898, p. 708, pl. 37, figs. 70 m and n, 71; Nobili, 1903 a, p. 8; J.Roux, 1917, p. 597, 1919, p. 334, and 1932, p. 569.

Palaeon (Eupalaemon) sundaicus partim, J.Roux, 1921, p. 590, and 1923, p. 6.

Palaeon (Eupalaemon) sundaicus var. de Man, 1897, p. 783, 1898, pl. 37, figs. o & p.

non *Palaeon (Eupalaemon) sundaicus* Weber, 1897, p. 165; Hilgendorf, 1898, p. 30; Coutiere, 1900, p. 1266.

Palaeon (Eupalaemon) sundaicus brachydactyla Nobili, 1899, p. 238.

Palaeon (Eupalaemon) sundaicus De Mani Nobili, 1899, p. 239.

Palaeon (Eupalaemon) acanthosoma Nobili, 1899,

p. 242; de Man, 1908, p. 369, 1915, p. 427, pl. 29, figs. 10 & 11; J.Roux, 1917, p. 597, 1919, p. 334, 1934, p. 218.

non *Palaeon sundaicus* Lanchester 1901, p. 568; Stebbing, 1915, p. 73.

non *Palaeon Sundaicus* Coutiere, 1901, p. 332, pl. 14, figs. 44–46.

Palaeon (Eupalaeon) sundaicus baramensis de Man, 1902, p. 769.

Palaeon (Eupalaeon) nasutus Nobili 1903 b, p. 9; Nouvel, 1932, p. 409.

? *Palaeon sundaicus* Lanchester, 1906, p. 132; Kubo, 1940, p. 20, fig. 11, 1941, p. 313, fig. 7.

Palaeon sulcatus Henderson and Mathai, 1910, p. 289, pl. 16, fig. 4; Panikkar, 1937, p. 346; Nataraj, 1942, p. 468.

non *Bythinis (Eupalaeon) sundaicus* Rathbun, 1910, p. 316.

non *Eupalaeon sundaicus* Stebbing, 1910, p. 384, Barnard, 1926, p. 121.

Palaeon (Eupalaeon) sp. de Man, 1915, p. 425, pl. 29, fig. 8.

non *Palaeon delagoae* Stebbing, 1915, p. 74, pl. 16; Rathbun, 1935, p. 28, figs. 1 & 2.

? *Macrobrachium sundaicus* Maki and Tsuchiya, 1923, p. 57, pl. 2, fig. 2.

? *Macrobrachium equidens* Maki and Tsuchiya, 1923, p. 62, pl. 6, fig. 1.

non *Urocaridella borradillei* Stebbing, 1923, p. 8, pl. 14.

non *Palaeon (Eupalaeon) sundaicus bataviensis* J.Roux, 1933, p. 5.

Macrobrachium sundaicus Suvatti, 1937, p. 49.

non *Palaeon sundaica* Barnard 1947, p. 390.

non *Palaeon (Eupalaeon) cf. sundaicus* Barnard, 1950, p. 775, figs. 148 e–h.

non *Palaeon (Eupalaeon) delagoae* Barnard, 1950, p. 776.

Macrobrachium equidens partim, Holthuis, 1950 a, p. 162, fig. 36.

Macrobrachium equidens Johnson, 1962 a, p. 56; Hall, 1962, p. 75.

MATERIAL EXAMINED:

British Museum: Burma, Mergui, 86.52, coll. Dr. Anderson, 3 males of 69.0 to 73.4 mm; Malaya, Penang, 83.24, Prestd. Commissioner for the Straits Settlements International Fisheries Exhibition, 1883, 1 damaged male of about 70 mm; Singapore, Bedford Lanchester coll., Siglap, ½ fm., 3 ovigerous females of 61.3 to 66.0 mm; Indonesia, Buru, Kayali, 1910.3.29.54, 1 ovigerous female of 89.5 mm, British Solomon Islands, Buntal, 11.4.92., Stebbing coll. 1928.12.393 – 396, coll. C. Hose, 2 ovigerous females of 76.0 to 82.5 mm;

British Solomon Islands, Lunga, Guadalcanal, R.A. Lever esq., 1 male of 82.0 mm.

Leiden: Malaya, Pt. Dickson, coll. Brongesama, Mar. 1946, in sea, 1 specimen of 71 mm.

Amsterdam: Indonesia, Nias, J.P.Kleiweg de Jwaan, 68 individuals of 33 to 128 mm. In this and the last museum I was also able to see the specimens of this species reported on by Holthuis (1950).

University of Singapore: Singapore, prawn ponds near Jurong river, high salinity brackish water, 15.2.54 31.5.54. and subsequent occasions, numerous individuals, coll. D.S.Johnson, D.Hall, P.Wickstead, and others, from small juveniles to adults of about 100 mm, including ovigerous females; Singapore, Bedok, on beach, coll. E.P.Chea, 1 ovigerous female of 80 mm; Singapore, S.Seletar, station 5, 13.6.58, high salinity brackish water, coll. T.Selvarajah, 104 individuals of 30.5 to 70., including ovigerous females of 58 to 70 mm.

NOTES:

Holthuis has given reasons why the name *M.sundaicus* cannot be used for the present species. He considers that the correct name is *M.equidens* (Dana). Whilst I agree with these conclusions I feel that it is necessary to point out that one of his pieces of confirmatory evidence is not valid. When Holthuis wrote his monograph only 2 species of *Macrobrachium* were recorded from Singapore. It is now known that 8 species occur there or have so occurred in the recent past. One of these is *M.idae* (Heller) which is very similar to the present species. Nonetheless I consider that Dana's figures and descriptions indicate the present form rather than *M.idae*. The present form is also much the commoner at Singapore. Thus Holthuis's identification of *M.equidens* (Dana) with *M.sundaicus* auct. seems justified.

The synonymy given agrees with that of Holthuis with the following modifications: I have deleted all African and Madagascan records, since I am convinced that these all refer to *M.rude*; I have further not accepted Lanchester's records of *Palaeon sundaicus* as referring to this species. His 1901 specimens were available to me at Cambridge. They are far too small to represent *Macrobrachium equidens* since both specimens are ovigerous although only 25½ and 29 mm in overall length. They also differ in many structural details from *M.equidens* and are more closely related to *M.asperulum* (Johnson, 1963 b.). I have not been able to examine the specimens on which Lanchester based his 1906 record; but I feel that this record must also be treated with doubt in view of the former confusion.

As Holthuis has already pointed out this species shows considerable variation in the length of the rostrum. Nobili's *Palaeon nasutus* is based on such a

variant. As Holthuis notes the number of dorsal, rostral teeth is usually 10 or 11. Rather rarely individuals are found with as few as 9 or as many as 12 dorsal teeth. Holthuis notes that the number of post-orbital teeth is inconstant — 2 or 3 teeth both being usual numbers. In adult individuals from Singapore the most frequent condition is 3 post-orbital teeth and the number maybe as high as 3½. By contrast in young individuals the number is usually 2 or 2½. Holthuis considers that the normal number of ventral rostral teeth is 5 or 6, sometimes 7 and that individuals with 4 ventral teeth are rare. He suggests this number as a possible criterion for females of the species. Unfortunately juveniles tend to have fewer ventral teeth than full grown individuals. Thus a sample of 20 small individuals from Singapore gave the following figures: 1 with 6 teeth; 3 with 5 teeth; 14 with 4 teeth; and 2 with 3 teeth. Adults from Singapore usually have 5 or 6 or more rarely 7 teeth. Even in adults a considerable number may have only 4 ventral teeth. This is so, for instance, in 2 out of the 3 Mergui specimens. Despite these variations in total length, detailed shape, and denticulation, the general form of the rostrum remains constant and can be used to distinguish the present form from related species.

DISTRIBUTION AND ECOLOGY:

It is necessary to delete from the detailed list given by Holthuis all African and Madagascan localities and also the records from Kuala Mabek, Jalor, and Patalung. New localities are Penang; Buru; Buntal; and Guadalcanal. The known distribution then extends from Travancore through to Amoy, the Philippines, New Britain, and the Solomon Isles. In addition there are doubtful records from Formosa and the Riu Kiu islands. Somewhat surprisingly there are no records from Ceylon. *M.equidens* is pre-eminently an inhabitant of high-salinity brackish waters. It is also found in shallow, inshore, marine waters, where it very probably is capable of breeding. It rarely enters pure freshwater.

M.rude (Heller)

= *Palaemon rudis* Heller, 1862, p. 527, 1865, p. 114; Ortmann, 1891, p. 716; Koelbel, 1892, p. 440; Henderson and Mathai, 1910, p. 291, pl. 17, fig. 5; Kemp, 1915, p. 268; Balss, 1930, p. 318; Sewell, 1934, p. 55; Menon, 1938, p. 288, figs. 1-20; Chopra, 1939, p. 223, pl. 2, fig. 2, 1943, p. 4.

Palaemon (s.s.) *Mossambicus* Hilgendorf, 1879, p. 839, pl. 4, fig. 17.

? *Palaemon mossambicus* partim Pfeffer, 1889, p. 34.

Palaemon mossambicus Ortmann, 1891, p. 741; Hilgendorf, 1898, p. 29; Colosi, 1918, p. 105.

Palaemon (*Eupalaemon*) *sundaicus* Weber, 1897, p. 165; Hilgendorf, 1898, p. 30; Coutiere, 1900, p. 1266.

Palaemon (*Eupalaemon*) *rudis* Coutiere, 1900, p. 1266, 1901, p. 288, pl. 12, figs. 23 and 24 Nobili,

1903, p. 11; J.Roux, 1934, p. 531; Vatova, 1943, p. 13, pl. 1, fig. 3; Barnard, 1950, p. 778.

Palaemon Sundaicus Coutiere, 1901, p. 332, pl. 14, figs. 44-46.

Palaemon (*Eupalaemon*) *Alcocki* Nobil, 1903, p. 9, fig. 5.

Eupalaemon rudis Stebbing, 1908, p. 41, 1910, p. 385.

Bythinis (*Eupalaemon*) *sundaicus* Rathbun, 1910, p. 316.

Eupalaemon sunaicus Stebbing, 1910, p. 384; Barnard, 1926, p. 121.

Palaemon sunaicus Stebbing, 1915, p. 73.

? *Palaemon delagoae* Stebbing, 1915, p. 74, pl. 16; Rathbun, 1935, p. 28, figs. 1 and 2.

Urocaridella borradillei Stebbing, 1923, p. 8, pl. 14.

Palaemon sunaica Barnard, 1947, p. 390.

Palaemon (*Eupalaemon*) cf. *sundaicus* Barnard, 1950, p. 775, figs. 148 e-h.

? *Palaemon* (*Eupalaemon*) *delagoae* Barnard, 1950, p. 776.

Palaemon (*Eupalaemon*) cf. *idae* var. *idella* Barnard, 1950, p. 777, figs. 148 i to l.

Macrobrachium rude Holthuis, 1950 a, p. 150; Mendis and Fernando, 1962, p. 71.

Macrobrachium equidens partim Holthuis, 1950 a, p. 162.

MATERIAL EXAMINED:

British Museum: S. Africa, Durban, Stebbing coll., 1928.12.1.397-399, 4 males of 93.6 to 95.5 mm and 1 ovigerous female of 76 mm, identified by Stebbing as *Palaemon rudis*; E. Africa, Nosovuni R., 4.1.54, 1 juvenile male of 49.4 mm; E. Africa, Nosovuni R., Seine net, 1955.1.24.8, presented Hugh Copley, 1 male of 76.7 mm identified as *M.equidens*; E. Africa, Kaomi R., Sabaki River Survey, 1955.1.24.2., 16th December, black when caught, 1 ovigerous female of 82.8 mm identified as *M.rude* or *M.equidens*; E. Africa, Sabaki R. at Kakonemi, 1951.4.16.1-6, coll. W.E.Frost, 10.7.48, 7 specimens of 67.5 to 93.0 mm, identified as *M.rude*; E. Africa, Sabaki R., 1955.1.24.1., Sabaki River Research Survey, presented by Hugh Copley, 1 male of 94.8 mm identified as *M.rude*; E. Africa, Sabaki R., 14.12.53, 1955.1.24.7., presented by Hugh Copley, 1 male of 85.3 mm identified as *M.equidens*; E. Africa, Sabaki R., 1955.1.24.36., prestd. by Hugh Copley, 1 ovigerous female of 67.5 mm and 3 males of 82.5 to 90.0 mm, identified as *M.equidens*; E. Africa, Tana R. At Wengi, 15.7.48, coll. W.E.Frost, 1 small damaged specimen, identified as *M.rude*; India, near Ennore, Madras, coll. J.R.Henderson, 3 large individuals including 2 ovigerous females; India, Madras, coll. F.Day, 6 males of 70.2 to 105 mm, and 6 ovigerous females of 74.8 to 92.8 mm.

Leiden: Ceylon, Arugum Bay, 12th April 1958, prest. C.H. Fernando, 1 ovigerous female of 75.0 mm and 1 ex-ovigerous female of 69.6 mm.

Amsterdam: S. Africa, Durban, 1894, M. Weber, 1 non-ovigerous female of 86.5 mm, identified by Holthuis as *M.equidens*; S. Africa, Umgevi R., nr. Durban, M.Weber, 1 non-ovigerous female of 44.5 mm, identified by Holthuis as *M.equidens*.

NOTES:

As is noted by Barnard (1950) the systematics of the large Palaemonid prawns of eastern and southern Africa is in a very unsatisfactory state. One of the principal factors contributing to this confusion has been the attempt to distinguish two species of prawns corresponding to *M.equidens* and *M.rude* amongst the fresh and brackish water river prawns of the area. In my opinion this attempt is doomed to failure since only *M.rude* extends to the African area. The specimens which authors have referred to *M.equidens* and its synonyms are to be interpreted as specimens of *M.rude* which for one reason or another have not yet attained to the full specific characters of the 2nd legs.

Fully adult males of *M.rude* are easily distinguishable from full grown males of *M.equidens* by the following features: the 2nd legs in *M.rude* are covered all over with a short, dense, velvety pubescence, whilst in *M.equidens* there is no setation, apart from occasional scattered hairs, except on the fingers; in *M.rude* the 2nd legs are covered by a very fine granulation which is often hidden beneath the pubescence, whereas in *M.equidens* the 2nd legs are distinctly spinescent (Holthuis's key is misleading in including *M.rude* amongst the species with spinescent legs). In *M.rude* both fingers have the cutting edge lined on either side by a row of tubercles which are often sharply pointed; such tubercles are absent in *M.equidens*; in *M.rude* the hepatic spine is very slightly lower than the antennal spine, whereas in *M.equidens* the two spines almost always lie at exactly the same level; finally there are important differences in the form of the rostrum which are discussed below.

It may seem surprising that confusion could have arisen in view of such differences. A contributing factor has been the prevailing confusion as to the identity of *M.sundaicus* which name has often included other species in addition to *M.equidens*. At least one of these, *M.mamillodactylus*, is more like *M.rude* in some respects than is *M.equidens* itself. More important has been the failure of workers to appreciate that in the genus *Macrobrachium* specific characters are often only completely developed in old males, so that they may be absent in sexually mature individuals. Full adult but relatively small individuals of both *M.rude* and *M.equidens* show only imperfect development of the specific characters. Thus most of the characters referring to the 2nd legs must be used with caution unless large males are available.

It is clear that the characters used by workers on African material to distinguish *M.sundaicus* from *M.rude* have been negative characters based on the absence of the characteristic features of full grown males of *M.rude*. Thus Hilgendorf (1898) considers that the distinguishing features of his *sundaicus* are: the smooth carapace; the absence of felt on the 2nd leg and on the 3rd joint of the 1st leg; and the absence of rows of tubercles on the fingers of the smaller chela. It is clear from the last statement that such tubercles may be present on the larger chela; this is sufficient to rule out any identification with *M.equidens* which never has such tubercles on either leg. All these distinctions are merely differences due to size and age variation. Similarly Barnard in dealing with his cf. *sundaicus* notes as possible differences from *M.rude* the smooth carapace and the fact that his male specimens have the 2nd legs lacking granulations, though covered with a felt-like pubescence. These specimens are of comparatively large size (up to 112 mm); but development of a spinulose carapace and of granulate 2nd legs is characteristic of very large males, and is probably inconstant even then. Neither of these features can be used to suggest relationship with *M.equidens* since a) males of *M.equidens* of this size have distinctly spinulose 2nd legs and b) males of *M.equidens* of this size have a somewhat rough carapace. The other features which Barnard mentions, such as the woolly pubescence and the presence of tubercles along either side of the cutting edges of the fingers, show that he was really dealing with *M.rude*, a conclusion which is confirmed by his fingers of individual rostra, all of which are of characteristic *M.rude* form. In my opinion the specimens assigned by Coutière to *P.sundaicus* are also representatives of *M.rude*. I have not seen the specimens on which Rathbun's record was based but, in view of the cumulative evidence that *M.equidens* does not extend to Africa I feel that these must be assigned to *M.rude*. The African specimens assigned by Weber to *P.sundaicus* and by Holthuis to *M.equidens* proved on re-examination to be specimens of *M.rude*. They agree with that species and disagree with *M.equidens* in the detailed shape of the antennal scale, the form of the rostrum, and the position of the hepatic spine. I consider that there is no reliable evidence for the occurrence of *M.equidens* in African or Madagascan waters and that all previous records of that species most probably refer to *M.rude*.

It will be clear from the above account that females and juveniles of these two species are very similar in structure. The slight difference in the position of the antennal and hepatic spines appears to be constant; but it is a very difficult character to use. The form of the antennal scale also shows slight differences. In this respect *M.rude* is intermediate between *M.equidens* and *M.mamillodactylus*. The outer margin of the scale is straight as in *M.equidens*; but the terminal portion of the scale is less produced and squarer than in *M.equidens* though somewhat more rounded than in *M.mamillodactylus*.

By far the best character to distinguish *M. equidens* and *M. rude*, in the absence of males, is the form of the rostrum. Unfortunately both species show a considerable amount of variation in details of rostral form, in details of rostral armature, and in rostral length. Thus it is difficult to frame a definition or produce illustrations to reveal these differences adequately. It is clear that the rostrum in *M. rude* is relatively much higher at the base and much more sharply tapering than that of *M. equidens*, which is comparatively slender and of more uniform width. The rostrum of *M. rude* is usually almost straight, whilst the rostrum of *M. equidens* is commonly much more upturned. On the average the rostrum of *M. equidens* tends to have fewer dorsal and more numerous ventral teeth than that of *M. rude*; but these differences are not constant. The rostral formula for *M. rude* is

$$\frac{10 - 15 \text{ (rarely 17)}}{3 - 6 \text{ (rarely 8)}}$$

The nature of Stebbing's *Palaemon delagoae* must, in my opinion remain doubtful, until such time as Stebbing's types are re-examined. Stebbing's own description is inadequate for identification. It can only be said from it that the specimen cannot be *M. equidens* and is probably not *M. rude* either. The form and armature of the 2nd legs and the position of the hepatic spine are suggestive of *M. idae*; but the rostrum is of the wrong form for that species. Barnard has re-examined the specimen but his short notes are again inadequate to determine its relationships. He states that the setation of the 2nd legs is confined to the fingers and is present on both fingers. The 2nd legs are also described as tuberculate. These features suggest identification with *M. idae* rather than with *M. rude*. *Palaemon delagoae* is thus most probably synonymous with *Macrobrachium idae* but the possibility that it is synonymous with *M. rude* cannot be ruled out until the specimen has once more been redescribed.

Palaemon (Eupalaemon) cf. idae var. idella of Barnard, on the contrary, is certainly neither *Macrobrachium idae* nor *M. idella*. The characters of the 2nd legs leave no doubt that these specimens are merely individuals of *M. rude* in which the rostrum is slightly abnormally formed.

DISTRIBUTION AND ECOLOGY:

M. rude appears to be common throughout the coastal regions of eastern Africa from Natal to Somaliland. It is also found in Madagascar, Ceylon, southern India, and eastern India north to the Ganges delta region. In India and possibly also in Ceylon its range overlaps with that of *M. equidens*. Like the latter species it is found in brackish waters; but it is more frequently encountered than that species in fresh waters.

The East African species of the genus *Macrobrachium*.

In view of the confusion which has characterized determinations of specimens of this genus from eastern

Africa the following listing of specific names which have been applied to prawns from this area together with their true identities may prove useful.

borradaillei Stebbing, 1923 (*Urocaridella*) = *M. rude* (Heller)
delagoae Stebbing, 1915, Barnard, 1950. (*Palaemon*) = ?*M. idae* (Heller)
delagoae Rathbun, 1935 (*Palaemon*) = ?*M. rude* (Heller) or *M. idae* (Heller)
dolichodactylus Hilgendorf, 1879, 1898. Coutière, 1901, 1902, Colosi, 1918, Stebbing, 1910, Vatova, 1943, Barnard, 1950 = *M. scabriculum* (Heller)
equidens Holthuis, 1950a (*Macrobrachium*) = *M. rude* (Heller)
idae Hilgendorf, 1869 (*Palaemon*) = *M. idae* (Heller)
cf. idae Ortman, 1894 (*Palaemon*) = ?*M. idae* (Heller)
idae idella Hilgendorf, 1898 (*Palaemon*) = *M. idella* (Hilgendorf)
cf. idae var. idella Barnard, 1950 (*Palaemon*) = *M. rude* (Heller)
lar Hilgendorf, 1898, Lenz, 1905, 1910 (*Palaemon*) = *M. lar* (Fabricius)
lepidactylus Hilgendorf, 1879, 1898, Barnard, 1950 = *M. lepidactylus* (Hilgendorf)
lepidactylus Stebbing, 1908, 1910 (*Macroterocher*) = *M. lepidactylus* (Hilgendorf)
lepidodactylus Pfeffer, (*Palaemon*) = *M. lar* (Fabricius) and possibly in part *M. lepidactylus* (Hilgendorf)
moorei Calman, 1899 (*Palaemon*) = *M. moorei* (Calman)
moorei Holthuis, 1950 (*Macrobrachium*) = *M. moorei* (Calman)
Mossambicus Hilgendorf, 1879, 1898, Colosi, 1918 (*Palaemon*) = *M. rude* (Heller)
niloticus P. Roux, 1838, Heller, 1862, Klunzinger, 1866, Hilgendorf 1898, J. Roux, 1927, Gordon, 1935, (*Palaemon*) = *M. niloticum* (P. Roux)
niloticum Holthuis, 1950 (*Macrobrachium*) = *M. niloticum* (P. Roux)
patsa Rathbun, 1935, Holthuis, 1950 (*Macrobrachium*) = *M. patsa* (Coutiere)
petersii Hilgendorf, 1879, 1898, Ortman, 1891, Weber, 1892, Barnard, 1950 (*Palaemon*) = *M. petersii* (Hilgendorf)
petersii Stebbing, 1910 (*Parapalaemon*) = *M. petersii* (Hilgendorf)
petersii Holthuis, 1950 (*Macrobrachium*) = *M. petersii* (Hilgendorf)
rudis Stebbing, 1908 (*Eupalaemon*) = *M. rude* (Heller)
rudis Vatova, 1943, Barnard, 1950 (*Palaemon*) = *M. rude* (Heller)
rude Holthuis, 1950 (*Macrobrachium*) = *M. rude* (Heller)
scabriculum Holthuis, 1950 (*Macrobrachium*) = *M. scabriculum* (Heller)
sundaicus Weber, 1897, Hilgendorf, 1898, Coutiere, 1901, Stebbing 1915 (*Palaemon*) = *M. rude* (Heller)
sundaicus Stebbing, 1910, Barnard, 1926 (*Eupalaemon*) = *M. rude* (Heller)
sundaicus Barnard, 1947 (*Palaemon*) = *M. rude* (Heller)
cf. sundaicus Barnard, 1950 (*Palaemon*) = *M. rude* (Heller)

The valid species occurring in eastern Africa are:

M.idae (Heller), from Zanzibar and possibly Dar-es-Salaam and Delagoa Bay.

M.idella (Hilgendorf) from 3 localities in Tanganyika

M.lar from Zanzibar and Pemba

M.lepidactylus from a number of localities ranging from the north eastern regions of Cape Colony through Natal to the eastern Transvaal and Tanganyika

M.moorei (Calman) from Lake Tanganyika

M.patsa (Coutiere) from Tsavo in Kenya

M.petersii (Hilgendorf) from Natal and Mossambique as far as north as the Zambesi

M.rude (Heller) abundant and widely distributed along the coastal strip from East London north to Somaliland

M.scabriculum (Heller) from the Zambesi to Somaliland.

Of these 10 species 2 are of doubtful validity.

M.idella may merely be a variety of *M.idae* and

M.petersii may be a subspecies of *M.scabriculum*.

Table 1. Measurements of individuals of *M. malcolmsonii malcolmsonii*. Measurements of carpus and chela refer to the larger second leg. All measurements are in millimetres.

Form	Locality	Overall Length	Carpus Length	Chela Length
High males	Unknown	148.0	84.0	112.8
	Madras	143.5	82.0	111.0
	Unknown	134.3	76.4	93.8
	Madras	111.0	60.0	80.5
Low males	Bombay	157.6	48.1	81.9
	Ceylon	137.0	44.3	66.3
	Bombay	122.7	31.1	50.1
	Bombay	90.6	20.7	28.5
Females	Unknown	115.9	20.2	26.1
	Madras	92.5	13.3	15.9

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