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VOLUME VI.

No. IX.—ON CARIDES FROM THE WESTERN INDIAN OCEAN.

BY L. A. BORRADAILE, M.A.

*(Lecturer in Zoology in the University of Cambridge, Fellow, Dean, and Lecturer
of Selwyn College.)*

(COMMUNICATED BY PROF. J. STANLEY GARDINER, M.A., F.R.S., F.L.S.)



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(Plates 58, 59.)

Read 2nd November, 1916.

THE prawns which are enumerated in this paper are the residue of several large collections, a great part of which has already been described elsewhere. They were gathered by Professor J. Stanley Gardiner's two expeditions to the Islands and Banks of the Western Indian Ocean, and by Mr J. C. Fryer in Aldabra. I have dealt with the Pónæides and Stenopides of these collections in an article in the Transactions of this Society which appeared in February 1910 ((2) Zool. xiii. pt. 2, p. 257), and with the freshwater Carides in other articles in the same publication ((2) Zool. xii. pt. 1, p. 63, and xiii. pt. 3, p. 405) and in Gardiner's Fauna of the Maldives (vol. i. p. 64). The Alpheidæ have been reported upon by Professor Coutière in Gardiner's Fauna of the Maldives (vol. ii. p. 852) and in the present volume, and the Pontoniidæ by myself, also in this volume (pp. 323—396). Only 26 species remain to be dealt with here, but these are by no means the least important part of the collections. Twelve of them were new to science, including one for which it has been necessary to found a new genus*, and there is an exceptionally large proportion of interesting forms. The common but remarkable species *Saron marmoratus* is of course included, and this allows me to make some remarks concerning Mr Kemp's recent discoveries with regard to the seeming dimorphism of the males, to which I first called attention in the year 1898. There is a new species of the genus *Thor*, hitherto only known to contain *T. paschalis* (Heller). The rare *Ligur uveæ*, hitherto only known by the specimens described by myself from the Loyalty Islands, has reappeared, and I am enabled to add some details to my original description. *Lysmatella* is a new genus related to *Hippolysmata* but, somewhat strangely, unprovided with mastigobranchs upon the legs. The specimens which I have referred to *Leander debilis* throw some light upon the meaning of the great variability of this species and upon the nature of the numerous forms related

* Short definitions of the new species and of the new genus have already appeared in the Annals and Magazine of Natural History for February, 1915.

to it, showing that we have here quite possibly a number of distinct local races—a rare phenomenon among Carides. *Nikoïdes maldivensis* is a second representative of a genus which has not been met with since it was described in Paulson's well-known but for a long time inaccessible paper on the Decapoda of the Red Sea. Lastly, a study of the species of *Amphipalæmon*, *Hymenocera*, and *Gnathophyllum* has elucidated the relationships of these very interesting and remarkable genera, and necessitated a very considerable rearrangement of families in the neighbourhood of the Crangenoïda. There is, indeed, no exaggeration in saying that the result of the examination of this little collection will be to bring about fundamental alterations in our ideas of the affinities of the higher families of the Carides.

It is unfortunately not possible at present to draw any conclusions concerning the geographical distribution of the Indopacific prawns.

The following is a list of the species, with comments upon facts of interest concerning them.

Superfamily PASIPHÆOÏDA.

Family PASIPHÆIDÆ.

Genus LEPTOCHELA.

1. *Leptochela robusta* Stimpson, 1860.

Proc. Acad. Philadelphia, 1860, p. 43. de Man, Abh. Senckenb. Ges. xxv. III. p. 902 (1902).

Haddumati Atoll, Maldive Is.

Superfamily PANDALOÏDA

Family PANDALIDÆ.

Subfamily PANDALINÆ.

Genus PANDALUS.

Subgenus PLESIONIKA.

2. *Pandalus (Plesionika) gracilis* Borradaile, 1915 (Plate 58, fig. 1).

Ann. Mag. Nat. Hist. (8), xv. p. 208.

Diagnosis: The *rostrum* is long (its tip appears to be damaged in the specimen) and of even width throughout. At its base two strong teeth stand above the eye on a crest which extends backwards over the first half of the carapace. The rostrum itself is gently upcurved from the base; about the hindermost third of its length is unarmed; the rest bears below a series of small sharp teeth, set wider apart towards the tip of the organ, and above eight minute spinules, widely set, the last two being somewhat larger than the rest. The *eye* is wider than its stalk, and has a distinct ocellus. The stalk of the *antennule* is less than the length of the antennal scale. The flagella

of antennule and antenna are broken short in the specimen. The *third maxilliped* reaches more than half-way along the antennal scale. The *first leg* is simple and sparsely hairy and barely falls short of the end of the third maxilliped. The *second leg* reaches the end of the first; its wrist is nine-jointed, the first five joints being longer and less distinct than the rest. The *legs of the last three pairs* are missing from the specimen. The third *abdominal tergum* is convex behind, but not produced into a spine. The sixth abdominal segment is longer than the fourth and fifth together. The telson is missing from the specimen.

Length of specimen from tip of rostrum to tip of uropods 49 mm.

The species appears to be related to *P. martius* A. M.-Edwards, 1883, and *P. ensis*, (A. M.-Edwards), 1881.

A single female specimen was taken at a depth of 200 fathoms in the Western Indian Ocean.

Genus HETEROCARPUS.

3. *Heterocarpus unicarinatus* Borradaile, 1915 (Plate 58, fig. 2).

Ann. Mag. Nat. Hist. (8), xv. p. 208.

A specimen taken in 637—665 fathoms near Providence Island is closely related to *H. longirostris* MacGillchrist, 1905 [Ann. Mag. N. H. (8), xv. p. 237] but distinguished by the loss of the hinder three-quarters of the antennal carina, of which the forepart is present though not sharply formed. The specimen is a good deal damaged, and may have presented other differences from *H. longirostris*. It measures 92 mm. to the tip of the rostrum, which is broken. Provisionally, at least, it deserves specific recognition.

4. *Heterocarpus affinis* Borradaile, 1915.

Ann. Mag. Nat. Hist. (8), xv. p. 208.

Specimens taken in 300—500 fathoms near Saya de Malha are nearly related to *H. alphonsi* Bate, 1888, but show the following points of difference: (1) the *rostrum* is much more strongly upcurved, and has three teeth on the carapace behind the orbit, (2) there are fewer joints in the wrists of the *second legs* (26 and 9, as against 40 and 11), (3) the *walking legs* considerably outreach the antennal scale. The *telson* bears five pairs of spines on the dorsal surface and three pairs at the end. The longest specimen is 12 cm. in length, including the rostrum.

Subfamily THALASSOCARINÆ.

Genus THALASSOCARIS.

5. *Thalassocaris crinitus* (Dana), 1852.

Regulus crinitus, Dana, U. S. Explor. Exped. Crust. i. p. 599; Atlas, Pl. 39, fig. 6.

The rostrum of this species may be somewhat longer than in the specimen figured by Dana, and the rostral formula varies within the limits $\frac{8-10}{2-3}$.

Specimens were taken in various depths down to 80 fathoms at Amirante I. Cargados Carajos, the Maldives, Saya de Malha, and the Seychelles.

6. *Thalassocaris affinis* Borradaile, 1915 (Plate 58, fig. 4).

Ann. Mag. Nat. Hist. (8), xv. p. 208.

Diagnosis: The species is closely related to *T. lucidus* (Dana), 1852, but differs from it in the following points: the *rostrum* is less strongly upcurved, and is usually rather shorter. Its formula is $\frac{8-10}{2-3}$. The "teeth" on the *antennal scale* are hooked thorns, stronger than in *T. lucidus* and set wider apart. The hands of the *second legs* are of the shape of *T. crinitus*—rectangular, with widely gaping fingers and a strong basal knob on the fixed finger, and a stout tooth on the moveable finger. The merus in the *walking legs* bears the stout thorns present in *T. crinitus* but neither mentioned nor figured by Dana for *T. lucidus*.

Length of the longest specimen 25 mm.

Many of the specimens are mature, and some of them are considerably larger than the smaller specimens of *T. crinitus*. *T. affinis* appears to be intermediate between *T. lucidus* and *T. crinitus*. It was taken at various depths down to 26 fathoms in the Maldives and at Saya de Malha.

7. *Thalassocaris maldivensis* Borradaile, 1915 (Plate 58, fig. 5).

Ann. Mag. Nat. Hist. (8), xv. p. 208.

Diagnosis: The *body* is stout and compressed. The *rostrum* outreaches the antennal scale, at first descends and then is horizontal, and has the formula $\frac{7-8}{2}$, two of the dorsal teeth standing behind the orbit with sometimes a vestigial tooth behind the first of them. Suborbital and antennal, but no supraorbital or hepatic *spines* are present. The *antennal stalk* is slightly outreached by the antennular, and extends to about one-third of the length of the *antennal scale*, which is without teeth on the outer edge. The *third maxilliped* nearly reaches the end of the antennal scale. The *first leg* ends at the middle of the last joint of the third maxilliped. The *second leg* outreaches the third maxilliped and has a small chela of simple form, the wrist about as long as the arm, and the fingers shorter than the palm. The *legs of the last three pairs* are sparsely hairy and of moderate length and stoutness. The abdominal *pleura* are sharp pointed. The *third abdominal somite* has no spine on its hinder edge. The *telson* is longer than the uropods and has four pairs of dorsal spines and two fixed terminal spines.

Length of the longest specimen 19 mm.

Peculiar features of the species are the absence of the spine on the third abdominal segment and of the supraorbital spines, and the feebleness of the second leg. The first maxilliped differs greatly from that figured by Dana for *T. lucidus*, but the latter was probably drawn from a damaged specimen.

Specimens were taken in Suvadiva, Mulaku, Haddumati, and S. Nilandu Atolls in the Maldives.

Superfamily PALÆMONOIDA.

Family ALPHEIDÆ.

The Alpheid Prawns collected by Professor Gardiner's Western Indian Ocean Expedition form the subject of a separate report by Prof. Couzière in this volume.

Family HIPPOLYTIDÆ.

Genus SARON.

8. *Saron marmoratus* (Olivier), 1811.

Palæmon marmoratus, Olivier, *Encycl.* viii. (*vide* H. M.-Edwards).

Hippolyte gibberosus and *H. marmoratus*, H. M.-Edwards, *H. N. Crust.* ii. pp. 378, 379, Pl. 25, fig. 8 (1837).

Hippolyte gibberosa and *H. marmorata*, de Man, *Arch. Naturg.* liii. i. p. 533 (1888).

Saron marmoratus, Borradaile, *Proc. Zool. Soc. Lond.*, 1898, p. 1009; Kemp, *Rec. Ind. Mus.* x. p. 84 (1914).

The rest of the synonymy of *S. marmoratus* will be found in the last two papers quoted.

Kemp (*loc. cit.*) has shown that the relation of the two forms of the male of this species is not, as I had formerly suggested, a true dimorphism, since the individuals do not fall into two well-defined groups but form a graded series. This does not appear either in the present specimens, which are *all* of the *gibberosus* type, or in those which served as the basis of my earlier remarks upon the subject, in which there were two sharply-defined groups. I have, however, no doubt that Mr Kemp's solution of the question is the correct one, and that the *marmoratus* characters are gradually assumed by the males with age.

The collection contains 28 specimens from Salomon, Amirante, the Maldives, Minikoi, and Coetivy, Seychelles.

9. *Saron neglectus* de Man, 1902.

Abh. Senckenb. Ges. xxv. p. 854, Pl. 26, fig. 58. Kemp, *Rec. Ind. Mus.* x. p. 87 (1914).

One specimen from Egmont Reef, Seychelles.

Genus LIGUR.

10. *Ligur weæ* (Borradaile), 1902.

Parhippolyte weæ, Borradaile, *Willey's Zool. Results*, p. 414, Pl. 38, figs. 11 a—g.

Ligur weæ, Kemp, *Rec. Ind. Mus.* x. p. 123 (1914).

The original description of this species omits the fact that the meropodites of the legs of the second pair, and the propodites of those of the last three pairs, are multiarticulate.

Numerous specimens from Aldabra.

Genus THOR.

11. *Thor maldivensis* Borradaile, 1915 (Plate 58, fig. 6).

Ann. Mag. Nat. Hist. (8), xv. p. 208.

Diagnosis: The *body* is moderately compressed. The *carapace* is short, not keeled, and has large supraorbital and small antennal spines. The *third abdominal segment* projects in the middle behind. The *rostrum* is very short, not reaching the end of the

first joint of the antennular stalk, its tip is simple, and it bears one tooth above at the level of the eye and none below. The *antennular stalk* is a little shorter than the antennal, its last two joints are very short and broad, and it bears a strong spine on each joint, those on the first two joints being sharp and external and the third broad, dorsal, and sutured. The *antennal stalk* is nearly half the length of the scale. The latter reaches nearly as far as the stouter flagellum of the antennule, has a convex inner edge, a straight outer edge, and a rounded end, and bears on the outer side a distal spine, which does not project as far as the end. The *third maxilliped* is strong, and outreaches the antennal scale in the male by more and in the female by less than the whole of the last joint. The last and antepenultimate joints are subequal, each more than twice as long as the penultimate joint, the last joint is spinous, and all the joints are hairy. The *first leg* in the female is stout, simple, and shorter than the third maxilliped. In the male, it is as long as the body, granulate, and stout, but with the chela no stouter than the rest of the limb, the arm and hand are subequal, and the fingers about one quarter the length of the palm, on which they are bent inwards at an obtuse angle, each bearing a low tooth. The *second leg* has the wrist 5-jointed, with the second joint much longer than any of the others and showing an indistinct ring near its proximal end. The *legs of the last three pairs* are alike in the two sexes, of medium length, with a blunt spine at the end of the carpopodite, a row of spinules under the propodite, and the dactyle short, stout, ending in a slender claw, and bearing below several moveable spinules of which the last is longer than the end claw. The *telson* is shorter than the uropods, narrow, and tapers to an obtusely triangular end bearing six spines, of which the intermediate pair are the longest.

Length of longest specimen 13 mm.

The genus *Thor* has hitherto contained only one known species, *T. paschalis* Heller 1861 (*T. floridanus* Kingsley). The present species has all the characters of the genus, including those of the mandible, but the great claw of the male is a new feature. The principal differences from *T. paschalis* are presented by the supraorbital spine, the rostrum, the first and third legs of the male, and the proportions of the joints of the second leg.

Specimens were taken at Malé Atoll in the Maldives, in Minikoi, and at Salomon I.

Genus TOZEUMA.

12. *Tozeuma armatum* Paulson, 1875.

Red Sea Crustacea, p. 99, Pl. 15. figs. 2*a*—*o*. Kemp, Rec. Ind. Mus. x. p. 106 (1914).

Specimens were taken in various depths in the Maldives, the Seychelles, and Cargados Carajos.

Genus LYSMATA.

13. *Lysmata affinis* Borradaile, 1915.

Ann. Mag. Nat. Hist. (8) xv. p. 209.

Diagnosis: a *Lysmata* closely related to *L. seticauda* (Risso), 1816, and to *L. chiltoni* Kemp, 1914, but distinguishable from them and from the other species of the genus

by the following combination of features: the *rostrum* reaches well beyond the eyes, but ends just before the middle of the second joint in the antennular stalks. Its formula is $\frac{5-6}{2-3}$, the lower teeth being small, but larger than in *L. chiltoni*, and the hinder of them standing below the last upper tooth. The *pterygostomial angle* is rectangular and usually produced into a spinule. The *thick flagellum* of the antennule is fused to the slender one for half its own length. The *antennal scale* curves gently outwards and narrows slightly towards the end, which is truncate and distinctly outreached by the distal spine, the *first leg* slightly outreaches the scale but falls considerably short of the end of the third maxilliped. The wrist joint is as long as, usually a trifle longer than, the chela. The *second legs* are equal or unequal. The longer of the pair outreaches the antennal scale by rather less than the whole wrist. The latter has 24—25 joints. There are double tips to the fingers. The *walking legs* have spinules below the meropodites. The first outreaches the antennal scale by the dactyle and nearly the whole propodite, the second by the propodite only, and the third falls a little short of the end of the scale.

Length of the longest specimen 31 mm.

Specimens were taken in Minikoi, Peros Banhos, Salomon, and the Seychelles.

Genus HIPPOLYSMATA.

14. *Hippolysmata vitatta* Stimpson, 1860.

Proc. Acad. Philadelphia, 1860, p. 26. de Man, Trans. Linn. Soc. London, (2) Zool. ix. p. 423 (1907). Kemp, Rec. Ind. Mus. x. p. 113 (1914).

Specimens were taken at Cargados Carajos in 30 fathoms, and in the Seychelles in 34 fathoms.

15. *Hippolysmata kükenethali* (de Man), 1902.

Merhippolyte orientalis, de Man (*nec* Bate), Weber's Zool. Ergebn. Reise Ost-Ind. ii. p. 407.

Hippolyte kükenethali, de Man, Abh. Senckenb. Ges. xxv. p. 849, Pl. 26, fig. 56 (1902).

Hippolysmata kükenethali, de Man, Trans. Linn. Soc. London, (2) Zool. ix. p. 426 (1907). Kemp, Rec. Ind. Mus. x. p. 115 (1914).

Ten specimens were taken on Egmont Reef, Seychelles. Each has a single tooth on the underside of the rostrum, and 14 or 15 joints in the wrists of the second legs.

Genus LYSMATELLA.

Borradaile, Ann. Mag. Nat. Hist. (8), xv. p. 206 (1915).

The collection contains three specimens of a new species which would have to be placed in the genus *Hippolysmata*, were it not for the absence of epipodites from the legs. In view of this somewhat important difference I have thought it best to establish for this species a new genus *Lysmatella*.

16. *Lyssmatella prima* Borradaile, 1915 (Plate 58, fig. 7).

Ann. Mag. Nat. Hist. (8), xv. p. 209.

Diagnosis: The *body* is compressed, the carapace of a good length, keeled in the forepart and provided with a strong antennal and a small pterygostomial spine. The *rostrum* is straight at first but gently upcurved towards the tip, outreaches the antennular stalk, and has the formula $\frac{8-11}{5-9}$, the first tooth standing detached on the carapace, the ventral teeth smaller than the dorsal, and all the teeth sloping very sharply forwards. The rostrum becomes relatively longer and more strongly curved as the individuals increase in size. The *antennule* has a long, slender stalk, and the stylocerite short, wide and curved. The *antennal scale* reaches the end of the penultimate joint of the antennular stalk, and is narrow, with nearly parallel sides and a broad, rounded end. The *third maxilliped* is as stout as the *first leg*, in which the hand and arm are subequal, the wrist a little shorter than either, and the fingers gape somewhat widely. In the *second leg* the wrist has 20—22 joints, of which the last is longer than any of the others. The dactyles of the *walking legs* are provided, besides the end-claw, with three moveable spines on the lower side, and of these the third is larger than the end-claw. The *telson* is barely shorter than the uropods, bears two pairs of moveable spines above, and is fringed with long, stout hairs.

Length of the longest specimen 19 mm.

Specimens were taken in Haddumati, Mulaku, and South Nilandu Atolls, Maldives.

Family PALÆMONIDÆ.

Subfamily PALÆMONINÆ.

Genus LEANDER.

17. *Leander debilis* (Dana), 1852.

Palaemon debilis, Dana, U. S. Explor. Exped. xiii. 1. (Crust.), p. 585, Pl. 38, figs. 6—7. de Man, Abh. Senckenb. Ges. xxv. III. p. 808 (1902).

The collection contains a large number of specimens of *L. debilis* from Aldabra which show the great variability which characterizes this species. The rostrum varies in length, shape, and dentation. It may be as long as, shorter than, or longer than the antennal scale. Its curves differ considerably in the specimens. Its formula in these examples is $\frac{2-6}{1-6}$, most commonly $\frac{5}{4}$, including the small tooth which is nearly always present near the tip. The size, shape, and spacing of the teeth varies. The wrist of the second leg varies in length, but usually falls a little short of the end of the antennal scale. The antennule agrees with de Man's description.

There are also a number of specimens from a "barachois" in Diego Garcia. These are less variable than the Aldabra specimens. The rostral formula is $\frac{4-8}{4-8}$, usually $\frac{6}{6}$. The average size is less than that of the Aldabra specimens, the largest specimen measuring 28 mm. in length. It is quite possible that we have here two distinct but closely allied species, such as the *L. debilis* and *L. gardineri* found in

Miladumadulu Atoll (Gardiner's Fauna of the Maldives, i. p. 98). In the case of the Miladumadulu species the habits and appearance of the prawns in the living state enabled the two forms to be distinguished with certainty. Possibly similar information would avail in the same way here.

Subfamily PONTONINÆ.

Many species of this subfamily are represented in the collection. They are enumerated in a separate article in this volume (pp. 323—396).

Superfamily CRANGONOIDA.

The bounds of this somewhat miscellaneous group must be enlarged to admit the genera *Anchistioides*, *Amphipalæmon*, and *Hymenocera*, which, in our present state of knowledge appear more closely related here than elsewhere. This addition involves two concessions in the definition of the group: (1) if *Anchistioides* and *Amphipalæmon* are to be admitted, it can no longer be stated that the mandible is always without incisor process, (2) the inclusion of *Hymenocera* makes it necessary to allow the persistence of a small representative of the second lobe of the maxilla.

Family ANCHISTIOIDIDÆ.

Borradaile, Ann. Mag. Nat. Hist. (8), xv. p. 205 (1915).

In 1899, reporting on the Macrura brought by Dr A. Willey from the South Seas, I established a genus *Palæmonopsis* for a new prawn, *P. willeyi*, taken in New Britain. In 1901, Nobili proposed to change the name of this genus to *Amphipalæmon*, on the ground that *Palæmonopsis* was preoccupied, having been used by Stimpson as a synonym of *Palæmonetes*. Both by Nobili and by myself the genus has been regarded as belonging to the Palæmonidæ.

The present collection contains two specimens, each representing a new species of *Amphipalæmon*. Examination of these, and re-examination of Dr Willey's original specimen, convinces me (1) that the characters of the new genus are so distinctive that it must become the type of a new family, (2) that the affinities of this family are at least as much with the Crangonoida as with the Palæmonoida, (3) that the genus *Anchistioides* founded by Paulson in 1875 is closely related to *Amphipalæmon*.

The characters of the Anchistioididæ may be stated as follows:

- (1) The *body* retains the typical caridoid facies.
- (2) The *rostrum* is well developed, compressed, and toothed.
- (3) There is no *supraorbital spine*, but there may be a blunt knob nearly in the same position.
- (4) The outer flagellum of the *antennula* bears at the base a short, thick, accessory flagellum. The stylocerite is inconspicuous or wanting.

(5) The *antenna* has a broad scale, truncate at the end, and is without a spine on its basipodite.

(6) The *mandible* is deeply cleft, the molar process has a broad end, surrounded with stout teeth, the incisor process is coarsely serrate, and there is no palp.

(7) The inner lacinia of the *maxillule* is round-ended, and not curved towards the outer lacinia.

(8) The laciniae of the *maxilla* are aborted.

(9) The exopodite of the *first maxilliped* has no flagellum, and its epipod is simple.

(10) The end-joint of the *second maxilliped* is applied to the inner edge of the recurved propodite. The epipodite of this limb is discoidal.

(11) The *third maxilliped* is slender, and has no exopodite, but a short broad epipodite.

(12) The *legs of the first two pairs* are without exopodites, chelate, with simple wrists, and subsimilar, but the second pair is longer and stouter than the first.

(13) The *legs of the last three pairs* are alike, without exopodites and adapted for walking.

(14) The *first five abdominal limbs* have a well-developed *appendix interna*, and in the first of them, especially in that of the male, the endopodite is small, so that it forms with the *appendix* a biramous organ.

(15) The *telson* bears two or three pairs of spines above, and at the end one strong pair of spines and several stout bristles, of which one or a pair are feathered.

(16) The *gills* comprise pleurobranchs for the legs and an arthrobranch for the third maxilliped. There are epipodites on the maxillipeds only.

The family appears to be transitional between the Palæmonoidea and the Crangonoidea.

The genera of Anchistioididæ may be distinguished as follows:

I. Without a blunt process of the carapace behind the eye. Scaphocerite present. The end of the telson bears, among others, one unfeathered bristle on each side and a pair of small lateral spines.

Anchistioides Paulson, 1875.

II. A blunt process of the carapace behind the eye. No scaphocerite. The end of the telson bears, among others, more than one unfeathered bristle on each side at the end of the telson, but no small lateral spine.

Amphipalæmon Nobili, 1901.

Genus AMPHIPALÆMON.

The species of *Amphipalæmon* are closely similar in most respects, but may be distinguished as follows:

I. Three pairs of spines on the dorsal side of the telson, and a median feathered bristle at the hinder end. Rostrum does not reach end of antennal scale [and is very deep and straight at base].

A. willeyi (Borradaile), 1899.

II. Two pairs of spines on the dorsal side of the telson, and a pair of feathered bristles at the hinder end. Rostrum at least reaches end of antennal scale.

A. Rostrum very deep, straight at base.

A. gardineri Borradaile, 1915.

B. Rostrum not very deep, arched at base.

A. cooperi Borradaile, 1915.

18. *Amphipalæmon gardineri* Borradaile, 1915 (Plate 59, fig. 14).

Ann. Mag. Nat. Hist. (8), xv. p. 209.

The most important difference between this species and *A. willeyi* lies in the arrangement of the spines of the telson. In the New Britain species, the two anterior pairs of spines on the dorsal side of this organ lie in its front half. In *A. gardineri* the second of them lies just behind the middle of the telson. In *A. willeyi* (Plate 59, fig. 13), the two small lateral spines of *Anchistioides*, which are also found in so many other Carides, have migrated to the dorsal surface of the telson. In *A. gardineri* they are altogether wanting. In the latter species, the adjoining spines, which thus become lateral, are longer than in *A. willeyi*. The pair of feathered bristles found in *Anchistioides* are present also in *A. gardineri*; in *A. willeyi* they are absent, but there is present a single median feathered bristle, shorter than those of *A. gardineri* and widened at the base.

Lastly, in *A. willeyi* there are a number of unfeathered bristles, of which three on each side are somewhat shorter than the rest. In *A. gardineri* only two such bristles are present.

Less important differences, which may quite possibly prove not to be constant, are: (1) that the rostrum has the formula $\frac{7}{3}$ and outreaches the antennal scale, and (2) that the first leg does not reach the end of the antennal scale, and (3) that the second leg outreaches the scale by only half the length of the palm, and its meropodite is relatively shorter.

The specimen, which measures 30 mm. in length, was taken in N. Malé Atoll.

19. *Amphipalæmon cooperi* Borradaile, 1915.

Ann. Mag. Nat. Hist. (8), xv. p. 209.

This species very closely resembles the preceding, but differs from it in the following points: (1) the rostrum has the formula $\frac{6}{3}$, barely outreaches the antennal scale, and is arched at the base and decidedly less deep, (2) the first leg reaches the end of the antennal scale, (3) the second leg outreaches the scale by the whole hand, (4) the

meropodite of this leg is longer than in either of the other species, equalling $\frac{6}{7}$ of the length of the hand, (5) the hinder pair of the dorsal spines of the telson lies farther back than in *A. gardineri*.

Length of single specimen 15 mm.

S. Nilandu Atoll.

Family GNATHOPHYLLIDÆ.

Professsor Gardiner's collection contains specimens of members of the genera *Gnathophyllum* and *Hymenocera* and also of the very interesting species described by Dr Balss as *Hymenocera ceratophthalma*. An examination of this material makes it quite clear that the species in question are all members of a single family. The principal characters of this family are as follows:

- (1) The body retains the typical caridoid facies, but is rather heavily built.
- (2) The *rostrum* is compressed and dentate.
- (3) The *antennal spine* alone remains on the carapace.
- (4) The *antennule* has a well-developed stylocerite, and the outer flagellum thick at the base and cleft for a very short distance at the end of the thick part.
- (5) In the *antenna* the scale may be broad or rather narrow, and is rounded at the end, and the spine of the basipodite is short or absent.
- (6) The *mandible* is simple, palpless, slender, and curved.
- (7) The inner lacinia of the maxillule is pointed and curved towards the outer lacinia.
- (8) The first lobe of the *maxilla* is totally lost and the second lobe is either lost or very small but still obscurely double.
- (9) The *first maxilliped* has a flagellum and the outer border of its epipodite is notched, but not deeply.
- (10) The end-joint of the *second maxilliped* is applied to the inner edge of the recurved propodite.
- (11) The *third maxilliped* has an exopodite, a simple epipodite, and an endopodite of four joints, some or all of which are greatly broadened.
- (12) The *legs of the first two pairs* are chelate, without exopodites and with simple wrists. The two pairs are more or less dissimilar, and the second pair is the larger.
- (13) The *legs of the last three pairs* are alike, without exopodites, and adapted for walking.
- (14) The *second to fifth abdominal limbs* have a well-developed *appendix interna*.
- (15) The *telson* bears two pairs of spines at the sides, and at the end an outer short and an inner longer pair of spines, a submedian pair of slender feathered spines, and a median pointed projection.

(16) The *gills* comprise pleurobranchs for the legs, an arthrobranch for the third maxilliped, and in *Hymenocera* the vestige of a pleurobranch for the latter limb. There are epipodites on the maxillipeds only.

A key to the genera of Gnathophyllidæ:

I. Ischium of third maxilliped narrow and moveably sutured to merus. Rostrum of a good length.

A. Mandible flattened. Lobe of maxilla present. Outer flagellum of antennule leaf-like.

Hymenocera Latreille, 1829.

B. Mandible subcylindrical. Lobe of maxilla lost. Outer flagellum of antennule normal.

Phyllognathia Borradaile, 1915.

II. Ischium of third maxilliped broad and marked off from merus by a notch only. Rostrum short.

[Mandible, maxilla and antennule as in *Phyllognathia*.]

Gnathophyllum Latreille, 1829.

Genus GNATHOPHYLLUM.

20. *Gnathophyllum fasciolatum* Stimpson, 1860 (Plate 59, fig. 8).

Proc. Ac. Philadelphia, 1860, p. 28. de Man, Arch. Naturg. liii. i. p. 496 (1888).
Abh. Senckenb. Ges. xxv. III. p. 762 (1902).

Gnathophyllum zebra, Richters, Meeresf. Mauritius, p. 161, Pl. 17, figs. 18—20 and 22 (1880).

All the specimens are completely bleached. A small antennal spine which is present in my specimens is not mentioned in any description of the species.

According to Nobili (Mem. Ac. Torino (2), lvii. p. 305), this species is identical with *G. americanus*, and should be known by that name.

Specimens were taken at Minikoi, Salomon I., and Egmont Reef, Seychelles.

Genus PHYLLOGNATHIA.

21. *Phyllognathia ceratophthalma* (Balss), 1914 (Plate 59, fig. 9).

Hymenocera ceratophthalma, Balss, Abh. k. Bayer. Ak. Wiss. Suppl. Bd. ii. 10, p. 54 (1914).

Phyllognathia ceratophthalma, Borradaile, Ann. Mag. Nat. Hist. (8), xv. p. 206 (1915).

Dr Balss has kindly communicated to me his opinion that this species is in reality a *Gnathophyllum*. Its transference to the Gnathophyllidæ will probably meet with approval, but in including it in *Gnathophyllum* some rather considerable differences between its mouth-parts and those of other species of the genus have to be discounted. In the third maxilliped of *Gnathophyllum*, the ischiopodite is fused with the meropodite,

though, by an exception to the rule in Carides, the boundary between these two joints is marked by a notch. In *H. ceratophthalma* the ischiopodite is distinct and even moveably articulated with the meropodite, a condition which I cannot remember to occur in any other Caridean except *Hymenocera*. In the second maxilliped of *G. fasciolatum* (the only species I have been able to examine), the last two joints form a very large scythe-shaped organ. In *H. ceratophthalma* they are rather smaller than in most Carides. Finally, in the maxillule of *G. fasciolatum* the outer lacinia is greatly enlarged, while in *H. ceratophthalma* it is of quite normal dimensions. In the characters of the second maxilla and mandible, however, *H. ceratophthalma* agrees very well with *Gnathophyllum*. Both the lobes of the maxilla are lost, and the mandible is simple, without palp, and of a slender, curved shape, with a blunt end provided with small teeth. I would suggest that it is advisable to establish a new genus of Gnathophyllidæ for Dr Balss's species. *Phyllognathia* would be an appropriate name for this species, which undoubtedly links *Hymenocera* with *Gnathophyllum*.

In Dr Balss's specimen the smaller leg of the second pair and the tip of the rostrum were missing. My specimen enables me to state that the rostrum slightly outreaches the antennular stalks and has the formula $\frac{7}{4}$, and that the smaller leg of the second pair has the same features as the larger but a somewhat narrower palm and less pronounced serration of the moveable finger. The larger leg of this pair is missing in my specimen; which was taken in S. Nilandu Atoll.

Genus HYMENOCERA.

The mandible of *Hymenocera* is of the same shape as that of *Gnathophyllum* save that it is flattened and ends in a serrated cutting edge, as though it represented the incisor process of the complete malacostracan mandible. In point of fact, however, there can be little doubt that it is really the molar process. The maxilla has a small outer lobe, which, however, retains traces of a notch. The telson is of precisely the same type as that of *Gnathophyllum*. The telson of *Crangon* is of the same type but more elongate. That of the Processidæ is more like those of the Pontoniinæ. The telson of *Glyphocrangon* is a much modified structure which has lost all spines.

22. *Hymenocera elegans* Heller, 1861 (Plate 59, fig. 10).

Verh. zool. bot. Ges. Wien, xi. p. 25; Sitzber. Ak. Wiss. Wien, xlv. i. p. 264, Pl. 3, figs. 9—14 (1861). Ortmann, Speng. Zool. Jahrb. Syst. v. p. 511, Pl. 37, fig. 11. A specimen was taken in Coetivy, Seychelles.

Family PROCESSIDÆ.

Genus PROCESSA.

23. ? *Processa processa* (Bate), 1888.

Nika processa, Bate, "Challenger" Macrura, p. 527, Pl. 95 (1883).

A specimen from the Seychelles which probably belonged to this species was unfortunately destroyed by an accident while it was under examination.

Genus NIKOIDES.

24. *Nikoides maldivensis* Borradaile, 1915 (Plate 58, fig. 11).

Ann. Mag. Nat. Hist. (8), xv. p. 209.

A single specimen, taken at the Amirante Is., is closely related to *N. danae* Pauls., 1875 (Res. Crust. Red Sea i. p. 98, Pl. 14, fig. 5), but differs from it in the following points: (1) the rostrum is of a different shape, the dorsal tooth being larger and placed much farther back, (2) the exopodite of the first leg is relatively shorter, reaching only half-way along the merus, (3) the carpopodites of the legs of the first pair are of equal length, (4) there are no spines on the ischium or merus in the legs of the last three pairs. The specimen measured 24 mm. in length. To the differences between *Processa* and *Nikoides* stated by Nobili, there should be added the presence in the latter of a single dorsal tooth on the rostrum.

Family GLYPHOCRANGONIDÆ.

Genus GLYPHOCRANGON.

Subgenus PLASTOCRANGON.

25. *Glyphocrangon (Plastocrangon) cæca* Wood-Mason, 1891.

Ann. Mag. Nat. Hist. Nov. 1891, p. 358; Ill. Zool. "Investigator" Crust. Pl. 3, fig. 1.

A single specimen taken in 300—500 fathoms at Saya de Malha.

Family CRANGONIDÆ.

Genus ÆGEON.

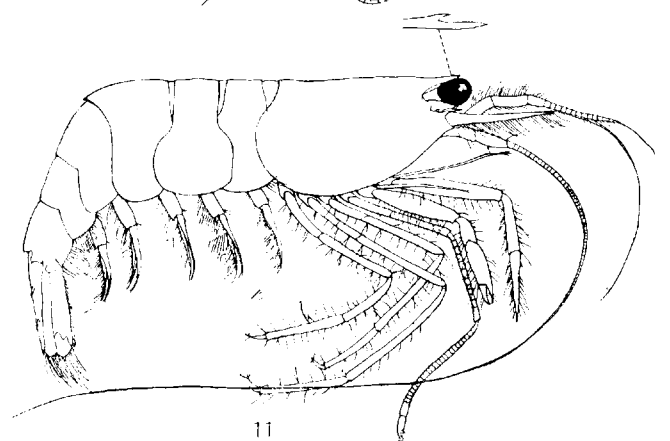
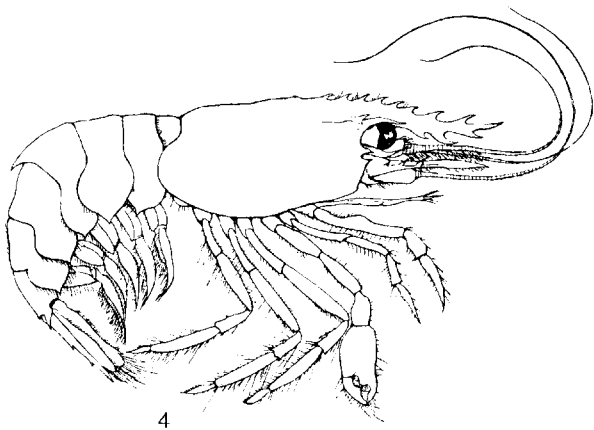
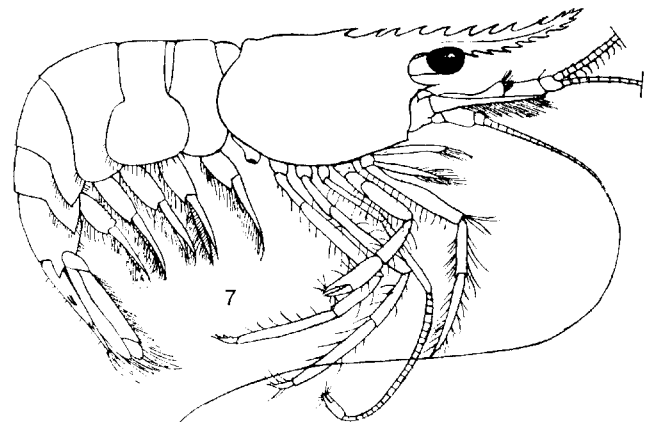
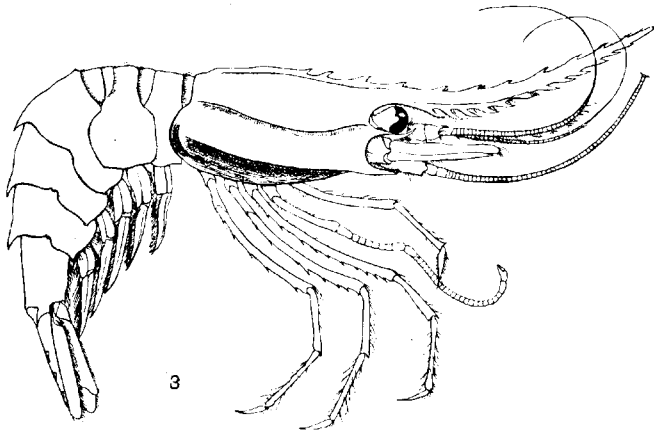
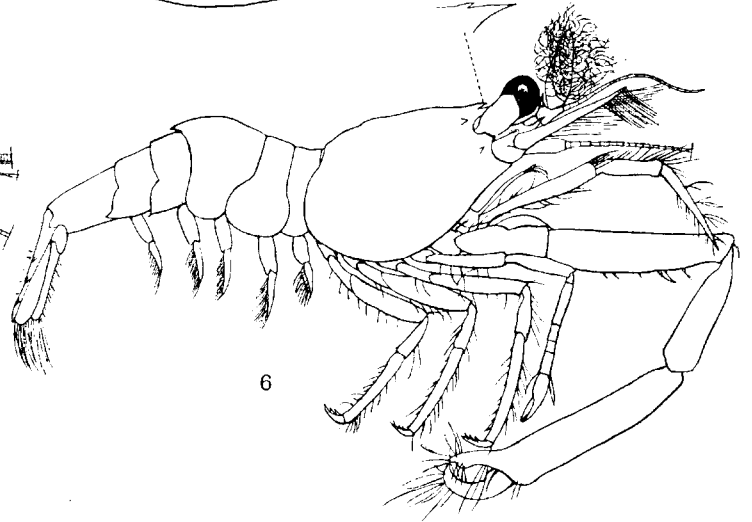
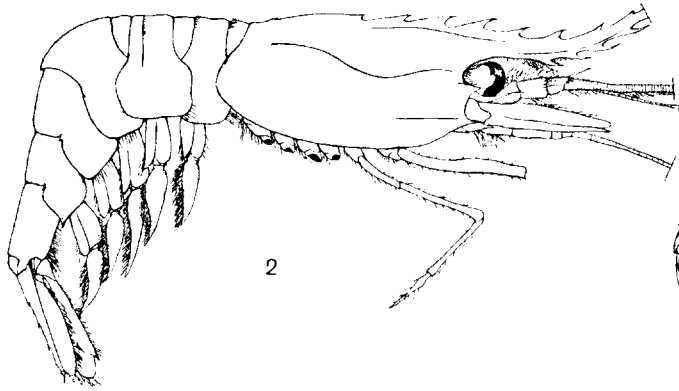
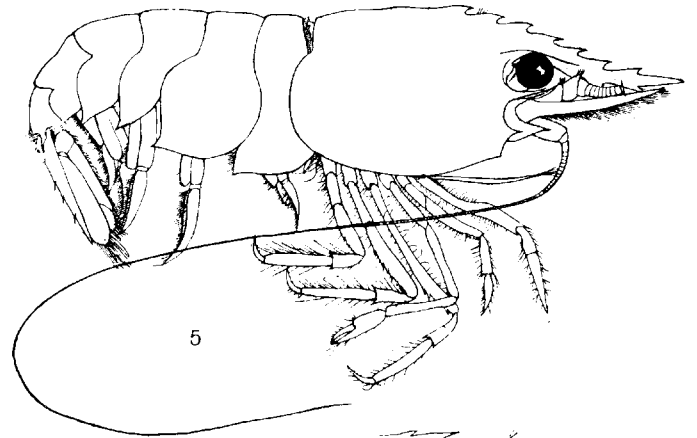
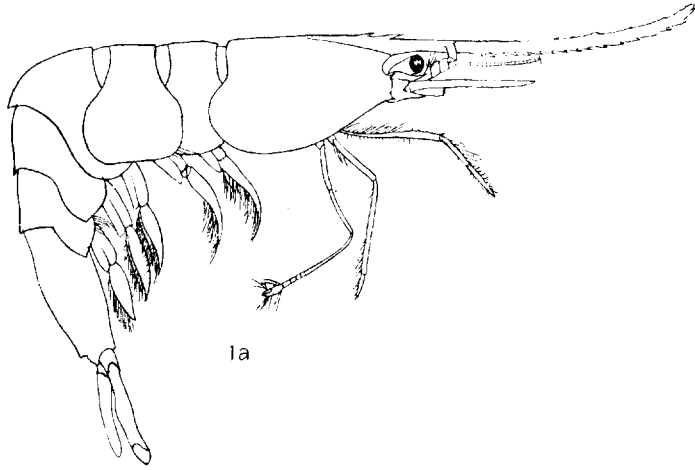
26. *Ægeon rugulosus* Borradaile, 1915 (Plate 59, fig. 12).

Ann. Mag. Nat. Hist. (8) xv. p. 210.

One damaged specimen, taken in Haddumati Atoll, Maldives, is related to *Æ. medius* (Alc. and And.), 1899, but differs from it in that: (1) the beading of the ridges of the carapace is much coarser, (2) there is no tooth on either side of the base of the rostrum, (3) the large spine near the pterygostomial angle of the carapace stands at the end of the supramarginal, not at that of the lateral ridge, (4) the dactyles of the first two walking legs are longer. The length of the specimen is 16 mm.

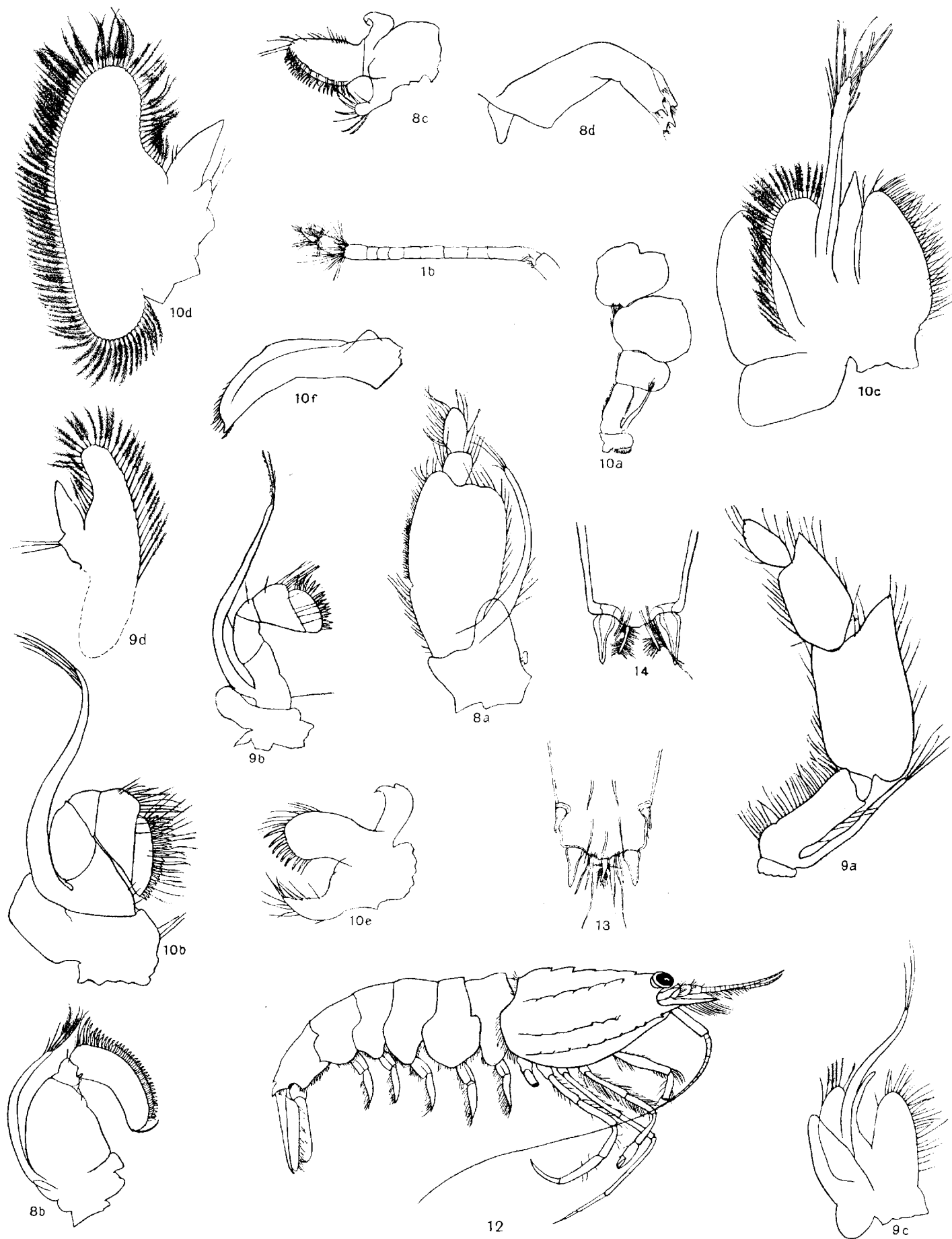
EXPLANATION OF PLATES 58, 59.

- Fig. 1. *Pandalus (Plesionika) gracilis* Borradaile, 1915 (Plates 58, 59). *a*, side view, $\times 2\frac{1}{2}$; *b*, end of second leg, $\times 12$.
- Fig. 2. *Heterocarpus unicarinatus* Borradaile, 1915 (Plate 58). Side view, $\times 1\frac{1}{2}$.
- Fig. 3. *Heterocarpus affinis* Borradaile, 1915 (Plate 58). Side view, nat. size.
- Fig. 4. *Thalassocaris affinis* Borradaile, 1915 (Plate 58). Side view, $\times 4$.
- Fig. 5. *Thalassocaris maldivensis* Borradaile, 1915 (Plate 58). Side view, $\times 4$.
- Fig. 6. *Thor maldivensis* Borradaile, 1915 (Plate 58). Side view, $\times 7$.
- Fig. 7. *Lysmatella prima* Borradaile, 1915 (Plate 58). Side view, $\times 4$.
- Fig. 8. *Gnathophyllum fasciolatum* Stimpson, 1860 (Plate 59). *a*, third maxilliped, $\times 16$; *b*, second maxilliped, $\times 16$; *c*, maxillule, $\times 16$; *d*, mandible, $\times 25$.
- Fig. 9. *Phyllognathia ceratophthalma* (Balss), 1914 (Plate 59). *a*, third maxilliped, $\times 16$; *b*, second maxilliped, $\times 16$; *c*, first maxilliped, $\times 16$; *d*, maxilla, $\times 16$.
- Fig. 10. *Hymenocera elegans* Heller, 1861 (Plate 59). *a*, third maxilliped, $\times 4$; *b*, second maxilliped, $\times 16$; *c*, first maxilliped, $\times 16$; *d*, maxilla, $\times 16$; *e*, maxillule, $\times 16$; *f*, mandible, $\times 25$.
- Fig. 11. *Nikoides maldivensis* Borradaile, 1915 (Plate 58). Side view, $\times 3$.
- Fig. 12. *Ægeon rugulosus* Borradaile, 1915 (Plate 59). Side view, $\times 4$.
- Fig. 13. *Amphipalaemon willeyi* Borradaile, 1899 (Plate 59). Telson, $\times 35$.
- Fig. 14. *Amphipalaemon gardineri* Borradaile, 1915 (Plate 59). Telson, $\times 35$.



CARIDES FROM THE WESTERN INDIAN OCEAN





CARIDES FROM THE WESTERN INDIAN OCEAN





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	Part VII.	1907	0	3	0	0	2	3
	Part VIII.	1907	0	4	0	0	3	0
	Part IX.	1909	1	1	0	0	15	9
	Part X.	1911	0	4	0	0	3	0
(<i>In progress.</i>)								
XI.	Part I.	1908	0	4	0	0	3	0
	Part II.	1909	0	8	0	0	6	0
	Part III.	1909	0	6	0	0	4	6
	Part IV.	1909	0	12	0	0	9	0
	Part V.	1909	0	2	0	0	1	6
	Part VI.	1910	0	11	0	0	8	3
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	Part XI.	1913	0	4	0	0	3	0
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(<i>In progress.</i>)								
XII.	Part I.	1907	1	8	0	1	1	0
	Part II.	1907	1	4	0	0	18	0
	Part III.	1908	0	16	0	0	12	0
	Part IV.	1909	1	10	0	1	2	6
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XIII.	Part I.	1909	1	4	0	0	18	0
	Part II.	1910	2	3	0	1	12	3
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	Part IV. Index	1910	0	5	0	0	3	9
XIV.	Part I.	1910	1	18	0	1	8	6
	Part II.	1911	1	0	0	0	15	0
	Part III.	1911	1	8	0	1	1	0
	Part IV. Index	1912	0	5	0	0	3	9
XV.	Part I.	1912	1	9	0	1	1	9
	Part II.	1912	1	4	0	0	18	0
	Part III.	1912	1	6	0	0	19	6
	Part IV.	1913	0	12	0	0	9	0
XVI.	Part I.	1913	1	4	0	0	18	0
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	Part III.	1913	0	12	0	0	9	0
	Part IV.	1914	1	10	0	1	2	6
	Part V. Index	1914	0	3	0	0	2	3
XVII.	Part I.	1914	2	0	0	1	10	0
	Part II.	1916	1	3	0	0	17	3
	Part III.	1917	1	5	0	0	18	9

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