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# OCCASIONAL NOTES ON AUSTRALIAN AMPHIPODA.

By

CHAS. CHILTON, M.A., D.Sc., F.L.S., C.M.Z.S.

(Professor of Biology, Canterbury College, New Zealand).

(Figures 1-5.)

Nos. 1 to 9.

During the last few years I have received from the Australian Museum and from other sources numerous specimens of Australian Amphipoda. The examination of these has brought to light many facts which seem worthy of publication, and it is proposed to give these in a series of papers as opportunity offers. In submitting the first of these papers I desire to express my grateful thanks to Dr. C. Anderson, Director of the Australian Museum, to Mr. Charles Hedley and to several members of the staff for the opportunity of examining and describing many of the species dealt with.

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No. 1.

## A NEW AUSTRALIAN SPECIES OF *Niphargus*.

In 1893 Mr. G. M. Thomson described two species of *Niphargus* from the fresh waters of Tasmania, viz., *N. montanus* and *N. mortoni*. The latter species is retained under the genus *Niphargus* by Stebbing in 1910, but the former is placed under *Neoniphargus* Stebbing to which Stebbing also assigns two species described by Sayce, viz.: *N. spenceri* and *N. fultoni*. Another species described by Sayce, *N. pulchellus* is also kept under *Niphargus* by Stebbing, and placed next to *N. mortoni*. The relationships of these species to one another and to the species of *Gammarus* described from Australia by Sayce and Geoffrey Smith will afford interesting work for future students of the Amphipoda.

In the meantime I am describing another new species of *Niphargus*. It differs considerably from those mentioned above, and comes close to species recently described from Chilka Lake, India, and from the Philippine Islands. These three species differ from the characters of *Niphargus* in one or two important characters and appear to belong to a special section of the genus which will probably have to be made into a separate genus. At present, however, I leave them under *Niphargus* as a matter of convenience. The following specific diagnosis may be given:—

NIPHARGUS AUSTRALIENSIS *sp. nov.*

Very near to *N. chilkaensis*. Eye not visible. Upper antenna with the first and second joints subequal, elongate, first much stouter than the second, third short, about one-third the length of the second, secondary appendage small, of two joints. Lower antenna with the flagellum half as long as the last joint of the peduncle and formed of a number of joints fused together, and two small separate joints at the end. First gnathopod with the posterior margin of the merus forming a rounded lobe covered with minute setæ and bearing a few long hairs; the carpus much longer than the propod, posterior margin and inner surface nearly covered with transverse rows of long fine setules; propod narrow at base, expanding distally, palm evenly convex, defined by a row of six or seven short stout setules. Second gnathopod much larger than the first, propod large, more than twice as long as the carpus, anterior margin regularly convex, palm occupying about two-thirds the posterior margin, defined by a distinct tooth, around which arise numerous fine setæ, thence for more than half the length of the palm concave, followed by irregularities up to the base of the finger; finger strongly curved, inner margin evenly concave. Fifth paræopod with the basal joint very large and greatly expanded; merus widening posteriorly so as to form a rounded lobe bearing five stout setules and some fine hairs, its anterior margin fringed with long fine hairs.

*Length*, about 10 mm.

*Locality*.—South-West Rocks, Trial Bay, New South Wales.

*Remarks*.—Of this species I have unfortunately only one specimen, probably a male, perhaps not quite fully developed. The resemblance to *N. chilkaensis*, from Chilka Lake, East Coast of Bengal,<sup>1</sup> in nearly all characters except the second gnathopod is very striking and it is quite possible that further specimens may be found bridging over the differences between the two forms. Dr. C. Anderson, Director of the Australian Museum, informs me that the specimen was collected in a tidal lagoon in the S.W. creek which is one of the small outlets of the Macleay River, Trial Bay, the spot where the specimen was secured being about four hundred yards from the sea. Apparently the conditions under which this species was living are not unlikely those of Chilka Lake.<sup>2</sup> Another species belonging to the same section of the genus occurs in the underground waters of the Philippine Islands.<sup>3</sup> The occurrence of three closely allied species of the genus *Niphargus* at Chilka Lake, India, in underground waters of the Philippine Islands and in a tidal bay in New South Wales is of considerable importance from the point of view of zoogeographical distribution.

<sup>1</sup> Chilton—Indian Museum Memoirs, v, 1921, p. 531.

<sup>2</sup> The branchiæ, as shown in fig. 1b, bear numerous circular markings each with a small crescentic mark. These are apparently cysts or egg-cases of some organism adhering to the branchiæ, but I have not been able to identify them.

<sup>3</sup> Chilton—Philippine Journal of Science, xvii, 1920, p. 515.

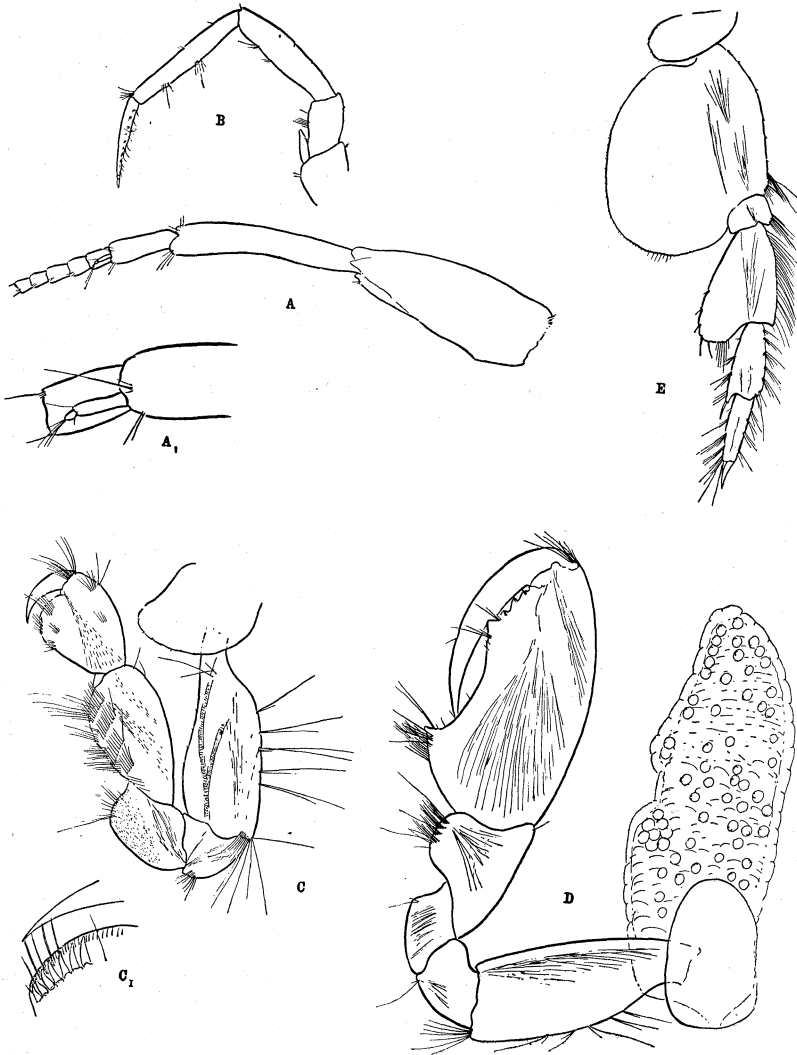


Fig. 1. *Niphargus australiensis* sp. nov.

- A. Basal portion of first antenna.
- A<sub>1</sub>. Portion of same more highly magnified to show the accessory flagellum.
- B. Second antenna.
- c. First gnathopod.
- c<sub>1</sub>. End of palm and finger, more highly magnified.
- D. Second gnathopod.
- E. Fifth peraeopod.

No. 2. TWO AUSTRALIAN SPECIES OF *Amphilochnus*.

I am recording the two species mentioned below under the name *Amphilochnus*, although each differs from the generic description as given by Stebbing<sup>4</sup> in one point, that is to say, in the possession of a well developed molar tubercle to the mandibles. The first species agrees so entirely with the description of the European specimens of *A. neapolitanus*, Della Valle, in all other respects that it must, I think, be referred to this species. The second species, *A. squamosus* G. M. Thomson, differs from the generic description also in the possession of a minute accessory appendage on the first antenna. It has been described by Chevreux under the name *Gitanopsis antarctica*, but as the specimen examined and described by Stebbing (under the name *A. marionis*) apparently had the molar tubercle of the mandible not so well developed as in the specimens I have examined, it may, I think, remain under the genus *Amphilochnus*.

The species of *Amphilochnus*, *Amphilochnoides*, *Gitana* and *Gitanopsis* are all small and the generic characters depend mainly on small differences in the mouth parts which can be found out only by dissection, and it is doubtful if the genera can be maintained as distinct. Certainly the Australian specimens of *A. neapolitanus* should, by the possession of the well-developed molar tubercle of the mandible, be placed under *Gitanopsis* while the other characters would necessitate their being placed under *Amphilochnus*.

## AMPHILOCHUS NEAPOLITANUS Della Valle.

*Amphilochnus neapolitanus*, Stebbing, K. Pr. Akademie Wiss., Berlin, Das Tierreich, Lief. 21, 1906, p. 150.

*Amphilochnus neapolitanus*, Chevreux, Soc. Zool. France, xxiii, 1911, p. 191.

I have two specimens from Coogee, New South Wales, sent by the Australian Museum, which on dissection appear to belong to this species; the gnathopoda agree precisely with the figures given by Della Valle, in the second the process from the carpus extending quite to the end of the palm and overlapping it with the slightly curved point. Both these specimens are small, one about 3 mm. long, the other not much more than half that size. I have other specimens from Port Jackson sent to me by Professor W. A. Haswell in 1918, and the first of these dissected and examined proved to be quite the same as the Coogee specimens. In another, apparently similar in all other respects, the process from the carpus in the second gnathopod did not quite reach the palm and did not end in a curved point. Walker has united his own species, *A. melanops* with *A. brunneus* Della Valle and is of opinion that both are to be considered as

<sup>4</sup> Stebbing—K. Pr. Akad. Wiss., Berlin, Das Tierreich, Lief. 21, 1906, p. 149.

synonyms of *A. neapolitanus*. In 1911 Chevreux recorded the two last named species from various localities in the Mediterranean, Algeria, etc., but found that the length of the carpal process of the posterior gnathopod was quite constant in each species and that in one it overlapped the palm even in small specimens measuring 1 mm. in length. These he therefore names *A. neapolitanus*, and considers the others in which the carpal process, though varying in length, does not reach to the palm, as *A. brunneus*. The two species, *A. neapolitanus* and *A. brunneus*, were originally described by Della Valle from the Gulf of Naples and, though the differences between them are very slight, he considered them as distinct species.

I have examined specimens of *Amphilochus* from Chilka Lake and referred them to *A. brunneus* as in none of those that I examined did the carpal process reach quite to the palm.<sup>5</sup>

There is, however, another character to be considered. In the genus *Amphilochus* as defined by Stebbing,<sup>6</sup> the mandible has the molar process feeble; it is figured by Della Valle as somewhat conical in shape and quite small for *A. neapolitanus* and is similarly described for *A. brunneus*. In the specimens from Coogee and from Port Jackson which I have examined, it is, however, by no means feeble, but well developed and strong, resembling the process figured by Sars for *Gitanopsis bispinosa*. This led me to re-examine the Chilka Lake specimens with special reference to this point, and I find that although in all other respects they agree with the characters of *Amphilochus brunneus* as given by Della Valle they have the molar process of the mandible well developed, and almost if not quite as large as in the Australian specimens.

Walker in 1904 doubtfully identified a specimen from Ceylon as *Amphilochus neapolitanus* Della Valle. He had only one young and imperfect specimen, 1.5 mm. long, and he gave no description either of the gnathopods or of the molar of the mandibles.

The genus *Gitanopsis* is distinguished from *Amphilochus* mainly owing to the well-developed molar. In the New Zealand specimens which have hitherto been referred to *A. squamosus* G. M. Thomson the molar is large and well developed. This species has been re-described by Chevreux from Antarctic specimens as *Gitanopsis antarctica*. On the other hand in *Amphilochus marionis* Stebbing, which I have considered to be the same as *A. squamosus* G. M. Thomson, the molar is apparently not so well developed, for Stebbing<sup>7</sup> says: "The molar tubercle (not shown in the figures *m*, *m*) is conical, scarcely if at all dentate."

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<sup>5</sup> Chilton—Indian Museum Memoirs, v, 1921, p. 524.

<sup>6</sup> Stebbing—K. Pr. Akad. Wiss., Berlin, Das Tierreich, Lief. 21, 1906, p. 149.

<sup>7</sup> Stebbing—Challenger Report, Zoology, xxix, 1888, p. 744.

I have been able to examine specimens of *Gitanopsis pusilla* Barnard (Ann. S. African Mus. xv, p. 145) from South Africa through the kindness of Mr. Barnard and cannot distinguish them from the Australian specimens I am referring to *Amphilocheus neapolitanus*. Mr. Barnard says it is distinguished from all other species by the very short telson. In the specimen I have examined the telson is longer in proportion to the third uropod than is shown in his figure and fully as long as in the Australian specimens, and even if there is a slight difference in the length of the telson, this seems to me to be more than counterbalanced by the very close resemblance in the other characters.

It appears from the facts mentioned above that not only do specimens vary in the length of the carpal process of the second gnathopod, but that specimens which agree in this character may differ from one another in the development of the molar process of the mandible. Apparently it is not a character varying with age, for all the numerous specimens that I have examined from Australia and New Zealand have the molar well developed, while in all the European specimens that have been referred to *Amphilocheus* the molar is feeble. In face of these facts the difficulty of classifying these small animals is increased and it seems doubtful whether the distinction between the different genera can be maintained. In the meantime I am recording the specimens from Coogee and Port Jackson under the name *Amphilocheus neapolitanus* Della Valle; the species was not previously known from Australia.

AMPHILOCHUS SQUAMOSUS *G. M. Thomson.*

*Amphilocheus squamosus*, Thomson, Ann. Mag. Nat. Hist., (5), vi, 1880, p. 4, pl. I, fig. 4, 4a.

*Amphilocheus squamosus*, Chilton, Trans. Roy. Soc. Edin., xlviii, 1912, p. 479.

*Amphilocheus marionis*, Stebbing, Challenger Report, Zoology, xxix, 1888, p. 743, pl. 38; K. Pr. Akademie Wiss., Berlin, Das Tierreich, Lief. 21, 1906, p. 151; Austr. Museum Memoir iv, 1910, p. 577.

*Gitanopsis antarctica*, Chevreux, 2me Expéd. Ant. Fr., 1912, p. 104.

This species was originally described by Mr. Thomson from New Zealand specimens, and probably his figure was taken from an immature specimen. In 1888 Stebbing described *A. marionis* from Marion Island and apparently had only "one specimen, a female with eggs." In 1912 I examined specimens obtained by the "Scotia" from the South Orkney Islands and came to the conclusion that they were the same as the New Zealand species, and I united *A. marionis* with it owing to the very close resemblance. In all the New Zealand and South Orkney specimens that I have examined the molar of the mandible is strong and fully developed. Apparently as stated above it is not so well developed in the specimen from Marion Island examined by Stebbing, so that here as in *A. neapolitanus* we apparently have specimens differing somewhat in the molar but quite similar in all other characters. In 1913 Chevreux described the species

*Gitanopsis antarctica* from Antarctic regions which is, I think, quite identical with *A. squamosus*. It has the molar well developed. In this identification I have had the advantage of examining a specimen of his species kindly sent to me by M. Chevreux. In 1910 Stebbing recorded *A. marionis* from Australian seas, but gave no further information about the molar of the mandible. In connection with Walker's suggestion that *A. marionis* might possibly be a synonym of *A. neapolitanus* Stebbing says that the telson of *A. marionis* is particularly short compared with most other species. An examination of numerous New Zealand specimens seems to show, however, that the telson may be considerably longer and narrower than that figured by Stebbing for *A. marionis*, and in one specimen it has at the extremity two minute crenulations just as Chevreux figures for *Gitanopsis antarctica*. Though the shape of the telson thus appears to be of little value as a specific distinction, *A. squamosus* differs markedly from *A. neapolitanus* in the character of the carpal lobe in the second gnathopod, and must be regarded as a distinct species. In the gnathopoda and in most of the other appendages it shows a close resemblance to *A. manudens* Bete, but in that species the mandibular molar is feeble, there is no accessory flagellum and the propod is produced beyond the base of the finger into an acute tooth.

*Amphilocheus squamosus* is widely distributed in Subantarctic seas, having been recorded from New Zealand, Australia, Peterman Island, South Orkneys and Marion Island.

### No. 3. THE AUSTRALIAN SPECIES OF *Leucothoe* AND *Paraleucothoe*

In 1880 Haswell described *Leucothoe commensalis* from specimens obtained in Port Jackson found in ascidians, etc., also *L. diemenensis* and *L. gracilis* from Tasmania. In 1884 Miers<sup>8</sup> added *L. brevidigitata* from Torres Strait but regarded *L. commensalis* as a variety of *L. spinicarpa* (Abildg.), the species common in northern seas. In 1893 in revising some of the Amphipoda of Australia Haswell mentions this and adds that "*L. gracilis* and *L. diemenensis* are to be regarded as marked varieties of the same" (i.e., of *L. spinicarpa*). In 1888 Stebbing described *L. flindersi* also from Torres Strait and *L. tridens* from New Zealand. In 1906 in "Das Tierreich" Amphipoda he gave *L. commensalis* as a separate species "close to *L. spinicarpa*." *L. diemenensis* and *L. gracilis* were given by him as being scarcely distinguishable from *L. commensalis*. He united *L. flindersi* with *L. brevidigitata* Miers, but keeps this, *L. traillii* G. M. Thomson (1882) from New Zealand, and *L. tridens* as separate species. In 1912 I identified *L. tridens* Stebbing with *L. traillii* G. M. Thomson and regarded both of these as synonyms of *L. spinicarpa* to which species I also referred *L. antarctica* Pfeffer from South Georgia (1888).

<sup>8</sup> Miers—Report H.M.S. "Alert," 1881-2 (1884), p. 313.



In his report on the Amphipoda of the "Thetis" Expedition Stebbing<sup>9</sup> still retains *L. commensalis* Haswell under that name but states: "It is perhaps only a matter of taste or convenience whether this should be taken as a distinct species or as a variety of *L. spinicarpa* Abildgaard." He mentions one or two points in which the second gnathopod differs slightly from Sars' figure of the European form, e.g., the palm being more strongly tuberculated as stated in Haswell's description. He adds that the postero-lateral angle of the third pleon segment is without sinus, but that a specimen sent to him some years previously under this name had the sinus and so had the "Thetis" specimen taken off Manning River (see below under "*I. assimilis*"). In the same report (p. 636) after giving *L. commensalis*, *L. brevidigitata*, *L. diemenensis* and *L. gracilis* in his list he adds—"It is unlikely that these names represent four distinct species. Dr. Della Valle (1893) may be right in practically uniting them all with *Leucothoe spinicarpa* (Abildgaard), which A. O. Walker (1909) declares to be cosmopolitan."

In 1880 Haswell had described *L. novæ-hollandiæ* from Port Jackson, a species differing from the species of *Leucothæ* particularly in the shape of the first gnathopod. In 1899 Stebbing established the genus *Paraleucothoe* for this species which is accordingly given in "Das Tierreich" Amphipoda as *Paraleucothoe novæ-hollandiæ* with additional information as to the mouth parts, etc., presumably based on specimens examined by Stebbing.

Some considerable time ago, in order to feel more confidence about the various identifications above referred to, I endeavoured to get co-types or named specimens of Haswell's species, and from the Macleay Museum, University of Sydney, I received the following tubes, which I have examined with the result mentioned in each case:—

Tube No. 1—labelled "*Leucothoe novæ-hollandiæ* Port Jackson."

This contains male and female specimens of this species, now known as *Paraleucothæ novæ-hollandiæ*, and also one specimen of *Leucothæ spinicarpa* (Abildg.).

„ No. 2—labelled "*Leucothoe commensalis* Haswell, Port Jackson."

These appear to me to be all *L. spinicarpa*, no appreciable difference being noted, although, as pointed out by Stebbing, the teeth, etc., on the palm of the second gnathopod vary and are not precisely the same as those in the individuals figured by Sars.

„ No. 3—labelled "*L. gracilis* Haswell, Tasmania."

Of this there is only one specimen, badly preserved and imperfect, but I see no reason for separating it from *L. spinicarpa* (Abildg.).

<sup>9</sup> Stebbing—Australian Museum Memoir iv, 1910, p. 580.

Tube No. 4—labelled "*Leucothoe* sp. ?" from Tasmania.

This also seems to me to belong to *L. spinicarpa* (Abildg.).

„ No. 5—labelled "*Leucothoe assimilis*, Port Denison."

Of this there is a single specimen, imperfect and poorly preserved. In the gnathopods and antennæ, etc., it seems to agree well with *L. spinicarpa*, but the third pleon segment has a sinus above the subacute posterolateral angle, somewhat similar to that described by Stebbing for *L. lilljeborgii* Boeck, and figured by Sars for this species under the name *L. imparicornis* Norman. The gnathopod, however, is much more like that of *L. spinicarpa* than the figure given by Sars for *L. imparicornis* Norman, which gives one the impression of being taken from an immature specimen. The name "*Leucothoe assimilis*" attached to the Macleay Museum specimen is, I presume, a MS. Museum name.

„ No. 6—labelled "Port Jackson."

Most of these unnamed specimens prove to be *L. spinicarpa*, but there are a few of *Paraleucothoe novæ-hollandiæ* which have been included among them.

I have also a tube sent from the Australian Museum labelled "*Leucothoe spinicarpa* Haswell, Port Stephens, Reg. No. P.3472." These also prove to be *L. spinicarpa* as named.

There seems to be considerable variation in the stoutness of the antennæ. I have one mounted specimen from Spencer Gulf, South Australia, in which the peduncles are specially stout and the flagella very short, being very similar to those of *L. tridens* as figured by Stebbing; in two other specimens, however, taken at the same time and place, the flagella are longer and the peduncles more slender and approaching closely to the typical form.

I therefore consider that all the forms mentioned above, with the exception of *Leucothoe novæ-hollandiæ* Haswell and *L. brevidigitata* Miers are to be looked upon as belonging to the widely distributed *L. spinicarpa* (Abildg.). In my report<sup>10</sup> on the "Endeavour" Amphipoda, I also added to the list of synonyms *L. miersi* Stebbing, from South Africa, as Barnard had already done in 1916. Barnard suggests that *L. brevidigitata* from Torres Strait is another possible synonym and this is probably the case though the first gnathopod as drawn by Stebbing (under the name *L. flindersi*) bears some resemblance to that of *Paraleucothoe novæ-hollandiæ* (Haswell).

The synonyms important for the Australian student may therefore be given as follows:—

<sup>10</sup> Chilton—Biological Results of the F.I.S. "Endeavour" 1909-14, v, 2, 1921, p. 59.

LEUCOTHOE SPINICARPA (*Abildg.*).

- Leucothoe spinicarpa* Stebbing, K. Pr. Akademie, Berlin, Das Tierreich, Lief. 21, 1906, p. 165; Walker, Nat. Ant. Arct. Exped., 1901-04, iii, Amphipoda, 1907, p. 18.
- L. commensalis*, *L. diemenensis* and *L. gracilis*, Haswell, P.L.S. N.S.W., iv, 1879, pp. 261-263.
- L. traillii*, *L. miersi*, *L. commensalis*, *L. tridens* and *L. brevidigitata*, Stebbing, K. Pr. Akademie, Berlin, Das Tierreich, Lief. 21, 1906, pp. 164-167.
- L. antarctica*, Pfeffer, Jahrb. Wiss. Anstalten zu Hamburg, v, 1888, p. 128.
- L. spinicarpa*, Chilton, Trans. Roy. Soc. Edinb., xlvi, 1912, p. 478; Indian Museum Memoirs, v, 1921, p. 59; Biological Results of the F.I.S. "Endeavour," 1909-14, v, 2, 1921, p. 59; Barnard, Ann. S. African Museum, xv, 1916, p. 148.

The species, as thus understood, is found in all seas. I have seen specimens from many localities on the east and south coasts of Australia, and from Tasmania and New Zealand. These differ in size, the largest being about 18 mm. in length, and exhibit variations in some other characters, but after comparison with European specimens I have not been able to find constant characters by which to subdivide them into different species.

I have recently examined some specimens from the Indian Museum collected at the Andaman Islands from the branchial sac of an Ascidian. These are small, only about 5 mm. long and in the gnathopods and other characters they agree with the figures given by Sars for *L. spinicarpa* even more closely than the Australian specimens do.

A specimen received from the Hawaiian Islands is very similar to those from the Andaman Islands and corresponds well with Sars' figures.

The fact that specimens have been found in Australia differing apparently from the others only in the presence of a sinus above the subacute postero-lateral angle of the third pleon segment and that a similar form (*L. lilljeborgii* Boeck) occurs in Europe along with the typical form seem to show that there is a closer connection between the forms with the sinus and the typical forms than is indicated by ranking them as two distinct species.

PARALEUCOTHOE NOVÆ-HOLLANDIÆ (*Haswell*).

- Paraleucothoe novæ-hollandiæ* Haswell, P.L.S. N.S.W., iv, 1879, p. 329; Stebbing, K. Pr. Akademie Wiss., Berlin, Das Tierreich, Lief. 21, 1906, p. 169.

I give figures of the first and second gnathopoda of the male which will sufficiently indicate their structure without a lengthy description. In the female the first gnathopod differs considerably from that of the male, having the basal joint somewhat widened, the carpus oval and less truncate at the extremity and the propod less abnormal in shape.

Specimens belonging to this species were taken by Dr. E. Mjöberg in Australian seas and will be more fully described in my report on the Amphipoda collected by him. (Report not yet published.)

This species is known from Port Jackson and from the north-west coast of Australia.

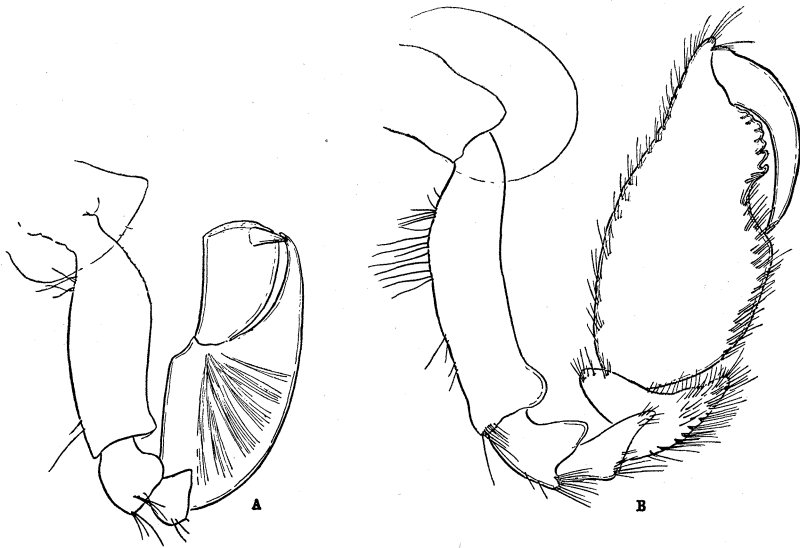


Fig. 2. *Paraleucothoe novæ-hollandiæ*.

- A. First gnathopod of male.  
B. Second gnathopod of male.

#### No. 4. UNUSUAL OCCURRENCE OF *Talitrus sylvaticus* Haswell.

In November, 1921, a tube of dried specimens of this species was sent to me by the Australian Museum with the following printed note:

“Mr. G. H. Halligan exhibited, in quantity, examples of an undetermined amphipod, which after rain, and with the wind in a certain direction, were to be found, regularly, strewn over the floor of the porch of his house at Hunter’s Hill. As his garden was kept in order, and there was nothing out of the ordinary in the way of cover for the animals, he was at a loss to know how they came to be so abundant; and he wished for an explanation of their occurrence.”—P.L.S. N.S.W., xxxix., 1914, p. 162.

I have mounted three specimens and although they were dry and imperfect they shew sufficient for identification and are certainly to be referred to *Talitrus sylvaticus* Haswell. In all three the third pleopod is quite small with the branches vestigial.

The species is widely distributed in many parts of Australia, and the animals are doubtless numerous in the garden and the combined wind and rain caused them to be driven to the porch. Perhaps the rain made their ordinary resting place too wet and in hopping out the wind carried them to the porch on the floor of which they could not conceal themselves. In the same way in Christchurch, New Zealand, the common earthworm comes to the surface in great numbers after heavy rain and is very evident on the asphalt paths while on lawns, etc., though equally abundant it is more easily concealed.

The allied New Zealand species *Parorchestia sylvicola*, may occur in numbers of gardens and some years ago Dr. F. W. Hilgendorf sent me specimens from a garden at Waihola, Otago, where they were eating into the strawberries.

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#### No. 5. THE AUSTRALIAN FRESHWATER SPECIES OF *Atyloides*.

The late Mr. Sayce described two species of freshwater Amphipods from Victoria which he referred to the genus *Atyloides*, viz.: *Atyloides gabrieli*<sup>11</sup> and *Atyloides fontana*<sup>12</sup>. The first species was obtained by Sayce from several localities in Victoria, in some cases at an altitude of about 1,500 ft.; the second species, *A. fontana*, was obtained from Wood's Point, at an altitude of about 3,000 ft.

I have received from Miss Marguerite Henry, B.Sc., Macleay Research Scholar, from a stream at the Jenolan Caves, specimens which prove to belong to *A. fontana*. These agree well with Sayce's description and, as he points out, they differ from *A. gabrieli* in the possession of numerous setæ on the inner lobe of the first maxilla, in the shape of the lobe on the carpus of the second gnathopod and in a few other details. I have also specimens of *A. gabrieli* sent to me years ago by Mr. Sayce which enable me to confirm the account he gives as to the differences between the two species. The difference between the two species in the inner lobe of the first maxilla is perhaps the most important one and has a very distinct bearing on the reliability of the characters used for distinguishing *Atyloides* and other allied genera and will be referred to later on.

In 1909 I described under the name of *Atyloides aucklandicus* specimens from fresh waters in the Lord Auckland Islands to the south of New Zealand referring them to the species which had received this name from Mr. A. O. Walker. I was at the time a little doubtful whether it was congeneric with the Australian species or not, but a comparison of the actual specimens has now convinced me that it is; it

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<sup>11</sup> Sayce—Proc. Royal Soc. Victoria, xiii, 1901, p. 230.

<sup>12</sup> Sayce—loc. cit., xv, 1902, p. 49.

can readily be distinguished, however, by the shorter and stouter gnathopods, and by the less developed lobes on their carpal joints and also by the shape of the telson which is somewhat ovoid, narrowing distally.

Dr. Tattersall<sup>13</sup> has recently described another freshwater species from Japan, which he refers to the genus *Atyloides*, viz.: *Atyloides japonica*, his specimens being obtained from the small torrent in hills behind Komatsu, on Lake Biwa.

The description and figures that he gives show that his Japan specimens undoubtedly belong to the same genus as the Australian species, and that it is closely allied to *A. fontana* Sayce. The occurrence of allied freshwater species of this genus in New Zealand, Australia and Japan is extremely interesting from the point of view of geographical distribution, and as Dr. Tattersall points out, finds a parallel in the genus *Paratya* among the *Macrura* and in other cases.

Dr. Tattersall has called attention to the presence of a number of finger-like processes on the sternum on certain of the thoracic segments in his species and compares them with similar processes found by Sars in *Gammarus pulex* and *Pontoporeia affinis*, by Smith in *Pontoporeia hoyi*, by Shoemaker in *Synurella johanseni* and by myself in *Gammarus barringtonensis*. I find that these processes are present also in both the species described by Sayce and in *Atyloides aucklandicus*. In the latter species, however, they are slightly broader than in the other two, and appear to be more similar to the ordinary branchia. What their function may be is uncertain, but apparently they have some connection with the freshwater habitat of the species in question. Tattersall says:—"They are quite distinct from the accessory branchial vesicles which I have described below in *Gammarus annandalei*, which are definitely additional processes on the outside of the branchial lamellae themselves." Similar processes are present in some freshwater species of *Hyalella* in South America, viz.: *H. jelskii*, *H. dybowskii* and *H. lubomirskii*. All three are found at altitudes of more than 2,000 metres and some of the other species in which these processes are found also live far above the sea-level; possibly the altitude may be one of the determining factors in their development.

The genus *Atyloides* should probably, as Tattersall points out, be considered a synonym of *Paramœra* Miers and therefore dropped and a new genus established for the freshwater species, but as there is much confusion in connection with these two and other allied genera it is well to retain *Atyloides* till some comprehensive revision can be made. In the diagnoses given by Stebbing of *Atyloides* and *Paramœra* the inner plate of the first maxilla is said to bear many setæ. This is true for *A. fontana* and *A. aucklandicus*, but in *A. gabrieli* there are only three, though that species is certainly congeneric with *A. fontana*. Evidently this character is not of generic importance in this group.

<sup>13</sup> Tattersall—Mem. Asiatic Society of Bengal, vi, 1922, p. 442.

No. 6. EURYSTHEUS THOMSONI (*Stebbing*).

*Eurystheus thomsoni* Stebbing, Austr. Museum Memoir iv, 1910, p. 614.

*Eurystheus thomsoni* Chilton, Biological Results F.I.S. "Endeavour," 1909-14, v, 2, 1921, p. 81.

The male of this species has been described by Stebbing and myself in the papers quoted above, and we have both pointed out that in the specimens examined the second gnathopoda were unequal, the greatly enlarged form being found on one side only. I stated that the male was not very dissimilar in the second gnathopod from *E. crassipes*

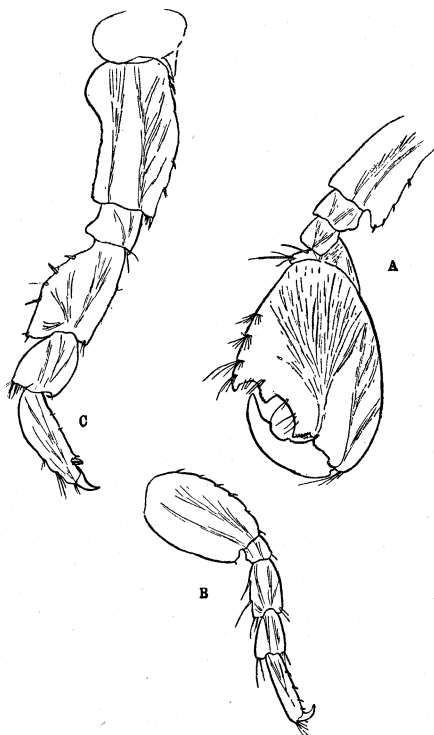


Fig. 3. *Eurystheus thomsoni* (Stebbing), male.

- a. second gnathopod.
- b. third peraeopod.
- c. fourth peraeopod.

(All the figures magnified equally.)

(Haswell), though the fourth peraeopod did not appear to be greatly broadened as in that species. I have, however, since received a male specimen collected at Balmoral, Port Jackson, by Mr. T. Whitelegge, and in this the fourth peraeopod is greatly enlarged, being very large in comparison with the third and the fifth. I give figures of the

third and fourth peræopods and also one of the second gnathopod since the dactyl bears two projections on its concave margin instead of one only, as in the specimen figured in the report on the "Endeavour" Amphipoda. I presume that the male now being described is more mature than the two previously examined by Stebbing and myself and that we have here another example showing that the different secondary sexual characters of the male may be developed at different ages, *e.g.*, the greatly enlarged fourth peræopods being developed only at a later stage than the characteristic second gnathopods.

It is evident from what has been stated above that *E. thomsoni* comes still closer to *E. crassipes* than I considered it to be in 1921.

#### No. 7. CERADOCUS RUBROMACULATUS Stimpson and

MAERA RAMSAYI Haswell.

In 1885 Haswell<sup>14</sup> united *Maera spinosa* Haswell and *M. ramsayi* Haswell with *Ceradocus rubromaculatus* (Stimpson) saying that these forms were separated mainly by the shape of the second gnathopoda and that he found "on examining a series of specimens, a perfect series of gradations in this respect from the form figured by Stimpson to typical forms of *M. spinosa* and *M. ramsayi*." He added that *Maera festiva* Chilton also belonged to the very variable species *C. rubromaculatus*.

Stebbing adopted this view in 1906, and in "Das Tierreich" Amphipoda *M. spinosa*, *M. ramsayi* and *M. festiva* are all given as synonyms of *C. rubromaculatus*. In his report on the "Thetis" Amphipoda<sup>15</sup>, however, he changed his opinion and gives them all as separate species saying "the position of all three should rather be regarded as still doubtful."

The specimens from which *M. festiva* was originally described all lacked the terminal uropoda, and as I pointed out at the time<sup>16</sup>, it was impossible to say whether the species was a *Maera* or a *Melita*. Many years afterwards I obtained specimens from Auckland, New Zealand, with the terminal uropoda still attached, and was able to say that the species was really a *Melita* and therefore quite distinct from *C. rubromaculatus*.

From the comparison of the description and figures and of specimens, I think that *M. spinosa* Haswell is certainly to be regarded as a synonym of *C. rubromaculatus*. Until recently, however, I had not seen any specimens that I could identify with *M. ramsayi* as described by Haswell. I have now been able to examine specimens from Port Jackson that agree closely with Haswell's original description. In general form, in the teeth on the posterior margin of the pleon segments and in the terminal uropoda they are very similar to *C. rubromaculatus*. The second gnathopoda are, however, very large

<sup>14</sup> Haswell—P.L.S. N.S.W., x, 1885, p. 105.

<sup>15</sup> Stebbing—Austr. Museum Memoir iv, 1910, pp. 642-3.

<sup>16</sup> Chilton—P.L.S. N.S.W., ix, 1885, p. 1037.



and massive, the "palm nearly transverse, defined by a strong, pointed, slightly curved tooth and armed with three other large compressed teeth." This differs considerably from the oblique palm usually found in *C. rubromaculatus*, and although it is true that the armature of the palm in this species is very variable, I have not seen forms quite intermediate between the usual one and that in *M. ramsayi*. Chevreux has described specimens of *C. rubromaculatus* from the Gambier Archipelago in which the palm was nearly transverse but the teeth on it are rather different from those of *M. ramsayi*. It matters little whether *M. ramsayi* is considered a form of *C. rubromaculatus* or a distinct species, but it is desirable that its distinctive gnathopod should be known, and I therefore give a figure taken from a Port Jackson specimen.

In the specimens of *C. ramsayi* that I have seen, the right and left second gnathopoda of the male are of unequal size; in Haswell's type specimen they were also unequal, as they frequently are in typical forms of *C. rubromaculatus* and in other species in which the gnathopoda are of large size.

*C. ramsayi* comes very close to *C. rubromaculatus* in the dentation of the terminal segments of the body, in the general characters of the appendages, and in the unsymmetrical second gnathopods, and as these appendages in the latter species show such great variation, I prefer to consider *C. ramsayi* as a well-marked variety of *C. rubromaculatus* rather than a separate species.

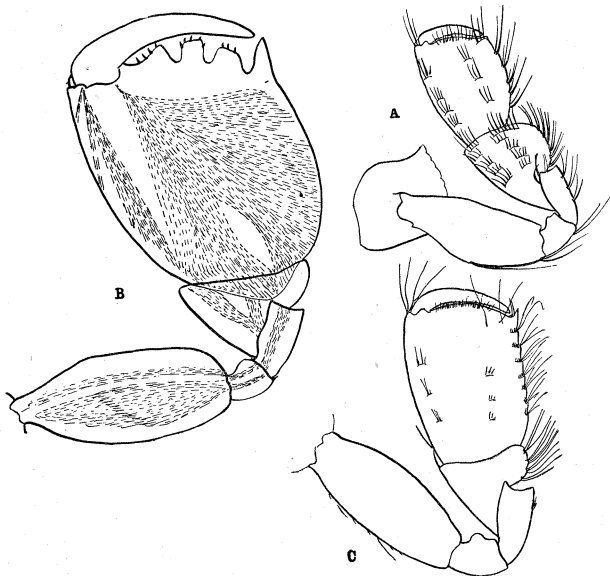


Fig. 4. *Ceradocus rubromaculatus* (Stimpson),  
var. *ramsayi*.

- A. first gnathopod of male.
- B. second gnathopod, the enlarged form from right side of body.
- C. second gnathopod, from left side of same specimen.

## No. 8. CHILTONIA AUSTRALIS (Sayce).

*Hyallela australis* Sayce, Proc. Roy. Soc. Victoria, xiii, 1900, pp. 226-230, pl. xxxvi.

*Chiltonia australis* Sayce, loc. cit., vol. xv, 1902, p. 47.

I have one small male from Parramatta (freshwater), New South Wales, collected by Mr. W. M. Thomson, that evidently belongs to this species. It agrees in all points very closely with Sayce's description and figures. As Sayce has pointed out, this species differs from the generic description given by Stebbing in having the minute terminal uropods two-jointed, not one-jointed as in *C. mihiwaka* (Chilton) and *C. subtenuis* Sayce.

Specimens from Moss Vale sent by Miss Marguerite Henry, B.Sc., prove to belong to the same species. This species was previously known from several localities in Victoria and from Lake Petrarch, Tasmania. More recently, I have received specimens from Prof. W. A. Haswell collected at Berrima and Bowral, and from Miss Henry specimens from Epping and Melbourne in Victoria.

The genus *Chiltonia* is very close to *Hyallela* to which several freshwater species from South America belong, and the species *C. australis* is practically intermediate between the two. The existence of closely allied freshwater amphipods in Australia, New Zealand, the Subantarctic Islands of New Zealand and in South America is important zoogeographically.

## No. 9. STENOThOE VALIDA Dana.

In the seas around Australia and New Zealand there are occasionally found specimens of a species of *Stenothoe* that has not been very satisfactorily identified up to the present. I have long felt practically certain that it is the same as the form described by Dana under the name *Stenothoe validus*, the agreement in the different appendages being very close, as will be seen from the descriptions given later on. Dana's species was based on specimens obtained at Rio de Janeiro, but has long remained doubtful. This appears to be due to the fact that in his figure of the whole animal, Dana shows distinctly four side plates, the first one being moderately large and not concealed by the second, and that he both figured and described the basal joint of the third peræopod as being expanded in the same way as in the fourth and fifth. Apparently, however, in all the species referred to the genus *Stenothoe* by Stebbing in 1906, the first side plate is quite small and nearly completely covered by the second and the basal joint of the third peræopod is narrow. If Dana's description with regard to these two points is accurate, his species would therefore differ from all the others in the genus, though agreeing so very closely in other characters that it must be considered identical with one or more of them. I feel convinced, therefore, that Dana's description is erroneous and probably due to the artist's drawing these two structures to agree with the normal condition in other amphipods.

The further history of the specimens which I refer to Dana's species is as follows, and is given in some detail, as it will tend to confirm the results otherwise arrived at.

In 1880 Haswell described from New South Wales two species, *Montagua miersii* and *M. longicornis*, differing in the antennæ and gnathopoda; these two were united by Stebbing in 1906 as the female and male of a species of *Stenothoe*. In 1883 I obtained from Lyttelton, New Zealand, some small specimens which I identified with *Montagua miersii* Haswell, changing the generic name, however, to *Montaguana* as *Montagua* was preoccupied. These specimens were in all probability females or immature males of Haswell's species. At that time I had not seen the mature male. Later on, in 1892, I identified, with some slight doubt, further specimens I had obtained with *Stenothoe adhaerens* Stebbing described from two females taken by the "Challenger" off Cape Agulhas, South Africa; I described the male and pointed out that it agreed somewhat closely with that of *Stenothoe marina* (Spence Bate) from Europe and that *Montagua longicornis* Haswell was probably the same as my New Zealand specimens. In 1888 Della Valle united under the name *Stenothoe valida* Dana not only these but also several other specimens that had been assigned to this genus.

My specimens of the fully developed male agree closely (except as indicated above) with Dana's figures. The form he described as a female also closely resembles New Zealand specimens taken along with the male. In large specimens that I have dissected and mounted of the male, the mouth parts seem to be more or less atrophied and imperfect. This appears to be also the case with the maxilliped of the male figured by Dana, for this is drawn as smaller and with fewer setæ than the corresponding appendage in the specimen he calls the female—this seems an additional argument for referring the New Zealand specimens to Dana's species.

From Oterangi Bay, Cook Strait, New Zealand, I have various specimens collected by Professor H. B. Kirk, from among which I have mounted specimens of the adult male, the female and the form I consider an immature male. As these were all collected at the same time and place and show in other points close resemblance, they must, I think, all belong to the same species and be looked upon as representing different stages of the growth of the two sexes. From another locality in Cook Strait and from Lyttelton, New Zealand, I have specimens forming similar series; specimens recently received from the Australian Museum collected in Port Jackson, New South Wales, are quite the same as those from New Zealand seas.

In 1910 Walker<sup>17</sup> identified specimens from Peru with *S. assimilis* Chevreux, a species originally found at Monaco, and after pointing out that this species differs from *S. gallensis* Walker in the last joint of the third uropod of the male which is upturned, serrate and blunt in *S. gallensis* but straight, smooth and sharply pointed in *S. assimilis*, he adds:—

“Both these species are so closely allied to *S. valida* Dana, 1852, that but for the fact that he has figured the third peræopods with a wide basal joint instead of the narrow one of the above two species, *S. assimilis* and *S. gallensis*, they might both be referred to it, notwithstanding the trifling difference in the third uropods. I have a strong suspicion that if Dana’s type-specimen could be discovered, it would be found that he had overlooked the difference in the form of the joints. *S. assimilis* would then be a synonym of *S. valida*.”

Chevreux had described *S. assimilis* in 1908 and compared it with *S. valida*, *S. dollfusi*, etc., but then kept it distinct from *S. valida* (Dana).<sup>18</sup> Later in 1913 Chevreux<sup>19</sup> for reasons stated identified *S. assimilis* with *S. valida*, having been able to examine specimens from Brazil which he considers to be *S. valida*.

I had written the first portion of this paper before I came across these references to Walker and Chevreux, but have allowed it to stand in order to show that Walker, Chevreux and myself all agree at the incorrectness of Dana’s original figures in the points referred to.

Before I came to this conclusion I had mounted about eighteen specimens of various sizes and of both male and female from different localities in New Zealand, and with the help of Miss Herriott, assistant at the Biological Laboratory, had examined them with regard to the side plates, mouth parts, and the third peræopod. I found that the first side plate was either very small or absent altogether, and that in all cases the basal joint of the third peræopod was narrow. It is to be remembered that in his original description of *S. gallensis* Walker described the basal joint of the third peræopod as being broadened, but afterwards corrected this statement, and that Chevreux has pointed out that by a slip in Della Valle’s description, the fifth and sixth pairs of legs were referred to in place of the sixth and seventh. In view of these and similar facts, it is evident that too great reliance cannot be placed on published descriptions, and that the actual specimens should be examined and compared wherever possible.

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<sup>17</sup> Walker—Proc. U.S. Nat. Mus., xxxviii, 1910, p. 621.

<sup>18</sup> Chevreux—Bull. Inst. Oceanog., 113, 1908.

<sup>19</sup> Chevreux—loc. cit., 262, 1913, p. 3.

Among the New Zealand specimens in two instances a form with narrow gnathopods and with the teeth at the end of the palm projecting almost at right angles to the palm itself, as figured by Chevreux for *S. dollfusi*, was taken along with the ordinary form described by Dana; both these forms occur also in Port Jackson, New South Wales. As I can find no difference among the females, I feel pretty certain that this should be considered another form of the male rather than a separate species so that *S. dollfusi* Chevreux will also become a synonym of *S. valida* Dana. This seems to be confirmed by the fact that Kunkel in his account of the amphipoda of the Bermudas records specimens as *S. valida*, while the figure that he gives shows a gnathopod very much like that figured for *S. dollfusi* by Chevreux.<sup>20</sup> The species described by Chevreux as *S. crenulata* from the Gambier Archipelago seems to come very close indeed to *S. valida*, but in it the ramus of the third uropods is curved, while in all the specimens of *S. valida* that I have been able to examine it is straight and pointed at the end in the usual way. Barnard considers *S. crenulata* a synonym of *S. gallensis* Walker and has recorded it from South Africa, referring his specimens to this species because the female specimens examined by him had this peculiar character of the third uropod.

It is evident that the different species assigned to this genus are all very similar in most characters except the gnathopoda, and it is quite possible that the number of species requires to be still further reduced. The characters of *S. marina* from Europe as given by Sars seem to correspond pretty closely with some of the female specimens of *S. valida*. I am in some doubt with regard to the shape and development of the second gnathopod in the females of this latter species, for apparently they show almost complete transitions from the form found in small specimens bearing eggs to the greatly enlarged gnathopods found in the fully adult males. At first I had considered these intermediate forms to be immature males, but some of these are certainly found bearing eggs. Kunkel has recorded both *S. marina* and *S. valida* from the Bermudas, and the figure that he gives of the form referred to *S. marina* corresponds very closely indeed with some of the females found in New Zealand that I have referred to as *S. valida*. Further investigation of this point and of the degeneration of the mouth parts in fully matured males is very desirable.

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<sup>20</sup> Since this was written, I have compared the New Zealand specimens with specimens of *S. dollfusi* taken at Banyuls-sur-mer on the south coast of France, and find complete correspondence both in the male and in the female. One of the two female specimens from Banyuls shows the concave palm as figured by Chevreux; another female from Banyuls, however, has the palm regularly convex as in *S. valida* Dana, and appears indistinguishable from New Zealand specimens.

The chief synonyms of *S. valida* may be given as follows:—

STENOTHOE VALIDA Dana.

*Stenothoe validus*, Dana, 1853 and 1855, U.S. Expl. Exped. 13 ii, p. 924, pl. 63, fig. 1 a-o.

*Stenothoe valida*, Stebbing, K. Pr. Akademie Wiss., Berlin, Das Tierreich, Lief. 21, 1906, p. 194.

*Stenothoe valida*, Walker, Proc. U.S. Nat. Museum, xxxviii, 1910, p. 621.

*Stenothoe valida*, Kunkel, Connecticut Acad. Arts & Sci., Trans., xvi, 1910, p. 16.

*Stenothoe valida*, Chevreux, Bull. Inst. Oceanogr. 262, 1913, p. 3.

*Stenothoe valida* (part) Della Valle, Fauna & Flora des Golfes von Neapel, xx, 1893, p. 566, pl. lviii, figs. 74-78.

*Stenothoe adhaerens*, Chilton, Trans. N.Z. Inst., xxiv, 1891 (1892), p. 259 (? not Stebbing, Chall. Rep. Zool. xxix, 1888, p. 199).

*Stenothoe assimilis*, Chevreux, Bull. Inst. Oceanogr. 113, 1908, p. 4.

*Stenothoe assimilis*, Walker, Proc. U.S. Nat. Museum, xxxviii, 1910, p. 621.

? *Stenothoe dollfusi* Chevreux, Bull. Soc. Zool. Fr., xvi, 1891, p. 260; Stebbing, K. Pr. Akademie Wiss., Berlin, Das Tierreich, Lief. 21, 1906, p. 196.

*Montagua miersii* and *Montagua longicornis*, Haswell, P.L.S. N.S.W., iv, 1880, p. 323, pl. 24, figs. 4 and 5.

*Montaguana miersii*, Chilton, Trans. N.Z. Inst., xv, 1883, p. 79.

*Probolium miersii*, Chilton, P.L.S. N.S.W., ix, 1885, p. 1043.

*Stenothoe miersii*, Stebbing, K. Pr. Akademie Wiss., Berlin, Das Tierreich, Lief. 21, 1906, p. 200.

*Size*.—About 5 mm.

*Colour*.—Whitish or pale yellowish.

*Distribution*.—South America, Australia, New Zealand, etc.

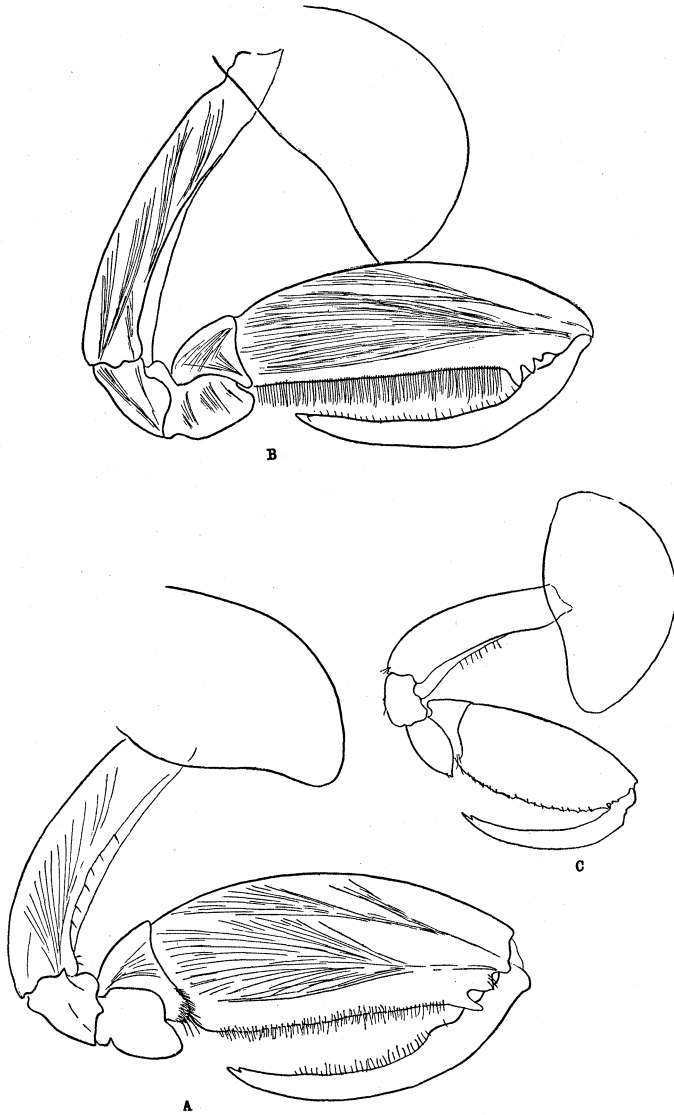


Figure 5. *Stenothoe valida* Dana.

- A. Second gnathopod of male (*S. valida* form).
- B. Second gnathopod of male (*S. dollfusi* form).
- C. Second gnathopod of female or immature male.