legs somewhat densely covered with long hairs, tarsi long, slender, compressed, densely haired. Last pair of legs somewhat shorter than the preceding. Abdomen of male of 5 joints subequal in length, 3rd rather narrower than the 1st and 2nd, 4th nearly as wide as the 3rd, last broadly rounded at the end; margin fringed with very short hairs, some longer ones being scattered on the surface. Abdomen of female with slight median ridge along its whole length.

Fulton and Grant have pointed out that the specimens from different localities differ slightly as to the prominence of the obscure teeth on the margin of the carapace, the hairiness of its surface, and the small teeth or tubercles on the wrist and hand of the cheliped of the male. These features were, however, found not to be constant, and I agree with them in considering all the forms as belonging to one species. Even if it should be necessary for systematic purposes to distinguish local varieties, it would not affect the importance of the fact that the same fresh-water crab is found in several lands now widely separated by sea.

Art. XXXIV. — *The New Zealand Species of the Amphipodan Genus* Elasmopus.

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[*Read before the Philosophical Institute of Canterbury, 2nd December, 1914.*]

In "Das Tierreich" *Amphipoda Gammaridea* Mr. Stebbing describes nine accepted species of the genus *Elasmopus* and four doubtful ones. Of these, two are recorded as having been found in New Zealand seas—viz., *E. subcarinatus* (Haswell) and *E. viridis* (Haswell)—both of which were also known from Australia, and were originally described in 1879 from Australian specimens. In the case of the first species, which had been redescribed by Mr. G. M. Thomson in 1882 under the name of *Maera petriei*, I pointed out many years ago that there were two forms of male apparently both belonging to this species, but no fuller investigation of the matter has yet been made, although in the meantime the species has been recorded from the shores of Ceylon and other places in the Indian Ocean. In the endeavour to work out an Australian species of *Elasmopus* I have been led to look into the New Zealand species, and the following notes are the result.

The genus appears to be closely allied to *Maera*, and in some cases it will probably be difficult to decide in which of the two genera a particular species should be placed. The species *E. subcarinatus* and those allied to it appear to be distinguishable from *Maera* by the small accessory flagellum, the robust peraeopoda, and by the third uropod not reaching far beyond the others.

I have not included *Maera viridis* (Haswell), which Stebbing has placed under *Elasmopus*, as it differs in several respects from the other species, and appears to me to be very close to *Maera inaequipes* (A. Costa) and best left under *Maera*.

So far as the New Zealand forms are concerned, the characters which seem most useful for distinguishing the species are whether the pleon is carinated or not, the character of the carination when present, and the shape of the second gnathopods in the male. The second gnathopoda are usually much more largely developed in the males than in the females, and their distinctive characters appear to be attained only in fully developed males, so that the particular form of gnathopoda may vary considerably owing to the age and development of the animal; and from what has been stated below it seems probable that in one species there are two forms of gnathopoda in the adult males, apparently similar to what has been described by Mrs. E. W. Sexton in the case of *Jassa falcata* (Montagu). In these cases it is, of course, difficult to decide whether we are dealing with one species with two forms of male, or with two different species in which the females are practically indistinguishable although the males are different. In the following list I have treated the forms as belonging to separate species, except in the one case where the differences between the males are confined to the second gnathopoda.

Elasmopus subcarinatus (Haswell). Figs. 1–6.

Megamoera subcarinatus Haswell, 1879, p. 335, pl. 21, fig. 4. *Moera petriei* G. M. Thomson, 1882, p. 236, pl. 18, fig. 3; Chilton, 1883, p. 82, pl. 2, fig. 4*a*. *Moera subcarinata* Chilton, 1884, p. 230; 1884A, p. 1039; and 1885, p. 368. *Elasmopus subcarinatus* Stebbing, 1906, p. 441 (with synonymy); 1910A, pp. 602 and 643; 1910B, p. 457: Walker, 1904, p. 275, pl. 5, fig. 34; 1909, p. 335.

The history of this species is briefly as follows: It was described in 1879 by Haswell from specimens obtained at Port Jackson, where it is common. He described only the male, and says the pleon is "dorsally carinate, the carina projecting posteriorly in the form of a compressed tooth," though it is really bicarinate, each carina ending in a tooth. In 1882 Thomson independently described the species under the name *Maera petriei* from two specimens from Stewart Island, New Zealand, correctly describing the "fourth segment of the pleon produced into two acute spines [teeth] on its postero-dorsal border"; his description applies to the male only. Shortly afterwards I obtained specimens in Lyttelton Harbour that I identified with *Maera petriei* Thomson, and in 1883 I described and figured the second gnathopod of the female, and at the same time pointed out that the males from Lyttelton differed from the description given by Thomson in the shape and hairiness of the second gnathopoda. A little later I collected in Port Jackson specimens that I had no hesitation in identifying with *Megamoera subcarinata* Haswell, the type of which came from that locality. The females were quite like those from Lyttelton which I had assigned to *Maera petriei*, and the males agreed with the description given by Thomson, thus differing slightly from those I had obtained at Lyttelton. Accordingly I united the two species, and drew attention to the fact that there appeared to be two forms of the male (1884A, p. 1039, and 1885, p. 368). The "Challenger" Expedition obtained two specimens from Station 168, off New Zealand, and in 1888 Mr. Stebbing, after comparing these with specimens of *Maera petriei* sent by me from Lyttelton and with Thomson's description, withdrew the specific name *persetosus*, under which he had commenced to describe them as a new species, and assigned the "Challenger"

specimens to Haswell's species, accepting the view that the males presented some variety of form in the second gnathopoda. The form described and figured by him closely corresponds with that of my Port Jackson specimens. He placed the species under the genus *Elasmopus* Costa.

In 1904 Walker referred specimens from Ceylon to *Elasmopus subcarinatus* (Haswell), drawing attention to differences among them in the second gnathopoda of the male, all of them having the hind margin densely setose, but none being quite like the one figured by Stebbing in the "Challenger" Report. In 1909 he assigned specimens from Cargados, in the Indian Ocean, to the same species; in these he says the wrist and hand of the second gnathopoda of the male "have an inflated appearance, and are almost naked. It appears to be the form described by Chilton (Proc. Linn. Soc. N.S.W., vol. ix, part 4) under *Moera petriei*, which he unites with this species; it is probably a condition of immaturity." In 1910 Stebbing recorded the species from Cape Colony, and says that a small male has the second gnathopod agreeing with that described and figured by Walker in 1904 from a Ceylon specimen.

If the specimens from these different localities are all rightly referred to *Elasmopus subcarinatus*, the species is a widely distributed one in Indian and Southern Oceans, and presents considerable differences in the form of the second gnathopoda of the male. I have never felt quite certain whether these differences were merely stages of growth in the development of the mature form, or whether we were dealing with a species with dimorphic males, or, again, with two different species with similar females but different males. Caution is necessary in coming to a conclusion, for there are other closely allied species of *Elasmopus* with male gnathopoda not unlike the setose form described by Thomson, Stebbing, and Walker; thus New Zealand specimens that I at first sight thought belonged here prove to differ also in the carination of the pleon, and to belong to the species *E. neglectus*, described below. Nearly all the forms I have personally collected in New Zealand have the male gnathopoda like that described by me under *Maera petriei*—*i.e.*, not densely fringed with long slender hairs. Thomson's Stewart Island specimens, on the other hand, have the gnathopoda densely fringed, as in the Port Jackson and "Challenger" specimens, and I have a similar specimen from Moko Hinou; so that the two forms do occur in New Zealand, and if Walker's identification of the Cargados specimen is correct the two forms also occur in the Indian Ocean, though they apparently have not been taken together. In the typical adult male second gnathopod as figured by Stebbing in the "Challenger" Report the palm shows distinct teeth and the hind margin in densely setose; in adult forms like this the posterior peraeopoda are particularly stout, and their terminal joints very setose. In younger specimens transitional stages in the development of these two characters are to be found, and the forms described by Walker, Stebbing, and Thomson are, I think, males of this form, some of them not yet fully developed, in which the teeth on the palm are less prominent, though the long slender setae are already present. In the gnathopod of the males described by me under *Maera petriei* the palm is differently toothed, and the long slender setae are entirely absent, though a few ordinary setae are present. This form occurs in specimens quite as large and apparently as fully developed as those with the setose gnathopoda, and from their difference in shape it is, I think, impossible to look upon them as stages leading up to the fully developed setose form. I consider them to be a different form of the male,

but, as in the carination of the pleon and in all other characters they are so closely similar, I consider them as belonging to the same species (*Elasmopus subcarinatus*). It is possible, as I pointed out in 1885, that the two forms are alternating forms of the male, the setose one assumed during the pairing season and the other during the periods between the pairing seasons—in this respect resembling the alternating forms described by Faxon in some species of *Cambarus*. I suggest the setose form as the one assumed during the pairing season, because similar long slender setae are found as a distinctive male character in many *Amphipoda*, *Isopoda*, and other *Crustacea*, and it is possible that they are sensory and of special use during the pairing season. This explanation would perhaps also account for the fact that all the males collected at any one time appear to belong either to one form or the other, and that the two are not taken together, though, of course, this and the fact that the non-setose form has not yet been recorded from Australia would be more easily accounted for on the supposition that we have two distinct species to deal with. However, Mrs. Sexton's results, which prove that in *Jassa falcata* (Montagu) two forms of male occur, changing at certain moults, induce me to think that we have only one species here also.

This species has been very fully described by Stebbing in his report on the "Challenger" *Amphipoda*, and the following brief description, based upon his shorter diagnosis in "Das Tierreich," *Gammaridea*, will be sufficient here.

Specific Diagnosis.

Female with fourth pleon segment bicarinate behind the dorsal depression, each carina ending in an acute tooth; third pleon segment with postero-lateral corner acutely produced. First antennae elongate, sometimes as long as the body, first joint about as long as the second but stouter and

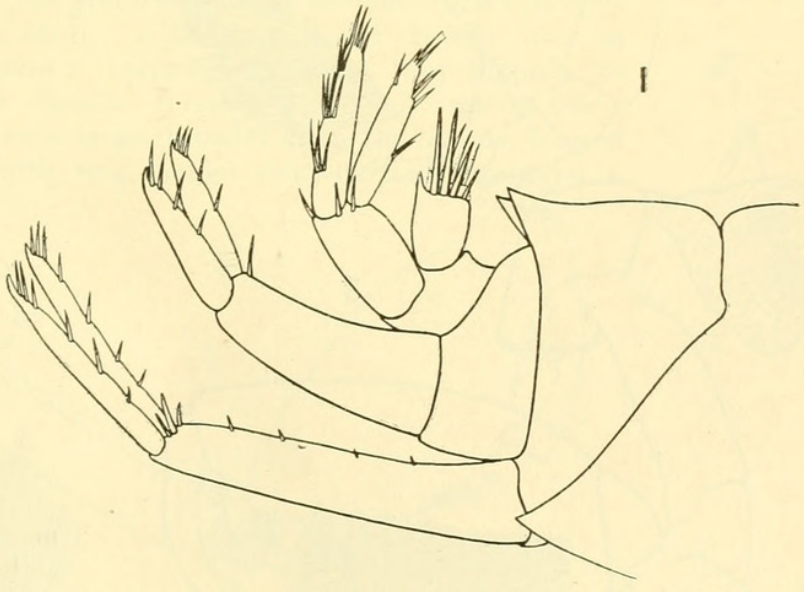
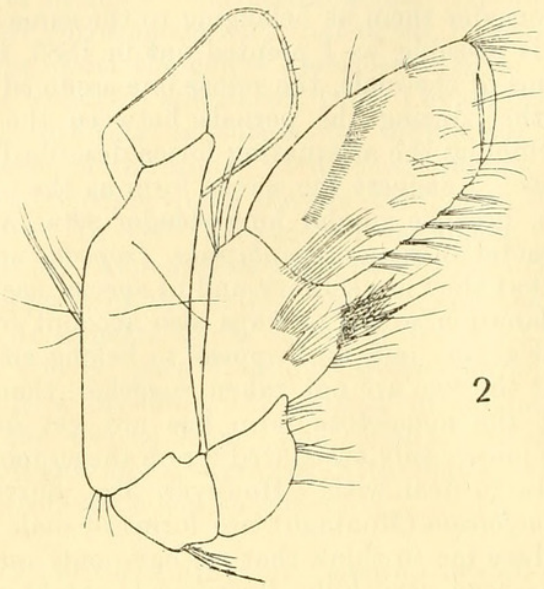


Fig. 1.—*Elasmopus subcarinatus*, male. Terminal portion of pleon with uropoda and telson.

bearing stout setae on the lower margin, third joint half as long as the second, flagellum longer than the peduncle, markedly setose, accessory flagellum well developed with six joints or less. Second antennae not much longer than the peduncle of the first, ultimate joint of peduncle shorter than the penultimate, flagellum shorter than peduncle.



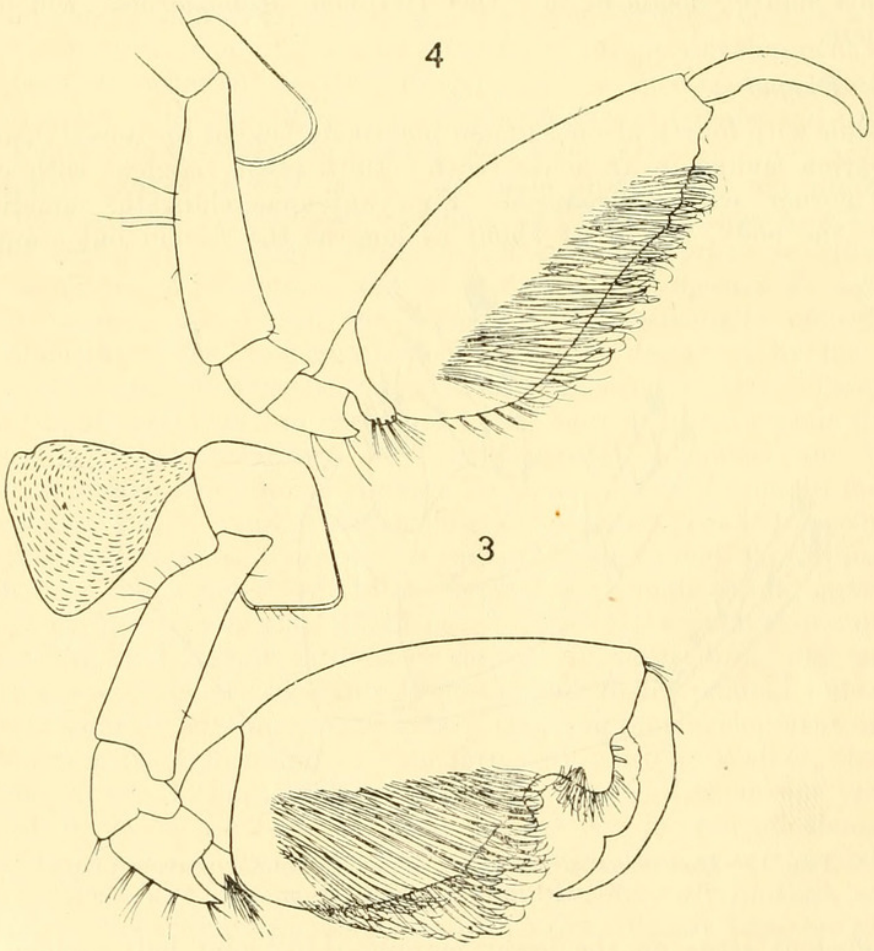


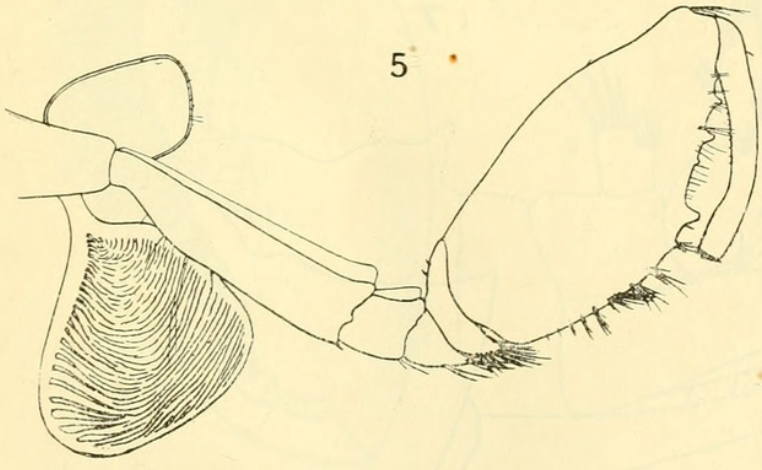
Fig. 2.—*Elasmopus subcarinatus.* First gnathopod.
Fig. 3.—*Elasmopus subcarinatus*, male, form 1. Second gnathopod of fully developed male.
Fig. 4.—*Elasmopus subcarinatus*, male, form 1. Second gnathopod of immature male.

Mandible with third joint of palp slender, its hind margin straight, front margin sparsely setose, not pectinate. First gnathopoda setose; ischium ending acutely; carpus not much shorter than propod, with numerous tufts of slender setae on its inferior margin and lower surface; propod oblong with palm slightly oblique, inner surface bearing a well-marked oblique comb-like row of short stout setae increasing in length towards the distal end of the row and numerous transverse rows or tufts on the hind margin and adjoining inner surface, also three similar transverse rows on the distal half of the anterior border, the third being at the base of the dactyl. Second gnathopoda similar in general form to the first, but larger; carpus longer than broad, fully half as long as the propod, both with numerous tufts of setae arranged on the whole as in the first gnathopod but without the charactertistic comb-like row on the inner surface of the propod.

Peraeopoda rather stout, basal joint rounded-oblong and well expanded, posterior margin simply serrate. Telson about as long as peduncle of third uropod, each lobe bearing three or four long setae at extremity and having the outer angle acutely produced.

Male differing from female in the second gnathopoda and the peraeopoda. The peraeopoda, especially the *fifth*, are stouter and more setose, but the posterior margin of the basal joints is only slightly serrate with long flat serrations; merus, carpus, and propod broadened and densely setose.

In the gnathopoda there are two forms. In form 1 the basal and ischial joints have the outer margins produced into a thin flat flange, especially at the distal end, and the anterior surface hollowed to received the greatly enlarged propod when it is bent back on them; ischium produced distally into an acute point; carpus very short, cup-shaped, its posterior border forming a densely setose lobe; propod very large, broader than the carpus, fringed behind with long slender setae partially arranged in



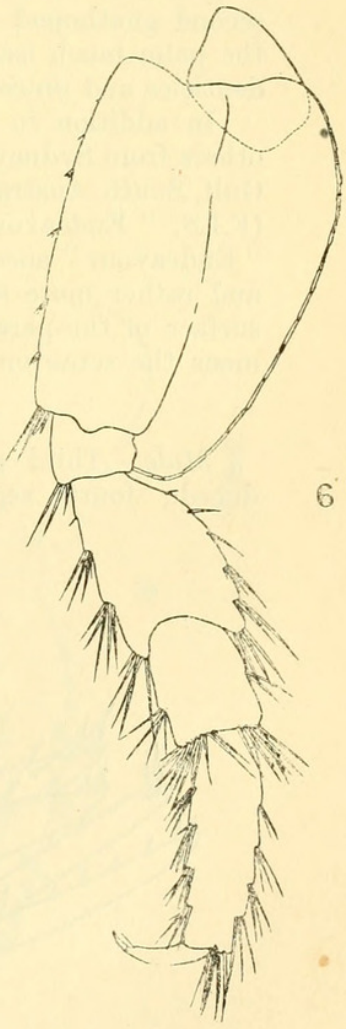


FIG. 5.—*Elasmopus subcarinatus*, male, form 2. Second gnathopod.
FIG. 6.—*Elasmopus subcarinatus*. Fifth peraeopod.

transverse rows, palm in fully developed individuals with a broad spinulose process near the finger-hinge followed by a deep cavity, a strong tooth, a feeble oblique emargination, and a defining denticle; dactyl stout, strongly bent, minutely dentate near the base, with a large triangular process opposite the central palmar tooth, apex subacute reaching the palmar denticle.

Form 2 is similar to form 1 except in the propod and dactyl. The propod is quite devoid of long slender setae, and has only a few small tufts of setae of the usual kind on the posterior margin; the palm bears three prominent teeth, between which are some smaller denticles, with a few scattered setae; dactyl broad with bluntly rounded apex, its inner margin slightly uneven but without denticles or processes.

Colour whitish.

Length, up to 15 mm.

Distribution.—Shores of New Zealand, Australia, Ceylon, South Africa, and Indian Ocean. Usually found at or below low-water mark.

In New Zealand this species occurs at moderate depths in all suitable localities from the Three Kings to Stewart Island. I recently obtained it with the dredge at a depth of 60 fathoms at the Three Kings and at another station about half-way between the Three Kings and Cape Maria van Diemen.

Remarks.—Immature males are more like the females, the characters of the gnathopoda and the broadened setose peraepoda being fully acquired only in adult males. In immature specimens of form 1 the propod of the second gnathopod may be densely haired, but the teeth and processes on the palm much less developed or even absent, and the dactyl without the denticles and process.

In addition to New Zealand specimens, I have been able to examine others from Sydney Harbour (collected by myself in 1884); from St. Vincent Gulf, South Australia (S. W. Fulton); and from Tasmania and Bass Strait (F.I.S. "Endeavour"). In all of these the males are of form 1. The "Endeavour" specimens are a little more slender than some of the others, and rather more setose, bearing a few long scattered setae on the dorsal surface of the peraeon and pleon. In the Sydney and New Zealand specimens the setae on the dorsal are scanty and small.

Elasmopus neglectus sp. nov. Figs. 7–10.

Male.—Third pleon segment with postero-lateral corner acutely produced; fourth segment with a single dorsal carina, ending posteriorly in

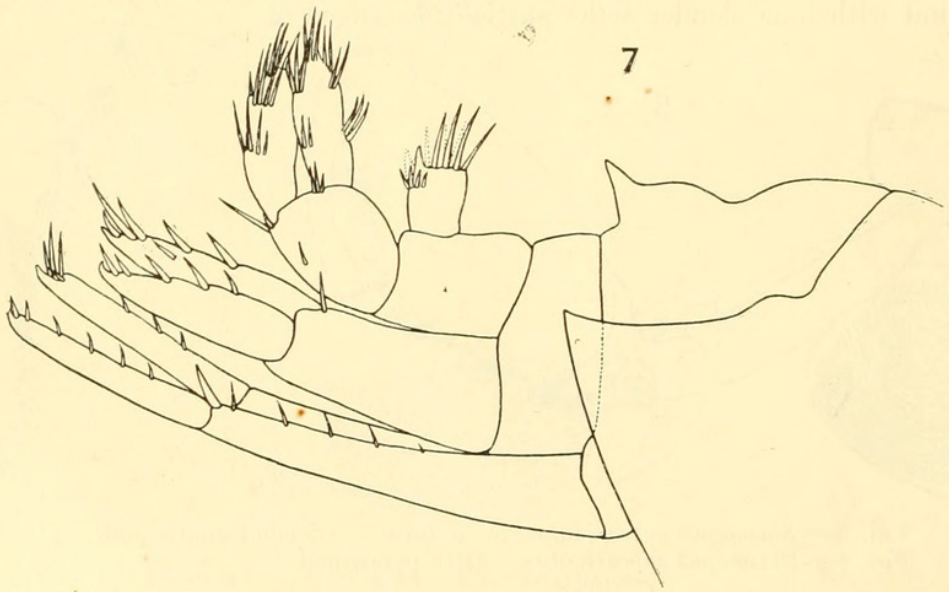
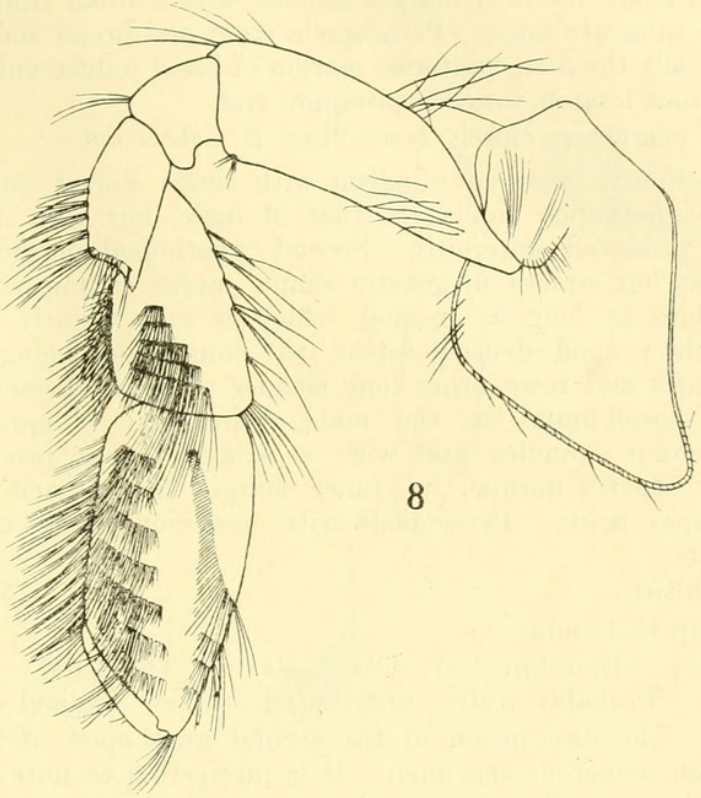


Fig. 7.—*Elasmopus neglectus*, male. Terminal portion of pleon, with uropoda and telson.

an acute point. Mandible with third joint of palp slender, its hind margin slightly convex, front margin pectinate. First gnathopod with side-plate produced anteriorly into a rounded lobe, the terminal joints densely setose

as in *E. subcarinatus*. Second gnathopod very large, ischium ending acutely, carpus short cup-shaped with densely setose posterior lobe, propod very



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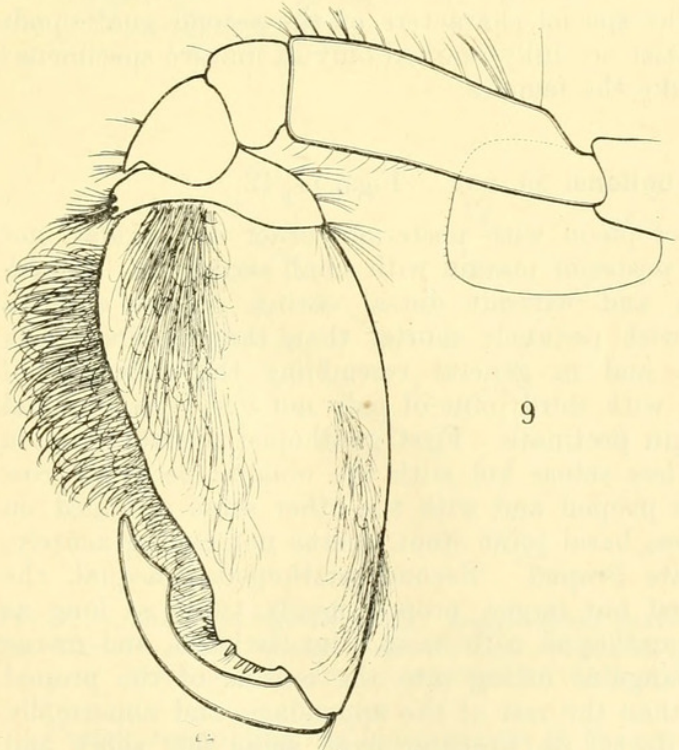

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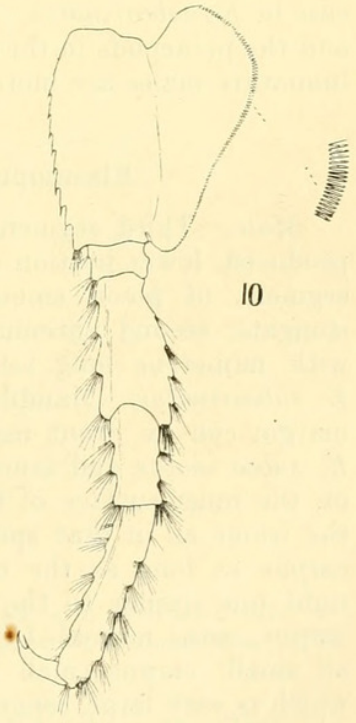

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FIG. 8.—*Elasmopus neglectus*, male. First gnathopod.
FIG. 9.—*Elasmopus neglectus*, male. Second gnathopod.
FIG. 10.—*Elasmopus neglectus*, male. Fifth peraeopod.

large, broadest proximally narrowing towards the distal end, palm long oblique not defined and with only a poorly marked spinose lobe near the

finger-hinge, whole lower margin and greater part of the propod densely fringed with long slender setae mostly arranged in transverse tufts and rows; dactyl stout, its inner margin smooth, with a broad triangular process towards the subacute apex. Peraeopoda stout and broad and very densely setose, especially the fifth, posterior margin of basal joint regularly pectinate the pectinations longest towards proximal end.

In other characters closely resembling *E. subcarinatus*.

Female.—Fourth segment of pleon with single dorsal carina as in the male. First gnathopod similar to that of male, but with side-plate not appreciably produced anteriorly. Second gnathopod considerably larger than the first but similar in general shape, merus ending acutely, carpus about one-third as long as propod, which is only slightly broader than carpus, whole propod densely setose, the long setae being arranged in transverse tufts and rows, other long slender setae are present apparently similar to those found in the male, palm very oblique defined by one or two stout spinules and with a small spinose process near the finger-hinge; dactyl normal, its inner margin smooth and without protuberance, apex acute. Peraeopoda with posterior margin of basal joints simply serrate.

Colour whitish.

Length, up to 15 mm.

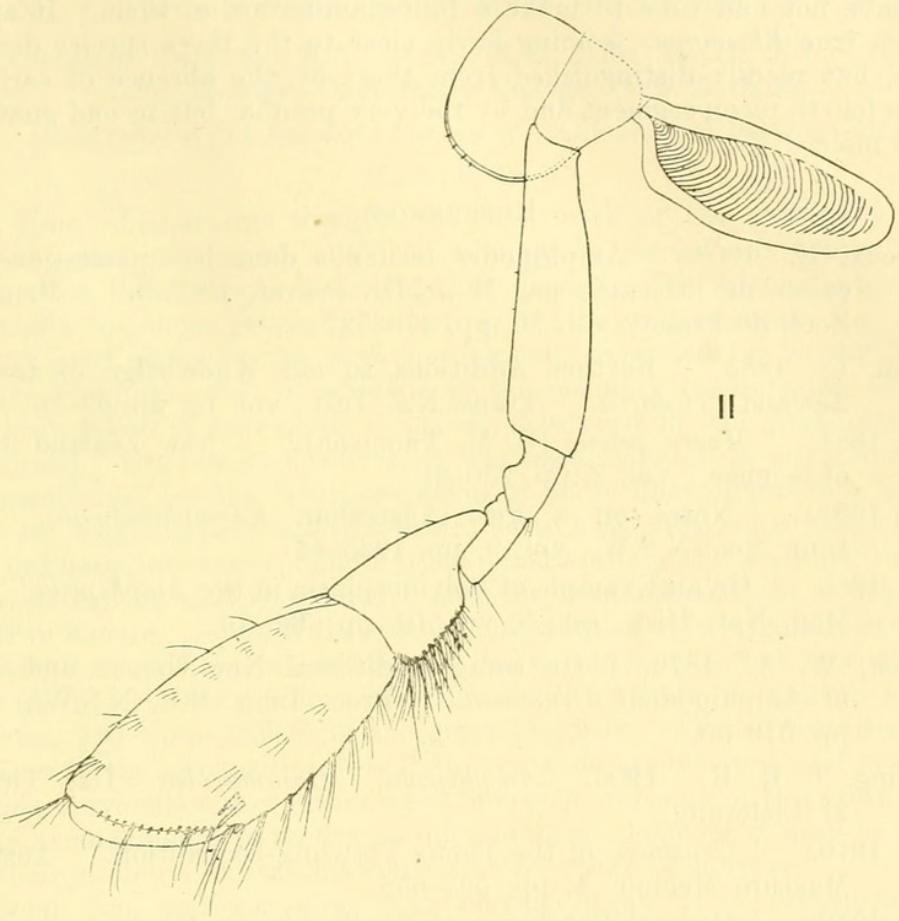
Distribution.—Blueskin Bay, Otago (G. M. Thomson); Moko Hinou (C. R. Gow). Probably widely distributed on New Zealand coasts.

Remarks.—The description of the second gnathopod of the female is taken from an ovigerous specimen. It is interesting to note that it shows more resemblance to the corresponding appendage in the male than is the case in *E. subcarinatus*. The special characters of the second gnathopods and the peraepods in the males are fully marked only in mature specimens; immature males are more like the females.

Elasmopus bollonsi sp. nov. Figs. 11, 12.

Male.—Third segment of pleon with posterior corner rectangular, not produced, lower portion of posterior margin with small serrations. Fourth segment of pleon smooth and without dorsal carina. First antenna elongate, second antenna with peduncle shorter than that of first, both with numerous long setae and in general resembling the antennae of *E. subcarinatus*. Mandible with third joint of palp not very slender, hind margin convex, front margin pectinate. First gnathopod shorter than in *E. subca inatus* and much less setose but with the oblique pectinate row on the inner surface of the propod and with the other setae arranged on the whole as in that species, basal joint stout, merus not ending acutely, carpus as long as the ovate propod. Second gnathopoda unequal, the right one similar to the first but larger, propod nearly twice as long as carpus, setae normal, left gnathopod with basal joint, ischium, and merus all small, carpus small triangular fitting into the outline of the propod which is very large, longer than the rest of the appendage, and abnormally shaped forming with the dactyl an irregular oval, setae few short and scattered, anterior margin sinuous, palm oblique defined by a bluntly rounded lobe and forming a depression on the inner side of the propod, near the finger-hinge is a small flat-topped tooth followed by a larger one of similar shape and then a low convex swelling, dactyl broad with blunt

extremity. Peraepoda fairly stout, with long setae, posterior border of basal joint serrate. Third uropoda short, not much longer than the telson.



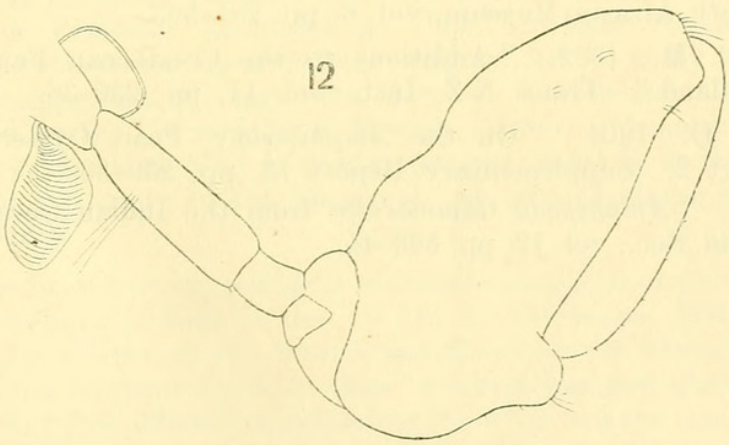


FIG. 11.—*Elasmopus bollonsi*, male. Right second gnathopod, seen from inner side.
FIG. 12.—*Elasmopus bollonsi*, male Left second gnathopod, seen from inner side. (The teeth on the palm are concealed by the dactyl.)

Female resembling the male, except in the second gnathopoda, which are of normal form.

Colour whitish.

Length of male, 8 mm.

Habitat.—Dredged off the Three Kings Islands, north of New Zealand, at a depth of 60 fathoms.

Remarks.—This specimen was obtained when the present paper was almost completed. I have only one male and two small female specimens, and have not had time to make a full examination of them. It appears to be a true *Elasmopus*, coming fairly close to the three species described above, but readily distinguished from them by the absence of carination on the fourth pleon segment and by the very peculiar left second gnathopod in the male.

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