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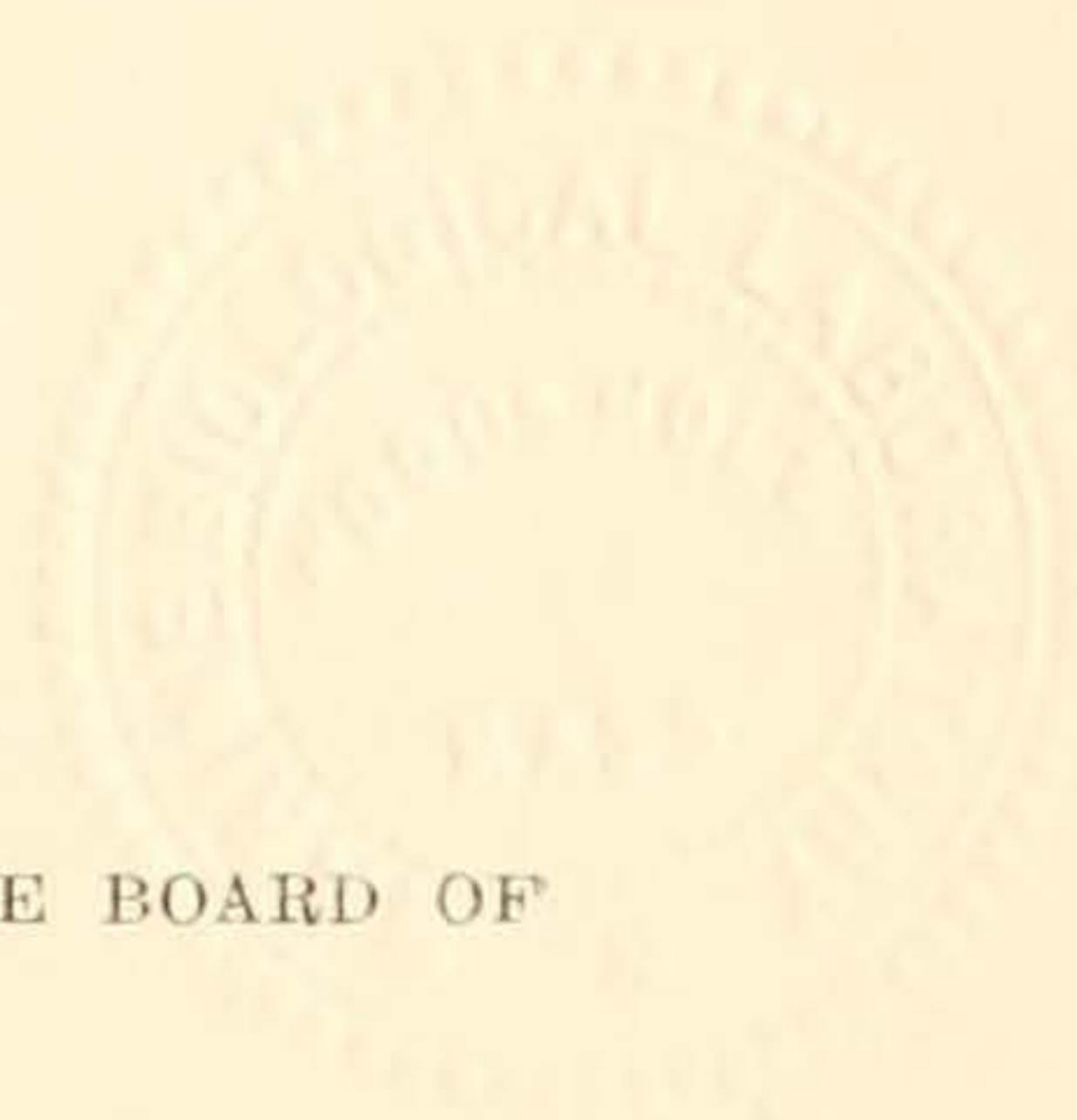
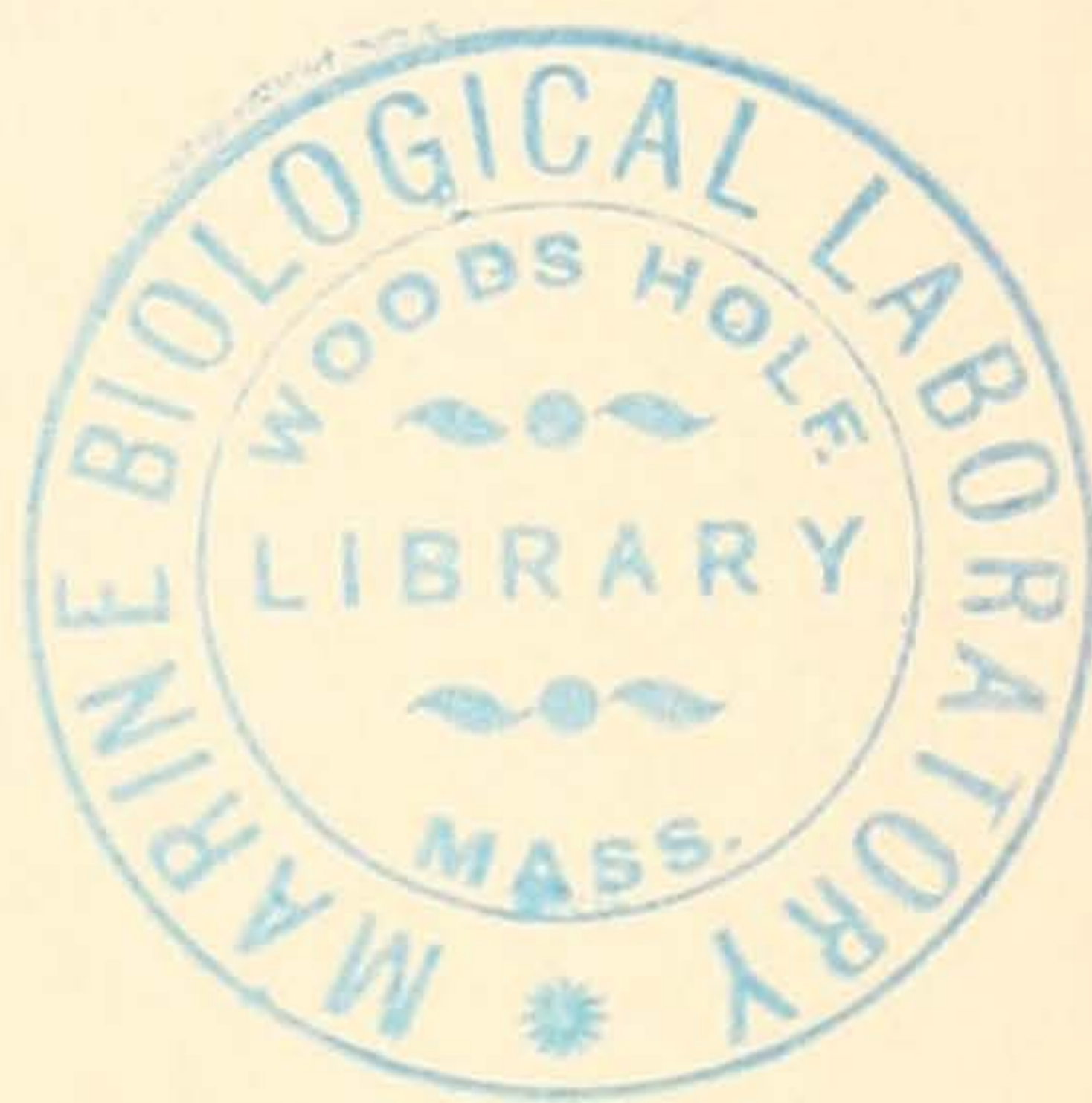
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to its former channel. I would have a number of large stones in the bottom of the pond to provide hiding-places, as the trout of all ages seem inclined to lie quiet during the day, and come out at dusk to rove about. While kept in the pond they should be fed regularly.

I have pleasure in adding that I have been greatly indebted to Mr. Ayson, of the Wellington Acclimatization Society, at Masterton, from whom I have received much valuable information, and small parcels of trout for experimental purposes.

ART. XXVIII.—*The Distribution and Varieties of the Freshwater Crayfish of New Zealand.*

By CHAS. CHILTON, M.A., B.Sc.

[Read before the Otago Institute, 11th September, 1888.]

PLATE X.

FOR some years past I have been engaged, whenever opportunity offered, in forming a collection of freshwater crayfish from the various parts of New Zealand, with a view of determining exactly how many species were represented, and what varieties of these species, if any, existed. By the assistance of several friends I have succeeded in getting a fairly representative collection from both islands, and I now give the somewhat meagre results that I have arrived at from the examination and comparison of specimens from the various localities.

It will be well first to state briefly what has been previously written on the subject.

Miers, in his catalogue of the stalk- and sessile-eyed *Crustacea* of New Zealand (pp. 72, 73), published in 1876, gives three species of freshwater crayfish as inhabiting New Zealand—viz., (1) *Paranephrops planifrons*, White (including under this *P. tenuicornis*, Dana), (2) *P. setosus*, Hutton, and (3) *P. zealandicus*, White.

P. planifrons is well known from many parts of the North Island, and *P. setosus* from the Avon, in North Canterbury, and from other localities in the South Island; but *P. zealandicus* does not seem to have been with certainty recognised since it was originally described by White. It was described in 1847, and, as I have already stated in a previous paper,* Professor Hutton, who described his *P.*

* "Trans. N. Z. Inst.," vol. xv., p. 151.

setosus in 1873, was not then able to consult White's description of *P. zealandicus*, or he would probably, he tells me, not have described his as a new species. I have, in my paper already referred to, discussed to some extent the probability of the identity of these two species, but at that time I was unable to give a decisive opinion on the matter, owing to the want of a sufficiently large collection to examine; and it was chiefly with a view of finally settling the question that I undertook the present investigation.

It is somewhat difficult to compare the descriptions of *P. setosus* and *P. zealandicus*, as they do not run exactly parallel; the differences, however, have been clearly stated by Miers,* who was able to examine the type-specimens of *P. zealandicus* in the British Museum, and to compare them with a specimen of *P. setosus*, Hutton. In speaking of *P. zealandicus* he says, "This species is certainly distinct from *P. setosus*, Hutton. In *P. zealandicus*, of which the type-specimens are in the British Museum collection, the hands are clothed externally with tufts of hair, arranged in longitudinal series, and are armed with spines only on the superior margins; and the sides of the carapace are smooth. In *P. setosus* there are spines arranged seriatly upon the external surface as well as the upper margin of the hand, and the branchial and hepatic regions of the carapace are armed with numerous unequal conical spines."

I have specimens, from streams at Dunedin, that agree fairly well with the description of *P. zealandicus* as given in Miers's catalogue; and, though they differ to some extent from *typical* specimens of *P. setosus*, the characters in which they differ vary, as I shall show in detail further on, to a large extent according to size and age, even in specimens taken from the same stream, and such a complete series of transitional forms is found that it will, I think, be necessary to combine the two species under the name *P. zealandicus*, which has priority over *P. setosus* by many years: but, in accordance with the rule suggested by Professor von Martens, and adopted by Professor Hutton, and by Mr. G. M. Thomson and myself,† the name must be written *Paranephrops neo-zelanicus*.

The differences between specimens of *P. planifrons* of different ages and localities are quite as great as those between different forms of *P. neo-zelanicus*; so that, if the latter species were divided, it would be necessary to divide the former also.

The only other reference to two species of *Paranephrops* from New Zealand besides *P. planifrons* that I can find is an

* "Ann. and Mag. N. H.," ser. 4, vol. xv., p. 412.

† See "Trans. N.Z. Inst.," vol. xvi., p. 187, and vol. xviii., p. 141.

incidental one by Wood-Mason. Speaking of the parasite (*Temnocephala*)* found on these crayfish he says, † “I have since received from my friend Mr. W. Guise Brittan, of Christchurch, New Zealand, an abundant supply of each of *two species* ‡ of crayfish from the rivers Avon and Waimakariri respectively.” (The italics are mine.)

In consequence of this notice I was exceedingly anxious to get specimens from the Waimakariri to compare with the Avon species, to see whether they differed or not; but for a long time I was unsuccessful. However, in September, 1885, one of my pupils brought me specimens, not, indeed, from the River Waimakariri itself, but from a creek at Rangiora that empties into one of its branches. These specimens, though differing in some respects from the typical specimens of *P. setosus*, and therein approaching the Dunedin specimens, are not sufficiently distinct to be considered a separate species. I have therefore no doubt that Wood-Mason's specimens all belonged to the one variable species—*P. neo-zelanicus*.

While examining into the identity of *P. setosus* and *P. zealandicus* I have at the same time examined and compared with them specimens of *P. planifrons* from various localities, and find that most of the points of difference hitherto given break down when a large number of specimens is examined, and that it is exceedingly difficult to find constant characters by which to separate them. At one time I was almost tempted to combine the two species (*P. planifrons* and *P. neo-zelanicus*) into one; but, in consideration of the distinctness between extreme forms, I have thought it best to keep them as two species, though with some intermediate specimens it is sometimes hard to decide which species they should be referred to. The various differences will be given in the detailed description further on, but for the sake of greater clearness I will briefly mention some of them here. The squame of the antenna is generally larger in *P. planifrons* than in *P. neo-zelanicus*, usually reaching slightly beyond the extremities of the rostrum and of the peduncles of the antennules and antennæ; but this character fails us in some specimens from Wellington and Pelorus Valley, &c. The sides of the carapace in *P. planifrons* do not, as a rule, bear so many or such well-developed spines as in *P. neo-zelanicus*; but the general arrangement is much the same, and some specimens of *P. planifrons* (as, for

* See below, Art. xxix.

† “Ann. and Mag. N. H.,” ser. 4, vol. xv., p. 336.

‡ He gives the name of one species only, however—viz, *Astacoides zealandicus*=*Paranephrops setosus*, Hutton.

instance, those from Nelson) are very spiny, while many of *P. neo-zelanicus* have the carapace almost smooth. In *P. planifrons*, again, the infero-posterior corner of the pleura of the abdominal segments is usually distinctly angular, while it is more or less rounded in *P. neo-zelanicus*; but this character, again, varies considerably in both species. The character that I have found most useful in distinguishing the two species is in the form, &c., of the great claws. In *P. planifrons* these are long, and have the basal portion of the propodos (without the fixed finger, that is) usually fully twice as long as the carpus, and generally more than twice as long as broad; and, though it sometimes bears a few scattered hairs, these are never abundant and are not arranged in tufts. In *P. neo-zelanicus* the propodos is usually somewhat compressed, it is generally less than twice as long as the carpus, and not more than twice as long as broad, and it is always abundantly covered with hairs arranged in tufts. The relative sizes of the different joints vary to a considerable extent; but I have found the abundant hairs in all my specimens of *P. neo-zelanicus*, and this forms the only character that I have been able to rely upon in all cases to distinguish this species from *P. planifrons*.

It has generally been stated hitherto that *P. planifrons* is confined to the North Island and is not found in the South, but is represented there by *P. neo-zelanicus*. In August, 1883, however, I received from the late Mr. J. C. Gully two very fine specimens of *P. planifrons* from a stream—the Maitai—at Nelson. It would hence appear that Cook Strait has not proved so great, or, rather, so old a barrier to these crayfish as the mountains in Nelson forming the northern continuation of the Southern Alps. As this point seemed to be of some importance in connection with the geographical distribution of the fauna of New Zealand, and as I was ignorant of the configuration of that part of the South Island, I applied to Professor Hutton for information. With his characteristic kindness and promptness he at once told me that there was no great division (by mountains, that is) between Nelson and Greymouth, but that the first great division would be along the Kaikoura Mountains and across westerly to Mount Franklin, and then down the Spencer Mountains and the Southern Alps; though the part between the Kaikoura Mountains and Mount Franklin is much broken by rivers, some running north and some south. He also told me that several North Island plants extend to Nelson and down the west coast to Westport and Greymouth. Another fact pointing in the same direction is found in the distribution of *Armadillo speciosus*, a terrestrial isopod. This is known from the North Island (Bay of Islands, *Dana*, and Wellington, *Hutton*), and I have specimens

from Nelson; but I have never heard of it occurring in the southern part of the South Island.

It was therefore to be anticipated that specimens of *Paranephrops* found north of the dividing-line mentioned by Professor Hutton would, like those from Nelson, belong to *P. planifrons* rather than to *P. neo-zelanicus*. To test this I applied to Mr. J. Rutland and Mr. R. Helms, and these gentlemen very kindly supplied me with specimens from Pelorus River and Greymouth respectively. These specimens, though to some extent intermediate, like those from Nelson, are without the characteristic tuft of hairs found in *P. neo-zelanicus*, and therefore belong, as I had anticipated, to *P. planifrons*, the North Island species.

The crayfish seem to be very widely distributed over all the different parts of New Zealand. Of *P. planifrons* I have specimens from Karaka, Manukau Harbour; Puriri Creek, Thames; Lake Roto-iti; Napier; Wellington; Nelson; Pelorus River; and Greymouth: and of *P. neo-zelanicus* from various streams in North Canterbury, from Oamaru, and from Dunedin. I have also heard of it from Southland and various portions of the interior of Otago, and Mr. G. M. Thomson has taken it in Stewart Island and in the western tributaries of the Waiau, in the south-west part of Otago.

A freshwater crayfish belonging to the same genus as those of New Zealand—*Paranephrops*—is said to be found in Fiji, and is mentioned by Professor Huxley in "The Crayfish," p. 313, and also in his paper in the "Proceedings of the Zoological Society," 1878, p. 770. In "The Crayfish," p. 313, he states that "considering their wide separation by sea, the amount of resemblance between the New Zealand and the Fiji specimens is very remarkable." As this fact is of some importance in connection with the question of the origin of the New Zealand fauna, I have in several ways endeavoured to get specimens from Fiji for comparison with those of New Zealand, but as yet I have been unable to hear of any one in Fiji who would collect them for me. It appears that the statement that *Paranephrops* is found in Fiji rests on two specimens in the British Museum, and I notice that Professor W. Faxon suggests that the locality-labels are perhaps erroneous.*

Before proceeding to give detailed descriptions of *P. planifrons* and *P. neo-zelanicus*, I desire to take this opportunity of thanking those friends who have kindly provided me with material—viz., Mr. T. F. Cheeseman, Auckland; Mr. A. Hamilton, Napier; Mr. T. W. Kirk, Wellington; the late Mr. J. C. Gully, Nelson; Mr. J. P. Grossman, Christ-

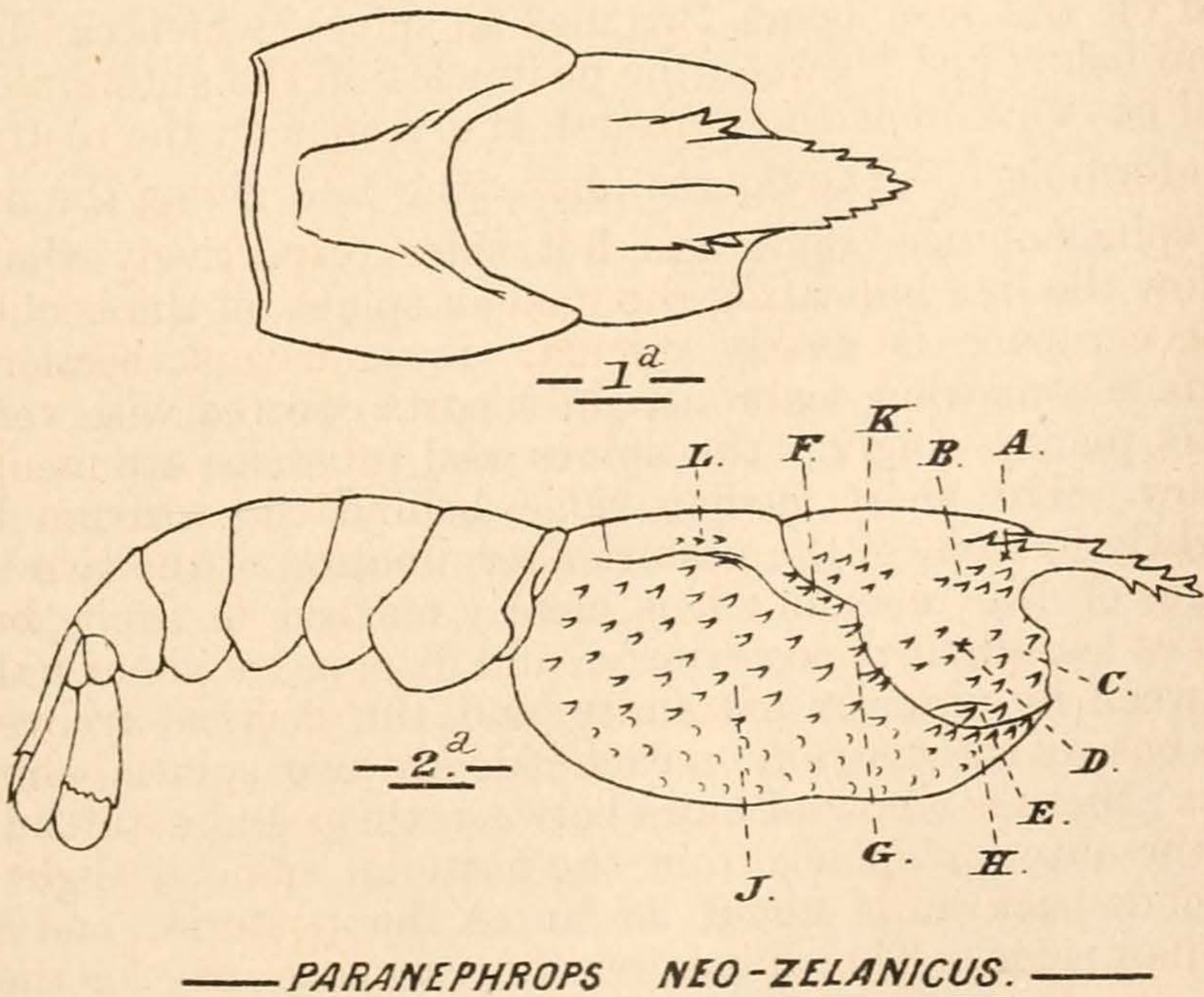
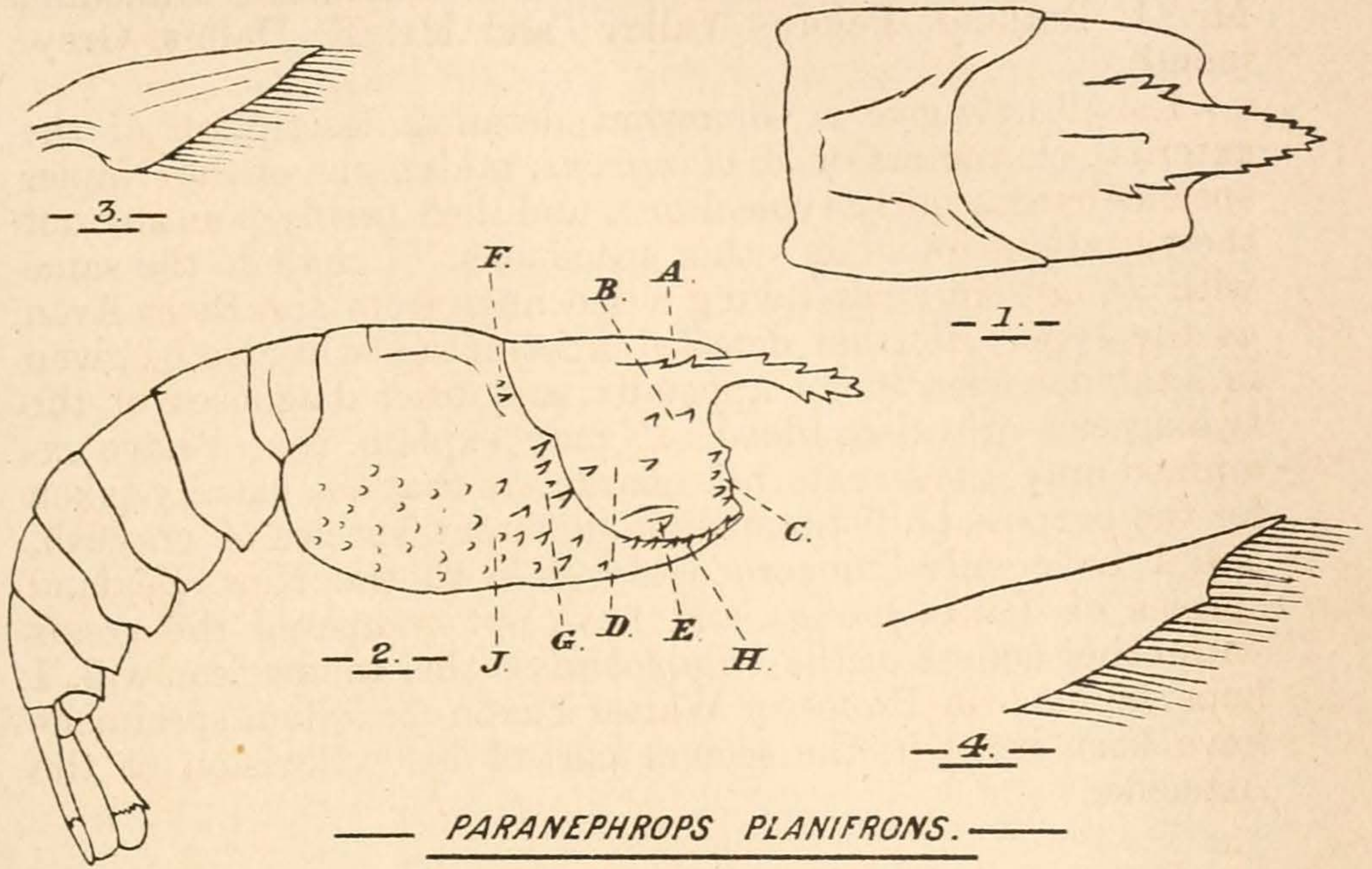
* "Revision of the Astacidae," part i., p. 2 (footnote).

church; Professor Parker and Mr. T. Butement, Dunedin; Mr. J. Rutland, Pelorus Valley; and Mr. R. Helms, Grey-mouth.

I shall now give a somewhat detailed description of the external characters of *P. planifrons*, taking one of the Napier specimens as a fairly typical one, and then briefly pointing out the variations found in other specimens. I shall do the same with *P. neo-zelanicus*, taking a specimen from the River Avon as the type. Further detailed information will also be given in a tabular form in an appendix, and brief diagnoses of the two species are also added. I may explain that I have examined only those external characters that are usually taken for the purpose of distinguishing different species of crayfish, and I have only concerned myself with the New Zealand species of *Paranephrops*, and have not compared the genus with other genera of the *Potamobiidæ*—this comparison will, I hope, be made by Professor Walter Faxon (to whom specimens have been sent) in the second part of his "Revision of the *Astacidæ*."

DESCRIPTION OF NAPIER SPECIMEN OF *P. planifrons*.

The specimen is a male, 5.25in. in length from the tip of the rostrum to the end of the telson; the greatest breadth is 1.2in.; the length of the antennæ is about 4in., and of the great claws 4.5in. The rostrum is elongate triangular, with raised margins bearing four spines on each side; it is keeled below, and on the keel bears two median spines, which can be seen from below just between the peduncles of the antennules. It will be convenient to represent the spines on the rostrum by the formula $\frac{4-4}{2}$, the figures above the line giving the number of spines on the right and left sides respectively, the figure below the line indicating the median spines on the keel below. The carapace is nearly circular in transverse section, the surface somewhat scabrous, most parts covered with very fine hairs placed singly; the spines and tubercles are mentioned below. The short median ridge behind the rostrum begins slightly in front of the posterior termination of the two lateral ridges of the rostrum; it is clearly marked in front, but becomes less distinct posteriorly, and disappears about half-way between its anterior extremity and the cervical groove. At the base of the rostrum on each side are two spines behind the eyes; there is a row of hairs between them and a tuft in front of the anterior spine; from the posterior spine a slight ridge extends backwards about as far as the posterior end of the median ridge. The spines on the carapace may for the sake of convenience of reference be divided into the following arbitrary groups (see Plate X., fig. 2):—



(1.) On the portion of the carapace in front of the cervical groove :

Group A, containing the two spines at base of the rostrum on each side.

Group B, two spines behind the eyes and below A.

Group C, three or four spines on anterior margin of the carapace, near the bases of the antennæ.

Group D, two or more spines on the part of the carapace posterior to C, and in front of the cervical groove.

Group E, one or two spines below D, and usually on a slight projection of the carapace.

(2.) On the portion of the carapace behind the cervical groove :

Group F, two spines immediately behind the cervical groove, and between it and the branchio-cardiac grooves, which here extend forwards and outwards towards the cervical groove.

Group G, four spines close behind the vertical portion of cervical groove below and in front of F.

Group H, six or seven spines along the cervical groove where it curves horizontally forwards (below group E).

Group J, includes the spines and tubercles on the branchiostegites, excluding those bordering the cervical groove and already enumerated. About six of the more anterior are distinctly spinous, the others gradually degenerate posteriorly into mere tubercles.

The peduncles of the antennæ and antennules both reach about to the end of the rostrum ; that of the antenna bears several spines on the under surface of the different joints. The squame of the antenna is large, and reaches rather beyond the end of the rostrum ; it is triangular, narrowing anteriorly, and at the end narrowing abruptly to a sharp point ; the inner edge is fringed with long setæ, and there is a deep longitudinal groove above. The anterior part of the epistoma, between the bases of the antennules, is broad, triangular, and flat, ending anteriorly in a sharp spine. The great claws are large and long, being about six-sevenths the length of the body. The propodos is not compressed, and its length (excluding the fixed finger) is about twice as great as that of the carpus, and about three times its own width ; it widens slightly towards the distal

end. The whole limb is densely spined: the basos has one spine on the inner margin; the ischios has a few on the inner margin, and one or two indistinctly marked on the outer margin; the meros has two irregular rows on the inner margin, and one row on the outer margin, and one spine on each side of the hinge; the carpus is spined all round, with a slight groove above, between two longitudinal rows; the propodos is densely spined in longitudinal rows, the largest spines being on the upper surface and the inner margin, and in one row of about six on the lower surface; there are two very regular rows on the outer margin, extending right to the end of the fixed finger. Both fingers are very spinous, inner margins with rounded teeth and a few hairs, the fingers ending in incurving spines. The pleura of the abdominal segments have the infero-posterior corner distinctly angled, the anterior edge being longer and more convex than the posterior, which, though slightly sinuous, scarcely curves forward; the anterior edge alone fringed with setæ.

The specimen I have described is the largest of *P. planifrons* that I have seen. I have two others from Nelson, 4.8in. long, and others from Lake Roto-iti, 4.15in. and 4in. long. On the other hand we may have mature specimens very much smaller: thus I have a female bearing eggs, from the Thames, only 2.4in. long, and another, from Wellington, 2.5in. From the measurements given in the table below it will be seen that the proportion of the greatest breadth of the carapace to the length varies to some extent, but is almost always less than one-fourth the length. When seen in dorsal view the sides of the branchiostegites are nearly parallel, so that the carapace is about the same width throughout the whole length of the branchiostegites. The sides, however, sometimes bulge slightly in the centre, but not to so great an extent as the Avon and Heathcote specimens of *P. neo-zelanicus*. (See Plate X., fig. 1, and compare it with fig. 1a.) The number of teeth on the rostrum varies very greatly, and very often differs on the two sides; the median teeth below are sometimes entirely absent, as in the Pelorus River specimens, where they are present in one specimen only. The spines, too, vary in distinctness, being very sharp and distinct in the Nelson and Greymouth specimens, but blunt and more or less rounded at the end in those from Lake Roto-iti. The rostrum is frequently depressed, as in the Napier specimen, but, again, is often quite horizontal, or only very slightly depressed. The median ridge on the carapace, behind the rostrum, varies much in length and distinctness, but usually does not extend so far back as in *P. neo-zelanicus*. With regard to the spines on the carapace, it must be remembered that the groups into which I have divided them, though useful

for easy reference, are purely arbitrary, and may not always be clearly distinguished. The spines often vary both in number and position on the two sides of the same specimen. In some specimens the spines are almost entirely absent, so that the whole of the carapace is nearly smooth; but usually some of the groups are represented, if not by spines, by small tubercles corresponding in position to the spines in other specimens. I have tabulated the number of spines of each group found in various specimens, and, though I need not give the tables, I can summarise some of the results here. Group A contains only two spines, and is invariably present; group B is frequently altogether absent, but may contain several spines, as in the Nelson specimens, extending into group D and group K, mentioned below; group C is usually represented, but often only by very small spines; group D is often absent in small specimens, but may contain as many as six spines, extending right back to the cervical groove; group E is seldom entirely absent, and never contains more than two spines; group F is often absent, and the spines in it are never large; group G is one of the most constant, and contains some of the largest spines, it is seldom entirely absent; group H, again, is also usually represented, though the number of spines varies very much, and they are sometimes very small and close together, so as to form only a row of more or less spinous tubercles; group J, including the spines and tubercles on the branchiostegites, is very variable—sometimes the spines are entirely absent, so that this part of the carapace is quite smooth, at other times the spines are represented by slight roughness only, but, again, as in the Nelson specimen, the whole of the branchiostegite may be thickly covered with well-developed spines. In the specimen from Nelson, two other groups, present in many specimens of *P. neo-zelanicus*, but not represented in other specimens of *P. planifrons*, are noticeable: they are, group K, containing 4–5 spines in front of the cervical groove and behind group B; and group L, containing two or three small spines on the cardiac portion of the carapace, usually by the sides of the branchio-cardiac grooves. (See Plate X. fig. 2a.) In this Nelson specimen the number of spines in each group is much greater than usual, and they run into one another so much that, as in some specimens of *P. neo-zelanicus*, it is difficult to distinguish them into the different groups. In the Lake Roto-iti specimens the spines are usually more or less blunt, and often degenerate into tubercles.

The squame of the antenna sometimes reaches only as far as the extremity of the rostrum, instead of beyond it as in the Napier specimen. The inner edge is generally straight in the centre, or even slightly concave; but sometimes more convex, as it usually is in *P. neo-zelanicus*. Towards the end it often

narrows somewhat abruptly, so that a portion of the margin here is very convex; I have never, however, seen it produced into a distinct point, as shown in Dana's figure of *P. tenuicornis*, and think this must be due to an exaggeration on the part of the artist. (Compare figs. 3 and 4 of Plate X.) The spines on the under surface of the joints of the peduncle of the antenna are often entirely absent in small specimens, even though sexually mature. The length of the antenna varies considerably (see table below): it may sometimes, as in Nelson specimens, be greater than that of the body itself. The great claws, again, vary very greatly, both in proportion to the body and in the shape and relative size of the different joints. Large, well-developed forms have the propodos long and thick (*i.e.*, not compressed), and are easily distinguished from those of *P. neo-zelanicus*; but in others the propodos is somewhat compressed, and is not so long in proportion to its breadth, thus approximating in appearance to those of *P. neo-zelanicus*. In the large specimens the propodos is often fully three times as long as broad, but in some specimens from the Thames, Greymouth, &c., it is not more than twice as long as broad, and in these it does not widen distally as it usually does in the others. In the same way the spines on the great claws vary to quite as great an extent as those on the carapace, but it would be tedious to enter into detail. In the Lake Roto-iti specimens those on the propodos are nearly all more or less tubercular, instead of being distinctly spinous, as is usually the case. The propodos, especially in the smaller specimens, often bears a few scattered hairs, but these are never arranged in tufts as in *P. neo-zelanicus*.

The distinctness of the infero-posterior angle of the abdominal pleura also varies very considerably, and it is sometimes quite rounded, as in *P. neo-zelanicus*.

DESCRIPTION OF AVON SPECIMEN OF *P. neo-zelanicus*.

As this specimen agrees in many respects with the one of *P. planifrons* already described, I shall only give those points in which it differs. The length of the body is 4.85in., greatest breadth 1.2in., length of antennæ 3.5in., of great claws 3.5in. The branchiostegites bulge considerably in the centre, so that the breadth here is much greater than in front of the cervical groove. The rostrum has $\frac{4-4}{1}$ as the formula for its spines, and is only slightly depressed. The median ridge behind the rostrum begins on a level with the anterior of the two spines at the side, and extends about three-fourths of the way back to the cervical groove. The spines on the carapace are very numerous, several of the groups running into one another. They may be briefly described as follows, using the same

groups as in *P. planifrons*: Group A, two, as usual; B, three or four, irregularly placed; C, five, but not arranged so regularly on the margin of the carapace as in *P. planifrons*; D, six, extending right back to the cervical groove, and running anteriorly into C; E, one, situated on slight prominence; F, two; G, four or five, very strong, extending into H; H, a row of about seven, extending along the under margin of the groove; J, the whole branchiostegite covered with well-developed spines, all sharp and distinct except those on the lower portions, which are rubbed by the legs and are rounded at the end—the spines extend much further up than is usual in *P. planifrons*, reaching almost to the branchio-cardiac grooves; K, a group of about eight well-marked spines; L, two or three small spines along the branchio-cardiac groove on each side. The squame of the antenna scarcely reaches beyond the extremity of the rostrum, and has its inner margin more convex than is usually the case in *P. planifrons*. The anterior portion of the epistoma is quite narrow, and ends anteriorly in a sharp spine. The great claws are much shorter and stouter than in extreme forms of *P. planifrons*, and have the propodos and the fingers thickly covered with dense tufts of hairs, chiefly arranged in longitudinal rows. The ischios and meros are somewhat *laterally* compressed, so that it will be convenient in describing the spines on them to speak of the upper and under *edges* and the outer and inner *sides*; the carpus and propodos are more or less *vertically* compressed, so that we can distinguish here the outer and inner *edges* and the upper and under *sides*. The spines on the great claws are then arranged as follows:—

Ischios—*Upper edge*, two blunt spines.

Under edge, two sharp spines.

Meros—*Upper edge*, one row dividing into two at the end, where there are also a few spines irregularly placed.

Under edge, two diverging rows, containing four to six spines each; one large spine at distal end between the two rows, and others placed irregularly.

The *outer* and *inner sides* of these joints without spines.

Carpus—Spined all round, the largest on the outer and inner edges; on the upper side the central portion is flat and free from spines.

Propodos—*Inner edge*, a row of four strong spines.

Outer edge, two rows, containing about twelve spines each, extending right along to the end of the fixed finger.

Upper side, various spines, chiefly arranged in two longitudinal rows.

Under side, spines chiefly arranged in two longitudinal rows; strong spines in the centre.

The fingers end in strong incurved spines, inner margins with three or four rounded prominences. The propodos (without the fixed finger) is one and a half times as long as the carpus, and about twice as long as broad. The pleura of the abdominal segments is quite rounded below, and has setæ both on anterior and posterior margins. (See Plate X., fig. 2a.)

All the parts I have thus described are subject to much variation, as in *P. planifrons*, and I need not go over each in detail, but only mention those in which this species sometimes differs from *P. planifrons*. The bulging of the branchiostegites is only found in the specimens from the Avon and Heathcote; the others have the sides straight as in *P. planifrons*. The epistoma is often narrow, but is sometimes broad, flat, and triangular, as in *P. planifrons*. The spines on the sides of the carapace vary very greatly: in large specimens, especially those from the Avon and Heathcote, they are very numerous and prominent; but in others, from Rangiora and Dunedin, only a few are represented, and the greater part is quite smooth. Some of these specimens would correspond fairly well with the description of *P. zealandicus*, White, as given in Miers's catalogue. The relative lengths of the joints of the great claws vary a good deal, as in *P. planifrons*; but these limbs are usually shorter and broader than in that species. The pleura of the abdominal segments often have the infero-posterior angle more pointed than in the Avon specimens, thus approaching *P. planifrons*. The large specimen in the Otago Museum, labelled *P. setosus* in Professor Hutton's handwriting, is the largest I have seen, being 6.3in. long; the sides of the branchiostegites are quite straight; the spines on the carapace, though numerous and well marked, are all rounded at the end, so as to be almost tuberculiform; the propodos of the great claws is very little compressed, and somewhat resembles that of *P. planifrons*, though stouter; and the upper margin bears very few spines, the tufts of hairs arising out of small tubercles instead.

In both species the females, especially when bearing eggs, have the abdomen wider than it is in the male, but beyond this I have noticed no other differences between the sexes.

I append brief diagnoses of the two species, with the synonymy so far as it is known to me.

PARANEPHROPS PLANIFRONS.

Paranephrops planifrons.

White, "Zool. Miscel.," p. 79 (1842).

Dieffenb., "Voy. New Zealand," ii., p. 267 (1843).

Miers, "Zool. 'Erebus' and 'Terror,'" Crust., p. 4, pl. iii., fig. 1 (1874); "Cat. N.Z. Crust.," p. 72 (1876).

Huxley, "Proc. Zool. Soc.," 1878, p. 770.

Paranephrops tenuicornis.

Dana, "U.S. Exped.," xiii., Crust., part i., p. 527, pl. xxxiii., fig. 4 (1852).

Basal scale of antennæ large, narrowing abruptly anteriorly, with deep groove above, reaching as far as or beyond the extremities of the rostrum and of the peduncles of the antennæ and antennules. Carapace nearly cylindrical, of same width throughout whole length of the branchiostegites, being a little less than one-fourth the total length of body; smooth, or with small tubercles on sides of branchiostegites, and spines along the cervical groove and elsewhere; two spines on each side of the base of the rostrum. Rostrum elongate, triangular, sometimes depressed, margins raised and usually with four teeth on each side, under surface keeled and usually with two teeth. Median ridge behind the rostrum clearly marked in front, arising slightly in front of the two lateral ridges of the rostrum, and reaching about half-way from its anterior extremity to the cervical groove, disappearing gradually. Anterior portion of the epistoma triangular, flat, narrowing anteriorly, and ending in a sharp spine. Great claws long, slender, propodos (without fixed finger) about twice as long as the carpus and about two and a half times as long as broad, whole limb densely spined; spines on propodos arranged more or less regularly in longitudinal rows, and with occasionally a few scattered hairs. Pleura of abdominal segments rather pointed at the infero-posterior angle, anterior edge longer and more convex than the posterior and fringed with setæ, posterior edge sinuous and scarcely curving forwards.

Length of largest specimen, 5.25in.

Habitat. North Island generally, and the north-western portion of the South Island as far south as Greymouth.

PARANEPHROPS NEO-ZELANICUS.

Astacus zealandicus.

White, "Proc. Zool. Soc.," p. 123 (1847); "Ann. and Mag. Nat. Hist." (ser. 2), i., p. 225 (1848).

Paranephrops zealandicus.

- Miers, "Zool. 'Erebus' and 'Terror,'" Crust., p. 4, pl. ii., fig. 2 (1874); "Cat. N.Z. Crust.," p. 73 (1876); "Ann. and Mag. Nat. Hist." (ser. 4), xv., p. 412 (1876); "Trans. N.Z. Inst.," ix., p. 475 (1877).
 Chilton, "Trans. N.Z. Inst.," xv., p. 151 (1883).

Astacoides zealandicus.

- Wood-Mason, "Ann. and Mag. Nat. Hist." (ser. 4), xv., p. 336 (1876).

Paranephrops setosus.

- Hutton, "Ann. and Mag. Nat. Hist." (ser. 4), xii., p. 402 (1873).
 Miers, "Cat. N.Z. Crust.," p. 72 (1876); "Ann. and Mag. Nat. Hist." (ser. 4), xv., p. 412 (1876); "Trans. N.Z. Inst.," ix., p. 475 (1877).
 Chilton, "Trans. N.Z. Inst.," xv., p. 150 (1883).

Basal scale of antennæ like that of *P. planifrons*, but not narrowing so abruptly, and extending only to the end of the rostrum. Carapace nearly cylindrical, greatest breadth generally a little less than one-fourth the length, of the same width throughout whole length of the branchiostegite, or bulging in centre; carapace nearly smooth, or with spines along the cervical groove and on the branchiostegite and elsewhere, spines usually more numerous than in *P. planifrons*; two spines on each side of the base of the rostrum. Rostrum elongate, triangular, sometimes depressed, margins raised and usually with four teeth on each side, under surface keeled and usually with two teeth. Median ridge behind rostrum arising on level with the first of the two spines at the base of the rostrum and extending backwards three-fourths of the distance to the cervical groove. Anterior portion of epistoma flat and triangular, or narrow, ending anteriorly in a sharp spine. Great claws stout, propodos usually compressed, one and a half times as long as the carpus and nearly twice as long as broad, both sides covered with small tufts of hair and with stout spines arranged chiefly in longitudinal rows. Pleura of abdominal segments usually rounded below, anterior edge longer than the posterior, which curves forward, both edges fringed with setæ.

Length of largest specimen, 6.3in.

Habitat. South Island generally, excepting north-western portion; Stewart Island.

TABLE OF MEASUREMENTS, ETC., OF DIFFERENT SPECIMENS.

Description of Specimen.	Length in Inches.	Greatest Breadth in Inches.	Length of Antennæ in Inches.	Length of Great Claws in Inches.	Spines on Rostrum.
<i>Paranephrops planifrons.</i>					
Napier specimen No. 1, ♂	5.25	1.2	4	4.5	$\frac{4-4}{2}$
" " No. 2, ♀	4.7	1.1	Broken	3.2	$\frac{5-4}{3}$
Roto-iti " No. 1, ♂	4.15	1	2.75	3	$\frac{4-4}{1}$
" " No. 2, ♂	4	1	3.5	3	$\frac{3-3}{2}$
Manukau " No. 1, ♀	3.25	0.7	3	2.25	$\frac{3-3}{2}$
" " No. 2, ♂	2.85	0.55	2.4	2	$\frac{4-4}{2}$
Nelson " No. 1, ♂	4.8	1.1	5.3	4.1	$\frac{4-5}{1}$
" " No. 2, ♂	4.8	1.1	4.6	4.1	Broken
Thames " No. 1, ♂	3	0.6	2.75	2.4	$\frac{3-2}{1}$
" " No. 2, ♀	2.4	0.5	1.9	1.6	$\frac{3-3}{1}$
Wellington specimen No. 1, ♀	2.5	0.5	1.7	Wanting	$\frac{6-5}{2}$
Greymouth specimen No. 1, ♀	3.5	0.8	3.2	2.4	$\frac{4-4}{2}$
Pelorus Valley specimen No. 1, ♀	3	0.6	2.5	2	$\frac{5-4}{0}$
<i>Paranephrops neo-zelanicus.</i>					
River Avon specimen No. 1, ♂	4.85	1.2	3.5	3.5	$\frac{4-4}{1}$
River Avon specimen No. 2, ♂	5.8	1.5	4	4.25	$\frac{5-5}{3}$
River Avon specimen No. 3, young ♀	2.2	0.45	1.7	1.35	$\frac{6-3}{1}$
River Heathcote specimen No. 1, ♀	3.6	0.85	2.75	2.25	$\frac{4-5}{2}$
Rangiora specimen No. 1, ♂	3.9	0.9	3	2.8	$\frac{4-4}{1}$
Oamaru specimen No. 1, young ♂	2.5	0.5	1.6	1.7	$\frac{5-6}{1}$
Dunedin specimen No. 1, ♀	2.8	0.5	1.9	1.7	$\frac{5-4}{0}$
Dunedin specimen No. 2	6.3	1.5	4.5	5	$\frac{5-6}{2}$

In the above tables I have given only a small selection of the specimens that I have examined and measured.

DESCRIPTION OF PLATE X.

- Fig. 1. *Paranephrops planifrons* (Napier specimen); carapace from above.
 Fig. 2. *The same*; side view, to show arrangement of spines, &c., on carapace.
 Fig. 3. *The same*; squame of antenna.
 Fig. 4. Squame of antenna of *Paranephrops tenuicornis*, Dana (after Dana).^{*}
 Fig. 1a. *Paranephrops neo-zelanicus* (Avon specimen); carapace from above.
 Fig. 2a. *The same*; side view, to show arrangement of the spines, &c., on carapace.

NOTE.—All the drawings are semi-diagrammatic.

ART. XXIX.—*Note on the Parasite (Temnocephala) found on the Freshwater Crayfish of New Zealand.*

BY CHARLES CHILTON, M.A., B.S.C.

[*Read before the Otago Institute, 11th September, 1888.*]

On both species of *Paranephrops* inhabiting New Zealand an ecto-parasite is found belonging to the genus *Temnocephala*, an aberrant monogenetic trematode. This has been mentioned by Wood-Mason,[†] who referred it to the typical species *T. chilensis*, Gay. Specimens were afterwards sent to Dr. W. A. Haswell, of Sydney, who has lately published a paper on the genus,[‡] and he has given it the name *T. novæ-zealandiæ*. Similar species are found on other freshwater crayfish of Australia and Tasmania, each having its peculiar species of parasite, viz.,—

T. fasciata, on *Astacopsis serratus*; streams of New South Wales.

T. quadricornis, on *Astacopsis franklinii*; northern rivers of Tasmania.

T. minor, on *Astacopsis bicarinatus*; streams of New South Wales.

* This is taken from a tracing kindly made for me by Professor Hutton from Dana's "Atlas," in the Canterbury Museum.

† "Ann and Mag. N.H.," ser. 4, xv., p. 336.

‡ "Q. J. of Micr. Science," xxviii., part 2, p. 279.