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Studies on
Palaemon affinis M.—Edw. 1837,
(Crustacea, Decapoda, Natantia.)
Part I. Synonymy and External
Morphology.

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Studies on *Palaemon affinis* M.—Edw. 1837, (Crustacea,
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Abstract

THIS common New Zealand marine littoral shrimp is referred to the subgenus *Palaemon* s.s. All previous distributional records are critically examined and the South African, Australian and South American records are regarded as doubtful. The external morphology is described in detail, and a brief comparison made with *P. serratus* and *P. elegans* of European waters and *P. northropi* of West Indian waters.

THE majority of species in the Natantia were long known in the literature only by curt diagnoses such that confusion between species has taken place in the past and some "species" have been credited with an extensive distribution. This has occurred in the case of the commonest New Zealand marine littoral shrimp, *Palaemon affinis* M.-Edwards, 1837, for which as yet there has been no complete morphological account. Holthuis (1952) states that in an earlier paper he demonstrated a confusion of species in that *P. affinis* was formerly regarded as having a south circumpolar range but extending in the Atlantic at least up to the West Indies. Holthuis has shown that the species of *Palaemon* occurring in the western Atlantic from Uruguay to the West Indies is *P. northropi* (Rankin, 1898) and records of *P. affinis* from those waters are erroneous. There are also now grounds to consider the circumpolar range of *P. affinis* as doubtful. Krauss (1843) recorded *P. quoianus* (syn. of *P. affinis*) from the coast of Natal, South Africa. Lenz and Strunck (1914) describing specimens from the German South Polar Expedition 1901-03, collected in Cape Town Harbour and Stebbing (1914) describing specimens from the Scottish National Antarctic Expedition 1902-04, collected at Saldanha and Reitz Bays, South Africa, both place them as *P. affinis*, and on the descriptions given the animals could belong to *P. affinis*. The data given clearly indicates the subgenus *Palaemon* but specific identification requires re-examination of the material. Miers (1876) has listed *P. affinis* from the Cape of Good Hope and the Falkland Islands, indicating possible unrecorded early specimens in the British Museum labelled as from these localities. Thomson's (1903) and Chilton's (1909) Falkland Islands records are probably *vide* Miers. Balss (1929) in a distributional chart showing the circumpolar distribution of this species, uses these records; but Barnard (1950) in his excellent comprehensive account, reports that he has been unable to confirm the presence of the species in South Africa even at the localities given by Krauss, Stebbing, and Lenz

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and Strunck. Records of the species in Australian waters are also now doubtful. Although Spence Bate (1888) describes and figures typical specimens from Port Jackson, Sydney, and both Thomson (1903) and Chilton (1909) refer to the species as occurring in Australia and Tasmania, both these Australian records probably being *fide* Bate, Haswell (1882) working at Sydney and Hale (1927) working at Adelaide have no reference to the species in Australian or Tasmanian waters. It is probable then that Spence Bate was handling erroneously labelled specimens. Barnard (1950) restricts the distribution of *P. affinis* to the West Indies and New Zealand without discussion on the occurrence in the former. Balss (1929) in his circumpolar distributional chart (p. 206) records *P. affinis* from the Magellan region of Chile but gives no authority for this record, nor is it mentioned in his text. Neither Doflein and Balss (1912) describing material from the Hamburg Magellan Expedition 1892-93, nor Ortmann (1911) describing the Crustacea of the Princeton University Expedition to Patagonia 1896-99, record *P. affinis* from these regions. Also Holthuis (1952) in an account of the Palaemoninae of the Americas does not include this species in that faunal list, but restricts it to the New Zealand coast. It is suggested therefore that Balss's unsupported record could well be an error during the preparation of his chart. Filhol (1886) records *P. affinis* from Campbell Island. The New Zealand Subantarctic Islands records of Thomson (1903), Chilton (1909) and Balss (1929) are all apparently based on Filhol. Chilton does not refer to any specimen collected by the Philosophical Institute of Canterbury Subantarctic Islands Expedition, 1907, in his account of the Crustacea. The collections of Natantia from the Cape Expedition are not available, but a small collection made by Mr. J. H. Sorensen at Campbell Island contains no *P. affinis*, although this includes a shore-line collection.

The type locality of *P. affinis* is given as New Zealand, the species being named by Milne-Edwards (1837) from material which was not well enough preserved for him to give a complete description. He stated that it resembled *P. squilla* (Linnaeus, 1758), a European species, differing only by the fact that the second pair of legs were shorter than in *P. squilla*. Following this brief account of *P. affinis*, Milne-Edwards gives a description of *P. quoianus* based on material collected in New Zealand by Quoy and Gaimard, naturalists on the "Astrolabe" during d'Urville's second visit to New Zealand, 1826-1829. The two species were recognised as the same by Miers, Thomson and others, with *P. affinis* having page priority. *P. quoianus* was described by M.-Edwards as very similar to *P. squilla*, though in this case he was able to give a short description. Thus the following intimately detailed account of the external morphology of typical specimens from various localities around the New Zealand coast and from the Chatham Islands has value in providing a basis for the checking of specimens similar to this species taken in other countries, so that the true range for *P. affinis* may be finally determined.

The following briefly sets out the records of *P. affinis* as formerly accepted other than for the West Atlantic:

1843. *Palaemon quoianus* Krauss, Südafrik. Crust.: 55. (South African record.) 1843. *Palaemon quoianus* White, Dieffenb. Voy. N.Z. II: 268. (N.Z. record.) 1852. *Palaemon affinis* Dana, U.S. Explor. Exped. Crust.: 584 (Descr., N.Z. record.); 1855 Atlas, Pl. 38, Fig. 5 a-g. 1876. *Leander affinis* Miers, Cat.

N.Z. Crust.: 85 (Descr., N.Z., Falkland Is. and S. African records.) 1886. *Leander affinis* Filhol, Miss. Ile. Campbell, Zool., 3 (2): 434 (Campbell Island record.) 1888. *Palaemon affinis* Spence Bate, "Challenger" Macrura: 782, Pl. 128, Fig. 5 (Descr., Fig., Australian record.) 1903. *Palaemon affinis* Thomson, *Trans. Linn. Soc.* ser. 2, VIII (ii): 450 (Descr. N.Z. record.) 1909. *Palaemon affinis* Chilton, Subantarctic Is. N.Z. ii: 614 (N.Z., Australian, Tasmanian, Falkland Is. and S. African records.) 1910. *Palaemon quoianus* Stebbing, *Ann. S. Afri. Mus.* VI: 384 (Krauss's S. African record.) 1911. *Leander affinis* Chilton, *Rec. Cant. Mus.* I (3): 305 (Chatham Is. record.) 1912. *Palaemon affinis* Thomson, *T.N.Z.I.* XLV: 240 (N.Z. record.) 1914. *Leander affinis* Lenz and Strunck, *Deutsch Südpolarexpedition*, 15 Zoo. 7 (3): 322 (Descr. S. African record.) 1914. *Leander affinis* Stebbing, *Trans. Roy. Soc. Edin.* 50: 287 (Descr. South African record.) 1921. *Palaemon affinis* Thomson, N.Z. Board Sci. Art. Bull. 2: 107 (N.Z. record.) 1925. *Leander affinis* Kemp, *Rec. Ind. Mus.* XXVII: 292 (N.Z., Chatham Is. and S. African records.) 1925. *Leander quoianus* Kemp, *Rec. Ind. Mus.* XXVII: 294 (close to *P. affinis*.) 1929. *Leander affinis* Balss, *Senckenbergiana* 11: 206 (Chile, N.Z., Subantarctic Is. and S. African records.) 1950. *Leander affinis*, *Leander quoianus* Barnard, *Ann. S. Afri. Mus.* XXXVIII: 781, 783 (review of S. African records.) 1952. *Palaemon affinis* Holthuis, Allan Hancock Foun. Occ. pap. 12: 196 (Comparison with *P. northropi*.)

Tribe: CARIDES

Family: PALAEMONIDAE

Subfamily: PALAEMONINAE

Palaemon Weber, 1795.*Palaemon (Palaemon) affinis* M.-Edwards, 1837.

1837. *Palaemon affinis* M.-Edwards, *Hist. Nat. Crust.* II: 391.

1837. *Palaemon quoianus* M.-Edwards, *Hist. Nat. Crust.* II: 393.

1876. *Leander affinis* Miers, *Cat. N.Z. Crust.*: 85.

1888. *Palaemon affinis* Spence Bate, "Challenger" Macrura: 782.

This species was placed by M.-Edwards (1837) in g. *Palaemon* Fabricius, 1798. Miers (1876) while placing it in the genus *Palaemon* Fabr. used *Leander* Desmarest, 1849, as a subgenus of *Palaemon* and referred to the species always as *Leander affinis*. Stebbing (1914) describing South African specimens, placed them as this species, which he put in the genus *Leander* and was followed in this by Lenz and Strunck (1914) and Balss (1929). Rathbun (1904) explained that *Palaemon* was referable to Weber, 1795. Holthuis (1952) shows clearly the differences between *Leander* and *Palaemon* Weber, 1795, which can be summarised as follows: in *Leander* the 1st pleopod of the male bears an appendix interna; the mandible, a two-jointed palp; the branchiostegal groove is absent; no transverse rows of hairs on the posterior margin of the propodite of the 5th walking leg. In *Palaemon* the 1st pleopod of the male does not bear an appendix interna, the mandible bears a two- or three-jointed palp, the branchiostegal groove is generally distinct and the propodite of the 5th walking leg has transverse rows of hairs on the distal portion of the posterior margin. Accordingly the present species is placed in the genus *Palaemon* Weber, 1795. Holthuis defines subgenera, and it can be clearly seen from his key (1952) that *P. affinis* belongs to the subgenus *Palaemon* s.s. Weber, 1795, by not having the elevated basal crest of the

rostrum characteristic of the subgenus *Nematopalaemon* Holthuis, 1950, and by having a three-jointed palp as distinct from the two-jointed palp characteristic of the subgenus *Palaeander* Holthuis, 1950.

The American East coast species with which it has been confused is *Palaemon* (*Palaeander*) *northropi* (Rankin, 1898), with a distribution from Bermuda to Uruguay. Heilprin (1888) first recorded specimens of *P. northropi* as *P. affinis*, and it was the practice to refer material from those waters to *Palaemon* or *Leander affinis*. Holthuis (1952) states that *Palaemon affinis* Heilprin (non M.-Edwards) is identical with *Palaemon northropi* (Rankin) and is quite distinct from *Palaemon affinis* M.-E. from New Zealand, the differences being:

- “1. The rostrum of *P. northropi* is longer and more slender. The unarmed distal portion is relatively longer than in *P. affinis*.
2. The free part of the shorter ramus of the upper antennular flagellum in *P. northropi* generally is shorter than the fused part, in *P. affinis* it is longer than the fused part.
3. The mandibular palp in *P. northropi* is two-, that of *P. affinis* three-jointed.
4. *P. northropi* is smaller and more slender than *P. affinis*.
5. *P. northropi* is a form of the American east coast, *P. affinis* is a species of N.Z. waters.”

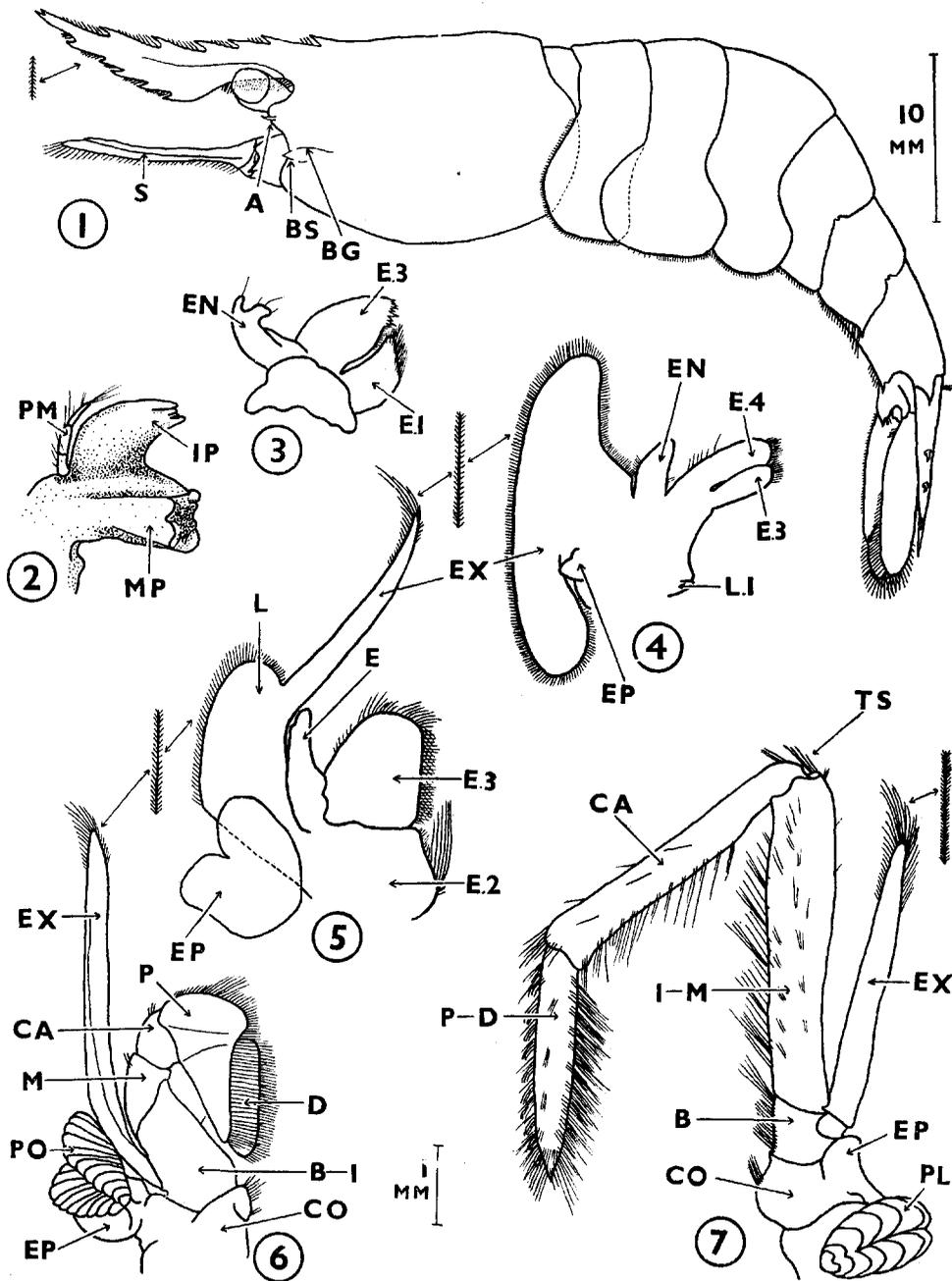
The following description is based on a large female specimen, since, locally females are more numerous in collections than are the smaller-sized males, and the female shows variation in the setation of the pleopods during the breeding and non-reproductive phases. Höglund (1943) discusses the importance of the breeding-dress. Useful differences between male and female are noted in the account.

Description of Study Specimen

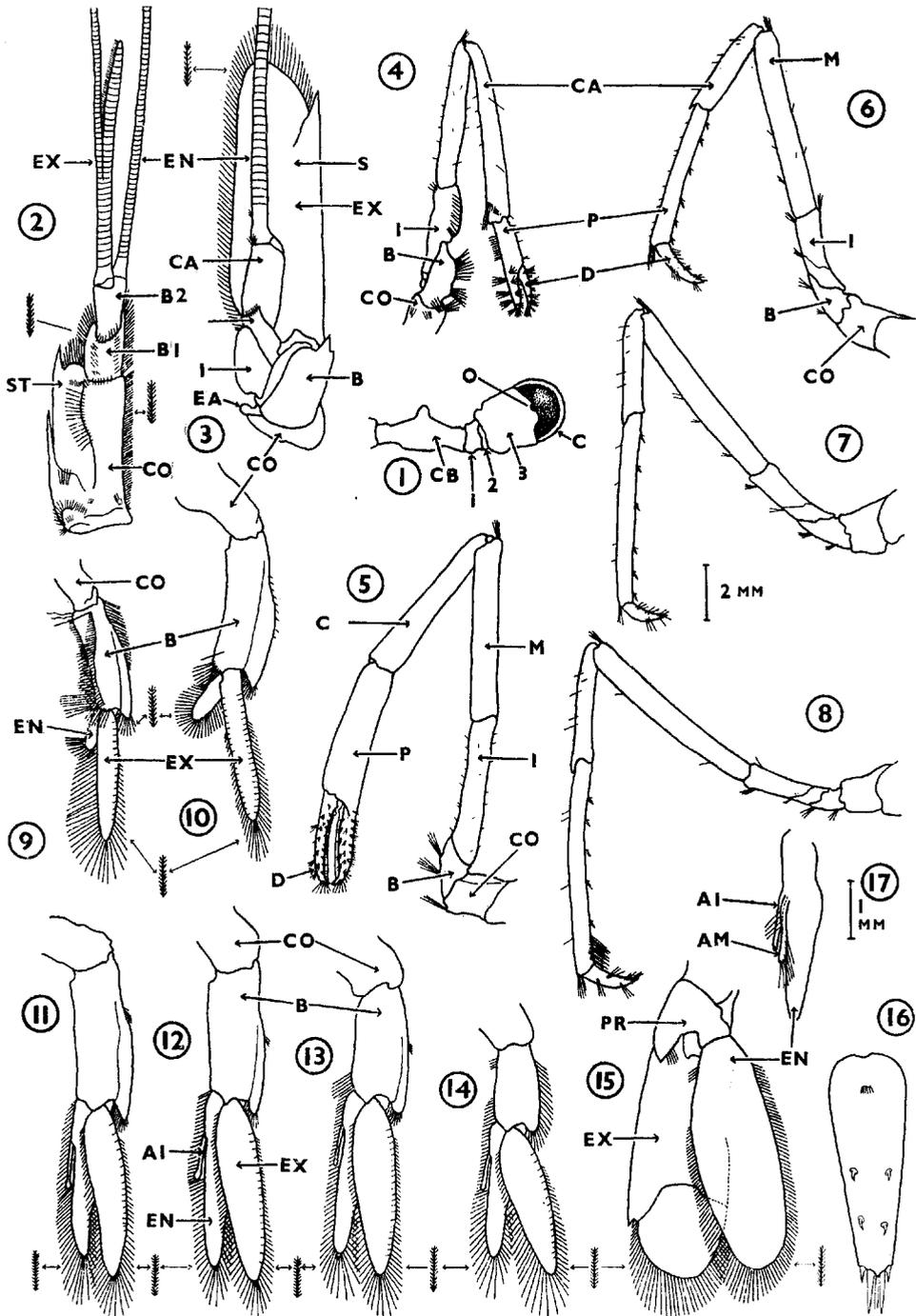
Carapace length, 13.3 mm., female, Lyall Bay, Wellington.

Rostrum compressed, slightly longer than the carapace, deepest in the middle, which is anterior to the cornea, curving slightly dorsally anterior to this, to end in an acute point; the proximal portion, two-thirds of the greatest depth, naked below but armed above with three anteriorly directed equally spaced teeth; three acute teeth anterior to these on the dorsal edge, the anterior, separated from the next by more than the average distance between the others, very small and immediately subterminal so that the tip of the rostrum is almost bifid in appearance. The ventral edge is armed with five anteriorly directed, slightly curved teeth, the 1st being just anterior to the deepest part of the rostrum and the 5th separated from the tip by more than the average distance between the others. A low lateral ridge commences at the posterior dorsal portion of the orbit, curves above the level of the cornea to pass along the mid-dorsal line of the rostrum and fades out above the 3rd tooth on the ventral edge. There are fine plumose setae present on the dorsal and ventral edges of the rostrum, between the teeth but not on the teeth themselves. Each side of the ventral proximal edge bears a row of plumose setae from inside the orbit to the anterior limit of the cornea.

Carapace deep, greatest depth is two-thirds of length. Surface smooth, armed with one dorsal anteriorly directed tooth placed at a distance behind the posterior



TEXT-FIG. 1.—*Palaemon (Palaemon) affinis* M.-Edw. FIG. 1—Carapace and abdomen, left lateral view. FIG. 2—Left mandible, dorsal view. FIG. 3—Left 1st maxilla, dorsal view. FIG. 4—Left 2nd maxilla, dorsal view. FIG. 5—Left 1st maxilliped, dorsal view. FIG. 6—Left 2nd maxilliped, dorsal view. FIG. 7—Left 3rd maxilliped, ventral view. All drawings are of study specimen (female, carapace length 13.3 mm.) and Figs. 2-7 are on the same scale.



TEXT-FIG. 2.—*Palaemon (Palaemon) affinis* M.-Edw. FIG. 1.—Right ocular peduncle, dorsal view. FIG. 2.—Left antennule, dorsal view. FIG. 3.—Left antenna, ventral view. FIG. 4.—Left 1st walking leg, medial view. FIG. 5.—Left 2nd walking leg, lateral view. FIG. 6.—Left 3rd walking leg, lateral view. FIG. 7.—Left 4th walking leg, lateral view. FIG. 8.—Left 5th walking leg, lateral view. FIG. 9.—Left 1st pleopod of a female in breeding dress, anterior view. FIG. 10.—Left 1st pleopod, anterior view. FIG. 11.—Left 2nd pleopod, anterior view. FIG. 12.—Left 3rd pleopod, anterior view. FIG. 13.—Left 4th pleopod, anterior view. FIG. 14.—Left 5th pleopod, anterior view. FIG. 15.—Left uropod, dorsal view. FIG. 16.—Telson, dorsal view. FIG. 17.—Endopodite of a left male 2nd pleopod, anterior view. All drawings, except Figs. 9 and 17, of the study specimen (female, carapace length 13.3 mm.) and all Figs. except Fig. 17 are on the same scale.

ABBREVIATIONS

A—Antennal spine.	EX—Exopodite.
AI—Appendix interna.	I—Isochopodite.
AM—Appendix masculina.	IP—Incisor process.
B—Basipodite.	L—Lateral lobe.
B1—First element of basipodite.	L.1—First lobe.
B2—Second element of basipodite.	M—Meropodite.
BG—Branchiostegal groove.	MP—Molar process.
BS—Branchiostegal spine.	O—Ocellus.
C—Cornea.	P—Propodite.
CA—Carpopodite.	PL—Pleurobranchium.
CB—Calcified bar.	PM—Mandibular palp.
CO—Coxopodite.	PO—Podobranchium.
D—Dactylopodite.	PR—Protopodite.
E1, 2, 3, 4. Endites 1, 2, 3 or 4.	S—Scaphocerite.
EA—Excretory aperture.	ST—Stylocerite.
EN—Endopodite.	TS—Terminal setae.
EP—EPIPodite.	1, 2, 3—Elements of the ocular peduncles.

tooth of the proximal portion of the rostrum equal to the depth of this portion, and thus in the line of the dorsal rostral series.

The rounded anteroventral angle of the orbit projects anteriorly to just beyond the base of the posterior dorsal tooth of the proximal portion of the rostrum, the orbit itself being two-thirds as deep as it is wide. Ventral to this angle the anterior edge of the carapace has a wide shallow emargination and an obtusely rounded anteroventral angle (the pterygostomial angle). This pterygostomial angle falls just short of the level of the anteroventral angle of the orbit. The ventral margin of the carapace curves smoothly from the pterygostomial angle to the deepest part of the carapace which is at approximately one half the distance between the anterior and posterior margins. Posterior to this, the ventral margin curves dorsally into the smoothly convex ventral half of the posterior margin, there being an obtuse posteroventral angle. The dorsal half of the posterior margin is widely emarginate above and is more anterior than the convex ventral half. The posteroventral margin, the ventral half of the posterior margin, and a small portion of the branchial region of the carapace are covered by the anterior projection of the pleuron of the 1st abdominal somite. The mid-dorsal line of the carapace is smooth and unarmed except for the single tooth described above. The surface of the carapace is smooth and except for the faint branchiostegal groove, shows no sign of grooves or ridges, but bears two anteriorly directed spines near the anterior margin. The antennal spine is strong and situated one-half its length behind the anterior margin just below the suborbital angle. The branchiostegal spine is situated just posterior to the anterior margin in the centre of the wide emargination. Two faint sutures can be seen running posteriorly from the dorsal and ventral edges of the spine, the dorsal one, the branchiostegal groove, being about four times the length of the spine and more distinct than the ventral one which is subequal in length to the spine.

Thus we have the carapace with a large dorsally curved rostrum barely longer than the scaphocerite, armed with seven teeth above and five below (i.e., counting the single dorsal tooth of the carapace in the rostral series). Two spines, the antennal and the branchiostegal, are present on the otherwise smooth carapace.

Rostral formula of study specimen: $\frac{6 + 1}{5}$

The abdomen is bent ventrally at the third somite and has the pleuron of the second somite overlapping that of the first and third. The first abdominal somite is just over two and one-half times as deep as it is long (length measured at the dorsal mid-line). The anterior margin of the tergum is weakly and irregularly emarginate, but the anterior margin of the pleuron expands over the posteroventral margin of the carapace, and then curves smoothly into the ventral margin. The posterior margin of the pleuron is covered by the anterior margin of the pleuron of the second somite. It has, however, a rounded posteroventral angle and a weakly emarginated posterior margin. The posterior margin of the tergum is weakly convex when viewed laterally, but curves smoothly from one side to the other, there being no ridge or spine on the straight mid-dorsal line of the somite. The posterior margins of all the following terga are similar to the above, and the surfaces of all the somites are quite smooth. Setae are present on the entire anterior and ventral margins of the pleuron of the first somite.

The second abdominal somite is two and one-half times as deep as it is long. The anterior margin of the tergum is obscured by the overlapping posterior margin of the preceding tergum. The anterior margin of the pleuron is convex and curves smoothly into the ventral margin, which is straight for a short distance before passing into the convex posterior margin, there being no posteroventral angle. There is a distinct emargination in the posterior lateral margin of the somite between the strongly convex pleural and weakly convex tergal margins. The mid-dorsal line is weakly convex and setae are present on the posterior half of the ventral margin of the pleuron.

The third abdominal somite is the largest and has a strongly convex mid-dorsal line giving the abdomen a distinct ventral bend. It is less than twice as deep as it is long. The anterior margins of the tergum and pleuron are obscured by the second somite. The ventral and posteroventral margins of the pleuron are smoothly convex and form an arc of a circle; the posterior margin is weakly concave, forming a wide shallow emargination before passing into the straight posterior margin of the tergum. Setae are present on the ventral margin of the pleuron.

The fourth abdominal somite is smaller than any of the preceding, its depth being only one and one-half times its length. The anterior margin of its tergum and pleuron are obscured by the third somite. The ventral margin of the pleuron is straight; there is a bluntly rounded posteroventral angle and relatively straight posterior margins of pleuron and tergum. A small emargination occurs at the junction on the posterior margin of the pleuron and tergum, and there is a small dark posterior projection within this emargination. Setae are present along the ventral margin of the pleuron.

The fifth abdominal somite is still smaller, its depth being one and one-half times its length. The anterior margin of both its tergum and pleuron are also obscured. The ventral margin is weakly convex and ends in an acute posteroventral tooth. The posterior margins of the pleuron and tergum make a straight line except for a small emargination and projection at the junction of the pleuron and tergum, similar to that on the fourth somite. Setae are present along the ventral margin of the pleuron.

The sixth abdominal somite is almost twice as long as it is deep. The ventral margin is very weakly concave and ends in an acute posteroventral tooth. Just above this there is a small tooth on the posterior margin which has an emargination in the ventral half and the dorsal half is produced into a wide lateral posteriorly projecting point as long as half the posterior margin. Setae are present on the posterior quarter of the ventral margin.

The telson is tapering, longer (measured along the mid-dorsal line) than the visible part of the sixth somite and its maximum length is a little more than three times its width. It is armed posteriorly with a small acute tooth in the mid-line. On either side of this medial tooth there is a long posteriorly directed spine, in length one and one-third the width of the posterior margin of the telson. Lateral to each of these long spines, there is another small posteriorly directed spine, one-third the length of the former, which arise as do the long spines from the posterior margin of the telson. Two long plumose setae arise, one on each side of the medial tooth, and project posteriorly almost as far as the long spines. Four small posteriorly curved subequal spines project as though through the dorsal integument of the telson, one pair at one half the distance between the anterior and posterior margins and the other pair at three-quarters of this distance.

The ocular peduncles arise laterally from a short transverse calcified bar which lies between the ventral proximal portion of the rostrum and the dorsal proximal portion of the antennules and is attached posteriorly. There is a short, blunt process, the interocular tooth, projecting anteriorly from the mid-dorsal line of this bar. The peduncle consists of three elements, the first short, the second, the shortest, being only partly visible, and a large third element which bears the corneal surface. The cornea is hemispherical and there is an outer clear layer of chitin separated from the inner pigmented cornea. On the centre of the dorsal proximal margin of the corneal surface, there is a small emargination bearing a prominent black ocellus.

The antennule consists of a protopodite of three elements and two flagella. The coxopodite is longer than it is wide, being one and one-half times as long as the basipodite, which consists of two elements. The coxopodite has a smooth deep excavation on the proximal portion of the dorsal surface to receive the ocular peduncles, and the distal portion is expanded. The coxopodite bears a large lateral plate, the stylocerite, subequal to the element itself. The stylocerite appears to be divided into two parts, separated by a faint irregular suture. The proximal part is small and has a prolongation of its lateral margin as an anteriorly projecting spine for half the length of the distal part, which also has an anteriorly projecting spine as a distal prolongation of its lateral margin. The medial face is flat and vertical, thus the coxopodite is triangular in cross section. There is a small anteriorly curved tooth half way along the medial edge of the ventral face, invisible in dorsal view. The coxopodite bears a single row of plumose setae along the dorsolateral side of the distal expansion, a row across the dorsal side of the expansion a little below the distal margin of the element, a small semi-circular plumose row flat on the posterodorsal region of the stylocerite and several small irregular tufts on the dorsal proximal portions of the element and stylocerite. On the ventral surface of the stylocerite there is one long plumose row near the lateral edge of the proximal part and another near the lateral edge of

the distal part which passes on to, and along, the convex distal margin. The articulation between coxopodite and basipodite is weakly concave, but that between the first element and the second is strongly concave, setose and with two small distal projections of the first element going one-third of the way up the lateral and medial faces of the second element. Another row of plumose setae is present along the dorsal part of the entire medial face of the coxopodite and continues along the medial face and projection of the first element, which also has a plumose row on the lateral distal projection and irregular lateral and medial longitudinal rows on the dorsal surface. There is a short plumose row on the distal part of the ventral surface of the second element, invisible in dorsal view. The exopodite and endopodite both articulate at the distal end of the second element, the endopodite articulation being slightly distal to that of the exopodite. The basal element of the exopodite is large, all the following elements being only about one-half its length. After a distance equal to the length of the basipodite, the exopodite bifurcates into two flagella, the inner of which is short, subequal to the coxopodite, thus being longer than the fused portion and bearing a large number of close transverse rows of short setae along its entire ventral surface. The outer flagellum is very long, many times the length of the protopodite and without setae. In the endopodite we have a large basal element and a long flagellum consisting of smaller equal elements. This flagellum is subequal in length to the outer flagellum of the exopodite and also without setae.

The antenna has a protopodite of two segments. The coxopodite is small and indefinite in outline, but the basipodite is large, long, and bears a stout anteriorly directed tooth on its distal ventrolateral edge. Very close to the proximal medial margin it bears the excretory aperture which is raised on a small projection. On the ventral face of the antenna the basipodite has two sinuous flanges, the margin of the more anterior is acutely convex. The exopodite is dorsal in position and obscures the proximal portion of the endopodite in dorsal view. The former is a broad, thin, dorsoventrally flattened ramus, the scaphocerite, extending anteriorly almost as far as the tip of the rostrum. The lateral edge is straight, without setae, terminating in a large strong spine. A small suture is visible on the ventral surface running from the medial posterior edge of the spine about the spine's length diagonally across the scaphocerite. The distal margin is strongly convex and projects beyond the lateral spine. A simple row of setae extends around the distal margin and along the straight medial margin. The endopodite consists of three elements and a multiarticulate flagellum. The ischiopodite and meropodite are smaller than the carpopodite and obliquely articulated, each partly overlapping ventrally the next element. The ischiopodite has an obtuse distal angle, while the distal margin of the meropodite is acutely convex ventrally and setose medially. The carpopodite is elongate, as long as the basipodite, parallel-sided and bears a few setae on the medial side of the distal margin. The flagellum is long and naked, the basal element being subequal to the length of the six following elements.

The mandible is trifold. A short, sturdy base extends distally in an anterior toothed incisor process and a medial molar process. The incisor process at its base is nearly horizontal, with its width transverse to the body. Its outer edge curves dorsally and medially so that its free end is nearly vertical. The free end bears four stout blunt teeth, the inner two being shorter than the outer two. A

small three-jointed palp arises from the angle between the incisor process and the base of the mandible on the lateral edge. This palp bears several long setae on its extremity and others on the three elements. The molar process is stout and subrectangular in section and trends dorsally, to end obliquely truncated in the medial plane with a concave surface around which is an incomplete wall composed of about four projecting lobes. These lobes differ a great deal in shape and appear to interlock with the corresponding lobes of the other mandible.

The paragnatha of the metastoma lie between the mandibles and the first maxillae.

In the first maxilla there are two endites, 1 and 3, and an endopodite. In dorsal view, the base is crescentic with the three processes attached to, and concealing, the base in ventral view. Endite 1, the smaller, is a little longer than it is wide, the anterolateral margin is weakly concave ending distally at a rounded angle adjacent to endite 3. The distal edge bears anteriorly directed setae. There is a long narrow cleft between the two endites which almost reaches to the base. Endite 3 is broad, but one and one-half times as long as it is wide. Its anterior margin is convex while its distal and posterior margins are also smoothly and continuously convex, giving the whole endite a subtriangular shape. It bears on its medial edge nine medially directed, stout, spine-like setae. There are also several short setae on the posterior margin adjacent to endite 1. The endopodite is stout, just over twice as long as it is wide and bifid at the tip, the short distal branch projecting anteriorly and bearing a single long seta at its extremity. The medial branch is curved inwards and bears three setae on its anterior edge.

The 2nd maxilla bears a bifurcated second lobe, a simple endopodite and a large flattened exopodite, the scaphognathite. On the proximal portion of the medial edge there is a slight swelling, the reduced 1st lobe. The 2nd lobe projects medially and is divided into endites 3 and 4 by a narrow cleft. Endite 3 is two and one-half times as long as it is wide, paddle-shaped, with a smooth margin and with the convex distal margin bearing a number of sharp setae. The anterior margin of endite 3 overlaps dorsally endite 4 to a small extent. Endite 4 is similarly two and one-half times as long as it is wide, the same shape but slightly larger than endite 3. The anterior margin of endite 4 bears a few setae while the convex distal margin also bears a number of sharp setae. The endopodite projects from the distal margin of the 2nd maxilla. It tapers, is bluntly angled distally, and bears a few setae near the base of its medial margin and on the medial third of its lateral margin. There is a short cleft between the endopodite and the exopodite, which is a large, flattened, smooth margined, extension of the lateral margin of the maxilla, projecting both anteriorly and posteriorly, in length almost three times the width of the base of the maxilla. The entire margin of the scaphognathite, from the edge adjacent to the endopodite, around the anterior projection, the lateral margin and the posterior projection, as far as its junction with the main body of the maxilla, bears plumose setae. This latter junction is obscured on the dorsal surface by a small laterally projecting structure (epipodite?).

The 1st maxilliped bears two medial endites, a small endopodite, an exopodite with prominent lateral lobe and a bilobed epipodite. Endite 2 is subrectangular. Its medial margin is smooth and bears many setae, those on the proximal portion being longer than the remainder and sloping sharply anteriorly. The distal margin

of endite 2 is a weakly concave suture with endite 3, the suture being at right angles to the straight medial edge of the endite 3, which bears several close rows of setae. There is also a row of medially directed setae paralleling the medial edge on the ventral surface of the two endites, and a distinct notch on the margin between these two endites. The distal margin of endite 3 is short and rounded and slopes laterally to meet the endopodite near its base. There are long setae on the distal margin and a few on the distal two-thirds of its lateral sloping margin. The proximal portion of its lateral margin is obscured by the endopodite. The endopodite is tapering, flattened, fingerlike, naked and subequal in length to endite 3. The distal half of the medial margin is weakly concave, while the proximal half has two small convex lobes. The lateral margin is irregularly convex and lies dorsally over the proximal medial edge of the exopodite. The exopodite is a long, thin structure and from the junction with its lateral lobe, to the tip, is twice the length of endite 3. The tip turns slightly laterally and bears at its distal end long laterally curved plumose setae as well as shorter ones on the distal portions of both margins. The lateral lobe is one and one-half times as long as, and subequal in width to, endite 3. Its distal margin is convex and its lateral margin nearly straight, and it bears plumose setae on both these margins. The epipodite is a flattened, bilobed structure with rounded margins dorsal to and partly overlying the proximal lateral margin of the maxilliped.

In the 2nd maxilliped the main axis of the appendage consists of six elements. There is also an exopodite, and an epipodite bearing a branchia. The coxopodite is a short, broad element with an indefinite proximal margin. It bears on its convex anteromedial margin a short row of setae, on its concave distal margin the fused basipodite-ischiopodite element and on its anterolateral margin the rounded, flattened epipodite which bears the bilobed podobranch on its dorsal surface. The basi-ischiopodite is the largest element present and is almost twice as long as it is broad. Its distal margin is sinuous and at an angle, making the weakly convex medial margin longer than the straight lateral margin, which bears the thin long exopodite nearly three times the length of the element itself. The exopodite has a tapering distal end with many plumose setae at the apex and on the extreme distal portions of the two margins. The basi-ischiopodite bears a single seta at the centre of its medial margin and a widely spaced row along the centre of its ventral surface continuing on the ventral surface of the meropodite. The meropodite and carpopodite are both short and bent medially, their lateral margins are strongly convex, each with a single tuft of setae on the distal portion, and the medial margin of the meropodite is very short, while that of the carpopodite is also short and concave. In ventral view both the medial and lateral margins of the carpopodite continue on to the ventral surface of the propodite as short, sharp projections beyond the line of the weakly convex, ventral distal margin. The propodite continues the extreme convexity of the ramus on its lateral margin, so that this margin is directed anteriorly and clothed with a row of setae; the anterior margin is longitudinal, straight, and setose, while the true medial margin is oblique and naked. As a result, the plate-like dactylopodite has an elongate rectangular form with the long lateral margin actually longitudinal and medial. This margin is setose and the dactylopodite itself is actually concealed above by setae from the sutural line with the propodite,

The latter element then is triangular in shape with the apex directed posteriorly and setose on all but the medial margin, which is oblique to the true main axis.

In the 3rd maxilliped the main axis of the appendage consists of five elements. There is also an epipodite and an exopodite. The coxopodite is short, bearing the rounded epipodite on its lateral margin, while the convex medial margin bears a few setae. The basipodite, subequal in length to the coxopodite, bears setae on its straight medial margin, and the small exopodite element arises from its distal margin just lateral to the base of the third element, the ischiomeropodite. Exopodite element 2 is thin, tapering, four-fifths the length of the ischiomeropodite and bears plumose setae on its distal margins. The ischiomeropodite is long, with straight lateral and medial margins, but strongly concave dorsal, and less strongly convex ventral faces. It bears several rows of scattered tufts as well as isolated setae on its medial margin, a prominent row along the centre of the distal one-third of the dorsal face and other setae scattered over its ventral face. The last two elements are bent towards the mid-line of the body. There is a small tuft of distally projecting setae on the distal margin of the ischiomeropodite, lateral to the articulation of the carpopodite. Tufts of this type on any element will be referred to as "terminal setae". The carpopodite is straight, subequal in length to the ischiomeropodite and bears terminal setae. There is a tuft on the extreme proximal portion of the lateral margin, many setae on its medial margin and setae thickly over its dorsal face. The tapering, pointed, cylindrical prodactylopodite, two-thirds the length of the ischiomeropodite, bears a great number of setae, arranged as follows; close rows on its medial margin and dorsal face, rows of tufts on its lateral margin and a row of tufts on its ventral face.

The 1st walking leg is chelate. The relative lengths of the elements from the coxopodite to dactylopodite, based on propodite length reduced to 10, are:—5:9:9:16:20:10:5. The proximal margin of the coxopodite is indefinite and the distal margin is concave. There are two short rows of setae on the mediodistal margin, one directed medially and the other laterally. Two other short rows are present on the anterior face of the element. The basipodite is irregularly shaped, there being a deep notch on the medial margin at the articulation with the coxopodite. A blunt extension of the mediodistal margin projects about one-half of the distance up the medial margin of the ischiopodite, while the lateral margin of the basipodite is very short. Two short rows of setae are present on the medial margin and two small tufts on the anterior face. The ischiopodite is ovoidal in section proximally, but is extended medially and throughout the distal half by a prominent medial flange which has a marginal row of setae. There are terminal setae on the lateral margin. The meropodite is a straight, parallel-sided element, subcircular in section, bearing a few isolated setae on both margins and a terminal cluster of setae. The proximal end of the carpopodite is so articulated with the meropodite that the axis of the appendage can flex through 180° in a longitudinal plane. The carpopodite is elongated, widening distally, subcircular in section, bearing a few isolated setae on its medial margin and anterior face. Terminal setae obscured by several long setae arise from the end of a short row of setae just proximal to the distal articulation, which is indented on its lateral side. The propodite is narrow, width one-quarter length, a few scattered setae are present on the lateral margin, short compact rows on the

proximal portion of the medial margin, and three rows of tufts of setae on the fixed finger, one row being on the anterior face, one on the outer margin, and one on the posterior face. The dactylopodite has three similarly placed rows of tufts. Each row on both the fixed and free fingers has four tufts.

The 2nd walking leg is also chelate, the relative lengths of the elements from the coxopodite to dactylopodite, based on propodite length reduced to 10, are:—2:3:6:7:6:10:4. The coxopodite is short, broad, subovoidal in section, with a weak ridge on the lateral face and a cluster of terminal setae on the irregularly convex posterior margin. The proximal margin is straight, the anterior is weakly convex, while the distal is irregularly convex. The basipodite has a long convex posterior margin, bearing two clusters of setae, which is six times the length of the anterior margin so that the exopodite is carried at a right angle to the coxopodite. The ischiopodite is a straight, cylindrical element, its proximal end oblique and its distal weakly convex, bearing a few setae scattered along the anterior and posterior margins. The meropodite is a straight, cylindrical element, tapering slightly distally and bearing terminal setae, with the meropodite-carpopodite articulation as in the 1st leg. The carpopodite is a straight, naked element, sub-circular in section and expanding distally with a concave distal margin. The propodite is large, parallel sided, naked and contracted slightly at the proximal articulation, to fit into the distal expansion of the carpopodite. The fixed finger is straight at first but curves towards the dactylopodite to end in a short point, transverse to the long axis of the element, interlocking with an opposing point on the dactylopodite. This latter element is longer and wider at its articulation than the fixed finger, and curves towards it in a similar manner. Both these elements on their entire inner margins bear a thin chitinous ridge. In the dactylopodite the proximal end of this ridge is expanded into two low blunt teeth, there being one such tooth, interlocking with these two, on the opposing ridge of the fixed finger. Both the fixed finger, and the dactylopodite, bear several irregular rows of tufts of setae on all faces and each has a proximal tuft at the distal end of the lateral face.

The 3rd, 4th, and 5th walking legs are nonchelate, the relative lengths of the elements from coxopodite to dactylopodite, based on propodite length reduced to 10, are for the 3rd leg:—3:4:6:12:7:10:4; for the 4th leg, 3:3:4:10:5:10:3; and for the 5th leg, 2:2:4:9:5:10:3. They are closely similar. The coxopodite is a stout element subcircular in cross section, with a proximal elongation of its anterior margin obscured by the pleurobranchia. Its distal margin is irregular with a small convex projection on the lateral side, and the posterior margin is convex. The basipodite is a short, curved element, its concave anterior margin being much shorter than its convex posterior margin, which bears two tufts of setae. The ischiopodite is subcircular in cross section, its anterior margin is weakly concave and bears a terminal tuft of setae on the 3rd leg and a few terminal setae on the 5th, while its posterior margin is straight and bears a terminal tuft and another tuft nearer the proximal margin on all legs. Its distal margin is straight and its irregularly convex proximal margin angled. There is a faint suture paralleling the proximal margin about one-third the distance along the element. The meropodite is a long, straight cylindrical element bearing terminal setae and has a few setae on the anterior margin in the 3rd leg, and on the posterior margin in all three legs. The proximal end of the carpopodite is so

articulated with the meropodite that the axis of the appendage can flex through 180° in a longitudinal plane. The carpopodite is straight, subcircular in section, with a few setae on the anterior margin and with a distal projection of this margin in all the legs to form a short blunt spine overlapping part of the anterior margin of the propodite. The propodite is a long, cylindrical element bearing two rows of short spines on its posterior margin, each spine having a single short seta just proximal to it. In the 3rd leg the lateral row has six spines and the medial row five. In the 4th leg both rows have six spines, while in the 5th leg the lateral row has five spines and the position of the distal spine of this row is occupied by a compact cluster of setae which extends to the distal articulation (this feature is of generic importance). The medial row of the 5th leg has six spines. The anterior margin of the propodite in all three legs bears a few isolated setae as well as a tuft of terminal setae. The tapering, pointed, cylindrical dactylopodite is short, curved posteriorly and bears irregular tufts and isolated setae scattered over its surface.

The 1st pleopod differs from the remaining four pleopods. The proximal articulation of the coxopodite with the body is indistinguishable, while the distal has a small convex projection on the anterior face. The basipodite is straight and flattened, with a small shoulder at the proximal end of the medial margin and with a flat flange on the entire lateral margin, bearing a few setae, this flange also extends distally beyond the distal articulation of the element. The basipodite has an irregularly convex distal margin and bears a short endopodite and a long exopodite. The flattened endopodite, one-third the length of the exopodite, arises partly posterior to it, its medial margin is concave, its distal end rounded and its lateral margin convex. The exopodite is a long, straight edged, blade-like element, tapering to a rounded distal end, and appears to be obscurely annulate, traces of the annulae being present on both margins. On this 1st pleopod there are four areas of plumose setae; a row on the distal portion of the lateral flange of the basipodite, a short row on the mediobasal angle of the basipodite, a row along the entire margin of the endopodite and a continuous row along the medial margin, the distal end and the lateral margin of the exopodite. A female in breeding-dress has longer and more numerous setae on the 1st pleopod. Breeding-dress is used by Höglund (1943) for the different arrangement of integument and setae which female *Palaemon squilla* forma *typica* assume at the moult preceding the breeding-period, and lose at the moult that succeeds this period. The four areas of plumose setae of the normal pleopod are present, now extending over the entire medial margin of the exopodite, but only on the distal end of the endopodite, as well as the following additional rows; a row along the proximal half of the lateral margin of the basipodite, corresponding to group VIII of Höglund, a row along the entire medial margin of the basipodite, beginning with about two long setae (VII : 3), then a row of short setae (VII), then a row of long setae (VII : 1) along the distal one-quarter of this margin and finally a long curving row of setae (X) along the anterior face of the basipodite. This last row begins near the proximal articulation with a single very long seta (VII : 3A) and then with short setae it continues down the medial side of the anterior face. The 2nd pleopod of a female in breeding-dress has also this anterior plumose row of setae (X) but not as well developed as in the 1st pleopod.

The remaining pleopods, 2nd, 3rd, 4th, and 5th, show very similar structure. The following description will cover them all. The coxopodite is as described for the 1st pleopod, except that the projection on the anterior side of the distal margin is replaced by a shallow emargination on the last two pleopods. The basipodite is also similar but becomes relatively shorter progressively from the 1st to the 5th pleopod, so that the lateral flange diminishes in prominence and the basipodite of the 5th pleopod is a short, sturdy element. The endopodite and exopodite are sub-equal and are both long and blade-like, tapering distally to a rounded end with their widest part one-third of the way down. The exopodite shows traces of annulae on the lateral margin, and arises both anteriorly and laterally, thus obscuring the anterior face of the endopodite. The endopodite bears on its medial margin the appendix interna, a small, thin, parallel-sided projection, slightly enlarged at its distal end, arising from an articulation one-fourth the distance down the medial margin and extending to one-half the distance down. (There is an appendix masculina on the male 2nd pleopod. It is a little longer than the appendix interna and bears setae along its anterior face and distal end.) Plumose setae can be present on four areas of these pleopods. There are some on the margin of the lateral flange, and a row on the distal end of this flange, but on the basipodite of the last pleopod the entire margin of this flange is setose. There is a row around the entire margin of the endopodite, extending on to the medial margin of the basipodite in the 4th and 5th pleopods and finally the entire margin of the exopodite is setose. On the 5th pleopod there are a few setae on the proximal half of the medial margin of the basipodite.

The uropod has the usual form. The coxopodite is not clearly defined possibly being a small area ventral to the protopodite (basipodite?) and completely hidden by the telson. The protopodite is a broad element with a convex lateral margin ending distally in a sharp tooth extending over the exopodite. There is a deep emargination in the centre of the distal margin, and the medial part of this margin bears the endopodite. The medial edge of the tooth carries a short row of setae. The exopodite arises ventrally from the protopodite and is partly obscured by the endopodite. The flattened exopodite has a strong, ventral setose ridge along its entire lateral margin which terminates in a tooth two-thirds of the distance towards the distal extremity. Medial to this tooth a sharp spine arises from the margin. At the level of this spine the exopodite is crossed by a concave suture, the distal one-third of the exopodite is thus subovoidal in shape and bears a row of long setae along its entire free margin. The endopodite is flattened, blade-like, subequal in length to the exopodite, with its widest part at the middle and with a rounded distal end. It bears setae along its entire margin, both lateral and medial, except for a small area about one-third the way down the lateral margin, and another at the proximal end of the medial margin.

The Branchial formula of *Palaemon affinis* is as follows:—

	g	h	i	k	l	m	n	o
Arthrobranchiae	—	—	—	—	—	—	—	—
Pleurobranchiae	—	—	1	1	1	1	1	1
Podobranchiae	—	1	—	—	—	—	—	—
Mastigobranchiae	1	1	1	—	—	—	—	—

g is the 1st maxilliped, h the 2nd, and o represents the 5th walking leg.

This is identical with the formula given by Calman (1909) for the genus *Palaemon* except that he records an arthrobranchia on the 3rd maxilliped, but I have been unable to determine the presence of this structure in *P. affinis*.

The following measurements were taken from large mature specimens of both sexes (mm.) :—

	♀ (study specimen)	♂
Length entire	57.2	36.0
Length carapace	13.3	6.1
Length rostrum	14.0	7.4
Length abdomen (pleon) ..	37.6	22.5
Length 3rd somite abdomen ..	7.4	4.6
Length 6th somite abdomen ..	6.7	4.1
Length telson	7.7	4.2
Length 1st walking leg ..	19.5	9.9
Length 2nd walking leg ..	26.0	13.7

The walking legs arranged in order of length from the longest to the shortest are as follows: 2nd, 5th, 4th, 3rd, and 1st. The standard measurement in use to compare the size of specimens of the same or different species is the length of the carapace, measured from the posterior margin of the orbit to the posterior margin of the carapace along the dorsal mid-line. Measurements of the abdomen, and therefore of the entire length, are inaccurate, due to the difficulty in extending preserved specimens.

The smallest egg-bearing female examined had a carapace length of 7.8 mm., and this can be taken as an indication of the size at which the female becomes mature.

The variation in the shape of the rostrum and in the number and distribution of the rostral teeth will be discussed in a later paper. A number of specimens showed variation in the arrangement of the dorsal spines of the telson. The usual form is two transverse rows of two, but other arrangements seen were: one member of a pair not in line; the posterior pair absent; one member from each pair absent or three spines absent.

COLOUR. The colour pattern shown by *P. affinis* in life is usually fairly constant; it consists mostly of longitudinal rows of green, red, orange or black chromatophores. In lateral view the carapace shows about 5 bands of colour. These are wavy and trend ventrally. There are also about 5 wavy bands of colour along each side of the abdomen. These bands have green, red and black chromatophores, the overall appearance being usually green. On both lateral posterior margins of the 6th abdominal segment and partly overlapping on to the protopodite of the uropod, there is a large, prominent round spot of bright orange, and dorsal to this, on each side, there is a smaller less prominent black spot. On the scaphocerites, uropods and telson there are shorter and less prominent bands of colour. On the 3rd maxilliped there is an orange-red spot on the ischiomeropodite/carpopodite articulation; on the distal end of the carpopodite and midway along the prodactylopodite. On the distal portion of the ischiopodite, and of all the more distal elements of the walking legs, there is also an orange-red spot. The entire protopodite and dactylopodite of the 1st and 2nd walking legs appear tinged with blue in life. There is a dark spot on the anterior distal portion of the basipodite of all the pleopods. All this colour is entirely lost soon after the shrimp is placed in alcohol.

DISCUSSION. *P. affinis* has been compared with *P. northropi*; with the European *Palaemon (Palaemon) serratus* (Pennant, 1777), the *Leander serratus* of many authors and with *Palaemon (Palaemon) elegans* Rathke. Holthuis (1949) has pointed out that *Leander* (or *Palaemon*) *squilla* (Linnaeus, 1758), = *P. elegans* Rathke. The author has not seen specimens of these species but from published descriptions and figures, using Borradaile (1917) for *P. serratus*, Höglund (1943) for *P. elegans* and Holthuis (1952) for *P. northropi*, the following points have been noted. The mandibular palp is three jointed in *P. affinis* and *P. serratus*, but two jointed in *P. elegans* and *P. northropi*. The 1st maxilla is very similar; however, the shape of endite 1 differs in the four species. The 2nd maxillae of the four species are very similar. The 1st maxillipeds differ in the shape of the lateral lobe of the exopodite, and in the structure of the endopodite, an apical lobe is shown in *P. serratus*. The 2nd maxillipeds of *P. affinis* and *P. serratus* are very similar, but that of *P. elegans* is different in its proportions.

It can be seen, therefore, that *P. affinis* is a distinct species, belonging to the subgenus *Palaemon*, found throughout New Zealand and in the Chatham Islands, with unsubstantiated records from the Subantarctic Islands, Australia and South Africa.

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LITERATURE CITED

- BALSS, H., 1929. Die Dekapoden (Crustaceen). Zoologische Ergebnisse der Reisen von Dr. L. Kohl-Larsen nach den subantarktischen Inseln bei Neuseeland und nach Süd-georgien: *Senckenbergiana* 11: 195-210.
- BARNARD, K. H., 1950. Descriptive Catalogue of South African Decapod Crustacea. *Ann. S. Afr. Mus.* XXXVIII: 1-837.
- BATE, C. SPENCE, 1888. Report on the Crustacea Macrura collected by H.M.S. Challenger during the years 1873-76. Rep. Voy. Challenger, Zool., XXIV: 1-942, Pls. 1-150.
- BORRADAILE, L. A., 1917. On the Structure and Function of the Mouthparts of the Palaemonid Prawns. *Proc. Zool. Soc. Lond.* 1917: 37-72.
- CALMAN, W. T., 1909. Crustacea in Lankester: a Treatise on Zoology VII (3): 1-346.
- CHILTON, C., 1909. The Subantarctic Islands of New Zealand. Wellington. Crustacea: 601-671.
- 1911. Scientific Results of the New Zealand Government Trawling Expedition, 1907. Crustacea. *Rec. Cant. Mus.* 1 (3): 285-312.
- DANA, J. D., 1852. Crustacea. United States Exploring Expedition. 13: 1-1620; 1855. Atlas: 1-27, Pls. 1-96.
- DESMAREST, E., 1849. Description d'un nouveau genre de Crustacés de la section des Décapodes Macroures, famille des Salicoques, tribu des Palémoniens (Genre *Leander*). *Ann. Soc. ent. France*, ser. 2, 7: 87-94, 2 figs.
- DOFLEIN, F. and BALSS, H., 1912. Die Dekapoden und Stomatopoden der Hamburger Magalhaisenschen Sammelreise 1892-93. *Zum Jahrb. Hamburg. Wiss. Anst.* XXIX: 25-41.
- FABRICIUS, J. C., 1798. Supplementum Entomologiae Systematicae: 1-572.
- FILHOL, H., 1886. Catalogue des Crustacés de la Nouvelle Zélande, des îles Auckland et Campbell. Passage de Vénus. Mission de L'île Campbell, Zool. 3 (2): 349-510. Pls. 38-55.
- HALE, H. M., 1927. The Crustaceans of South Australia. Part I. Gov. Printer, Adelaide.

- HASWELL, W. A., 1882. Catalogue of the Australian Stalk- and Sessile-eyed Crustacea. Australian Museum, Sydney: 1-324, Pls. 4.
- HEILPRIN, A., 1888. Contributions to the Natural History of the Bermuda Islands. *Proc. Acad. Nat. Sci. Phila.* 1888: 302-328.
- HÖGLUND, H., 1943. On the Biology and Larval Development of *Leander squilla* (L.) forma *typica* de Man. *Svenska Hydrograph. Biol. Komm.* Ny serie, Biol. II: 1-44, 4 pl.
- HOLTHUIS, L. B., 1949. The Caridean Crustacea of the Canary Islands. *Zool. Medel. Leiden* XXX (15): 227-255.
- 1950. The Palaemonidae collected by the Siboga and Snellius Expeditions with Remarks on other Species. I. Subfamily Palaemoninae. The Decapoda of the Siboga Expedition. Part X. Siboga Exped., mon. 39a 9: 1-268, figs. 1-52, was, until a short time ago, not available in New Zealand. Since this paper was written, I have been able to see this important work. In it Holthuis describes *P. affinis* from specimens from Sumner, South Island, New Zealand and finding no constant differences between it and *Palaemon scroenus* (Heller, 1862), an Australian form, he synonymises the two species.
- 1952. A General Revision of the Palaemonidae (Crustacea Decapoda Natantia) of the Americas. II: The Subfamily Palaemoninae. *Allan Hancock Found. Publ. Occ. Pap.* 12: 1-396.
- KEMP, S., 1925. Notes on the Crustacea Decapoda in the Indian Museum XVII: On Various Caridea. *Rec. Ind. Mus.* XXVII: 249-343.
- KRAUSS, F., 1843. Die Südafrikanischen Crustaceen: 1-68, pls. 1-4.
- LENZ, H. and STRUNCK, K., 1914. Die Dekapoden der Deutschen Südpolar-Expedition 1901-1903. 1: Brachyuren und Maeruren mit Ausschluss der Sergestiden. Deutsche Südpolar-Expedition 1901-1903, XV. *Zool.* VII (3): 261-345, pls. XII-XXII.
- MIERS, E. J., 1876. Catalogue of the Stalk- and Sessile-Eyed Crustacea of New Zealand. *Col. Mus. Geo. Sur. Dept.*: 1-130.
- MILNE-EDWARDS, H., 1837. Histoire naturelle des Crustacés, comprenant l'anatomie, la physiologie et la classification de ces animaux. II: 1-532.
- ORTMANN, A. E., 1911. Crustacea of Southern Patagonia. Princeton Univ. Exped. Patagonia 1896-1899. III (4): 635-667.
- RANKIN, W. M., 1898. The Northrop Collection of Crustacea from the Bahamas. *Ann. New York Acad. Sci.* II: 225-254, pls. 29, 30.
- RATHBUN, M. J., 1904. Some Changes in Crustacean Nomenclature. *Proc. Biol. Soc. Wash.* XVII: 169-172.
- STEBBING, T. R. R., 1910. General Catalogue of South African Crustacea. *Ann. S. Afri. Mus.* VI: 281-593.
- 1914. Stalk-eyed Crustacea Malacostraca of the Scottish National Antarctic Expedition. *Trans. Roy. Soc. Edin.* 50: 253-308.
- THOMSON, G. M., 1903. On the New Zealand Phyllobranchiate Crustacea—*Macrura*. *Trans. Linn. Soc. Lond. Zool.* ser 2, 8: 433-453, pls. 27-29.
- 1912. The Natural History of Otago Harbour and the Adjacent Sea. *Trans. N.Z. Inst.* XLV: 225-251.
- 1921. History of the Portobello Marine Fish-Hatchery and Biological Station. N.Z. Board of Sci. and Art, Bull. 2: 1-131.
- WEBER, 1795. Nomenclature Entomologicus.
- WHITE, A. and DOUBLEDAY, E., 1843. Crustacea, in: E. Dieffenbach, Travels in New Zealand. London. II: 265-295.