

# Identification of New Zealand's terrestrial amphipods (Crustacea: Amphipoda: Talitridae)

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**ABSTRACT:** A checklist and an illustrated key to the identification of the 28 described species and species groups of terrestrial amphipods (Crustacea: Amphipoda: Talitridae) of New Zealand are provided. Twenty-five species are endemic, belonging to six endemic genera (*Kanikania*, *Makawe*, *Parorchestia*, *Puburuburu*, *Tara* and *Waematau*). A brief history of New Zealand terrestrial amphipod taxonomy and an overview of the group's diversity are presented. Identification methods and terminology are defined, with terrestrial amphipod morphology described and illustrated. The key is intended as a stand-alone identification guide, and is designed to enable identification of individuals of either sex in the absence of specimens of the opposite sex.

**KEYWORDS:** Amphipoda, terrestrial amphipods, Talitridae, talitrids, landhoppers, talitrid identification, checklist, key, New Zealand.

## Introduction

Terrestrial amphipods, commonly known as 'landhoppers', occur throughout tropical and Southern Hemisphere regions, notably in South Africa, Madagascar, India, Sri Lanka, Burma, Singapore, Indonesia, the Philippines, Japan, most Indian and Pacific Ocean island groups, and many Atlantic islands. They are a conspicuous element of the macro-invertebrate faunas of New Guinea, Australia and New Zealand, but are rare in South America (Friend 1987). In most of these countries, terrestrial amphipods make up a significant component of the leaf litter and soil faunas, especially in forests, but also in grasslands of New Zealand (Friend 1987; Duncan 1994), in other damp habitats from supralittoral to subalpine zones, and even at alpine altitudes. In these habitats, talitrid amphipods are frequently abundant and play a major role in natural litter decomposition (Friend & Richardson 1986).

Although commonly called landhoppers, these amphipods are not all strictly terrestrial. Most are associated with damp habitats, because their cuticles are not impervious to water loss and their ventral gills must be kept moist for effective respiration and to prevent desiccation. Additionally, some species appear equally at home on the forest floor or when immersed in small forest streams. So far, no true stream-dwellers have been reported, and the occurrence of individuals of some species in water may simply indicate their ability to live in both habitats.

Densities of landhoppers can be very high for such large invertebrates (large adults of many species may be up to c. 20 mm long, and some are even larger), with numbers of 1230–2670/m<sup>2</sup> reported for *Makawe hurleyi* in New Zealand (Duncan 1994). A native Tasmanian forest species (*Keratroides angulosus*) attained densities as high as 6815/m<sup>2</sup> (Friend 1980), with more than 10,000/m<sup>2</sup> for the mix of species coexisting in this habitat (Friend & Richardson

1987). Even invasive species can reach high densities in their adopted countries: the Australian *Arcialitrus dorrieni* occurred at densities of up to 3265/m<sup>2</sup> in Cornwall, UK (Richardson 1980), and at similar densities (up to 3969/m<sup>2</sup>) in Northern Ireland (O'Hanlon & Bolger 1993), compared with up to 3956/m<sup>2</sup> in its native New South Wales.

With such high population densities, landhoppers appear to play a significant role in the ecology of their environments. Apparently, the presence of landhoppers leads to increased soil microfloral activity and increased soil respiration rates, and these are both increased further by the presence of a second species of landhopper, even when the total landhopper density remains unchanged (Richardson & Morton 1986). Their role in forest and soil ecology appears to be mostly as shredders, with populations ingesting up to 25% of the litter fall in their native forests (Friend & Richardson 1986) and in invaded forests (O'Hanlon & Bolger 1999), and the amount ingested is broadly correlated with landhopper densities (Friend & Richardson 1986). Associated with these crustaceans' consumption of leaf litter and bioturbation is their effect on soil chemistry. They accelerate the release of potassium into soil water, but reduce the rate of cation leaching, perhaps because cations in the soil become bound into the compacted faecal pellets typically produced by landhoppers (Friend & Richardson 1986).

Densities of landhoppers in New Zealand forests and grassland habitats are largely unreported, but they are expected to be no lower, on average, than those reported for landhoppers elsewhere. It is also notable that landhoppers are a significant source of food for an array of birds where this has been investigated (Friend & Richardson 1986), although this is not well documented in New Zealand (Fenwick in press). Thus, their role in the ecology of New Zealand's soils and terrestrial ecosystems, especially its relatively undisturbed ecosystems, is probably very substantial.

## New Zealand landhopper diversity

Despite their ecological importance, terrestrial amphipods are poorly researched in New Zealand. The first New Zealand landhopper was described by Dana in 1852. Chilton (1909, 1911, 1916, 1917, 1925) added several species (as well as confusing some species). Hurley (1955, 1957) reviewed all species in considerable detail, providing some very useful illustrations and identification keys. Duncan

(1968, 1994) reviewed the New Zealand landhoppers, erecting several new genera and species. His identification key (1994), however, required a matched male and female for unequivocal identification of many species.

Species of the family Talitridae belong to one of two broad groups: landhoppers, the non-marine species (often regarded as truly terrestrial); and supralittoral beach fleas and sandhoppers, species that live either on upper shore levels or are restricted to coastal zones with strong marine influences. There are various morphological and evolutionary divisions in the group, notably based on the claws (dactyls) on walking legs 1–2 (pereopods 3–4) (Bousfield 1982).

The New Zealand terrestrial amphipod fauna comprises some 28 described species, plus several additional undescribed species. Three adventive species, apparently introduced with plants brought to New Zealand, are known (K.W. Duncan 1994, pers. comm., 2004) and others are likely to be discovered. The status of some of these is uncertain, and Duncan (1994) reported that the geographic range of at least one adventive varied from year to year with differing climatic conditions.

All six of New Zealand's native landhopper genera are endemic. Duncan (1994: 36) noted that species of *Parorchestia* 'beyond New Zealand need formal regrouping. *Parorchestia* as defined herein is endemic to New Zealand.' Similarly, therefore, all 25 described native species are restricted to New Zealand (or were in pre-European times). Within New Zealand, some genera and species are quite restricted in their geographic distributions. For example, all species of *Waematau* appear confined to specific locations north of Auckland; *Parorchestia longicornis* and *Kanikania motuensis* occur only on Stewart Island; *Tara similaris* is confined to The Snares; and *Makawe maynei* is found only on Campbell Island, whereas its congeners *M. parva* and *M. insularis* are restricted to the Auckland Islands (Duncan 1994). Because a number of diverse species have such restricted distributions, a more comprehensive analysis of the fauna based on a more careful and complete examination of existing collections is likely to be very rewarding.

## Identification of New Zealand landhoppers

The key provided in this paper, developed from Duncan (1994) and other taxonomic works, is an attempt to eliminate

the need for both sexes to be associated with each other in order to enable reliable identifications. It also aims to eliminate some errors and inconsistencies present in Duncan's (1994) keys and illustrations.

Note that this key, or the use of Duncan's various generic names here, is not intended to confirm or support those genera or their groupings of species. Equally, it is not intended as a rejection of those groupings. The motivation for preparing this key was partly frustration with the absence of useful generic diagnoses that use a consistent set of reasonably visible morphological characters, the non-conventional usage of several descriptors of morphological characters (e.g. chelate instead of subchelate), the inadequately detailed figures within Duncan (1994), and the absence of any meaningful discussion of characters and genera of the New Zealand talitrids. Thus, this key is one step in an essential re-examination of this group of taxa and, certainly, does not represent the last word on identification and systematics of this morphologically conservative group.

The key includes all described New Zealand terrestrial talitrids, but excludes supralittoral taxa belonging to '*Orchestia*', *Transorchestia* and *Talorchestia* (mostly species with dissimilar dactyls on pereopods 3–4). It also includes the three adventive species known from New Zealand. Because of the nature of this project, however, we were unable to undertake the much-needed re-illustration of all New Zealand terrestrial talitrids using type specimens. Instead, we illustrate a subset of appendages of one species from each of the more widely distributed genera to show the range of differences in the characteristics used in the identification key.

After this key was first prepared, it was used to identify talitrid collections from museums in order to create a database of their distribution for the Department of Conservation under its Terrestrial and Freshwater Biodiversity Information System (TFBIS) initiative. During the process of identifying more than 2000 specimens, we attempted to resolve several discrepancies. We also encountered several unidentifiable specimens, probably because they are presently undescribed, but perhaps because they may be unknown adventives. In an attempt to add these records to the database and make the key useful with respect to these entities, we noted key characteristics of these taxa and included six of them, either within the key or as notes under endpoints in the key. Subsequent to completing the key, we discovered three additional undescribed species, some closely related to known native species.

## Methods and conventions

A set of about 40 characters was tabulated for males and females of every species included in Duncan (1994), based on both formal descriptions and illustrations. The key couplets (paired alternative sets of characters) were developed from these and tested by attempting to key out both males and females of all species. Modifications and additions were made as appropriate. To confirm its accuracy, the draft key was then used in tandem with Duncan's (1994) and Hurley's (1957) keys to identify several hundred specimens from collections of many species.

A few species have multiple entries in the key to accommodate either sexual dimorphism or known variability in one or more characters. The final couplet for many species includes additional information, which is given in square brackets and italicised. This information lists additional diagnostic characters, although these characters are not necessarily alternatives to those provided for species keying via the other option in the key couplet.

Our approach here has been to illustrate only the more definitive characters. All illustrations are of medium to large adult females (head to telson tip lengths 12–20 mm), unless otherwise indicated. Generally, male appendages were illustrated only when they differed appreciably from those of females. Because it has not been possible to illustrate all species in this paper, references are frequently given to illustrations of parts from other species that are generally similar to the character in question, but not exactly the same. In such instances, 'cf.' (the abbreviation for 'compare') precedes the figure number.

Illustrations were made using a camera lucida on both stereo (whole animal illustration only) and compound (dissected appendages) microscopes. Larger female individuals of each species were selected for illustration, and appendages were dissected off the right side and mounted in glycerol. Illustrations show appendages in lateral view only (ornamentation on the medial face is deliberately excluded), except that the pleopods are drawn in anterior view and the telson is drawn in dorsal aspect. Thus, the outer rami of uropods 1–2 frequently overlap their respective inner rami in the illustrations. Except in Figs 1–4 and in the illustrations of parts of an appendage, gnathopods 1–2 and any pereopods are shown at the same scale for each species (but scales for these differ between species), as are illustrations of the pleopods and uropods. The telson for each species is shown at the same scale as the uropods.

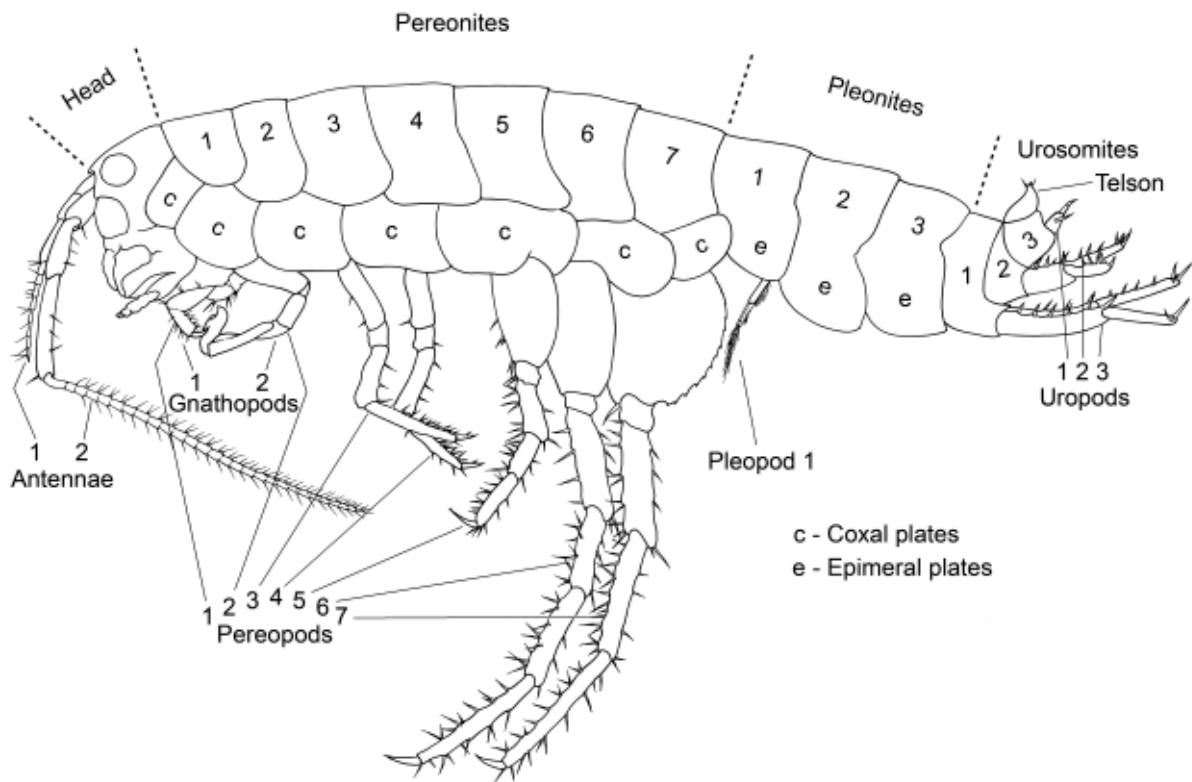


Fig. 1 Adult female *Puburuburu aotearoa* (lateral view), showing terminology for body and appendages (pleopods 2–3 hidden behind epimeral plates 2–3) (NMNZ CR.10,368: Pickersgill I., Queen Charlotte Sound, Marlborough; coll. B.A. Holloway, 7 Sep. 1961; from leaf mould).

Repositories (CM, Canterbury Museum; NIWA, National Institute of Water and Atmospheric Research; NMNZ, National Museum of New Zealand Te Papa Tongarewa) and registration numbers of illustrated specimens are given within figure legends.

## Talitrid morphology

Talitrid amphipods seem very conservative in their morphologies, often with little variation in structure between species. Consequently, their taxonomy relies on the setation and spination of the pleopods and uropods and, to a lesser extent, of the telson, and on the morphology of gnathopods 1–2 (Fig. 1). Identification does take time and careful examination, but, with some experience, the characters become less daunting.

The gnathopods (modified first two pairs of walking legs, Fig. 1) frequently provide major clues in the identification of marine amphipods, but they seem less useful in talitrids, especially below the genus level. There are two main reasons

for this. First, articles 5–6 (carpus, propodus) of gnathopod 1 (Fig. 2) are usually very small and are twisted medially across the body, making details of their structure very difficult to see in whole animals under a stereomicroscope. Second, gnathopod 2 (Fig. 2) morphology apparently varies within species, at least with stage of sexual development (this is especially true for sandhoppers and beach fleas, whose males tend to have much enlarged second gnathopods), making the condition of articles 5–6 less reliable for species identification. Gnathopod 1 seems less variable, however, and some of the more obvious characteristics are useful, especially the development of subchelation. Another reason for the apparent low reliance on gnathopod characters in landhoppers is that previous workers generally illustrated them poorly, so that better illustration should make them far more useful. Coxal gills also yield useful characters for identification (e.g. Friend 1987), but these have not been illustrated well enough to be useful for identifying the New Zealand species.

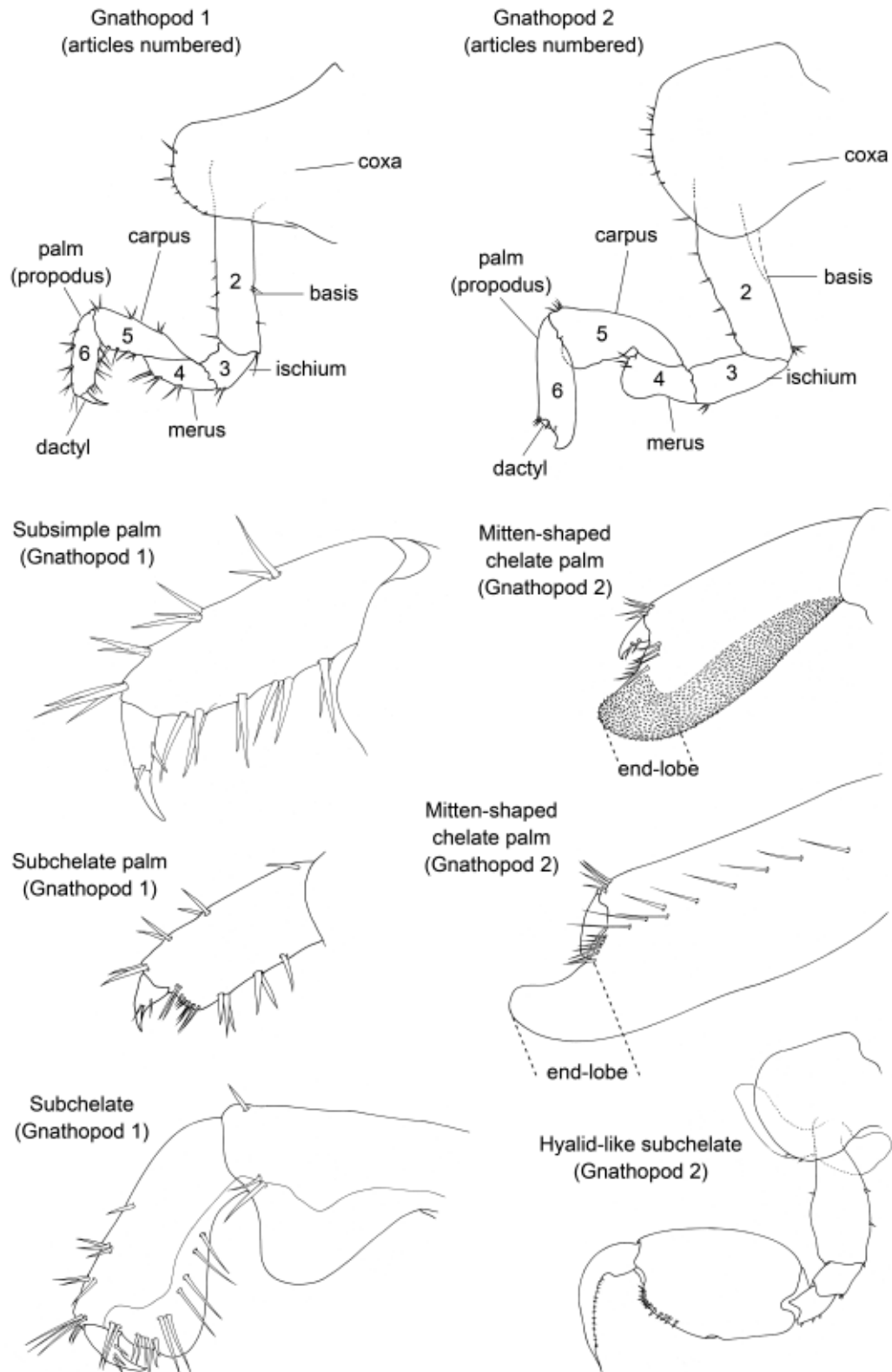


Fig. 2 Gnathopods (= pereopods) 1 (left) and 2 (right) from various species showing terminology and typical talitrid form, as well as variations of article 6 and dactyl into subsimple and subchelate (gnathopod 1), and mitten-shaped chelate and hyalid-like subchelate (gnathopod 2) forms of each.

## Examination of specimens

Because many of the characters used to distinguish species in this key are small and/or delicate, high magnification is often used. We find that the characters are most visible if a range of magnifications is used, although rarely as high as 40x because the gains in magnification generally lead to losses in depth of field and available light. A solid watchglass, filled to the top (to avoid the effects of any meniscus that forms around forceps, needles, etc., that are used to manipulate the specimens) with alcohol (or whatever liquid your specimens are in) is our preferred container for examining specimens under the microscope. Lighting is very important, with unidirectional light almost always being best. Arrange your light source so that it is all coming from one direction (i.e. both wands from a cold lamp on the same side). An arrangement that works well is to have the two fibre-optic sources from a cold lamp coming from a position equivalent to about 1–2 o'clock, with one source at about 45° to the microscope stage and the other very low down, shining almost horizontally through the wall of the watchglass. This maximises available light, shadow and reflection, making surface features (e.g. epimera) and smaller, less easily seen characters far more visible, even with mediocre optics.

Beginners to identifying amphipods may find it easier to remove appendages in order to examine them. However, with a bit of skill and familiarity with talitrid morphology, most characters needed for identification (even the maxilliped outer plate) can be seen in intact medium-sized specimens. Once the identification is complete, all dissected parts should be returned to the vial, along with the dissected carcass, so that they are available for future reference. If they are very small or there are other specimens in the vial, a separate vial or mini-vial for the dissected specimen and appendages is preferable.

## Terminology

The terminology and numbering of the body, pereopods and other appendages given here (Figs 1–4) follows that in common use today (e.g. Barnard & Karaman 1991). A few additional terms have also been used:

**Article** The unit (joint or segment – although the latter is best avoided, because a segment is more correctly part of the body, not the limb) of amphipod (and crustacean) appendages. Thus, the walking leg comprises seven articles,

each either numbered or named depending upon the author (see Figs 2–4).

**End-lobe** Refers to that part of gnathopod 2 article 6 in the mitten-shaped form (characteristic of talitrid amphipods) that extends distally beyond the insertion of the dactyl (Fig. 2).

**Palm** That portion of article 6 (propodus) of chelate or subchelate gnathopods against which the dactyl closes or opposes (the grasping surface against which the claw closes).

**Palm angle** The approximate angle in degrees of the general orientation of a gnathopod palm from the long axis of article 6. Thus, a transverse palm has a palm angle of *c.* 90°, an oblique palm has an angle <90°, and a chelate or mitten-shaped palm has an angle >90° (Fig. 2).

**Setae and spines** Today, most amphipod systematists define setae as cuticular extensions that articulate with the cuticle surface, in order to differentiate them unequivocally from non-articulating cuticular cusps, which were often referred to as 'spines'. Shorter, stouter 'setae', previously referred to as 'spines', are now termed **robust setae**. Longer, more slender setae are now termed **slender setae**, whereas previously they were commonly called 'setae'. For simplicity, we persist with the terms spine and setae for stout and slender articulating extensions of the cuticle.

**Shaft spines** These are spines on the shafts of uropod peduncles or rami (Fig. 4). They refer specifically to spines along the dorsal (including dorsolateral and dorsomedial) surfaces of these articles, but specifically exclude spines forming a terminal or apical cluster on these articles, which are often very difficult to count.

**Subequal** Used here to indicate that the lengths or widths of appendages or parts of appendages are exactly equal or more or less equal. Generally, subequal means that one dimension (e.g. article length) on a named article or appendage is within *c.* <20% of the same dimension on another.

**Subsimple** Refers to gnathopods that have a slightly widened article 6, so that this has something of a palm (surface against which the dactyl can close). Thus, article 6 either has a very short distal margin (relative to the dactyl), or it is widened proximally and tapers distally, suggesting an apparent palm with an angle of *c.* 30° or less. Such gnathopods (Fig. 2) are intermediate between subchelate and simple.

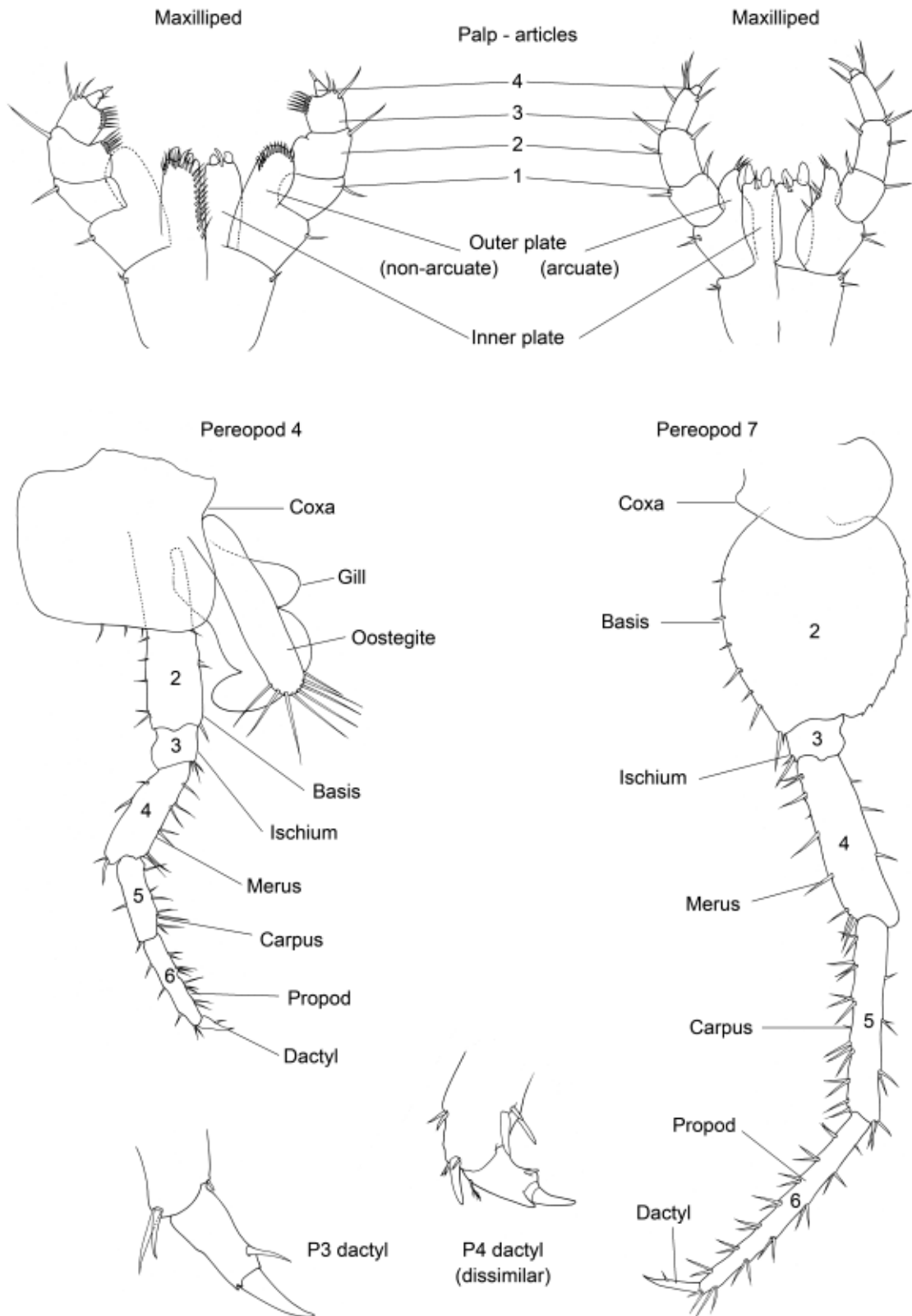


Fig. 3 Structure and terminology of maxillipeds (ovate non-arcuate and arcuate outer plates, left and right, respectively), and pereopods 4 and 7. Detail of pereopods 3 and 4 dactyls showing structure of typical dactyls (as in pereopod 3) and nature of pereopod 4 dactyl when dissimilar from pereopod 3.

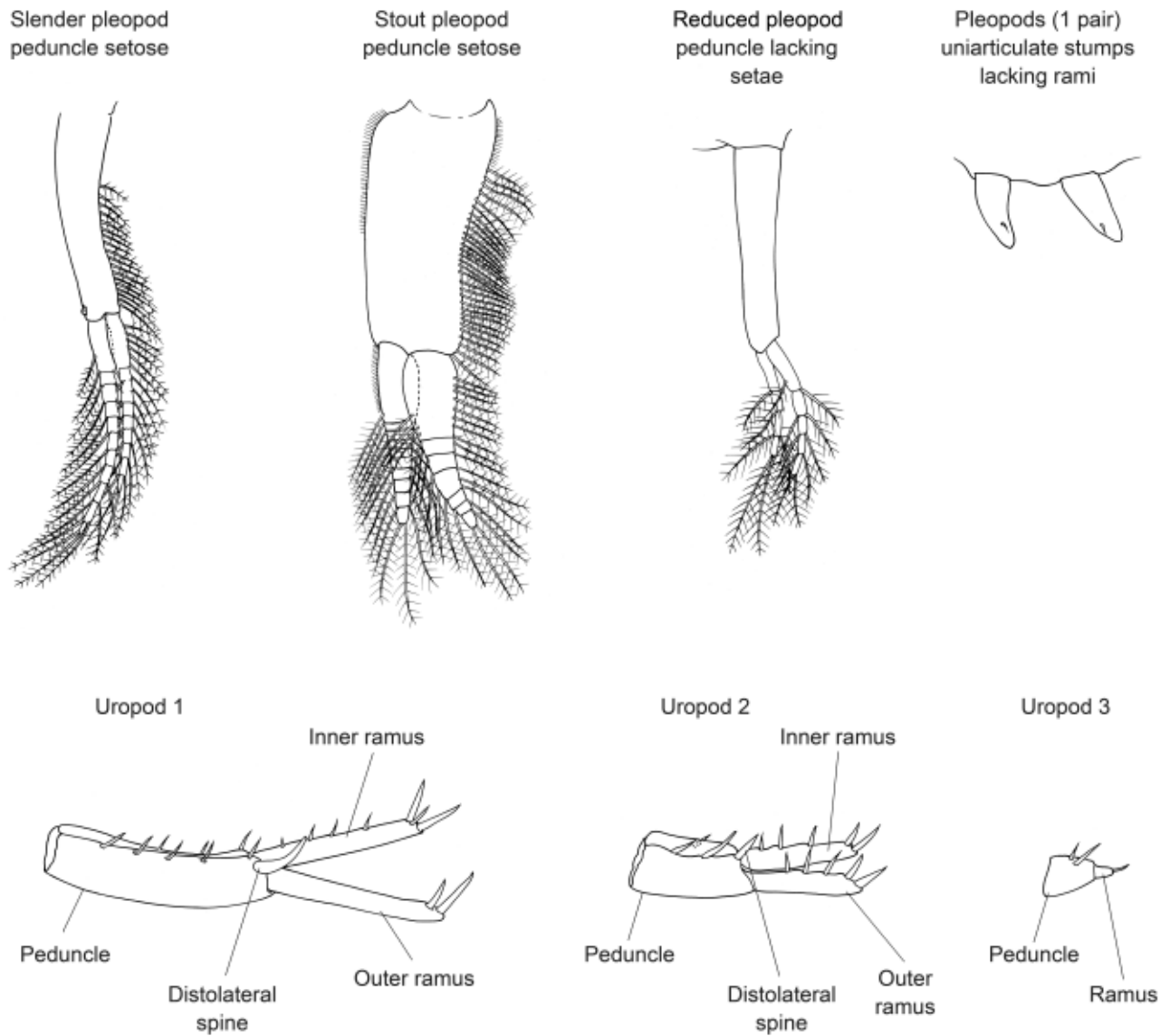


Fig. 4 Structure and terminology of pleopods and uropods, and variation in development of pleopods.

**Checklist of the New Zealand terrestrial amphipod fauna**

(A = adventive; E = endemic)

1. *Arcitalitrus dorrieni* (Hunt, 1925) A
2. *Arcitalitrus sylvaticus* (Haswell, 1880) A
3. *Kanikania improvisa* (Chilton, 1909) E
4. *Kanikania motuensis* Duncan, 1994 E
5. *Kanikania rubroannulata* (Hurley, 1957) E
6. *Makawe hurleyi* (Duncan, 1968) E
7. *Makawe insularis* (Chilton, 1909) E
8. *Makawe maymei* (Chilton, 1909) E
9. *Makawe otamatuakeke* Duncan, 1994 E
10. *Makawe parva* (Chilton, 1909) E
11. *Makawe waihekensis* Duncan, 1994 E
12. *Parorchestia ihurawao* Duncan, 1994 E
13. *Parorchestia lesliensis* (Hurley, 1957) E
14. *Parorchestia longicornis* (Stephensen, 1938) E
15. *Parorchestia tenuis* (Dana, 1852) E
16. *Puhuruhuru aotearoa* Duncan, 1994 E
17. *Puhuruhuru patersoni* (Stephensen, 1938) E
18. *Talitroides topitotum* (Burt, 1934) A
19. *Tara hauturu* Duncan, 1994 E
20. *Tara simularis* (Hurley, 1957) E



21. <i>Tara sinbadensis</i> (Hurley, 1957) E	Unnamed species
22. <i>Tara sylvicola</i> (Dana, 1852) E	? <i>Austrotroides</i> sp.
23. <i>Tara taranaki</i> Duncan, 1994 E	<i>Makawe</i> sp. A
24. <i>Waematau kaitaia</i> Duncan, 1994 E	<i>Makawe</i> sp. B
25. <i>Waematau manawatahi</i> Duncan, 1994 E	<i>Makawe</i> sp. C
26. <i>Waematau muriwhenua</i> Duncan, 1994 E	<i>Puhuruhuru</i> sp. A
27. <i>Waematau reinga</i> Duncan, 1994 E	<i>Tara</i> sp. A
28. <i>Waematau unuwahao</i> Duncan, 1994 E	<i>Tara</i> sp. B

## Key to species of New Zealand Talitridae

- 1 a Pereopod 3–4 dactyls different, pereopod 4 dactyl abruptly constricted, narrowed or posterior margin notched near mid-point (Fig. 3); uropod 1 peduncle with 10 or more dorsal shaft spines, distolateral spine not enlarged; uropod 1 outer ramus with dorsal shaft spines in all species, often densely spinose; pleopods 1–3 always fully developed, peduncles usually with conspicuous spines. Supralittoral beachfleas. *'Orchestia', Talorchestia, Transorchestia*
- b Pereopod 3–4 dactyls similar, both evenly tapered, not notched, abruptly constricted or narrowed (Fig. 3); uropod 1 peduncle with <10 dorsal shaft spines, distolateral spine enlarged (0.2–0.5 times length of outer ramus) in several species; uropod 1 outer ramus lacking shaft spines in many species (but 2–8 in some species); pleopods 1–3 absent, variously reduced or fully developed, peduncles lacking conspicuous spines. 2
- 2 (1) a Gnathopod 1 simple (Fig. 2) or subsimple (i.e. either no distinct distal margin and/or distal margin <0.5 times dactyl length) (Fig. 5), article 6 narrow, sublinear or tapering distally, not large, palm angle less than *c.* 30°. 3
- b Gnathopod 1 subchelate, small or large, article 6 expanded variously, tapering or widening slightly, palm angle 45–90°, dactyl less than, equal to or longer than palm (Figs 8, 9, 12). 10
- 3 (2) a Pleopods 1–3 all present and biramous (Figs 7, 10, 17); gnathopod 2 article 6 mitten-shaped (Figs 2, 6, 8, 11, 12, 14, 16). 4
- b One or more pairs of pleopods essentially absent, reduced to short stumps lacking both peduncles and rami (Figs 13, 15), or pleopod 3 lacking obvious rami (Fig. 15); gnathopod 2 mitten-shaped (Figs 6, 8, 11, 14, 16), hyalid-like (Fig. 9) in one species. 6
- 4 (3) a Uropod 1 distolateral spine (Fig. 4) not enlarged (<0.2 times length of outer ramus) (cf. Fig. 13), outer ramus with 2–3 shaft (i.e. not apical or terminal) spines (cf. Fig. 17); pleopods 1–3 moderately developed, peduncles without lateral setae (cf. pleopod 1, Fig. 10); antenna 2 flagellum of 11–13 articles; pereopods 6–7 article 2 not evenly tapering distally, posterodistal lobe broad, subquadrate [*male gnathopod 1 enlarged, quadrate, palm transverse; telson with 1–2 terminal and 2–3 lateral spines on each lobe*]. The Snares. *Tara similaris*
- b Uropod 1 distolateral spine enlarged (>0.2 times length of outer ramus) (Fig. 7), outer ramus with 0 (rarely 1–2) shaft (i.e. not apical or terminal) spines (Figs 7, 10, 15). 5
- 5 (4) a Pleopods 1–3 long and slender, peduncles laterally weakly to strongly setose, outer rami subequal in length to peduncles (Fig. 7); telson with 1 long spine each side plus apical spines (Fig. 7); gnathopod 2 end-lobe well developed, tapered, curved (Fig. 6) [*males have subchelate gnathopod 1 (Fig. 5); pereopod 3–4 gills reaching distal end of article 2, unequally bilobate (Fig. 6); pereopod 6 gills broad, not reaching mid-point of pereopod 7 article 2*]. Three Kings Islands, North and South Islands, Stewart Island. *Puburuburu aotearoa* ♀
- b Pleopods 1–3 slender, peduncles not laterally setose; rami short, <0.5 times peduncle length; telson with 2–3 very long lateral and apical spines; gnathopod 2 end-lobe large, untapered, evenly rounded (cf. Fig. 11). Kaitaia to Mt Taranaki. *Puburuburu* sp. A

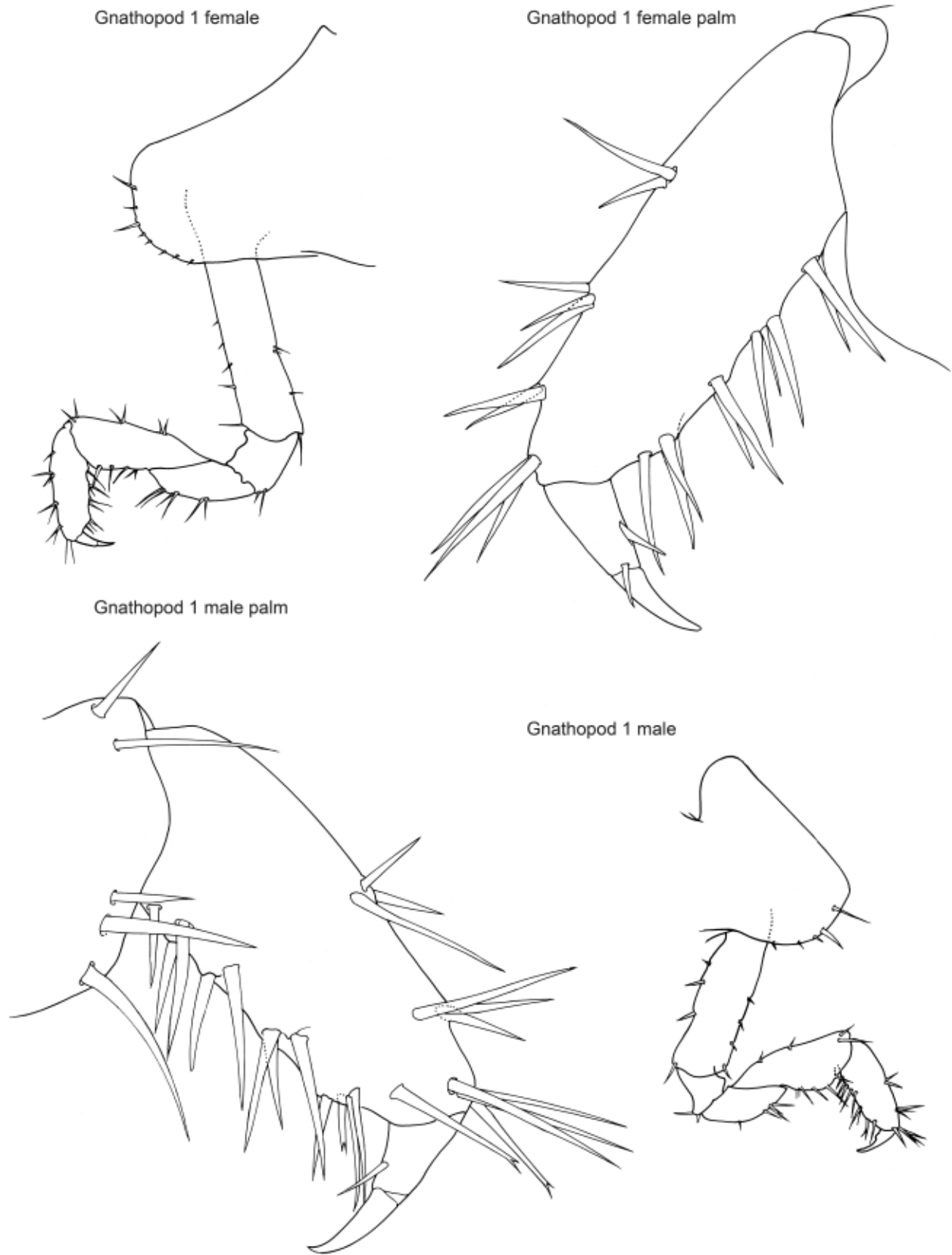


Fig. 5 *Puburuburu aotearoa* gnathopod 1 and palm (article 6) of adult female (upper) and male (lower) (NMNZ CR.10,368: Pickersgill I., Queen Charlotte Sound, Marlborough; coll. B.A. Holloway, 7 Sep. 1961; from leaf mould).

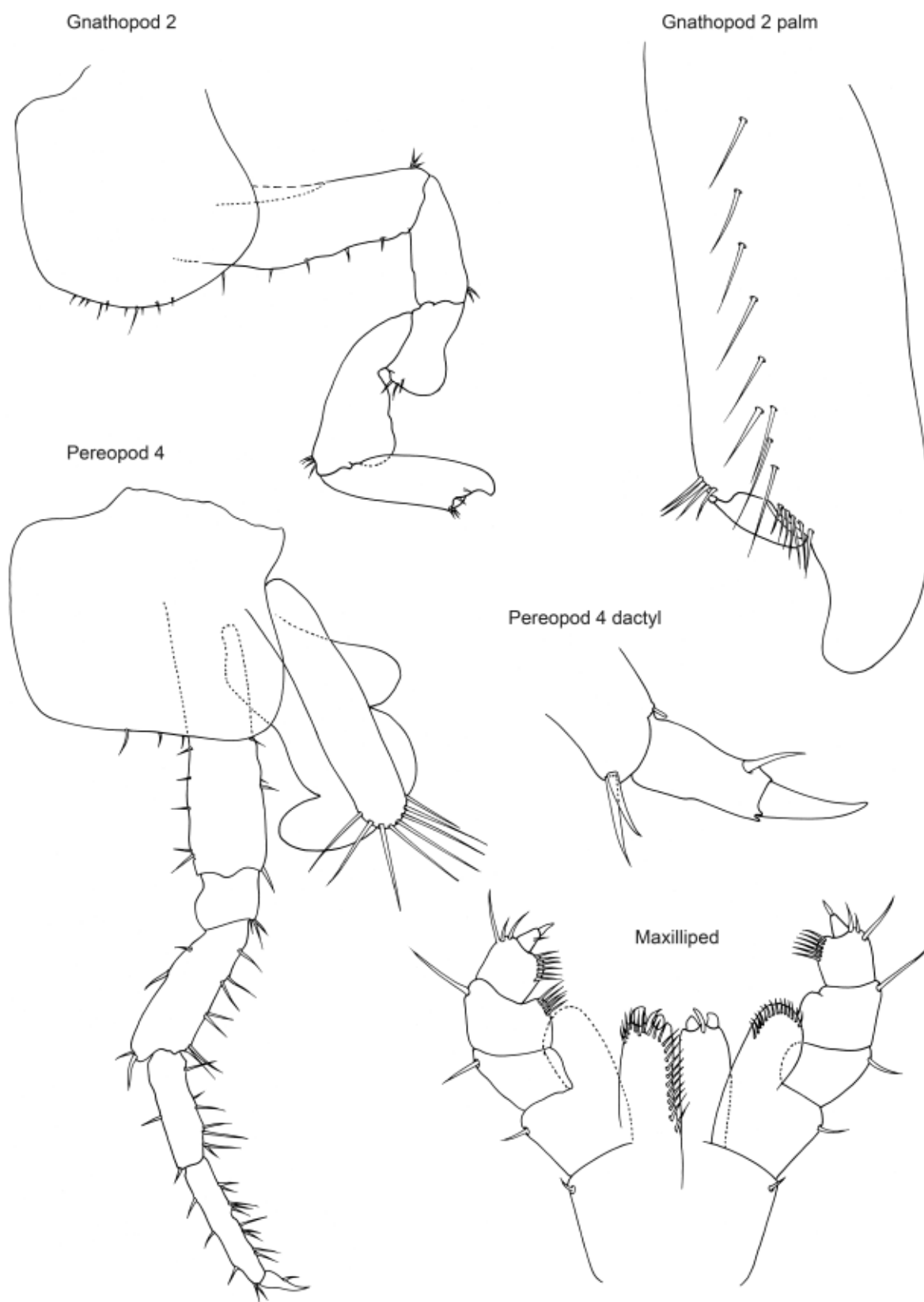


Fig. 6 *Puburuburu aotearoa* adult female gnathopod 2 and palm (article 6), pereopod 4 dactyl, maxilliped and pereopod 4 (NMNZ CR.10,368: Pickersgill I., Queen Charlotte Sound, Marlborough; coll. B.A. Holloway, 7 Sep. 1961; from leaf mould).

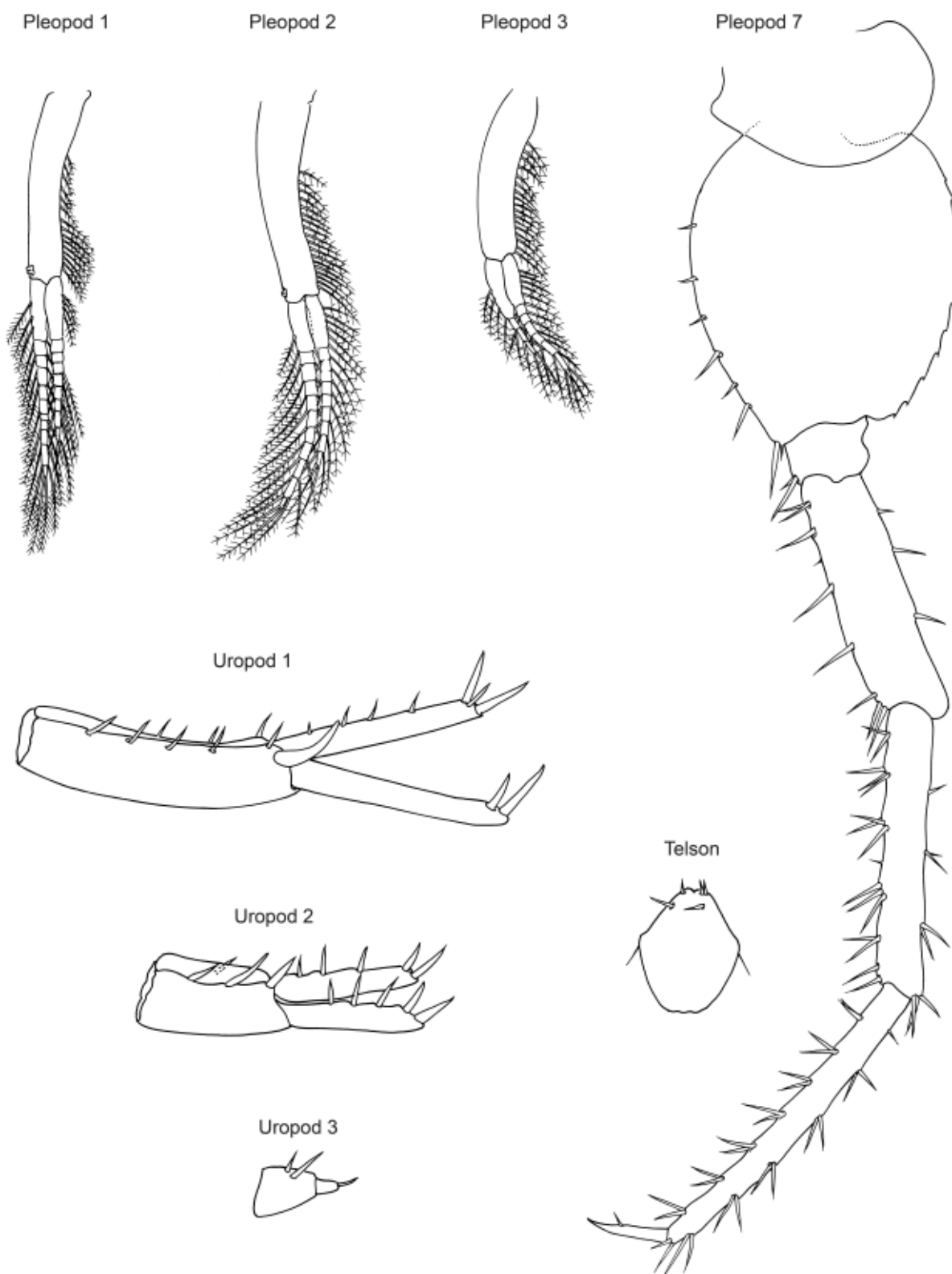


Fig. 7 *Puburuhuru aotearoa* adult female pereopod 7, pleopods 1–3, uropods 1–3 and telson (NMNZ CR.10,368: Pickersgill I., Queen Charlotte Sound, Marlborough; coll. B.A. Holloway, 7 Sep. 1961; from leaf mould).

- 6 (3) a Pleopods 1–3 reduced to minute stumps lacking rami (cf. Fig. 13); uropod 1 outer ramus lacking shaft spines (cf. Fig. 7); gnathopod 2 mitten-shaped in females (cf. Fig. 6), hyalid-like (but variable) in males (cf. Fig. 9) [*antenna 2 flagellum of 14–18 articles, pereopod 6 gill entire, arcuate, extending to distal end of pereopod 7 article 2*]. Otago–Southland (coastal), Stewart Island and outlying islands, The Snares, introduced to Macquarie Island (Richardson & Jackson 1995). *Puburuburu patersoni*
- b Pleopods 1–2 present, not reduced in size, biramous (cf. Fig. 15); pleopod 3 reduced, not biramous, lacking distinct rami (peduncle may be *c.* normal, not reduced in size) (cf. Fig. 15). 7
- 7 (6) a Pleopod 3 almost as long as pleopods 1–2, uniramous, a minute uniaarticulate inner ramus only present [*antenna 1 reaching almost to distal end of antenna 2 peduncle article 5; pleopods 1–2 peduncles laterally setose, inner rami half as long as outer; uropod 1 outer ramus lacking shaft spines; gnathopod 2 mitten-shaped in both sexes; antenna 2 flagellum of 14–16 articles*]. Adventive (Europe, Britain, North America, Brazil, India, Hong Kong, China, Australia, Hawaii, Norfolk, Marquesas, Madagascar, Mauritius, plus numerous other islands and countries), northern New Zealand? *Talitroides topitotum*
- b Pleopod 3 reduced to minute stump that is very much shorter than pleopods 1–2 peduncles (cf. Fig. 15). 8
- 8 (7) a Maxilliped outer plate broadly rounded distally, medial margin straight (cf. Fig. 6) [*pereopod 6 gill slender, arcuate lobe, extending to distal end of article 2; uropod 1 peduncle with 2 lateral and 2 medial shaft spines, outer ramus naked, inner ramus with 0 lateral and 3 medial shaft spines; uropod 2 peduncle with 2 lateral and 1 medial shaft spines, outer ramus with 2 shaft spines, inner ramus with 0 lateral and 2–3 medial shaft spines; telson with 1 distal and 2 lateral spines on each lobe*]. *?Austrotroides sp.*
- b Maxilliped outer plate arcuate:<sup>1</sup> narrow and subacute distally, medial margin concave (cf. Fig. 15). 9
- 9 (8) a Pleopod 2 peduncle not stout, scarcely tapered, distal width *c.* 0.75 times proximal width; rami poorly setose in males [*antenna 1 reaching 0.3 times along antenna 2 peduncle article 5; uropod 1 outer ramus lacking shaft spines; gnathopod 2 mitten-shaped in both sexes, article 5 posterior margin weakly bilobed; antenna 2 flagellum of 22–23 articles*]. Adventive (Australia (native) and Britain), Nelson northwards, rare in Christchurch and Greymouth; usually in urban environments. *Arcitalitrus sylvaticus*
- b Pleopod 2 peduncle moderately stout, strongly tapered (base twice distal width) [*antenna 1 reaching almost to mid-point of antenna 2 peduncle article 5; uropod 1 outer ramus lacking shaft spines; gnathopod 2 mitten-shaped in both sexes, article 5 posterior margin strongly bilobed; antenna 2 flagellum of 22–23 articles; pereopod 6 gill broad, abruptly tapered and distally incised (chela-like in appearance), extending ventrally almost to distal end of pereopod 7 article 2; telson with 5–6 marginal spines on each lobe*]. Adventive (Australia (native) and Britain), Northland, Auckland, Waikato, central Canterbury, Otago Lakes. *Arcitalitrus dorrieni*
- 10 (2) a Pleopods 1–3 all moderately to well developed and biramous (pleopod 3 may be slightly reduced but is biramous) (cf. Figs 7, 10, 17) [*gnathopod 2 article 6 mitten-shaped, hyalid-like or otherwise developed*]. 11
- b Pleopods 2 and 3 reduced to minute stumps or pleopod 3 reduced and lacking rami (cf. Fig. 13) [*gnathopod 2 article 6 always mitten-shaped (both sexes)*]. 17
- 11 (10) a Uropod 1 peduncle with large distolateral spine >0.25 times length of outer ramus (cf. Figs 7, 10); outer ramus with 0–3 spines on shaft. 12
- b Uropod 1 distolateral spine absent or <0.2 times outer ramus length (cf. Fig. 13), outer ramus with >3 shaft spines dorsally (cf. Fig. 17) [*gnathopod 1 article 6 shorter than article 5, subrectangular, widened slightly distally, palm transverse; pleopods 1–3 slender, moderately developed, peduncles all naked*]. 21
- 12 (11) a Pleopod peduncles (always pleopod 2) naked, lacking long setae laterally (but may have short setae or fuzz <0.5 times peduncle width) [*pleopods all biramous, variously developed, long or short*]. 13
- b Peduncles of at least pleopods 1–2 or 2–3 or 3 laterally setose (i.e. >3–4 setae that are >0.5 times width of peduncle; may need to remove pleopods to see these) [*pleopods all biramous, variously developed, long or short*]. 25

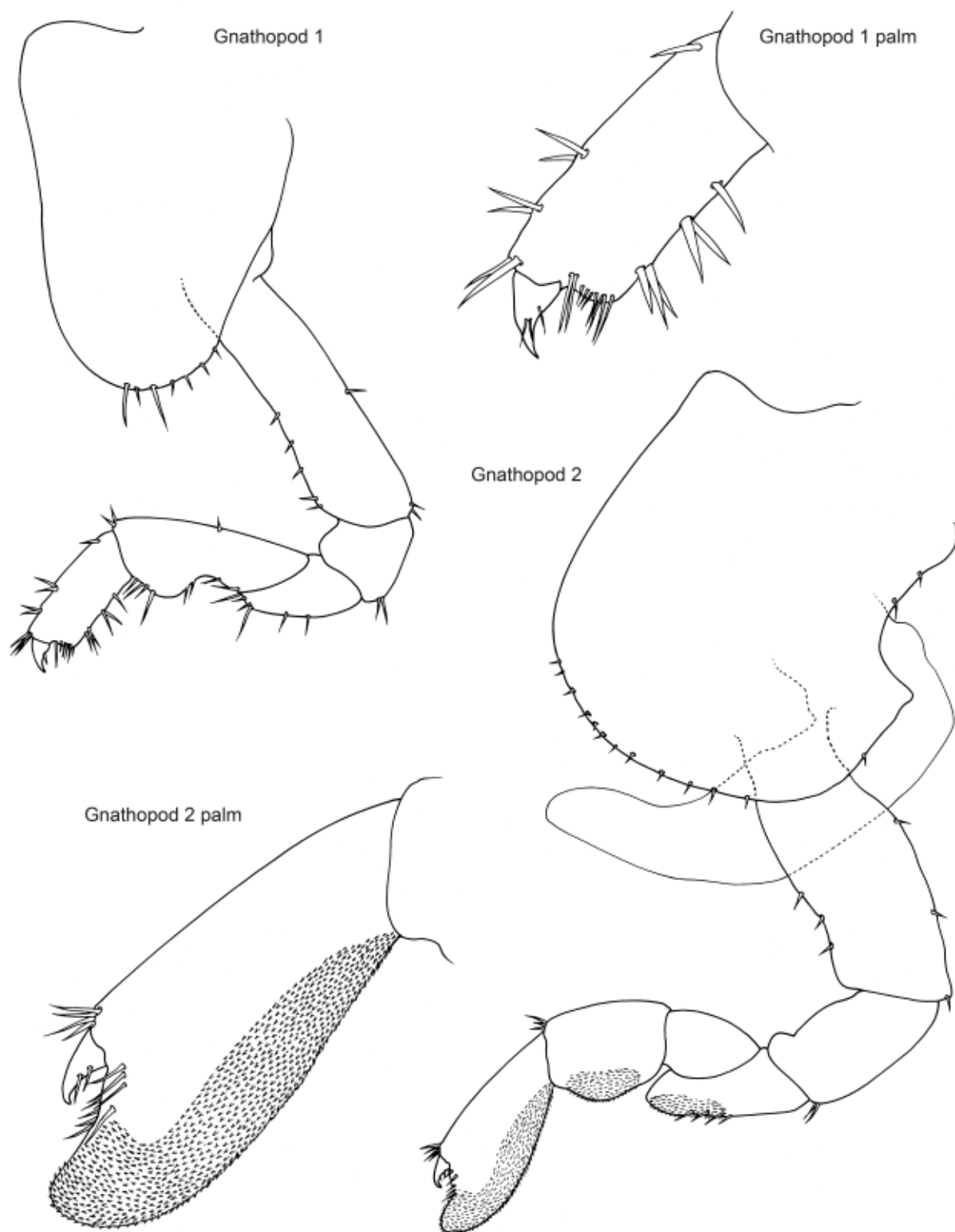


Fig. 8 *Parorchestia tenuis* adult female gnathopods 1–2 and their palms (NIWA GW492-1: Owaka River, Purekireki, Otago; coll. S. Moore, 20 Sep. 1996).

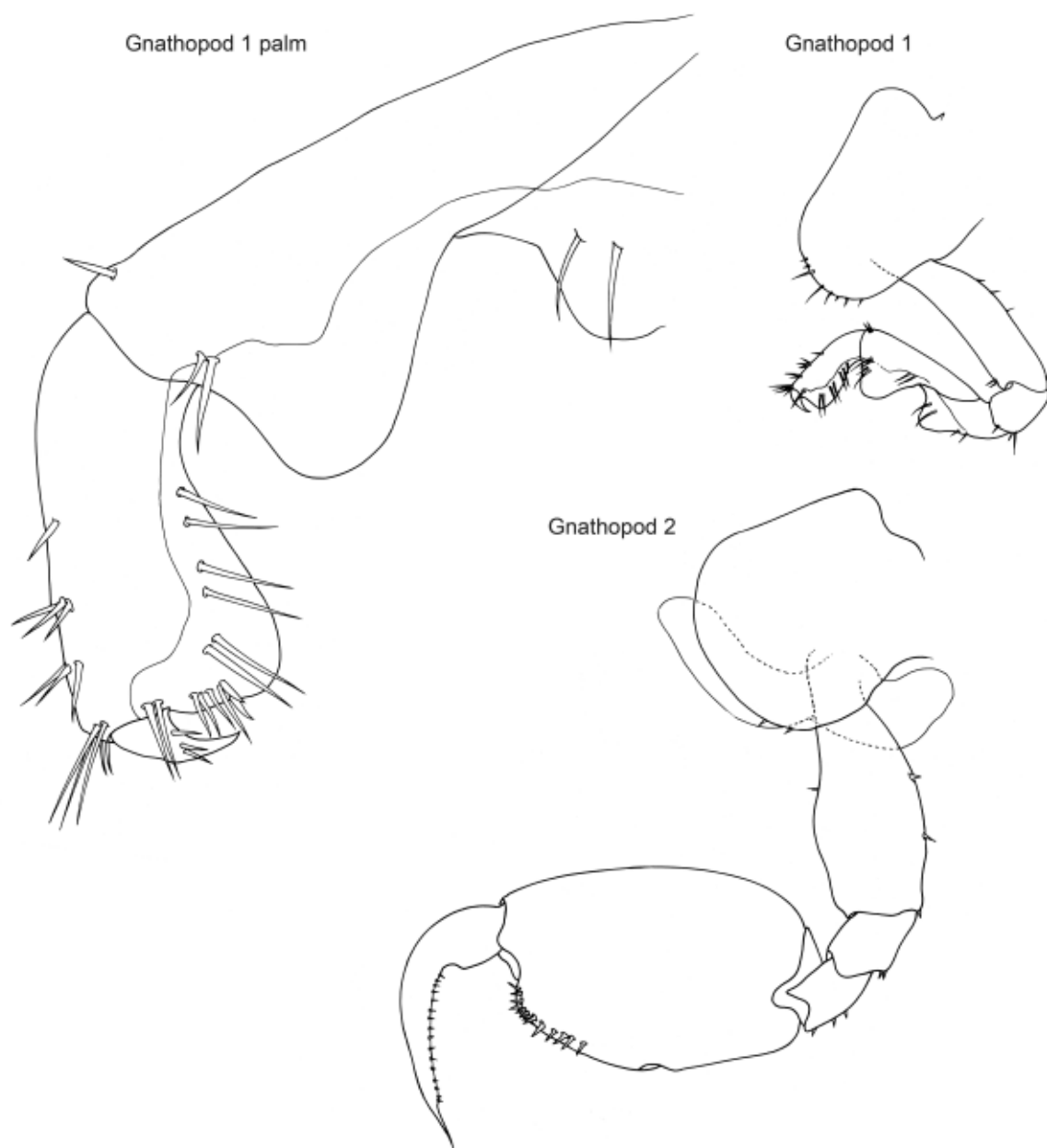


Fig. 9 *Parorchestia tenuis* adult male gnathopods 1–2 and gnathopod 1 palm (NIWA GW492-1: Owaka River, Purekireki, Otago; coll. S. Moore, 20 Sep. 1996).

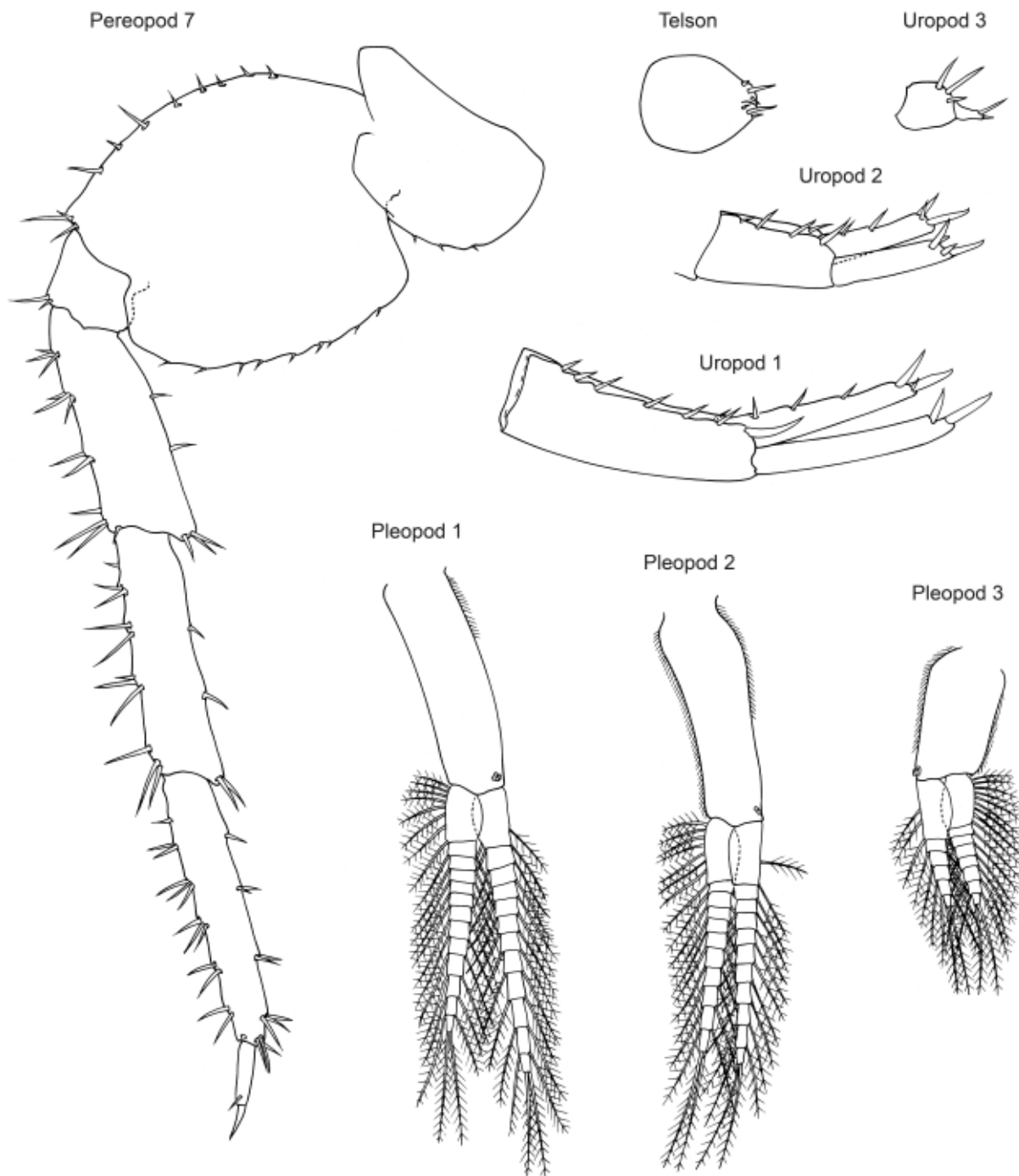


Fig. 10 *Parorchestia tenuis* adult female pereopod 7, pleopods 1–3, uropods 1–3, telson (NIWA GW492-1: Owaka River, Purekireki, Otago; coll. S. Moore, 20 Sep. 1996).



- 13 (12) a Uropod 2 outer ramus lacking spines on shaft (cf. Figs 10, 15). 14  
 b Uropod 2 outer ramus shaft with (1–)2 or more spines dorsally (cf. Figs 7, 13, 17). 33
- 14 (13) a Pleopods 1–2 slender, peduncles >3 times longer than wide (3 stouter), rami subequal in length, subequal in length to peduncle (Fig. 10); gnathopod 2 article 6 not enlarged and mitten-shaped in females (Fig. 8), enlarged and hyalid-like in males (Fig. 9) [*antenna 2 flagellum of 22–30 articles; pereopod 6 gill broadly rounded distally, almost reaching mid-point of pereopod 7 article 2; uropod 1 peduncle with 6–8 spines dorsally on shaft, distolateral spine c. 0.3 times outer ramus length; uropod 2 peduncle with 4–7 spines on shaft, outer ramus shaft naked, inner with 4 spines on shaft; telson with 2 spines apically (1 large, 1 small) and 0 laterally on each lobe*]. North Island, West Coast of South Island, Stewart Island, ?Campbell Island. *Parorchestia tenuis*  
 b Pleopods (always pleopod 2) stout, peduncles c. 2 times longer than wide, rami usually unequal in length and shorter than peduncle (cf. Fig. 17); gnathopod 2 article 6 not enlarged, mitten-shaped in both sexes (cf. Figs 6, 11, 12, 14, 16). 15
- 15 (14) a Uropod 1 peduncle with 3–4 spines dorsally on shaft, distolateral spine c. 0.5 times outer ramus length; uropod 2 peduncle with 2–3 shaft spines (cf. Fig. 10); pleopod rami about equal in length; antenna 2 flagellum of c. 16–19 articles. East coast of South Island from Kaikoura to Otago, Fiordland; lowland to montane beech forest. *Parorchestia iburawao*  
 b Uropod 1 peduncle with >5 spines dorsally on shaft, distolateral spine <0.5 times outer ramus length (cf. Figs 10, 17); uropod 2 peduncle with 1–5 shaft spines; pleopod rami distinctly unequal in length (cf. Fig. 7); antenna 2 flagellum of >20 articles. 16
- 16 (15) a Uropod 2 peduncle with 1 spine dorsally along its shaft, inner ramus with 3–4 medial shaft spines; antenna 2 flagellum of 24–30 articles. Stewart Island and associated islands. *Kanikania motuensis*  
 b Uropod 2 peduncle with 2–5 shaft spines (cf. Figs 7, 13), inner ramus with 2–7 medial shaft spines (cf. Figs 7, 13); antenna 2 flagellum of 44 articles. Southland (Bluff), Stewart Island. *Parorchestia longicornis*
- 17 (10) a Both pleopods 2 and 3 reduced to minute stumps (cf. Fig. 13); uropod 1 peduncle lacking an enlarged distolateral spine (cf. Fig. 13); antenna 2 flagellum of 12–17 articles. 18  
 b Pleopod 3 only reduced to either minute stumps (cf. Fig. 15) or to short peduncle lacking distinct rami; uropod 1 peduncle with distolateral spine >0.25 times length of outer ramus (cf. Figs 7, 10, 15, 17); antennae 2 flagellum of 13–21 articles. 19  
 c Pleopods 1–3 all reduced to minute stumps lacking rami. Otago–Southland (coastal), Stewart Island and outlying islands, The Snares. *Puburuburu patersoni*
- 18 (17) a Uropod 2 outer ramus with 1 (–2) shaft spines (Fig. 13); telson with 1–2 apical and 3–5 lateral spines each side (Fig. 12); gnathopod 1 articles 5–6 subequal in length (Fig. 11) or article 6 subrectangular and article 5 as long as wide (Fig. 12); gnathopod 2 article 6 subovate in shape, widened distally, posterior margin convex, end-lobe broad, anterior margin c. 150° (Fig. 11) [*male gnathopod 1 article 6 slightly enlarged, subrectangular, article 5 with narrow posterior lobe; female gnathopod 2 palm c. 160°*]. Northern North Island, Coromandel and northern off-shore islands, Wellington, Marlborough Sounds. *Kanikania rubroannulata*  
 b Uropod 2 outer ramus with 3 shaft spines (cf. Fig. 7); telson with 3 apical spines on each side, lacking lateral spines (cf. Fig. 10); gnathopod 1 article 6 c. 0.7 times length of article 5; gnathopod 2 article 6 narrow, not widened distally, sublinear in shape, posterior margin straight, end-lobe anterior margin c. 180°. Northland. *Waematau unuwbaio*
- 19 (17) a Uropod 2 outer ramus 0 (?1) shaft spines (cf. Figs 10, 15); telson with 2 apical and no marginal spines each side (cf. Fig. 17) [*female gnathopod 1 articles 5–6 subequal in length; male gnathopod 2 article 6 rectangular, palm transverse with small distal projection; uropod 1 distolateral spine 0.5 times length of outer ramus*]. Wellington, Nelson, eastern South Island to Southland; hills and mountains. *Parorchestia lesliensis*  
 b Uropod 2 outer ramus with 2–3 shaft spines (cf. Figs 7, 13); gnathopod 1 article 6 shorter than article 5 (cf. Fig. 16). 20

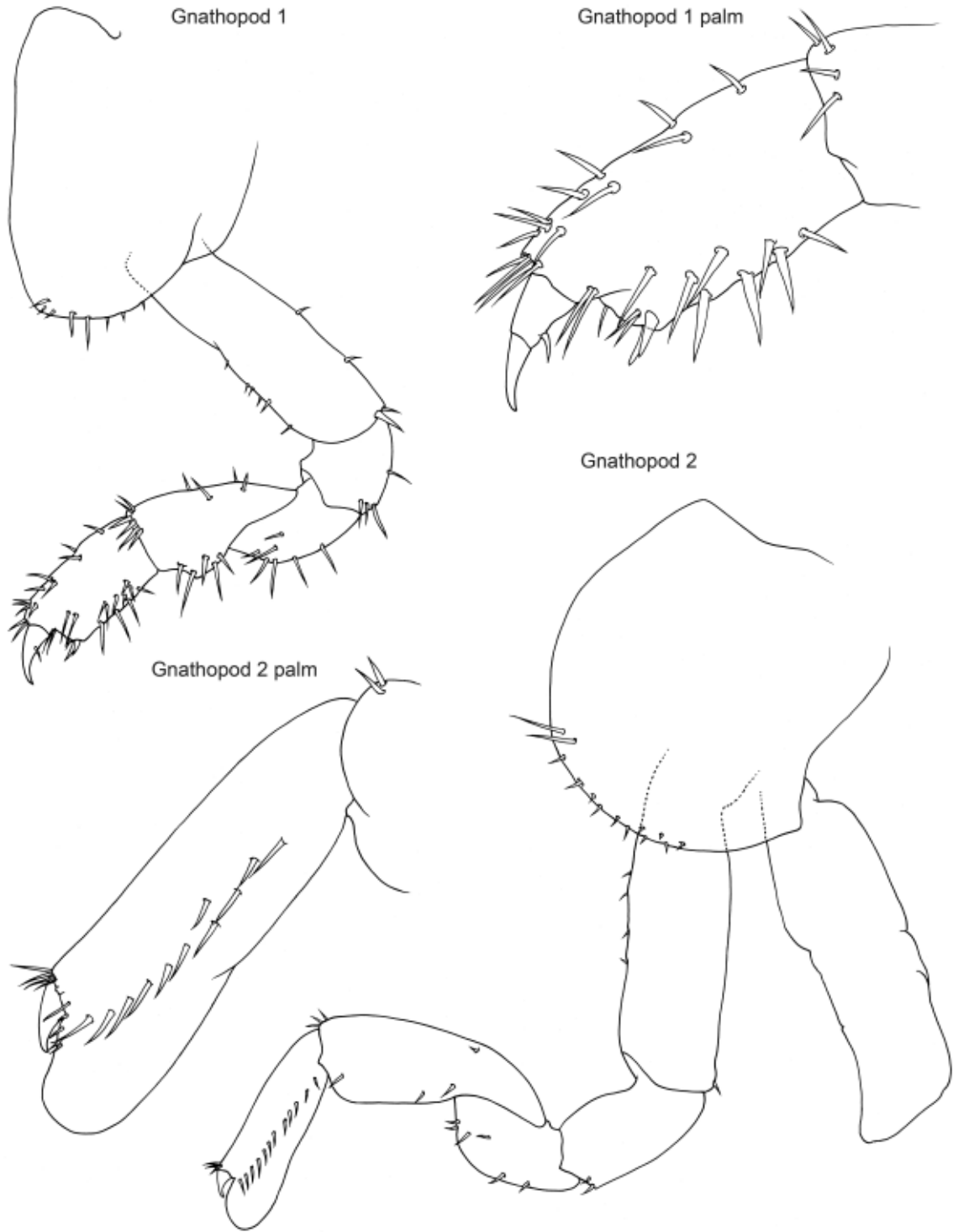


Fig. 11 *Kanikania rubroannulata* adult female gnathopods 1–2 and palms (NMNZ CR.10,415: Lady Alice I., Hen and Chicken Is, Northland; coll. I. McFadden, 17 Feb. 1983; in pitfall trap).

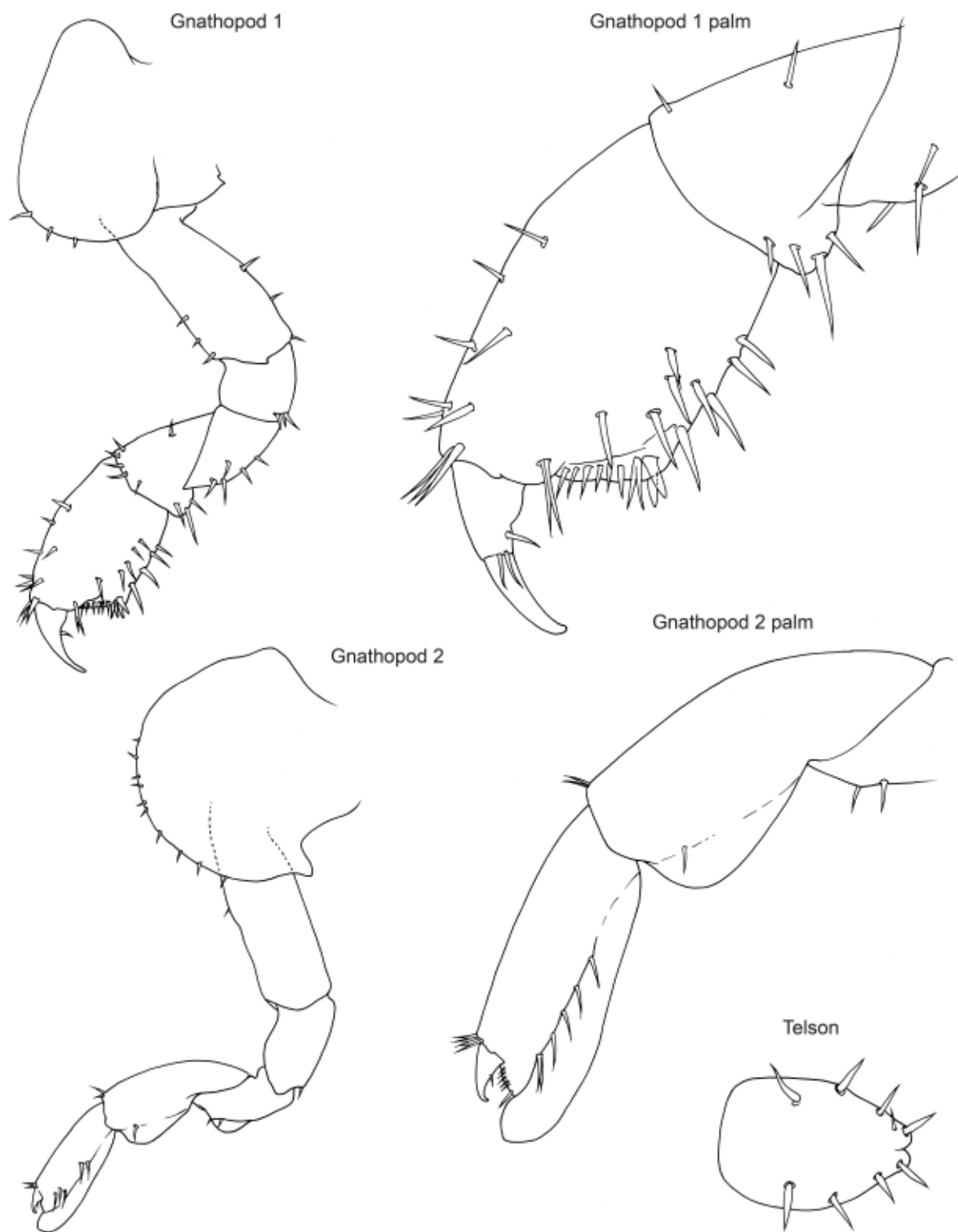


Fig. 12 *Kanikania rubroannulata* adult male gnathopods 1–2, their palms and telson (NMNZ CR.10,415: Lady Alice I., Hen and Chicken Is, Northland; coll. I. McFadden, 17 Feb. 1983; in pitfall trap).

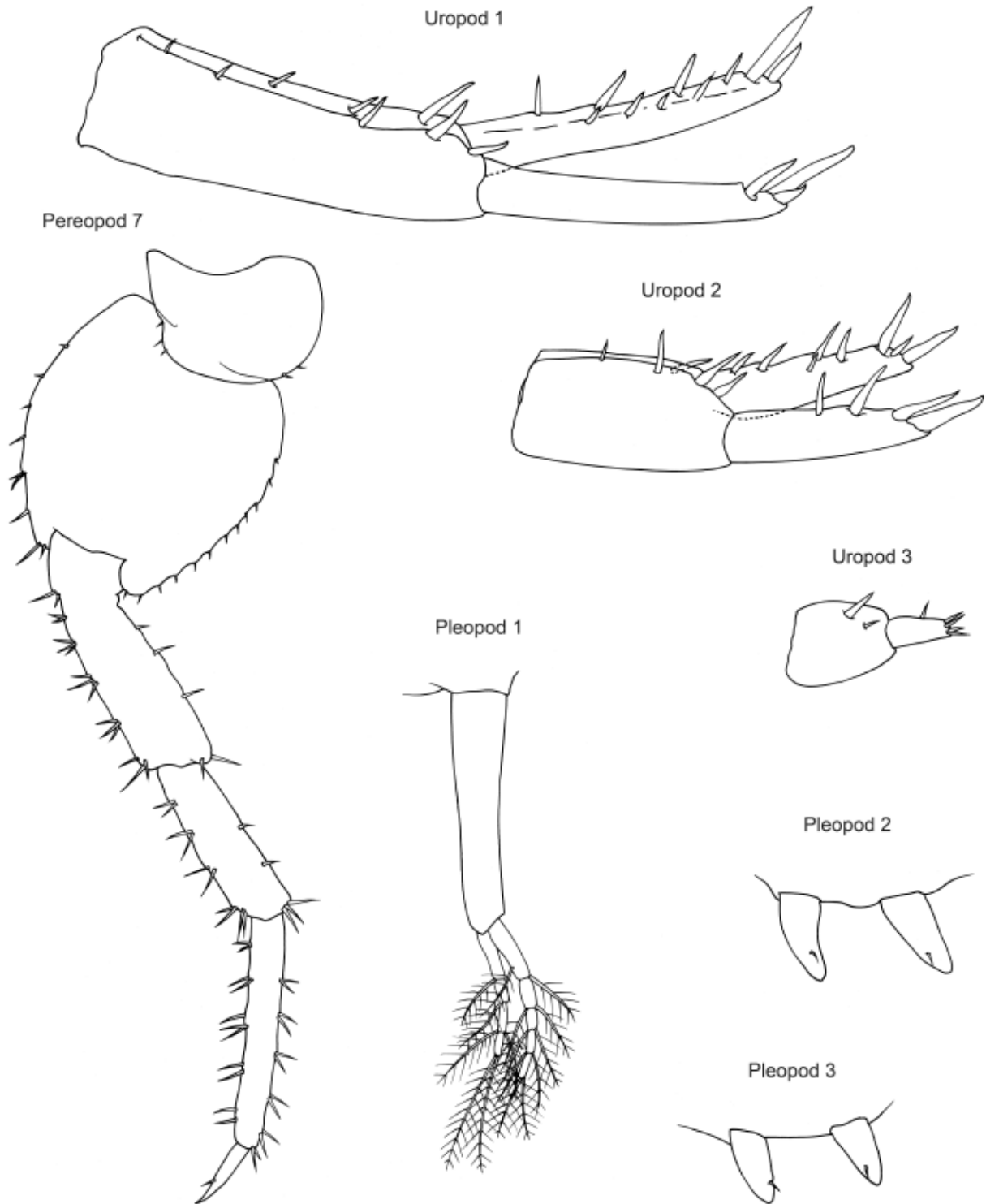


Fig. 13 *Kanikania rubroannulata* adult female pereopod 7, pleopods 1–3 and uropods 1–3 (NMNZ CR.10,415: Lady Alice I., Hen and Chicken Is, Northland; coll. I. McFadden, 17 Feb. 1983; in pitfall trap).

- 20 (19) a Uropod 1 peduncle shaft with 1–2 spines; telson with 1 apical and 2 lateral spines each side; antenna 2 flagellum of *c.* 21 articles; gnathopod 1 article 6 *c.* half length of article 5 [*gnathopod 2 article 6 widened distally, posterior margin broadly convex*]. Northland (Cape Reinga). *Waematau reinga*
- b Uropod 1 peduncle shaft with >5 spines (cf. Figs 7, 10, 13, 17); telson with 1–2 apical and no lateral spines each side (cf. Figs 10, 17); antenna 2 flagellum of *c.* 14–17 articles; gnathopod 1 article 6 *c.* 0.7 times length of article 5 [*gnathopod 2 article 6 not widened distally, posterior margin straight*]. Northland (North Cape). *Waematau muriwbenua*
- 21 (11) a Uropod 1 inner ramus shaft with 3–4 spines (cf. Figs 7, 10, 15); antenna 2 flagellum of *c.* 11 articles. 22
- b Uropod 1 inner ramus shaft with 5–7 spines (cf. Fig. 17); antenna 2 flagellum of 18 articles. 23
- 22 (21) a Uropod 1 peduncle with 5 lateral and 4–5 medial shaft spines, outer ramus with 1 shaft spine, inner ramus with 2 shaft spines; uropod 2 outer ramus with 1 shaft spine, inner ramus with 2 shaft spines [*male gnathopod 2 article 6 subsquare, palm transverse, dactyl stumpy, shorter than palm; female gnathopod 2 article 6 ovate, end-lobe short, untapered, rounded to subquadrate, palm angle 180°; telson with 1–2 apical and 2–3 lateral spines each side*]. The Snares. *Tara similaris*
- b Uropod 1 peduncle with 4 lateral and 3 medial shaft spines, outer ramus with 2 lateral and 0 medial shaft spines; uropod 2 outer ramus with 1 lateral and 0 medial shaft spines, inner ramus with 0 lateral and 2 medial shaft spines [*pleopods 1–3 moderately stout, peduncles naked, spaced*]. *Tara sp. A*
- 23 (21) a Uropod 2 peduncle with 0–1 dorsolateral shaft spines [*male gnathopod 2 article 6 enlarged, hyalid-like, palm oblique, dactyl tip closing against triangular defining flange; female gnathopod 2 article 2 inflated, article 6 mitten-like, subovate, subequal to article 5 in length; telson with 1 small spine plus 1–3 minute spines apically each side, no lateral spines*]. Northland. *Tara sylvicola*
- b Uropod 2 peduncle with 2 or more dorsolateral shaft spines. 24
- 24 (23) a Uropod 2 peduncle with 2 shaft spines; gnathopod 2 article 6 mitten-shaped in both sexes, article 5 unevenly widened distally, posterodistally subquadrate [*gnathopod 1 article 6 0.5 times article 5 in length; antenna 2 flagellum of 18–21 articles; uropod 3 peduncle with 4 distolateral spines, ramus twice as long as wide; telson with 2 apical spines each side and no lateral spines*]. Little Barrier Island. *Tara hauturu*
- b Uropod 2 peduncle with 3–4 shaft spines; gnathopod 2 article 6 mitten-shaped in female, article 5 produced posterodistally into rounded lobe; male gnathopod 2 hyalid-like, article 6 enlarged, subovate, palm oblique (cf. Fig. 9), dactyl closing beside triangular defining flange [*male gnathopod 1 article 6 >2 times longer than wide, >0.5 times article 5 in length; antenna 2 flagellum of 20–22 articles; uropod 3 peduncle with 3 distolateral spines, ramus 3 times longer than wide, exceeding telson; telson with 4 marginal spines*]. Taranaki. *Tara taranaki*
- 25 (12) a Uropod 1 outer ramus lacking shaft spines (cf. Figs 7, 10, 13, 15); gnathopod 2 article 6 either not greatly expanded (cf. Figs 11, 12), mitten-shaped in both sexes and end-lobe anterior margin oblique, not strongly concave, or article 6 expanded and hyalid-like (cf. Fig. 9). 26
- b Uropod 1 outer ramus with 2–3 shaft spines; gnathopod 2 article 6 not greatly expanded, mitten-shaped in both sexes, end-lobe anterior margin distinctly to slightly concave (cf. Figs 6, 16). 29
- 26 (25) a Pleopods 1–3 all with peduncles laterally setose (>6 long setae) (cf. Fig. 7); gnathopod 2 article 6 small, mitten-shaped in both sexes, end-lobe anterior margin straight to slightly concave (cf. Figs 8, 12). 27
- b Pleopod 3 only with peduncle laterally setose (>2–3 long setae); male gnathopod 2 hyalid-like (cf. Fig. 9), female gnathopod 2 mitten-shaped; uropod 2 outer ramus lacking shaft spines (cf. Fig. 10) [*male gnathopod 2 article 6 enlarged, palm oblique, article 5 reduced and inserted anterior to article 4*]. Subantarctic Islands only. 31
- 27 (26) a Uropod 2 outer ramus shaft with (2–)3 spines (Fig. 7); gnathopod 2 article 6 end-lobe tapered, anterior margin oblique, not parallel to article axis (Fig. 6) [*antenna 2 flagellum of 29–32 articles; gnathopod 1 distinctly subchelate in male (flagellum palm angle 80°), subsimple in female (dactyl greatly exceeding palm); gnathopod 2 article 6*

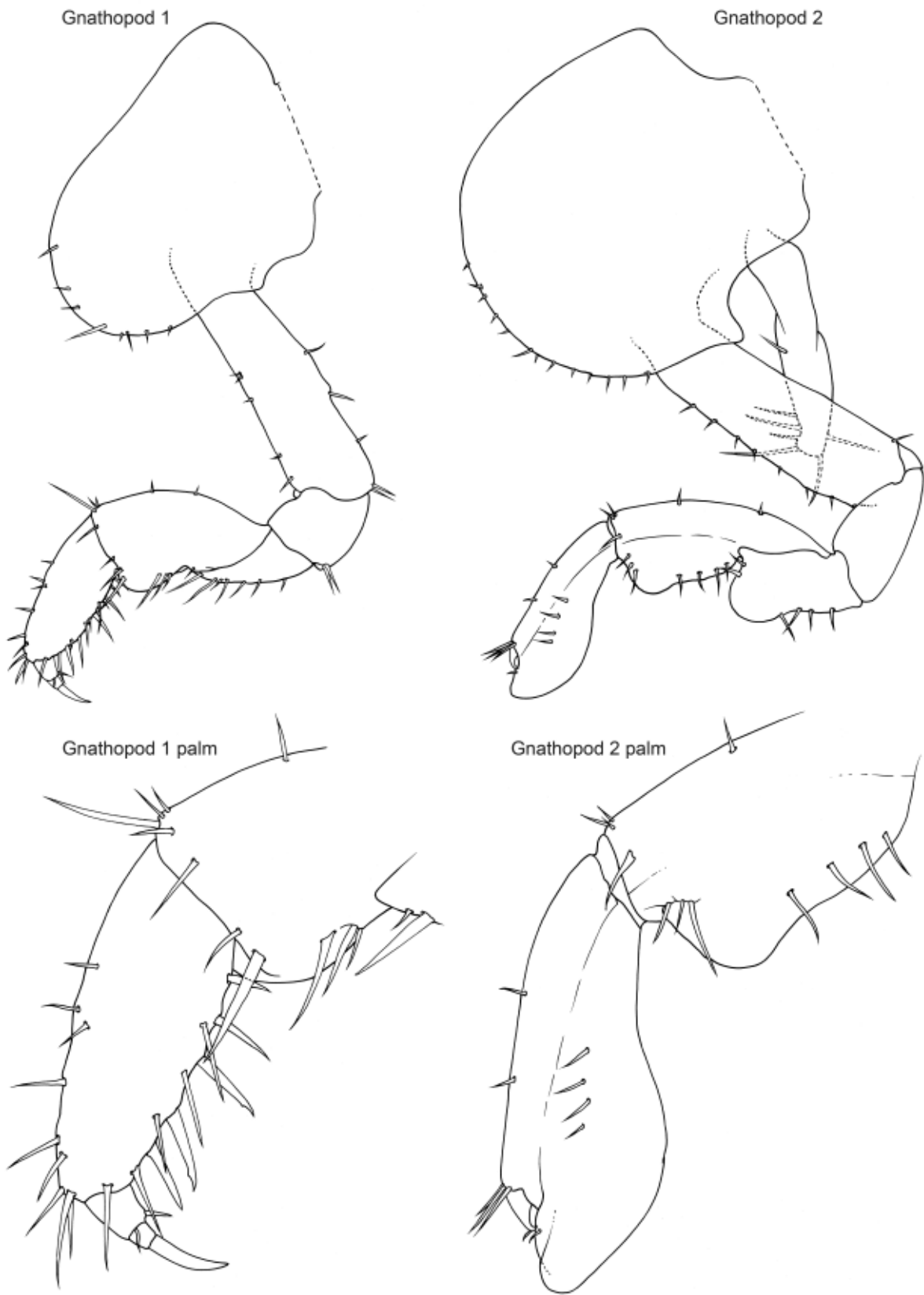


Fig. 14 *Arcitalitrus dorrieni* adult female gnathopods 1–2 and palms (NMNZ CR.10,285: Matarau, Whangarei, Northland; coll. Botany Division, DSIR, 31 Jan. 1980; from litter in lowland forest).

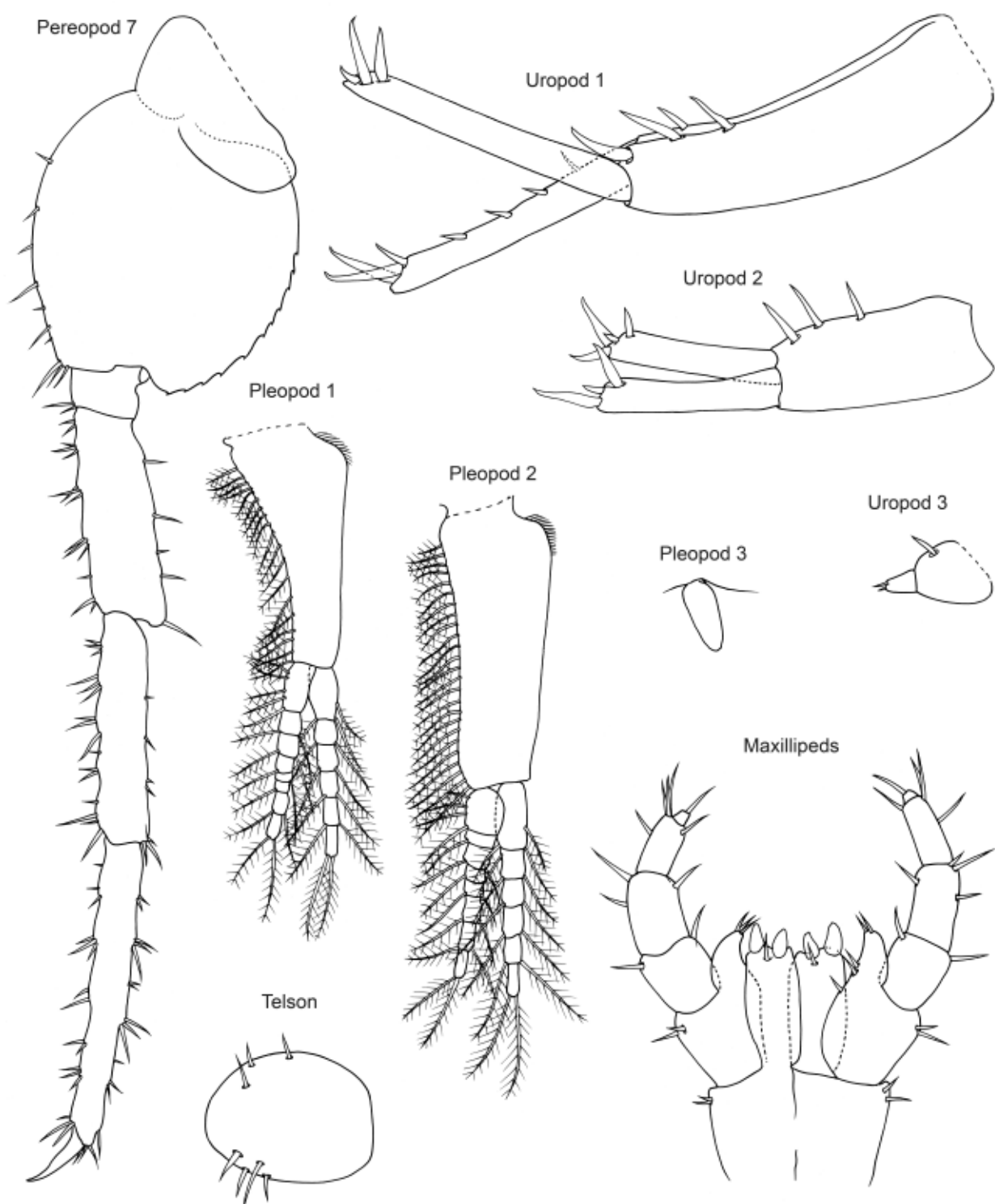


Fig. 15 *Arcitalitrus dorrieni* adult female maxilliped, pereopod 7, pleopods 1–3, uropods 1–3, telson (NMNZ CR.10,285: Matarau, Whangarei, Northland; coll. Botany Division, DSIR, 31 Jan. 1980; from litter in lowland forest).

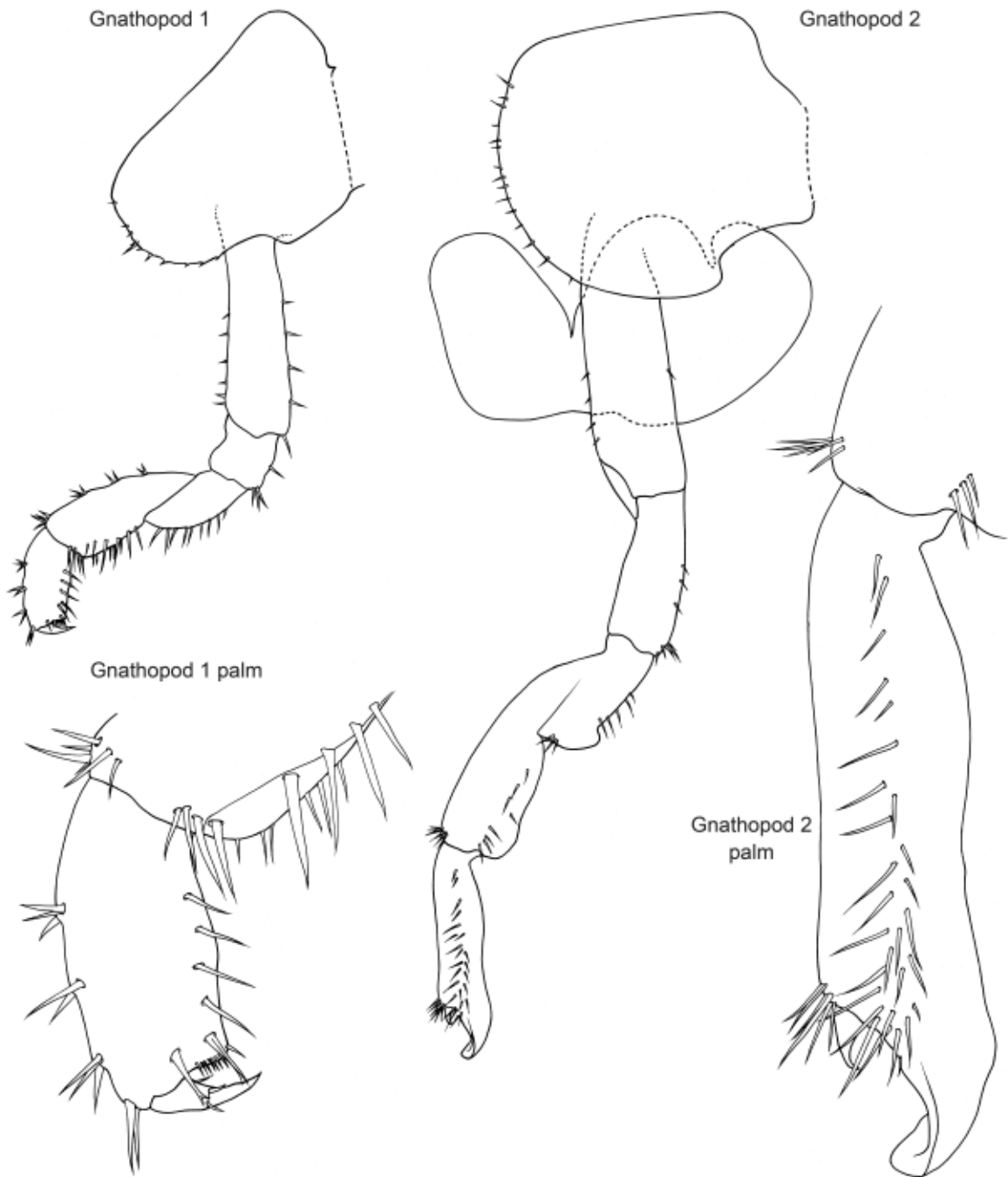


Fig. 16 *Makawe hurleyi* adult female gnathopods 1–2 and palms (CM unregistered: Oyster Flat, Hinewai Reserve, Banks Peninsula, Canterbury; coll. 11–21 Nov. 1997; in pitfall traps).



*moderately stout, palm and end-lobe continuous, slightly concave, sloping at c. 45° to straight posterior margin; pereopod 6 gills not exceeding mid-point of pereopod 7 article 2; uropod 1 peduncle with 4 lateral and 4 medial shaft spines; uropod 2 peduncle with 2–3 lateral and 1–2 medial shaft spines*. Three Kings Islands, North and South Islands, Stewart Island. *Puburuburu aotearoa* ♂

- b Uropod 2 outer ramus shaft naked (cf. Figs 10, 15); gnathopod 2 article 6 end-lobe untapered, anterior margin parallel to article axis, not oblique (cf. Fig. 11). 28

28 (27) a Uropod 1 inner ramus with 4 shaft spines (cf. Figs 7, 15); uropod 2 peduncle with 1–2 lateral and 1–2 medial shaft spines, outer ramus with 0 shaft spines, inner with 3 lateral and 3 medial shaft spines [*antenna 2 flagellum of 17–19 articles; gnathopod 1 distinctly subchelate in male and female, dactyl fitting transverse palm; pleopods 1–3 rami subequal; telson lacking lateral spines, 1–2 apical spines on each lobe*]. Oamaru only. *Makawe otamatuakeke*

- b Uropod 1 inner ramus with 0 lateral and 2 medial shaft spines; uropod 2 peduncle with 1 lateral and 1 medial shaft spine, outer ramus with 0 shaft spines, inner with 1 medial shaft spine. Wellington (Somes Island).

*Makawe* sp. B

- c Uropod 1 inner ramus with 0 lateral and 1 medial shaft spine; uropod 2 peduncle with 2 lateral and 1 medial shaft spines, outer ramus with 0 shaft spines, inner with 2 medial shaft spines [*uropod 3 ramus twice as long as wide, subequal in length to peduncle; pleopods 1–3 slender*]. Ohakune. *Makawe* sp. C

- d Uropod 1 inner ramus with 0 lateral and 3–5 medial shaft spines; uropod 2 peduncle with 3 lateral and 2 medial shaft spines, outer ramus with 0 shaft spines, inner with 0 lateral and 3 medial shaft spines. Wellington (Red Rocks). *Makawe* sp. A

29 (25) a Pleopods 1–2 stout, subequal in size; pleopod 3 about half as long as pleopods 1–2 (cf. Fig. 17); uropod 2 outer ramus shaft with 2–4 spines (cf. Fig. 17); telson with 1 spine apically on each lobe (Fig. 17) [*uropod 2 peduncle shaft with 4–6? spines dorsally*]. 30

- b Pleopods 1–3 not stout, subequal in size, pleopod 3 not reduced (Fig. 7); uropod 2 peduncle shaft with 1–2 spines dorsally, outer ramus shaft with 3 spines (Fig. 7); telson with 2–4 spines apically on each lobe (Fig. 7) [*gnathopod 1 distinctly subchelate in male, subsimple in female; gnathopod 2 article 6 not slender, palm and end-lobe continuous, slightly concave, sloping at c. 45° to straight posterior margin*]. Three Kings Islands, North and South Islands, Stewart Island. *Puburuburu aotearoa* ♂

30 (29) a Coxa 1 distal (ventral) margin rounded, convex, anterodistal corner rounded (Fig. 16); gnathopod 2 articles 5–6 subequal in width distally (Fig. 16); uropod 1 rami shorter than peduncle (Fig. 17). Eastern South Island from Kaikoura to Invercargill, Chatham Islands. *Makawe burleyi*

- b Coxa 1 distal (ventral) margin truncate, slightly concave, anterodistal corner subrectangular; gnathopod 2 article 5 >2 times width of article 6; uropod 1 rami about as long as peduncle. Waiheke Island (Auckland) only.

*Makawe waihekensis*

31 (26) a Uropod 1 peduncle shaft with 2–4 lateral and 0 medial spines; pleopods 2–3 stout (cf. Fig. 17); antenna 2 flagellum of 10–13 articles [*gnathopod 1 small, subchelate, palm transverse; male gnathopod 2 article 6 smoothly ovate; articles 4 and 6 abutting, article 5 placed well anterior to posterior margin of these articles; female gnathopod 2 article 6 end-lobe produced posteriorly into broadly rounded lobe, twice as wide as article 6 proximal width; male pereopod 7 articles 4–5 inflated*]. Auckland Islands. *Makawe parva*

- b Uropod 1 peduncle with >5 lateral and 2–4 medial shaft spines; pleopods 1–2 slender; antenna 2 flagellum of usually >15 articles [*male pereopod 7 articles 4–5 linear, not inflated*]. 32

32 (31) a Pleopods 1–2 rami subequal in length [*antenna 2 flagellum of 26–31 articles; male gnathopod 2 article 6 enlarged, semicircular, palm almost transverse, with proximal cusp and wide distal excavation, defining angle quadrate; female gnathopod 2 article 6 almost as wide as article 5, posterior margin straight, almost parallel to anterior margin, palm almost transverse, end-lobe short, angular*]. Auckland Islands. *Makawe maynei*

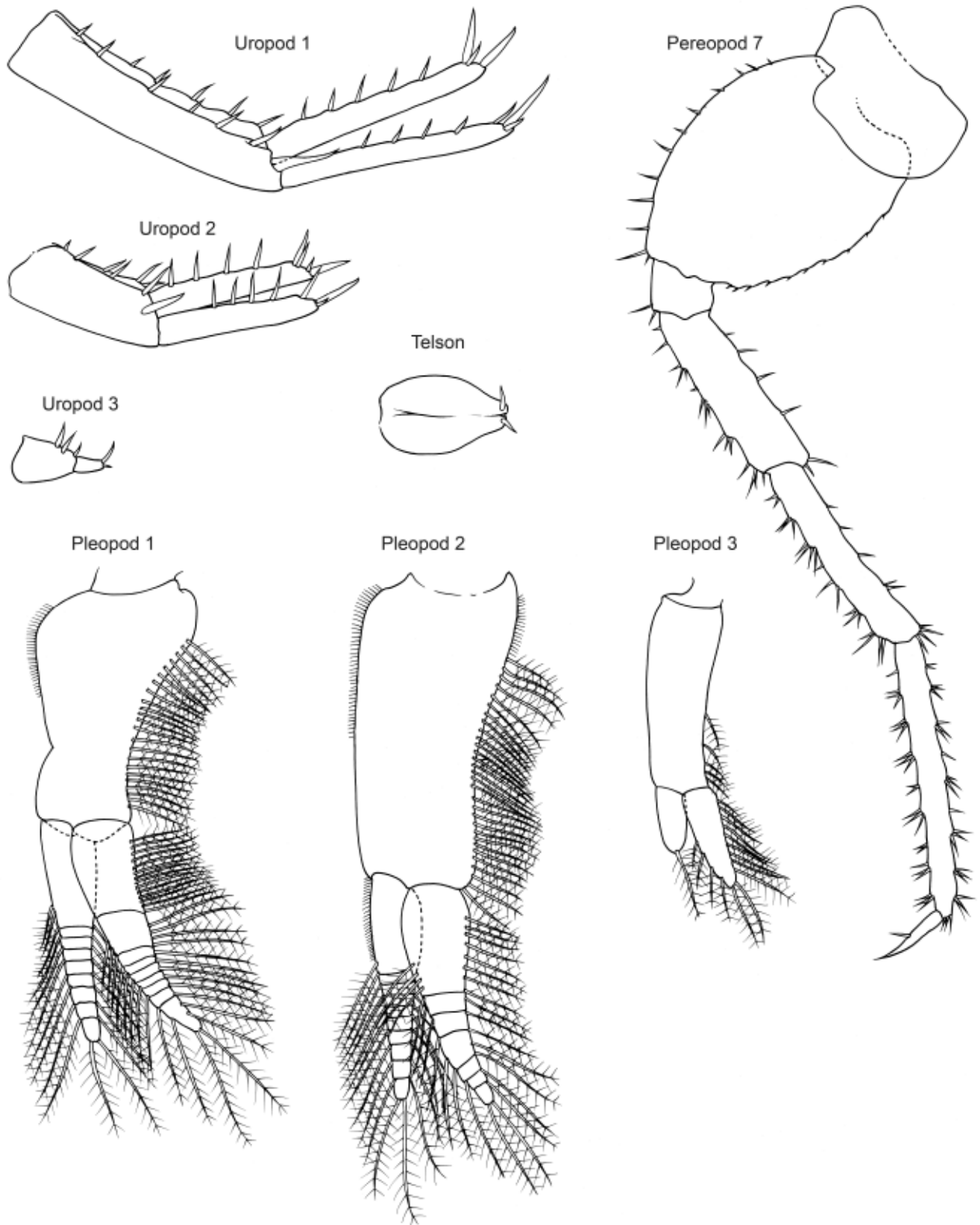


Fig. 17 *Makawe hurleyi* adult female pereopod 7, pleopods 1–3, uropods 1–3, telson (CM unregistered: Oyster Flat, Hinewai Reserve, Banks Peninsula, Canterbury; coll. 11–21 Nov. 1997; in pitfall traps).

- b Pleopods 1–3 rami unequal in length, outer ramus *c.* 0.5 times inner for pleopods 1–2, almost equal for pleopod 3 [antenna 1 short, peduncle 3–4 articulate, just reaching distal end of antenna 2 article 4; antenna 2 flagellum of *c.* 25 articles; male gnathopod 2 article 6 enlarged, subtriangular, palm oblique, with acute proximal cusp, wide distal excavation defined by acute process near mid-point of article's posterior margin; female gnathopod 2 article 6 *c.* 0.5 times width of article 5, posterior slightly concave or straight, divergent from anterior margin, palm angle almost 180°, end-lobe evenly rounded, moderately developed. Campbell and Auckland Islands.

*Makawe insularis*

- 33 (13) a Uropod 1 outer ramus shaft with 2–4 spines or 2–6 very small spines (cf. Fig. 17) Subantarctic Islands, ?Fiordland. 34

- b Uropod 1 outer ramus with 0 (1?) shaft spines (cf. Figs 7, 10, 13, 15) northern North Island. 36

- 34 (33) a Uropod 1 outer ramus with 2–6 very small dorsal spines on shaft; gnathopod 1 subchelate as in *T. sylvicola*; gnathopod 2 mitten-shaped; male gnathopod 2 enlarged, hyalid-like (cf. Fig. 9). Fiordland. *Tara* sp. B

- b Uropod 1 outer ramus with 2–3 medium to large spines only on shaft. 35

- 35 (34) a Pleopods 1–3 slender, rami subequal in length; gnathopod 1 palm almost transverse [female gnathopod 2 mitten-shaped, end-lobe untapered, distal margin subquadrate, anterior margin very short, 180°; male gnathopod 2 article 6 widened distally, triangular, palm oblique, longer than posterior margin; uropod 1 peduncle distolateral spine 0.3–0.5 times length of outer ramus]. Westland, Fiordland. *Tara sinbadensis*

- b Pleopods 1–3 stout, rami conspicuously unequal in length; gnathopod 1 palm oblique (30–60°) [antenna 1 peduncle reaching end of antenna 2 article 4, flagellum reaching end of antenna 2 article 5; antenna 2 with long flagellum, peduncle article 5 as long as head; gnathopod 2 mitten-shaped in both sexes, end-lobe evenly tapered to narrowly rounded apex; uropod 1 peduncle distolateral spine not reaching mid-point of outer ramus; uropod 3 just reaching end of telson, ramus *c.* 0.7 times peduncle length, 2–3 times as long as wide]. The Snares.

*Kanikania improvisa*

- 36 (33) a Uropod 3 peduncle exceeding telson, compressed laterally into laminate plate guarding side of telson, with 2 dorsolateral spines, ramus well developed, cylindrical, longer than wide; uropod 1 peduncle with 2–3 spines dorsolaterally along shaft; uropod 2 outer ramus with 3, and inner ramus with 4 spines on shaft; telson with 2 spines apically on each lobe, none laterally [gnathopod 1 male and female subchelate; male gnathopod 2 mitten-shaped, article 5 bilobed posteriorly, article 6 subequal to 5 in length, end-lobe untapered, broadly rounded, palm 120°; male gnathopod 2 large, hyalid-like]. Northland. *Waematau kaitaia*

- b Uropod 3 peduncle not reaching end of telson, not laminate, not guarding sides of telson, lacking dorsolateral spines; uropod 1 peduncle with 3–4 lateral and 4 medial shaft spines; uropod 2 outer ramus with 3–4, and inner ramus with 4, medial and 1 small lateral shaft spines; telson with 3–4 spines apically on each lobe, none laterally [male gnathopod 2 large, hyalid-like; female gnathopod 2 article 6 mitten-shaped, not widened distally, end-lobe anterior margin 180°, evenly rounded distally; pereopod 6 gill with long arcuate lobe almost reaching mid-point of pereopod 2]. Northland, Auckland, Three Kings Islands. *Waematau manawatabi*

## Acknowledgements

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We also gratefully acknowledge the assistance of Kelly Duncan for discussions on landhopper morphology, distribution and systematics. Thanks also to two anonymous referees who improved the final paper and the clarity of the key by carefully checking them, as well as the illustrations and other technical details.

## Note

- 1 The shape of the maxilliped outer plate is incorrect in Duncan's Plate 1 (1994: 83).

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