

A New Genus and Five New Species of Phoxocephalidae (Crustacea: Amphipoda) from the Eastern Tasman Sea, the Otago Shelf, and The Snares, New Zealand

JOANNE TAYLOR¹  AND RACHAEL A. PEART² 

¹ Museums Victoria, GPO BOX 666, Melbourne VIC 3001, Australia

² National Institute of Water & Atmospheric Research Ltd (NIWA), New Zealand

ABSTRACT. One new genus and five new species of the family Phoxocephalidae G. O. Sars, 1891 are described from material collected in waters off Aotearoa New Zealand. Within the subfamily Harpiniinae Barnard & Drummond, 1978, *Palabriaphoxus lowryi* sp. nov. and *P. barnardi* sp. nov. share morphological affinities, including the narrow basis of pereopod 5 and powerful pereopod 6 with *P. palabria* (J. L. Barnard, 1961), which is herein redescribed. Within the Phoxocephalinae, a new species, *Protophoxus munida* sp. nov. is described and the type species of the genus, *Protophoxus australis* (K. H. Barnard, 1930), is redescribed based on material collected from the Otago shelf. Additionally, *Zeaphoxus* gen. nov. is erected for two new species, *Z. senecio* sp. nov. and *Z. zealandicus* sp. nov., collected from the Tasman Sea, Otago Shelf, and The Snares.

Introduction

New species discoveries of Phoxocephalidae G. O. Sars, 1891 over the past two decades frequently do not strictly conform to the described subfamilies or genera of Barnard & Karaman (1991). The inability to assign new taxa to existing subfamilies and genera has resulted in significant revisions or the erection of new, often monotypic genera (Alonso de Pina, 1993, 2001; Ortiz & Lalana, 1999; Taylor & Poore, 2001; Taylor, 2002, 2006; Senna, 2010; Chiesa & Alonso, 2011; Andrade & Senna, 2020). Several of the new genera were established based on the recombination of known character traits rather than new or advanced ones, or on the grounds of a few unusual characteristics, with several paraphyletic taxa remaining (Taylor, 2003, 2006).

Alonso de Pina *et al.* (2008) proposed that the division of nine phoxocephalid subfamilies (Barnard & Drummond, 1978) be no longer recognized until such time that further

phylogenetic studies are done. Over subsequent years, the current classification of Phoxocephalidae, based on morphology, came to recognize only two subfamilies: Harpiniinae Barnard & Drummond, 1978, diagnosed mainly by pereopod 5 with a narrow basis; and Phoxocephalinae Sars, 1891, characterized by pereopod 5 with a stout basis (De Broyer *et al.*, 2007; Senna & Souza-Filho, 2011; Lowry & Myers 2017; Andrade & Senna, 2019a, b, 2020; Horton *et al.*, 2022).

Phoxocephalid collections from the eastern Tasman Sea, the Otago Shelf, and shallow waters of The Snares, housed in the National Institute of Water & Atmospheric Research (NIWA), were examined by Jerry Barnard in the mid-1980s. Together with Jim Lowry, they identified five species as new and noted that the morphological diversity among the species was so great that the argument could be made to assign several to new genera. After Barnard's passing in 1991, the draft manuscript was further developed

Keywords: Amphipoda, new taxa, Phoxocephalidae, New Zealand

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ORCID ID: Joanne Taylor <https://orcid.org/0000-0002-0804-0678>, Rachael A. Peart <https://orcid.org/0000-0001-5968-0811>

Corresponding author: Joanne Taylor jtaylor@museum.vic.gov.au

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by co-author Lowry in 1992, but until this time the taxa remained unpublished. Lowry shared the unpublished species descriptions and illustrations with Joanne Taylor in 1998 to include in a phylogenetic analysis using morphology as part of her PhD studies (Taylor, 2003). The phylogenetic results, differing substantially from Barnard's and Lowry's original schema, informed the decision herein to redescribe the genus *Palabriaphoxus* to accommodate two of the new species and to establish a new genus for a further two new species, described herein. In addition, the monotypic genus *Protophoxus* is redescribed based on its type species, with an additional new species named based on material collected from the Otago shelf.

Materials and methods

Abbreviations used: A, antenna; H, head; LL, lower lip; UL, upper lip; MD, mandible; MX, maxilla; MP, maxilliped; p, palp; E, epistome; G, gnathopod; P, pereopod; EP, epimera; C, coxa; U, uropod; T, telson; L, left; r, right; PL, pleopod; UR, urosome; NIWA, National Institute of Water & Atmospheric Research Ltd; AM, Australian Museum, Sydney; NHMD, Natural History Museum, Denmark (formerly Zoological Museum, University of Copenhagen), where material is lodged. All dissections and illustrations follow the conventions of Barnard & Drummond (1978) whereby the left side of the animal is illustrated unless otherwise stated. Illustrations were inked using drawing film and pens. Scanned and adjusted using Photoshop®. Descriptions of the new species closely follow that of other species described in Barnard & Drummond (1978) and Andrade & Senna (2020b). Accordingly, the carpus of gnathopod 1 is so-called "cryptic" whereby the posterior margin is concealed by the abutment of propodus and merus. Use of term Mark "M" on R3 is the point marking end of article 1 of inner ramus designated M100; length of outer ramus expressed as a percentage of the line that measures the length of inner ramus article 1.

Taxonomic account

Superfamily Haustoroidea Stebbing, 1906

Family Phoxocephalidae Sars, 1891

Subfamily Harpiniinae Barnard &
Drummond, 1978

Palabriaphoxus Gurjanova, 1977

Palabriaphoxus Gurjanova, 1977: 74.—Barnard & Karaman, 1991: 623.

Type species. *Harpinia palabria* J. L. Barnard, 1961, original designation.

Diagnosis of female. Rostrum fully developed, unconstricted (tapering abruptly in *P. barnardi* sp. nov.). Eyes absent (tiny—small in *P. lowryi* sp. nov.). Antenna 1 peduncle article 2 variable in length, ventral setae narrowly to widely spread, placed apically or in middle. Antenna 2 peduncle article 1 not ensiform (weakly so in *P. barnardi* sp. nov.); article 3 with 2–5 setae; facial slender and robust setae

on article 4 in 1 main row or clump or 2 or more poorly defined rows; article 5 especially short. Prebuccal parts not extended forward, truncate, not strongly distinct, neither part dominant. Right mandibular incisor with 3 teeth; molar not tritritive, small, pillow shaped, with 3 or fewer splayed, diverse, articulate to semiarticulate robust setae, palpal hump medium; right lacinia mobilis either absent or bifid, asymmetrical, (subflabellate in *P. lowryi* sp. nov., flabellate in *P. palabria*), mandibular palp thin to medium, article 1 short (slightly elongate in *P. palabria*), article 2 without outer setae (single outer setae in *P. latifrons*), apex of article 3 oblique. Maxilla 1 palp 2-articulate, inner plate with 4 setae, outer plate with 9–11 setal teeth, 1 setal tooth especially thickened. Maxilliped inner plates not basally fused, palp article 3 apex not protuberant, dactylus weakly to strongly elongate, apical nail distinct, elongate. Gnathopods small to medium, similar to diverse, gnathopod 2 not or weakly enlarged; carpus of gnathopods 1–2 short to medium, free (gnathopod 2 cryptic in *P. lowryi* sp. nov.), palms oblique, propodi ordinary to almond shaped, weakly elongate, not or poorly setose anteriorly. Pereopod 5 basis, merus and carpus narrow. Pereopod 6 merus and carpus broadened. Pereopod 7 basis without facial setae, weakly to strongly setose and moderately to strongly toothed posteroventrally, ischium enlarged, merus ordinary, (strongly lobed in *P. lowryi* sp. nov.). Epimeron 1–2 with medium posterior setae, without midfacial setae above ventral edge. Epimeron 3-setose ventrally and facially (weakly in *P. barnardi* sp. nov.), not setose posteriorly, with large posteroventral tooth (elongate in *P. lowryi* sp. nov.). Urosomite 3 without dorsal hook or special process. Uropod 1 peduncle without basoventral setae, without dorsolateral robust setae (present in *Palabriaphoxus barnardi* sp. nov.), outer ramus medium (shortened in *P. lowryi* sp. nov.), inner ramus with robust setae on dorsolateral and dorsomedial margins (barely 2 rows in *P. barnardi* sp. nov.), rami variously spinose. Uropod 2 peduncle with only 1 medial (sometimes enlarged) simple or robust seta confined apically, inner ramus ordinary (reduced in *P. palabria*), peduncle apices of uropods 1–2 not combed. Uropod 3 peduncle lacking extra subapical slender or robust setae, article 2 of outer ramus short to medium, without setae or carrying elongate apical setae. Telson with pair of midlateral or dorsal setules on each side, with 1–4 apical setae on each lobe. Six pairs of gills.

Sexual dimorphism. Antenna 1 peduncle articles 1–3 without patch of fine setae in males; primary flagellum with calynophore. Calceoli absent or present on peduncle of male antenna 2 (male unknown in *P. barnardi* sp. nov.). Antennae 1–2, flagella unreduced in female.

Remarks. Two new species from the Tasman Sea belonging to the subfamily Harpiniinae are described. The generic placement according to Barnard & Karaman (1991) is not straightforward for either *Palabriaphoxus barnardi* sp. nov. or *P. lowryi* sp. nov. as the diagnoses and keys rely heavily on the morphology of male antenna 2, which is unknown in the former. Both new species have a combination of morphological characters that could justify their placement in several of the genera that exhibit a narrow basis of pereopod 5. The preliminary morphological phylogeny of Taylor (2003) places both new species in a clade with representative species of seven genera that share a single strict synapomorphy (narrow basis of pereopod 5). The

suggestion that several genera belonging to the Harpiniinae could potentially be synonymized into a single genus *Harpinia* was proposed by Karaman (1980) and Taylor (2003), but not until such time that all known species were included in the phylogeny as it was acknowledged that the structure of the tree may change with their inclusion. A further attempt to resolve the structure within the subfamily Harpiniinae using both morphology and the CO1 gene sequences was undertaken by Spencer (2022) and preliminary results also suggest a revision is required as not all genera are supported and the monophyly of the Harpiniinae is questioned. Options currently available for placement of these two new species from New Zealand are: 1) erect two new monotypic genera based on the recombination of known character states; 2) synonymize

multiple genera with narrow basis of pereopod 5; or 3) placement in an existing genus that can be best expanded to include the new taxa. Owing to their morphological similarity to *Palabriaphoxus palabria* (J. L. Barnard, 1961) (the type species of *Palabriaphoxus*), also known from the Tasman Sea, we redescribe this genus to accommodate the two new species. Characters that the four known species of *Palabriaphoxus* share include: antenna 2 flagellum of female multiarticulate; right mandibular incisor with 3–4 teeth, mandibular molar non-tritritive, reduced to a small hump, maxilla 1 palp 2-articulate, gnathopod 1–2 similar in size (gnathopod 2 slightly enlarged in *Palabriaphoxus lowryi* sp. nov.), pereopod 5 basis of narrow form, pereopod 6 greatly enlarged with thickened merus-propodus, pereopod 7 usually with enlarged ischium.

Key to world species of *Palabriaphoxus*

- 1 Posteroventral corner of coxae 1–3 with prominent extended acute tooth [Antarctic; 180–1098 m] *Palabriaphoxus latifrons*
- Posteroventral corner of coxae 1–3 smooth or with reduced small acute tooth 2
- 2 Uropod 1 peduncle without enlarged robust setae. Antenna 1 peduncle article 2 setae placed distally. Antenna 2 peduncle article 3 with 5 stiff robust setae. Pereopods 3–4 carpus setae displaced and dispersed near posterior margin. Rami of uropods 1–2 never fully spinose; uropod 2 peduncle with with robust setae only ... [Tasman Sea & The Snares; 7–133 m] .. *Palabriaphoxus lowryi* sp. nov.
- Uropod 1 peduncle with enlarged robust setae. Antenna 1 peduncle article 2 setae placed in middle. Antenna 2 peduncle article 3 with 2 stiff robust setae plus setule. Pereopods 3–4 carpus setae placed near anterodistal margin. Uropods 1–2 rami with robust setae; uropod 2 peduncle with mixture of robust and slender setae 3
- 3 Antenna 1 peduncle article 2 elongate. Antenna 2 peduncle article 4 elongate. Maxilla 1 outer plate with 11 robust setae. Gnathopod 2 enlarged, slender seta forming dominant posterior element on pereopods 3–4 carpus. Urosome with basoventral setae. Telson with lateral robust setae. Epimera 1–2 with facial setae [circum-New Zealand; 10–610 m] *Palabriaphoxus palabria*
- Antenna 1 peduncle article 2 shortened. Antenna 2 peduncle article 4 shortened. Maxilla 1 outer plate with 9 robust setae. Gnathopod 2 not enlarged, robust setae forming dominant posterior element on pereopods 3–4 carpus. Urosome without basoventral setae. Telson without lateral robust setae. Epimera 1–2 without facial setae [Tasman Sea; 520 m] *Palabriaphoxus barnardi* sp. nov.

Palabriaphoxus palabria (J. L. Barnard, 1961)

Figs 1–5

Harpinia palabria J. L. Barnard, 1961: 71, fig. 41.

Palabriaphoxus palabris Gurjanova, 1977: 74, fig. 4.

Holotype: NHMD CRU 7687, female, eastern Tasman Sea, 40°10'S 170°10'E, 610 m, Globigerina ooze, RV *Galathea*, PGI 0.2, Station 626, 20 January 1952. **Paratypes:** NHMD921700, 10 specimens, collected together with holotype.

Additional material examined. AM P39535, female “k”, 3.47 mm; AM P39536, female “m”, 3.35 mm; AM P39537, female “n”, 2.65 mm; AM P39538, “p”, 3.16 mm; AM P39539, “q”, 2.63 mm; eastern Tasman Sea, 42°53.9'S 170°0.5'E, anchor box dredge, 245 m, P. K. Probert on RV *Tangaroa*, 19 February 1982, cruise 1131, Station Q692. NIWA 115623, “a-1”, 3.45 mm; NIWA 115624, female “z”, 3.43 mm; NIWA 115625, male “y”, 3.38 mm; NIWA 115626, eastern Tasman Sea 41°58.5'S 170°28.1'E, anchor box dredge, 507 m, P. K. Probert on RV *Tangaroa*, 4 March 1982, cruise 1131, Station Q723.

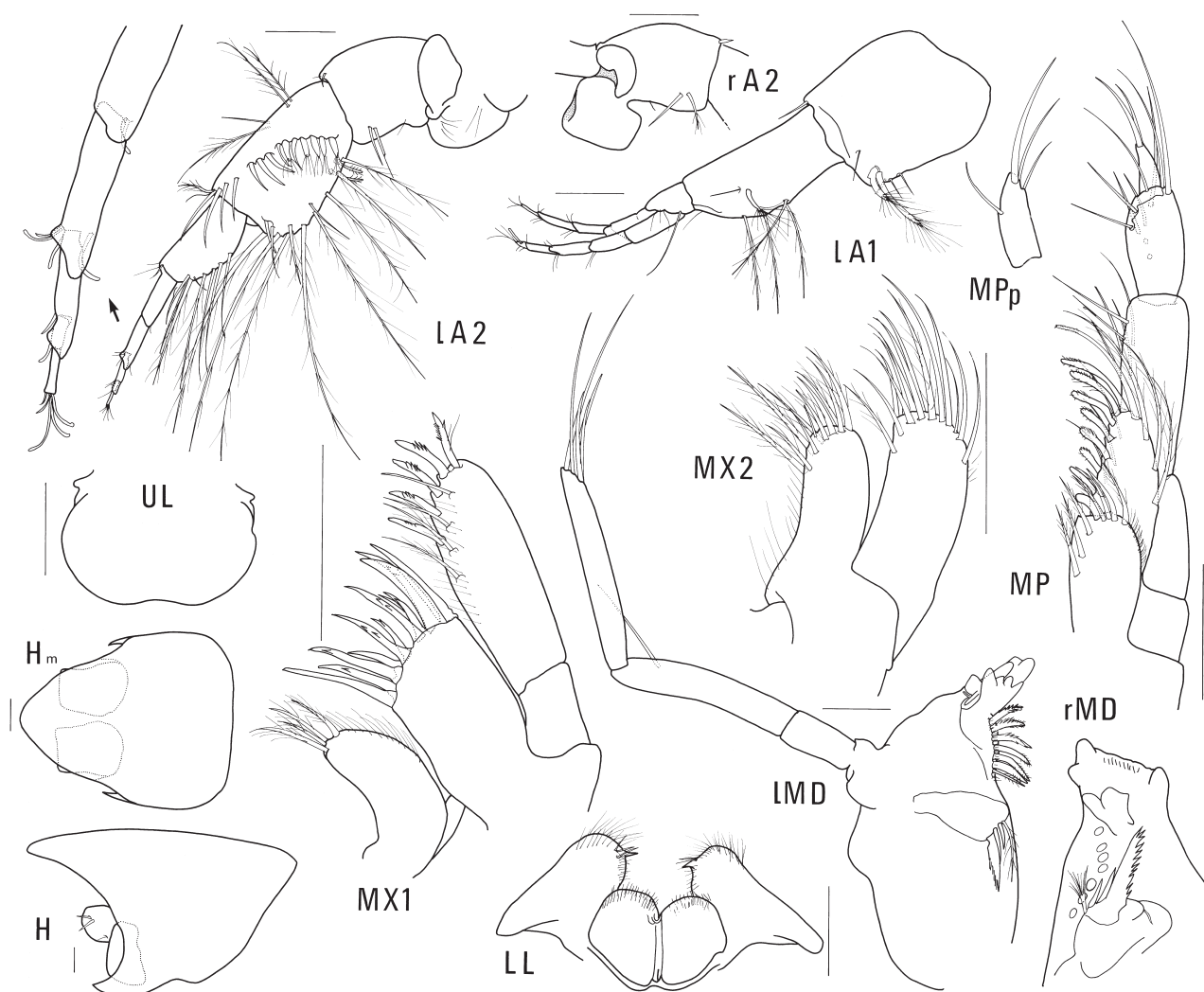


Figure 1. *Palabriaphoxus palabria* (J. L. Barnard, 1961), AM P39535, female “k”, 3.47 mm; AM P39536, female “m”, 3.35 mm, dorsal view of head, eastern Tasman Sea. Scales represent 0.1 mm.

Diagnosis. Eyes absent. Antenna 1 peduncular article 1 ventral apex not ensiform, peduncle article 2 elongate and setae placed in middle. Antenna 2 peduncle article 3 with 2 stiff robust setae plus setule, peduncular article 4 elongate with facial robust setae. Left mandible lacinia mobilis with 4 teeth. Right mandible lacinia mobilis bifid. Maxilla 1 inner plate shorter than outer, outer plate with 11 robust setae. Maxilliped palp article 3 not produced. Posteroventral corner of coxae 1–3 with small acute tooth. Gnathopods 1–2 carpus not cryptic. Gnathopod 2 enlarged, propodus with robust seta near palmar corner. Pereopods 3–4 carpus setae placed near anterodistal margin. Slender seta forming dominant posterior element on pereopods 3–4 carpus. Pereopod 5 basis narrow, much longer than wide. Pereopod 6 basis anterior margin setose with long robust setae, posterodistal corner produced as toothed lobe. Pereopod 7 merus, carpus, and propodus narrow; dactylus long. Urosome with basoventral setae. Epimera 1–2 with facial setae. Uropods 1–2 rami with robust seta. Uropod 1 peduncle with enlarged robust setae. Uropod 2 peduncle with mixture of robust and slender setae. Uropod 3 outer ramus article 2 with 2 long apical setae; inner ramus short, about $0.6 \times$ the length of outer. Telson deeply cleft, apically with 3 slender plumose setae, marginally with 4 long plumose setae on each side, with lateral robust setae.

Description. FEMALE, based on non-type, AM P39535, specimen “k”, 3.47 mm.

Head: Eyes absent; rostrum entire, unconstricted, reaching middle of article 1 of antenna 1; posteroventral corner of head produced into large tooth curved anteriorly. Antenna 1 peduncle article 1 stout, $1.2 \times$ as long as wide, ventral margin with 3 setules and 2 plumose setae (distal corner), dorsal margin unproduced distally with 1 distal setule; article 2 narrower than but as long as article 1, ventral margin with 4 long plumose setae, facial margin with 1 brush seta; article 3, short, ventral margin with 2 setae, facial margin with 1 plumose and 1 simple seta; primary flagellum 5-articulate; accessory flagellum 5-articulate, fifth articles reduced. Antenna 2 peduncle article 3 ventral margin with 2 simple setae, dorsal margin with 1 short seta distally; article 4 ventral margin with 8 long plumose setae, facial margin with row of 14 robust (becoming less robust distalwards) short setae, dorsal margin with 4 long plumose setae; article 5 $0.6 \times$ length of article 4, ventral margin with 5 plumose, and 1 distal robust setae; flagellum 5-articulate.

Mouthparts: Left mandible molar weakly elongate, plaque armed with 2 short robust setae, 1 long plumose seta and 1 large-toothed robust seta, incisor with 4 teeth divided into 2 groups, lacinia mobilis with 4 teeth, accessory setal row

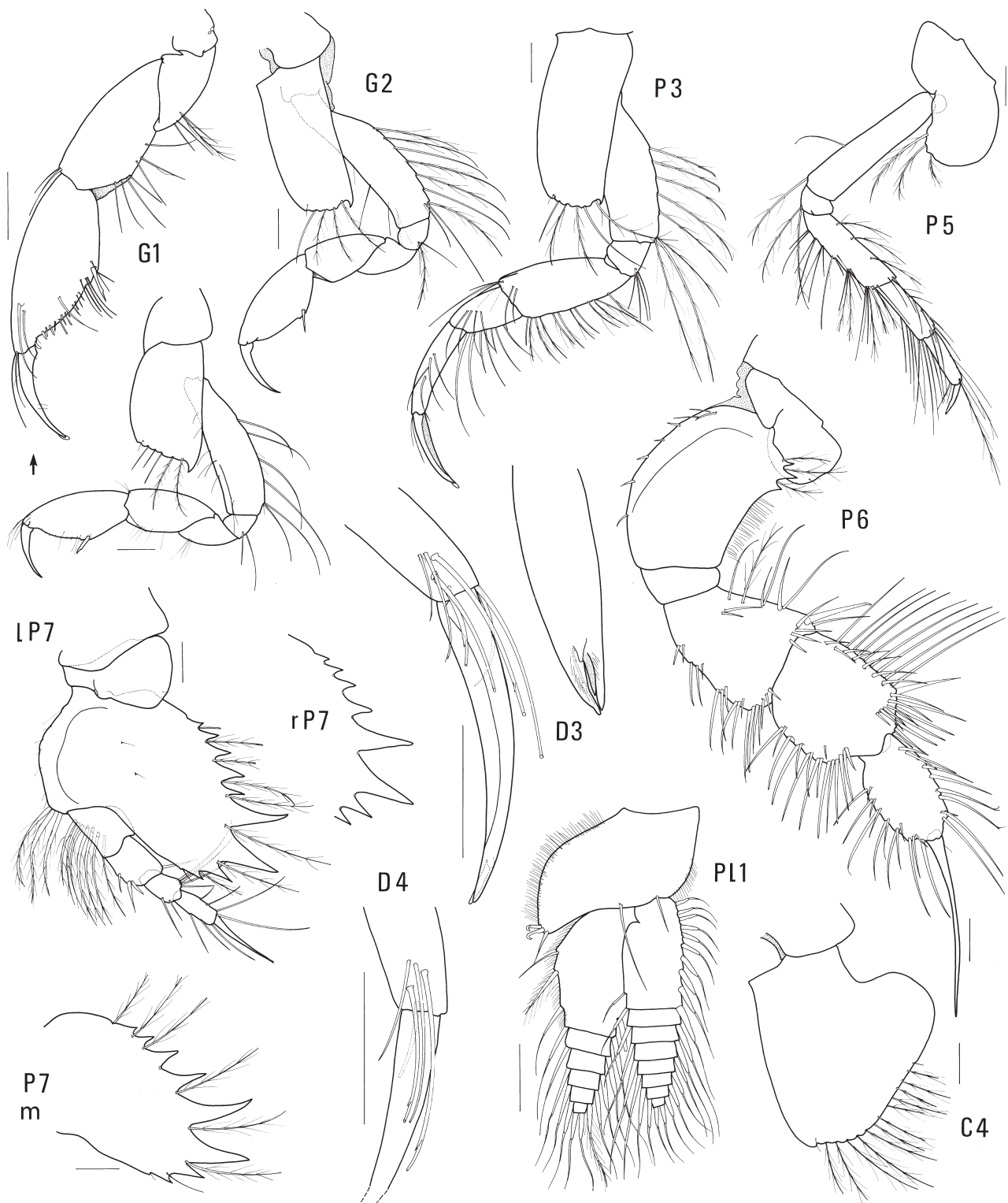


Figure 2. *Palabriaphoxus palabria* (J. L. Barnard, 1961), AM P39535, female “k”, 3.47 mm, AM P39536, female “m”, 3.35 mm, basis of pereopod 7, eastern Tasman Sea. Scales represent 0.1 mm.

with 7 multicuspidate stout setae, palpar hump medium; palp 3-articulate, article 1 $0.5 \times$ article 2, article 2 straight, narrow, with 1 elongate inner apical seta and no other short inner setae and no outer setae, $0.7 \times$ article 3, article 3 apex oblique with 5 long, slender setae. Right mandible incisor blade like with 3 teeth and notch, lacinia mobilis bifid, distal branch flabellate shorter than proximal, accessory setal row with 7 multicuspidate stout setae. Maxilla 1 inner plate with 4 apical

plumose setae; outer plate with 11 stout multicuspidate setae; palp 2-articulate, article 2 with 4 slender setae forming row medially and 5-toothed robust setae laterally and apically. Maxilla 2 inner plate subequal to outer plate but slightly narrower, with 11 plumose setae; outer plate with 13 long pectinate setae apically stretching laterally. Maxilliped inner plate with 1 short robust seta apically and 7 long plumose setae apicofacially and medially; outer plate with 8 medial

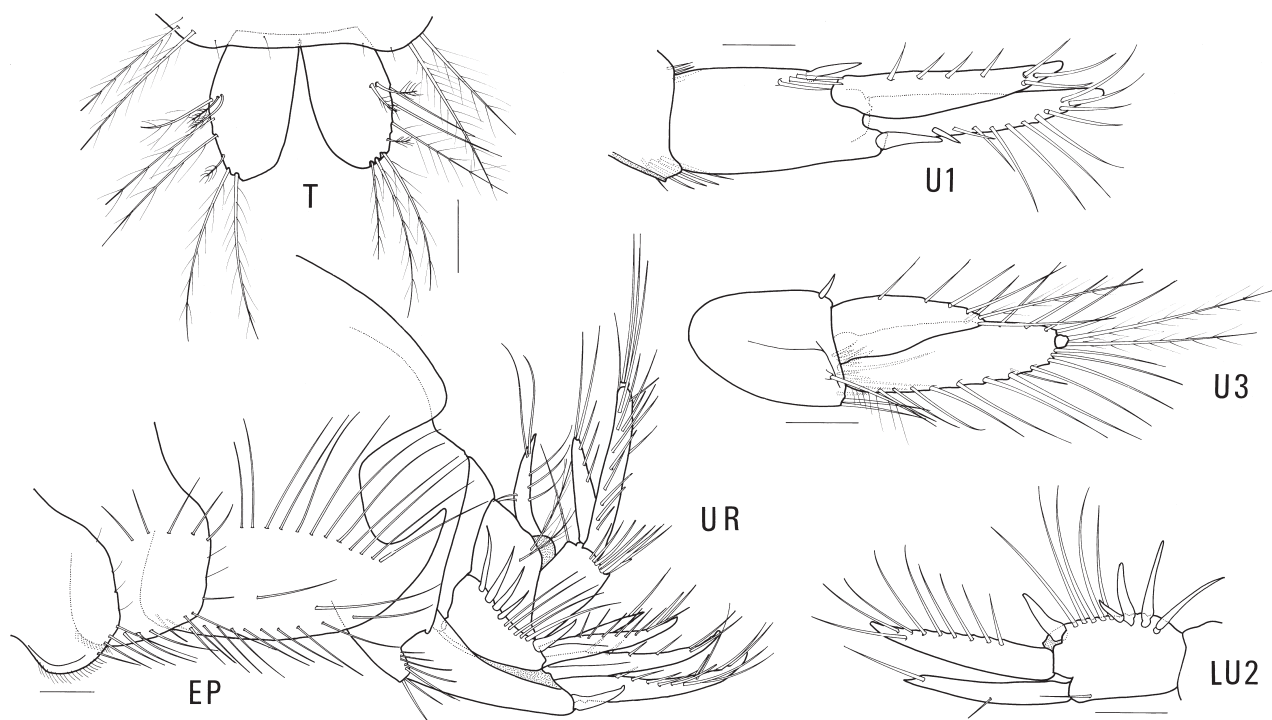


Figure 3. *Palabriaphoxus palabria* (J. L. Barnard, 1961), AM P39535, female “k”, 3.47 mm, eastern Tasman Sea. Scales represent 0.1 mm.

and apical robust setae, 3 apicolateral setae; palp article 1 without apicolateral setae, article 2 medial margin weakly setose, article 3 not produced, without upper facial setae, no lateral setae, article 4 short to medium, subtriangular, with 1 seta laterally, 3 apical setae and 1 long apical nail.

Pereon: Gnathopod 1 coxa ventral margin not expanded but defined by sharp tooth, anterior margin slightly convex, with 2 plumose setae; basis about $2.4 \times$ as long as wide, posterior margin with 4 long plumose setae medially and 2 long setae distally; ischium small and subrectangular, posterior margin with 2 simple setae; merus posterior margin with 4 plumose setae, facial margin without setae; carpus short, $2 \times$ as long as wide, anterior margin with 2 setae distally, posterior margin with 7 long setae; propodus $2 \times$ as long as wide, anterior margin with 2 setae distally, posterior margin without setae proximal to defining robust seta; palm setose and slightly convex, acute; dactylus reaching palmar corner, outer margin without setae, inner with 2 setae. Gnathopod 2 similar in size to gnathopod 1; coxa subrectangular with acute tooth on posteroventral corner, ventral margin with 5 plumose setae, anterior margin very weakly convex; basis about $3 \times$ as long as wide, posterior margin with 7 long plumose setae and 2 distally, anterior margin with 2 plumose setae; ischium small and subrectangular, posterior distal corner with 3 long plumose setae; merus margins without setae; carpus short, subtriangular, $2 \times$ longer than wide, margins without setae; propodus $2 \times$ as long as wide, anterior margin with tuft of setae distally, posterior margin weakly setose, with 1 robust seta defining palm, palm slightly convex, acute; dactylus reaching palmar corner, outer margin without setae. Pereopod 3 coxa subrectangular, ventral margin with 6 plumose setae, posteroventral corner produced to form small acute tooth; basis $3.5 \times$ as long as wide, posterior margin with 5 long plumose setae and distally tipped with 3 long plumose setae, anterior margin without setae; ischium small and subrectangular, posterior margin with 4 distal plumose

setae; merus weakly inflated, anterodistal corner bearing 3 setae, posterior margin moderately setose with 12 medium to long plumose setae; carpus posterior margin moderately setose, with 7 plumose setae, with 4 facial plumose setae; propodus posterior margin without setae, facial surface with 4 long setae; dactylus $0.75 \times$ length of propodus. Pereopod 4 coxa expanded posteriorly to form broadly rounded lobe, ventral margin with 12 long plumose setae and 2 very small simple setae, distal articles similar to pereopod 3. Pereopod 5 coxa weakly bilobate, expanded posteroventrally, posteroventral lobe with 3 plumose setae; basis narrow and straight sided, $4.4 \times$ as long as wide, anterior margin with 1 long seta marginally and 1 plumose seta distally, posterior margin without setae; ischium small and subrectangular, anterior margin with 2 long plumose setae distally; merus anterior margin moderately setose, with 15 long slender plumose setae marginally and 8 distally, posterior margin with 3 long plumose setae marginally and 2 long plumose setae distally; carpus anterior margin moderately setose, with 4 long plumose setae marginally and 5 long plumose setae distally, posterior margin with 5 plumose setae marginally and with 4 setae distally; propodus anterior margin with 6 long plumose setae marginally and 2 long plumose setae distally, posterior margin with 2 long plumose setae marginally and 2 distally, no facial setae are present; dactylus $0.52 \times$ as long as propodus. Pereopod 6 much longer than all other pereopods; coxa weakly expanded posteroventrally, posterior margin with 1 short seta and not covered with setules; basis about $1.59 \times$ as long as wide, anterior margin convex, bearing 8 slender robust setae marginally, no distal setae, posterior margin concave distally fringed with even, fine, slender setae, expanded to form toothed proximal lobe bearing 3 long plumose setae between each tooth; ischium small and subrectangular without setae; merus: carpus: propodus length ratio 1:1.1:0.95; merus as long as wide, anterior margin without robust setae but with sets of slender

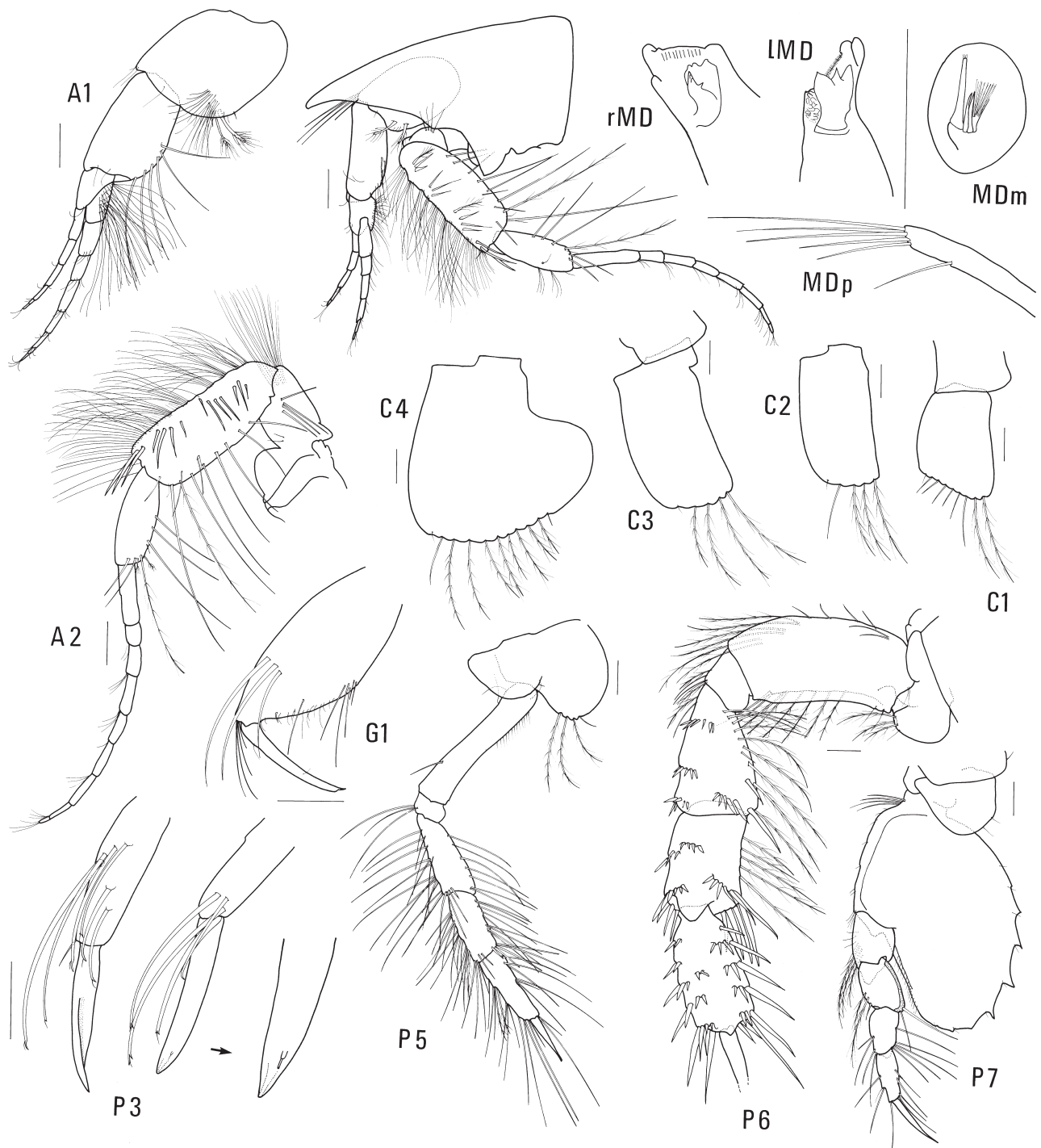


Figure 4. *Palabriaphoxus palabria* (J. L. Barnard, 1961), NIWA 115625, male “y”, 3.38 mm, eastern Tasman Sea. Scales represent 0.1 mm.

simple setae (2-3-3-3-7) along margin and distally, posterior margin with 6 long slender setae (of which 1 plumose), distally with 5 slender simple setae and 1 long robust seta, 2 small slender setae on facial surface; carpus $1.2 \times$ longer than wide, anterior margin lined with 15 long slender setae and 1 facially, posterior margin with 16 long slender setae marginally, distal corner with 1 long robust seta and 2 rows each with 6 long slender setae; propodus $1.6 \times$ as long as wide, $0.8 \times$ length of carpus, anterior and posterior margins lined with 15 and 10 long slender simple setae respectively; dactylus elongate, $1.6 \times$ length of propodus. Pereopod 7 coxa small and subtrapezoidal, slightly expanded posteriorly,

posterior margin with 1 short seta; basis as long as wide (including the posteroventral lobe), strongly expanded posteroventrally to form strongly-toothed posteroventral lobe reaching beyond the distal margin of propodus, anterior margin bearing 7 small slender setae marginally and 3 long plumose setae distally, posterior margin strongly serrate, with plumose setae in inter-dental notches, 8 in total, 2 small setae on facial surface; ischium subrectangular, $1.3 \times$ as long as wide, anterior margin with 7 long slender plumose setae starting marginally and extending to facial surface; merus subequal in length to ischium, anterior margin with 2 robust and 1 slender setae, posterior margin with 1 slender seta

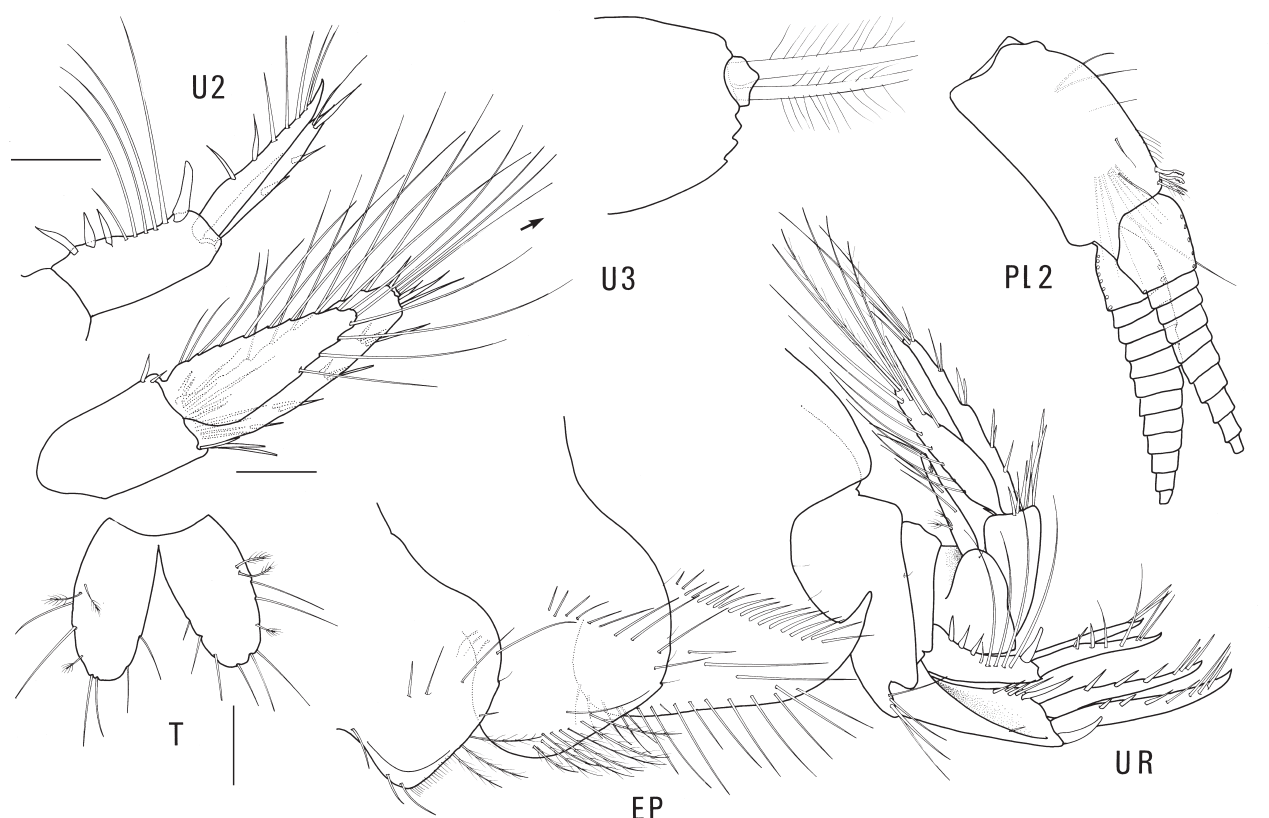


Figure 5. *Palabriaphoxus palabria* (J. L. Barnard, 1961), NIWA 115625, male “y”, 3.38 mm, eastern Tasman Sea. Scales represent 0.1 mm.

distally; carpus short $0.6 \times$ merus length, anterior margin with 2 distal slender simple setae, posterior margin with 4 slender simple setae distally; propodus narrow and $1.3 \times$ carpus, anterior and posterior margins with 3 and 4 setae respectively; dactylus elongate, $1.2 \times$ longer than propodus.

Pleon: Epimeron 1 anteroventral corner without setae, ventral margin with fringe of small fine setae, posterior margin convex, posteroventral corner with 4 long plumose slender setae, posterior margin with 4 small setae. Epimeron 2 anteroventral corner rounded, ventral margin with fringe of fine setae anteriorly followed by row of 7 long slender plumose setae reaching to posteroventral corner, posteroventral corner subquadrate, posterior margin straight with 4 long slender setae, facial surface with arc of 4 long slender simple setae. Epimeron 3 anteroventral corner rounded, ventral margin weakly concave lined with 12 long, slender, simple setae, posteroventral corner produced to form long acute, curved projection, posterior margin without setae, facial surface with 2 arcs of long slender, simple setae, the dorsal arc with 12 setae, ventral arc with 3 setae. Uropod 1 peduncle $1.9 \times$ as long as wide, dorsomedial margin with 1 large robust seta and 3 long slender simple setae, dorsolateral distal corner with 1 large robust seta; outer ramus dorsal margin with 1 robust seta proximally and 7 long slender simple setae along margin and 3 slender simple setae sub-apically; inner ramus slightly shorter than outer, dorsal margin with 4 long slender simple setae marginally and 3 slender simple setae sub-apically. Uropod 2 peduncle $1.6 \times$ as long as wide, dorsomedial margin with 1 slender, simple seta distally, dorsolateral margin with 4 long robust setae proximally, then 5 long slender simple setae marginally and then 1 large robust seta apically; outer ramus dorsal margin with 6 long slender simple setae marginally and 3

long slender simple setae sub-apically; inner ramus shorter than outer, dorsolateral margin with 1 slender seta and 1 long slender seta sub-apically. Uropod 3 peduncle $1.3 \times$ as long as wide, with 3 long slender plumose setae ventrodorsally and 1 robust seta dorsodistally; outer ramus 2-articulate, article 1 ventrolateral margin with 10 long setae and 3 long setae apically, dorsolateral margin with 3 long slender setae marginally and 1 long seta apically; article 2 tiny $0.08 \times$ length of article 1, as long as wide, tipped with 2 long plumose slender setae; inner ramus $0.65 \times$ length of outer ramus, outer margin lined with 4 long slender plumose setae and 2 long slender setae apically. Telson short, completely cleft, each lobe broad and weakly truncated apically, has 2 mid-facial short plumose setae, 4 slender plumose marginal setae (3 long 1 short) and 3 long slender plumose apical setae. Urosomite 3 with 2 long slender plumose setae either side of telson insertion.

MALE, based on NIWA 115625, male “y” 3.38 mm.

Head: Rostrum $0.63 \times$ length of antenna 1; posteroventral corner of head produced into large tooth directed ventrally. Antenna 1 peduncle article 1 stout, as long as wide, ventral margin with distal tuft of slender simple setae and 2 plumose setae (distal corner), dorsal margin unproduced distally with 1 distal setule; article 2 narrower than and shorter than ($0.86 \times$) article 1, ventral margin with 6 long plumose setae, without facial setae; article 3 short triangular, ventral, and facial margins without setae; primary flagellum 8-articulate, last article reduced, article 1 with callynophores occupying most of surface; accessory flagellum 5-articulate, fifth article reduced. Antenna 2 peduncle article 4 ventral margin with 10 long evenly spaced plumose setae, facial margin with uneven row of 13 slender short setae, dorsal margin lined

with 8 tufts of 4–12 long slender simple setae; article 5 $0.5 \times$ length of article 4, ventral margin with 3 marginal plumose setae and 3 distal long plumose setae; flagellum 9-articulate.

Mouthparts: Right mandible with 7 accessory setae, left with 8, left lacinia mobilis with 3 teeth, main robust seta of molar less serrate, on left side with 4 denticles on apex, palp with extra inner subapical seta. Palp of maxilla 1 with 5 robust setae and 3 slender facial setae, remainder as in female; inner plate of maxilla 2 with 3 medial setae, outer plate with 2 lateral setae; inner plate of maxilliped with 4 medial setae, outer plate with 8 seta-teeth and 3 setae, dactylus with 2 accessory setae.

Pereon: Coxae 1–3 ventral margins without prominent extended acute tooth on posteroventral corner. Gnathopods 1–2 palms without defining robust setae. Pereopod 6 basis proximal posterior lobe reduced and not serrate, row of setae on posterior margin distinct, composed of 8 long, slender, plumose setae, not fringe like, anterior margin with 4 short simple proximal setae, and 6 long, plumose distal setae; ischium with 4 long plumose setae on distal half of anterior margin; merus: carpus: propodus length ratio 1:0.75:0.98; merus, carpus, and propodus all narrower than in female, of different proportions; merus, carpus, and propodus all with rows of facial short robust setae, no long plumose setae. Pereopod 7 basis expanded but lobe only weakly serrate, inter-tooth setae small and simple, lobe only reaching to end of merus; carpus longer in proportion to propodus; dactylus as long as propodus.

Pleon: Epimeron 2 with more setae in facial arc. Epimeron 3 with more setae in upper facial arc, arc straight not curved. Uropod 3 peduncle $1.7 \times$ as long as wide, with 2 robust setae distally; outer ramus, article 1, margins covered with long plumose setae, article 2, with 2 long plumose setae apically; inner ramus shorter than outer ramus, margins covered with long plumose setae. Pleopods 1–3: coupling hooks 2 and 2 accessories; posterior facial setae on peduncle = 15+–10+–10+; articles on outer rami = 12–13–12, inner rami = 10–10–10; setae on article 1 of outer and inner rami respectively, on outer and inner sides respectively = 8–2–1–5, 8–1–1–5, 8–2–1–5.

Remarks. *Palabriaphoxus palabria* has previously been recognized as the only species of this genus occurring in New Zealand waters and was thought to range around the entirety of the New Zealand coastline. This study and further observations bring this supposed expansive distribution into doubt.

Palabriaphoxus palabria can be distinguished by the long rows of facial setae on the epimera 2–3 (*P. barnardi* facial setae absent, *P. lowryi* facial setae present only on epimeron 3); coxa 1–4 of female have an obvious, small acute tooth on the posteroventral corner, the male has this tooth but greatly reduced (*P. barnardi* tooth is reduced, *P. lowryi* unable to be seen); pereopod 6 basis has a serrated (various size with male and female) proximal posterior corner (absent in *P. barnardi* and *P. lowryi*).

Palabriaphoxus palabria is closest morphologically to *P. barnardi* with the main differences being the length of the antenna 1 article 2 (*P. palabria*, elongate; *P. barnardi*, short), antenna 2 peduncle article 4 (*P. palabria*, elongate, *P. barnardi* short); basoventral urosomal setae on urosome (*P. barnardi* absent); telson with lateral robust setae (*P. barnardi* robust setae absent).

Closer investigation of the numerous collections identified as *P. palabria* from around New Zealand, beyond the scope of this study, will most likely show that many are referable to one of the two new species described below as well as additional new species. This will most likely reduce the confirmed geographical range of *P. palabria*.

Distribution. Previously regarded as circum-New Zealand, but currently known with certainty only from off Westland; other New Zealand records require confirmation. New Zealand, 10–610 m.

Palabriaphoxus barnardi sp. nov.

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Figs 6–7

Holotype: NIWA 115630, female “v”, 3.73 mm, eastern Tasman Sea, $42^{\circ}48.5'S$ $169^{\circ}53.5'E$, anchor-box dredge, 520 m, P. K. Probert on RV *Tangaroa*, 20 February 1982, Cruise 1131, Station Q694. **Paratypes:** NIWA 115631, female “w”, 3.60 mm, NIWA 115632, female “x”, 3.44 mm, collected with holotype.

Etymology. Named in honour of the enormous contribution to phoxocephalid taxonomy made by Jerry Laurens Barnard.

Diagnosis. Eyes absent. Antenna 1 peduncular article 1 ventral apex not ensiform, peduncle article 2 shortened. Antenna 2 peduncle article 3 with 2 robust setae, article 4 shortened with facial robust setae. Right mandible lacinia mobilis multi-toothed. Maxilla 1 inner plate shorter than outer, outer plate with 9 multicuspidate robust setae. Maxilliped palp article 3 not produced. Posteroventral corner of coxae 1–3 with very small acute tooth. Gnathopods 1–2 carpus not cryptic. Gnathopod 2 similar sized to gnathopod 1, propodus with 1 robust seta near palmar corner. Pereopods 3–4 carpus setae placed near anterodistal margin. Robust setae forming dominant posterior element on pereopods 3–4 carpus. Pereopod 5 basis narrow, much longer than wide. Pereopod 6 basis anterior margin setose with long robust setae, posterodistal corner produced as toothed lobe. Pereopod 7 merus, carpus, and propodus narrow; dactylus long. Urosome without basoventral setae. Epimera 1–2 without facial setae. Uropods 1–2 rami with robust setae. Uropod 1 peduncle with enlarged robust setae. Uropod 2 peduncle with mixture of robust and slender setae. Uropod 3 outer ramus article 2 with 2 long apical setae; inner ramus short, about $0.7 \times$ the length of outer. Telson deeply cleft, apically with 1 slender plumose seta per lobe, marginally without setae on each side, without lateral robust setae.

Description. FEMALE, based on NIWA 115630, holotype, female “v”, 3.73 mm.

Head: Eyes absent; rostrum entire, weakly constricted, tapering rapidly, narrow, reaching apex of peduncle article 2 on antenna 1; posteroventral corner of head weakly produced into small tooth not curved. Antenna 1 peduncle article 1 stout, $1.5 \times$ as long as wide, $1.6 \times$ as long as and $2.5 \times$ as wide as article 2, ventral margin with 3 setules and 2 plumose setae (distal corner), dorsal margin unproduced distally, with 1 distal setule; article 2 narrower than and shorter than article 1, ventral margin with 5 long plumose setae, facial margin with 2 brush setae; article 3 short, triangular, ventral margin

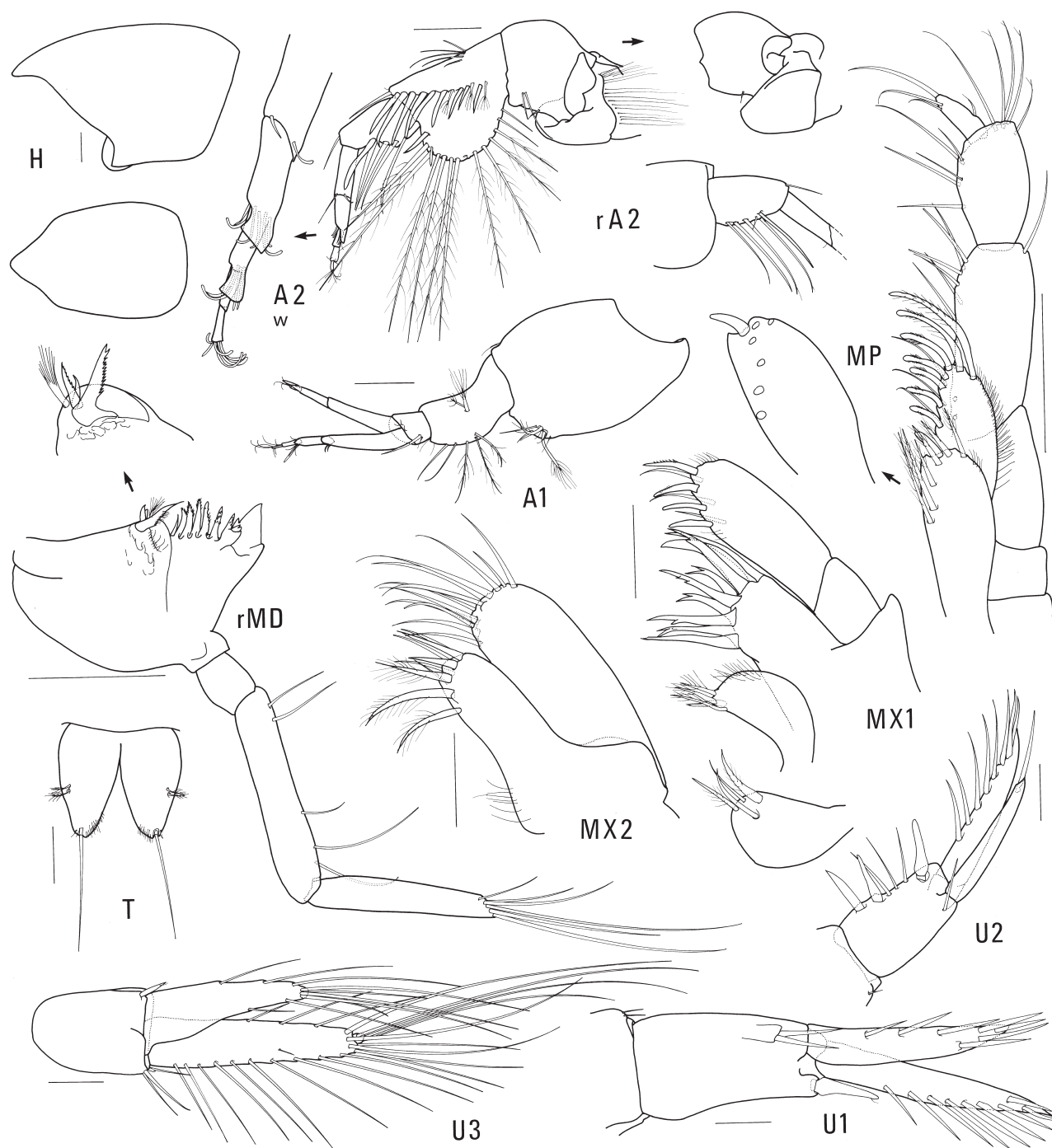


Figure 6. *Palabriaphoxus barnardi* sp. nov., holotype, female “v”, NIWA 115630, 3.73 mm; paratype, female “w”, NIWA 115631, eastern Tasman Sea. Scales for MX1 and MX2 represent 0.05 mm. Scales represent 0.1 mm.

with 1 seta, facial margin without setae; primary flagellum 4-articulate, first article elongate; accessory flagellum 2-articulate, first article elongate. Antenna 2 peduncle article 3 ventral margin with 2 simple setae; article 4 ventral margin with 13 long plumose setae and 2 short robust setae, facial margin with row of 9 robust (becoming longer distalwards) short setae, dorsal margin with tuft of 5 long plumose setae and 1 long robust seta on distal corner; article 5 $0.7 \times$ length of article 4, ventral margin with 5 plumose and 1 distal long robust seta; flagellum 5-articulate.

Mouthparts: Right mandible molar as weakly elongate plaque armed with 2 short robust setae, 1 short stubby

plumose seta and 1 large-toothed robust seta, incisor blade like divided into 3 teeth, lacinia mobilis multi-toothed, accessory setal row with 6 multicuspitate stout setae, palpal hump small; palp 3-articulate, article 1 $0.25 \times$ article 2, article 2 straight, narrow, with 2 slender proximal setae and 3 distal slender setae on inner margin and no setae on outer margin, $1.1 \times$ article 3, article 3 apex oblique with 6 long, slender setae. Maxilla 1 inner plate with 4 apical plumose setae, and small setules on medial margin; outer plate with 9 stout multicuspitate setae; palp 2-articulate, article 2 with 3 slender setae forming row medially and 4 weakly-toothed robust setae laterally and apically. Maxilla 2 inner plate

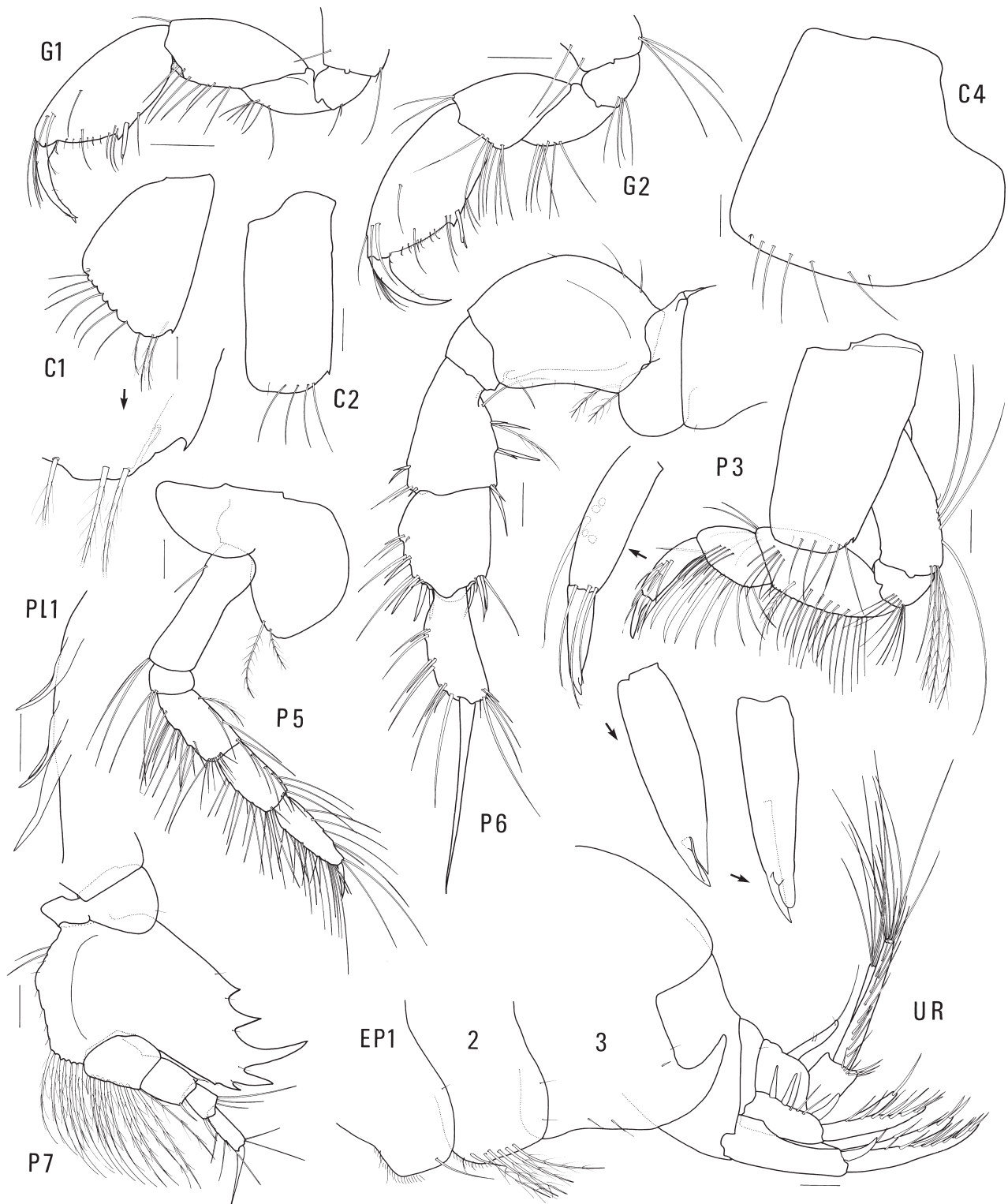


Figure 7. *Palabriaphoxus barnardi* sp. nov., holotype female “v”, NIWA 115630, 3.73 mm, eastern Tasman Sea. Scales for PL1 represent 0.02 mm. Other scales represent 0.1 mm.

slightly shorter than outer plate and slightly narrower, with 9 plumose setae; outer plate with 11 long slightly plumose setae apically stretching laterally. Maxilliped inner plate with 1 short robust seta apically and 5 long plumose setae apicofacially and medially; outer plate with 7 medial and apical blunt long robust setae, 3 apicolateral setae; palp article 1 without apicolateral setae, article 2 medial margin

weakly setose, article 3 not produced, without upper facial setae, with 5 medial setae, and 5 apical setae, article 4 long subtriangular, with 1 seta laterally, 2 apical setae, apical nail elongate.

Pereon: Gnathopod 1 coxa ventral margin slightly expanded posterodistally with tiny sharp tooth on postero-ventral corner, anterior margin slightly convex, ventral margin

with 10 long slender plumose setae; basis undocumented; ischium small and subrectangular, posterodistal corner with 2 simple setae; merus posterior margin with 5 plumose setae; carpus $2 \times$ as long as wide, anterior margin with 1 seta distally, posterior margin with 8 long setae; propodus $2.1 \times$ as long as wide, $1.22 \times$ length of carpus, anterior margin with 4 setae distally, posterior margin with 1 seta proximal to defining robust seta, 5 slender setae on facial surface; palm weakly setose and slightly convex, acute and produced to form small acute tooth at definition of palm, with 1 robust seta; dactylus reaching palmar corner, inner margin with 2 setae. Gnathopod 2 of similar size to gnathopod 1; coxa subrectangular with small acute tooth on posteroventral corner, ventral margin with 4 plumose setae, anterior margin weakly convex; basis undocumented; ischium small and subrectangular, posterior distal corner with 4 long plumose setae; merus posterior margin with 6 long slender setae; carpus short, subtriangular, $1.6 \times$ longer than wide, anterior margin without setae, posterior margin with tuft of 11 long slender setae distally; propodus $1.7 \times$ as long as wide, $1.3 \times$ carpus length, anterior margin with tuft of setae distally, posterior margin weakly setose, with 1 robust seta defining palm, palm slightly convex, acute, forming small acute tooth defining palm; dactylus reaching palmar corner. Pereopod 3 coxa subrectangular, ventral margin with 5 simple setae, posteroventral corner produced to form very small acute tooth; basis $2.6 \times$ as long as wide, posterior margin with 4 long plumose setae and distally tipped with 4 long plumose setae; ischium small and subrectangular, posterior margin with 8 distal plumose setae; merus weakly inflated, anterodistal corner bearing 2 setae, posterior margin setose with 24 medium to long plumose setae, and 5 facial setae; carpus posterior margin setose with 10 slender to robust setae, with 4 facial plumose setae; propodus posterior margin without setae, facial surface with 5 robust setae; dactylus $0.6 \times$ length of propodus. Pereopod 4 coxa expanded posteriorly to form broadly rounded lobe, ventral margin with 5 long plumose setae and 2 very small simple setae; distal articles similar to pereopod 3. Pereopod 5 coxa bilobate, expanded posteroventrally, posteroventral lobe with 2 plumose setae; basis narrow and straight sided with slight expansion proximally, $3.25 \times$ as long as wide, anterior margin with 1 long seta marginally and 2 plumose setae distally, posterior margin without setae; ischium small and subrectangular, anterior margin with 3 long plumose setae distally; merus anterior margin setose, with 15 long slender plumose setae marginally and 10 distally, posterior margin with 3 long plumose setae marginally and 2 long plumose setae distally; carpus anterior margin moderately setose, with 12 long plumose setae marginally and 6 long plumose setae distally, posterior margin with 6 plumose setae marginally and with 3 setae distally; propodus anterior margin with 12 long plumose setae marginally and 6 long plumose setae distally, posterior margin with 5 long plumose setae marginally and 2 distally, no facial setae present; dactylus $0.35 \times$ as long as propodus. Pereopod 6 much longer than all other pereopods; coxa weakly expanded posteroventrally, posterior margin with 2 long plumose setae and not covered with setules; basis about $1.3 \times$ as long as wide, anterior margin convex, bearing 3 slender setae marginally, posterior margin straight without fringe of setae, 1 small slender seta, not expanded proximally; ischium small and subrectangular without setae; merus: carpus: propodus length ratio 1:1.2:0.8; merus $1.4 \times$

longer than wide, anterior margin with 2 small robust setae, posterior margin with 2 tufts of large slender setae composed of 2 setae each, distally with 2 slender simple setae, no setae on facial surface; carpus $1.1 \times$ longer than wide anterior margin lined with 3 rows of long robust setae each row/tuft consisting of 3 setae, 2 robust setae distally, posterior margin distal corner with 5 long robust setae; propodus $2.0 \times$ longer than wide, similar in length to carpus, anterior margin with 3 rows of long slender setae each composed of 3 setae, and 1 long slender seta distally, posterior margin with 6 setae distally; dactylus elongate, $1.75 \times$ the length of propodus. Pereopod 7 coxa small and subtrapezoidal, slightly expanded posteriorly, posterior margin with 1 short seta; basis $1.2 \times$ longer than wide (including the posteroventral lobe), strongly expanded posteroventrally to form strongly-toothed posteroventral lobe reaching beyond propodus, anterior margin bearing 8 small slender setae marginally and 6 long plumose setae distally, posterior margin strongly serrate with curved teeth, with small slender seta between teeth, 5 in total, no setae on facial surface; ischium subrectangular, $1.1 \times$ as long as wide, anterior margin with 11 long slender plumose setae marginally; merus shorter than ischium ($0.8 \times$), anterior margin with 1 slender seta and 1 distally, posterior margin with 1 slender seta distally; carpus short $0.7 \times$ merus length, anterior margin with 1 distal slender simple seta, posterior margin with 3 slender simple setae distally; propodus narrow and $1.5 \times$ carpus, anterior margin with 2 slender setae marginally and 1 distally, posterior margin with 2 slender setae distally; dactylus elongate, $1.2 \times$ longer than propodus.

Pleon: Epimeron 1 anteroventral corner with 2 small slender setae and fringe of setules, ventral margin with 1 small slender seta, posterior margin convex, posteroventral corner without setae, posterior margin with 1 small seta. Epimeron 2 anteroventral corner rounded with fringe of small setules, ventral margin with 5 long slender plumose setae, posteroventral corner slightly rounded, posterior margin weakly convex with 2 small slender setae, facial surface without setae. Epimeron 3 anteroventral corner rounded, ventral margin weakly concave with 2 small, slender, simple setae, posteroventral corner produced to form long acute, curved projection, posterior margin with 2 small slender setae, plate facial surface without setae. Uropod 1 peduncle $1.7 \times$ as long as wide, dorsomedial margin with 2 long slender simple setae, dorsolateral distal corner with 1 large robust seta; outer ramus dorsal margin with 7 long slender simple setae along margin and 2 slender simple setae sub-apically; inner ramus slightly shorter than outer, dorsal margin with 4 long slender simple setae marginally and 3 slender simple setae sub-apically. Uropod 2 peduncle $1.6 \times$ longer than wide, dorsomedial margin with 1 slender, simple seta distally, dorsolateral margin with 2 long robust setae proximally then 3 long slender simple setae marginally and then 1 large robust seta apically; outer ramus dorsal margin with 7 long slender simple setae marginally and 2 sub-apically; inner ramus shorter than outer, margins without setae and with 1 long slender seta sub-apically. Uropod 3 peduncle $1.4 \times$ as long as wide, with 3 long slender plumose setae ventrodistally and 1 robust seta dorsodistally; outer ramus 2-articulate, article 1 ventrolateral margin with 11 long setae and 3 long setae apically, dorsolateral margin with 3 long slender setae marginally and 1 long seta apically; article 2 tiny $0.06 \times$ length of article 1, wider than long, tipped with

3 long plumose slender setae apically; inner ramus shorter than outer ramus ($0.7 \times$), outer margin lined with 3 long slender plumose setae and 3 long slender setae apically. Telson short, 87% cleft, each lobe narrow and weakly rounded apically, each lobe with 2 mid-facial short plumose setae and 1 long slender apical seta and fine setules covering apices. Urosomite 3 without plumose setae on either side of telson insertion.

MALE. Unknown.

Remarks. *Palabriaphoxus barnardi* sp. nov. is currently known from the type locality and from very few specimens. This situation will change once further examination of the collections identified as *P. palabria* from around New Zealand can be undertaken. *Palabriaphoxus barnardi* is the closest in morphology to *P. palabria* but differs chiefly in the shorter length of antenna 1 article 2 and antenna 2 article 4 (elongated in *P. palabria*), the absence of a serrated extended corner on the proximal posterior corner of the P6 basis, the absence of lateral robust setae on the telson and the absence of basoventral setae on the urosome (both present on *P. palabria*).

Distribution. Eastern Tasman Sea; 520 m.

Palabriaphoxus lowryi sp. nov.

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Figs 8–11

Holotype: NIWA 115627, ovigerous female “a”, 5.20 mm, eastern Tasman Sea, $41^{\circ}08.2'S$ $172^{\circ}03.4'E$, anchor box dredge, 51 m, P. K. Probert on RV *Tangaroa*, 5 March 1982, cruise 1131, Station Q726. **Paratype:** NIWA 115629, female “c”, collected with holotype.

Additional material examined. AM P39540, male “m”, 2.51 mm, AM P39541, female “m-1”, 3.94 mm, AM P39542, 2 specimens “m2” and “m3”; eastern Tasman Sea, $41^{\circ}38.8'S$ $171^{\circ}39.1'E$, anchor box dredge, 32 m, P. K. Probert on RV *Tangaroa*, cruise 1131, Station Q714, 27 February 1982. AM P39543, 1 female, eastern Tasman Sea, $42^{\circ}24.5'S$ $170^{\circ}57.5'E$, anchor box dredge, 133 m, P. K. Probert on RV *Tangaroa*, cruise 1131, Station Q717, 28 February 1982. NIWA, specimens “h”, “i” and “j”; Senecio Pool, The Snares, $48^{\circ}07'S$ $166^{\circ}36'E$, among deposits of terrestrial plant detritus, 7 m, G. D. Fenwick, 6 January 1977, SA3487.

Etymology. The name is for Jim Lowry, in memory of his enthusiasm for amphipods and his mentoring of both authors.

Diagnosis. Eyes present. Antenna 1 peduncular article 1 ventral apex not ensiform, peduncle article 2 shortened. Antenna 2 peduncle article 3 with 5 robust setae, article 4 shortened with facial robust setae. Right mandible lacinia mobilis multi-toothed. Maxilla 1 inner plate shorter than outer, outer plate with 9 multicuspidate robust setae. Maxilliped palp article 3 not produced. Posteroventral corner of coxae 1–3 with very small acute tooth. Gnathopods 1–2 carpus not cryptic. Gnathopod 2 similar sized to gnathopod 1, propodus with 1 robust seta near palmar corner. Pereopods 3–4 carpus setae placed near anterodistal margin. Robust setae forming dominant posterior element on pereopods 3–4 carpus. Pereopod 5 basis narrow, much longer than wide.

Pereopod 6 basis anterior margin without setae, posterodistal corner not produced to form lobe. Pereopod 7 merus, carpus, and propodus narrow; dactylus long. Urosome without basoventral setae. Epimera 1–2 without facial setae. Uropods 1–2 rami never fully spinose. Uropod 1 peduncle without enlarged robust setae. Uropod 2 peduncle only with robust setae. Uropod 3 outer ramus article 2 with 2 long apical setae; inner ramus long, about $1.2 \times$ the length of outer. Telson deeply cleft, apically with 3 slender plumose setae per lobe, marginally without setae on each side, without lateral robust setae.

Description. FEMALE, based on NIWA 115627, holotype, female “a”, 5.20 mm.

Head: Eyes present, very small and partly obscured; rostrum unconstricted, broad, reaching distal end of article 3 of antenna 1 peduncle; posteroventral corner of head produced into small tooth curved anteriorly. Antenna 1 peduncle article 1 stout, $1.3 \times$ as long as wide, $1.85 \times$ as long as article 2, ventral margin with 6 plumose setae (distal corner and onto ventral margin), dorsal margin unproduced distally; article 2 narrower and shorter than article 1, ventral margin with 7 long plumose setae, facial margin with 1 slender seta; article 3 short and subrectangular, ventral margin with 2 setae, facial margin with 4 plumose/brush setae; primary flagellum 7-articulate, first article elongated; accessory flagellum 6-articulate. Antenna 2 peduncle article 3 ventral margin with 5 simple setae; article 4 ventral margin expanded with 6 long plumose setae, facial margin with row of 12 robust plumose (becoming less robust distally) short setae, dorsal margin with 1 small seta and 16 long slender plumose setae distally and 4 long plumose setae inset facially; article 5 $0.7 \times$ length of article 4, ventral margin with 8 plumose, and 1 distal small plumose setae; flagellum 8-articulate, article 8 very small.

Mouthparts: Left mandible molar as a weakly elongate plaque armed with 2-toothed robust setae, and 1 short plumose seta, incisor blade like divided into 3 teeth, lacinia mobilis with 5 teeth, accessory setal row with 9 multicuspidate stout setae, palpal hump reduced; palp not documented. Right mandible incisor blade like with 3 teeth, lacinia mobilis reduced/broken off, accessory setal row with 9 multicuspidate stout setae; palp 3-articulate, article 1 $0.14 \times$ article 2, article 2 straight, slightly inflated, with 6 elongate inner margin setae, no outer setae, $1.06 \times$ article 3, article 3 apex oblique with 8 long, slender setae. Maxilla 1 inner plate with 4 short apical plumose setae, and setules on lateral margin; outer plate with 11 stout multicuspidate setae; palp 2-articulate, article 2 with 8 slender setae laterally and apically. Maxilla 2 inner plate subequal to outer plate but slightly narrower, with 8 plumose setae; outer plate with 13 long pectinate setae apically stretching laterally; both plates with setules. Maxilliped inner plate with 1 short robust seta apically and 6 long plumose setae apicofacially and medially; outer plate with 8 medial and apical robust setae, 3 lateral setae; palp article 1 without apicolateral setae, article 2 medial margin weakly setose, article 3 not produced, with slender facial setae, lateral setae on both margins, article 4 long subrectangular, with 2 setae laterally, 1 apical seta and 1 long apical nail.

Pereon: Gnathopod 1 coxa ventral margin expanded to form triangular shape, no posteroventral tooth, with 8 plumose setae; basis not documented; ischium small and

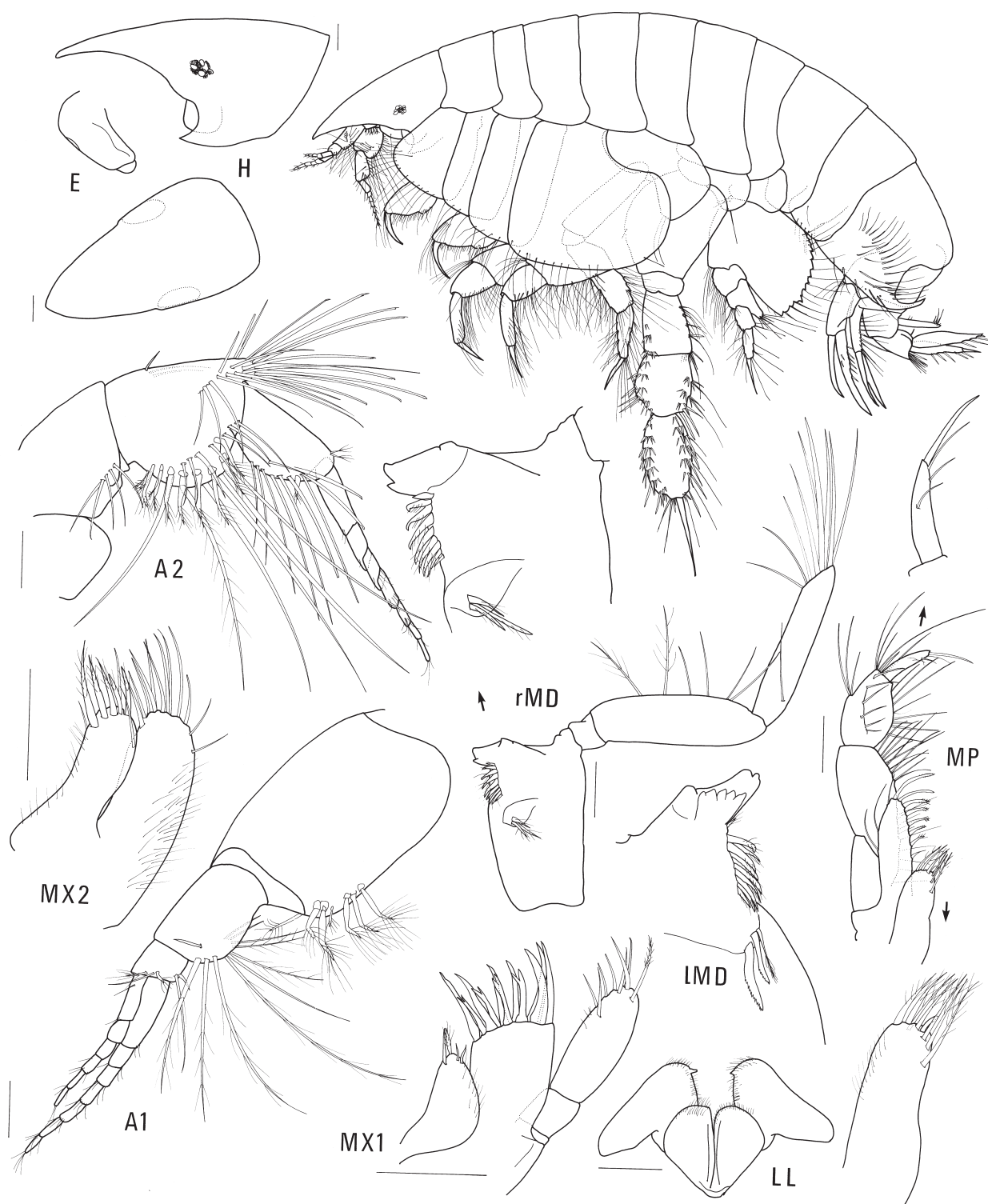


Figure 8. *Palabriaphoxus lowryi* sp. nov., holotype female “a”, NIWA 115627, 5.20 mm, eastern Tasman Sea. Scales represent 0.1 mm.

subrectangular, posterior margin without setae; merus posterior margin with 13 simple slender setae, facial margin without setae; carpus short, $1.5 \times$ as long as wide, anterior margin with 1 seta distally, posterior margin with 9 long setae; propodus $1.6 \times$ as long as wide, anterior margin with 8 setae distally, posterior margin without setae proximal to defining robust seta, facial margin with 5 long slender setae; palm densely setose with many short robust setae and longer slender setae and slightly convex, acute, produced to form

small subacute corner; dactylus reaching palmar corner, outer margin with 1 small seta. Gnathopod 2 slightly larger than gnathopod 1; coxa subrectangular without tooth on posteroventral corner, ventral margin with 5 plumose setae, anterior margin very weakly convex; basis not documented; ischium small and subrectangular, posterior distal corner with 5 long weakly plumose setae; merus subtriangular, posterior margin produced slightly to form small rounded lobe, with 13 long, slender weakly plumose setae, anterior

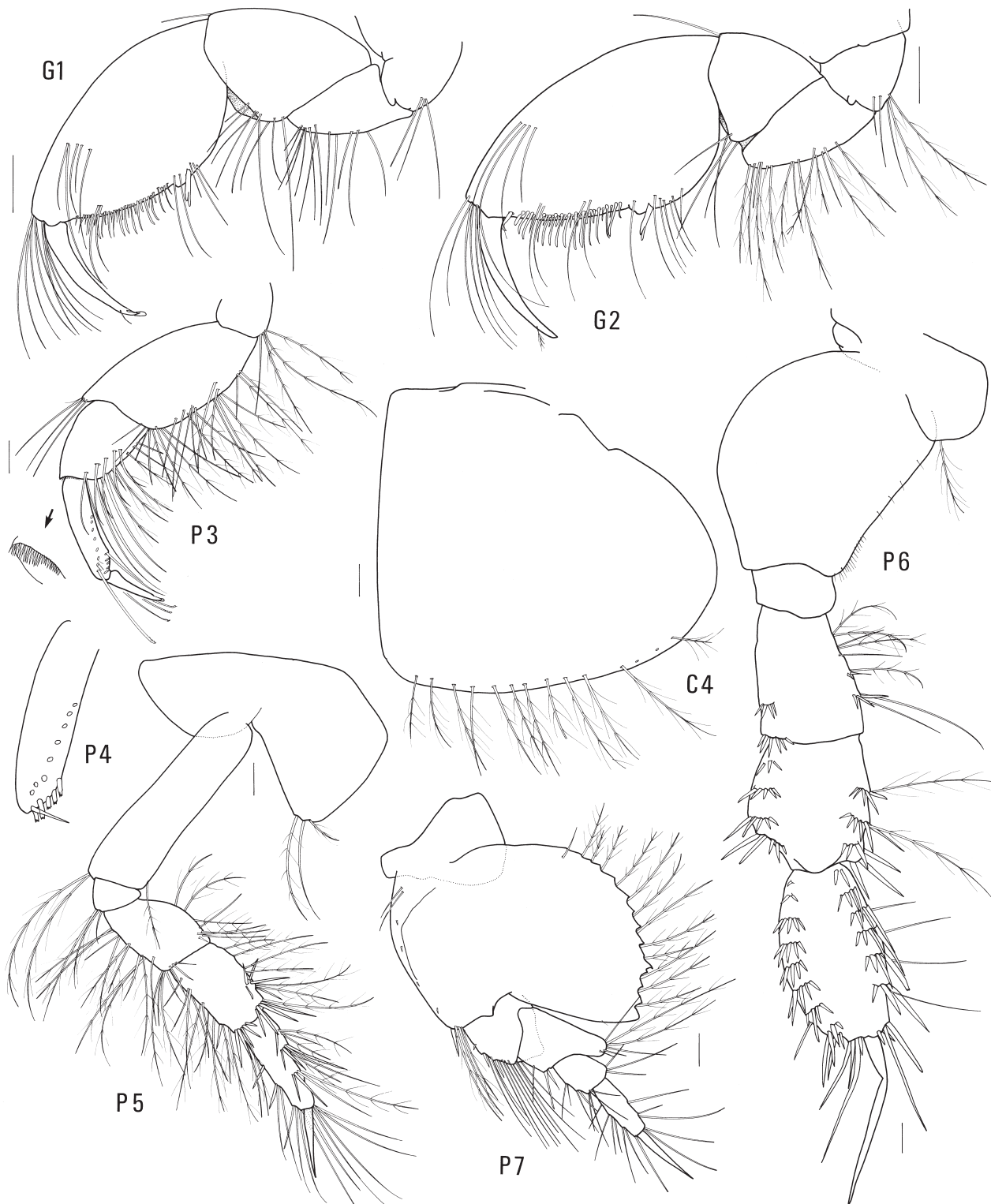


Figure 9. *Palabriaphoxus lowryi* sp. nov., holotype, female “a”, NIWA 115627, 5.20 mm, eastern Tasman Sea. Scales represent 0.1 mm.

margin reduced; carpus short, subtriangular, $0.84 \times$ long as wide, posterior margin with 4 setae; propodus $1.6 \times$ as long as wide, anterior margin with tuft of 7 setae distally, posterior margin weakly setose, with 1 robust seta defining palm, palm slightly convex, acute, produced posteroventrally to form small rounded defining corner; dactylus reaching palmar corner, outer margin with 1 small distal seta. Pereopod 3 coxa subrectangular, ventral margin with 7 plumose setae,

posteroventral corner not produced to form tooth; basis not documented; ischium small and subrectangular, with 4 distal plumose setae; merus weakly inflated, anterior margin extended distally to form small rounded lobe bearing 3 long slender setae, posterior margin moderately setose with 20 medium to long plumose setae; carpus posterior margin setose, with 15 plumose setae, with 5 facial plumose setae, distal margin of article lined with fringe of short, dense robust

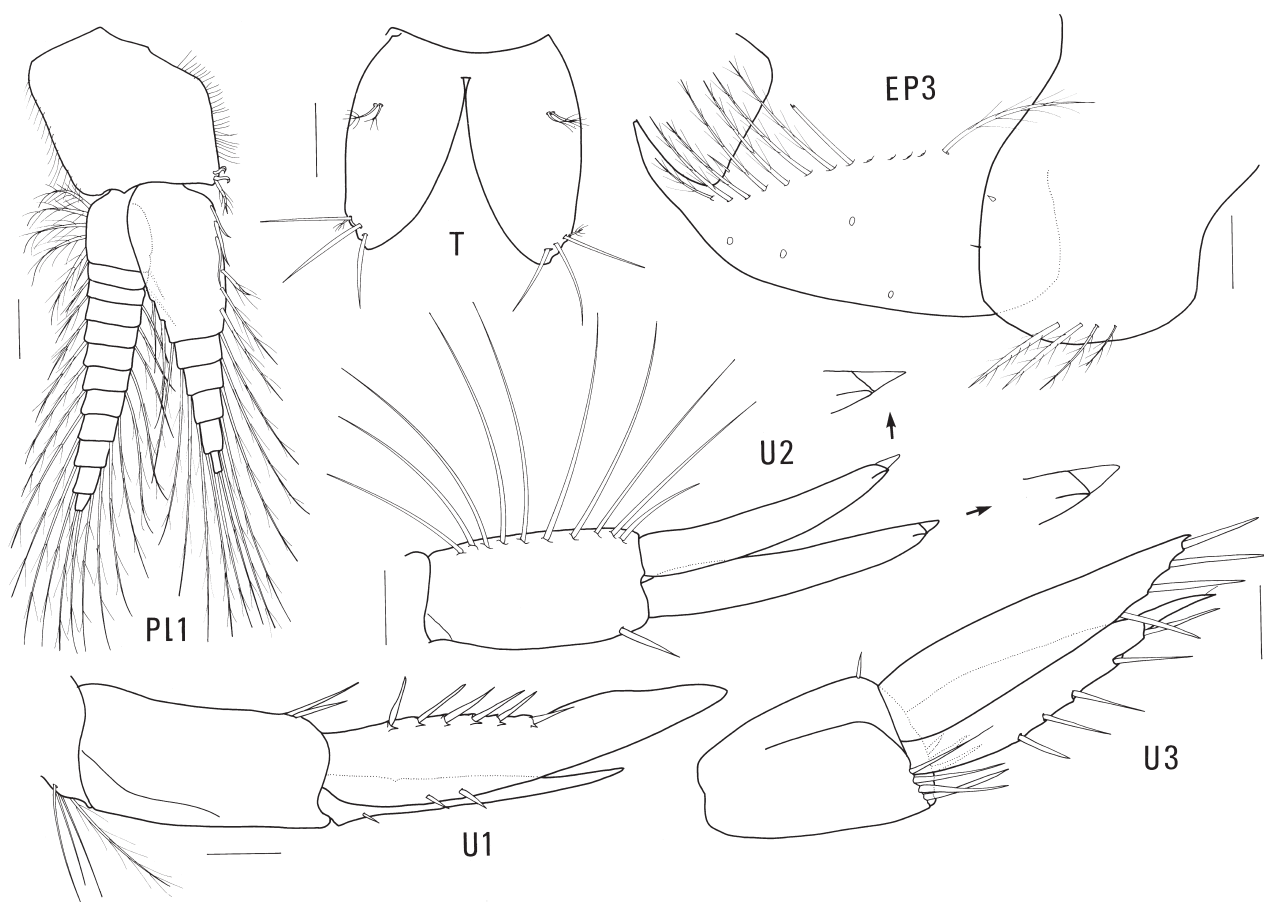


Figure 10. *Palabriaphoxus lowryi* sp. nov., holotype, female “a”, NIWA 115627, 5.20 mm, eastern Tasman Sea. Scales represent 0.1 mm.

setules; propodus posterior margin without setae, facial surface with 8 long setae in long curved row; dactylus $0.53 \times$ length of propodus. Pereopod 4 coxa expanded posteriorly to form broadly rounded lobe, all of posterior margin convex, ventral margin with 14 long plumose setae and 2 very small simple setae; distal articles similar to pereopod 3. Pereopod 5 coxa bilobate, expanded posteroventrally, posteroventral lobe angular with 3 plumose setae; basis narrow and straight sided, $4 \times$ as long as wide, anterior margin with 2 plumose setae distally, posterior margin with 1 seta distally; ischium small and subrectangular, anterior margin with 3 long plumose setae distally; merus anterior margin moderately setose, with 10 long slender plumose setae marginally and 7 distally, posterior margin with 4 long plumose setae marginally and 3 long plumose setae distally; carpus anterior margin setose, with 11 long plumose setae marginally and 2 long plumose and 5 long robust setae distally, posterior margin with 6 plumose and 5 long robust setae marginally and with 1 long plumose and 4 robust setae distally; propodus anterior margin with 4 long simple setae marginally and 3 long simple setae distally, posterior margin with 6 long plumose and 6 long simple setae marginally and 6 distally, facial setae absent; dactylus $0.62 \times$ as long as propodus. Pereopod 6 much longer than other pereopods; coxa weakly expanded posteroventrally, posterior margin with 1 long plumose seta and not covered with setules; basis about $1.2 \times$ as long as wide, anterior margin strongly convex, without setae, posterior margin almost straight, distally fringed with even, fine slender setae, not expanded to form proximal lobe, without proximal teeth; ischium small and subrectangular;

merus: carpus: propodus length ratio $1:1:1.4$; merus $1.3 \times$ as long as wide, anterior margin with row of 4 small robust setae marginally and row of 5 robust setae distally, posterior margin with 8 long plumose setae and 5 short robust setae, distally without setae; carpus shorter than wide ($0.75 \times$), anterior margin lined with 4 rows of 3–4 robust setae each, posterior margin with 2 long slender setae and 4 rows of 4–5 robust setae marginally, distal corner with 1 long robust seta; propodus $1.8 \times$ as long as wide, $1.4 \times$ length of carpus, anterior and posterior margins lined with rows of 4–5 short robust setae; dactylus elongate, same length of propodus. Pereopod 7 coxa small and subtrapezoidal, slightly expanded posteriorly; basis as long as wide (including the posteroventral lobe), strongly expanded posteroventrally to form weakly-toothed posteroventral lobe reaching to distal margin of merus lobe, anterior margin bearing 2 slender setae marginally and 5 long plumose setae distally, posterior margin weakly serrate, with plumose setae in inter-dental notches, 13 in total; ischium subrectangular, $1.3 \times$ as long as wide, anterior margin with 12 long slender plumose setae starting marginally and extending to facial surface; merus longer than ischium, anterior margin with 3 slender setae, posterior margin extended distally to form long rounded lobe extending halfway along carpal posterior margin, lobe tipped with 6 long slender setae; carpus short and subrectangular $0.6 \times$ merus length, anterior margin with 4 long slender setae and tipped with 3 small slender simple setae, posterior margin with 3 slender simple setae distally; propodus narrow and $1.6 \times$ carpus, anterior and posterior margins with 4 and 3 setae respectively; dactylus elongate, as long as propodus.

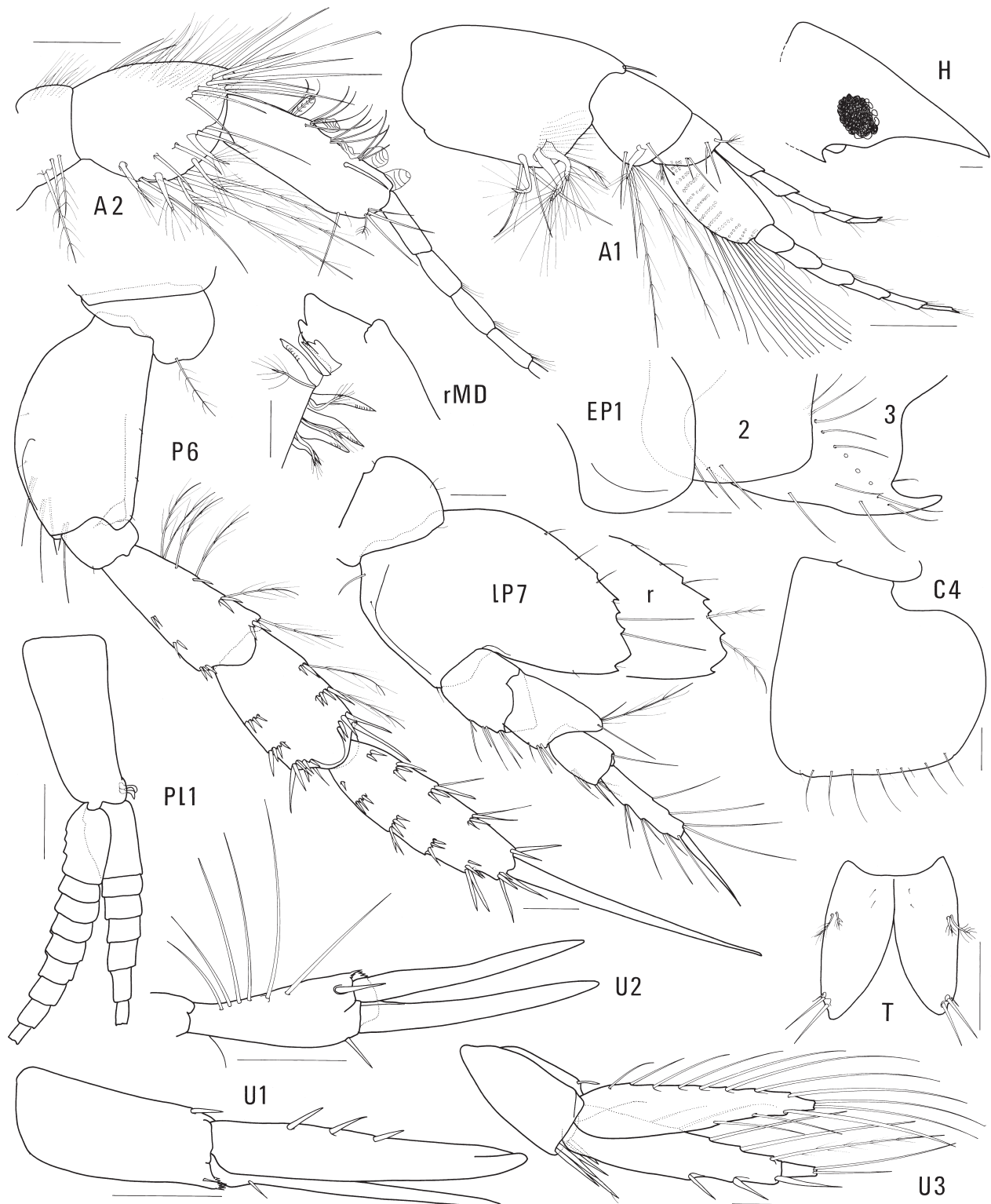


Figure 11. *Palabriaphoxus lowryi* sp. nov., paratype, male “m”, NIWA 115629, 2.51 mm, eastern Tasman Sea. Scale for rMD represents 0.02 mm. Scales for other parts represent 0.1 mm.

Pleon: Epimeron 1 setation unknown. Epimeron 2 anteroventral corner rounded, ventral margin with row of 4 long slender plumose setae reaching to posteroventral corner, posteroventral corner subquadrate, posterior margin straight with 2 short slender setae, facial setae absent. Epimeron 3 anteroventral corner rounded, ventral margin weakly convex lined with 3 long, slender, simple setae, posteroventral corner produced to form long acute, straight projection, posterior

margin without setae, plate facial surface with 1 long arc of 14 long slender, simple setae. Uropod 1 peduncle $1.6 \times$ as long as wide, dorsomedial margin with 2 long slender simple setae, dorsolateral distal corner without robust seta; outer ramus dorsal margin with 6 robust setae along margin and no setae sub-apically; inner ramus shorter than outer, dorsal margin with 1 small slender simple seta marginally and no setae sub-apically. Uropod 2 peduncle $1.6 \times$ as long as wide,

dorsomedial margin with 1 slender, simple seta distally, dorsolateral margin with 10 long slender setae marginally; outer ramus margins without setae and division resembling apical nail near the apical region; inner ramus subequal to outer, margins without setae. Uropod 3 peduncle $1.2 \times$ as long as wide, with 4 short slender setae ventrodistally and 1 short robust seta dorsodistally; outer ramus 2-articulate, article 1 ventrolateral margin with 4 long setae and 1 long seta apically; article 2 long, thin, spiniform, $0.3 \times$ length of article 1; inner ramus $1.2 \times$ longer than outer ramus, outer margin with 1 long slender setae apically, inner margin with 3 long slender setae. Telson short, 85% cleft, each lobe broad, narrow apically, with 2 mid-facial short plumose setae, 3 long slender apical setae. Urosomite 3 without setae on either side of telson insertion.

MALE, based on AM P39540, male “m” 2.51 mm.

Head: Rostrum as in female; posteroventral corner of head produced into small tooth directed anteriorly. Antenna 1 peduncle article 1 stout, $1.5 \times$ longer than wide, ventral margin with distal tuft of slender simple setae and 2 plumose setae (distal corner), dorsal margin slightly produced distally with 1 distal setule; article 2 narrower than and shorter than ($0.48 \times$) article 1, ventral margin with 5 long plumose setae and 3 small setules, with facial robust brush setae; article 3 short triangular, ventral margin with 6 small setae, facial margin without setae; primary flagellum 8-articulate, first article elongated and broadened, last article reduced, article 1 with callynophore occupying most of surface; accessory flagellum 6-articulate, sixth article reduced. Antenna 2 peduncle article 4 ventral margin with 4 long evenly spaced plumose setae and with 8 facial robust setae, dorsal margin lined with long slender setae with 4 long slender plumose setae and 4 robust setae distally; article 5 $1.2 \times$ length of article 4, ventral margin with 3 apical long plumose setae, dorsal margin with 4 tufts of 3–4 slender setae and 5 calceoli; flagellum at least 5-articulate. Right mandible with 9 accessory setae, right lacinia mobilis with 3 weak teeth.

Pereon: Pereopod 4 coxa proximal posterior margin concave. Pereopod 6 basis posterior straight, no lobe and smooth, anterior margin with 3 slender setae and 1 wide robust seta distally; ischium without setae; merus: carpus: propodus length ratio 1:0.9:1.2; merus, carpus, and propodus are all narrower than female and different proportions; merus, carpus, and propodus all with rows of facial short robust setae, long plumose setae absent; dactylus elongated, $1.3 \times$ length of propodus. Pereopod 7 basis also expanded but lobe only weakly serrate, only 6 inter-tooth setae small and simple, lobe shorter, almost reaching end of merus; carpus longer in proportion to propodus; dactylus slightly shorter than propodus ($0.9 \times$).

Pleon: Epimeron 1 longer than epimeron 2. Epimeron 2 ventral margin with 3 long slender plumose setae. Epimeron 3 with 3 setae on ventral margin, facial arc straight with 11 slender setae. Uropod 3 peduncle $1.7 \times$ as long as wide, with 4 robust setae distally; outer ramus article 1, margins covered with long plumose setae, and 2 robust setae, article 2 with 2 long plumose setae apically; inner ramus as long as outer ramus, margins covered with long plumose setae.

Remarks. *Palabriaphoxus lowryi* sp. nov., like *P. barnardi* will probably prove to have a wider range once the extensive series in research collections, previously identified as *P. palabria*, has been examined. The most obvious difference

between *P. lowryi* and its congeners is the shape of the pereopod 7 basis (rounded and weakly scalloped, *P. palabria* and *P. barnardi* have strong elongated serrations and the basis is curved and narrower), as well as the other differences noted above.

Distribution. Eastern Tasman Sea and The Snares; 7–133 m.

Subfamily Phoxocephalinae Sars, 1891

Protophoxus K. H. Barnard, 1930

Protophoxus K. H. Barnard, 1930: 335.—Barnard & Drummond, 1976: 532; 1978: 189.

Type species. *Protophoxus australis* K. H. Barnard, 1930, by monotypy.

Diagnosis. Rostrum fully developed, unconstricted or weakly constricted. Eyes present. Antennae 1–2, flagella unreduced in female. Antenna 1 peduncle article 2 shortened, ventral setae widely spread, in middle. Antenna 2 peduncle article 1 not ensiform; article 3 with 1 seta and 1 setule; facial setae on article 4 in 1–3 weak or well-defined rows; article 5 ordinary in size. Prebuccal appendages not extended forward, rounded, massive, not strongly distinct, upper lip dominant. Right mandibular incisor with 4–5 teeth; molar not triturative, small, pillow shaped, with 3 or more splayed, semiarticulate robust setae, with patch of fine setae; palpal hump medium; right lacinia mobilis bifid, thin; mandibular palp medium to thin, article 1 short, article 2 without outer setae, apex of article 3 oblique. Lower lip with salivary cones. Maxilla 1 palp 2-articulate, inner plate with 4 setae, outer plate with 11 setal-teeth, 1 setal-tooth especially thickened. Maxilliped outer plates thin, elongate, ordinarily with robust and slender setae, palp article 3 apex not or scarcely protuberant, dactylus elongate, apical nail distinct, medium. Gnathopods small, similar. Gnathopod 1 carpus medium, free, palms acute, propodi oval to rectangular, poorly setose anteriorly. Pereopods 3–4 carpus setose posteroproximally, all posterior robust setae on propodus of pereopods 3–4 thick and stiff, midapical robust setae present. Pereopod 5 basis broad, tapering. Pereopods 5–6 merus-carpus broad to medium, basis not setose posteriorly. Pereopod 7 basis without facial and ventral setae, merus not lobed. Epimeron 1–2 lacking elongate posterior setae, with midfacial setae below ventral facial ridge. Epimeron 3 variously setose, smooth posteriorly. Urosomite 3 without dorsal hook or special process. Uropod 1 peduncle without apicoventral enlarged robust seta, with special enlarged apicolateral robust seta, without basoventral setae, with dorsolateral and medial robust setae widely spread; inner ramus with marginal robust setae in 1 row, no rami continuously spinose to apex. Uropod 2 peduncle with only 1 medial robust seta confined apically, apex combed. Uropod 3 peduncle lacking extra subapical robust or slender setae, article 2 of outer ramus elongate, with 2 elongate apical setae. Telson with pair of midlateral or dorsal setules on each side, with 1 or more apical robust setae on each lobe. Five pairs of gills.

Sexual dimorphism. Antenna 1 peduncle article 1 with patch of fine setae in male. Calceoli present on male primary flagellum of antenna 1 and on peduncle article 5 of male antenna 2.

Key to world species of *Protophoxus*

- 1 Peduncle of uropod 1 with displaced robust seta on medial and lateral apices. Epimeron 3 lacking facial setation. Head without constriction in dorsal view [New Zealand, Otago Shelf; 132 m depth] ... *Protophoxus munida* sp. nov.
- Peduncle of uropod 1 with displaced robust seta only on lateral apex. Epimeron 3 with facial setation. Head with constriction in dorsal view [New Zealand; 0–195 m] *Protophoxus australis*

Protophoxus australis (K. H. Barnard, 1930)

Figs 12–14

Phoxus batei.—Thomson, 1882: 232–233, pl. 17, figs. 2a–e (not Haswell, 1879).

Protophoxus australis K. H. Barnard, 1930: 335–336, fig. 12a–c.

Pontharpinia australis.—Hurley, 1954: 581–587, figs. 1–28.

Material examined. AM P25859, specimen “q3”, female, 5.5 mm, Otago Shelf, New Zealand, 45°51'S 170°57'E, sand bottom, 132 m, P. K. Probert on RV *Munida*, MU74/114, 4 June 1974; NIWA 115616, specimen “q1”, juvenile male, 3.41 mm, off west coast of South Island, New Zealand, 40°51.8'S 171°28'E, 195 m, P. K. Probert on RV *Tangaroa*, Cruise 1131, Q729, 6 March 1982.

Diagnosis. Eyes present. Head with constriction in dorsal view. Antenna 1 peduncular article 1 ventral apex not ensiform, peduncle article 2 shortened. Antenna 2 peduncle article 3 with robust setae, article 4 shortened with facial robust setae. Right mandible lacinia mobilis bifid. Maxilla 1 inner plate moderately large, outer plate with 11 multicuspidate robust setae. Maxilliped palp article 3 not produced. Posteroventral corner of coxae 1–3 without tooth. Gnathopods 1–2 carpus not cryptic. Gnathopod 2 similar sized to gnathopod 1, propodus with 1 robust seta near palmar corner. Pereopods 3–4 carpus setae placed near anterodistal margin. Robust setae forming dominant posterior element on pereopods 3–4 carpus. Pereopod 5 basis broad. Pereopod 6 basis anterior margin without setae, posterodistal corner not produced to form a lobe. Pereopod 7 merus, carpus, and propodus narrow; dactylus long. Urosome without basoventral setae. Epimera 1–2 with facial setae. Uropods 1–2 rami never fully spinose. Uropod 1 peduncle with displaced robust seta only on lateral apex. Uropod 2 peduncle only with robust setae. Uropod 3 outer ramus article 2 with 2 long apical setae; inner ramus medium length, about 0.5 × the length of outer. Telson deeply cleft, apically with 2 robust setae per lobe, marginally without setae on each side, without lateral robust setae.

Description. FEMALE, based on AM P25859, female “q3”, 5.5 mm.

Head: Eyes medium, largely occluded with pigment. Head about 0.20 × body length, greatest width about 0.70 × length; rostrum constricted, of medium breadth, reaching end of article 1 on antenna 1. Antenna 1 peduncle article 1 1.5 × as long as wide, 2 × as wide as article 2, ventral margin with 6 setules, weakly produced dorsal apex with 3 setae; article 2 0.6 × as long as article 1, with ventral horseshoe cycle of 20 setae; primary flagellum 11-articulate, 0.84 × as long as

peduncle, lacking large aesthetascs; accessory flagellum with 9 articles. Antennae 2 peduncle article 4 facial setal formula = 5-4-3, dorsal margin with 2 robust setae, ventral margin with 6–7 groups of 1–4 long to medium setae, 1 distoventral elongate robust seta; article 5 flabellate 0.8 × as long as article 4, facial setal formula = 2-2-1, ventral margin with 4 sets of 1 short and 1 elongate seta each, 1 distoventral medium robust seta; flagellum 1.6 × as long as articles 4–5 of peduncle combined, 12-articulate.

Mouthparts: Mandibles with small palpal hump; right incisor with 5 teeth; left incisor with 5 teeth in 2 weak sections; right lacinia mobilis bifid, distal branch flabellate, scarcely shorter than proximal, proximal section simple, pointed; left lacinia mobilis with 4 teeth; right accessory setal row with 7 multicuspidate stout setae, left with 8; molar bulbous, weak, with 1 thick penicillate seta in middle, disjunct from 2 slightly smaller simple robust setae, each molar with gross patch of fine setae; palp article 1 short, article 2 with 3 elongate inner setae and 2 other short inner setae, article 3 1.1 × as long as article 2, oblique apex with 11 long, slender setae. Maxilla 1 inner plate moderately large, with 2 elongate apicofacial pappose setae (1 on each face), 2 apicolateral much shorter simple setae; palp article 2 with 2 medial marginal setae, and 5 apical marginal setae (1 robust and 4 slender simple) and 2 submarginal setae. Maxilla 2 plates extending subequally, of subequal breadth, outer with 6 apicolateral setae, inner with 2 medial setae. Maxilliped inner plate with 2 large apical robust setae, 4 apicofacial setae, 4 medial setae; outer plate with 11 medial and apical robust setae, 4 apicolateral setae; palp article 1 with 1 apicolateral seta, medial margin of article 2 moderately setose, article 3 not produced, with 9 facial setae, 3 lateral setae, nail of article 4 medium, with 1 accessory setule.

Pereon: Coxa 1 scarcely expanded distally, anterior margin almost straight, main ventral setae of coxae 1–4 = 10-9-8-4, posterior most seta of coxae 1–2 shortened. Coxa 4 anterior and posterior margins divergent, posterior margin oblique, convex, posteroventral margin not bevelled, posterodorsal corner subrounded, posterodorsal margin short, concave, width to length ratio of coxa 4 = 30:35. Coxae 5–7 posteroventral setule formula = 2-4-4. Gnathopods 1–2 small, slender, weakly diverse; width ratios of carpus-propodus on gnathopods 1–2 = 11:16 and 10:16, length ratios = 23:30 and 18:29; palmar humps ordinary, palms acute; gnathopods 1–2 carpus medium and short respectively, of gnathopod 1 ovate, posterior margin of 1 rounded, of 2 scarcely lobate, of gnathopod 2 short, subtriangular. Pereopods 3–4 similar, facial setae formula on merus = 7 and 5, on carpus = 7 and 7; main robust seta of carpus extending to M. 95 on propodus, carpus without posteroproximal robust setae; setal formula of propodus = 5-5 plus 1, mid-distal robust seta acclivity on inner margin of dactyli of pereopods 3–4 moderately large.

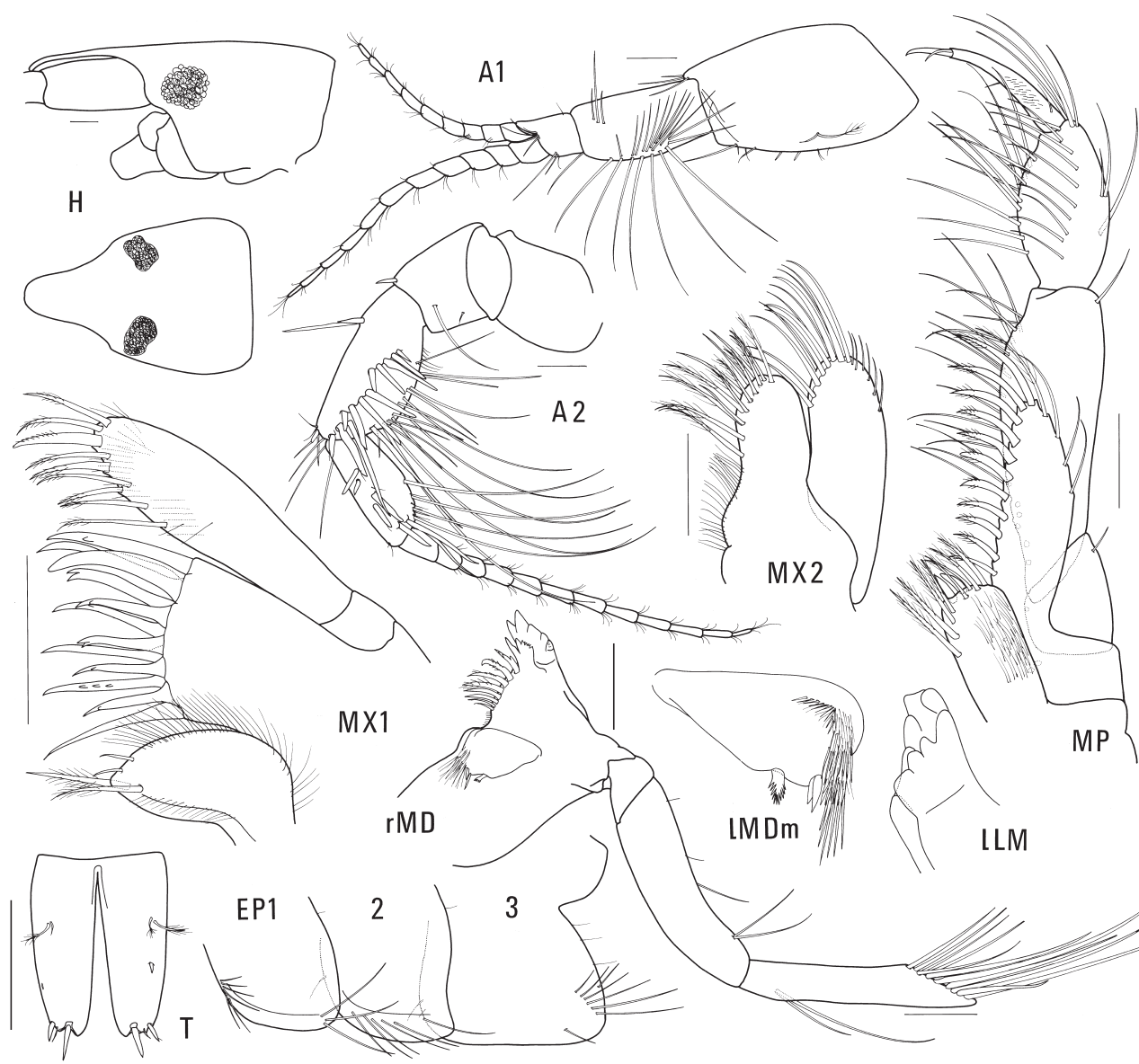


Figure 12. *Protophoxus australis* (K. H. Barnard, 1930), female “q-3”, AM P25859, 5.5 mm, Otago Shelf, New Zealand. Scales represent 0.1 mm.

Pereopods 5–6 merus-carpus of medium width, facial robust setal rows poorly developed. Pereopods 5–7 basis facial ridge formula = 0-1-1, ridge of pereopod 7 long. Pereopod 5 basis slightly tapering distally; width ratios of basis, merus, carpus, propodus of pereopod 5 = 17:11:10:5, of pereopod 6 = 27: 18:9:? (broken), of pereopod 7 = 37:9:8:4, length ratios of pereopod 5 = 29:12:16:17, of pereopod 6 = 35:33: 16:?, of pereopod 7 = 40:10:11:13. Pereopod 7 basis reaching middle of carpus. Pereopods 5 and 7 merus without elongate posterodistal lobe; medial apex of propodus truncate, finely combed.

Pleon: Epimeron 1 posteroventral corner rounded, posterior margin convex, with setule, anteroventral margin with 6 short setae, ventral margin naked, posterior corner with 3 facial setae. Epimeron 2 posteroventral corner weakly and broadly protuberant, posterior margin sinuate, facial setae in 2 groups of 8 (row) and 1. Epimeron 3 posteroventral corner rounded, posterior margin convex, smooth, with 4 setules, posteroventral face with 1 seta, midposterior face

with oblique row of 6 setae. Urosomite 1 with ventrolateral and ventral row of 9+ setae, no ventral robust setae at base of uropod 1. Urosomite 3 weakly protuberant dorsally. Uropod 1 peduncle with 3 apicolateral robust setae, medially with 7 marginal slender setae and robust setae becoming thicker apically, outer ramus with 5 lateral robust setae, inner with 3 medial. Uropod 2 peduncle with 6 dorsal robust setae, medially with 1 medium apical robust seta, outer ramus with 5 dorsal robust setae, inner with 2 medial robust setae. Uropods 1–2 rami with articulate enlarged apical nails, lacking accessory nails. Uropod 3 peduncle with 6 apicoventral robust setae, dorsally with 1 lateral robust seta, 1 medial robust seta and no setules; rami feminine, inner extending to M.47 on article 2 of outer ramus, apex with 1 seta, article 2 of outer ramus elongate, $0.4 \times$ as long as article 1, with 1 long, 1 short setae, medial margin of article 1 with 1 subequal seta, lateral margin with 3 acclivities, setal formula = 2-2-2-2. Setal formula = 0. Telson elongate, length to width ratio = 15:11, almost fully cleft, each apex medium,

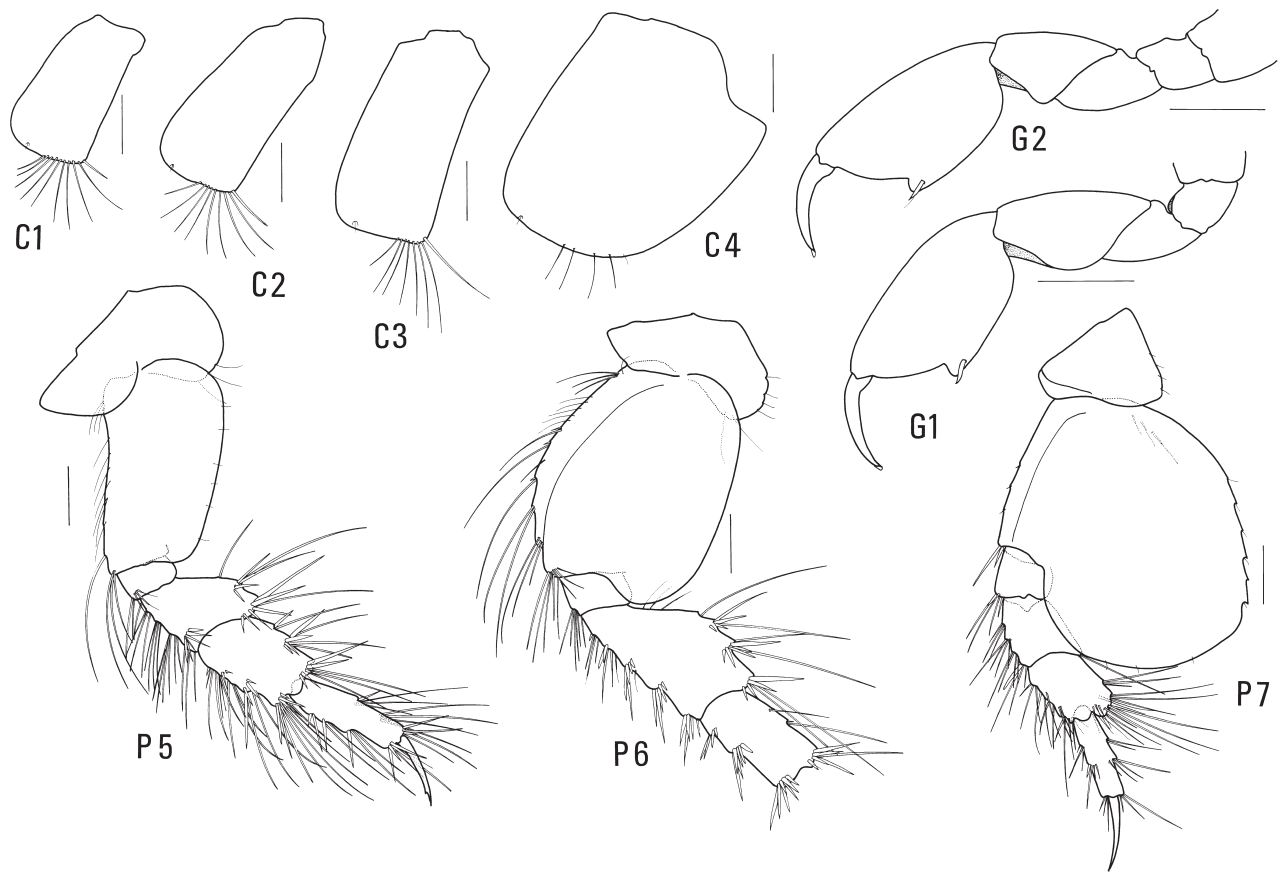


Figure 13. *Protophoxus australis* (K. H. Barnard, 1930), female “q-3”, AM P25859, 5.5 mm, Otago Shelf, New Zealand. Scales represent 0.2 mm.

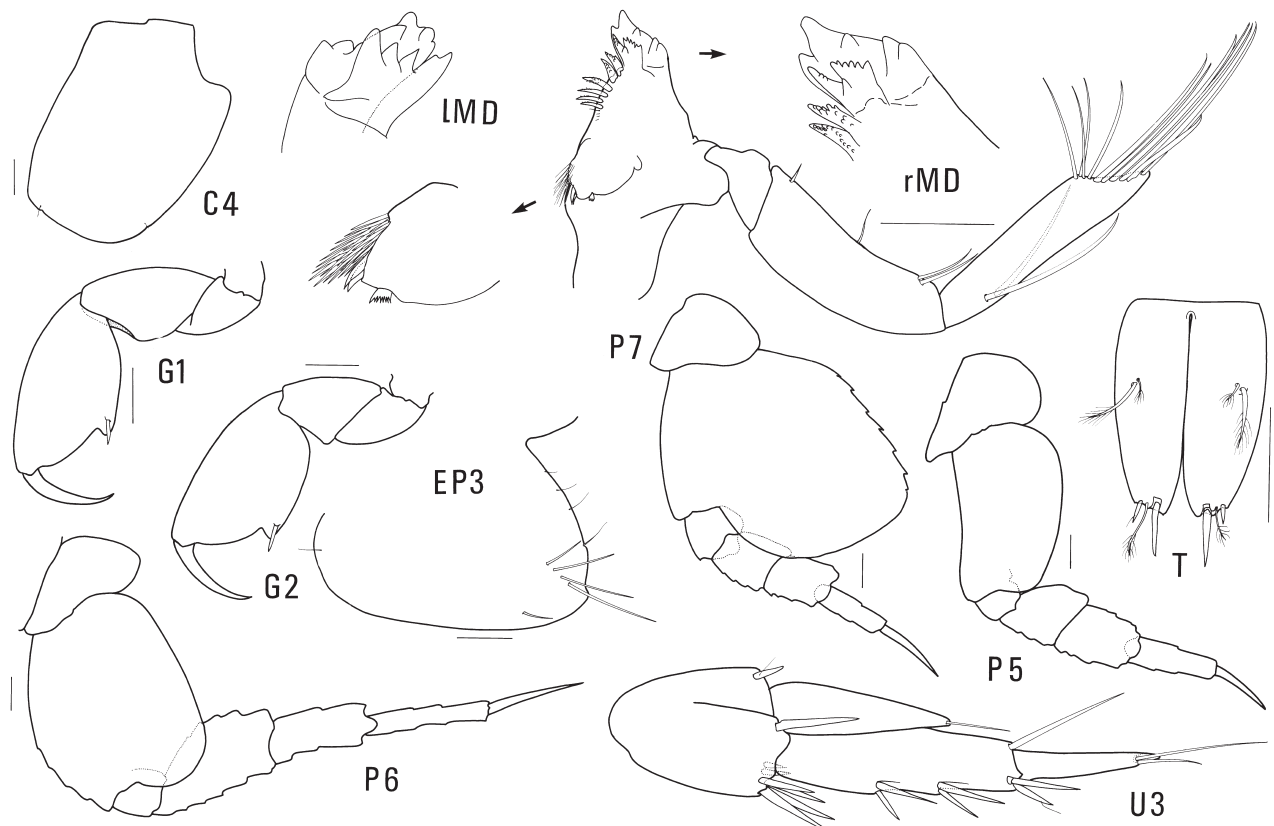


Figure 14. *Protophoxus australis* (K. H. Barnard, 1930), juvenile male “q-1”, NIWA 115616, 3.4 mm, Otago Shelf, New Zealand. Scales represent 0.1 mm.

weakly notched, lateral acclivity absent, with apicolateral robust setae and medial setule, then middle apical robust setae, basodorsal setules diverse.

JUVENILE MALE, based on NIWA 115616, male “q1”, 3.41 mm. Mandibular palp article 2 setae shortened and less setose. Gnathopods slightly stouter and shorter; coxa 4 slightly narrowed. Epimera broadened. Main apical robust seta on each lobe of telson elongate. Uropod 3 remaining in feminine form.

Remarks. Only the male of *Protophoxus australis* was known previously. The female differs from the male in the fewer bulbar setules on peduncle article 1 of antenna 1, the lack of calceoli on the antennae, the smaller eyes, the narrower telson with robust setae set more directly on the apices of each lobe, the weaker setation on uropod 3, the shorter inner ramus of uropod 3 (see female-like uropod 3 of “q1” specimen), the smaller epimeron 1, the weakly sinuate posterior margin of epimeron 2, the weaker spination of the pereopods, and the stronger excavation on coxa 4.

Protophoxus australis differs from *Pr. munida* sp. nov. primarily by the presence of facial setae on epimeron 3 (absent on *Pr. munida*) and the head in dorsal view abruptly tapering (not abruptly tapering in *Pr. munida*).

Distribution. New Zealand: off Three Kings Island, surface, and Spirits Bay, North Auckland; Port Chalmers; Paterson Inlet, Stewart Island; 0–195 m depth.

Protophoxus munida sp. nov.

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Figs 15–16

Holotype: AM P39544, female “q2”, 6.0 mm, Otago Shelf, New Zealand, 45°51'S 170°57'E, sand bottom, 132 m, P. K. Probert on RV *Munida*, 4 June 1974, MU74/114.

Etymology. Named for the RV *Munida*, University of Otago research vessel; used as a noun in apposition.

Diagnosis. Eyes present. Head without constriction in dorsal view. Antenna 1 peduncular article 1 ventral apex not ensiform, peduncle article 2 shortened. Antenna 2 peduncle article 3 with robust setae, article 4 shortened with facial robust setae. Right mandible lacinia mobilis bifid. Maxilla 1 inner plate moderately large, outer plate with 11 multicuspidate robust setae. Maxilliped palp article 3 not produced. Posteroventral corner of coxae 1–3 without tooth. Gnathopods 1–2 carpus not cryptic. Gnathopod 2 similar sized to gnathopod 1, propodus with 1 robust seta near palmar corner. Pereopods 3–4 carpus setae placed near anterodistal margin. Robust setae forming dominant posterior element on pereopods 3–4 carpus. Pereopod 5 basis broad. Pereopod 6 basis anterior margin without setae, posterodistal corner not produced to form a lobe. Pereopod 7 merus, carpus, and propodus narrow; dactylus long. Urosome without basoventral setae. Epimera 1–2 without facial setae. Uropods 1–2 rami never fully spinose. Uropod 1 peduncle with displaced robust seta on medial and lateral apices. Uropod 2 peduncle only with robust setae. Uropod 3 outer ramus article 2 with 2 long apical setae; inner ramus medium length, about 0.5 × the length of outer. Telson deeply cleft, apically with 1 robust seta per lobe, marginally without setae on each side, without lateral robust setae.

Description. FEMALE, based on AM P39544, female, holotype, “q-2”, 6.2 mm.

Head: Eyes medium, largely free of pigment. Head about 0.18 × body length, greatest width about 0.75 × length; rostrum not constricted, broad, reaching middle of peduncle article 2 on antenna 1. Antenna 1 peduncle article 1 1.6 × as long as wide, about 2 × as wide as article 2, ventral margin with about 8 setules, weakly produced dorsal apex with 3 setae; article 2 0.6 × as long as article 1, with ventral horseshoe cycle of 12 setae; primary flagellum 13-articulate, almost as long as peduncle, lacking large aesthetascs; accessory flagellum 10-articulate. Antennae 2 peduncle article 4 main setal formula = 4-5-2, dorsal margin with notch with 2 robust setae and 1 slender seta, ventral margin with 6 groups of 1–4 long to medium setae, 1 distoventral elongate robust seta; article 5 almost 0.8 × as long as article 4, facial robust setae formula = 3-2, ventral margin with 4 sets of 1 elongate seta each, 3 distoventral medium to short robust setae; flagellum about 1.45 × as long as articles 4–5 of peduncle combined, 14-articulate.

Mouthparts: Mandibles with small palpal hump; right incisor with 4 teeth; left incisor with 4 weak humps in 2 branches; right lacinia mobilis bifid, distal branch flabellate, shorter than proximal, proximal branch simple, pointed; left lacinia mobilis with 4 teeth; right accessory setal row with 8 multicuspidate stout setae; molar bulbous, weak, with 3 small amalgamated robust setae and disjunct flabellate robust setae, each molar with patch of fine setae; palp article 1 short, article 2 with 1 elongate inner seta and 3 other short inner setae, article 3 about as long as article 2, oblique apex with 10 elongate slender setae. Maxilla 1 inner plate medium, with 2 elongate apical or mediofacial pappose setae, 2 apicolateral much shorter simple setae; palp article 2 with 1 medial marginal seta, and 2 apical robust setae and 7 other robust and slender setae (2 broken off in figure). Maxilla 2 plates extending equally, of equal breadth, outer with 5 apicolateral setae, inner with 1 medial seta. Maxilliped inner plate with 2 large thick apical robust setae, 3 apicofacial setae, 5 medial setae; outer plate with 11 medial and apical robust setae, 4 apicolateral setae; some setae set into cuspidate recesses; palp article 1 with 1 apicolateral seta, medial margin of article 2 moderately setose, article 3 scarcely produced, with 8 facial setae, 4 lateral setae, nail of article 4 medium, with 1 accessory setule.

Pereon: Coxa 1 slightly expanded distally, anterior margin almost straight, main ventral setae of coxae 1–4 = 11-10-8-3, posterior most seta of coxae 1–3 shortened; anterior and posterior margins of coxa 4 almost parallel, posterior margin almost vertical, almost straight, posteroventral margin not bevelled, posterodorsal corner rounded, posterodorsal margin short, concave, width to length ratio of coxa 4 = 13:16. Coxae 5–7 posteroventral setule formula = 1-4-5. Gnathopods 1–2 slightly enlarged, weakly diverse; width ratios of carpus-propodus on gnathopods 1–2 = 12:17 and 31:30, length ratios = 31:30 and 26:29; palmar humps medium, palms acute; carpus of gnathopods 1–2 elongate to medium respectively, of gnathopod 1 subovate, posterior margin of 1 flat, of 2 lobate, of gnathopod 2 triangular. Pereopods 3–4 similar, facial setae formula on merus = 3, on carpus = 5; main robust seta of carpus extending to M. 100 on propodus, carpus without posteroproximal robust setae; setal formula of propodus = 5-4 plus mid-distal robust setae, acclivity on

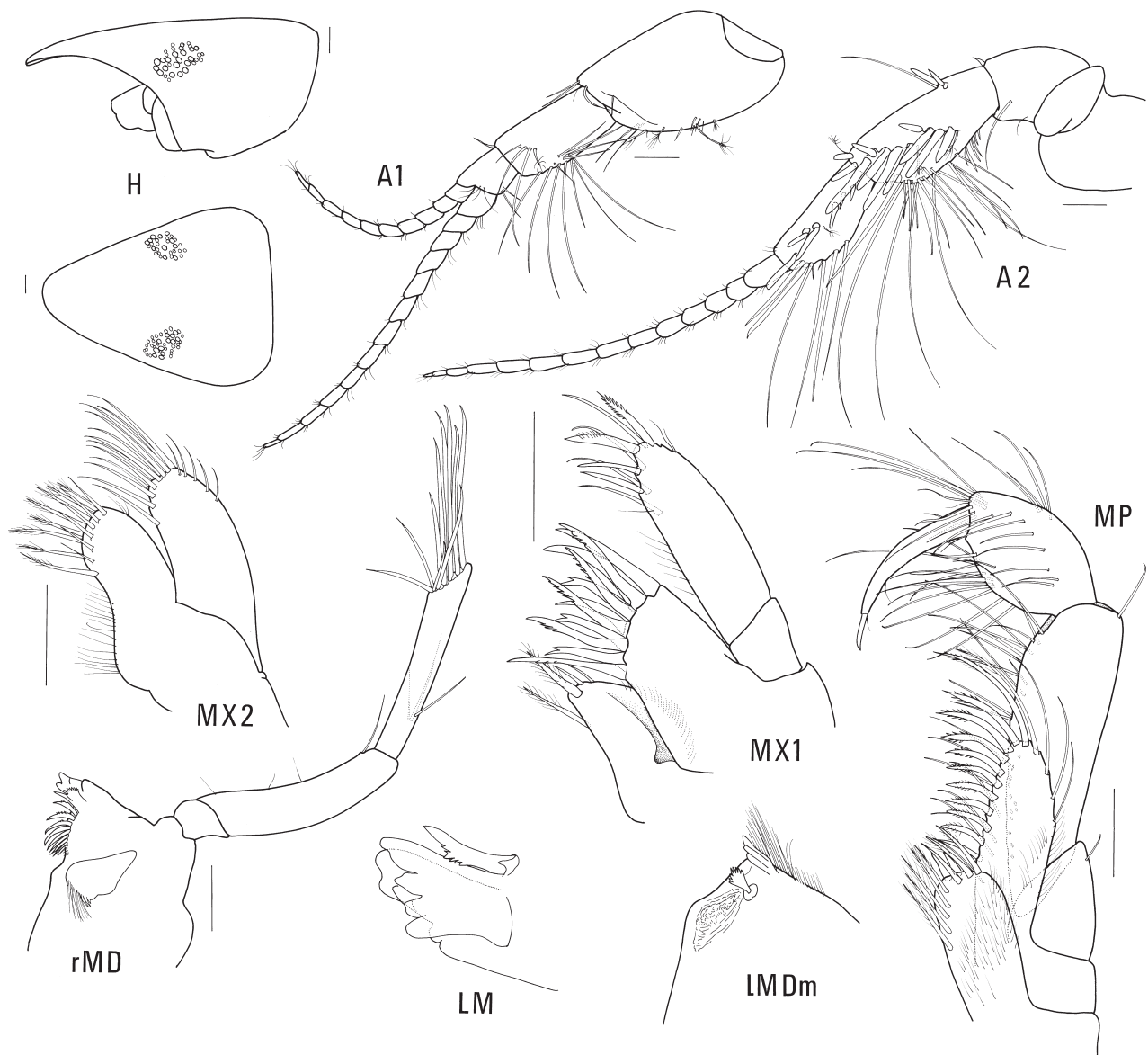


Figure 15. *Protophoxus munida* sp. nov., holotype female “q-2”, AM P39544, 6.0 mm, Otago Shelf, New Zealand. Scales represent 0.1 mm.

inner margin of dactyli of pereopods 3–4 weak. Pereopods 5–6 merus–carpus narrow, facial robust setae rows poorly developed, facial ridge formula on basis of pereopods 5–7 = 0-1-1, ridge of pereopod 7 long; width ratios basis, merus, carpus, propodus of pereopod 5 = 16:10:9:4, of pereopod 6 = 27:15:9:5, of pereopod 7 = 35:7:7:3, length ratios of pereopod 5 = 27:12:15:17, of pereopod 6 = 34:32:18:24, of pereopod 7 = 41:11:10:12. Pereopod 7 basis almost reaching apex of carpus. Pereopods 5 and 7 merus without especially elongate posterodistal lobe; medial apex of propodus truncate, finely combed.

Pleon: Epimeron 1, posteroventral corner subquadrate, posterior margin almost straight, with setule, anteroventral margin with 5 short setae, posteroventral margin and corner with row of 3 elongate setae. Epimeron 2 posteroventral corner subquadrate, weakly protuberant, posterior margin almost straight, with 2 setules, facial setae in 1 row of 7, no pair set vertically. Epimeron 3 posteroventral corner rounded to quadrate, posterior margin convex, scarcely crenulate, with 2 long setae and 4 setules, ventral face with 4 small setae. Urosomite 1 with cluster of 4 midventral setae.

Urosomite 3 not protuberant dorsally. Uropod 1 peduncle with 5 tiny apicolateral robust setae and very large apical robust setae, no basofacial setae, medially with 4 marginal robust setae becoming larger apically, outer ramus with 6 dorsal robust setae, inner with 3. Uropod 2 peduncle with 7 dorsal robust setae, medially with 1 medium apical robust seta, outer ramus with 5 dorsal robust setae, inner with 2. Uropods 1–2 rami with articulate enlarged apical nails, lacking accessory nail. Uropod 3 peduncle with 1 mid ventral and 1 apical robust seta, dorsally with 2–2 lateral robust setae, 1 medial robust seta; rami feminine, inner extending to M.45 on article 2 of outer ramus, apex with 1 seta, otherwise naked, article 2 with 2 elongate setae, medial margin of article 1 with 1 apical robust setae, lateral margin with 3 acclivities, setal formula = 2-2-2-2, setal formula = 0. Telson elongate, length to width ratio = 15:13, almost fully cleft, each apex broad, bevelled, acclivity absent, with ordinary lateral setule, 1 apicolateral robust seta as long as setule, basodorsal setules diverse.

MALE. Unknown.

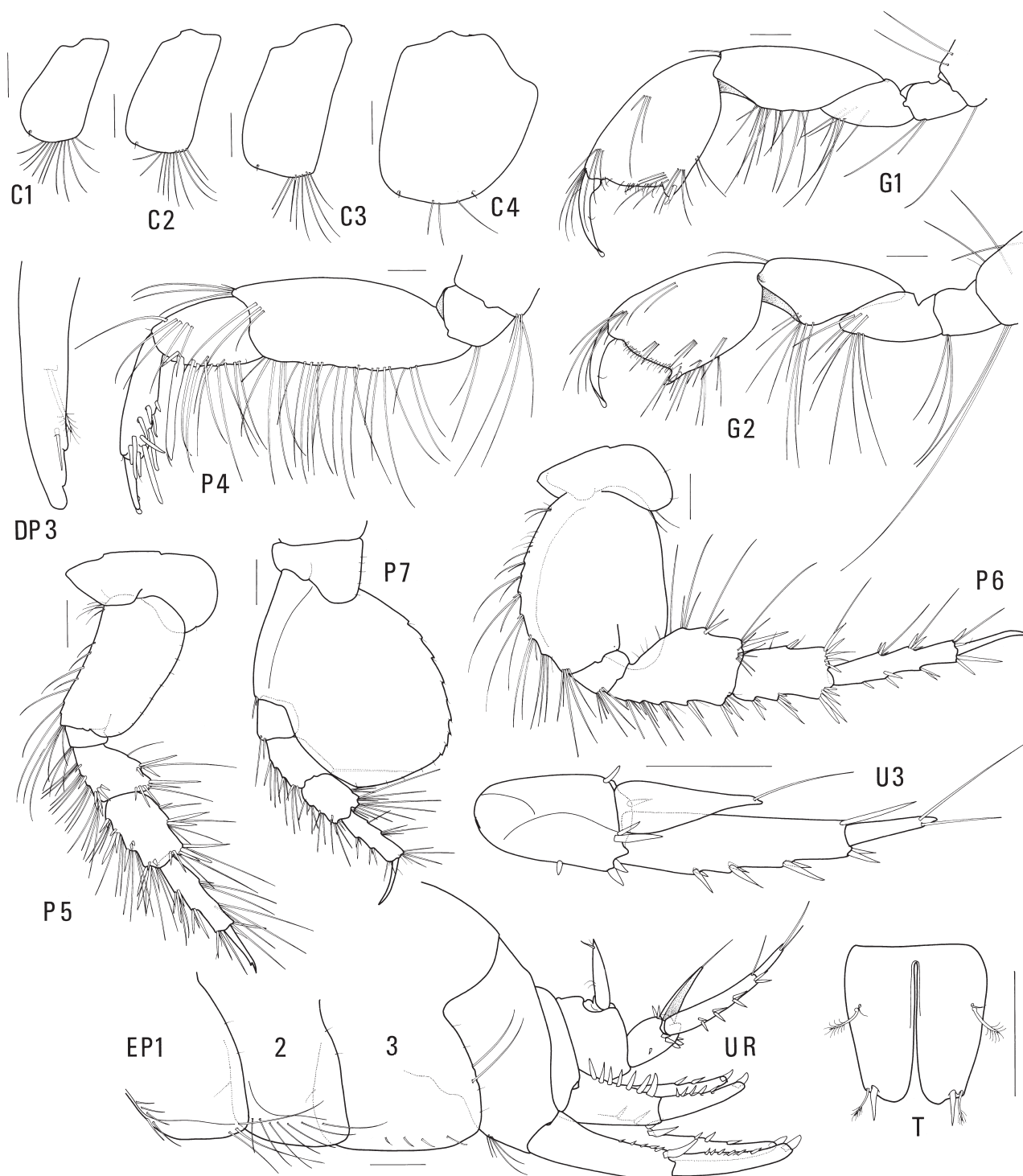


Figure 16. *Protophoxus munida* sp. nov., holotype female “q-2”, AM P39544, 6.0 mm, Otago Shelf, New Zealand. Scales represent 0.2 mm.

Remarks. *Protophoxus munida* sp. nov. differs from *Pr. australis* in the presence of a large displaced robust seta on the medial apex of uropod 1 peduncle in addition to the generically important displaced robust seta on the lateral apex. The presence of this seta is also a feature of *Parharpinia* Stebbing, 1899 but *Protophoxus* further differs from *Parharpinia* in lacking the strong posterior setation on epimera 1–2, the lack of ventral setation on the pereopod 7 basis and the distinct nail on the maxillipedal palp. Thus, *Pr. munida* has a displaced robust seta on both sides of the uropod 1 peduncle and further differs

from *Pr. australis* in the setation of epimeron 3, differing placement of facial setae and having sparse posterior setation, in the not constricted head from dorsal view; and in the absence of dorsal robust setae on the telson in adults.

The absence of dorsal robust setae on the telson of *P. munida* recalls species of *Birubius* from Australia, but that genus lacks any displaced robust setae on uropod 1 and has a non-tapered basis of pereopod 5.

Distribution. New Zealand, Otago Shelf; 132 m depth.

***Zeaphoxus* gen. nov.**

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Diagnosis. Rostrum fully developed, unconstricted. Eyes present. Antennae 1–2, flagella unreduced in female. Article 2 of antenna 1 ordinary, ventral setae widely spread, in middle. Antenna 1 peduncle article 2 not or weakly ensiform; article 3 with 2 setules; facial robust setae on article 4 primarily in 1 row; article 5 ordinary. Prebuccal appendages not extended forward, rounded, massive, not strongly distinct, epistome dominant. Right mandibular incisor with 3 teeth; molar not tritritative, small, pillow shaped, with 3 semi-articulate robust setae, 1 of these enlarged, with patch of fine setae; palpal hump medium; right lacinia mobilis bifid, broad; mandibular palp thin, article 1 short, article 2 without outer setae, apex of article 3 oblique, all distal setae confined to apex. Lower lip with salivary cones. Maxilla 1 palp 2-articulate, inner plate with 4 setae, outer plate with 11 robust setae, 1 robust seta especially thickened. Maxilla 2 ordinarily setose, outer plate scarcely enlarged. Maxilliped outer plates thin, elongate, spinose, and setose, apex of palp article 3 scarcely protuberant, dactylus elongate, apical nail indistinct, mostly immersed, short. Gnathopods small, weakly diverse, propodus of gnathopod 2 distinctly larger than on gnathopod 1; carpus of gnathopod 1 free, of gnathopod 2 very short and almost cryptic, palms acute, propodi ordinary, almond shaped, poorly setose anteriorly. Pereopods 3–4 carpus with posteroproximal setae, all posterior robust setae on propodus thin and stiff, midapical robust setae present. Pereopod 5 basis broad, tapering, Pereopods 5–6 basis not setose posteriorly, merus-carpus medium to narrow. Pereopod 7 basis without ventral and facial setae, with only 1 facial ridge, ischium slightly enlarged and strongly setose anteroventrally, merus not lobed. Epimera 1–2 lacking elongate posterior setae, with midfacial setae below ventral facial ridge. Epimeron 3 setose facially, smooth posteriorly. Urosomite 1 generally naked except for sparse apicoventral setae or robust setae near base of uropod 1. Urosomite 3 without dorsal hook or special process. Uropod 1 peduncle without apicoventral enlarged robust setae, with special enlarged apical robust seta, with basoventral setae, with dorsolateral robust setae narrowly spread, very weak, confined apically, medial robust setae

widely spread. Uropod 1 outer ramus ordinary, inner ramus with marginal robust setae in 1 row, no rami of uropods 1–2 continuously spinose to apex. Uropod 2 inner ramus ordinary. Uropod 3 peduncle lacking extra slender or robust setae, article 2 of outer ramus short, with 2 medium apical setae. Telson with pair of midlateral or dorsal setules on each side, 2 apical robust setae on each lobe, without special dorsal and lateral slender and robust setae. Five pairs of gills.

Sexual dimorphism. Male not known.

Type species. *Zeaphoxus zealandicus* sp. nov.

Etymology. From New Zealand and “phoxus” a common root of genera in Phoxocephalidae. Gender masculine.

Remarks. *Zeaphoxus* gen. nov. and two new species, *Zeaphoxus senecio* sp. nov. from the Tasman Sea and The Snares, 7–507 m and *Zeaphoxus zealandicus* sp. nov. from the Otago Shelf, 65 m are recognized. These new species could not definitively be keyed to either a subfamily or genus according to Barnard & Karaman (1991) due in part to the recombination of characters including: structure of the molar (small, pillow shaped, and non-tritritative), length of article 2 of antennae 1 (elongate) and gnathopods 1–2 diverse in size with gnathopod 2 obviously larger than gnathopod 1. The preliminary morphological phylogeny of Taylor (2003) elucidated that they share a combination of traits with species belonging to the genera *Eyakia*, *Leongathus*, and *Mesophoxus*, including antenna 1, peduncle article 2 with ventral setae situated on middle, right mandibular incisor with 3 teeth and pereopod 5 of broad form but tapering distally. Taylor (2006) was faced with a similar dilemma when trying to place a new species collected from the Tasman Sea. The partly tritritate molar but narrow basis of pereopod 5 in part informed the decision to redescribe the genus *Leongathus* to accommodate *Leongathus alannah* Taylor, 2006 rather than erecting another monotypic genus. Although these authors note *Zeaphoxus* gen. nov. has morphological affinities with both *Eyakia* and *Mesophoxus* from North Pacific waters, and with species of *Leongathus*, known from the Tasman Sea and southern Australia, the decision to establish a new genus instead of making an emended diagnosis of an existing genus is taken in this instance.

Key to the world species of *Zeaphoxus*

- 1 Dorsolateral margin of uropod 1 peduncle with 2 robust setae; dorsal margin of uropod 2 peduncle with short apical robust setae and elongate proximal setae. Proximal branch of right lacinia mobilis not longer than distal branch [New Zealand, Otago Shelf; 65 m] .. *Zeaphoxus zealandicus* sp. nov.
- Dorsolateral margin of uropod 1 peduncle with 5 or 6 robust setae; dorsal margin of uropod 2 peduncle with all medium similar robust setae. Proximal branch of right lacinia mobilis much longer than distal branch [Tasman Sea & The Snares; 7–507 m] *Zeaphoxus senecio* sp. nov.

Zeaphoxus senecio sp. nov.

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Figs 17–19

Holotype: NIWA 115621, female “d”, 12.58 mm, Senecio Pool, The Snares, 48°07'S 166°36'E, among deposits of terrestrial plant detritus, 7 m, SA3487, G. D. Fenwick, 6 January 1977. **Paratype:** NIWA 115622, juvenile “e”, 5.48 mm, collected together with holotype.

Other material examined. AM P39545, juvenile “f1”, 3.82 mm plus 9 specimens, eastern Tasman Sea, 41°58.5'S 170°28.1'E, 507 m, P. K. Probert on RV *Tangaroa*, cruise 1131, Station Q723, 4 March 1982; NIWA 115633, 1 specimen, eastern Tasman Sea, 41°15.102'S 170°37.5'E, 560 m, P. K. Probert on RV *Tangaroa*, cruise 1131, Station Q700, 23 February 1982; NIWA 115634, 2 specimens, eastern Tasman Sea, 42°25.5'S 171°05.502'E, 37 m, P. K. Probert on RV *Tangaroa*, cruise 1131, Station Q725, 4 March 1982; AM P25803, 3 specimens, Otago Shelf, New Zealand, 45°53'S 170°51'E, sandy gravel, bottom, 93 m, P. K. Probert on RV *Munida*, MU75/54, 19 February 1975.

Etymology. Named for the type locality; used as a noun in apposition.

Diagnosis. Eyes present. Head without constriction in dorsal view. Antenna 1 peduncular article 1 ventral apex not ensiform, peduncle article 2 shortened. Antenna 2 peduncle article 3 with robust setae, article 4 shortened with facial robust setae. Right mandible lacinia mobilis bifid, proximal branch much longer than distal branch. Maxilla 1 inner plate moderately large, outer plate with 11 multicuspidate robust setae. Maxilliped palp article 3 weakly produced. Posteroventral corner of coxae 1–3 without tooth. Gnathopods 1–2 carpus not cryptic. Gnathopod 2 similar sized to gnathopod 1, propodus with 1 robust seta near palmar corner. Pereopods 3–4 carpus setae placed near anterodistal margin. Robust setae forming dominant posterior element on pereopods 3–4 carpus. Pereopod 5 basis broad. Pereopod 6 basis anterior margin without setae, posterodistal corner not produced to form a lobe. Pereopod 7 merus, carpus, and propodus narrow; dactylus long. Urosome without basoventral setae. Epimera 1–2 without facial setae. Uropods 1–2 rami never fully spinose, rami with articulate enlarged apical nails, lacking accessory nails. Uropod 1 peduncle with 5–6 robust setae on dorsolateral margin. Uropod 2 peduncle only with robust setae. Uropod 3 outer ramus article 2 with 2 long apical setae; inner ramus medium length, about 0.5 × the length of outer. Telson deeply cleft, apically with 1 robust seta per lobe, marginally without setae on each side, without lateral robust setae.

Description. FEMALE, based on NIWA 115621, holotype, female “d”, 12.58 mm.

Head: Eyes large, largely occluded with pigment. Head about $0.20 \times$ total body length, greatest width about $0.75 \times$ length; rostrum not constricted, broad, reaching middle of article 2 on antenna 1. Antenna 1 peduncle article 1 $1.7 \times$ as long as wide, about half as wide as article 2, ventral margin with about 10 setules, weakly produced dorsal apex with 3 setae; article 2 about half as long as article 1, with ventral horseshoe cycle arc of 12 setae; primary flagellum 13-articulate, $0.7 \times$ as long as peduncle, lacking large

aesthetascs; accessory flagellum 11-articulate. Antenna 2 peduncle article 4 main setal formula = 2-6-4, dorsal margin with notch with 2 setae and 1 robust setae, ventral margin with 5 groups of 2–4 elongate to medium setae, 1 distoventral elongate robust setae; article 5 almost $0.8 \times$ as long as article 4, facial robust setae formula = 3, ventral margin with 6 sets of 1 elongate seta each, 1 distoventral medium robust setae; flagellum about as long as articles 4–5 of peduncle combined, 14 articulate.

Mouthparts: Mandibles with small palpal hump; right incisor with 3 teeth; left incisor with 3 weak humps in 2 branches; right lacinia mobilis bifid, distal branch flabellate, shorter than proximal, proximal branch simple, pointed; left lacinia mobilis with 4 teeth; right accessory setal row with 10 multicuspidate stout setae, left with 11; molar bulbous, weak, with 1 large curved robust seta and 2 much smaller simple robust setae, no disjunct robust setae, each molar with patch of fine seta; palp article 1 short, article 2 with 3 elongate inner setae and 1 other short inner seta and no outer setae, article 3 about $1.1 \times$ as long as article 2, oblique apex with 10 elongate robust setae. Maxilla 1 inner plate medium, with 2 elongate apicomedial pappose setae, 2 apicolateral much shorter setae; palp article 2 with 4 medial marginal robust setae, and 2 apical and 5 submarginal setae. Maxilla 2 plates extending subequally, of diverse breadth, outer with 4 apicolateral setae, inner with 2–3 medial setae. Maxilliped inner plate with 3 large apical robust setae, 3 apicofacial plumose setae and 2 medial setae; outer plate with 14 medial and apical robust setae, 6 apicolateral setae; some setae set into cuspidate recesses; palp article 1 with 3 apicolateral setae, medial margin of article 2 moderately setose, article 3 scarcely produced, with 8 facial setae, 2 lateral setae, article 4 long, with 2 accessory setules, nail short.

Pereon: Coxa 1 not expanded distally, anterior margin almost straight, main ventral setae of coxae 1–4 = 7-8-12-many, posterior most seta of coxae 1–4 not shortened; anterior and posterior margins of coxa 4 parallel, posterior margin almost vertical, convex, posteroventral margin not bevelled, posterodorsal corner rounded, posterodorsal margin short, concave, width to length ratio of coxa 4 = 9:10. Coxae 5–7 posteroventral setule formula = 5-8-1. Gnathopods 1–2 slightly enlarged, weakly diverse, width ratios of carpus-propodus on gnathopods 1–2 = 12:15 and 23:32, length ratios = 12:21 and 16:37; palmar humps small to medium palms acute, with 1 robust seta defining palm; gnathopods 1–2 carpus medium and short respectively, of gnathopod 1 ovate, posterior margin of 1 flat, of 2 lobate, of gnathopod 2 short, subcryptic, triangular. Pereopods 3–4 similar, facial setae formula on merus = 7 and 5, on carpus = 7 and 6; main robust setae of carpus extending to M.58 on propodus, carpus without posteroproximal robust setae; setal formula of propodus = 5-2 plus mid-distal robust setae acclivity on inner margin of dactyls of pereopods 3–4 large, weak. Pereopods 5–6 merus-carpus narrow, facial robust setal rows poorly developed. Pereopods 5–7 facial ridge formula on basis = 0-1-1, ridge of pereopod 7 long; width ratios of basis, merus, carpus, propodus of pereopod 5 = 22:11:10:6, of pereopod 6 = 33:11:10:5, of pereopod 7 = 40:9:8:4, length ratios of pereopod 5 = 30:13:16:16, of pereopod 6 = 40:22:25:25, of pereopod 7 = 45:10:11:16. Pereopod 7 basis reaching middle of merus. Pereopods 5 and 7 merus without especially elongate posterodistal lobe; medial apex of propodus truncate, uncombed.

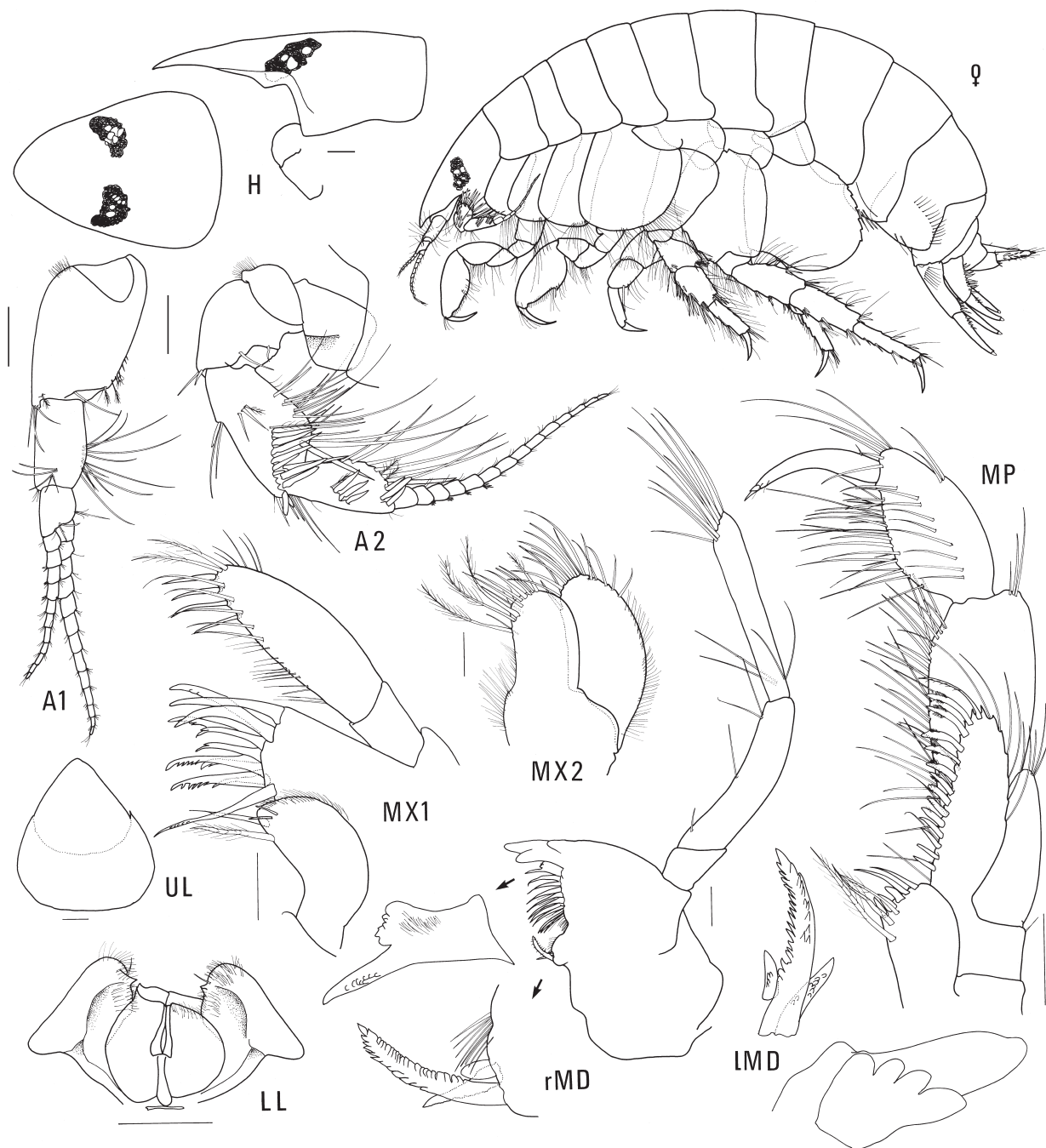


Figure 17. *Zeaphoxus senecio* sp. nov., holotype, female “d”, NIWA 115621, 12.58 mm, The Snares, New Zealand. Scales represent 0.1 mm.

Pleon: Epimeron 1, posteroventral corner rounded, posterior margin convex, with setule, anteroventral margin with 9 short setae, ventral margin with 13 elongate setae. Epimeron 2 posteroventral corner quadrate, weakly protuberant, posterior margin almost straight, with setule, facial setae = 2 rows of 8-8, posterior most pair set vertically. Epimeron 3 posteroventral corner subquadrate, posterior margin almost straight, scarcely serrate, 2-setose, uppermost tiny setules, ventral margin with 3 posterior narrowly spread setae, face with obliquely horizontal middle row of 11 setae. Urosomite 1 without ventral robust setae at base of uropod 1. Urosomite 3 not protuberant dorsally. Uropods 1–2 rami with articulate enlarged apical nails, lacking accessory nails.

Uropod 1 peduncle with 6 apicolateral robust setae and 7 basofacial setae, medially with 6 marginal slender setae and robust setae becoming thicker distally, outer ramus with 4 lateral and 2 medial robust setae, inner with 1 medial. Uropod 2 peduncle with 10 dorsal robust setae, medially with 1 medium apical robust setae, outer ramus with 3 dorsal robust setae, inner naked. Uropod 3 peduncle with 8 ventral robust setae, dorsally with 1 lateral robust setae, 1 medial robust setae and 2 setules; rami feminine, inner extending to M.67 on article 2 of outer ramus, apex with 2 setae, medial margin with 3 setae, article 2 of outer ramus with 2 elongate setae, medial margin of article 1 with 5 setae, lateral margin with 5 acclivities, setal formula = 2-2-2-2-2-2 (1 short robust seta).

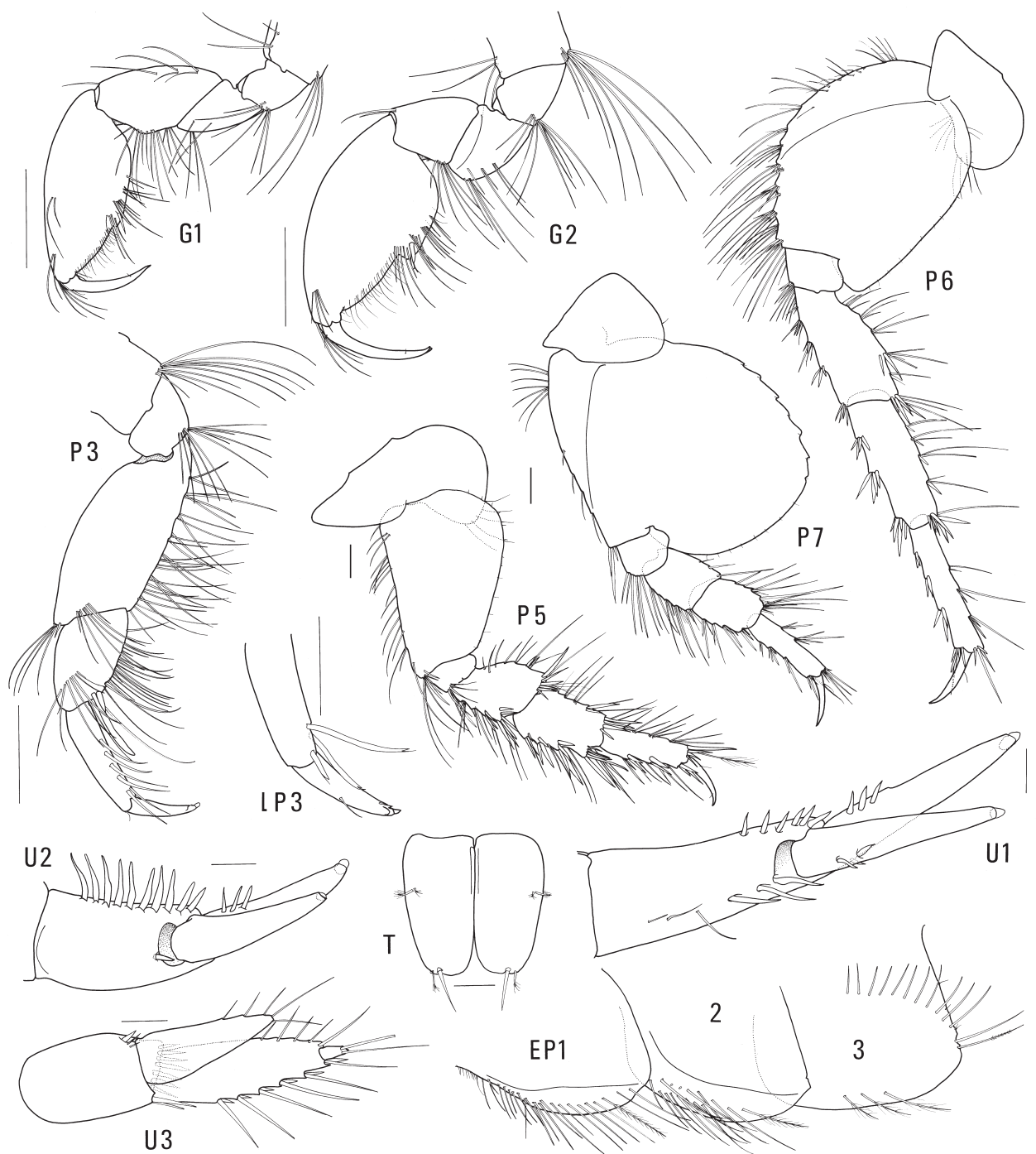


Figure 18. *Zeaphoxus senecio* sp. nov., holotype, female “d”, NIWA 115621, 12.58 mm, The Snares, New Zealand. Scales for G1–2, P3 represent 0.5 mm, other scales represent 0.1 mm.

Setal formula = 0. Telson short, length to width ratio = 1:1, fully cleft, each apex broad, truncate, acclivity absent, with lateral setule, with long robust seta and setule, midlateral setules diverse.

MALE. Unknown.

JUVENILE, based on NIWA 115622, juvenile “e” 5.48 mm length. As in adult but setae sparser and other parts not as well developed: antenna 1 primary flagellum = 8-articulate, accessory = 7-articulate, article 2 of peduncle with 4 ventral setae 3-3; antenna 2 peduncle article 4 main setal formula =

4-3, article 5 = 2 and 2, dorsal robust setae of article 4 = 3, no midproximal facial robust seta set, ventral setae = 3 sets of 2 each plus pair of apicoposterior elongate robust setae, article 5 with 5 apical and ventral robust setae; right lacinia mobilis distal branch with 4 teeth, right accessory setal row with 7.5 multicuspidate stout setae, left accessory setal row with 8.5 multicuspidate stout setae. Gnathopod 1 propodus more slender and attenuated than in adult. Pereopod 3 merus facial setae = 2, of carpus = 2; setal formula on propodus of pereopods 3–4 = 2-1-1 and 3-1-1. Pereopod 7 basis posterior serrations = 5. Epimeron 2 facial setae = 6 and 1, epimeron 3

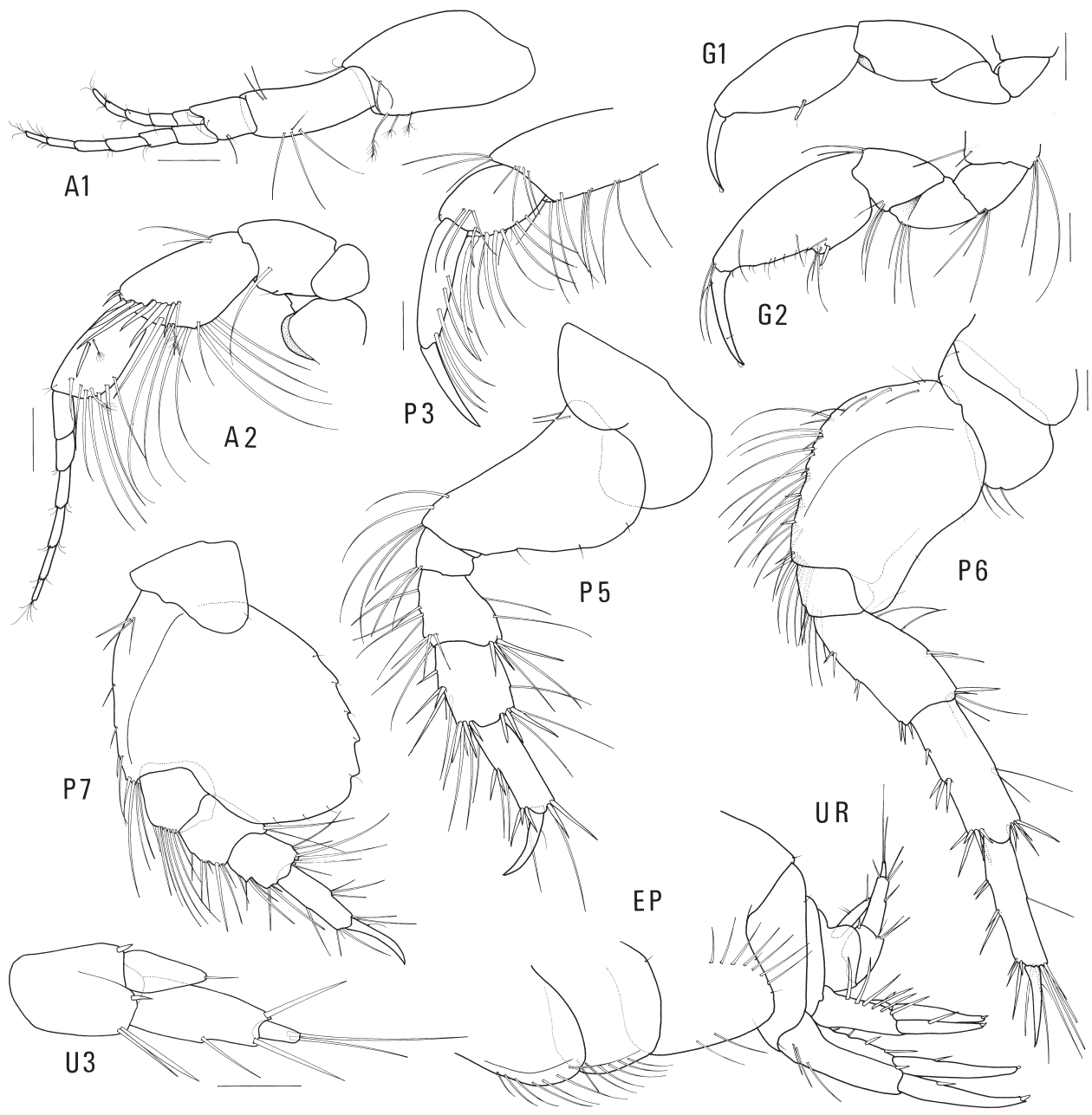


Figure 19. *Zeaphoxus senecio* sp. nov., juvenile “f-1”, AM P39545, 3.82 mm, eastern Tasman Sea. Scales represent 0.1 mm.

with 1 ventral seta, 1 setule at corner, dorsal row = 1 at rear and 6 facial. Uropod 1 robust and slender setal formulas; basofacial = 3, peduncle apicolateral = 3, outer ramus = 2, inner = 1; uropod 2 peduncle = 5, outer ramus = 1, inner = 0; uropod 3 outer ramus lateral = 1-2-2.

Adults from AM P25803 show that the robust setae on the dorsolateral margin of uropod 1 peduncle vary from 5–6.

Remarks. *Zeaphoxus senecio* sp. nov. differs from *Z. zealandicus* sp. nov. in having more robust setae on the dorsolateral margin of peduncle on uropod 1, in having similar sized robust setae on the dorsal margin of peduncle on uropod 2 and in having the proximal branch of the right lacinia mobilis much longer than distal branch.

Distribution. Tasman Sea and The Snares; 7–507 m.

Zeaphoxus zealandicus sp. nov.

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Figs 20–22

Holotype. AM P25882, female “y-2”, 11.7 mm, Otago Shelf, New Zealand, 45°48'S 170°51'E, gravel, sand, mud bottom, 65 m, P. K. Probert on RV *Munida*, MU74/198, 15 October 1974.

Etymology. Named for New Zealand.

Diagnosis. Eyes present. Head without constriction in dorsal view. Antenna 1 peduncular article 1 ventral apex not ensiform, peduncle article 2 shortened. Antenna 2 peduncle article 3 with robust setae, article 4 shortened with facial robust setae. Right mandible lacinia mobilis bifid, proximal

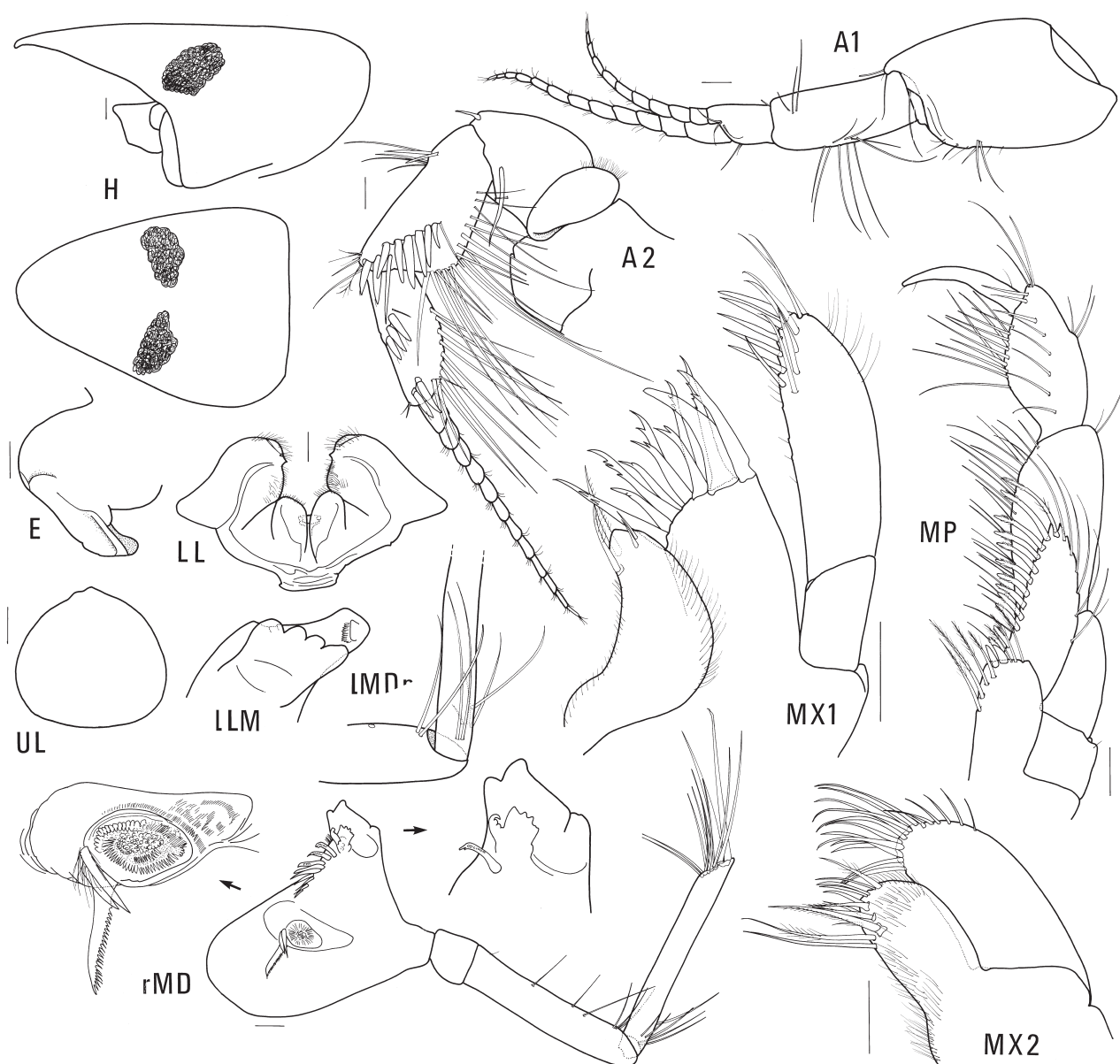


Figure 20. *Zeaphoxus zealandicus* sp. nov., holotype, female “y-2”, AM P25882, 11.7 mm, Otago Shelf, New Zealand. Scales represent 0.1 mm.

branch same length as distal branch. Maxilla 1 inner plate large, outer plate with 11 multicuspitate robust setae. Maxilliped palp article 3 weakly produced. Posteroventral corner of coxae 1–3 without tooth. Gnathopods 1–2 carpus not cryptic. Gnathopod 2 similar sized to gnathopod 1, propodus with 1 robust seta near palmar corner. Pereopods 3–4 carpus setae placed near anterodistal margin. Robust setae forming dominant posterior element on pereopods 3–4 carpus. Pereopod 5 basis broad. Pereopod 6 basis anterior margin without setae, posterodistal corner not produced to form lobe. Pereopod 7 merus, carpus, and propodus narrow; dactylus long. Urosome without basoventral setae. Epimera 1–2 without facial setae. Uropods 1–2 rami never fully spinose, rami with articulate enlarged apical nails, lacking accessory nails. Uropod 1 peduncle with 2 robust setae on dorsolateral margin. Uropod 2 peduncle dorsal margin with short apical robust setae and elongate proximal setae. Uropod 3 outer ramus article 2 with 2 long apical setae; inner ramus medium length, about $0.5 \times$ length of outer. Telson deeply

cleft, apically with 1 robust seta per lobe, marginally without setae on each side, with 1 small lateral robust seta.

Description. FEMALE, based on AM P25882, female “y-2” holotype, 11.7 mm.

Head: Eyes large, largely occluded with pigment. Head about $0.19 \times$ body length, greatest width about $0.75 \times$ length; rostrum not constricted, broad, reaching middle of article 2 on antenna 1. Antenna 1 peduncle article 1 $1.7 \times$ as long as wide, $2.3 \times$ as wide as article 2, ventral margin with about 9 setules, weakly produced dorsal apex with 1 seta; article 2 about $0.7 \times$ as long as article 1, with ventral horseshoe cycle of 9 setae; primary flagellum 12-articulate about $0.6 \times$ as long as peduncle, lacking large aesthetascs; accessory flagellum 10-articulate. Antenna 2 peduncle article 4 main setal formula = 5-3, dorsal margin with notch with 6 setae, ventral margin with 10–11 groups of 1–4 elongate to medium setae, 1 distoventral elongate robust seta; article 5 almost $0.7 \times$ as long as article 4, facial setal formula = 3-2, dorsal

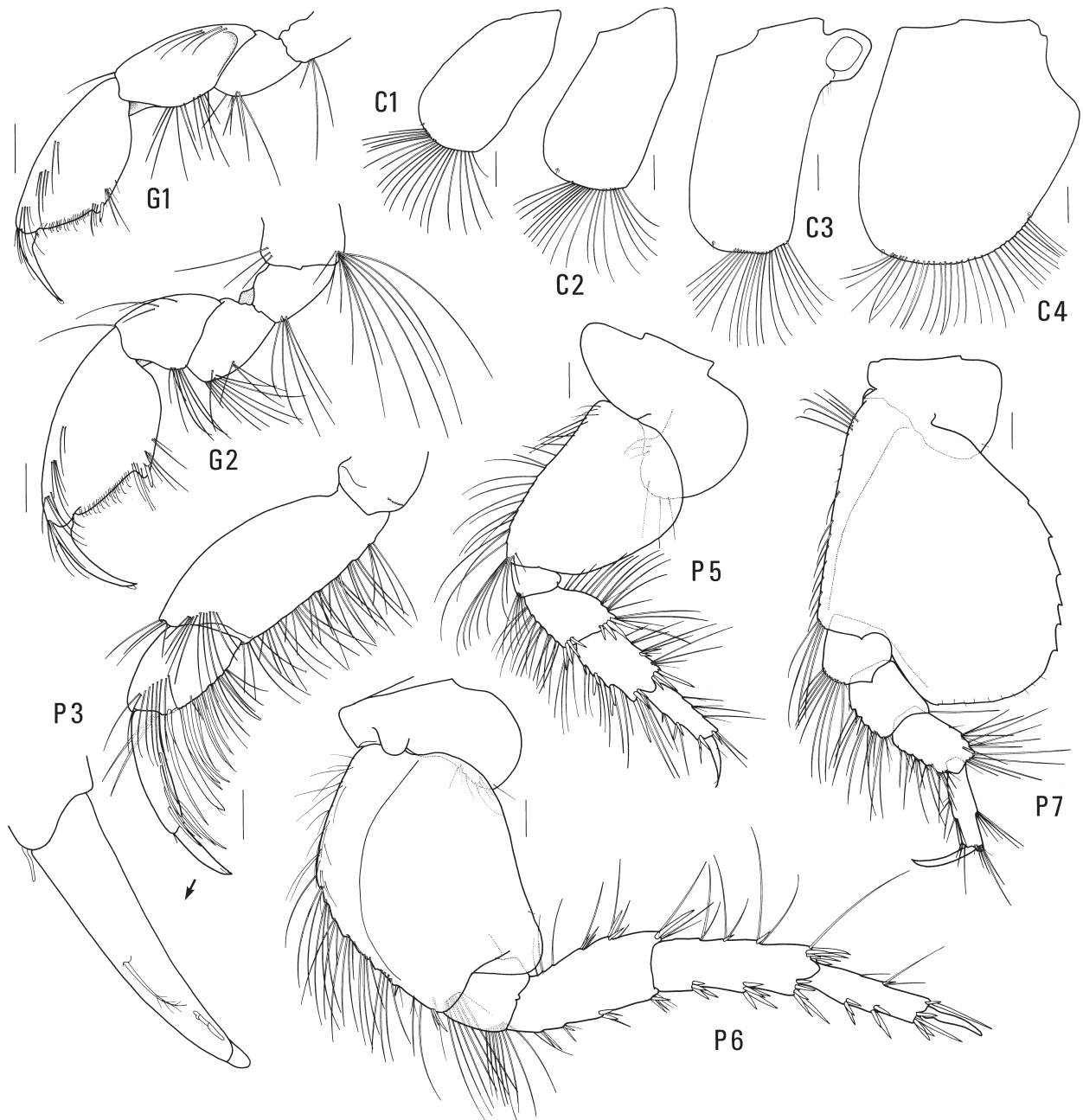


Figure 21. *Zeaphoxus zealandicus* sp. nov., holotype, female “y-2”, AM P25882, 11.7 mm, Otago Shelf, New Zealand. Scales represent 0.2 mm.

margin naked, ventral margin with 10 sets of 1 elongate seta each, 1 distoventral medium robust seta; flagellum about as long as articles 4–5 of peduncle combined, 12-articulate.

Mouthparts: Mandibles with medium palpar hump; right incisor with 3 teeth; left incisor with 2 weak humps in 2 branches; right lacinia mobilis bifid, distal branch flabellate, not shorter than proximal, proximal branch weakly denticulate; left lacinia mobilis with 4 teeth; right accessory setal row with 7 multicuspitate stout setae; molar bulbous, weak, with 1 large serrate robust seta and 2 much smaller simple robust setae, no disjunct robust setae, each molar with patch of fine setae; palp article 1 short, article 2 with 5 elongate inner setae and no outer setae, article 3 about 1.1 × as long as article 2, oblique apex with 10 elongate robust setae. Maxilla 1 inner plate large, with 2 elongate subapical pappose setae, 2 apicolateral much shorter setae; palp article

2 with 1 medial marginal robust seta, and 5 apical robust setae and 5 submarginal slender setae. Maxilla 2 plates extending subequally, of subequal breadth, outer with 5 apicolateral setae, inner with 2 medial setae. Maxilliped inner plate with 2 large apical robust setae, 3 apicofacial plumose setae, 4 medial plumose setae; outer plate with 12 medial and apical seta-teeth, 6 apicolateral setae; some setae set into cuspidate recesses; palp article 1 with 1 apicolateral seta, medial margin of article 2 moderately setose, article 3 scarcely produced, with 6 facial setae, 3 lateral setae, nail of article 4 immersed and almost absent, with 2 accessory setules.

Pereon: Coxa 1 not expanded distally, anterior margin almost straight, main ventral setae of coxae 1–4 = 20–19–19–31, posterior most seta of coxae 1–2 shortened; anterior and posterior margins of coxa 4 weakly divergent, posterior margin almost vertical, straight, posteroventral margin

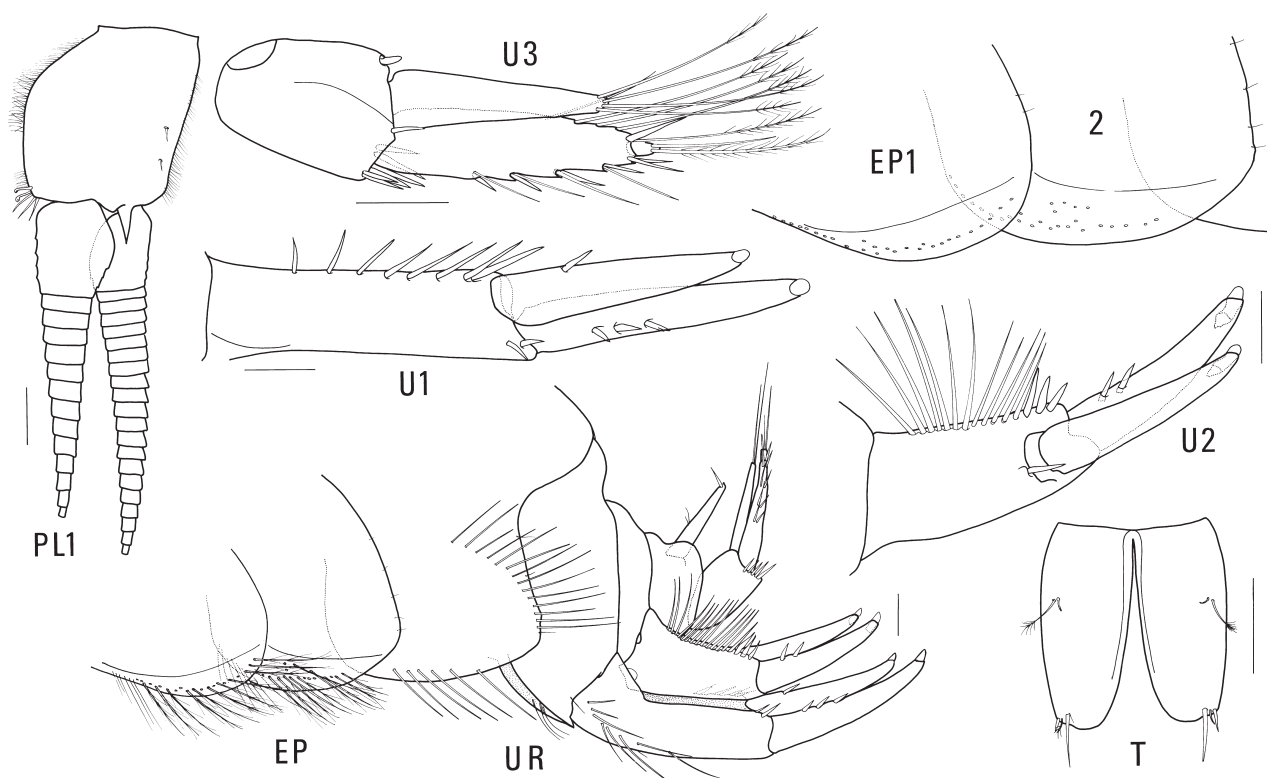


Figure 22. *Zeaphoxus zealandicus* sp. nov., holotype, female “y-2”, AMP25882, 11.7 mm, Otago Shelf, New Zealand. Scales represent 0.2 mm.

not bevelled, posterodorsal corner rounded, posterodorsal margin of medium length, concave, width to length ratio of coxa 4 = 18:21. Coxae 5–7 posteroventral setule formula = 3-7-1. Gnathopods 1–2 weakly diverse, gnathopod 2 slightly enlarged, width ratios of carpus-propodus on gnathopods 1–2 = 12:14 and 13:19, length ratios = 26:27 and 19:33; palmar humps short to medium, palms acute, with 1 robust seta defining palm; gnathopods 1–2 carpus medium and short respectively, of gnathopod 1 ovate, posterior margin of gnathopod 1 flat, of gnathopod 2 lobate, of gnathopod 2 short, triangular. Pereopods 3–4 similar, facial setae formula on merus = 11, on carpus = 9; main robust seta of carpus extending to M.110 on propodus, carpus without posteroproximal robust setae; setal formula of propodus = 4-2 plus mid-distal robust setae very elongate and often curved, robust setae acclivity on inner margin of dactyls of pereopods 3–4 weak to absent. Pereopods 5–6 merus-carpus narrow, facial robust setae rows poorly developed, facial ridge formula on basis of pereopods 5–7 = 0-1-1, ridge of pereopod 7 long; width ratios of basis, merus, carpus, propodus of pereopod 5 = 23:10:8:4, of pereopod 6 = 35:13:9:6, of pereopod 7 = 42:11:8:4, length ratios of pereopod 5 = 33:12:15:14, of pereopod 6 = 48:25:29:22, of pereopod 7 = 55:12:13:15. Pereopod 5 basis tapering distally. Pereopod 7 basis reaching middle of merus. Pereopods 5 and 7 merus without especially elongate posterodistal lobe; medial apex of propodus truncate, uncombed, deeply fimbriate.

Pleon: Epimeron 1 posteroventral corner rounded, posterior margin convex, with setule (not shown), anteroventral margin with 6–9 short setae, ventral margin with 19–21 elongate setae, ragged anteriorly (some broken off in figure). Epimeron 2 posteroventral corner rounded, posterior margin convex, with 5 setules, facial setae = 2–3 irregular rows of 19, anterior setae irregular and set vertically.

Epimeron 3 posteroventral corner subquadrate, posterior margin straight, scarcely serrate, with 3 setules, ventral margin with 6 widely spread setae, face with obliquely horizontal posterior row of 14 setae. Urosomite 1 with 3 midventral setae; articulation line complete in middle. Urosomite 3 weakly protuberant dorsally. Uropods 1–2 rami with articulate enlarged apical nails, lacking accessory nails. Uropod 1 peduncle with 2 small apicolateral robust setae and 8 basofacial setae, medially with 4 small marginal robust setae, outer ramus with 3 dorsal robust setae, inner with 1 medial. Uropod 2 peduncle with 12–14 dorsal setae and 3 apical robust setae, medially with 1 medium apical robust seta, outer ramus with 2 dorsal robust setae, inner naked. Uropod 3 peduncle with 6 apicoventral robust setae, dorsally with 1 lateral robust seta, 1 medial robust seta; rami submasculine, inner extending to M.80 on article 2 of outer ramus, apex with 5 setae, other margins naked, article 2 of outer ramus tiny, with 2 elongate setae, medial margin of article 1 with 4 setae, lateral margin with 4 acclivities, setal formula = 1-1-1-1-2 setal formula = 1-1-1-1-0. Telson elongate, length to width ratio = 15:30, fully cleft, each apex broad, truncate, acclivity absent, with tiny lateral robust seta, setule next medial shorter than robust seta, next medial robust setae elongate, basodorsal setules diverse.

MALE: Unknown.

Remarks. *Zeaphoxus zealandicus* sp. nov. differs from *Z. senecio* sp. nov. in having fewer robust setae on the dorsolateral margin of peduncle on uropod 1, in having variably sized robust setae on the dorsal margin of peduncle on uropod 2 and in having the proximal branch of the right lacinia mobilis more similar in size to the distal branch.

Distribution. New Zealand, Otago Shelf; 65–93 m.

Conclusion

This paper is a first step in documenting the extensive phoxocephalid fauna present in New Zealand waters. There are many species identified to only Phoxocephalidae in the NIWA Invertebrate collection, and this paper just touches the surface of the diversity and complexity of this fauna. Jim Lowry and, to some extent, Jerry Barnard worked hard to try and document and describe this diversity and were constantly struck by the extent of the diversity and range of this group of amphipods. There is much more work to be done, for many more years.

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References

- Alonso de Pina, G. M. 1993. *Linca pinata*, a new phoxocephalid genus and species (Crustacea: Amphipoda) from the Argentine continental shelf. *Proceedings of the Biological Society of Washington* 106: 497–507.
- Alonso de Pina, G. M. 2001. Two new phoxocephalids (Crustacea: Amphipoda: Phoxocephalidae) from the south-west Atlantic. *Journal of Natural History* 35: 517–537.
<https://doi.org/10.1080/00222930151098198>
- Alonso de Pina, G. M., M. Rauschert, and C. De Broyer. 2008. A catalogue of the Antarctic and sub-Antarctic Phoxocephalidae (Crustacea: Amphipoda: Gammaridea) with taxonomic, distribution and ecological data. *Zootaxa* 1752: 1–40
<https://doi.org/10.11646/zootaxa.1752.1.1>
- Andrade, L. F., and A. R. Senna. 2019a. Two new species of *Cephalophoxoides* Gurjanova, 1977 (Crustacea: Amphipoda: Phoxocephalidae) from southeastern Brazil, with comments on the taxonomic status of the genus. *Zootaxa* 4712: 531–551.
<https://doi.org/10.11646/zootaxa.4712.4.3>
- Andrade, L. F., and A. R. Senna. 2019b. First record of the genus *Limnoporeia* Fearn-Wannan, 1968 (Crustacea: Amphipoda: Phoxocephalidae) from the Atlantic Ocean, with description of a new species. *Journal of Natural History* 53: 2517–2531.
<https://doi.org/10.1080/00222933.2019.1705931>
- Andrade, L. F., and A. R. Senna. 2020a. *Atlantiphoxus wajapi* n. gen., n. sp. (Crustacea: Amphipoda: Phoxocephalidae), a new deep-sea amphipod from the southwestern Atlantic. *Scientia Marina* 84(2): 155–166.
<https://doi.org/10.3989/scimar.05001.16A>
- Andrade, L. F., and A. R. Senna. 2020b. A novel species of *Heterophoxus* Shoemaker, 1925 (Crustacea, Amphipoda, Phoxocephalidae) from southeast and southern Brazil, with an identification key to world species of the genus. *European Journal of Taxonomy* 592: 1–16.
<https://doi.org/10.5852/ejt.2020.592>
- Barnard, J. L. 1961. Gammaridean Amphipoda from depths of 400 to 6000 meters. *Galathea Report* 5: 23–128.
- Barnard, J. L., and M. M. Drummond. 1976. Clarification of five genera of the Phoxocephalidae (Marine Amphipoda). *Proceedings of the Biological Society of Washington* 88: 515–547.
- Barnard, J. L., and M. M. Drummond. 1978. Gammaridean Amphipoda of Australia, Part III: The Phoxocephalidae. *Smithsonian Contributions to Zoology* 245: 1–551.
<https://doi.org/10.5479/si.00810282.245>
- Barnard, J. L., and G. S. Karaman. 1991. The families and genera of marine gammaridean Amphipoda (except marine gammaroids). *Records of the Australian Museum, Supplement* 13 (part 2): 419–866.
<https://doi.org/10.3853/j.0812-7387.13.1991.367>
- Barnard, K. H. 1930. Amphipoda. *British Antarctic ("Terra Nova") Expedition, 1910. Natural History Reports, Zoology* 8: 307–454.
- Chiesa, I. L., and G. M. Alonso. 2011. Redescription and generic assignment of *Fuegiphoxus uncinatus* (Chevreux, 1912) (Crustacea, Amphipoda, Phoxocephalidae). *Zoosystema* 33: 219–233.
<https://doi.org/10.5252/z2011n2a5>
- De Broyer C., J. K. Lowry, K. Jażdżewski, and H. Robert. 2007. Part 1. Catalogue of the Gammaridean and Corophiidean Amphipoda (Crustacea) of the Southern Ocean, with distribution and ecological data. In *Census of Antarctic Marine Life: Synopsis of the Amphipoda of the Southern Ocean, Volume 1*, ed. C. De Broyer. *Bulletin de l'Institut royal des Sciences naturelles de Belgique* 77(supplement 1): 1–325.
- Gurjanova, E. 1977. Novoe v sistematike semejstva Phoxocephalidae sensu lato (Amphipoda, Gammaridea). *Soobshchenie I. [Some new data in taxonomy of family Phoxocephalidae sensu lato (Amphipoda, Gammaridea). Report 1.] Issledovanija Fauny Morej* 21(29): 67–87.
- Horton, T., J. Lowry, C. De Broyer, D. Bellan-Santini, C. O. Coleman, L. Corbari, M. J. Costello, M. Daneliya, J.-C. Dauvin, C. Fišer, R. Gasca, M. Grabowski, J. M. Guerra-García, E. Hendrycks, L. Hughes, D. Jaume, K. Jażdżewski, Y.-H. Kim, R. King, T. Krapp-Schickel, S. LeCroy, A.-N. Lörz, T. Mamos, A. R. Senna, C. Serejo, B. Sket, J. F. Souza-Filho, A. H. Tandberg, J. D. Thomas, M. Thurston, W. Vader, R. Väinölä, R. Vonk, K. White, and W. Zeidler. 2022. *World Amphipoda Database. Phoxocephalidae G.O. Sars, 1891*. Accessed 4 October 2022 through: World Register of Marine Species at:
<https://www.marinespecies.org/aphia.php?p=taxdetails&id=101403>
- Hurley, D. E. 1954. Studies on the New Zealand Amphipodan Fauna No. 3. The Family Phoxocephalidae. *Transactions of the Royal Society of New Zealand* 81: 579–599.
- Karaman, G. S. 1980. *Cocoharpinia iliffei*, new genus and species from Bermuda, with remarks to other genera and species (Fam. Phoxocephalidae). Institute for Biological and Medical Research, Montenegro, Titograd., 9–10, pp. 149–175.
- Lowry, J. K., and A. A. Myers. 2017. A phylogeny and classification of the Amphipoda with the establishment of the new order Ingolfiellida (Crustacea: Peracarida). *Zootaxa* 4265: 1–89.
<https://doi.org/10.11646/zootaxa.4265.1.1>

- Ortiz, M., and R. Lalana. 1999. Amphipoda (Crustacea) from Indonesia collected by the expedition of "Grigore Antipa" Museum from Bucharest. *Travaux du Museum d'histoire naturelle* 41: 155–198.
- Sars, G. O. 1891. *An account of the Crustacea of Norway, with short descriptions and figures of all the species*. Volume I: 69–212, pls. 25–72. Christiania and Copenhagen: Cammermeyers Forlag. [Lysianassidae (continued); Pontoporeiidae, Phoxocephalidae, Ampeliscidae, Stegocephalidae, Amphilochidae]
- Senna, A. R. 2010. A new genus and five new species of Phoxocephalidae (Crustacea: Amphipoda) from the south-east Brazilian deep sea. *Journal of Natural History* 44: 2075–2118. <https://doi.org/10.1080/00222933.2010.486081>
- Senna, A. R., and J. F. Souza-Filho. 2011. A new species of *Pseudharpinia* (Amphipoda: Haustorioidea: Phoxocephalidae) from South-eastern Brazilian continental shelf. *Nauplius* 19: 7–16. <https://doi.org/10.1590/S0104-64972011000100002>
- Spencer, M. K. 2022. *Taxonomic and Systematic Studies of the Phoxocephalidae (Amphipoda, Crustacea) using Cladistic Morphological Character Analyses, with a Case Study of the Harpiniinae from Environmental Impact Assessment surveys*. Unpublished PhD Thesis. Southampton: University of Southampton.
- Taylor, J. 2002. A review of the genus *Wildus* (Amphipoda: Phoxocephalidae) with a description of a new species from the Andaman Sea, Thailand. *Phuket Marine Center Special Publication* 23(1): 253–263.
- Taylor, J. 2003. *The Impact of Phylogenetic Analysis on the Existing Classification of the Phoxocephalidae (Amphipoda)*. Unpublished PhD thesis. Melbourne: University of Melbourne, 263 pp.
- Taylor, J. 2006. A new species of *Leongathus* from the Tasman Sea collected during the 2003 NORFANZ Expedition (Crustacea: Amphipoda: Phoxocephalidae). *Memoirs of Museum Victoria* 63(2): 207–213. <https://doi.org/10.24199/j.mmv.2006.63.16>
- Taylor, J., and G. C. B. Poore. 2001. Descriptions of new species of *Birubius* (Amphipoda: Phoxocephalidae) from Australia and Papua New Guinea with comments on the *Birubius-Kulgaphoxus-Tickalerus-Yan* complex. *Memoirs of Museum Victoria* 58(2): 255–295. <https://doi.org/10.24199/j.mmv.2001.58.15>
- Thomson, G. M. 1882. Additions to the Crustacean Fauna of New Zealand. *Transactions and Proceedings of the New Zealand Institute* 14: 230–238.