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Amathillopsidae (Crustacea: Amphipoda) from New Zealand, Including the Description of a New Species

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Abstract. *Amathillopis lowry*, a new species of the family Amathillopsidae is described from the south west Pacific. *In situ* images show this amphipod species new to science clinging to a stalked sponge in 4600-metre depth. This increases the number of New Zealand amathillopsid amphipods to three.

Introduction

The genus *Amathillopsis* currently consists of 13 species globally with only one (prior to this paper), *Amathillopsis grevei* J. L. Barnard, 1961, recorded from New Zealand waters. There are, however, three species known from neighbouring regions: *Amathillopsis australis* Stebbing, 1883, from the Coral Sea; and *A. charlottae* Coleman, 1998 and *A. roroi* Coleman & Coleman, 2008, both from the Antarctic Peninsula. Species of *Amathillopsis* are often enigmatic, being recorded only rarely and mostly in more recent years as deep-sea exploration technology has developed.

Recently in New Zealand waters, amathillopsid amphipods have been observed to cling to stalked sponges in over 4000 m depths. Photographs and video footage were taken by the Remotely Operated Vehicle *Kiel 6000* from the RV *Geomar Kiel* and samples of amphipods collected. Species of *Amathillopsis* have now been observed by ROVs and other camera systems on a number of occasions globally, clinging in pairs (and occasionally in larger numbers), to tubular or stalk-like structures growing in soft substrates, and also on corals attached to hard substrates (Lörz & Horton, 2021). This recently observed species of *Amathillopsis* has been identified as new to science and is described here in detail. An extension of range for the Antarctic *Amathillopsis charlottae* into the New Zealand EEZ (recorded here) now brings the total of species in this genus in New Zealand waters to three (Fig. 1).

The new species, and hence this paper, is dedicated to Dr Jim Lowry as his exploration of both New Zealand and Antarctic waters lead to the discovery of many new amphipod species as well as range extensions of others.

Materials and methods

Collection methods and locations. During the SO254 expedition on the RV *Sonne*, the ROV *KIEL 6000* was deployed in northern New Zealand waters at station 10ROV03, in the abyssal basin between the Three Kings Ridge and Colville Ridge, Pacific Ocean (30°59.448396'S 177°30.059508'W, depth 4159.4 m), conducting photo and video transects as well as physical sampling. The specimens of the new species of *Amathillopsis* were initially photographed and filmed *in situ*, after which the ROV collected them into a sampling box. Once on board, the specimens collected were immediately photographed and preserved in ethanol.

Keywords: Amphipoda, new species, New Zealand, Remotely Operated Vehicle (ROV), abyssal
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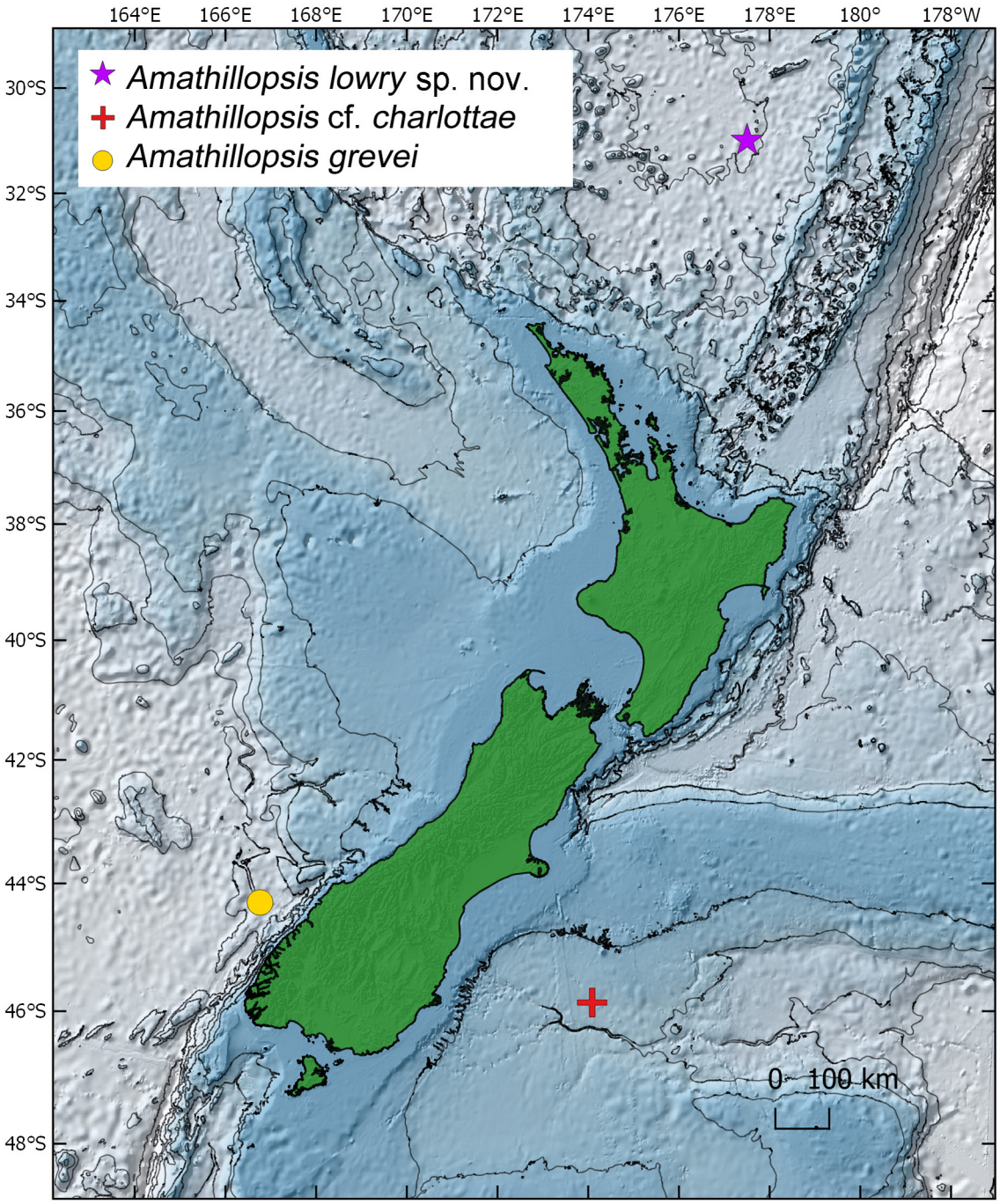

Figure 1. Distribution of the three species of *Amathillopis* known from New Zealand waters: *Amathillopis lowry* sp. nov.; *A. grevei* Barnard, 1961; and *A.* cf. *charlottae* Coleman, 1998.

Taxonomic methods. The adult male holotype and female paratype specimens were photographed *in situ* by the ROV *KIEL 6000* and photographed on board of the RV *Sonne*.

The pencil drawings were made using both a Leica M9.5 (dissecting microscope) and a Zeiss Axioskope 2plus (compound microscope). Pencil drawings were scanned and inked digitally using Adobe® Photoshop and a WACOM™ digitize r tablet. Type material is deposited in the Invertebrate Collection of the National Institute of Water & Atmospheric Research, Wellington, New Zealand (NIWA). Setal and mouthpart classifications follow Watling (1989) and Lowry & Stoddart (1992, 1993, 1995).

The following abbreviations are used in Figs 2, 3–5, 9, 10: A, antenna; G, gnathopod; H, head; Hb, habitus; LL, lower lip; Md, mandible; Mx, maxilla; Mxp, maxilliped; P, pereopod; T, telson; U, uropod; UL, upper lip; L, left; R, right.

Genetic methods. DNA was extracted from specimens using the Qiagen DNeasy Blood and Tissue kit (Qiagen GmbH, Hilden) according to the manufacturer's instructions. Tissue was extracted from the second pleopod of the animals. DNA was diluted at 1:10 before amplification by PCR. Each PCR reaction contained 5 µL of 5× reaction buffer, 25 pmol of both the forward and reverse primer, dNTPs to a final

concentration of 0.2 mM each, and 0.5 U Kapa 2G Robust Hotstart DNA polymerase Taq (Sigma-Aldrich, St Louis, MO). The COI marker was amplified and sequenced using primers LCO1490 and HCO2198 (Folmer *et al*., 1994). PCR settings for amplifying CO1 sequences consisted of initial denaturing of 5 min at 95°C, 35 cycles of 30 s at 95°C, 30 s at 48°C, 45 s at 72°C, and final extension of 5 min at 72°C. PCR products were purified using ExoSAP-IT (USB, Cleveland, Ohio, USA) according to the manufacturers' instructions, and were sequenced at Macrogen Inc., (Seoul, South Korea).

Sequences were trimmed and aligned using Geneious Prime 2021.2.2 (https://www.geneious.com) and compared to sequences in GenBank using BLAST (Altschul *et al*., 1990). COI derived from the New Zealand specimens were aligned with representative sequences from other *Amathillopsis* species in GenBank. Relevant voucher information, taxonomic classification and sequence were deposited in GenBank (ON644605).

Systematics

Order Amphipoda Latreille, 1816

Suborder Amphilochidea Lowry & Myers, 2017

Family Amathillopsidae Pirlot, 1934

Subfamily Amathillopsinae Pirlot, 1934

Amathillopsis Heller, 1875

Amathillopsis Heller, 1875: 35.—Stebbing, 1906: 384.—Gurjanova, 1955: 209 (key).—J. L. Barnard, 1969: 394.—J. L. Barnard & Karaman, 1991: 390.

Acanthopleustes Holmes, 1908: 533 (type species *Acanthopleustes annectens* Holmes, 1908, by original designation).

Type species. *Amathillopsis spinigera* Heller, 1875 (by original designation).

Species composition. *Amathillopsis affinis* Miers, 1881, *A. annectens* (Holmes, 1908), *A. atlantica* Chevreux, 1908, *A. australis* Stebbing, 1883, *A. charlottae* Coleman, 1998, *A. comorensis* Ledoyer, 1986, *A. grevei* J. L. Barnard, 1961, *A. inkenae* Lörz & Horton, 2021, *A. pacifica* Gurjanova, 1955, *A. pacifica margo* J. L. Barnard, 1967, *A. roroi* Coleman & Coleman, 2008, *A. septemdentata* Ledoyer, 1978, *A. spinigera* Heller, 1875, *A. takahashiae* Tomikawa & Mawatari, 2006.

Amathillopsis lowry sp. nov.

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Figs 2–8

Holotype: NIWA 127043, male, 34.5 mm, abyssal basin between Three Kings and Colville Ridges, Pacific Ocean, 30°59.448396'S 177°30.059508'W, depth 4159.4 m, SO254_10ROV03, 01 February 2017. **Paratype**: NIWA 156301, female, 29.5 mm, collected with holotype.

Diagnosis. Pereonite 3 without mid-dorsal projection, pereonite 4 with small, rounded mid-dorsal projections. Pereonites 5–7 with large mid-dorsal projections, increasing in size. Pleonites 1–3 mid-dorsal projections large and angular. Urosomite 1 mid-dorsal projection small and rounded, urosomites 2 without obvious carination and urosomite 3 with slight rounded hump distally. Male gnathopod 1–2 posterodistal basis lobe reduced, female gnathopods 1 and 2 strongly developed. Small, acute tooth on posterodistal corner of epimeron 3. Telson elongated (longer than wide), developed into a weakly trifid apex.

Description of holotype (male, 34.5 mm, NIWA127043). *Head* slightly shorter than pereonites 1 and 2 combined, rostrum very short, pointed, lateral cephalic lobe strongly quadrate, eyes present, pigmented, white in fresh specimen. Pereonites 1–3 indistinctly keeled dorsally; pereonite 4–7 with mid-dorsal curved processes, increasing in length. Pleonites 1–3 each with posteriorly curved mid-dorsal process. Epimeral plate 1 with ventral margin rounded, posteroventral corner rounded; epimeral plates 2 with ventral margin rounded, posteroventral corner toothed; epimeral plate 3 with ventral margin curved and posteroventral corner produced into a small acute tooth. Urosomite 1 weakly carinated with rounded process, urosomite 2 lacking dorsal armature, urosomite 3 weakly dorsally carinate with small, rounded mid-dorsal process. Antenna 1 as long as body length, with peduncular articles 1, 2, and 3 in length ratio of 1.0: 1.1: 0.4, respectively; peduncular 1 article 1 longer than head length; accessory flagellum uniarticulate, spine-like; primary flagellum consisting of more than 60 articles. Antenna 2 0.8 times as long as antenna 1; peduncular article 3 reaching to one-third length of peduncular article 1 of antenna 1; peduncular article 4 long, 1.7 times as long as peduncular article 5, flagellum slightly longer than peduncle, 54-articulate.

Mouthparts. Upper lip with slight depression in apical margin, bearing 2 groups of setae. Lower lip with outer lobes broad, setulose; inner lobes indistinct, fused. Mandibles with left incisor bearing 9 teeth, left lacinia mobilis with 4 teeth; accessory setal row with 12 setae, some bearing row of minute protuberances. Right mandible incisor with 6 teeth, lacinia mobilis with 4 teeth, and accessory setal row with 12 setae. Molar developed, triturative. Palp articles 1, 2, and 3 in length ratio of 1: 3: 3, respectively (for both left and right sides), article 1 with setae on distal corners, article 2 with marginal and submarginal setae, and article 3 with marginal and terminal setae. Maxilla 1 with inner plate ovoid and bearing 3 short, and 4 long slender plumose setae; outer plate rectangular, with 10 large robust setae (5 toothed); palp 2-articulate, longer than outer plate, terminally with 10 long robust setae, outer lateral margin lined with 7 slightly plumose slender setae. Maxilla 2 inner plate slightly broader than outer plate, bearing row of long plumose setae. Maxilliped inner plate reaching base of palp, with 3 robust nodular setae on distomedial margin, distolateral margin with apical robust setae; outer plate exceeding distal margin of palp article 1. Maxilliped palp long, raptorial, broken off; articles 2 and 3 heavily setose.

Pereon. Coxae 1 rounded, coxae 2–4 produced angularly anteroventrally. Coxae 5 and 6 wider than long, bilobate. Coxa 7 small and rounded. Gnathopod 1 subchelate, basis posterior margin without robust setae, posterodistal lobe vestigial; ischium about half length of merus; merus produced posterodistally to form narrow rounded lobe; carpus slightly shorter than propodus, posteroventral lobe

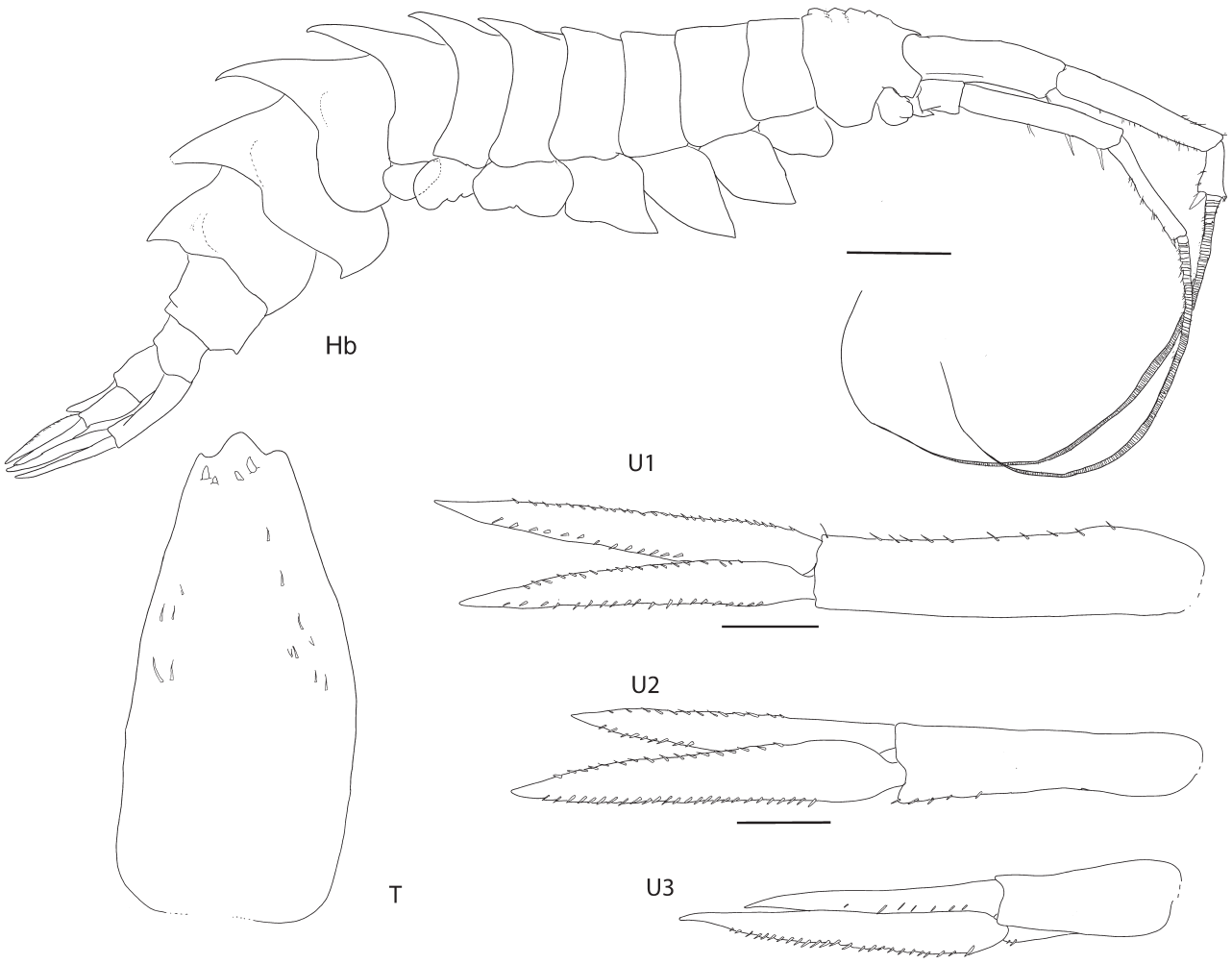

Figure 2. *Amathilliopsis lowry* sp. nov., holotype male, 34.5 mm, NIWA 127043. Scale: Hb 5 mm, U1–3 1 mm, T 0.75 mm.

broadly rounded, allowing propodus to fold over distally; propodus 2 times longer than wide, ovoid, with 5 medial rows of 4–12 slender simple setae, anterior margin with 3 long rows of 5–15 long slender simple setae and 3 tufts of 2 or 3 separate small slender setae; palm not differentiated from posterior margin, lined with tufts of slender setae and 5 short robust setae along convex palm. Propodus with row of 12 long slender simple setae distally. Dactylus long, slender and gently curved, reaching length of propodus. Gnathopod 2 subchelate, basis with posterodistal lobe reduced; ischium half length of merus. Merus produced posterodistally to form acute lobe lined with long slender simple setae. Carpus twice as long as merus and 0.75 times as long as propodus; ventral lobe broadly rounded, slightly directed distally, positioned allowing propodus to fold over; propodus narrow (twice as long as broad), ovoid. Anterior margin lined with 5 rows of slender simple setae containing 2–10 setae; medial surface with 6 rows of 4–7. Palm not differentiated from posterior margin, convex and lined with long slender simple setae and 12 short robust setae. Dactylus long, slender, gently curved, reaching length of propodus. Pereopod 3 basis with row of robust setae along weakly convex posterior margin, ischium short, as long as wide; merus margins subparallel with slight anterior curvature, anteroventral lobe; propodus wider and longer than merus; dactylus half-length of propodus, rounded. Pereopod 4 similar to pereopod 3. Pereopods 5–7 anterior and posterior margins of basis sub-parallel, linear, posterior lobe lacking; ischium short, as long as wide; merus margins subparallel with slight anterior curvature; proportions of carpus: propodus: dactylus is 18: 22: 17.

Uropods. Uropod 1 long, peduncle as long as inner ramus, medial margin of peduncle with robust setae, inner and outer ramus lateral and medial margins with robust setae, outer ramus 0.9 times as long as inner. Uropod 2 with peduncle length 0.6 times inner ramus, lateral margin with robust setae; outer ramus same length as peduncle, lateral and medial margins with robust setae; outer ramus 0.6 times inner, lateral and medial margins with robust setae. Uropod 3 peduncle length nearly half length of inner ramus; dorsomedial margin of peduncle with 2 robust setae distally; inner ramus with lateral and medial margins bearing robust setae, outer ramus 0.8 times as long as inner, lateral and medial margins with robust setae. Telson length 1.5 times width, each side bearing 2 short robust setae apically plus a number of small slender setae medially. Apically having appearance of being trifid, however, but appearing slightly uneven, possibly owing to damage.

Table 1. Comparison of morphological characteristics of New Zealand amathillopsid species.

character	*A. lowry*	*A. grevei*	*A. charlottae*	*A.* cf. *charlottae*
pereonites 1–4 mid-dorsal	keeled on 4	absent	keeled on 2–4	absent
pereonites 5–7 mid-dorsal projections	strong, acute, increasing in size posteriorly	medium, acute, increasing in size posteriorly	strong, acute, increasing in size posteriorly	medium to strong, acute, increasing posteriorly
pleonites 1–3 mid-dorsal	strong, acute on 1–3, slightly decreasing in size	medium, acute on 1–3, decreasing in size	strong, acute on 1–2, slightly smaller on 3	strong, acute on 1–3, decreasing in size
urosomite 1	mid-dorsal projection	present (weak)	absent	absent
gnathopod posterodistal basis lobe	reduced/absent on gnathopod 1 and 2 (male), strongly developed on gnathopod 1 and 2 (female)	slightly developed on gnathopod 2 only	developed on gnathopod 1 and 2	developed on gnathopod 1 and 2
mandible palp article 3 : article 2 length	1 : 1	unknown	1 : 1	1 : 1
telson	weakly trifid	emarginate	entire	weakly emarginate
antenna 1 accessory flagellum	uniarticulate, spine-like	uniarticulate, ordinary	uniarticulate, ordinary	uniarticulate, ordinary.

Variation. Paratype female, 29.5 mm, in situ photographed (Fig. 5B) and photographed on board (Figs 7, 8). Antenna 1 peduncular articles of different proportion from male. Spine-like accessory flagellum short. Gnathopod 1 basis expanded to form large posterodistal lobe lined on both sides by many short robust setae reaching almost to junction with coxa; basis medial face lined with rows of long slender setae. Merus weakly produced to form small rounded strongly setose posterodistal lobe. Carpus expanded to form large broadly rounded lobe. Carpus medial surface with 12 long rows of 4–12 long slender simple setae. Carpus anterior margin without slender setae but defined distally by row of 8 long slender simple setae. Posterior and distal carpal margins densely lined with long slender simple setae. Carpus similar length to propodus. Propodus narrow (2.2 times as long as wide). Anterior margin of propodus lined with 3 rows of 10–12 slender, simple setae, and 2 tufts of 2 or 3 small setae. Medial face of propodus with 4 rows of 6–12 long slender setae. Gnathopod 2 basis expanded to form large posterodistal lobe lined with many short robust setae on both sides reaching up to near junction with coxa. Carpus posterior margin densely lined with rows of slender simple setae. Telson long, narrow, emarginate at apex (possibly damaged).

Etymology. The species is named for Dr Jim Lowry, our amphipod colleague who dedicated his scientific expertise to Amphipoda. Used as a noun in apposition.

Colour. In live specimens, *Amathillopsis lowry* sp. nov. has a white body and antennae; the last three segments of both gnathopods as well as the mouthparts are red. The eyes are clearly visible, solid white, in live and fresh condition, but faded when preserved.

Depth range. 4159.4 m.

Distribution. Only known from the southwest Pacific, from the abyssal basin between Three Kings and Colville Ridges, 4159.4 m.

Remarks. *Amathillopsis lowry* sp. nov. differs from all other known species of *Amathillopsis* by the combination of the following characters: pereonites 1–3 mid-dorsally smooth, pereonites 5–7 strong, acute, progressively increasing in size; urosomite 1 mid-dorsal projection reduced to a small rounded hump; gnathopod 1 and 2 posterodistal basis lobe greatly reduced and weakly setose in male but strongly present and covered in robust setae in female; telson shape entire, and longer than wide, but produced in the centre to

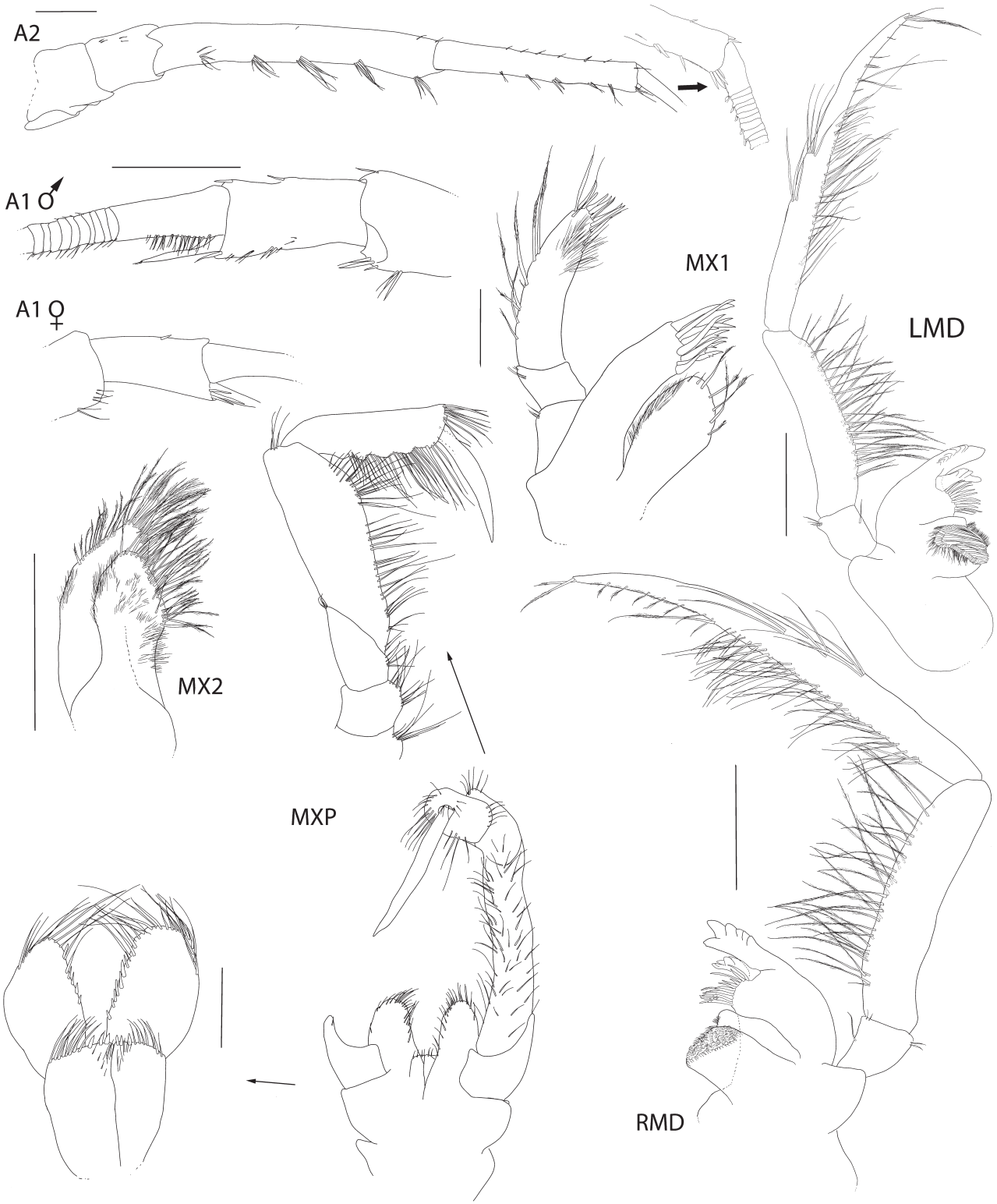

Figure 3. *Amathilliopsis lowry* sp. nov.: holotype male, 34.5 mm, NIWA 127043; paratype female, 29.5 mm, NIWA 156301 (A1 only). Scale 1 mm.

give a tridentate appearance.

Amathillopsis lowry sp. nov. is most similar to *A. charlottae*, (Table 1), collected from the Antarctic Peninsula at 607 m, and *A. grevei* from 3580 m in the Tasman Sea. The new species has a similar development of the dorsal processes and smooth urosomite 1, but no posterodistal lobes on the basis of male gnathopod 2 as in *A. charlottae*. The telson of *A. lowry* sp. nov. differs from all other species of *Amathillopsis* in the elongated shape and pseudo-trifid apical shape.

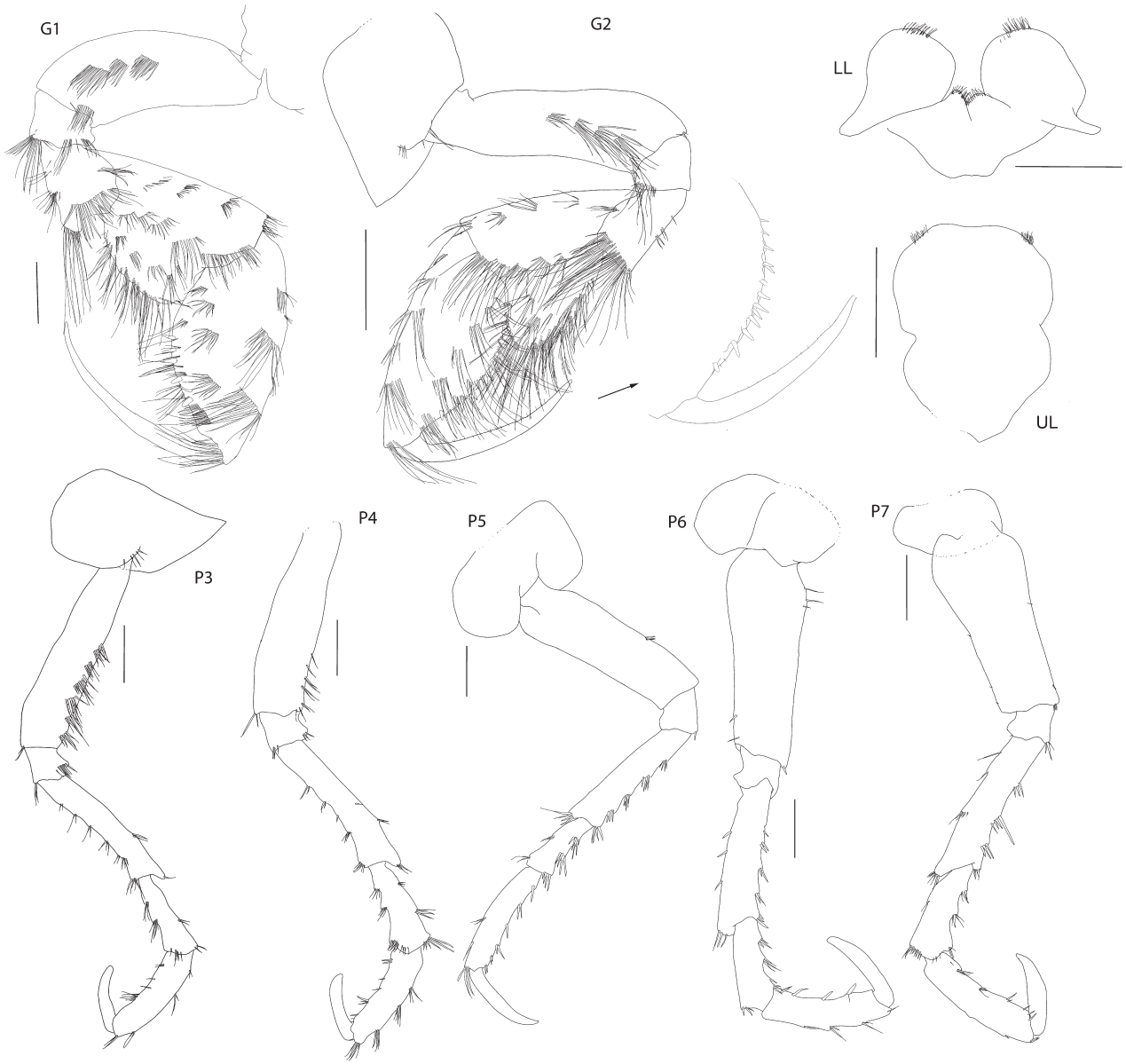

Figure 4. *Amathilliopsis lowry* sp. nov., holotype male, 34.5 mm, NIWA 127043. Scale: G1, G2 0.5 mm; all others 1 mm.

Amathillopsis grevei Barnard, 1961

Holotype: Male, 13 mm, Tasman Sea, 44°18'S 166°46'E, 3580 m, clay, 17 January 1952.

Diagnosis (after Barnard, 1961). Eyes absent; dorsal projections reaching maximum length on pereonite 7; pleonites 1–2, sometimes 3, smooth; dorsal projections commencing as small elements on pereonite 3 and increasing progressively in size through pereonite 7; anterior corners of first 4 coxae angular but not very sharp and not attenuated; coxae relatively short, quadrate; posterior lobes on propodus of gnathopods blunt, not attenuated; posterior margin of gnathopod 2 ischium slightly but not grossly lobate and bearing small marginal robust setae, this condition slightly developed on gnathopod 1; posteroventral corners of epimeron 2 and 3 greatly reduced evident; posterior end of pleonite 6 with small medial tooth; telson broad, short, apically emarginate. Accessory flagellum composed of single slender article tipped with 2 or 3 setae.

Remarks. As discussed by Lörz & Horton (2021), care should be taken in use of the relative sizes of the dorsal processes in distinguishing species because these are likely to vary ontogenetically, as in the two type specimens of *Amathillopsis inkenae* Lörz & Horton, 2021, where the larger male paratype has more pronounced, acute processes than the smaller male holotype. This is also likely to occur in other species in the genus. We consider the possibility that *Amathillopsis grevei*, which is only known from a single specimen of 13 mm, was described from an immature specimen.

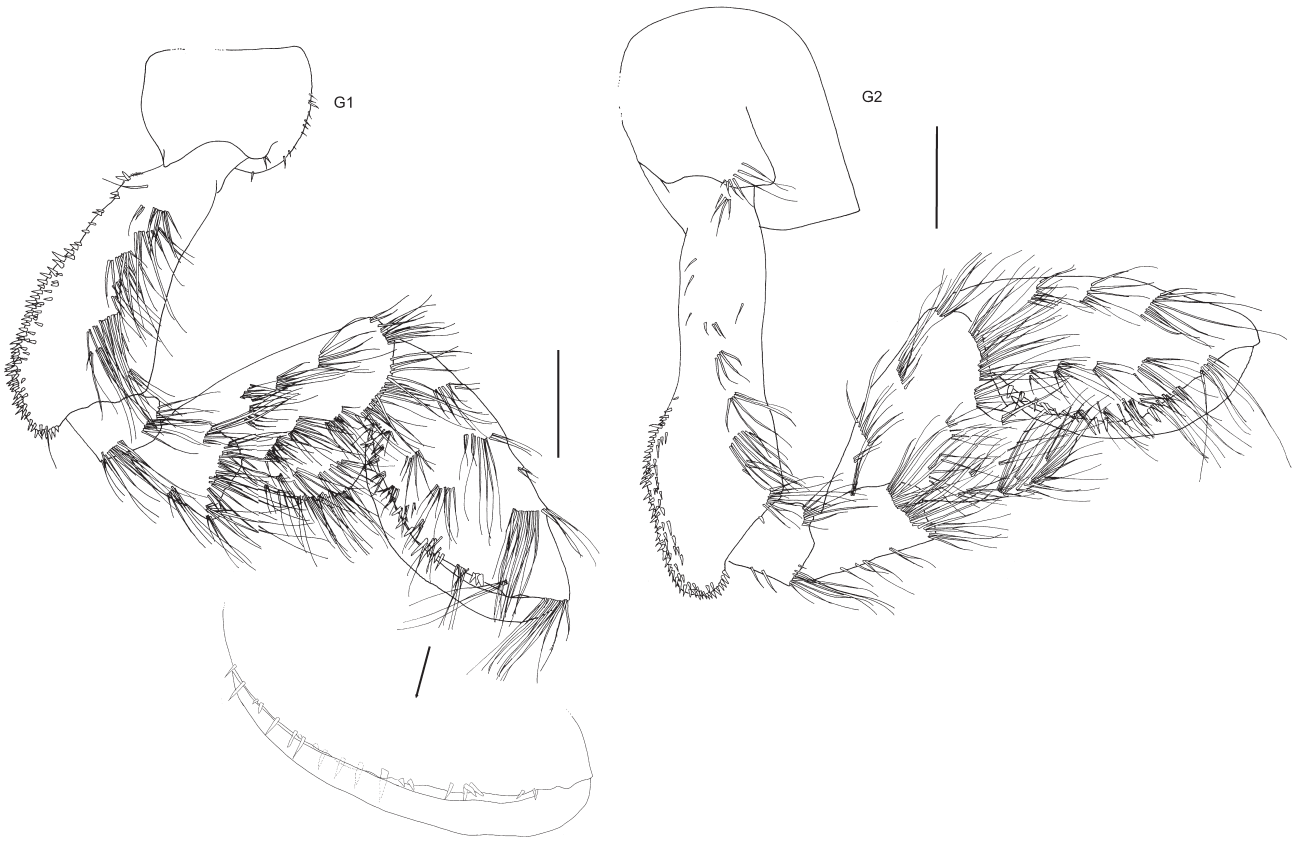

Figure 5. *Amathilliopsis lowry* sp. nov., paratype, NIWA 156301, female, 29.5 mm, gnathopods 1 and 2. Scale 1 mm.

Amathillopsis cf. *charlottae* Coleman, 1998

Figs 9–10

Type locality. Antarctic Peninsula, 66°33.10'S 68°41.90'W, depth 607 m, *Polarstern* cruise 42 ANT XIV/2, station 177, Agassiz-Trawl.

Material examined. NIWA 84392 (figured) and NIWA 156317 (3 specimens), Canterbury Basin, east of South Island, New Zealand, 45.872°S 174.082°E, 1676 m, NZOI station S152, 26 October 1979.

Diagnosis. (Based on Coleman, 1998). *Head* with short rostrum, anteroventral angle deeply excavate, ocular lobe with short acute process, with ridge parallel to ventral margin; Pereonite 1 somewhat longer than 2 and 3. Pereonite 2–4 indistinctly keeled dorsally; pereonite 5 with short carina and 5 or 6 with long pointed, weakly posteriorly curved processes. Similar but slightly longer processes on pleonites 1–2 and a shorter one on pleonite 3, about half length of that on pleonite 2. Epimeral plate 1 ventrally truncate, obtuse posteroventrally; plate 2 posteroventrally acute, plates 1 and 2 laterally ridged; posterolateral margin of epimeral plate 3 sinuous, posteroventral angle acute. Urosomite 1 as long as segment 2 and 3 combined; urosomite 2 shortest; urosomite 3 with shallow keel, slightly overreaching posterior margin, with shallow depression in lateral view.

Distribution. Southern Canterbury basin, New Zealand, Antarctic Peninsula.

Remarks. While analysing the Amathillopsidae held in the NIWA collection, we encountered specimens collected off southeast New Zealand that were remarkably similar to *A. charlottae*, originally described by Coleman (1998) from the Weddell Sea. While Coleman (1998) stated that *A. charlottae* had no eyes "or pigments lost in alcohol", the New Zealand material shows distinct small, round eyes. The lateral surface of the New Zealand material seems smoother than Coleman's Antarctic material. The morphological differences between the New Zealand and the Weddell Sea specimens were too minute to establish a new species, and our attempts to secure DNA sequences failed. We therefore refer to the New Zealand specimens as *A.* cf. *charlottae*.

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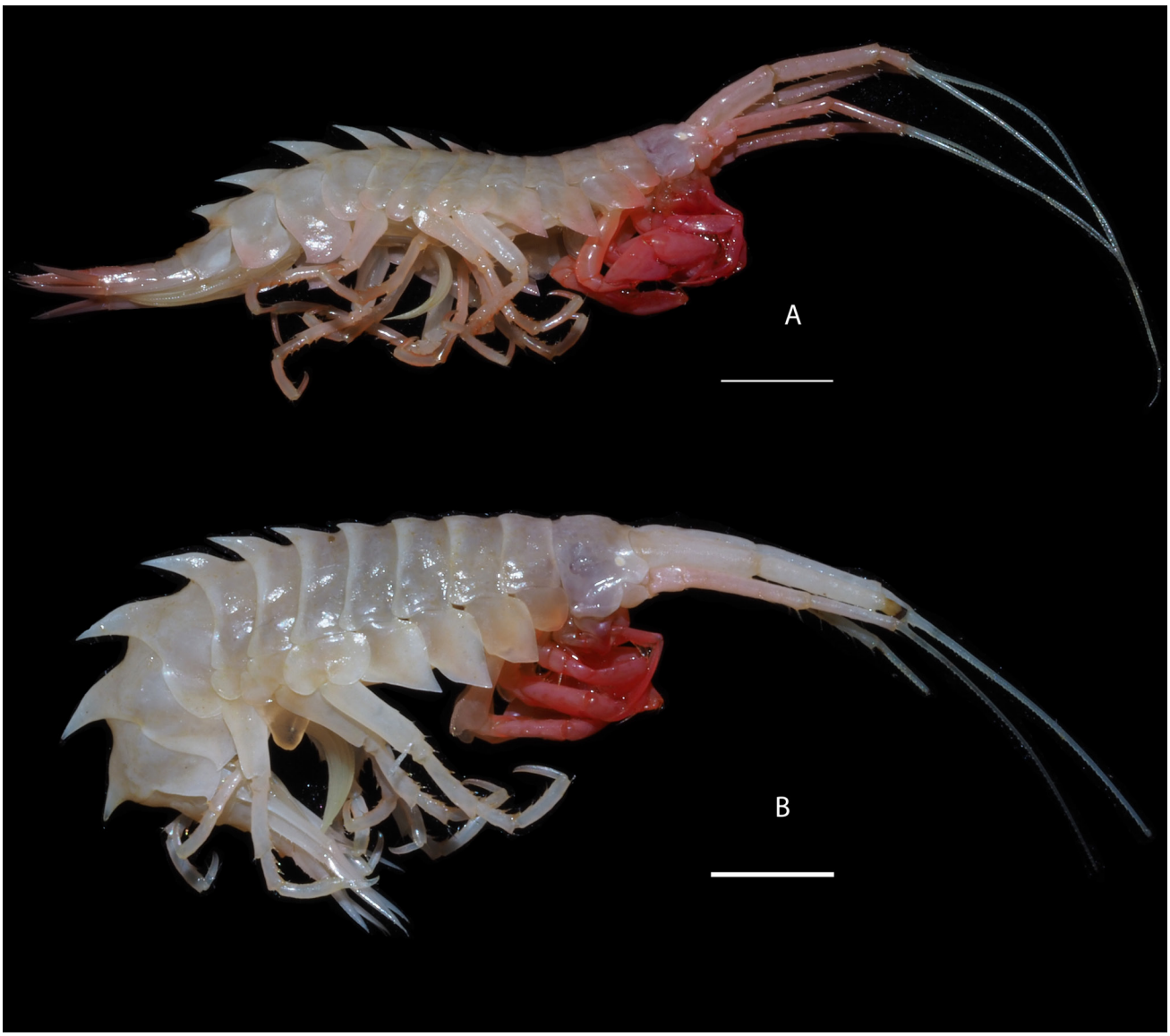

Figure 6. *Amathilliopsis lowry* sp. nov.: (A) holotype male 34.5 mm, NIWA 127043; (B) paratype female, 29.5 mm, NIWA 156301. Photographed immediately after capture. Scale 5 mm.

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Figure 7. In situ image of three specimens of *Amathillopsis lowry* sp. nov. on sponge tubes, ROV *Kiel 6000*, Geomar, 4159 m depth, abyssal basin between Three Kings Ridge and Colville Ridge, Pacific Ocean.

Figure 8. In situ image of paratype *Amathillopsis lowry* sp. nov., NIWA 156301, 4159 m abyssal basin between Three Kings Ridge and Colville Ridge, Pacific Ocean.

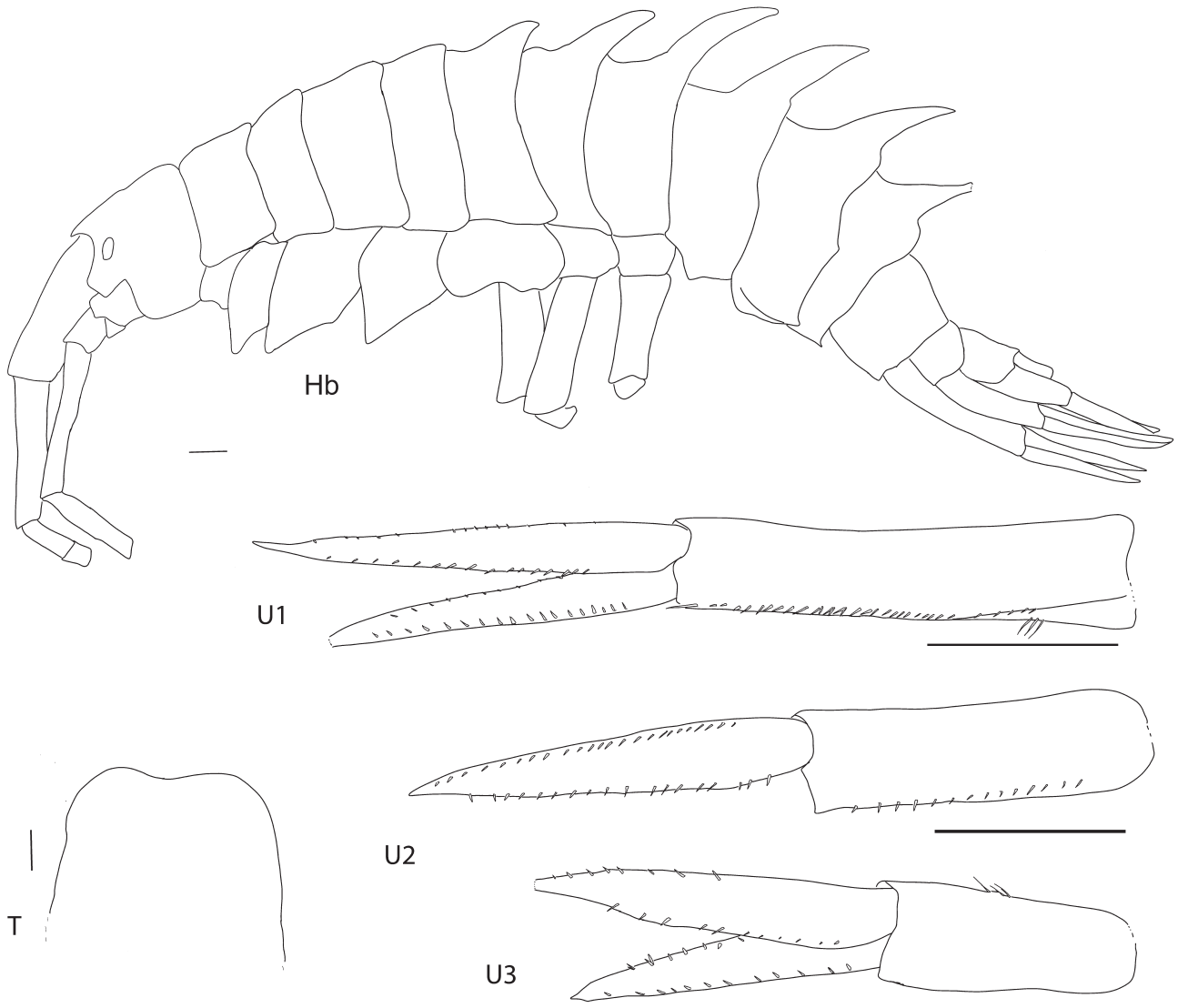

Figure 9. *Amathillopsis* cf. *charlottae* Coleman, 1998, male, 21.5 mm, NIWA 84392. Scale: Hb, U1–3 1 mm, T 0.2 mm.

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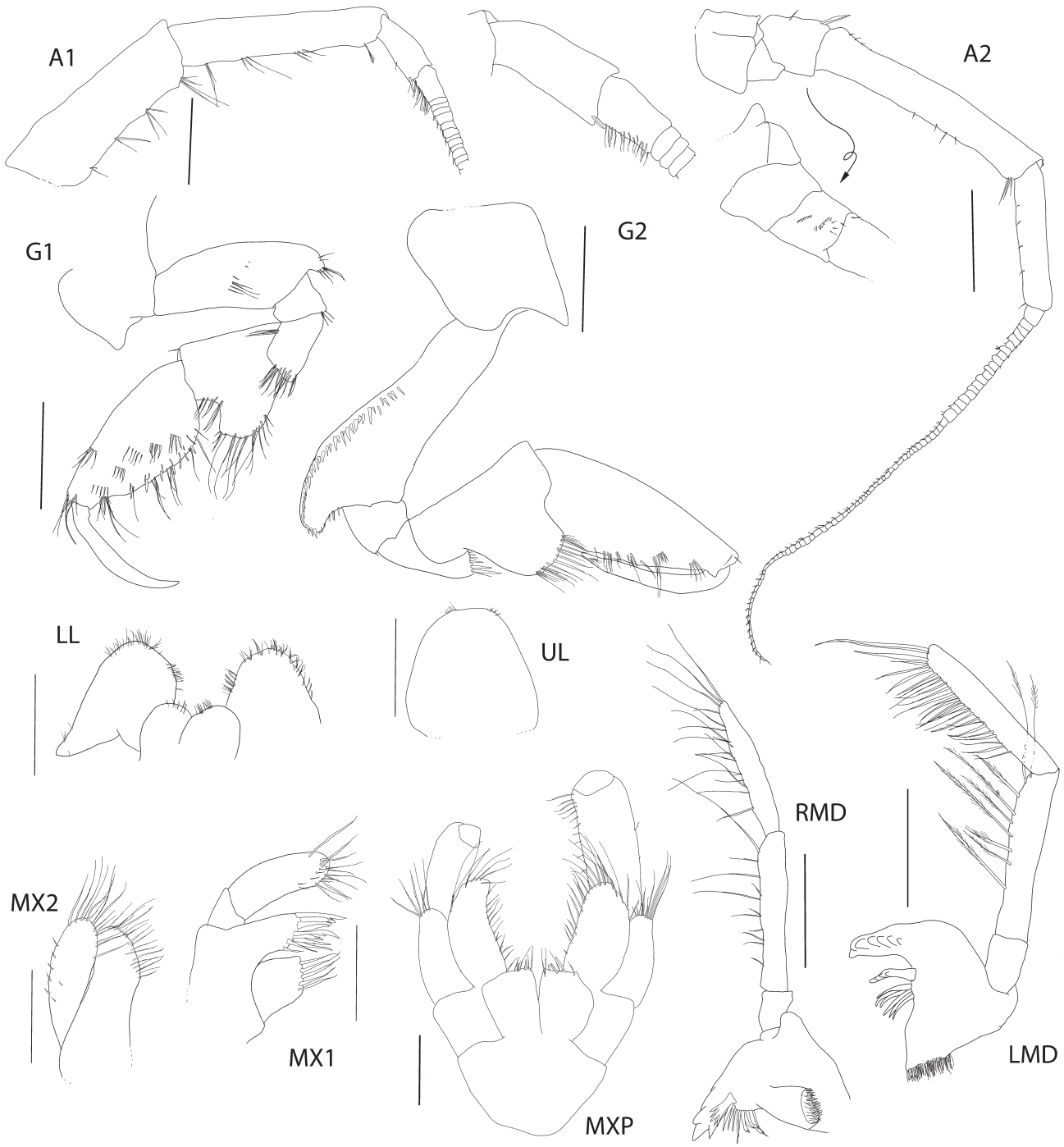

Figure 10. *Amathillopsis* cf. *charlottae* Coleman, 1998, male, 21.5 mm, NIWA 84392. Scale 1 mm.

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