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Caprellidae (Crustacea: Amphipoda) of Aotearoa New Zealand waters: a constantly changing landscape

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Abstract

A snapshot of the changing landscape of the Aotearoa New Zealand caprellid fauna is presented. This study is primarily an examination of historic material, mainly from the NIWA Invertebrate Collection. The caprellid fauna from this region suffers from similar problems to many amphipod groups recorded in the Southern Hemisphere. These problems primarily have arisen from Northern Hemisphere researchers (during the years 1760–1920), examining the fauna, and after seeing similarities to known, familiar fauna, assume they are the same organism, creating a concept of 'cosmopolitan' species. The fauna is rarely examined in detail as it is abundant, diverse and not considered commercially important. Therefore, the assumed 'cosmopolitan' species names are used regularly and repeatedly in ecological and other studies, forming assumptions regarding distributions and influence. This situation is compounded by the introduction of invasive species and the need to assess potential related impacts. Therefore, to resolve some of these issues, this study uses an integrative (using both morphological and molecular methods where possible) approach to review the known species of the family Caprellidae from New Zealand waters and describes six new species: *Caprella perplexa* **sp. nov.**, *Caprella sarahae* **sp. nov.**, *Caprella serenae* **sp. nov.**, *Caprellina judyae* **sp. nov.**, *Caprellina plumea* **sp. nov.**, *Noculacia anima* **sp. nov.** and one resurrected species, *Caprella novaezealandiae* to the fauna. A dichotomous key to the New Zealand caprellid fauna is provided, and molecular and morphological analysis and biogeographic comments on the origins of the fauna are also provided. This paper specifically examines the complex of caprellid species from Aotearoa New Zealand and almost doubles the described fauna from 8 species to 15 species.

Key words: *Caprella*, *Caprellina*, *Noculacia* morphology, molecular, new species, biosecurity

Introduction

The Caprellidae Leach, 1814 are a distinctive and complex group of amphipods composed of 451 species (Horton *et al*. 2024), with a confusing higher taxonomy but with a distinctive skeletal shape leading to the common name of skeleton shrimps. Myers & Lowry (2003) revised the family group classification, and the five families were combined to form one, Caprellidae. There are now three subfamilies: Caprellinae (63 genera), Paracercopinae (3 genera), and Phtisicinae (30 genera), with the majority of species (380) placed in Caprellinae and the majority of these (186 species) in the genus *Caprella* Lamarck, 1801 (Horton *et al.* 2024).

Caprellid amphipods are found at depths ranging from the littoral to the abyssal and are common in many shallow-water marine epibiotic fouling communities. Like all amphipods, caprellids lack any planktonic stage and are generally poor swimmers. Caprellids spend their lives as mobile epibionts on various natural and artificial substratum. Under appropriate conditions they can attain high densities and represent an important link between primary producers and higher trophic levels (e.g., Vassilenko 1991; Hosono 2009; Woods 2009; Best & Stachowicz 2012). Passive rafting on drifting materials such as flotsam, bryozoans and seaweed clumps (e.g., Pederson and Peterson 2002; Sano *et al.* 2003; Thiel *et al.* 2003; Astudillo *et al.* 2009), and even on mobile marine fauna (e.g., Vader 1972; Caine 1986), are the main natural means of dispersal for caprellids. However, maritime vessels and aquaculture activities are the significant anthropogenic vectors that disperse them further and more rapidly (Buschbaum & Gutow 2005; Ashton *et al.* 2007; Cook *et al.* 2007; Boos *et al.* 2011; Guerra-García *et al.* 2011; Ros *et al.* 2013a), resulting in often geographically disjunct species occurrences (e.g., Ros *et al.* 2013b). The Caprellidae includes several adventive species/species groups (e.g., *Caprella mutica* Schurin, 1935, and *C. scaura* Templeton, 1836).

Caprellids have been known to be transported on ship hulls, propellers, ropes, coconuts husks, and turtle carapaces. The prehensile morphology of the posterior pereopods and clinging behaviour enhances their likelihood of being transported long distances. Species of the family are, for the most part, generalist feeders, being mainly detritivores but also preying on a variety of organisms (Guerra-García & Tierno de Figueroa, 2009). Some are free-living, whereas others are more strongly associated with other invertebrates (McCain 1979).

This paper presents an overview of the constantly changing landscape of the Aotearoa New Zealand caprellid fauna. Caprellids have been recorded in New Zealand waters since the late-1800s (Kirk 1878, 1879a, b; Thomson 1878, 1879, 1881). Thomson & Chilton (1885) recorded New Zealand as having: *Caprellina longicollis* Nicolet, 1849 (synonymising *Caprellina novae-zealandiae* Thomson, 1879) recorded from Stewart Island/Rakiura, Dunedin and Oamaru; *Caprella equilibra* Say, 1818 (synonymising *Caprella novae-zealandiae* Kirk, 1879) recorded from Dunedin, Oamaru, Lyttelton, Cook Strait, plus a cosmopolitan distribution; and *Caprella linearis* (Linnaeus, 1767) (synonymising *Caprella lobata* (Müller, 1776) recorded by Kirk 1879) recorded from Cook Strait plus a cosmopolitan

distribution. This followed the trend of the time to synonymise species with European/Northern Hemisphere species or to report only Northern Hemisphere species in the Southern Hemisphere despite morphological differences.

Extensive studies on the New Zealand amphipods by Chilton (1883–1926) and Hurley (1952–1980) saw no new or revised caprellid records. McCain (1969) then revised the status of the current New Zealand caprellids and described a single new species, *Pseudoprotomima hurleyi*. This revision also noted that only three species should now be recorded from New Zealand waters: *Caprella equilibra* Say, 1818; *Caprellina longicollis* Nicolet, 1849; and *Pseudoprotomima hurleyi* McCain, 1969. However, McCain did remove *Caprella novae-zealandiae* Kirk, 1879 from synonymy with *Caprella equilibra* and cited it as closest to *Caprella penantis* Leach, 1814, but this was considered unrecognisable, mainly due to not finding any current material (McCain 1968, 1969). McCain (1969) also noted that *Caprella linearis* as occurring in New Zealand should be considered *Caprella equilibra* and that *Caprella lobata* was also unrecognisable. McCain continued research on caprellids and subsequently described a new species from the *Caprella equilibra* complex from the New Zealand subantarctic Islands (McCain 1979)—*Caprella manneringi* McCain, 1979.

After McCain's works (McCain & Gray 1971; McCain 1979), very little research was done on New Zealand caprellids until 2003 with an examination of the subantarctic fauna based on Australian Museum material (Guerra-García 2003). Guerra-García (2003) described the subantarctic fauna from the New Zealand-governed Campbell Islands/Moutere Ihupuku, Auckland Islands/Motu Maha, Antipodes Islands/Moutere Mahue and Snares Islands/Tini Heke, and the Australian territory of Macquarie Island. Known species were reviewed, and two new species (including one new genus) were described: *Caprellaporema subantarctica* Guerra-García, 2003; and *Pseudaeginella campbellensis* Guerra-García, 2003. Subsequently, the only new records of caprellid species in New Zealand waters were three records of known introduced/invasive species: *Caprella mutica* Schurin, 1935 (Willis *et al.* 2009); *Caprella andreae* Mayer, 1890 (Woods *et al.* 2014); and *Caprella scauroides* Mayer, 1903 (Peart *et al.* 2019).

The need for a revision of the New Zealand amphipod fauna is long overdue. There are approximately 560 known amphipod species in New Zealand waters, with an estimated 48% of these currently considered to be endemic (Schnabel *et al.* 2023). Based on work on other groups, evidence of multiple species from previously considered single cosmopolitan species, and early researchers with Euro-centric taxonomic concepts (e.g., Chilton), this figure is considerably underestimated. Caprellids, above most other amphipods in the New Zealand environment, appear to be most 'visible' to the general public, particularly vessel owners/operators. There are regular public enquiries to biosecurity agencies regarding the identification of these crustaceans, and ongoing biosecurity surveillance for marine non-indigenous species which have prompted this revision.

This study uses an integrative (using both morphological and molecular methods where possible) approach to review the known species of the family Caprellidae from New Zealand waters.

Materials and Methods

Systematics

The material examined for this paper was primarily sourced from the NIWA (National Institute of Water and Atmospheric Research) Invertebrate Collection (NIC) and the Marine Invasive Taxonomic Service (MITS), New Zealand. Type material, reference material and extra material examined are deposited in the NIC. The distribution of the caprellid species described in this paper in the New Zealand Exclusive Economic Zone is illustrated in Fig. 1.

Material was drawn (in habitus) under a Leica MX12s dissecting microscope using a camera lucida. Specimens were dissected in ethanol (80%) and appendages mounted on permanent slides using Aquatex™ mounting media. Appendages were drawn under the compound microscope (with camera lucida) Zeiss Axioskop 2 plus. The upper lip was not dissected unless it was obvious on the animals. The drawings were scanned, then digitally inked and plates constructed using Adobe Photoshop CS 2020. Body length was measured from the tip of the rostrum to the end of the abdomen, to the nearest 0.5 mm. Current classification of the Caprellidae follows Myers & Lowry (2003) and WoRMS (Horton *et al.* 2024).

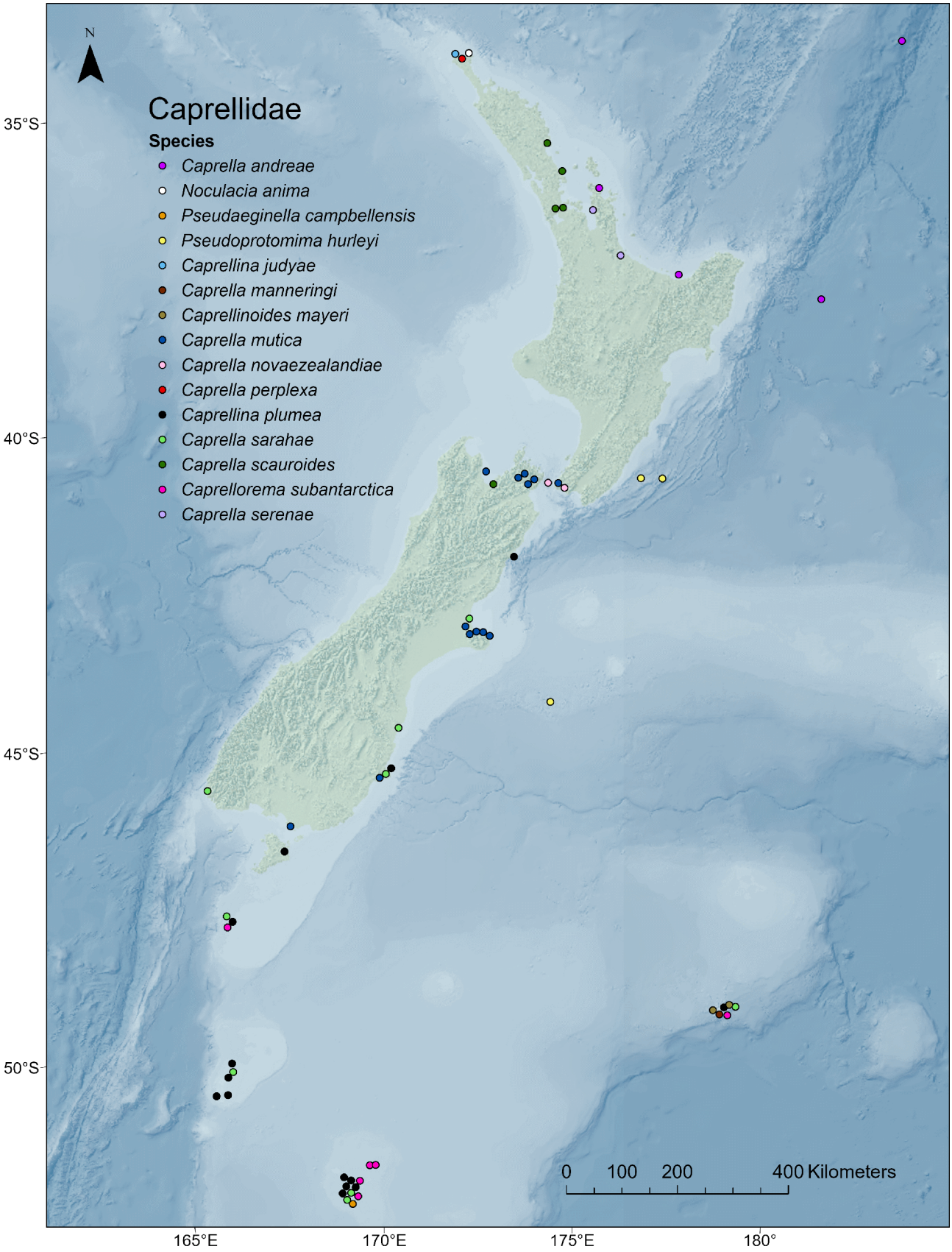

FIGURE 1. Distribution of caprellid species in the New Zealand Exclusive Economic Zone (map: E. Leunissen, NIWA).

The biosecurity classification terms used are adventive (introduced), cryptogenic and native (Campbell *et al.* 2018). However, cryptogenic is used sparingly to avoid the confusion of use. Defined as species that could not be demonstrably determined to be either native or introduced (Carlton 1996), the term cryptogenic has been used to indicate that a species is suspected of being introduced but without sufficient evidence to support this. The term native will be used for most of the new and known species as there is no sufficient reason to assume they are introduced and are sufficiently different from the known international species.

Abbreviations used include A1: antenna 1, A2: antenna 2, MD: mandible, MX1: maxilla 1, MX2: maxilla 2, MXP: maxilliped, G1: gnathopod 1, G2: gnathopod 2, P5: pereopod 5, P6: pereopod 6, P7: pereopod 7, ABD: Abdomen.

Molecular protocols

DNA was extracted from caprellid specimens using the Qiagen Dneasy Blood and tissue kit (Qiagen GmbH, Hilden) according to the manufacturer's instructions. An approximately 658bp fragment of the mitochondrial cytochrome oxidase I (COI) gene was amplified using primers LCOI 1490/HCO2198 (Folmer *et al.* 1994), and an approximately 1050bp fragment of the nuclear small subunit ribosomal gene (nSSU) was amplified using primers 18S-ai/18S-bi (Whiting 2002) as in Peart *et al.* (2019). PCR products were purified using ExoSAP-IT (Affymetrix, Santa Clara, CA USA), and sequenced at Macrogen Inc. (Seoul, Korea). Sequences were trimmed and aligned using Geneious Prime 2021 (Biomatters Ltd, Auckland; https://www.geneious.com).

BLAST searches (Altschul *et al.* 1990, https://blast.ncbi.nlm.nih.gov/) were used to compare the sequences with those already in the database and to identify GenBank sequences with high homology to the sequences. The sequences were aligned with those of other *Caprella* taxa, including sequences from Caprellidae genera *Pseududoprotella*, *Phtisica* and *Protomima* as outgroups. The COI and nSSU data were analysed separately rather than concatenated as relatively few taxa had been sequenced at both markers, leading to significant differences in the taxon sets between the two markers. Sequences were aligned using MUSCLE 3.8.425 (Edgar 2004) implemented in Geneious and checked by eye. Unalignable regions were removed from the 18S alignment using GBLOCKS (http://molevol.cmima.csic.es/castresana/Gblocks_server.html; Talavera & Castresana 2007), at the default settings.

An appropriate partitioning strategy (for COI) and models of sequence evolution were identified using IQ-TREE (Minh *et al.* 2019; Kalyaanamoorthy *et al.* 2017). We used IQ-TREE to estimate the maximum likelihood (ML) tree under this partitioning strategy and models, partitioning by codon with models Tne+I+G, TPM3+F+I and TIM2+F+G for codons 1,2 and 3 respectively. Support was estimated under both the Shimodaira-Hasegawa-like approximate likelihood ratio test (SH-like aLRT, Anisimova & Gascuel 2006) and 1000 ML bootstrap replicates (BS). The nSSU analysis was not partitioned, and was analysed under the recommended model K2P+I+G.

MrBayes v3.2.6 (Ronquist *et al.* 2012) was used to implement Bayesian analyses. Since MrBayes uses a more restricted suite of models than IQ-TREE, we used a second IQ-TREE analysis to identify appropriate partitioning and models for the Bayesian analysis. For COI, this was SYM+I+G4, F81+F+I and GTR+F+G4 for codons 1, 2 and 3 respectively, and for the nSSU K2P+I+G. For the Bayesian analyses we ran four MCMC chains for 5 million generations, sampling every 1000 generations. Burnin values were assessed through inspection of log-likelihood plots and average parameter values using Tracer V1.7.2 (Rambaut *et al.* 2018) and were confirmed by inspection of potential scale reduction factor (PSRF) values calculated in MrBayes. Trees were visualised using FigTree 1.4.4 (http://tree.bio.ed.uk/software/figtree).

Results

Molecular data

The molecular analysis revealed an incomplete view of the status of New Zealand's caprellids. This is due to the lack of comprehensive sequencing on a variety of specimens. None of our COI or nSSU sequences were identical to any sequences in GenBank. The COI sequences from the two specimens of *Caprella serenae* **sp. nov.** (M7 and M6) were identical and differed from those of *Caprella novaezealandiae* (M8) from the Wellington region by 74 substitutions, indicating that these taxa are not conspecific. These sequences differed from all other sequences in our dataset by more than 90 substitutions. In the COI phylogenetic analysis (Fig. 2) these two taxa are placed within

Caprella, but there is no support for a strong association with each other, nor with any named taxon. In our analysis there is moderate support (aLRT/BS/PP 97.6/-/1) for a clade consisting of *C. penantis, C. dilatata, C. andreae* and two unnamed taxa; the New Zealand taxa are not resolved within this clade. These specimens are also distinct from two specimens of *Caprella scauroides* reported previously from the northern North Island of New Zealand (Peart *et al.* 2019). The nSSU sequences of the two specimens of *C. serenae* were identical and differed from the *C. novaezealandiae* sequence by two substitutions. The nSSU analysis (Appendix 1) corroborates the resolution of our taxa within *Caprella*, and the distinction between morphologically similar species.

The other obvious result for CO1 sequencing (Fig. 2) is the verification of the placement of New Zealand specimens of *Caprella scauroides* with morphologically identical specimens collected from Japan.

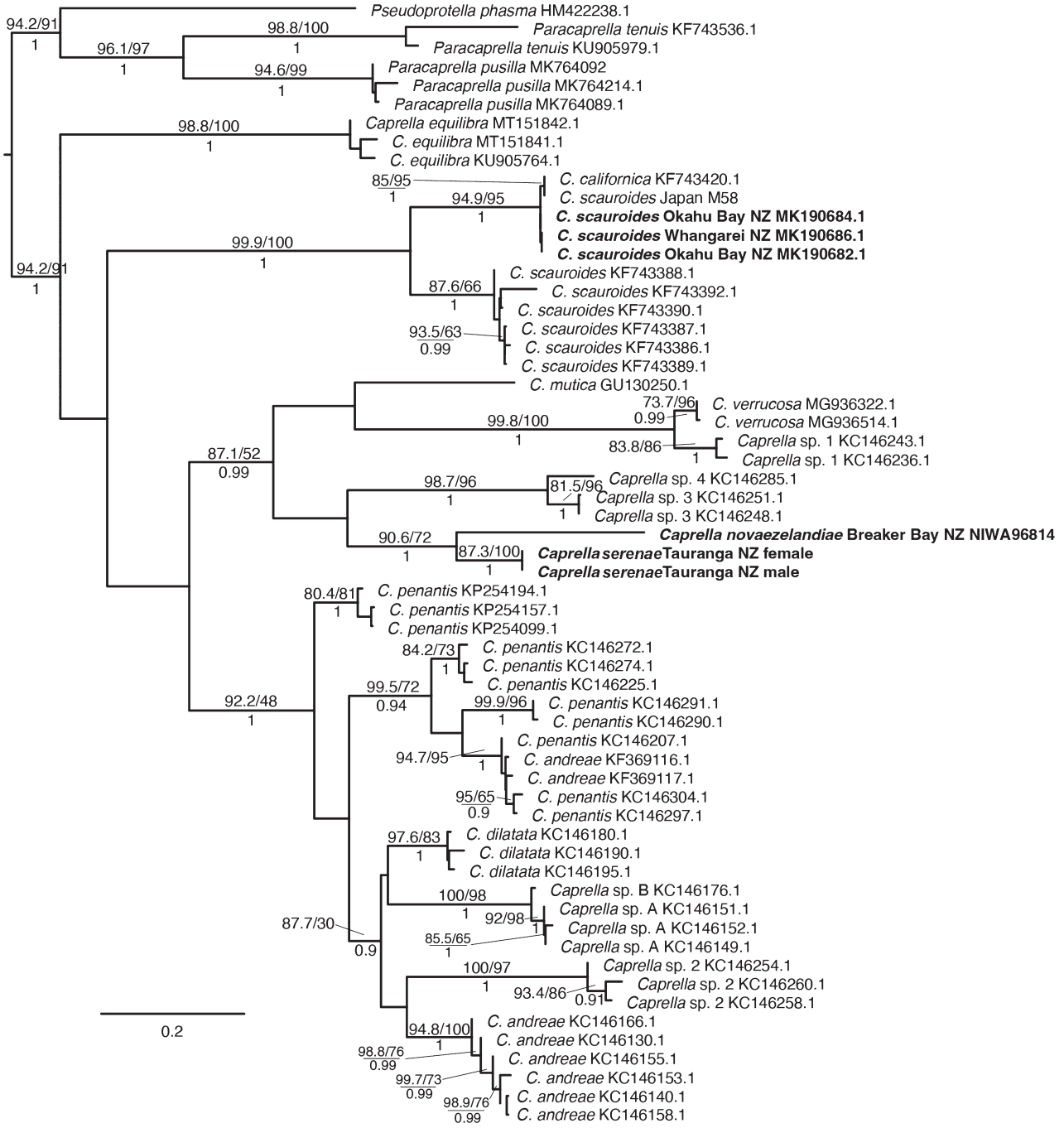

FIGURE 2. Maximum likelihood phylogram based on COI sequence data. Support values are shown on each branch: approximate Likelihood Ratio Test (aLRT, %) and ML bootstrap (%) values above, and Bayesian PP values below. Only values greater than 80% (aLRT), 80% (bootstrap) and 0.9 (PP) are shown; all support values are shown if two support methods for a clade reach the cutoff value. Sequences from New Zealand taxa in bold.

Systematics

Order Amphipoda Latreille, 1816

Suborder Senticaudata Lowry & Myers, 2013

Infraorder Corophiida Lowry & Myers, 2013

Superfamily Caprelloidea Leach, 1814

Family Caprellidae Leach, 1814

Subfamily Caprellinae Leach, 1814

Caprella Lamarck, 1801

Diagnosis. Mandible lacking palp; incisor and lacinia mobilis each with 5 teeth and setae; molar well developed. Lower lip inner and outer lobes with dense, short setae. Maxilla 1 palp with spines and setae, outer plate with 6–8 bifid robust setae, inner plate absent. Maxilla 2 long with setae on apical margin. Maxilliped with inner plate shorter or equal to outer one, both with spines and setae. Antenna 2 flagellum with two articles. Pereopods 3–4 lacking. Pereopods 5–7 normal. Male: anterior pleopods generally with two articles, posterior pleopod rudimentary or lacking. Female without pleopods. Gills on pereonites 3–4.

Type species. *Cancer linearis* Linnaeus, 1767 (type by subsequent designation).

Species composition. Including this publication, 190 species. This includes 186 species as recorded in Horton *et al*. (2024) (both accepted and uncertain species), one newly resurrected species (*Caprella novaezealandiae* Kirk, 1879) and three newly described species (*Caprella perplexa* **sp. nov.**, *Caprella sarahae* **sp. nov.**, and *Caprella serenae* **sp. nov.**) reported in this paper.

Caprella andreae Mayer, 1890

(Figs. 1–3, Appendix 1)

Caprella acutifrons f. *andreae* Mayer, 1890: 51–55, pl. 2: fig. 38, pl. 4 figs. 56, 70, 71; Mayer, 1903: 80.—Stephensen, 1929: 182.—Utinomi, 1947: 71.

Caprella andreae.—McCain, 1968: 116, fig. 2.—Lee, 1988: 100.—Krapp-Schickel, 1993: 777, fig. 530.—Aoki & Kikuchi, 1995: 54–61.—Sezgin *et al.,* 2009: 433–437.—Lee & Hong, 2011: 41–44, fig. 25.—Cabezas *et al*., 2013a: 483–497.—Woods *et al*., 2014: 97–102.—Schnabel *et al*., 2023: 422, 436.

Type locality. Atlantic coast of the United States of America.

Material examined. NIWA 88602, 30 specimens (5–15 mm), Bay of Plenty, 36°32.00’ S, 175°33’E, surface longline, TRIP3768/6; NIWA 157724, more than 200 specimens, 38°12.005’S, 179°47.87’W, on DART surface buoy amongst hydroids, DART C, December 2021; NIWA 98319, 14 specimens, rafting on floating pumice, surface waters above west side of Kermadec Trench, 33°58.889’S, 178°30.277’W, collected off the side of the *RV Kaharoa* from water surface during KAH1301 HADEEP IV cruise.

Diagnosis. Head with short, blunt triangular projection, directed forward; body otherwise smooth and robust. Antenna 1 shorter than ½ of body; peduncle articles 1–2 inflated in male, sparsely setose, longer than flagellum. Antenna 2 longer than peduncle of antenna 1, bearing long dense setae on ventral margin. Gnathopod 1 robust, with palmar margin of propodus setose with pair of proximal grasping spines; palm somewhat straight; dactylus serrate. Pereonite 2 without ventral projection. Gnathopod 2 in male arising at midlength of pereonite 2; basis shorter than ½ of propodus and ½ of pereonite 2; palmar region of propodus slightly concave, densely setose with distal rectangular projection and slight proximal spiniform process; dactylus strong, apex pointed and constricted medially with distal end slightly serrate. Gnathopod 2 in female inserted distally on pereonite 2; palm of propodus convex. Gills rounded and quite large and inflated in male, maximum diameter subequal in length to pereonite 4. Gills oval to elliptical and

smaller in female. Pereopods 5–7 increasing in length posteriorly; palmar margin of propodus convex bearing short dense setae with two median grasping spines.

Distribution. Northern New Zealand. Global distribution: north-eastern Atlantic; Mediterranean Sea; Hawaii; Sea of Japan; Korean Strait; Atlantic coast of the USA; and Cuba (McCain 1968; Aoki & Kikuchi 1995; Foster *et al.* 2004; Sezgin *et al.* 2009); South Solitary Island, New South Wales, Australia (one specimen only, requiring verification).

New Zealand biosecurity status. Adventive in New Zealand.

Remarks. *Caprella andreae* is adventive and was first recorded in New Zealand waters from a mussel farm by Woods *et al.* (2014). *Caprella andreae* is typically found in shallow-water habitats (<60 m depth) such as seagrass, offshore buoys, and finfish farms. It is regarded as an obligate "rafter" on substrates such as driftwood, buoys and seaweed, and is epibiotic on sea turtles (McCain 1968; Aoki & Kikuchi 1995; Relini *et al.* 2000; Foster *et al.* 2004; Sezgin *et al.* 2009; Cabezas *et al.* 2013a). It is close morphologically to *C. dilatata* Krøyer, 1843, *C. penantis* Leach, 1814*, C. novaezealandiae* Kirk, 1878 and *C. serenae* **sp. nov.** (Table 2). It has a robust, strong body with a small forward pointing projection on the head, convex pereopod 5–7 palms, and strongly rounded gills.

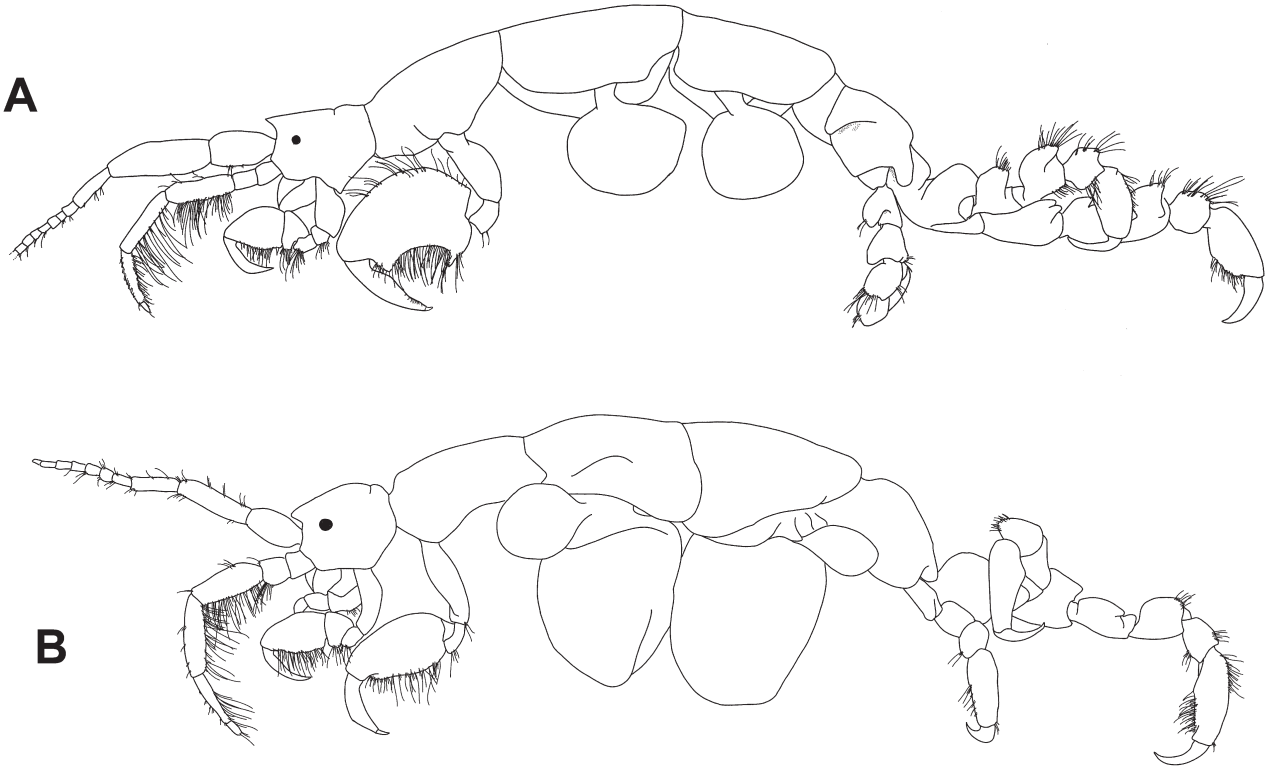

FIGURE 3. *Caprella andreae* Mayer, 1890, Bay of Plenty, New Zealand. In habitus: A, NIWA 88602 male, 15 mm; B, NIWA 88602 female, 11 mm.

Caprella equilibra Say, 1818

(Fig. 2, Appendix 1)

Caprella equilibra Say, 1818: 391–392.—Schellenberg, 1926: 470.—McCain, 1968: 26–30, figs. 12–13, 55.—McCain & Steinberg, 1970: 19–21.—McCain & Gray, 1971: 113–114, fig. 3.—McCain, 1979: 471.—De Broyer & Jażdżewski, 1993: 103.—Krapp-Schickel, 1993: 782–783, fig. 533.—De Broyer & Rauschert, 1999: 287.—Guerra-García & Thiel, 2001: 878–879.—Guerra-García, 2003: 181–182, fig. 4.—Lowry & Stoddart, 2003: 22–23.—De Broyer *et al.,* 2004: 66.—De Broyer *et al.* 2007: 244–245.—Webber *et al.,* 2010: 155 (unnumbered fig.), 156, 219.—Schnabel *et al*., 2023: 436.

Caprella aequilibra.—Mayer, 1882: 45, pl. 1: fig. 7, pl. 2: figs. 1–11, pl. 4: figs. 20–25, pl. 5: figs. 16–18.—Chevreux & Fage, 1925: 455, fig. 433.

Caprella monacantha Heller, 1866: 54, figs. 17–19.

Type locality. South Carolina, United States of America.

Distribution. ?Cosmopolitan; 0–3000 m.

New Zealand biosecurity status. Presumed adventive in New Zealand.

Remarks. Specimens identified as *Caprella equilibra* are the most common species reported in the New Zealand shallow water environment. However, detailed study into the morphological and molecular variations that can be aligned to distributional ranges of the species were beyond the scope of this paper. Therefore, due to this and the early synonymisation of a variety of nominated species with *Caprella equilibra* (Thomson & Chilton, 1886), it is uncertain if *Caprella equilibra* sensu stricto occurs in New Zealand. Despite the very similar morphology between records, this study reveals there are potentially multiple species in New Zealand waters under *Caprella equilibra*. Molecular studies across many groups of marine invertebrates have shown that despite presumed cosmopolitan distributions, many such species actually comprise species complexes (e.g., Fehlauer-Ale *et al.* 2014; Cabezas *et al.* 2013a, Cabezas *et al.* 2013b). Darling & Carlton (2018) presented the concept of 'pseudocosmopolitan' species. These are taxa that are considered cosmopolitan until they have detailed molecular assessment that proves they are in fact genetically and geographically distinct species. There are numerous records of *C. equilibra* recorded in New Zealand, from systematics checklists (Kirk, 1878) to ecological and biosecurity evaluations, such as Ahyong & Wilkins (2011). Until a detailed study can be carried out to re-examine previous records, and, ideally with resampling of fresh material, *C. equilibra* is provisionally treated as part of the New Zealand fauna. It has been observed that *C. equilibra* has potentially a higher dispersal ability and thus have a naturally wide distribution as it has been observed for long periods in the water column and has a huge potential to occupy artificial substrates (Guerra-García, pers comm.) and therefore cannot yet be excluded from New Zealand's fauna without further data.

Due to the uncertain distribution patterns in New Zealand, this species has been omitted from the map despite forms being known from New Zealand. McCain (1979) started moving different forms out of synonymy with *C. equilibra* showing very similar morphological forms previously documented as that species.

Molecular sequences presented here (Fig. 2) are from elsewhere in the world, and, as mentioned above, it was beyond the scope of this paper to fully evaluate the status of New Zealand records of *C. equilibra*. The sequences noted here in the analysis demonstrate the distance from *Caprella equilibra* sensu lato of *Caprella novaezealandiae* (resurrected here), which Thomson & Chilton (1886) had synonymised under *C. equilibra*.

Caprella manneringi McCain, 1979

(Fig. 1)

Caprella manneringi McCain, 1979: 471–473, fig. 1.—Guerra-García, 2003: 182–185, figs 5–8.—Webber *et al.,* 2010: 219.—Schnabel *et al*., 2023: 436.

Type Locality. Reef Point, Antipodes Island, New Zealand.

Material examined. NIWA 125322, 5 male specimens (6.5–7.0 mm), Bounty Island, 49°40.572'S, 178°43.945'E; NIWA 125321, 1 specimen, D. Freeman, New Zealand Department of Conservation, Bounty-Antipodes Islands Expedition, 4–24 March 2009, Windward Island, Antipodes Islands, 6 m, 49°40.572'S, 178°43.945'E, boulders, overhangs, rock wall, *Durvillea* sp.

Diagnosis. Head rectangular but without projection; body smooth and robust. Antenna 1 just over ⅓ of the body; peduncle articles 1–2 slender in male and female, sparsely setose, flagellum reaching to ½ the length of peduncle article 2. Antenna 2 shorter than antenna 1, reaching halfway along flagellum, bearing long setae on ventral margin. Gnathopod 1 robust, with palmar margin of propodus setose with pair of proximal grasping spines; palm straight; dactylus smooth. Pereonite 2 with acute ventral projection between gnathopods. Gnathopod 2 in male arising in distal half of pereonite 2; basis approximately ⅓ length of propodus and just under ½ of pereonite 2; palmar region of propodus straight, weakly setose with posterior corner large, subacute bearing robust setae, large acute tooth predactylar and no secondary tooth; dactylus strong, apex pointed and unconstricted with distal end smooth. Gnathopod 2 in female inserted midpoint on pereonite 2; palm of propodus convex. Gills short and slender in both sexes. Pereopods 5–7 of similar sizes; palmar margin of propodus convex, uneven and short bearing sparse short setae with two median grasping spines and expanded subacute posterior corner.

Distribution. Antipodes Island (type locality), Snares Islands/Tini Heke, New Zealand.

New Zealand biosecurity status. Native.

Remarks. Known only from New Zealand's subantarctic islands, *Caprella manneringi* was originally described

from specimens found on the asteroid *Anasterias suteri* (de Loriol, 1894). More recent samples of *C. manneringi* from the type locality were also found on this species of sea star. *Caprella manneringi* is part of the *Caprella equilibra* species complex, all of which have an acute ventral projection on pereonite 2. This makes it similar to two other New Zealand species, *Caprella perplexa* **sp. nov.** and *C. sarahae* **sp. nov**. The morphological characteristics separating *C. manneringi* from others in the complex are the short robust body shape, the convex/sinuous palmar margin of pereopods 5–7, and the short male pereonites 1 and 2 (Table 3).

Caprella mutica Schurin, 1935

(Fig. 1, 4–5)

Caprella mutica Schurin, 1935: 198–199, fig. 1; 1937: 27–28, fig. 7–8.—Utinomi, 1947: 75.—Utinomi, 1964: 14, fig. 1.—Vassilenko, 1974: 201, figs. 118–119.—Arimoto, 1976: 111, fig. 59.—Willis *et al.* 2004: 1027–1028, fig. 1.—Faasse, 2005: 22, figs. 1–3.—Willis *et al.* 2009: 249–259.—Turcotte & Sainte-Marie, 2009: 1, fig. 1.—Boos *et al.,* 2011: 129–156.—Peters & Robinson*,* 2017: 61–66.—Daneliya & Laakkonen, 2012: 1, figs. 2–3.—Webber *et al.,* 2010: 156, 219.—Schnabel *et al*., 2023: 436.

Type locality. Peter the Great Bay, Siberian coast of the Sea of Japan.

Material examined. NIWA 155320 (MITS 75069), many males and females, Lyttelton Harbour/Whakaraupō, LYT-29241-AM, 07/2019.

Diagnosis. Head rounded, without projection; body covered in angular projections and setae, pereonites are robust. Antenna 1 over half of body (0.6 ×); peduncular articles 1–2 expanded, robust and densely setose in males and slender and, sparsely setose in females,—longer than the flagellum (males) and slightly shorter than the flagellum in females. Antenna 2 reaching to ½ length of article 2 of peduncle of antenna 1, bearing long dense setae on ventral margin (male). Antenna 2 reaching beyond antenna 1 peduncle, bearing long setae on ventral margin (female). Gnathopod 1 small but robust, with palmar margin of propodus setose with pair of proximal grasping spines; palm somewhat straight; dactylus serrate. Gnathopod 2 arising at distal ⅓ of pereonite 2 (male); basis approximately the length of propodus and ⅔ length of pereonite 2 (male); palmar region of propodus sinuous, setose with posterior corner blunt bearing robust setae, large acute tooth predactylar and secondary tooth of same length just posterior to predactylar tooth with excavation in between; dactylus strong, apex pointed and unconstricted with distal end smooth. Gnathopod 2 in female inserted just anteriorly of midpoint on pereonite 2; palm of propodus slightly convex. Gills long and slender in both sexes. Pereopods 5–7 increasing in length posteriorly; palmar margin of propodus straight bearing short dense setae with two median grasping spines and expanded posterior corner.

Distribution. South Island/Te Waipounamu; lower North Island/Te Ika-a-Māui, New Zealand (Table 1). Also extensively found in Europe, North America, South Africa and Japan.

New Zealand biosecurity status. Adventive, but well established in New Zealand.

Remarks. Although similar morphological variations are present in males of overseas forms of *C. mutica*, this species is quite distinctive amongst New Zealand caprellids. The males have dense spiny projections covering pereonites 3–7, densest on pereonites 3–5. Pereonites 1–2 are covered in thick long setae extending along the first antennae, reaching all over the second gnathopods but absent on the first gnathopods. The females have reduced spination over the body, and very little setation. The males have articles 1–3 of antenna 1 enlarged, and pereonites 1–2 (when pereonite 1 combined with the head) of subequal length.

Caprella mutica is native to north-east Asia (Peter the Great Bay, Vladivostok) and has a complex history of global invasion. This species is especially prevalent in temperate northern hemisphere waters (including Europe, North America and Asia) and has an isolated occurrence in the Southern Hemisphere from New Zealand waters (Boos *et al.* 2011), and southern Africa (Peters & Robinson 2017). Detailed studies of similar climates and conditions around Australia, and southern America do not record this species (Thiel *et al*. 2003; Guerra-García & Takeuchi 2004). Introduced populations of this species are associated with artificial environments including shipping, marinas and aquaculture facilities, but in its native environment are associated with macroalgae and aquaculture structures (Boos *et al.* 2011).

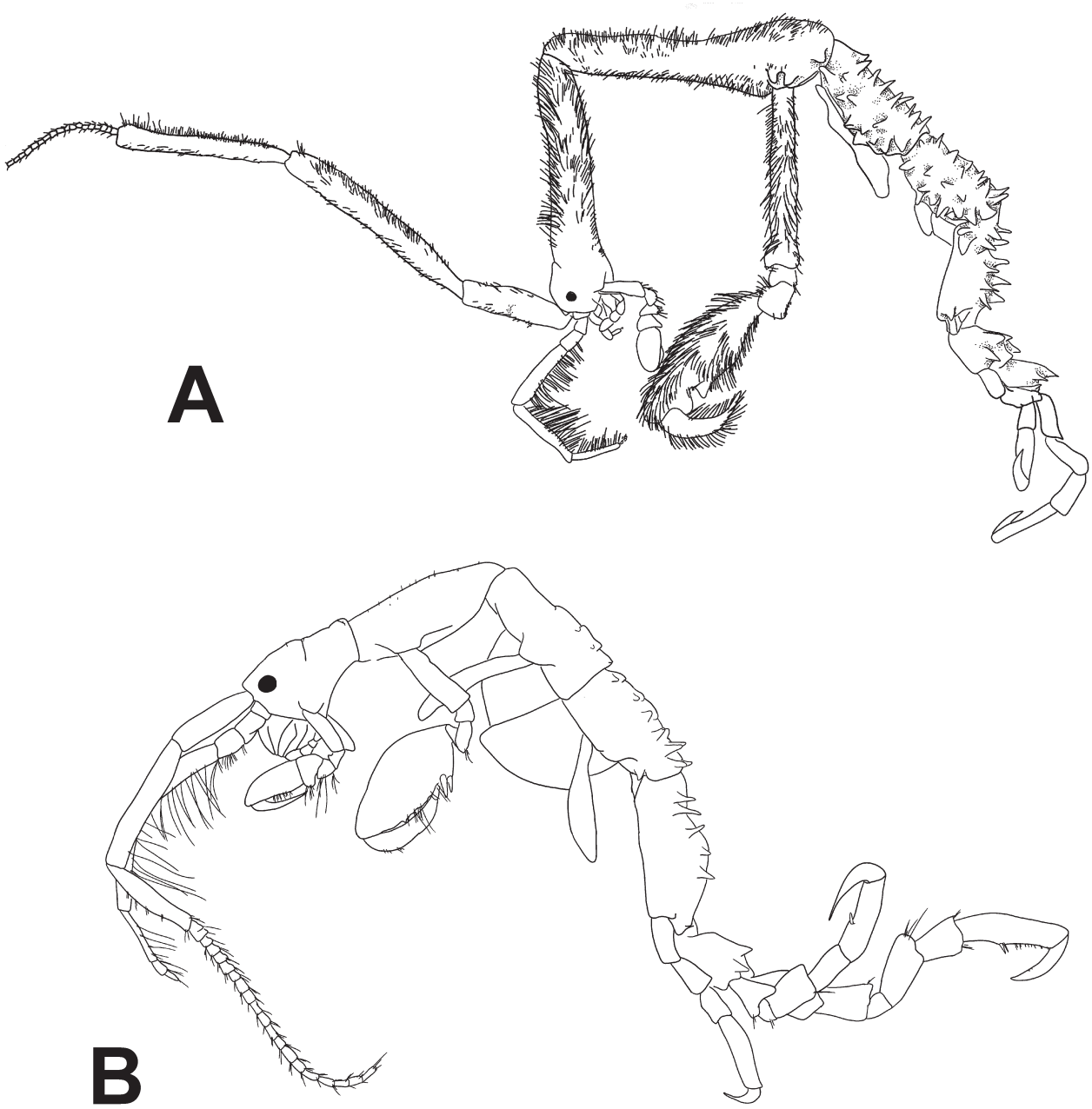

FIGURE 4. *Caprella mutica* Schurin, 1935, Lyttelton Harbour/Whakaraupō, New Zealand. A, male, NIWA 155320, 24.5 mm; B, female, NIWA 155320, 10.5 mm.

Caprella mutica was first recorded from New Zealand in 2002 but documented officially in 2008 (Woods *et al*. 2008; Ahyong & Wilkens 2011). First noted from in the southern Port of Timaru in 2002 as part of a national baseline biota survey of ports and marinas (Inglis *et al*. 2006), the distribution is now considered to be in most major ports on the South Island/Te Waipounamu, with a vessel biofouling record for Wellington New Zealand (Fig. 1) (Willis *et al.* 2009) (Table 1). This distributional record, though quite extensive, is primarily restricted to major ports and areas of aquaculture activities but not to smaller centers largely due to the sampling effort of the long-running (since 2002) targeted surveillance programme for non-indigenous species in 12 ports and marinas around New Zealand (National Marine High Risk Site Surveillance (NMHRSS) programme) undertaken for the Ministry for Primary Industries (MPI, Biosecurity New Zealand). This indicates that the species could potentially be more widespread than these records suggest. The known distribution for *C. mutica* in New Zealand is synanthropic and associated with maritime vessels and associated infrastructure, and aquaculture operations such as finfish and mussel farms (Fig. 5) (Woods, unpublished data) (Table 1).

TABLE 1. First recorded detections of *Caprella mutica* at coastal locations around New Zealand further to those recorded by Willis *et al.* (2009). Date of first detection and substratum type are provided. Population abundances (number of caprellids per m^2) measured at the time of detection are also provided (where recorded) along with source.

Location	Sub-location	Coordinates	Date of detection	Substratum	Est. Population density (ind^{-1} m^2)	Source
Wellington Harbour	Evans Bay Marina	-41°18.682'S 174°47.9'E	13/11/2007		Vessel biofouling-only record—no evidence to date of resident population	https://www.marinebiosecurity.org.nz
Tasman Bay	Offshore from Motueka	-41°3.381'S 173°7.4334'E	1/03/2012	Mussel farm	?	Atalah *et al.* 2016
Marlborough Sounds	Crail Bay (Pelorus Sound)	-41°6.0186'S 173°58.0182'E	14/09/2011	Mussel and salmon farms	49,393	Woods, unpubl. Data
	Yncyca Bay (Pelorus Sound)	-41°8.1036'S 173°53.3088'E	27/03/2012	Mussel farm	16,333	Woods, unpubl. Data
	Ruakaka Bay (Queen Charlotte Sound)	-41°12.6732'S 174°8.436'E	9/04/2013	Salmon farm	39,214	Woods, unpubl. Data
	Waikawa Marina (Queen Charlotte Sound)	-41°15.9798'S 174°2.226'E	22/02/2016	Marina pontoon	100	https://www.marinebiosecurity.org.nz/ and Woods, unpubl. Data
Banks Peninsula	Port Levy	-43°36.633'S 172°49.8984'E	22/04/2010	Mussel farm	171,250	Woods, unpubl. Data
	Scrubby Bay	-43°37.569'S 172°57.3864'E	30/08/2012	Mussel farm	73,804	Woods, unpubl. Data
	Big Bay	-43°36.8082'S 172°53.3814'E	30/08/2012	Mussel farm	36,902	Woods, unpubl. Data
	Diamond Harbour (Lyttelton Harbour/ Whakaraupō)	43°37.4856'S 172°44.2272'E	17/02/2014	Recreational yacht	33,600	(https://www.marinebiosecurity.org.nz/ and Woods, unpubl. Data)
	Purau Bay (Lyttelton Harbour/Whakaraupō)	-43°37.875'S 172°44.9718'E	12/09/2017	Recreational yacht	24,600	(https://www.marinebiosecurity.org.nz/ and Woods, unpubl. Data)
Otago Harbour	Port Otago	-45°52.818'S 170°30.3768'E	6/10/2010	Marina pontoon	5	(https://www.marinebiosecurity.org.nz/ and Woods, unpubl. Data)
Bluff Harbour	Greenpoint	-46°34.7286'S 168°18.5808'E	25/08/2011	Recreational yacht and launch	100	(https://www.marinebiosecurity.org.nz/ and Woods, unpubl. Data)

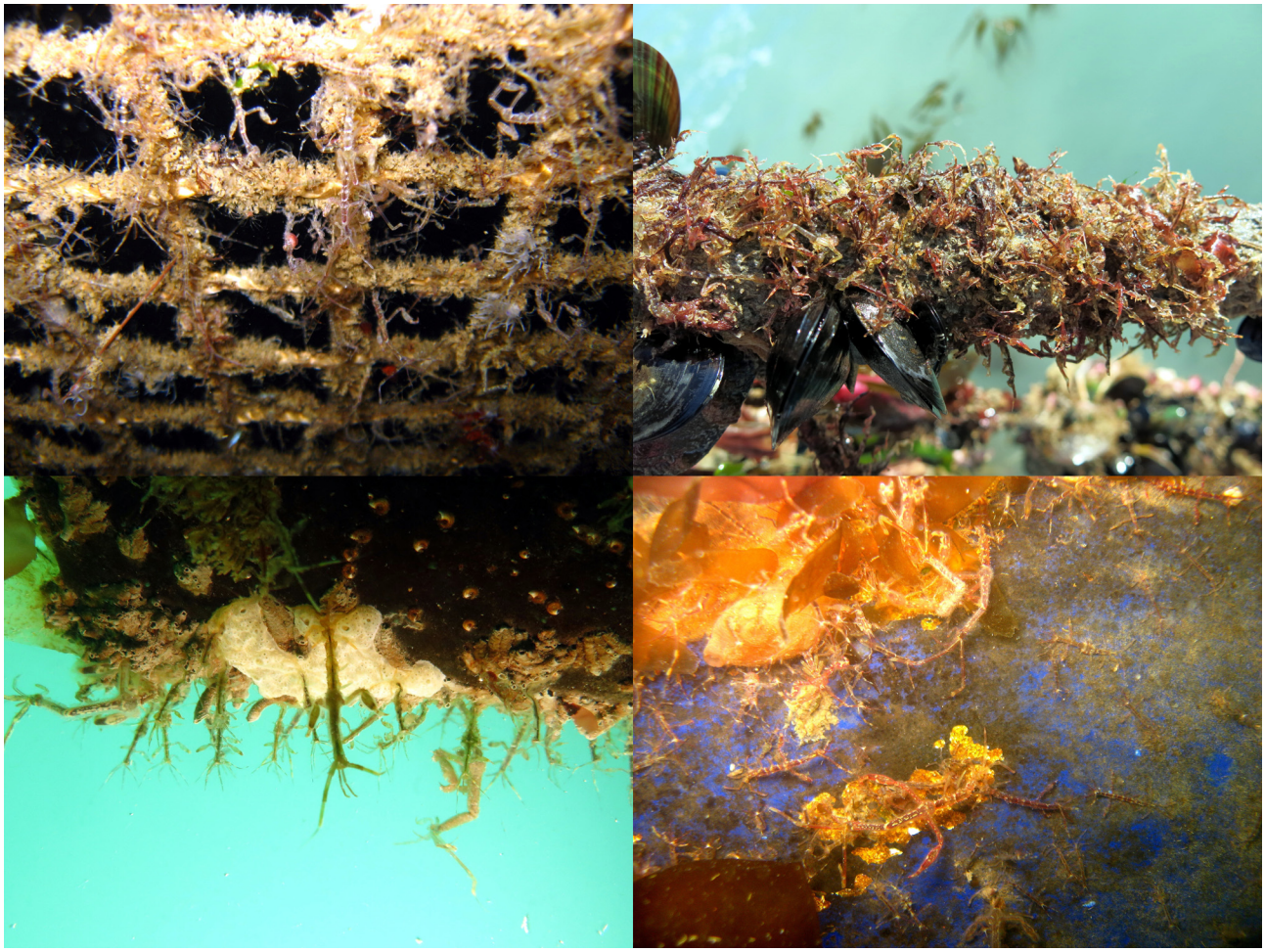

FIGURE 5. *Caprella mutica* Schurin, 1935, in situ, showing different fouling situations: finfish farm netting (top left); mussel farm backbone rope (top right); marina pontoon (bottom left); and vessel hull (bottom right) (images: C. Woods, NIWA).

Caprella novaezealandiae Kirk, 1878

(Figs. 1–2, 6–8, Appendix 1)

Caprella novae-zealandiae Kirk, 1878a: 465–466.—Kirk, 1878b: 393–394.—McCain, 1969: 286–287.—Thomson, 1879: 330.
[?l *Caprella novae-zealandiae*.—Mayer, 1882: 71–72; 1890: 76.
Caprella equilibra.—Thomson & Chilton, 1879: 330.

Type material. Neotype: NIWA 155308, male (13 mm), Breaker Bay, Wellington, Cook Strait, New Zealand, 41°19.8'S, 174°49.932'E, 0 m, Z15829, on *Macrocystis* sp., coll. A-N. Lörz & M. Thiel, 30/01/2013.

Type locality. Breaker Bay, Wellington, Cook Strait, New Zealand, 41°19.8'S, 174°49.932'E.

Other material examined. NIWA 114870, 1 female (9 mm; drawn and dissected), Breaker Bay, Wellington, Cook Strait, New Zealand, 41°19.8'S, 174°49.932'E, 0 m, Z15829, on *Macrocystis* sp., A-N. Lörz & M. Thiel, 30/01/2013; NIWA 155309, 1 male (6 mm), Breaker Bay, Wellington, Cook Strait, New Zealand, 41°19.8'S, 174°49.932'E, 0 m, Z15828, on *Macrocystis* sp., coll. A-N. Lörz & M. Thiel, 01/02/2013; NIWA 155310, 1 male (7 mm), Breaker Bay, Wellington, Cook Strait, New Zealand, 41°19.8'S, 174°49.932'E, 0 m, Z15829, on *Macrocystis* sp., coll. A-N. Lörz & M. Thiel, 30/01/2013; NIWA 155311, 1 female (7 mm), Breaker Bay, Wellington, Cook Strait, New Zealand, 41°19.8'S 174°49.932'E, 0 m, Z15829, on *Macrocystis* sp., coll. A-N. Lörz & M. Thiel, 30/01/2013; NIWA 155321, 2 females (6–7 mm), 2 males (8 mm), Breaker Bay, Wellington, Cook Strait, New Zealand, 41°19.8'S, 174°49.932'E, 0 m, Z15828, on *Macrocystis* sp., coll. A-N. Lörz & M. Thiel, 01/02/2013; NIWA 155322, 1 female (6 mm), Breaker Bay, Wellington, Cook Strait, New Zealand, 41°19.8'S, 174°49.932'E,

0 m, Z15829, on *Macrocystis* sp., coll. A-N. Lörz & M. Thiel, 30/01/2013; NIWA 155323, 1 female (8 mm), 1 juvenile (4 mm), Breaker Bay, Wellington, Cook Strait, New Zealand, 41°19.8'S, 174°49.932'E, 0 m, Z15829, on *Macrocystis* sp., coll. A-N. Lörz & M. Thiel, 30/01/2013; NIWA 155324, 1 female (7 mm), Breaker Bay, Wellington, Cook Strait, New Zealand, 41°19.8'S, 174°49.932'E, 0 m, Z15829, on *Macrocystis* sp., coll. A-N. Lörz & M. Thiel, 30/01/2013.

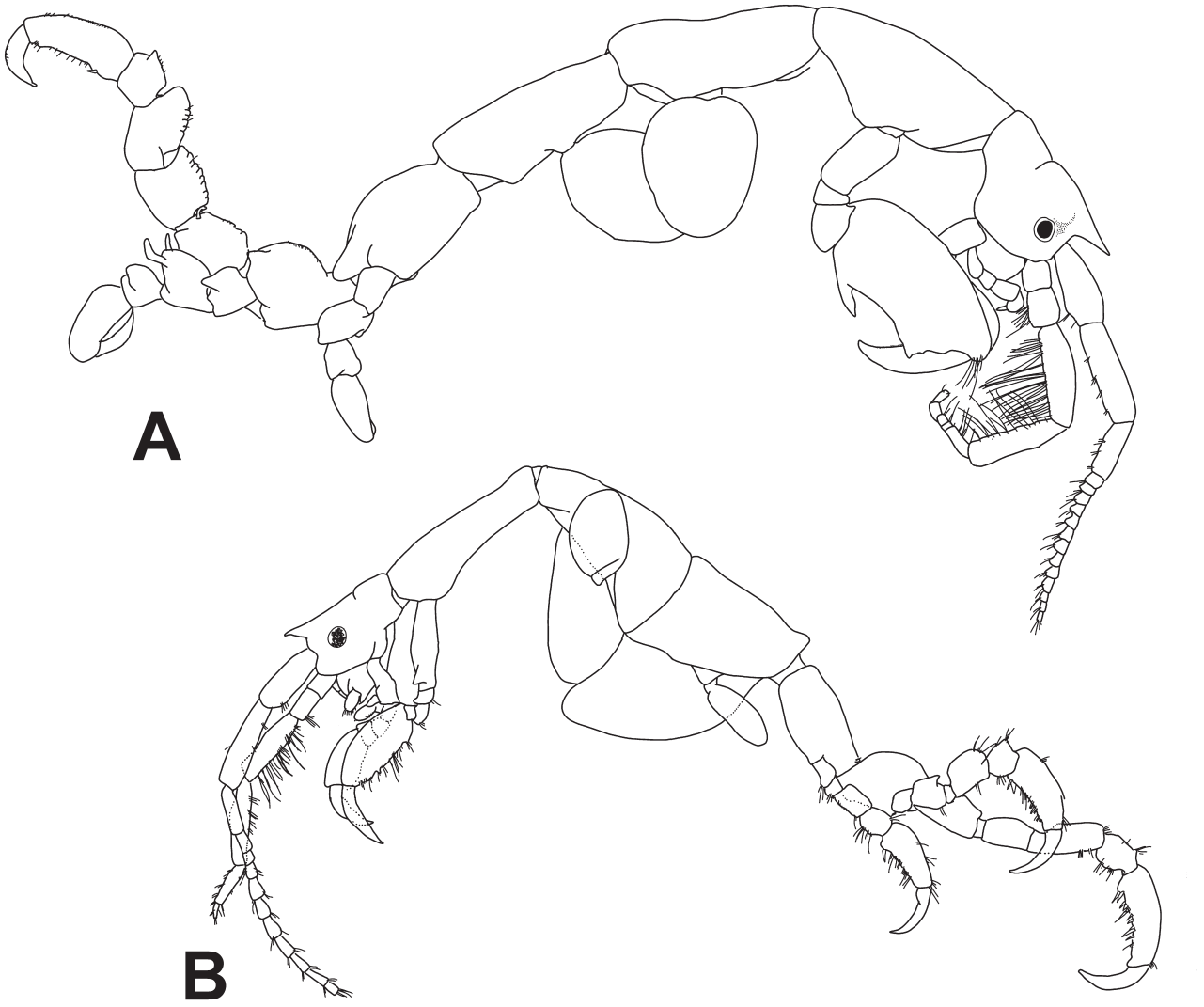

FIGURE 6. *Caprella novaezealandiae* Kirk, 1878, Eve Bay, Wellington, New Zealand: A, neotype, male, NIWA 155308, 13 mm; B, female, NIWA 114870, 9 mm.

Diagnosis. Head with subacute triangular projection, directed forward; body otherwise smooth and robust, pereonite 4 with small distal hump. Antenna 1 shorter than ½ of body; peduncle articles 1–2 slender in male and female, sparsely setose, longer than flagellum. Antenna 2 longer than peduncle of antenna 1, bearing long dense setae on ventral margin. Mandible without palp. Gnathopod 1 robust, with palmar margin of propodus setose with pair of proximal grasping spines; palm straight; dactylus serrate. Gnathopod 2 in male arising at midlength of pereonite 2; basis longer than ½ length of propodus (0.65 ×) and less than ½ of pereonite 2 (0.38 ×); palmar region of propodus concave, weakly setose with distal rectangular projection/shelf and prominent long proximal spiniform defining tooth; dactylus strong, apex acute and constricted medially with inner margin serrate. Gnathopod 2 in female inserted distally on pereonite 2; palm of propodus straight. Gills rounded and quite large and inflated in male, maximum diameter ½ of length to pereonite 4. Gills oval to elliptical and smaller in female. Pereopods 3 and 4 absent. Pereopods 5–7 similar in length posteriorly; palmar margin of propodus straight bearing short robust and simple setae with two median toothed grasping spines.

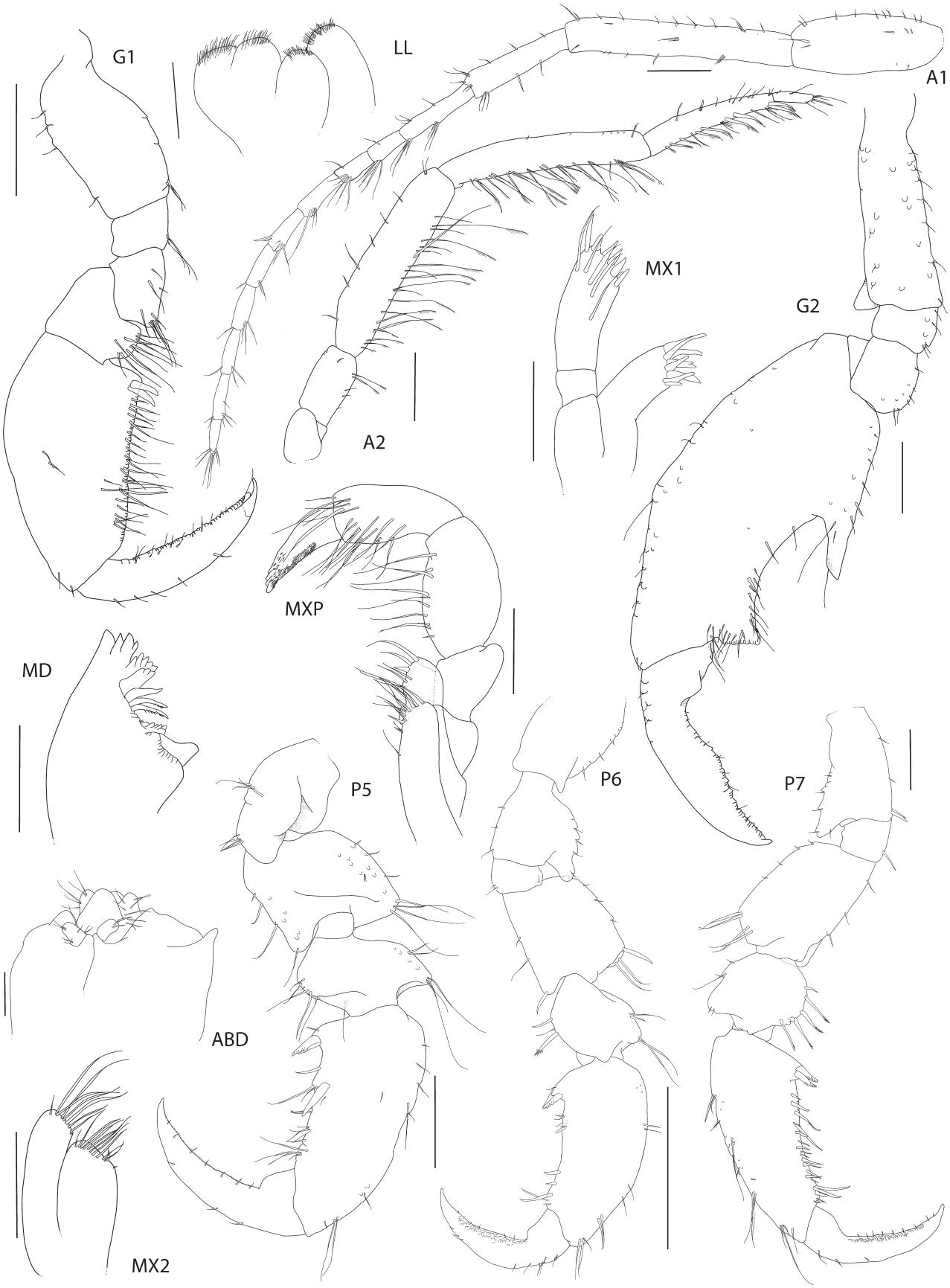

FIGURE 7. *Caprella novaezealandiae* Kirk, 1878, neotype male, NIWA 155308, 13 mm, Eve Bay, Wellington, New Zealand. Scales: 0.1 mm, mouthparts, abdomen; 0.2 mm for A1–2, G1–2, P5, P7; 0.5 mm for P6.

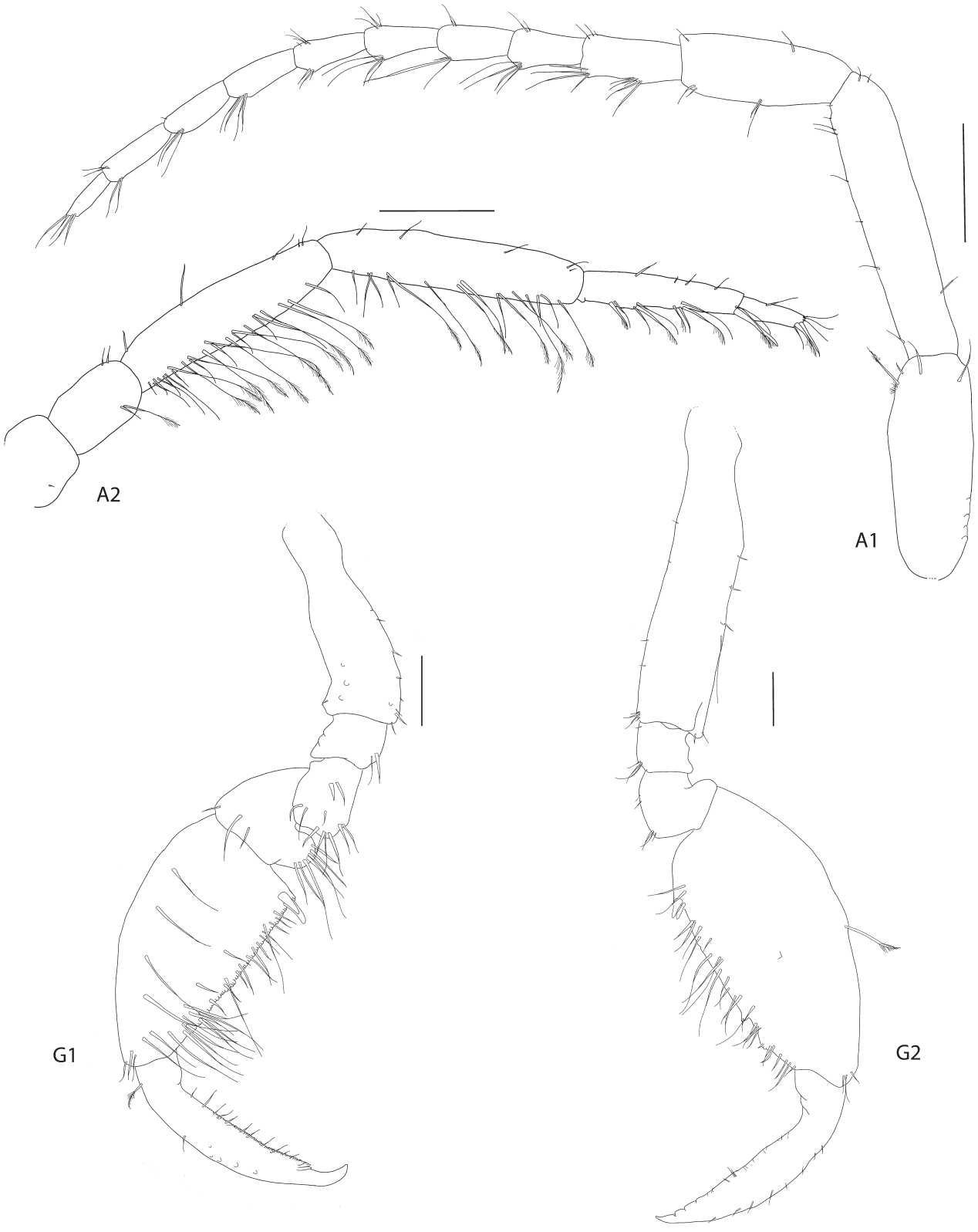

FIGURE 8. *Caprella novaezealandiae* Kirk, 1878, Breaker Bay, New Zealand, female, NIWA 114870, 9 mm. Scales 0.2 mm.

Description of neotype. (Male, 13 mm, NIWA 155308). Body: head anterodistal margin produced to form an anteriorly directed tooth. Head fused with pereonite 1, suture present and visible. Pereonite smooth, no dorsal projections; pereonite 4 with rounded distal hump. Ratio of lengths pereonites 1 (not including head) 1: 3.4: 3.25: 3.25: 2.2: 1.7: 1.2.

Head: Antenna 1 0.37 × body; peduncular article 2 the longest, 1.2 × article 1, 1.7 × article 3; flagellum 0.7 × peduncular length with 13 articles. Antenna 2 0.8 × antenna 1 length; peduncular article 4 subequal in length to article 5 (1.1 ×). Mouthparts: lower lip inner plate rounded. Mandible right incisor with five teeth, lacinia mobilis with seven teeth followed by three plumose setae, molar distinct. Mandible left incisor with five teeth, lacinia mobilis with three toothed teeth followed by two plumose setae, molar distinct. Maxilla 1 outer plate with seven apical tooth-like robust setae; palp two-articulate; article 2 longer than article 1 (3.5 ×) with six apical robust setae and single line of five medial slender setae. Maxilla 2 inner plate, oval, with 12 marginal and apical slender setae; outer plate with nine mainly apical slender setae, inner plate shorter than outer plate. Maxilliped inner plate with two stout setae on distal margin, with line of setae on entire distal margin and along distal half of inner margin; outer plate 1.5 × inner plate with four robust setae on inner margin, slender setae apically; palp four-articulate, article 2 longest, setose along entire inner margin; dactylus inserted apically, no setose lobe/hood apically, fine hair-like setae along length medially, slight serration at tip.

Gnathopod 1 basis subequal to ischium, merus, carpus combined, posterodistal lobe absent; merus produced to form subacute, setose posterior lobe; carpus subtriangular, densely setose on posterior lobe, posterior lobe broadly rounded extended in line with merus lobe; propodus subtriangular to subrectangular, length 1.7 × width, setae not along anterior margin; palm beginning ¼ distance along posterior margin; proximal defining corner equipped with pair of smooth robust setae (grasping spines) followed by ca. 25 setae along palm, palm slightly serrated; dactylus weakly curved, inner margin rounded serrated, small setae along both inner and outer margins, slightly bifid tip. Gnathopod 2 basis anterior margin smooth, medial surface covered in small protuberances, basis slightly produced to form small triangular flange; ischium 0.15 × basis, without anterior distal triangular lobe; propodus longer than wide (length 1.9 × width); anterior margin with protuberances and small setae and on long seta; palm beginning ⅓ distance along posterior margin, proximal defining tooth long without robust setae, apically grinding surface and one slender seta; palm with predactylar rectangular shelf/projection, row of small setae along palm; dactylus outer margin proximal ⅓ with small setae, inner margin serrated. Gill 3 length 0.67 × pereonite 3; gill 4 subequal to gill 3. Pereopod 5 basis 0.55 × propodus, posterior margin smooth and expanded distally to form subacute flange; ischium 0.6 × basis; merus 0.25 × basis; carpus 0.64 × basis, anterior margin lined with slender setae, posterior margin produced to form subacute setose lobe; propodus longest, with paired combed robust setae 0.25 along posterior margin on rounded corner, palm straight lined with 2 robust and 12 slender setae; propodus posterior margin lined with occasional setae; propodus length 2.1 × width; dactylus long reaching to defining corner, curved, inner margin smooth but with fringe of small setae, outer margin with occasional setae. Pereopod 6 subequal in length to pereopod 5, similar structure to P5; length propodus 2.1 × width; dactylus inner margin with grinding surface. Pereopod 7 similar to pereopods 5 and 6; propodus posterior margin lined with slender setae; length propodus 2.3 × width.

Variations/ sexual dimorphism. Mature female, NIWA 114870, 9 mm. Ratio of pereonites 1–7 (not including head) 1: 4.5: 4.5: 3.5: 3.0: 2.2: 1.5. Antennae 1 slightly shorter than ½ body. Antenna 1 slender; peduncle article 2 longest, 1.2 × article 1, 1.7 × article 3; articles 1 longer than article 3 (1.4 ×); flagellum nine articles, flagellum subequal to peduncle. Antenna 2 reaching past the peduncle of antenna 1, and to halfway along flagellum. Gnathopod 1 basis subequal—slightly longer than ischium, merus, carpus combined (1.1 ×); carpus subtriangular, setose on broadly rounded posterior lobe; propodus subtriangular, length 1.8 × width, without setae along anterior margin; palm beginning ⅕ along posterior margin; proximal defining corner equipped with pair of smooth robust setae followed by ca. 22 setae along slightly serrate palm; dactylus weakly curved, serrate inner margin. Gnathopod 2 basis anterior margin smooth, slightly produced to form small triangular flange; ischium 0.15 × basis, without lobe; propodus longer than wide (length 2.1 × width); palm beginning ¼ along posterior margin, proximal defining corner with two smooth robust setae; palm setose and smooth, with two small rounded teeth/projections situated on distal ¼ of palm, dactylus inner margin distally serrate and lined with small setae, outer margin with small setae.

Distribution. Wellington, Cook Strait, New Zealand

New Zealand biosecurity status. Native.

Genbank Accession numbers: SUB14807890 M08Cnzelandiae COI PQ522032; SUB14807870 M08_Cnzelandiae_nSSU PQ521244.

TABLE 2. Morphological differences between related species of the *Caprella penantis* complex.

	C. penantis (of Krapp-Schickel, 1993)	*C. pitu* Sánchez-Moyano, Garcia-Asencio & Guerra-Garcia, 2014	*C. novaezealandiae* Kirk, 1878	*C. serenae* **sp. nov.**	*C. andreae* Mayer, 1890
Type locality	England, UK	Mexico	Wellington, NZ	Tauranga, NZ	Atlantic coast of USA
Length	Unknown	9 mm	13 mm	9.5 mm	15 mm
Head: projection	Small, straight, subacute	Small, straight, acute	Long, straight, acute	Long, curved ventrally at the tip, acute	Short, straight acute
Head/pereonite suture	Obvious	Absent/reduced	Obvious	Obvious	Slight
Head: pereonites (1–7)	1: 0.5: 2.6: 2.5: 2.5: 1.8: 1.2: 1	1: 0.4: 2.5: 2.3: 2.2: 1.3: 1.3: 1.2	1: 0.7: 2.7: 2.5: 2.4: 2: 1.4: 0.9	1: 0.8: 3.9: 2.6: 2.6: 2: 0.9: 0.6	1: 0.6: 2.6: 3.1: 2.7: 1.8: 1.6: 0.9
A1: body	Reaching midpoint pereonite 3	Reaching midpoint pereonite 3	Reaching to ¼ pereonite 3	Reaching to ¼ pereonite 3	Reaching to ¼ pereonite 3
A1 articles (1:2:3)	1: 1.3: 0.6	1: 1.5: 0.7	1: 1.3: 0.7	1: 1.6: 0.8	1: 1.7: 0.7
A1 peduncle	Slender	Robust	Slender	Slender	Robust
A1 flagellum	= peduncle art 1 + 2	= peduncle art 1 + ½ art 2	= peduncle art 1 + ¾ art 2	= peduncle art 1 + ¾ art 2	= peduncle art 1 + ½ art 2
A2: A1	Reaching midpoint flagellum	Reaching to end of article 2 peduncle	Reaching ⅔ flagellum	Reaching midpoint flagellum	Reaching ⅔ flagellum
A2: art 4: art 5	1: 1	1: 1	1: 0.8	1: 1.2	1: 1
Mxp dactylus	Unknown	Smooth, slightly setose	Serrate both margins, setose	Smooth, slightly setose	Unknown
G1 propodus	Subtriangular, medial setae, palm straight, v. small acute corner with 2 grasping robust setae	Subtriangular, medial setae, palm straight, acute corner with 2 grasping robust setae	Subrectangular, no setae, palm straight, subacute corner, with 2 robust setae	Subtriangular, medial setae, palm straight, reduced corner, 1 robust seta	Subtriangular, medial setae, palm straight, small acute corner with 2 grasping robust setae

.....continued on the next page

TABLE 2. (Continued)

	C. penantis (of Krapp-Schickel, 1993)	*C. pitu* Sánchez-Moyano, Garcia-Asencio & Guerra-Garcia, 2014	*C. novaezealandiae* Kirk, 1878	*C. serenae* **sp. nov.**	*C. andreae* Mayer, 1890
G1 dactylus	Serrate, not setose, tip bifid, ¾ length of palm	Serrate, not setose, tip bifid, length of palm	Serrate, setose, tip simple, ¾ length of palm	Serrate, setose, tip simple, overreaching palm	Smooth, not setose, tip simple, ¾ length of palm
G2 propodus	Broad, medially setose, smooth, predactylar shelf small, defining acute tooth	Broad, not setose, rugose, shelf small, small defining tooth	Broad, not setose, slightly rugose, predactylar shelf large, long acute defining tooth	Broad, slightly setose, rugose, large shelf, large acute defining tooth	Broad, medially setose, smooth, predactylar shelf large, defining subacute tooth
G2 dactylus	Distally serrate, acute	Distally serrate, acute	All margins serrate, tip acute	All margins serrate, tip slightly bifid	Margins smooth, tip simple, acute
P5–7 basis—carpus	Articles similar proportions, all as wide as long, lobate	Articles similar proportions, all as wide as long, lobate	P5 basis—carpus broad as long, P6–7 merus longer than broad, lobate	Articles similar proportions, all wider than long, strongly lobate	Articles similar proportions, all as wide as long, lobate
P5–7 propodus	Narrow, palm slightly concave	Narrow, no palm, margin straight	Broadish, palm defined by corner & 2 robust setae, concave, slightly rugose	Broadish, palm defined by corner & 2 robust setae, concave, strongly rugose	Broad, short palm, defined by 1 robust seta, convex
P5–7 dactylus	Not setose	Not setose	Setose both margins	Setose outer margin	Not setose

Remarks. We remove *Caprella novaezealandiae* from synonymy with *Caprella penantis* Leach, 1814 (placed in synonymy by McCain 1968) and establish NIWA 155308 as the neotype for *Caprella novaezealandiae* Kirk, 1878. No type specimens were formally assigned and there is no evidence of any extant original material of Kirk's. The neotype is from the original type locality (Wellington, Cook Strait, New Zealand) and fits as closely as possible to the original description. The original description documented a caprellid of approximately 25 mm with a forward directed tooth on the head; first pereonite short, second longest and then subsequent pereonites decreasing in length; antennae 1 ⅖ of body; antennae 1 flagellum articles distal corners produced without setae, antenna 2 reaching to the end of antenna 1 peduncular article 2; gnathopod 2 attached in the distal ½ of pereonite 2, propodus ovate, palm with prominent posterior tooth and a smaller but distinct anterior tooth (not a lobe), dactylus strongly curved; pereopods 5–7 with concave palm with posterodistal defining tooth.

Caprella novaezealandiae as described here differs from the original description by the articles of antenna 1 flagellum, which, while also being produced, bear small setae, and antenna 2 is longer in proportion to antenna 1, reaching past the peduncle. These differences could be related to size. The longest specimen (neotype) examined was a male of 13 mm, notably shorter than the inch-long specimen documented in Kirk (1878).

Caprella novaezealandiae and *C. serenae* **sp. nov**. are part of the complex of species morphologically similar to *Caprella penantis* Leach, 1814. In the original description, Kirk mentions that *C. novaezealandiae* has similarities to *C. geometrica* and both species were placed in synonymy with *C. penantis* by McCain (1968), moving it from synonymy with *C. equilibra* (placed there by Thomson & Chilton 1885, 1886). However, in his treatise on New Zealand caprellids, McCain (1969: 286) also treats *C. novaezealandiae* as unrecognisable and that "*Caprella novae-zealandiae* as having an anteriorly directed triangular tooth on the cephalon" and mentions that it is close to *Caprella geometrica*, a member of the *Caprella acutifrons-penantis* complex. "Perhaps *Caprella novae-zealandiae* is indeed a member of this complex since its species occur throughout the world. If so, Kirk's name would have priority over any of Mayer's varietal names (1882, 1890) and should possibly replace one or other of the names now in use for Pacific forms of this complex. I have no material of this species …" (McCain 1969: 286–287).

Caprella penantis was originally considered a cosmopolitan species. However, recent studies have shown, like so many other seemingly 'cosmopolitan' species, that it is a complex of closely related, morphological similar (but not indistinguishable) species (Cabezas *et al.* 2013b; Sánchez-Moyano *et al.* 2014, Cabezas *et al*. 2022). Both *C. novaezealandiae* and *C. serenae* **sp. nov.** belong in the '*penantis'* complex of species. The analysis by Cabezas *et al*. (2022) indicated that there were three main lineages of *Caprella penantis* sensu stricto. As there are a number of forms of *C. penantis* around the world, it is very difficult compare all the forms together. Therefore the New Zealand species and those on an opposite side of the Pacific Ocean (anecdotally there are strong similarities between New Zealand's marine fauna and that on the south-eastern side of the Pacific Ocean) were compared (Table 2). Despite possessing similarities, such as the presence of an acute/subacute projection on the head and the shape of gnathopod 2 propodus (short and robust with one dominant tooth), there are distinct morphological differences separating both these New Zealand species from the '*penantis'* species group (Table 2).

With the diversity of *C. penantis*-like forms in New Zealand as shown in this paper, it is reasonable to assume that *C. penantis* does not occur (as yet) in New Zealand waters. This seems to be corroborated by the molecular evidence provided (Fig. 2, Appendix 1). The COI sequence analysis supports these distinctions (Fig. 2) with *C. novaezealandiae* differing from *C. serenae* by 74 substitutions, consistent with being a distinct species. These sequences differed significantly from the other species in the analysis and even differed significantly from *C. penantis* and *C. andreae* despite the obvious morphological similarities.

Caprella perplexa sp. nov.

(Figs. 1, 9–11)

Type material. Holotype: NIWA 155325, male (9.5 mm), KAH1706/Grab 34A/67.19, Spirits Bay, Northland, North Island, New Zealand, 34°23.7402'S 172°48.978'E, 32 m, 2/06/2017, NIWA. Paratypes: NIWA 155326, female (6 mm); NIWA 155327, 17 specimens (females, males, juveniles, 3–8 mm), same collection data as the holotype.

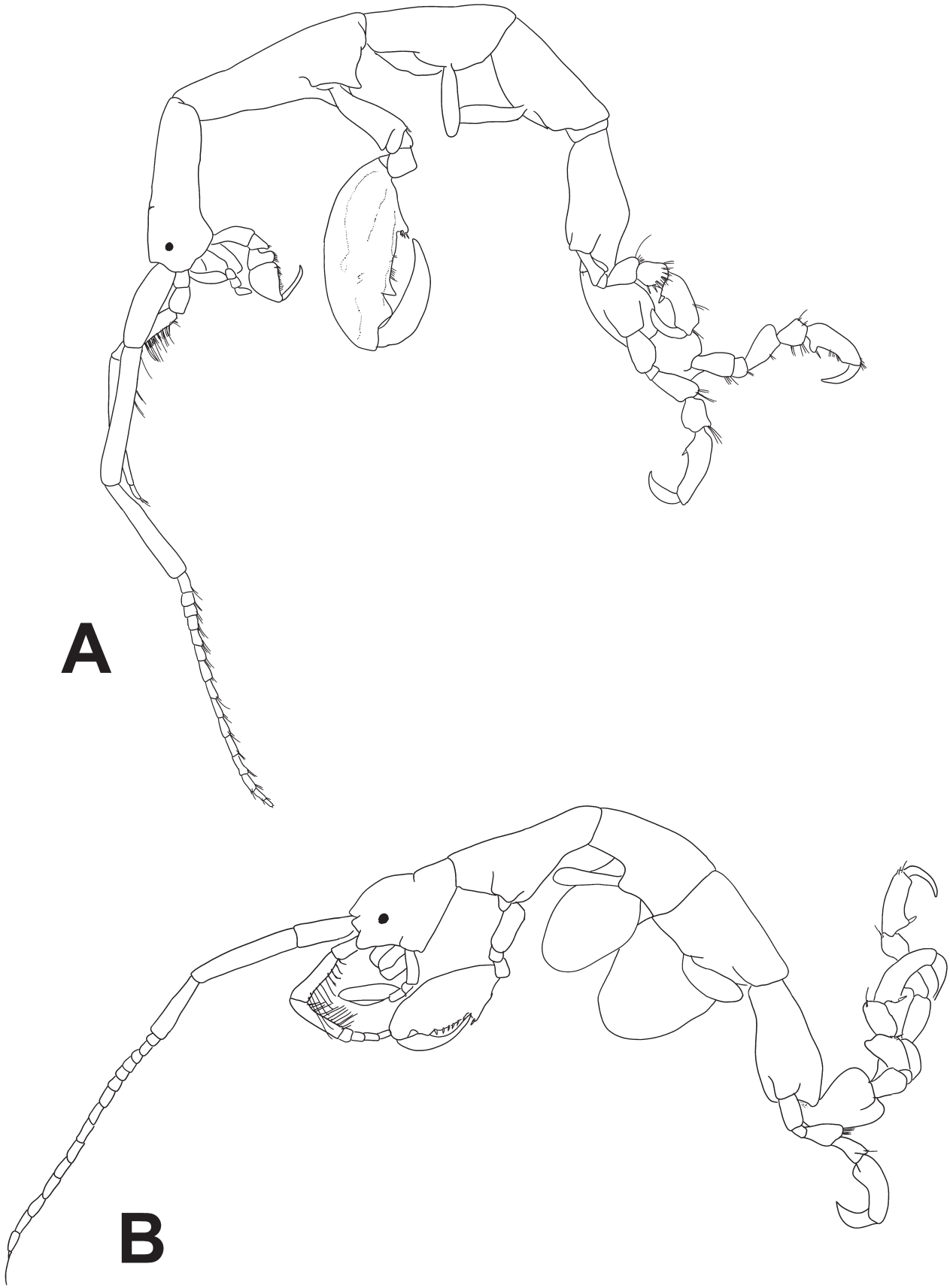

FIGURE 9. *Caprella perplexa* **sp. nov**., Piwhane/Spirits Bay, Northland, New Zealand, habitus: A, holotype male, NIWA 155325, 9.5 mm; B, paratype, female, NIWA 155326, 6 mm.

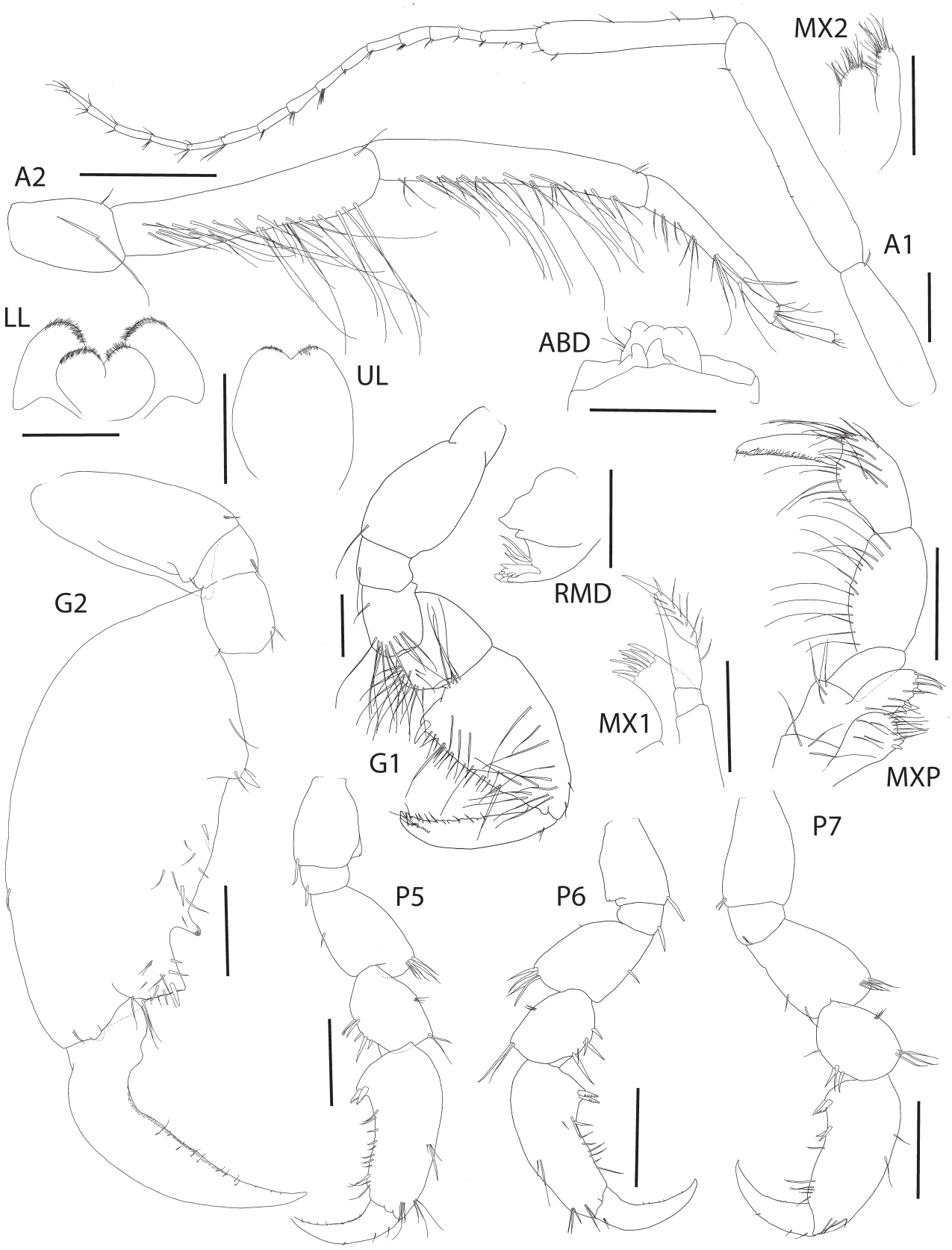

FIGURE 10. *Caprella perplexa* **sp. nov**. holotype male, NIWA 155325, 9.5 mm, Spirits Bay, Northland, New Zealand. Scales: 0.2 mm, mouthparts and gnathopod 1; 0.5 mm, antennae 1–2, gnathopod 2, pereopods 5–7, abdomen.

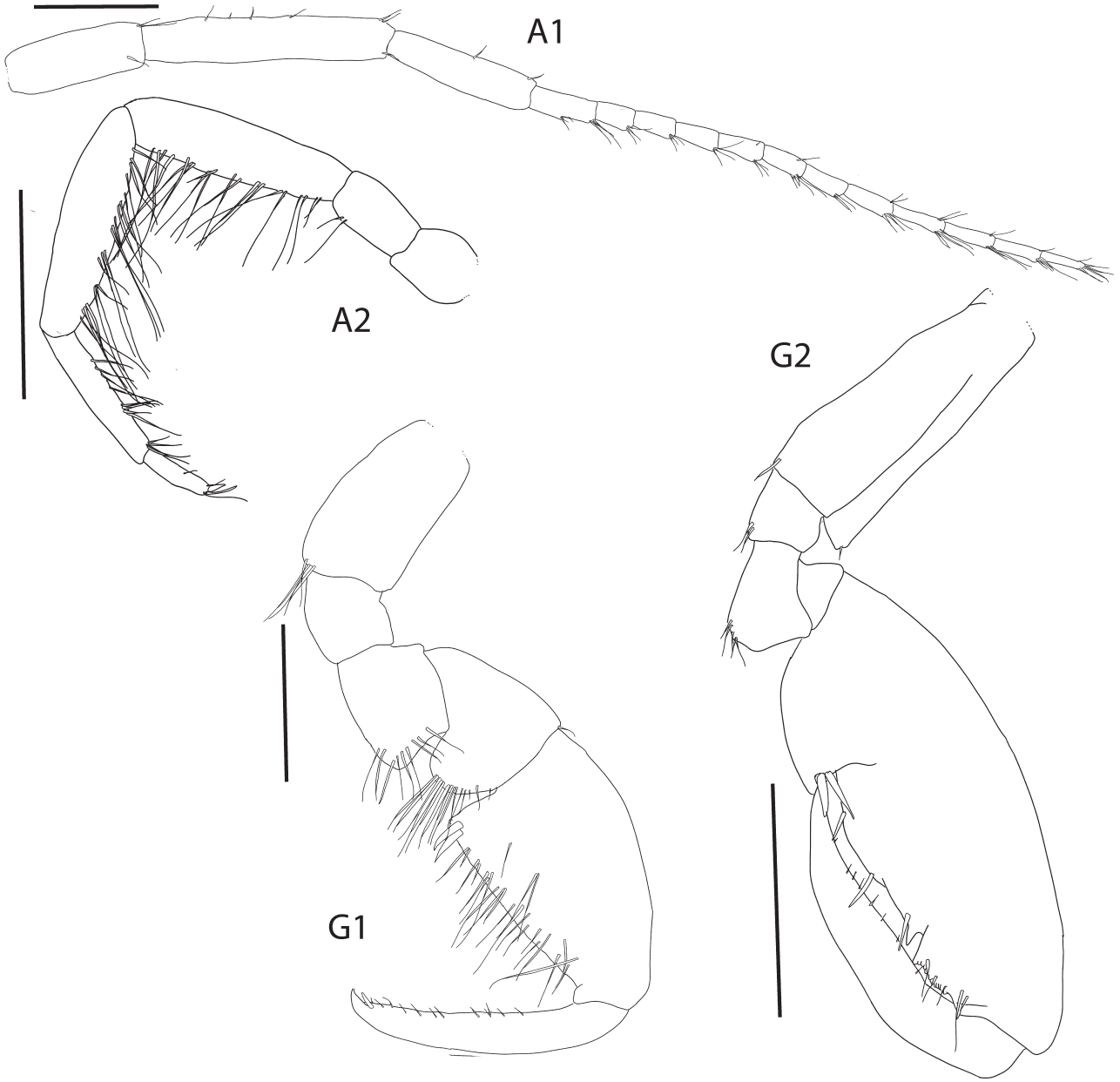

FIGURE 11. *Caprella perplexa* **sp. nov.,** paratype female, NIWA 155326, 6 mm, Spirits Bay, Northland, New Zealand. Scales: 0.2 mm, gnathopod 1; 0.5 mm, antennae 1–2, gnathopod 2.

Other material examined. NIWA 155328, 1 juvenile (3 mm), KAH1706/Grab4A.1/17/41, Piwhane/Spirits Bay, Northland, North Island, New Zealand, 34°21.54'S 172°45.3498'E, 51 m, coll. NIWA, 30/05/2017; NIWA155329, 4 juveniles (3–4 mm), KAH1706/Grab 36A.1/69.2, Spirit's Bay, Northland, North Island, New Zealand, 34°23.718'S 172°46.818'E, 31 m, coll. NIWA, 02/06/2017; NIWA 155330 (MITS75145), OPX30232, Russell, Bay of Islands, North Island, New Zealand, 35°15.7187'S 174°7.2492'E, 0–1 m, collected from a pontoon, coll. NIWA, 13/11/2019.

Type locality. Piwhane/Spirits Bay, North Island, New Zealand.

Etymology. The species name, *perplexa*, refers to the nature of the complex of species associated with *Caprella equilibra* Say, 1818 to which this new species belongs. It is a Latin adjective used to indicate something is complicated.

Diagnosis. Head rectangular, without projection; body smooth and robust. Antenna 1 over half body; peduncle articles 1–2 slender in male and female, sparsely setose, subequal in length to flagellum. Antenna 2 reaching to

⅓ length of article 3 of peduncle of antenna 1, bearing long dense setae on ventral margin. Gnathopod 1 robust, with palmar margin of propodus setose with proximal robust seta; palm straight; dactylus inner margin serrate. Gnathopod 2 in male arising at distal one-third of pereonite 2; basis approximately ½ length of propodus and half-length of pereonite 2; palmar region of propodus straight, weakly setose with posterior corner subacute bearing robust seta, large subquadrate tooth predactylar and secondary tooth of same length just posterior to predactylar tooth; dactylus strong, apex pointed and unconstricted with distal end smooth. Gnathopod 2 in female inserted midpoint on pereonite 2; palm of propodus convex. Gills long and slender in both sexes. Pereopods 5–7 increasing in length posteriorly; palmar margin of propodus concave bearing short dense setae with two median grasping spines and expanded posterior corner.

Description. (Based on holotype male, 9.5 mm, NIWA 155325). Body. Head anterodistal margin rectangular, not produced forward. Head fused with pereonite 1, suture present and visible. Pereonites no dorsal projections; only slight posterior pointing lateral projections on pereonite 2 at gnathopod insertion point, all other pereonites without lateral projections. Ratio of lengths pereonites 1 (not including head)—7 1: 1.7: 1.3: 1.2: 1.2: 0.8: 0.5. Head. Antenna 1 0.65 × body; peduncular article 2 longest, 1.75 × article 1, 1.3 × article 3; flagellum 0.7 × peduncular length with 16 articles. Antenna 2 0.45 × antenna 1 length, peduncular article 4 subequal to article 5.

Mouthparts: upper lip deeper than wide, bilobed, setose. Lower lip, inner lobe round, significantly shorter than outer lobes. Mandible left incisor with 5 teeth, lacinia mobilis with five teeth followed by three plumose setae, molar distinct, bladed. Maxilla 1 outer plate with seven stout apical setal-teeth; palp two-articulate; article 2 longer than article 1 (4.5 ×) with 10 lateral slender setae and single line of apical robust setae. Maxilla 2 inner plate, oval, with ca. 15 setae; outer plate with ca. 15 apical setae, outer plate longer than inner plate. Maxilliped inner plate (basal endite) with two stout setae on inner half of distal margin, with line of setae on entire distal margin; outer plate (ischial endite) 2.0 × inner plate (basal endite) with five well-spaced robust setae on inner margin, with row seven medial slender setae; palp 4-articulate, article 2 longest, setose along entire inner margin; article 3 2.0 × article 1, setose on lateral to distal part, and medially; dactylus inner and medial surfaces setose with fine hairs; dactylus same length as article 3.

Gnathopod 1 basis subequal to ischium, merus, carpus combined; carpus subtriangular, densely setose, posterior lobe broadly rounded; propodus triangular, length 1.4 × width (at widest point), setae on medially; palm beginning close to posterior margin; proximal projection equipped with robust seta followed by many slender setae of varying lengths along palm; dactylus weakly curved, inner margin with small setae, tip bifid. Gnathopod 2 basis with anterodistal triangular projection, with bifid corner; ischium 0.2 × basis, without distal triangular projection; propodus longer than wide (length 1.7 × width); palm beginning approximately ⅓ along posterior margin, proximal projection with single robust seta followed by one slender seta; palm with predactylar subquadrate projection with grinding surface preceded by rounded excavation and narrower, rounded tooth almost as long as predactylar tooth, sparse slender setae along palm. Gill 3 length 0.5 × pereonite 3, elongate; gill 4 subequal with gill 3. Pereopod 5 basis 0.6 × propodus, with small bifid, distal projection; ischium 0.3 × basis; merus 1.0 × basis; carpus 1.0 × basis, setose along distal inner margin; propodus longest, with paired, combed robust setae on posteroproximal corner, 0.3 along posterior margin, propodus twice as long as wide (at posteroproximal corner); palm concave with sparse slender setae along margin; dactylus strongly curved. Pereopod 6 longer than pereopod 5 (1.3 × longer). Pereopod 6 shorter than pereopod 5, but with similar proportions and shape. Pereopod 7 same length as pereopod 6. Penis short. Uropod 1 vestigial with 3 lateral setae. Uropod 2 vestigial.

Paratype mature female, NIWA 155326, 6 mm. Ratio of lengths pereonites 1 (not including head)—7 1: 4: 3: 3.1: 3: 2: 1.7. Antenna 1 peduncular article 2 longest 1.75 × article 1, 1.6 × article 3; flagellum 1.1 × peduncular length with 12 articles. Antenna 2 0.35 × antenna 1 length. Gnathopod 2 inserted halfway along pereonite 2; basis 0.30 × pereonite 2 length; palm beginning ⅓ along posterior margin.

Ecology. This species was reported from grab samples from a benthic survey from depths of 31–52 m. The exact habitat is not known.

Distribution. North Island, New Zealand.

New Zealand biosecurity status. Native.

Remarks. *Caprella perplexa* **sp. nov**. is closely related to the seemingly cosmopolitan species, *Caprella equilibra* Say, 1818. It is highly doubtful, however, that *C. equilibra* is a true cosmopolitan species. Even though there are numerous comments on the globally conservative nature of the morphology of this species, both morphological and molecular information is provided to suggest that this is in fact a species complex. *Caprella perplexa* **sp.**

nov. is morphologically similar but does differ from Say's original description by the position of the gnathopod 2 (positioned in the first third of the body, as opposed to halfway). *Caprella equilibra* was first recorded in New Zealand waters by Thomson & Chilton (1885).

Caprella novaezealandiae was synonymised with *C. equilibra* by Thomson & Chilton (1885) (but was removed by McCain 1968). Chilton was notorious for assigning northern hemisphere names to geographically disparate, but morphologically similar species. There are three (*Caprella manneringi, C. perplexa* **sp. nov.** and *C. sarahae* **sp. nov**.), and potentially more, species involved in the *C. equilibra* complex in the New Zealand region. There is also doubt as to whether *C. equilibra* sensu stricto occurs in the New Zealand region at all. A detailed collection and analysis programme, with both detailed morphological and molecular analysis throughout the New Zealand region is recommended for an accurate picture of this complex. These species generally all have an elongated pereonite 1 and 2, elongated gnathopod 2, and a ventral acute projection on pereonite 2. The differences between these species are compared to other significant records of the *C. equilibra* complex (Table 3). *Caprella perplexa* is closest to *C. sarahae* **sp. nov**. but they differ mainly by the proportion and shape of antenna 1 (flagellum long and narrow in *C. perplexa*, short and robust in *C. sarahae*), the gnathopod 1 merus posterior lobe broadly rounded (*C. perplexa*) and subacute and narrow (*C. sarahae*), pereonite 6 longer than 7 (*C. perplexa*), and the same length (*C. sarahae*).

There were difficulties with securing molecular sequences for the material (old material originally rinsed in formalin). *Caprella manneringi* is predominantly found on asteroids in the subantarctic, *C. sarahae* has a wider distribution (see species notes) whereas *C. perplexa* seems to be more restricted to the northern region of the North Island.

Caprella sarahae sp. nov.

(Figs. 1, 12–14)

Type material. Holotype: NIWA 155331, male (13 mm), SA-3543, stn Z18756, Hoho Islet, Snares Islands/Tini Heke, New Zealand, 48°7.002'S 166°36'E, 0–1 m, amongst turf of hydroids in rock crevices in lower *Durvillea* sp. zone, coll. G.D. Fenwick, 17/02/1977. Paratypes: NIWA 155332, female (7 mm), SA-3543, Hoho Islet, Snares Islands/Tini Heke, New Zealand, 48°7.002'S 166°36'E, 0–1 m, amongst turf of hydroids in rock crevices in lower *Durvillea* sp. zone, coll. G.D. Fenwick, 17/02/1977. Paratypes: NIWA 155333, approximately 200 specimens (males, females and juveniles, 3–13 mm), SA-3543, Hoho Islet, Snares Islands/Tini Heke, New Zealand, 48°7.002'S 166°36'E, 0–1 m, coll. G.D. Fenwick, 17/02/1977.

Other material examined. NIWA 155334, approximately 150 specimens (males, females and juveniles, 4–13 mm), SA-3544, stn Z18757, Hoho Islet, Snares Islands/Tini Heke, New Zealand, 48°7.002'S 166°36'E, 0–1m, under rocks and among hydroids in rock pool, lower *Durvillea* sp. zone, coll. G.D. Fenwick, 17/02/1977.

Type locality. Hoho Islet, Snares Islands/Tini Heke, New Zealand, 48°7.002'S 166°36'E.

Etymology. The species is named for Sarah Allen of NIWA who has sent the first author (RP) numerous specimens of *Caprella* to identify through MITS (Marine Invasives Taxonomic Service), leading primarily to this paper.

Diagnosis. Head rectangular, with slight, rounded projection; body smooth and robust. Antenna 1 over ½ of body (0.71 ×); peduncular articles 1–2 robust and expanded in male and slender in female, sparsely setose, longer than flagellum (3.9 ×). Antenna 2 reaching to ½ length of article 2 of peduncle of antenna 1, bearing long setae on ventral margin. Pereonite 1 and 2 comprising half body length. Gnathopod 1 robust, with palmar margin of propodus setose with pair of proximal grasping spines on rounded tooth; palm straight; dactylus smooth. Gnathopod 2 in male arising at distal third of pereonite 2; basis approximately ½ length of propodus and one-third length of pereonite 2; palmar region of propodus straight, weakly setose with posterior corner truncated bearing short robust seta, two teeth predactylar; dactylus strong, apex pointed and unconstricted with distal end smooth, inner margin slightly sinuous. Gnathopod 2 in female inserted at anterior one-third of pereonite 2; palm of propodus slightly sinuous. Pereonite 2 with acute ventral projection between insertion of gnathopods 2. Gills short and oval in both sexes. Pereopods 5–7 of similar lengths; palmar margin of propodus concave lined with short dense robust setae with two combed grasping spines and slightly expanded posterior corner.

TABLE 3. Morphological characters distinguishing records/taxa associated with the *Caprella equilibra* complex.

Type locality: South Carolina, USA	*C. equilibra* sensu Krapp-Schickel, 1993 (Mediterranean Sea)	*C. equilibra* sensu Sanchez-Moyano *et al.* 2014 (Mexico)	*C. equilibra* sensu Guerra-Garcia, 2003 (Campbell Island, Snares Islands)	*C. manneringi* McCain, 1979 (Stewart Island, South Island, NZ)	C. *perplexa* **sp. nov.** (Piwhane/Spirits Bay, North Island, NZ)	C. *sarahae* **sp. nov.** (Snares Islands/Tini Heke, NZ)
Length (mature? Male)	13–20 mm	10 mm	6.5 mm	6.5 mm	9.5 mm	13 mm?
Head: pereonite 1: per. 2: per. 3: per. 4: per. 5: per. 6: per. 7	1: 2.5: 3.3: 1.5: 1.3: 1.3: 0.5: 0.6	1: 2.2: 3.8: 2: 1.8: 2.4: 0.9: 1	1: 2.9: 4.3: 2.1: 2.2: 2.6: 1.1: 0.9	1: 0.8: 2.1: 1.3: 1.3: 1.3: 0.7: 0.7	1: 2: 3.5: 2.7: 2.4: 2.4: 1.6: 1	1: 2: 3.9: 1.9: 1.9: 1.4: 1.2: 1.2
Head anterior shape	Rectangular, not projected	Rounded, no projection	Rectangular, no projection	Rectangular, slight projection	Rectangular, slight projection	Rectangular, rounded projection
Antenna 1: length to body	= pereonites 1 + 2	>pereonites 1 + 2 + 3	= pereonites 1 + 2 + 3	≈ pereonites 1 + 2	>pereonites 1 + 2 + 3	>pereonites 1 + 2 + 3
Antenna 1: flagellum length	= article 1 (≈ 0.16 A1)	= article 1 + ⅓ article 2 (≈ 0.25 A1)	= article 1 + ½ article 2 (≈ 0.3 A1)	= article 1 + ⅔ article 2 (≈ 0.4 A1)	= article 1 + article 2 + article 3 (≈ 0.5 A1)	= article 1 + ⅓ article 2 (≈0.3 A1)
Antenna 1: flagellum # articles	12–16 articles	12-13 articles	15 articles	8 articles	16 articles (long, narrow articles)	15 articles (robust short articles)
G1 merus posterior lobe shape	Rectangular/truncated	Rounded/subacute	Rounded? (not clear)	Broadly rounded	Broadly rounded	Subacute, narrow
G2: basis length × width	1.82 × (length:width)	3.3 × (length:width)	1.75 × (length:width)	1.4 × (length:width)	2 × (length:width)	1.75 × (length:width)
Length to whole G2	0.25 × (basis: whole G2)	0.26 × (basis: whole G2)	0.21 × (basis: whole G2)	0.20 × (basis: whole G2)	0.26 × (basis: whole G2)	0.27 × (basis: whole G2)
G2 palm teeth	Large predactyla ‘shelf’, palm defining subacute tooth with one robust seta	Large predactyla ‘shelf’, small midpalmar acute tooth, palm defining subacute tooth with one robust seta	Large predactyla ‘shelf’, small midpalmar acute tooth, palm defining subacute tooth with one robust seta	Large predactyla ‘shelf’, palm defining subacute tooth with one robust seta	Large predactyla ‘shelf’, small midpalmar acute tooth, palm defining subacute tooth with one robust seta	Large predactyla ‘shelf’, palm defining subacute tooth with one robust seta
Pereopods 5–7 propodus	Length 1.9 × width; palm 0.66 × length posterior margin, palm straight	Length 2.8 × width; palm 0.8 × length posterior margin, palm concave	Length 2.3 × width; palm 0.64 × length posterior margin, palm straight	Length 1.5 × width; palm 0.33 × length posterior margin, palm convex	Length 2.0 × width; palm 0.66 × length posterior margin, palm concave	Length 1.4 × width; palm 0.7 × length posterior margin, palm concave
Pereopods 5–7 Palm setation	Occasional robust setae (< 5)	2-3 robust setae, occasional slender setae	Detail not visible	3 robust setae	1-2 robust setae, occasional slender setae	With > 10 robust setae lining palm
Pereopod 7 merus	Length 2 × width,	Length 4.4 × width	Length 2.8 × width	Length 1 × width	Length 1.2 × width	Length 1.2 × width

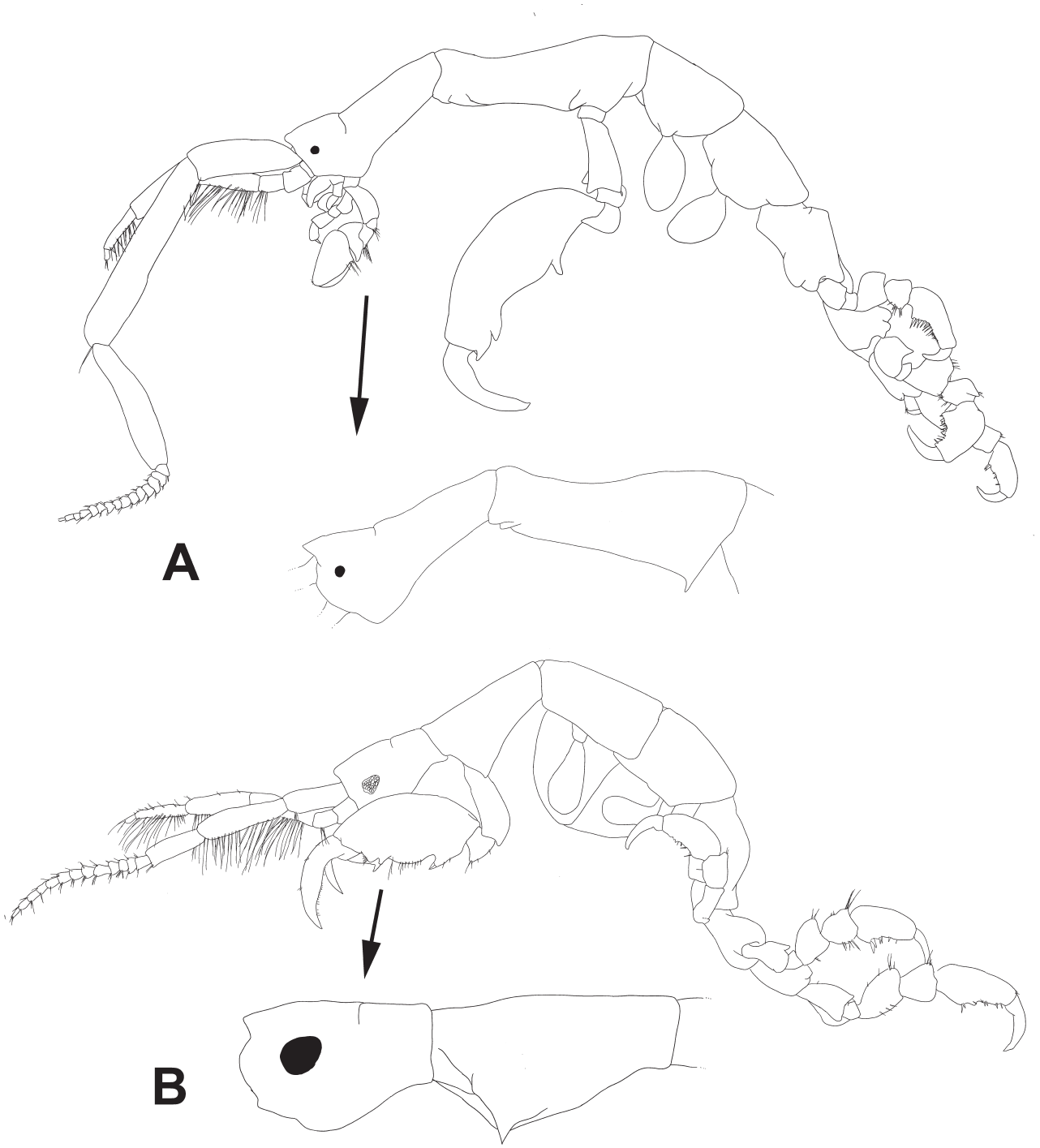

FIGURE 12. *Caprella sarahae* **sp. nov**., habitus with enlargements of head and pereonites 1–2, Hoho Islet, Snares Islands/Tini Heke, New Zealand. A, holotype male, 13 mm, NIWA 155331; B, paratype female, 7 mm, NIWA 155332.

Description. (Based on holotype male, 9.5 mm). Body: Head anterodistal margin rectangular, male slightly produced forward. Head fused with pereonite 1, suture present and visible. Pereonite smooth, no dorsal projections; pereonite 2 with lateral, anterior angled projection over gnathopod 2 insertion, all other pereonites without lateral projections. Ratio of lengths pereonites 1 (not including head) 1: 1.9: 1: 1: 0.7: 0.6: 0.6.

Head: Antenna 1 0.71 × body; peduncular article 2 longest, 1.9 × article 1, 1.5 × article 3; flagellum 0.3 × peduncular length with 15 articles. Antenna 2 0.5 × antenna 1 length; peduncular article 4 subequal in length to article 5.

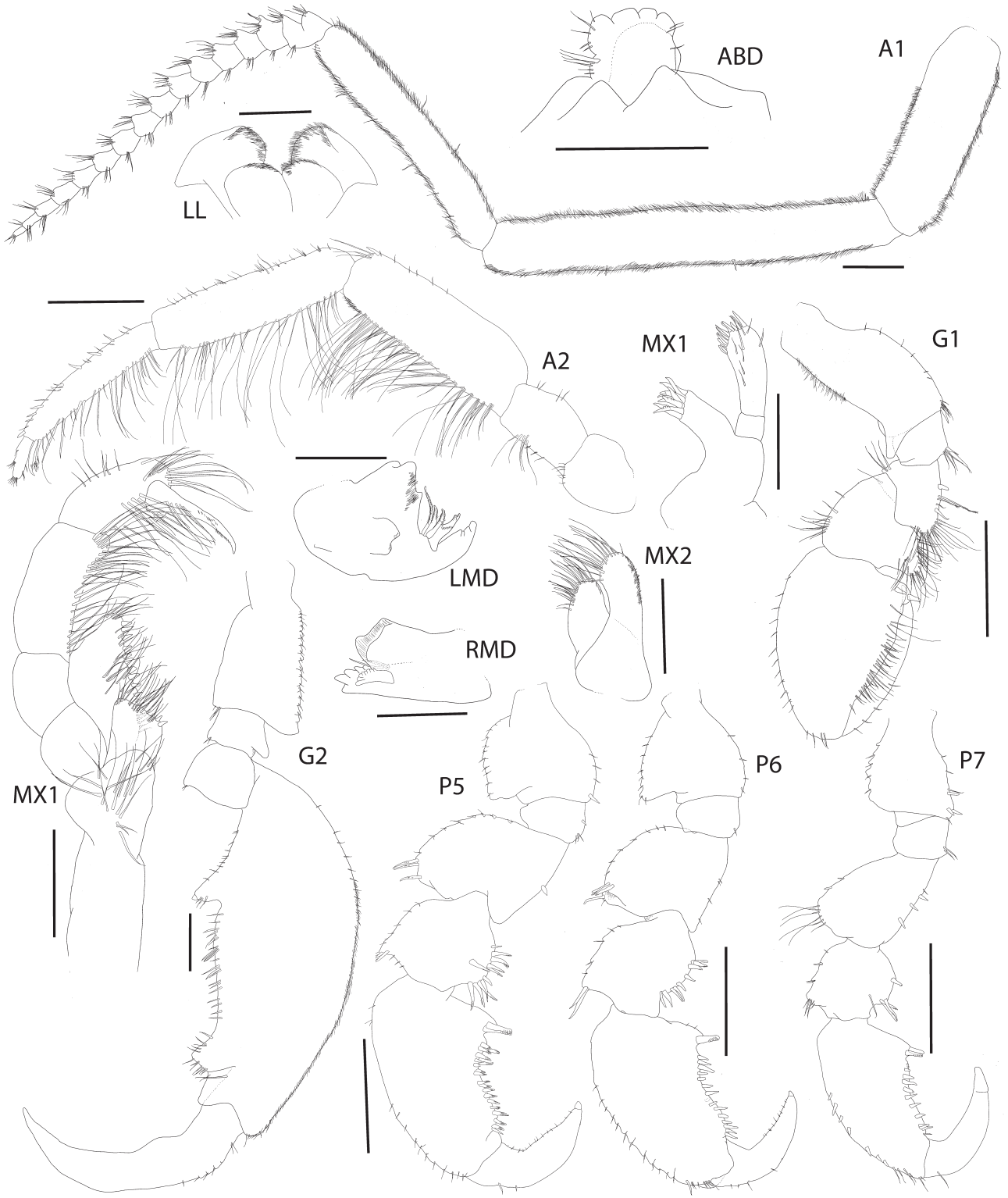

FIGURE 13. *Caprella sarahae* **sp. nov.,** habitus, holotype male, 13 mm, NIWA 155331, Hoho Islet, Snares Islands/Tini Heke, New Zealand. Scales: 0.2 mm, mouthparts; 0.5 mm, antennae 1–2, gnathopods 1–2, pereopods 5–7, abdomen.

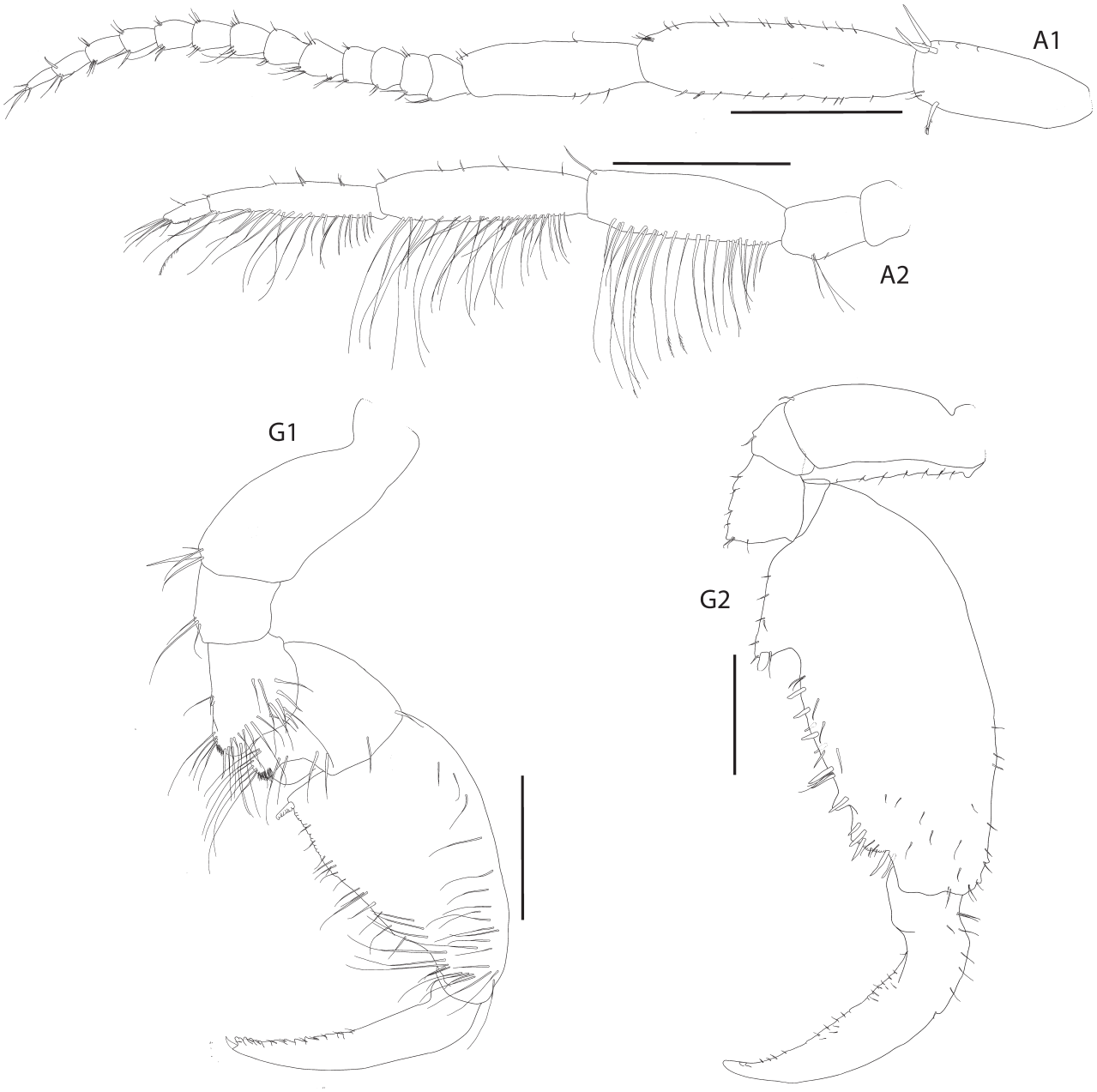

FIGURE 14. *Caprella sarahae* **sp. nov.,** habitus, paratype female, 7 mm, NIWA 155332, Hoho Islet, Snares Islands/Tini Heke, New Zealand. Scales: 0.2 mm, antennae 1–2, gnathopods 1–2.

Mouthparts: lower lip, inner lobe round. Mandible right incisor with five teeth, lacinia mobilis with seven teeth followed by three plumose setae, molar distinct. Mandible left incisor with four teeth, lacinia mobilis with two toothed teeth followed by three plumose setae, molar distinct. Maxilla 1 outer plate with seven stout apical setal-teeth; palp two-articulate; article 2 4.1 × article 1 with 14 apical robust setae and single line of medial slender setae. Maxilla 2 inner plate, oval, with ca. 23 marginal and apical slender setae; outer plate with ca. 14 mainly apical slender setae, inner plate shorter than outer plate. Maxilliped inner plate with two stout setae on inner corner of distal margin, with line of setae on entire distal margin; outer plate 2.0 × inner plate with ca. 10 robust setae on inner margin, slender setae apically; palp four-articulate, article 2 longest, setose along entire inner margin, inner margin concave; dactylus inserted subapically, therefore producing setose lobe/hood apically, setose along length medially, acute tip.

Gnathopod 1 basis subequal to ischium, merus, carpus combined; carpus subtriangular, densely setose on

posterior lobe; propodus subovate, length 1.2 × width, setae along anterior margin; palm beginning at posterior margin; proximal projection equipped with pair of robust setae (grasping spines) followed by ca. 32 setae along palm; dactylus weakly curved, smooth inner margin. Gnathopod 2 basis anterior margin serrate, produced to form triangular flange; ischium 0.3 × basis, with anterior distal triangular lobe; propodus longer than wide (length 2.4 × width); palm beginning ⅓ along posterior margin, proximal projection with single small robust seta (grasping spine) followed by three slender setae; palm with double triangular projection prepalmar, row of small setae along palm. Gill 3 length 0.7 × pereonite 3; gill 4 subequal to gill 3. Pereopod 5 basis 0.6 × propodus, posterior margin serrated and expanded distally to form subacute flange; ischium 0.3 × basis; merus 0.75 × basis expanded posteriorly to form rounded lobe; carpus 0.95 × basis, anterior margin lined with robust plumose setae; propodus longest, with paired combed robust setae 0.3 along posterior margin on rounded corner, palm lined with 19 plumose robust setae; propodus posterior margin lined with setae distally; length propodus 1.6 × width; dactylus short, strongly curved. Pereopod 6 subequal in length to pereopod 5, similar structure to P5; length propodus 1.7 × width. Pereopod 7 slightly shorter than pereopod 6 (0.9 × shorter); propodus posterior margin lined on distal half with robust setae; length propodus 1.8 × width.

Paratype mature female, NIWA 155332, 7 mm. Ratio of pereonites 1–7 (not including head) 1: 3.8: 3.7: 2.6: 3: 1.9: 1.6. Antennae 1 approximately ½ body length. Antenna 1 slender; peduncle article 2 longest, 1.5 × article 1, 1.55 × article 3; articles 1 and 3 subequal; flagellum 14 articles, shorter than peduncle (0.7 ×). Antenna 2 reaching to length of peduncle. Gnathopod 1 basis shorter than ischium, merus, carpus combined; carpus subtriangular, densely setose on cup-shaped posterior lobe; propodus subtriangular, length 1.6 × width, setae along anterior margin; palm beginning at posterior margin; proximal projection equipped with pair of combed robust setae followed by ca. 17 setae along slightly serrate palm; dactylus weakly curved, serrate inner margin. Gnathopod 2 basis anterior margin serrate, produced to form triangular flange; ischium 0.15 × basis, without lobe; propodus longer than wide (length 2 × width); palm beginning ⅓ along posterior margin, proximal projection with single small robust seta followed by 1 slender seta; palm with subrectangular subquadrate projection prepalmar, plus small subacute projection ⅔ along palm, row of robust and slender setae along palm, dactylus inner margin slightly serrate and lined with small setae.

Distribution. New Zealand.

New Zealand biosecurity status. Native.

Remarks. As mentioned above, *Caprella equilibra* is known as a presumed cosmopolitan species with supposedly very little morphological variation across the globe. McCain (1968) gave a very detailed synonymy. Guerra-Garcia (2003) noted that the specimens examined from the subantarctic islands of New Zealand were almost identical to those examined by Krapp-Schickel (1993) from the Mediterranean Sea. Whether it is truly a cosmopolitan species or an early invader (recorded from New Zealand in the 1870s), or a species complex is difficult to determine at present. There are significant differences between the members of the complex of species (Table 3) and show that *Caprella sarahae* **sp. nov**. is a distinct species.

Caprella scauroides Mayer, 1903

(Figs. 1–2, 15, Appendix 1)

Caprella californica.—McCain & Steinberg, 1970, 14 (in part).—Arimoto & Kikuchi, 1977: 91–92, fig. 1b.—Takeuchi, 1995, 199, fig. 21–181.—Takeuchi 1999: 7.—Aoki & Takeda, 2006: 67.—Lee & Hong, 2009: 318.—Montelli, 2010: 726, fig. 1.

Caprella (Spinicephara) californica.—Arimoto, 1976: 139–146, figs. 75–77.—Arimoto, 1978: 27.

Caprella scaura f. d (?).—Mayer, 1890: 72, pl. 4: figs 43–44.

Caprella scaura f. scauroides—Mayer, 1903: 118–119, pl. 5: figs. 16–18.—Utinomi, 1947: 77.

Caprella scaura scauroides.—Krapp *et al*., 2006: 3.

Caprella scauroides.—Takeuchi & Oyamada, 2013: 371–381.—Peart *et al.,* 2019: 361–375.—Schnabel *et al.*, 414–415, 456, fig. 28.1.

Type Locality. Hong Kong/Japan.

Material examined. NIWA 136876 (MITS 73603), 121 specimens (very large males, ovigerous females, over 82 juveniles), Station BNZ (AAP) 14933-AM, The Landing, Ōkahu Bay, Waitematā Harbour, New Zealand, 36°51.0316’S, 174°48.60498’E, coll. Phil Johnstone & Jeff Tyrell, 29/05/2017; NIWA 136877 (MITS 73604),

over 50 specimens (very large males, ovigerous females, juveniles), Ōrakei Marina, Waitematā Harbour, New Zealand, 36°51.0084'S, 174°48.849'E, mooring line, AKL24 ExtraDive1, coll. NIWA, 24/05/2017,; NIWA 136878 (MITS 73858), 202 mature males, 132 ovigerous females, 150 juveniles, WRE 26236-AM 7/11/2017, McLeod Bay, Whangārei Harbour, New Zealand, 35°48.9012'S, 174°29.9718'E, 5 m depth from a mooring; NIWA 136879 (MITS 24429), 10 specimens, NIW193BTI, hull of the vessel *Aoix*, Nelson Marina, New Zealand, 41°15.51252'S, 173°16.87602'E, coll. NIWA, 12/01/2005; NIWA 155336, 25 specimens (males, females and juveniles), stn Z18758, Mathesons Bay, Leigh, North Island, New Zealand, 36°17.4168'S 174°47.8836'E, 2–3 m, from *Carpophyllum plumosum,* coll. R. Taylor & S. Patke, 16/06/2017; NIWA 155335 (MITS 75145), OPX30232, Ōpua, North Island, New Zealand, 35°15.718'S 174°7.2492'E, 0–1 m, collected from a pontoon, coll. NIWA, 13/11/2019; NIWA 155337, many males, females and juveniles, 4–20 mm, stn Z18759, off Yusu, Uwajima, Ehime, Japan, 33°11.85'N 132°27.768'E, 0–1 m, on oyster aquaculture, coll. I. Takeuchi, 22/07/2019; NIWA 155338, 15 specimens (males, females, juveniles, 7–22 mm), stn Z18760, off International coastal research Centre, Otsuchi, Iwate, Japan, 39°21.036'N 141°56.1'E, 2–5 m, coll. I. Takeuchi, 13/05/1993.

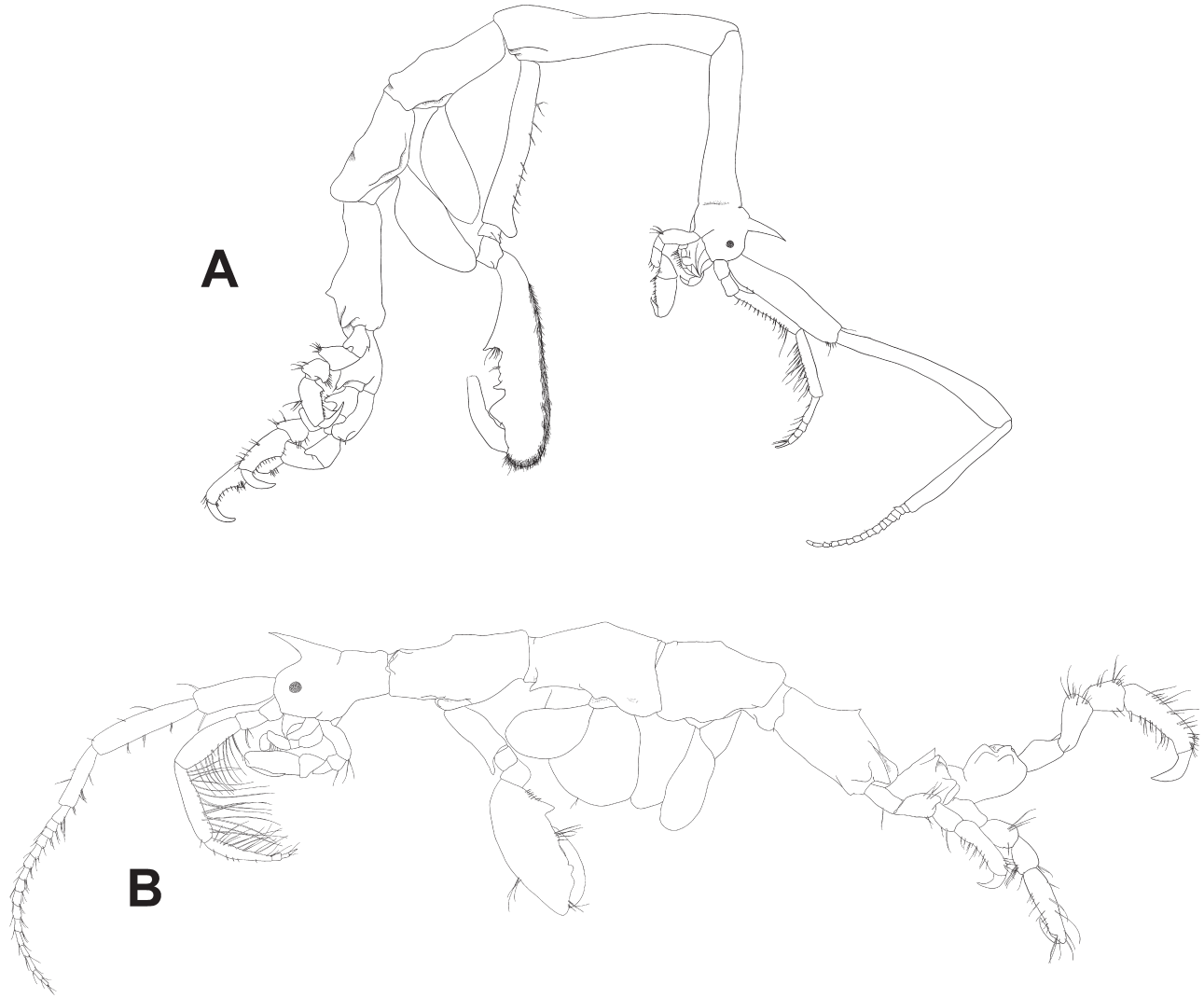

FIGURE 15. *Caprella scauroides* Mayer, 1903, Ōkahu Bay, Waitematā Harbour, New Zealand. A, male 22 mm, NIWA 136876; B, female 11 mm, NIWA 136876.

Diagnosis. Head rounded, with long, acute forward-directed projection; anterior body smooth and slender, posteriorly pereonites more sculptured. Antenna 1 over ½ of body (× 0.6); peduncle articles 1–2 robust in male, slender in female, sparsely setose; peduncle articles 1 and 2 longer than flagellum. Antenna 2 reaching to ½ length of peduncular article 2 of antenna 1 (male) and longer than antenna 1 peduncle (female), bearing short to long dense

setae on ventral margin. Gnathopod 1 small and robust, with palmar margin of propodus setose with pair of proximal grasping spines; palm somewhat straight; dactylus slightly serrate. Gnathopod 2 arising at distal end of pereonite 2 (male), and mid pereonite 2 (female); basis subequal to propodus and the length of pereonite 2; propodus produced to form rounded, setose distal lobe; palmar region of propodus primarily straight, strongly setose on anterior margin, weakly setose on posterior margin, palm with three teeth, posterior tooth subacute and triangular, small acute mid-palmar tooth, large predactylar ledge-like tooth; dactylus strong, inner margin sinuous, apex pointed and unconstricted with distal end smooth; outer margin setose. Gnathopod 2 in female palm of propodus convex, palm bearing three small teeth and weakly setose; propodus anterior margin weakly setose. Gills long and ovoid in both sexes. Pereopod 5 shortest, pereopods 6–7 similar in length; palmar margin of propodus slightly concave bearing short dense setae with two median grasping spines and expanded posterior corner.

Distribution. North Island, New Zealand. Australia (Cockburn Sound, Western Australia; Hobsons Bay, Victoria; Port of Cairns, Queensland; and Sydney Harbour, New South Wales), coastal Japan (Honshu, Kyushu and Shikoku islands, Sea of Honshu Island, Seto Inland Sea, Uwa Sea), Korea (South Jeolla Province (Jeollanam-do)) and the Yellow Sea.

New Zealand biosecurity status. Adventive (Peart *et al*. 2019).

Genbank Accession Numbers: SUB14807870 M58 Cscauroides_nSSU PQ521245; SUB14807890 M58 Cscauroides COI PQ522033.

Remarks. *Caprella scauroides* has been only recently recorded in New Zealand waters (Peart *et al*. 2019) and is close in morphology to *C. californica* Stimpson, 1856. It differs from *C. californica* by the rounded shape of the gnathopod 2 propodus distal lobe (angular in *C. californica*), the straight angle of the anterodistal head projection (curved in *C. californica*) and pereonites 3 and 4 equal in length to pereonite 5 (shorter than pereonite 5 in *C. californica*). *Caprella scauroides* is non-indigenous in New Zealand waters, originally recorded from Hong Kong and adjacent waters.

This species has been found on numerous shallow-water artificial substrates from ship hulls to moorings and wharf piles. It has also recently been recorded from the brown alga *Carpophyllum* spp. Collections from Japan were sampled from key localities were received too late to be analysed by Peart *et al*. (2019), and have now been sequenced (Fig. 27, Appendix 1) and determined to all represent the same species.

Caprella serenae sp. nov.

(Figs. 1–2, 16–18, Appendix 1)

Type material. Holotype: NIWA 155339 (MITS 72042), male (14 mm), TRG23229, Tauranga, North Island, New Zealand, 37°38.1144’S 176°10.5024’E, depth not known, found on swing moorings during shore search, 19/07/2016. Paratypes: NIWA 155340, male (11 mm); NIWA 155341, female (8 mm), same collection data as holotype.

Other material examined. NIWA 155342, more than 100 specimens, stn Z18761, Wilson Bay, Coromandel, North Island, New Zealand, 36°53.25’S 175°25.5498’E, on rope, 1–2 m, coll. R. D’Archino & W. Nelson, 10/10/2020.

Etymology. The species is named for Dr Serena Keeler of NIWA, who has guided and encouraged the senior author in understanding New Zealand caprellids in a biosecurity context and who originally provided the funding for describing this material.

Diagnosis. Head with long, subacute, narrow triangular projection (reaching ½ of antenna 1 article 1), directed forward with ventrally directed tip; body robust otherwise without projections. Antenna 1 slightly shorter than ½ of body (0.4 ×); peduncle articles 1–2 not inflated in male, sparsely setose, longer than flagellum. Antenna 2 shorter than antenna 1 (0.7 ×), bearing long dense setae on ventral margin. Mandible without palp. Gnathopod 1 robust, with palmar margin of propodus setose with one proximal grasping spine; palm somewhat straight; dactylus serrate. Gnathopod 2 in male arising slightly anteriorly to the mid-point of pereonite 2; basis approximately ½ the length of propodus and 0.4 × of pereonite 2; palmar region of propodus concave, slightly setose with distal rectangular projection and slight proximal spiniform process; dactylus strong, apex pointed and constricted medially with distal end slightly serrate. Gnathopod 2 in female inserted distally on pereonite 2; palm of propodus sinuous. Gills rounded and quite large and inflated in male, maximum diameter half of length of pereonite 4. Gills oval to rounded and smaller in female. Pereopods 3 and 4 absent. Pereopods 5–7 increasing in length posteriorly; palmar margin of propodus convex bearing short, robust and slender setae with two median grasping spines.

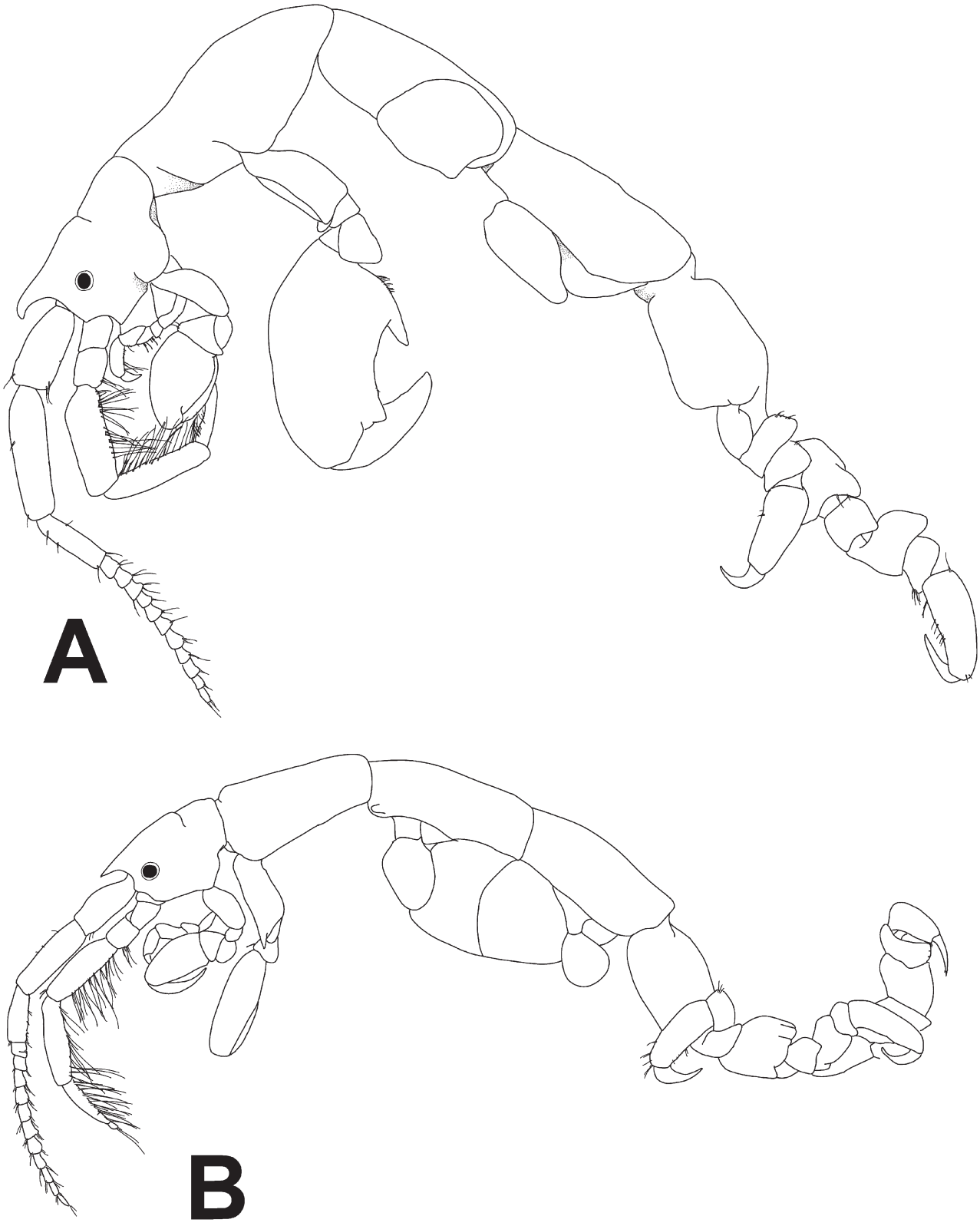

FIGURE 16. *Caprella serenae* **sp. nov**., Tauranga, North Island, New Zealand: A, holotype male, 14 mm, NIWA 155339; B, paratype female, 8 mm, NIWA 155341.

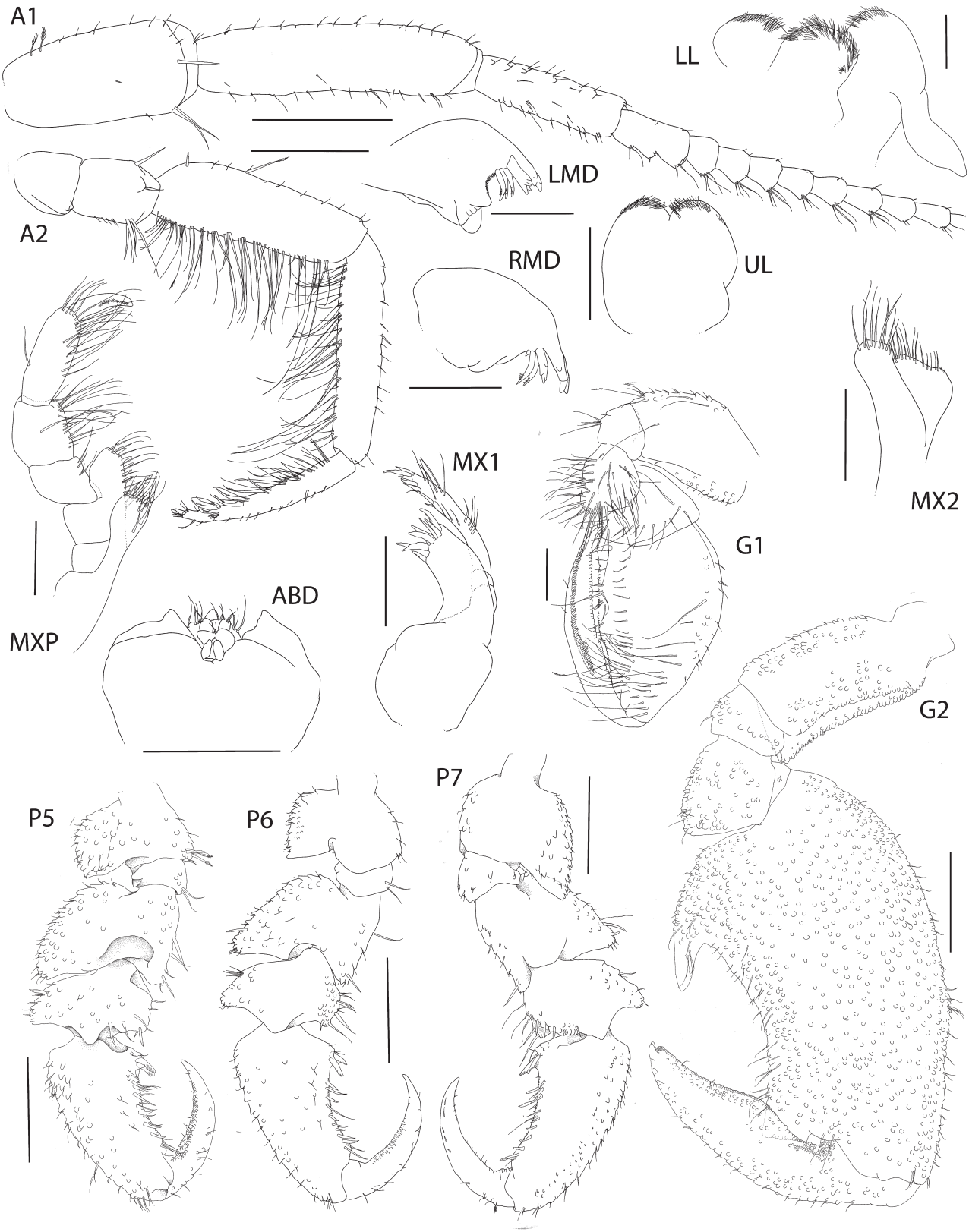

FIGURE 17. *Caprella serenae* **sp. nov**., holotype male, 14 mm, NIWA 155339. Tauranga, North Island, New Zealand. Scales: A1–2 (0.5 mm), mouthparts (0.2 mm), G1–2, P5–7 (0.5 mm), Abd scales represent 0.5 mm.

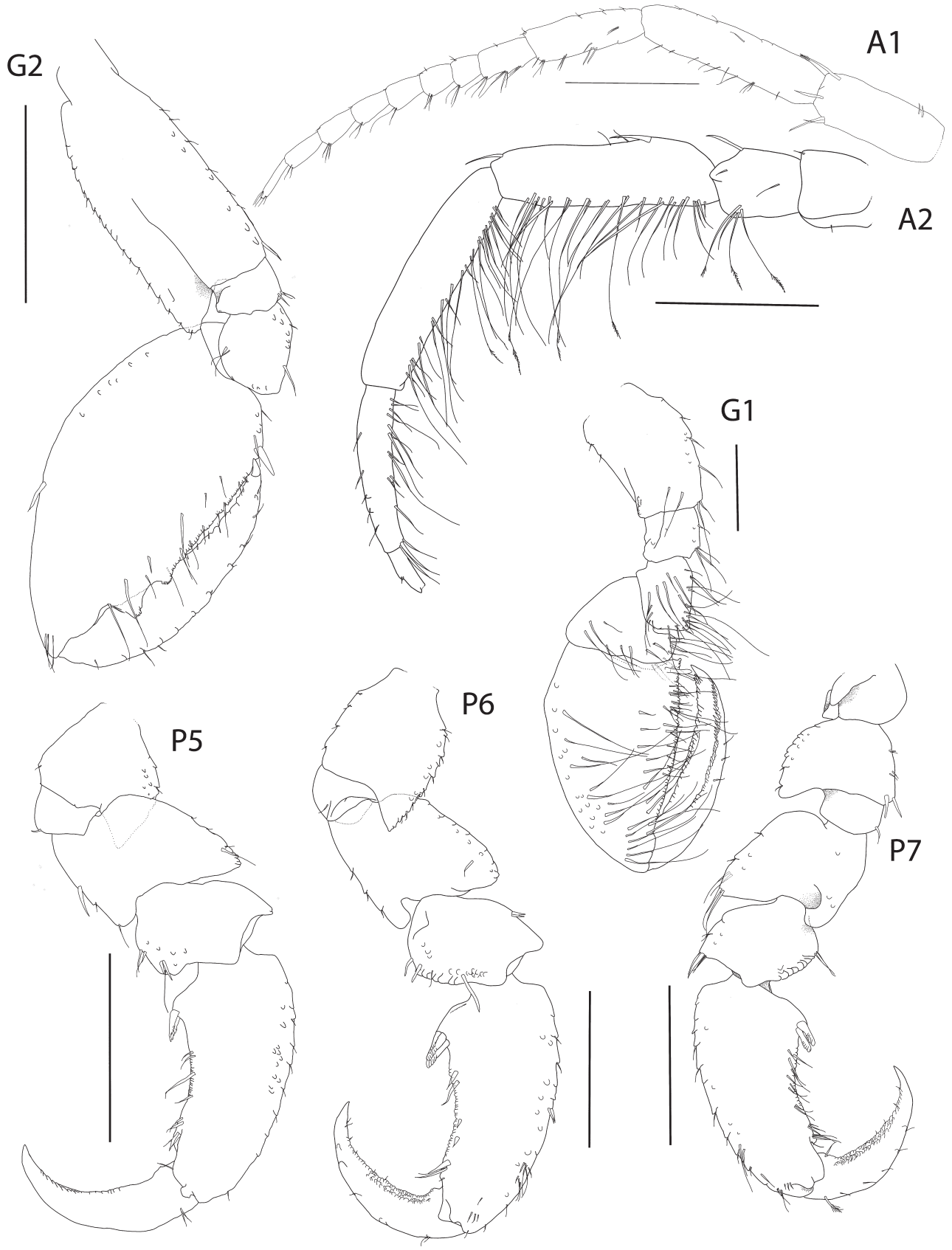

FIGURE 18. *Caprella serenae* **sp. nov**., paratype female, 8 mm, NIWA 155341, Tauranga, North Island, New Zealand. Scales: A1–2 (0.5 mm), G1–2 (0.2 mm), P5–7 (0.2 mm).

Description. (Based on holotype male, 9.5 mm, NIWA 155339). Body: head anterodistal margin produced to form anteriorly directed tooth. Head fused with pereonite 1, suture present and visible. Pereonite smooth, no dorsal projections; pereonite 4 without distal hump. Ratio of lengths pereonites 1 (not including head) 1: 3.6: 3: 2.9: 2.4: 1.6: obscured. Head. Antenna 1 0.35 × body (approximately); peduncular article 2 longest, 1.6 × article 1, 1.9 × article 3; flagellum 0.4 × peduncular length with 12 articles. Antenna 2 0.7 × antenna 1 length; peduncular article 4 subequal in length to article 5 (0.96 ×). Mouthparts: lower lip inner plate rounded. Mandible right incisor with four teeth, lacinia mobilis with five teeth followed by two plumose setae. Mandible left incisor with four teeth, lacinia mobilis with five toothed teeth followed by three plumose setae, molar distinct. Maxilla 1 outer plate with eight apical tooth-like robust setae; palp two-articulate; article 2 longer than article 1 (7.8 ×) with six apical robust setae and 15 medial and lateral slender setae. Maxilla 2 inner plate broad with truncated apex, with 13 mostly apical slender setae; outer plate rounded/truncated apically with nine apical slender setae, inner plate shorter than outer plate. Maxilliped inner plate with 14 slender setae on entire distal margin and along distal ½ of inner margin; outer plate 1.5 × inner plate with five robust setae on inner margin, slender setae both laterally and apically; palp four-articulate, article 3 longest, setose along entire inner margin of articles 1–3; dactylus inserted apically, no setose lobe/hood apically, fine hair-like setae along length medially, smooth tip. Gnathopod 1 basis subequal to ischium, merus, and carpus combined, small rounded posterodistal lobe present; merus produced to form rounded, setose posterior lobe; carpus subtriangular, densely setose on posterior lobe and across whole article, posterior lobe small, rounded, shorter than merus lobe; propodus subtriangular to subovoid, length 1.4 × width, setae along anterior margin; palm beginning at intersection of posterior margin and carpus; proximal defining corner equipped with pair of smooth robust setae (grasping spines) followed by ca. 12 setae along palm, palm serrated; dactylus weakly curved, inner margin rounded serrated, small setae along both inner and outer margins, simple tip; medial row of small conical robust setae ¾ length of dactylus. Gnathopod 2 basis anterior margin lined with rounded serrations, medial surface covered in small protuberances, basis produced to form triangular flange; ischium 0.23 × basis, without anterior distal triangular lobe; propodus longer than wide (length 1.5 × width); anterior margin with protuberances and small setae and on long seta; palm beginning ⅓ along posterior margin, proximal defining tooth long without robust setae, apically without grinding surface but with 2 slender setae; palm with predactylar rectangular shelf/projection, row of small setae along palm; dactylus outer margin with small setae along entire margin, inner margin serrated and sinuous. Gill 3 length 0.6 × pereonite 3; gill 4 subequal to gill 3. Pereopod 5 basis 0.5 × propodus, posterior margin serrated and expanded distally to form subacute flange; ischium 0.3 × basis; merus 1.1 × basis, anterior margin lined with slender setae, posterior margin produced to form subacute setose lobe; carpus 1.05 × basis, anterior margin lined with slender setae, posterior margin produced to form subacute setose lobe; propodus longest, with paired combed robust setae 0.25 along posterior margin on rounded corner, palm concave lined with 15 slender setae; propodus posterior margin lined with setae and serrated; propodus length 1.7 × width; dactylus long, reaching to defining corner, curved, inner margin highly textured with fringe of small setae, outer margin with setae. Pereopod 6 slightly longer than pereopod 5, similar structure to P5; propodus length 1.6 × width; dactylus inner margin with grinding surface. Pereopod 7 similar to pereopods 5 and 6; propodus posterior margin lined with slender setae; length propodus 1.75 × width.

Paratype (mature female, NIWA 155341, 8 mm). Ratio of pereonites 1–7 (not including head) 1: 4.2: 4.5: 4.4: 2.8: 1.8: 2.3. Antennae 1 slightly shorter than ½ body . Antenna 1 slender; peduncle article 2 longest, 1.5 × article 1, 2.25 × article 3; article 1 longer than article 3 (1.5 ×); flagellum 8 articles, flagellum shorter than peduncle. Antenna 2 reaching past the peduncle of antenna 1, and to ⅔ length of flagellum. Gnathopod 1 basis shorter than ischium, merus, carpus combined (0.75 ×); carpus subtriangular, setose on broadly rounded posterior lobe; propodus subtriangular, length 1.5 × width, without setae along anterior margin; palm beginning ⅛ along posterior margin; proximal defining corner, acute and equipped with pair of smooth robust setae followed by ca. 20 setae along serrated palm; dactylus weakly curved, serrate inner margin, with cusps near the tip. Gnathopod 2 basis anterior margin serrated, strongly produced to form large triangular flange; ischium 0.14 × basis, without lobe; propodus longer than wide (length 1.6 × width); palm beginning ¼ along posterior margin, proximal defining corner with two smooth robust setae; palm setose and serrated, with two subacute projections situated on distal ½ of palm, dactylus inner margin distally serrate and lined with small setae, outer margin with small setae and weakly serrate.

Distribution. Tauranga, North Island, New Zealand

New Zealand biosecurity status. Native.

Genbank Accession Numbers: SUB14807890 M06 Cserenae COI PQ522030; SUB14807890 M07 Cserenae COI PQ522031; SUB14807870 M06 Cserenae nSSU PQ521242; SUB14807870 M07 Cserenae nSSU PQ521243.

Remarks. *Caprella serenae* **sp. nov.** belongs to the *C. penantis* species complex, along with *C. novaezealandiae*. A table of differences and similarities is provided (Table 2). This species can be confused with *C. novaezealandiae* but can be separated by the presence of strongly rugose pereopods and the proportions of the pereonites, pereonite 2 of *C. serenae* 1.5 × pereonite 3 whereas pereonite 2 of *C. novaezealandiae* is subequal in length to pereonite 3.

Caprellaporema Guerra-García, 2003

Diagnosis. (After Guerra-García 2003). Antennae short. Flagellum of antenna 1 two-articulate. Flagellum of antenna 2 two-articulate, the proximal article being very reduced. Gills present on pereonites 3 and 4. Pereopods 3 and 4 absent. Pereopod 5 two-articulate. Pereopods 6 and 7 six-articulate, long and narrow. Mandibular palp three-articulate. Molar absent. Male abdomen with pair of small appendages and pair lobes. Female abdomen without appendages.

Type species. *Caprellaporema subantarctica* Guerra-García, 2003 (type by original designation).

Species composition. One species: *Caprellaporema subantarctica* Guerra-García, 2003

Caprellaporema subantarctica Guerra-García, 2003
(Fig. 1)

Caprellaporema subantarctica Guerra-García, 2003: 190–193, figs. 15–18.

Diagnosis. Head rounded, without projection; body smooth and slender. Pereonite 1 very small, fused with head. Antenna 1 very short, reaching halfway along pereonite 2; peduncle articles 1–2 slender in male and female, sparsely setose, flagellum length of peduncle article 1, 2 articles. Antenna 2 reaching to end of peduncular article 3 of antenna 1 (male and female), bearing very few setae, flagellum 2 articles. Gnathopod 1 small and robust, carpus extended posteriorly to form subacute lobe, palmar margin of propodus setose with pair of proximal grasping spines; palm slightly convex; dactylus inner margin smooth, reaching ½ length of the palm. Gnathopod 2 arising at proximal end of pereonite 2 (male and female); basis subequal to propodus and slightly longer than pereonite 2; propodus rounded; palmar region of propodus convex, lined with short robust setae, not setose on posterior margin, palm without teeth, defined by subacute posterior tooth; dactylus strong, inner margin smooth, apex acute and unconstricted with distal end smooth; outer margin not setose. Gills very small in both sexes. Pereopod 5 two-articulate, pereopod 6 shorter than pereopod 7, both long and narrow; no obvious palmar margin.

Distribution. Subantarctic Islands.

New Zealand biosecurity status. Native.

Remarks. *Caprellaporema subantarctica* has not been found since first described.

Noculacia Mayer, 1903

Diagnosis. (After Guerra-García 2002). Antenna 2 flagellum two-articulate. Mandibular molar absent; palp three-articulate; setal formula 1-x-1; incisor and left lacinia mobilis five-toothed. Maxilla 1 with six spiniform setae on outer plate. Gills on pereonites 3 and 4. Pereopods 3 and 4 one or two-articulate. Abdomen without appendages.

Type species. *Noculacia bullata* Mayer, 1903 (type by original designation).

Species composition. Four species (including the new species): *Noculacia africana* Guerra-García 2002, *Noculacia anima* **sp. nov.**, *Noculacia australiensis* Guerra-García 2002, *Noculacia bullata* Mayer, 1903.

Noculacia anima sp. nov.
(Figs. 1, 19–21)

Type material. Holotype: NIWA 155343, male (7.5 mm), KAH1706/GRAB 38B.1/72.42, Piwhane/Spirits Bay, Northland, New Zealand, 34°23.718'S 172°43.17'E, 35 m, 02/06/2017, NIWA. Paratypes: NIWA 155534, female (5.5 mm); NIWA 155535, 3 juveniles (3–4 mm), from same locality and collection details as holotype.

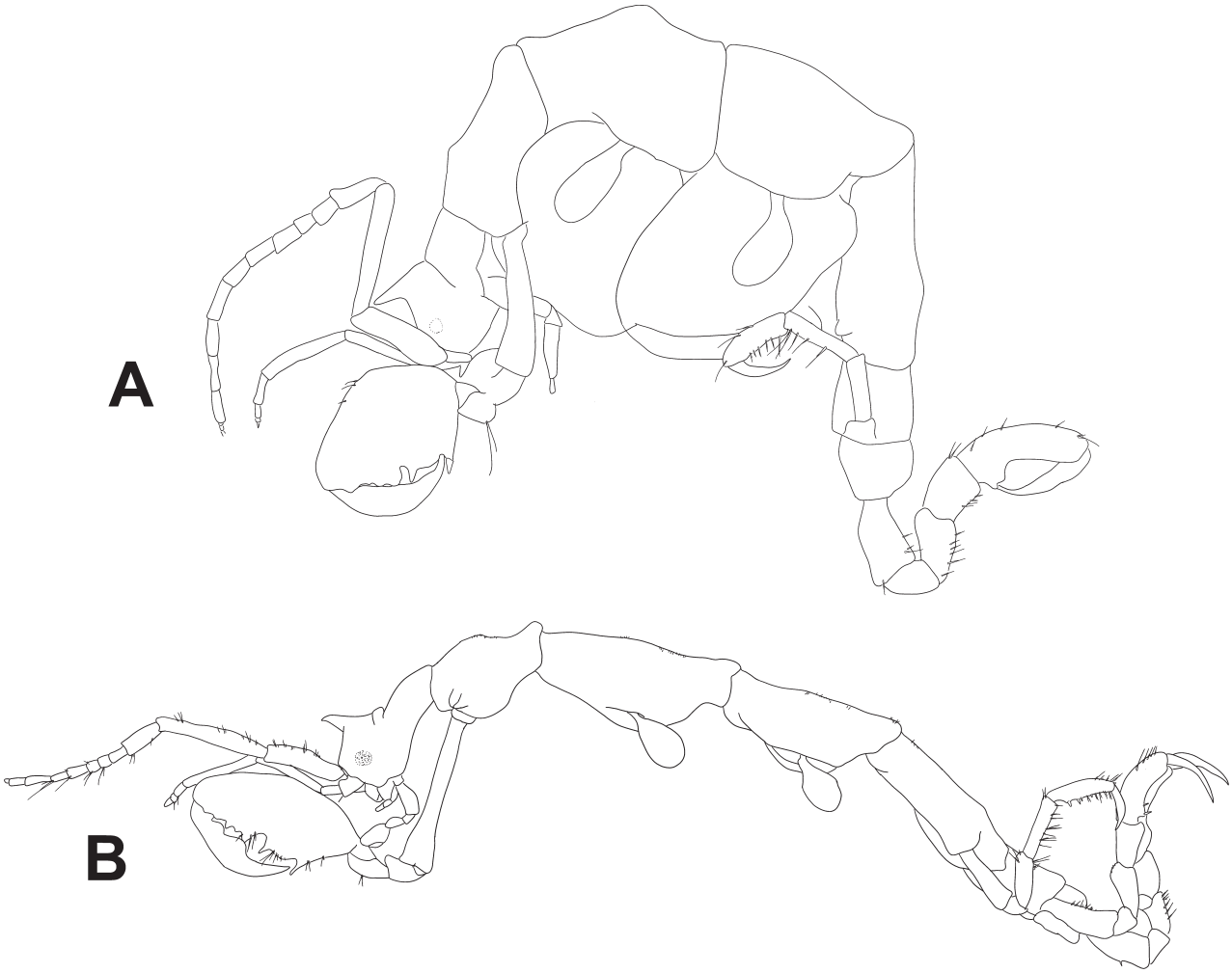

FIGURE 19. *Noculacia anima* **sp. nov.,** Piwhane/Spirits Bay, Northland, New Zealand: A, holotype male, 7.5 mm, NIWA 155343; B, paratype female, 5.5 mm, NIWA 155534.

Other material examined. NIWA 155536, 1 male (6 mm), 1 female (5mm), KAH1706/GRAB 27B/110.17, Piwhane/Spirits Bay, Northland, New Zealand, 34°21.63'S 172°46.74'E, 55 m, coll. NIWA, 04/06/2017; NIWA 155537, 1 female (6 mm), KAH1706/GRAB15A.1/39.16, Piwhane/Spirits Bay, Northland, New Zealand, 34°22.32'S 172°48.4302'E, 49 m, coll. NIWA, 30/05/2017; NIWA 155538, 1 juvenile (5 mm), KAH1706/GRAB36A.1/69.2, Piwhane/Spirits Bay, Northland, New Zealand, 34°23.7498'S 172°46.818'E, 32 m, coll. NIWA, 02/06/2017; NIWA 155539, 4 males and juveniles, 4–6 mm, KAH1706/GRAB40A/74.44, Piwhane/Spirits Bay, Northland, New Zealand, 34°22.69025'S 172°43.578'E, 44 m, coll. NIWA, 02/06/2017; NIWA 155540, 1 juvenile (4 mm), KAH1706/GRAB11B.3/86.22, Piwhane/Spirits Bay, Northland, New Zealand, 34°23.058'S 172°49.038'E, 41 m, coll. NIWA, 03/06/2017.

Etymology. The species name is derived from the Latin for spirit or breath, referring to the type locality name, Piwhane/Spirits Bay. It is a noun used in apposition.

Diagnosis.: Pereonite 1 with dorsal acute projection, bent forward. Pereonite 2 without dorsal projection anteriorly, no dorsal projection distally, with lateral acute projections (one on each side) near insertion of gnathopod 2. Pereonite 3–5 without dorsal or lateral projections. Mandibular palp article 3 setal formula 1-3-1. Inner lobes of lower lip rounded and not fused. Gnathopod 1 propodus margins smooth. Gnathopod 1 dactylus simple. Basis of gnathopod 2 with distal projection near coxa, basis longer than pereonite 2 length. Gills longer than wide. Pereopods 3 and 4 two-articulate, not spindle-shaped, both tipped with single simple seta. Pereopod 5 slender, slightly reduced in size.

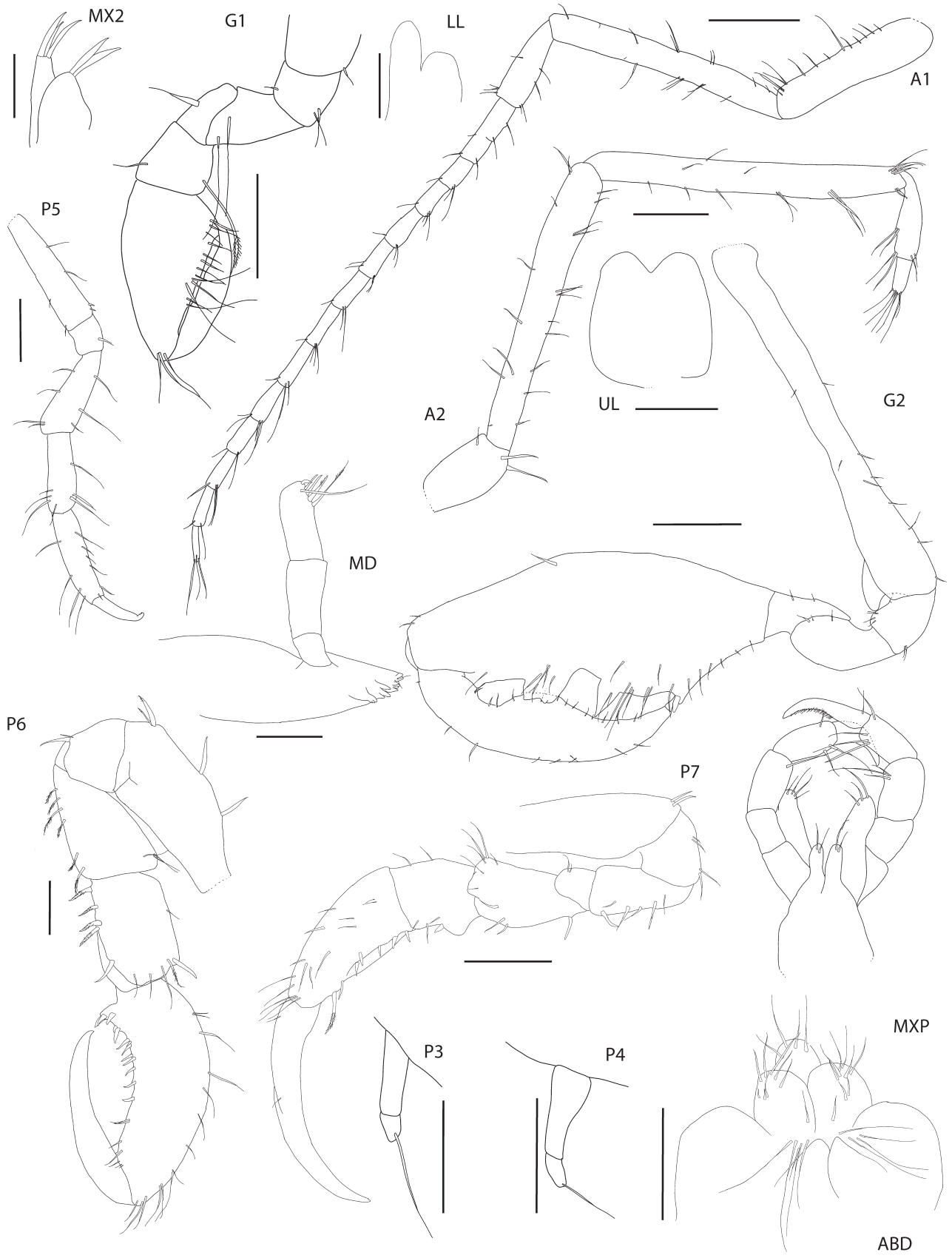

FIGURE 20. *Noculacia anima* **sp. nov**., holotype male, 7.5 mm, NIWA 155343, Piwhane/Spirits Bay, Northland, New Zealand. Scales: 0.1 mm, LL, UL, MD, MX2, MXP, P3–4; 0.2 mm, A2, G1, P5–7, ABD; 0.5 mm, A1, G2.

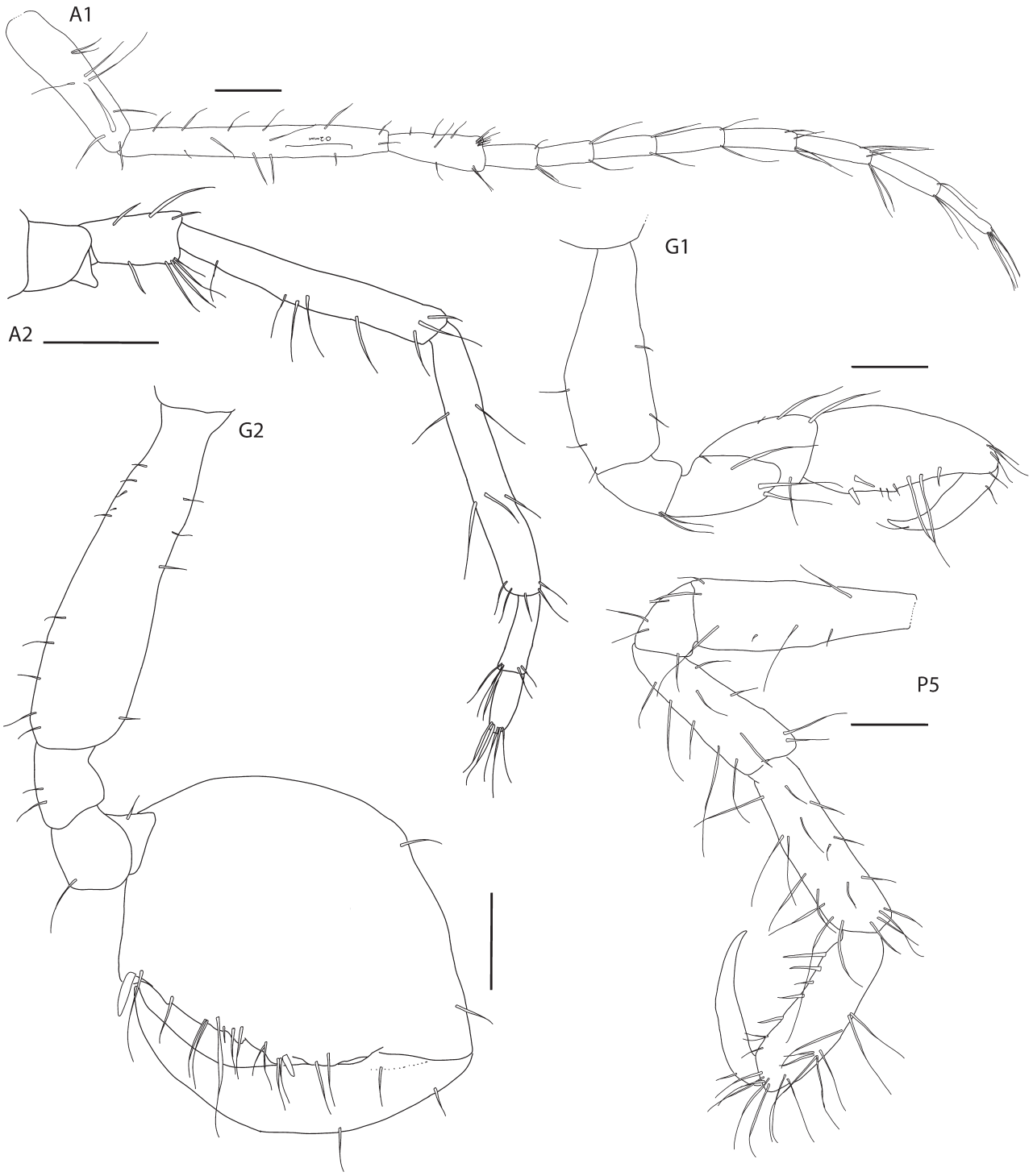

FIGURE 21. *Noculacia anima* **sp. nov.,** paratype female, 5.5 mm, NIWA 155534, Piwhane/Spirits Bay, Northland, New Zealand. Scales 0.2 mm.

Description. (Based on holotype male, NIWA 155343, 7.5 mm). Head with dorsal acute projection, bent forward. Eyes present and distinctive. Body smooth, not setose. Pereonite 1 fused with head, suture present, without projections. Pereonite 2 without dorsal projections, with two lateral acute projections (one on each side) near insertion of gnathopod 2. Pereonites 3–7 without dorsal or lateral projections. Pereonite 3 longest. Pereonite 7 shortest. Ratio of head to pereonites is 1: 1: 1.8: 3.2: 2.8: 2.6: 0.9: 0.7. Gills present at middle of pereonites 3–4, ovoid, length about 1.8 × width. Antenna 1 reaching halfway along pereonite 3; peduncle sparsely setose; article

1 robust, article 2 longest, longer than article 1 (1.4 ×) and article 3 (2.8 ×); article 3 shortest; flagellum with 13 articles. Antenna 2 sparsely setose, reaching to halfway along article 3 of antenna 1 peduncle; proximal peduncular article with distal projection (gland cone); swimming setae absent; distal two peduncular articles subequal in length, flagellum two-articulate. Mouthparts: upper lip symmetrically bilobed, smooth apically. Mandibles without mandibular molar. Three-articulate palp with setal formula 1-3-1, with single apical robust seta; left mandible with incisor five-toothed, lacinia mobilis three-toothed, followed by an accessory blade. Lower lip smooth, without setulae; inner lobes rounded and almost fused. Maxilla 2 inner lobe shorter than outer lobe, inner lobe subtriangular, with two apical setae, outer lobe elongated, with three apical setae. Maxilliped inner plate small and rounded, about ¼ of outer plate in length, carrying two apical setae; outer plate elongated, with three or four apical setae; palp four-articulate, sparsely setose, distal article (dactylus) curved and provided with rows of minute setulae.

Gnathopod 1 basis longer than combination of ischium, merus and carpus; grasping margin of propodus smooth; no obvious grasping spines, dactylus inner margin without short setulae, simple distally. Gnathopod 2 basis considerably longer than pereonite 2, with an anterodistal acute projection; ischium small, rectangular; merus rounded; carpus short and triangular; propodus of gnathopod 2 elongate, length 2.5 × width, slightly setose, palm defined by small subacute posterodistal corner; palm features two palmar projections, proximalmost sharply acute, distalmost strongly subquadrate; dactylus inner margin sinuous, both margins with minute setulae.

Pereopods 3 and 4 greatly reduced, two-articulate, provided with one distal simple slender seta; article 1 straight sided (not spindle shaped). Pereopod 5 reduced in robustness and length compared to pereopods 6–7, articles slender and weakly setose; propodus narrow and palm not defined by corner or grasping spines. Pereopods 6–7 similar in shape and size; propodus with row of setae on concave inner margin; proximal projection provided with two grasping spines; dactylus without row of fine setulae.

Pleon without appendages, two lateral lobes with simple setae and single smooth dorsal lobe.

Variations (paratype female, 5.5 mm). Antennae 1–2 less robust and less setose than in male; flagellum of antenna 1 with eight articles. Body pereonite 2 without lateral acute projections. Pereonites 3 and 5 same length and longest. Pereonites 1 and 7 shortest. Ratio of head to pereonites is 1: 0.8: 2.6: 3: 2.8: 3: 1.5: 0.9. Oostegites present on pereonites 3 and 4. Lateral lobes of pleon less setose than in male.

Distribution. Only reported from Piwhane/Spirits Bay, North Island, New Zealand.

New Zealand biosecurity status. Native.

Remarks. *Noculacia* is not commonly recorded and only has three species previously described globally (*N. africana* Guerra-García, 2002; *N. australiensis* Guerra-García, 2002; and *N. bullata* Mayer, 1903). This genus also has strong similarities with *Peudaeginella* (a genus with one recorded New Zealand species). The only consistent difference between these two genera appears to be the number of articles in the reduced pereopods 3 and 4. As sometimes these articles are fused and a suture is present (*N. africana*), these two genera may prove to be synonyms, but a more detailed analysis is required than what is in the scope of this paper. Therefore, this new species is placed in *Noculacia*. The new species *N. anima* has an acute head projection (in both sexes) and smooth remainder of the body, and distinctly two-articulate straight sided pereopods 3 and 4 tipped with only one seta each. *Noculacia africana* (from southern Africa) has a very small head projection (male only), a smooth body, and pereopods 3 and 4 are uniarticulate and spindle-shaped, but with fusion suture, and each tipped with two slender setae.

Comparably, *N. australiensis* (from western and southern Australia) has no projections on the head (male and female), extensive body projections and two-articulate, slightly spindle-shaped pereopods 3 and 4 each tipped with only one slender seta; and *N. bullata* (from Indonesia) has small projections on head (male and female), numerous body projections, and uniarticulate (no suture present), spindle-shaped pereopods 3 and 4, tipped with one seta each.

Pseudaeginella Mayer, 1890

Diagnosis. Head and pereonite 1 partially fused (suture clear). Head with one dorsal projection, bent forward. Flagellum of antenna 1 more than two-articulate. Flagellum of antenna 2 two-articulate, swimming setae absent. Mandibular palp three-articulate, molar usually very small or absent, setal formula 1-x-1. Inner plate of maxilliped smaller than outer plate. Gnathopod 1 dactylus usually bifid. Gills present on pereonites 3 and 4. Pereonites 6 and 7 separated (not fused). Pereopods 3 and 4 one-articulate, vestigial. Pereopods 5–7 six-articulate. Abdomen without appendages. (After Ros *et al.* 2017 and Iwasa-Arai *et al*. 2019).

Type species. *Aeginella tristanensis* Stebbing, 1888 accepted as *Pseudaeginella tristanensis* (Stebbing, 1888) (type by monotypy).

Species composition. 15 species: *Pseudaeginella arraialensis* Ros, Lacerda & Guerra-García, 2017, *Pseudaeginella biscaynensis* (McCain, 1968), *Pseudaeginella campbellensis* Guerra-García, 2003, *Pseudaeginella carinaspinosa* Shin, Lee, Heo & Kim, 2023, *Pseudaeginella colombiensis* Guerra-García, Krapp-Schickel & Müller, 2006, *Pseudaeginella freirei* Siqueira & Iwasa-Arai, 2019, *Pseudaeginella hormozensis* Momtazi & Sari, 2013, *Pseudaeginella inae* Krapp-Schickel & Guerra-García, 2005, *Pseudaeginella makranensis* Momtazi, Khalaji-Pirbalouty & Golestaninasab, 2023, *Pseudaeginella montoucheti* (Quitete, 1971), *Pseudaeginella multispinosa* (Schellenberg, 1928), *Pseudaeginella polynesica* (Müller, 1990), *Pseudaeginella sanctipauli* Laubitz, 1995, *Pseudaeginella tanzaniensis* (Guerra-García, 2001a), *Pseudaeginella telukrimau* Lim, Azman, Takeuchi & Othman, 2017, *Pseudaeginella tristanensis* (Stebbing, 1888), *Pseudaeginella vaderi* Guerra-García, 2004, *Pseudaeginella antiguae* Barnard, 1932 nomen dubium.

Pseudaeginella campbellensis Guerra-García, 2003

(Fig. 1)

Pseudaeginella campbellensis Guerra-García, 2003: 185–189, figs. 9–13.—Lacerda *et al.,* 2011:11–14, fig. 5C.—Iwasa-Arai *et al.*, 2019: 5–9, fig. 7.—Shin *et al*., 2023: 170–171.

Material examined. NIWA 125329, 2 specimens, Ringdove Bay, Antipodes Islands, New Zealand, 49°42.38298'S 178°47.15814'E, 5–25 m, on SCUBA, from *Macrocystis* sp. on boulders and rock wall, coll. D. Freeman, 10/03/2009.

Diagnosis. Pereonite 1 with dorsal acute projection, bent forward. Pereonite 2 without dorsal projection anteriorly, with two parallel dorsal small projections medially, low straight dorsal projection distally, without minute anterolateral acute projections (one on each side) or lateral acute projections (one on each side) near the coxa of gnathopod 2. Pereonite 3–5 without dorsal projections. Pereonites 3–4 with acute lateral projections near the gills. Pereopods 3–4 with two setae distally. Pereonite 5 with small anterolateral projections (one on each side). Gnathopod 1 dactylus bifid. Basis of gnathopod 2 with distal projection near coxa, basis longer than pereonite 2 length. Gnathopod 2 propodal palm slightly setose, with one mid-medial tooth and preceding excavation, posterior corner defined by tooth and distal spine. Anterior margin with one large anteromedial projection. Gills as long as wide. Right mandibular incisor with six teeth, palp article 3 with apical robust seta.

Distribution. Currently only known from Campbell Island and the Antipodes Islands, subantarctic islands of New Zealand.

New Zealand biosecurity status. Native.

Remarks. Guerra-Garcia (2003) described this species from a variety of habitats at relatively shallow depths.

Subfamily PHTISCINAE Vassilenko, 1968

Caprellina Thomson, 1879

Diagnosis. Flagellum of antenna 2 of two–five articles, swimming setae absent. Mandibular palp three-segmented, setal formula for distal article 1-x-1, molar absent. Outer lobe of maxilliped slightly longer than inner lobe. Gills on pereonites 2–4. Pereopods 3 and 4 absent. Pereopod 5 three- or four-articulate, inserted slightly posterior to midlength of pereonite 5. Abdomen of bothe sexes with pair of biarticulated appendages and pair of uniarticulate appendages, penes lateral. (After McCain 1970; Laubitz 1993).

Type species: *Caprellina novae-zealandiae* Thompson, 1879 (= *Caprellina longicollis* Nicolet, 1849). Type by monotypy.

Species composition. Five species including the new species: *Caprellina bispinosa* Müller, 1990, *Caprellina judyae* **sp. nov.**, *Caprellina longicollis* Nicolet, 1849, *Caprellina plumea* **sp. nov.,** *Caprellina spiniger K.H. Barnard, 1916*,

***Caprellina judyae* sp. nov.**
(Figs. 1, 22–24)

Type material. Holotype: NIWA 155541, male (11.5 mm), KAH1706/49, Piwhane/Spirits Bay, Northland, New Zealand, 34°22.5498'S 172°46.17'E, 42 m, coll. NIWA, 01/06/2017. Paratypes: NIWA 155542, female (9 mm), KAH1706/ 29, Piwhane/Spirits Bay, Northland, New Zealand, 34°22.95'S 172°46.698'E, 32 m, coll. NIWA, 30/05/2017. NIWA 155542, male (13 mm), KAH1706/ 29, Piwhane/Spirits Bay, Northland, New Zealand, 34°22.95'S 172°46.698'E, 32 m, coll. NIWA, 30/05/2017.

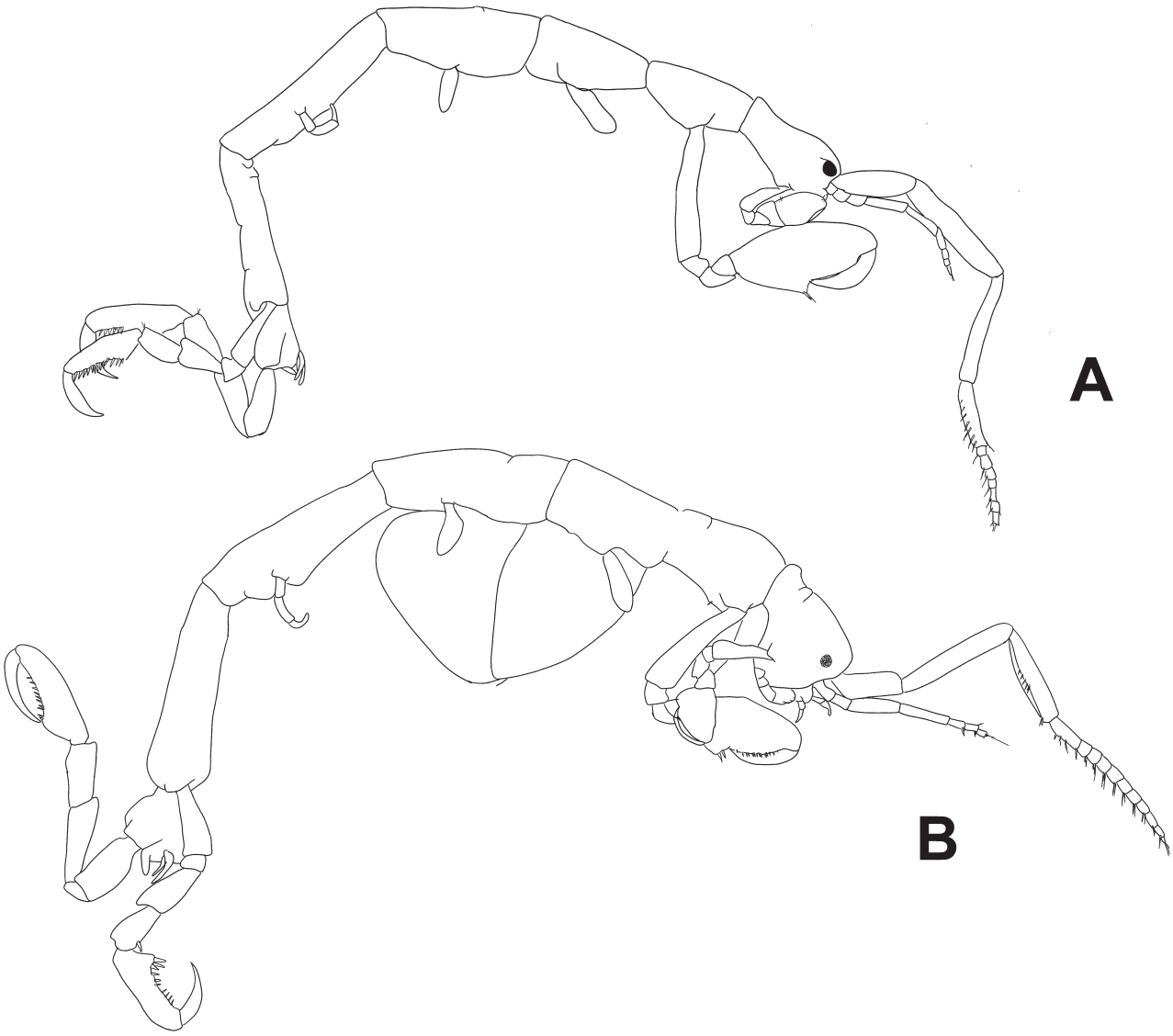

FIGURE 22. *Caprellina judyae* **sp. nov.,** Piwhane/Spirits Bay, Northland, New Zealand: A, holotype male, 11.5 mm, NIWA155541; B, paratype, female, 9 mm.

Other material examined. NIWA 155543, 4 males, 2 females, 6–7 mm, KAH1706/ 95, Piwhane/Spirits Bay, Northland, New Zealand, 34°22.98'S 172°48.042'E, 42 m, coll. NIWA, 04/06/2017; NIWA 155544, 1 male (6 mm), KAH170664, Piwhane/Spirits Bay, Northland, New Zealand, 34°21.54'S 172°49.5'E, 55 m, coll. NIWA, 02/06/2017; NIWA 155545, 3 males, 2 females, 6–7 mm, KAH1706/ 72, Piwhane/Spirits Bay, Northland, New Zealand, 34°23.718'S 172°43.17'E, 35 m, coll. NIWA, 02/06/2017; NIWA 155546, 1 male (5 mm), 1 juvenile (4 mm), KAH1706/ 35, Piwhane/Spirits Bay, Northland, New Zealand, 34°22.9902'S 172°49.05'E, 43 m, coll. NIWA, 31/05/2017; NIWA 155547, 1 specimen, juvenile, 4 mm, KAH1706/ 70, Piwhane/Spirits Bay, Northland, New Zealand, 34°23.675'S 172°45.96'E, 31 m, coll. NIWA, 02/06/2017; NIWA 155548, 1 juvenile (6 mm), KAH1706/

35, Piwhane/Spirits Bay, Northland, New Zealand, 34°22.99'S 172°49.05'E, 43 m, coll. NIWA, 31/05/2017; NIWA 155549, 1 juvenile (6 mm), KAH1706/ 23, Piwhane/Spirits Bay, Northland, New Zealand, 34°23.178'S 172°45.222'E, 36 m, coll. NIWA, 30/05/2017; NIWA 155550, 1 juvenile (3 mm), KAH1706/ 88, Piwhane/Spirits Bay, Northland, New Zealand, 34°22.98'S 172°49.518'E, 45 m, coll. NIWA, 03/06/2017; NIWA 155551, 2 males (5–6 mm), KAH1706/ 109, Piwhane/Spirits Bay, Northland, New Zealand, 34°21.642'S 172°47.622'E, 55 m, coll. NIWA, 04/06/2017; NIWA 155552, 1 male (7 mm), KAH1706/ 30, Piwhane/Spirits Bay, Northland, New Zealand, 34°23.01'S 172°47.022'E, 32 m, coll. NIWA, 30/05/2017; NIWA 155553, 1 male (6 mm), KAH1706/ 101, Piwhane/Spirits Bay, Northland, New Zealand, 34°22.3098'S 172°46.1898'E, 45 m, coll. NIWA, 04/06/2017; NIWA 155554, 5 females (4–7 mm), 15 males (5–8 mm), KAH1706/ 29, Piwhane/Spirits Bay, Northland, New Zealand, 34°22.95'S 172°46.698'E, 32 m, coll. NIWA, 30/05/2017; NIWA 155555, 1 male (6 mm), KAH1706/ 100, Piwhane/Spirits Bay, Northland, New Zealand, 34°22.44'S 172°45.72'E, 43 m, coll. NIWA, 04/06/2017; NIWA 155556, 1 male (6 mm), KAH1706/ 14, Piwhane/Spirits Bay, Northland, New Zealand, 34°22.2498'S 172°44.4702'E, 44 m, NIWA, 29/05/2017; NIWA 155557, 1 male (7 mm), KAH1706/69, Piwhane/Spirits Bay, Northland, New Zealand, 34°23.7498'S 172°46.818'E, 31 m, coll. NIWA, 02/06/2017; NIWA 155558, 1 male (7 mm), 1 juvenile (4 mm), KAH1706/ 26, Piwhane/Spirits Bay, Northland, New Zealand, 34°23.7498'S 172°44.94'E, 33 m, coll. NIWA, 30/05/2017; NIWA 155559, 1 male (6 mm), Z15829, Breaker Bay, Wellington, New Zealand, 41°19.8'S 174°49.92'E, on *Macrocystis* sp., 0–1 m, coll. A.-N. Lörz & M. Theil, 30/01/2013.

Type locality. Piwhane/Spirits Bay, Northland, North Island, New Zealand, 34°22.5498'S 172°46.17'E.

Etymology. This species is named for Dr Judy Sutherland who has tirelessly worked on the sequencing of numerous caprellids the first author sent her way. She has also committed countless hours training the author in the whys and wherefores of molecular phylogenetics.

Diagnosis. Head rounded, no projection; body smooth and robust. Antenna 1 approximately ½ of body; peduncle articles 1–2 narrow, sparsely setose, longer than flagellum. Antenna 2 shorter than peduncle of antenna 1, no dense setae on ventral margin. Gnathopod 1 small and robust, with palmar margin of propodus setose with five proximal grasping spines; palm somewhat convex; dactylus smooth but setose. Pereonite 2 without ventral projection. Gnathopod 2 in male arising at midlength of pereonite 2; basis subequal in length to propodus and longer than pereonite 2; palmar region of propodus slightly convex and slightly sinuous, with subacute corner mid posterior margin defining the palm, this corner armed with three robust setae/ grasping spines; palm lined with small robust setae; dactylus curved, reaching palm corner, inner margin smooth and lined with small setae. Gnathopod 2 in female inserted anteriorly on pereonite 2; palm of propodus convex. Gills small and oval, longer than wide. Peropod 5 reduced with three articles, articles 1 and 2 straight sided. Pereopods 6–7 similar in size and length; propodus narrow, palmar margin of propodus concave bearing short dense setae with three grasping spines. Appendages without downy covering.

Description. (Based on holotype, male, 11.5 mm, and paratype male, 13 mm). Pereonites increasing in length with pereonite 5 the longest and pereonites 1 and 7 similar lengths (1: 2: 2.3: 2.9: 3.8: 3.2: 1.1), pereonite 5 about 1.3 × pereonite 4 and 1.2 × pereonite 6. Gills oval, length about 2.5 × width. Antenna 1 proportion of articles and flagellum changing with size. Antenna 1 peduncle article 1: 2: 3: flagellum is 1: 1.8: 1.6: 2, with nine articles in flagellum. Antenna 2 0.3 × antenna 1; flagellum with four articles. Mandibles with three-articulate palp; distal article with 5 setae (in the form of 1 + × + 1, where × = 3) and article constricted to form distal setose beak shape; penultimate article with five–nine setae.

Mandibular molar absent. Right mandible incisor with five teeth, lacinia mobilis slightly serrated, followed by accessory plates and setal row containing eight–nine serrated setae. Left mandible incisor with five teeth, lacinia mobilis with eight small teeth, no accessory plates or setal row. Maxilla 1 outer plate with five teeth; distal article of palp setose, with six robust setae apically and seven slender plumose setae. Maxilla 2 inner plate slightly shorter than outer plate, both apically setose. Maxilliped inner plate with two slightly serrate robust setae; outer plate setose; palp article 4 about ½ length article 3, with distal short, rounded setose projection; dactylus with setose inner margin. Gnathopod 1 basis longer than ischium, merus and carpus combined. Propodus rounded to subtriangular; palm slightly convex lined with row of robust setae defined by slight corner and five toothed robust setae (also called grasping spines). Inner margin of dactylus smooth but setose. Gnathopod 2 inserted mid pereonite 2; basis longer than pereonite 2. Ischium as long as merus, both longer than carpus (1.2 ×); propodus subequal in length to basis, with subacute corner mid-posterior margin defining palm, this corner armed with 3 robust setae/ grasping spines; palm slightly convex and slightly sinuous and lined with small robust setae; dactylus curved, reaching palm corner, inner margin smooth and lined with small setae.

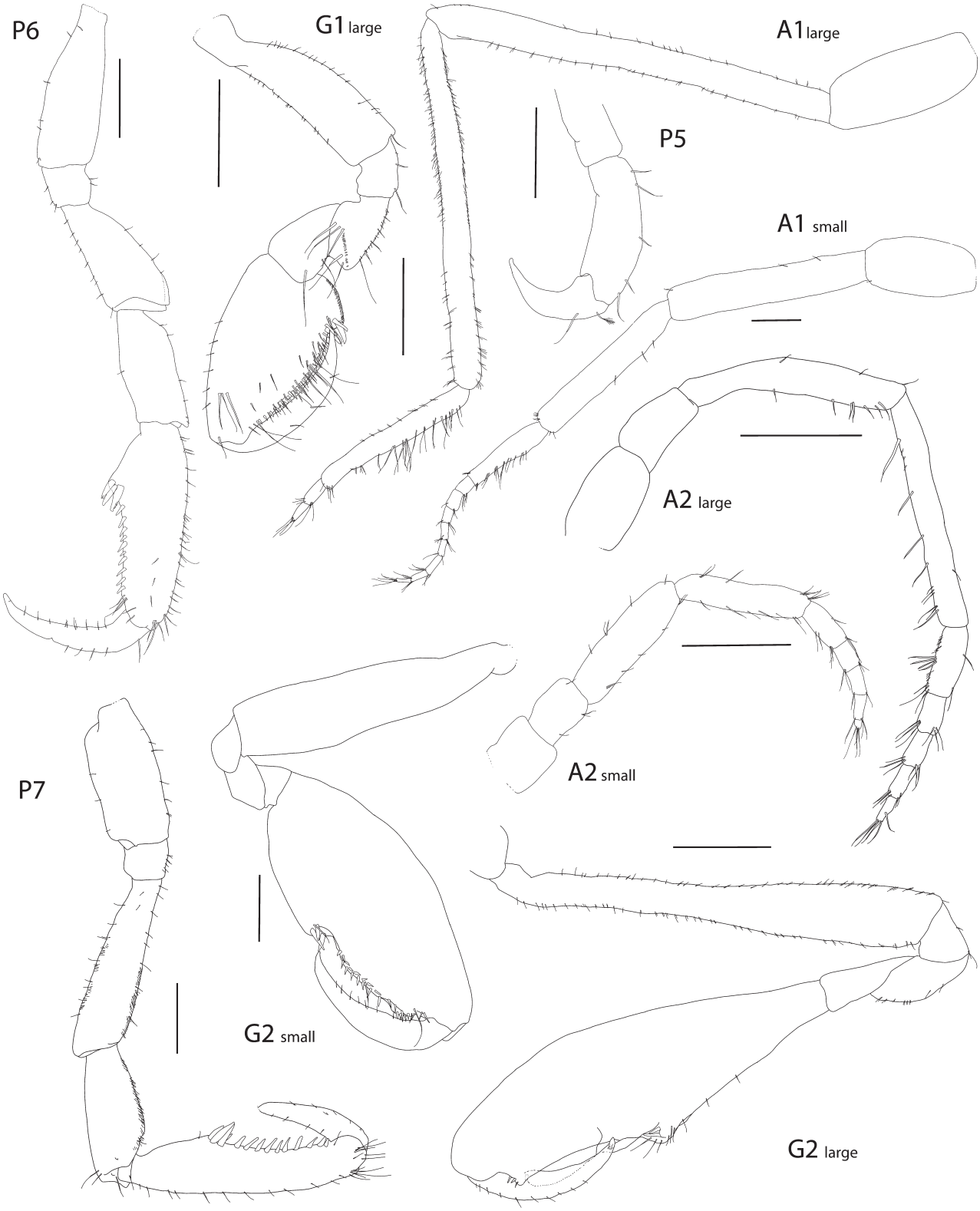

FIGURE 23. *Caprellina judyae* **sp. nov.,** Piwhane/Spirits Bay, Northland, New Zealand: holotype male, 11.5 mm, NIWA 155541; paratype male, 13 mm. Scales: 1 mm, paratype A1 and G2; 0.5 mm holotype A1–2, large A2, large G1, P6 and P7; 0.2 mm, P5.

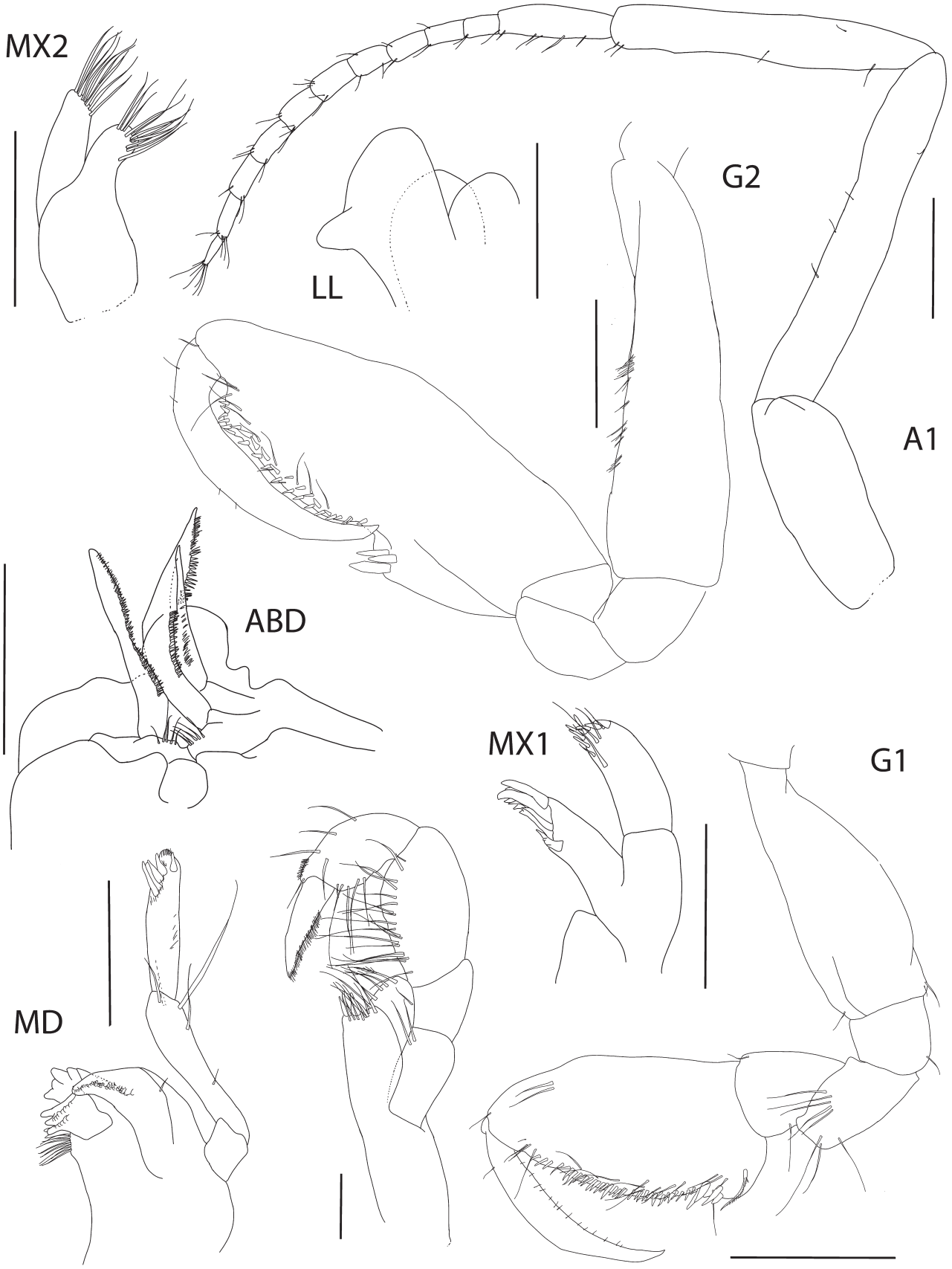

FIGURE 24. *Caprellina judyae* **sp. nov.,** Piwhane/Spirits Bay, Northland, New Zealand: holotype male, 11.5 mm, NIWA 155541; paratype female, 9 mm, NIWA 155542. Scales: 0.2 mm, male mouthparts (LL, MD, MX1, and MX2); 0.5 mm, female A1, G1–2, male, ABD.

TABLE 4. Distinguishing characters between taxa and records of the *Caprellina longicollis* complex.

	Caprellina longicollis	*C. longicollis*	*C. longicollis*	*C. judyae* **sp. nov**.	*C. plumea* **sp. nov.**
	Redescription—male up to 11.6 mm. Chile, Guerra-García, 2002	McCain, 1969, male 15 mm. NZ	Guerra-García & Takeuchi, 2004. Tasmania, male 11.5 mm	Piwhane/Spirits Bay, Northern NZ, male 11.5–13 mm	This paper, Snares Islands/ Tini Heke, Subantarctic Islands, NZ male 15 mm
Pereonites 1: 2: 3: 4: 5: 6: 7	1: 1: 1: 1: 1.3: 1.3: <1	1: 1.3: 1.6: 2: 2.5: 1.6: 0.5	1: 2: 2.7: 3.3: 3.3: 2.8: 1.1	1: 2: 2.3: 2.9: 3.8: 3.2: 1.1	1: 1: 0.76: 1: 1.2: 1: 0.4
MD palp article 3	4 setae, distally beaked and finely setose	8 setae, distally beaked and finely setose	-	5 setae, distally beaked and finely setose	6 setae distally beaked and finely setose
Maxilla 1—palp article 2	9 apical and 9 medial plumose setae	Many robust and simple setae running apically and laterally	-	6 apical robust setae and 7 slender setae	7 apical robust setae
Maxilliped inner plate	3 serrate robust setae	2 serrate robust setae	-	2 slightly serrate robust setae	3 strongly serrate robust setae
Maxilliped palp penultimate article	Setose with acute, setose distal projection	Setose without projection	-	Setose with rounded setose projection	Setose with slight setose projection
Antenna 1 to body	0.8 × body	0.55 × body	0.4 × body	0.5 × body	0.7 × body
Antenna 1 art 1: 2: 3: flagellum	1: 2.8: 2.5: 2.2	1: 2: 1.7: 1.7	1: 1.4: 0.75: 2.3	1: 2.6: 2.3: 1.4 (large) 1: 1.8: 1.6: 2 (small)	1: 2.8: 2.4: 2.2
Gnathopod 1: basis	= ischium + merus + carpus	-	= ischium + merus + carpus	>ischium + merus + carpus	>ischium + merus + carpus
Gnathopod 2: ischium/ merus/carpus	Ischium and carpus short, merus 2× carpus	Ischium 2 × merus, merus = carpus	Ischium = merus + carpus, merus 0.5 × carpus	Large: ischium<merus<carpus Smaller: ischium = merus >carpus	Ischium 0.85× merus = carpus
Gnathopod 2: propodus	= basis	>basis (1.2 ×)	>basis (1.2 ×)	<basis (0.9 ×)—large =basis—small	<basis (0.88 ×)
Gnathopod 2: propodus	1 grasping spine	2 grasping spines	2 grasping spines	2 grasping spines	1 grasping spine
Pereopod 5:	3 articles, article 2 with small cusp	3–4 articles, article 2 smooth	3 articles, article 2 smooth	3 articles, article 2 smooth	3 articles, article 2 with cusp
Pereopod 6–7	Narrow, 2–3 grasping spines, robust setae along palm	3 grasping spines, robust setae along palm	Narrow, 3–5 grasping spines, robust setae along palm	Narrow, 3–4 grasping spines, robust setae along palm	Robust, 2–3 grasping spines, long robust setae along palm
Abdomen: uropod 1	Ramus slightly shorter than peduncle, 'serrate' along ⅔ length of one margin	Ramus about ½ length of peduncle, smooth margins	-	Ramus longer than peduncle, serrate along length of one margin	Ramus same length as peduncle, both margins of peduncle and ramus serrate
Abdomen: uropod 2	No ramus, 1 serrate margin ⅔ length	No ramus, smooth margins	-	No ramus. 1 margin serrate along entire length.	No ramus, both margins serrate along entire length

Pereopods 3 and 4 absent. Pereopod 5 reduced to three articles; articles 1 and 2 with smooth edges, article 2 with five lateral setae, article 3 curved as dactylus with two marginal setae (one plumose). Pereopods 6 and 7 subequal in robustness, similar in length, articles long and narrow; propodus almost rectangular, narrow, palm defining corner ⅓ along margin armed with cluster of three large robust setae/grasping spines; palm concave and lined with numerous robust setae, posterior margin lined with simple slender setae.

Penes as long as wide. Abdomen with pair of small protuberances, as reduced pleopods, apically setose, and two pairs of uropods. Uropod 1 cylindrical and curved inwards; ramus longer than peduncle, margin serrate. Uropod 2 shorter than uropod 1, serrate without ramus.

Variation: male, 13 mm. Antenna 1 approximately ⅔ body; proportion of articles and flagellum changing with size (1: 2.6: 2.3: 1.4 with 3 articles in flagellum). Antenna 2 with five articles. Gnathopod 2 basis greatly longer than pereonite 2, longer than propodus, ischium shorter than merus (0.8 ×), merus shorter than carpus (0.8 ×); propodus long, narrow and robust (length 2.75 × width), posterior margin with palm defining rounded tooth ⅗ along margin bearing two robust setae (grasping spines) and four slender simple setae; palm slightly concave, smooth and without setae, with pre-dactylar acute tooth at the join of the propodus and dactylus; dactylus about ⅔ length of palm, curved with smooth inner margin and setae on outer margin.

Female paratype, 9 mm. Gnathopod 1 basis subequal in length to ischium + merus + carpus. Gnathopod 2 basis shorter than pereonite 2 and inserted at the anterior end of pereonite 2, basis longer than propodus; ischium shorter than merus (0.8 ×), merus shorter than carpus (0.7 ×); propodus with prominent palm defining corner armed with 3 large robust setae (grasping spines) approximately ⅖ along posterior margin; palm sinuous and lined with both robust and slender setae; dactylus just reaching to the defining corner.

Distribution. Piwhane/Spirits Bay, Northland, and a possible record from Breaker Bay, Wellington, North Island, New Zealand.

Remarks. *Caprellina judyae* **sp. nov.** belongs to a complex of species similar to *Caprellina longicollis* Nicolet, 1849. *Caprellina longicollis* was long thought to be a southern cosmopolitan species, but recently, has been challenged (Takeuchi pers. com.); this species and the genus are currently being reviewed by Takeuchi. *Caprellina* was originally described from New Zealand waters by Thomson (1879), but the type species, *Caprellina longicollis*, was described from Chilean waters, with type material now lost. Guerra-García (2001b) redescribed this species based on Chilean material and compared it to the other species in this genus, *C. spiniger* Barnard, 1916 (South Africa) and *C. bispinosa* Müller, 1990 (Society Islands). McCain (1969) reported *Caprellina longicollis* as the most common of all New Zealand caprellids in his samples and noted a range encompassing all the New Zealand coast. Guerra-García annotated the species from Tasmania, Western Australia and subantarctic New Zealand, and, although maintained *Caprellina longicollis* sensu lato, pointed out morphological variation among populations (Guerra-García 2001b, 2003, 2004; Guerra-García & Takeuchi 2004). De Broyer *et al*. (2004), based on these morphological differences, suggested the existence of a species complex within *Caprellina longicollis sensu lato,* and indicated that specimens from Chile, Tasmania and New Zealand belonged to, at least, three different species. Indeed, the present study reveals that there is variation in the morphology between *C. judyae, C. longicollis* (reported from New Zealand), the redescription of *C. longicollis* from Chile, and material noted from Tasmania, Australia. Unfortunately, despite redescribing *C. longicollis* in early 2002, Guerra-García annotated the species from Tasmania. There are differences, however, in the pereonite proportions, the antennae proportions, the shape of the pereopod 6 and 7 palm, and the mouthparts of *Caprellina longicollis* from different regions (Table 4). Whatever the status of *C. longicollis* from each of the studied regions, *C. judyae* **sp. nov.** is readily distinguished from each of these, warranting recognition as a new species.

Caprellina longicollis (Nicolet, 1849)

Caprella longicollis Nicolet, 1849: 251, pl. 4: fig. 5.
Caprellina novae-zealandiae Thomson, 1879: 330.
Caprellina longicollis.—Thomson & Chilton, 1885: 141; Stebbing, 1910: 470–471; Barnard, 1930: 440; McCain, 1969: 289–290, fig. 2.—Guerra-García, 2001b: 1293–1303, figs. 1–7.—Guerra-García, 2003: 180, fig. 2.—DeBroyer *et al.*, 2004: 79–80, fig. 15.—Webber *et al.,* 2010: 156, 219.—Schnabel *et al*., 2023: 436.
Caprellinopsis longicollis, Chilton, 1909: 605, 648; Stephensen, 1927: 354, 385.

Type locality. Chile.

Distribution. Mediterranean Sea, Southern Ocean, widespread southern distribution.

New Zealand biosecurity status. Currently indeterminate.

Remarks. This study supports the contention that records of *Caprella longicollis* from New Zealand waters may represent other species (Takeuchi, pers com.). Despite the very similar morphology between the Tasmanian, New Zealand and Chilean records, this study shows there are potentially multiple separate species in New Zealand waters. Detailed studies across many different groups of marine invertebrates have shown that despite presumed cosmopolitan distributions, many represent radiations of morphologically similar, closely related species (e.g., Fehlauer-Ale *et al.* 2014; Cabezas *et al.* 2013a, b.). This is due to the uncertain identification of many records and the similarity in morphology that was not closely scrutinised. Until a detailed study can be carried out examining every record and resampling fresh material to be able understand the molecular landscape of New Zealand caprellids, *C. longicollis* is tentatively regarded as occurring in New Zealand.

Caprellina plumea sp. nov.

(Figs. 1, 25–27)

Type material. Holotype: NIWA 155560, male (15 mm), Z18762, SA-3501, Cod Cavern, Snares Islands/Tini Heke, subantarctic, New Zealand, 48°1.272498'S 166°36.7708'E, on algae on rock, 11–13 m, coll. G.D. Fenwick, 17/01/1977. Paratypes: NIWA 155562, female (10 mm); NIWA 155563, 5 specimens (males and females, 10–13 mm), same collection data as holotype.

Other material examined. NIWA 155564, 6 specimens (5 males, 1 female, 10–15 mm), stn SA-3539, Seal Cove pool, Snares Islands/Tini Heke, New Zealand, 48°1.338'S 166°36.66'E, 0–1 m, coll. G.D. Fenwick, 04/02/1977; NIWA 155565, 3 specimens (2 males, 1 female, 10–18 mm), Z18763, SA-3396, north side of Seal Point, Snares Islands/Tini Heke, New Zealand, 48°1.281'S 166°36.754998'E, 0–1 m, coll. G.D. Fenwick, 04/02/1977; NIWA 155566, 6 specimens (5 males, 1 female, 8–13 mm), Z18764, SA-3456, Alert Stack, Snares Islands/Tini Heke, New Zealand, 48°22.42'S 166°34.597836'E, 5–10 m, coll. G.D. Fenwick, 20/12/1976; NIWA 155567, 3 specimens (2 males, 1 female, 10–15 mm), Z18765, SA-3403, Snares Islands/Tini Heke, New Zealand, 48°2.158164'S 166°b34.097334'E, 0–1 m, coll. G.D. Fenwick, 04/02/1977; NIWA 155568, 1 female (11 mm), Z18765, SA-3552, Snares Islands/Tini Heke, New Zealand, 48°2.158164'S 166°34.097334'E, 0–1 m, coll. G.D. Fenwick, 04/02/1977; NIWA 155569, 4 specimens (3 males, 1 female, 8–12 mm), Z18766, SA-3401, Station Point, Snares Islands/Tini Heke, New Zealand, 48°1.391664'S 166°36.63333'E, 0–1 m, coll. G.D. Fenwick, 17/11/1976; NIWA 155570, 6 specimens (5 males, 1 female, 10–15 mm), Z18767, SA-3387, Senecio pool, Snares Islands/Tini Heke, New Zealand, 48°1.42717'S 166°36.6885'E, 3 m, coll. G.D. Fenwick, 14/11/1976.

Etymology. The species name is from the Latin adjective, *plumeus*, meaning downy or fuzzy, alluding to the presence of small setae on the margins of all the appendages.

Diagnosis. Head rounded, no projection; body smooth and robust. Antenna 1 approximately ¾ of body; peduncle articles 1–2 narrow, sparsely setose, longer than flagellum. Antenna 2 shorter than peduncle of antenna 1, no dense setae on ventral margin. Gnathopod 1 small and robust, with palmar margin of propodus setose with five of proximal grasping spines; palm somewhat convex; dactylus smooth but setose. Pereonite 2 without ventral projection. Gnathopod 2 in male arising at midlength of pereonite 2; basis slightly shorter than propodus and longer than pereonite 2; propodus with subacute corner mid-posterior margin defining palm, this corner armed with 2 robust setae/grasping spines; palm slightly convex and slightly sinuous and lined with small slender setae; dactylus strongly curved, reaching ⅔ along palm corner, inner margin smooth and lined with small setae. Gnathopod 2 in female inserted anteriorly on pereonite 2; palm of propodus convex. Gills small and oval, longer than wide. Pereopod 5 reduced with three articles, articles 2 with cusp on margin. Pereopods 6–7 similar in size and length; propodus wide, palmar margin of propodus concave bearing short dense setae with three grasping spines. Appendages with downy covering.

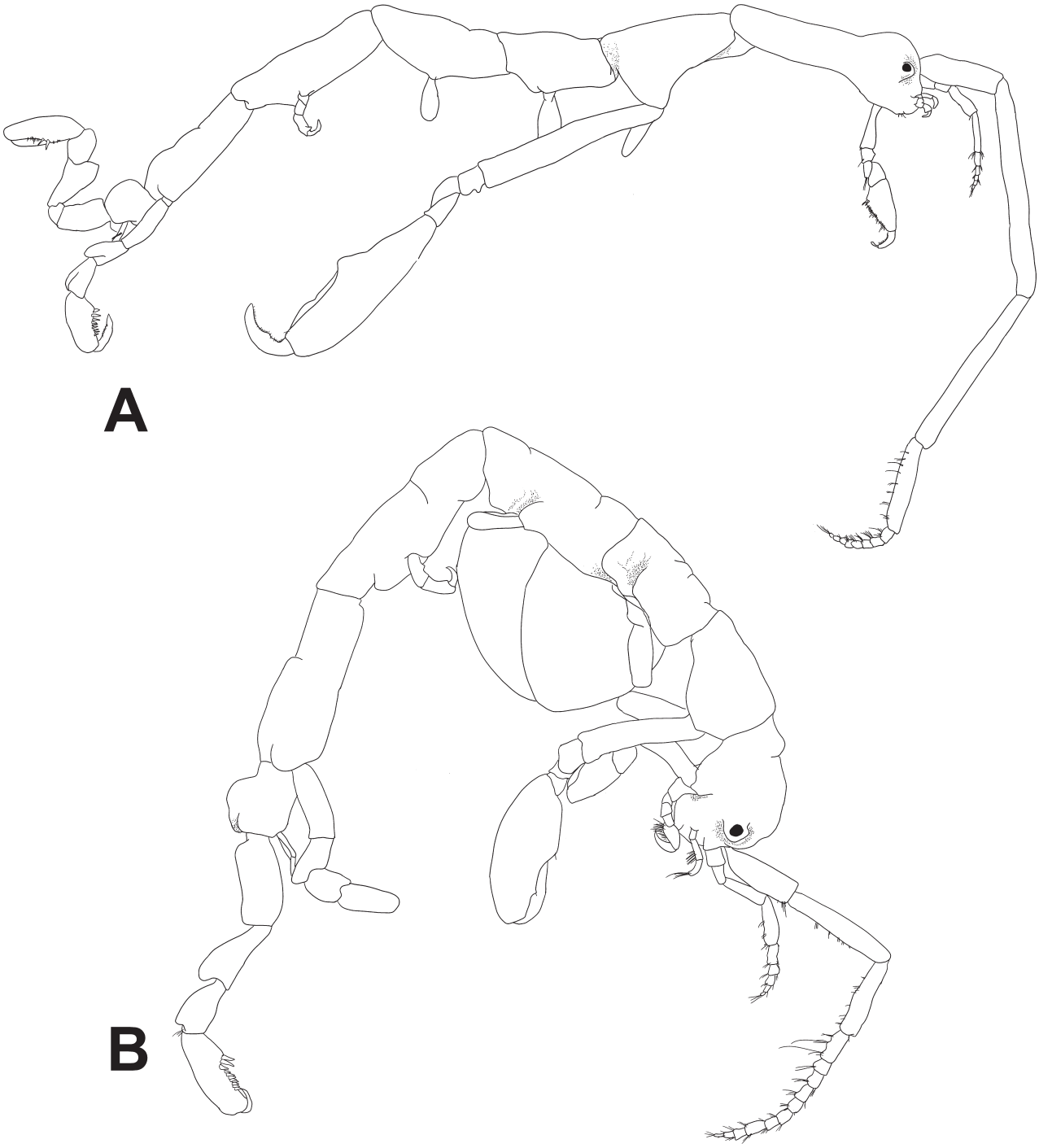

FIGURE 25. *Caprellina plumea* **sp. nov.,** Snares Island/Tini Heke, New Zealand: A, holotype male, 15 mm, NIWA 155560; B, paratype, female, 10 mm, NIWA 155562.

Description. (Based on male, 15 mm). Head rounded dorsally. Pereonites increasing in length with pereonite 5 longest and pereonites 1, 2 and 6 similar lengths (1: 1: 0.76: 1: 1.2: 1: 0.4), pereonite 5 about 1.2 × pereonite 4 and 1.2 × pereonite 6. Body smooth. Gills oval, length about 2.5 × width. Antenna 1 nearly ¾ body length; proportion of articles and flagellum changes with size. Antenna 1 peduncle article 1: 2: 3: flagellum is 1: 2.8: 2.4: 2.2 with 9 articles in flagellum, margins lined with fine setae. Antenna 2 ¼ antenna 1; flagellum with five articles; margins lined with fine setae Mandibles with three-articulate palp; distal article with six setae (in form of 1 + × + 1, where × = 4) and article is constricted to form distal setose beak shape; penultimate article with nine setae. Mandibular molar absent. Right mandible incisor with five teeth, lacinia mobilis slightly serrated, followed by accessory plates and

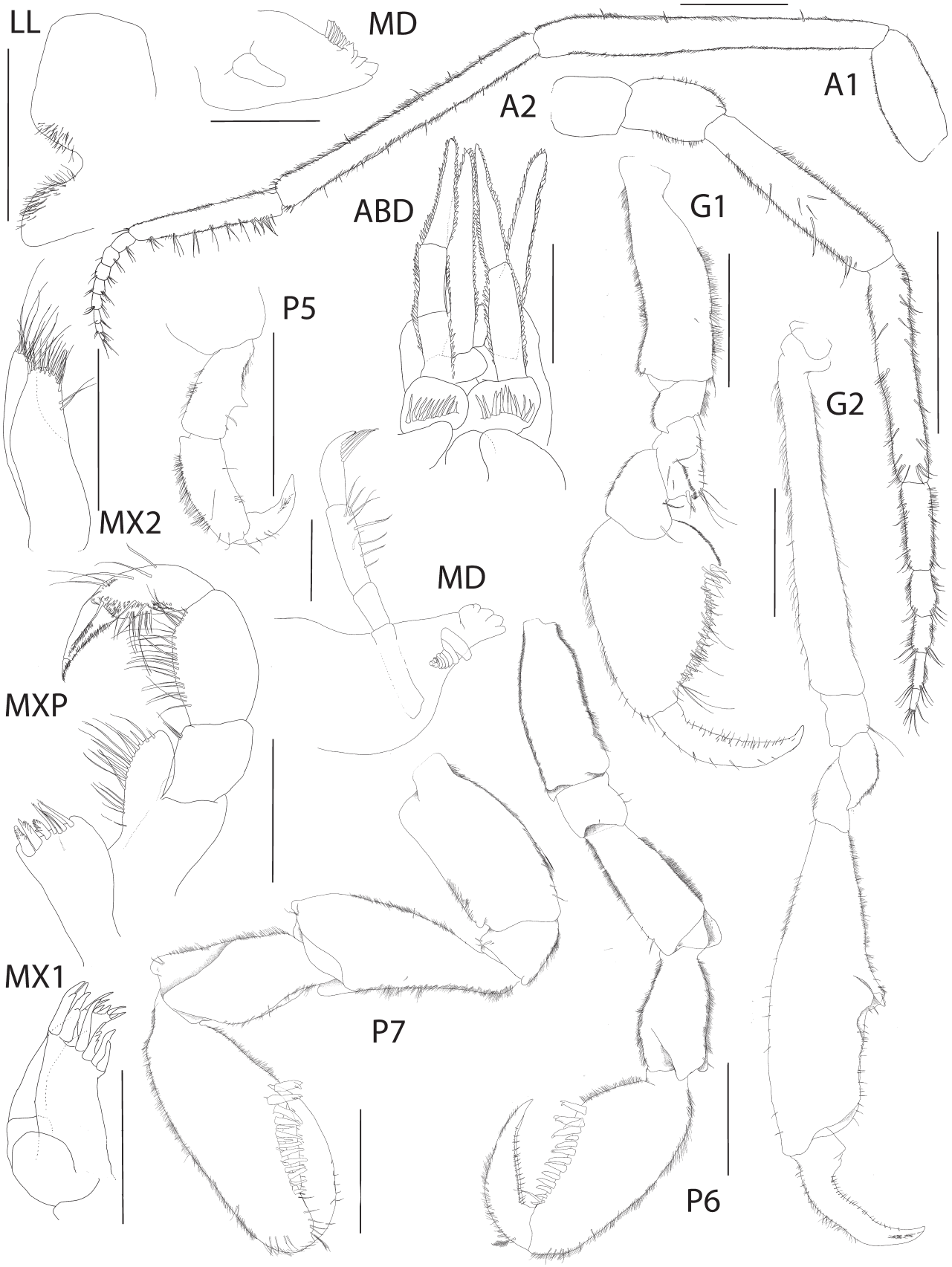

FIGURE 26. *Caprellina plumea* **sp. nov.** male, 15 mm, NIWA 155560, Snares Island/Tini Heke, New Zealand. Scales: 0.2 mm, mouthparts, ABD; 0.5 mm, A2, G1–2, P5–7; 1.0 mm, A1.

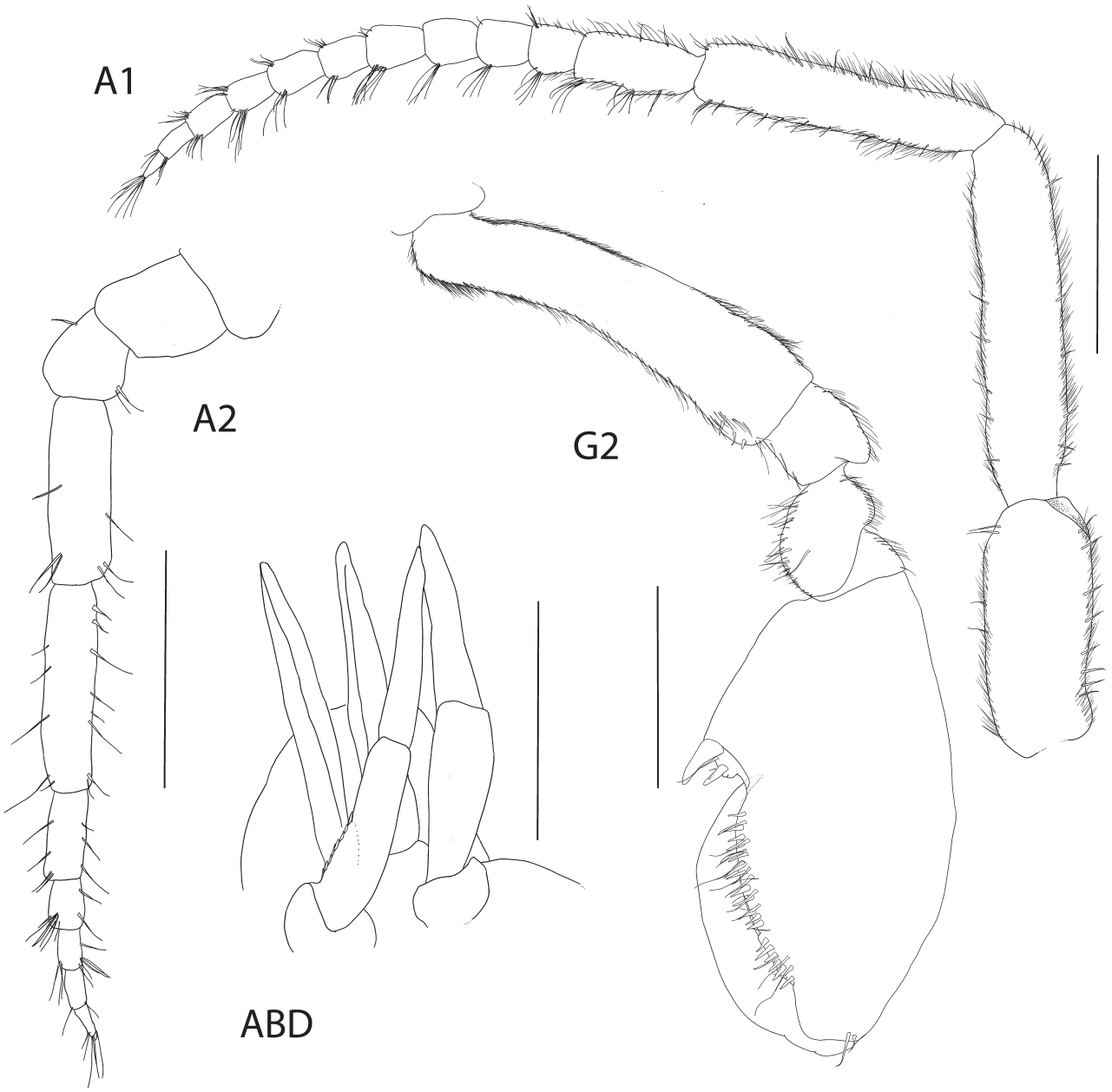

FIGURE 27. *Caprellina plumea* **sp. nov**., paratype female, 10 mm, NIWA 155562, Snares Island/Tini Heke, New Zealand. Scales: 0.2 mm ABD, G2; 0.5 mm, A1–2.

setal row containing eight–nine serrated setae. Left mandible incisor with five teeth, lacinia mobilis with small teeth, with accessory plates and without setal row. Maxilla 1 outer plate with seven teeth; distal article of palp setose, with seven robust setae apically. Maxilla 2 inner plate slightly shorter than outer plate, both apically setose. Maxilliped inner plate with three strongly serrate robust setae; outer plate setose; palp article 4 about ¾ length article 3, with distal short, rounded setose projection; dactylus with setose inner margin and setal fringe medially.

Gnathopod 1 basis longer than ischium, merus and carpus combined; propodus rounded to subtriangular; palm slightly convex lined with row of robust setae defined by slight corner and five smooth robust setae (grasping spines); inner margin of dactylus smooth but strongly setose. Margins lined with small, fine setae. Gnathopod 2 inserted mid pereonite 2; basis longer than pereonite 2; ischium subequal in length to merus (0.9 ×), and both are shorter than carpus (0.75 ×); propodus slightly shorter in length to basis, with subacute corner mid posterior margin defining palm, this corner armed with two robust setae/ grasping spines; palm slightly convex and slightly sinuous and lined with small slender setae; dactylus strongly curved, reaching ⅔ along palm corner, inner margin smooth

and lined with small setae. All margins lined with fine small setae. Pereopods 3 and 4 absent. Pereopod 5 reduced to three articles; articles 1 with cusp on posterior margin, article 2 with few lateral setae, article 3 curved as dactylus with numerous marginal setae. All margins lined with fine, small setae. Pereopods 6 and 7 subequal in robustness, similar in length, articles long but robust; propodus almost ovoid, broad, palm defining corner ½ way along margin armed with cluster of two–three large toothed robust setae (grasping spines); palm concave and lined with numerous robust setae, all margins lined with fine, short setae. Penes as long as wide.

Abdomen with pair of little protuberances, as reduced pleopods, medially setose, and two pairs of uropods. Uropod 1 cylindrical and straight; ramus same length as peduncle, both margins serrate. Uropod 2 subequal to uropod 1, both margins serrate without ramus.

Variation. Female paratype, 10 mm. Gnathopod 1 basis subequal in length to ischium + merus + carpus. Gnathopod 2 basis shorter than pereonite 2 and inserted at anterior end of pereonite 2, basis longer than propodus; ischium shorter than merus (0.8 ×), merus shorter than carpus (0.7 ×); propodus with prominent palm defining corner armed with three large robust setae (grasping spines) approximately ⅖ along posterior margin; palm sinuous and lined with both robust and slender setae; dactylus just reaching to defining corner.

Distribution. Southern New Zealand, including the subantarctic islands.

Remarks. *Caprellina plumea* **sp. nov.** is in the complex of species that are morphologically similar to *Caprellina longicollis* (Nicolet, 1849). The establishment of this new species and *C. judyae* are based on the morphological differences (Table 4) compared with *C. longicollis* from Chile (Guerra-Garcia 2001b—redescription) and detailed comments in DeBroyer *et al.* (2004). The latter paper noted that the variety and extent of morphological characteristics indicates the presence of a species complex rather than a single cosmopolitan species.

The primary characteristics that differentiate *C. plumea* from others in this complex include the increased setosity of the appendages, the proportions of the pereonites (pereonite 1 a similar size to pereonite 2 this is similar to *Caprellina longicollis* sensu stricto whilst differing to *C. judyae* and *C. longicollis* sensu lato). *Caprellina plumea* **sp. nov.** has the ramus of the uropod 1 at the same length as the peduncle, and both margins of peduncle and ramus serrate, whereas *C. judyae* has uropod 1 ramus longer than peduncle, serrate along length of only one margin, and *Caprellina longicollis* sensu stricto has the uropod 1 ramus slightly shorter than the peduncle, and is serrate only along ⅔ length of only one margin (Table 4).

Caprellinoides Stebbing, 1888

Diagnosis. Flagellum of antenna 2 of two–six articles, swimming setae absent. Mandibular palp three segmented, setal formula for distal article 1-x-1, molar absent. Outer lobe of maxilliped longer than inner lobe. Gills on pereonites 2–4. Pereopods 3 and 4 absent. Pereopod 5 three-articulate, inserted slightly posterior to midlength of pereonite 5. Abdomen of male and female with pair of bi-articulate appendages, penes lateral.

Type species. *Caprellinoides tristanensis* Stebbing, 1888 (type by monotypy)

Species composition. Three species: *Caprellinoides mayeri* Pfeffer, 1888*, Caprellinoides singularis* Guerra-García, 2001*c*, Caprellinoides tristanensis Stebbing, 1888.

Remarks: De Broyer *et al*. (2004) notes that *Caprellinoides* is a difficult genus to assess and the current distinctions between the species are not clear.

Caprellinoides mayeri (Pfeffer, 1888)

(Fig. 1)

Caprellina mayeri Pfeffer, 1888: 137–139, pl. 3: fig. 4
Piperella grata Mayer, 1903: 59, pl. 2: fig 29, pl. 7: figs. 40–45, pl. 9: figs. 24–25, 62.
Caprellinoides mayeri Mayer, 1890: 88, pl. 5: figs. 57–58, pl. 6: figs. 15, 26, pl. 7: fig. 48.—McCain & Steinberg, 1970: 47.—McCain & Gray, 1971: 116–119, fig. 4–5.—Laubitz, 1991: 36–38, fig. 6.—Guerra-García, 2003: 180–181, fig. 3.—Webber *et al.*, 2010: 219.—Schnabel *et al*., 2023: 436.
Caprellinoides spinosus K.H. Barnard, 1930: 441, fig. 62.

Diagnosis. Head rounded, no projection; body with subacute projections on pereonites 2, 3, and 4. Antenna 1 approximately ¼ of body; peduncle articles 1–2 narrow, sparsely setose, shorter than flagellum. Antenna 2 shorter

than peduncle of antenna 1, no dense setae on ventral margin. Gnathopod 1 very small, with palmar margin of propodus weakly setose with two proximal grasping spines; palm straight; dactylus smooth without setae. Pereonite 2 without ventral projection. Gnathopod 2 in male arising anteriorly midlength of pereonite 2; basis shorter than propodus and shorter than pereonite 2; propodus with subacute corner ¼ along posterior margin defining palm, this corner is armed with one robust seta/grasping spine; palm convex and lined with small slender setae; dactylus slightly curved, reaching to palm corner, inner margin smooth and not with setae. Gnathopod 2 in female inserted anteriorly on pereonite 2; palm of propodus straight. Gills small and oval, longer than wide. Pereopod 5 reduced with three articles, articles 2 with straight margins, article 3 small and rounded not like dactylus. Pereopod 6 slightly smaller in length and size than pereopod 7; propodus narrow, palmar margin of propodus concave bearing short setae with one grasping spine; palm defined by large subacute corner near junction of propodus and carpus. Appendages without downy covering.

Distribution. Antarctic and subantarctic waters; 1–412 m. (De Broyer *et al*., 2007).

Pseudoprotomima McCain, 1969

Diagnosis. Flagellum of antenna 2 of four articles, swimming setae absent. Mandibular palp three-segmented, setal formula for distal article 1-x-1, molar absent. Outer lobe of maxilliped subequal in length to inner lobe. Gills on pereonites 2–4. Pereopods 3–5 six-segmented. Abdomen of both sexes with pair of uniarticulate appendages, penes lateral. (After McCain 1969)

Type species. *Pseudoprotomima hurleyi* McCain, 1969 (type by original designation).

Species composition. Three species.: *Pseudoprotomima grandimana* Guerra-García, 2004*, Pseudoprotomima hedgpethi* McCain & Gray, 1971*, Pseudoprotomima hurleyi* McCain, 1969

Pseudoprotomima hurleyi McCain, 1969

(Fig. 1)

Diagnosis. Head rounded, no projection; body smooth and slender. Antenna 1 approximately ½ of body; peduncle articles 1–2 narrow, sparsely setose, longer than flagellum. Antenna 2 longer than peduncle of antenna 1, without dense setae on ventral margin, flagellum with four articles. Gnathopod 1 small and slender, with palmar margin of propodus setose with three proximal grasping spines; palm somewhat convex and defined by broad, subquadrate corner; dactylus smooth but weakly setose. Pereonite 2 without ventral projection. Gnathopod 2 in male arising from anterior end of pereonite 2; basis shorter than propodus and shorter than pereonite 2; propodus with small subacute corner ⅓ along posterior margin defining palm, this corner armed with 3 robust setae/grasping spines; palm slightly convex and slightly sinuous and lined with small slender setae; dactylus slightly curved, reaching all along to palm corner, inner margin smooth and lined with small setae. Gills small and oval, longer than wide. Pereopod 3–5 slender, six-segmented. Pereopod 3 dactylus longer than propodus. Pereopods 5 shorter than pereopods 3 and 4, dactylus slightly shorter than propodus. Pereopods 6–7 similar in size and length and narrow; propodus narrow, not defined by corner or grasping spines, palmar margin of propodus straight and not defined, dactylus much shorter than propodus. Appendages without downy covering.

Remarks. *Pseudoprotomima hurleyi* is the only deep-water caprellid known from New Zealand waters, but globally, a number of species occur deeper than 500 m.

Distribution. Chatham Rise and Canterbury Basin, New Zealand.

Key to New Zealand species of the family Caprellidae

1. Gills present on only pereonites 3 and 4 2
- Gills present on pereonites 2–4 13
2. Pereopods 3–4 present (reduced) 3
- Pereopods 3–4 absent 4
3. Pereonite 2 with two (paired) dorsal projections opposite gnathopod insertion, and one distally. Pereopods 3–4 uni-articulate . . . . . *Pseudaeginella campbellensis* Guerra-García, 2003

- Pereonite 2 with one low rounded projection distally, body smooth. Pereopods 3–4 bi-articulate . . . *Noculacia anima* **sp. nov.**
4. Pereopod 5 two-articulate. . . . . .*Caprellaporema subantarctica* Guerra-García, 2003
- Pereopod 5 six-articulate . . . . . *Caprella*, 5
5. Head with large acute, anterior pointing projection 6
- Head without dorsal projection/with reduced subquadrate projection 8
6. Antenna 2 reaching well past peduncle of antenna 1. Male gnathopod 2 without anterodistal lobe 7
- Antenna 2 shorter than or subequal to peduncle of antenna 1. Male gnathopod 2 with large rounded anterodistal lobe . . . . . *Caprella scauroides* Mayer, 1903
7. Pereopods 6–7 merus longer than broad. Maxilliped dactylus serrate on both margins. Gnathopod 2 propodus slightly rugose. . . . . *Caprella novaezealandiae* Kirk, 1879
- Pereopods 6–7 merus broader than long. Maxilliped dactylus both margins smooth. Gnathopod 2 propodus strongly rugose . . . . . *Caprella serenae* **sp. nov**.
8. Pereonites 3–5 covered in projections and setae . . . . . *Caprella mutica* Schurin, 1935
- Pereonites 3–5 smooth, ?glabrous 9
9. Pereopods 5–7 propodus anterior palm convex 10
- Pereopods 5–7 propodus anterior palm concave 11
10. Ventral projection between gnathopods on pereonite 2. Gills ovoid 12
- Ventral projection absent . . . . . *Caprella andreae* Mayer, 1890
11. Gnathopod 1 merus subquadrate/truncated . . . . . *Caprella equilibra* Say, 1818 *sensu lato*
- Gnathopod 1 merus rounded . . . . . *Caprella manneringi* McCain, 1979
12. Head with blunt projection. Gnathopod 1 merus posterior lobe subacute, narrow . . . . . *Caprella sarahae* **sp. nov.**
- Head without projection. Gnathopod 1 merus posterior lobe broadly rounded. . . . . .*Caprella perplexa* **sp. nov.**
13. Pereopods 3–4 present . . . . . *Pseudoprotomima hurleyi* McCain, 1969
- Pereopods 3–4 absent 14
14. Pereopod 5 composed of two articles. Head with projection . . . . . *Caprellinoides mayeri* (Pfeffer, 1888)
- Pereopod 5 composed of three articles. Head without projection . . . . . .*Caprellina*, 15
15. Maxilliped inner plate with two slightly serrate robust setae. Uropod 1 ramus longer than peduncle . . . . . .*Caprellina judyae* **sp. nov.**
- Maxilliped inner plate with three serrated robust setae. Uropod 1 ramus as long as or shorter than peduncle 16
16. Pereopods 6–7 distal articles narrow. Uropod 1 ramus shorter than peduncle. Uropods 1–2 only one margin serrate but only ⅔ of length of margin . . . . . .*Caprellina longicollis* Nicolet, 1849 *sensu lato*
- Pereopods 6–7 distal articles broad. Uropod 1 ramus as long as peduncle. Uropods 1–2 both margins serrate . . . . . *Caprellina plumea* **sp. nov.**

Discussion

This study provides a much-needed updated overview of the caprellid fauna of New Zealand. The molecular and morphological results reflect a common situation observed in amphipods around the world, where detailed studies provide a picture of numerous clusters of similar but distinct species that can be grouped around certain body types.

This paper documents a significant increase in the diversity of caprellid species known from New Zealand waters. It was expected that New Zealand would have more than the eight valid species, as caprellids in Australian and Chilean waters are diverse and abundant, and there are biogeographic parallels to some extent between the regions. The diversity of these regions is influenced by the large latitudinal changes, ranging from subtropical to subantarctic. The relative isolation of the Australian and New Zealand waters means that the area has generally high species diversity and endemicity rates. The increase in numbers can be mainly attributed to undertaking detailed examinations of both the morphology and molecular characters, and to a lesser extent the slight increase in the detection of invasive (non-indigenous) species in recent years.

The molecular analysis, even though limited by quality of material, shows that in a preliminary way, there is much greater diversity than previously acknowledged. This study also shows that both molecular and morphological studies need to be complementary. Groups of amphipods, like the caprellids, are abundant and easily recognised by even the general public and so many species are assumed to be either known native species or an invasive species. Once observed in detail, there is an obvious diversity in species and distributional range. Often the specimens sent to researchers by the general public have been poorly preserved and so molecular sequencing can be unfruitful.

Future studies should involve a dedicated collection programme of the wide range of habitats and areas and the specimens collected immediately sequenced (or as soon as possible) to gain a full understanding of the true extent of species such as *Caprella equilibra* and *Caprellina longicollis*. This will probably change the caprellid landscape of

New Zealand once again but will provide a more comprehensive view of this complex fauna and so give us a firmer platform from which to manage invasive species and the New Zealand food web.

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APPENDIX 1. Maximum likelihood phylogram based on nSSU sequence data. Support values are shown on each branch: approximate Likelihood Ratio Test (aLRT, %) and ML bootstrap (%) values above, and Bayesian PP values below. Only values greater than 80% (aLRT), 80% (bootstrap) and 0.9 (PP) are shown; all support values are shown if two support methods for a clade reach the cutoff value. Sequences from New Zealand taxa are in bold.