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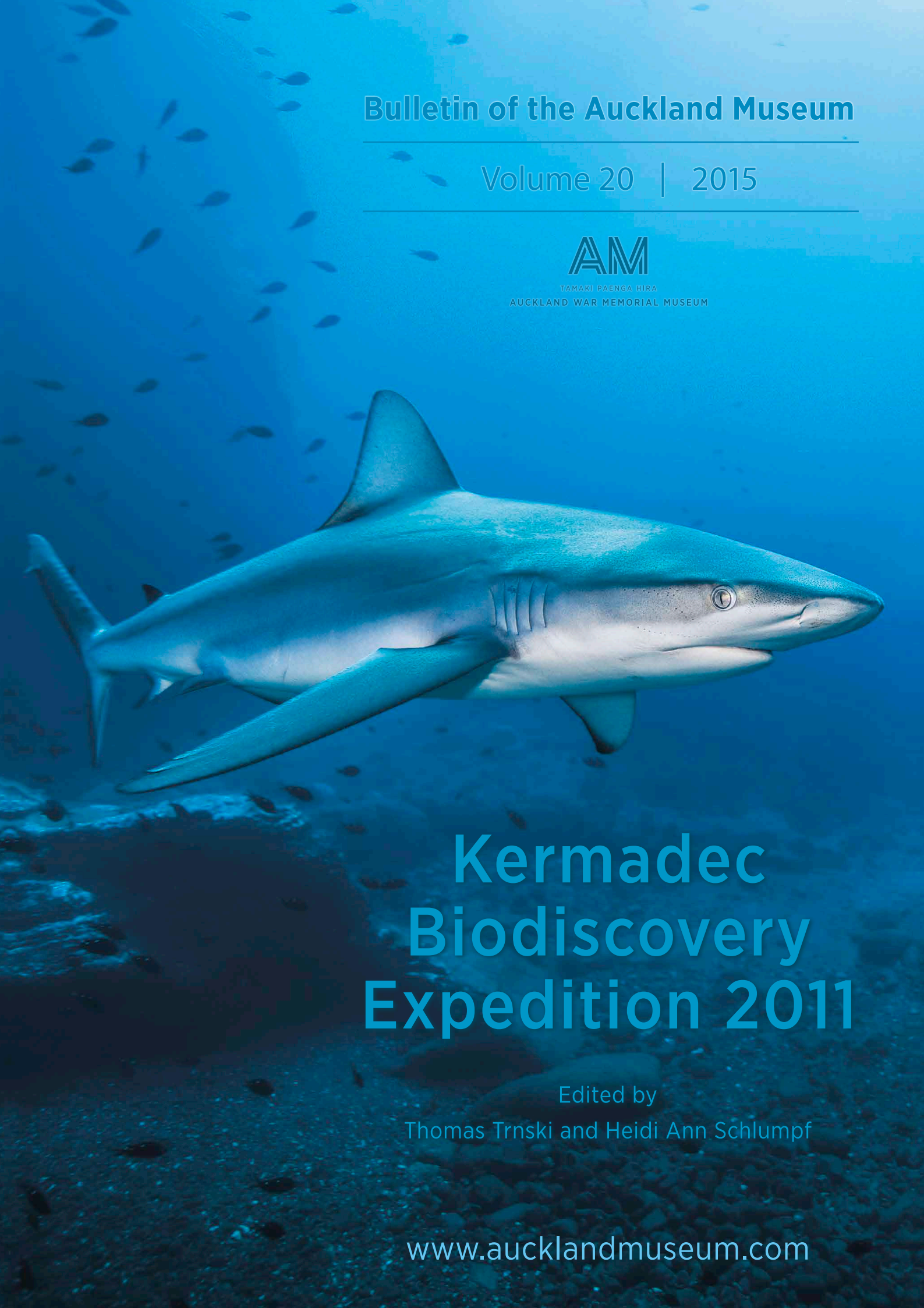

Kermadec Biodiscovery Expedition 2011

Edited by
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Tanaidacea (Crustacea: Peracarida) of the Kermadec Biodiscovery Expedition 2011, with a new sub-family of Paratanaidae: Metatanainae

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Abstract

Six species of tanaidacean – one apseudomorphan (*Paradoxapseudes floppae* sp. nov.) and five tanaidomorphans (*Zeuxo kermadecensis* sp. nov., *Tanais* sp., *Leptochelia acrolophus* sp. nov., *Metatanais progenitor* sp. nov., and *Aparatanais tetradonta* sp. nov.) – are recorded from the Kermadec Islands (SW Pacific) that extend from Raoul Island in the North to L'Esperance Rock in the South. Five are considered to be new species but with close relatives in warm-temperate/tropical eastern Australia, Melanesia-Polynesia, or New Zealand. A new paratanaid subfamily, Metatanainae, is established from new morphological data and recording of the first dimorphic males of the genus *Metatanais*. Two genera, *Metatanais* and *Tanais*, are new records for the New Zealand marine fauna. Because of insufficient comparative evidence, no firm conclusions can be drawn about the predominant zoogeographic affinities, or origins, of the Kermadec Islands tanaidacean fauna, but it is likely that both warm-water and southern (i.e. New Zealand) sources are involved.

Keywords

Kermadec Islands; Tanaidacea; Paratanaidae; Metatanainae; *Aparatanais*; *Leptochelia*; *Metatanais*; *Paradoxapseudes*; *Tanais*; *Zeuxo*

INTRODUCTION

Ever since Charles Darwin's voyage on *HMS Beagle* and Alfred Wallace's discoveries in Indonesia, remote or isolated islands have fascinated evolutionary biologists, taxonomists, and zoogeographers, since they offer potential for discovering endemic species and the challenge of elucidating the origins of the fauna (Quammen, 1996). New Zealand (NZ) has several distant island groups within its Exclusive Economic Zone (EEZ); the most familiar are perhaps those in the cold Subantarctic (e.g. the Auckland Islands, and Campbell Island), south of NZ proper. At the other latitudinal extreme are the subtropical Kermadec Islands – principally Raoul Island, Macauley Island, the Cheeseman & Curtis islands, and L'Esperance and Havre rocks. These are emergent structures of Pleistocene-Holocene origin, 0.6–1.4 million years old, situated along the volcanic chain in the South-west Pacific that extends in a NNE/SSW axis from Tonga to northern New Zealand (Wright, 2010).

Comprehensive faunal inventories of the marine environment (e.g. Gordon, 2010) are, like biogeography, essential components for understanding New Zealand's biodiversity. Support for these initiatives must come from reliable data collected from numerous habitats and geographic localities. Following the Wellington conference in 2010, "DEEP – Talks and thoughts celebrating diversity in New Zealand's untouched Kermadecs" sponsored by The Pew Environment Group (e.g. Gardner, 2010; Trnski *et al,* 2010), an expedition organised by the Auckland Museum and participants from the Australian Museum, Museum of New Zealand Te Papa Tongarewa, and New Zealand Department of Conservation, carried out shallow-water biological sampling and surveying at these islands in May 2011 (http://kermadec.aucklandmuseum.com). The overall results of this (the Kermadec Biodiscovery Expedition 2011) are described by Trnski (2015) and Keable & Reid (2015). Among the smaller invertebrates collected were tanaidaceans, a group of peracarid crustaceans with phylogenetic affinities to isopods, amphipods and cumaceans (e.g. Wilson, 2009).

Of the 24 peracarid species recorded by Chilton (1911) from the Kermadec Islands, no shallow-water (<200 m) tanaidaceans were listed, only amphipods and isopods. As far as I know, no tanaidacean records have been published in the 100 years since then. However, for comparison and context we can consider records of tanaidaceans from an arc around the Kermadec Islands: from eastern warm-temperate and tropical Australia, i.e. New South Wales and Queensland (e.g. Băcescu,

1981; Bamber, 2008a, 2013; Błażewicz-Paszkowycz & Bamber, 2007; Błażewicz-Paszkowycz & Zemko, 2009; Boesch, 1973; Chilton, 1885; Edgar, 2008, 2012; Guţu, 2006; Hale, 1933; Haswell, 1882; Lang, 1970; Larsen, 2001; Larsen & Heard, 2001; Larsen & Wilson, 1998; Whitelegge, 1901); New Caledonia and the Loyalty Islands (Bamber, 2006; 2013; Bamber & Boxshall, 2006 [slope fauna]; Bamber, 2007 [slope fauna]; Stebbing, 1900); Vanuatu (Bamber, 2009); Ovalau and Vatulele [Fiji group] (Dana, 1852; Guţu & Iliffe, 2011); the Cook Islands (Guţu, 2008); the Touamotu Islands (Nobili, 1906); through to New Zealand (Bird, 2008, 2011, 2012a, b; Bird & Bamber, 2013; Gardiner, 1973; Knight & Heard, 2006; Sieg, 1980a - these modern authors citing 19th century papers by C. Chilton and G. M. Thomson).

The Kermadec Biodiscovery Expedition 2011 is significant because within the material there are six tanaidacean species, comprising one apseudomorphan (a new species of *Paradoxapseudes* Guţu, 1991) and five tanaidomorphans (an unidentified species of *Tanais* sp. and a new species from each of the genera *Aparatanais* Bird & Bamber, 2013; *Leptochelia* Dana, 1849; *Metatanais* Shiino, 1952, and *Zeuxo* Templeton, 1840). *Metatanais* is partly represented by dimorphic natatory males, the first to be described for this genus. These, together with morphological details revealed by the females, enable *Metatanais* to be assigned firmly to the family Paratanaidae Lang, 1949, and within a new subfamily that is diagnosed here.

MATERIALS AND METHODS

The surveyed sites and sampling methods for the Kermadec Biodiscovery Expedition 2011 are described by Trnski & de Lange (2015), and the invertebrates (including tanaidaceans) are listed by Keable & Reid (2015). The tanaidaceans were primarily from diver-collected material (sometimes with the use of an airlift). In the following text, the stated range of invertebrate substrata in the distribution and habitat sections is for the sample/site as a whole and may not be specific to the actual tanaidacean niche.

Type material has been deposited in the Australian Museum (P. accession prefix) and the Auckland War Memorial Museum – Tamaki Paenga Hira (AIM MA accession prefix).

Terminology follows Bird & Bamber (2013). In the species accounts, the following abbreviations are used for the distributional summaries: Ck – Cook Islands; Fi – Fiji group; NC – New Caledonia; NSW – New South Wales; NZ – New Zealand; Qld – Queensland; Tou – Touamotu Islands. These sections do not include other localities that may be published for the species although comments are made where relevant.

Bibliographies and synonyms are kept to a minimum but see Sieg (1983) or Anderson (2013) for accounts that are more complete.

Drawings were prepared with a WACOM Intuos4 drawing tablet and Adobe Illustrator CS4.

SYSTEMATICS

Order TANAIDACEA Dana, 1849
Suborder APSEUDOMORPHA Sieg, 1980b
Superfamily APSEUDOIDEA Leach, 1814
Family APSEUDIDAE Leach, 1814
Genus *Paradoxapseudes* Guţu, 1991

Paradoxapseudes Guţu, 1991: 349–350 (new genus and diagnosis); Guţu, 2008: 23–32 (remarks on genus, including synonymisation of *Gollumudes*, see below); Guţu, 2008: 32–38 (description of *P. edgari*).
Gollumudes Bamber, 2000: 40 (new genus and diagnosis); Guţu, 2001: 85–86 (remarks on genus; transfer from Parapseudidae to Apseudidae); Guţu, 2006: 97–98 (remarks on genus); Guţu, 2007: 55–56 (remarks on genus).
Apseudes Leach, 1814: Edgar, 1997: 279 (for *A. larakia*, see below).

Type species. *Paradoxapseudes cubensis* Guţu, 1991.

Composition in area. *Paradoxapseudes edgari* Guţu, 2008 [Ck]; ***P. floppae* sp. nov.**; *P. larakia* (Edgar, 1997) [Qld]; *Paradoxapseudes* spp. (as *Gollumudes* spp., *sensu* Gordon, 2010) [NZ].

Remarks. The original diagnosis of this apseudid genus was partly based on the vestigial nature of the inner antennular flagellum of *Paradoxapseudes cubensis* Guţu, 1991 that was later recognised as an aberration (Guţu, 2008). *Paradoxapseudes* is also characterised by the presence of inferodistal combs on the propodus of both pereopod-5 and pereopod-6. The genus currently holds 15 known species (Anderson, 2013; Tzeng & Hsueh, 2014b), elevated from the pre-2008 count by the synonymisation of *Gollumudes*, the description of two more species from Bass Strait, *P. attenuata* Błażewicz-Paszkowycz & Bamber, 2012 and *P. paneacis* Błażewicz-Paszkowycz & Bamber, 2012, and *P. pangcahi* Tseng & Hsueh, 2014 from Taiwan. *Gollumudes* was originally classified within the Parapseudidae Guţu, 1981 based on the absence of a coxal apophysis on pereopod-1 but this was later revised by Guţu (2001) and Bamber (2008b). Several morphological characters discriminating the species of *Paradoxapseudes* were usefully tabulated by Tzeng & Hsueh (2014b).

Paradoxapseudes floppae sp. nov. (Figures 1–5)

Diagnosis. *Female. Rostrum* shallow-hastate. *Pleotelson* 1.25 times longer than broad (ltb). *Antennule* article-1 with proximomedial serration and distomedial apophysis; main flagellum six-segmented; one aesthetasc on segment-3 and segment-5; accessory flagellum two-segmented. *Antenna* flagellum six-segmented. *Mandible* palp article-1 with three medial setae; article-2 with about seven medial setae. *Chelipeds* dimorphic or similar; exopod with six setae; basis with inferior spine (thick seta); carpus of large form (left) with two inferior apophyses, smaller form (right) with simple or bifid

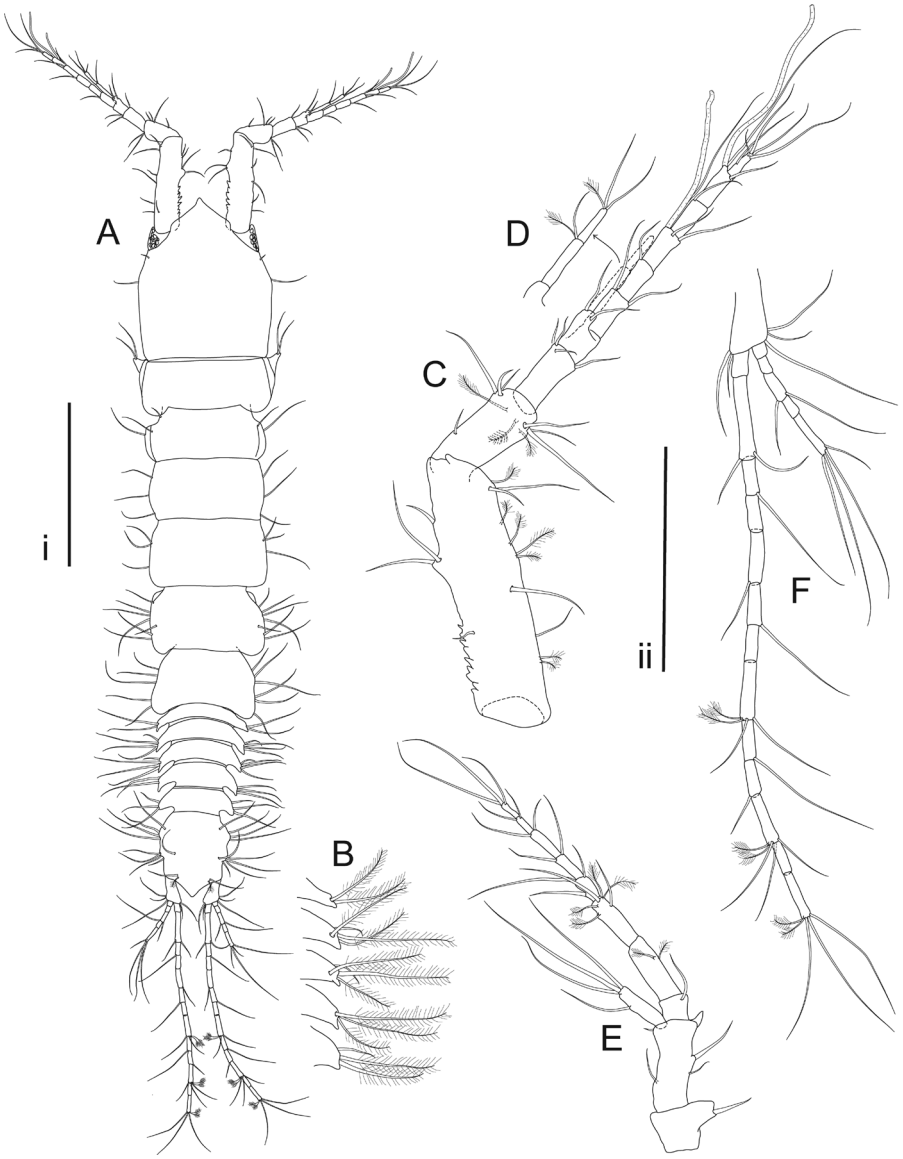

Figure 1. *Paradoxapseudes floppae* sp. nov., female (holotype): *A* habitus, pleonal setae simplified for clarity; *B* pleonal epimera. Female (paratype, AM P.87385): *C* antennule; *D* antennule accessory flagellum; *E* antenna; *F* uropod. Scale bars: i: *A*, 0.5 mm; ii: *B*–*F*, 0.25 mm.

distal apophysis; non-dimorphic chelipeds similar to those of larger form of dimorphic female, but smaller, right carpus with one distal apophysis. *Pereopod-1* coxa with well-developed anterior apophysis; basis superior margin with five plumose setae; propodus with four inferior spines. *Pereopod-6* basis with *ca*. twelve superior plumose setae; merus and carpus with superior plumose setae. *Uropod* exopod and endopod five- and *ca*.13-segmented respectively.

Male. Weakly dimorphic, smaller than female. *Antennule* main flagellum six-segmented; one aesthetasc on segment-3 and 5. *Chelipeds* similar to larger form of dimorphic female, but smaller; exopod with fewer setae; right carpus with one distal apophysis.

Etymology. For my lovely daughter Florence, as a 20th birthday gift, from her pet name.

Type material. Holotype: ovigerous (ov.) ♀, 2.0 mm, K2011-77-2, AIM MA73440, washing from antipatharian, 24 m, western side of Cheeseman Island, 30° 32' 06" S 178° 34' 11" W, coll. by S.J. Keable and A. Reid, 23 May 2011.

Paratypes (by island group): Raoul: one non-ov.♀, K2011-2-1, P.87596; one preparatory (prep.) ♀ (chelipeds missing), K2011-23, AIM MA73444; one non-ov.♀, one ♂?, K2011-42-1, P.87595; one non-ov.♀ (chelipeds missing), one ♂, K2011-47-2, AIM MA73443.

Macauley: one prep.♀, K2011-71-2, P.87597.

Cheeseman & Curtis: one non-ov.♀ (chelipeds missing), K2011-77-2, AIM MA73441; one non-ov.♀, one prep.♀ (chelipeds missing), one ov.♀ (chelipeds missing, P.90996, partly dissected on microslides P.87385), K2011-92-1, P.87385.

L'Esperance: one prep.♀ (chelipeds missing), K2011-99-3, AIM MA73442.

Description. *Female (preparatory or ovigerous)*. *Habitus* (Figure 1A), fairly stout, 5.3 times longer than broad [holotype]; length 1.4–2.7 mm (preparatory 1.4–2.7 mm, n=4; ovigerous 2.0–2.1 mm, n=2). *Cephalothorax* about as long as pereonites 1–3 combined, 1.2 times ltb, posteriolateral margins sub-parallel; rostrum shallow-hastate, with weakly concave anterolateral margins. *Pereon* 50% of body length; pereonites all shorter than broad, pereonites 1–2 shortest, subequal; pereonites 4–5 longest, subequal; pereonites 1–4 subrectangular, without prominent lateral apophyses; pereonites 5–6 narrower anteriorly; setation as figured. *Pleon* just shorter than pereonites 5–6 combined, weakly tapered posteriorly, but pleonites progressively longer; epimera (Figure 1B) well-developed, reflexed, with three or four apical pinnate setae. *Pleotelson* as long as three preceding pleonites, 1.2 times ltb, lateral margins with two processes each bearing four setae; other setation as figured.

Antennule (Figure 1C–D) article-1 four times ltb, medial margin with proximal spines and mid-distal apophysis; article-2 smooth, about twice as long as broad; article-3 about 0.6 times length of article-2; article-4 with two distal setae at base of accessory flagellum; main flagellum six-segmented, segment-6 offset on segment-5; segment-3 and 5 each with aesthetasc; accessory flagellum two-segmented, shorter than segments 1–3 of main flagellum, segments slender; other setation as figured. *Antenna* (Figure 1E) article-1 with superior apophysis and seta; article-2 2.5 times ltb, with superodistal spine; flagellum five-segmented, segment-1 just shorter but broader than segment-2, segments 2–3 longest; squama as long as article-5 of peduncle, with four distal setae; other setation as figured.

Epistome (Figure 2A) long and acute. *Mandibles* (Figure 2B–E) typical; left mandible molar apex blunt, with corrugated ridges and granular surface, setal row with about five bifid or excavate-tipped spines, lacinia broad and crenulate, incisor four-cusped; palp article-1 with two medial setae, article-2 about 2.8 times ltb, with seven medial setae, article-3 with about eight distal and terminal setae; right mandible (Figure 2C, E) similar to left but without lacinia. *Maxilliped* (Figure 2F–H) bases with about three distolateral apophyses and long plumose distomedial seta; endite with two medial coupling hooks, about five medial setae, three distolateral curved spines and about six distomedial blunt or bifid spines; palp article-1 short, with long medial seta; article-2 with distolateral seta and two rows of medial setae; article-3 smaller than article-2 but larger than article-4, with two medial rows of setae; article-4 with about eight distal setae; other setation as figured. Other mouthparts not observed/recovered.

Cheliped (Figure 3) dimorphic in holotype female, exopod present on both: *right cheliped* (Figure 3A–C) gracile, smaller than left cheliped; basis 1.6 times ltb (main body), inferior margin with proximal seta and midlength robust seta [spine], and two distal setae; merus arcuate with two inferodistal setae; carpus 2.3 times ltb,

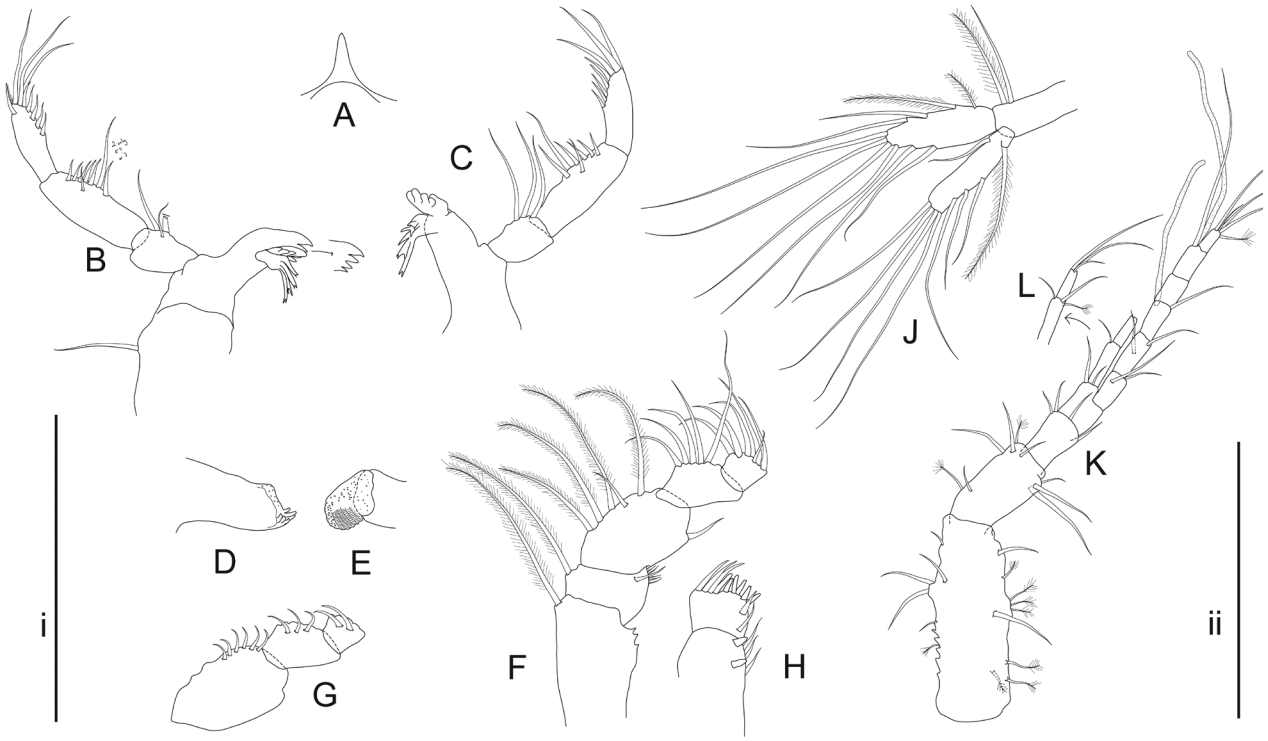

Figure 2. *Paradoxapseudes floppae* sp. nov., female (paratype, P.87385): *A* epistome, ventral; *B–C* left and right mandibles respectively; *D–E* left and right mandible molars; *F* maxilliped (lateral); *G* maxilliped palp articles 2–4 oral setae; *H* maxilliped endite; *J* pleopod (all setae plumose). Male (paratype, AIM MA73443): *K* antennule; *L* accessory flagellum. Scale bars: i: *A–H*, 0.25 mm; ii: *J–L*, 0.25 mm.

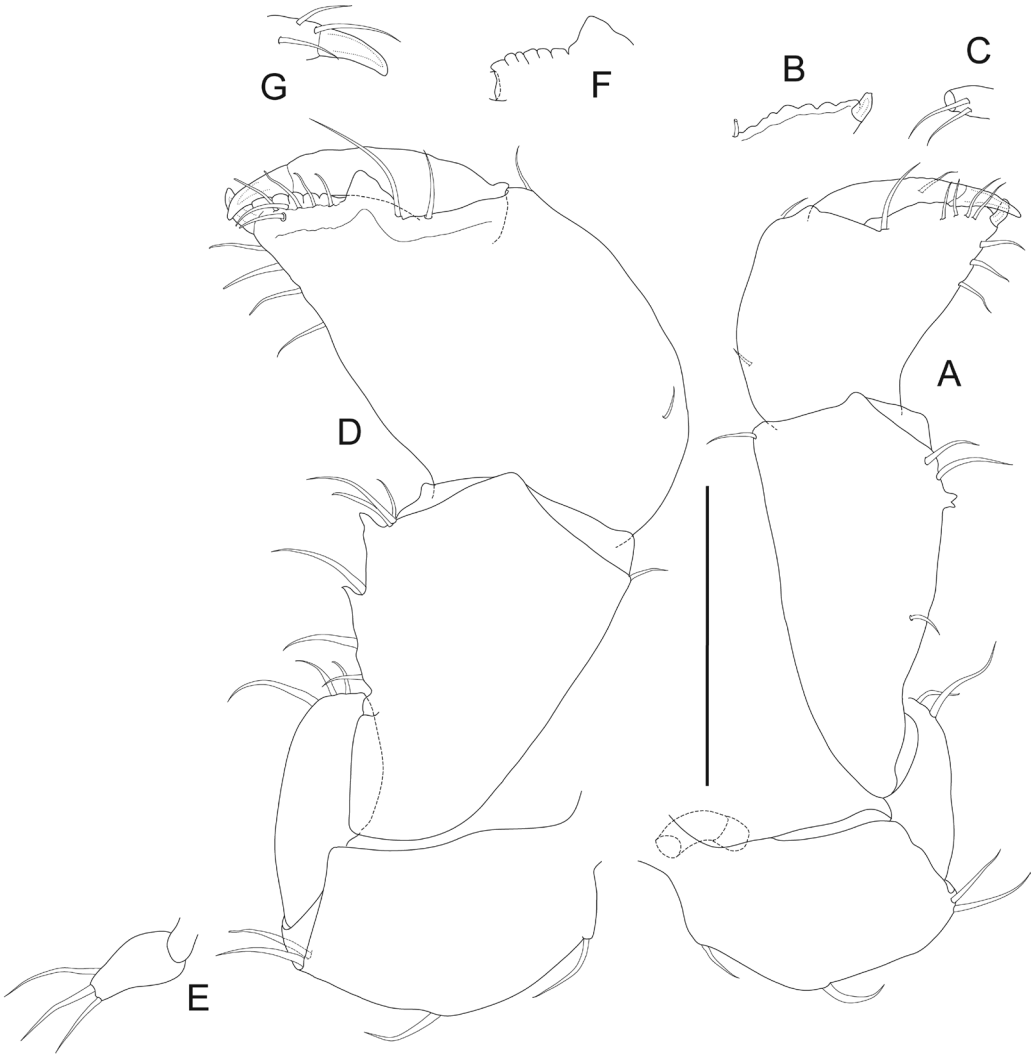

Figure 3. *Paradoxapseudes floppae* sp. nov., female (holotype) : *A* right cheliped; *B* right cheliped incisive margin; *C* right dactylus medial setae; *D* left cheliped; *E* cheliped exopod; *F* left cheliped incisive margin; *G* left dactylus medial setae. Scale bar: 0.25 mm.

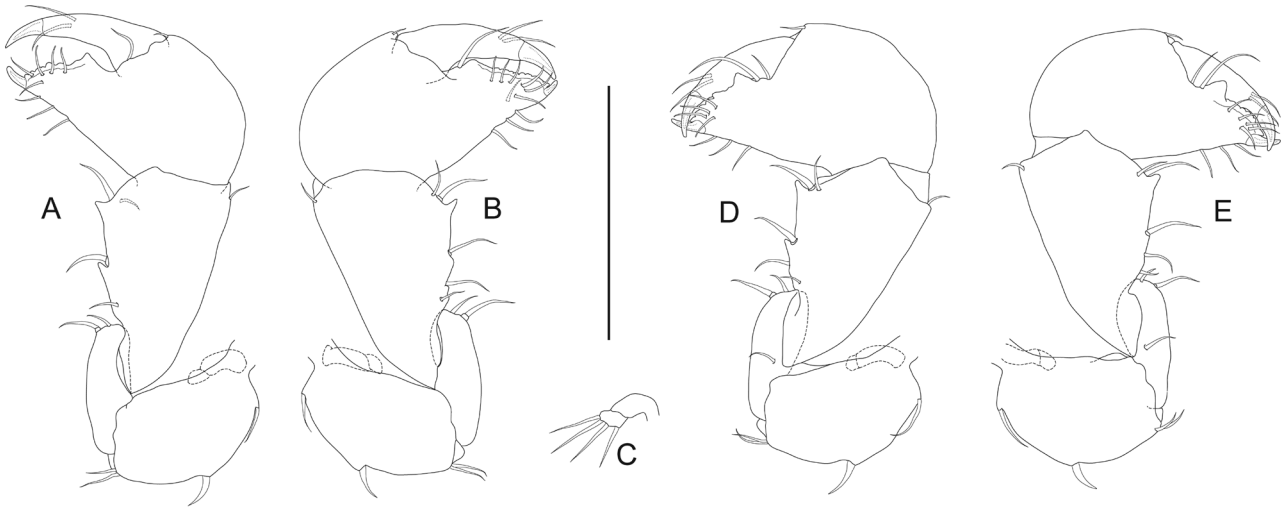

Figure 4. *Paradoxapseudes floppae* sp. nov., neuter/non-ovigerous female (paratype, P. 87595): *A* left cheliped; *B* right cheliped. Paratype Male (paratype, AIM MA73443): *C* cheliped exopod; *D* left cheliped; *E* right cheliped. Scale bar: 0.25 mm.

with superodistal seta, inferior margin with proximal seta, distal bifid apophysis and two distal seta; chela shorter but wider than carpus, 1.7 times ltb, palm with proximal and distal superior setae and seta near articulation with dactylus; fixed finger with three inferior setae and four setae near crenulate incisive margin, terminal spine small; dactylus with three distomedial setae; *left cheliped* (Figure 3D–G) robust; basis similar to right, but with two inferior setae; merus with three inferodistal setae; carpus stout, 1.7 times ltb, with superodistal seta, inferior margin with three apophyses, distalmost shorter and blunter than proximal two, with six setae; chela longer and wider than carpus, almost twice as long as broad, fixed finger with four inferior setae, incisive margin distally crenulate, with prominent triangular apophysis, and six setae; dactylus similar to right.

Pereopod-1 (Figure 5A) fossorial, much larger than posterior pereopods; exopod (Figure 5B) three-articled (proximal fused with basis?), article-3 with six setae; coxa with acute anterior apophysis bearing three setae; basis just over twice as long as broad, with five superior plumose setae; ischium much broader than long; merus strongly expanded distally, with single superior and inferior spines; carpus about 0.6 times as long as merus, with one superior and two inferior spines; propodus just shorter and narrower than carpus, with two superior and four inferior stout spines and one superodistal gracile pectinate spine; dactylus and unguis together just shorter than propodus, dactylus with proximal accessory spine; other setation as figured. *Pereopod-2* (Figure 5C) smaller than pereopod-1; coxa with two anterior setae; basis 3.6 times ltb; ischium about as long as broad; merus with two inferodistal spines; carpus just longer than merus, with one superodistal spine and three inferior spines; propodus 1.4 times longer than carpus, with four inferior spines, one superior spine, and one longer superodistal spines; dactylus unguis together as long as propodus; other setation as figured. *Pereopod-3* (Figure 5D) similar to pereopod-2 but slightly smaller; coxa with one anterior seta; ischium with superior seta.

Pereopod-4 (Figure 5E) coxa with long seta; basis 3.7 times ltb, with three superoproximal pinnate sensory setae (PSS), inferodistal apex with three setae; ischium with superodistal seta and three inferodistal setae; merus about twice as long as broad, with two spines and four setae; carpus about twice as long as merus, with six inferior spines, two longer superior spines, and four setae; propodus slightly shorter than carpus, with superior PSS, one inferior spine, five distal pectinate spines, one long superodistal spine and about four shorter superodistal spines; dactylus-unguis about 0.8 times length of propodus, dactylus with proximal and distal accessory setae. *Pereopod-5* (Figure 5F) similar to pereopod-4 but carpus with only four inferior spines;

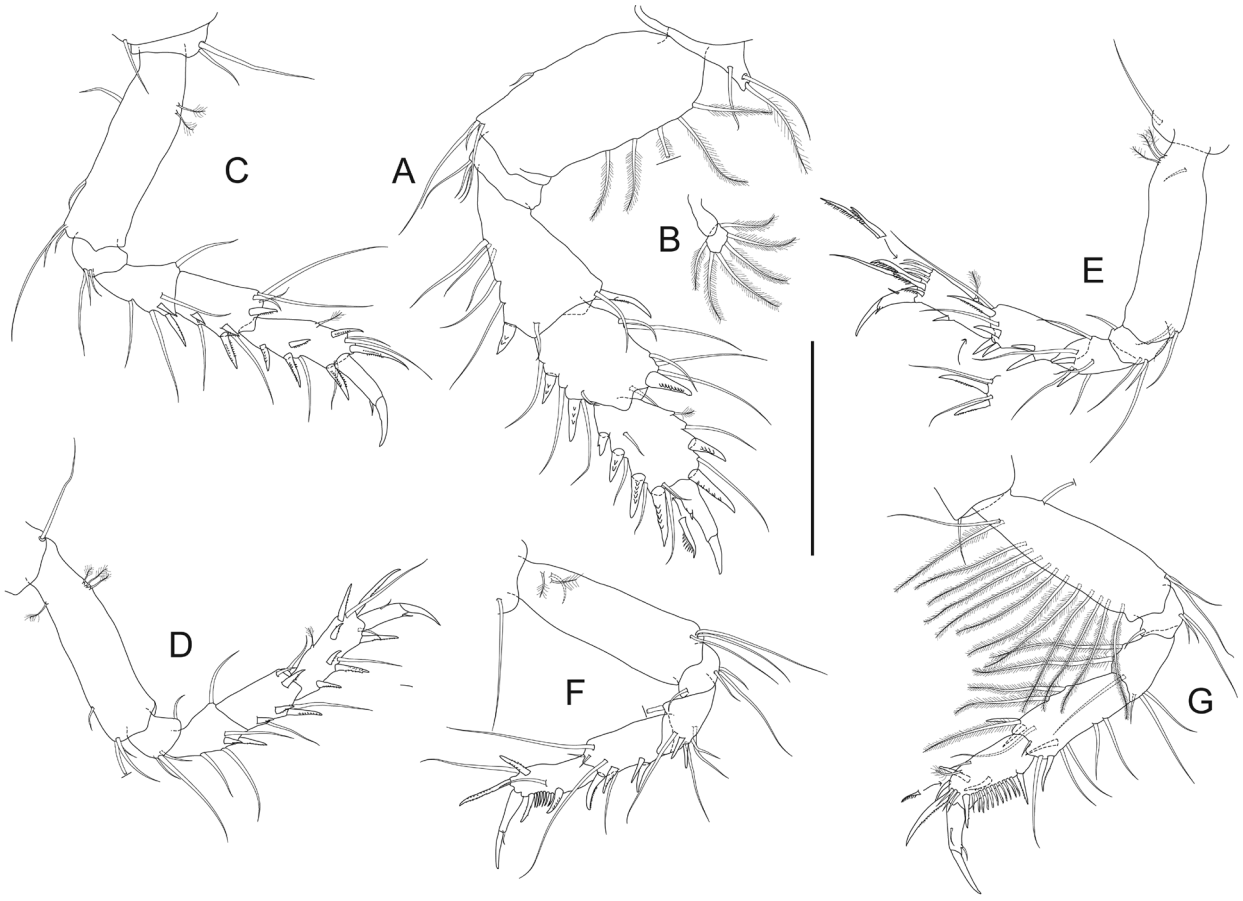

Figure 5. *Paradoxapseudes floppae* sp. nov., female (paratype, AM P.87385): *A* pereopod-1; *B* pereopod-1 exopod; *C–G* pereopods 2–6 respectively. Scale bar: 0.25 mm.

propodus without distal pectinate spines or superior PSS, but with inferodistal comb of about six blade-like (minutely pectinate) spines. *Pereopod-6* (Figure 5G) similar to pereopod-5 but basis with two proximal simple setae and superior fringe of twelve pinnate setae; propodus with four stout spines, one long superodistal spine, one distal pectinate spine, one superior PSS and comb of about twelve blade-like (minutely pectinate) spines; other setation as figured.

Pleopod (Figure 2J) typical of genus, peduncle medial margin with two distal plumose setae; endopod slightly broader than exopod, with four medial and six distal plumose setae; exopod with proximal seta on both margins and seven in distal fringe.

Uropod (Figure 1F) peduncle about 2.8 times ltb; exopod five-segmented (dissected paratype); endopod 13-segmented (dissected paratype), with proximal segment short, segment-2 elongate. Setation as figured.

Non-ovigerous female (or neuter). Similar to mature female but no obvious indication of oostegites or male penial cone; length 1.1–1.5 mm (n=5). *Antennule* main flagellum five or six-segmented. *Chelipeds* (Figure 4A–C) left and right similar, smaller than in mature female; exopod with four setae; right carpus with one distinct, distal apophysis, left with two apophyses.

Male. Generally similar to non-ovigerous female, but with penial cone on sternum of pereonite-6; length 1.4 mm (n=2). *Antennule* (Figure 2K–L) similar to that of female, but articles 1 and 3 stouter, 2.6 and 1.5 times ltb respectively; main flagellum as female, six–segmented. *Cheliped* (Figure 4D–E) similar to that of small female but merus with lateral seta.

Distribution and habitat. Herald Islands, Milne Islets, Nugent Island, South Meyer Island (all Raoul group), Macauley Island, Cheeseman & Curtis Islands, L'Esperance Rock; 10–27 m, from rocks, cobbles, coarse sand, coral, shell debris, and antipatharian and yellow sponge.

Remarks. This is a typical *Paradoxapseudes* species but *P. floppae* sp. nov. can be distinguished from others by the combination of characters outlined in the diagnosis. Compared to *P. edgari* and *P. larakia* it differs from the former at least by the shorter pereon and pleotelson, three setae on mandibular palp article-1, presence of apophyses on the cheliped carpus, and four inferior spines on the propodus of pereopod-1; from the latter principally by the serrate margin on the antennules' basal article (often difficult to observe when detritus is adhered), the inferior apophyses on the cheliped carpus, shorter chela (on small form), more numerous plumose setae on the basis of pereopod-6 and two plumose setae on the carpus of pereopod-6. In spite of the differences, *P. larakia* may represent the closest relative to *P. floppae* among the known species of *Paradoxapseudes*. No consistent or obvious differences could be observed among the specimens from the various Kermadec islet groups and it is provisionally assumed that all belong to the same species.

There is a complex pattern of cheliped forms, the pattern hindered by the high frequency of specimens with these appendages missing. Smaller individuals have non-dimorphic chelipeds that are fairly similar in shape to that of the larger form of the holotype female. The presence of dimorphic chelipeds on the same female, rather than on different individuals or sexes, has been noted for other species such as *P. littoralis* (Guțu, 2007: 57). This has implications for the recognition or discrimination of males and females, or, to paraphrase, 'dimorphic chelipeds do not a male make'.

Suborder TANAIDOMORPHA Sieg, 1980b
Superfamily TANAIDOIDEA Nobili, 1906
Family TANAIDIDAE Nobili, 1906
Subfamily PANCOLINAE Sieg, 1980a
Genus *Zeuxo* Templeton, 1840

Zeuxo: Sieg, 1980a: 184–189 (genus diagnosis, phylogeny and key to species); Bamber, 2006: 2–6 (description of *Z. cloacarattus*); Bamber, 2008: 163–166 (description of *Z. amiti*); Bird, 2008: 7 (remarks on genus; also redescription of *Z. novaezealandiae* (Thomson, 1879)); Edgar, 2008: 46–47 (genus diagnosis and key to Australian species).

Type species. *Zeuxo westwoodiana* Templeton, 1840

Composition in area. *Zeuxo (Parazeuxo) amiti* Bamber, 2008a [Qld]; *Zeuxo (P.) belli* Edgar, 2008 [Qld]; *Zeuxo (P.) cloacarattus* Bamber 2006 [NC]; *Zeuxo (P.) mooneyi* Edgar, 2008a [NSW]; *Zeuxo (P.) russi* Edgar, 2008 [Qld]; *Zeuxo (P.) seurati* (Nobili, 1906) [Tou]; ***Zeuxo (Zeuxo) kermadecensis* sp. nov.**; *Zeuxo (Z.) normani* (Richardson) [NSW]; *Zeuxo (Z.) novaezealandiae* (Thomson, 1879) [NZ].

Remarks. The genus has been greatly expanded since the substantial monograph on the family by Sieg (1980a) and currently holds 31 published species (Anderson, 2013; Larsen, 2014) distributed in two subgenera, *Zeuxo* (*Parazeuxo*) Sieg, 1980a (13 species) and *Zeuxo* (*Zeuxo*) Templeton, 1840 (twelve species), with six *incertae sedis*. A major contribution from Edgar (2008) covered seven species from Australia, and Bamber (2006, 2008a) described two other species from the area considered here (see Introduction). Although Bird (2008) redescribed *Z. novaezealandiae*, other *Zeuxo* records in New Zealand remain unpublished including some Australian species recovered from boat hulls. This warm-temperate and tropical arc from eastern Australia to Fiji is dominated (67% of the species) by the subgenus *Zeuxo (Parazeuxo)* rather than *Zeuxo (Zeuxo)*. However, it should be noted that Larsen *et al* (2014) were of the opinion that the two subgenera were invalid.

Zeuxo (Zeuxo) kermadecensis sp. nov. (Figures 6–12)

Diagnosis. *Female*. *Antennule* article-1 2.5 times longer than article-2; article-4 with three aesthetascs. *Mandibles* with left lacinia subconical, with small accessory spine; right mandible lacinia small, acuminate. *Pereopod-1* coxa with acuminate spur with two apophyses and three setae. *Pereopods 2–3* carpus with six spines, longest less than half as long as propodus. *Pereopods 4–6* merus

with two superodistal (tergal) setae, carpus with six (pereopod-6) or seven spines. *Pleopod* peduncle with one medial and five lateral setae; endopod with two medial setae. *Uropod* five or six-segmented, plus peduncle.

Male as female but slightly dimorphic. *Antennule* with up to ten distal aesthetascs. *Cheliped* more massive; fixed finger incisive margin straight.

Etymology. Named after the Kermadec Islands chain.

Type material. Holotype: ov. ♀, 2.7 mm, K2011-2-1, AIM MA73462, vertical rock wall with a few shallow grooves, margin at base with sand to gravel, with emergent rocks and algae, 20–22.4 m, west side of South Meyer Island (Raoul Island), 29° 14’ 48” S 177° 52’ 54” W, coll. A. Ballance, C.A.J. Duffy, M. Francis, S.J. Keable, M.A. McGrouther, A. Reid, T. Trnski, S. Ullrich, and L.G. Wiren, 12 May 2011.
Allotype: ♂, 2.4 mm, K2011-2-1, AIM MA73463; details as for holotype.
Paratypes (by island group): Raoul: one manca-II, one manca-III, 23 neuters, eight prep. ♀♀, 12 ov.♀♀ (one partly dissected on microslides), 14 prep. ♂♂ (one cheliped dissected on microslide), 17 ♂♂ (one partly dissected on microslide), K2011-2-1, P.87405, P.90995 (one prep.♂ partially dissected of previous), AIM MA73466 (one manca-III, one ov.♀ of previous); one prep. ♀, one prep. ♂, K2011-3-2, AIM MA73456, AIM MA73468; one prep. ♀, one ov. ♀, one ♂, K2011-10-2, AIM MA73447; three neuters, five prep. ♀♀, five ov. ♀♀, three post-ov. ♀♀, two prep. ♂♂, eight ♂♂, K2011-10-5, AIM MA73464, AIM MA73453; one

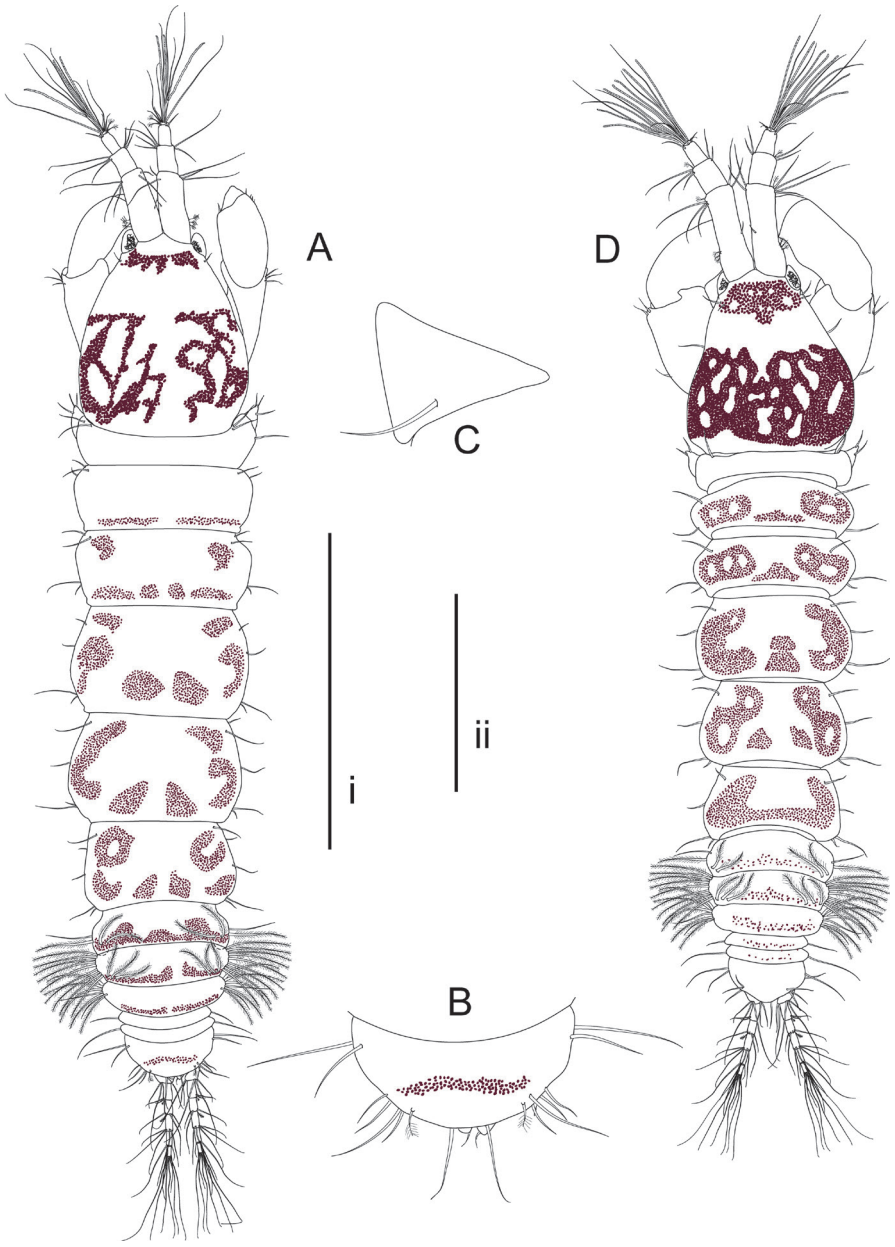

Figure 6. *Zeuxo kermadecensis* sp. nov., female (holotype): *A* habitus; *B* pleotelson; *C* cheliped sclerite. Male (allotype): *D* habitus. Scale bars: i: *A*, *D*, 1 mm; ii: *B*–*C*, 0.25 mm.

ov. ♀, one prep. ♂, K2011-19-1, AIM MA73455; two neuters, four ov.♀♀, four prep. ♂♂, two ♂♂, K2011-23-4, AIM MA73450, AIM MA73467; two neuters, four ov. ♀♀, four prep. ♂♂, two ♂♂, K2011-28-3, AIM MA73449, AIM MA73458; one ov. ♀, K2011-42-4, AIM MA73461; one ♂, K2011-42-5, AIM MA73452; one prep. ♀, K2011-55-1, AIM MA73445; one prep. ♂, one ♂, K2011-56-2, AIM MA73457; one prep. ♀?, two ♂♂ K2011-56-5, AIM MA73446, AIM MA73451.
Macauley: one ov. ♀, K2011-70-3, AIM MA73460.
Cheeseman & Curtis: two prep. ♀♀, one ov. ♀, one prep. ♂, K2011-77-2, AIM MA73448; one prep.♀, K2011-92-1, AIM MA73465.
L'Esperance: one ♂, K2011-99-2, AIM MA73459; one neuter, three ov. ♀♀, K2011-99-3, AIM MA73454.

Description. *Female*. *Habitus* (Figure 6A) fairly stout, 4.9 times ltb; pigmented brown-purple on cephalothorax, pereonites 2–6, pleonites, and pleotelson; length 1.7–3.2 mm (ovigerous, n=22), 1.8–3.1 mm (preparatory, n=13), 2.1–2.7 mm (post-ovigerous, n=3). *Cephalothorax* longer than pereonites 1–3 combined, 1.2 times ltb, with distolateral group of three setae; setae of coxal sclerite and cheliped basis also visible from dorsal view. *Pereon* with pereonite-1 shortest (and unpigmented), pereonites 2–3 subequal, pereonites 4–5 longest, pereonite-6 about as long as pereonite-3, narrower than pereonite-5; all with dorsolateral and posteriolateral setae. *Pleon* as long as pereonite-6 and half of pereonite-5 combined; pleonites 1–3 with several lateral-epimeral plumose setae (*ca*. one, nine and five respectively) and one or two long simple setae, pleonites 1–2 also with group of dorsolateral setae (two and three respectively); pleonites 4–5 very short, with long simple lateral seta. *Pleotelson* (Figure 6B) about 2.3 times ltb, with anterolateral, posteriolateral and posterior setae, as figured.

Antennule (Figure 7A) 0.6 times as long as cephalothorax; article-1 60% of total length, 2.5 times ltb, and 2.5 times longer than article-2; article-2 1.5 times ltb; article-3 0.75 times length of article-2; article-4 very short, with two or three aesthetascs [mostly three]; other setation as figured. *Antenna* (Figure 7B) article-2 almost twice as long as broad, with superior, lateral and inferior setae; article-3 as long as broad, with combs; article-4 as long as article-2; article-5 0.8 times as long as article-4; article-6 as long as broad, with corona of six (?) long setae; article-7 very small with three (?) long setae and one PSS; other setation as figured.

Labrum (Figure 8A) typical, hood-like; densely setulate. *Mandibles* (Figure 8B–E) left mandible lacinia subconical, with small acuminate accessory spine; right mandible lacinia small, spiniform. *Labium* (Figure 8F) typical; both lobes distally setulate, outer lobe with small setulate palp. *Maxillule* (Figure 8G–H) endite with distal combs and setules, with nine terminal spines (one thinner than rest); palp with six apical setae. *Maxilla* not observed. *Maxilliped* (Figure 8J–N) typical, coxa with one seta; basis lateral margin setulate, with one distal seta; endite distally setulate, with two medial coupling hooks, two large distal pinnate setae and two smaller

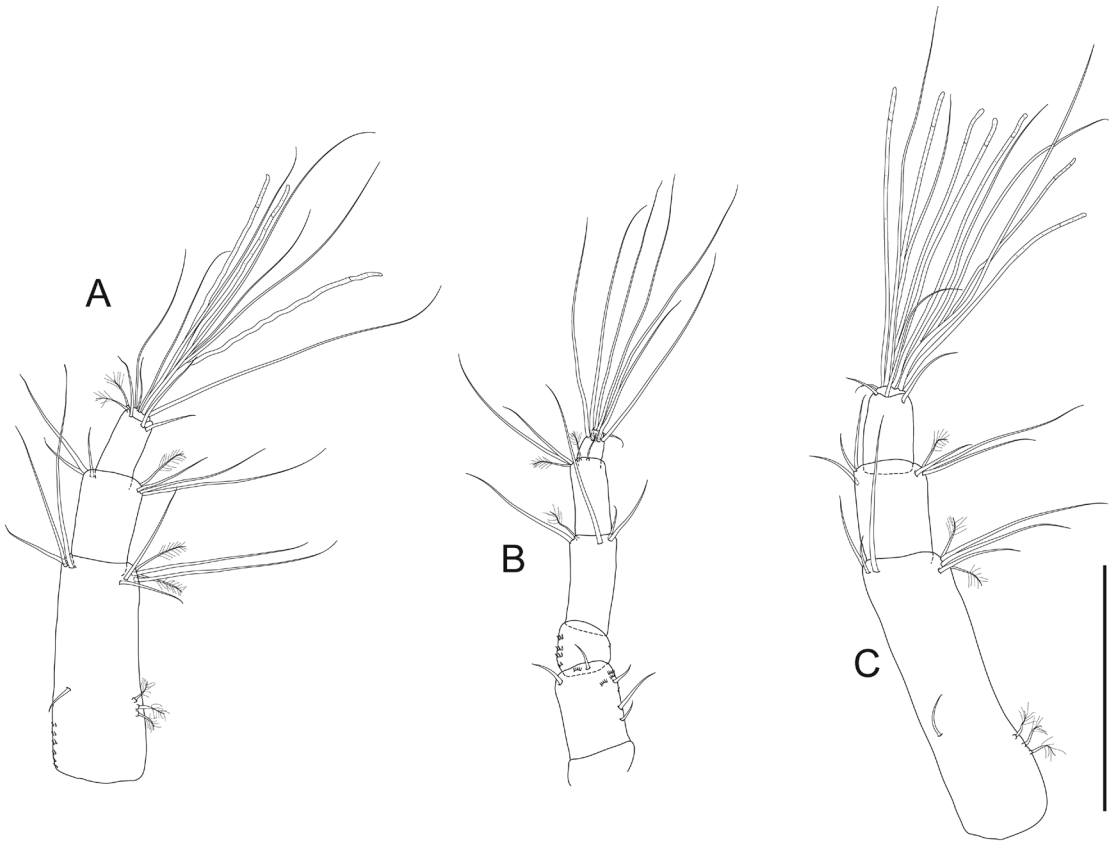

Figure 7. *Zeuxo kermadecensis* sp. nov., female (paratype, AM P.87405): *A* antennule; *B* antenna. Male (allotype): *C* antennule. Scale bar: 0.25 mm.

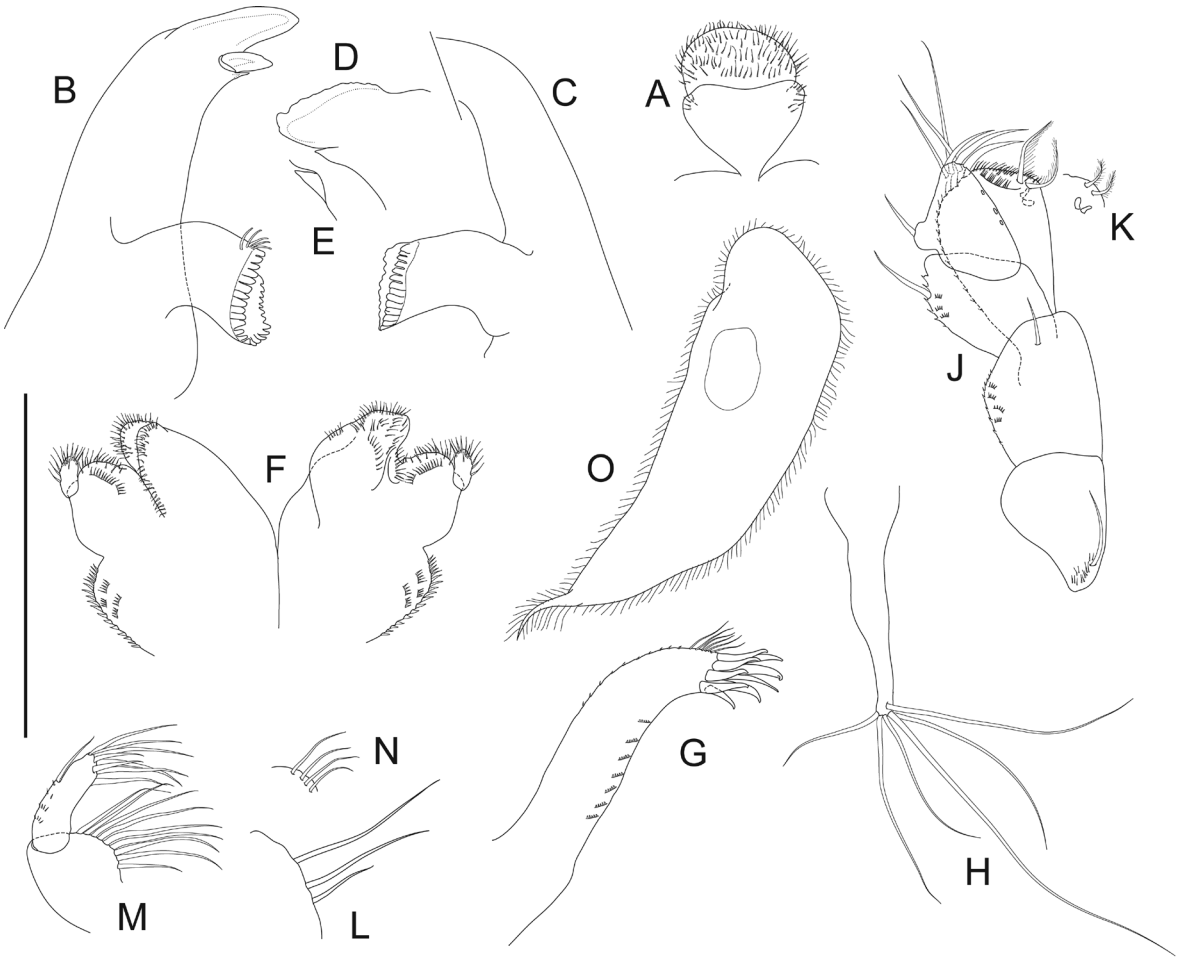

Figure 8. *Zeuxo kermadecensis* sp. nov., female (paratype, AM P.87405): *A* labrum; *B*–*C* left and right mandibles respectively; *D* right mandible, distal (from another female paratype, P.87405); *E* right mandible lacinia; *F* labium; *G*–*H* maxillule endite and palp respectively; *J* maxilliped, half; *K* maxilliped endite setae, oral surface; *L* maxilliped palp article-2 medial setae; *M* maxilliped palp articles 3–4; *N* maxilliped palp article-3 setae oral aspect; *O* epignath. Scale bar: 0.25 mm.

[oral] setae; palp article-1 with lateral seta; article-2 with lateral seta and about nine medial and distomedial serrulate seta; article-3 with two rows of about twelve medial setae; article-4 with subdistal seta and about ten distal setae. *Epignath* (Figure 8O) typical, linguiform, finely setulate on all margins, apex with setulate process.

Cheliped (Figure 9A–B) coxal sclerite triangular, with superior seta; basis posterior lobe as large as anterior mass, latter with superodistal seta and inferodistal seta; merus with two inferior setae and two setae near articulation with basis; carpus 1.8 times ltb, superior margin with one proximal seta and distal group of four setae, inferior margin with four setae; chela as long as but narrower than carpus, 2.5 times ltb; palm with medial pectinate spine and five lateral setae near articulation with dactylus; fixed finger with five inferior setae, two distomedial setae and five lateral setae near incisive margin, incisive margin raised with distal apophysis; dactylus inferior margin with at least eight spines progressively stouter distally, with distomedial spine.

Pereopod-1 (Figure 10A) coxa with acuminate spur with two small spines and three setae; ischio-basis 4.6 times ltb, with proximal seta; merus 1.8 times ltb, with supero- and inferodistal setae; carpus subrectangular, 1.2 times longer than merus, just over twice as long as broad, with three distal setae; propodus about as long as merus and carpus combined, five times ltb, tapering, with medial seta, small superior PSS, one superodistal seta and three inferodistal setae; dactylus shorter than unguis, together 0.7 times as long as propodus. *Pereopod-2* (Figure 10B) ischio-basis broader than in pereopod-1, 2.9 times ltb, with supero-proximal simple seta and two PSS, inferodistal margin with three setae; merus geniculate, 2.6 times ltb, with superodistal seta, three inferodistal setae and inferodistal [lateral] spine; carpus shorter than merus, 1.5 times ltb, with superodistal setae, two inferodistal setae and six spines; propodus 0.7 times as wide as carpus, 1.4 times longer, with superior PSS, two superodistal seta (one small) and three inferodistal setae (distalmost stout); dactylus with accessory seta, together with unguis half as long as that in pereopod-1. *Pereopod-3* (Figure 10C) similar to pereopod-2 but merus and carpus with two inferodistal setae, and one inferodistal seta respectively.

Pereopod-4 (Figure 10D) ischio-basis broader than in pereopods 2–3, 2.7 times ltb, with two superoproximal

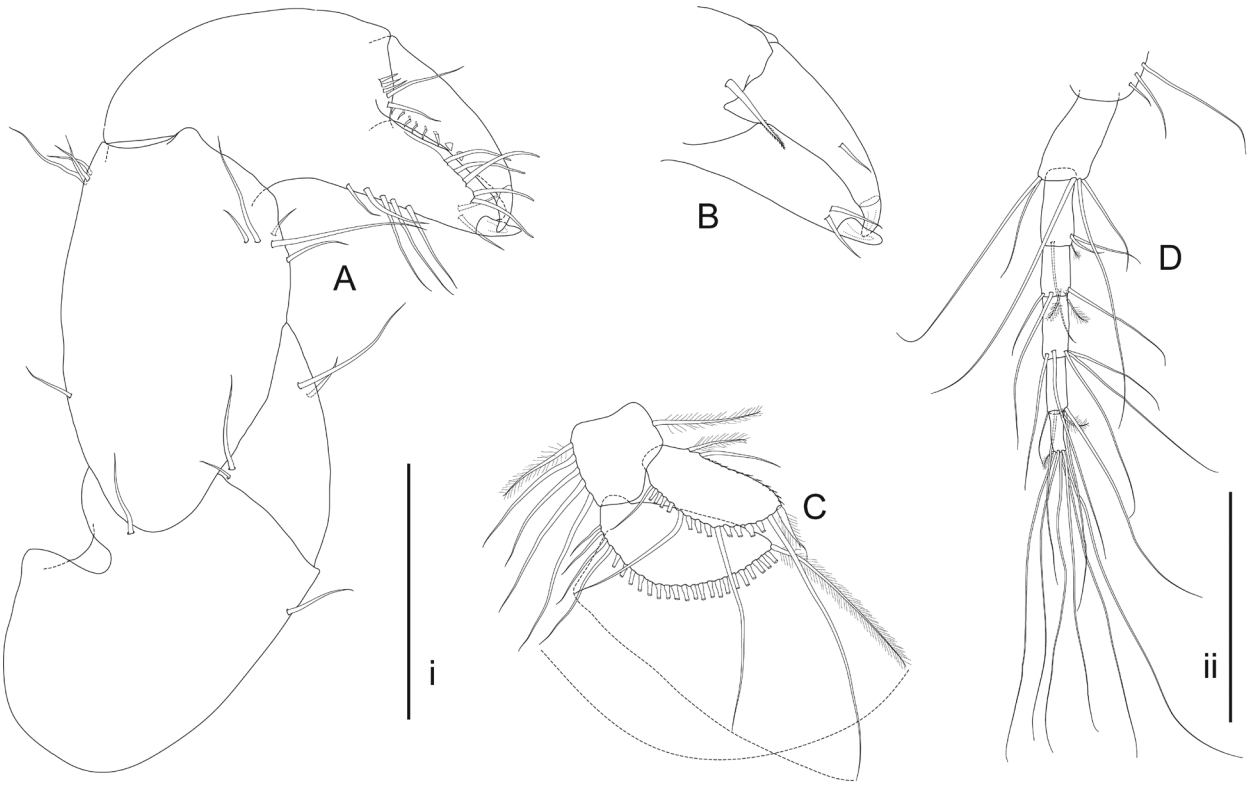

Figure 9. *Zeuxo kermadecensis* sp. nov., female (paratype, AM P.87405): *A* cheliped; *B* chela (left); *C* pleopod; *D* uropod. Scale bars: i: *A*–*B*, 0.25 mm; ii: *C*–*D*, 0.25 mm.

PSS and three inferodistal setae; merus geniculate, 2.5 times ltb, with two superodistal setae, one inferodistal seta, and two inferodistal serrulate spines; carpus just shorter than merus, with two superodistal setae and seven distal spines; propodus about as long as carpus, narrower and slightly arcuate, with superodistal PSS, three distal setae and one inferodistal seta; dactylus and unguis claw-like, dactylus with proximal spinules, unguis with double comb of spines. *Pereopod-5* (Figure 10E) similar to pereopod-4 but merus with two inferodistal setae. *Pereopod-6* (Figure 10F) similar to pereopods 4–5 but ischio-basis with three superoproximal PSS, merus with two inferodistal setae, carpus with six spines, and propodus with distolateral fringe of eight blade-like spines.

Pleopod (Figure 9C) peduncle as long as broad, medial margin with one seta, lateral margin with five setae; endopod 2.4 times ltb, medial margin setulate with two proximal setae; lateral margin with fringe of about 15 setae, distalmost thickest, with whip-like tip; exopod 2.3 times ltb, with lateral fringe of about 25 setae.

Uropod (Figure 9D) peduncle just over twice as long as broad, with five distal setae; endopod 4–6 segmented (ovigerous and preparatory females mostly five-segmented); post-ovigerous female four or five-segmented, setation as figured.

Manca-II. Without pereopods-6 or pleopods; length 0.9 mm (n=1). *Antennule* article-4 with one aesthetasc. *Uropod* with three-segmented endopod.

Manca-III. With rudimentary pereopods-6 and pleopods; length 0.9 mm (n=1). *Antennule* article-4 with one aesthetasc. *Uropod* with three-segmented endopod.

Neuter. Essentially similar to female; length 1.0–2.8 mm (n=21). *Antennule* article-4 with two or three aesthetascs (mostly three). *Uropod* endopod 3–5 segmented (mostly four-segmented).

Preparatory male. Similar to female or neuter progressively to adult male; length 1.3–2.5 mm (n=25). *Pereonite-6* sternum with slightly raised, paired genital cones. *Antennule* article-4 with four to eight aesthetascs. *Cheliped* (Figure 11A) as female or progressively like adult male. *Uropod* endopod 4–5 segmented (mostly four-segmented).

Mature male. *Habitus* (Figure 6D) fairly stout, 4.5 times ltb; length 1.8–2.5 mm (n=20). *Cephalothorax* proportionately slightly larger than female. *Genital cones* more elevated than in preparatory male. *Antennule* (Figure 7C) longer than in female, 0.8 times length of cephalothorax; article-1 3.6 times ltb, article-4 with seven to ten aesthetascs (mostly eight). *Cheliped* (Figure 11B–D) larger and stouter than female; fixed finger triangular, dactylus arcuate. *Uropod* endopod 4–5 segmented (mostly five-segmented).

Distribution and habitat. Milne Islets, North Chanter Island, North and South Meyer Islands (all Raoul group), Raoul Island, Macauley Island, Cheeseman & Curtis Islands, and L'Esperance Rock; 5–24 m; from various substrata including antipatharian sponge, boulders, cobbles, coral, pebbly-sand, rock walls, shelly debris, and tufting red algae.

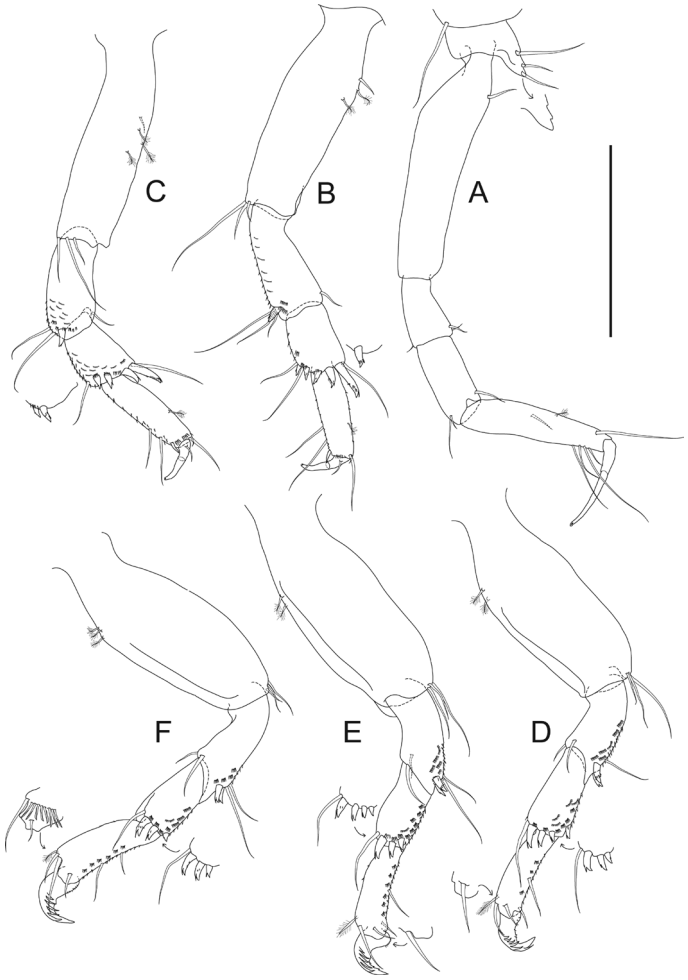

Figure 10. *Zeuxo kermadecensis* sp. nov., female (paratype, AM P.87405): *A*–*F* pereopods 1–6 respectively, with details of obscured setation. Scale bar: 0.25 mm.

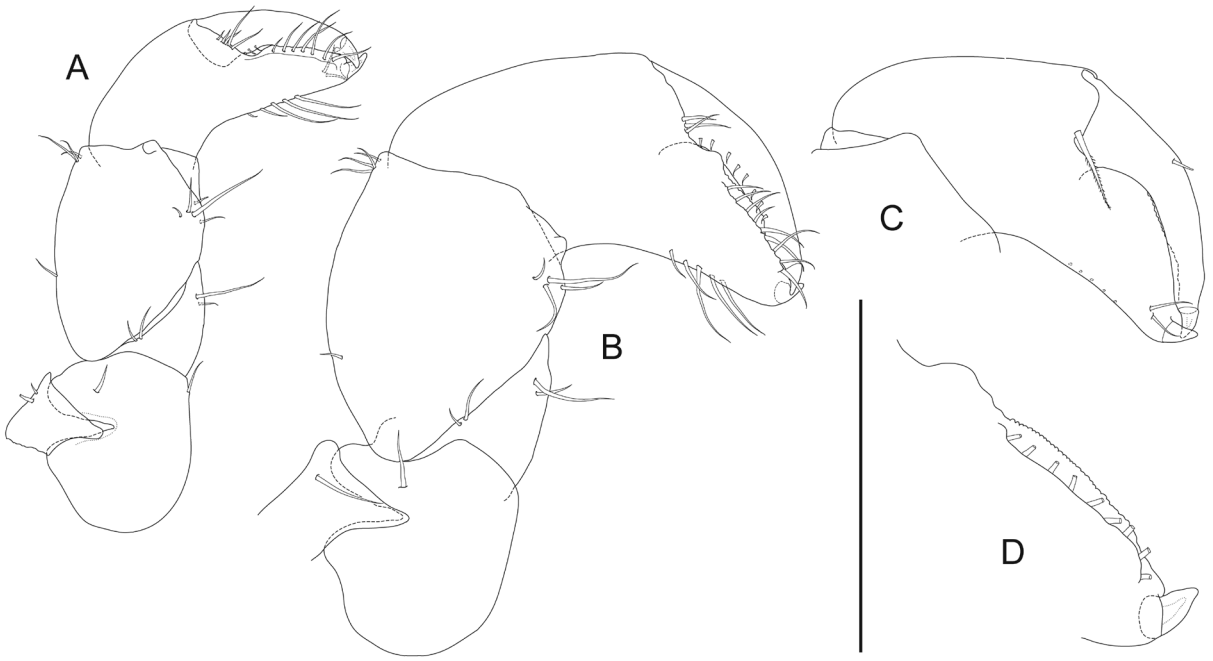

Figure 11. *Zeuxo kermadecensis* sp. nov., preparatory male (paratype, 1.8 mm, antennule with eight aesthetascs, uropod six-segmented, AM P.87405): *A* cheliped. Male (allotype): *B* cheliped; *C* chela, left medial aspect; *D* cheliped fixed finger incisive margin. Scale bar: *A*–*C*, 0.5 mm; *D*, 0.25 mm.

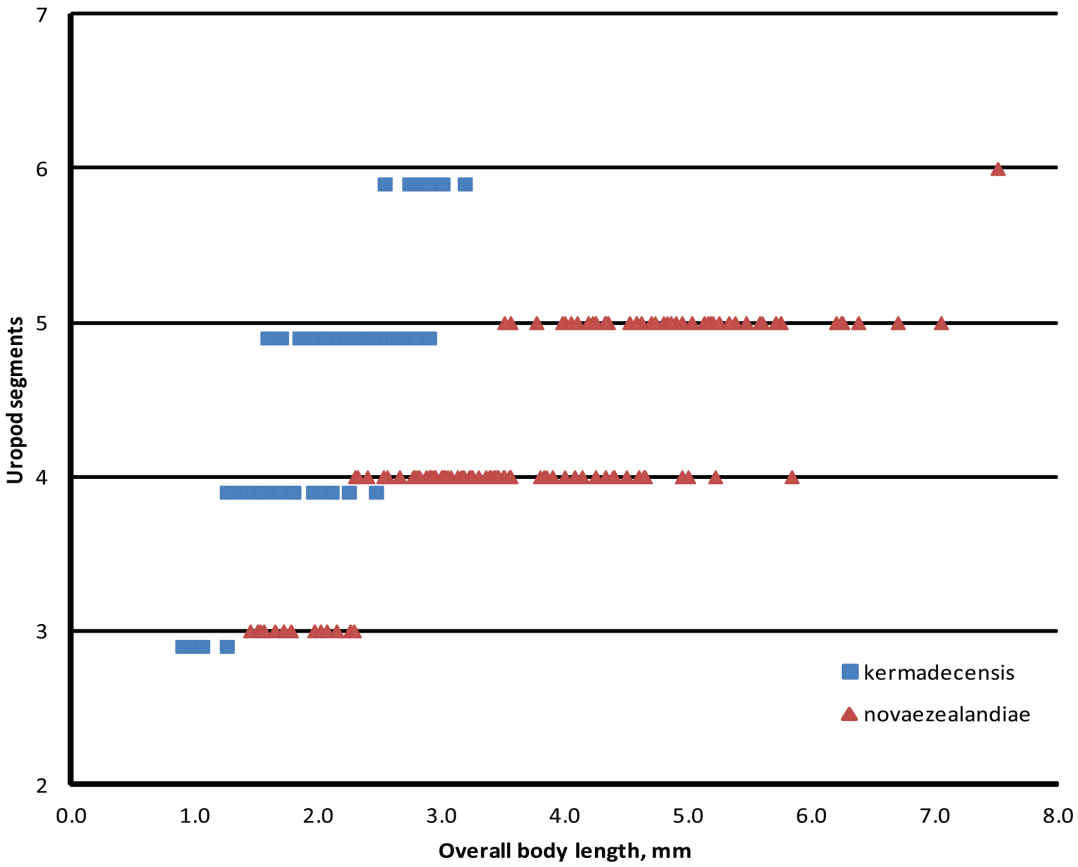

Figure 12. Plot of uropod-segment count for *Zeuxo kermadecensis* sp. nov. and *Z. novaezealandiae*. Values for the former are slightly displaced on the Y-axis for clarity.

Remarks. This species clearly falls into the subgenus *Zeuxo* (*Zeuxo)* based on Sieg's diagnosis: the presence of a prominent coxal apophysis on pereopod-1, two tergal (superodistal) setae on the merus of pereopods 4–6, and two inner (medial) setae on the pleopod endopod. No differences could be observed in individuals from the different island locations. It is also typical in having five-segmented uropods, a condition found in six of the twelve described *Zeuxo* (*Z.*) species. It is one of three species that lack an accessory spine or seta on the right mandible and have a simple spine adjacent to the left lacinia.

Apart from the mandible morphology, which it shares with *Z. (Z.) nannioggae* Bamber, 2005 and *Z. (Z.). kirkmani* Edgar, 2008 (although that species has a bifid or trifid right lacinia), *Z. (Z.) kermadecensis* sp. nov. is most similar to *Z. (Z.) novaezealandiae* or *Z. (Z.) normani*. However, it would 'key out' at *Z. (P.) seurati* in Sieg's (1980a) version or fail at couplet '7' in the Edgar (2008) Australian-species key. Although placed within *Parazeuxo*, *Z. cloacarattus* from New Caledonia is also somewhat similar to *Z. kermadecensis* in having a coxal spur on pereopod-1 (albeit weaker), two superodistal setae on the merus of pereopod-6, and a similar number of uropod segments. It differs, for example, through the absence of an accessory spine on both mandibles and a proportionately longer antennule article-1.

As with most species with multisegmented uropods, including leptocheliids (Larsen & Froufe, 2013), some individuals were recorded with an unequal number of uropod segments, or scarcely-formed segments in transition from count *n* to *n+1*. The actual count of uropod segments is strongly allometric and becomes stable only at the size/stage of sexual maturation. Similarly, the number of antennular aesthetascs is development-related. The body-size versus uropod-segment count of *Z. kermadecensis* compared with *Z. novaezealandiae,* which has many similar features, is shown in Figure 12.

That belongs to the subgenus *Zeuxo* rather than the predominant warm-water subgenus *Parazeuxo* might suggest that it may have arrived from the cooler south, i.e. New Zealand – possibly as a sibling to *Z. novaezealandiae*. That species has a different habitat preference, recorded in high numbers in intertidal muddy sands (Bird, 2008).

Subfamily TANAIDINAE Dana, 1849
Genus *Tanais* Latreille

Type species. *Tanais dulongii* (Audouin).

Composition in area. *Tanais* sp. (see below).

Remarks. This is a small genus of only six accepted species and three of uncertain status (Anderson, 2013; Tzeng & Hsueh, 2014a) whose literature, nomenclature, and synonymy are highly complex (Sieg, 1983, Anderson *op.cit*.). No species has been recorded previously in the area considered here. Further away in the Indo-Pacific region, *T. dulongii* has been reported from Victoria, South

Australia, and Western Australia [WA] (Poore, 2002 - cited by Edgar, 2008), *T. cf. dulongii sensu* Edgar, 2008 from the Swan Estuary [WA], *Tanais pongo* Bamber, 2005 from Esperance [WA], *T. tinhauae* Bamber & Bird, 1997 from Hong Kong, and *T. nuwalianensis* Tzeng & Hsueh, 2014 from Taiwan. The genus is strongly suspected of dispersal by shipping.

Tanais sp. (Figure 13)

Material examined. One neuter (right cheliped dissected on microslide), K2011-54-1, AIM MA33248.

Remarks. A single specimen, 1.2 mm long, was recorded from the rocky intertidal zone at Fishing Rock, Raoul. It conforms to the general pattern of *Tanais*, rather than *Austrotanais* Edgar, 2008, by having four pleonites (Figure 13A). Of the three species mentioned above, this Kermadecian *Tanais* resembles *T. dulongii* with uropods of a peduncle and two segments (Figure 13D), not three segments as in *T. tinhauae,* or four in *T. pongo*. The proportions of the antennule (Figure 13B) and setation of the cheliped propodus (Figure 13C) differ from *T. cf. dulongii sensu* Edgar but ultimately no firm conclusions can be based on this single specimen.

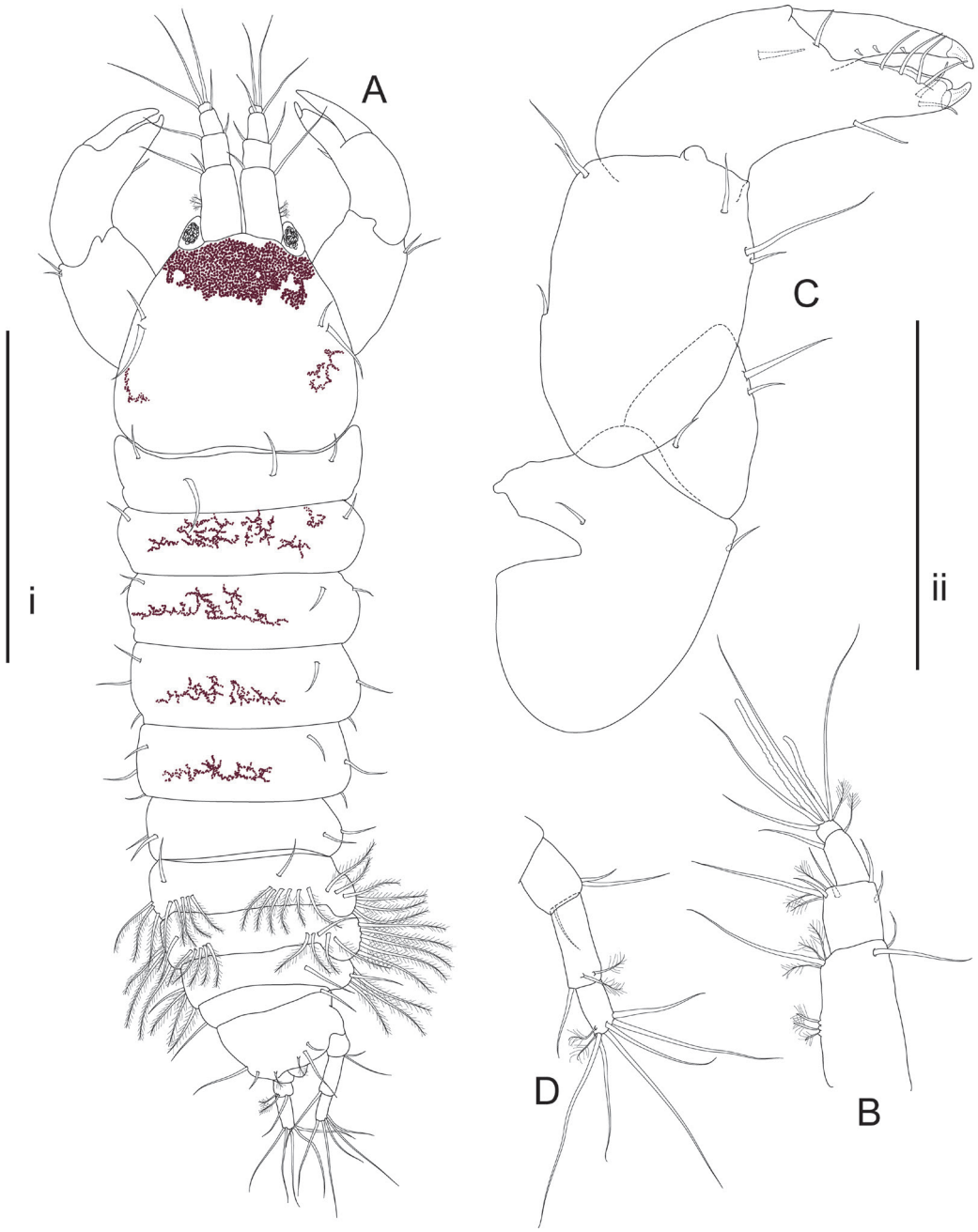

Figure 13. *Tanais* sp., neuter, AIM MA33248: *A* habitus (pereon and pleon slightly distorted); *B* antennule; *C* cheliped; *D* uropod. Scale bars: i: *A*, 0.5 mm; ii: *B*–*D*, 0.25 mm.

Superfamily PARATANAOIDEA Lang, 1949
Family LEPTOCHELIIDAE Lang, 1973
Genus *Leptochelia* Dana, 1849

Leptochelia: Bamber, 2008a: 184–205 (remarks on genus, descriptions of five new species), 211–212 (key to Australian leptocheliids); Bamber, 2010: 289–308 (remarks on genus and redescription of *L. savignyi* (Krøyer)); Bamber, 2013: 7–9 (remarks on genus and transfer of *L. bulbus*); Guţu & Iliffe, 2011: 352–361 (remarks on genus, description of *L. vatulelensis*); Edgar, 2012: 3–19 (description of two new Australian species and redescription of *L. ignotus* (Chilton, 1885)); 35–36 (key to Australian leptocheliids); Larsen & Froufe, 2013: 107–122 (remarks on genus and description of *L. africana*); Stebbing, 1900: 615–618 (remarks on *L. minuta* and description of *L. lifuensis*).
Paratanais: Chilton (1885): 1042 (for *P. ignotus*; see Edgar, 2008: 3–12).

Type species. *Leptochelia minuta* Dana, 1849.

Composition in area. *Leptochelia acrolophus* sp.nov; *L. bulbus* (Bamber, 2006) [NC]; *L. dijonesae* Bamber, 2008a [Qld]; *L. guduroo* Bamber, 2008a [Qld]; *L. ignota* (Chilton, 1885) [NSW]; *L. karragarra*, Bamber 2008a [Qld]; *L. lifuensis* Stebbing, 1900 [NC]; *L. minuta* Dana, 1849 [Fi, NC]; *L. myora* Bamber, 2008a [Qld]; *L. opteros* Bamber, 2008a [Qld]; *L. vatulelensis* Guţu & Iliffe, 2011 [Fi].

Remarks. *Leptochelia* is a huge and perhaps overburdened genus, which is now receiving a considerable amount of attention (e.g. Bamber, 2010; Edgar, 2012), including genetic studies (Larsen & Froufe, 2013). It can be divided broadly into two groups based on the development of the dimorphic males' chelipeds: the *minuta*-group (including the synonymised *Hargeria* Lang, 1973) that is characterised by males with extremely elongate chelipeds and the *savignyi*-group whose males have less attenuated chelipeds (e.g. Bamber, 2008a: 184–186). Within the area considered here, only *L. minuta* itself represents the nominal group although other species almost certainly remain to be discovered. Taxonomic studies of other leptocheliids in the area (those in the genera *Konarus* Bamber, 2006, *Parakonarus* Bird, 2011, and *Pseudoleptochelia* Lang, 1973) have significantly altered the classification of some species (Bamber, 2013); for example, the female of *Pseudoleptochelia bulbus* Bamber, 2006 from New Caledonia is now recognised to be a *Leptochelia* species.

Leptochelia acrolophus sp. nov. (Figures 14–20)

Type material. Holotype: prep. ♀, 3.5 mm, K2011-10-5, AIM MA73425, sheer rock walls, boulders and cobble, gutters and steep drop offs, and clumping red algae, 5–15.5 m, north west corner of North Meyer Island (Raoul Island), 29° 14' 30" S 177° 52' 40" W, coll. M. Francis, S.J. Keable, M.A. McGrouther, A. Reid, T. Trnski, S. Ullrich, L.G. Wiren, 13 May 2011.

Allotype: secondary (2°) ♂, 2.85 mm, K2011-10-5, AIM MA73424, details as for holotype.

Paratypes [by island group]: Raoul: three non-ov. ♀♀, one ov. ♀, one 2° ♂, K2011-2-1, AIM MA73427, AIM MA73428; one manca-II, eight non-ov.♀♀, one ov.♀, K2011-3-2, AIM MA73431; one 2° ♂ K2011-3, P.89267; one non-ov. ♀, one 2° ♂ (partly dissected on microslides), K2011-10-2, P.87590; 14 non-ov.♀♀, three prep.♀♀ (one, 3.5 mm, partially dissected on microslides P.92557), two ov.♀♀, one post-ov.♀ (?), K2011-10-5, P.92558; two non-ov.♀♀, AIM MA73426; one non-ov. ♀, K2011-19-3, P.87378; nine non-ov.♀♀, one 2° ♂, K2011-23-4, AIM MA73429; one non-ov. ♀, K2011-28-1, P.89270; one non-ov. ♀, K2011-28-2, AIM MA73430; one ov.♀, K2011-29-1, P.87383; five non-ov.♀♀, two 2° ♂♂, K2011-42-4, P.87404; two non-ov. ♀♀, K2011-54-4, P.87396; one non-ov. ♀, K2011-56, P.87399; one non-ov. ♀, K2011-62-8, AIM MA73432.
Macauley: one non-ov.♀, K2011-70-3, AIM MA73433; one ov. ♀, K2011-71-2, AIM MA73434.
L'Esperance: one non-ov.♀, one prep.♀, K2011-99-3, AIM MA73435, AIM MA73436; one manca-III, K2011-99-4, P.87402.

Etymology. From the Greek noun ακρόλοφος (akrolophos), meaning 'mountain crest or ridge', alluding to the Kermadec Islands as part of a long oceanic volcanic ridge.

Diagnosis. *Female. Cephalothorax* 1.4 times ltb. *Antennule* article-2 longest distal seta as long as article-2. *Antenna* article-1 with inferodistal seta; article-2 superior and inferior spines subequal; article-3 without distolateral seta. *Maxilliped* bases with four setae; palp article-2 with lateral seta not on distinct apophysis. *Cheliped* basis superodistal margin without apophysis; propodus with four inferior setae. *Pereopod-1* dactylus and unguis as long as propodus. *Pereopods 2–3* carpus with two inferior spines. *Uropod* peduncle naked; endopod five-segmented (mature individuals), exopod 1-segmented, over half length of segment-1 of endopod.

Secondary male. Antennule article-1 0.7 times as long as cephalothorax; article-2 half length as long as article-1; flagellum eight-segmented. *Cheliped* about half as long as body, without elongate carpus or chela; basis superodistal margin without apophysis; fixed finger just longer than palm, incisive margin with two triangular apophyses; dactylus proximal incisive margin crenulate. *Pereopods 4–6* basis with superior flange. *Uropod* peduncle with four distolateral setae; endopod five-segmented; exopod 1-segmented, over half length of segment-1 of endopod.

Description. *Female. Habitus* (Figure 14A) fairly slender, 6.3 times ltb; length 1.3–4.4 mm (n=51), of which preparatory females 3.5–3.9 mm (n=6), ovigerous females 3.3–3.8 mm (n=5), and post-ovigerous 2.5 mm (n=1). *Cephalothorax* (Figure 14B–C) 1.4 times ltb, shorter than pereonites 1–3 combined, carapace entire but with slight indication of thoracomere-2, lateral margins with seta just posterior to eyelobe [but cheliped sclerite and

basis setae also visible in dorsal view]; rostrum pointed, weakly produced; eyes conical with dark pigment. *Pereon* with weakly convex margins of pereonites 1–6, all shorter than broad, 0.4, 0.5, 0.6, 0.7, 0.8, and 0.7 times ltb respectively, with at least anterolateral setae. *Pleon* 18% of body length, just longer than broad, epimera 1–4 with seta, epimera-5 with three setae. *Pleotelson* as long as pleonite-5, rounded with weakly produced posterior margin, with deflexed apex bearing two long setae (Figure 14D); other setation as figured.

Antennule (Figure 14E) 0.75 times length of cephalothorax, 5.4 ltb; article-1 0.59 times total length, about 3.5 times ltb, lateral margin with three proximal PSS and two long setae with associated PSS, distalmost longer than article-2, medial margin with two setae; article-2 twice as long as broad, with two distal setae, longest 0.9 times length of article; article-3 just shorter than article-2, with two distal setae and one PSS; cap-like segment with four setae and an aesthetasc. *Antenna* (Figure 14F) 0.9 times as long as antennule; article-1 with inferodistal seta; article-2 with subequal supero- and inferodistal thorn-like spines; article-3 0.9 times length of article-2, with superodistal thorn-like spine; article-4 3.5 times ltb, as long as articles 2 and 3 combined, with sub-distal PSS and three simple distal setae (two longer than article-5); article-5 with one short and two longer setae; article-6 with six setae.

Labrum (Figure 15A) typical, hood-shaped, setulate. *Mandibles* (Figure 15B–C) typical; incisor of right mandible weakly bifid, with crenulate distal margin

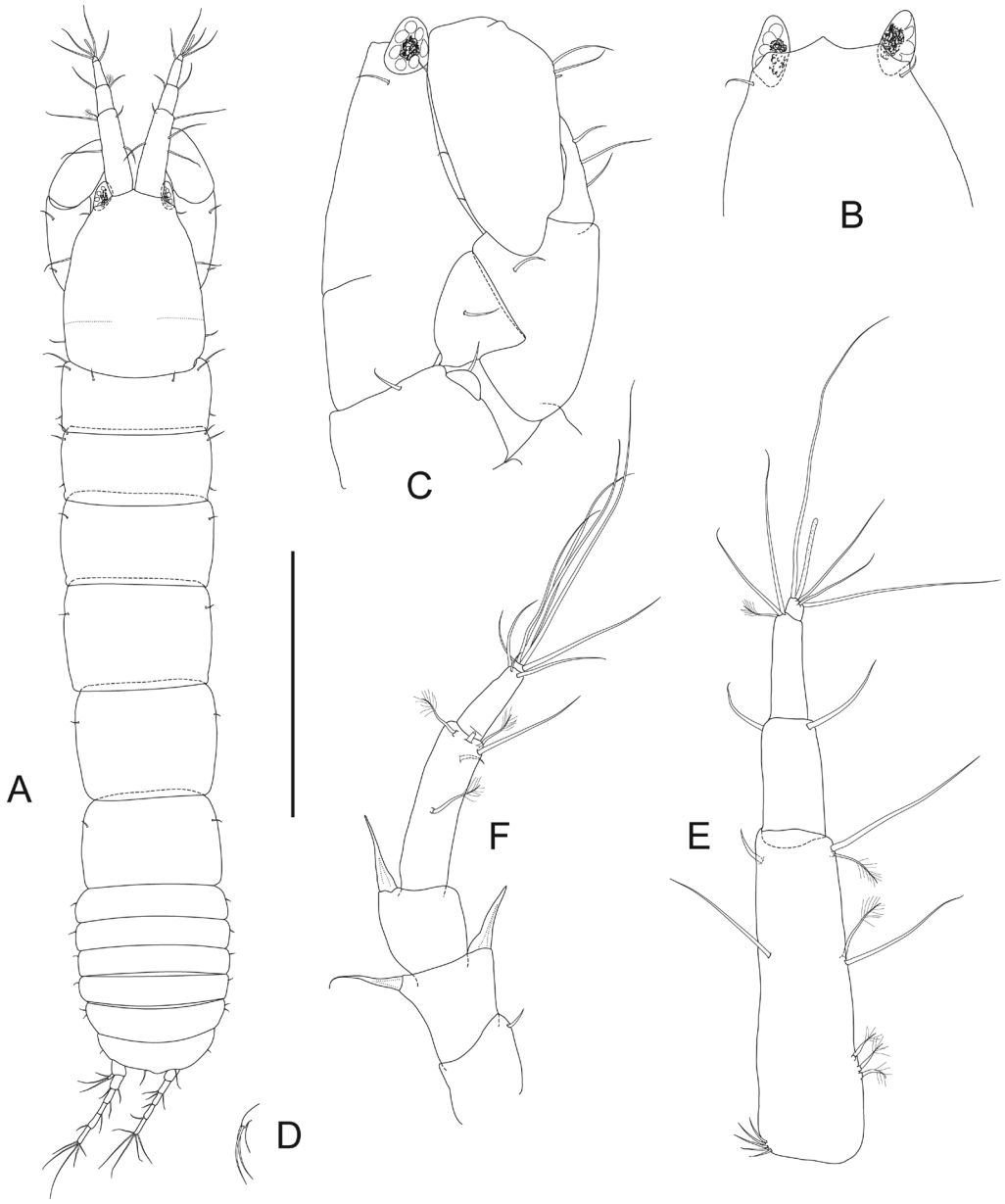

Figure 14. *Leptochelia acrolophus* sp. nov., female (holotype): *A* habitus; *B* cephalothorax anterior; *C* cephalothorax-cheliped articulation, lateral; *D* pleotelson apical setae; lateral; Female (paratype, P.87392): *E* antennule; *F* antenna. Scale bar: *A*, 1 mm; *B*–*D*, 0.5 mm; *E*–*F*, 0.25 mm.

and finely setulate inferodistal margin, molar with spinose-ridged and granulose apex; left mandible incisor crenulate, with setulate inferodistal margin, lacinia broad and distally crenulate, molar as in right mandible. *Labium* (Figure 15D) typical, outer lobes broader but not as long as inner, distally setulate. *Maxillule* (Figure 15E) endite setulate on distal part, with at least ten terminal spines and outer corona of finer setae and setules; palp with two setae. *Maxilla* (Figure 15F) of similar size to maxilliped endite, sub-ovate, naked. *Maxillipeds* (Figure 15G–L) basis with four long setae [mature individuals]; endite distal margin with large lateral seta, one molariform (medial) and two spatulate spines, and with two medial pectinate spines (coupling hooks); palp article-2 with lateral seta and four unequal medial setae, medial margin finely setulate, article-3 with about ten setae (in two rows); article-4 with about ten setae. *Epignath* (Figure 15M) thin, straplike, with acuminate apex, finely setulate on all margins.

Cheliped (Figure 16A–B) coxal sclerite triangular, reaching posterior of cephalothorax, with seta (visible in dorsal view); basis posterior lobe reaching pereonite-1, anterior mass with superolateral seta; merus with three dispersed inferior setae; carpus 1.9 times ltb, with three superior setae and three inferior setae; chela shorter and narrower than carpus, propodus twice as long as broad, palm typically sub-parallel, with medial comb of four spines and long sinuate spine near articulation with dactylus, fixed finger 0.25 times length of palm, with four inferior/medial setae and three near incisive

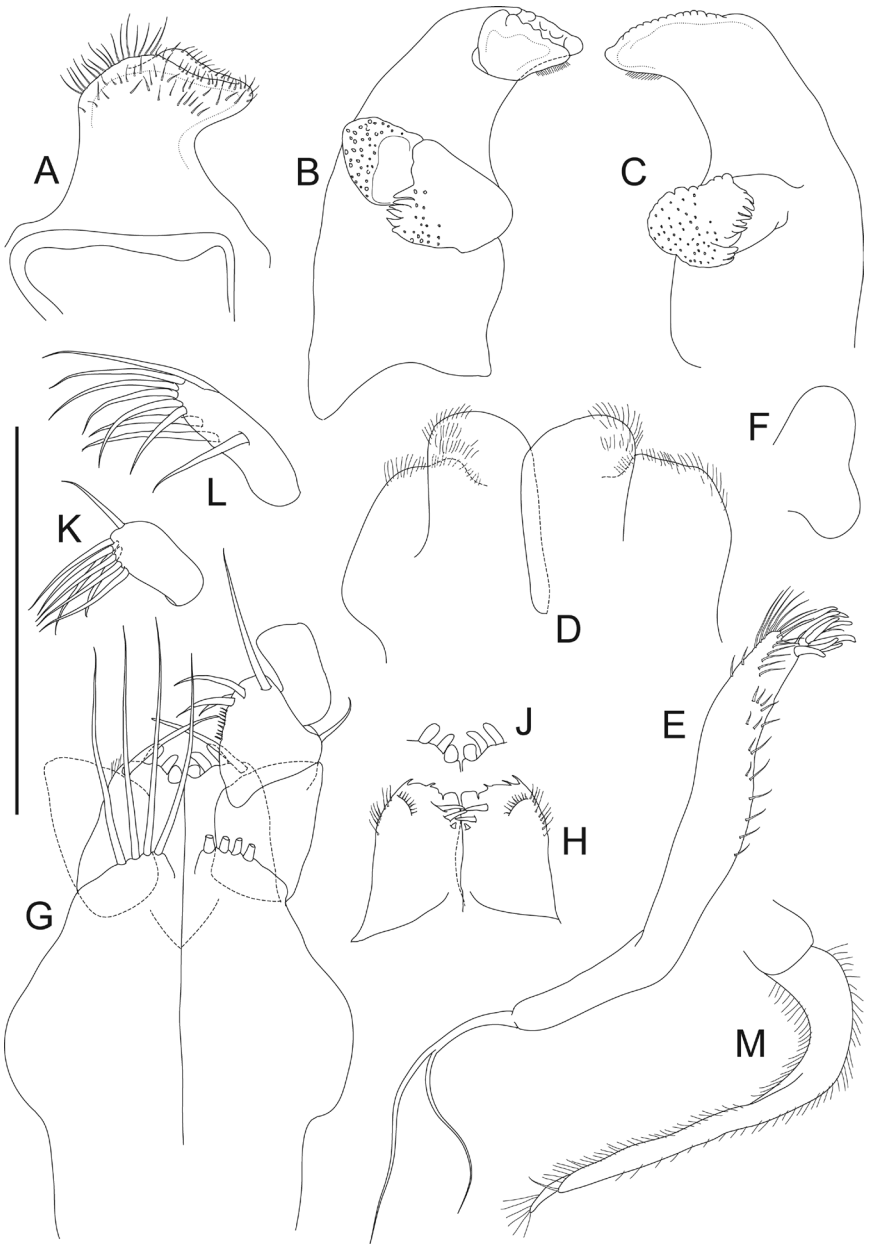

Figure 15. *Leptochelia acrolophus* sp. nov., female (paratype, P.87392): *A* labrum; *B–C* left and right mandibles respectively; *D* labium; *E* maxillule; *F* maxilla; *G* maxilliped (palp details restricted); *H* maxilliped endite oral face, except tubercles; *J* maxilliped endite tubercles; *K–L* maxilliped palp articles 3–4 respectively; *M* epignath. Scale bar: 0.25 mm.

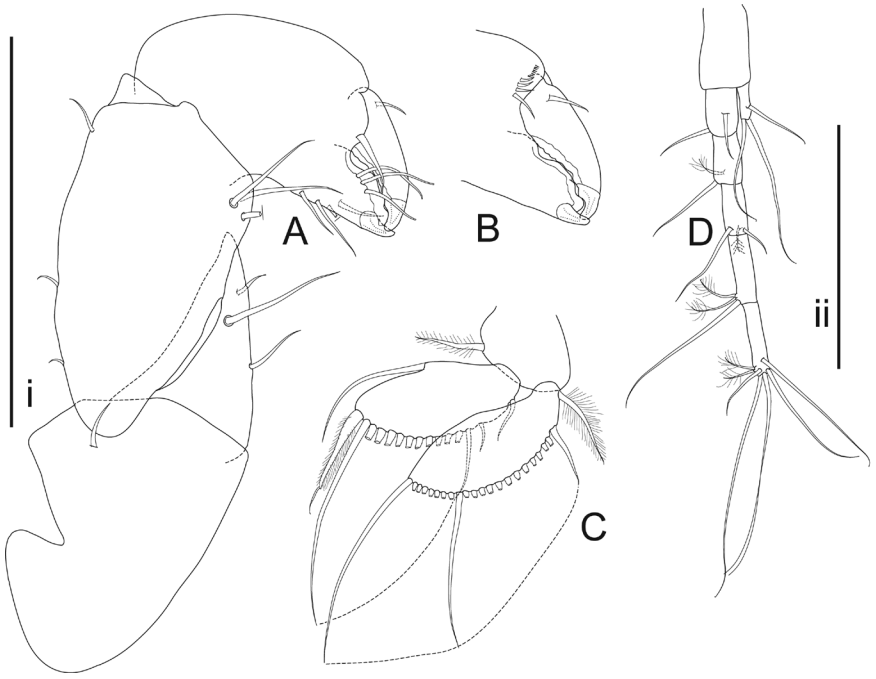

Figure 16. *Leptochelia acrolophus* sp. nov., female (paratype, P.87392): *A* cheliped; *B* left chela, medial; *C* pleopod; *D* uropod. Scale bars: i: *A*–*B*, 0.5 mm; ii: *C*–*D*, 0.25 mm.

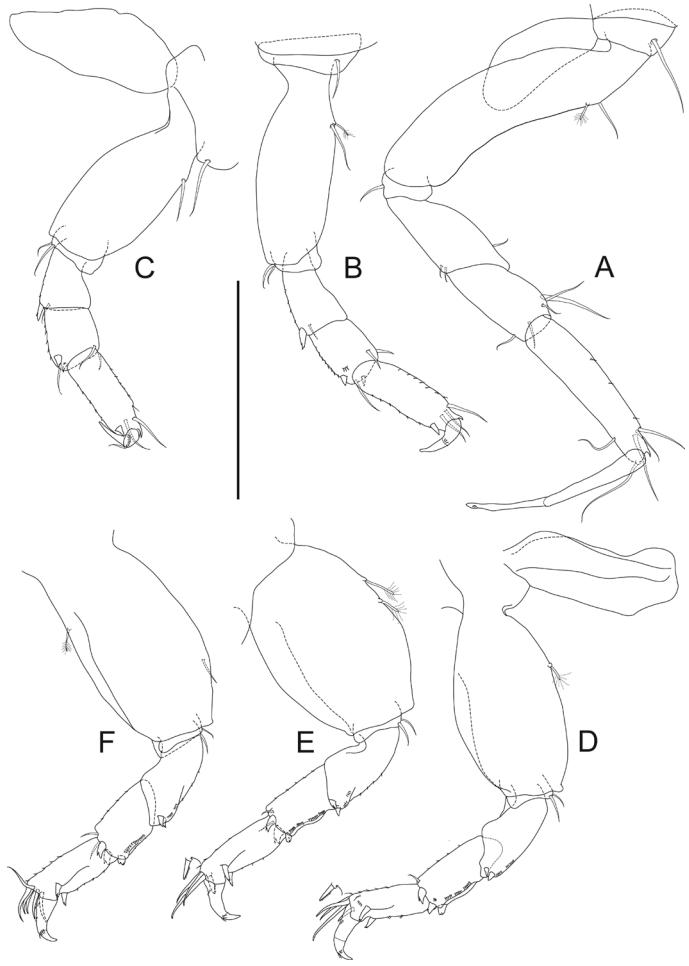

Figure 17. *Leptochelia acrolophus* sp. nov., female (paratype, P.87392): *A*–*F* pereopods 1–6 respectively, each with detail of obscured setation. Scale bar: 0.25 mm.

margin, incisive margin raised, undulate; dactylus with proximomedial spine, incisive margin crenulate.

Pereopod-1 (Figure 17A) coxa with seta (and oostegite bud in preparatory female, as figured); basis arcuate, four times ltb, with proximal superior seta and PSS; ischium with seta; merus about twice as long as broad, distal margin strongly oblique with carpus, with small superodistal seta and two small inferodistal setae; carpus as long as merus, with three superodistal seta (one much stronger than others), one mediodistal seta, and two inferodistal setae (one simple, one peg-like); propodus as long as superior margin length of merus and carpus combined, slightly tapering, with three unequal superodistal setae and one inferodistal seta; dactylus 1.5 times longer than unguis, with proximal accessory seta; unguis with distal pore, together with dactylus as long as propodus. *Pereopod-2* (Figure 17B) coxa with seta (and oostegite bud in preparatory female); basis broader than in pereopod-1, 2.7 times ltb, with proximal superior seta and PSS; ischium heavily shielded by basis, with two unequal setae; merus about 1.6 times ltb, with inferodistal spine (lateral) and seta (medial); carpus as long as merus, stout, just longer than broad, with two superodistal setae, two inferodistal spines (medial weaker and more acuminate) and one seta, inferior margin more spinulate than merus; propodus 2.5 times ltb, longer than carpus, with three superodistal (and mediodistal) setae and one inferodistal spine; dactylus with accessory seta, as long as unguis, together claw-like. *Pereopod-3* (Figure 17C) similar to pereopod-2 but basis without proximal superior PSS; merus, carpus and propodus all slightly shorter; propodus with two superodistal setae.

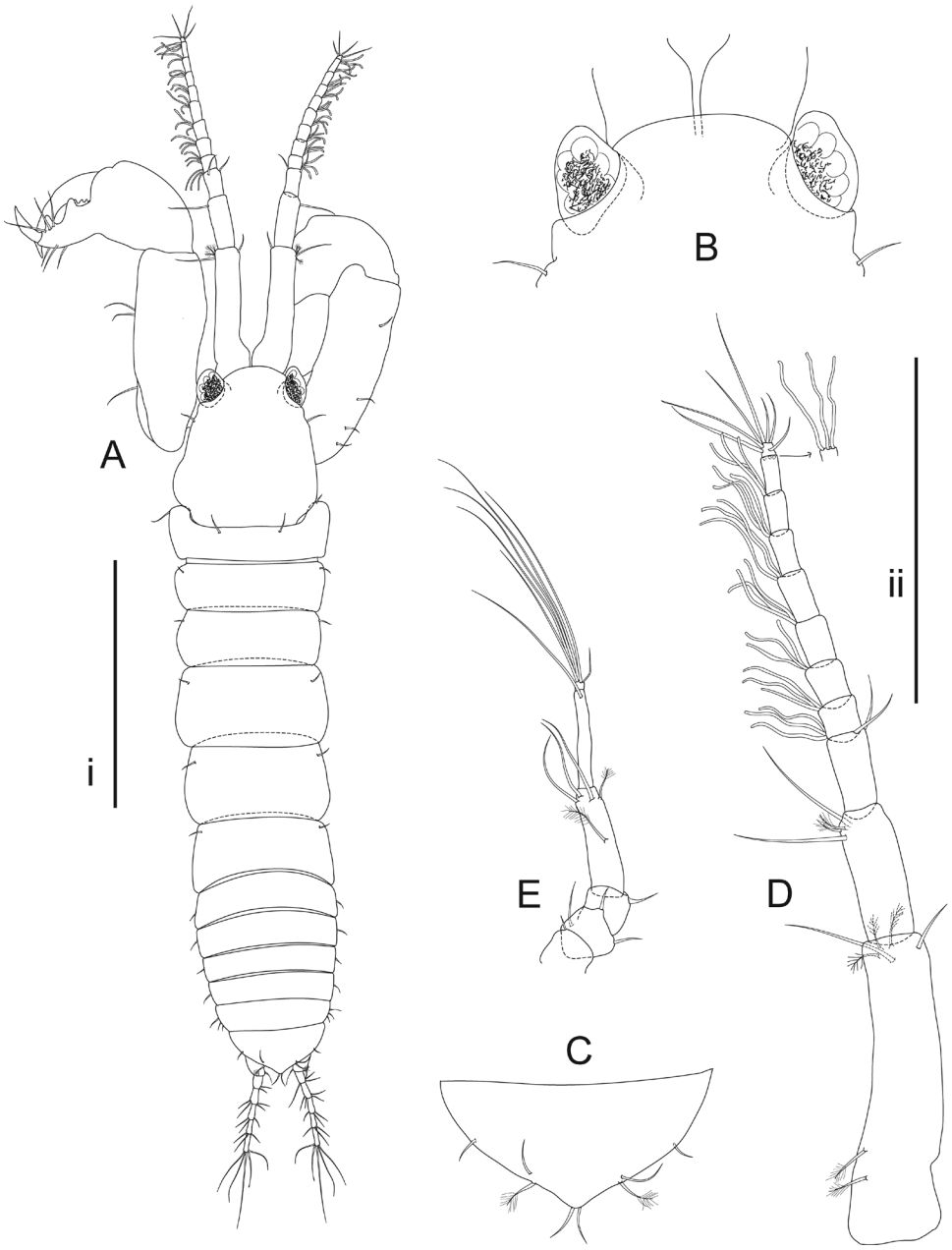

Figure 18. *Leptochelia acrolophus* sp. nov., male (allotype): *A* habitus; *B* cephalothorax anterior; *C* pleotelson. Male (paratype, P.87590): *D* antennule; *E* antenna. Scale bars: i: *A*, 1 mm; ii: *B*–*E*, 0.25 mm.

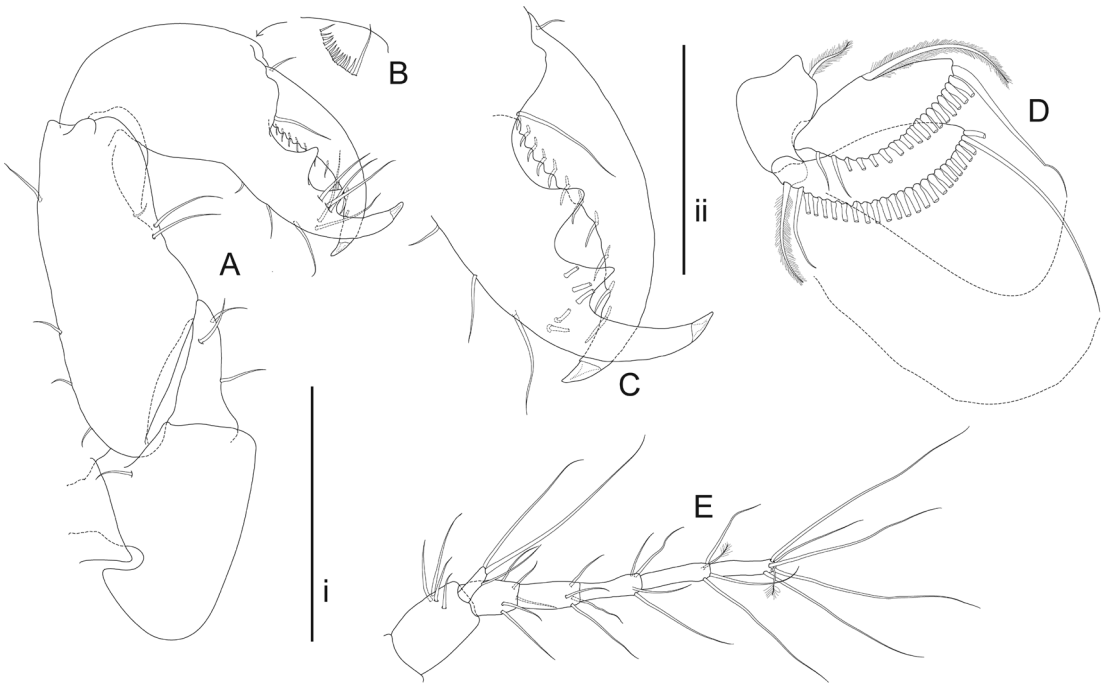

Figure 19. *Leptochelia acrolophus* sp. nov., male (paratype, P.87590): ***A*** cheliped (right); ***B*** chela medial comb (left); ***C*** cheliped fixed finger and dactylus, obscuring setae omitted; ***D*** pleopod; ***E*** uropod. Scale bars: i: ***A***–***B***, 0.5 mm; ***D***–***E***, 0.25 mm; ii: ***C***, 0.25 mm.

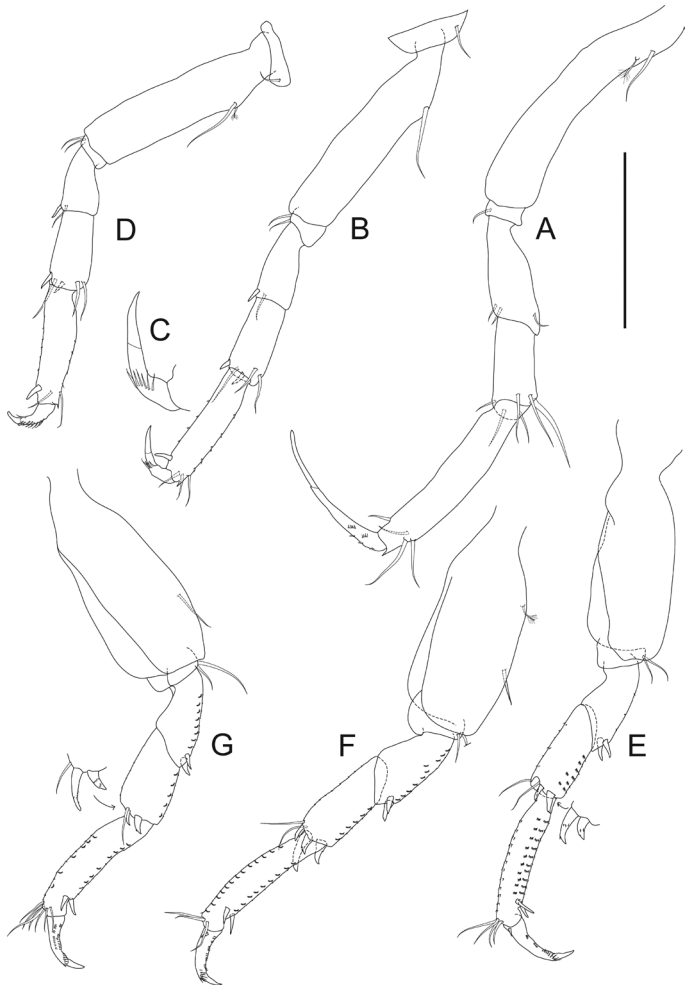

Figure 20. *Leptochelia acrolophus* sp. nov., male (paratype, P.87590): ***A***–***B*** pereopods 1–2 respectively; ***C*** pereopod-2 claw; ***D***–***G*** pereopods 3–6 respectively, with details of obscured setation. Scale bar: 0.25 mm.

Pereopod-4 (Figure 17D) coxa without seta (and with oostegite bud in preparatory female, as figured); basis broader than in pereopods 2–3, twice as long as broad, with superior groove and inferior PSS; ischium heavily shielded by basis, with two unequal setae; merus sub-geniculate, about twice as long as broad, with two stout inferodistal spines; carpus about as long as merus, with three distal spines and one superodistal seta, inferior margin spinulate; propodus slightly shorter and narrower than carpus, with three superodistal slender spines, one pectinate spine (medial, as drawn), and two inferodistal spines; dactylus and unguis claw-like, about half length of propodus, dactylus with proximal spinule and distally setulate. *Pereopod-5* (Figure 17E) similar to pereopod-4 but basis broader, 1.5 times ltb, with two inferior PSS; carpus with two distal setae *Pereopod-6* (Figure 17F) similar to pereopod-5 but basis proportion as pereopod-4, with superior PSS and inferior simple seta; propodus with six slender distal spines, one longer than rest.

Pleopod (Figure 16C) peduncle as long as broad, medial margin with plumose seta; rami subequal, sub-ovate, about 2.3–2.4 times ltb; endopod medial margin with plumose seta at mid-length, lateral margin with proximal circumplumose seta separated by small gap from fringe of 14 plumose setae, distalmost with whip-like tip; exopod lateral margin with proximal circumplumose seta separated by small gap from fringe of 22 plumose setae.

Uropod (Figure 16D) peduncle longer than broad, naked; endopod 3–5 segmented but size-dependent: all specimens under 1.88 mm three-segmented; between 1.94 and 2.26 mm four or five-segmented; all specimens over 2.26 mm [and all mature individuals] five-segmented, some individuals with unequal number; at least one simple seta on sub-terminal segments, segments 2–5 with one or more PSS; exopod three-quarters length of segment-1 of endopod, with three setae.

Manca-II. *Habitus* similar to small non-ovigerous female but without pereopods-6 and pleopods; uropod endopod three-segmented; length 0.9 mm (n=1).

Manca-III. *Habitus* similar to small non-ovigerous female but with rudimentary pereopods-6 and pleopods; uropod endopod three-segmented; length 1.0 mm (n=1).

Secondary male. *Habitus* (Figure 18A) fairly stout, 4.8 times ltb; length 1.9–2.9 mm (n=7). *Cephalothorax* just longer than broad, rostrum (Figure 18B) spatulate with anterior shallowly convex. *Pereonites* 1–3 subequal, about 0.3 times as long as broad; pereonites 4–6 longer, subequal. *Pleon* 23% of body length, 1.2 times longer than broad. *Pleotelson* (Figure 18C) proportionately longer than in female; setation as figured. *Antennule* (Figure 18D) twice as long as cephalothorax; peduncle three-articled, article-1 4.3 times ltb, with basal thickening; article-2 2.5 times ltb; article-3 half length of article-2, simple; flagellum 6–10 segmented [size-related; allotype nine-segmented], last segment much smaller than preceding segments, all except terminal with bundle of aesthetascs, segment-1 with two bundles; other setation as figured. *Antenna* (Figure 18E) similar to that in female but articles 2-3 spines weaker and article-5 longer and thinner.

Mouthparts fused solid mass. *Maxilliped* present but reduced.

Cheliped (Figure 19A–C) typical non-elongate form; carpus narrower distally, about three times ltb; chela as long and as wide as carpus; palm and fixed finger equal in length, medial comb oblique, with about 14 spines; fixed finger with two triangular apophyses on incisive margin; dactylus with proximal crenulation on incisive margin and row of peg-like spines; other setation as figured.

Pereopod-1 (Figure 20A) coxa with seta; basis arcuate, 6.4 times ltb, superior margin with proximal PSS and seta; ischium with seta; merus wider distally, about 2.5 times ltb, with superodistal seta and two inferodistal setae; carpus as long as merus, with six distal setae, largest superodistal; propodus as long as merus and carpus combined, slender, five times ltb, with three superodistal seta and slender inferodistal spine; dactylus longer than unguis, with proximal spinules, together with unguis 0.8 times as long as propodus. *Pereopod-2* (Figure 20B–C) 0.7 times length of pereopod-1, all articles proportionately shorter; basis four times ltb; ischium with two setae; merus with inferodistal spine and seta; carpus twice as long as broad, with three distal setae and two distal spines; propodus times ltb, setation as pereopod-1; dactylus and unguis together shorter than in pereopod-1, half length of propodus, dactylus with setulate fringe. *Pereopod-3* (Figure 19D) similar to pereopod-2 but slightly smaller; propodus with two superodistal setae.

Pereopod-4 (Figure 20E) basis three times ltb, superior margin with thin flange extending 60% of length, about 0.4 times width of main article distally; ischium strongly shielded by basis, with two setae; merus geniculate, with two inferodistal spines; carpus about as long as merus, 2.5 times ltb, with two distal setae and four curved spines (larger pair medial in orientation shown); propodus 1.5 times longer than carpus, slender, 5.5 times ltb, with two inferodistal spines and four superodistal setae; dactylus and unguis claw-like, about half as long as propodus, with small proximal spine and distal/inferior setules. *Pereopod-5* (Figure 20F) similar to pereopod-4 but basis with seta and PSS. *Pereopod-6* (Figure 20G) similar to pereopods 4–5 but propodus with seven superodistal setae, one longer and thicker than other six.

Pleopod (Figure 19D) similar to that of female but with two or three additional setae on distal fringe of exopod and endopod.

Uropod (Figure 19E) similar to female, but peduncle with lateral row of four setae; endopod five-segmented; one terminal seta much longer than rest.

Distribution and habitat. Herald Islands, North and South Meyer Islands (all Raoul group), Raoul Island, Macauley Island, and L'Esperance Rock; 0–27 m, from various hard substrata in rockpools, sublittorally on rock surfaces, under boulders, among coarse sand, coral, clumping red algae, and gravel.

Remarks. This species, *Leptochelia acrolophus* sp. nov., was one of the more common of the Kermadec tanaidaceans, with 72 identified specimens. No

differences could be observed in individuals from the different island locations. It falls into the broad *Leptochelia savignyi*-group. Bamber (2005) very usefully examined several morphometrics and characters in this group, and constructed a key to the Australian leptocheliids (Bamber, 2008a). As is typical of most *Leptochelia* species, *Leptochelia acrolophus* presents a mosaic of characters; in detail, it may belong in a sub-group with *L. opteros* and *L. ignotus* that are characterised or keyed in Bamber (2008a) and Edgar (2012) by a one-segmented uropod exopod shorter than segment-1 of the endopod in females and superior flanges on the basis of one or more of the male's pereopods 4–6. It differs from these two species principally by the female's combination of four maxilliped basis setae and two inferodistal spines on the carpus of pereopods 2–3, and the male's cheliped dactylus with proximal crenulation on the incisive margin and flanges on the basis of pereopods 4–6. *Leptochelia bulbus* shares with *L. acrolophus* a weakly demarcated carapace but lacks a cap-like terminal segment on the antennule, has five maxilliped basis setae, peg-like spines on the superior margin of the cheliped carpus, and a seven-segmented uropod endopod and a longer exopod. Also from New Caledonia (Isle of Pines, off the southeastern tip of NC), *L. lifuensis* females have the antenna article-3 with an inferodistal spine and have two-segmented uropod exopods. New material of this species would be required to confirm any further distinctions or similarities with *L. acrolophus* or *L. bulbus*.

As the males of *L. acrolophus* are considerably larger than the mancae or small neuters it suggests these are secondary, derived from females (i.e. protogynous). A marked disparity in size in these males also implies that there may be two phases – the putative post-ovigerous female of length 2.5 mm (in K2011-10-5) being smaller than the other preparatory and ovigerous females (3.3–3.9 mm). The under-representation of the smaller ovigerous females matching most the males for size is an apparent anomaly. Stebbing (1900) also noted size differences between males and females in *L. lifuensis* and was cautious about their conspecificity.

For the Raoul Island *Leptochelia* material, the sex ratio is 1.3:1 (mature/maturing females to males) or 8.4:1 if non-ovigerous females are included; this is an unusually equitable ratio for *Leptochelia* species (Bamber, 2010), although similar to the 4.9:1 measured for some populations of *Parakonarus kopure* Bird, 2011, and suggests that the sampling took place during a significant breeding event.

While eastern Australian waters hold a rich leptocheliid fauna, that of New Zealand's North Island littoral is dominated by *Parakonarus kopure* and only a few small *Leptochelia*-like specimens have been recorded (yet to be described) from scattered localities (Bird unpublished). Close morphological similarities suggest that the Kermadecian *L. acrolophus* is derived from a *L. ignotus* or *L. opteros*-like ancestor.

Family PARATANAIDAE Lang, 1949
METATANAINAE new Sub-family

Diagnosis. *Female.* C*uticle* well calcified. *Eyes* present. *Pleon* without plumose epimeral setae. *Antennule* three-articled, setae stiff/blunt, not setulated, terminal aesthetasc present. *Antenna* articles 2–3 with stiff superodistal seta, article-2 without inferodistal apophysis or seta. *Maxilliped* basis without seta, endites forming cup-shaped apparatus, without distal tubercles. *Cheliped* sclerite massive, triangular; merus inferior margin not longer than that of carpus, setation reduced, with small spines; chela without long medial spines. *Pereopods 2–3* carpus with three distal spines. *Pereopods 4–6* carpus with four [relatively simple] distal spines. *Pleopods* present [reduced or vestigial] or absent. *Uropod* without exopod, endopod stout, much shorter than peduncle.

Male. C*ephalothorax* narrowed anteriorly. *Antennule* flagellum three-segmented. *Cheliped* fixed finger and dactylus with prominent apophyses on incisive margins. *Pleopod* fully developed, with distal setae.

Etymology. The subfamily name is derived from the stem of '*Metatanaidis'*, the genitive singular of the genus name *Metatanais*, with the elided form for both simplicity and prevailing use, as permitted by ICZN Article 29.3.1.1.

Type genus. *Metatanais* Shiino, 1952, by original designation.

Remarks. The familial classification of the genus *Metatanais* has changed over the years, although the definitions of the families involved have altered considerably during this period. In previous classifications *Metatanais* has been regarded as a tanaid (Shiino, 1952), then a nototanaid (Sieg, 1976). In a phylogenetic analysis by Bird & Larsen (2009) it was proposed to be *incertae sedis*, but with some affinity to the Paratanaidae. This relationship to various paratanaid genera such as *Atemtanais* Bird, 2011 and *Aparatanais* Bird & Bamber, 2013 was reiterated by Bird & Bamber (2013). Apart from the form of the maxilliped that is restricted to the Paratanaidae and general setation of the pereopods, characters suggesting a closer relationship to these previously-mentioned paratanaid genera include the expression of many setae of a rather stiff, blunt-ended type on appendages (including antennules and uropods), a reduction in size (or total loss) of the pair of distal maxilliped endite tubercles, and uropods that are comparatively stout. The most recent review of *Metatanais* was produced by Błażewicz-Paszkowycz & Zemko (2009).

Material examined here shows that for *Metatanais* the maxilliped endite structure and pereopod setation place this taxon closest to the Paratanainae Lang, 1949 rather than the Bathytanaidinae Larsen & Heard, 2001, Nototanaidae Sieg, 1976 and Tanaissuidae Bird & Larsen, 2009. The maxilliped endites are typically paratanaid although in entire specimens they appear narrower, even conical, because the lateral margins are reflexed. Additional characters such as the carpus of

pereopods 4–6 having four spines and a seta (at least in the new species described below) and that of pereopods 2–3 bearing three spines and a seta, exclude it from Nototanaidae; there the most common pattern is of only two spines, inferodistal on the carpus of pereopods 2–3, and the maxilliped endites are flared, but are not proximally wider than the basis. These and other variant characters seen within the Nototanaidae and the three paratanaid subfamilies are shown in Table 1.

Overall, the structure of the female uropod, the lack of tubercles on the maxilliped endite and the male's antennule and chela conformations do not match any within the Paratanainae and Bathytanaidinae and a new subfamily within the Paratanaidae is proposed here.

Genus *Metatanais* Shiino, 1952

Metatanais: Shiino, 1952: 23–24 (new genus and diagnosis), 24–27 (description of *M. cylindricus*); Błażewicz-Paszkowycz & Zemko, 2009: 131–132 (genus diagnosis and remarks), 132–134 (redescription of *M. cylindricus*), 134–139 (description of *M. bipunctatus*); Bird & Larsen, 2009: 151, 156 (remarks on classification); Bird & Bamber, 2013: 7 (remarks on classification).

Type species. *Metatanais cylindricus* Shiino, 1952.

Composition in area. *Metatanais bipunctatus* Błażewicz-Paszkowycz & Zemko, 2009 [Qld]; ***M. progenitor* sp. nov**.

Table 1. Some of the variant characters among the families Nototanaidae and Paratanaidae.

Character	Nototanaidae	Paratanaidae sf. Bathytanaidinae	Paratanaidae sf. Paratanainae	Paratanaidae sf. Metatanainae
Pleon epimera seta	long or simple	circumplumose or simple	circumplumose or simple	simple
Antennule articles	3	4	3, 4 or 5	3
Antennule setae	simple	setulate and simple	simple and blunt	blunt
Antenna article-2 inferior apophysis	absent	lamellate	absent or small (basal to seta)	absent
Mandible molar	broad triturative; broad or narrow crushing-piercing	broad crushing-piercing	broad crushing-piercing	broad crushing-piercing
Maxilliped bases extension over endites	Present/absent	absent	absent	absent
Maxilliped bases seta	short/long	long	long	absent
Maxilliped endites	narrow base, flared	wider than bases	wider than bases	wider than bases
Maxilliped endite tubercles	present/absent	present	present	absent
Maxilliped endite setae	1 or 2 simple	1 simple	1 thick-blunt	1 thick-blunt
Maxilliped palp article-2 long seta	present/absent	absent	absent	absent
Cheliped carpus inferior setae	1 or 2	2	2	1
Cheliped propodus inferior setae	1, 2 or ≥5	1	2	1
Cheliped palm margins	parallel	parallel or flared	parallel	parallel
Pereopods 2–3 carpus spines	1 or 2 inferior only/ 4	1 (minute) or absent (setae only)	3	3
Pereopods 4–6 carpus spines	3 or 4, molariform absent	4, molariform present/absent	4, molariform absent	4, molariform absent
Pereopods 4–5 propodus superodistal spine	long/short	long	short	short
Pereopod-6 propodus superodistal spines	3 or >4	3	3	3
Pleopods	present, well-developed	present, well-developed	present, well-developed	present, vestigial [or absent?]
Uropod exopod	present, slender	present, slender	present, slender or stout	absent

Diagnosis. See Błażewicz-Paszkowycz & Zemko (2009) but also subfamilial characters.

Remarks. There are conflicting views on the sex of the specimens observed by Shiino (1952) that were considered to be male or preparatory female by Błażewicz-Paszkowycz & Zemko (2009), even though all of Shiino's material (23 specimens) were probably female, as he surmised, as no mention was made of specimens without pleopods. The collection of two undoubted males during this Kermadec expedition puts aside this uncertainty, at least for the material examined here. Apart from issues of gender discrimination, there are discrepancies or uncertainties with regard to the number of carpal spines on pereopods 4–6 in the literature: three (pereopod-6) or four (pereopods 4–5) were recorded for *M. cylindricus sensu* Shiino. In addition, the shape of the cheliped sclerite is variously described and no separate pleonal tergites and sternites are shown for *M. bipunctatus*. The mesial comb on the chela has not generally been observed or recorded before; for the new species described below it has seven spines, a number generally larger than in most paratanains.

In unambiguous males of the genus, the body shape is paratanain-like rather than nototanaid although the narrow cephalothorax is more of a nototanaid character. The antennule has fewer flagellar segments than in other paratanains (*Aparatanais*, *Atemtanais*, *Paratanais* Dana, *Penteparatanais* Bird & Bamber, 2013, *Triparatanais* Bamber & Chatterjee, 2010, and *Xeplenois* Bamber, 2005), while the chela has a general shape (particularly that of the dactylus) that is most similar to those of nototanaids such as *Nototanais* Richardson or *Nesotanais* Shiino, rather than paratanains or bathytanaidins.

Metatanais progenitor sp. nov. (Figures 21–25)

Etymology. From the Latin noun *progenitor*; this refers to the species forming the basis of a new subfamily.

Diagnosis. *Female. Carapace* and *pereon* unpigmented. *Cephalothorax* as long as broad (just wider in holotype). *Pleonites* with separate tergite and sternite, and with small sternal spurs. *Antennule* article-1 2.3 times ltb. *Pereopods 4–6* carpus with four distal spines; pereopod-6 propodus 3.3 times ltb. *Pleopods* setiferous on pleonite-1 only, vestigial on pleonites 2–5.

Male. As for genus diagnosis but provisional on males of other species being described.

Material examined. Holotype: non-ov. ♀, 1.5 mm, K2011-23-4, AIM MA73438, base of vertical rock wall with rocks, cobble and coarse sand, and tufting algae, 27 m, Milne Islets (Raoul Island), 29° 16' 56" S 177° 54' 10" W, coll. C. Bedford, S.J. Keable, M.A. McGrouther, A. Reid, C. Struthers, T. Trnski, S. Ullrich, L.G. Wiren, and V. Zintzen, 15 May 2011

Allotype: natatory ♂, 1.4 mm, K2011-42-4, AIM MA73437, indefinable substrate, 10 m, west side of North Chanter Island, Herald Islands (Raoul Island), 29° 15' 06" S 177° 51' 21" W, coll. A. Ballance and S.J. Keable, 16 May 2011.

Paratypes (all Raoul): one non-ov. ♀, one ♂ (one pleopod dissected on microslide), K2011-3-2, P.89271; two non-ov. ♀♀ (one partly dissected on microslides), K2011-23-4, AIM MA73439.

Description. *Female (non-ovigerous)*. *Habitus* (Figure 21A–B) robust and stout, 4.6 times ltb, cuticle well-calcified; length 1.5–1.7 mm (n=four). *Cephalothorax* just shorter than broad, about as long as pereonites 1–3 combined, narrower anteriorly; rostrum pointed, weakly produced; eyes conical. *Pereon* with all pereonites much shorter than broad, pereonite-1 shortest, pereonite-4 longest, pereonites 2–3 and 5 subequal. *Pleon* just longer than broad, 23% of body length, tergites much more extensive than sternites, sternites with small recurved spurs, pleonite-5 with short stiff lateral seta. *Pleotelson* as long as pleonites 3–5 combined, rounded, with small decurved apical process, and two posteriolateral stiff setae.

Antennule (Figure 21C–D) just over half length of cephalothorax; article-1 broad, 2.3 times ltb, cupping article-2, with two lateral stiff blunt setae, three proximal PSS and three inferodistal PSS set on small pedestal; article-2shorter than broad, with small distomedial seta; article-3 about twice as long as article-2, with one PSS, one small seta, three thick setae (one longer than others) and thick aesthetasc. *Antenna* (Figure 21E) 75% length of antennule; article-1 short and naked; article-2 1.5 times ltb, slightly wider distally, with stiff superodistal seta and small lateral seta; article-3 half as long as article-2, shorter than broad, with stiff superodistal seta; article-4 almost as long as articles 2–3 combined, with one subdistal PPS, one simple set and at least two distal PSS; article-5 twice as long as broad, with two distal setae; article-6 cap-like, with one small seta and four long stiff setae.

Labrum not observed. *Mandibles* (Figure 22A–B) with relatively short crushing molar; right incisor bifid with crenulate distal margin; left incisor crenulate, lacinia broad, with crenulate distal margin. *Labium* (Figure 22C) wider than broad, outer lobes smaller and overlapped by inner, both distally setulate. *Maxillule* (Figure 22D) endite with nine terminal spines. *Maxilla* not observed. *Maxilliped* (Figure 22E–H) bases unfused, naked; endites slightly wider than bases, conical in ventral view but broader and serrate-setulate in full profile, with long, stiff mediodistal seta; palp article-1shorter than broad, naked, article-2 with lateral seta (articulation overlapped by article-1), with three medial serrulate setae, one thicker than others, article-3 with four medial serrulate setae, article-4 with superodistal seta and five serrulate terminal setae. *Epignath* (Figure 22J) typical, thin straplike, with group of apical setules.

Cheliped (Figure 22K) coxal sclerite massive, triangular, reaching posterior of cephalothorax, strongly overlapping basis anterior mass; basis with posterior lobe much smaller than anterior mass, reaching pereonite-1, naked (?); merus inferior margin longer than that of carpus, with small robust inferior spine; carpus 1.4 times ltb, superior margin with one proximal seta, inferior margin with one small robust spine; chela longer but narrower than carpus, 2.1 times ltb, palm with small robust inferior spine and mesial comb of

seven spines, fixed finger shorter than palm, incisive margin with two lateral setae and large rounded distal tooth, dactylus with stout mesial spine.

Pereopod-1 (Figure 23A) coxa annular, with seta; basis 5.7 times ltb, naked; ischium with small seta; merus 2.3 times ltb, with small and stout inferodistal seta; carpus as long as merus with four distal setae; propodus 1.5 times longer than carpus, and narrower, with two superodistal setae, one larger than other, and small stout inferodistal seta; dactylus and unguis equally long, together about half length of propodus. *Pereopod-2* (Figure 23B) slightly shorter than pereopod-1 (merus, carpus, propodus); coxa with seta; ischium naked; merus with less oblique articulation with carpus, with inferodistal seta and small spine; carpus as long as merus, with three stout spines and seta; propodus with superodistal seta only; dactylus slightly shorter than unguis. *Pereopod-3* (Figure 23C) similar to pereopod-2 but shorter; carpus and propodus more gracile.

Pereopod-4 (Figure 23D) coxa naked; basis slightly wider than that in pereopods 2–3, 3.6 times ltb; ischium with stiff seta; merus geniculate, about twice as long as broad, with two robust inferodistal spines; carpus as long as merus, with four distal spines and one stiff superodistal seta; propodus 3.3 times ltb, 1.3 times longer than carpus, with one superior PSS, one superodistal spine and two short inferodistal spines; dactylus and unguis claw-like, unguis shorter than dactylus, together about half length of propodus. *Pereopod-5* (Figure 23E) similar to pereopod-4. *Pereopod-6* (Figure 23F) similar to pereopods 4–5 but propodus without superior PSS and with three robust superodistal spines.

Pleopod (Figure 23G) difficult to observe, apart from pleopod-1; pleopod-1 peduncle longer than broad,

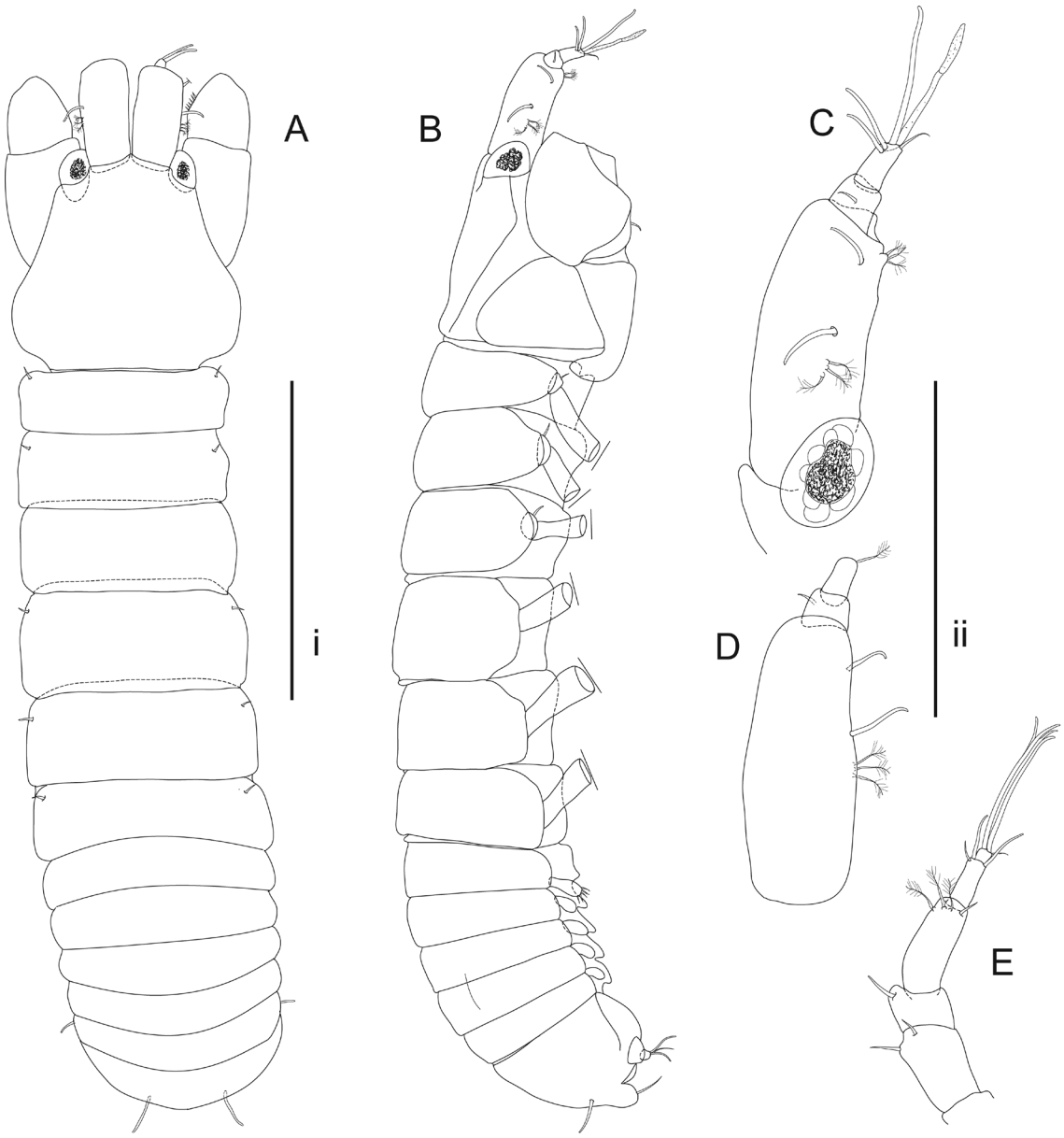

Figure 21. *Metatanais progenitor* sp. nov., female (holotype): *A–B* habitus, dorsal and lateral respectively, chela omitted for clarity; *C* antennule, lateral; *D* antennule, dorsal, apical setae missing; *E* antenna. Scale bars: i: *A–B*, 0.5 mm; ii: *C–E*, 0.25 mm.

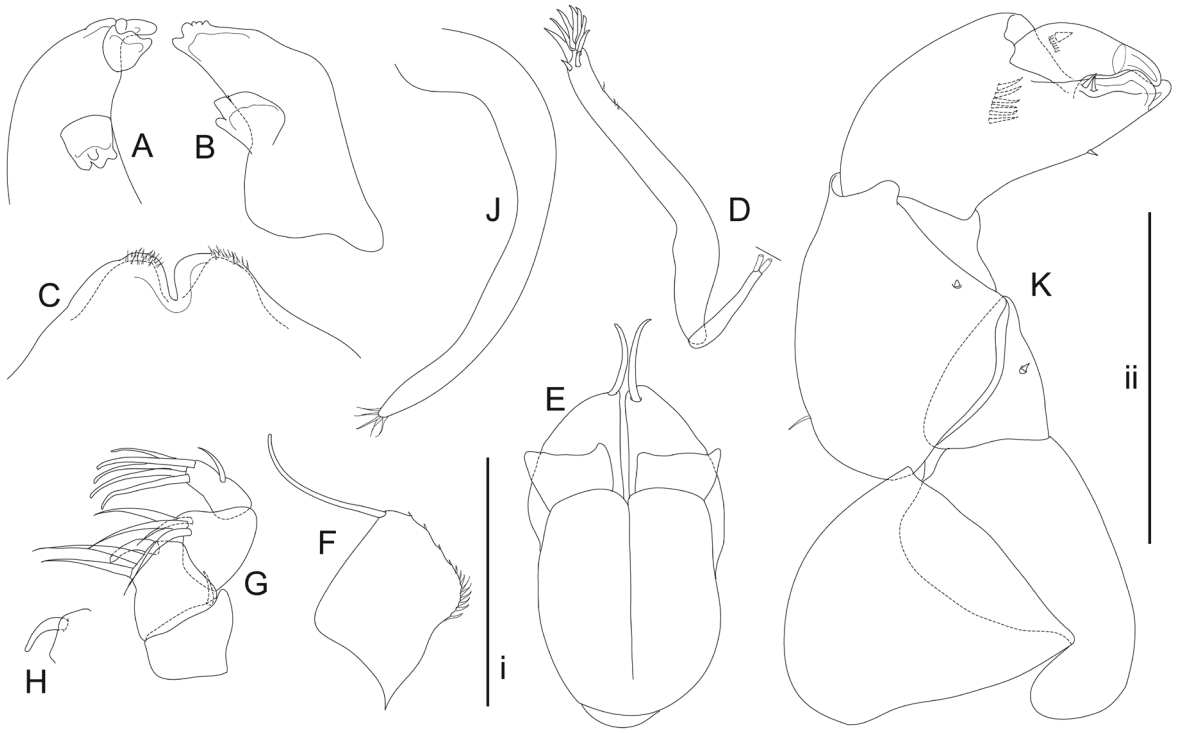

Figure 22. *Metatanais progenitor* sp. nov., female (paratype, AIM MA73439): *A*–*B* left and right mandibles respectively; *C* labium; *D* maxillule; *E* maxilliped, palp articles 2–4 omitted; *F* maxilliped endite, full profile; *G* maxilliped palp; *H* maxilliped palp article-2 medial spine; *J* epignath: *K* cheliped. Scale bars: i: *A*–*J*, 0.125 mm; ii: *K*, 0.25 mm.

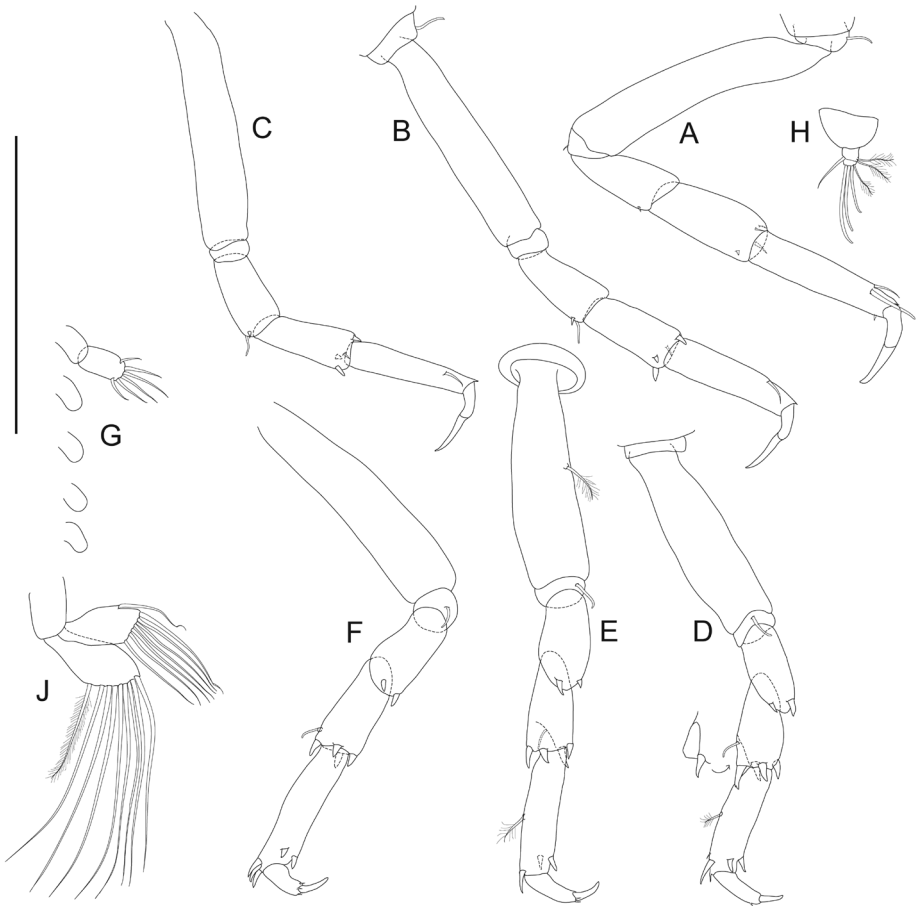

Figure 23. *Metatanais progenitor* sp. nov., female (paratype, AIM MA73439): *A*–*F* pereopods 1–6 respectively (*D* with detail of obscured setation); *G* pleopods 1–5; *H* uropod. Male (allotype): *J* pleopod. Scale bar: 0.25 mm.

with single ramus; ramus longer than peduncle, twice as long as broad, with six distal setae; pleopods 2–5 rudimentary, naked.

Uropod (Figure 23H) small, peduncle shorter than broad; endopod two-segmented, half length of peduncle, segment-1 with distal seta and two PSS, segment-2 cap-like, with one PSS and three long stiff setae.

Secondary male. *Habitus* (Figure 24A,D) fairly stout, about five times ltb; length 1.2–1.4 mm (n=2). *Cephalothorax* as long as broad, even narrower anteriorly than in female. *Pereon* with all pereonites much shorter than broad, subequal. *Pleon* slightly tapering, 1.2 times ltb, pleonites just shorter than pereonite-6, all with stiff dorsolateral setae. *Pleotelson* (Figure 24E) as long as pleonites 4–5 combined, with medial ridge and pointed apical process, pair of stiff blunt setae and groups of PSS.

Antennule (Figure 24B) similar to female but article-1 more slender, almost three times ltb, article-2 very short, bearing one stiff seta; flagellum of three segments, segments 1–2 short, each with bundle of long aesthetascs, segment-3 longer than segments 1–2 combined, with three stiff blunt setae and large aesthetasc. *Antenna* similar to that in female.

Mouthparts reduced. *Maxilliped* (Figure 25F) smaller than in female, with one medial seta on palp articles 2–3.

Cheliped (Figure 25A–E) dimorphic re female; merus with longer seta than in female; carpus stout, 1.2 times ltb, with complex posterior margin, with two superior setae and one inferior seta longer than in female; chela longer than carpus, palm lateral margin with seta near articulation with dactylus, medial comb vertical, with about twelve spines; fixed finger and dactylus on

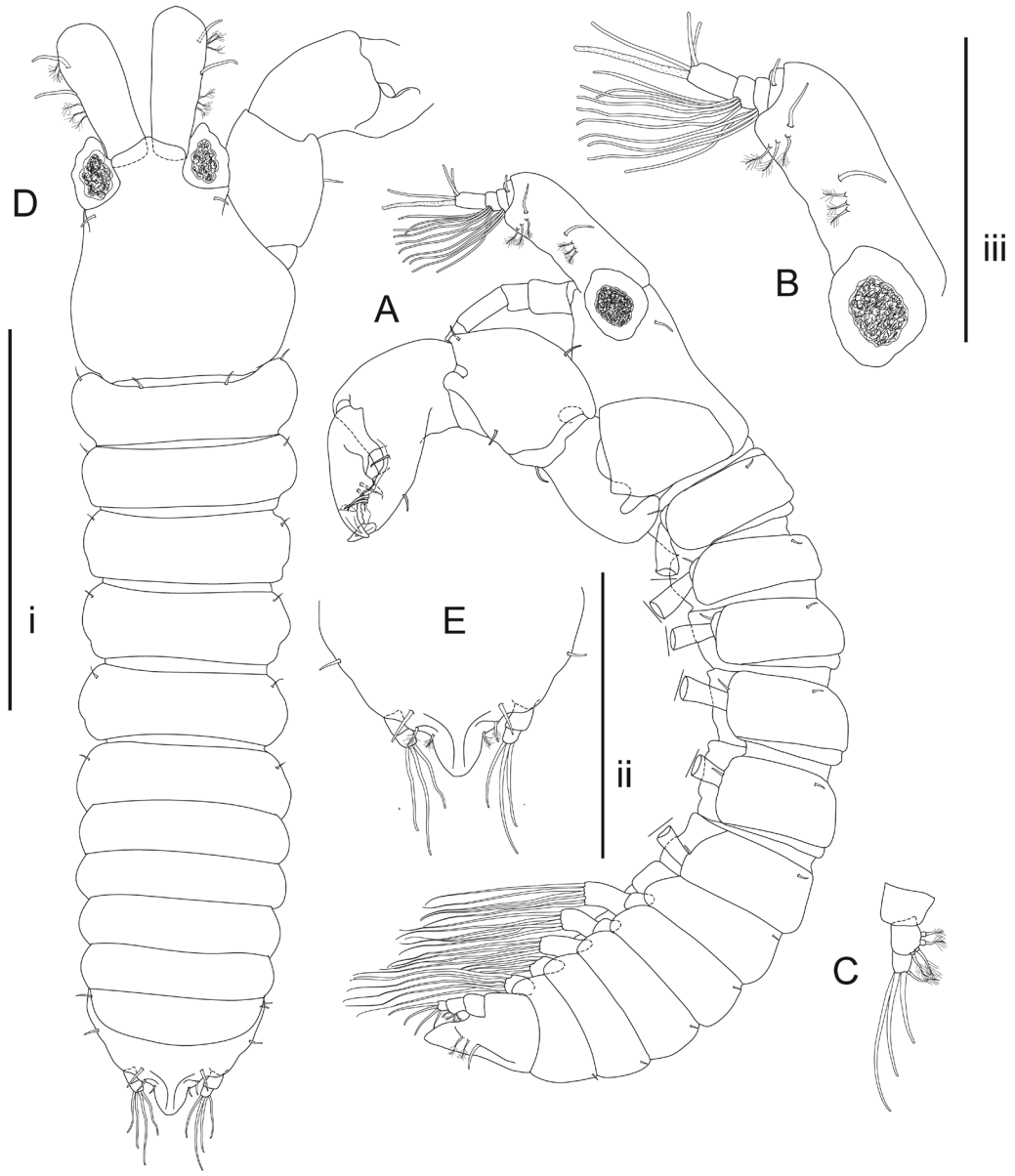

Figure 24. *Metatanais progenitor* sp. nov., male (allotype): *A* habitus, lateral; *B* antennule, lateral; *C* uropod. Male (paratype, P.89271): *D* habitus, dorsal; *E* pleotelson. Scale bars: i: *A*, *D*, 0.5 mm; ii: *E*, 0.25 mm; iii: *B*–*C*, 0.25 mm.

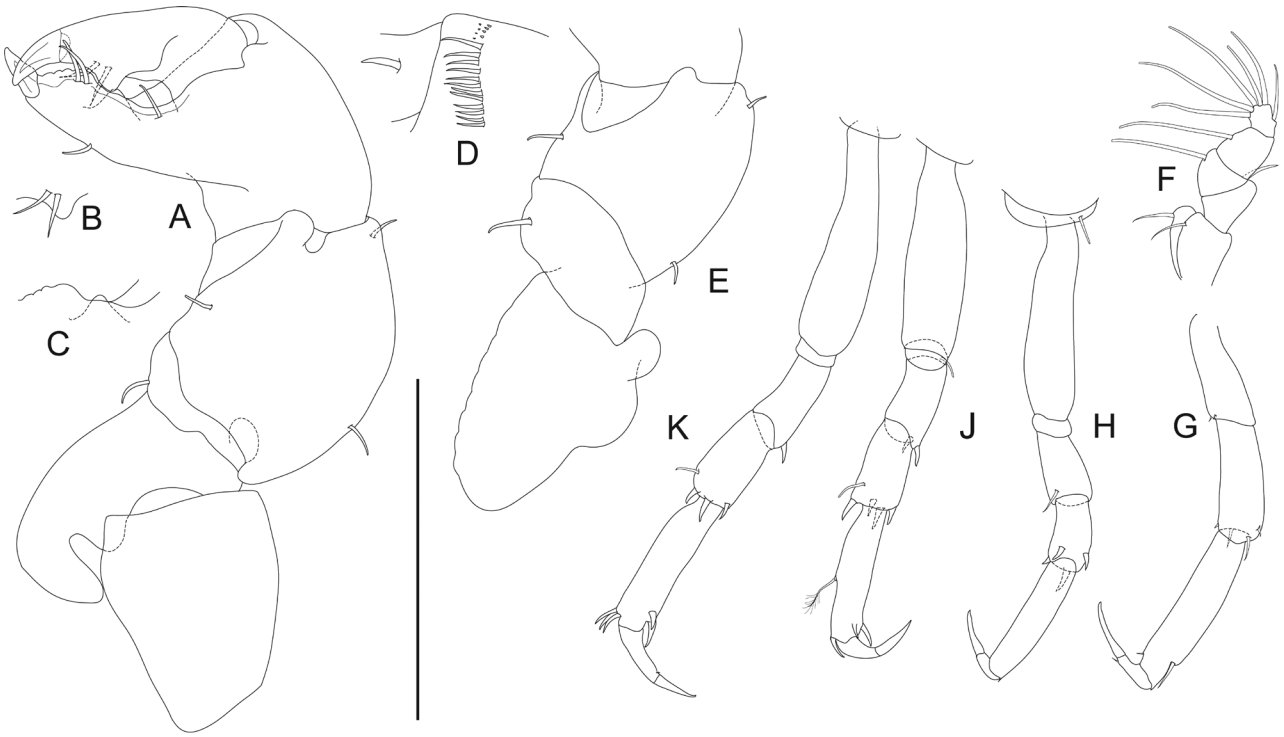

Figure 25. *Metatanais progenitor* sp. nov., male (allotype): *A* cheliped, left; *B* cheliped dactylus inferior apophysis; *C* cheliped fixed finger incisive margin apophysis; *D* cheliped, right, propodus comb; *E* cheliped, right, medial aspect. Male (paratype, P.89271): *F* maxilliped, lateral; *G* pereopod-1 distal; *H* pereopod-3; *J* pereopod-4; *K* pereopod-6. Scale bar: 0.25 mm.

different axis to palm, fixed finger arcuate, with convex inferior margin with longer seta than in female, with medial triangular process and distal raised apophysis and two spines near incisive margin; dactylus broad-based and strongly tapering, with proximomedial spine, lateral and inferior margin with sinuate ridge-apophysis, medially with two spines.

Pereopod-1 (Figure 25G) similar to that in female but merus with two small inferodistal seta; propodus superodistal seta smaller. *Pereopods 2–3* (Figure 25H) similar to that in female, but merus and carpus shorter and carpus with four (longer) distal spines; propodus without distal setae.

Pereopods 4–6 (Figure 25J–K) similar to that in female, but carpal distal spines more slender.

Pleopod (Figure 23J) on all pleonites, biramous, relatively small; peduncle twice as long as broad; endopod about as long as peduncle, with distomedial seta with whip-like tip, and six distolateral seta, distalmost with whip-like tip; exopod 1.3 time larger than endopod, with nine distolateral setae.

Uropod (Figure 24C) similar to that in female but endopod relative larger, longer than peduncle, segment-1 with row of four PSS, segment-2 with four long stiff setae.

Distribution and habitat. South Meyer Island, Herald Islands (both Raoul group), and Raoul Island; 10–27 m, from coarse sand, cobbles, rock rubble, and tufting algae.

Remarks. The females of *M. progenitor* sp. nov. can be distinguished from the two other described species by the combination of characters outlined in the diagnosis. The most significant outcome of the discovery of this species is the record of the first male for the genus *Metatanais*.

Subfamily PARATANAINAE Lang, 1949
Genus *Aparatanais* Bird & Bamber, 2013

Aparatanais: Bird & Bamber, 2013: 12 (new genus and diagnosis, synonymisation of several *Paratanais* species, see below); 12–16 (remarks on *A. malignus*); 16–20 (description of *A. timutimu*); Tzeng & Hsueh, 2014a: 52–57 (description of *A. lenoprimorum*).
Paratanais Dana: Sieg, 1981: 1271; Guţu & Ramos, 1995: 39; Larsen, 2001: 368; Larsen *et al*, 2012: 34; only for *A. spinanotandus*, *A. denticulatus*, *A. malignus*, and *A. vicentetis* respectively.

Type species. *Aparatanais spinanotandus* (Sieg, 1981)

Composition in area. *Aparatanais malignus* (Larsen, 2001) [NSW]; *A. timutimu* Bird & Bamber, 2013 [NZ].

Remarks. This genus was recently split from *Paratanais,* based largely on the presence of a highly robust pectinate or multifurcate spine on article-2 of the maxilliped palp, a kukri-shaped spine on the cheliped palm and (relative to most *Paratanais* species) short uropods (Bird & Bamber, 2013).

Aparatanais tetradonta sp. nov. (Figures 26–28)

Diagnosis. *Female*. *Carapace* entire. *Pleonites 1–4* with epimeral circumplumose seta. *Maxilliped* palp article-2 medial spine with four projections. *Cheliped* palm 1.6 times ltb, with one anterior spine. *Pereopod-1* merus elongate, longer than propodus. *Uropod* endopod 1.4 times longer than peduncle.

Male unknown.

Etymology. From the Greek τέσσερα (tessera) 'four' and δόντι (donta) 'teeth', alluding to the maxilliped palp spine.

Material examined. Holotype: non-ov. ♀, 3.1 mm, K2011-47-2, AIM MA70103, swim-through and sheer rock walls, including yellow sponge from rock wall on roof of swim-through, 21 m, south west side of Nugent Island (Raoul Island), 29° 13' 54" S 177° 52' 13" W, coll. S.J. Keable and A. Reid, 17 May 2011.

Paratypes (by island group): Raoul: one non-ov. ♀, K2011-3-2, P.87395; one non-ov. ♀, K2011-23-4, P.87387; one non-ov. ♀, K2011-42-1, P.90999; one ov. ♀, K2011-42-2, P.90998; two manca-III, 15 non-ov. ♀♀ (one partially dissected on two microslides), one ov. ♀, K2011-47-2, AIM MA70266.

Macauley: one non-ov. ♀, K2011-70-3, P.87403.

Description. *Female (non-ovigerous)*. *Habitus* (Figure 26A) fairly slender, 6.3 times ltb (extended); length 1.7–3.7 mm (n=20). *Cephalothorax* just longer than broad, longer than pereonites 1–2 combined. *Pereon* with all pereonites shorter than broad, pereonite-1 shortest, pereonites 2–3

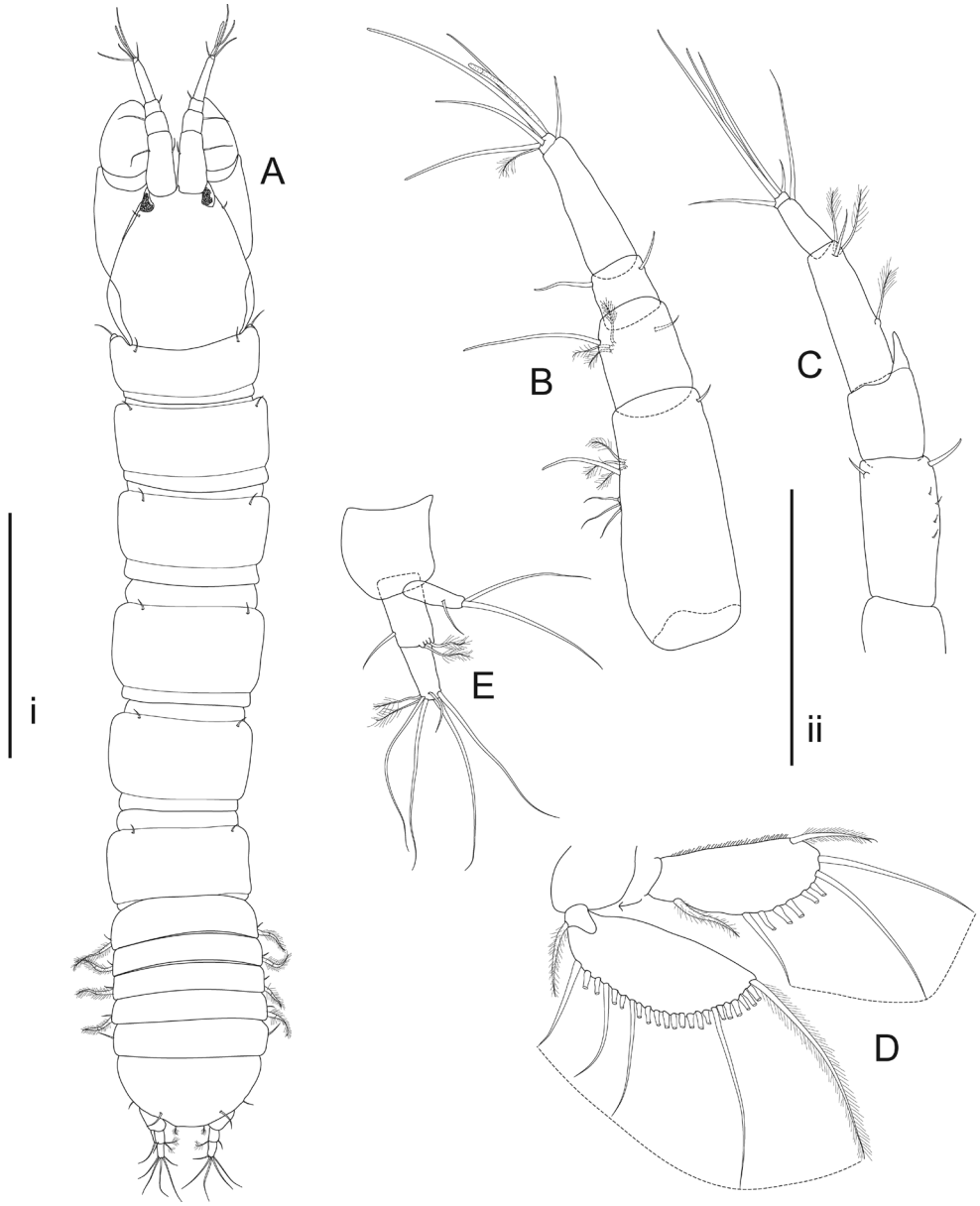

Figure 26. *Aparatanais tetradonta* sp. nov., female (holotype): *A* habitus. Female (paratype, AIM MA70103): *B* antennule; *C* antenna; *D* pleopod; *E* uropod. Scale bars: i: *A*, 1 mm; ii: *B*–*E*, 0.25 mm.

subequal, pereonite-4 longest. *Pleon* as long as broad, about 17% of body length. *Pleotelson* just longer than or equal to pleonites 4–5 combined, with two posteriolateral setae, two posteriodorsal setae and two posterior PSS.

Antennule (Figure 26B) about 0.9 times as long as cephalothorax, five times ltb; article-1 about as long as articles 2–4, setation typical; article-2 as long as broad; article-3half as long as article-2, shorter than broad; article-4 as long as articles 2–3 combined, with distal seta; cap-like segment with four simple setae, one aesthetasc and one PSS. *Antenna* (Figure 26C) article-1 naked; article-2 not inflated, twice as long as broad, twice as long as article-3, with setulate superior margin, superodistal seta, and small inferodistal seta on small apophysis; article-3 just longer than broad, with acute superodistal spine; article-4 just shorter than article-2, with proximal PSS, other setation as figured; article-5 less than half as long as article-4, twice as long as broad, with long distal seta; article-6 cap-like, with four long and one short seta.

Labrum (Figure 27A) distally setulate, typical. *Mandibles* typical, lacinia (Figure 27B) broad and distally crenulate. *Maxillule* (Figure 27C) with nine terminal spines, typical. *Maxilla* (Figure 27D) subtriangular, featureless. *Maxillipeds* (Figure 27E,G) typical, basis with seta about as long as endite; endites with mediodistal spines rounded, relatively small, medial seta as long as endite; palp article-2 lateral seta shorter than article, medial margin with long stiff seta, one weakly serrulate spine and four-cusped stout spine (Figure 27F); article-3 with medial apophysis bearing three serrulate setae, with one inner (oral) serrulate seta; article-4 with proximomedial setules, one superior seta and five distal serrulate setae. *Epignath* not observed.

Cheliped (Figure 27H–K) with coxal sclerite extending to posterior margin of cephalothorax; basis times ltb, posterior lobe about 0.8 times length of anterior mass, latter with superodistal seta; merus typical, with inferodistal seta; carpus times 1.8 ltb, setation typical; chela just longer than, but just narrower than carpus, propodus 2.3 times ltb, palm 2.6 times longer than fixed finger; palm with two inferodistal setae, large kukri-shaped spine near articulation with dactylus, and stout superomedial serrulate spine fixed finger typical, with large distal tooth (brown); dactylus strong, with proximomedial spine, distally brown.

Pereopod-1 (Figure 28A) coxa with seta; basis arcuate, 4.7 times ltb, with superoproximal seta; ischium with small seta; merus elongate, 3.7 times ltb, with two small inferodistal setae; carpus 0.75 times as long as merus, 2.5 times ltb, with two superodistal setae (one large and blunt), one mediodistal seta, and one inferodistal seta; propodus as long as merus, with three unequal superodistal setae and one inferodistal seta; dactylus shorter than unguis, with accessory seta; unguis together with dactylus just shorter than propodus. *Pereopod-2* (Figure 28B) coxa with seta; basis broader than in pereopod-1, 3.9 times ltb, with superoproximal seta; ischium with seta; merus 1.5 times ltb, with inferodistal spine and seta (medial); carpus longer than merus, 1.7 times ltb, with superodistal seta (medial) and large serrulate spine, and two inferodistal serrulate spines; propodus just shorter than merus and carpus combined, with two unequal superodistal setae and

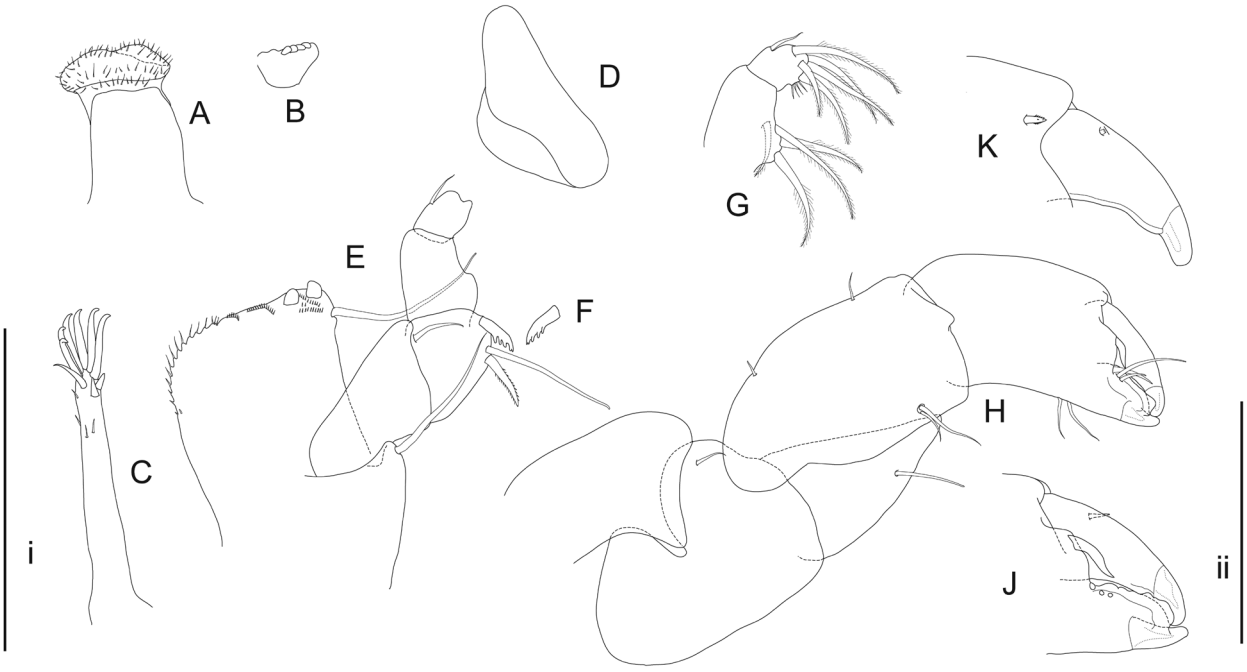

Figure 27. *Aparatanais tetradonta* sp. nov., female (paratype, AIM MA70103 *A* labrum; *B* left mandible lacinia; *C* maxillule endite; *D* maxilla; *E* maxilliped, half, slightly displaced; *F* maxilliped palp article-2 spine; *G* maxilliped palp articles 3–4; *H* cheliped; *J* chela, distal; *K* cheliped propodus and dactylus, medial aspect. Scale bars: i: *A*–*G*, 0.25 mm, *H*, 0.5 mm; ii: *J*–*K*, 0.25 mm.

longer inferodistal seta; dactylus with accessory seta, shorter than unguis; unguis together with dactylus about 0.7 times length of propodus. *Pereopod-3* (Figure 28C) similar to pereopod-2 but slightly shorter overall and basis broader, 2.3 times ltb; dactylus and unguis shorter.

Pereopod-4 (Figure 28D) basis broader than in pereopods 2–3, twice as long as broad, inferodistal margin with one simple seta and two PSS; ischium with two unequal setae; merus sub-geniculate, with two inferodistal serrulate spines, and setulate inferior margin; carpus just shorter than merus, with superodistal seta and four distal serrulate spines, inferior margin with paired spinulate ridges; propodus longer than carpus, widest at midlength with superior PSS, with superodistal slender spine and two unequal inferodistal serrulate spines; dactylus and unguis claw-like, unguis half length of dactylus. *Pereopod-5* (Figure 28E) similar to pereopod-4. *Pereopod-6* (Figure 28F) similar to pereopods 4–5 but basis without PPS; propodus without superior PSS and with three slender superodistal spines.

Pleopod (Figure 26D) peduncle as long as broad; rami unequal in length and proportion; endopod 2.5 times ltb, with distomedial seta, proximolateral seta circumplumose, separated by gap from fringe of eight distolateral setae distalmost whip-like, and medial margin setulate; exopod larger, 2.7 times longer than broad, with small proximal article bearing seta, large article with fringe of 25 lateral plumose setae.

Uropod (Figure 26E) peduncle as long as broad; endopod two-segmented, 1.4 times longer than peduncle, setation typical; exopod one-segmented, 0.75 times length of peduncle and as long as segment-1 of endopod, setation typical.

Ovigerous female. Similar to non-ovigerous female but slightly dorso-ventrally compressed and with four pairs of oostegites; length 2.5–2.8 mm (n=2).

Manca-III. With rudimentary pereopods-6 and pleopods; length 1.4–1.5 mm (n=2).

Distribution and habitat. Herald Island, Milne Islets, Nugent Island, South Meyer Island [all Raoul group], and Macauley Island; 10–27 m, from cobble, coarse sand, rocks, and yellow sponge.

Remarks. *Aparatanais tetradonta* sp. nov. is very similar to *A. malignus* (from Sydney Harbour, NSW)

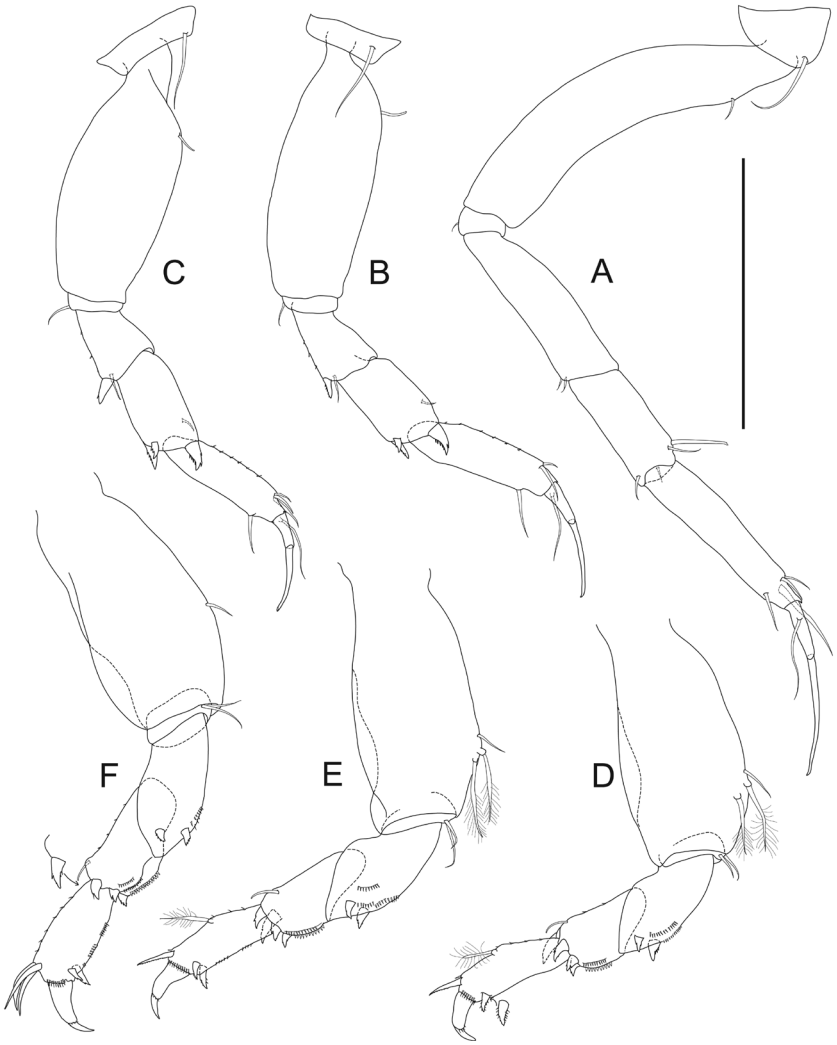

Figure 28. *Aparatanais tetradonta* sp. nov., female (paratype, AIM MA70103): *A–F* pereopods 1–6 respectively, with details of obscured setation. Scale bar: 0.25 mm.

but has fewer cusps on the modified palp article-2 spine, a more slender chela, more gracile pereopods 2–3, and longer uropod rami (endopod shorter than peduncle in *A. malignus*); it differs from the NZ *A. timutimu* in much the same characters. These data suggest that *A. malignus* and *A. timutimu* are a sister species and they (or a common ancestor) were a possible source for colonisation of the Kermadec Islands. No differences could be observed in individuals from the different island locations.

DISCUSSION

Subtropical in location and water-temperature regime, with an annual range 16–26°C (Brook, 1998), the Kermadec Islands are the antithesis of the relatively species-poor Subantarctic islands in terms of potential tanaidacean diversity (Bird, in prep.); this view would be confirmed if these peracarids follow some other marine invertebrates by exhibiting a latitudinal gradient in species diversity (e.g. Roy *et al.*, 1998). Yet 'only' six species were recorded during the Kermadec Biodiscovery Expedition 2011. All were recorded from the Raoul Island group, declining to two at the Cheeseman & Curtis Islands and three at L'Esperance Rock; this pattern (Table 2), mirrored in the total number of recorded invertebrate species, may be partly a consequence of uneven sampling effort (Keable & Reid, 2015) but geological age, remoteness, and habitat area are other factors to consider.

The most common species was *Zeuxo kermadecensis* followed by *Leptochelia acrolophus* although only the former was found at all four island groups along with the fourth-ranked species, *Paradoxapseudes floppae*. Two samples (K2011-42-4, K2011-23-4) from the Raoul Island group each contained four species: *Aparatanais tetradonta*, *Leptochelia acrolophus*, *Paradoxapseudes floppae*, and *Zeuxo kermadecensis*. Two of the genera, *Metatanais* and *Tanais*, are new records for the New Zealand region and *Paradoxapseudes* is represented by a defined species rather than as two undescribed *Gollumudes* species (Gordon, 2010), known from as far south as Campbell Island. The endemism level appears to be 100%, at least for the five named species.

As well as the overview of the Kermadec Biodiscovery Expedition 2011 fauna (Keable & Reid, 2015) other publications have dealt with some other groups, such as the maerid amphipods (Bopiah & Hughes, 2013) and sea cucumbers (O'Loughlin & Vandenspiegel, 2012). Brook (1998) gave an excellent summary of possible immigration routes for the molluscan fauna, who established that 19% of this group was endemic to the Kermadec Islands. Useful general accounts have also been presented by Morton (2004) and Trnski *et al*., (2010).

The region's hydrology is central to understanding the origins of the Kermadecian shallow-water fauna and likelihood of allopatric speciation. This hydrology is highly complex and variable (Brook, 1998; Trnski *et al* 2010) and the water masses/currents that impinge on the Kermadec Islands for ill-defined periods are the Southwest Pacific Gyre, Trade Wind Drift, East Australian Current (via the Tasman Front), and possibly offshoots from the East Auckland Current that arrives from New Zealand. The larval development times of some species carried from distant (700 km) putative sources by these systems would seem to be shorter than passage times to the Kermadec system (Trnski *et al*., *op.cit*.). It is likely that local recruitment will be the overwhelmingly dominant process in Kermadecian tanaidaceans, whose direct development and marsupial care are highly suited to this regime, *once a population has been established by other means*.

Stranding of algal flotsam is perhaps the most likely mechanism by which tanaidaceans (and other invertebrates with direct development) arrive at remote island groups (Highsmith, 1985, Martel & Chia, 1991; Morton & Britton, 2000; Bamber, 2012). This possibility of passive drift was reinforced to me recently when I examined two holdfasts from a mass of bladder kelp, *Macrocystis pyrifera* (L.) C. Agardh, stranded on Waikanae beach (Kāpiti, North Island, NZ) in April 2013. These complex holdfasts contained at least 91 specimens of *Zeuxoides rimuwhero* Bird, 2008 and 14 of *Paratanais paraoa* Bird, 2011; these common New Zealand forms are similar to two of the most common taxa in the Kermadecian fauna. Although the *nearest* source of this algal raft was only six kilometres away, across the Rauoterangi Channel on the infra-littoral fringe of Kāpiti Island, it was stated by Hobday (2000), in a fine study of the same kelp species in Californian waters, that such rafts may stay afloat for

Table 2. Summary distribution of Tanaidacea by island group in the Kermadec Islands, ranked by total abundance.

Taxon	Total	Raoul	Macauley	Cheeseman & Curtis	L'Esperance
Zeuxo kermadecensis	159	*	*	*	*
Leptochelia acrolophus	76	*	*		*
Aparatanais tetradonta	22	*	*		
Paradoxapseudes floppae	13	*	*	*	*
Metatanais progenitor	6	*			
Tanais sp.	1	*			

up to 100 days and many invertebrate taxa persist in them for considerable periods.

This study found a 100% endemism rate among shallow-water Kermadecian tanaidaceans, but this may be misleading. Ideally, the extent of any faunal relationship with the main islands of New Zealand should be further investigated but meaningful comparisons are currently hindered because published tanaidacean records from the warm northern region (essentially north of Auckland) are almost non-existent, especially for the littoral and shallow-sublittoral (Bird, 2008, 2011; Bird & Bamber, 2013). There appear to be no published records of tanaidaceans from Norfolk Island and Lord Howe Island (Ponder *et al*, 2002: 77), both of which are potential sources of immigrant species to the Kermadec Islands chain (Brook, 1998; Trnski *et al*., 2010).

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