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A new deep-sea crustacean family of Tanaidacea is established from Aotearoa New Zealand and Southeast Australia based principally on morphology

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We establish a new deep-sea tanaidacean family, Arthruridae n. fam., separated from the family Tanaellidae Larsen and Wilson, 2002, and based on a morphology-based phylogenetic analysis. This new taxon is supported by molecular evidence from a recent study of the newly described Caudalongidae Błażewicz & Bird 2024. Arthrurids resemble tanaellids such as *Tanaella* Norman & Stebbing, 1886 with their robust bodies, or *Arhaphuroides* Sieg, 1986 with their fused projecting uropod exopod, but also exhibit some agathotanaid-like features. These include the pereonite shape, pleon-pleotelson configuration, and pereopod morphology that are absent in the more diverse Tanaellidae, but arthrurids have a more plesiomorphic cheliped-cephalothorax articulation compared to those in the Agathotanaidae Lang, 1971. A large epignath seta, large coxal sclerite on the cephalothorax, and sticklike pereopods are among characters distinguishing the Arthruridae from most tanaellids. Two new genera are established, *Arthruropsis* n. gen. and *Paralibanius* n. gen., with the former tanaellid *Arhaphuroides bombus* Larsen, 2005, transferred to *Arthruropsis* n. gen. Six new species from bathyal New Zealand waters are described, *Libanius concertator* n. sp., *L. intonsus* n. sp., *L. largitas* n. sp., *L. projectus* n. sp., *L. tangaroa* n. sp., and *Paralibanius taitonga* n. sp., along with three from the southeastern Australia slope, *Libanius australis* n. sp., *L. brevicarpus* n. sp., and *L. clisicola* n. sp. We provide a key to the 13 known arthrurid species.

Keywords Arthruridae, Deep-sea, New genera, New species, Tanaellidae, Taxonomy

Among the many invertebrate groups living in deep-sea sediments are the abundant peracarid crustaceans, composed principally of amphipods, isopods, cumaceans, and tanaidaceans. Yet, the tanaidaceans "belong to the most highly underestimated deep-sea organisms"[1]. Among these is the frequently recorded family Tanaellidae Larsen and Wilson, 2002[2] that currently includes the genera *Araphura* Bird and Holdich, 1984[3], *Arhaphuroides* Sieg, 1986[4]; *Arthrura* Kudinova-Pasternak, 1966[5], *Inconnivus* Błażewicz-Paszkowycz and Bamber, 2012[6], and *Tanaella* Norman and Stebbing, 1886[7]. Larsen and Wilson[2]established this family based on a morphology-based phylogenetic analysis using 52 characters of the contemporary paratanaoidean genera, but it was considered by them to be a 'weakly supported clade'[2]. It was distinguishable from the then new family Colletteidae Larsen and Wilson, 2002[2]principally having species lacking a coxa on pereopods 4–6, these being present in the colletteids although this character is surprisingly difficult to identify with light microscopy and may exhibit overlooked structural diversity. The Tanaellidae appears to be morphologically and genetically heterogenous[8] and its component genera are probably polyphyletic, with apparent disparity especially among the *Araphura-Arhaphuroides* complex[6].

Arthrura itself has a complex taxonomic history and is currently represented by five described species[9]. Four of these were originally assigned to the agathotanaid genus *Paranarthrura* Hansen, 1913[10] or the genus *Libanius* Lang, 1971[11], although the latter was initially classified in the Paratanaidae by Lang[11] who recognised that the cheliped-cephalothorax attachment was non-agathotanaid in character. *Libanius* was synonymised with *Arthrura* by Sieg and Zibrowius: 1988) [12]seemingly based on the shared character of a pair of bifid terminal

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spines on the maxillule endite ('maxilla-1' in their terminology), although the maxillular spines figured by Lang[11]Figs. 16a–c, 20 g–h) appear coarsely pectinate rather than bifid.

Undoubtedly, the general and detailed morphology of *Arthrura sensu lato* does resemble that of *Paranarthrura*, particularly with respect to pereonite shape, the small and narrow pleon lacking pleopods in females, thin sticklike pereopods, *inter alia*, and it appears quite distinct from other tanaellid genera with which it was grouped in the phylogenetic analysis[2]. Its phylogenetics were not fully resolved previously and were conflicting with respect to the two species evaluated by these authors, *A. andriashevi* Kudinova-Pasternak, 1966[5] and *A. pulcher* (as *Libanius pulcher* Lang, 1971[11]), the former assigned to the family Tanaellidae and the latter to a poorly resolved Colletteidae. *Arthrura* is also a seldom-reported genus in the published literature, most records referring to *A. monacantha* from the South Atlantic, Scotia Sea, and Weddell Sea, at depths 385–4931 m[11,13–18]. In Aotearoa New Zealand (NZ) waters the genus has been recorded both as *Arthrura monacanthus*[sic.][19] and *Arthrura* sp.NZ#1[20].

The discovery of nine putative *Arthrura*-like morphospecies in Australian and NZ deep-sea waters has provoked a fresh look at their familial assignment. In this paper a monophyletic group is established as a new family, with support from morphological and previous molecular evidence[8] to include *Arthrura*, two new genera and nine new species. A partial analysis of Tanaellidae, centred on the NZ species, is the subject of a separate publication, but its generic composition is reduced here with the removal of *Arthrura* to a new family. The study also supports ongoing research on the fauna of the SE Australian slope[21,22].

Results

Morphological tree topology

For analysis A, a majority rule (MR50) consensus topology of 1000 trees (not figured) exhibited a typically low consistency index (CI)[23] of 0.2219 but nevertheless displayed the *Arthrura*-group species, together with *Arhaphuroides bombus*, as a sister clade to other tanaellids. A similar MR50 tree (Fig. 1) using tree-bisection-reconnection (TBR), and Accelerated transformation settings (ACCTRAN) yielded a higher CI value, 0.3828 and supported the former's essential topology yet implying a remaining significant level of homoplasy. Topologies within the non-*Arthrura* Tanaellidae will be described elsewhere and supported by a more pertinent/focused character-state suite, although it is probable that this ingroup is split into two clades, one composed predominantly of *Araphura* species and the other of *Tanaella/Arhaphuroides*-related taxa. This is supported by a recent molecular analysis[8] based on 18 S rRNA and COI-markers of eleven deep sea tanaidomorphan families, where it was considered that the genera *Araphura*, *Arthrura*, and *Tanaella* (via their representative species) might constitute separate families.

Synapomorphies for the *Arthrura* ingroup appear to be limited to the large epignath and long carpus of pereopods 1–3, along with characters shared with agathotanaids such as a small and narrow pleon-pentagonal pleotelson combination, (a consequence of reduced musculature because of lack of the pleopods), and relatively narrow/stiff pleopods carried only by males. These differences, plus those summarised in Table 1; Fig. 2, are sufficient to split the *Arthrura* group from the Tanaellidae and establish a new family – see below.

A further analysis of the *Arthrura*-group (B) revealed a slightly different topology of the *Arthrura* clade, with a heuristic search MR50 consensus of one tree (Fig. 3) and CI of 0.7221 and RCI of 0.4422. A NZ species, *Paralibanius taitonga* n. gen. n. sp. (see below) appears to be basal to the remaining *Arthrura*-like clades, yet it has the apparent synapomorphy of anteriad-attached chelipeds (see below). The type species for the genus, *A. andriashevi*, also appears to be distinct from the other morphospecies, as is the tanaellid *Arhaphuroides bombus*.

The remaining species are divided into two clades: a main group including the two described *Libanius* species (Figs. 1 and 3 as *L. monacanthus* and *L. pulcher*) and the others containing five species from New Zealand. The latter group is characterised by a short antenna article-3 dorsodistal seta, relatively short cheliped fixed finger (cf. palm), intermediate-length pereopod-1 merus inferodistal spine, two pereopod-1 carpal setae, very thin pereopod-4 [> 12 L: W], geniculate/arcuate uropod peduncle, stout uropod endopod (only *L. monacanthus* and *L. pulcher*) and exopod, the latter being relatively short compared to the former. The sister clade consists of the three Australian morphospecies, based on their relatively long pleotelson [≥ 9% BL], intermediate-length antennule, long cheliped basis compared to the merus [> 1.4×], the pereopod-2 propodus longer than either carpus or merus, the pereopod-4 propodus about as long as carpus, and simple (not geniculate/arcuate) uropod peduncle. Apart from *Libanius largitas* n. sp. (see below), the NZ species also have slightly more slender posterior pereopods (represented by pereopod-4), i.e. 12–14.4 L: W, compared to 9.2–11 L: W.

This tree is used support the following generic attributions within the new family, albeit with modifications based on some observed synapomorphies.

Taxonomy

Family Arthruridae n. fam

LSID urn: lsid: zoobank.org:act:1C11F461-89D8-4721-9B78-81E78F3EE4FA

Diagnosis

Cuticle well calcified, ornamented and often shiny, white, and brittle. *Carapace* flask-shaped or domed-capsule ("egg-shaped,"[5]); eyelobes absent or reduced, optical elements absent; rostrum shallow but acute. *Pereonites* lateral margins with supracoxal projections, more rarely smoothly convex; pereonite-1 weakly trapezoidal [narrower posteriad], with or without hyposphenium. *Pleon* narrower than pereon and pleotelson, or about equal; pleonites well-defined or slightly obscure; epimeral setation sparse, with setae at least on pleonite-5. *Pleotelson* pentagonal ["agathotanaoid"] or sub-cupiliform [cf. "cupiliform"[7]). *Antennule* four-articled; article-1 without distomesial seta; article-2 weakly overlapping article-3, shorter than articles 3–4 combined. *Antenna*

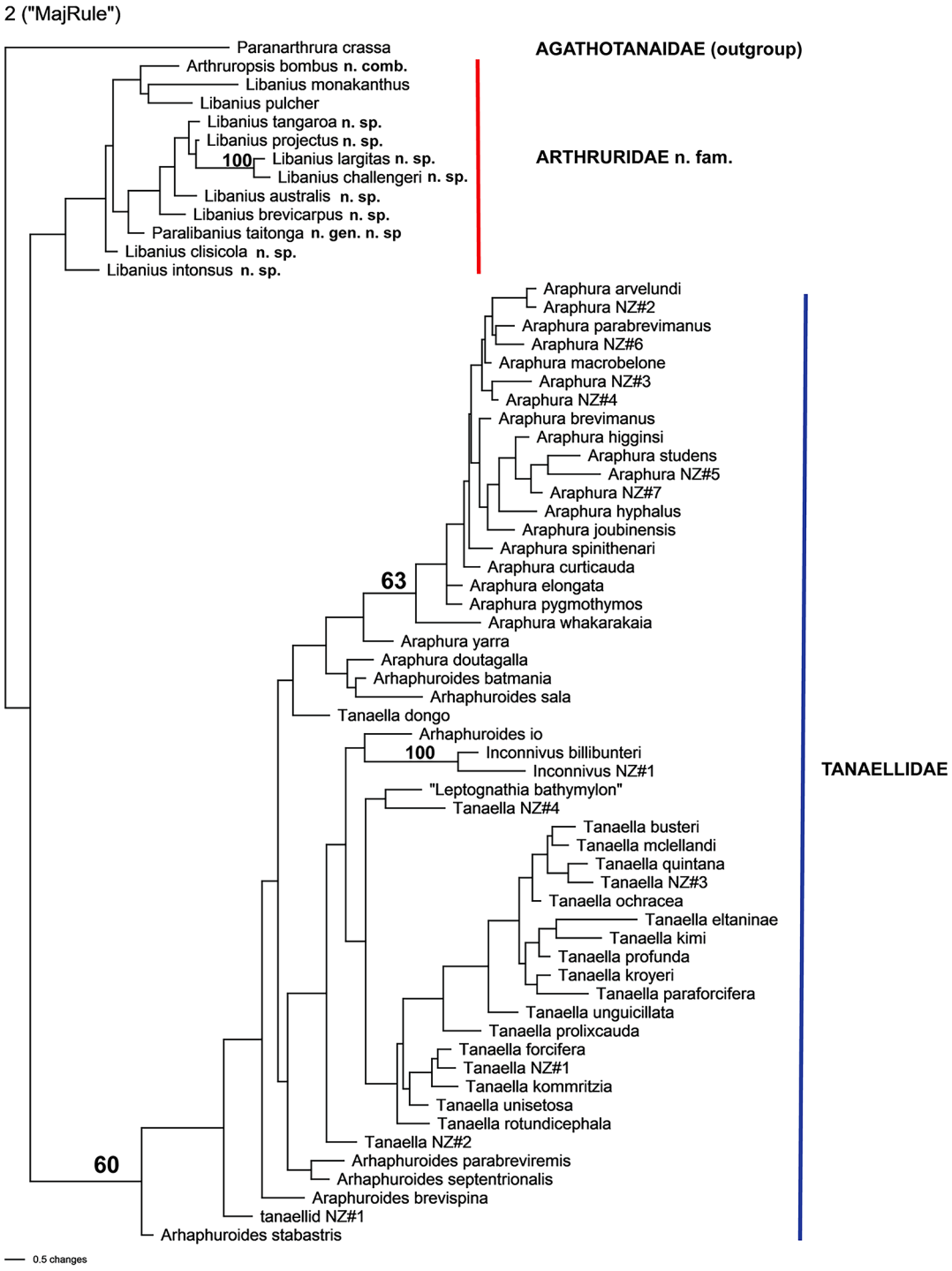

Fig. 1. Representative cladogram of the family Tanaellidae *sensu* Larsen and Wilson (2002)[6] based on a PAUP heuristic analysis using TBR, ACCTRAN, 63 taxa (Table 2) and 98 characters; majority rule-50 consistency index 0.3828. Bootstrap values shown next to branches. New taxon names added retrospectively after analysis.

six-articled; article-2 longer/larger than article-3, with dorsodistal seta, with or without distolateral seta; article-3 with dorsodistal seta; article-4 without fusion line. *Mandible* molar cylindrical, apex coronal or palmate/subcoronal, with > five terminal spines and/or tubercles. *Maxillule* endite with seven or eight terminal spines, at least one bifid or pectinate. *Maxilliped* bases together chordate or cuneate, with weak medial ridge proximally setose, or naked; endites not fused, with two distal low-rounded tubercles ['gustatory cusps'[24]) and one or two setae. *Epignath* with large terminal seta. *Cheliped* with posterodorsal attachment to cephalothorax, *via* large sclerite extending to posterior of carapace; basis with posterior lobe; chela fixed finger with two ventral setae, incisive margin without proximal diastema and process; dactylus dorsal margin smooth, ventral margin without

Character	*Arthrura*-group	Tanaellidae
Cephalothorax shape	domed capsule [or flask]	flask or 'lozenge'
Pereonite lateral margins	with supracoxal process	smooth, convex
Pleon W	narrower than pereon/ pleotelson	as wide as pereon/pleotelson
Pleotelson shape	pentagonal [or sub-cupiliform]	cupiliform, truncate or regular
Antenna article-4	entire (Fig. 2A)	entire or with fusion line (Fig. 2B)
Epignath distal seta	large, setulate (Fig. 2C)	relatively small (Fig. 2D)
Cheliped chela shape	subparallel margins (Fig. 2E)	subparallel or flared margins (Fig. 2F)
Pereopod-1 propodus L	merus only shorter except monacanthus	merus and carpus shorter
Pereopods 2–3 L: W	sticklike, > 12	rarely sticklike
Pereopods 2–3 merus L: W	most slender, > 2	most not slender or stout, < 1.4
Pereopod-2 carpus L: W	very slender, > 3 (Fig. 2G)	stout, < 2 or slender, < 3 (Fig. 2H)
Pereopods 2–3 propodus inferodistal spines	1 or 2 (spines/spine and seta)	1
Pereopods 4–6 form, L:W	most sticklike, > 10	rarely sticklike
Pereopods 4–6 carpus L: W	slender, > 2.5	rarely slender
Pleopods in female	absent	present or absent
Pleopods configuration	tent-like, stiff/oar-shaped	not-tent-like, flexible/oval
Uropod endopod segments	2	1 or 2
Uropod exopod [fused]	well-developed	well-developed or reduced

Table 1. Principal characters distinguishing *Arthrura*-group and Tanaellidae species.

proximal process, with/without peglike spines. *Pereopods 1–6* sticklike. *Pereopods 1–3* merus shorter than carpus and propodus, with one inferodistal spine; carpus very slender (> 3 L: W), with three slender distal spines and one or more setae; pereopod-1 propodus with two inferodistal spines (one mesial and weaker). *Pereopods 4–6* ischium with two short setae, rarely one; merus slender (> 1.5 L: W); carpus slender (> 2 L: W) with three slender distal spines and one seta; propodus with superior plumose sensory seta (PSS) [pereopods 4–5 only] and one or two (pereopod-6) slender superodistal spines. *Pleopods* absent in female; present in non-swimming males, straplike, in tent-like configuration; rami without proximal setae. *Uropod* exopod fused with peduncle, well-developed, oblique from or proximate to endopod; endopods bisegmented, or unisegmented, axial to peduncle, not forcipate.

Type genus
Arthrura Kudinova-Pasternak, 1966[5].

Other genera
Libanius Lang, 1971[11], *Arthruropsis* n. gen., *Paralibanius* n. gen.

Etymology
From first-described genus *Arthrura.*

Invariant-implicit characters
Carapace usually with small seta adjacent to eyelobes. *Pereonites* all shorter than broad, at most equal. *Antenna* article-1 naked. *Labium* outer lobes much reduced or absent. *Labrum* truncate in dorsal or ventral view, hood-like, distally setose. *Maxilliped* endites subrectangular, weakly flared, each with setulate distolateral corner; palp article-1 without setae; article-2 with lateral seta and three mesial setae, simple and variously pinnate/pectinate; article-3 with four mesial setae (two small, two large) except *A. bombus* (three setae); article-4 with one subdistal and five terminal setae. *Cheliped* smooth, without crenulation or nodules; sidepiece naked; merus with one ventral seta; carpus with two ventral setae, usually with single proximo- and dorsodistal setae; palm with near-parallel dorsal and ventral margins, and distolateral spine near dactylus attachment; fixed finger with three setae on lateral incisive margin; dactylus with proximomesial spine. *Pereopods 1–3* coxa annular, with distal seta; ischium with one short seta. *Pereopod-1* carpus setae short; claw L similar to pereopods 2–3. *Pereopods 4–6* merus with two slender inferodistal spines; propodus with two inferodistal spines and short acuminate process above dactylus attachment. *Uropod* extending beyond pleotelson.

Remarks
The nine *Arthrura*-like morphospecies from NZ and SE Australian waters form part of this family-level taxon that can be distinguished from the tanaellids. As mentioned above, Tanaellidae is a precariously defined family with considerable morphological diversity and the genus *Arthrura* is a clear outlier in this respect (Fig. 1). In the recent account of the new family Caudalongidae Błażewicz and Bird, 2024[8] based on both morphological and molecular methods analysed with Bayesian inference and RaxML maximum likelihood analysis, four undescribed *Arthrura* species formed a clade excluding several *Tanaella* species, with robust statistical support indicated by a bootstrap value of 0.76 and posterior probability of 1 in the Bayesian analysis In that study, the

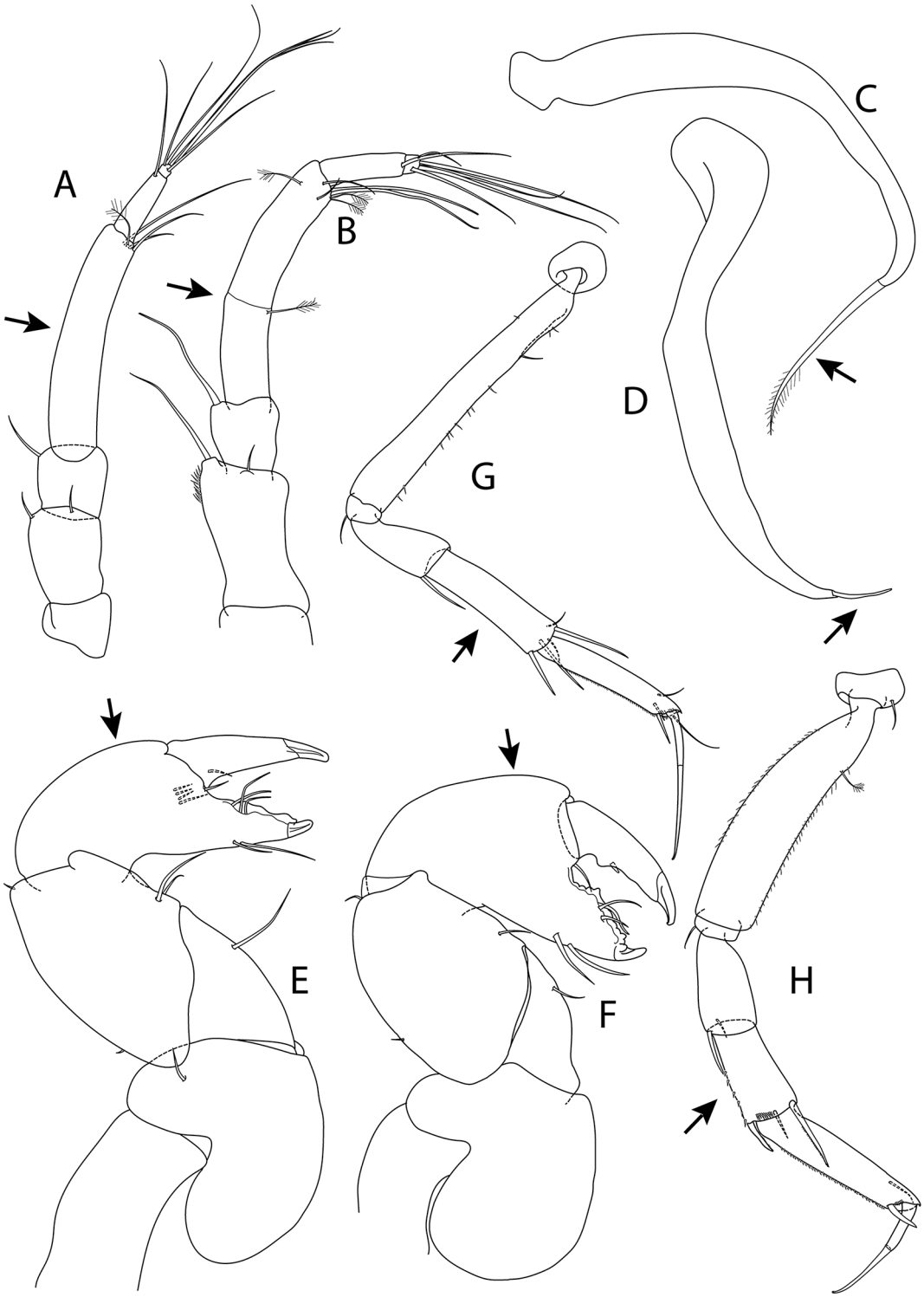

Fig. 2. Four salient morphological differences between Arthruridae n. fam. and Tanaellidae, represented by the antenna, epignath, cheliped, and pereopod-1 of *Libanius projectus* n. sp., A, C, E, G respectively, and *Tanaella unguicillata* (from BIOICE Stns 2403 and 2844), B, D, F, and H, respectively. Not to scale.

phylogenetic value of the cheliped sclerite was emphasised. Arthrurids have a relatively large version that extends to the posterior margin of the carapace, which contrasts with that of core tanaellids (such as *Tanaella*) where it is usually narrower and often partly obscured (Fig. 4; Błażewicz et al. 2024[8]: Fig. 5A; Table 2). Arthruridae n. fam. also shares more characters with Agathotanaidae (e.g. the genera *Paragathotanais* Lang, 1971[25] and *Paranarthrura*) such as the pleon-pleopod-pleotelson configuration mentioned previously (apomorphic relative to tanaellids?), and generally 'sticklike' pereopods (plesiomorphic?). It retains what might be inferred as a

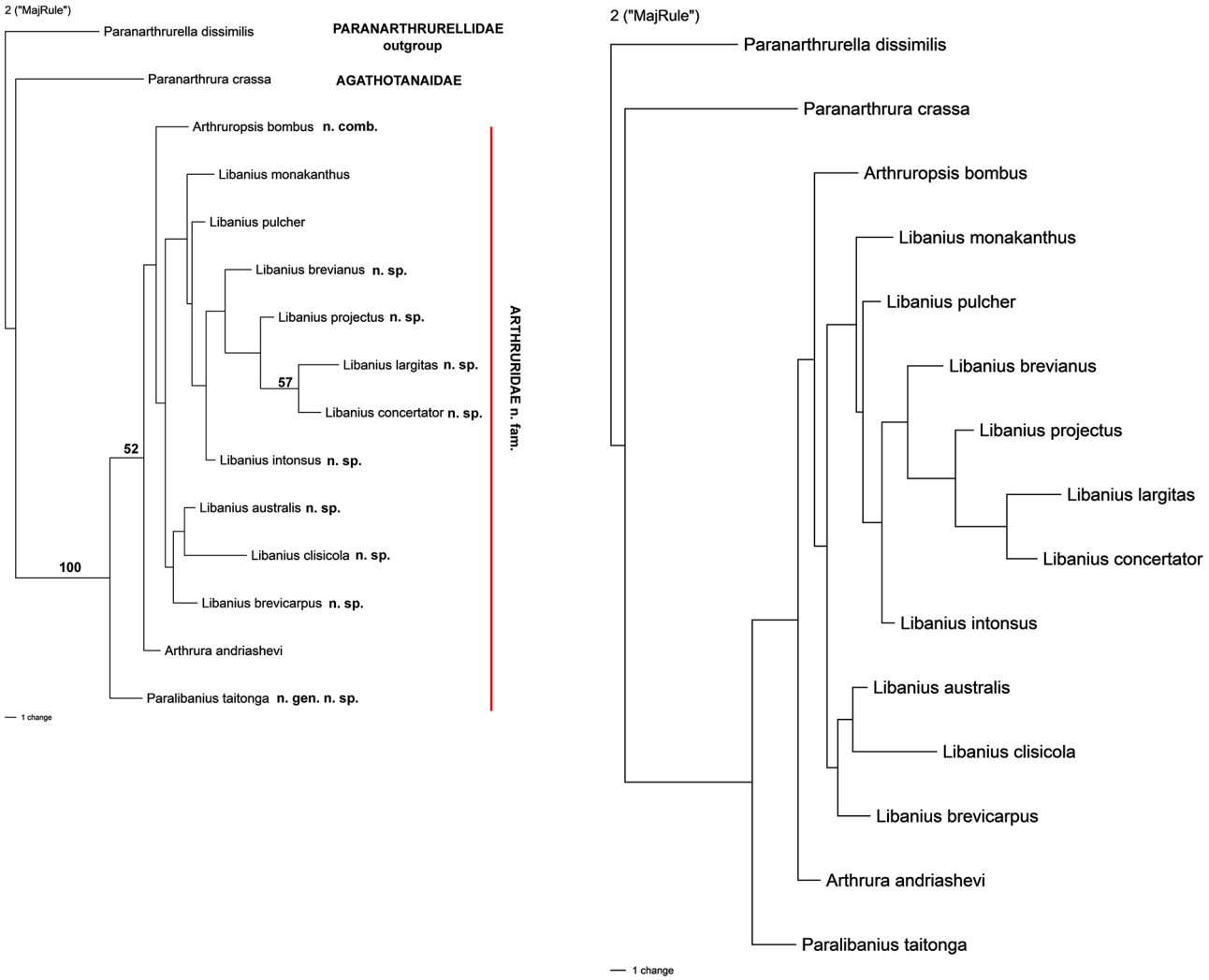

Fig. 3. Representative cladogram of the *Arthrura*-group based on a PAUP heuristic analysis using TBR, ACCTRAN, 15 taxa and 98 characters; majority rule-50 consistency index 0.7221. Bootstrap values shown next to branches. New taxon names added retrospectively after analysis.

more plesiomorphic mandible morphology (a non-reflexed and complex molar) and an anaxial cheliped-cephalothorax articulation (the cheliped basis with a free posterior lobe; 'proximalen Vorsprunge'[11]). Other paratanaoideans have a similar pseudo-agathotanaid combination of characters, such as the caudalongids: *Caudalonga* Larsen, 2005[26], *Facultatotanais* Błażewicz and Bird, 2024[8], *Macrinella* Lang, 1971[11], *Pseudoarthrura* Larsen, 2005[26], and *Universitatotanais* Błażewicz and Jakiel, 2024[8], but with an unfused, or at least only partly fused uropod exopod, and smaller, dorsally located sclerite (Błażewicz et al. 2024: Fig. 6A; Table 2)[8]. The shape of the cheliped palm is also distinct from many tanaellids, particularly those of *Tanaella* and *Araphura*, with sub-parallel dorsal and ventral margins, a form seen widely in other paratanoidean families such as Leptocheliidae Lang, 1973[27], Paratanaidae Lang, 1949[28], Pseudotanaidae Sieg, 1976[29], and Typhlotanaidae Sieg, 1984[30]. A more distally flared palm is expressed in the Akanthophoreidae Sieg, 1986[15] and Tanaellidae (see above).

A notable diagnostic character of the Arthruridae is the large maxilliped epignath with a prominent distal seta (Fig. 2C); in a few preserved specimens this can be seen protruding from the posterior dorsolateral branchial openings on the cephalothorax (e.g. Figure 22A). This was emphasised as a unique character among the Paratanaidae [sic.] by Lang (1971[11]: 389) in his description of the genus *Libanius*. It now serves as a family diagnostic.

Along with this level of morphological distinctiveness from other families is variation within the existing and novel species that can be hypothesised as genus-level clusters. The new family, Arthruridae, is here established to hold four genera (two new) and 13 species (one a new combination, nine new). Although the type species *Arthrura andriashevi* (and now the type genus) is relatively poorly described, and the holotype consists only of an appendage-less body (and no cephalothorax), the decision to use the name is pragmatic should future studies synonymise any of the newly-described or restored genera (such as *Libanius*) with *Arthrura*.

***Arthrura* Kudinova-Pasternak, 1966.**

Arthrura Kudinova-Pasternak, 1966.—Kudinova-Pasternak (1973)[31]: 162, *non Arthrura s.s.* (=*Armatognathia* Kudinova-Pasternak, 1987[32]).
Libanius Lang, 1971.—Sieg and Zibrowius (1988)[12]: 193.
Paranarthrura Hansen, 1913.—Vanhöffen (1914)[13], as *Paranarthrura monacanthus.*

Diagnosis
Adapted from Kudinova-Pasternak[5]. Arthrurid **with cephalothorax < 20% BL** [except *Paralibanius* n. gen., see below). *Pereonites* with supracoxal projections; with hyposphenium on pereonite-1. *Pleon* narrower than pereon and pleotelson; pleonites distinct. *Pleotelson* pentagonal. *Antennule* intermediate relative to cephalothorax L [≈0.75 L: W]; article-1 slender [>3 L: W]. *Antenna* article-2 shorter than broad, only slighter longer than article-3, dorsal margin simple; article-3 dorsal seta shorter than article; article-5 intermediate L [2.7 L: W]. *Mandible* molar coronal, with blunt and sharp tubercles. *Maxillule* endite with two bifid spines. *Maxilliped* bases without medial setulate process. ***Cheliped* carpus dorsal margins spinulate**. *Pereopod-1* thin sticklike [≈15 L: W] overall. *Pereopod-1* (at least) basis with setulate superior margin; merus inferodistal spine long [=article L); propodus with distolateral slender spine (superodistal seta overlooked?). *Pereopods 2–3* carpus with one distal

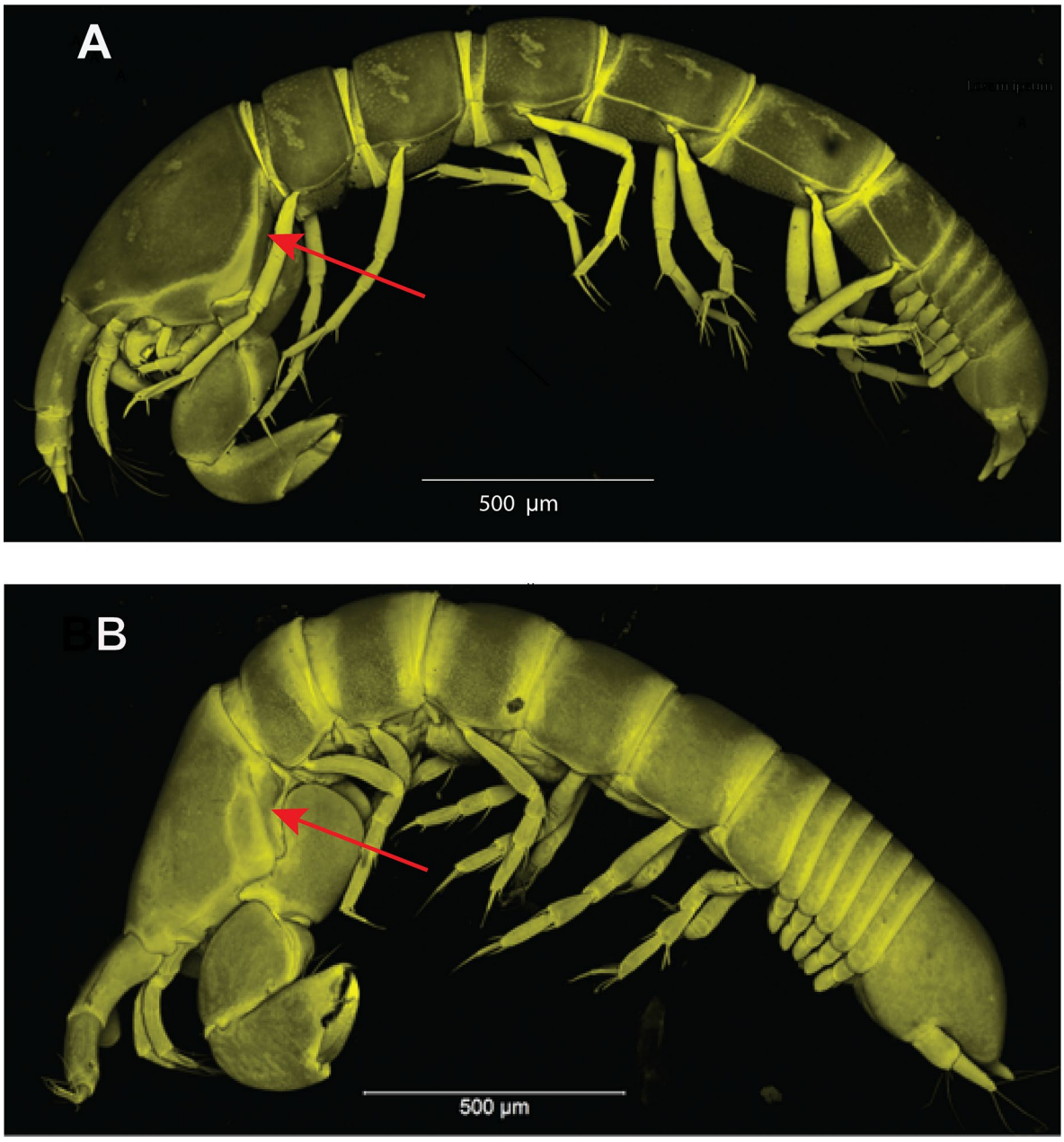

Fig. 4. Confocal images of A, an *Arthrura* sp. (Kurile-Kamchatka Trench) sp.; B, an *Tanaella* sp. (North Atlantic) in lateral view; red arrows indicate the cheliped-cephalothorax sclerite.

seta. *Pereopods 4–6* claw clearly longer [> 1.2×] than propodus. *Uropod* longer than pleotelson; peduncle simple; endopod bisegmented, L:W intermediate [3–5 L: W]; exopod divergent from endopod.

Type species
Arthrura andriashevi Kudinova-Pasternak, 1966[5], by original designation.

Geographic range
North Pacific, East Pacific.

Bathymetric range
Abyssal, 4000–6085 m.

Remarks
This type species remains enigmatic and not fully-described, yet it usually falls into its own clade in iterations of morphological phylogenetic analyses by a combination of characters that exclude the apparent synapomorphy of a spinulate margin on the cheliped carpus. The synonymy of *Libanius* is not definitive and here *Arthrura andriashevi* is retained as the only species in the genus. In her description of *A. andriashevi*, Kudinova-Pasternak referred to both specimens as 'females without oostegites' although the larger is certainly a male, having pleopods. In arthrurids, females lack pleopods and these only start to develop in juvenile males, as in agathotanaids such as *Paranarthrura*. They were usefully illustrated and described for *A. monacantha*[15]. Vanhöffen's specimen (p.479, Fig. 16a)[13] is that of a juvenile male.

Arthrura andriashevi does not appear to have been recorded since its original discovery from two sites ≈ 3700 km apart: the Emperor Trough (North Pacific) at 6065 m depth, and the Sukuku Basin, SE of Japan, at 4000–4150 m (Kudinova-Pasternak 1966)[5]. Neither specimen was designated as a holotype, so the type locality of *A. andriashevi* is unresolved. This wide distribution, both geographic and bathymetric, appears unlikely but this could be resolved with the recovery of *Arthrura*-like species from these areas.

Another species, *Libanius longicephalus* Kudinova-Pasternak, 1978[33], currently listed under the genus *Arthrura*[8], has an articulated uropod exopod, excluding it from the Arthruridae. It is insufficiently described but the holotype (and only specimen) may be a juvenile male with undeveloped pleopods. However, the characteristic minute distal article on the exopod uropod (Fig. 6)[33] is similar to that observed in *Leptognathioides biarticulata* Bird, 2014[34] and *Portaratrum holdichi* Bird, 2014[34], but as Kudinova-Pasternak made no mention of a spur on the sternum of pleonite-5, we consider *Libanius longicephalus* a congener of the former genus, as *Leptognathioides longicephalus* n. comb.

***Arthruropsis* n. gen.**
LSID urn: lsid: zoobank.org:act:058460C1-2AEC-400E-AE74-AC3BA9B90C0A
Arhaphuroides.—Larsen (2005)[26]: 232–239, in part [for *A. bombus*].

Diagnosis
Arthrurid with *pereonites 1–6* lateral margins with supracoxal projections; pereonite-1 without hyposphenium. ***Pleon* as wide as pereon and pleotelson**; pleonites distinct. ***Pleotelson* sub-cupiliform**. *Antennule* long relative to cephalothorax [≈ 0.8×]; article-1 not slender [≈ 2.8 L: W]. *Antenna* article-2 slightly longer than broad, **with dorsodistal apophysis**; article-3 dorsal seta longer than article; article-5 fairly slender [3.7 L: W]. *Mandible* molar coronal, with low tubercles and longer spines. *Maxillule* endite with two coarsely pectinate ("multifurcate"[26]) spines. *Maxilliped* bases without medial setulate process. *Cheliped* basis posterior lobe reaching pereonite-1; carpus dorsal margin smooth. *Pereopods 1–6* basis smooth. *Pereopod-1* thin sticklike [≈ 15 L: W overall]; merus inferodistal spine long [= article L]; propodus with inferodistal spine and distolateral seta (superodistal seta overlooked?). *Pereopods 2–3* carpus with one distal seta. *Pereopods 4–6* thin, sticklike [≈ 11 L: W]; claw slightly longer [< 1.2×] than propodus. *Uropod* slightly longer than pleotelson; peduncle simple; **endopod unisegmented** (or weakly bisegmented), L:W intermediate [4 L: W]; exopod proximate to endopod.

Type species
Arthruropsis bombus (Larsen, 2005)[26] n. comb.

Etymology
A combination of the genus nomen *Arthrura* and the Greek suffix ὄψις '*opsis*,' suggesting affinity or likeness. Gender masculine.

Geographic range
Gulf of Mexico, Northwest Atlantic.

Bathymetric range
Bathyal, 658–677 m.

Remarks
Among the arthrurids, *Arthruropsis*is principally characterised by the wide pleon, a near-cupiliform (or at least non-agathotanaoid) pleotelson (Fig. 69[26]), an apparent lack of pleonal setation, relatively long antennule, the antennal article-2 with a dorsodistal apophysis, and weakly segmented (or unisegmented) uropod endopod.

Geographic separation and apparent isolation of *Arthruropsis bombus* from other arthrurids support evidence from morphology that is a distinct taxon from *Arthrura*, and *Arhaphuroides bombus* is now placed in this new genus. The genus *Arhaphuroides* belongs in Tanaellidae *sensu stricto* and can be difficult to distinguish from *Araphura* and is probably polyphyletic (Bird unpublished work).

***Libanius* Lang, 1971**.
Arthrura.—Gordon et al.. (2010): 224[19]; Kaiser et al.. (2018)[35]: 12, Table 6.

Diagnosis
Arthrurid with *cephalothorax* ≥ 20% BL. *Pereonites* with strong or weak supracoxal projections; pereonite-1 with or without hyposphenium. *Pleon* narrower than pereon and pleotelson; pleonites distinct or indistinct. *Pleotelson* pentagonal. *Antennule* not long relative to cephalothorax [< 0.8×] (except *L. concertator* n. sp., see below); article-1 fairly stout to slender [2–3.5 L: W]. *Antenna* article-2 longer than broad, dorsal margin simple; article-3 dorsal seta longer than article or not; article-5 fairly slender or slender [> 2.5 L: W]. *Mandible* molar coronal or subpalmate, with low tubercles and longer spines. *Maxilliped* bases usually with medial setulate process. *Cheliped* basis posterior lobe just short of, or reaching, pereonite-1; carpus dorsal margin smooth. *Pereopods 1–6* basis smooth. *Pereopod-1* thin, sticklike [> 12.5 L: W] overall; merus inferodistal spine intermediate or long [> distal width; = article L]; carpus with one or two distal setae; propodus with inferodistal spine and distolateral seta [except one species, see below]. *Pereopods 2–3* carpus with one or two distal setae; propodus with inferodistal spine. *Pereopods 4–6* stout to very thin sticklike [9.2–14.4 L: W]; claw slightly shorter to longer [< 1.2×] than propodus. *Uropod* shorter to longer than pleotelson; peduncle simple or arcuate/geniculate; endopod bisegmented, L:W usually stout or intermediate [< 5 L: W]; exopod divergent or proximate to endopod.

Type species
Libanius pulcher Lang, 1971[11], by original designation.

Other species
Libanius australis n. sp., *Libanius brevicarpus* n. sp., *Libanius clisicola* n. sp., *Libanius concertator* n. sp.; *Libanius intonsus* n. sp.; *Libanius largitas* n. sp.; *Libanius monacanthus*; *Libanius projectus* n. sp.; *Libanius tangaroa* n. sp.

Geographic range
Eastern Central Pacific, Subantarctic Southern Ocean, Southwest Pacific.

Bathymetric range
Bathyal–abyssal, 204–4052 m.

Remarks
The genus as defined here remains heterogenous at the scale of relatively minor or subtle morphological differences with more obvious variant characters being the presence/absence of a hyposphenium on pereonite-1, the length of the uropod exopod (shortest in *L. pulcher*), and presence/absence of setules on the basis of pereopods 1–3. It is distinguishable from *Arthrura* by the lack of spinules on the dorsal margin of the cheliped carpus, and longer cephalothorax (proportional to body length), and from *Paralibanius* n. gen. by the more posterior attachment of the chelipeds on the cephalothorax.

***Libanius australis* n. sp.**
LSID urn: lsid: zoobank.org:act:F799BCA8-902F-4B38-BDF2-113BA3F25C87
(Figs. 1, 3 and 5–7)

Type material
HOLOTYPE: non-ov. ♀, 5.5 mm, J.57786, SLOPE Stn 32. PARATYPES: 1 manca-3, 2 non-ov. ♀♀, 1 posterior frag. (non-ov. ♀) (most decalcified), J.57867, 1 non-ov. ♀ dissected on microslides, J.57,785, 1 ♂, ICUL.13160 (ex. J.57867), SLOPE Stn 32; 2 non-ov. ♀♀ (one in 2 pieces), 1 ov. ♀, J.57849, SLOPE Stn 33; 1 manca-2 in 2 pieces, 1 non-ov. ♀? (damaged anterior frag.), 1 juvenile (juv.) ♂, 1 ♂ (small), J.57850, SLOPE Stn 33; 1 manca-2, 10 non-ov. ♀♀, 1 anterior fragment (non-ov. ♀?), 1 juv. ♂, 1 ♂, J.39274, 1 ♂, ICUL13161 (ex. J.39273/4), SLOPE Stn 40; small non-ov. ♀ (decalcified), J.57898, SLOPE Stn 40; small non-ov. ♀ (decalcified), J.62707, SLOPE Stn 45; 1 non-ov. ♀ (decalcified), J.37859, SLOPE Stn 46.

Type locality
Tasman Sea, South of Point Hicks, Victoria, Australia, 1000 m.

Etymology
From the Latin adjective *australis* for 'southern', alluding to the Australian locality.

Diagnosis
Libanius with *cephalothorax* longer than pereonites 1–2 combined. *Pereonite-1* L: W intermediate [0.33 L: W], without hyposphenium; pereonite-6 not long [0.6 L: W]. *Pleon* just shorter than broad, pleonites distinct. *Pleotelson* L: W intermediate [≈ 0.7×], 0.8× pleon L. *Antennule* L intermediate relative to cephalothorax [≈ 0.7×]. *Antenna* article-2 2× article-3 L, distodorsal setae very short; article-4 fairly slender [4.1 L: W]. *Mandible* molar broad coronal. *Maxillule* endite with two coarsely pectinate spines. *Cheliped* basis not reaching posterior of

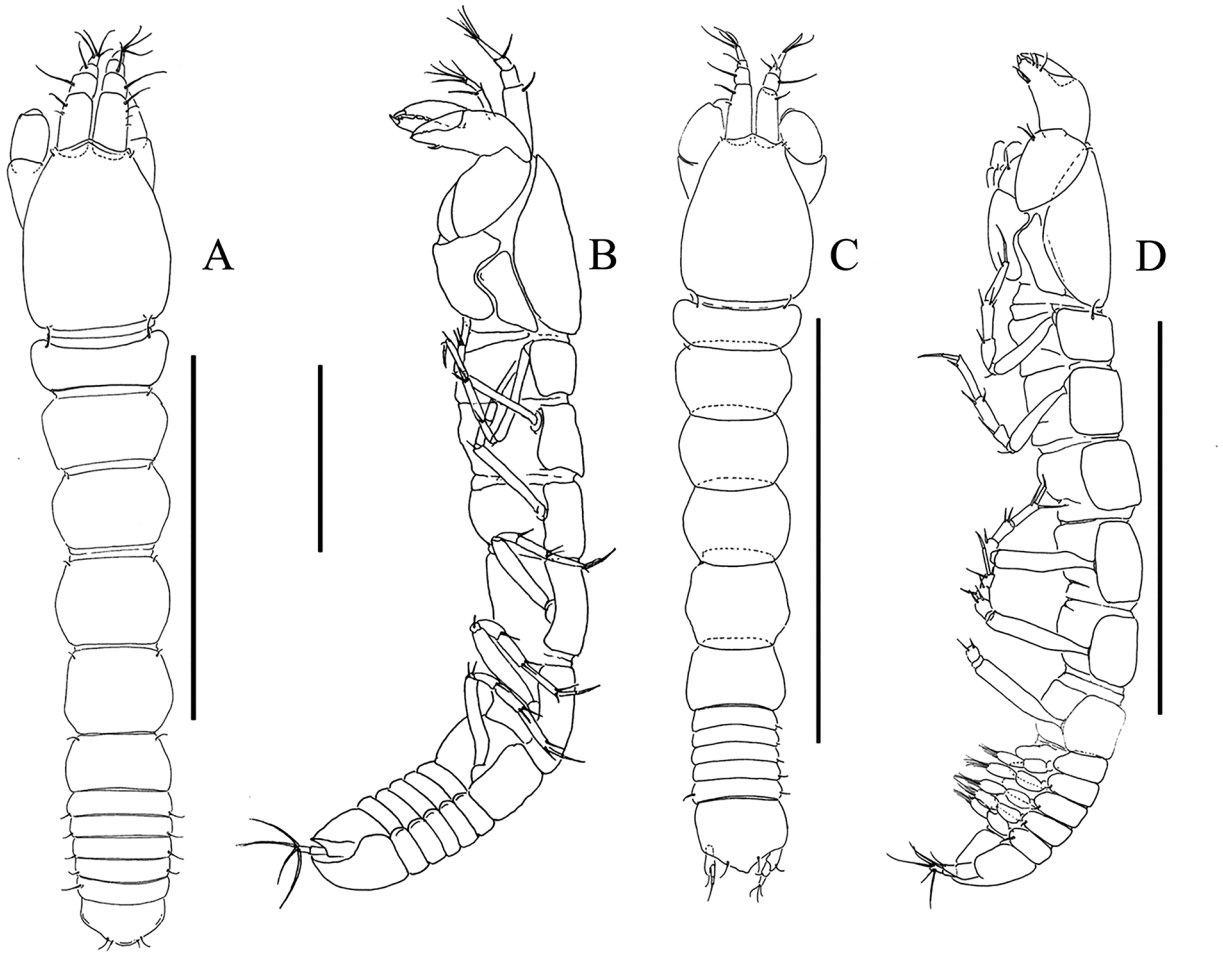

Fig. 5. *Libanius australis* n. sp., A–B, holotype non-ovigerous female, J.57786, dorsal and lateral; C–D, paratype male. Scale bars: 1 mm.

cephalothorax; basis much longer [≈ 1.6×] than merus; merus slightly longer [1.4×] than that of carpus ventral margin; chela L: W intermediate [≈ 2.3 L: W], slightly narrower than carpus, palm dorsal and ventral margins about parallel, with 5-spined mesial comb. *Pereopods 1–3* basis without groups of setules. *Pereopod-1* merus inferodistal spine as long as article; carpus L: W intermediate [3.7 L: W]. *Pereopod-2* carpus with one distal seta. *Pereopods 4–6* overall thin [≈ 11 L: W]; merus stout [1.5 L: W], much shorter than carpus [≈ 0.5×]; carpus slender [3.6 L: W]; claw ≈ propodus L. *Uropod* slightly shorter than pleotelson [≈ 0.8×]; peduncle simple; endopod L: W intermediate [3.5 L: W]; exopod L: W intermediate [2.9 L: W], proximate to endopod.

Description

Holotype non-ovigerous female: *Habitus* Fig. 5 A–B) fairly slender, 7 L: W. *Cephalothorax* ≈ 1.25 L: W, 23% BL, L reaching half of pereonite-3. *Pereon* slightly tapering posteriad, pereonites 2–6 with convex lateral margins, pereonites 4–6 with more distinct process over pereopod attachment, 0.33, 0.53, 0.65, 0.81, 0.94, and 0.6 L: W, respectively. *Pleon* parallel-sided, 0.9 L: W, 11.5% BL; pleonites naked (but see male with epimeral setae). *Pleotelson* slightly longer than pleonites 2–5 combined), 0.73 L: W, posterior weakly-produced, with two simple dorsoposterior setae.

Paratype non-ovigerous female: *Antennule* Fig. 6 A) 3.6 L: W overall; article-1 0.55× L of whole, 2 L: W, with two groups of three lateral PSS, and long distolateral seta (on holotype); article-2 ≈ 0.29× article-1 L, ≈ 0.9 L: W, not overlapping article-3 dorsally, with two distolateral seta, and distomesial seta; article-3 shorter than broad, with single distolateral (long) and distomesial (shorter) setae and one PSS; article-4 slender, 3 L: W, with five setae and one aesthetasc. *Antenna* Fig. 6B) ≈ 0.85× antennule L; article-1 shorter than broad; article-2 1.2 L: W,

Fig. 6. *Libanius australis* n. sp., paratype non-ovigerous female, J. 57785, A, antennule; B, antenna; C, labrum: D–E, left and right mandibles respectively; ; F, labium; ; G, maxillule endite; H, maxilliped, one palp omitted; H', maxillule endite; I, epignath. Scale bars: 0.1 mm.

Fig. 7. *Libanius australis* n. sp., paratype non-ovigerous female, J. 57785, A, right cheliped; B–G, pereopods 1–6 respectively; H, uropod. Scale bars: 0.1 mm.

dorsum slightly raised, with dorsodistal seta half as long as article-3, and with distoventral seta; article-3 shorter than broad, with longer dorsodistal seta; article-4 longer than articles 1–3 CL, with two long and one short distal setae, and three PSS; article-5 3.8 L: W, 0.37× article-4 L, with distal seta; article-6 small, with five setae.

Mouthparts: *Labrum* Fig. 6 C) typical of genus, hood-like, distally setulate. *Mandibles* Fig. 6D–E) with left incisor with about six cusps, lacinia as long as incisory, subconical, molar broad, apex with blunt tubercles and array of about eight acuminate spines; right incisor tricuspid, molar as for left mandible. *Labium* Fig. 6 F) medial lobes longer than broad, subtriangular, with apical setules. *Maxillule* Fig. 6G) endite with sparse distal setules, apex with eight spines of various thickness. *Maxilla* not observed.

Maxilliped Fig. 6 H) bases together chordate, 1.5 L: W, partly extending over endites, with median setulate ridge, with seta near articulation with palps; endites typical, mesial tubercles broad and shallow, and two distal setae; palp ≈ 0.9× basis L, article-1 as long as broad, article-2 sub-triangular, as long as broad, setation typical; article-3 subrectangular, as long as article-2, 1.5 L: W, setation typical; article-4 slender, subrectangular, shorter than article-3, 3.3 L: W, setation typical. *Epignath* Fig. 6I), typical, as long as maxilliped.

Cheliped Fig. 7 A) robust; bases as long as broad, posterior lobe shorter and lower than anterior mass; merus simple; carpus narrower distally, 1.5 L: W, with round posterior lobe, setation typical; chela 1.3× carpus L, palm 1.1 L: W; fixed finger 0.8× palm L.

Pereopod-1 Fig. 7B) slender, almost 15 L: W overall; coxa annular, with seta; basis slender, 6.5 L: W, with proximal superior PSS; merus 1.8 L: W; carpus subrectangular, ≈ 1.7× merus L, spines typical, superodistal spine over half propodus L, with one distal seta; propodus narrower and just shorter than carpus, 4.5 L: W, with superodistal seta and inferodistal spine and seta; dactylus with accessory seta, unguis twice as long as dactylus, together ≈ 0.9× propodus L. *Pereopod-2* Fig. 7 C) similar to pereopod-1 but basis with superior seta and PSS; propodus without inferodistal seta. *Pereopod-3* Fig. 7D) similar to pereopod-2 but basis merus and carpus slightly shorter.

Pereopod-4 Fig. 7E) basis slender, 4.5 L: W, with one inferior PSS; merus stout; carpus slender, subrectangular, 1.9× merus L; propodus slender, as long as carpus, 4.4 L: W, inferior margin with row of small spinules; dactylus longer than unguis. *Pereopod-5* Fig. 7 F) similar to pereopod-4 but basis with two superior and two inferior PSS. *Pereopod-6* Fig. 7G) similar to pereopod–5 but basis naked; propodus setation typical.

Uropod Fig. 7 H) peduncle fairly slender, 2 L: W; endopod 1.2× peduncle L, segment-1 longer than segment-2, with two large distomesial PSS, segment-2 with one subdistal seta, four apical setae and one PSS; exopod strong, arcuate, reaching distal of segment-1 of endopod.

*Male*abitus (Fig. 5C–D) similar to non-ovigerous female but with stouter antennules and pleopods with setae; BL 2–2.2 mm.

Distribution
Recorded from the southwestern Tasman Sea off Gippsland, Victoria, and eastern Tasmania.

Bathymetric range
Bathyal, 400–1000 m.

Remark
In the second phylogenetic analysis (Fig. 3) *L. australis* is shown as a sister to *Libanius clisicola* n. sp. (see below) among the clade of three Australian species, but it differs in its shorter pereonite-1 and pleon, stouter antennule article-1, pereopod-1 merus and propodus, proportionally shorter pereopod-4 merus relatively to the carpus, and more slender uropod peduncle. It appears to have no synapomorphy to distinguish it from all other species of *Libanius*.

***Libanius brevicarpus* n. sp.**
LSID urn: lsid: zoobank.org:act:0945FDAC-0253-485A-8BE0-8AC515499349
(Figs. 1, 3 and 8–9, 37 C)

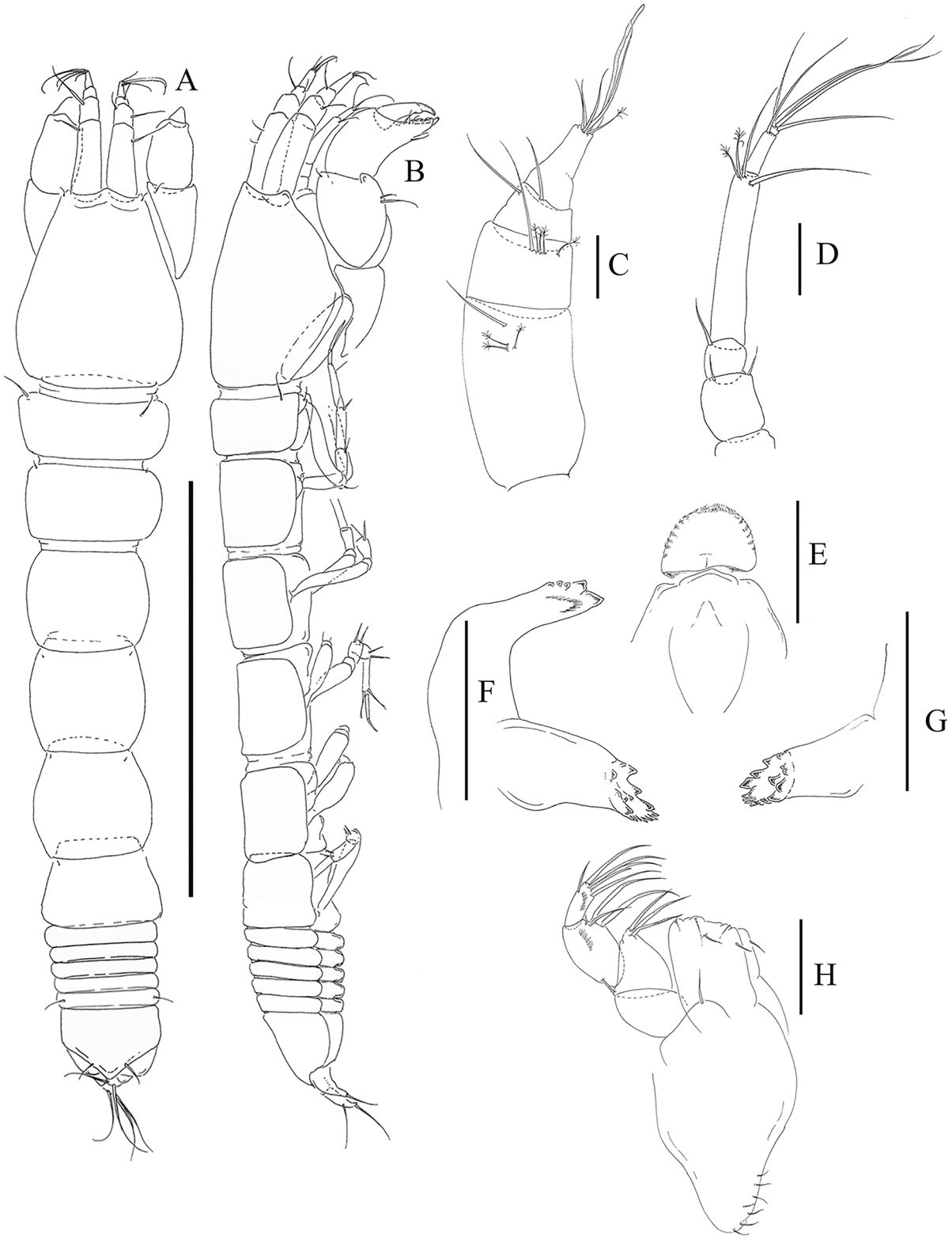

Fig. 8. *Libanius brevicarpus* n. sp., holotype non-ovigerous female, J.71186, A–B, dorsal and lateral. Paratype male, ICUL.13177, C, antenna, lateral; D, antenna; E, labrum; F, right mandible; G, left mandible molar; H, maxilliped (one palp omitted). Scale bars: A–B 1 mm, C–H 0.1 mm.

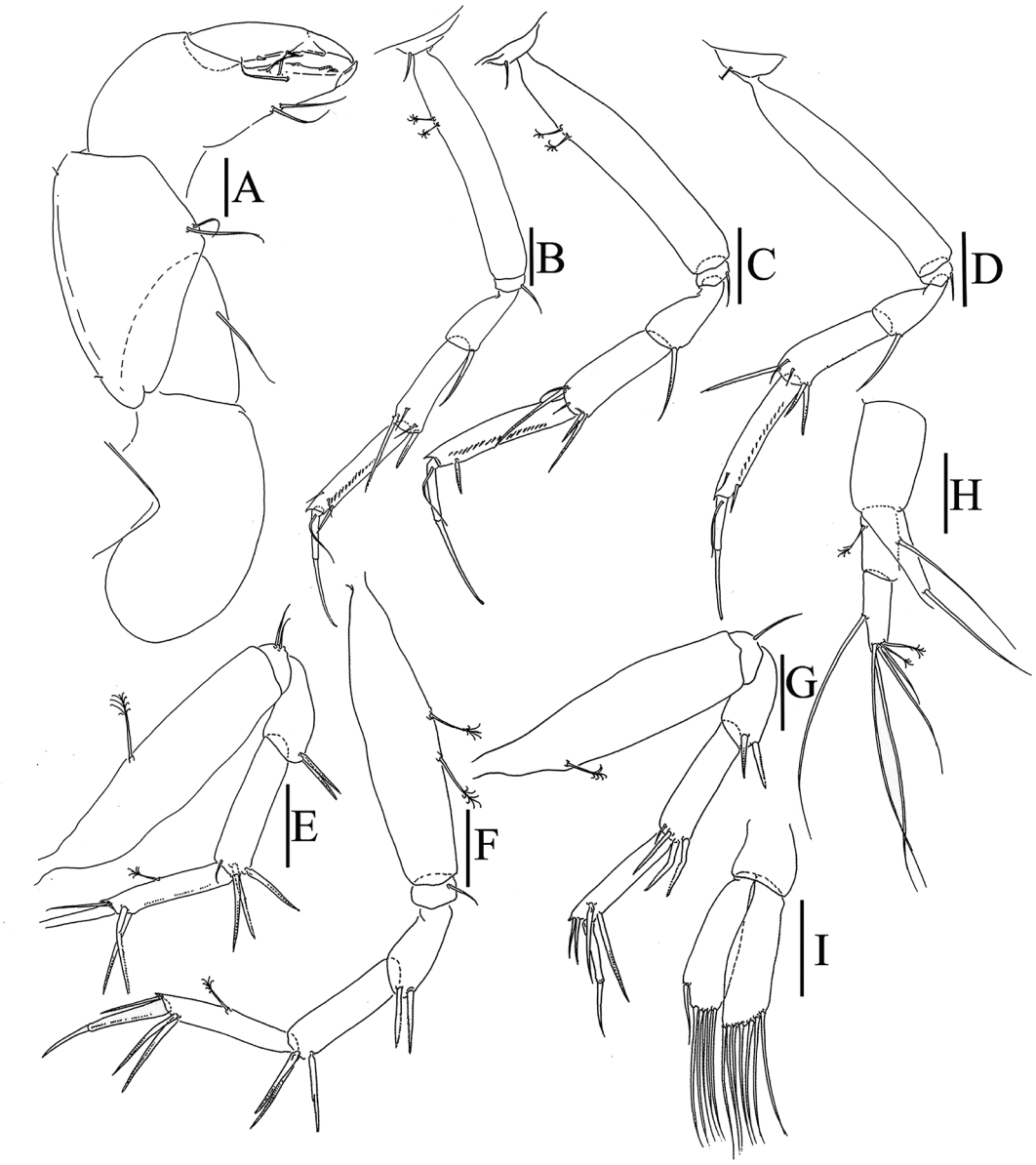

Fig. 9. *Libanius brevicarpus* n. sp., paratype male, ICUL.13177, A, cheliped; B–G, pereopods 1–6 respectively; H, uropod; I, pleopod. Scale bars: 0.1 mm.

Type material

HOLOTYPE: non-ov. ♀, 2.7 mm, J.71186, SLOPE Stn 1. PARATYPE: 1 ♂, dissected on microslides, ICUL.13177 [ex.J.57819], SLOPE Stn 1.

Type locality

Tasman Sea, off Nowra, NSW, Australia, 204 m.

Etymology

From the Latin *brevis* 'short' and the pereopod article *carpus*, alluding to the short carpus on each of pereopods 4–6.

Diagnosis

Libanius with *cephalothorax* longer than pereonites 1–2 combined. *Pereonite-1* short [0.33 L: W], without hyposphenium; **pereonite-6 long [0.7 L: W]**. *Pleon* as long as broad, pleonites distinct. *Pleotelson* L: W intermediate [0.8×], 0.9× pleon L. *Antennule* L intermediate relative to cephalothorax [0.75×]. *Antenna* article-2 much longer [1.8×] than article-3, distodorsal setae short; article-4 fairly slender [5.6 L: W]. *Mandible* molar broad coronal. *Cheliped* basis not reaching posterior of cephalothorax; basis much longer [1.5×] than merus; merus much longer [2.5×] than that of carpus ventral margin; chela L: W intermediate [≈ 2.4 L: W], slightly narrower

than carpus, palm dorsal and ventral margins parallel. *Pereopods 1–3* basis without groups of setules. *Pereopod-1* merus inferodistal spine as long as article; carpus fairly stout [3.4 L: W]; **propodus with one inferodistal spine**, without distolateral seta *Pereopod-2* carpus with two distal setae. *Pereopods 4–6* overall thin [≈ 9.2 L: W]; merus L: W intermediate [2 L: W], shorter than carpus [≈ 0.7×]; **carpus stout [2.1 L: W]**; claw ≈ propodus L. *Uropod* as long as pleotelson; peduncle simple; endopod L: W intermediate [4.25 L: W]; exopod slender [≈ 4 L: W], proximate to endopod.

Description

Holotype non-ovigerous female: *Habitus* Fig. 8 A–B) fairly stout, 5.4 L: W. *Cephalothorax* Fig. 37 C) ≈ 1.1 L: W, 23% BL, L reaching half of pereonite-3. *Pereon* slightly tapering posteriad, pereonites 2–6 with distinct process over pereopod attachments, ≈ 0.33, 0.56, 0.57, 0.77, 0.79, and 0.7 L: W respectively. *Pleon* parallel-sided, as long as broad, 11% BL; pleonites naked. *Pleotelson* typical of genus.

Male paratype: *Antennule* Fig. 8 C) ≈ 0.75× cephalothorax L (holotype female), stouter than in female, 3.7 L: W overall; article-1 0.44× L of whole, 1.6 L: W, with distolateral group of three lateral PSS, and long distolateral seta; article-2 ≈ 0.4× article-1 L, ≈ 0.7 L: W, not overlapping article-3 dorsally, with distolateral seta and four PSS; article-3 shorter than broad, with single distolateral and distomesial setae; article-4 slender, with incipient division, 2.5 L: W, with five setae, one aesthetasc and one PSS. *Antenna* Fig. 8D) ≈ 0.7× antennule L; article-1 shorter than broad; article-2 1.1 L: W, dorsum slightly raised, with short dorsodistal and distoventral setae; article-3 shorter than broad, with longer dorsodistal seta; article-4 longer than articles 1–3 CL, with two long setae and two PSS; article-5 3.3 L: W, 0.26× article-4 L, with distal seta; article-6 small, with five setae.

Mouthparts (paratype): *Labrum* Fig. 8E) typical. *Mandibles* Fig. 8 F–G) with left incisor and lacinia not recovered, molar broad, apex with blunt tubercles and array of about eight acuminate spines and comb of thinner spines; right incisor five-cuspid, molar as for left mandible. *Labium*, *maxillule* and *maxilla* not observed.

Maxilliped Fig. 8 H) bases together chordate, 1.5 L: W, partly extending over endites, with median setulate ridge, with seta near articulation with palps; endites typical, mesial tubercles broad and shallow, and two distal setae; palp ≈ 0.9× basis L, article-1 as long as broad, article-2 sub-triangular, as long as broad, setation typical; article-3 subrectangular, as long as article-2, 1.5 L: W, setation typical; article-4 slender, subrectangular, shorter than article-3, 2.6 L: W, setation typical. *Epignath* not recovered.

Cheliped Fig. 9 A, 37 C) robust; bases as long as broad, posterior lobe not much smaller than anterior mass; merus long; carpus narrower distally, 1.7 L: W, with round posterior lobe, setation typical; chela 1.1× carpus L, palm as long as broad, mesial comb not observed; fixed finger 1.2× palm L; dactylus with about three peglike spines on incisive margin.

Pereopod-1 Fig. 9B) very slender, 13.5 L: W overall; coxa annular, with seta; basis slender, 6.25 L: W, with two proximal superior PSS; merus 2.4 L: W; carpus subrectangular, ≈ 1.4× merus L, spines typical, superodistal spine ≈ 0.5× propodus L, with two distal setae; propodus narrower and longer than carpus, 5.8 L: W, with small superodistal seta, and inferodistal spine and seta; dactylus with accessory seta, unguis 1.4× dactylus L, together ≈ propodus L. *Pereopod-2* Fig. 9 C) similar to pereopod-1 but carpus with two distal setae and PSS; propodus without superodistal seta (probably lost on figured specimen). *Pereopod-3* Fig. 9D) similar to pereopod-2 but basis without PSS; propodus with superodistal seta.

Pereopod-4 Fig. 9E) basis slender, 4.3 L: W, with one inferior PSS; merus not slender, carpus slender, setation typical; propodus slender, longer than carpus, 5.8 L: W, setation typical, (thinner superodistal spine missing?), inferior margin with row of small spinules, small acute apophysis above dactylus insertion; claw broken – see pereopod-5. *Pereopod-5* Fig. 9 F) similar to pereopod-4 but basis with two inferior PSS; dactylus longer than unguis, together as long as propodus. *Pereopod-6* Fig. 9G) similar to pereopod–5 but basis with superior PSS; propodus setation typical.

Pleopod Fig. 9 H) typical; both rami straplike, endopod slightly shorter than exopod with subdistal seta and five terminal setae, exopod with seven distal setae.

Uropod Fig. 9I) peduncle fairly slender, 1.7 L: W; endopod 1.4× peduncle L, segment-1 longer than segment-2, naked (PSS possibly lost/broken), segment-2 with one subdistal seta, four apical setae and two PSS; exopod strong, not arcuate, reaching beyond distal of segment-1 of endopod.

Distribution

Recorded only from the type locality.

Bathymetric range

Shallow bathyal, 204 m.

Remarks

Without a pereonite-1 hyposphenium or setose pereopod bases, *L. brevicarpus* n. sp. is distinguished from similar *Libanius* species by its relatively long pereonite-6 and stout pereopod-4 carpus. Compared to the other two Australian species it also differs in having a slightly longer antennule article-1 and antenna article-2, the cheliped slightly more anterior on the ventrum of the cephalothorax, and a more slender uropod exopod.

This species has the shallowest bathymetric record of all the arthrurids- just shallower than those for the NZ species *L. tangaroa* n. sp. (see below).

***Libanius clisicola* n. sp.**

LSID urn: lsid: zoobank.org:act:4AAC3036-1EB4-409B-8348-A0D9458C08F1

(Figs. 1, 3 and 10–13)

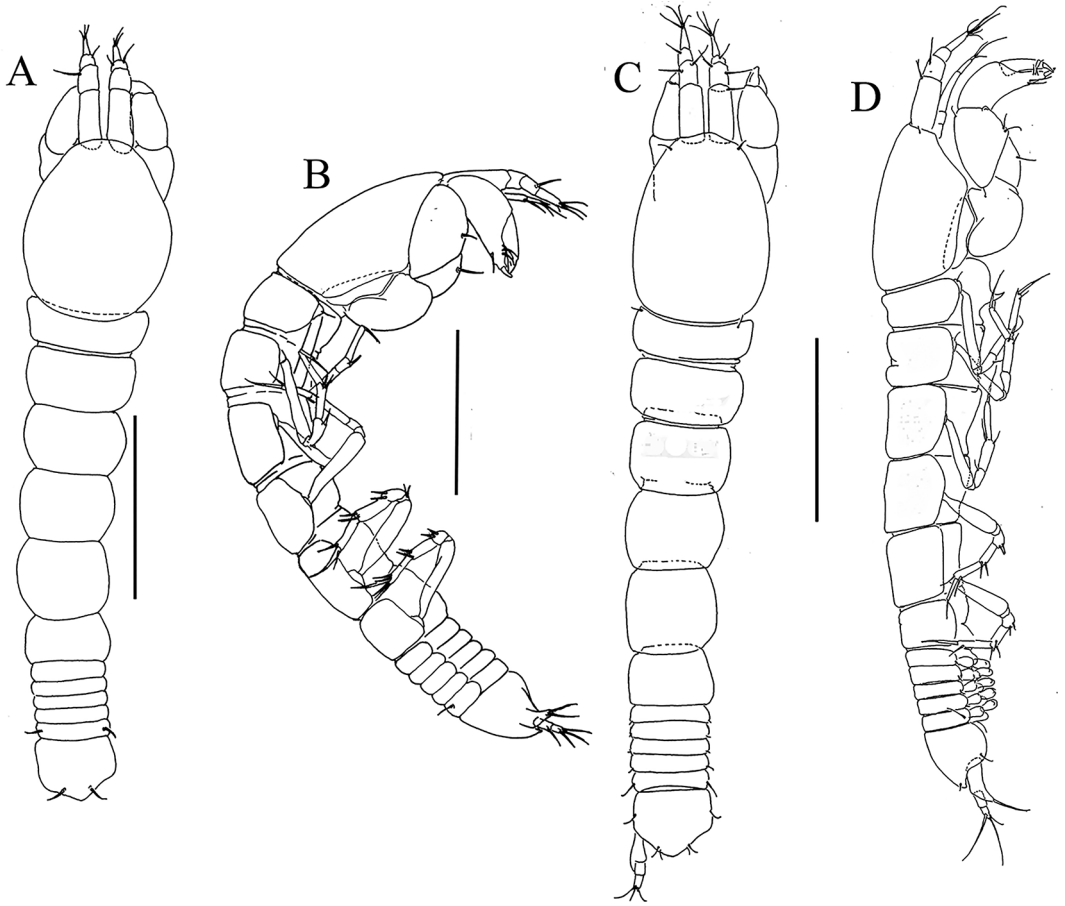

Fig. 10. *Libanius clisicola* n. sp., paratype non-ovigerous female, ICUL.13223, A-B, dorsal and lateral. Holotype male, J.37884, C-D, dorsal and lateral. Scale bars: 1 mm.

Etymology
From the Latin noun *concertator*, a "contender (or challenger)"; referring to the type locality, itself named for the *HMS Challenger*, a *Pearl Class* screw corvette that was used for the historic British oceanographic cruise of December 1872 to May 1876[36].

Diagnosis
Libanius with *cephalothorax* slightly longer than pereonites 1–2 combined. ***Pereonite-1*** **relatively long [≈ 0.5 L: W]**, without hyposphenium; pereonite-6 not long [0.56 L: W]. *Pleon* about as long as broad, pleonites weakly defined. *Pleotelson* short [0.6 L: W], ≈ 0.7× pleon L. ***Antennule*** **long relative to cephalothorax [≈ 0.8×]**. *Antenna* article-2 1.4× article-3 L, distodorsal seta shorter than article-3; article-4 slender [8.3 L: W]. *Mandible* molar broad coronal. *Maxillule* endite with one coarsely pectinate (trifid?) spine. *Cheliped* basis not quite reaching posterior of cephalothorax; basis longer [2.5×] than merus; merus longer [1.6×] than ventral margin of carpus; chela L: W intermediate [2.4 L: W], slightly narrower than carpus, palm dorsal and ventral margins clearly divergent, with 3-spined mesial comb. *Pereopods 1–6* basis without groups of setules. *Pereopod-1* merus inferodistal spine L longer than article; **carpus very slender [5.6 L: W]**. *Pereopod-2* carpus with one distal seta. *Pereopods 4–6* overall very thin [13.6 L: W]; merus slender [2.6 L: W], shorter than carpus [0.7×]; claw longer [1.4×] than propodus. *Uropod* longer [1.3×] than pleotelson; peduncle geniculate; **endopod slender [≈ 6.5 L: W]**, longer than peduncle; exopod fairly slender [≈ 3.5 L: W], proximate to endopod.

Description
Holotype non-ovigerous female: *Habitus* Fig. 14 A) fairly stout, 5.7 L: W. *Cephalothorax* ≈ 1.2 L: W, 21% BL, slightly longer than pereonites 1–2 (excluding interpereonal; gaps) combined; carapace with small seta adjacent to eyelobes. *Pereon* slightly tapering posteriad, 0.5, 0.64, 0.61, 0.68, 0.65, and 0.58 L: W respectively; each with anterolateral seta, pereonites 4–6 also with posterolateral seta. *Pleon* parallel-sided, 10% BL; pleonites 1 and 5 slightly longer than rest. *Pleotelson* Fig. 14B) slightly longer than pleonites 3–5 combined (holotype), posterior weakly-produced, with two simple setae and two PSS, with one seta anteroventral to uropod insertion, with small conical apex with four setae (ventral-most pair deflexed); anterolateral anal ridges not meeting medially, gap between these and pleonite-5 less than 25% of pleotelson L.

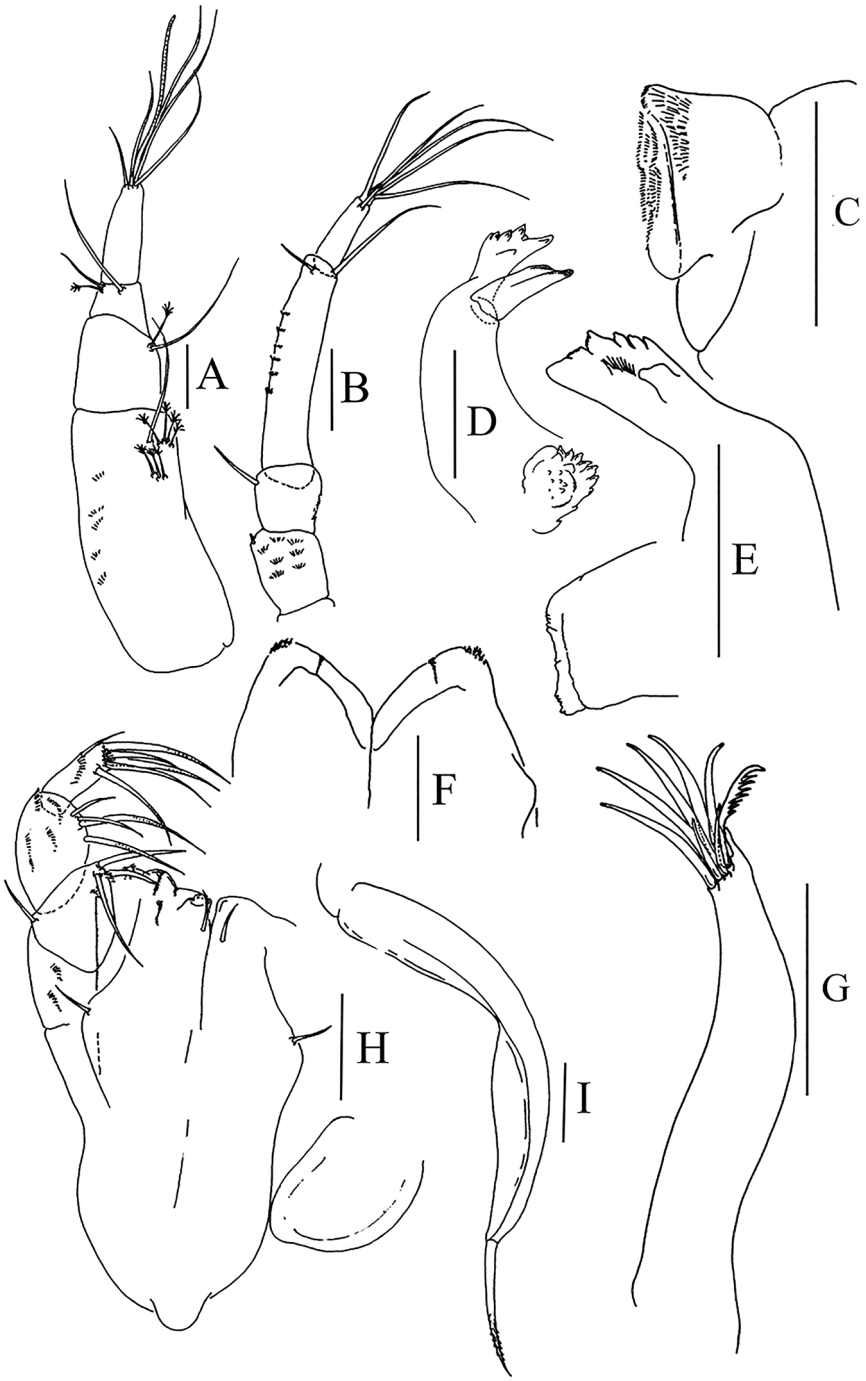

Fig. 11. *Libanius clisicola* n. sp., paratype non-ovigerous female, ICUL.13223, A, antennule; B, antenna; C, E, left and right mandible respectively; D, labrum; F, labium; G, maxillule endite; H, maxilliped and maxilla; I, epignath. Scale bars: 0.1 mm.

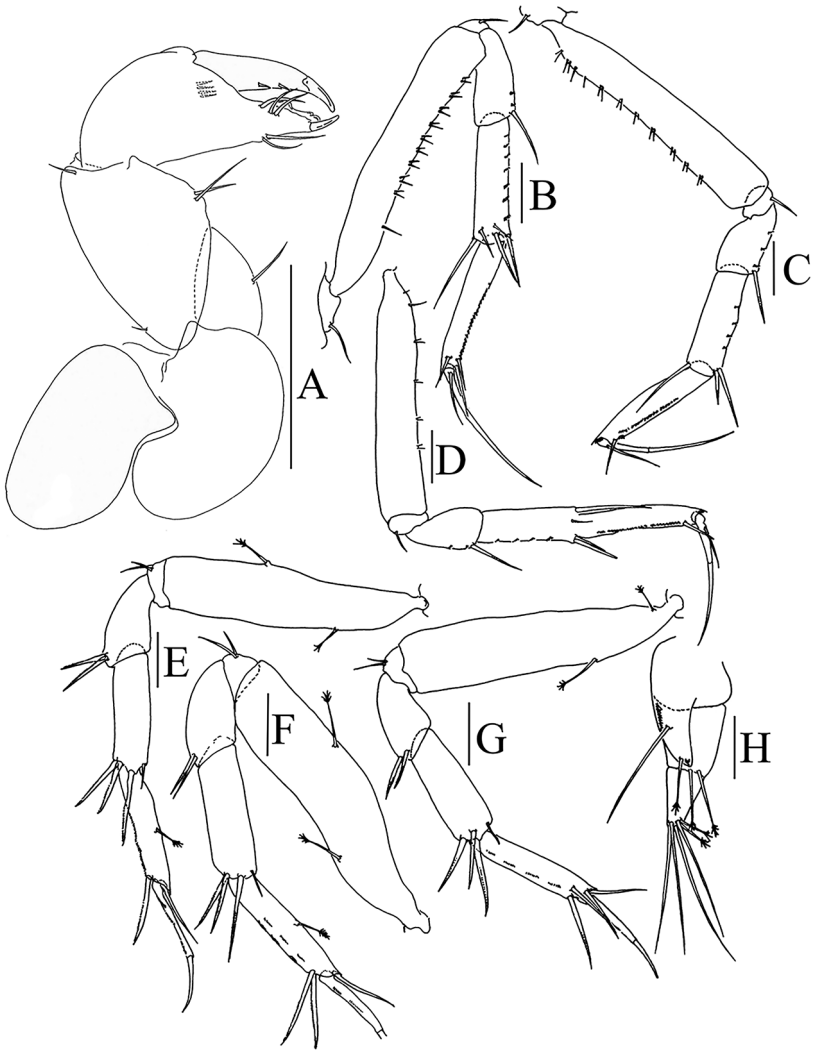

Fig. 12. *Libanius clisicola* n. sp., paratype non-ovigerous female, ICUL.13223, A, cheliped; B–G, pereopods 1–6 respectively; H, uropod. Scale bars: 0.1 mm.

Type material
HOLOTYPE: juv. ♂, 5 mm, J.37884, SLOPE Stn 15. PARATYPES: 2 manca-3 (decalcified), J.57830, 1 non-ov. ♀, 5.6 mm, dissected on microslides, ICUL.13223 (ex.J.57830), 1 juv. ♂, J.71187, SLOPE Stn 25.

Type locality
Tasman Sea, off Nowra, NSW, Australia, 1750 m.

Etymology
From the Greek *klísi* κλίση 'gradient' (or 'inclination', etc.) and Latin suffix *-cola* 'dweller', alluding both to the bathymetric zone and the project SLOPE itself.

Diagnosis
Libanius with *cephalothorax* as long as pereonites 1–3 combined. *Pereonite-1* L: W intermediate [≈ 0.44 L: W], with hyposphenium. ***Pleon* longer than broad [1.2 L: W]**, pleonites distinct. *Pleotelson* almost as long as broad. *Antennule* L intermediate relative to cephalothorax [≈ 0.65×]. *Antenna* article-2 slightly longer [1.25×] than article-3, **distodorsal setae very short**; article-4 fairly slender [4.9 L: W]. *Mandible* molar broad coronal. *Maxillule* endite with one coarsely pectinate spine. *Cheliped* basis reaching posterior of cephalothorax; basis much longer [≈ 1.6×] than merus; merus slightly longer [1.4×] than that of carpus ventral margin; chela L: W intermediate [≈ 2.4 L: W], slightly narrower than carpus, palm dorsal and ventral margins clearly divergent, with 4-spined mesial comb. *Pereopods 1–3* basis with groups of setules. *Pereopod-1* merus inferodistal spine shorter than article; carpus fairly stout [3.5 L: W]. ***Pereopod-2* carpus without setae**. *Pereopods 4–6* overall thin [≈ 10.5 L: W]; merus stout [1.7 L: W], shorter than carpus [≈ 0.65×]; carpus slender [3.25 L: W]; claw ≈ propodus L. *Uropod* shorter than pleotelson [≈ 0.6×]; peduncle simple; endopod stout [2.7 L: W]; exopod L: W intermediate [2.3 L: W], proximate to endopod.

Fig. 13. *Libanius clisicola* n. sp., holotype juvenile male, ICUL.13,23, lateral.

Description

Paratype non-ovigerous female: *Habitus* Fig. 10 A–B) fairly stout, 5.1 L: W. *Cephalothorax* ≈ 1.3 L: W, 25% BL. *Pereon* slightly tapering posteriad, pereonites 2–6 with convex lateral margins, 0.44, 0.57, 0.78, 0.76, 1.0, and 0.64 L: W respectively. *Pleon* parallel-sided, 10% BL; pleonites 1 and 5 slightly longer than rest; pleonite-5 with two dorsolateral setae. *Pleotelson* slightly longer than pleonites 3–5 combined (holotype), almost as long as broad, posterior weakly-produced, with two simple dorsoposterior setae.

Antennule Fig. 11 A) ≈ 0.65× cephalothorax L (holotype), 4.5 L: W overall; article-1 0.55× L of whole, 2.45 L: W, with two groups of three lateral PSS, and long distolateral seta; article-2 ≈ 0.35x article-1 L, ≈ 1.1 L: W, weakly overlapping article-3 dorsally, with distolateral seta and one PSS; article-3 shorter than broad, with single distolateral (long) and distomesial (shorter) setae and one PSS; article-4 slender, 2.9 L: W, with five setae and one aesthetasc. *Antenna* Fig. 11B) ≈ 0.8× antennule L; article-1 shorter than broad; article-2 1.25 L: W, distally wider, dorsum slightly raised, with scattered microtrichia; article-3 as long as broad, with longer dorsodistal seta; article-4 longer than articles 1–3 CL, 4.9 L: W, with one long and one short distal setae; article-5 3.25 L: W, 0.33× article-4 L, with distal seta; article-6 small, with four setae.

Mouthparts (paratype): *Labrum*Fig. 11C) typical. *Mandibles* Fig. 11D–E) with left incisor distally wider, with about six cusps, lacinia as long as incisory, subconical, molar broad, apex with blunt tubercles and array of about eight acuminate spines; right incisor with several cusps, molar as for left mandible. *Labium* Fig. 11 F) medial lobes longer than broad, subtriangular, with apical setules. *Maxillule* Fig. 11G) endite with sparse distal setules, apex with eight spines of various thickness. *Maxilla* Fig. 11 H) subovate.

Maxilliped Fig. 11 H) basal pedestal broader than bases, bases together cuneate (or deltoid), 1.5 L: W, partly extending over endites, with weak, naked median ridge, and seta near articulation with palps; endites typical, mesial tubercles broad and shallow, and two distal setae. Palp ≈ 0.8× basis L, article-1 as long as broad; article-2 sub-triangular, as long as broad, setation typical; article-3 subrectangular, as long as article-2, 1.5 L: W, setation typical; article-4 slender, subrectangular, shorter than article-3, 3.3 L: W, setation typical. *Epignath* Fig. 11I), typical, as long as maxilliped.

Cheliped Fig. 12 A) robust; bases as long as broad, posterior lobe shorter and lower than anterior mass, latter with small dorsolateral seta; merus simple; carpus narrower distally, 1.5 L: W, with round posterior lobe, setation typical; chela 1.3× carpus L, palm 1.2 L: W; fixed finger ≈ palm L; dactylus with ventral margin with two peglike spines.

Pereopod-1 Fig. 12B) very slender, 15 L: W overall; coxa annular, with seta; basis slender, 6.8 L: W, with proximal superior seta and groups of setules along superior margin; merus ≈ 2.2 L: W; carpus elongate, subrectangular, ≈ 1.5x merus L, spines typical, superodistal spine ≈ 0.5× propodus L, with two small distal setae; propodus narrower and just shorter than carpus, 5.5 L: W, with superodistal seta, and inferodistal spine and seta, inferior margin with spinules; dactylus with accessory seta, unguis twice as long as dactylus, together ≈ 1.2× propodus L. *Pereopod-2* Fig. 12 C) similar to pereopod-1 but basis, merus, carpus and propodus (4.7 L: W) very slightly shorter; propodus with one inferodistal spine. *Pereopod-3* Fig. 12D) similar to pereopod-2 but basis very slightly shorter.

Pereopod-4 Fig. 12E) basis slender and as long as those of pereopods 1–2, 4.4 L: W, with one inferior and one superior PSS; merus stout; carpus slender, subrectangular; propodus slender, slightly longer than carpus, 5.5 L: W, setation typical, inferior margin with row of small spinules; dactylus longer than unguis, with inferior spinules. *Pereopod-5* Fig. 14 F) similar to pereopod-4. *Pereopod-6* Fig. 12G) similar to pereopod–5 but basis with inferior PSS in proximal position; propodus setation typical.

Uropod Fig. 12 H) fairly stout, 1.2 L: W; endopod 1.5× peduncle L, segment-1 slightly longer than segment-2, with two large distomesial PSS, segment-2 with four apical setae and two PSS; exopod strong, arcuate, reaching about half length of endopod (distal of segment-1), with one subdistal and two distal setae (one broken on figured specimen).

Juvenile male: *Habitus* Fig. 10 C–D, 13) similar to non-ovigerous female; BL holotype 5 mm, paratype J.71187, 4 mm. *Carapace* with seta posterior to antennule (possibly lost on holotype). *Pleon* epimera with seta (possibly lost on holotype). *Antennule* stouter, 4 L: W. *Pleopods* present but rudimentary, naked.

Distribution
Recorded from the southwestern Tasman Sea off Nowra (NSW) to off Gippsland (Victoria).

Bathymetric range
Bathyal, 1500–1850 m.

Remarks
Overall, *L. clisicola* n. sp. most closely resembles *L. australis*, but it has the most elongate pleotelson of all *Libanius* species, a relatively slender pleon (longer than broad), a very short distodorsal seta on antenna article-2, and small groups of setae on the bases of pereopods 1–3.

***Libanius concertator* n. sp.**
LSID urn: lsid: zoobank.org:act:08C901A5-2312-44BB-8067-DAB5124B8A46
(Figs. 1, 3 and 14–16, 32 A–B; 36 A)

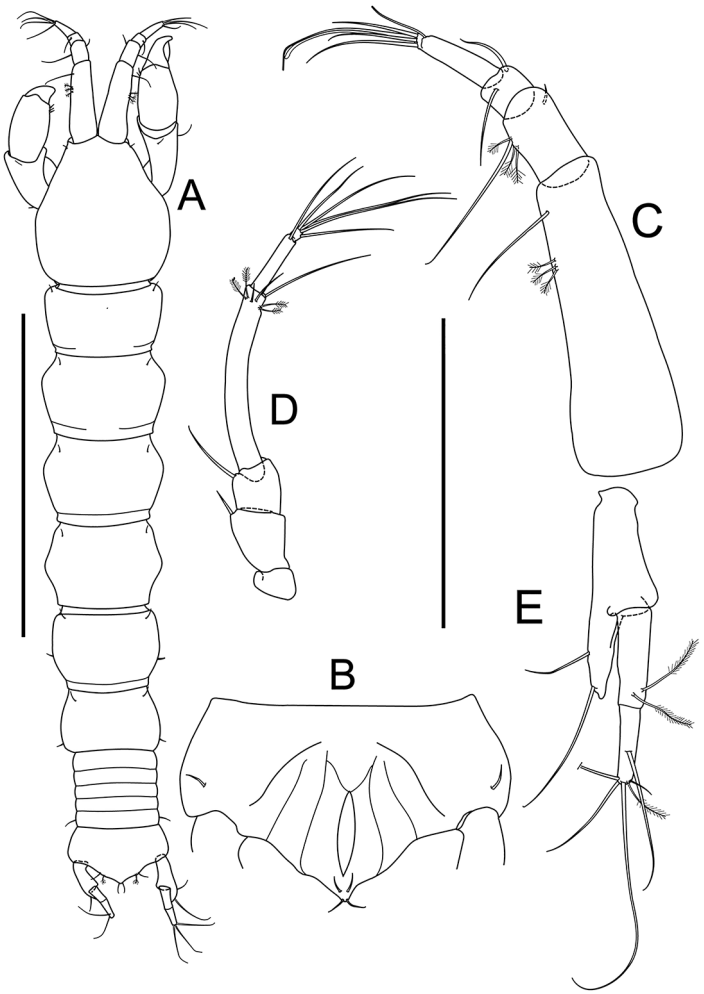

Fig. 14. *Libanius concertator* n. sp., holotype female, NIWA 173617: A, habitus; B, cephalothorax, posteroventral; C, pleotelson, ventral. Paratype female, NIWA 173621: D, antennule; E, antenna; F, uropod. Scale bars: A 1 mm; B–F 0.25 mm.

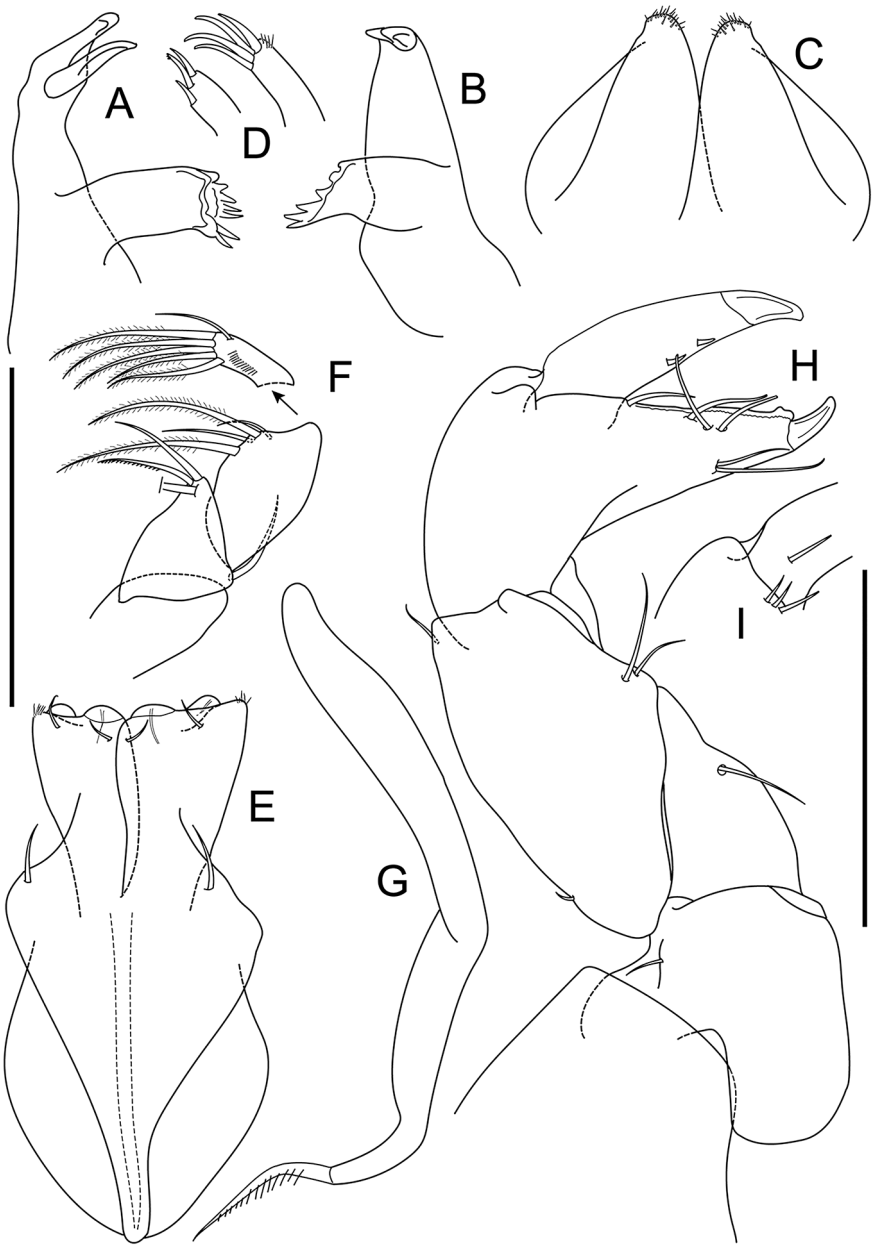

Fig. 15. *Libanius concertator* n. sp., paratype female, NIWA 173621: A–B, left and right mandible respectively; C, labium; D, maxillule endite, distal, with obscured spines; E, maxilliped bases and endites; F, maxilliped palp; G, epignath; H, cheliped; I, palm mesial, with spine comb. Scale bars: A–G 0.125 mm; H–I 0.25 mm.

Type material
HOLOTYPE: non-ov. ♀, 3.03/3.88 mm, NIWA 173617, TAN0707 Stn 119, 40.5305°S 178.5136°W, 533 m, epibenthic sled, 13 November 2011. PARATYPES: non-ov. ♀, NIWA 133401, NZOI Stn Q689; juv. ♂, NIWA 173619, TAN0707 Stn 105; 1 manca-3, NIWA 173620, 3 non-ov. ♀♀, 1 ov. ♀, NIWA 42,934, 1 non-ov. ♀ dissected on 2 microslides and remains in ethanol, NIWA 173621, TAN0707 Stn 119.

Other material
2 non-ov. ♀♀, NIWA 173618, TAN0705 Stn 136; 1 non-ov. ♀, NIWA 173622, TAN1004, Stn 27.

Type locality
Challenger Plateau, Tasman Sea, Southwest Pacific, 533 m.

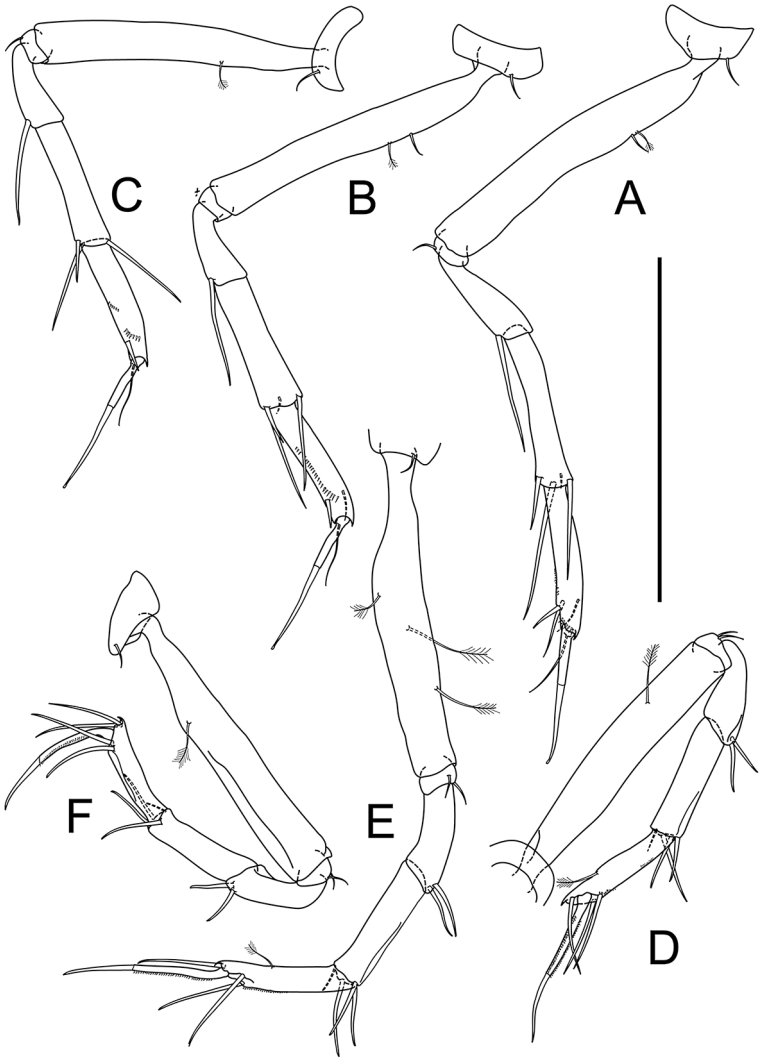

Fig. 16. *Libanius concertator* n. sp., paratype female, NIWA 173621: A–F, pereopods 1–6, respectively. Scale bar: 0.25 mm.

Antennule Fig. 14 C) 5.6 L: W overall; article-1 0.6× L of whole, 3.4 L: W, with three lateral PSS, distolateral seta and three PSS; article-2 ≈ 0.3× article-1 L, ≈ 1.6 L: W, not overlapping article-3 dorsally, with distolateral seta, smaller distomesial seta, and three PSS; article-3 as long as broad, with single distolateral (long) and distomesial (shorter) setae; article-4 slender, 3.3 L: W, with one thin seta, four long setae, and one aesthetasc closely applied one of the setae (fused?). *Antenna* Fig. 14D) ≈ 0.75× antennule L; article-1 shorter than broad; article-2 1.25 L: W, distally wider, dorsum slightly raised; article-3 as long as broad, with longer dorsodistal seta; article-4 1.3× articles 1–3 CL, with one long and two short distal setae, and four distal PSS; article-5 slender [5 L: W], as long as article-2, with distal seta; article-6 small, with five setae, two possibly fused.

Mouthparts (paratype): *Labrum* (not figured) typical. *Mandibles* Fig. 15 A–B) with left incisor narrow and weakly crenate, lacinia as long as incisory, subconical (?), molar broad, apex with about four blunt tubercles and array of about seven acuminate spines; right incisor weakly tricuspid, molar as for left mandible. *Labium* Fig. 15 C) medial lobes longer than broad, subtriangular, with apical setules. *Maxillule* Fig. 15D) endite with sparse distal setules, apex with seven spines of various thickness, one strongly pectinate. *Maxilla* not recovered.

Maxilliped Fig. 15E–F) basal pedestal broader than bases, bases together 1.6 L: W, median ridge with apical setules; endites typical; palp ≈ 0.9× basis L, article-1 as long as broad; article-2 sub-triangular, as long as broad, setation typical, one mesial seta stouter and more pectinate than others; article-3 subrectangular, as long as article-2, 1.6 L: W, setation typical; article-4 slender, subrectangular, shorter than article-3, 3.3 L: W, setation typical, with longitudinal fringe of setules. *Epignath* Fig. 15G), typical, as long as maxilliped.

Cheliped Fig. 15 H–I) robust; bases fully occluding cephalothorax ventrum, partly separated by anteriad-produced sternal apophysis; basis as long as broad, as long as merus, posterior lobe shorter than anterior mass, latter with small dorsolateral seta; merus long; carpus narrower distally, 1.7 L: W, with round posterior lobe;

chela 1.2× carpus L, palm as long as broad; fixed finger ≈ 1.5× palm L; dactylus incisive margin with two peglike spines and distal co-axial spine.

Pereopod-1 Fig. 16 A) slightly more slender (1.3×) than pereopod-4; basis slender, 7.6 L: W, with proximal superior seta and PSS; merus ≈ 3 L: W, inferodistal spine longer than merus; carpus elongate, subrectangular, ≈ 1.4× merus L, superodistal spine almost as long as propodus; propodus narrower and just shorter than carpus, 5.5 L: W, distolateral spine thinner than inferodistal spine inferior margin with spinules, and setules near dactylus insertion; unguis clearly longer than dactylus [1.5×], together with dactylus ≈ 0.9× propodus L. *Pereopod-2* Fig. 16B) similar to pereopod-1 but basis, merus, carpus and propodus (4.6 L: W) very slightly shorter. *Pereopod-3* Fig. 16 C) similar to pereopod-2 but basis very slightly shorter, without superodistal seta.

Pereopod-4 Fig. 16D) basis slender and as long as those of pereopods 1–2, 6.3 L: W, with one inferior PSS; merus slender; carpus slender, subrectangular, 1.2× merus L, 4 L: W; propodus slender, as long as carpus, 4.8 L: W, inferior margin with row of small spinules; dactylus longer than unguis, with two rows of spinules. *Pereopod-5* Fig. 16E) similar to pereopod-4 but basis with two inferior and one superior PSS. *Pereopod-6* Fig. 16 F) similar to pereopods–5 but basis without inferior PSS; propodus setation typical.

Uropod Fig. 14E) projecting beyond pleotelson; peduncle slender (2.5 L: W); endopod weakly bi-segmented, 1.4× peduncle L, segment-1 slightly longer than segment-2, with two large distomesial PSS, segment-2 with one subdistal seta, three long, one small thin, terminal setae and one terminal PSS; exopod strong, acute, proximate to endopod, reaching about half length of endopod (distal of segment-1), with single long subdistal and distal setae.

Manca-3: BL 1.67 mm. *Pereopod-6* rudimentary. *Pleopods* absent.

Non-ovigerous female: As holotype, BL 2.6–3.9 mm (n = 9), 5.5–5.7 L:W.

Ovigerous female: Similar to non-ovigerous female but with oostegites. *Pleon* 7% BL; BL 2.9 mm.

Juvenile male: Habitus (Fig. 32A) similar to non-ovigerous female; BL 2.12–2.39 mm (allotype BL 2.12 mm). *Antennule* stouter, 4.5 L:W. *Pleopods* (Fig. 32B) present but rudimentary, naked.

Distribution

Recorded from the Challenger Plateau, west of New Zealand, the northern flank of the Chatham Rise, and the Hikurangi Margin.

Bathymetric range

Shallow bathyal, 532–1013 m.

Remarks

One of five species of *Libanius* from NZ waters, *L. concertator* n. sp. shares with *L. largitas* n. sp. (see below) a weak definition of the pleonites in most specimens, the relatively long antennule article-1, antennule article-2 only slightly shorter than articles 3–4 combined, the cheliped slightly anterior on the cephalothorax ventrum, and the pereopods 4–6 claw longer than the propodus. For differences between these morphometrically similar species (Table 2) see remarks for *L. largitas* n. sp.

Of 12 post-mancae specimens only one is a (juvenile) male, i.e. a relatively high sex ratio of 1: 11 males to females. Eight specimens were in a single sample, from TAN0707 Stn 119, at 533 m on the Challenger Plateau, west of Te Ika-a-Māui North Island.

TAXON	manca-2	manca-3	neuter	ov. female	juv. male	male	carapace: BL (mm)	pleotelson: BL (mm)
Libanius concertator n. sp.	n/d	1.6	2.5–3.9 (10)	2.86	2.1	n/d	0.185× + 0.11 $r^2 = 0.9626$	0.0432× + 0.11 $r^2 = 0.4439$
L. intonsus n. sp.	2.2	2.4–2.8 (3)	3.7–5.7 (34)	4.5–5.2 (2)	2.4–4.8 (7)	4.1–4.5 (5)	0.218× + 0.01 $r^2 = 0.9113$	0.1134× − 0.11 $r^2 = 0.7184$
L. largitas n. sp.	1.3	n/d	2.6–4.0 (6)	3.6	n/d	n/d	0.186× + 0.1 $r^2 = 0.9852$	0.1794× + 0.13 $r^2 = 0.971$
L. projectus n. sp.	1.7–2.4 (20)	2.0–2.5 (8)	3.3–5.3 (27)	4.6	2.8–3.9 (15)	4.3–4.7 (7)	0.186× + 0.15 $r^2 = 0.9433$	0.1023× + 0.02 $r^2 = 0.777$
L. tangaroa n. sp.	1.7	2.4	2.7–4.5 (13)	4.2	2.5–2.6 (3)	3.1–3.2 (6)	0.197× + 0.19 $r^2 = 0.9414$	0.0657× + 0.09 $r^2 = 0.6362$
Paralibanius taitonga n. gen. n.sp.	1.7–1.9 (12)	2.3–2.4 (3)	3.8–4.4 (5)	3.4–3.7 (3)	2.3–3.0 (3)	3.4–3.7 (4)	0.2119× − 0.01 $r^2 = 0.9839$	0.119× − 0.134 $r^2 = 0.8616737$

Table 2. Body lengths (mm), carapace, and pleotelson ratios (for non-ov. females) of New Zealand arthrurid species.

***Libanius intonsus* n. sp.**
LSID urn: lsid: zoobank.org:act:BC26B891-F091-4BA2-B334-CCBF64A24771
Ocean Census species 45.
(Figs. 1, 3 and 17–21, 32 C–D, 36B)

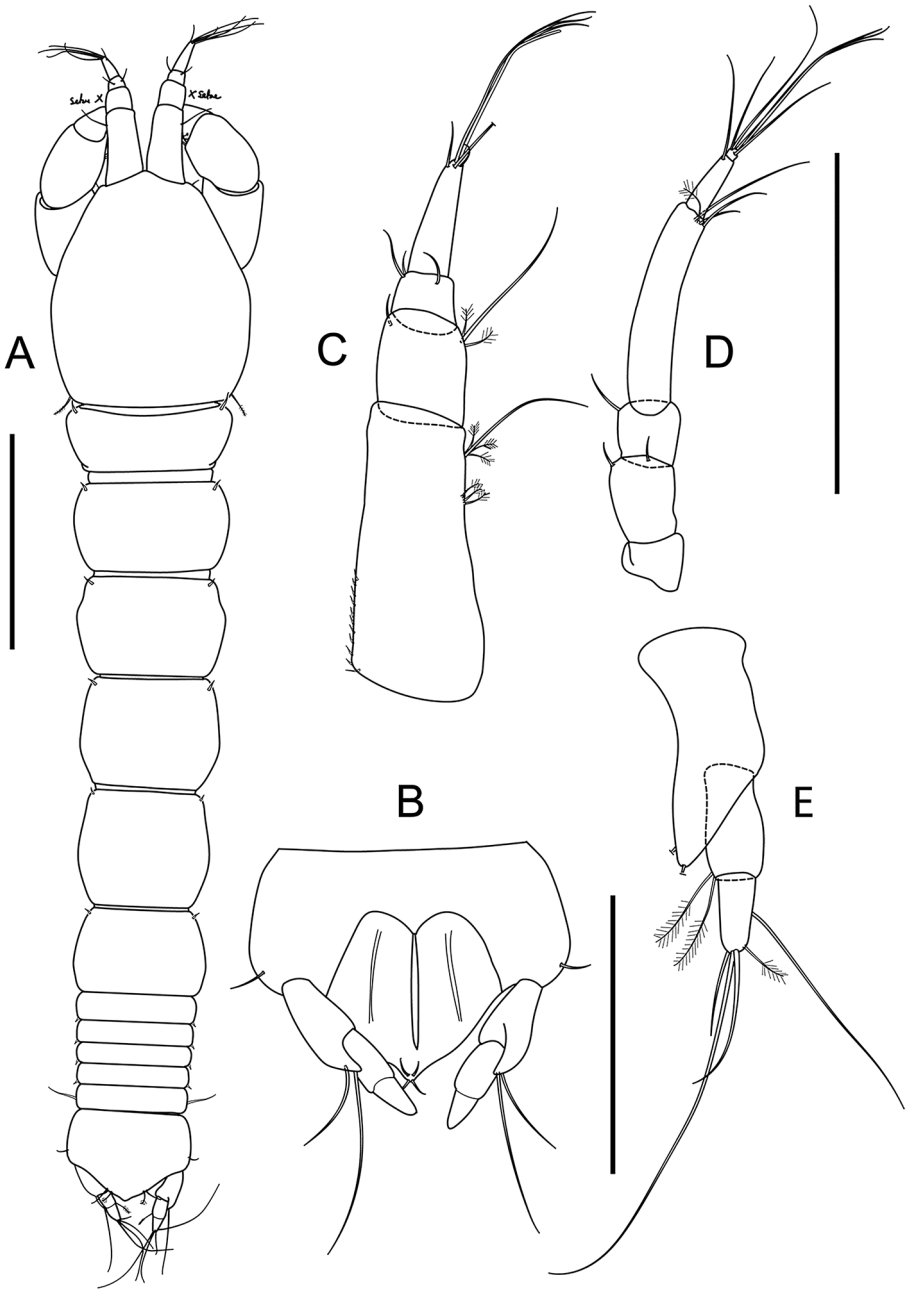

Fig. 17. *Libanius intonsus* n. sp., holotype female, NIWA 13950: A, habitus; B, pleotelson, ventral. Paratype female, NIWA 173623: C, antennule; D, antenna; E, uropod. Scale bars: A, C 1 mm; B–D 0.5 mm; E 0.25 mm.

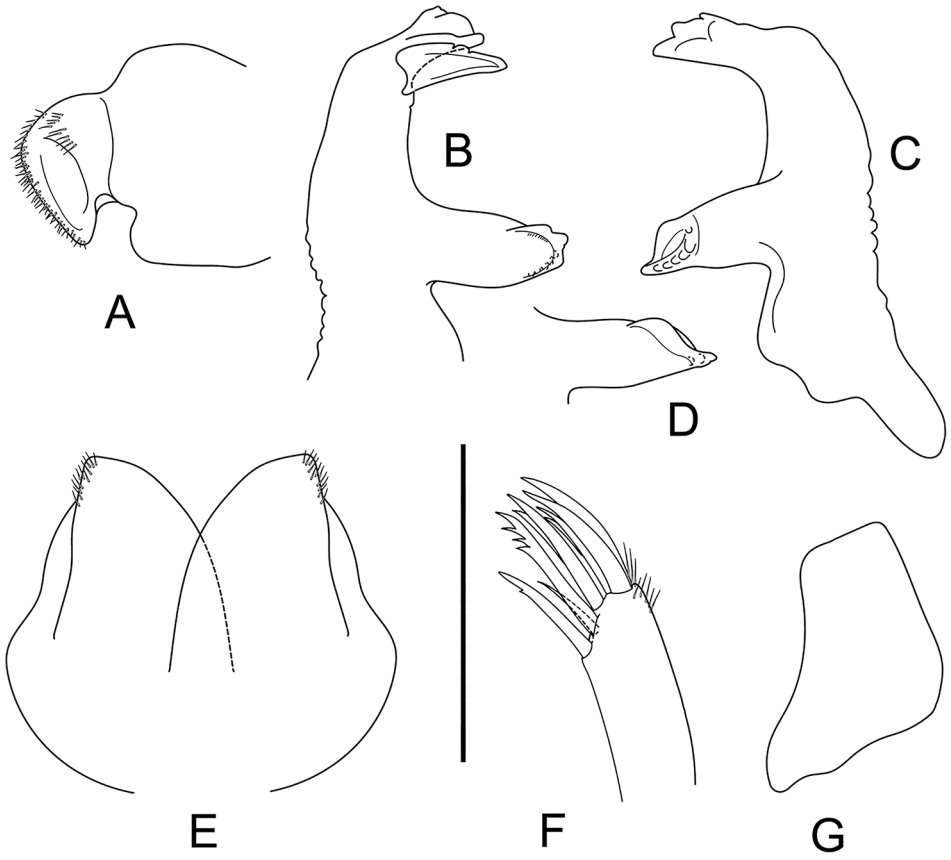

Fig. 18. *Libanius intonsus* n. sp., paratype female, NIWA 173623: A, labrum, lateral; B, left mandible; C, right mandible; D, right molar, inner aspect; E, labium; F, maxillule endite, distal; G, maxilla. Scale bars: A–E, G, 0.25 mm; F 0.125 mm.

Type material
HOLOTYPE: non-ov. ♀, 5.0 mm, NIWA 13950, NZOI Stn S152. PARATYPES: 2 non ov. ♀♀, 1 ♂, NIWA 12829, 20 non-ov. ♀♀ [1 dissected on 4 microslides, NIWA 173623], 1 ov. ♀, 1 juv. ♂, 1 ♂, NIWA 173629, NZOI Stn S152; 1 manca-2, 1 non-ov. ♀, 1 juv. ♂, NIWA 173624, TAN2402, Stn 47.

Other material
3 non ov. ♀♀, 1 ov. ♀, NIWA 14197, NZOI Stn S150; 14 non ov. ♀♀, 2 juv. ♂♂, 3 ♂♂, NIWA 12811, 1 non-ov. ♀, NIWA 14010, NZOI Stn S151; 1 non-ov. ♀, 3 juv. ♂♂, NIWA 80855, TAN0705 Stn 48; 1 manca-3, NIWA 173625, TAN1006 Stn K8; 1 non-ov. ♀, NIWA 173626, TAN1501 Stn Caravel; 1 manca-3, NIWA 173627, TAN1904, Stn 62; 1 manca-3, NIWA 173628, TAN1904, Stn 70.

Type locality
45.8717°S 171.0817°E, Chatham Rise (southern flank), NZEEZ, Southwest Pacific, 1676 m.

Etymology
From the Latin adjective *intonsus*, "unshaved," alluding to the sparsely setulate pereopods 1–3.

Diagnosis
Libanius with *cephalothorax* ≈ pereonites 1–3 CL. Pereonite-1 short [< 0.4 L: W]; pereonite-1 without hyposphenium; pereonite-6 not long [0.65 L: W]. *Pleon* as long as broad, pleonites well defined. *Pleotelson* not stout [≈ 0.75 L: W, ≈ 0.8× pleon L]. *Antennule* short relative to cephalothorax [≈ 0.6×]. *Antenna* article-2 1.5× article-3 L, distodorsal seta about half article-3 L; article-4 L: W fairly slender [≈ 5 L: W]. *Mandible* molar broad coronal. *Maxillule* endite with one coarsely pectinate spine. *Cheliped* basis reaching posterior of cephalothorax; basis slightly longer [1.2×] than merus; merus much longer [2.7×] than ventral margin of carpus; chela slender [≈ 2.6 L: W], clearly narrower [0.75×] than sub-parallel, palm with 4-spined mesial comb. *Pereopods 1–3* basis, carpus, and ventral margins with groups of setules. *Pereopod-1* merus inferodistal spine shorter than article; carpus fairly stout [≈ 3.6 L: W]. *Pereopod-2* carpus with two distal setae. *Pereopods 4–6* overall very thin [12 L: W]; merus stout [≈ 1.6 L: W], much shorter than carpus [< 0.6×]; claw ≈ propodus L. *Uropod* shorter than

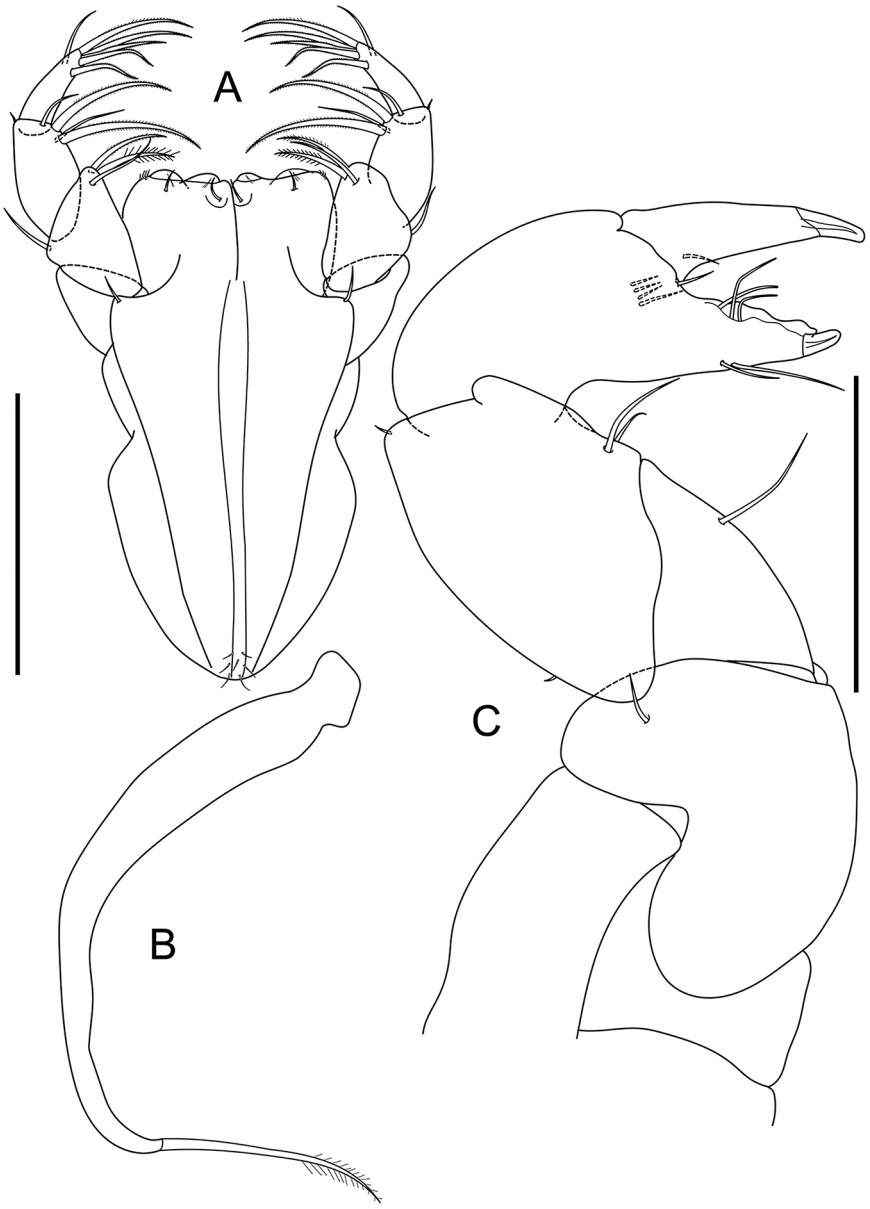

Fig. 19. *Libanius intonsus* n. sp., paratype female, NIWA 173623: A, maxilliped; B, epignath; C, right cheliped. Scale bars: A–B 0.25 mm; C 0.5 mm.

pleotelson [0.75×]; peduncle geniculate; endopod L: W intermediate [≈ 3.4 L: W], longer than peduncle; exopod stout [≈ 1.8 L: W], proximate to endopod.

Description

Holotype non-ovigerous female: *Habitus* Fig. 17 A, 36B) fairly stout, 4.8 L: W. *Cephalothorax* 1.05 L: W, 23% of BL. *Pereon* slightly tapering posteriad, 55% of BL; pereonites with weak convex lateral margins, pereonites 4–6 with weak lateral process over coxal attachments, 0.35, 0.57, 0.68, 0.81, 0.87, and 0.65 L: W respectively; each with anterolateral seta. *Pleon* slightly tapering posteriad, as long as broad, 11.5% of BL, pleonites 1 and 5 slightly longer than the others; pleonites, tergites and sternites distinct, epimera with seta, that of pleonite-5 long. *Pleotelson* Fig. 17B) as long as pleonites 2–5 combined, 10% of BL; posterior weakly produced, with two simple setae and two PSS, with one seta anterior to uropod attachment; apex conical with four setae, ventral-most longer and more deflexed; anterolateral anal ridges meeting medially, gap between these and pleonite-5 ≈ 30% of pleotelson L.

Paratype non-ovigerous female, 5.3 mm, NIWA 173623: *Antennule* Fig. 17 C) 4.6 L: W; article-1 ≈ 0.55× of TL (total length), 2.5 L: W, with proximomesial setules, three lateral PSS, distolateral seta and two or three PSS; article-2 0.33× article-1 L, ≈ 1.1 L: W, with distolateral seta and three PSS, and small distomesial seta; article-3 shorter than broad, with single distolateral (long) and distomesial (shorter) setae, and one distolateral PSS; article-4 slender, 3.7 L: W, with three thin setae, three long setae, and one aesthetasc closely applied to one of

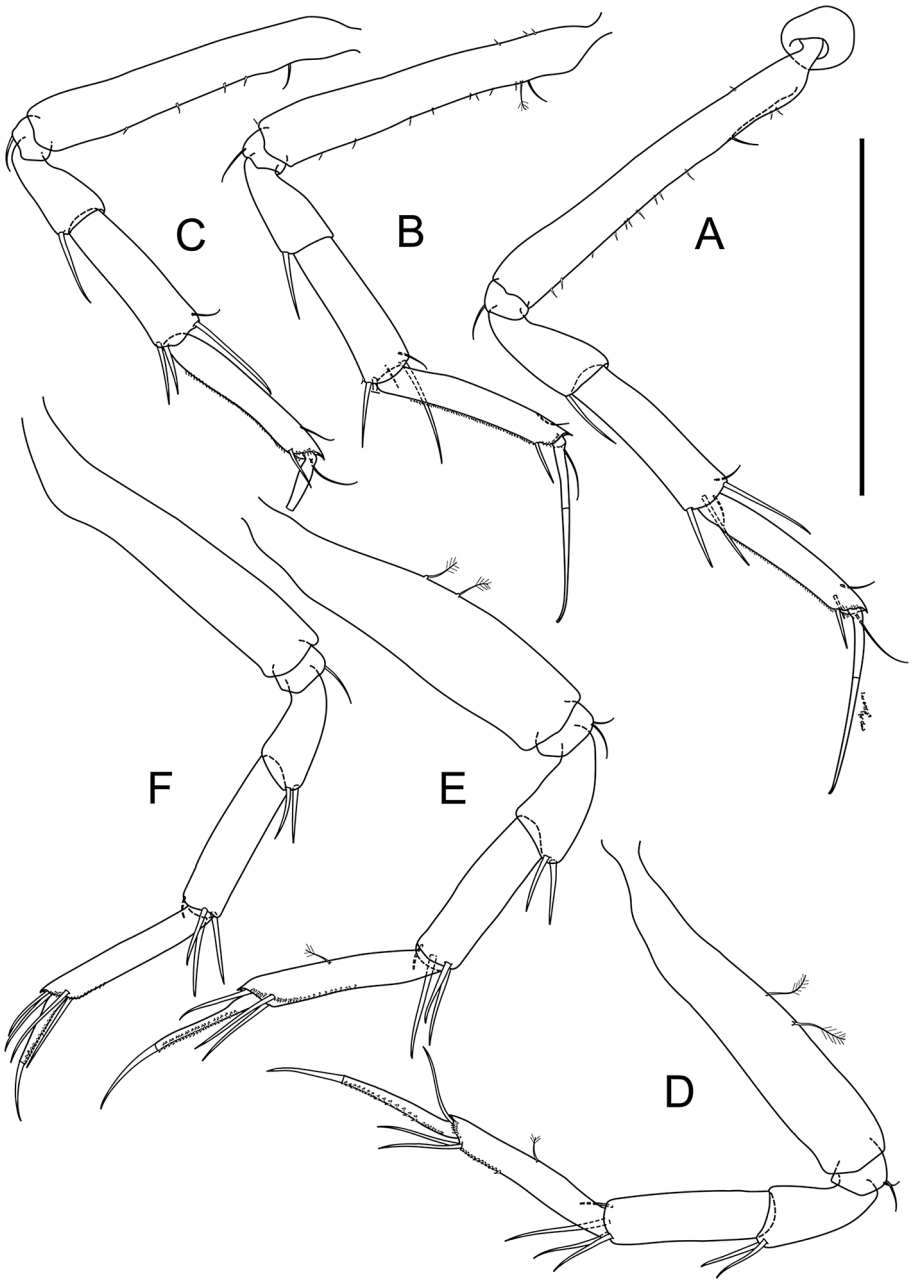

Fig. 20. *Libanius intonsus* n. sp., paratype female, NIWA 173623: A–F, pereopods 1–6, respectively; all bayonet spines finely pectinate. Scale bar: 0.5 mm.

the setae (fused?). *Antenna* Fig. 17D) ≈ 0.8× antennule L; article-1 shorter than broad; article-2 ≈ 1.3 L: W, dorsal margin raised (convex), with dorsodistal seta, and distolateral seta; article-3 smaller than article-2, slightly wider than broad, with dorsodistal seta about as long as article; article-4 1.2× articles 1–3 combined length (CL), with two long and two short distal setae, and one (?) distal PSS; article-5 shorter than article-2, 3 L: W, with distal seta; article-6 small, with six setae.

Mouthparts (paratype): *Labrum* Fig. 18 A) typical. *Mandibles* Fig. 18B–D) body with rugose outer margin; left incisor distally broad in full profile, crenulate, lacinia as long as incisor, subrectangular, weakly tricuspid, molar broad, larger than incisor, with apex bearing at least six small subterminal tubercles; right incisor three-cusped, molar similar to that of left mandible. *Labium* Fig. 18E) typical, medial lobes longer than broad, subtriangular, with apical setules. *Maxillule* Fig. 18 F) endite with distal setules, apex with eight spines of various thickness. *Maxilla* Fig. 18G, 21B) laminate, almost as large as maxilliped endite.

Maxilliped Fig. 19 A, 21 A) basal pedestal broader than bases, bases together cuneate, 1.7 L: W, median ridge with proximal setules; endites typical; palp ≈ 0.8× basis L, article-1 as long as broad; article-2 sub-triangular, as long as broad, setation typical; article-3 subrectangular, narrower than article-2, twice as long as broad, setation

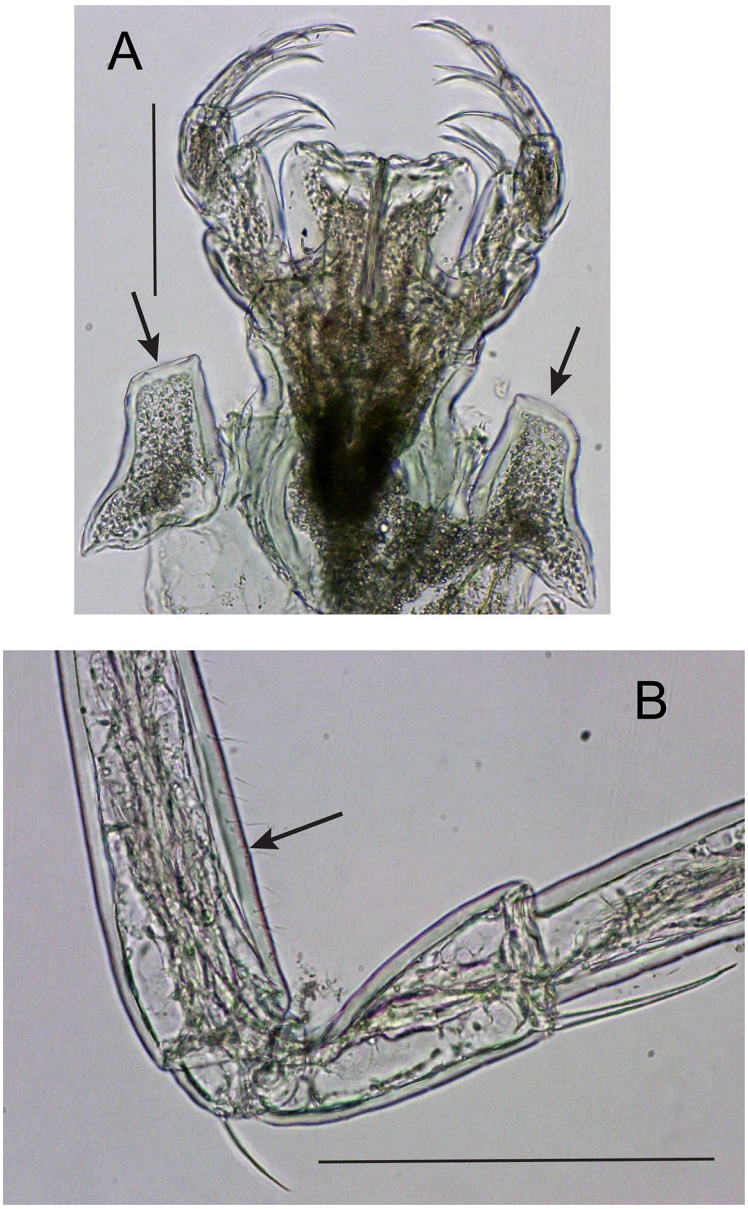

Fig. 21. *Libanius intonsus* n. sp., paratype female, NIWA 173623: A, maxilliped and maxilla (arrowed); B, pereopod-1 basis–merus, small setal groups arrowed. Scale bars: 0.2 mm.

typical; article-4 slender, subrectangular, shorter than article-3, 3 L: W, setation typical. *Epignath* Fig. 19B) typical, as long as maxilliped, with large pectinate distal seta.

Cheliped Fig. 19 C) robust; basis 0.9 L: W, left and right occluding ventrum of cephalothorax, posterior lobe slightly longer than anterior mass, latter with small dorsolateral seta; merus ventral margin long; carpus slightly narrower distally, 1.7 L: W; chela 1.2× carpus L, 2.6 L: W, palm 1.3 L: W; fixed finger slightly shorter than palm, incisive margin with two widely-spaced low teeth, and larger distal weakly bifid tooth; dactylus incisive margin apparently smooth.

Pereopod-1 Fig. 20 A, 21B) overall very thin, 20 L: W; basis very slender, 9.0 L: W, with proximal superior seta, and sparsely distributed setules (or naked); merus 1.8 L: W; carpus elongate, subrectangular, 1.7× merus L, spines typical, with two distomesial setae; propodus narrower but 1.1× carpus L, 6.0 L: W, with superodistal seta and two unequal distolateral and inferodistal spines, mesial inferior margin with row of spinules, and

setule comb near dactylus insertion; unguis 1.8× longer than dactylus, together as long as propodus. *Pereopod-2* Fig. 20B) similar to pereopod-1 but 17 L: W overall; basis stouter 7.7 L: W, with proximal superior seta and PSS; merus shorter and slightly stouter, 1.7 L: W; carpus shorter and slightly stouter, 3 L: W, spines typica; claw just shorter than propodus. *Pereopod-3* Fig. 20 C) similar to pereopod-2 but slightly shorter, 15.5 L: W overall; basis and merus each slightly shorter and stouter, 6.9× and 1.5 L: W respectively, basis with simple seta only; carpus, propodus and claw similar, but carpus with one superodistal seta.

Pereopod-4 Fig. 20D) 12 L: W overall; basis slender and as long as that of pereopod-1, slightly wider, 5.7 L: W, with two inferior PSS; merus stout; carpus slender, subrectangular, 1.7× merus L, 3.2 L: W; propodus slender, slightly longer than carpus, 5.7 L: W, setation typical, with inferior margin with double row of small spinules; dactylus longer than unguis, pectinate. *Pereopod-5* Fig. 20E) as pereopod-4, but basis stouter, 4.2 L: W; carpus slightly shorter; claw as long as propodus. *Pereopod-6* Fig. 20 F) similar to pereopod–5 but basis naked (PSS not observed) and slightly more slender, 5.7 L: W; merus smaller, 1.8 L: W; propodus slightly shorter and more slender, 5.9 L: W, setation typical.

Uropod Fig. 17E) peduncle 1.7 L: W; endopod 1.4× peduncle L, segment-2 shorter than segment-1, segment-1 with two large distomesial PSS, segment-2 with one subdistal seta, one small and three long terminal setae, and one terminal PSS; exopod strong, arcuate, proximate to or weakly divergent from endopod, reaching half endopod L but short of endopod segment-1 distal, with single long subdistal and distal setae.

Manca-2: BL 2.2 mm (n = 1). Pereonite-6 very short and pereopods-6 absent.

Manca-3: BL 2.4–2.8 mm (n = 3). Pereonite-6 short and pereopods-6 rudimentary.

Non-ovigerous female: As holotype, 4.5–5.7 L:W (n = 14), BL 3.65–5.65 mm (n = 33). Pleon 10–13% BL, mean 12.2% (n = 33).

Ovigerous female: As non-ovigerous female but with oostegites; BL 4.5–5.2 mm (n = 2).

Juvenile male: Habitus similar to non-ovigerous female; BL 2.4–4.8mm (n = 7). Pleon 12.1% BL (n = 7). Pleopods present, rudimentary, naked.

Male: Habitus (Fig. 32C) similar to female but slightly stouter, 4.8–5.1 L:W (n = 4); pleon usually slightly longer, 13.0–15.5% BL (n = 5, mean 14.6%), BL 4.1–4.5 mm (n = 5; allotype BL 4.1 mm). Antennule (Fig. 32D) stouter than female, 4.2 L:W overall, articles 1–4 2.0, 0.9, 0.7 and 3.4 L:W respectively (figured specimen), article-4 with incipient division. Pleopods present, typical; peduncle longer than broad, rami oar-shaped.

Distribution

Recorded from the Hikurangi Margin, Kaikoura Canyon, southern flank of the Chatham Rise, and Bounty Trough.

Bathymetric range

Bathyal, 1127–1676 m.

Remarks

This large *Libanius* species appears as the basal taxon of the NZ clade (Fig. 3). *Libanius intonsus* n. sp. is the only NZ arthrurid species that sometimes has scattered setules on the basis of pereopods 1–3 (Fig. 21B), although these are also present in *A. andriashevi* and *L. clisicola*, possibly as plesiomorphies. Some specimens lack these structures, perhaps through loss during preservation or as variation. This species has similar cephalothorax proportions similar to those of *L. tangaroa* and a longer, more rounded pleotelson but can be distinguished from this and the other *Libanius* species by the more slender chela (≈2.7 L: W) and carpus of pereopods 2–3, and stouter merus of pereopods 4–6.

The overall sample ratio of males to females is 1: 5.2. No mancae stages have yet been recorded. It is the deepest-occurring arthrurid species within the region and only one specimen of *Paralibanius taitonga* n. gen. n.sp. (see below) has been recorded in the same sample, NZOI S152, at 1676 m.

***Libanius largitas* n. sp.**

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(Figs. 1, 33 and 22–24, 36 C, 37B)

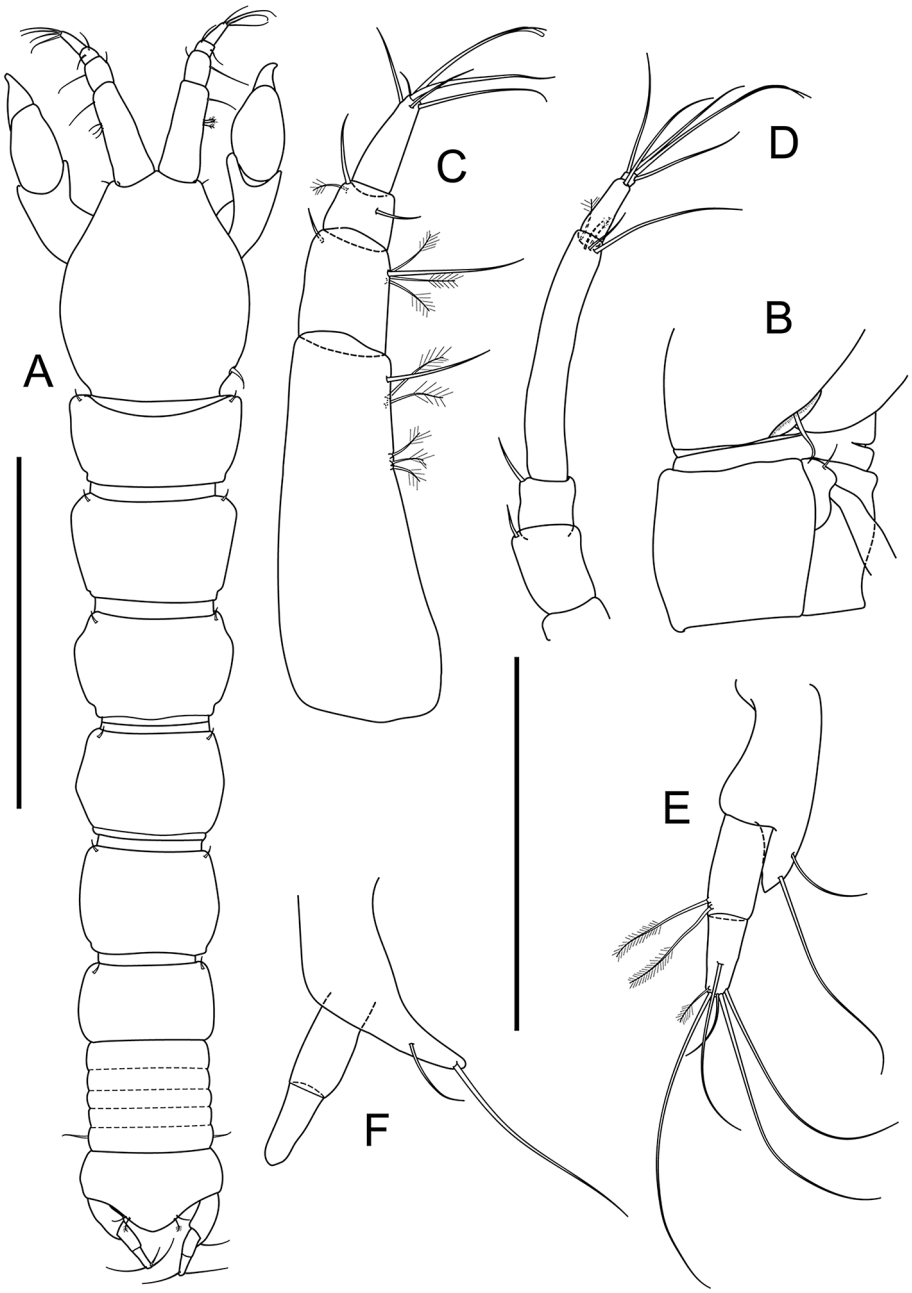

Fig. 22. *Libanius largitas* n. sp., holotype female, NIWA 173630: A, habitus; B, cephalothorax (with protruding epignath seta) and pereonite-1, lateral. Paratype female, NIWA 17633: C, antennule; D, antenna; E–F, uropod. Scale bars: A 1 mm; B–F 0.25 mm.

Type material
HOLOTYPE: non-ov. ♀, 3.95 mm, NIWA 173630, TAN1501 Stn Caravel.
PARATYPES: non-ov. ♀, NIWA 173631, TAN1116 Stn 68; 1 manca-2, 3 non-ov. ♀♀, 1 ov. ♀, NIWA 173632, 1 non-ov. ♀ dissected on 2 microslides, NIWA 173633,TAN1501 Stn Caravel.

Type locality
45.64°S 171.50°E, Bounty Trough, NZEEZ, Southwest Pacific, 1127 m.

Etymology
From the Latin noun *largitas*, "bounty, abundance"; referring to the type locality, itself named for the *HMS Bounty*, a former merchant collier taken up by the Royal Navy, which sailed past New Zealand under the command of Captain Bligh, September 1788[36]; used as a noun in apposition.

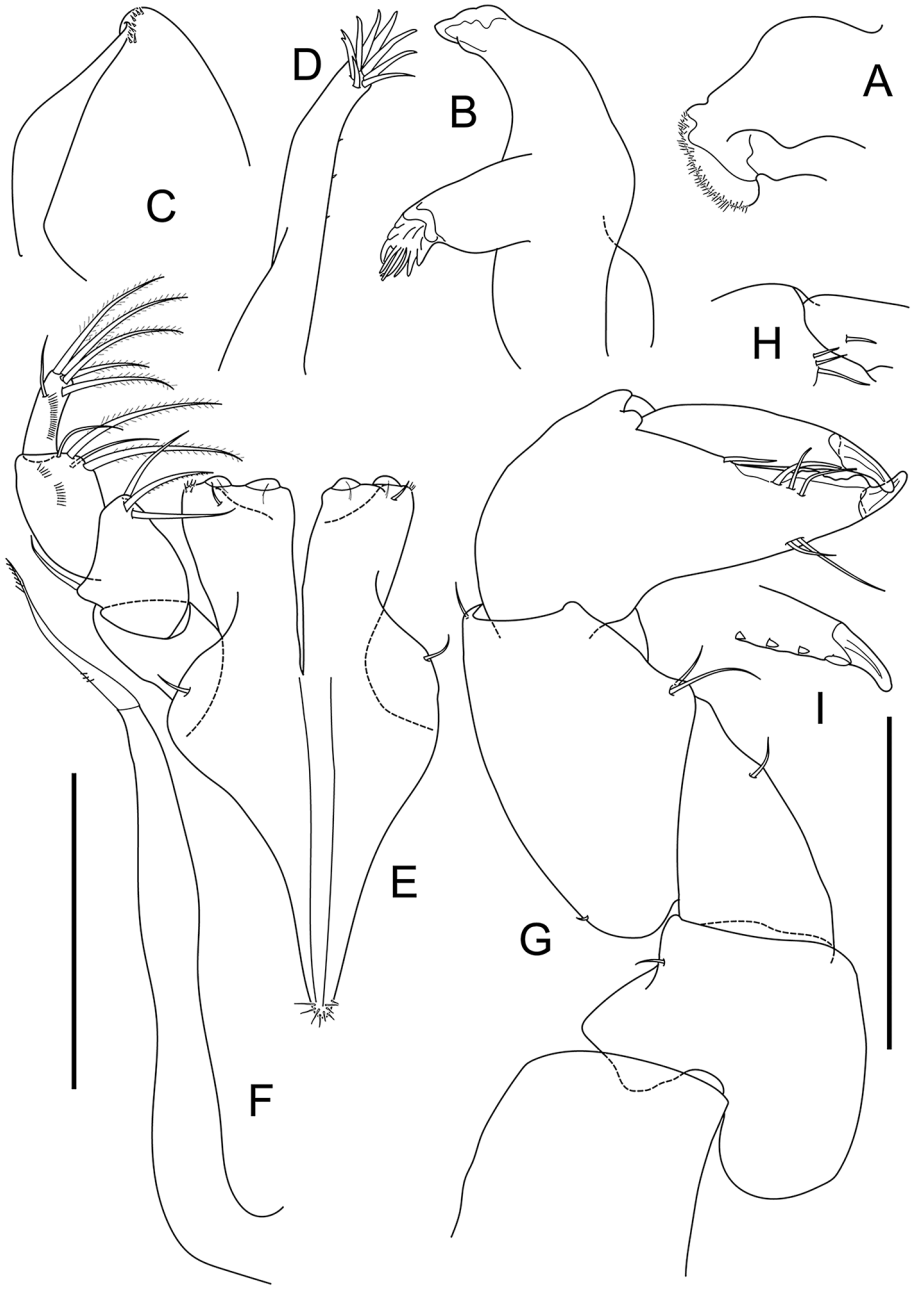

Fig. 23. *Libanius largitas* n. sp., paratype female, NIWA 173633: A, labrum; B, right mandible; C, labium; D, maxillule endite; E, maxilliped, pedestal omitted; F, epignath; G, cheliped; H, palm mesial view, with spine comb; I, cheliped dactylus mesial view. Scale bars: A–F 0.125 mm; G–I 0.25 mm.

Diagnosis

Libanius with *cephalothorax* longer than pereonites 1–2 combined. *Pereonite-1* short [≈ 0.25 L: W], without hyposphenium. *Pereonite-6* not long [0.56 L: W]. *Pleon* stout [0.85 L: W], pleonites sometimes indistinct. *Pleotelson* stout [≈ 0.56 L: W] ≈ 0.7× pleon L. *Antennule* L intermediate relative to cephalothorax [≈ 0.75×]. *Antenna* article-2 1.9× article-3 L, distodorsal seta ≈ 0.5× article-3 L; article-4 slender [≈ 7 L: W]. *Mandible* molar broad coronal. *Maxillule* endite with one bifid spine. *Cheliped* basis not quite reaching posterior of cephalothorax; basis just shorter [≈ 0.9×] than merus; merus much longer (≈ 2.5×) than that of carpus ventral margin; chela L: W intermediate [≈ 2.3 L: W], slightly narrower [≈ 0.9×] than carpus, palm dorsal and ventral margins clearly divergent; palm with 3-spined mesial comb. *Pereopods 1–3* basis without groups of setules. *Pereopod-1* merus inferodistal spine as long as article; carpus fairly slender [≈ 4.1 L: W]. *Pereopod-2* carpus with one distal seta. *Pereopods 4–6* overall thin [10.8 L: W]; merus L: W intermediate [2.4 L: W], **only slightly shorter than carpus [≈ 0.8×]**; **carpus L: W intermediate [2.8 L: W]**; claw longer than propodus [1.3×]. *Uropod* slightly

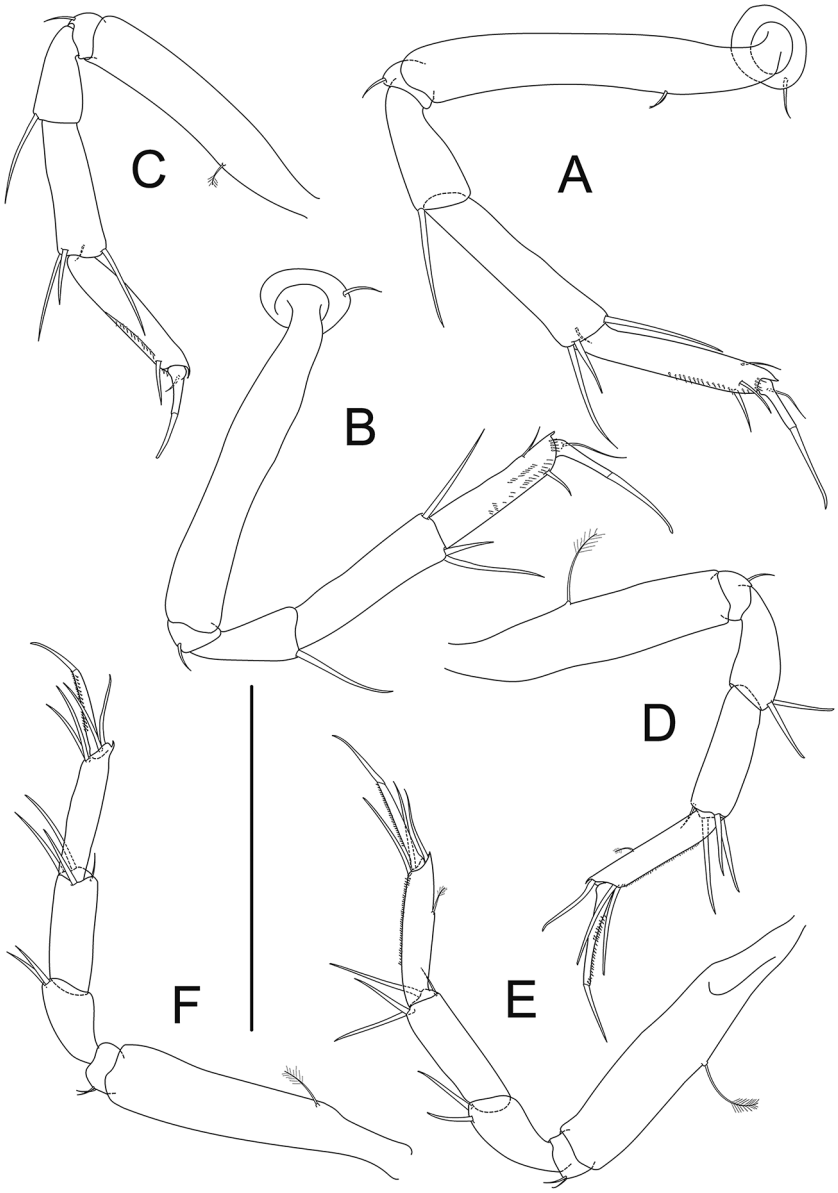

Fig. 24. *Libanius largitas* n. sp., paratype female, NIWA 173633: A–F, pereopods 1–6, respectively. Scale bar: 0.25 mm.

longer than pleotelson; peduncle geniculate; endopod L: W intermediate [4.9 L: W]; exopod fairly stout [≈ 2 L: W], proximate to endopod.

Description

Holotype non-ovigerous female: *Habitus* Fig. 22 A, 36 C) fairly stout, 5.6 L: W. *Cephalothorax* ≈ 1.2 L: W, L reaching half of pereonite-3 (excluding interpereonal gaps); branchial openingFig. . 22B) with setulate fringe, epignath setae sometimes visible. *Pereon* slightly tapering posteriad, pereonites with weakly convex lateral margins, pereonites 4–6 sometimes with weak process over coxal attachments, 0.40, 0.59, 0.63, 0.0.66, 0.70, and 0.58 L: W respectively (holotype); each with anterolateral seta. *Pleon* parallel-sided, 10.7% of body, pleonites and tergites/sternites weakly defined, pleonites 1 and 5 slightly longer than rest; pleonites without epimeral seta, pleonite-5 with one supero-epimeral seta. *Pleotelson* as long as pleonites 2–5 combined, posterior weakly-produced, with two simple setae and two PSS, with one seta anteroventral to uropod insertion (a large specimen has a small conical apex with four setae, the ventral-most pair longer and more deflexed).

Paratype non-ovigerous female (NIWA 173633). *Antennule* Fig. 22 C) 5 L: W overall; article-1 0.6× L of whole, 3 L: W, with three lateral PSS, distolateral seta and three PSS; article-2 0.33× article-1 L, ≈ 1.4 L: W, with distolateral seta, smaller distomesial seta, and three PSS; article-3 as long as broad, with single distolateral (long) and distomesial (shorter) setae; article-4 slender, 3.1 L: W, with two thin setae, four long setae, and one aesthetasc closely applied one of the setae (fused?). *Antenna* Fig. 22D) ≈ 0.75× antennule L; article-1 shorter than broad;

article-2 1.4 L: W, dorsal margin not raised; article-3 as long as broad, with longer dorsodistal seta; article-4 1.6× articles 1–3 CL, with one long and two short distal setae, and two distal PSS; article-5 0.75× article-2 L, 3 L: W, with distal seta; article-6 small, with five setae, two possibly fused.

Mouthparts (paratype): *Labrum* Fig. 23 A) typical. *Mandibles* Fig. 23B) with left incisor and lacinia unknown (not recovered), molar broad-coronal, with apex similar to that of right mandible; right incisor weakly tricuspid, molar apex slightly depressed, with a few round sub-terminal tubercles and about seven apical spines. *Labium* Fig. 23 C) medial lobes longer than broad, subtriangular, with apical setules. *Maxillule* Fig. 23D) endite with sparse ornamentation of microtrichia, apex with seven spines of various thickness. *Maxilla* not recovered.

Maxilliped Fig. 23E) basal pedestal broader than bases, bases together cuneate, 1.5 L: W; endites typical, endites typical; palp ≈ 0.9× basis L, article-1 as long as broad; article-2 sub-triangular, as long as broad, setation typical, one mesial seta stouter and more pectinate than others; article-3 subrectangular, as long as article-2, 1.7 L: W, setation typical; article-4 slender, subrectangular, shorter than article-3, 3 L: W, setation typical, with longitudinal fringe of setules. *Epignath* Fig. 23 F) typical, elongate, as long as maxilliped.

Cheliped Fig. 23G–I, 36B) robust, bases occluding cephalothorax ventrum, basis 0.9 L: W, posterior lobe shorter than anterior mass, latter with small dorsolateral seta; merus ventral margin twice long; carpus narrower distally, 1.6 L: W, with round posterior lobe; chela 1.3× carpus L, palm 1.1 L: W; fixed finger ≈ 1.2× palm L, incisive margin with two widely-spaced low teeth; dactylus incisive margin with two peglike spines and distal co-axial spine.

Pereopod-1 Fig. 24 A) overall very thin, 19.3 L: W; basis slender, 7.3 L: W, with proximal superior PSS; merus 2.4 L: W; carpus elongate, subrectangular, ≈ 1.5× merus L, spines typical, with one distal seta; propodus narrower and just shorter than carpus, 5.9 L: W, with superodistal seta, inferodistal spine, and distolateral spine (thinner and mesial), inferior margin with row of spinules, and setule comb near dactylus insertion; dactylus accessory seta not observed, dactylus and unguis together ≈ 0.8× propodus L. *Pereopod-2* Fig. 24B) similar to pereopod-1 but basis, merus, carpus and propodus very slightly shorter, but propodus still very slender (5.25 L: W). *Pereopod-3* Fig. 24 C) similar to pereopod-2 but basis very slightly shorter.

Pereopod-4 Fig. 24D) basis slender, 4.5 L: W, and as long as those of pereopods 1–3, slightly wider, with one inferior PSS; merus not slender; carpus slender, subrectangular, slightly longer than merus; propodus slender, as long as carpus, 5 L: W, inferior margin with row of small spinules; dactylus longer than unguis, pectinate. *Pereopod-5* Fig. 24E) as pereopod-4. *Pereopod-6* Fig. 24 F) similar to pereopods 4–5, setation typical.

Uropod Fig. 22E–F) peduncle 1.9 L: W; endopod 1.25× peduncle L, segment-1 slightly longer than segment-2, segment-1 with two large distomesial PSS, segment-2 with one subdistal seta, one small thin, and three long terminal setae, and one terminal PSS; exopod strong, acute, reaching just short of distal of endopod segment-1, with single long subdistal and distal setae.

Manca-2: BL 1.74–1.85 mm (n = 12); pereopods-6 and pleopods absent. Another, 1.3 mm, specimen is in poor condition and may not be this species.

Manca-3: BL 2.26–2.35 mm (n = 3). Pereopod-6 rudimentary. Pleopods absent. Non-ovigerous female. Habitus as holotype, 5.7–6.7 L:W (n = 5); BL 2.61–4.39 mm (n = 9). Pleon 8.5–11.5% BL (n = 8).

Ovigerous female: As non-ovigerous female but pereon slightly dorsoventrally compressed; BL 3.5 mm.

Male: Unknown.

Distribution

Recorded only from the southern flank of the Chatham Rise and Bounty Trough, off the southeastern seaboard of Te Waipounamu South Island.

Bathymetric range

Bathyal, 1011–1127 m.

Remarks

Most similar to *L. concertator*, *L. largitas* n. sp. shares many of its pleonal, antennule, antenna, cheliped, and pereopod characters but differs in 33 of the 98 listed characters (Tables S1, S2) among which are a relatively longer pereonite-1, relatively longer antennule, more slender antenna article-4, longer cheliped merus relative to ventral margin of carpus, and a more pereopod-1 carpus and uropod endopod. They may be sister species, or even conspecific, separated by geography, with *L. largitas* on the southeastern seaboard of NZ, and *L. concertator* largely on the western side (e.g. Challenger Plateau). No males of this scarce species have been recorded.

***Libanius projectus* n. sp.**

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Ocean Census species 46.

(Figs. 1 and 3, 5 A, C, E, G, 25-28, 32E–F, 36D, 37 A)

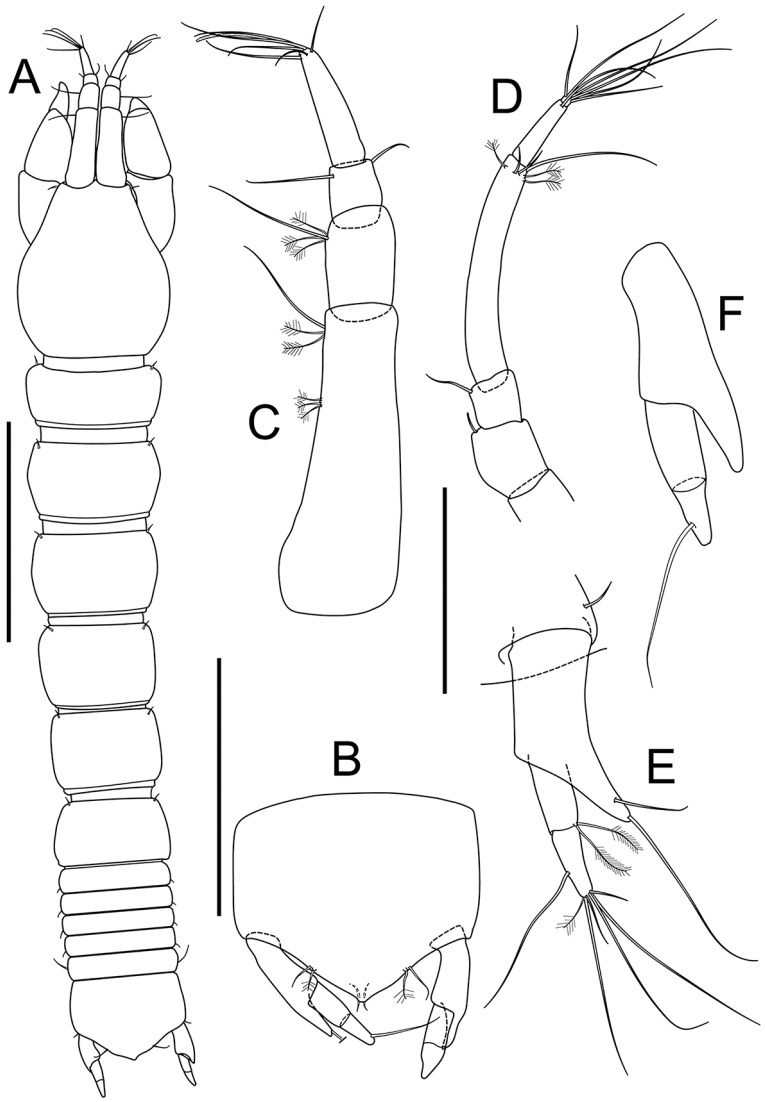

Fig. 25. *Libanius projectus* n. sp., holotype female, NIWA 173634: A, habitus; B, pleotelson. Paratype female, NIWA 173635: C, antennule; D, antenna; E, uropod. Holotype female, NIWA 173634: F, uropod [most setae missing]. Scale bars: A 1 mm; C–F 0.25 mm.

Type material
HOLOTYPE: non-ov. ♀, 5.43 mm, NIWA 173634, TAN1501 Stn Caravel. PARATYPES: 28 manca-2, 10 non-ov. ♀♀ (1 dissected on 2 microslides, NIWA 173635), 1 ov. ♀, 7 juv. ♂♂, 5 ♂♂, NIWA 173636, TAN1501 Stn Caravel.

Other material
1 non-ov. ♀ post-dissected remnant, NIWA 27317 (chelipeds on microslide), post-dissected remnant, NIWA 27318, NZOI Stn E416. Both originally deposited as types for unpublished "*Libanius projectus*" by Jurgen Sieg; 2 non ov. ♀♀, NIWA 13970, NZOI Stn S153; 10 non ov. ♀♀, 1 ♂, NIWA 13771, NZOI Stn S154; juv. ♂, NIWA 173637, TAN0705 Stn 45; 1 non-ov. ♀, NIWA 173638, TAN0705 Stn 48; 2 manca-3, 3 non-ov. ♀♀, 1 juv. ♂, NIWA 173639, 6 manca-3, 5 non-ov. ♀♀, 6 juv. ♂♂, 1 ♂, NIWA 173640, TAN0705 Stn 49; 2 manca-3, NIWA 173641, TAN0705 Stn 160; 2 non-ov. ♀♀, NIWA 173642, TAN0705 Stn 276; 1 juv. ♂, NIWA 173643, TAN1004 Stn 127; 1 manca-2, 1 non-ov. ♀, 1 juv. ♂, NIWA 173644, TAN2402, Stn 37.

Type locality
45.64°S 171.50°E, Bounty Trough, NZEEZ, Southwest Pacific, 1127 m.

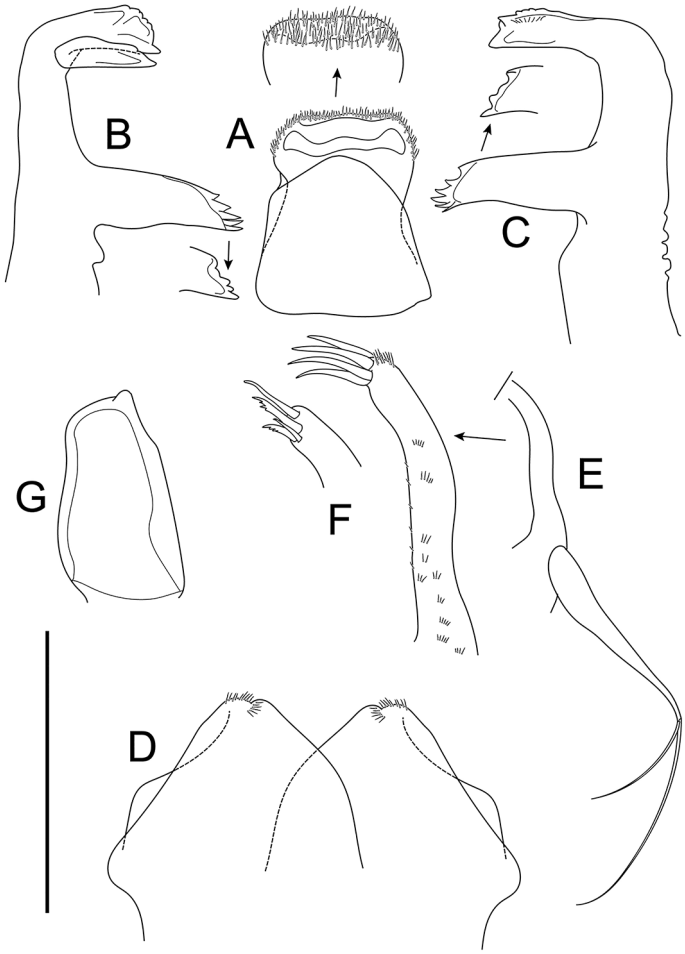

Fig. 26. *Libanius projectus* n. sp., paratype female, NIWA 173635: A, labrum; B–C left and right mandible respectively [with obscured spines]; D, labium; E, maxillule: F, maxillule endite, with obscured spines; G, maxilla. Scale bar: 0.125 mm.

Etymology
Adoption of an unpublished nomen proposed by either Karl Lang or Jürgen Sieg for this species, based on the Latin adjective *projectus*, "projecting, jutting out"; presumably referring to the uropod exopod.

Diagnosis
Libanius with *cephalothorax* longer than pereonites 1–2 combined. *Pereonite-1* short [≈ 0.4 L: W], without hyposphenium. *Pereonite-6* not long [0.55 L: W]. *Pleon* as long as broad, pleonites distinct. *Pleotelson* stout [≈ 0.75 L: W], 0.75× pleon L. *Antennule* L intermediate relative to cephalothorax [≈ 0.78×]. *Antenna* article-2 1.3× article-3 L, distodorsal seta short; article-4 very slender [8.3 L: W]. *Mandible* molar broad coronal. *Maxillule* endite with two coarsely pectinate spines. *Cheliped* basis reaching posterior of cephalothorax; basis clearly longer [1.3x] than merus; merus longer [1.7×] than that of carpus ventral margin; chela L: W intermediate [≈ 2.2 L: W], ≈ carpus W, palm dorsal and ventral margins clearly divergent, with 5-spined mesial comb. *Pereopods 1–3* basis without groups of setules. *Pereopod-1* merus inferodistal spine as long as article; carpus fairly stout [3.2 L: W]. *Pereopod-2* carpus with two distal setae. *Pereopods 4–6* overall very thin [≈ 12 L: W]; merus L: W intermediate [2.3 L: W], shorter than carpus [≈ 0.7×]; carpus slender [3.1 L: W]; claw ≈ propodus L. *Uropod* shorter than pleotelson; peduncle geniculate; endopod L: W intermediate [4.6 L: W]; exopod L: W intermediate [3 L: W], proximate or divergent to endopod.

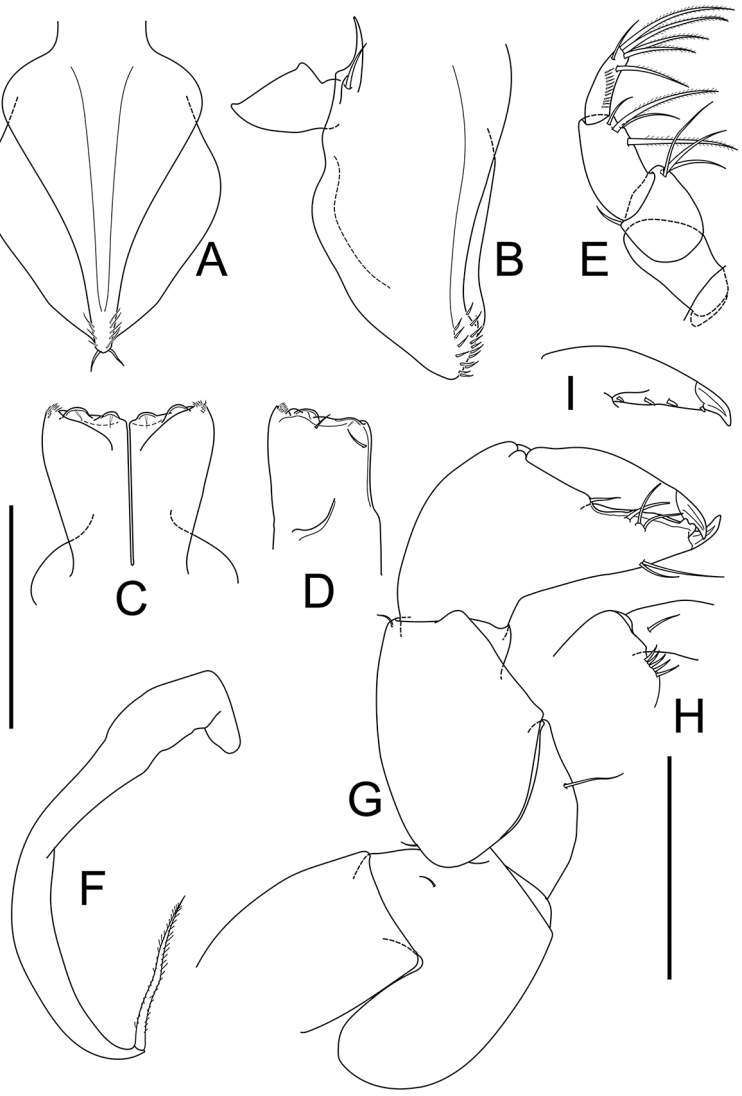

Fig. 27. *Libanius projectus* n. sp., paratype female, NIWA 173635: A, maxilliped bases; B, maxilliped bases, lateral view; C, maxilliped endites, aboral; D, maxilliped endite, oral; E, maxilliped palp; F, epignath; G, cheliped; H, palm mesial, with spine comb; cheliped dactylus mesial view. Scale bar: A–F 0.125 mm, G–H 0.25 mm.

Description

Holotype non-ovigerous female: *Habitus* Fig. 25 A, 36D) fairly slender, 6 L: W, BL 5.43 mm. *Cephalothorax* Fig. 37 A) 1.2 L: W, L reaching half of pereonite-3, 22% of BL. *Pereon* slightly tapering posteriad, 54% of BL; pereonites with weak convex lateral margins, pereonites 4–6 with weak lateral process over coxal attachments, 0.4, 0.56, 0.62, 0.72, 0.70, and 0.56 L: W respectively; each with anterolateral seta. *Pleon* parallel-sided, 12.6% of BL, pleonites 1 and 5 slightly longer than the others; tergites and sternites distinct, epimera with seta, that of pleonite-5 long. *Pleotelson* Fig. 25B) almost as long as pleonites 2–5 combined, 10% of BL; posterior weakly produced, with two simple setae and two PSS, with one seta anterior to uropod attachment; apex conical with four setae, ventral-most longer and more deflexed; anterolateral anal ridges meeting medially, gap between these and pleonite-5 ≈ 30% of pleotelson L.

Paratype non-ovigerous female, NIWA 173635: *Antennule* Fig. 25 C) article-1 ≈ 0.54× TL, 3.2 L: W, with three lateral PSS, distolateral seta and two or three PSS; article-2 0.3× article-1 L, ≈ 1.4 L: W, with distolateral seta and three PSS; article-3 as long as broad, with single distolateral (long) and distomesial (shorter) setae; article-4 slender, 3.9 L: W, with two thin setae, four long setae, and one aesthetasc closely applied to one of the setae (fused?). *Antenna* Fig. 25D) ≈ 0.8× antennule L; article-1 shorter than broad; article-2 ≈ 1.2 L: W, dorsal margin

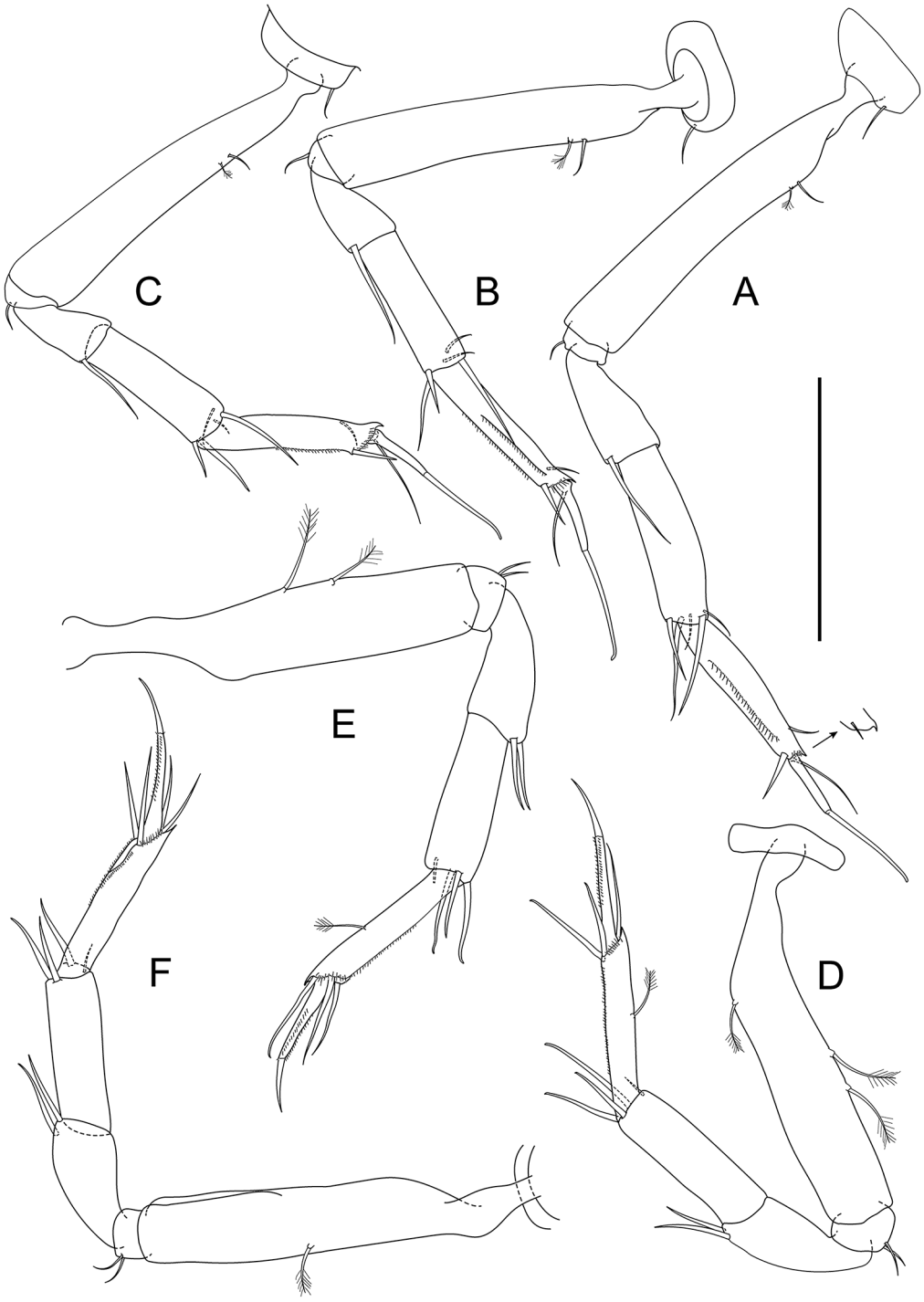

Fig. 28. *Libanius projectus* n. sp., paratype female, NIWA 173635: A–F, pereopods 1–6, respectively. Scale bar: 0.25 mm.

raised (convex), with dorsodistal stiff seta half article-3 L; article-3 slightlyt longer than broad, with longer dorsodistal seta; article-4 1.45× articles 1–3 combined length, with one long and two short distal setae, and three (?) distal PSS; article-5 as long as article-2, 4.3 L: W, with distal seta; article-6 small, with six setae.

Mouthparts (paratype): *Labrum* Fig. 25 A) typical. *Mandibles* Fig. 26B–C) with left incisor distally broad in full profile, crenulate, lacinia as long as incisor, subrectangular, molar broad coronal, larger than incisor, with apex bearing three or four small subterminal tubercles and about six sharp spines; right incisor three-cusped, molar similar to that of left mandible. *Labium* Fig. 26D) medial lobes longer than broad, subtriangular, with

apical setules. *Maxillule* Fig. 26E–F) endite with rows of microtrichia, apex with several fine setae and eight spines of various thickness. *Maxilla* Fig. 26G) laminate, subrectangular, almost as large as maxilliped endite.

Maxilliped Fig. 27 A–E) basal pedestal broader than bases, bases together cuneate, 1.6 L: W, median ridge with double row of proximal setules; endites typical; palp ≈ 0.9× basis L, article-1 as longer than broad; article-2 sub-triangular, as long as broad, setation typical; article-3 subrectangular, shorter than article-2, twice as long as broad, setation typical; article-4 slender, subrectangular, shorter than article-3, 3.6 L: W, setation typical, with longitudinal fringe of setules. *Epignath* Fig. 27 F) as long as maxilliped, with large pectinate distal seta.

Cheliped Fig. 27G–I, 37 A) robust; left and right occluding ventrum of cephalothorax, 1.3 L: W, posterior lobe as long as anterior mass, latter with small dorsolateral seta; merus ventral margin long; carpus narrower distally, 1.4 L: W, with round posterior lobe; chela 1.4× carpus L palm 1.1 L: W; fixed finger as long as palm, incisive margin with two widely-spaced low teeth, and larger distal bifid tooth; dactylus without proximomesial spine (?), incisive margin with two peglike spines and distal co-axial spine.

Pereopod-1 Fig. 28 A) overall very thin, 15.6 L: W; basis slender, 7.1 L: W, with proximal superior seta and small PSS; merus 2.2 L: W; carpus elongate, subrectangular, 1.5× merus L, spines typical, with two distomesial setae; propodus narrower but as long as carpus, 5.3 L: W, with superodistal seta and two inferodistal spines, one thinner than other, mesial inferior margin with row of spinules, and setule comb near dactylus insertion; dactylus with accessory seta, unguis slightly longer than dactylus [1.4×], together with dactylus ≈ propodus L. *Pereopod-2* Fig. 28B) similar to pereopod-1 but merus, carpus and propodus each slightly shorter. *Pereopod-3* Fig. 28 C) similar to pereopod-2 but merus, carpus, propodus and claw each slightly shorter.

Pereopod-4 Fig. 28D) basis slender and as long as those of pereopods 1–3, slightly wider, 5.4 L: W, with one superior and two inferior PSS; merus not slender; carpus slender, subrectangular, 1.2× merus L; propodus slender, slightly longer than carpus, 6 L: W, inferior margin with double row of small spinules; dactylus longer than unguis, pectinate. *Pereopod-5* Fig. 28E) as pereopod-4, but basis without superior PSS. *Pereopod-6* Fig. 28 F) similar to pereopod–5 but basis with one inferior PSS; propodus setation typical.

Uropod Fig. 25E–F) peduncle 1.8 L: W; endopod almost as long as peduncle, segments about equal in length, segment-1 with two large distomesial PSS, segment-2 with one subdistal seta, three long, two small thin, terminal setae and one (?) terminal PSS; exopod strong, acute, divergent from endopod, reaching half endopod L, with single long subdistal and distal setae.

Manca-2. BL 1.74–2.4 mm ($n = 20$); pereonite-6 very short; pereopods-6 and pleopods absent.

Manca-3. BL 2.0–2.5 mm ($n = 8$); pereopods-6 rudimentary; pleopods absent.

Non-ovigerous female: As holotype, 5.25–6.0 L: W (mean 5.5, $n = 16$), BL 3.3–5.3 mm ($n = 27$). *Pleon* 10.1–13.5% BL (mean 11.9%, $n = 27$).

Ovigerous female: As non-ovigerous female but pereon slightly dorsoventrally compressed; BL 4.6 mm (n = 1).

Juvenile male: Habitus similar to non-ovigerous female; 5.1–5.8 L:W (mean 5.3, n = 9), BL 2.8–3.9 mm (n = 15). Pleopods present, rudimentary, naked.

Male: Habitus (Fig. 32E) similar to female but slightly stouter, 5.5–6.1 L:W (n = 5; allotype 6.0 L:W); pleon generally longer, 12.2–16.8% BL (mean 15.4%, n = 7, allotype 16.7%); BL 4.3–4.7 mm (n = 7; allotype BL 4.6 mm). Antennule stouter, 4.3 L:W overall, articles 1–4 2.2, 0.9, 0.6 and 3.1 L:W respectively (allotype), article-4 with incipient division. Pleopods (Fig. 32F) near-rigid, held in tent-like configuration; peduncle slightly longer than broad; rami about equal in size and shape, 2.9 L:W, endopod with superodistal seta and fringe of eight setae, shorter than ramus; exopod with distal fringe of nine setae.

Distribution

Recorded from the southern slope of the southern flank of the Chatham Rise and Bounty Trough, as well as the Hikurangi Margin.

Bathymetric range

Bathyal, 982–1386 m.

Remarks

This species was one of those NZ tanaids starting to receive taxonomic attention by Karl Lang and Jürgen Sieg in the 1970–1980 period, which was left uncompleted, although unpublished types were deposited. In the second phylogenetic analysis (Fig. 3), *L. projectus* n. sp. nests within a clade of other NZ *Libanius* species but has a proportionally shorter cephalothorax than *L. tangaroa* n. sp. (see below) and a longer pleotelson, smooth pereopod bases, and well-defined pleonites.

Of 55 post-manca specimens of certain life stage 23 are males of various stages of development, resulting in a relatively low sex ratio of 1: 1.4 males to females. The largest number of specimens in a single sample is 24, from TAN0705 Stn 49, at 1237 m on the southern flank of the Chatham Rise.

***Libanius tangaroa* n. sp.**

LSID urn: lsid: zoobank.org:

Ocean Census species 47.

(Figs. 1, 3 and 29–31, 32G–H, 36E)

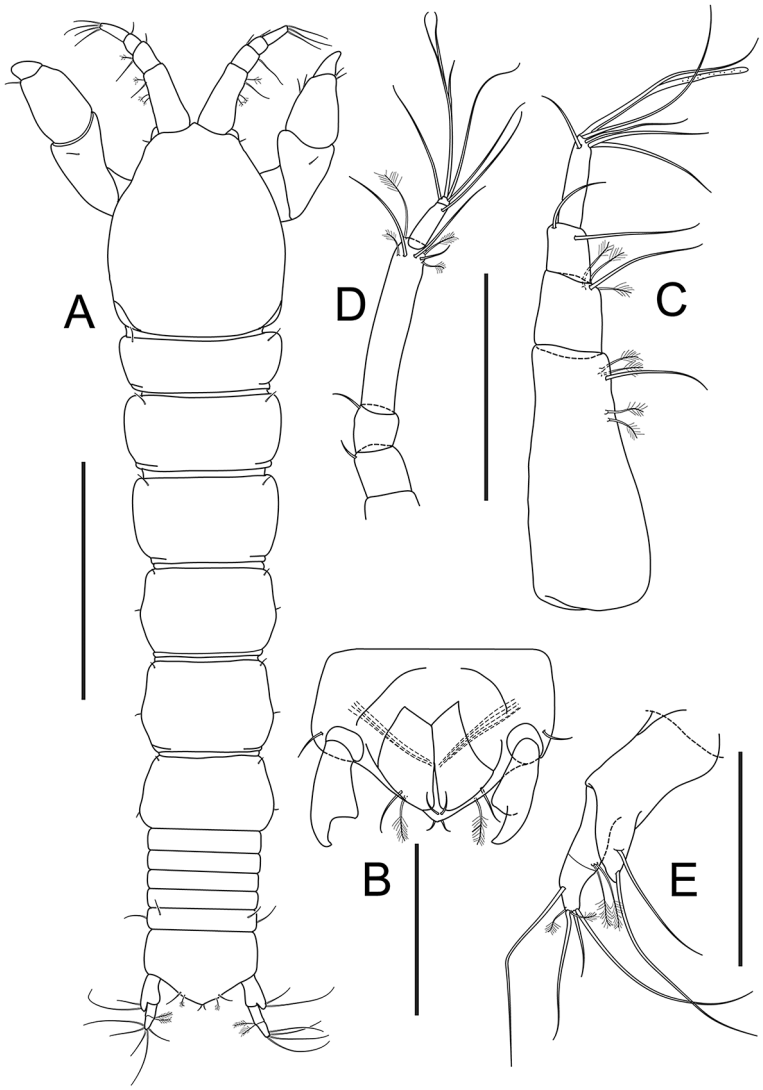

Fig. 29. *Libanius tangaroa* n. sp., holotype female, NIWA 173645: A, habitus; B, pleotelson, ventral. Paratype female, NIWA 173646: C, antennule; D, antenna; E, uropod. Scale bars: A 1 mm; B 0.25 mm; C–E 0.2 mm.

Type material
HOLOTYPE: non-ovigerous (non-ov.) ♀, NIWA 173645, 3.65 mm, TAN1116 Stn 89. PARATYPES: 1 non-ov. ♀, dissected on 2 microslides, NIWA 173646, TAN0705 Stn 83; 1 ♂, NIWA 173647, TAN1116 Stn 89; 4 non-ov. ♀♀ (one partly dissected on 1 microslide, NIWA 173648), 2 juv. ♂♂ (1 with a pleopod dissected on microslide), NIWA 173649, TAN0705 Stn 251; 1 non-ov. ♀, 1 ♂, NIWA 173650, TAN1116 Stn 31; 2 ♂♂, NIWA 173651, TAN1116 Stn 33.

Other material
1 non-ov. ♀, NIWA 142262, NZOI Stn F753; 1 non-ov. ♀, NIWA 12821, NZOI Stn S138; 1 non-ov. ♀, NIWA 173652, TAN0705 Stn 24; 1 manca-2, 1 non-ov. ♀, 2 ♂♂, NIWA 173653, TAN1116 Stn 89; 2 non-ov. ♀♀, NIWA 96069, 1 ov. ♀, 1 juv. ♂, NIWA 96068, TAN1306 Stn 30; one ♂, NIWA 173654, TAN2303 Stn 22; 1 non-ov. ♀, NIWA 173655, TAN2303 Stn 47; 1 ov. ♀, NIWA 173656, TAN2303 Stn 85; 1 manca-3, 1 non-ov. ♀, NIWA 173657, TAN2402, Stn 11.

Type locality
43° 29.76'S 178° 19.84'E, near-crest southern slope of the Chatham Rise, NZEEZ, Southwest Pacific, 463 m.

Etymology
From Te reo Māori, Tangaroa, an *atua* (ancestor) connected to the ocean; also, for *RV Tangaroa*, the principal research vessel of NIWA.

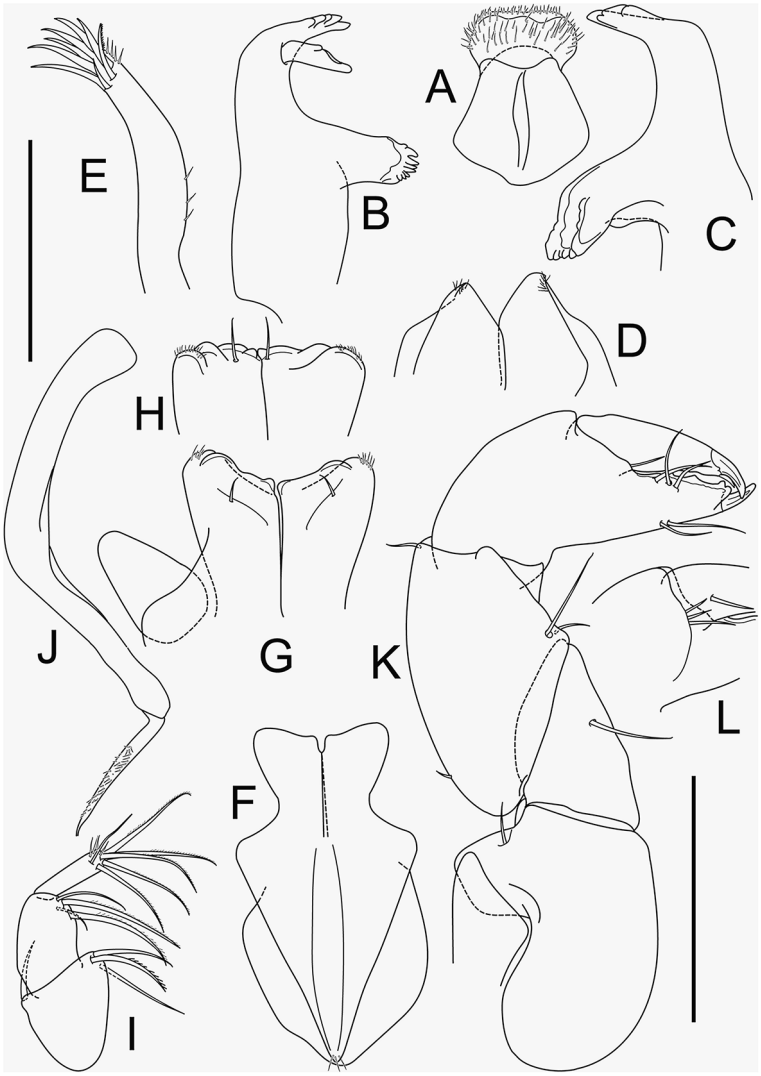

Fig. 30. *Libanius tangaroa* n. sp., paratype female, NIWA 173646: A, labrum; B–C left and right mandible respectively; D, labium; E, maxillule endite, distal; F, maxilliped, palps and setation omitted; G, maxilliped endites, aboral; H, maxilliped endites, oral; I, maxilliped palp articles 1–3; J, epignath; K, cheliped; L, palm mesial, with spine comb. Scale bars: A–I 0.125 mm; J–K 0.25 mm.

Diagnosis
Libanius with *cephalothorax* relatively large, as long as pereonites 1–3 combined. *Pereonite-1* short [< 0.4 L: W], without hyposphenium; pereonite-6 not long [≈ 0.5 L: W]. *Pleon* stout [0.9 L: W], pleonites well defined. *Pleotelson* fairly stout [0.65 L: W], ≈ 0.75× pleon L. *Antennule* short relative to cephalothorax [0.6×]. *Antenna* article-2 clearly longer [1.7×] than article-3; article-4 L: W intermediate [≈ 5 L: W]. *Mandible* molar broad coronal. *Maxillule* endite with one finely pectinate spine. *Cheliped* basis reaching posterior of cephalothorax; basis longer than merus; merus ≈ 2× carpus ventral margin L; chela L: W intermediate [≈ 2.4 L: W], slightly narrower than carpus, palm dorsal and ventral margins subparallel, with 3-spined mesial comb. *Pereopods 1–6* basis without groups of setules. *Pereopod-1* merus inferodistal spine L shorter than merus; carpus slender [4.3 L: W]. *Pereopod-2* carpus with one distal seta. *Pereopods 4–6* overall very thin [14.4 L: W]; merus slender [2.5 L: W]; propodus fairly stout [≈ 4.6 L: W]; **claw shorter than propodus**. *Uropod* just shorter than pleotelson; peduncle arcuate; endopod L: W intermediate [3.7 L: W], ≈ peduncle L; exopod stout [2.5 L: W], proximate to endopod.

Description
Holotype non-ovigerous female: *Habitus* Fig. 29 A, 36E) fairly stout, 4.9 L: W. *Cephalothorax* 1.2 L: W, 25% of body length. *Pereon* slightly tapering posteriad, pereonites 1–3 with weakly convex lateral margins, pereonites 4–6 with weak process over coxal attachments, 0.31, 0.47, 0.53, 0.63, 0.68, and 0.56 L: W respectively; each with anterolateral seta, coxal seta visible in dorsal view on pereonites 4–6 at least. *Pleon* parallel-sided, 11.6% of BL, pleonites 1 and 5 slightly longer than rest; tergites and sternites distinct, pleonite-5 with long epimeral seta and shorter anterodorsal seta. *Pleotelson* Fig. 29B) almost as long as pleonites 2–5 combined, ≈ 0.65 L: W, lateral margins weakly tapering posteriad, posterior weakly-produced, with two simple setae and two PSS, with small

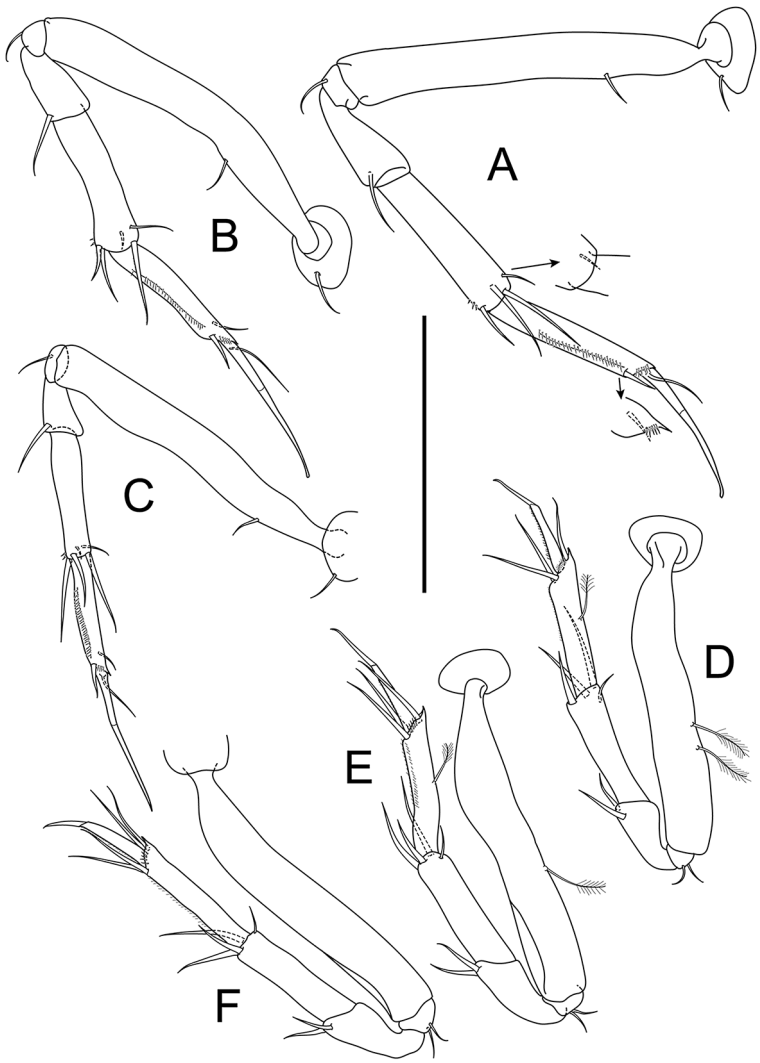

Fig. 31. *Libanius tangaroa* n. sp., paratype female, NIWA 173646: A–F, pereopods 1–6, respectively. Scale bar: 0.25 mm.

conical apex with four setae (two longest deflexed); anterolateral anal ridges meeting medially, and one seta anteroventral to uropod insertion.

Paratype non-ovigerous female, NIWA 173646: *Antennule* Fig. 29 C) 0.6× cephalothorax L (holotype), ≈ 4.4 L: W overall; article-1 ≈ 0.56× L of whole, 2.5 L: W, with two lateral PSS, distolateral seta and two or three PSS; article-2 0.3× article-1 L, 1.2 L: W, with distolateral seta and three PSS; article-3 ≈ 1.4 L: W, with single distolateral (long) and distomesial (shorter) setae; article-4 slender, 4 L: W, with two thin setae, four long setae, and one aesthetasc closely applied one of the setae (fused?). *Antenna* Fig. 29D) 0.8× antennule L; article-1 shorter than broad; article-2 ≈ 1.2 L: W, dorsal margin slightly raised (convex); article-3 smaller than article-2, slightly longer than broad, dorsodistal seta longer than that of article-2; article-4 1.4× articles 1–3 CL, 5 L: W, with one short and two long distal setae, and four distal PSS; article-5 slightly longer than article-3, 3 L: W, with distal seta; article-6 small, with six setae, three possibly fused.

Mouthparts: *Labrum* Fig. 30 A) typical; epistome round in lateral view. *Mandibles* Fig. 30B–C) with left incisor narrow but strongly crenulate, lacinia as large as incisor, subrectangular with irregular crenation, molar coronal, bearing a few small sub-terminal tubercles and about eight blunt terminal spines; right incisor four-cusped, molar similar to that of left mandible, as large as or larger than incisor, slightly deflexed. *Labium* Fig. 30D) medial lobes longer than broad, subtriangular, with apical setules. *Maxillule* Fig. 30E) endite apex with setules and seven spines of various thickness, one finely pectinate; palp with two long unequal setae. *Maxilla* not observed.

Maxilliped Fig. 30 F–I) basal pedestal broad cordiform, bases together cuneate, narrower, 1.4 L: W, with slight median ridge with several proximal setules; endites typical, but sub-mesial tubercle broad and shallow, mesial tubercle smaller and triangular, and one distal seta; palp ≈ 0.75× basis L, article-1 longer than broad; article-2 triangular, as long as broad, setation typical, with one mesial seta stronger and more pectinate than others; article-3 subrectangular, shorter than article-2, 1.6 L: W, setation typical, setae; article-4 slender, subrectangular, just shorter than article-3, 3.5 L: W, setation typical, with several distal setules. *Epignath* Fig. 31 J) typical.

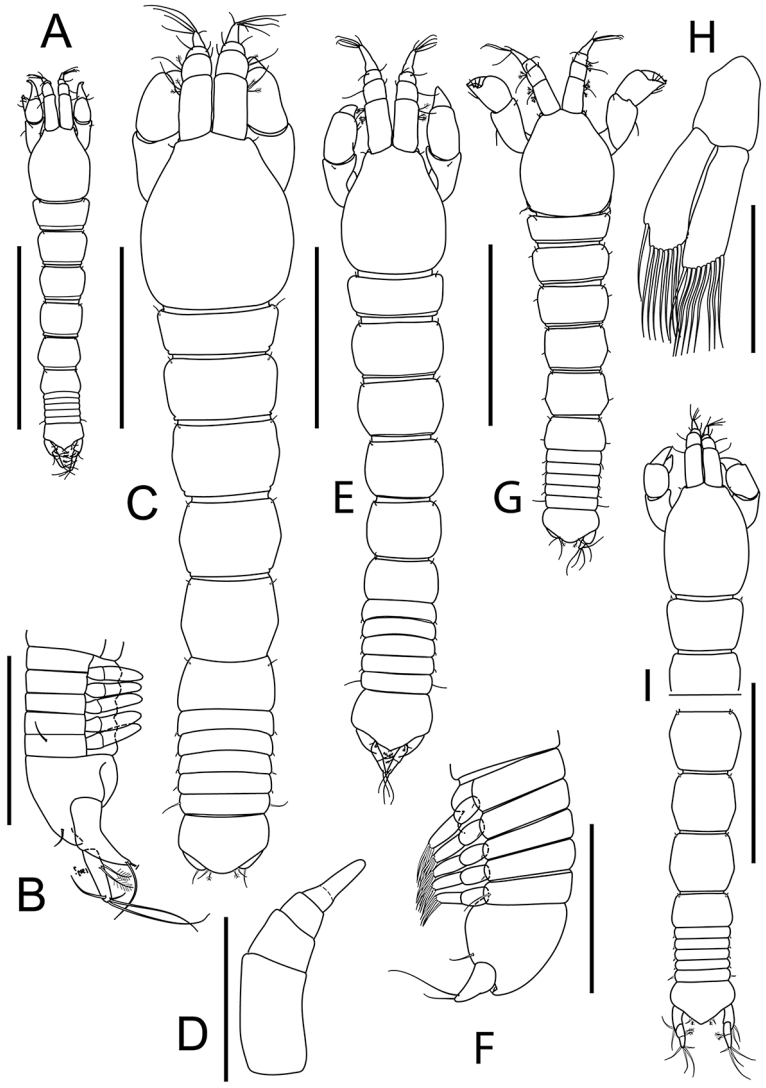

Fig. 32. *Libanius concertator* n. sp., paratype juvenile male, NIWA 173619: A, habitus; B, pleon and pleotelson, lateral. *Libanius intonsus* n. sp., paratype male, NIWA 173629: C, habitus; D, antennule, lateral view, setation omitted. *Libanius projectus* n. sp., paratype male, NIWA 173636: E, habitus; F, pleon and pleotelson, lateral. *Libanius tangaroa* n. sp., paratype male, NIWA 173647, G, habitus; H, pleopod. *Paralibanius taitonga* n. gen. n. sp., male, NIWA 173662: I, habitus, body broken between pereonites 2 and 3. Scale bars: A, C, E, G, I 1 mm; B, F 0.25 mm, H 0.125 mm.

W]; **ischium with one seta**; claw slightly clearly longer [> 1.2×] than propodus. *Uropod* as long as pleotelson; peduncle geniculate; endopod bisegmented, L:W intermediate [3 L: W]; exopod proximate to endopod.

Type species
Paralibanius taitonga n. gen. n. sp. by original designation here.

Etymology
A combination of the genus nomen *Libanius* and the Greek prefix '*para*,' suggesting affinity or likeness. Gender masculine.

Geographic range
Great South Basin, Southwest Pacific.

Remarks
The principal diagnostic characters for this new genus are the advanced position of the chelipeds, short antenna article-5, and relatively stout pereopods. The appearance of the cheliped-cephalothorax configuration almost mimics that of the agathotanaid genus *Paragathotanais* but with the presence of a (short) posterior lobe on the basis.

Cheliped Fig. 30 K–L) robust; basis 1.4 L: W, 1.25 merus L, posterior lobe almost reaching posterior of cephalothorax, about as long as anterior mass, latter with dorsolateral seta; merus ventral margin 2.3x longer than that of carpus; carpus narrower distally, 1.7 L: W; chela 1.2× carpus L but slightly narrower, 2.4 L: W, palm dorsal and ventral margins almost parallel (very weak flare), 1.3 L: W, with mesial comb of three spines; fixed finger as long as palm, incisive margin with two widely-spaced triangular teeth, and larger distal bifid tooth; dactylus incisive margin with one distal co-axial spine.

Pereopod-1 Fig. 31 A) basis slender, 7.3 L: W, with proximal superior seta; merus 2.5 L: W, slender inferodistal spine shorter than merus; carpus elongate, 1.5× merus L, distally wider, 4.3 L: W, spines typical and with one distomesial seta; propodus narrower but as long as carpus, 5.9 L: W, with superodistal seta, coaxial inferodistal spine and distolateral spine, mesial inferior margin with row of spinules; unguis clearly longer than dactylus (1.7×), together with dactylus ≈ 0.9× propodus L. *Pereopod-2* Fig. 31B) similar to pereopod-1 but basis, merus, carpus and propodus each slightly shorter. *Pereopod-3* Fig. 31 C) similar to pereopod-2 but basis, merus, carpus, propodus and claw each slightly shorter; carpus with one distomesial seta.

Pereopod-4 Fig. 31D) basis slender but of similar width to those of pereopods 1–3, 6.5 L: W, with two inferior PSS; merus ≈ 2.5 L: W; carpus slender, 1.5× merus L, 3.8 L: W; propodus slender, slightly longer than carpus, 4.6 L: W, inferior margin with double row of small spinules; dactylus longer than unguis, pectinate, together ≈ 0.8× propodus L. *Pereopod-5* Fig. 31E) as pereopod-4, but basis with one inferior PSS. *Pereopod-6* Fig. 31 F) similar to pereopods 4–5 but basis without PSS; propodus setation typical.

Uropod Fig. 29E) ≈ 0.8× as long as pleotelson; peduncle slightly arcuate, twice as long as broad; exopod strong, proximate to endopod or slightly divergent, ≈ 2.5 L: W (mid-length), reaching half endopod L, with single long subdistal and distal setae; endopod almost as long as peduncle, ≈ 3.7 L: W, segment-1 with two large distomesial PSS, segment-2 with one subdistal seta, three terminal setae and two small terminal PSS.

Manca-2. BL 1.7 mm ($n = 1$); pereopods-6 and pleopods absent.

Manca-3. BL 2.4 mm ($n = 1$); pereopods-6 rudimentary, pleopods absent.

Non-ovigerous female: As holotype, 4.0–5.5 L: W ($n = 9$); BL 2.7–4.8 mm ($n = 14$). *Pleon* 10.2–13.0% of BL ($n = 14$, mean 11.6%).

Ovigerous female: As non-ovigerous female but with oostegites; BL 4.0 mm (n = 1).

Juvenile male: Habitus similar to non-ovigerous female; BL 2.4–3.5 mm (n = 6). Pleon 11.5–13.2% of BL (n = 5, mean 12.1%). Pleopods present, rami oval, ≈ 2 L:W, naked.

Male: Habitus (Fig. 32G) similar to female but slightly stouter, 4.6–4.9 L:W (n = 6 allotype 4.6 L:W); pleon generally longer, 13.9–15.6% BL (n = 7, mean 14.6%; allotype 14.7%), with distinct tergites and sternites, epimera with seta; BL 3.1–3.2 mm (n = 6). Antennule stouter, 3.8 L:W overall, articles 1–4 1.9, 1.1, 0.9 and 2.8 L:W respectively (allotype). Pleopods (Fig. 32H) peduncle 1.4 L:W; rami of similar straplike shape, but exopod slightly longer, ≈ 3 L:W; endopod with subdistal superior seta and terminal fringe of seven setae, exopod with terminal fringe of nine setae.

Distribution

Recorded from nine sites on the southern slope and crest of the Chatham Rise, and the Memoo Gap; one from the Bounty Trough.

Bathymetric range

Shallow bathyal, 463–790 m.

Remarks

This *Libanius* species is distinguishable mainly by the relatively large cephalothorax compared to the other *Libanius* species (25–26% of BL in males, mean 25%, $n = 6$); 23–28% in females, mean 26%, $n = 14$; Table 2), and relatively short pereonite-1 and antennules. The short pleotelson with a narrow gap between the anal valves and the anterior margin (Fig. 29B) further distinguishes *L. tangaroa* n. sp. from *L. projectus*. The most likely species in NZ waters that it could be confused with is *L. intonsus* with a similar 'large-cephalothorax' habitus, but this taxon is generally larger, has proportionately longer pereonites 1–3, setules on the pereopods 1–3, and a stouter merus on pereopods 2 and 4.

Of 23 post-manca specimens, nine are males of various stages of development, yielding a relatively low sex ratio of 1: 1.6 males to females. The largest number of specimens in a single sample is six, from TAN0705 Stn 251, at 525 m near the crest of the Chatham Rise and *L. tangaroa* appears to be largely, but not completely, separated bathymetrically from the other five NZ species.

***Paralibanius* n. gen.**

LSID urn: lsid: zoobank.org:act:6B4833B6-49A1-46A4-929E-690CA40C5DF5

Diagnosis

Arthrurid with *pereonites* 1–6 lateral margins with supracoxal projections; pereonite-1 without hyposphenium. *Pleon* narrower than pereon and pleotelson; pleonites distinct. *Pleotelson* pentagonal. *Antennule* not long relative to cephalothorax [0.6–0.8×]; article-1 not slender [≈ 2.7 L: W]. *Antenna* article-2 about as long as broad, dorsal margin simple; article-3 dorsal seta longer than article; **article-5 stout-short [2.3 L: W]**. *Mandible* molar coronal, with low tubercles and longer spines. *Maxillule* endite with one bifid spine. *Maxilliped* bases with distomedial setulate process. ***Chelipeds* attached anteriad on cephalothorax ventrum, separated from posterior margin by broad transverse sclerite**; carpus dorsal margin smooth. *Pereopods 1–6* basis smooth. ***Pereopod-1* stout sticklike [11 L: W overall]**; merus inferodistal spine long [= article L]; carpus with one distal seta; propodus with inferodistal and distolateral seta. *Pereopods 2–3* carpus with one distal seta. *Pereopods 4–6* stout sticklike [< 10 L:

***Paralibanius taitonga* n. sp.**
LSID urn: lsid: zoobank.org:act:025C0D9D-1563-4F06-8917-B2A7EE70CAC8
Ocean Census species 48.
(Figs. 1, 3 and 33–35, 32I, 36 F, 37D)

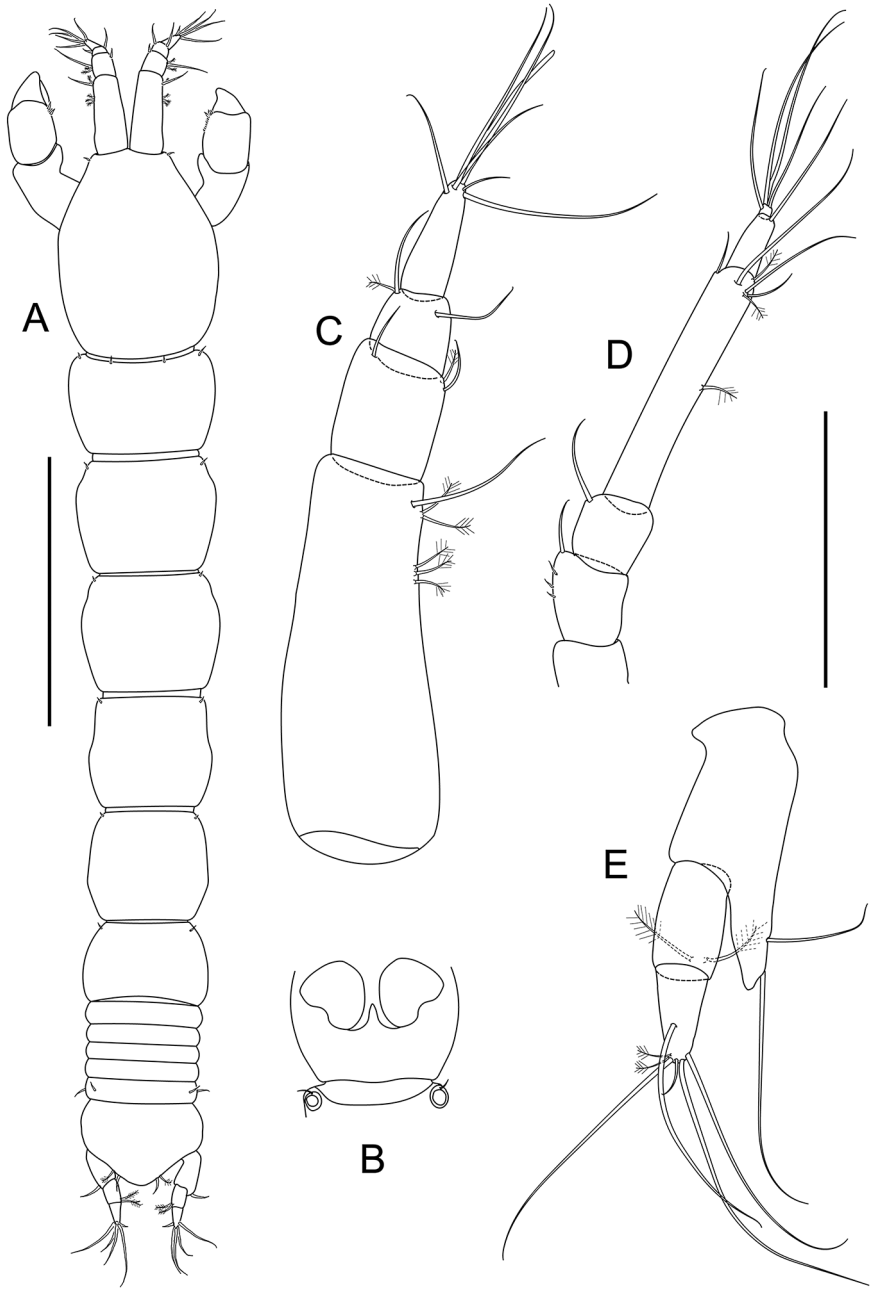

Fig. 33. *Paralibanius taitonga* n. gen. n. sp. holotype non-ovigerous female, NIWA 173658: A, habitus. Paratype non-ovigerous female, NIWA 173659: B, antennule; C, antenna; D, uropod. Scale bars: A, 1 mm; B–D 0.25 mm.

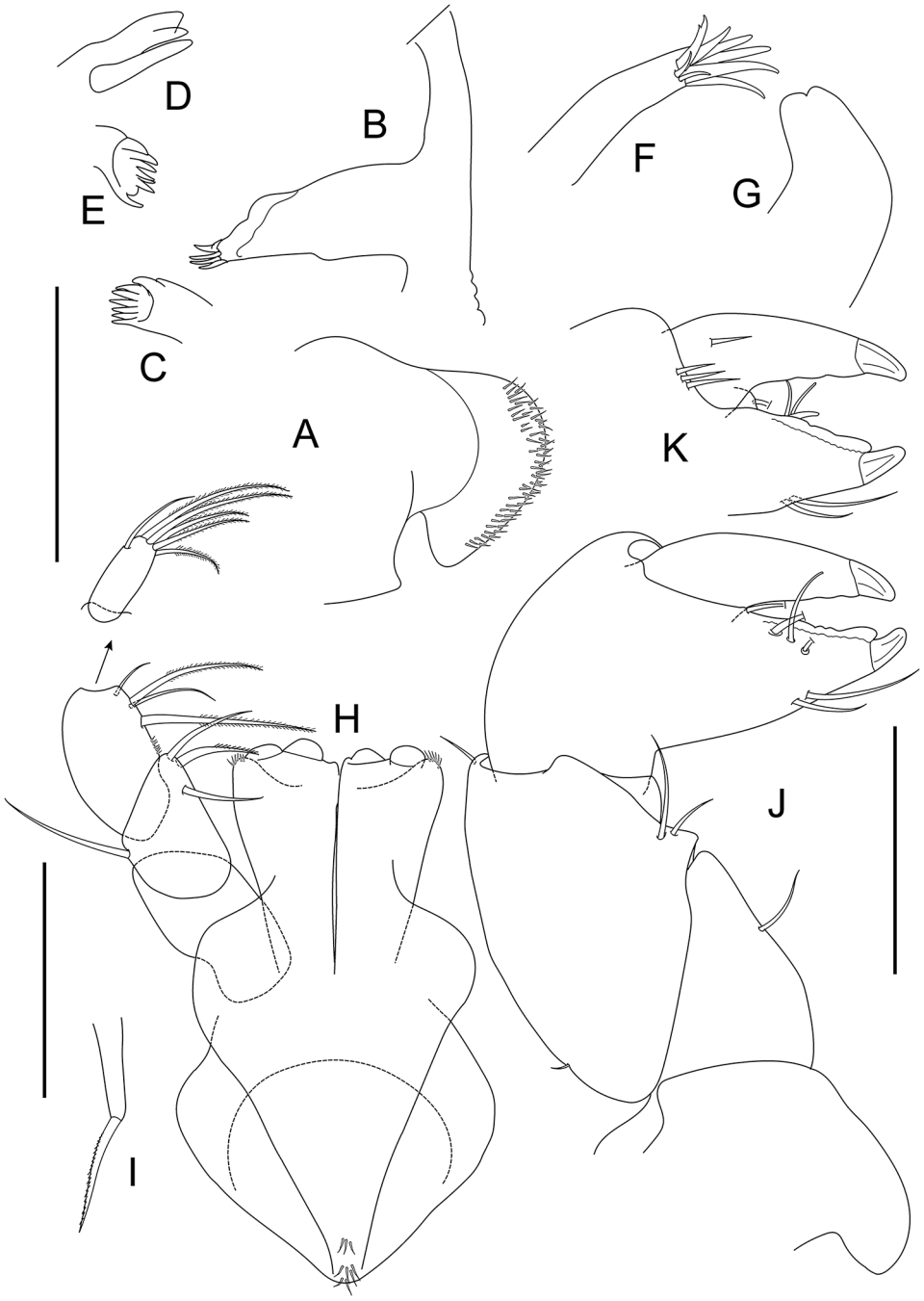

Fig. 34. *Paralibanius taitonga* n. gen. n. sp. paratype non-ovigerous female NIWA 173659: A, labrum; B, right mandible (incisor obscured); C, right mandible molar (unworn); D, left incisor (unworn); E, left molar (unworn); F, maxillule endite; G, maxilla (distal); H, maxilliped (one palp omitted); I, epignath terminal seta; J, right cheliped; K, left chela. Scale bars: A–I, 0.125 mm; J–K, 0.25 mm.

Type material
HOLOTYPE: non-ov. ♀, 4.3 mm, NIWA 173658, TAN1902, Stn 67. PARATYPES: 1 non-ov. ♀, dissected on 3 microslides, NIWA 173659, TAN2202 Stn 93; 1 juv. ♂, NIWA 173660, TAN1902, Stn 42; 1 non-ov. ♀, 1 ov. ♀, 2 ♂♂, NIWA 173661, TAN2402, Stn 47.

Other material
1 ♂, NIWA 173662, NZOI Stn S152; 1 juv. ♂, NIWA 173663, TAN1501, Stn REF5; 1 manca-2, NIWA 173664, TAN1902, Stn 133; 1 manca-2, NIWA 173665, TAN1902, Stn 135; 1 manca-3, NIWA 173666, TAN1902, Stn 167; 1 manca-3, NIWA 173667, TAN1902, Stn 186; 1 manca-3, NIWA 173668, TAN1902, Stn 218; 1 manca-3, NIWA 173669, TAN2202, Stn 74; 1 juv. ♂, NIWA 173670, TAN2202, Stn 76; 1 manca-3, NIWA 173671, TAN2202, Stn

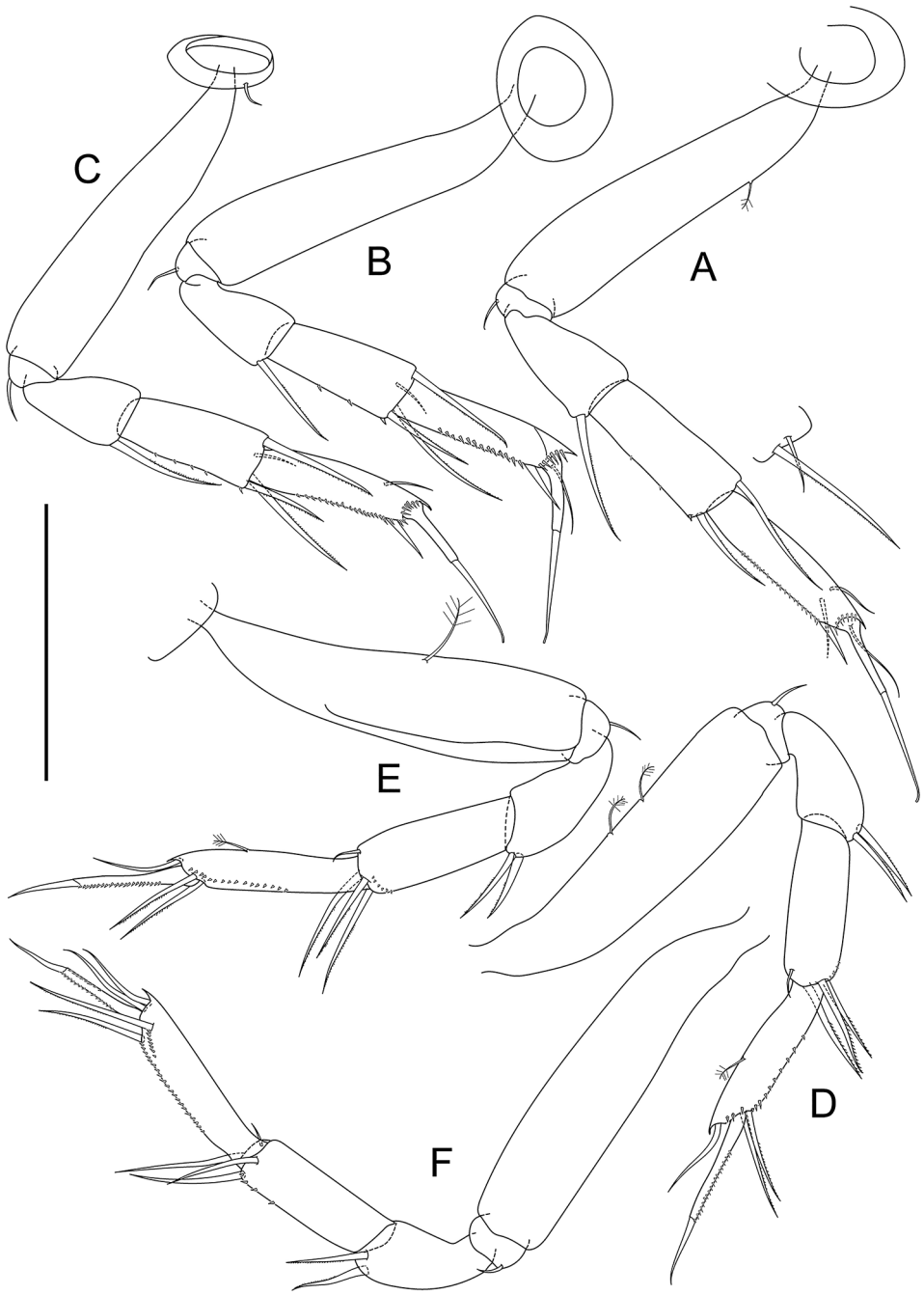

Fig. 35. *Paralibanius taitonga* n. gen. n. sp. paratype non-ovigerous female NIWA 173659: A–F pereopods 1–6 respectively, pereopod-1 with detail of obscured mesial setation. Scale bar: 0.25 mm.

83; 14 manca-2, NIWA 173672, TAN2202, Stn 93; 1 ♂, NIWA 173673, TAN2402 Stn 53; 1 juv. ♂, NIWA 173674, TAN2402, Stn 55.

Type locality
46.9°S 171.6°E, Great South Basin, NZEEZ, Southwest Pacific, 1284–1287 m.

Etymology
Use of Te reo Māori noun *taitonga* 'the South', referring to the southerly NZ locality recorded for this species; used as a noun in apposition.

Diagnosis
As for genus.

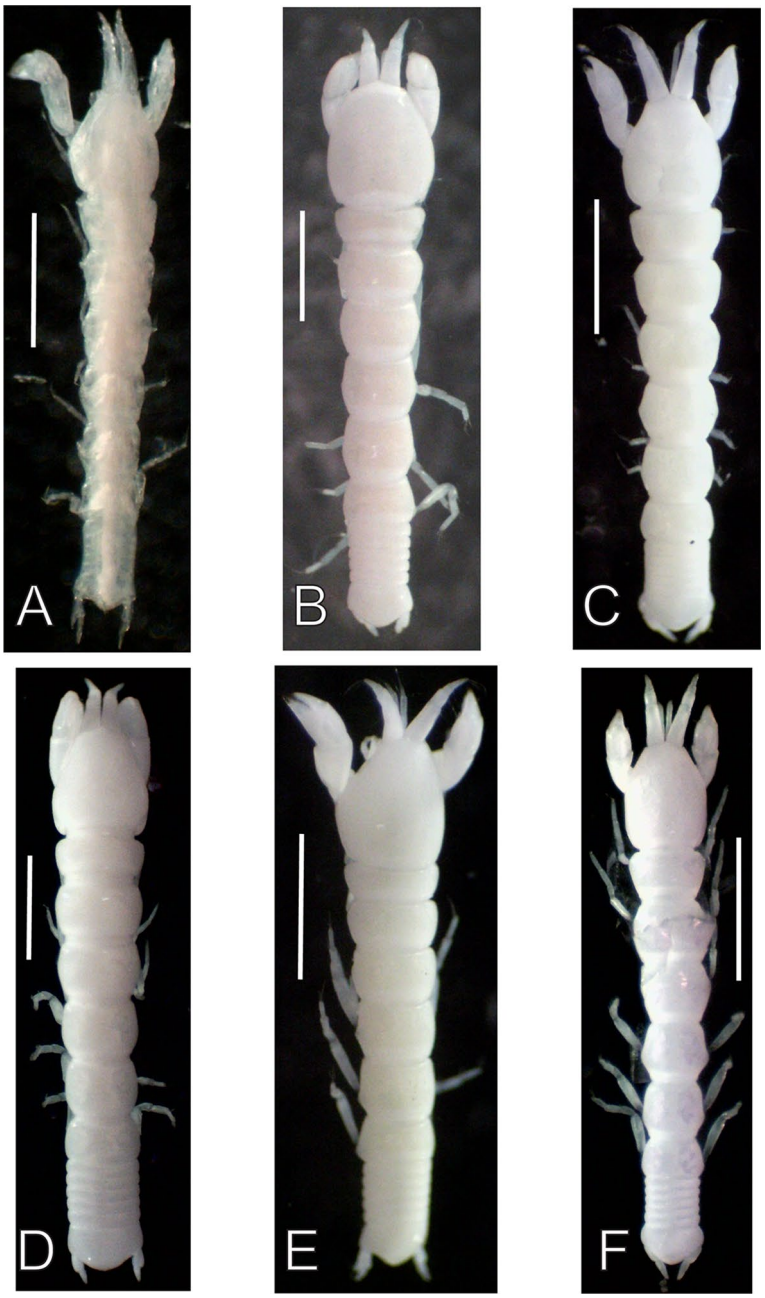

Fig. 36. New Zealand arthrurid species comparative habitus. A, *Libanius concertator* n. sp.; B, *L. intonsus* n. sp.; C, *L. largitas* n. sp.; D, *L. projectus* n. sp.; E, *L. tangaroa* n. sp.; F, *Paralibanius taitonga* n. gen. n. sp. Scale bars: 1 mm.

Description

Holotype non-ovigerous female: *Habitus* Fig. 33 A, 36 F) fairly slender, 6.4 L: W; cuticle brittle and finely pitted, BL 4.3 mm. *Cephalothorax* 1.29 L: W, as long as pereonites 1–2 combined. *Pereon* slightly tapering posteriad, pereonites 1–3 with weakly convex lateral margins, pereonites 4–6 with weak process over coxal attachments, ≈ 0.6, 0.8, 0.0.8, 0.9, 0.9, and 0.6 L: W respectively; each with anterolateral seta. *Pleon* parallel-sided, 0.92 L: W, 10% of BL, 1.4× pereonite-6 L, pleonites 1 and 5 slightly longer than rest; tergites and sternites distinct, pleonite-5 with epimeral seta and anterodorsal seta. *Pleotelson* almost as long as pleonites 2–5 combined, ≈ 0.7 L: W, posterior weakly-produced, with two simple setae and two PSS, with small conical apex with four setae (two longest deflexed); anterolateral anal ridges meeting medially, and one seta anteroventral to uropod insertion.

Paratype non-ovigerous female, NIWA 173659: *Antennule* Fig. 33B) 0.6× cephalothorax L (holotype), ≈ 4.7 L: W overall; article-1 ≈ 0.6× L of whole, 2.7 L: W, with three lateral PSS, distolateral seta and two or three PSS; article-2 0.3× article-1 L, 1.2 L: W, with distomesial seta, long distolateral seta and two PSS; article-3 ≈ 0.9 L: W, with single distolateral and distomesial setae and distomesial PSS; article-4 slender, 3 L: W, with two short setae, four long setae, and one aesthetasc. *Antenna* Fig. 33 C) 0.7× antennule L; article-1 shorter than broad;

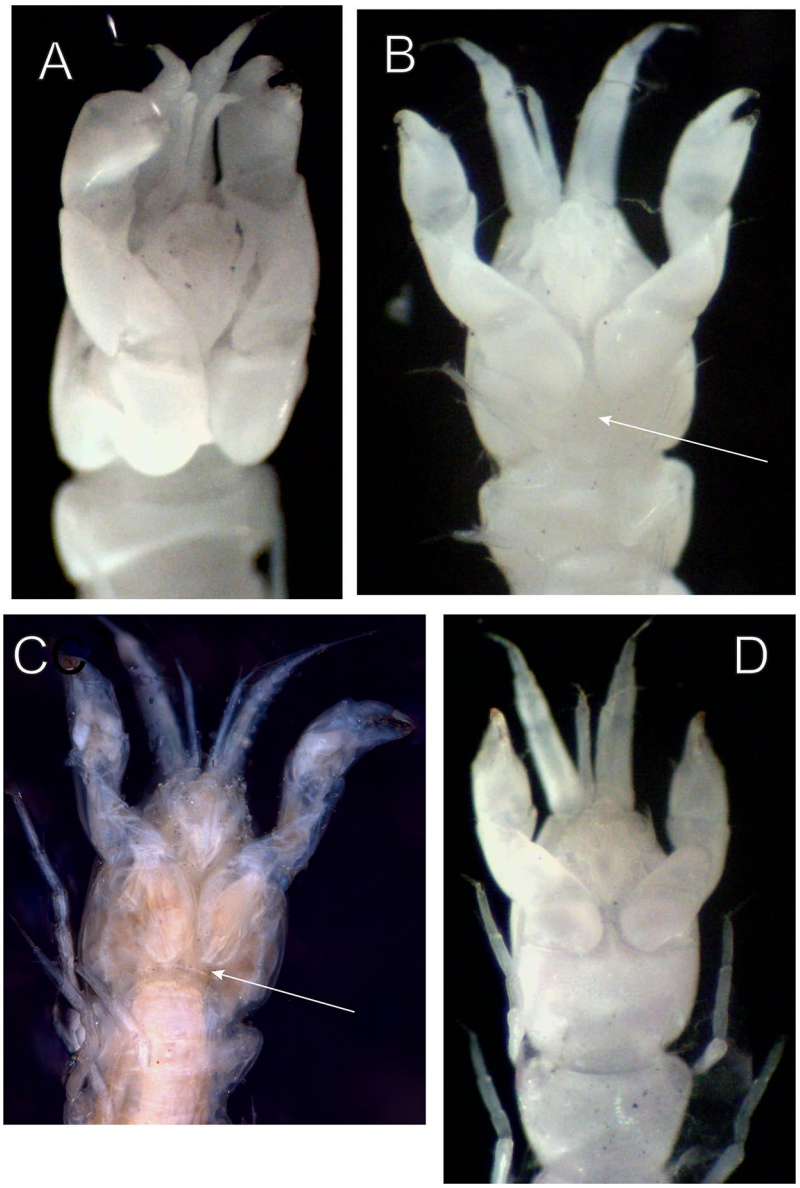

Fig. 37. Variation in cheliped-cephalothorax attachment. A, *Libanius projectus* with cheliped basis reaching pereonite-1; B, *L. largitas* n. sp. and C, *L. brevicarpus* n. sp. with basis slightly anterior of pereonite-1, arrows show concave posterior margin of cephalothorax sternite; D, *Paralibanius taitonga* n. gen. n. sp. with cheliped attachment well-advanced on sternite, separated by strip of cuticle.

article-2 slightly longer than broad, dorsal margin slightly raised (convex), with a few setules; article-3 smaller than article-2, slightly longer than broad, dorsodistal seta longer than that of article-2; article-4 1.3× articles 1–3 CL, 5.5 L: W, with two short and two long distal setae, and two distal PSS; article-5 shorter than article-3, 2.3 L: W, with distal seta; article-6 small, with four setae.

Mouthparts: *Labrum* Fig. 34 A) typical. *Mandibles* Fig. 34B–E) with left incisor narrow, bifid, lacinia as large as incisor, narrow; molar bearing about eight terminal spines; right molar with rugose proximal margin, incisor apex not observed, molar similar to that of left mandible. *Labium* not observed. *Maxillule*Fig. 34 F) endite apex with setules and eight spines of various thickness, one bifid. *Maxilla* Fig. 34G) longer than broad.

Maxilliped Fig. 34 H) basal pedestal broad cordiform, bases together cuneate, narrower, 1.5 L: W, with slight median ridge with several proximal setules; endites typical, but setae not observed (broken?); palp ≈ basis L, article-1 longer than broad; article-2 triangular, as long as broad, setation typical, lateral seta long, with one mesial seta stronger and more pectinate than others; article-3 subrectangular, as long as article-2, setation typical; article-4 slender, subrectangular, just shorter than article-3, 2.3 L: W, setation typical. *Epignath* Fig. 34I) typical.

Cheliped Fig. 33B, 34 J–K, 37D) robust; basis 1.4 L: W, ventral margin 0.9× that of merus, posterior lobe clearly anterior of rear margin of cephalothorax, smaller than anterior mass, latter without dorsolateral seta (possibly broken); merus ventral margin 3× longer than that of carpus; carpus narrower distally, 1.5 L: W; chela 1.25× carpus L but slightly narrower, ≈ 2 L: W, palm 0.9 L: W, dorsal and ventral margins divergent, with mesial

comb of three spines; fixed finger 1.2× palm L, incisive margin with distal tooth; dactylus simple, with proximo-mesial spine.

Pereopod-1 Fig. 35 A) 11 L: W overall; coxa annular with seta (lost on figured specimen); basis fairly slender, 5 L: W, with proximal superior PSS; merus 1.6 L: W, slender inferodistal spine as long as merus; carpus 1.4× merus L, 2.5 L: W, spines typical, with one distomesial seta; propodus narrower and longer than carpus, 4.2 L: W, with superodistal seta, distolateral spine, and stronger sub-coaxial inferodistal pectinate spine, mesial inferior margin with row of spinules; dactylus with accessory seta, unguis clearly longer than dactylus, together with dactylus ≈ 1.1× propodus L. *Pereopod-2* Fig. 35B) similar to pereopod-1 but basis, merus, carpus and propodus each slightly shorter; propodus without distolateral spine. *Pereopod-3* Fig. 35 C) similar to pereopod-2.

Pereopod-4 Fig. 35D) not sticklike, 8.7 L: W overall; basis fairly slender, 4 L: W, but slightly wider than those of pereopods 1–3, with two inferior PSS; merus ≈ 1.6 L: W; carpus slender, 1.7× merus L, 2.8 L: W; propodus slender, as long as carpus, 4.2 L: W, inferior margin with double row of small spinules; dactylus longer than unguis, pectinate, together slightly longer than propodus. *Pereopod-5* Fig. 35E) as pereopod-4, but basis with one inferior PSS. *Pereopod-6* Fig. 35 F) similar to pereopods 4–5 but basis without PSS; propodus setation typical.

Uropod Fig. 33D) ≈ 0.8× as long as pleotelson; peduncle proximally geniculate, 1.7 L: W; endopod as long as peduncle, ≈ 3 L: W, segment-1 1.5 L: W, with two large distomesial PSS, segment-2 as along as segment-1, with one subdistal seta, three long and one short terminal setae and two small terminal PSS; exopod strong, proximate to endopod or slightly divergent, ≈ 2.8 L: W (mid-length), reaching half endopod L, with single long subdistal and distal setae.

Manca-2: *Body* 5.7–6.1 L: W ($n = 7$), pereonite-6 very short; BL 1.74–1.85 mm ($n = 12$). Pereopod-6 absent.

Manca-3: *Body* 5.5–6.1 L: W ($n = 2$), pereonite-6 very short; BL 2.26–2.35 mm ($n = 3$). Pereopod-6 rudimentary.

Non-ovigerous female: As for holotype, 6.1–6.7 L: W ($n = 4$); BL 3.8–4.4 mm ($n = 4$). *Pleon* 9.6–10.8% of BL ($n = 4$).

Ovigerous female: As for non-ovigerous female but with oostegites, 6.5–6.6 L: W ($n = 2$); BL 3.4–3.7 mm ($n = 2$).

Juvenile male: *Habitus* similar to non-ovigerous female, 5.4–6.8 L: W ($n = 5$); BL 2.4–3.3 mm ($n = 6$). *Pleon* 10.2–11.7% of BL ($n = 6$). *Pleopods* present, rami oval, ≈ 2 L: W, naked.

Male: *Habitus* Fig. 32 H) similar to female but slightly stouter, 5.4–6.4 L: W ($n = 3$); *pleon* generally longer, 10.3–14.7% BL ($n = 3$), BL 3.4–3.7 mm ($n = 3$). *Antennule* stouter, 4.2 L: W overall.

Distribution
Recorded from three sites in the Bounty Trough, eleven sites in the Great South Basin, and one from the Challenger Plateau.

Bathymetric range
Bathyal, 1284–1676 m, most ≈ 1300 m.

Remarks
This species is the most recognisable among the Antipodean species of arthrurids, with its diagnostic cheliped attachment. Its distribution is predominantly southeastern in the NZ region but with a putative single record (and singleton) from the western seaboard of Te Waipounamu South Island.

arthrurid sp. indet.

Material
1 manca-3, TAN1004, Stn 38; 1 manca-3, TAN1004, Stn 53.

Remarks
This category is for specimens that could not be easily placed in any of the four nominal species because of the poor state of preservation, incompleteness, or falling outside of the morphological envelope in some way.

Key to species of Arthruridae

1. Cheliped basis attachment clearly separated from posterior margin of cephalothorax by large gap (about as long as cheliped basis) .....*Paralibanius taitonga* n. gen. n. sp. [NZ bathyal]

   - Cheliped basis attachment posterior on cephalothorax (posterior lobe reaching or almost reaching pereonite-1.....2.

2. Pereonite-1 with hyposphenium.....3.

   - Pereonite-1 without hyposphenium.....5.

3. Pereopod bases smooth, lacking groups of setules.....*Libanius monacanthus* [Subantarctic].

- Pereopods 1–3 basis with groups of setules.....4.

4. Cephalothorax as long as pereonites 1–2 combined; cheliped carpus dorsal margin spinulate.....*Arthrura andriashevi* [North Pacific abyssal]

- Cephalothorax as long as pereonites 1–3 combined; cheliped carpus dorsal margin smooth.....*Libanius clisicola* sp. n. [SE Australia bathyal]

5. Pleon as wide as pereon and pleotelson; pleotelson sub-cupiliform.....*Arthruropsis bombus* n. comb. [Gulf of Mexico]

- Pleon narrower than pereon and pleotelson; pleotelson sub-pentagonal.....6.

6. Pleonite definition often weak; pleotelson stout [< 0.6 L: W]; cheliped basis shorter than merus.....7.

- Pleonite definition distinct; pleotelson not stout [> 0.6 L: W]; cheliped basis longer than merus.....8.

7. Pereonite-1 relatively long [0.5 L: W]; cheliped merus ventral margin ≈ 2.5× that of carpus. .....*L. concertator* sp. n. [NZ bathyal]

- Pereonite-1 relatively short [0.24 L: W]; cheliped merus ventral margin ≈ 2× that of carpus. .....*L. largitas* sp. n. [NZ bathyal]

8. Uropod exopod about as long as broad.....*L. pulcher* [N. Pacific abyssal].

- Uropod exopod clearly longer than broad.....9.

9. Cheliped basis much longer [> 1.4×] than merus; pereopod-1 carpus with one distal seta.....10.

- Cheliped basis slightly longer [> 1×] than merus; pereopod-1 carpus with two distal setae.....11.

10. Cheliped merus slightly longer than free ventral margin of carpus [1.5×]; pereopod-4 carpus not stout [< 2.5 L: W].....*L. australis* sp. n. [SE Australia bathyal]

- Cheliped merus much longer than free ventral margin of carpus [2.5×]; pereopod-4 carpus stout [3.5 L: W].....*L. brevicarpus* sp. n. [SE Australia bathyal]

11. Cephalothorax proportionately large [23–28% BL] and as long as pereonites 1–3 combined; pereopod-2 merus slender [> 2.25 L: W].....*L. tangaroa* sp. n. [NZ bathyal]

- Cephalothorax proportionately not large [21–26% BL] and shorter than pereonites 1–3 combined; pereopod-2 merus stout [< 1.8 L: W].....12

12. Antenna article-4 slender [≈ 8 L: W]; cheliped chela not slender [2.2 L: W]; pereopods 1–3 basis without groups of setules.....*L. projectus* sp. n. [NZ bathyal]

- Antenna article-4 not slender [≈ 5.5 L: W]; cheliped chela slender [≈ 2.7 L: W]; pereopod-1 basis with scattered setules. .*L. intonsus* sp. n. [NZ bathyal]

Discussion

New Zealand cruise/survey backgrounds

With the addition of Arthruridae to the subfamily Paratanaoidea 22 families are now recognised in this large group of tanaidaceans[9]. Arthrurids are relatively large tanaidomorphans that are identifiable in deep-sea samples by their white/off-white shiny cuticle, robust appearance, slender pereopods, and short and narrow pleon lacking pleopods (in females). Although they have an appearance close to that of paranarthrurellids, some tanaellids, and agathotanaids, the arthrurids' cheliped basis having a distinct posterior lobe avoids confusion with the last family. Other differences and similarities between arthrurids, agathotanaids, and paranarthrurellids are summarised in Table 3.

It is notable that six arthrurid species have been recorded from the NZ bathyal, adjacent to the two main islands. The tectonic, topographic, and hydrographic seascape around NZ is complex, dynamic, and biodiverse on this largely submerged continental remnant[37] with a high proportion (37%) of endemic crustacean species[38]. Never abundant, arthrurids are relatively frequent in bathyal samples of 463–1667 m, around NZ, particularly on and adjacent to the Chatham Rise[20], and in one analysis (Table 4) the Arthruridae holds the median frequency

Character	*Paranarthrurella*	*Paranarthrura*	Arthruridae
Cephalothorax	flask-shaped	flask-shaped	domed capsule
Cephalothorax	> pereonites1–2 CL	< p1–2 CL	≥ p1–2 CL
Pleon	slender [> 1.1 L: W]	slender	not slender/stout [< 1.1 L: W]
Pleotelson	tabular	agathotanaoid	agathotanaoid
Antennule	stout [< 5 L: W]	very slender [> 7 L: W]	stout or slender
Antennule article-2	< 0.4× article-1 L	> 0.4× article-1 L	< 0.4× article-1 L
Antenna article-2	slender [> 1.75 L: W]	slender [> 1.75 L: W]	not slender [< 1.75 L: W]
Antenna article-2 dorsodistal seta	short	long [> article-3 L]	short
Mandible molar	deflexed, blunt	deflexed, acuminate	opposing, coronal/palmate
Maxilliped endite setae	long	long	short
Epignath seta	absent?	absent?	large-long
Cheliped basis posterior lobe	present	absent	present
Cheliped merus v carpus ventral margin	clearly longer	clearly shorter	clearly longer
Cheliped palm mesial comb	dorsomedial	ventral	medial/dorsomedial
Cheliped palm ventral setae	2	1	2
Pereopods 1–3 merus ventrodistal	spine and seta	spine and seta	spine
Pereopods 1–3 merus inferodistal spine	short [< merus distal W]	long [= merus L]	long [> merus W, = L]
Pereopod-1 propodus	slender [> 5 L: W]	stout [< 4 L: W]	slender [> 4–5 L: W]
Pereopod-1 propodus superodistal	2 spines	seta and spine	seta and spine
Pereopod-1 unguis	slightly > dactylus L	< dactylus L	slightly/clearly > dactylus L
Pereopods 4–6 carpus	very slender [> 5 L: W]	stout [< 3 L: W]	very slender or not stout [> 3 L: W]
Pereopods 4–5 propodus superior PSS	present	absent	present
Pleopods in female	present	absent	absent
Uropod peduncle	stout [L < W], < 0.4× TL	stout [L < W], < 0.4× TL	slender [L > W], > 0.4× or > 0.5× TL
Uropod exopod	articulated	fused	fused

Table 3. Characters distinguishing arthruridae from paranarthrurellids and agathotanaids (*Paranarthrurella dissimilis* and *P. crassa* used as exemplars here, respectively).

(4.3%) among the tanaidomorphan families and 3.1% for all tanaids. For individual geographic localities, excluding those with sparse data, the relative frequency ranges between 0.5% and 10.1% of tanaidomorphs. The highest spot density is from a 10 cm diameter multicore from the Great South Basin at 1329 m, with 16 individuals of *Paralibanius taitonga*, with an average 2.1 for all arthrurids (based on 51 cores) where present, i.e. 207 m^{-2}. It is presumed that they are detritivores, similar to the *Paranarthrura*species investigated by[39] as part of a study on trophic isotope relationships of invertebrates on the Chatham Rise.

The known global distribution of the Arthruridae appears to be centred on the Pacific, with some circum-Antarctic dispersal for *Libanius monacanthus*[13,17] and one species, *Arthruropsis bombus*, from the Northwestern Atlantic[26]. No records of the family have yet been obtained from the Northeast Atlantic from Iceland to the Bay of Biscay, Iberian seas or Mediterranean out of over 50,000 identified tanaid specimens (Bird unpublished work). The six NZ species are partly segregated by geography and bathymetry with *L. concertator* largely from the Tasman Sea and a possible extension to the eastern side of Te Ika-a-Māui North Island north of the Chatham Rise, and the other three species near-separated by the Chatham Rise itself or bathymetry. One species, *L. intonsus*, was recorded from a region on the Hikurangi Margin where gas hydrates leak methane through sea-floor seeps, sampled during the TAN1904 HYDEE II program[40].

While there is currently insufficient information to usefully hypothesise any evolutionary history for the Arthruridae it can be inferred that they exhibit what might be considered a plesiomorphic morphology, or at least one that is associated with a certain non-fossorial and low-motility lifestyle. Other groups with a broadly similar habitus and pereopod morphology are the paranarthrurellids[41] and some of the larger and more robust agathotanaids, notably in the genus *Paranarthrura*[17,42], with features outlined above. Even the generally larger and probably more plesiomorphic neotanaids could be included in this category, being epifaunal inhabitants of soft deep-sea sediments[43], or at least sheltering in the very superficial layer.

It is anticipated that other arthrurids will be discovered and described from greater (abyssal) depths in New Zealand and Australian ocean regions and in other Pacific localities, hopefully allowing the testing of the taxonomic decisions made in this paper and placing the family in the broader context of tanaidacean diversity. Ideally, new material of the type genus represented by *Arthrura andriashevi* would clarify the relationship between

	Northland Slope	Challenger Plateau	Bay of Plenty	Hikurangi Margin	Kaikoura Canyon	Chatham Rise North	Chtaham Rise Crest	Chatham Rise South	Mernoo Gap	Bounty Trough	Great South Basin	All	All	Tanaidomorphs
FAMILY	233–900 m	265–1560 m	701–1523 m	670–2082 m	304–3113 m	420–1940 m	346 m	424–1433 m	494–570 m	1002–1295 m	500–1610 m	total	Frequency A	Frequency B
APSEUDIDAE	10	619	7	15	1	89		28	4	53		826	14.4	
SPHYRAPIDAE		722										722	12.6	
PARAPSEUDIDAE		8		1		38		12	2	14	8	83	1.5	
PSEUDOTANAIDAE	3	90	1	335	38	107	11	77	13	96	39	811	14.2	19.8
TYPHLOTANAIDAE	1	5		77	77	43	22	48		283	22	579	10.1	14.1
COLLETTEIDAE		12	9	129	9	1		9		218	80	467	8.2	11.4
TANAELLIDAE		37	4	229	62	25		25		38	40	460	8.0	11.2
ANARTHRURIDAE		14	1	162	7	7		1	2	185	24	403	7.0	9.8
AGATHOTANAIDAE		9		166	1	23		113		5	49	367	6.4	9.0
TANAISSUIDAE			2	23						114	79	218	3.8	5.3
INCERTAE CEDIS		7	4	68	7	14		4		71	24	201	3.5	4.9
ARTHRURIDAE		**10**		**6**	**1**	**18**		**41**	**4**	**66**	**29**	**175**	**3.1**	**4.3**
LEPTOGNATHIIDAE		21	4	15	1					107	9	157	2.7	3.8
HAMATIPEDIDAE		1	1	5	5	13	5	32		72	4	138	2.4	3.4
AKANTHOPHOREIDAE		17	4	23	4	12	1	10	2	25	18	116	2.0	2.8
NEOTANAIDAE								22		10	23	55	1.0	1.3
PARATANAIDAE-Bathytanaidinae	1	2		4	2	6	6	1		4	11	36	0.6	0.9
PARATANAIDAE-Paratanaidinae				19			10					29	0.5	0.7
CRYPTOCOPEIDAE				1				8				9	0.2	0.2
NOTOTANAIDAE		1		5				1		1		8	0.1	0.2
PARANARTHRURELLIDAE											3	3	0.1	0.1
TANAOPSIDAE								2				2	0.03	0.05
LEPTOCHELIIDAE			1									1	0.02	0.02
Total	15	1592	38	1283	215	396	55	436	27	1362	462	5838		
% arthrurids	**5**	**0.6**	**0.0**	**0.5**	**0.5**	**4.6**	**0.0**	**9.4**	**14.8**	**4.9**	**6.3**	**3.0**		
Total Tanaidomorpha	0.0	233	31	1267	214	269	55	396	21	1295	454	4220		
% arthrurids	**0.0**	**4.3**	**0.0**	**0.5**	**0.5**	**6.7**	**0.0**	**10.4**	**19.1**	**5.1**	**6.4**	**4.1**		

Table 4. Comparative frequency and abundance of arthruridae in relation to recorded Tanaidacean families in New Zealand waters > 200 m. Not adjusted for sampling method and sample sizes. 'Northland slope' from Ahipara to Manukau harbour; 'challenger plateau' data include that for Hokitika Canyon; 'Chatham Rise North' includes that for 'Wairarapa Basin'. Frequency % A and arthruridae % A include apseudomorphans, B excludes this group.

Cruise	Stn	Latitude	Longitude	Depth (m)	Date	Gear	Locality	Taxa
NZOI	E416	−45.3500	171.9500	1225	13/10/1965	DU	Bounty Trough	Lp
NZOI	F753	−44.75	174.50	790	18/08/1966	MT	Chatham Rise S	Lt
NZOI	Q689	−42.252	170.008	948	17/02/1981	LD	Challenger Plateau	Lc
NZOI	S138	−44.5900	174.8267	785	24/10/1979	MT	Chatham Rise S	Lt
NZOI	S150	−45.7667	174.4083	1640	26/10/1979	EBS	Bounty Trough	Li
NZOI	S151	−45.7633	174.5083	1586	26/10/1979	EBS	Chatham Rise S	Li
NZOI	S152	−45.8717	174.0817	1676	26/10/1979	EBS	Chatham Rise S	Li, Pt
NZOI	S153	−45.3517	173.5967	1386	27/10/1979	EBS	Chatham Rise S	Lp
NZOI	S154	−45.4033	173.9967	1373	27/10/1979	EBS	Chatham Rise S	Lp
TAN0705	24	−42.4556	178.2091	512	04/04/2007	HS	Chatham Rise S	Lt
TAN0705	45	−42.9934	179.0045	1241	06/04/2007	MC	Chatham Rise S	Lp
TAN0705	48	−44.2907	177.0855	1241	06/04/2007	MC	Chatham Rise S	Lp
TAN0705	49	−44.2911	177.0863	1242	06/04/2007	HS	Chatham Rise S	Li, Lp
TAN0705	83	−43.5864	179.379	529	09/04/2007	MC	Chatham Rise S	Lt
TAN0705	136	−43.5864	179.379	641	14/04/2007	HS	Chatham Rise N	Lc?
TAN0705	160	−43.9820	179.6258	1024	16/04/2007	HS	Chatham Rise N	Lp
TAN0705	251	−42.5961	178.8003	529	24/04/2007	HS	Chatham Rise N	Lt
TAN0705	276	−44.5599	−178.4796	1196	26/04/2007	HS	Chatham Rise N	Lp
TAN0707	105	−40.1315	170.2115	804	05/06/2007	HS	Challenger Plateau	Lc
TAN0707	119	−40.5305	170.5136	533	06/06/2007	HS	Challenger Plateau	Lc
TAN1004	27	−41.4983	175.7043	1013	17/04/2010	MC	Hikurangi Margin	Lc?
TAN1004	38	−41.5937	175.8532	1121	19/04/2010	MC	Hikurangi Margin	indet.
TAN1004	53	−41.4570	175.8967	956	20/04/2010	MC	Hikurangi Margin	indet.
TAN1004	127	−42.1228	174.5397	1177	27/04/2010	MC	Hikurangi Margin	Lp
TAN1006	K8	−42.5692	173.73	1420	03/05/2010	MC	Kaikoura Canyon	Li
TAN1116	31	−43.32	174.3480	495.5	05/11/2011	HS	Memoo Gap	Lt
TAN1116	33	−43.2335	174.1037	569.5	05/11/2011	HS	Memoo Gap	Lt
TAN1116	68	−44.134	178.5287	1011	11/11/2011	BT	Chatham Rise S	Ll
TAN1116	89	−43.496	178.3306	463	13/11/2011	BS	Chatham Rise S	Lt
TAN1306	30	−44.1825	175.1807	527	9/6/2013	MC	Chatham Rise S	Lt
TAN1501	REF5	−37.9117	172.7052	1558	7/01/2015	MC	Challenger Plateau	Pt?
TAN1501	Caravel	−45.6376	171.5030	1127	01/2015	MC	Bounty Trough	Li?, Lp, Lp
TAN1902	60	−46.9369	171.6453	1322	8/03/2019	MC	Great South Basin	Pt
TAN1902	133	−46.8369	171.9542	1370	14/03/2019	MC	Great South Basin	Pt
TAN1902	135	−46.7172	171.9228	1308	14/03/2019	MC	Great South Basin	Pt
TAN1902	167	−47.0222	171.6023	1335	18/03/2019	MC	Great South Basin	Pt
TAN1902	186	−46.4806	171.7617	1357	19/03/2019	MC	Great South Basin	Pt
TAN1902	218	−47.1792	171.8894	1367	22/03/2019	MC	Great South Basin	Pt
TAN1904	62	−42.4250	176.3510	1226	13/07/2019	MC	Hikurangi Margin	Li
TAN1904	70	−41.4253	176.3509	1235	14/07/2019	MC	Hikurangi Margin	Li
TAN2202	42	−46.9313	171.6407	1284	15/02/2022	MC	Great South Basin	Pt
TAN2202	67	−46.9378	171.6379	1287	17/02/2022	MC	Great South Basin	Pt
TAN2202	76	−46.9399	171.6370	1291	17/02/2022	MC	Great South Basin	Pt
TAN2202	83	−46.8968	171.7537	1292	18/02/2022	MC	Great South Basin	Pt
TAN2202	93	−47.0224	171.6022	1289	18/02/2022	MC	Great South Basin	Pt
TAN2303	22	−46.9364	171.6420	1329	9/3/2023	MC	Great South Basin	Pt
TAN2303	47	−46.9271	171.6427	1320	11/3/2023	MC	Great South Basin	Pt
TAN2303	85	−46.8969	171.7537	1341	15/3/2023	MC	Great South Basin	Pt
TAN2402	11	−45.8722	171.2196	783	10/02/2024	EBS	Bounty Trough	Lt
TAN2402	37	−46.4945	170.8700	982	13/02/2024	EBS	Bounty Trough	Lp
TAN2402	47	−46.7919	170.9708	1645	14/02/2024	EBS	Bounty Trough	Li, Pt
TAN2402	53	−47.107	172.0877	1388	15/02/2024	MC	Bounty Trough	Pt
TAN2402	55	−47.1045	172.0896	1389	15/02/2024	EBS	Bounty Trough	Pt
SLOPE	1	34.9919	151.0988	204	14/07/1986	ES	NSW, off Nowra	Lb
SLOPE	15	−34.9733	151.3867	1650–1750	16/07/1986	OT	NSW, off Nowra	Lcl
SLOPE	25	−38.4317	148.9767	1850	21/07/1986	ES	Vic, S of Pt. Hicks	Lcl

Continued

Cruise	Stn	Latitude	Longitude	Depth (m)	Date	Gear	Locality	Taxa
SLOPE	27	−38.4167	149.0	1500	22/07/1986	ES	Vic, S of Pt. Hicks	Lcl
SLOPE	32	−38.365	149.3333	1000	23/07/1986	ES	Vic, S of Pt. Hicks	La
SLOPE	33	−38.3267	149.405	930	23/07/1986	ES	Vic, S of Pt. Hicks	La
SLOPE	40	−38.295	149.1883	400	24/07/1986	ES	Vic, S of Pt. Hicks	La
SLOPE	45	−42.0367	148.645	800	27/07/1986	ES	Tas, off Freycinet Peninsula	La
SLOPE	46	−42.0033	148.6283	720	27/07/1986	ES	Tas, off Freycinet Peninsula	La

Table 5. Sample details for Tanaellid material examined in this study. Positions given in decimal degrees; mean data for sled samples; S—South, N—North. Gear code: DU, dredge undefined; EBS, epibenthic sledge; HS, hyperbenthic sled; LD, letterbox dredge; MC, multicorer. MT, menzies trawl, OT, otter trawl. Taxa code: La—*Libanius australis* n. Sp., Lb—*L. brevicarpus* n. sp., Lcl—*L. lisicola* n. Sp., Lco—*Libanius concertator* n. sp., Li—*L. intonsus* n. sp., Ll—*L. largitas* n. sp., Lp—*L. projectus* n. sp., Lt—*L. tangaroa* n. sp., *Pt*— *Paralibanius taitonga* n. gen. n. sp.

it and the re-established *Libanius*, while future sampling could usefully contribute suitable material to obtain genetic sequences and allow truly integrative taxonomy of tanaidaceans[8,22,44], although solely morphological studies are not yet redundant[45,46].

Materials and methods

Specimen collection

Tanaidacea used in this study were collected during multidisciplinary cruises conducted by the *New Zealand Institute for Water and Atmospheric Research* (NIWA), and older *New Zealand Oceanographic Institute* (NZOI) surveys. Epibenthic sleds or multicores were the principal means of sample collection during the period 1965–2024. Australian SLOPE samples were gathered from depths exceeding 200 m, spanning the east and south coasts of Australia, over three campaigns aboard the R.V. *Franklin*in 1986–1988 and 1994; diverse collection methods were employed, including employment of the Woods Hole Oceanographic Institution epibenthic sled, the Reineck box-corer, and the Beam trawl[47]. Details of the samples yielding relevant tanaids are shown in Table 5, and brief descriptions of the NZ surveys given below. Maps of the Australian and NZ study areas with named localities and sites from where arthrurids have been recorded are shown as Fig. 38, created with use of QGIS version 3.24 *Tisler*. Almost all of the NZ material was initially fixed with formaldehyde solution, rendering it unsuitable for molecular analysis but this nevertheless remains a valuable and unique resource for taxonomy Type material is deposited in the NIWA Invertebrate Collection Greta Point, Wellington, New Zealand, and Museums Victoria, Melbourne (accession prefix J.). A few specimens are retained in the Department of Invertebrate Zoology and Hydrobiology, University of Lodz, Poland (accession prefix ICUL). The new nomenclatural acts are registered with ZooBank.

Specimen examination

Specimens were dissected and mounted in glycerine or Brunel Micro Ltd Aqueous Mountant, then sealed with nail varnish, Gyceel, or melted paraffin wax (as described by Błażewicz et al.. 2021[21]). Drawings were made using an Olympus CX43 and Nikon Eclipse 50i with attached *camera lucida*and digitally inked using Adobe Illustrator 2021, some details being amended by use of imported photographs taken using a Dino-Eye (AnMo Electronics Corporation) eyepiece digital device. Confocal laser scanning microscopy images were obtained by us using methods described by several authors[8,22].

Terminology

'Dorsal' and 'ventral' are used for main body parts, antennules, antennae and chelipeds, as this is unambiguous, but 'superior' and 'inferior' for other appendages (mainly the pereopods)[48]. The use of 'sclerite' (equivalent to the 'seitenstück'[49]or 'sidepiece'[50]) for the cuticular plate dorsally-adjacent to the cheliped attachment is retained[7]. 'Seta' and 'spine' are used to discriminate between relatively long/slender and relatively short/robust articulated cuticular structures even though they are structurally homologous. 'Setule' refers to short, almost hairlike, setae on structures such as the labrum and occasionally on pereopods[51]. Setation on the main body segments when described as pairs implies an equivalent seta on both sides of the segment. Comparisons of setal and segment counts are usually based on compatible life stages, primarily mature individuals, to minimise allometric influences. It is inferred that the 'males' reported here may not be a definitive or unique sexual stage, with the possibility that the group could have a rare natatory (and life-terminal) form that would be extremely difficult to recognise without molecular analyses. When bearing fully-formed pleopods with setae they are referred to as 'males', if with developing (naked) pleopods then 'juvenile' is applied. Ratios are mostly abbreviated, e.g. 'L: W' equates to 'times longer than broad', as are dimensions, L for 'length,' and W for 'width', with prefixes C (combined) or T (total). Pereopod overall length: width ratios exclude the coxa and claw, with W from the basis. Diagnoses cover useful variant and synapomorphic characters and are not repeated in the descriptions; phrases in bold indicate autapomorphies. Bibliographies and synonyms are kept to a minimum but see Sieg *Crustaceorum Catalogus*[52], Anderson's webpage[53], or WoRMS[9] for more complete accounts.

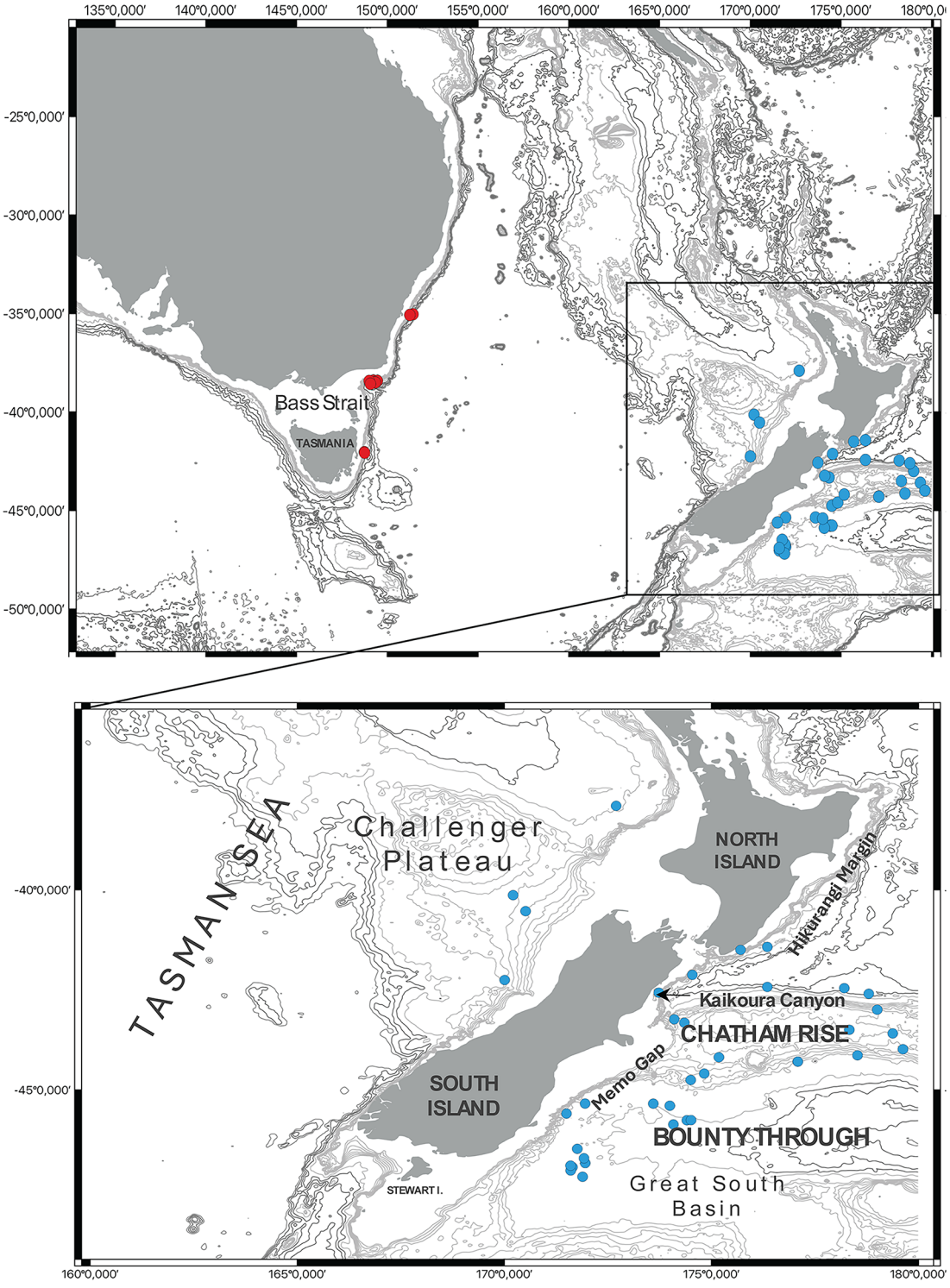

Fig. 38. Map of the Southeastern Australia and NZ regions with distribution of all bathyal (> 200 m) sample points from where arthrurid tanaids have been identified, red and blue indicating Australian and New Zealand locations.

Nomenclatural acts

To be finalised if and when manuscript is accepted.

Morphology-based phylogenetic analyses

We used taxa from the entire family Tanaellidae for a phylogenetic analysis, based on largely on literature review, but had to exclude some through paucity of descriptions or illustrations (e.g. *Araphura cuspirostris* Dojiri and Sieg,1997[55], *Arthrura andriashevi* Kudinova-Pasternak, 1966[5], and *Tanaella propinquus* Dojiri and Sieg,1997[55]). Apart from the NZ species, voucher specimens of *Araphura brevimanus* (Lilljeborg, 1864[56]) (genus type species), *Arhaphuroides brevispina* (Bird and Holdich, 1984[3]), *Tanaella ochracea* Hansen, 1913[10], and *T. unguicillata* Norman and Stebbing, 1886[7] (genus type species) were used to confirm certain characters. The

Species
Paranarthrura crassa Bird and Holdich, 1989 [outgroup] *Paranarthrurella dissimilis* Lang, 1972 [outgroup]
Araphura arvelundi Larsen and Araújo-Silva, 2009
Araphura brevimanus (Lilljeborg, 1864)
Araphura curticauda Larsen, 2005
Araphura doutagalla Błażewicz-Paszkowycz and Bamber, 2012
Araphura elongata (Shiino, 1970)
Araphura higginsi Sieg and Dojiri, 1989
Araphura hyphalus Bird, 2022 [*in* Lubinevsky et al. 2022)
Arhaphuroides io Bamber, 2005
Araphura joubinensis Sieg and Dojiri, 1989
Araphura macrobelone Błażewicz-Paszkowycz, Bamber and Cunha, 2011
Araphura parabrevimanus Lang, 1968
Araphura pygmothymos Błażewicz-Paszkowycz and Bamber, 2012
Araphura spinithenari Larsen, 2005
Araphura studens Błażewicz and Dębiec, 2017
Araphura whakarakaia Bird, 2011
Araphura yarra Błażewicz-Paszkowycz and Bamber, 2012
Arhaphuroides brevispina (Bird and Holdich, 1984)
Arhaphuroides batmania Błażewicz-Paszkowycz and Bamber, 2012 *Arhaphuroides bombus* Larsen, 2005
Arhaphuroides parabreviremis Sieg, 1986
Arhaphuroides sala Błażewicz-Paszkowycz and Bamber, 2012
Arhaphuroides septentrionalis Sieg and Dojiri, 1989
Arhaphuroides stabastris Błażewicz-Paszkowycz and Bamber, 2012 *Arthrura andriashevi* Kudinova-Pasternak, 1966 *Arthrura monacantha* (Vanhöffen, 1914) *Arthrura pulcher* (Lang, 1971)
Inconnivus billibunteri Błażewicz-Paszkowycz and Bamber, 2012
Tanaella busteri Drumm and Bird, 2016
Tanaella dongo Bamber, 2005
Tanaella eltaninae Guerrero-Kommritz and Błażewicz-Paszkowycz, 2004
Tanaella forcifera (Lang, 1968)
Tanaella kimi Guerrero-Kommritz and Błażewicz-Paszkowycz, 2004
Tanaella kommritzia Larsen and Shimomura, 2007
Tanaella kroyeri Larsen and Araújo-Silva, 2009
Tanaella mclellandi Larsen and Heard, 2004
Tanaella ochracea Hansen, 1913
Tanaella paraforcifera (Lang, 1968)
Tanaella profunda Guerrero-Kommritz and Błażewicz-Paszkowycz, 2004
Tanaella prolixcauda Larsen and Heard, 2004
Tanaella quintanai Morales-Núñez and Ardila, 2019
Tanaella rotundicephala Sieg, 1986
Tanaella unguicillata Norman and Stebbing, 1886
Tanaella tuberculata Kudinova-Pasternak, 1989
Tanaella unisetosa Sieg, 1986

Table 6. Described tanaellid species used in the PAUP analyses, with outgroup taxa.

robust agathotanaid *Paranarthrura crassa* Bird and Holdich, 1989[57] was used as an outgroup as it has superficial morphological similarity to the equally robust genus *Arthrura*, although it has both a putatively apomorphic cheliped-cephalothorax articulation (the basis lacking a posterior lobe/condyle) and mandible molar[56]. A valuable character that could not be adequately or consistently scored was the shape and configuration of the lateral cheliped-cephalothorax sclerite, although this is partly conveyed by the orientation of the cheliped-cephalothorax orientation.

Sixty-three tanaellid taxa were selected (Table 6 for described species), including the NZ morphospecies (seven *Araphura*, six *Arthrura*, one *Inconnivus*, four *Tanaella*-group, and two others: '*Leptognathia bathymylon*', and 'tanaellid NZ#1') and three putative Australian *Arthrura*-like taxa. Analyses were performed with PAUP (version 4.0a, build 169) from a starting matrix of over 200 tanaidomorphan morphological characters, only 98 were used after removal of those with zero weight or that were otherwise unreliable/erratic (Table S1). These were all treated as unordered and unweighted. This process could have been extended but concern about increasingly subjective/biased decision-making prevailed (in any case, morphology-based trees are often fragile, susceptible to even minor changes in the number or content of the characters used). Heuristic search, majority rule-50% (MR50) consensus trees were adopted. A similar analysis (B) was performed a different character suite (also 98 characters, Table S2) on the *Arthrura*-group again using *Paranarthrura crassa* but also *Paranarthrurella dissimilis* Lang, 1972[58] as the outgroup taxa as they both have a general habitus and morphology resembling that of the *Arthrura* and *Arthrura*-like species. In this analysis, sufficient data were available for *A. andriashevi* to allow its inclusion, albeit with a few missing scores.

New Zealand cruise/survey backgrounds

KAH0706: Exploration of Chemosynthetic Habitats of the New Zealand Region.

RENEWZ II (KAH0706) voyage, was a component of the project *Exploration of Chemosynthetic Habitats of the New Zealand Region*, funded by NOAA Ocean Exploration and NIWA, with co-funding from Woods Hole Oceanographic Institution, Scripps Oceanographic Institution, and the University of Hawaii.

TAN0616: RENEWZ I - NEW ZEEPS. The first component of the project *Exploration of Chemosynthetic Habitats of the New Zealand Region*, funded by NOAA Ocean Exploration and NIWA, with co-funding from Woods Hole Oceanographic Institution, Scripps Oceanographic Institution, and the University of Hawaii.

TAN0705 and TAN0707: Oceans Survey 2020 Chatham Rise (TAN0705) and Challenger Plateau (TAN0707). The *Biodiversity Ocean Survey 20/20 Chatham/Challenger Biodiversity and Seabed Habitat Project*, jointly funded by the New Zealand Ministry of Fisheries, Land Information New Zealand, National Institute of Water and Atmospheric Research, and Department of Conservation.

TAN1004: Vulnerable Deep-Sea Communities 1 (Southern Hikurangi Margin and Eastern Cook Strait). Specimens were collected by NIWA as part of the *Impact of resource use on vulnerable deep-sea communities project* (CO1 × 0906), funded by the New Zealand Foundation for Research, Science and Technology.

TAN1006: Kaikoura 3-Biophysical Moorings 19. Specimens were collected by NIWA at biophysical mooring sites in Kaikoura Canyon and the Chatham Rise/STF for research in collaboration with researchers from Victoria University of Wellington, University of Otago, University of Hawaii and NIWA.

TAN1116: Fisheries Oceanography II (Chatham Rise). This work was supported by the New Zealand government under *Coasts and Oceans* core funding from the Ministry of Business, Innovation and Employment. Project: *Food-web dynamics of New Zealand marine ecosystems*.

TAN1501: Specimens were collected as part of a commercial project for Anadarko (Anadarko New Zealand Company and Anadarko New Zealand Taranaki Company) on voyages TAN1310 and TAN1501.

TAN1902, TAN2202, and TAN2303: Specimens were collected as part of an environmental survey for OMV New Zealand Limited and its Joint Venture Partners (Beach Energy Resources NZ (Tāwhaki) Limited, and Mitsui E&P Australia Pty Limited).

TAN1904: HYDEE II Specimens were collected by NIWA on the HYDEE II (TAN1904) voyage as part of research programme *Economic Opportunities and Environmental Implications of Energy Extraction from Gas Hydrates*, funded by the New Zealand Ministry for Business, Innovation and Employment (C05 × 1708).

TAN2402 Specimens were collected as part of the Ocean Census project (https://oceancensus.org) in collaboration with NIWA and Museum of New Zealand/Te Papa Tongarewa, aboard the *RV. Tangaroa*, 8 February–22 March 2024. This expedition surveyed the benthic biodiversity of the Bounty Trough, including the continental slope and canyons off the Otago coast, though to the abyssal plain and several seamounts.

Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

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References

1. Błażewicz-Paszkowycz, M., Bamber, R. N. & Anderson, G. Diversity of Tanaidacea (Crustacea: Peracarida) in the world's Oceans – How Far have we come? *PLoS ONE*. **7** (4), 1–11 (2012).
2. Larsen, K. & Wilson, G. D. F. Tanaidacean phylogeny, the first step: the superfamily Paratanaidoidea. *J. Zool. Syst. Evol. Res.* **40**, 205–222 (2002).
3. Bird, G. J. & Holdich, D. M. New deep-sea leptognathiid Tanaids (Crustacea, Tanaidacea) from the North-east Atlantic. *Zool. Scr.* **13**, 285–315 (1984).
4. Sieg, J. Tanaidacea (Crustacea) von der antartiks und subantarktis. II. Tanaidacea gesammelt von dr. J. W. Wägele während der Deutschen antarktis expedition 1983. *Mitteilungen Aus Dem Zool. Museum Der Univ. Kiel*. **fl, H. 4, Kiel 4**, 1–80 (1986).

5. Kudinova-Pasternak, R. K. On a N.w abyssal Tanaidacean from the Pacific, *Arthrura Andriashevi* N. gen., N. sp. *Crustaceana* **12**, 258–260 (1966).
6. Błażewicz-Paszkowycz, M. & Bamber, R. N. The shallow-water Tanaidacea (Arthropoda: malacostraca: Peracarida) of the bass Strait, Victoria, Australia (other than the Tanaidae). *Mem. Museum Vic.* **69**, 1–235 (2012).
7. Norman, A. M. & Stebbing, T. R. R. V. On the Crustacea isopoda of the 'lightning,''porcupine,' and 'valorous" expeditions. ' *Trans. Zool. Soc. Lond.* **12**, 77–141 (1886).
8. Błażewicz, M., Jakiel, A., Bird, G. J. & Studzian, M. Integrative taxonomy supports the establishment of a new deep-sea family of Tanaidacea (Peracarida). *Zool. J. Linn. Soc.* **20**, 1–56 (2024).
9. WoRMS Editorial Board. World Register of Marine Species. Available from. (2024). https://www.marinespecies.org *at VLIZ. Accessed https://doi:10.14284/17* (2024).
10. Hansen, H. J. Crustacea malacostraca. II. IV. The order Tanaidacea. *Dan. Ingolf-Exped*. **3**, 1–145 (1913).
11. Lang, K. Taxonomische und phylogenetische untersuchungen Über die Tanaidaceen. 6. Revision der Gattung Paranarthrura Hansen, 1913, und aufstellung von Zwei Neuen familien, vier Neuen gattungen und Zwei Neuen Arten. *Arkiv För Zoologi Ser. 2.* **23**, 361–401 (1971).
12. Sieg, J. & Zibrowius, H. Association of a tube inhabiting Tanaidacean, *Bifidia scleractinicola* gen. nov., n. sp., with bathyal scleractinians off New Caledonia (Crustacea Tanaidacea - Cnidaria Scleractinia). *Mésogée* 48, 189–199 (1988).
13. Vanhöffen, E. Die Isopoden. in *Deutsche Südpolar-Expedition 1901–1903 im Auftrage des Reichsamtes des Innern* (ed. Von Drygalski, E.) 1-154Druck und Verlag von Geotg Reimer, (1914).
14. Kudinova-Pasternak, R. K. & Tanaidacea Crustacea, Malacostraca) from the Atlantic sector of Antarctic and subantartic. *Tr. Instituta Okeanol Akad. Nauk. SSSR*. **103**, 194–229 (1975).
15. Sieg, J. Tanaidacea (Crustacea) von der Antarktic and subantarktis. II. Tanaidacea gesammelt von dr. J. W. Wägele während der Deutschen antarktis expedition 1983. *Mitteilungen Aus Dem Zool. Museum Univ. Kiel*. **II**, 1–80 (1986).
16. Kussakin, G. O. Isopoda and Tanaidacea from the coastal zones of the Antarctic and subantarctic. *Explor. Fauna Seas IV (XII) Biol. Results Sov Antarct. Exped*. **3**, 220–380 (1966).
17. Jóźwiak, P. & Błażewicz-Paszkowycz, M. New records of the family Agathotanaidae (Crustacea: Tanaidacea) in the Antarctic, with remarks on *Arthrura monacantha* (Vanhöffen, 1914). *Zootaxa* **2785**, 32–52 (2011).
18. Błażewicz-Paszkowycz, M. The biogeographic Atlas of the Southern Ocean. in *Biogeographic Atlas of the Southern Ocean Ocean* (ed. De Broyer C., Koubbi P., Griffiths H.J., Raymond B., Udekem d'Acoz C. d', et al.) 173–180 (Census of Antarctic Marine Life SCAR-Marine Biodiversity Information Network, (2014).
19. Gordon, D. P. *New Zealand Inventory of Biodiversity. Volume 2. Kingdom Animalia. Chaetognatha, Ecdysozoa, Ischnofossils*224 (Canterbury University, 2010).
20. Kaiser, S., Lörz, A. N., Bird, G., Malyutina, M. & Bowden, D. Benthic boundary layer macrofauna from the upper slope of the Chatham Rise (SW Pacific). *Mar. Ecol.* e12521 (2018). https://doi.org/10.1111/maec.12521
21. Błażewicz, M., Jakiel, A. & Bird, J. G Pseudotanais Sars, 1882 (Crustacea: Tanaidacea) from the SE Australian slope: A gap in our knowledge. *Front. Mar. Sci.* **8**, 779001 (2021).
22. Gellert, M., Bird, G. J., Stępień, A., Studzian, M. & Błażewicz, M. A hidden diversity in the Atlantic and the SE Pacific: Hamatipedidae N. fam. *Front. Mar. Sci.* **8**, 773437 (2022).
23. Quicke, D. L. J. *Principles and Techniques of Contemporary Taxonomy* (Chapman and Hall, 1993).
24. Lang, K. Die gattungen *Agathotanais* Hansen und *Paragathotanais* N. gen. *Tanaidacea Crustaceana*. **21**, 57–71 (1971).
25. Segadilha, J. L., Gellert, M. & Błażewicz, M. A new genus of Tanaidacea (Peracarida, Typhlotanaidae) from the Atlantic slope. *Mar. Biodivers.* **48**, 915–925 (2018).
26. Larsen, K. *Deep-sea Tanaidacea (Peracarida) from the Gulf of Mexico. Crustaceana. Monographs* 5Leiden,. (2005).
27. Lang, K. Taxonomische und phylogenetische untersuchungen Über die Tanaidaceen (Crustacea). 8. Die gattungen Leptochelia Dana, Paratanais Dana, Heterotanais G. O. Sars und Nototanais Richardson, Dazu einige bemerkungen Über die Monokonop. *Zool. Scr.* **2**, 197–229 (1973).
28. Lang, K. Contribution to the systematics and synonymics of the Tanaidacea. *Ark. För Zool.* **42**, 1–14 (1949).
29. Sieg, J. Zum natürlichen system der Dikonophora Lang (Crustacea, Tanaidacea). *J. Zool. Syst. Evol. Res.* **14**, 177–198 (1976).
30. Sieg, J. Neuere erkenntnisse zum natürlichen system der Tanaidacea. *Zoologica* **136**, 1–132 (1984).
31. Kudinova-Pasternak, R. K. & Tanaidacea Crustacea, Malacostraca) collected on the R/V Vitjaz in the region of the Aleutian trench and Gulf of Alaska. *Trudý Instituta Okeanologii Akademija Nauk. SSSR*. **91**, 141–168 (1973).
32. Kudinova-Pasternak, R. K. Novye Tanaidacea (Crustacea) Iz Madagaskarkoi Kothovyny Indiiskogo Okeana) [Les genres nouveaux des Tanaidacea (Crustacea) du bassin de Madagascar de l´Ocean Indien]. *Zoologicheskii Zhurnal*. **66** (1), 28–36 (1987).
33. Kudinova-Pasternak, R. K. & Tanaidacea Crustacea, Malacostraca) from the deep-sea trenches of the Western part of the Pacific. *Tr. Instituta Okeanol Akad. Nauk. SSSR*. **108**, 115–135 (1978).
34. Bird, G. J. & Tanaidacea Crustacea: Peracarida) of the North-east Atlantic: the genera *Leptognathioides* and *Portaratrum* of the 'Atlantic margin'. *J. Nat. Hist.* **48**, 1771–1815 (2014).
35. Kaiser, S., Brix, S., Kihara, T. C., Janssen, A. & Jennings, R. M. Integrative species delimitation in the deep-sea genus *Thaumastosoma* Hessler, 1970 (Isopoda, Asellota, Nannoniscidae) reveals a new genus and species from the Atlantic and central Pacific Abyss. *Deep Res. Part. II Top. Stud. Oceanogr.* **148**, 151–179 (2018).
36. Rice, A. L. *British Oceanographic Vessels 1800–1950* (The Ray Society, 1986).
37. Lörz, A. N. Biodiversity of an unknown new Zealand habitat: bathyal invertebrate assemblages in the benthic boundary layer. *Mar. Biodivers.* **41**, 299–312 (2011).
38. Schnabel, K. E., Peart, R. A. & Bradford-Grieve, J. Kingdom of Animalia, phylum Arthropoda, Subphylum Crustacea (shrimps, crabs, lobsters, barnacles, and kin). in *The Marine Biota of Aotearoa New Zealand. Updating our marine biodiversity inventory. NIWA Biodiversity Memoir* 411–445 (2023).
39. Leduc, D., Brown, J. C. S., Bury, S. J. & Lörz, A. N. High intraspecific variability in the diet of a deep-sea nematode: stable isotope and fatty acid analyses of Deontostoma tridentum on Chatham rise, Southwest Pacific. *Deep Res. Part. I Oceanogr. Res. Pap*. **97**, 10–18 (2014).
40. Leduc, D. New nematode species and genera (Nematoda: Chromadorea) from cold seeps on Hikurangi margin, new Zealand. *Eur. J. Taxon*. **856**, 1–45 (2023).
41. Błażewicz, M., Jóźwiak, P., Jennings, R. M., Studzian, M. & Frutos, I. Integrative systematics and ecology of a new deep-sea family of Tanaidacean crustaceans. *Sci. Rep.* **9** (1), 1–70 (2019).
42. Larsen, K., Bird, G. & Ota, M. The ANDEEP Tanaidacea (Crustacea: Peracarida) revisited I: the family Agathotanaidae Lang, with description of four new species. *Zootaxa* **3630** (3), 424–444 (2013).
43. Gardiner, L. F. The systematics, postmarsupial development, and ecology of the deep-sea family Neotanaidae (Crustacea: Tanaidacea). *Smithson. Contrib. Zool.* **170**, 1–265 (1975).
44. Gellert, M., Palero, F. & Błażewicz, M. Mislabeling and nomenclatorial confusion of Typhlotanais sandersi Kudinova- Pasternak, 1985 (Crustacea: Tanaidacea) and establishment of a new genus. *PeerJ* **1985**, 1–25 (2022).
45. Gellert, M., Bird, G., Stępień, A., Studzian, M. & Błażewicz, M. A hidden diversity in the Atlantic and the SE Pacific: Hamatipedidae N. Fam. (Crustacea: Tanaidacea). *Front. Mar. Sci.* **8**, 1–25 (2022).
46. Błażewicz, M. et al. from the Southern Ocean: diversity and bathymetric pattern. *Eur. Zool.* 88, 1–76 (2021). (1976) (Crustacea: Peracarida).

47. Poore, G. C. B., Just, J. & Cohen, B. F. Composition and diversity of Crustacea isopoda of the southeastern Australian continental slope. *Deep Sea Res. Part. I Oceanogr. Res. Pap.* **41**, 677–693 (1994).
48. Bird, G. J. & Tanaidacea Crustacea: Peracarida) from the Southern French Polynesia expedition, 2014. I. Tanaidomorpha. *Zootaxa* **4548**, 1–75 (2019).
49. Sieg, J. Neue Erkenntnisse zum System der Tanaidacea. Eine phylogenetische Studie. 177–198 (1984).
50. Sieg, J. Tanaidacea of the Antarctic and subantarctic 1. On material collected at Tieraa de Fuego, Isla de Los Estados, and the West Coast of the Antarctic. *Antarct. Res. Ser.* **45**, 1–180 (1986).
51. Garm, A. & Watling, L. The crustacean ontegument: setae, setules, and other ornamentation. in Functional Morphology and Divresity (eds Watling, L. & Thiel, M.) vol. 6: 167–198 (Oxford University Press, (2013).
52. Sieg, J. *Tanaidacea. Crustaceorum Catalogus* (Dr. W. Junk, 1983).
53. Anderson, G. Tanaidacea - Recent Scholarship (2000). -present https://aquila.usm.edu/tanaids30/6
54. Dojiri, M. & Sieg, J. The Tanaidacea. in *Taxonomic Atlas of the Benthic Fauna of the Santa Maria Basin and Western Santa Barbara Channel. Volume 11. The Crustacea Part 2. The Isopoda, Cumacea and Tanaidacea* (eds Blake, J.A., & Scott, P.H.) 181–268 (Santa Barbara Museum of Natural History, 1997).
55. Lilljeborg, W. Bidrag Til Kännedommen Om de Inom Sverige och Norrige förekommande crustaceer Af isopodernas underordning och Tanaidernas Familj. *Inbjudningsskrift till Åhörande Af Offentliga Föreläsninge*. **1865**, 1–31 (1864).
56. Bird, G. J. & Holdich, D. M. Deep-sea Tanaidacea (Crustacea) of the North-east Atlantic: the genus *Paranarthrura* Hansen. *J. Nat. Hist.* **23**, 137–167 (1989).
57. Lang, K. *Bathytanais bathybrothes* (Beddard) und *Leptognathia dissimilis* N. Sp. (Tanaidacea). *Crustaceana Supplement*, 221–236 (1972).

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Author contributions

G.J.B. conceived the idea and developed the manuscript based on the A-NZ material. M.B. contributed the Australian aspect of the study with drawings and other information. Both authors were involved with the writing.

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Competing interests

The authors declare no competing interests.

Ethics and permits

No permits were required for this study and the surveys were carried out by formal scientific institutions.

Additional information

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