Zootaxa 1002: 1–20 (2005)
www.mapress.com/zootaxa/

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

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New sphaeromatids (Crustacea: Isopoda: Sphaeromatidea) from coastal and freshwater habitats in New Zealand

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Abstract

Exosphaeroma waitemata sp. nov. is described from the Waitamata Estuary, Auckland, northern North Island; it is characterised by the setose pereopods and body margins, setose uropod rami with distally acute exopods, and males with coxae 6 posteriorly extended and acute; the species is regarded as *incertae sedis*. A new genus and new species of Sphaeromatidae, *Makarasphaera amnicosa* gen. nov., sp. nov. is described from maritime freshwater streams and seeps from the Wellington and Wairarapa region of the southern North Island of New Zealand. The genus characterised by the thickened ventrolateral margins of pereonite 1, head deeply immersed in pereonite 1, elongate penial processes, short and mesially produced pleopod 1 peduncle, flask-shaped appendix masculina, pleopods 4 and 5 without thickened ridges, pleopod 5 with reduced scale patches, and the pleon with only one short suture running to the poster margin.

Key words: Isopoda, Sphaeromatidae, *Exosphaeroma*, *Makarasphaera*, freshwater, estuaries, New Zealand, Pacific, southwest Pacific

Introduction

Knowledge of the New Zealand sphaeromatid fauna rests with the monograph of Hurley & Jansen (1977) which documented and diagnosed the entire family for New Zealand waters, and the more recent publications of Stephenson & Riley (1997) and Sket & Bruce (2004). There has been no other taxonomic work on New Zealand Sphaeromatidae despite prolific activity on this family in Australia (e.g. Bruce 2003 and references therein), the Caribbean (e.g. Kensley 1984; Kensley & Schotte 1987, 1994; Kensley *et al.* 1997; Wetzer & Bruce 1999) and also the Indian Ocean (see Kensley 2001; Schotte & Kensley 2005). Minor nomenclatural changes to New Zealand species have resulted from recommendations and generic reassignments, notably by Harrison & Holdich (Harrison & Holdich 1984), more recently in Bruce (2003).

Since the publication of Hurley & Jansen (1977) a further 34 sphaeromatid genera have been described world wide, a rate of more than one per year. The criteria for discrim-

Accepted by J. Olesen: 16 May 2005; published: 1 Jun. 2005

inating genera are now far narrower than before. New Zealand's shallow-water marine sphaeromatids species are largely documented (although few are adequately described), but it is likely that considerable changes are necessary at generic level to more accurately reflect the levels of sphaeromatid diversity and endemism in New Zealand. The discovery of the two new species described here in such close proximity to two major cities, Auckland and Wellington, both species being found in readily accessible habitats, indicates that the New Zealand coastal and marine crustacean fauna is still so little documented.

Methods

Terminology, measurements and descriptions follow Bruce (e.g. 1997, 2003). The generic description was produced using a DELTA (Dallwitz *et al*. 1997) generic data set that is in preparation. Abbreviations: RS—robust seta/setae; CP—circumplumose setae; PMS—plumose marginal setae; NIWA—National Institute of Water and Atmospheric Research, Invertebrate Collection.

Suborder Sphaeromatidea Wägele, 1989
Family Sphaeromatidae Latreille, 1825
Genus *Exosphaeroma* Stebbing, 1900

Remarks: See Bruce (2003) for a recent synonymy, diagnosis, comments on the genus, and a list of species. Eight species, including the new species described here, are known from New Zealand (Hurley & Jansen 1977; see also species list in Bruce 2003).

Exosphaeroma waitemata sp. nov. (Figs 1–4)

Material examined.— **Holotype**: ♂ (5.9 mm), Hobsonville, Waitemata Estuary, Auckland, North Island, New Zealand, 36°47.959'S, 174°40.643'E, June 2001, sand flats (NIWA 4068).

Paratypes: 3 ♂ (imm. 3.0, 3.5 [dissected]; ~ 5 [crushed] mm), 2 juveniles (3.0, 1.9 mm), same data as holotype (NIWA 4069). ♀ (non-ovig. 3.8 mm), Shoal Bay, Waitemata Estuary, Auckland, 36°49.072'S, 174°45.131'E, stn 14-4 (NIWA 4070). ♂ (crushed, uropod dissected), 3 ♀ (non-ovig. 3.7 mm, remainder crushed), manca (1.7 mm), Little Shoal Bay, Waitemata Estuary, Auckland, stn 14-2 (NIWA 4071). Manca (crushed, 1.2 mm), Little Shoal Bay, Waitemata Estuary, Auckland, stn 14-3 (NIWA 4072).

Description of male. Body 1.8 times as long as greatest width, weakly ovate, widest at pereonite 6; dorsal surfaces smooth. Cephalon anterior margin without transverse ridges, rostral process weakly developed, visible in dorsal view. Head about 1.2 times as long as

pereonite 1, pereonite 1 about 1.4 times as long as pereonite 2; pereonites 2–6 subequal in length, pereonite 7 slightly shorter than 6. Coxae 2–7 ventrally subtruncate, ventral margin with setae; coxae of pereonite 6 extending posterior to and overlapping coxae of pereonite 7, posteriorly acute. Pleon medially about 2.5 times as long as pereonite 7, posterior margin with sublateral 'keys'. Pleotelson strongly vaulted, posterior margin produced to narrowly rounded apex; ventral margin broad, with shallow and wide excavation.

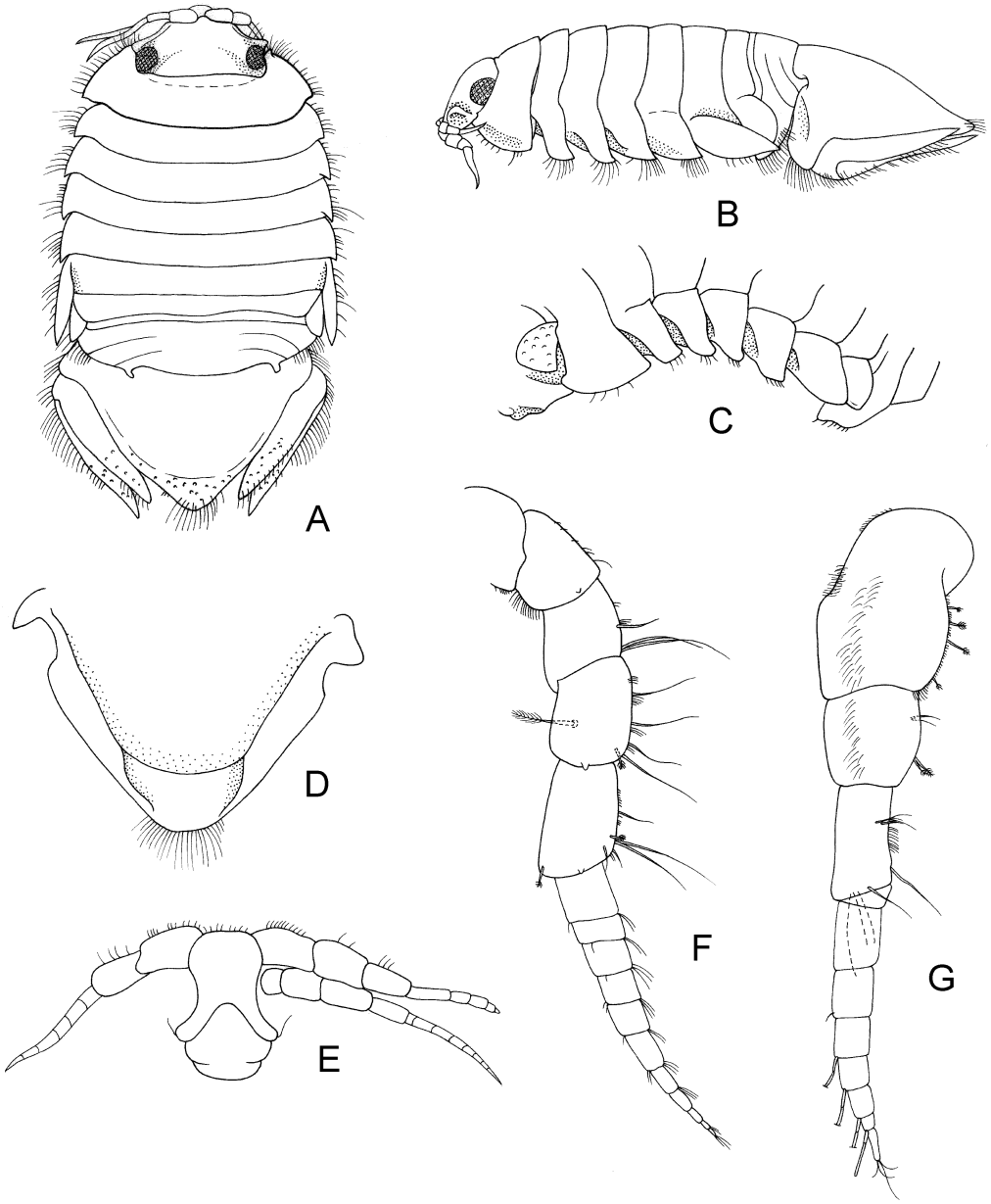

FIGURE 1. *Exosphaeroma waitemata* sp. nov. A, B, D and E, holotype; F, G, ♂ 3.5 mm. A, dorsal view; B, lateral view; C, lateral view, 3.0 mm juvenile: pereon and pleon; D, pleotelson, posterior margin, ventral view; E, frons; F, antenna; G, antennule.

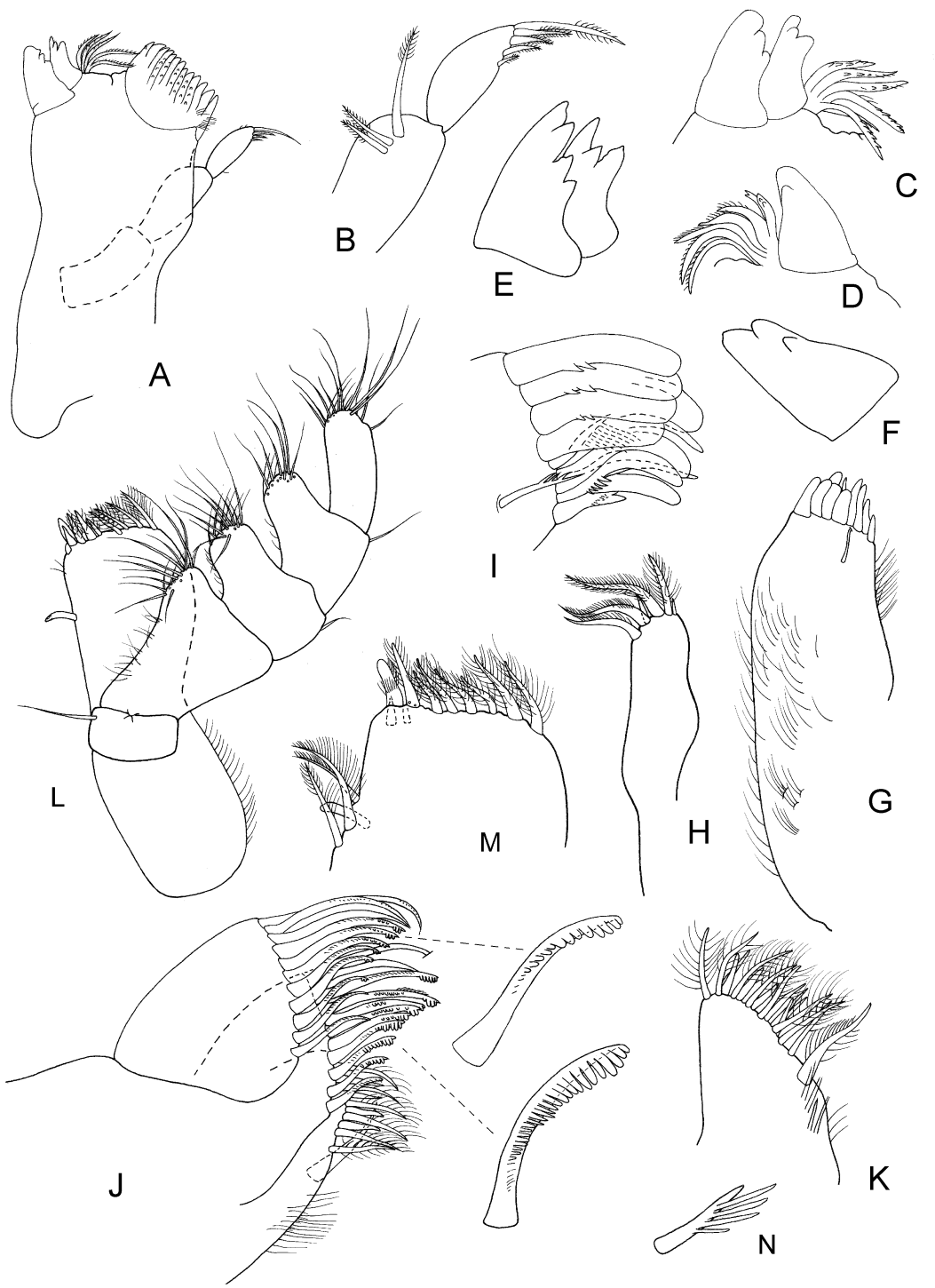

FIGURE 2. *Exosphaeroma waitemata* sp. nov., dissected paratype. A, right mandible; B, mandible palp article 3; C, left mandible, distal part; D, right mandible, distal part; E, left mandible incisor and lacinia mobilis, pre-moult; F, right mandible incisor, pre-moult; G, maxillule, lateral lobe; H, maxillule, mesial lobe; I, maxillule apex, pre-moult; J, maxilla; K, maxilla mesial lobe; L, maxilliped; M, maxilliped endite, distal margin; N, pectinate robust seta, gnathal surface of maxillule.

Antennule peduncle article 1 1.4 times as long as wide, about 1.9 times as long as article 2, anterior and posterior margins convex; article 3 about two-thirds as long as article 1, 2.3 times as long as wide, 1.3 times as long as article 2; flagellum 7-articled, extending to anterior of pereonite 1, about 2.5 times as long article 3. *Antenna* relatively robust, peduncle articles 1 and 2 short, article 2 posterior margin with scale-setae; article 3 about 0.6 times as long as article 4; articles 4 and 5 subequal in length; articles 3–5 collinear; flagellum about 0.8 times as long as peduncle, extending to middle of margin of pereonite 1, with 11 articles.

Epistome anteriorly sub-truncate, anterior lateral margins rounded, with prominent medial constriction. *Left mandible* incisor with 4 cusps, lacinia mobilis with 3 cusps, spine row of 6 curved, serrate spines; right mandible incisor with 3 indistinct cusps, spine row of 2 broad-based distally serrate spines and 5 curved serrate spines; molar process round, crushing surface strongly ridged; palp articles 1 and 2 subequal in length, article 2 distolateral margin with 3 biserrate setae; article 3 with 5 biserrate setae, terminal seta being longest. *Maxillule* mesial lobe with 4 long, strongly CP RS and two short simple RS, lateral lobe with 8 broad-based, truncate RS and 2 curved, slender RS on gnathal surface, twelfth prominently pectinate seta set between these; truncate RS weakly serrate (2–4 teeth) or simple. *Maxilla* lateral lobe and middle lobe each with 11 curved, pectinate RS respectively, mesial lobe with about 18 serrate and biserrate RS, proximal seta longest. *Maxilliped* endite lateral margin strongly convex, distal margin sub-truncate, with 7 sinuate CP RS, I blunt and 1 acute RS at sublateral angle, distomesial margin with 3 CP RS and single coupling hook; palp articles 2–4 moderately lobate articles 2–5 with about 26, 22, 20 and 164 setae respectively, these setae being set in 2 rows.

Pereopod 1 without setulose fringe on inferior margins; *basis* about 3.7 times as long as greatest width, approximately twice as long as propodus; *ischium* 0.7 times as long as basis, 2.3 times as long as greatest width, superior margin with proximal, sinuate, acute RS, distal two-thirds with 5 long prominent simple setae; *merus* about 0.7 times as long as ischium, about 1.6 times as long as greatest width, superior distal angle with 8 acute long simple setae, inferior margin with 9 long simple setae distal-most being longest; *carpus* 1.38 times as long as wide, inferior margin with 6 long stiff simple setae; *propodus* 2.50 times as long as greatest width, 1.1 times as long as ischium, inferior margin with 4 simple setae, 3 small RS and distally with 1 blunt RS; mesial surface with 5 submarginal biserrate RS; *dactylus* 0.8 times as long as propodus, unguis inferior margin smooth, secondary unguis curved, pectinate. *Pereopod 2* inferior proximal margin and submarginal surface of ischium–carpus with setulose fringe; *basis* 3.2 times as long as greatest width, inferodistal angle with single long simple seta, superior margin with widely spaced small penicilate setae; ischium 0.8 times as long as basis, 3.0 times as long as greatest width, distal half of superior margin with 8 evenly spaced long simple setae, distal inferior margin with 4 long simple setae; *merus* about half as long as ischium, superior distal angle about 12 long simple seta, inferior margin about 10 moderate and long simple seta; *carpus* slightly (1.1)

times longer than merus, 1.5 times as long as greatest width, anterodistal angle with about 8 long simple seta, inferior margin with 8 long, stiff simple setae; *propodus* 0.7 times as long as ischium, 2.4 times as long as proximal width, superior distal angle with 1 long simple seta, inferior margin with weak setulose fringe and distal serrated scales, distal half with 5 stiff simple setae; *dactylus* 0.7 as long as propodus, inferior margin distally with scales, secondary unguis simple. Pereopod 3 similar to pereopod 2. *Pereopods 3–4* with moderately developed setulose fringe on inferior margins of merus and carpus of pereopods 2–4. *Pereopods 5–7* similar, ischium–carpus broad, bilaterally compressed; with more and far longer RS than pereopods 1–3. *Pereopod 7 basis* 4.0 times as long as greatest width, inferodistal angle with 2 long simple setae, proximal superior margin with patch of scale setae; *ischium* 0.7 times as long as basis, 1.2 times as long as greatest width, proximal superior margin scale setae, distal superior margin about 12 long simple setae, inferior distal angle with 8 long simple setae; *merus* 0.6 times as long as ischium, superior distal angle with 7 long simple setae (extending to distal margin of carpus), inferior margin with setulose fringe, distal margin with 9 long distally biserrate setae; *carpus* 1.6 times as long as merus, anterodistal margin with 8 short, acute biserrate and 4 long setae, inferior margin with setulose fringe, inferior distal angle with 8 long distally biserrate setae; *propodus* 0.9 times as long as ischium, 3.1 times as long as wide, inferior margin setulose, distally with 5 long setae, superior distal angle with 1 short palmate seta; *dactylus* 0.5 as long as propodus.

Penes slender, mutually adjacent, distally rounded; approximately 5 times as long as basal width (examined in situ).

Pleopod 1 exopod and endopod with c. 45 and 26 PMS respectively, exopod proximolateral RS present; endopod and exopod subequal in length, endopod 1.5 times as long as greatest width, distal margin truncate. *Pleopod 2* exopod and endopod with c. 42 and 32 PMS respectively; *appendix masculin*a 13 times as long as basal width, distally folded, apically narrowly rounded. *Pleopod 3* exopod and endopod with c. 38 and 14 PMS respectively; exopod transverse suture entire. *Pleopod 4* rami without thick ridges, lateral, exopod transverse suture entire, lateral margin with continuous evenly spaced fine simple setae. *Pleopod 5* rami without thick ridges; exopod transverse suture entire, with 2 scale patches, lateral margin with numerous evenly spaced simple setae. *Uropod* exopod 0.8 as long as endopod, 5.2 times as long as greatest width, extending slightly beyond apex of endopod, straight, margins weakly convex, converging to sub-acute apex; endopod 4.8 as long as basal width, straight, apex bluntly rounded; both rami rounded in cross section with fine nodules and abundant simples and sparsely plumose setae.

Female. Similar to male. Coxa 6 not expanded.

Size. To 5.9 mm; many specimens were received damaged, and the size range for adults could not be determined.

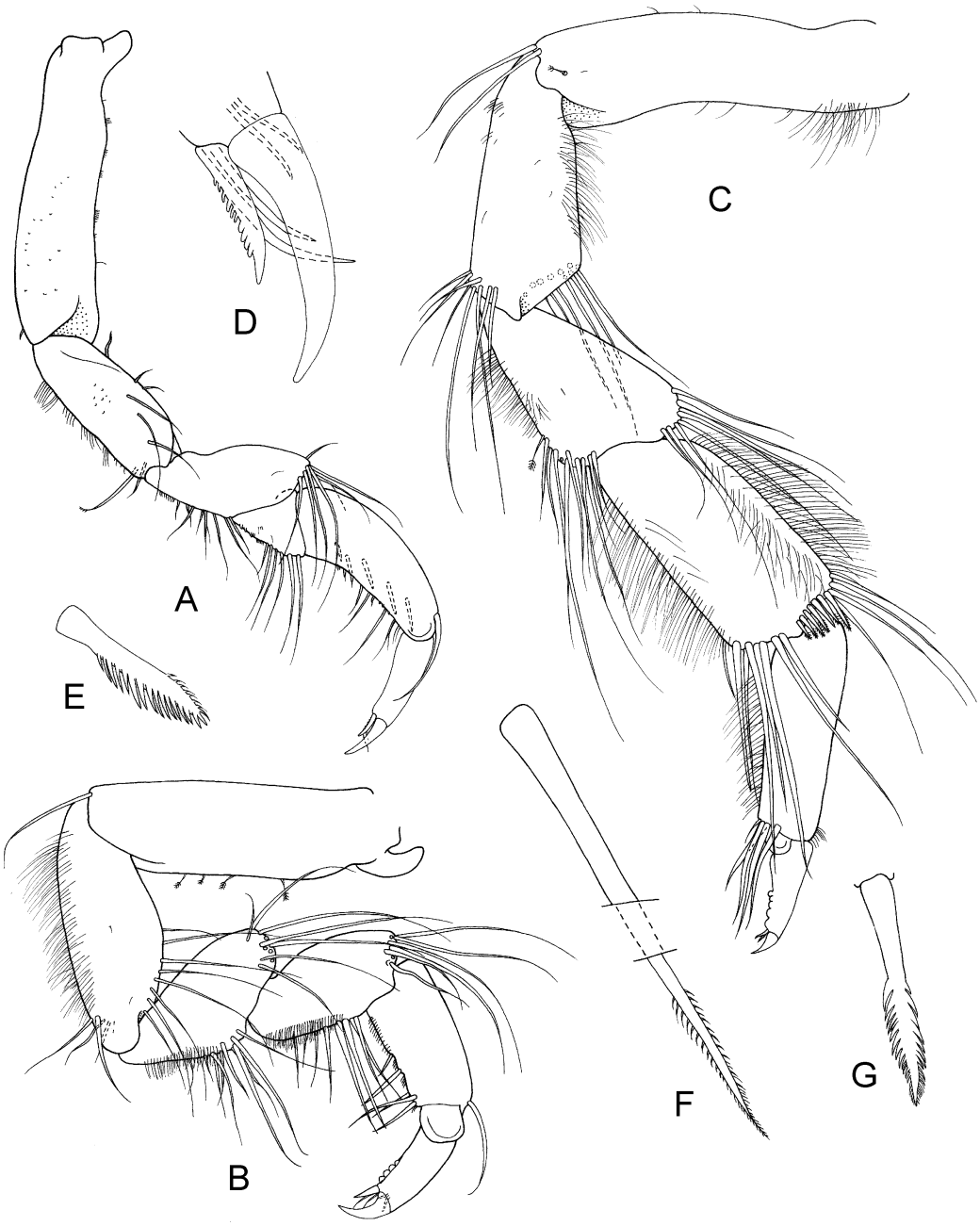

FIGURE 3. *Exosphaeroma waitemata* sp. nov., holotype. A, pereopod 1; B, pereopod 2; C, pereopod 7; D, pereopod 1 dactylus; E, robust setae from mesial margin, pereopod 1 propodus; F, long seta, pereopod 7, merus inferodistal angle (base and apex only); G, serrate seta, pereopod 7 carpus, distal margin.

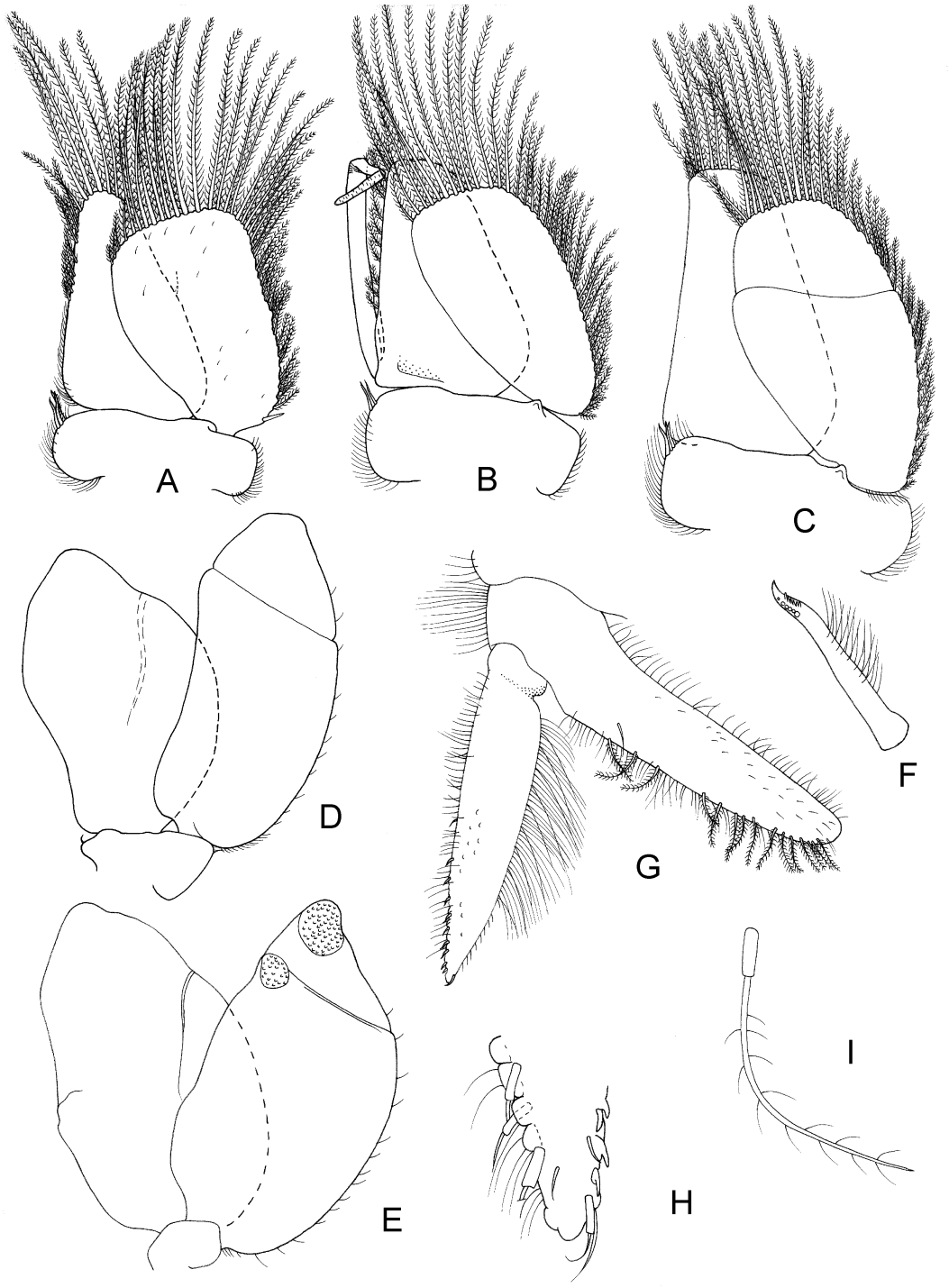

FIGURE 4. *Exosphaeroma waitemata* sp. nov. A–F, holotype, remainder crushed ♂ paratype. A–E, pleopods 1–5 respectively; F, coupling hook, pleopod 1; G, uropod; H, uropod exopod apex; F, seta, uropod dorsal surface.

Remarks: *Exosphaeroma waitemata* sp. nov. is immediately recognised by thick, setose uropods with a terminally acute exopod, in conjunction with heavily setose pereopods. The expanded and posteriorly acute male coxa 6 is a further character with which to confirm identity. These characters separate the species from all other *Exosphaeroma* as well as from all other New Zealand Sphaeromatidae.

Exosphaeroma falcatum Tattersall, 1921, known only from northern North Island is similar in appearance, with similar uropodal exopods. *Exosphaeroma falcatum* is far smaller than *E. waitemata* (up to 2.5 mm compared to nearly 6 mm), lacks setose body margins and uropods, has a more elongate epistome, and has notably more slender pereopods 5–7. The adult female of *E. falcatum* has a conspicuous hook-shaped process on the uropodal endopod.

Despite the superficially rather different appearance to most species of *Exosphaeroma*, notably the strongly setose pereopods and males with an expanded sixth coxal plate, the new species is retained within *Exosphaeroma*, with the proviso that it is regarded as *incertae sedis*. The pereopod morphology, with strongly developed setae, is of the same pattern as shown by some other species such as *Exosphaeroma agmokara* Bruce, 2003, and the form of the penial processes and pleopods accords entirely with that of *Exosphaeroma*. The most significant difference is that in *E. waitemata* sp. nov. the dorsal surface of the posterior margin of pleonite 1 lacks the two flush, sub-median lobes that are typical of *Exosphaeroma*, and which are a possible generic apomorphy. Other differences include pereopod 1 with a pectinate secondary unguis on the dactylus (otherwise always simple in *Exosphaeroma* s. str.), and the thick (in section) uropodal rami (always lamellar in *Exosphaeroma* s. str.), male coxae 6 expanded and posteriorly produced (not so in *Exosphaeroma* s. str.), and the posterior margin of pereonite 7 without a median angle (present in species close to the type species of *Exosphaeroma* s. str.). In the absence of any phylogenetic hypotheses for the Sphaeromatidae, and given the similarity of penial and appendage morphology, the species is provisionally retained within *Exosphaeroma*.

Superficially *Exosphaeroma waitemata* sp. nov. is similar to species of *Tholozodium* Eleftheriou, Holdich & Harrison, 1980 (see Harrison & Ellis 1991, p. 921 for discussion of the synonymy of *Basphaeroma* Taberner, 1988a with *Tholozodium*), a genus known from sandy, exposed beaches northern Indian Ocean (Eleftheriou *et al.* 1980), and sheltered freshwater sandy habitats in Brazil and Argentina (Pires 1982; Taberner 1988). Given that *E. waitemata* sp. nov. and *Tholozodium* are both sand dwellers, a large part of that similarity may result from convergent adaptations to a similar habitat, specifically the long setae on the pereopods. The pleotelson segmentation, pereopod 1 shape and pleopod morphology, among other characters, all differ substantially.

Etymology. The name of the type locality, the Waitemata Estuary (noun in apposition).

***Makarasphaera* gen. nov.**

Type species. *Makarasphaera amnicosa* sp. nov., here designated.

Diagnosis: Head deeply immersed in pereonite 1; pereonite 1 lateral margins ventrally thickened and flat; pleonite 1 medially fused to remainder of pleon; single short suture running to posterior of pleon. Pleotelson posterior margin simple, entire. Antennule peduncle not flattened or expanded; article collinear. Pereopods secondary unguis simple; inferior margins without setulose fringe, superior margins of ischium without long setae. Penial processes long, extending to pleopod rami, entirely separate, basally in contact. Pleopods lamellar, all rami membranous, without thickened ridges; appendix masculina basal, flask-shaped, distally abruptly narrowed.

Description. *Body* vaulted, dorsal surfaces smooth, without setae, with ability to conglobate; not or weakly sexually dimorphic. *Head* with rostral point present, simple, not separating antennular bases; anterior margin simple, without incision, lateral margins not laterally extended to body outline. *Eyes* lateral, simple. *Pereonites* all smooth; 2–7 with posterior margin not raised; pereonite 1 lateral margins anteriorly produced, laterally enclosing head, anteriorly without keys. *Sternite 1* without cuticular mesial extensions. *Pereonite 6* simple, without bosses, processes or marginal extensions. *Pereonite 7* as wide as pereonite 6, forming part of body outline, dorsally without bosses, processes or marginal extensions. *Coxae* ventrally wide, those of pereonites 2–7 overlapping anterior over posterior, rectilinear, coxae without ventral ‘lock and key’ processes, with grooved articulation; those of pereonite 6 not large, not overlapping those of pereonite 7. *Pleon* consisting of 2 visible segments (as determined by lateral sutures); pleonite 1 medially fused to pleonite 2; posterior margin even, as wide as remainder of pleon, extending to pleon lateral margins; pleonal sternite absent; single short suture running to posterior margin; dorsal surface without process; posterior margin even, with 'keys'. *Pleotelson* vaulted, anteriorly as wide as pleon, without dorsal process; posterior margin entire, simple, arcuate; lateral margins simple.

Membrana cingula absent.

Antennule peduncle with basal articles mesially not in contact, articles 1 and 2 robust, article 3 slender; article 1 not anteriorly produced, without anterior lobe; article 2 short, less than 0.4 times as long as article 1, without anterodistal lobe; articles 1 and 2 not flattened; with articles 2 and 3 collinear, article 3 longer than article 2; flagellum shorter than peduncle, longer than peduncular article 3. *Antenna* peduncle articles all collinear, articles less robust than antennule, peduncular articles all of sub-similar thickness.

Epistome anteriorly acute, without median constriction, anteriorly flush with head, not projecting, anteriorly not prominently extended, elongate, posteriorly enclosing labrum. *Mandible* incisor wide, multicuspid; lacinia mobilis present, tri-cuspid; spine row normal; molar process gnathal surface with transverse ridges, rounded. *Maxillule* lateral lobe robust setae with some or all serrate, medial lobe with 4 major robust setae, these setae

being strongly plumose. *Maxilla* with setae on middle and lateral lobes serrate and nodular. *Maxilliped* palp articles 2–4 medial margins lobate, article 2 not expanded.

Pereopod 1 ambulatory; dactylus secondary unguis slender, simple. *Pereopod 2* similar in proportion to pereopod 3; dactylus with secondary unguis slender and simple. *Pereopods 3–7* dactylus with secondary unguis simple. Pereopods with inferior margins of ischium to carpus not bearing dense setulose fringe, ischium superior margin with sinuate acute robust seta(e), 1–3 or 4 ischium superior margin without long stiff slender setae.

Penial processes entirely separate, basally in contact, long (extending to pleopod rami), tapering smoothly from base, apex acute.

Pleopod 1 rami not operculate; exopod lamellar; exopod with longitudinal axis weakly oblique; endopod of similar proportions to exopod, medial margin lamellar, distally triangular, endopod proximomedial heel absent; exopod distally truncate, exopod distal margins not serrate. *Pleopod 2* endopod about as long as pleopod 1; exopod distal margins not deeply serrate; *appendix masculina* inserted basally, proximal lobe absent, basally swollen ('flask-shaped' or 'distally abruptly narrowed'), about as long as endopod, distally acute. *Pleopod 3* exopod transverse suture absent, endopod of similar proportions to exopod. *Pleopod 4* rami with PMS (endopod with 1 plumose seta); exopod transverse suture absent, exopod thickened transverse ridges absent, exopod lateral margin not thickened, exopod lateral margin with short simple marginal setae; endopod thickened transverse ridges absent; mesial margin without deep distal notch; without proximomedial lobe. *Pleopod 5* exopod transverse suture absent, thickened transverse ridges absent, lateral margin without short simple setae, lateral margin not thickened, scale patches 2 discrete patches (scarcely evident); endopod with thickened transverse ridges absent, endopod without proximomedial lobe.

Uropod rami not strongly flattened, not forming part of continuous body outline; exopod lamellar, exopod reduced, mobile, inserted at anterolateral angle, lateral margin simple, smooth, distally narrowly rounded; endopod lamellar, distally acute.

Female: No ovigerous females present in the material examined. Non-ovigerous females similar to males except for sexual characters.

Remarks: The simple arcuate pleotelson with no trace of an exit channel or ventral excavation, anterior pereopods with a simple secondary unguis, and lamellar uropods suggest a similarity with genera such as *Exosphaeroma* Stebbing, 1900 (see Bruce 2003 for recent diagnosis and discussion of the genus) and the recently described endemic New Zealand genus *Bilistra* Sket & Bruce, 2004. In contrast to those and other related genera, including the Northern Hemisphere freshwater and estuarine genus *Gnorimosphaeroma* Menzies, 1954, *Makarasphaera* gen. nov. has the pleon reduced to a single segment with only a weak indication of a single suture on the posterior margin. *Makarasphaera* has elongate penial processes, and the shape of the endopod and peduncle of pleopod 1 are more similar to those of *Dynamenella* Hansen, 1905 rather than to *Exosphaeroma*, as is the shape of the appendix masculina; the short pleonal suture running to the posterior margin

of the pleon is further character shared with such genera as *Dynamenella* and *Paradella* Harrison & Holdich, 1982 (see Harrison & Holdich 1982 for figures).

The endemic and potentially sympatric genus *Bilistra* (the genus is known only from the northern South Island), which has a similar body and uropod shape, can be easily distinguished by its larger size (6.8–10.6 mm, compared to under 3 mm for *Makarasphaera*), the head extending clear of pereonite 1 (vs. deeply immersed in pereonite 1), dense setulose fringe on the inferior margins of the pereopods and prominent, long sutures on the pleon; in addition the shape of the peduncle and endopod of pleopod 1 are dissimilar, and the appendix masculina of *Bilistra* is slender and straight sided, extending well beyond the distal margin of the ramus (the penial processes for *Bilistra* have not been described).

Taberner (1988b) redescribed the species *Pseudosphaeroma platense* (Giambiagi, 1922), recorded from freshwater river beaches in Argentina. Harrison (1984) excluded the species from *Pseudosphaeroma* Chilton, 1909, commenting that a new genus would likely be necessary to contain the South American species. *Pseudosphaeroma platense* is similar in body form to *Makarasphaera*, but the morphology of pleopod 1 and 2, the shape of the appendix masculina and the penial processes all differ substantially, and that species is not likely to belong in *Makarasphaera*. *Pseudosphaeroma* differs from *Makarasphaera* in having the posterior margin of the pleotelson upturned, two pleonal sutures running the lateral margins, both rami of pleopods 4 and 5 with thickened ridges, and short penial processes; all species of *Pseudosphaeroma* show some dorsal nodular ornamentation. The genus *Pseudosphaeroma* is represented in marine habitats around New Zealand, but is not known from freshwater.

Etymology. The type locality name is used in combination with the ending *–sphaera* to indicate the family affinity; gender feminine.

Makarasphaera amnicosa sp. nov. (Figs 5–8)

Material examined.— **Holotype**: ♂ (2.6 mm), western end of Ohariu Bay (= 'Makara Beach'), North Island, 41°13.125'S, 174°42.374'E, 2 January 2004, small, flowing, freshwater stream, ~15 metres from pebble beach berm, under rocks, coll. N.L., J. and S. Bruce (NIWA 4073).

Paratypes: 4♂ (2.8 [dissected], 2.8 [maxillipeds], 2.6, 2.5 mm), 3♀ (non-ovig. 2.8, 2.7, 2.7 mm), manca (1.6 mm), same data as holotype (NIWA 4074).

Additional material: 22 specimens, ♂, ♀♀ and mancas from type locality (NIWA 4075). 12 specimens, males, females, Cape Palliser, North Island, 41°36.406'S, 175°16.107'E, 23 Nov 2003, west of cape, freshwater seep above highest tide level, coll. N.L. Bruce and Jørgen Olesen (NIWA 4076).

Description of male. *Body* about 1.7 times as long as greatest width, strongly vaulted, lateral margins subparallel, widest at pereonite 6; dorsal surfaces smooth. Cephalon anterior margin without distinct transverse ridge, ventral rostral process weakly developed.

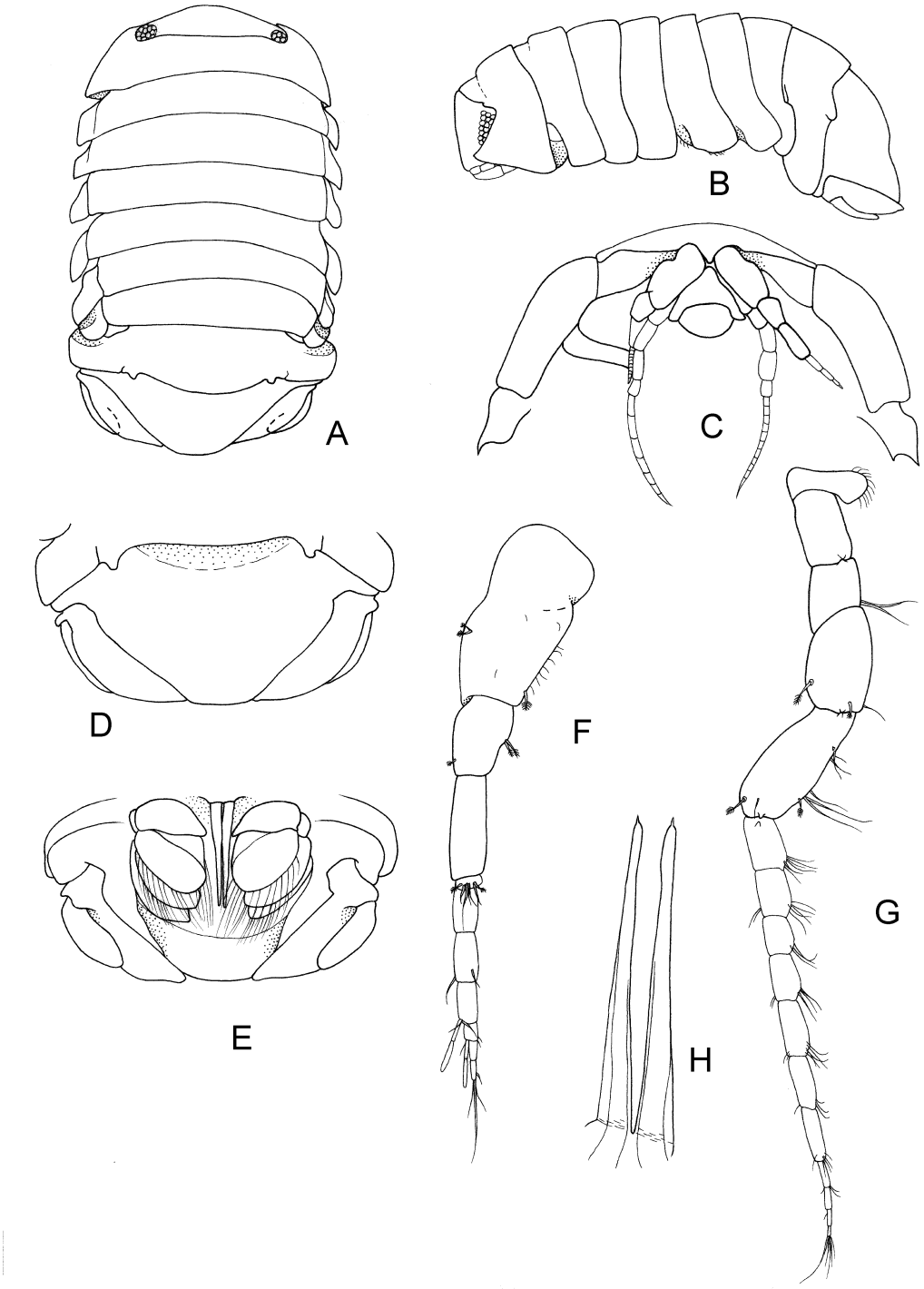

FIGURE 5. *Makarasphaera amnicosa* sp. nov. A–E, holotype, remainder ♂ paratype. A, dorsal view; B, lateral view; C, frons and anterior of head in ventral view; D, pleotelson and uropods, dorsal view; E, pleotelson and uropods, ventral view; F, antennule; G, antenna; H, penial processes.

Head and pereonite 1 subequal in length, unornamented; pereonites 2–7 subequal in length (in lateral view); posterior margins of pereonites without transverse submarginal dorsal ridge. Coxae without evident sutures, progressively increasing in size posteriorly. *Pleon* sublateral 'keys' weakly developed. *Pleotelson* without ornamentation; posterior margin wide, subtruncate.

Antennule peduncle article 1 2.0 times as long as wide, about 2.2 times as long as article 2; posterior margin of articles 1 and 2 with 1 and 2 brush-tipped sensory setae; article 3 about 1.4 times as long as article 2, 0.6 times as long as article 1, 3.1 times as long as wide; flagellum 6-articled, extending to posterior of pereonite 1, about 1.8 times as long article 3. *Antenna* peduncle article 1 short, about 0.2 times as long as article 2; articles 2–5 becoming progressively longer; article 4 about 1.9 times as long as article 3, about 0.7 as long as article 5; flagellum 1.1 times as long as peduncle, extending to pereonite 3, with 11 articles.

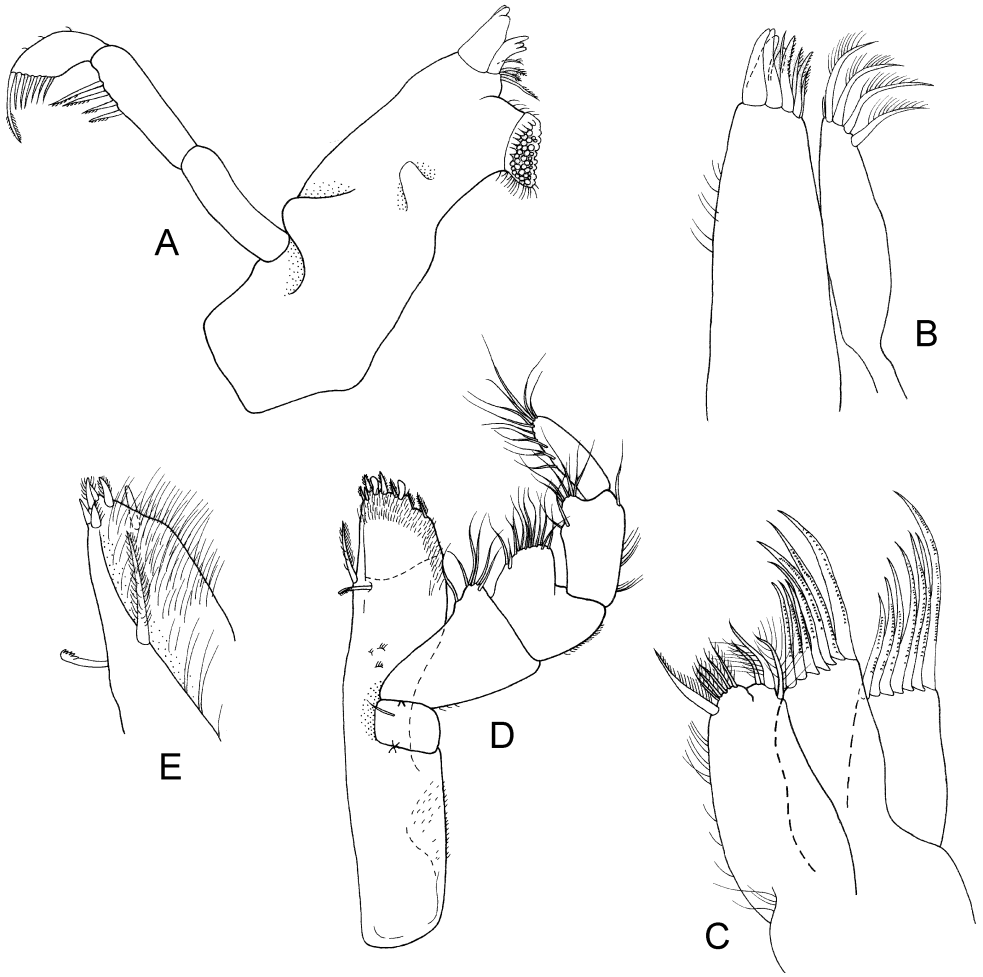

FIGURE 6. *Makarasphaera amnicosa* sp. nov. ♂ paratype. A, right mandible; B, maxillule; C, maxilla; D, maxilliped; E, maxilliped endite, dorsal view.

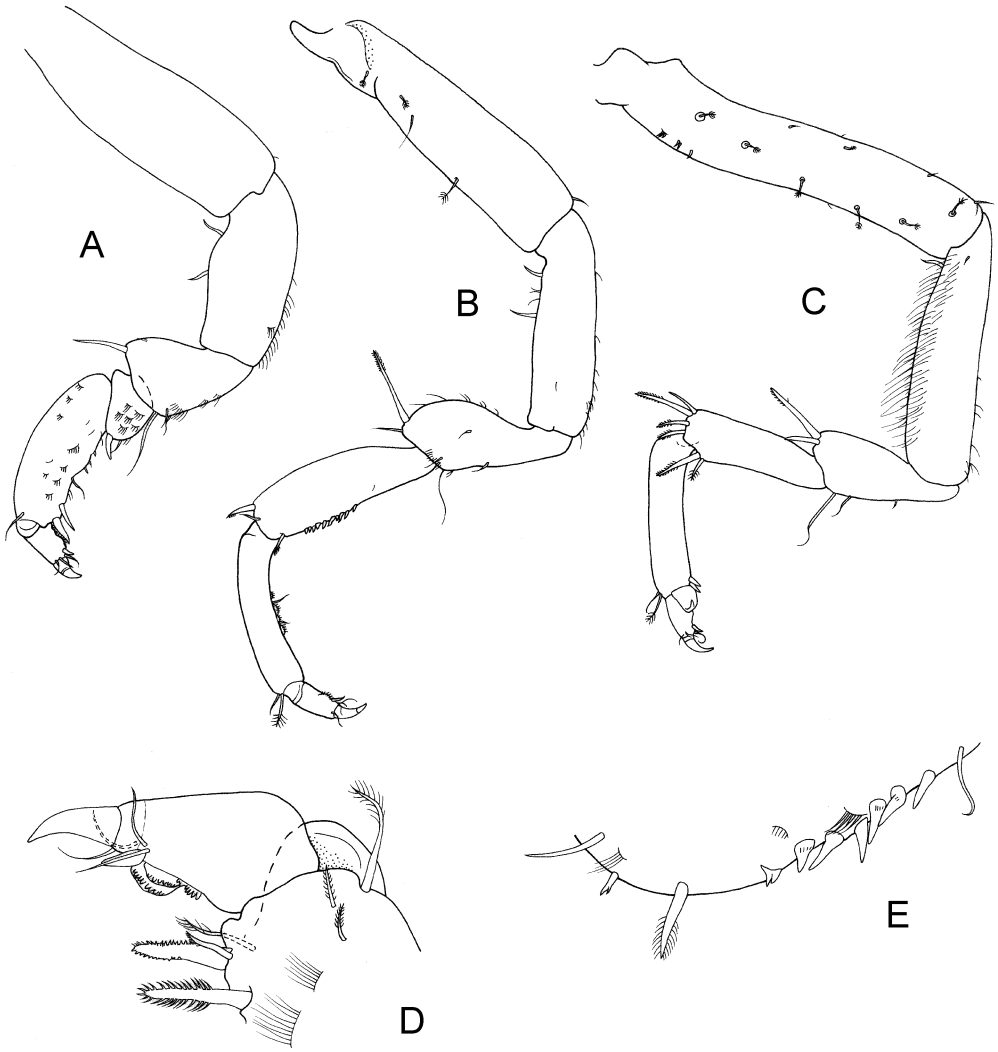

FIGURE 7. *Makarasphaera amnicosa* sp. nov. ♂ paratype. A, pereopod 1; B, pereopod 2; C, pereopod 7; D, pereopod 1 dactylus; E, scales, inferior margin, pereopod 2 merus.

Epistome anteriorly narrowly rounded, without lateral constriction. *Left mandible* incisor with 3 cusps, lacinia mobilis with 3 cusps, spine row of 4 serrate spines; molar process with gnathal surface circular, surface prominently nodular; palp articles 1 and 2 subequal in length, article 2 distolateral margin with 4 distally biserrate setae, becoming progressively longer distally; article 3 with 7 serrate setae, terminal seta being largest. *Maxillule* mesial lobe with 4 long, strongly pectinate RS and 1 shorter simple RS, lateral lobe with 9 peripheral RS on gnathal surface, twelfth seta set between these; 4 proximomesial RS serrate, distolateral RS smooth. *Maxilla* lateral lobe and middle lobe each with 7 curved finely nodular RS, mesial lobe with 9 plumose and CP RS. *Maxilliped* endite lateral margin sinuate, distal margin oblique, with 1 simple acute RS at sublateral angle, 2 blunt simple RS and 6 CP RS; single mesial CP RS distal to coupling hook; distal mesial surface of

with mass of long scale-setae; palp articles 2–4 weakly lobed; articles 2–5 with 6, 12, 9 and 12 setae respectively.

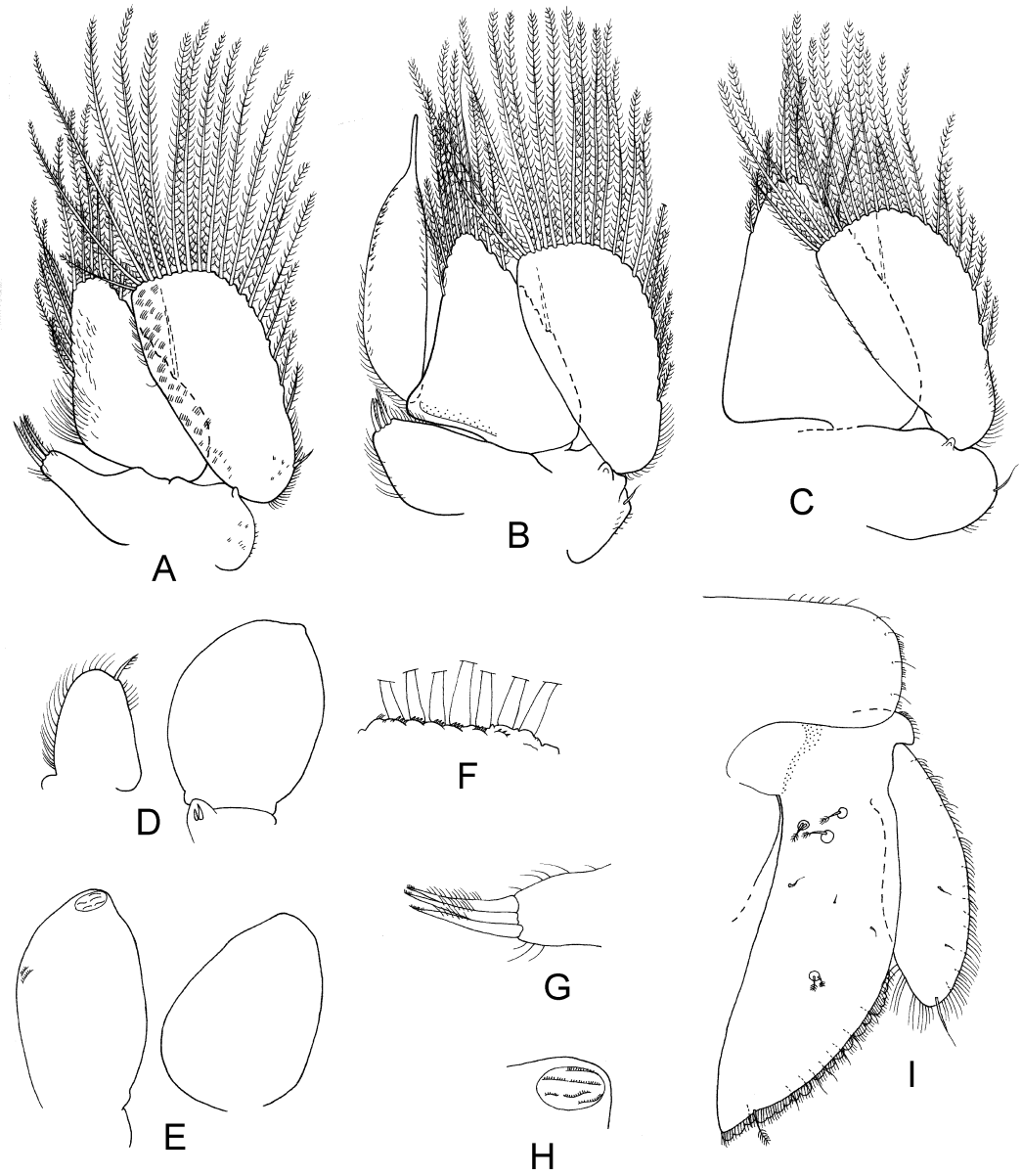

FIGURE 8. *Makarasphaera amnicosa* sp. nov. ♂ paratype. A–E, pleopods 1–5 respectively; F, distal margin, pleopod 1 endopod; G, coupling hooks, pleopod 1; H, scale patch, pleopod 5 endopod; I, uropod.

Pereopod 1 robust, *basis* about 2.9 times as long as greatest width, approximately 1.7 times as long as propodus; *ischium* 1.1 times as long as propodus, 2.1 times as long as

greatest width, superior margin with 1 proximal and one mid-distal acute short simple RS, distal inferior margin with sparse scale-setae; *merus* about 0.6 as long as ischium, 1.2 times as long as greatest width, superior distal angle with 1 acute simple RS, inferior margin with sparse scale-setae, inferior distal angle with 2 short and 1 long simple setae; *carpus* approximately as 0.8 long as wide, inferior margin 0.5 times as long as merus, inferior distal angle with 1 RS and 2 short simple setae; *propodus* 3.0 times as long as greatest width, inferior margin with simple setae and scales, inferodistal angle with 2 biserrate RS and 1 distally plumose seta; *dactylus* 0.4 times as long as propodus, unguis inferior margin with prominent serrate cuticular scales, secondary unguis straight, simple. Pereopods 2–7 elongate and slender in comparison to pereopod 1. *Pereopod 2 basis* 3.6 times as long as greatest width, inferodistal angle with single simple seta, superior margin with 3 widely spaced palmate setae; *ischium* 0.7 times as long as basis, 3.6 times as long as greatest width, proximal superior margin with 2 single acute RS, inferior distal margin with sparse short simple setae; *merus* 0.7 times as long as ischium, superior distal angle with 1 long distally biserrate RS and 1 short seta, inferior distal angle with 1 long simple setae; *carpus* 1.3 times as long as merus, 3.2 times as long as wide, anterodistal angle with 1 biserrate and 1 simple setae, inferior margin with prominent acute scales midlength; *propodus* 0.8 times as long as ischium, 5.5 times as long as wide, superior distal angle with 2 setae, inferior margin with serrate scales, with 2 simple setae. *Pereopods 5–7* similar, longer than pereopods 2 and 3. *Pereopod 7 basis* 5.0 times as long as greatest width, inferodistal angle with 1 simple setae, superior margin proximally with few serrate scales, with many widely-spaced small sensory palmate seta; *ischium* 0.7 times as long as basis, 3.6 times as long as greatest width, superior margin with abundant scale setae, with 1 short proximal acute RS, inferior distal angle with 1 seta; *merus* 0.6 times as long as ischium, 2.3 times as long as wide, superior distal margin with 1 distally biserrate and 1 short simple RS, inferior margin with 2 simple seta, inferodistal angle with l long simple seta; *carpus* as long as merus, 2.8 times as long as wide, superior distal angle with 3 biserrate and 1 simple RS, inferodistal margin with 1 biserrate and 1 plumose RS; *propodus* 0.7 times as long as ischium, 5.0 times as long as wide, superior distal angle with 2 setae, inferior margin distally with 2 simple RS.

Penial processes separate, mutually adjacent, 8.6 as long as basal width, with acuminate apex.

Pleopod 1 exopod and endopod with 19 and 15 PMS respectively; endopod 0.8 as long as exopod, 1.5 times as long as greatest width, proximal lateral margin weakly convex; exopod with oblique axis, distal margin subtruncate; peduncle mesial margin extended, with 3 coupling hooks. *Pleopod 2* exopod and endopod with 21 and 13 PMS respectively; *appendix masculina* 4.5 times as long as basal width, 1.5 times as long as endopod, distal quarter abruptly narrowed, apex narrowly rounded; endopod mesial margin concave, lateral margin weakly convex; exopod 1.4 times as long as endopod, distal margin subtruncate. *Pleopod* 3 exopod and endopod with 20 and 11 PMS respectively. *Pleopod 4* both

rami lacking any trace of ridges, without transverse suture; endopod 0.6 as long as exopod, with marginal fine simple setae and single distal plumose seta; exopod glabrous. *Pleopod 5* both rami lacking any trace of ridges, without transverse suture; exopod with 2 weakly developed scale patches, margin of both rami without setae. *Uropod* exopod 0.6 as long as endopod, margins smooth, with fringe of short setae scale-setae, distally narrowly rounded; endopod 3.2 times as long as wide, lateral margin convex, narrowing distally to acute apex, mesial margin weakly sinuate.

Female: Body shape similar to that of male. Brood-pouch structure not known.

Remarks. The species is distinguished by the generic characters.

Distribution. Lower North Island, New Zealand, at Makara (near Wellington) and Cape Palliser on the southeastern coast.

Habitat. The species is found in freshwater seeps and fast-flowing small streams above the reach of tidal influence, but within range of salt spray during storm periods. All specimens were under pebbles and stones, or under pieces of wood; usually in groups, occasionally singly.

Etymology. The epithet is derived from the *amnicus* (Latin—'of a stream') alluding to the habitat at the type locality.

Acknowledgements

This research was supported by FRST contract COX0129. I thank Drs Carolyn Lundquist, Vonda Cummings and Judi Hewitt who sent the specimens for identification and granted permission to work on this material. Material was collected under contract to Auckland Regional Council (#KMP03210). Thanks to Dr Jørgen Olesen (Zoologisk Museum, University of Copenhagen, Denmark), to Julie and Sylvie Bruce, all of whom assisted in local field collections and to Sylvie Bruce for inking my pencil drawings. This work contributes to (in part) the NSF grant project DEB0129317 to Dr Regina Wetzer of the Natural History Museum of Los Angles County, USA.

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