Zootaxa 1173: 39–56 (2006)
www.mapress.com/zootaxa/

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)
1173

New species of Gnathiidae (Crustacea, Isopoda, Cymothoida) from seamounts off northern New Zealand

JÖRUNDUR SVAVARSSON
Institute of Biology, University of Iceland, Askja—Natural Science Building, Sturlugata 7, 101 Reykjavík, Iceland. E-mail: jorundur@hi.is

Abstract

Gnathiid isopods collected from seamounts off northern New Zealand were examined. Two species of gnathiids were found, *Caecognathia nieli* sp. nov., and *Gnathia sifae* sp. nov. *Caecognathia nieli* sp. nov. is easily distinguished from all other known New Zealand gnathiid species in shape of the head, having an evenly rounded frontal border, and a fine bifid notch. *Gnathia sifae* sp. nov. is distinguished from all other New Zealand gnathiid species in having a distinct mediofrontal process on the cephalon, but no frontolateral processes. It is further clearly distinguished from the co-occurring species, *Caecognathia nieli* sp. nov., in having relatively larger eyes and of different shape, in the presence of lateral projections on the pereopods and in the shape of the appendix masculina.

Key words: Gnathiids, Cymothoida, *Caecognathia,* new species, seamounts, New Zealand

Introduction

Several studies have indicated a high diversity and density of a variety of invertebrates on seamounts (e.g. Koslow *et al*. 2001). Little is still known of the frequency and interaction of external parasites on fish in such communities. Seamounts often hold dense fish stocks, such as the orange roughy (*Hoplostethus atlanticus* Collett, 1889) or redfish (*Sebastus* spp.) and are in many areas important fishing grounds (Bull *et al*. 2001; Dower & Perry 2001). One of the groups which one would expect to flourish on seamounts having large fish stocks are the gnathiid isopods (Arthropoda, Isopoda), because of their parasitic larval stage on fish.

Gnathiid isopods live as adults in cavities and crevices on the sea floor, such as in sponges, coral rubble, or sediment cavities while as larvae they are external fish parasites (Monod 1926; Upton 1987; Klitgaard 1997; Smit & Davies 2004). This group of

Accepted by N. Bruce: 27 Feb. 2006; published: 13 Apr. 2006

invertebrates is important and particularly abundant in coral reefs, being the most common external parasites on coral reef fish (Grutter *et al*. 2000). Species of the family have been found in most parts of the world oceans and have been recorded from the intertidal (Tanaka & Aoki 1999) to abyssal depths (Cohen & Poore 1994). Presently there are 182 named species of gnathiids from the world oceans (Kensley *et al.* 2005). Though many gnathiid species have been recorded from Australian waters (Holdich & Harrison 1980; Cohen & Poore 1994) and gnathiids are frequently reported from the Pacific and Indian Oceans (Müller 1989a, 1989b; Nunomura 1992, 1998; Svavarsson & Gísladóttir 2002; Svavarsson 2002; Svavarsson & Jörundsdóttir 2004), few species have been reported known from New Zealand. This includes six species described and included in Monod's (1926) monograph and two recently described species by Cohen & Poore (1994). In all eight gnathiid species are now known from New Zealand.

During a stay at the National Institute of Water and Atmospheric Research (NIWA), Wellington, New Zealand, I had the opportunity to examine specimens recently collected during sampling on seamounts within the New Zealand Economic Zone, and held at NIWA. The material held two new species, which are here described. Available type specimens of earlier described species of gnathiids from New Zealand, held at the Zoological Museum, University of Copenhagen, were examined.

Terminology follows Cohen & Poore (1994). The material is deposited at the National Institute of Water and Atmospheric Research (NIWA), Wellington, New Zealand, and the Icelandic Museum of Natural History (IMNH), Reykjavik, Iceland.

Systematics

Family Gnathiidae Leach

Genus *Caecognathia* Dollfus

Caecognathia nieli sp. nov.
(Figs 1–5)

Material examined

Holotype. male, 6.2 mm, stn. TAN 0107/001, 19 May 2001, 35º44.51'S, 178º30.20'E, epibenthic sled, 260–470 m, scoria rubble (NIWA 22435). **Paratypes**. Stn. TAN 0107/001, 19 May 2001, 35º44.51'S, 178º30.20'E, epibenthic sled, 260–470 m, scoria rubble, 69 males (NIWA 22436; IMNH 2005.05.10); stn. TAN 0107/052, 20 May 2001, 35º43.89'S, 178º30.09'E, epibenthic sled, 1032–440 m, 49 males (NIWA 22437); stn. TAN 0107/224, 23 May 2001, 35º44.35'S, 178º29.74'E, 200–500 m, scoria rubble, 2 males (NIWA 22438). Other non-type material (females and larvae). Stn. TAN 0107/001, 19 May 2001, 35º44.51'S, 178º30.20'E, epibenthic sled, 260–470 m, scoria rubble, 26 females and 8 larvae (NIWA 22438); stn. TAN 0107/052, 20 May 2001, 35º43.89'S, 178º30.09'E, epibenthic sled, 1032–440 m, 10 females and 39 larvae (NIWA 22440); stn. TAN 0107/224, 23 May 2001, 35º44.35'S, 178º29.74'E, 200–500 m, scoria rubble, 1 female (NIWA 22441).

Diagnosis

Eyes small, bulbous. Frontal border evenly rounded, anteriorly with fine bifid notch; moderately curved. Mandible with armed carina, with fine dentations and smooth long blade. Appendix masculina curved, with bulbous tip.

Description

Body length 4.8–6.2 mm. *Body* about 2.9 times as long as wide (Fig. 1). Cephalosome (Fig. 2A–D) semi-pentagonal, about 1.3 times wider than long, lateral margins convex. Numerous fine granules on cephalosome. Frontal border evenly rounded, anteriorly with fine bifid notch; border fringed with fine tubercles and several fine setae; broad dorsal sulcus. Supraocular lobe long, pointed. Posterior median tubercle present. Eyes small, well developed, bulbous, lateral and sessile, eyes length about 0.2 times cephalosome length. *Pereon* (Fig. 1) evenly sided, with several long setae along body, numerous fine granules anteriorly on pereonites, pereonites subequal in width, widest at pereonites 2 and 3, about 1.1 times as wide as cephalosome. Pereonite 1 dorsally reaching lateral margins, only partially obscured by cephalon. Pereonite 2 about 2 times longer than pereonite 1, pereonite 5 with areae laterales, pereonite 6 with lobi laterales, lobuii present; pereonite 7 narrow. *Pleonites* (Fig. 1) subequal, pleonal epimeria prominent on pleonites 2 to 4, fine row of setae posteriorly on all pleonites.

Antenna 1 (Fig. 2E) short, smaller than antenna 2; second article of peduncle with few plumose setae distally. Flagellum with 5 articles; about 1.5 times as long as article 3 of peduncle; first article small, few fine setae and aesthetascs on distal articles.

Antenna 2 (Fig. 2F) about 1.7 times longer than antenna 1; peduncle articles 3 and 4 with few long, plumose setae distally, several slender setae medioventrally on article 3, numerous setae medioventrally on article 4; flagellum with 7 articles, flagellum about 1.2 times as long as peduncle article 4.

Mandible (Fig. 2A-D, G) about 0.4 times as long as cephalon width, moderately curved, armed carina, with fine dentations; smooth long blade.

Maxilliped (Fig. 2H) with 5 articles; external margin of article 1 fringed with fine, small setae; external margins of articles 2–5 with stout plumose setae, 7 on article 2, 11 on article 3, 5 on article 4, around 8 setae on external margin and distally on article 5; endite reaching article 3, with 4 coupling hooks (Fig. 2I).

Pylopod (Fig. 2J) with 3 articles, external and internal margins fringed with fine setae; article 1 about 1.6 times longer than wide, external margin of article 1 with about 60 plumose setae, plumose setae intermediate and similar in size, plumose setae sparsely distributed on posterior margin, dense on lateral margin, several simple setae present on distal end and on internal margin; article 2 small, width 0.1 times length of article 1, fringed with fine setae, few simple setae distally; article 3 minute (Fig. 2K).

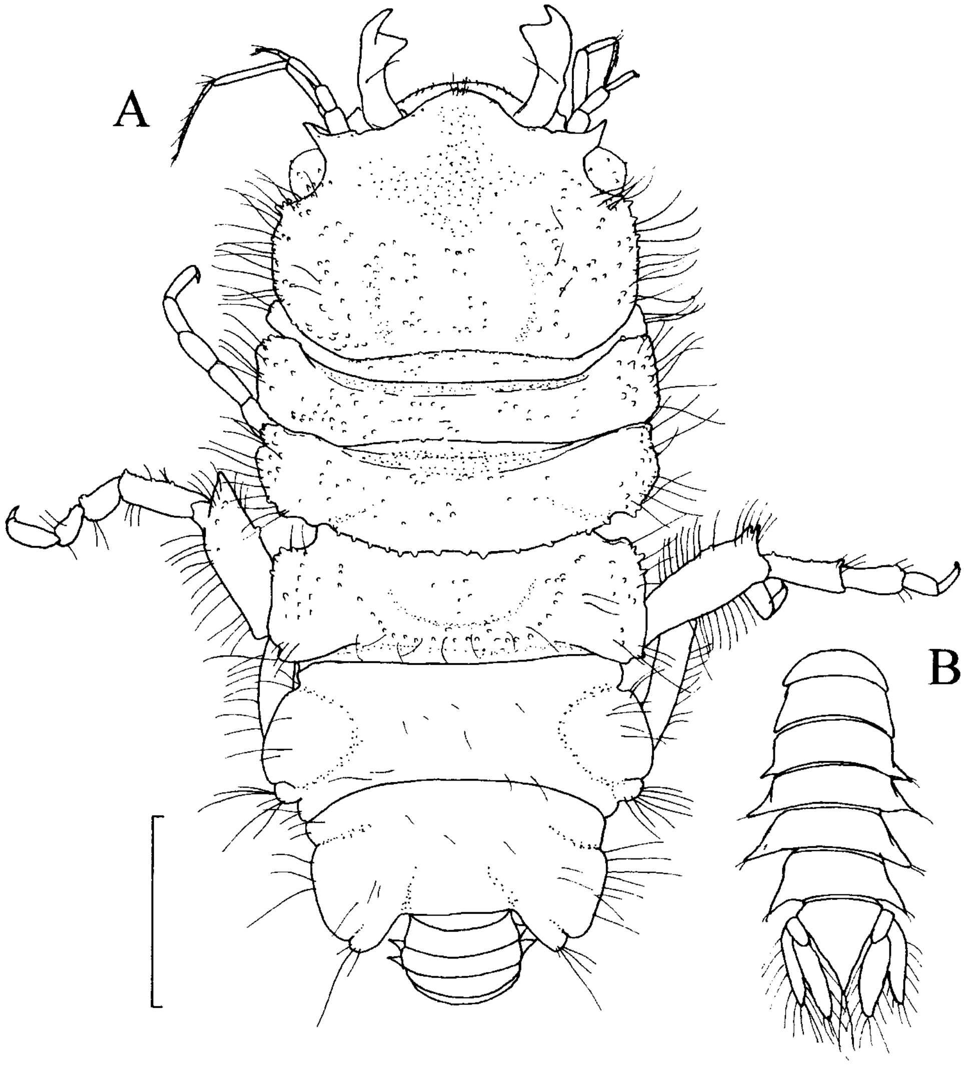

FIGURE 1. *Caecognathia nieli* sp. nov. Male holotype, 6.2 mm (NIWA 22435). A, body (pleonites down turned). B, pleonites and pleotelson (slightly down turned). Scale: 1.0 mm.

Pereopods 2, 3, 5 and 6 slender, similar in shape (Figs 3 and 4); pereopod 4 with stout basis (Fig. 4). Numerous long seta on basis of all pereopods, ischium of pereopod 2 more setose that ischium of other pereopods; propodus of pereopods 2 to 6 with 2 spines, ventrodistally and ventrally about one third length of ventral margin from anterior end of propodus. Basis of pereopod 4 dorsodistally with 2 large processes.

Pleopod 1 (Fig. 5A) protopod with 3 coupling hooks. Endopod distally with 7 plumose setae; exopod length as endopod length, distally with 10 plumose setae.

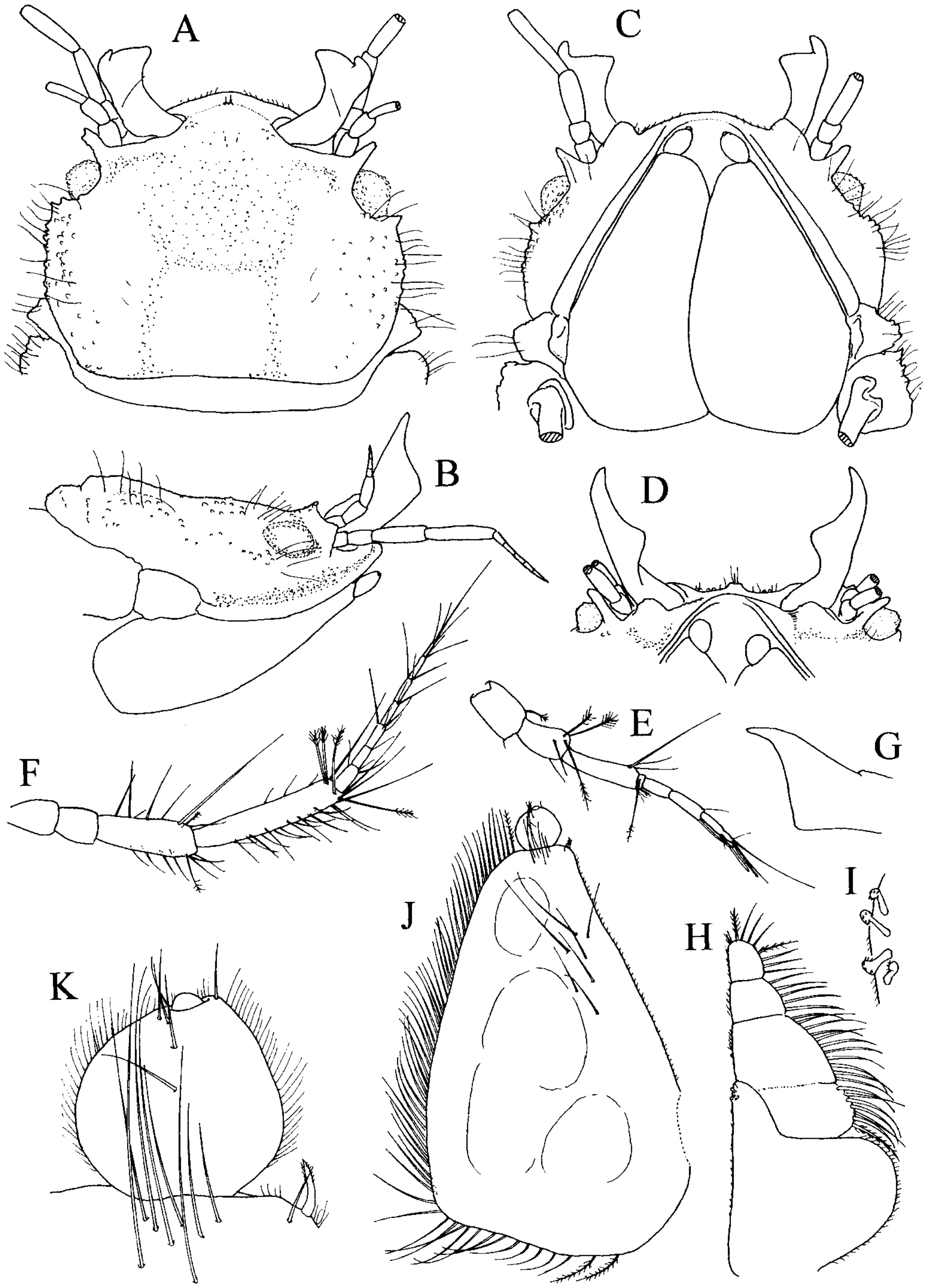

FIGURE 2. *Caecognathia nieli* sp. nov. Male paratype, 6.1 mm (NIWA 22436). A, cephalosome, dorsal view. B, cephalosome, lateral view. C, cephalosome, ventral view. D, anterior part of cephalosome, anteroventral view. E, antenna 1. F, antenna 2. G, mandible. H, maxilliped (fine setulose on large setae omitted from large setae). I, coupling hooks of maxilliped. J, pylopod (fine setulose on large setae omitted from large setae). K, third article of pylopod.

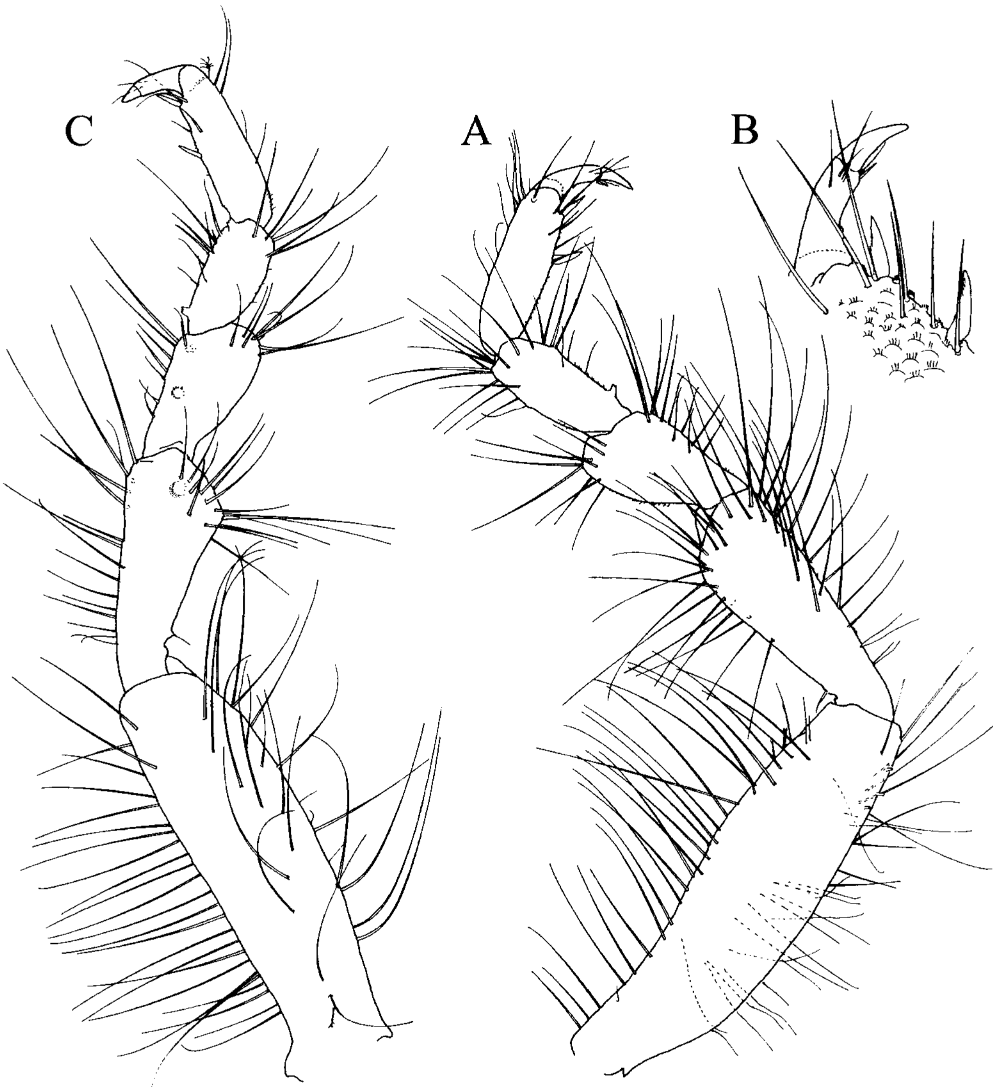

FIGURE 3. *Caecognathia nieli* sp. nov. Male paratype, 6.1 mm (NIWA 22436). A, pereopod 2. B, dactylus of pereopod 2. C, pereopod 3.

Pleopod 2 (Fig. 5B) protopod with 2 coupling hooks, appendix masculina short, strongly curved, with bulbous tip. Endopod distally with 8 plumose setae; exopod about 0.9 times endopod length, distally with 11 plumose setae.

Pleopod 3 (Fig. 5C) protopod with 2 coupling hooks. Endopod distally with 8 plumose setae; exopod about 0.9 times endopod length, distally with 11 plumose setae.

Pleopods 4 and 5 similar to pleopod 3.

Pleotelson (Fig. 5D) 1.2 times longer than wide, strongly concave near insertion of uropods, evenly decreasing in width towards posterior end of pleotelson; 2 setae posteriorly near lateral margins; distally 2 setae.

FIGURE 4. *Caecognathia nieli* sp. nov. Male paratype, 6.1 mm (NIWA 22436). A, pereopod 4. B, pereopod 5. C, pereopod 6.

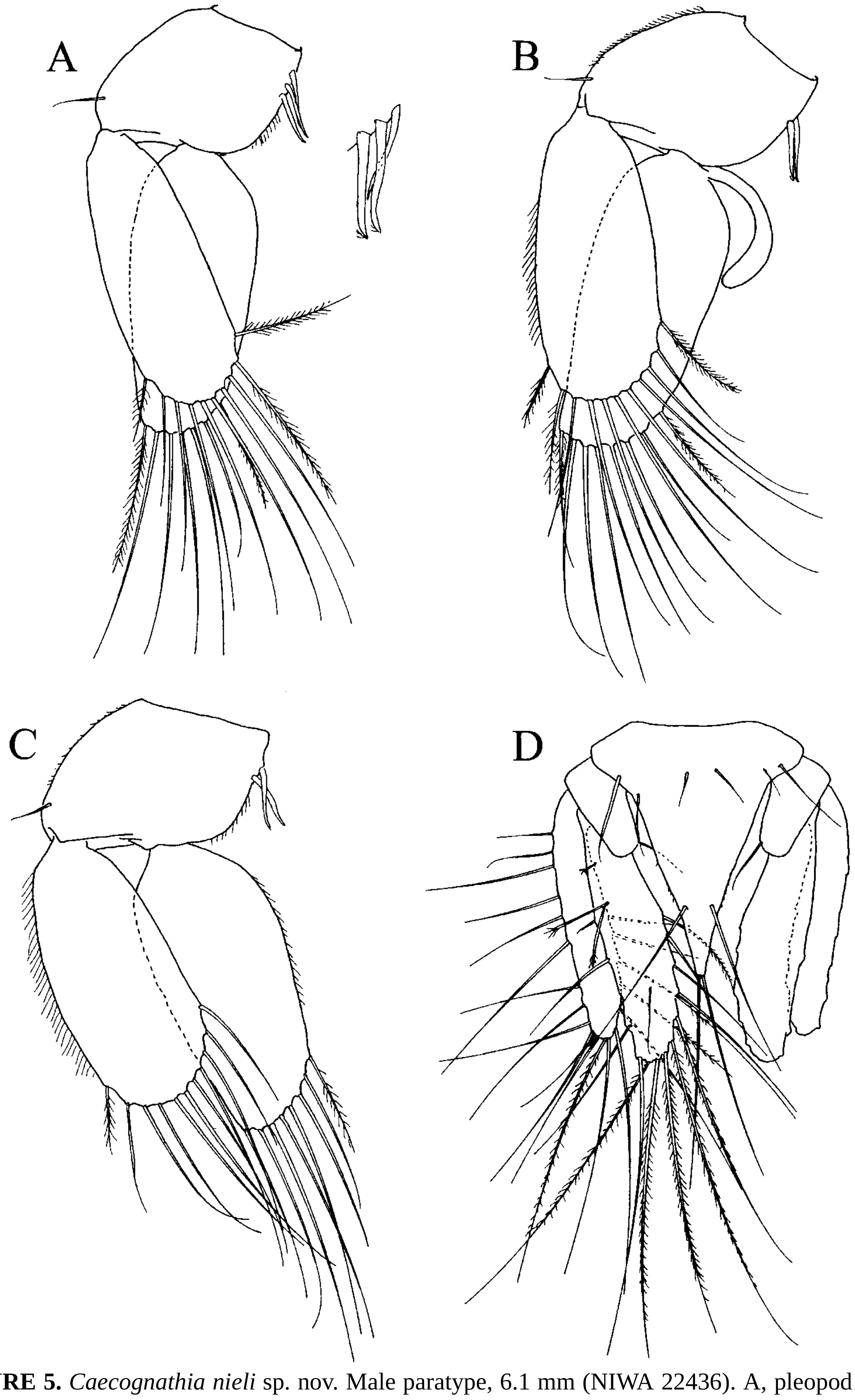

FIGURE 5. *Caecognathia nieli* sp. nov. Male paratype, 6.1 mm (NIWA 22436). A, pleopod 1. B, pleopod 2. C, pleopod 3. D, uropods and pleotelson.

Uropodal (Fig. 5D) endopod about as long as exopod, about 3.3 times longer than wide, fringed with about 9 sparsely plumose setae on distomedial margin and on apex, longest plumose setae about 1.3 times longer than endopod, few long simple seta laterodistally; 3 broom-like setae on dorsal surface near proximal end, 1 near distal end. E xopod about 5 times as long as wide, fringed with few plumose setae mediodistally and distally, several long, simple setae laterally and laterodistally.

Etymology

The species is named in honour of Niel Bruce, for his extensive contribution to isopod research.

Remarks

Caecognathia nieli sp. nov. is easily distinguished from all other known New Zealand gnathiid species in shape of the head, having an evenly rounded frontal border, and a fine bifid notch. The species is further clearly distinguishable from the co-occurring species, *Gnathia sifae* sp. nov., in having small, round eyes, in the absence of a distinct mediofrontal process, and in having the pleotelson evenly decreasing in width towards the posterior end.

C. nieli was found in large numbers in scoria rubble on the Rumble III seamount sitting to the north of the Bay of Plenty, New Zealand. The scoria rubble seems to be a good habitat for gnathiids, holding numerous cavities available for the benthic stages of the isopods.

Distribution

North of Bay of Plenty, New Zealand.

Genus *Gnathia* Leach

Gnathia sifae sp. nov.

(Figs 6–10)

Material examined

Holotype. male, 8.8 mm, stn. TAN 0107/001, 19 May 2001, 35º44.51’S, 178º30.20’E, epibenthic sled, 260-470 m, scoria rubble (NIWA 22442). **Paratypes**. Stn. TAN 0107/001, 19 May 2001, 35º44.51’S, 178º30.20’E, epibenthic sled, 260–470 m, scoria rubble, 92 males (NIWA 22443; IMNH 2005.05.11); stn. TAN 0107/224, 23 May 2001, 35º44.35’S, 178º29.74’E, 200–500 m, scoria rubble, 6 males (NIWA 22444).

Other non-type material. Stn. TAN. 0107/001, 19 May 2001, 35º44.51’S, 178º30.20’E, epibenthic sled, 260–470 m, scoria rubble, 19 females and 6 larvae (NIWA 22445); stn. TAN 0107/224, 23 May 2001, 35º44.35’S, 178º29.74’E, 200–500 m, scoria rubble, 1 female and 1 larva (NIWA 22446).

Diagnosis

Frontal border with distinct mediofrontal process, with several notches. Eyes large. Mandible moderately curved, armed carina, with fine dentations and smooth long blade. Pereonite 5 with areae laterales, pereonite 6 with lobi laterales. Pereopods with projections laterally near ventral margin, holding rounded cuticular extensions. Basis of pereopod 4 dorsodistally with 2 processes.

Description

Body length 7.0–8.8 mm. Body about 2.6 times as long as wide (Fig. 6). *Cephalosome* (Fig. 7A–C) semi-pentagonal, about 0.7 times as long as wide, lateral margins convex. Numerous fine granules on cephalosome. Frontal border with distinct mediofrontal process, mediofrontal process with several notches and several fine setae, broad dorsal sulcus. Supraocular lobe long, pointed. Posterior median tubercle present. Weak paraocular ornamentation. Eyes well developed, elongated, lateral and sessile, eyes length (full length seen in lateral view) 0.4 times cephalosome length. *Pereon* (Fig. 6) evenly sided, with several long setae along body, numerous fine granules anteriorly on pereonites, pereonites subequal in width, widest at pereonites 2 and 3, about 1.1 times wider than cephalosome. *Pereonite* 1 dorsally reaching lateral margins, only partially obscured by cephalon. *Pereonite* 2 slightly wider than pereonite 1, pereonite 5 with areae laterales, pereonite 6 with weak lobi laterales, pereonite 7 narrow. *Pleonites* (Fig. 6) subequal, pleonal epimeria prominent on pleonites 2 to 4, fine row of setae posteriorly on all pleonites.

Antenna 1 (Fig. 7D) short, smaller than antenna 2; second and third articles of peduncle with few plumose setae distally, 3 plumose setae medially. Flagellum with 5 articles; about 0.9 times as long as article 3 of peduncle; first article small, few fine setae and aesthetascs on distal articles.

Antenna 2 (Fig. 7E) about 2 times longer than antenna 1; peduncle 3 and 4 with few long, plumose setae distally, several slender setae medioventrally; flagellum with 7 articles, flagellum about 1.7 times as long as peduncle article 4.

Mandible (Fig. 7A-C, F) about 0.4 times as long as cephalon width, moderately curved, armed carina, with fine dentations; smooth long blade.

Maxilliped (Fig. 7G) with 5 articles; external margin of article 1 fringed with fine, small setae; external margins of articles 2–5 with stout plumose setae, 7 on article 2, 9 on article 3, 6 on article 4, around 13 setae on external margin and distally on article 5; endite reaching article 3, with 4 coupling hooks (Fig. 7H).

Pylopod (Fig. 7I) with 3 articles, external and internal margins fringed with fine setae; article 1 about 1.4 times longer than wide, lateral and posterior margins form obtuse angle, external margin of article 1 with about 66 plumose setae, plumose setae intermediate and similar in size, simple setae present on distal end and on internal margin; second article with fringed with fine setae, few simple setae distally; third article minute (Fig. 7J).

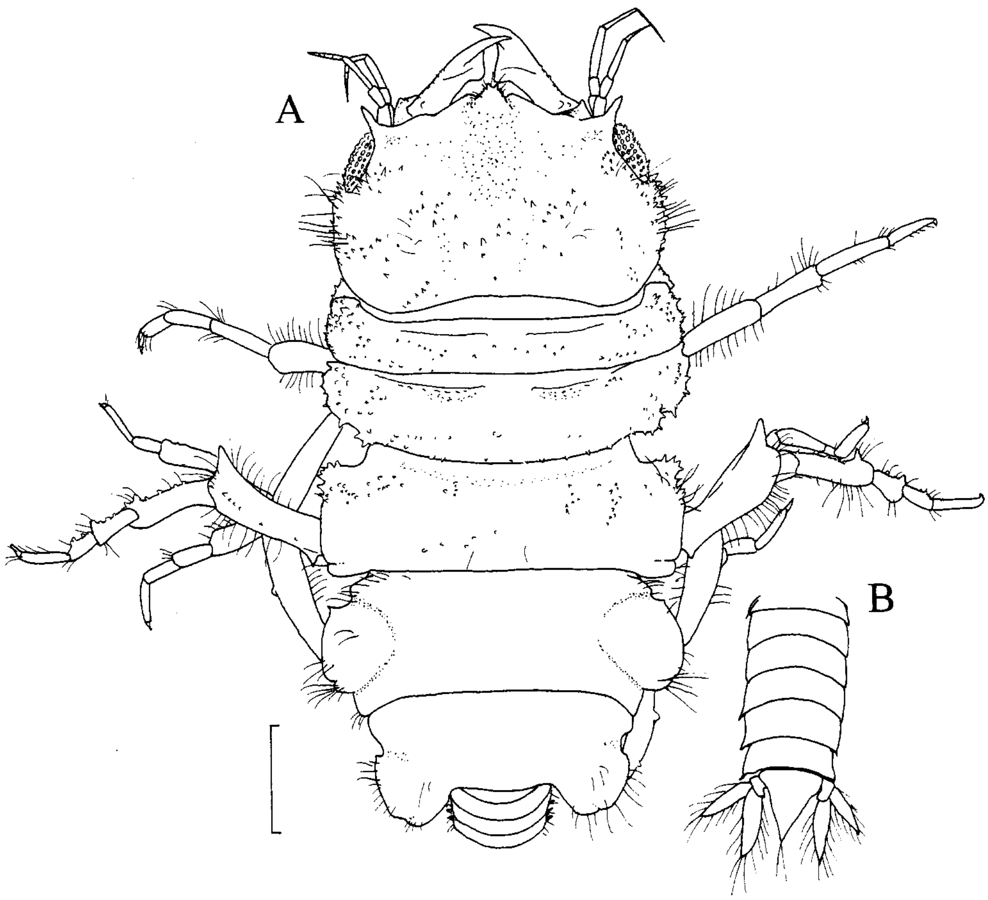

FIGURE 6. *Gnathia sifae* sp. nov. A. Male holotype, 8.8 mm (NIWA 22442). A, body (pleonites down turned). B, pleonites and pleotelson (slightly down turned). Scale: 0.5 mm.

Pereopods (Figs 8–9) similar is shape, with numerous long plumose setae on basis, long setae distally on merus, ischium and carpus. Several fine seta laterodistally on propodus; robust seta medioventrally and ventrodistally; rounded projections laterally near ventral margin, holding rounded cuticular extensions. Basis of pereopod 4 dorsodistally with 2 processes (Fig. 9A).

Pleopod 1 (Fig. 10A) protopod with 3 coupling hooks. Endopod 2.1 times longer than wide, distally with 7 plumose setae, longest plumose setae 0.5 times endopod length; exopod 0.8 times endopod length, 2 times longer than wide, distally with 10 plumose setae, longest plumose setae 0.75 times exopod length.

Pleopod 2 (Fig. 10B) protopod with 2 coupling hooks, appendix masculina short, curved. Endopod 2.2 times longer than wide, distally with 8 plumose setae, longest plumose setae 0.4 times endopod length; exopod 0.9 times endopod length, 1.9 times longer than wide, distally with 11 plumose setae, longest plumose setae 0.7 times exopod length.

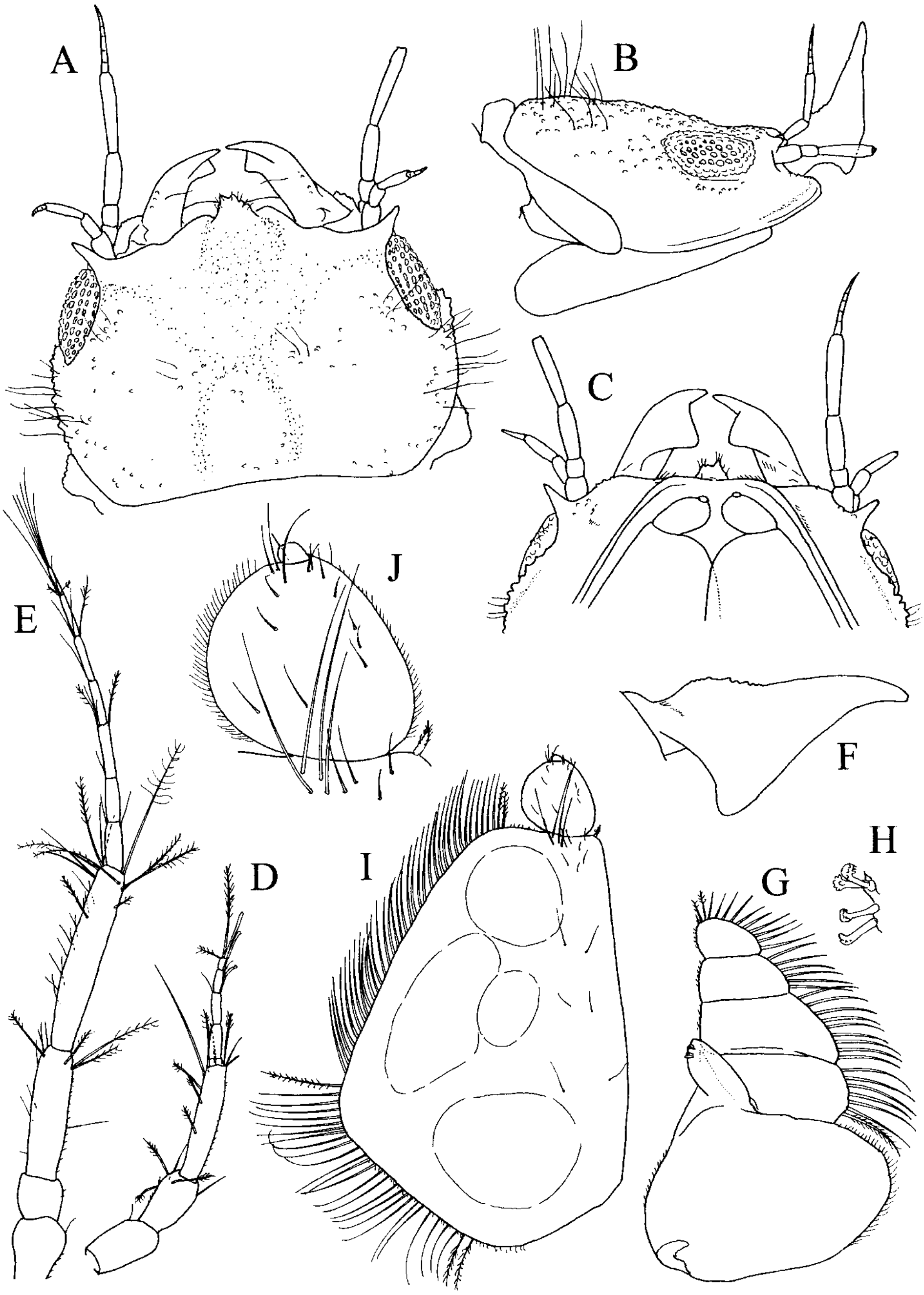

FIGURE 7. *Gnathia sifae* sp. nov. Male paratype, 7.6 mm (NIWA 22443). A, cephalosome, dorsal view. B, cephalosome, lateral view. C, anterior part of cephalosome, ventral view. D, antenna 1. E, antenna 2. F, mandible. G, maxilliped (fine setulose on large setae omitted from large setae). H, coupling hooks of maxilliped. I, pylopod (fine setulose on large setae omitted from large setae). J, third article of pylopod.

FIGURE 8. *Gnathia sifae* sp. nov. Male paratype, 7.6 mm (NIWA 22443). A, pereopod 2. B, dactylus of pereopod 2. C, pereopod 3.

Pleopod 3 (Fig. 10C) protopod with 2 coupling hooks. Endopod 2 times longer than wide, distally with 8 plumose setae, longest plumose setae 0.6 times endopod length; exopod 0.7 times endopod length, 1.9 times longer than wide, distally with 11 plumose setae, longest plumose setae 0.7 times exopod length.

Pleopods 4 and 5 similar to pleopod 3; with same number of plumose setae and coupling hooks.

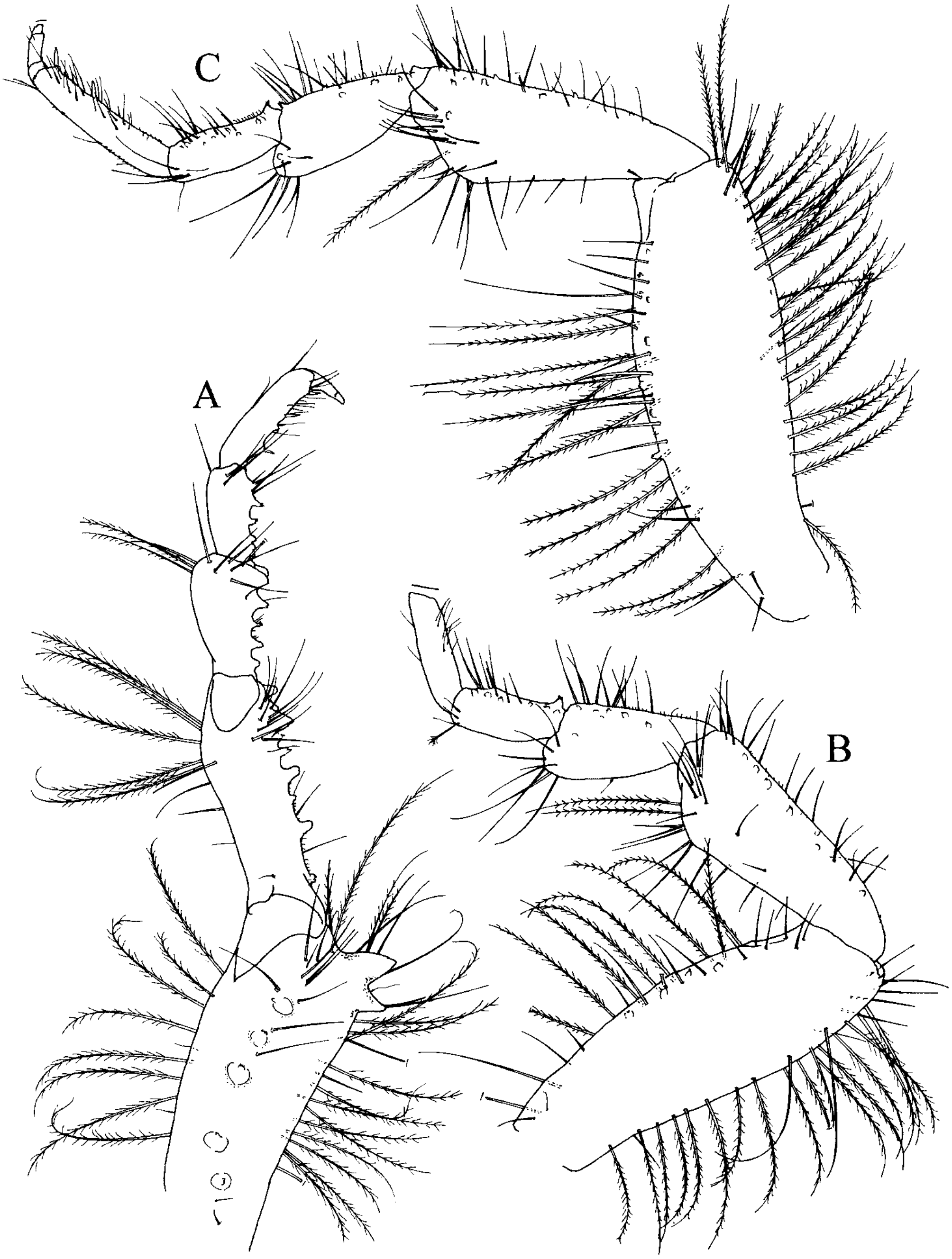

FIGURE 9. *Gnathia sifae* sp. nov. Male paratype, 7.6 mm (NIWA 22443). A, pereopod 4. B, pereopod 5. C, pereopod 6.

Pleotelson (Fig. 10D) 1.3 times longer than wide, strongly concave near insertion of uropods, slightly concave about one third from distal end, lateral margins with cuticular extensions; 2 setae posteriorly near lateral margins; distally 2 setae.

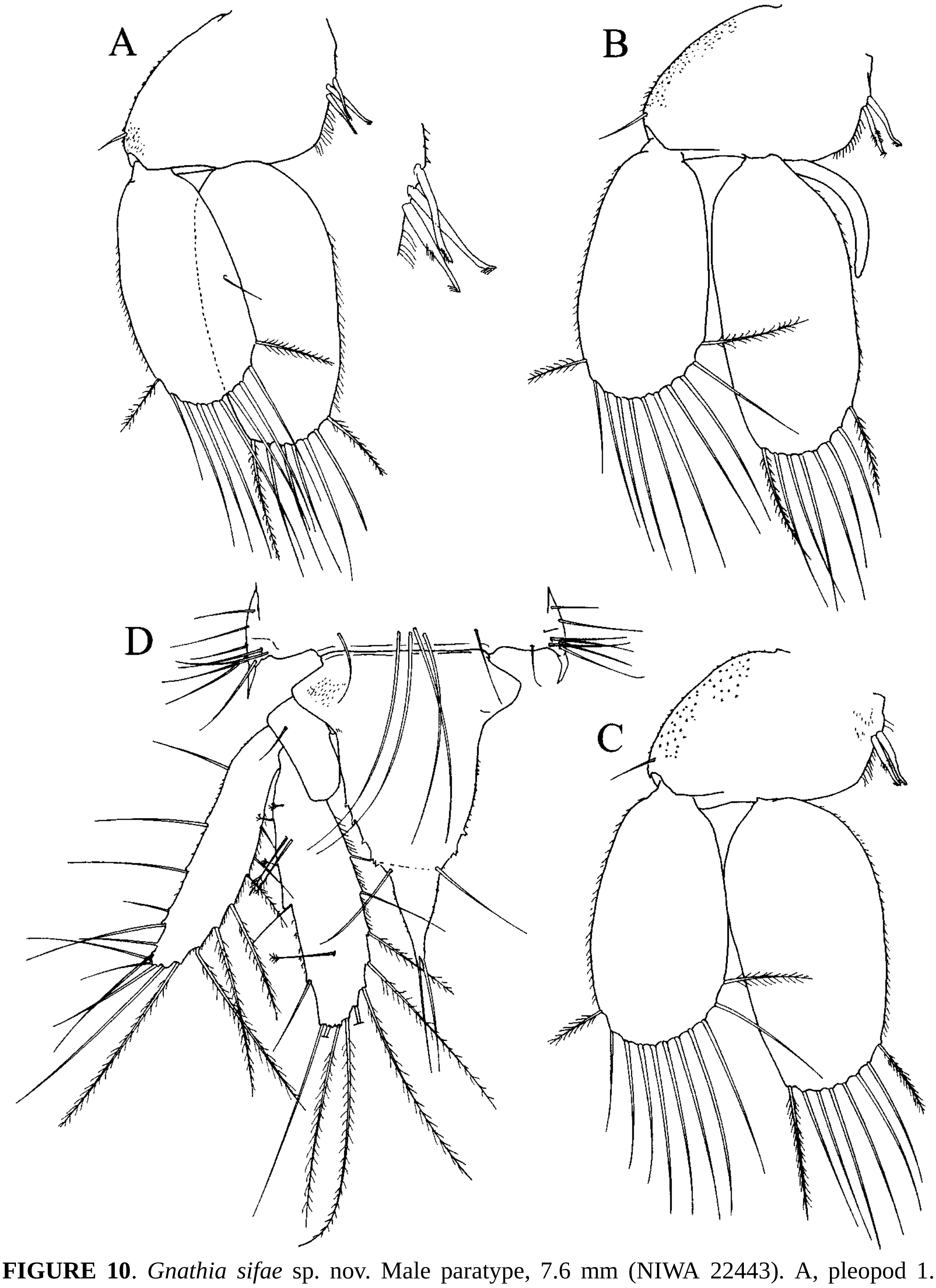

FIGURE 10. *Gnathia sifae* sp. nov. Male paratype, 7.6 mm (NIWA 22443). A, pleopod 1. B, pleopod 2. C, pleopod 3. D, uropods and pleotelson.

Uropodal (Fig. 10D) endopod about as long as exopod, about 3.3 times longer than wide, fringed with about 9 plumose setae on distomedial margin and on apex, longest plumose setae about as long as endopod, few long simple seta laterodistally, 2 broom-like setae on dorsal surface near proximal end, 1 broom-like seta near distal end. Exopod about 4.6 times as long as wide, fringed with few plumose setae mediodistally and distally, few simple setae laterally and laterodistally.

Etymology

The species is named in honour of my wife, Sif, for her understanding and patience towards my scientific work over the years.

Remarks

Gnathia sifae sp. nov. is easily distinguished from all other New Zealand gnathiid species in having a distinct mediofrontal process on the cephalon, but no frontolateral processes. It is further clearly distinguished from the co-occurring species, *Caecognathia nieli* sp. nov., in having relatively larger eyes and of different shape, in the presence of lateral projections on the pereopods and in the shape of the appendix masculina. The species is in some ways similar to *Caecognathia polythrix* (Monod, 1926). In addition to having the above mentioned mediofrontal process, *G. sifae* is considerable larger than *C. polythrix* (adult males 2.3–2.8 mm). The latter species is generally more tuberculate, for instance at the lateroventral surface of the cephalon, which is smooth in *G. sifae*.

G. sifae was found in large numbers in scoria rubble on the Rumble III seamount sitting to the north of the Bay of Plenty, New Zealand.

Distribution

North of Bay of Plenty, New Zealand.

Discussion

The isopod fauna of New Zealand is still fairly poorly known, although some families and genera have received attention recently (e.g. Bruce 2002, 2003, 2004a, 2004b, 2004c, 2005; Just & Wilson 2004; Merrin 2004). This is particularly true for the gnathiid isopods, of which only eight species have previously been recorded from New Zealand. Six of these species were reported during the first part of last century by Monod (1926): *Caecognathia polythrix* (Monod, 1926), *C. regalis* (Monod, 1926), *C. pacifica* (Monod, 1926), *C. akaroensis* (Monod, 1926), *Thaumastognathia diceros* Monod, 1926 and *Gnathia brachyuropus* Monod, 1926, the latter known only from a praniza larva. The species described by Monod were all collected in fairly shallow waters: *T. diceros*, *C. regalis* and *C. polythrix* at the Three Kings at 118 m, *C. akaroensis* at Akaroa harbour at 10 m, and *C. pacifica* in Coleville Channel at 64 m. *Gnathia brachyuropus* was observed at Akaroa (10 m) and Lyttelton harbours. Much later Cohen & Poore (1994) reported *Bathygnathia tapinoma* Cohen & Poore, 1994 and *B. vollenhovia* Cohen & Poore, 1994 from deep water, both from a depth of 924 m off the west coast of the South Island (Cohen & Poore 1994). The New Zealand gnathiid fauna is presumably still quite under-sampled, in particular in deeper waters.

The present paper adds two species to the New Zealand gnathiid fauna, bringing the total to 10 known species. There is no information available on which fish species these gnathiids parasitize during their larval praniza stage. It is not unlikely that the orange roughy (*H. atlanticus*) is among the hosts, being very abundant on seamounts in New Zealand waters (Bull *et al*. 2001).

Acknowledgements

I wish to thank Niel Bruce for his hospitality and everlasting help during my sabbatical visit in New Zealand and to NIWA in 2001 and in particular Dennis Gordon for provision of excellent working facilities. I wish to thank Jørgen Olesen, Zoological Museum, Copenhagen, for loan of the types of *C. polythrix*.

The present descriptions contribute to NIWA's Foundation for Research, Science and Technology (FRST) project 'Seamounts: their importance to fisheries and marine ecosystems' (C01X0028), and I thank Drs Malcolm Clark and Ashley Rowden for granting access to this material; this work also contributes to and was carried under the context of FRST program (contract COXØ219) *Biodiversity of New Zealand Aquatic Environments*.

References

Bull, B., Doonan, I., Tracey, D. & Hart, A. (2001) Diel variation in spawning orange roughy (*Hoplostethus atlanticus*, Trachichthyidae) abundance over a seamount feature on the north-west Chatham Rise. *New Zealand Journal of Marine and Freshwater Research*, 35, 435–444.

Bruce, N.L. (2002) *Tridentella rosemariae* sp. nov. (Crustacea: Isopoda: Tridentellidae), from northern New Zealand waters. *Crustaceana*, 75(2), 159–170.

Bruce, N.L. (2003) A new deep-water species of *Natatolana* (Crustacea: Isopoda: Cirolanidae) from the Chatham Rise, eastern New Zealand. *Zootaxa*, 265, 1–12.

Bruce, N.L. (2004a) New species of the *Cirolana* "*parva*-group" (Crustacea: Isopoda: Cirolanidae) from coastal habitats around New Zealand. *Species Diversity*, 9, 47–66.

Bruce, N.L. (2004b) *Mexicope sushara* sp. nov., the first New Zealand record of the isopod crustacean family Acanthaspidiidae (Asellota). *Zootaxa*, 489, 1–11.

Bruce, N.L. (2004c) Reassessment of the isopod crustacean *Aega deshaysiana* (Milne Edwards, 1840) (Cymothoida: Aegidae) — a world-wide complex of 21 species. *Zoological Journal of the Linnean Society*, 142(2), 135–232.

Bruce, N.L. (2005) New Sphaeromatidae (Crustacea: Isopoda: Sphaeromatidea) from coastal and freshwater habitats in New Zealand. *Zootaxa*, 1002, 1–20.

Cohen, B.F. & Poore, G.C.B. (1994) Phylogeny and biogeography of the Gnathiidae (Crustacea: Isopoda) with descriptions of new genera and species, most from south-eastern Australia. *Memoirs of the Museum of Victoria*, 54, 271–397.

Dower, J.F. & Perry, R.I. (2001) High abundance of larval rockfish over Cobb Seamount, an isolated seamount in the Northeast Pacific. *Fisheries Oceanography*, 10, 268–274.

Holdich, D.M. & Harrison, K. (1980) The crustacean isopod genus *Gnathia* Leach from Queensland waters with descriptions of nine new species. *Australian Journal of Marine and Freshwater Research*, 31, 215–240.

Grutter, A.S., Lester, R.J.G. & Greenwood, J. (2000) Emergence rates from the benthos of the parasitic juveniles of gnathiid isopods. *Marine Ecology Progress Series*, 207, 123–127.

Just, J., & Wilson, G.D.F. (2004) Revision of the *Paramunna* complex (Isopoda: Asellota: Paramunnidae). *Invertebrate Systematics*, 18(4), 377–466.

Kensley, B., Schotte, M. & Schilling, S. (2005) World list of marine, freshwater and terrestrial isopod crustaceans. Smithsonian Institution, Washington, DC, USA. Available from http://www.nmnh.si.edu/iz/isopod/ (accessed May 2005).

Klitgaard, A.B. (1997) The distribution and habitats in the North Atlantic of two gnathiid species (Crustacea, Isopoda) and their reproductive biology in the Denmark Strait and north of Iceland. *Meddelelser om Grønland, Bioscience*, 47, 1–32.

Koslow, J.A., Gowlett-Holmes, K., Lowry, J.K., O'Hara, T., Poore, G.C.B. & Williams, A. (2001) Seamount benthic macrofauna off southern Tasmania: Community structure and impacts of trawling. *Marine Ecology Progress Series*, 213, 111–125.

Merrin, K.L. (2004) Review of the deep-water asellote genus *Notopais* Hodgson, 1910 (Crustacea: Isopoda: Munnopsididae) with description of three new species from the south-western Pacific. *Zootaxa*, 513, 1–27.

Monod, T. (1926) Les Gnathiidæ. Essai monographique (Morphologie, Biologie, Systématique). *Mémoires de la Société des Sciences Naturelles du Maroc*, 13, 1–668.

Müller, H.-G. (1989a) Redescription of *Gnathia sugashimaensis* Nunomura (Crustacea: Isopoda) from Japan. *Publications of the Seto Marine Biological Laboratory*, 34, 25–30.

Müller, H.-G. (1989b) A new species of marine isopod of the genus *Gnathia* from the Fiji Islands, the South Pacific. *Publications of the Seto Marine Biological Laboratory*, 34, 31–35.

Nunomura, N. (1992) Marine Isopoda from Amakusa, Kyushu (II). *Publications from the Amakusa Marine Biological Laboratory*, 11, 59–71.

Nunomura, N. (1998) A new species of the gnathiid isopod crustacean from the sea off Sanriku, Northern Japan. *Bulletin of the Toyama Science Museum*, 21, 55–60.

Smit, N.J. & Davies, A.J. (2004) The curious life-style of the parasitic stages of gnathiid isopods. *Advances in Parasitology*, 58, 289–391.

Svavarsson, J. (2002) Gnathiidae (Crustacea, Isopoda) from the Andaman Sea, Thailand: new records and a new species. *In*: Bruce, N.L., M. Berggren & S. Bussawarit (Eds) *Proceedings of the International Workshop on the Crustacea in the Andaman Sea, Phuket Marine Biological Center, 29 November–20 December 1998, Phuket Marine Biological Center Special Publication, 23*, Phuket Marine Biology Center, Phuket, pp. 149–156.

Svavarsson, J. & Gísladóttir, E. (2002) *Elaphognathia korachaensis* n. sp., a new gnathiid species (Crustacea, Isopoda) from Thailand. *In*: Bruce, N.L., M. Berggren & S. Bussawarit (Eds.) *Proceedings of the International Workshop on the Crustacea in the Andaman Sea, Phuket Marine Biological Center, 29 November–20 December 1998, Phuket Marine Biological Center Special Publication, 23*, Phuket Marine Biology Center, Phuket, pp. 157–164.

Svavarsson, J. & Jörundsdóttir, K. (2004) A new gnathiid species (Crustacea, Isopoda, Cymothoida) from Rodrigues, Mauritius, Indian Ocean. *Journal of Natural History*, 38, 3103–3111.

Tanaka, K. & Aoki, M. (1999) Spatial distribution patterns of the sponge-dwelling gnathiid isopod *Elaphognathia cornigera* (Nunomura) on an intertidal rocky shore of the Izu Peninsula, southern Japan. *Crustacean Research*, 28, 160–167.

Upton, N.P.D. (1987) Asynchronous male and female life cycles in the sexually dimorphic, harem-forming isopod *Paragnathia formica* (Crustacea: Isopoda). *Journal of Zoology*, 212, 667–690.

