

Two new species of the deep-water asellotan genus *Notopais* Hodgson, 1910 (Crustacea: Isopoda: Munnopsidae) from the south-western Pacific

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Abstract: Two new species of *Notopais* are described, *Notopais echinatus* sp. nov. from the continental slope of eastern Australia, at a depth of 2400–2500 metres, and *Notopais euaxos* sp. nov. from the Chatham Rise off the eastern coast of South Island, New Zealand, from depths of 2476–2542, the greatest recorded depths for the genus.

Résumé: Deux nouvelles espèces profondes d'isopodes asellotes du genre *Notopais* Hodgson, 1910 (Crustacea: Isopoda: Munnopsidae) du Sud-Ouest de l'Océan Pacifique. Deux nouvelles espèces du genre *Notopais* sont décrites, *Notopais echinatus* sp. nov. Du talus continental à l'est de l'Australie, à une profondeur de 2400–2500 mètres, et *Notopais euaxos* sp. nov. de la Ride Chatham au large de la côte est de l'Île du Sud, Nouvelle Zélande, à une profondeur de 2476–2542 mètres, les plus grandes profondeurs connues pour le genre.

Keywords: *Notopais*, Munnopsidae, Taxonomy, Pacific, Deep sea, Australia, New Zealand, Crustacea

Introduction

The munnopsid genus *Notopais* Hodgson, 1910, one of six genera in the sub-family Ilyarachninae Hansen, 1916, has been most recently reviewed by Merrin (2004). *Notopais* has an exclusive Southern Hemisphere distribution, to a depth of 2600 metres, and is currently composed of seven species – five from the waters around Antarctica and one

each from off south-eastern Australia and New Zealand (Merrin, 2004).

This paper describes a further two new species of *Notopais*, one from the continental slope of eastern Australia and the other from the Chatham Rise to the east of New Zealand's South Island. For methods refer to Merrin (2004).

Abbreviations: PS – penicillate seta/ae; SRS –sensillate robust seta/ae; RS – robust seta/ae; SS – simple seta/ae; AM – Australian Museum, Sydney; NIWA – National Institute for Water and Atmospheric Research, Wellington.

Taxonomy

Family MUNNOPSISIDAE Lilljeborg, 1864
Subfamily Ilyarachninae Hansen, 1916

Notopais Hodgson, 1910

Notopais Hodgson, 1910: 69.—Merrin, 2004: 3–4.

Remarks

Merrin (2004) presented a revised generic diagnosis to the genus. Both *N. echinatus* sp. nov. and *N. euaxos* sp. nov. are found at depths between 2400 and 2600 metres, the greatest depth known for this genus, and a depth extension of a little less than 1 kilometre (*N. zealandica* Merrin, 2004 had been recorded from 1640 metres).

Notopais echinatus sp. nov.
(Figs 1 & 3)

Material examined

Holotype. Female (two halves together, 8.5 mm), stn FR1086-4, continental slope of eastern Australia, east of Flinders Island, Tasman Sea, 40°45.94–46.54'S, 149°01.62–00.27'E, 2400–2500 m, 10 December 1986, clay, thick mud, light grey colour, some rock (siltstone) (AM P.72860). Paratypes. 3 female, (8.0 mm [two halves together, dissected], 6.0 mm [dissected]) 2 male (7.0 mm [two halves together, dissected]), 4 fragments, type locality (AM P.62613).

Description

Female. Body about 2.5 times as long as greatest width (from spine tip to spine tip) of pereonite 2; pereonites 2 and 3 width sub-equal, widest; cuticle calcified, with many tubercles. Cephalon with 2 large and 4 small spines; lateral margins with several small spines; posterolateral margins sub-rectangular. Pereonites 1–4 with numerous tubercles; anterior margins each with 4 well-developed sub-marginal spines, laterally each with pair of marginal spines, pereonite 4 with additional pair of lateral spines; pereonites 5–7 dorsally with many pairs of spines and tubercles; pereonite 5 anterior margin with 2 pairs of widely spaced spines, anterolateral margin twice indented; pereonite 6 with small anterolateral lobes, ventrally with 6 scattered setae; pereonite 7 anterolateral margins rounded, ventrally with row of setae. Pleonite 1 with 1 pair of spines. Pleon as long as proximal width, posterior tip rounded, dorsally with several pairs of tubercles.

Antenna 1 of 9 articles; article 1 elongate, distal ends rounded, 1.7 times as long as wide, mesial margin with 3 SRS (2 long, 1 short), surface with 2 PS and 1 RS, lateral

margin with 8 SRS, distal margin with 3 PS and 1 SRS; article 2 0.3 times as long article 1, 1.8 times as long as wide, with 1 mesial SS, distally with 2 RS and 1 PS; article 5 with 1 SS; from article 7, each article has an aesthetasc; terminal article also with 1 PS and 1 SS.

Mandible lacinia mobilis and spine row absent; molar small, with 5 uni-serrate setae. Maxilla 1 lateral and mesial margins with fine SS; lateral lobe 2.1 times as wide as mesial lobe, distal margin with few fine SS, 3 RS, 1 dentate RS, 2 dentate pectinate RS and 6 pectinate RS; mesial lobe distally with 8 SS and 2 long pectinate setae. Maxilla 2 lateral lobe margins with fine SS, distally with 4 long pectinate setae; middle lobe as wide as lateral lobe, distally with 4 long pectinate setae; mesial lobe 2.0 times as wide as lateral lobe, margins and surface with fine SS, distally with 6 SS, 7 toothed setae and 1 long pectinate seta. Maxilliped coxa rectangular, 1.2 times as long as wide, 0.3 times as long as basis (including endite); basis elongate, 2.4 times as long as wide (including endite), distolateral margin with 1 SS; endite with 5 coupling hooks, distally with 6 blunter SS, 8 fan setae (distomesial one longest) and many fine SS; palp article 1 wide, shortest, rectangular, 0.3 times as long as basal endite, distolateral margin with 1 SS, distomesial margin with 1 SS; article 2 3.9 times as long as and 1.2 as wide as article 1, 1.6 times as wide as basal endite, lateral margin with 7 SS and cuticular scales, mesial margin with 6 distally pappose setae (of varying lengths); article 3 1.9 times as long as and 0.8 times as wide as article 1, mesial margin with 1 long SS and 16 distally pappose setae (2 sub-marginal); article 4 rectangular, with distomesial bulge, 1.1 times as long and 0.4 times as wide as article 1, lateral margin with 2 SS, distomesial margin with 4 SS and 4 distally pappose setae; article 5 small, rectangular, narrow, 0.9 times as long as and 0.1 times as wide as article 1, lateral margin with 1 SS, distally with 5 SS; epipod 1.8 times as long as wide, and as long as basis, lateral margin with fine SS and few scattered SS.

Pereopod 1 basis 4.5 times as long as wide, inferior margin with 4 SS and 1 distal SRS, superior margin with 1 SS and 1 SRS; ischium 5.0 times as long as wide, inferior margin with 3 evenly spaced SS, mesial surface with 3 SS, superior margin with 2 SRS and 1 distal SS; merus 1.1 times as long as wide, inferior margin with 2 marginal SRS and 3 RS, mesial surface with 2 SRS, distosuperior margin with 3 SS; carpus 5.9 times as long as wide, inferior margin with 3 SS (in proximal half), superior margin with 3 evenly spaced SS; propodus 7.7 times as long as wide, inferior margin with 8 SS (all in distal half, 5 sub-marginal), mesial surface with 2 SS, superior margin with 3 distal SS; dactylus 2.6 times as long as proximal width, superior margin with 2 SS.

Pereopod 2 basis 4.2 times as long as wide, inferior margin with 3 SRS, superior margin with 3 SRS (1 on dis-

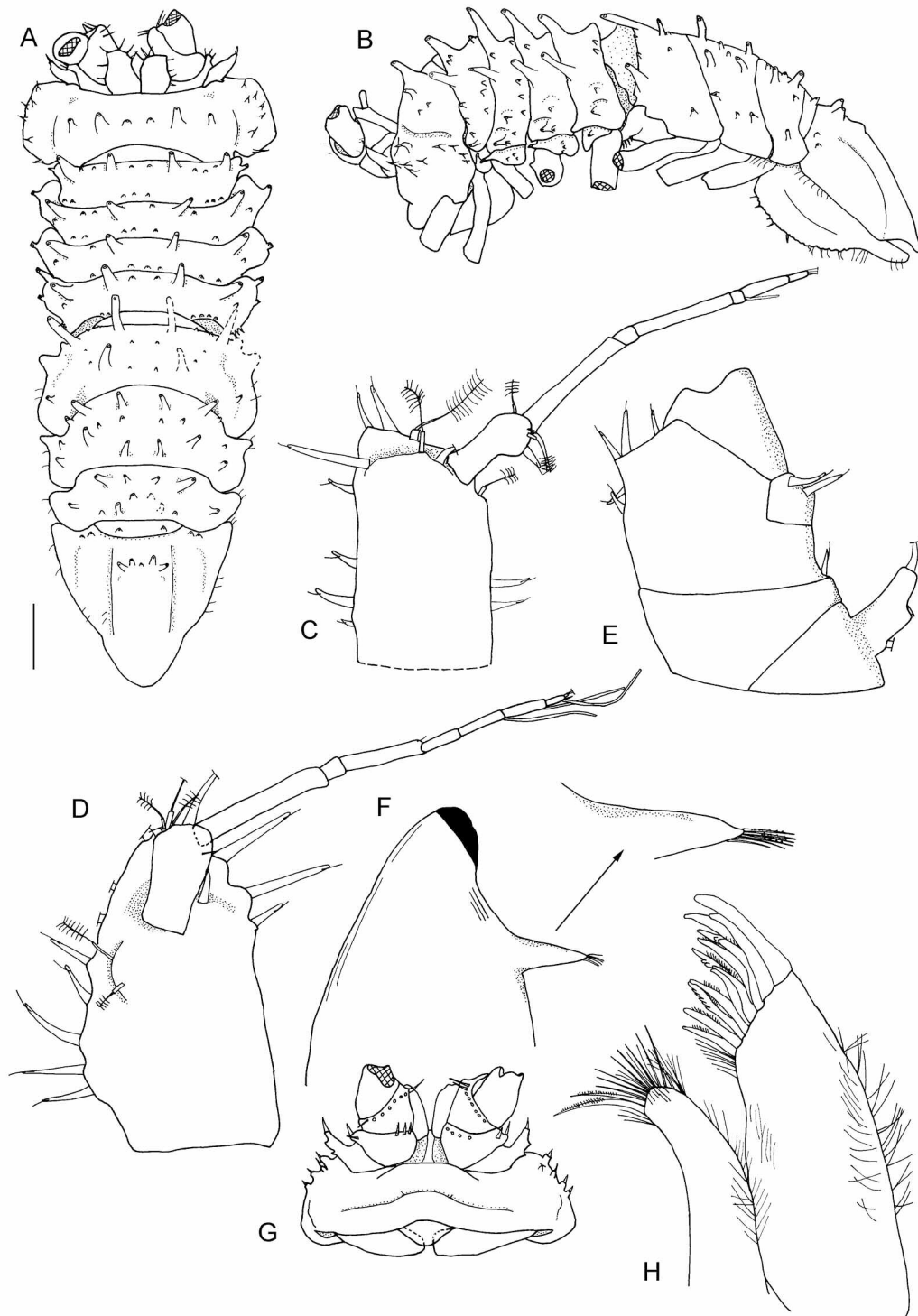


Figure 1. *Notopais echinatus* sp. nov. **A, B & G.** Female holotype (8.5 mm; AM P.72860). **D, F & H.** Female paratype (8.0 mm; AM P.62613). **C & E.** Male paratype (7.0 mm; AM P.62613). **A.** Dorsal view. **B.** Lateral view. **C.** Right antenna 1. **D.** Left antenna 1. **E.** Right antenna 2. **F.** Right mandible. **G.** Ventral view of cephalon. **H.** Left maxilla 1. Scale bar = 1 mm, for dorsal and lateral views only.

Figure 1. *Notopais echinatus* sp. nov. **A, B & G.** holotype femelle (8.5 mm; AM P.72860), **D, F & H.** paratype femelle (8.0 mm; AM P.62613), **C & E.** paratype mâle (7.0 mm; AM P.62613). **A.** vue dorsale ; **B.** vue latérale ; **C.** antennule droite ; **D.** antennule gauche ; **E.** antenne droite ; **F.** mandibule droite ; **G.** cephalon, vue ventrale ; **H.** maxillule gauche. Échelle = 1 mm, vue dorsale et latérale.

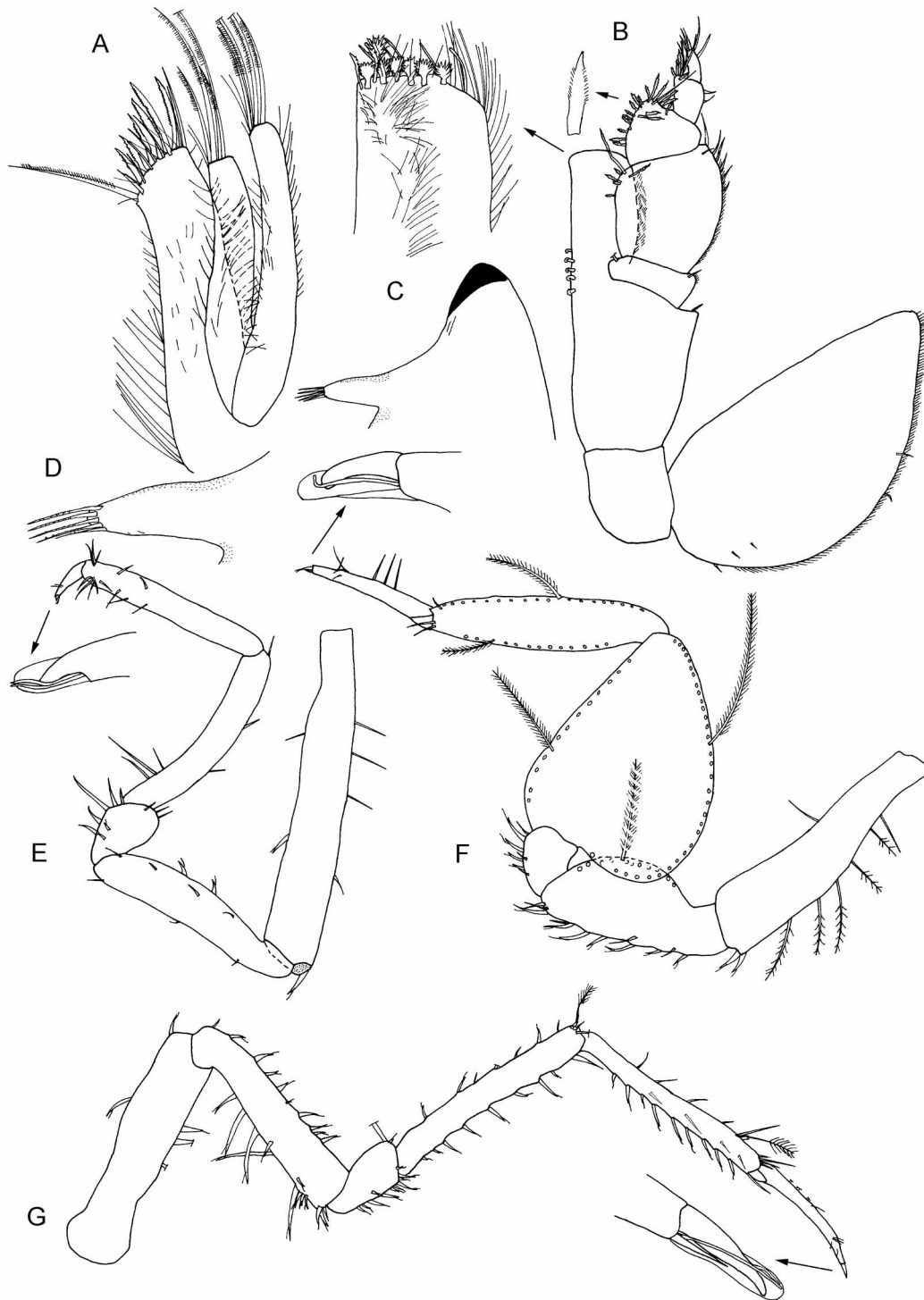


Figure 2. *Notopais echinatus* sp. nov. **A–D.** female paratype, **E–G.** from second female paratype only (6.0 mm; AM P.62613). **A.** left maxilla 2; **B.** left maxilliped; **C.** left mandible; **D.** left mandibular molar; **E.** right pereopod 1; **F.** left pereopod 6; **G.** left pereopod 2.

Figure 2. *Notopais echinatus* sp. nov. **A–D.** paratype femelle, **E–G.** du second paratype femelle seul (6.0 mm; AM P.62613). **A.** maxille gauche ; **B.** maxillipède gauche ; **C.** mandibule gauche ; **D.** mandibule molaire gauche ; **E.** péréiopode 1 droite ; **F.** péréiopode 6 gauche ; **G.** péréiopode 2 gauche.

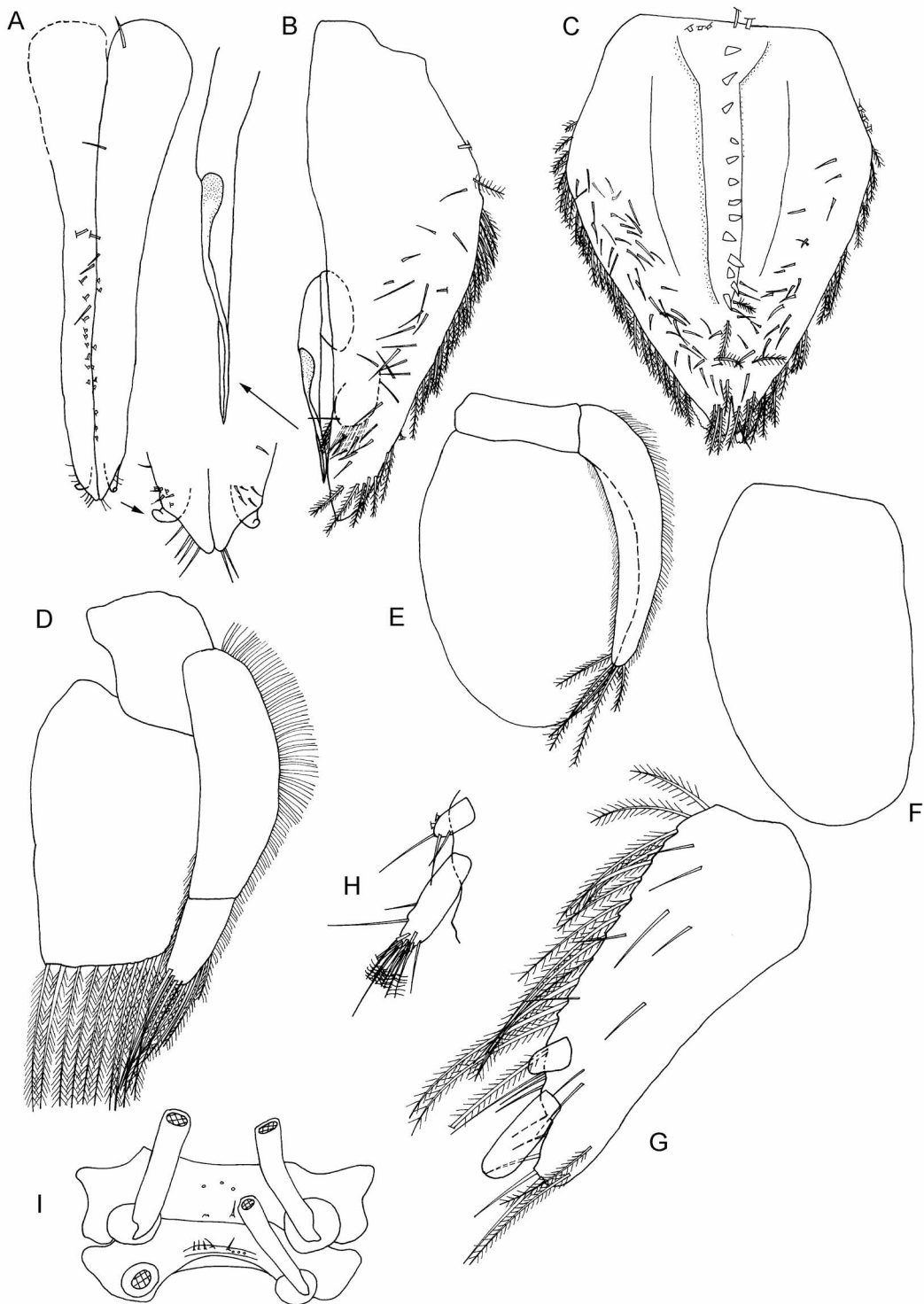


Figure 3. *Notopais echinatus* sp. nov. **A & B.** male paratype, **C–H.** female paratype, **I.** female holotype. **A.** pleopod 1; **B.** left pleopod 2; **C.** operculum; **D.** left pleopod 3; **E.** left pleopod 4; **F.** right pleopod 5; **G.** left uropod; **H.** endopod and exopod of left uropod; **I.** ventral view of pereonites 6 and 7.

Figure 3. *Notopais echinatus* sp. nov. **A & B.** paratype mâle, **C–H.** paratype femelle, **I.** holotype femelle. **A.** pléopode 1; **B.** pléopode 2 gauche; **C.** opercule; **D.** pléopode 3 gauche; **E.** pléopode 4 gauche; **F.** pléopode 5 droite; **G.** uropode gauche; **H.** endopodite et exopodite de l'uropode gauche; **I.** péréonites 6 et 7 vue ventrale.

tal margin); ischium 4.6 times as long as wide, inferior margin with 13 SRS (of varying lengths, 2 sub-marginal), superior margin with 9 SRS and 1 proximal SS; merus 1.7 times as long as wide, inferior margin with 9 SRS, mesial surface with 2 SRS, distosuperior margin with 2 SRS (1 long and 1 short); carpus 7.9 times as long as wide, inferior margin with 9 SRS (lengths varying), superior margin with 6 SRS, 4 SS and 1 PS (all evenly spaced except for 2 SRS, 1 SS and 1 PS on distosuperior margin); propodus 10.2 times as long as wide, inferior margin with 9 SRS and 1 distal SS, mesial surface with 4 SS, superior margin with 4 evenly spaced SS and 2 small sub-marginal SS, distally with 1 long SS, 1 PS and a clump of 4 SS; dactylus 6.9 times as long as proximal width, superior margin with 9 small SS and mesial surface with 5 SS.

Pereopod 6 basis 4.1 times as long as wide, inferior margin with 1 proximal SS, 5 plumose setae and 2 distal SRS, superior margin with 1 SS (at mid-point); ischium 2.2 times as long as wide, inferior margin with 7 long SRS and 5 SS (4 SS are sub-marginal); merus 1.1 times as long as wide, inferior margin with 4 long SRS and 3 sub-marginal SS; carpus 1.2 times as long as wide; propodus 4.2 times as long as wide, inferior margin with 2 distal SS, superior margin with 1 distal SS; dactylus 5.8 times as long as proximal width, with 7 SS.

Operculum 2.1 times as long as proximal width, median keel provided with row of RS and few RS proximally, surface with scattered SS, distally with 11 plumose setae (6 of these in a row, 3 each side of medial split), medial excision and veined lamellar extension, lateral margins with numerous plumose setae. Pleopod 3 exopod 1.2 times length of endopod, with row of fine SS, distally with 10 long plumose setae; endopod 1.7 times as long as wide, with 10 long plumose setae. Pleopod 4 exopod distally with 5 long plumose setae; endopod oval, 1.4 times as long as wide. Pleopod 5 1.6 times as long as wide.

Uropod protopod 2.5 times as long as wide, lateral margin with 4 SS and 14 plumose setae, surface with 9 scattered SS, distomesial angle produced, not extending past endopod, provided with 4 SS and 2 plumose setae; exopod small, 0.1 times as long as protopod, 0.5 times as long as endopod, with 5 SS; endopod 0.2 times as long as protopod, with 5 SS and 7 PS.

Male. Antenna 1 with 8 articles; article 1 and 2 ratios similar to female; article 1 mesial margin with 5 SRS, distal margin with 3 SRS and 2 PS, lateral margin with 2 SRS and 1 PS; article 2 2.3 times as long as wide, distal margin with 2 SRS and 3 PS; article 6 with 1 aesthetasc. Antenna 2 damaged; article 1 lateral margin with 2 SRS; article 2 1.1 times as long as article 1, distolateral margin with 1 SRS; article 3 1.9 times as long as article 1, scale with 2 SRS, distomesial margin with 5 SRS; article 4 small, 1.3 times as long as article 1, with no ornamentation.

Pleopod 1 about 3.3 times as long as proximal width, lateral margins indented 0.5 from proximal end, with 24 SS (13+11) on either side of centre margin, distally with 20 SS (8+12). Pleopod 2 protopod 3.1 times as long as wide, lateral margin with row of plumose setae, surface with 29 SS, distal margin with 4 plumose setae (all sub-marginal), mesial margin with 4 plumose setae; exopod 0.1 times as long as protopod, with fines SS; stylet 0.5 times as long as protopod, not hooking up into proximal part of protopod, terminating to a point; sperm duct 0.6 times as long as stylet.

Remarks

Notopais echinatus sp. nov. is most similar to *Notopais euaxos* sp. nov., both species differing from all others in the genus in being highly ornamented, with numerous dorsal pereonal spines and tubercles. In dorsal view, *N. echinatus* differs from *N. euaxos* by having larger spines on the anterior margins of pereonites 1–4; fewer tubercles on the posterior margin of pereonites 1–4; pereonite 5 anterior margin with four evenly spaced spines as opposed to a pair of widely spaced spines; more large spines on pereonites 5–7; and a different patterning of spines and tubercles on the pleon. Other differences between the two species include: *N. echinatus* antenna 2 article 1 with fewer robust setae and article 3 distolateral margin only having two sensillate robust setae, while in the same position in *N. euaxos* is a small rounded distolateral angle with five robust setae; pereopod 1 of *N. echinatus* has fewer setae than its counterpart, especially on the inferior margins of the merus and carpus; and the operculum of *N. echinatus* has numerous plumose setae and simple setae between the end of the keel and the distal margin, while in *N. euaxos* there are no setae in this area, with just a few long plumose setae at the distal end of the medial keel.

The unguis, which has been illustrated for the respective pereopods of both *N. echinatus* and *N. euaxos*, differs to that illustrated for *Notopais minya* Merrin, 2004 and *N. zealandica* (see Merrin 2004). All pereopodal ungui in both *N. minya* and *N. zealandica* have been illustrated with two sensillae and these sensillae are pointed. Closer examination has shown that the sensillae more blunt than originally thought and that the unguis has two sensillae in pereopods 1 and 2 (pereopods 3 and 4 remain unknown for the genus) and only one sensilla for pereopods 5–7 (pers. obs.). Re-examination of the type material for *N. minya* and *N. zealandica* shows the structure of the unguis to be the same as that described here.

Distribution

Known only from the type locality, east of Flinders Island, Tasman Sea, Australia, between the depths of 2400–2500 metres.

Etymology

From the Latin *echinatus* (= spiny or prickly); in reference to the dorsal spines and tubercles.

Notopais euaxos sp. nov.
(Figs 4 & 5)

Material examined

Holotype. Female (9.0 mm), Chatham Rise, South Island, New Zealand, stn S202, 42°14.77–16.6'S, 175°8.6–10.6'E, epibenthic sled, 2476–2542 m, 2 November 1979, R.V. *Tangaroa* (NIWA 23786). Paratype. Female (12.5 mm), same data as holotype, (NIWA 23785).

Description

Body about 2.7 times as long as greatest width (from spine tip to spine tip) of pereonite 2; pereonites 2 and 3 width sub-equal, widest; cuticle calcified, with many tubercles. Cephalon with 2 large and 2 small spines and numerous tubercles; lateral margins with several small spines; posterolateral margins rounded, but almost square. Pereonite 1 anterior margin with 2 widely-spaced sub-marginal spines, pereonites 2–4 with 4 sub-marginal spines, numerous tubercles between these spines, posterior margins with row many tubercles; pereonites 1–3 anterolateral margins smooth, pereonite 4 anterolateral margins with small spines; pereonite 2 with 3 pairs of small lateral spines, pereonite 3 with 2 pairs, pereonite 4 with 1 pair of spines; pereonites 5–7 dorsally with at least 1 pair of spines and numerous tubercles; pereonite 5 anterior margin with 2 pairs of widely-spaced spines, anterolateral margin square; pereonite 6 anterolateral margin with small lobes; pereonite 6 ventrally with no ornamentation; pereonite 7 ventrally with row of setae. Pleonite 1 with 1 pair of spines. Pleon as long as proximal width, lateral sides indent and posterior end coming to a rounded point, dorsally with several pairs of tubercles.

Antenna 1 damaged; article 1 elongate, distal end rounded, 1.8 times as long as wide, mesial margin with 5 SRS, surface with 5 PS, lateral margin with 8 SRS, distal margin with 1 long PS; article 2 0.5 times as long as article 1, 2.3 times as long as wide, lateral margin with 1 SRS, distomesial corner with 3 PS, mesial margin with 1 PS and 1 SS; article 3 0.9 times as long as article 1, mesial margin with 2 SRS. Antenna 2 damaged; article 1 lateral margin with 3 RS, mesial margin with 1 RS; article 2 0.6 times as long as article 1, distolateral margin with 2 SRS; article 3 as long as article 1, scale with 5 RS (1 sub-marginal), mesial margin with 3 SRS, distomesial margin with 7 SRS (5 in a clump, 2 separate); article 4 0.9 times as long as article 1, with no ornamentation.

Mandible lacinia mobilis and spine row absent; molar small, distally with 11 uni-serrate setae. Maxilla 1 lateral and mesial margins with fine SS; lateral lobe 1.7 times as wide as mesial lobe, distal margin with numerous fine SS, 8 RS, 2 dentate RS and 2 robust pectinate setae; mesial lobe distally with 1 SS and 2 long pectinate setae. Maxilla 2 lateral lobe margins with fine SS, distally with 4 long pectinate setae; middle lobe 0.9 times as wide as lateral lobe, distally with 4 long pectinate setae; mesial lobe 1.9 times as wide as lateral lobe, mesial and distal margins with fine SS, distally with 7 SS, 9 toothed setae and 1 long pectinate seta. Maxilliped coxa roughly triangular, 1.0 times as long as wide, 0.3 times as long as basis (including endite); basis elongate, 2.6 times as long as wide (including endite); endite with 7 coupling hooks, distally with 7 SS, 9 fan setae (distomesial one longest) and many fine SS; palp article 1 wide, shortest, 0.2 times as long as basal endite, distolateral margin with 1 SS, distomesial margin with 1 SS; article 2 5.0 times as long as and 1.3 as wide as article 1, 1.6 times as wide as basal endite, lateral margin with 11 SS (1 sub-marginal), mesial margin with 3 distally pappose setae and 1 long SS; article 3 2.5 times as long as and 0.8 times as wide as article 1, mesial margin with 4 long SS and 16 distally pappose setae; articles 4 and 5 rectangular; article 4 1.7 times as long as and 0.3 as wide as article 1, lateral margin with 3 SS, distomesial margin with 3 SS; article 5 narrow, setae missing, 1.3 times as long as and 0.1 times as wide as article 1; epipod 1.8 times as long as wide and as long as basis.

Pereopod 1 basis 7.2 times as long as wide, inferior margin with 7 SS, lateral surface with 1 SS, superior margin with 3 SS and 1 medial SRS; ischium 5.4 times as long as wide, inferior margin with 6 SS, lateral surface with 6 scattered SS, superior margin with 5 SS; merus 1.1 times as long as wide, inferior margin with 5 SS and 17 SRS, lateral surface with 1 SS, distosuperior margin with 2 SS; carpus 6.3 times as long as wide, inferior margin with 8 SS (lengths varying, all in proximal half), superior margin with 2 SS; propodus 9.9 times as long as wide, inferior margin with 12 SS, lateral surface with 4 SS, superior margin with 1 SS; dactylus 3.1 times as long as proximal width, superior margin with 4 SS.

Operculum 3.2 times as long as proximal width, distally with medial excision and veined lamellar extension, medial keel provided with row of RS (possibly all SRS, given last one is), scattered SS and proximally with 3 plumose setae, surface with scattered SS, lateral margins with numerous plumose setae. Pleopod 3 exopod 1.1 times as long as endopod with row of fine SS, distally with 12 long plumose setae; endopod 1.8 times as long as wide with 18 long plumose setae. Pleopod 4 exopod distally with 5 long plumose setae; endopod oval, 1.3 times as long as wide. Pleopod 5 1.9 times as long as wide.

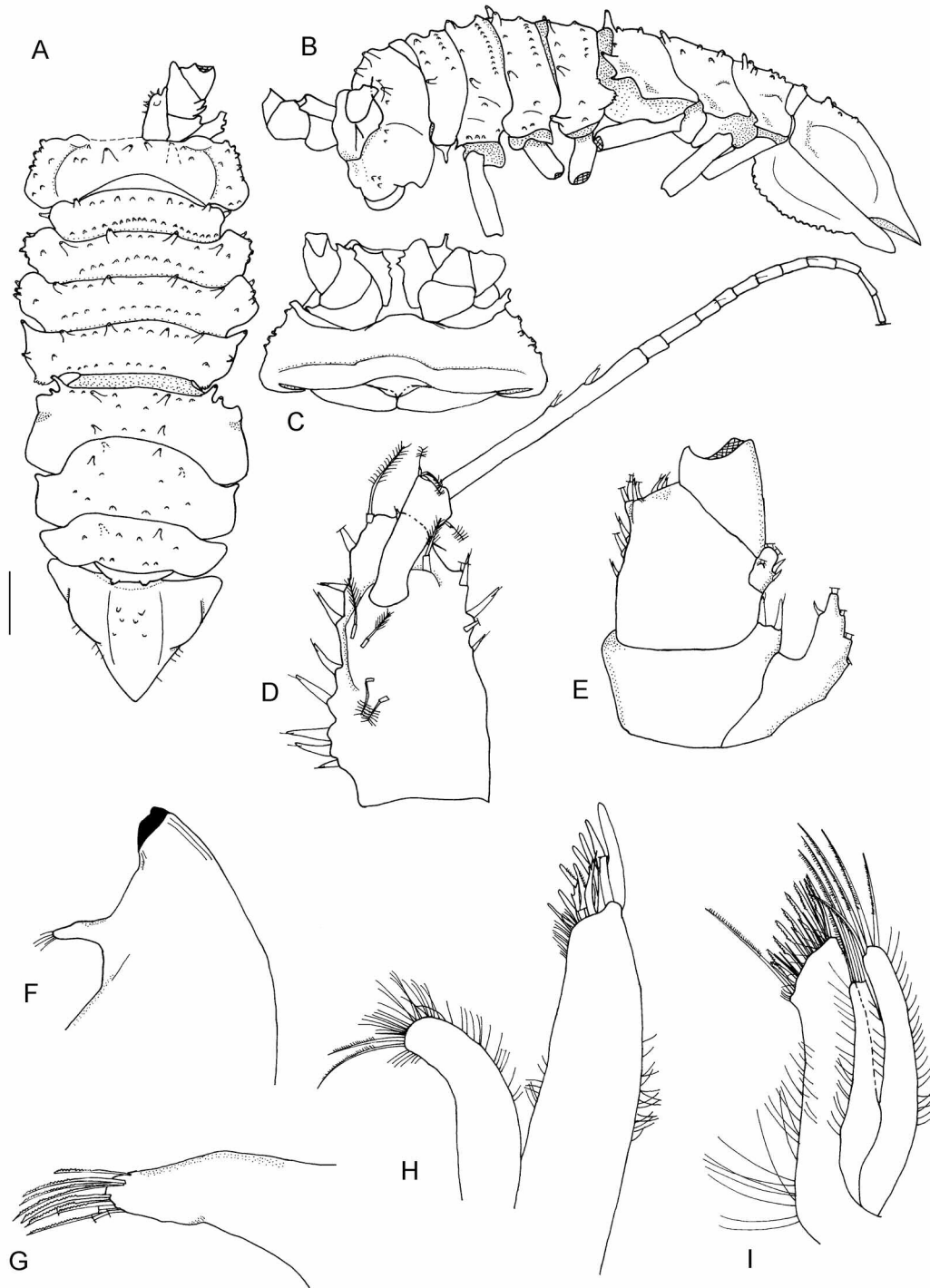


Figure 4. *Notopais euaxos* sp. nov. **A–C.** female holotype (8.5 mm; NIWA 23786), **D–I.** female paratype (12.5 mm; NIWA 23785). **A.** dorsal view; **B.** lateral view; **C.** ventral view of cephalon; **D.** left antenna 1; **E.** right antenna 2; **F.** left mandible; **G.** molar of left mandible; **H.** left maxilla 1; **I.** left maxilla 2. Scale bar = 1 mm, for dorsal and lateral views only.

Figure 4. *Notopais euaxos* sp. nov. **A–C.** holotype femelle (8.5 mm; NIWA 23786), **D–I.** paratype femelle (12.5 mm; NIWA 23785). **A.** vue dorsale ; **B.** vue latérale ; **C.** cephalon, vue ventrale ; **D.** antennule gauche ; **D.** antenne droite ; **F.** mandibule gauche ; **G.** molaire mandibule gauche ; **H.** maxillule gauche ; **I.** maxille gauche. Échelle = 1 mm, vue dorsale et latérale.

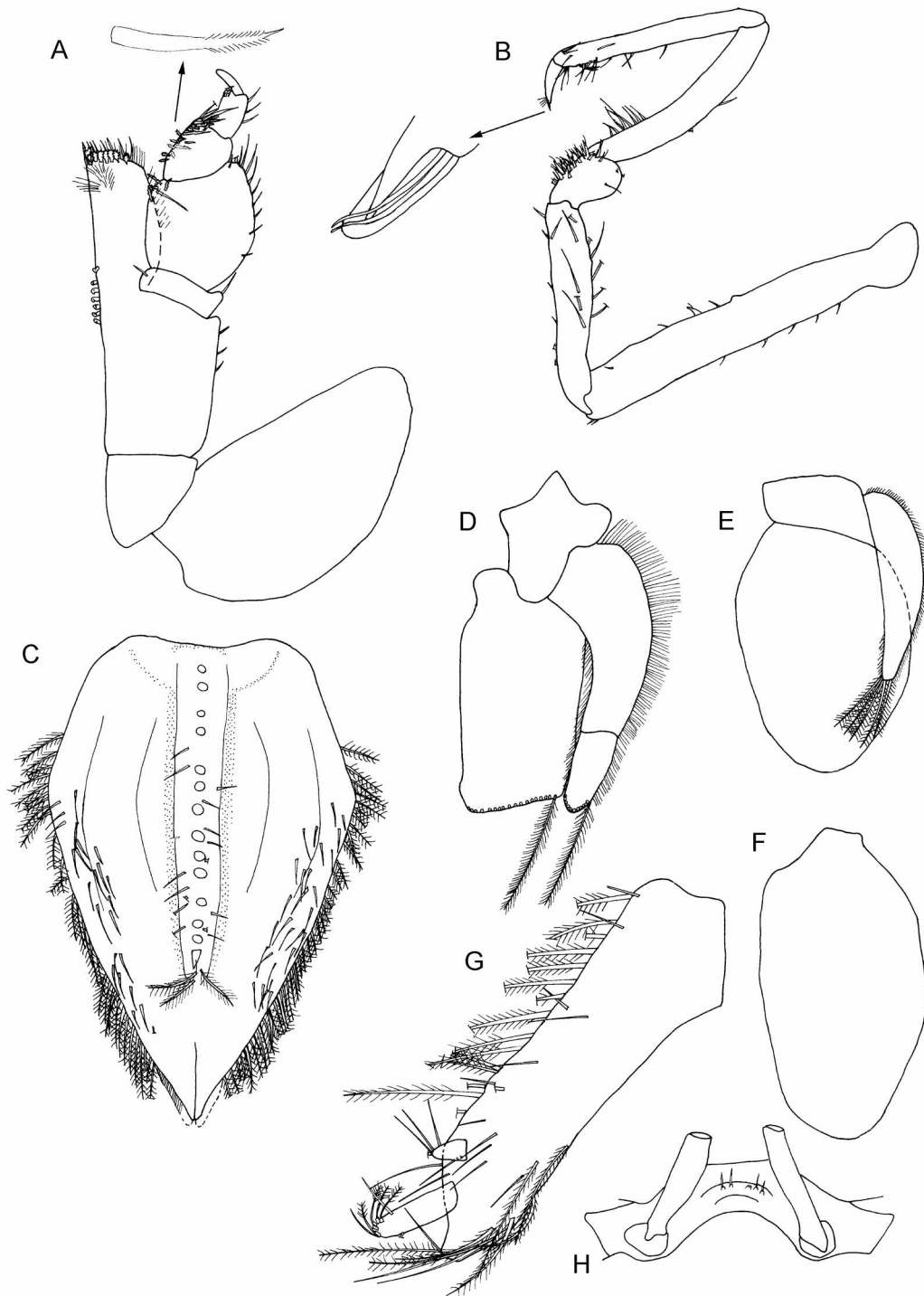


Figure 5. *Notopais euaxos* sp. nov. **A, D–G.** female paratype, **B, C & H.** female holotype. **A.** left maxilliped; **B.** right pereopod 1; **C.** operculum; **D.** left pleopod 3; **E.** left pleopod 4; **F.** left pleopod 5; **G.** left uropod; **H.** ventral view of pereonite 7.

Figure 5. *Notopais euaxos* sp. nov. **A, D–G.** paratype femelle, **B, C & H.** holotype femelle. **A.** maxillipède gauche ; **B.** péréiopode 1 gauche ; **C.** opercule ; **D.** pléopode 3 gauche ; **E.** pléopode 4 gauche ; **F.** pléopode 5 gauche ; **G.** uropode gauche ; **H.** péréionite 7 vue ventrale.

Uropod protopod 3.4 times as long as wide, margins sub-parallel, lateral margin provided with 8 SS and 13 plumose setae, mesial margin with 1 SS and 5 plumose setae, surface with 9 scattered SS and 1 plumose seta, distomesial angle produced, not extending past endopod, provided with 1 plumose seta and 2 SS; exopod small, 0.1 times as long as protopod, 0.4 times as long as endopod, with 4 SS; endopod 0.2 times as long as protopod, with 3 SS and 5 PS.

Remarks

See 'Remarks' for *N. echinatus*.

Distribution

Known only from type locality.

Etymology

The Greek word euaxos (easily broken), alluding to the frequently broken pedestal setae.

Acknowledgments

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