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ORIGINAL ARTICLE

Hirondellea namarensis (Crustacea: Amphipoda: Lysianassoidea: Hirondelleidae), a new deep-water scavenger species from the Mid-Atlantic Ridge

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Abstract
A new species of the deep-sea scavenging genus *Hirondellea* (Crustacea: Amphipoda) is described from bathyal depths in the Azores region and on the Mid-Atlantic Ridge. The new species belongs to a group of *Hirondellea* species which possess an incised inner ramus of uropod 2 and an anteriorly directed spine on epimeron 1. It can be distinguished from other members of this group by a combination of characters: the gnathopod 1 and 2 palm shape; the broadly rounded epimeron 3; the longer telson and broadly rounded head lobe; and the broadly rounded epistome. The species most closely resembles *H. wolfendeni*, from which it can be distinguished by the shape of the propod of gnathopod 2 and the length of the pereopod 7 propodus. An updated key to the genus *Hirondellea* is provided.

Key words: *Crustacea, Amphipoda, Lysianassoidea, Hirondelleidae, North Atlantic Ocean, Mid-Atlantic Ridge,* Hirondellea

Introduction

Material for this study comes from the 4-year multidisciplinary programme, ECOMAR, which aimed to test the hypothesis that the presence of the Mid-Atlantic Ridge leads to enhanced biodiversity and biomass of mid-ocean deep-sea communities. Four sites were investigated: east and west of the Ridge and north and south of the Charlie Gibbs Fracture Zone (CGFZ). In all 16, baited traps were set at these four sites in 2007, 2009 and 2010 and more than 250,000 amphipods were collected. *Centromedon zoe* Horton & Thurston, 2011, one of the most abundant species from the study area, has been described elsewhere. Here we report on another new species from the same collection, found in great abundance, but only at the southern stations. The amphipod genus *Hirondellea* Chevreux, 1889 is a cosmopolitan, largely bathyal genus. A new family, Hirondelleidae Lowry & Stoddart 2010, was established to incorporate the genus and 6 new species have been added in recent years (Lowry & Stoddart 2010; Horton & Thurston 2011). This article describes another new species from the North Atlantic Ocean. *Hirondellea namarensis* sp. nov. is one of the most abundant scavenging amphipods collected at around 2500 m from the Azores region and Mid-Atlantic Ridge south of the CGFZ.

Materials and methods

Amphipods were collected by means of baited traps. The trap rigs consisted of a benthic and an epibenthic trap (set 1 m above the bottom) within a large metal frame incorporating a mechanical acoustic release attached to ballast. The trap set was deployed for 24–48 h. On receipt of an acoustic signal from the ship the ballast was released allowing the trap to rise to the surface. Material was fixed in 4% formaldehyde and then transferred to 80% Industrial Methylated Spirits (80% IMS) on return to the laboratory. A Leica™ MZ7.5 dissection microscope was used to examine the specimens and carry out dissection. Dissected parts were

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mounted in polyvinyl-lactophenol (PVL) stained with lignin pink. Using an Olympus™ BX51 compound microscope illustrations were prepared and were scanned and inked digitally using Adobe® Illustrator® and a WACOM™ digitizer tablet, as described in Coleman (2003). Setal and mouthpart classifications follow Watling (1989) and Lowry & Stoddart (1992, 1995).

Type specimens have been deposited at the Natural History Museum, London (NHMUK). The following abbreviations have been used: *A1–A2*, antennae; *E*, epistome and upper lip; *Ep*, epimeral plate; *G*, gnathopod; *H*, head; *IP*, inner plate; *L*, lower lip; *Md*, mandible; *Mx*, maxilla; *Mxp*, maxilliped; *P*, pereopod; *ST*, setal tooth; *T*, telson; *U*, uropod; all parts are left side unless otherwise indicated.

Taxonomy

Superfamily Lysianassoidea
Family Hirondelleidae

Diagnosis

Head, exposed, much deeper than long, not extending much below insertion of antenna 2, without cheek notch. *Antennae*, calceoli present in male, absent in female. *Antenna 1*, with callynophore in male and female; accessory flagellum article 1 forming a cap partially covering callynophore. *Antenna 2*, peduncular article 3 without distal hook. *Epistome and upper lip*, separate. *Mouthpart bundle*, subquadrate. *Mandible*, incisors well developed, symmetrical, convex, smooth; left lacinia mobilis rod-like, right lacinia mobilis absent; accessory setal row with 5 or less robust setae, with distal setal tuft; molar a setose tongue, occasionally with small triturating surface, or large flap-like, weakly setose; palp inserted approximately mid-anteriorly. *Maxilla 1*, inner plate with 2 apical pappose setae, one very broad at base; outer plate with setal-teeth in 7/4 arrangement (or rarely in 8/3 crown arrangement); setal-teeth large; setal-tooth 6 slender, setal-tooth 7 slender, slightly or strongly displaced from setal-tooth 6; palp large, with apical robust setae and subterminal lateral notch. *Maxilla 2*, inner plate not significantly shorter than outer plate, without oblique row of facial setae. *Maxilliped*, coxa and basis normal; outer plate medial setae small, blunt or bead-shaped, outer plate without apical setae; palp 4-articulate, article 4 well-developed. *Gnathopod 1*, subchelate or parachelate; coxa large but shorter than coxa 2 and tapering distally, or reduced; merus and carpus not rotated; ischium short; carpus short; propodus large; dactylus slightly curved. *Gnathopod 2*, coxa large, subequal in size to coxa 3; carpus rectolinear or rectangular, with palmate setae; propodus rectangular, with palmate setae; dactylus minute. *Pereopods*, all simple; distal spurs absent. *Pereopod 4*, coxa with well-developed posteroventral lobe. *Pereopod 5*, coxa anterior and posterior lobes subequal. *Pereopod 6*, coxa posterior lobe slightly deeper than anterior lobe, or much deeper than anterior lobe. *Uropod 2*, inner ramus with or without constriction. *Uropod 3*, biramous. *Telson*, cleft. (Lowry & Stoddart 2010.)

Genus *Hirondellea* Chevreux, 1889

Hirondellea Chevreux, 1889: 285; Stebbing 1906: 16; Gurjanova 1962: 88; J.L. Barnard 1969: 345; Barnard & Ingram 1990: 7; Barnard & Karaman 1991: 490; Lowry & Stoddart 2010: 38.

Tetronychia Stephenson, 1923: 63; Schellenberg 1926: 251 (type species *Tetronychia abyssalis* Stephenson, 1923 by monotypy).

Type species: *Hirondellea trioculata* Chevreux, 1889, original designation.

Remarks

The genus contains 17 species: *Hirondellea abyssalis* (Stephensen, 1923); *H. antarctica* (Schellenberg, 1926); *H. brevicaudata* Chevreux, 1910; *H. diamantina* Lowry & Stoddart, 2010; *H. dubia* Dahl, 1959; *H. endeavour* Lowry & Stoddart, 2010; *H. fidenter* Barnard, 1966; *H. franklin* Lowry & Stoddart, 2010; *H. gigas* (Birstein & Vinogradov, 1955); *H. glutonis* Barnard & Ingram, 1990; *H. guyoti* Barnard & Ingram, 1990; *H. kapala* Lowry & Stoddart, 2010; *H. naturaliste* Lowry & Stoddart, 2010; *Hirondellea namarensis* sp. nov; *H. sindhusagar* Horton & Thurston, 2009; *H. trioculata* Chevreux, 1889; *H. wolfendeni* (Tattersall, 1909).

The key to the genus *Hirondellea* has been amended after Lowry & Stoddart (2010) and included here. The material recorded by K.H. Barnard (1930) as *Hirondellea antarctica* does not key out here. Barnard recorded the posteroventral margin of epimeron 3 as rounded. It probably represents a separate species.

Key to world *Hirondellea* species

1a. Uropod 2, inner ramus incised 2
1b. Uropod 2, inner ramus not incised 12
2a. Epimeron 3, posteroventral corner produced into a large spine ..... *H. diamantina*

2b. Epimeron 3, posteroventral corner subquadrate or rounded 3
3a. Epimeron 3, posteroventral corner subquadrate 4
3b. Epimeron 3, posteroventral corner broadly rounded 7
4a. Gnathopod 2 palm large, excavate ..... *H. guyoti*
4b. Gnathopod 2 minutely subchelate or chelate 5
5a. Gnathopod 2 minutely subchelate ..... *H. antarctica*
5b. Gnathopod 2 minutely chelate 6
6a. Gnathopod 1 palm concave; dactylus with few (2) subterminal spines ..... *H. glutonis*
6b. Gnathopod 1 minutely chelate; dactylus with many subterminal spines ..... *H. trioculata*
7a. Gnathopod 2 palm short, transverse 8
7b. Gnathopod 2 minutely chelate 9
8a. Epistome strongly produced epimeron 1, anteroventral corner with a sharp, inwardly directed point ..... *H. franklin*
8b. Epistome weakly produced epimeron 1, anteroventral corner rounded ..... *H. kapala*
9a. Epistome strongly produced ventrally truncate; gnathopod 1 palm slightly excavate 10
9b. Epistome weakly produced gnathopod 1 palm straight 11
10a. Gnathopod 2 propodus slender, narrowing distally ..... *H. wolfendeni*
10b. Gnathopod 2 propodus broad, parallel-sided ..... *H. namarensis* sp. nov.
11a. Epimeron 1, anteroventral corner with a sharp, inwardly directed point ..... *H. naturaliste*
11b. Epimeron 1, anteroventral corner rounded ..... *H. fidenter*
12a. Epimeron 3, posteroventral corner produced into a large spine ..... *H. endeavour*
12b. Epimeron 3, posteroventral corner rounded or subquadrate 13
13a. Epimeron 3, posteroventral corner subquadrate 14
13b. Epimeron 3, posteroventral corner rounded 16
14a. Uropod 3 outer ramus article 2 very long, subequal to article 1 ..... *H. sindhusagar*
14b. Uropod 3 outer ramus article 2 long, about 0.4 × article 1 15
15a. Gnathopod 1, dactyl with many subterminal spines on inner margin ..... *H. gigas*
15b. Gnathopod 1, dactyl without subterminal spines on inner margin ..... *H. dubia*
16a. Gnathopod 1, dactyl as long as palm ..... *H. abyssalis*
16b. Gnathopod 1, dactyl over-reaching palm ..... *H. brevicaudata*

***Hirondellea namarensis* sp. nov.**
(Figures 1–3)

Holotype

NHMUK 2012.1051 (dissected specimen and 6 slides), 9.7 mm female, northern Mid-Atlantic Ridge, RRV *James Cook*, station number JC037/013; freefall, acoustically released, baited trap, deployed 8–10 August 2009, 49°01.16′N, 27°42.29′W, 2627 m, bottom time 41.75 h.

Paratypes

NHMUK 2012.1052–1053 (one male dissected), two males (one 7.9 mm), same station data as holotype; NHMUK 2012.1092–1096), five females, same station data as holotype.

Comparative material examined

697 specimens, Mid-Atlantic Ridge, JC037/013, 8–10 August 2009, 49°01.16′N, 27°42.29′W, 2627 m; 18 specimens, Mid-Atlantic Ridge, JC037/018, 10–17 August 2009, 49°01.2′N, 27°42.03′W, 2500 m; 15 specimens, Mid-Atlantic Ridge, JC037/025, 17–18 August 2009, 49°02.23′N, 27°53.66′W, 1830 m; 26 specimens, base of Sedlo Seamount, Azores, Stn. 56319#1, 21–23 November 2003, 40°11.43′N, 26°33.99′W, 2655 m. All retained in the Discovery Collections at the National Oceanography Centre, Southampton.

Description

Based on adult female holotype, 9.7 mm. Head: exposed, deeper than long; lateral cephalic lobe large, very broadly rounded; eyes present, faded in alcohol, sickle-shaped, non-ocellate. Antenna 1: short, 0.21 × body; peduncular article 1 short, length 1.1 × width; peduncular article 2 short, 0.25 × article 1; peduncular article 3 short, 0.2 × article 1; primary flagellum 14-articulate; accessory flagellum long, 0.6 × primary flagellum, 6-articulate, forming cap; callynophore present weak, 2-field, with 2 strong robust setae distally; calceoli absent. Antenna 2: length 1.22 × antenna 1; peduncle without brush setae; peduncular article 1 not greatly enlarged; article 3 short, 0.75 × article 4; flagellum well-developed, 16-articulate.

Mouthpart bundle: subquadrate. Epistome and upper lip separate, epistome dominant. Epistome prominent and broadly rounded. Upper lip: produced, rounded apically. Mandible: incisor ventral margin smooth with hook on internal margin; a

Figure 1. *Hirondellea namarensis* sp. nov. Holotype female, 9.7 mm, habitus, gnathopods 1 and 2, uropods and telson. See Materials and methods for explanation of abbreviations.

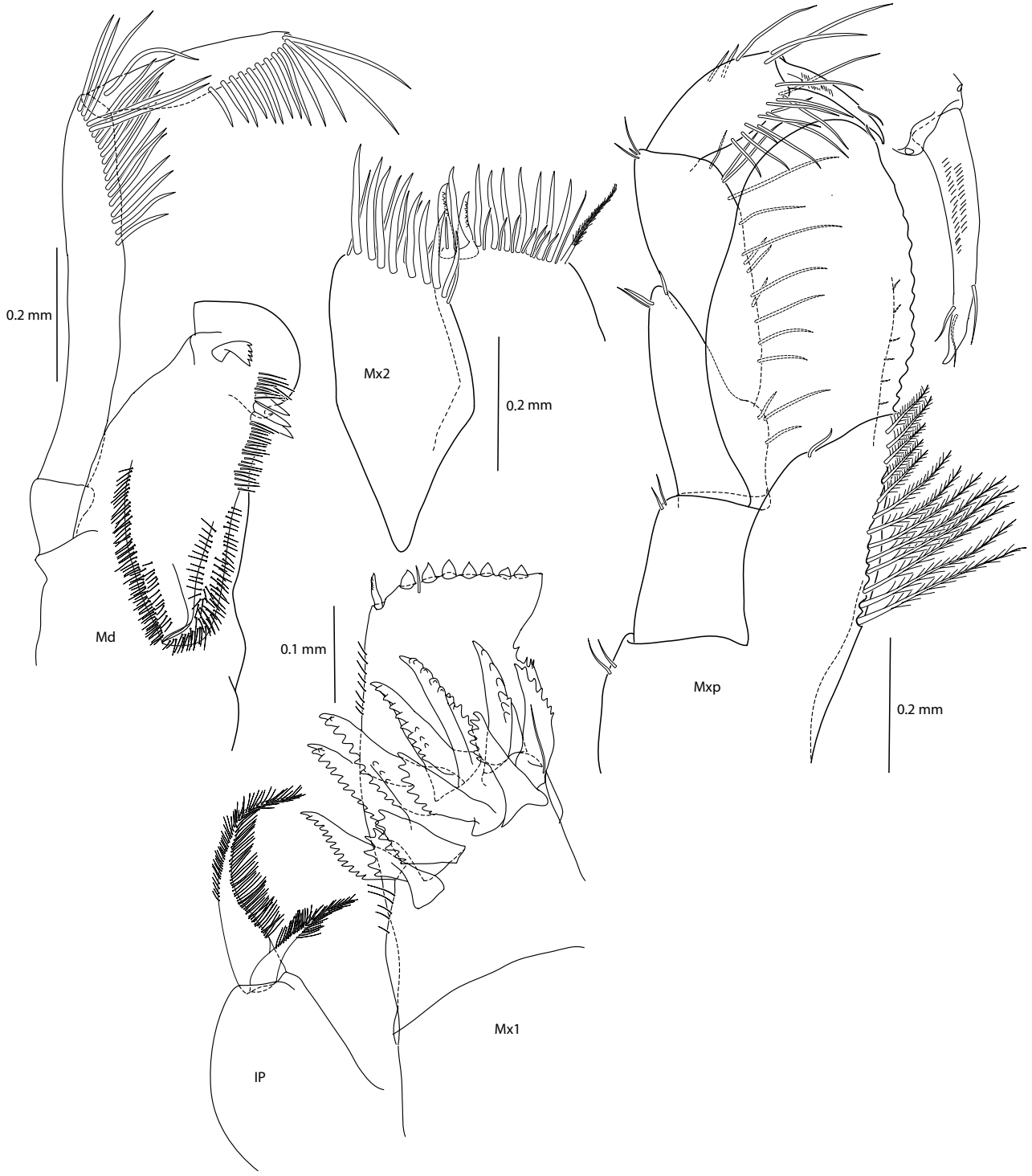

Figure 2. *Hirondellea namarensis* sp. nov. Holotype female, 9.7 mm, mouthparts. See Materials and methods for explanation of abbreviations.

small stemmed, distally serrate lacinia mobilis present on left mandible only; left accessory setal row with 3 simple robust setae; molar a setose tongue; palp attached proximal to molar; article 1 short, 1.3 × width; article 2 slender, 7.3 × width, with 19 distolateral A2 setae; article 3 slender, blade-like, with 11 D3 setae, 1 A3 seta and 2 E3 setae. Maxilla 1: inner plate narrow, with 2 apical setae, 1 enlarged and falcate; outer plate with setal teeth in 7/4 arrangement, ST1–7 large and slender, multi-cuspidate, STA–D large, broad, STA–C 6-cuspidate, STD 5-cuspidate; palp large, 2-articulate, article 2 with 7 apical robust setae, 1 flag seta, 1 subapical seta and 3/4 subterminal lateral notches. Maxilla 2: inner plate

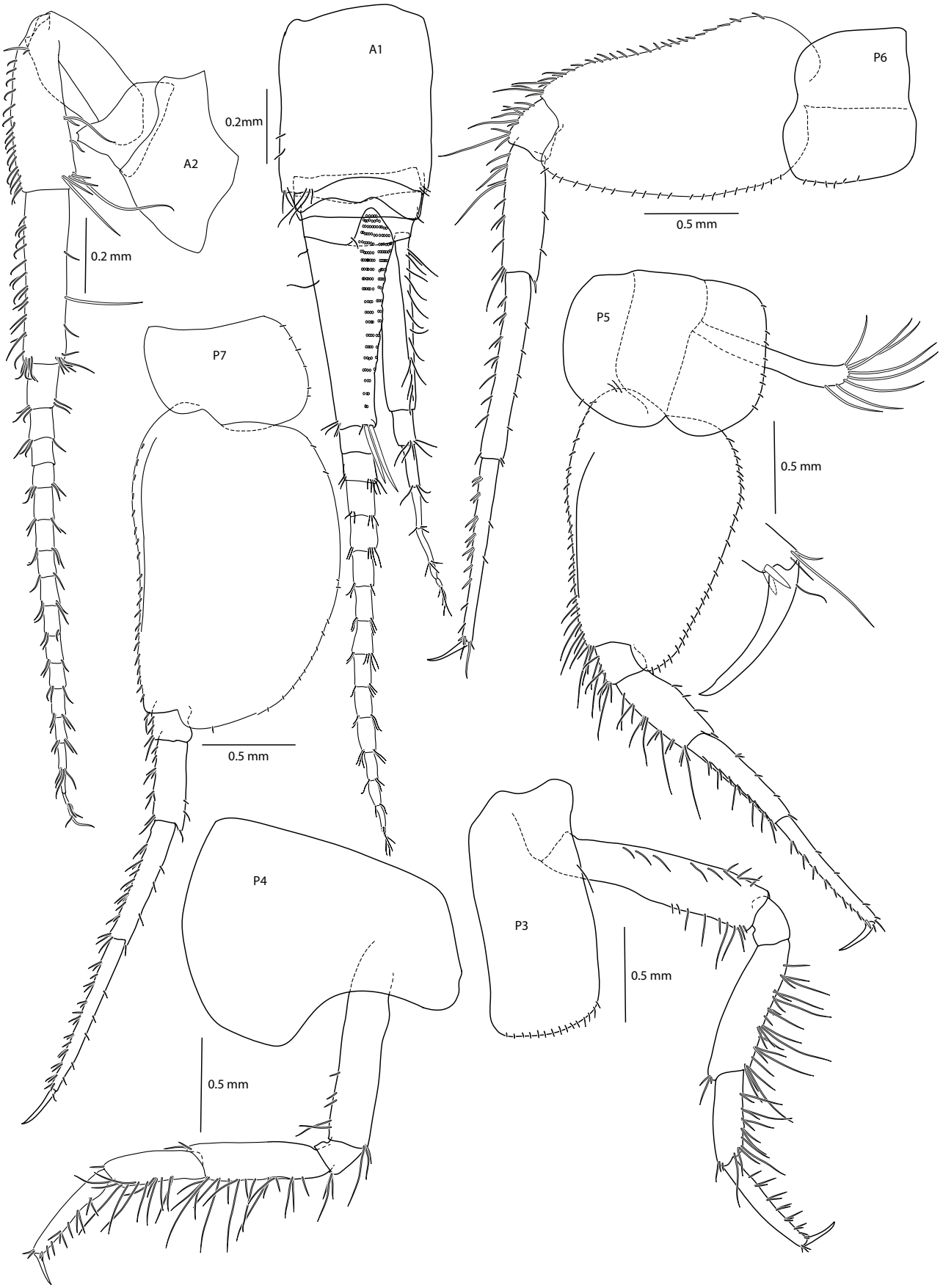

Figure 3. *Hirondellea namarensis* sp. nov. Holotype female, 9.7 mm, pereopods and antennae. See Materials and methods for explanation of abbreviations.

broad, truncate distally, just shorter than outer plate. Maxilliped: inner plate large, subovate, with 1 simple seta on apical margin; 13 plumose setae in medial setal row, decreasing in length distally; outer plate medium, ovate, with medial margin weakly crenulate; palp large, 4-articulate, article 2 slender, length 2.4 × width, article 3 long, slender, length 2.3 × width, article 4 well-developed, with 2 subterminal setae.

Gnathopod 1: subchelate; coxa reduced, shorter than coxa 2, tapered, anterior margin straight, anteroventral corner rounded; basis long, length 3.2 × width, setose anteriorly; ischium short, length 0.9 × width; carpus subtriangular, longer than propodus, length 1.5 × width; propodus margins converging distally; palmar angle acute, palm straight dactyl greatly overreaching palm edge. Gnathopod 2: minutely chelate, coxa large, a little shorter than coxa 3; ischium long, length 3.2 × width; carpus length 3.1 × width; propodus subrectangular, palmar angle obtuse, palm straight, weakly pectinate distally; dactylus inserted at anterior corner of propodus, reaching palm edge. Pereopod 3: coxa large, subrectangular; basis slender, straight, margins subparallel, propodus posterior margin with simple setae, dactylus long, weakly curved. Pereopod 4: coxa deeper than wide, with posteroventral lobe broadly rounded; propodus posterior margin with simple setae. Pereopods 5-7 distal articles slender. Pereopod 5: coxa equilobate; basis weakly expanded, posterior margin straight, posterior lobe rounded. Pereopod 6: coxa small, weakly lobate posteriorly; basis weakly expanded, posterodistal lobe rounded. Pereopod 7: coxa small, weakly lobate posteriorly; basis expanded and rounded, proximal posterior margin convex, posterodistal lobe broadly rounded.

Pleonites 1–3: smooth dorsally. Pleonite 3: extended over urus. Epimeron 1: anteroventral corner with prominent anterior-directed tooth. Epimeron 2: posteroventral corner subquadrate. Epimeron 3: posteroventral corner rounded, ventral margin without setae. Urosomite 1: anterior sinus present, boss a rounded hump. Uropod 1: peduncle subequal in length to inner ramus, without apicolateral robust setae, 1 apicomedial robust seta, and 3 dorsomedial setae; outer ramus subequal in length to inner ramus; inner ramus with 8 medial robust setae, without lateral robust setae and neither margin microsetose; outer ramus with 4 medial robust setae but without lateral robust setae. Uropod 2: peduncle 0.94 × inner ramus, with 1 apicolateral robust seta, 1 apicomedial robust seta, 4 dorsomedial robust setae, and with 2 dorsolateral robust setae; outer ramus subequal to inner ramus. Inner ramus constricted, with 6 medial robust setae, 3 lateral robust setae, and with neither margin microsetose; outer ramus with 1 medial robust seta, 7 lateral robust setae, and with medial margin microsetose. Uropod 3: peduncle 0.77 × inner ramus, 4 apicomedial robust setae, 2 medial simple slender setae; inner ramus subequal to outer ramus, with 3 medial robust setae and 4 lateral setae; outer ramus 2-articulate, article 2 0.4 × article 1, with medial margin microsetose, article 1 with tooth on medial margin, 2 lateral robust setae; joint between articles 1 and 2 strongly oblique. Telson: broad, slightly tapering, length 1.6 × breadth, cleft 50%; lobes with 4 dorsal robust setae, apices incised with 1 robust seta.

Male

As for female except antenna 1 with 11 articles in the primary flagellum and a greater number of aesthetascs. Antenna 2: calceoli present on articles of the flagellum.

Etymology

The specific name *namarensis* refers to a contraction of the type locality – the *N*orth *A*tlantic *M*id-*A*tlantic *R*idge.

Remarks

This new species resembles very closely *Hirondellea wolfendeni* (Tattersall, 1909) which was transferred to this genus from *Anonyx* by Lowry & Stoddart (2010). In order to compare *Hirondellea wolfendeni* with our material we attempted to locate the type material. In the same paper, Tattersall also described a new genus and species of bathypelagic isopod, *Xenuraega ptilocera* Tattersall, 1909, which was redescribed by Bruce (1993) who stated in his introduction: 'It would seem that much of the material collected by Wolfenden during his extensive north Atlantic oceanographic expeditions was not deposited in any museum, but retained in his own collections'. Dr. Richard Norris Wolfenden (1854–1926), was a British copepod specialist. He undertook extensive north Atlantic oceanographic expeditions from 1899 until 1905, to the Azores, Madeira and Gibraltar. He sent much of the material from the cruises to different specialists and published on radiolarians and copepods. Although many of Wolfenden's specimens were given to The Natural History Museum, London (Damkaer 2000), the type material of *Hirondellea wolfendeni* is not amongst them (M. Lowe, pers. comm.). Tattersall spent the last 20 years of his life working in the Department of Zoology, University College Cardiff. The Department donated Tattersall material to the National Museum of Wales in the early 1980s (A. Mackie,

pers. comm.). It appears that although the holotype of *Xenuraega ptilocera* (NMW.Z.1983.004.29), thought lost by Bruce (1993), has been located, there is no evidence to show that the type material of *Anonyx wolfendeni* was transferred at the same time. We can only assume that the type material is very likely to have been lost.

Despite the lack of type material, Tattersall's description and illustration are adequate to make a comparison with this new material, which was taken from the same region as the single specimen collected by Wolfenden (near the Azores, 39°53′N, 26°32′W, in 600–700 fathoms (1097–1280 m)). *Hirondellea namarensis* differs from *H. wolfendeni* in having broadly rounded rather than straight head lobes (as indicated in Tattersall's description, not apparent in his illustrations). Whereas Tattersall's specimen did not have eyes, a faded eye can be distinguished in our material. It is possible that the eye on Tattersall's specimen had faded in alcohol and could no longer be seen. Antenna 2 articles 4 and 5 are subequal in length (Tattersall's illustration shows article 5 to be about 1/3 longer than article 4). The mandible in Tattersall's illustration is unclear and appears to depict a well-developed columnar molar, while that in our material shows a setose tongue. The mandibular palp article 2 has 19 setae, article 3 has 13 setae (cf. 11 and 14 in *H. wolfendeni*). The shape of the maxilliped outer plate differs and exceeds article 2 of the palp in the new species while it is exceeded by article 2 in Tattersall's material. The most striking difference and what can be considered the key character is the shape of the propod of gnathopod 2, which in *H. namarensis* is parallel sided with a robust anterodistal margin. The gnathopod 2 propod in *H. wolfendeni* narrows distally and is more slender. Pereopod 7 propodus is longer than carpus (about 1/3 longer) in *H. namarensis*, while *H. wolfendeni* has the propodus subequal to the carpus. Unfortunately, the form of epimeron 1 is not illustrated or mentioned in Tattersall's description so we do not know if it has an anterior-directed hook or not. Similarly, we have no information on the urosome 1 boss.

Hirondellea namarensis sp. nov. differs from *H. endeavour*, *H. sindhusagar*, *H. gigas*, *H. dubia*, *H. abyssalis* and *H. brevicaudata* in possessing an incised inner ramus of uropod 2. *Hirondellea namarensis* sp. nov. has an anteriorly directed spine on epimeron 1 which distinguishes it from *H. glutonis*, *H. fidenter*, *H. kapala* and *H. trioculata*. Of the remaining 5 species possessing an incised inner ramus of uropod 2 and an anteriorly directed spine on epimeron 1, *H. namarensis* sp. nov. differs from *H. guyoti* in the gnathopod 2 palm which is not large and deeply excavate; from *H. diamantina* in having a broadly rounded epimeron 3 (not produced into a large spine); from *H. franklin* in the longer telson and broadly rounded head lobe (not acute); from *H. naturaliste* in the form of the gnathopods and the broadly rounded (not truncated) epistome; from *H. antarctica* in the straight palm of gnathopod 1 (not strongly concave).

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