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Ten thousand kilometres away and still the same species? The mystery of identity of *Scopelocheirus* sp. (Amphipoda: Scopelocheiridae) from the South Atlantic

Michael L. Zettler[1], Ralf Bastrop[2], and James K. Lowry[3]†

[1] Leibniz Institute for Baltic Sea Research, Seestraße 15, 18115 Rostock-Warnemünde, Germany

[2] University of Rostock, Animal Physiology, Albert-Einstein-Str. 1, 18051 Rostock, Germany

[3] Australian Museum Research Institute,
Australian Museum, 1 William Street, Sydney NSW 2010, Australia (deceased 4 November 2021)

Abstract. During two campaigns, one in the Kattegat (Denmark) in 2018, and the other off Namibia in 2019, the same fish baited trap was applied to catch scavenging amphipods at two stations each. The water depths in both areas were between 50 and 130 m. In addition to very few individuals of other species (Isopoda and Amphipoda), the samples consisted mainly of *Scopelocheirus* sp. The species from the Kattegat was identified as *S. hopei*. The question arises as to whether it is possible that the same species could dominate scavenging communities in sea areas more than 10,000 km apart. At first glance, the scopelocheirid amphipods of the northern and southern hemispheres appear identical, but subtle morphological and large genetic differences led to the conclusion that we are dealing with a previously undescribed species off Namibia. We have named it *Scopelocheirus sossi* sp. nov.

Introduction

Scavenging amphipods have a widespread distribution and occur mainly in the deep sea. Most of them belong to the Parvorder Lysianassidira, which includes the family Scopelocheiridae Lowry & Stoddart, 1997. It is a small family of scavenging amphipods containing two subfamilies, Scopelocheirinae Kilgallen & Lowry, 2015 and Paracallisominae Kilgallen & Lowry, 2015. The Scopelocheirinae contains three genera (*Aroui* Chevreux, 1911; *Paracallisomopsis* Gurjanova, 1962; *Scopelocheirus* Spence Bate, 1857), and eight species that live in temperate and boreal waters and, unlike many other scavenger species, live mainly in shallow waters of the Mediterranean, the North and South Atlantic, and the Pacific. They are scavengers feeding on carrion at the sea bed, with only few exceptions (Lowry & Stoddart, 1989). One of the most common representatives of this subfamily is *Scopelocheirus hopei* (Costa *in* Hope, 1851). It has a wide geographical distribution in the Atlantic (Kilgallen & Lowry, 2015), with records ranging from the Barents Sea (Gurjanova, 1951) in the North to Guinea-Bissau (Mateus & Mateus, 1986) in the South. It has been recorded in the North Atlantic Ocean (Stebbing, 1906; Chevreux & Fage, 1925; Palerud & Vader, 1991), in the English Channel (Dauvin, 1988), around the British Isles (Stebbing, 1906; Chevreux & Fage, 1925; Lincoln, 1979; Nickell & Moore, 1991), in the North Sea and the Norwegian Sea (Sars, 1895; Stebbing, 1906; Palerud & Vader, 1991) and in the Baltic Sea (Stebbing, 1906; Zettler & Zettler, 2017). It is also present in the Mediterranean Sea (Costa, 1851; Stebbing, 1906; Chevreux & Fage, 1925; Diviacco & Ruffo, 1989; Albertelli *et al.*, 1992; Kaïm-Malka, 2003). This

Keywords: Denmark, Namibia, *Scopelocheirus hopei*, *Scopelocheirus sossi* sp. nov., taxonomy, DNA barcodes, 18s rRNA
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ORCID iD: Michael L. Zettler 0000-0002-5437-5495, Ralf Bastrop 0000-0003-2772-2970, James K. Lowry 0000-0003-0437-6753
Corresponding author: Michael L. Zettler michael.zettler@io-warnemuende.de
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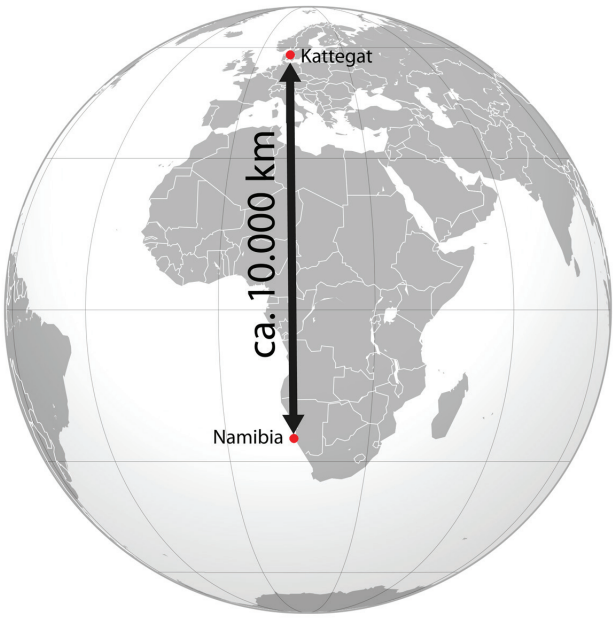

Figure 1. Sampling points are indicated by red dots.

species is present over a wide bathymetric range, from the circalittoral zone to the bathyal-abyssal zone, and it has been collected at depths ranging from 15 to 2,620 m (Kilgallen & Lowry, 2015; Zettler & Zettler, 2017).

During sampling campaigns using fish-baited amphipod traps in the Kattegat (Denmark) and southern Atlantic (Namibia), we found the genus *Scopelocheirus*. At first glance, the scopelocheirid amphipods of the northern and southern hemispheres appear identical. Using morphological and genetic methods, we were able to establish that there are two very similar species of the same genus.

Material and methods

Benthic organisms were collected with a fish-baited amphipod trap at water depths between 50 and 130 m during cruises of the RV "Elisabeth Mann Borgese" in 2018 in the Kattegat (Denmark) and the RV "Meteor" in 2019 in waters off Namibia (Fig. 1). The trap (Fig. 2) was mounted on a lander system about 1 m above the sea floor for between 17 and 40 hours. The two sampled stations in the Kattegat were northeast of the Danish island of Anholt in water depths between 50 and 118 m (see Table 1). The introduction to the Kattegat area is exemplarily described in ecological studies by Göransson (2017) and Josefson *et al.* (2017).

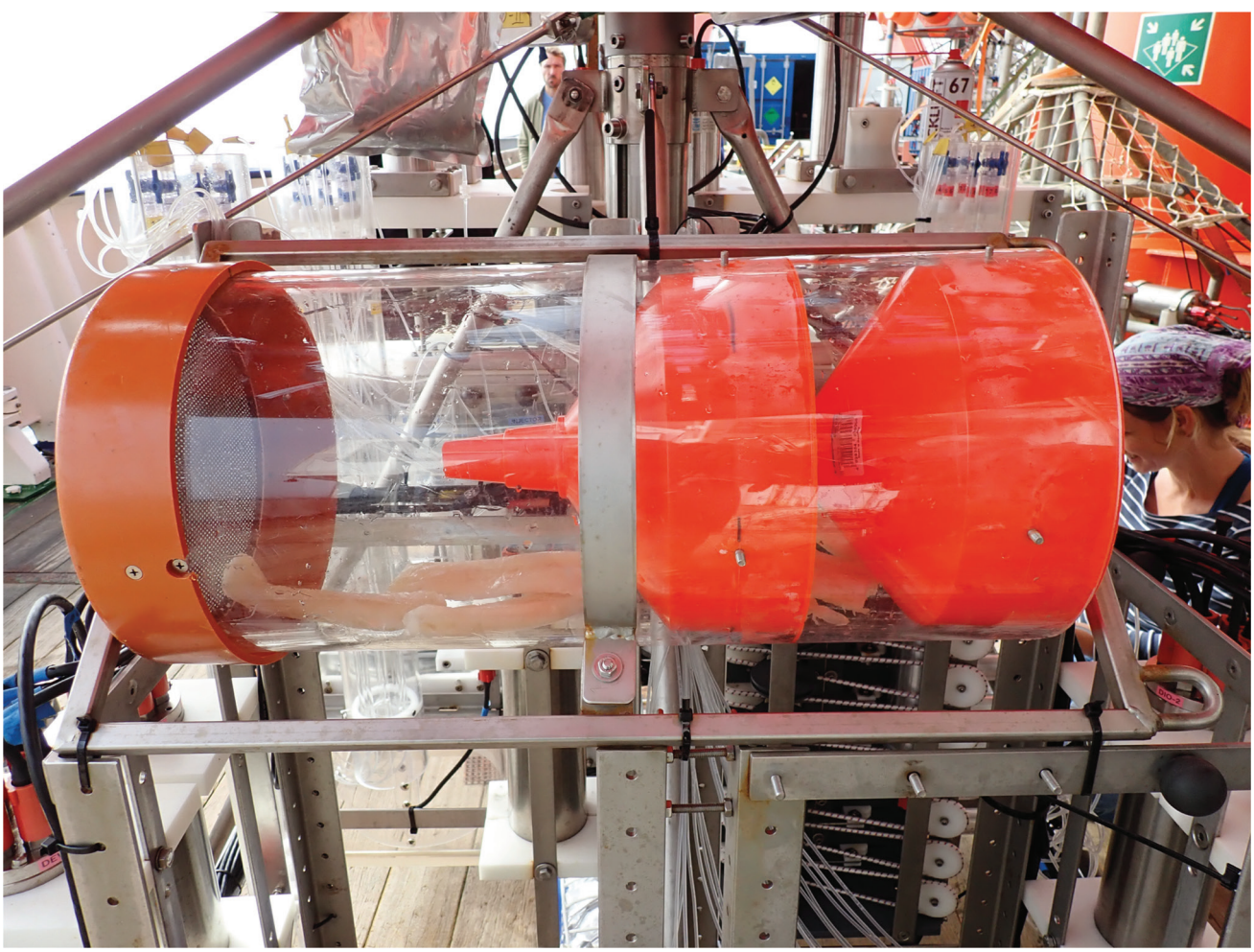

Figure 2. Double parlour style amphipod trap with fish bait mounted on lander system at *ca.* 1 m above seabed.

Table 1. List of sampling stations, where, and for how long, the amphipod traps were exposed.

station number	latitude	longitude	depth (m)	date	duration (h)
PP46	56.8492°N	11.7498°E	50	27 Aug 2018	25
PP63	57.0451°N	11.6441°E	118	29 Aug 2018	17
M157-41	25.0000°S	14.3775°E	130	05 Sep 2019	40
M157-43	25.0001°S	14.5611°E	107	06 Sep 2019	37

The two stations off Namibia were about 100 km west of Sossusvlei (Namib Desert) in 107 and 130 m water depth, respectively (see Table 1). The marine environment off Namibia belongs to the Benguela Current Large Marine Ecosystem (BCLME), which is one of the world's largest coastal upwelling areas. The introduction into the investigation area is comprehensively described in several ecological studies (Shannon *et al.*, 2006; Eisenbarth & Zettler, 2016; Zettler *et al.*, 2009, 2013; Zettler & Pollehne, 2013).

All samples were fixed in 70% ethanol solution on board. The animals were later examined using a compound microscope with up to 800× magnification. Dissected appendages were mounted in glycerine on non-permanent slides. Digital microphotographs were made using an AxioCam ICC3 and ERc5s (Carl Zeiss MicroImaging GmbH, Jena) and AxioVision software (Carl Zeiss Imaging Solutions GmbH, Jena). The resulting files were imported into Adobe Illustrator CS5 (Adobe Systems Incorporated) and digital line drawings made using a WACOM Intuos digitiser board and a microscope for zooming and controlling. The type material and other specimens of *Scopelocheirus sossi* sp. nov. are deposited in the collections of the Museum für Naturkunde, Berlin, Germany (ZMB).

Three specimens of *Scopelocheirus sossi* sp. nov. were included in the genetic study. The study of *Scopelocheirus hopei* was discontinued because the fixation of the animals after capture did not allow isolation of suitable DNA and thus no further processing.

Total DNA was extracted from ethanol preserved tissue by a silica gel-based spin column procedure according to the protocol of the innuPREP DNA Mini Kit (AJ Innuscreen GmbH). PCR amplification of cytochrome c oxidase subunit I (COI)] was carried out in 30 µL reactions containing 2-3µl DNA template, 3 µl 10× reaction buffer, 3.0 mM MgCl2, 250 µ M of each dNTP, 10 pmol of each primer and 1.1 U of Taq polymerase. All chemicals and primers were purchased from Merck (Sigma-Aldrich). Primer sequences for PCR and sequencing are listed in Table 2. New COI primers were designed using the available GenBank sequences of *Scopelocheirus* spp. New 18S primers were designed by

Table 2. Primers used for amplification and sequencing of three molecular marker genes.

gene/primer	sequence (5'–3')	direction	reference
18S rDNA			
1F	TACCTGGTTGATCCTGCCAGTAG	forward	Giribet *et al*., 1996
3F	GTTCGATTCCGGAGAGGGA	forward	Giribet *et al*., 1996
9R	GATCCTTCCGCAGGTTCACCTAC	reverse	Giribet *et al*., 1996
18Sa2.0	ATGGTTGCAAAGCTGAAAC	forward	Whiting *et al*., 1997
18Sbi	GAGTCTCGTTCGTTATCGGA	reverse	Whiting *et al*., 1997
18Sfw	CCTAYCTGGTTGATCCTGCCAGT	forward	Englisch & Koenemann, 2001
18F997	TTCGAAGACGATCAGATACCG	forward	Struck *et al*., 2002
18 L	GAATTACCGCGGCTGCTGGCACC	reverse	Halanych *et al*., 1995
18Srev	TAATGATCCTTCCGCAGGTT	reverse	Englisch & Koenemann, 2001
Sossi_18Sf1	GTAGTGACGAAATCTAACGATGCG	forward	present study
Sossi_18Sf2	AGGCACGCAAATTACCCAATCC	forward	present study
Sossi_18Sr1	GTAGCGCGCGTGCGGCCCAGAAC	reverse	present study
Sossi_18Sr2	GTTACCCGCTCCTGTCGGAGTAGG	reverse	present study
28S rDNA			
28Srd4.8a	ACCTATTCTCAAACTTTAAATGG	forward	Schwendinger & Giribet, 2005
28Srd7b1	GACTTCCCTTACCTACAT	reverse	Schwendinger & Giribet, 2005
COI			
HCO2198	TAAACTTCAGGGTGACCAAAAAATCA	reverse	Folmer *et al*., 1994
Sco_COIintf1	ATYYTAGGTGCCTGAKCAAGAG	forward	present study
Sco_COIintf2	GTARTWGTDACWGCTCATGCTTTTG	forward	present study
Sco_COIintf3	TCAACAGTRATTAATATACGAAG	forward	present study
Sco_COIintf4	GTAGAAAGAGGAGTAGGDACTGG	forward	present study
Sco_COIintr1	CTTCGTATATTAATYACTGTTGA	reverse	present study
Sco_COIintr2	CCAGTHCCTACTCCTCTTTCTAC	reverse	present study
Sco_COIintr3	GGGTCWCCTCCWCCWCTWGGGTCAA	reverse	present study

Figure 3. Habitus photograph of *Scopelocheirus hopei* (Costa *in* Hope, 1851), male, 6 mm, Kattegat (Denmark), stn. PP46.

using *S. sossi* sp. nov. 18S sequences. PCR temperature profile for amplification consisted of the following steps: initial denaturation at 94°C for 1 min; 38 cycles of 30 s at 94°C, 30 s at 50°C and 1 min at 72°C, followed by 5 min at 72°C. For amplification of 18S the PCR reaction (30 µL) consisted of 250 µM of each dNTP, 10 pmol of each primer, 1.1 U of Taq polymerase, 3 µ l 10× reaction buffer, 1.5 mM $MgCl_2$, and 3 µl DNA template. PCR profile was: 94°C for 5 min; 38 cycles of 30 s at 94°C, 50 s at 52°C and 3 min 20 s at 72°C; and 7 min at 70°C. PCR product purification procedure: The PCR products were extracted from agarose gel following to the protocol of the innuPREP Gel Extraction Kit (AJ Innuscreen GmbH).

The sequencing of PCR products was performed using dideoxy chain termination method and cycle sequencing (Sanger *et al.*, 1977) using "BigDyeTM Terminator v.1.1 Cycle Sequencing Kit" (Applied BiosystemsTM). The primers used for sequencing were the same as those for PCR amplification. Sequencing products were purified following the GenomeLab Sequencing Chemistry Protocol 3.2 (Beckman Coulter). The cycle sequencing products were analysed by using capillary separation on an Applied Biosystems Genetic Analyzer 3130xl (Hitachi) and were sequenced in both directions. All sequences obtained in this study were deposited to NCBI GenBank (see Table 3). Recorded DNA sequences were manually checked and aligned with BioEdit (Hall, 1999).

Permits for sampling from Namibian authorities. National Commission on Research, Science and Technology: RPIV00812019

Abbreviations. A 1,2 = antenna 1,2; L = labium; LM = labrum; Md = mandible; Mx1,2 = maxilla 1, 2; Mp = maxilliped; G 1,2 = gnathopods 1,2; P 3–7 = pereopods 3–7; E 1–3 = epimeral plates 1–3; U 1–3 = uropods 1–3; T = telson; ZMB = Zoological Museum Berlin

Table 3. Sequence data of *Scopelocheirus sossi* sp. nov. and GenBank accession numbers. Identical sequences were determined for all examined individuals for the respective sequence fragment.

	18S rDNA	28S rDNA	COI
accession numbers	OM503026	OM523028	OM480647
base pairs	2272	472	586

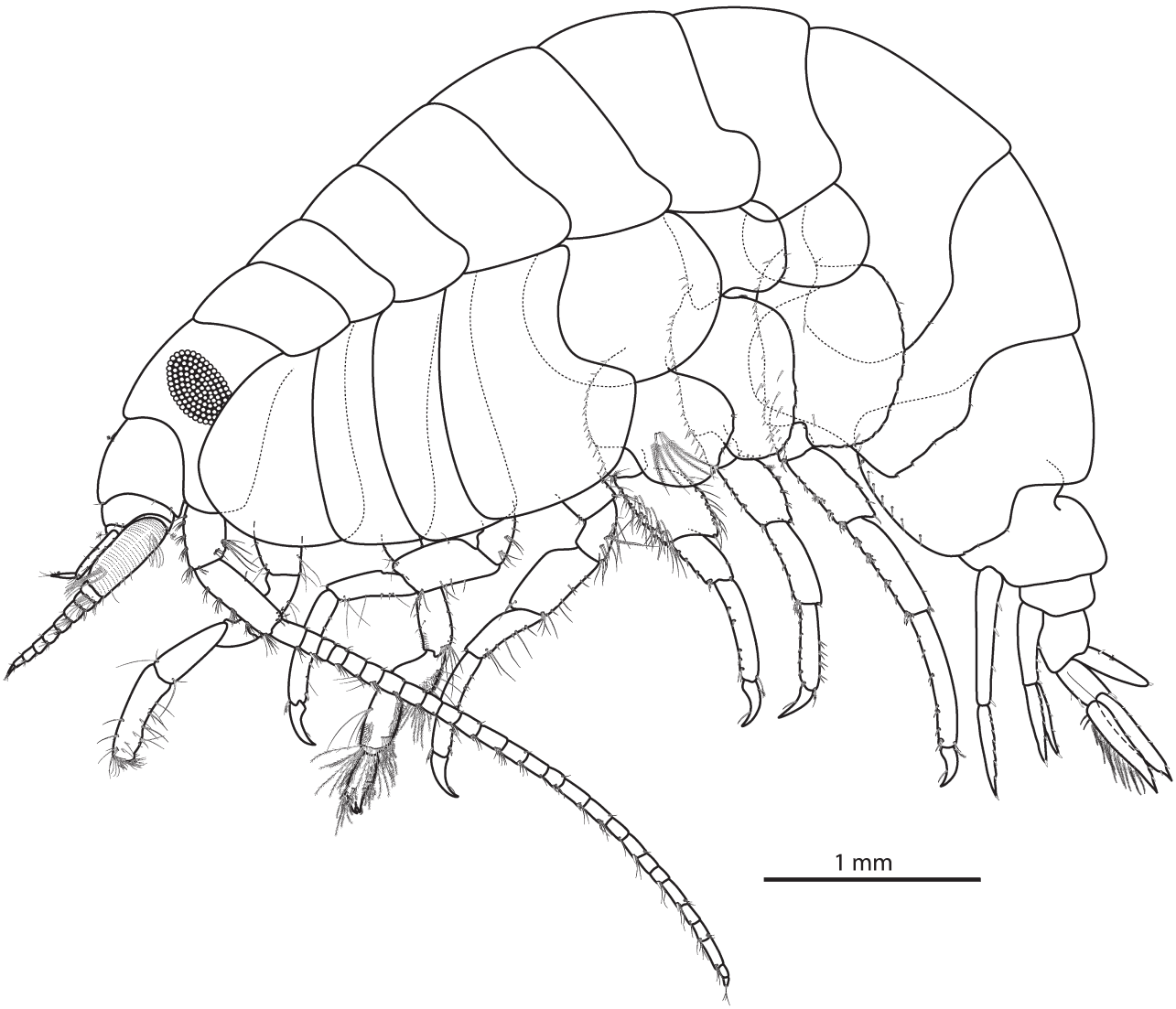

Figure 4. *Scopelocheirus hopei* (Costa *in* Hope, 1851), male, 5.9 mm, Kattegat (Denmark), habitus, Stn. PP46.

Systematics

Suborder Amphilochidea Lowry & Myers, 2017

Infraorder Lysianassida Lowry & Myers, 2017

Parvorder Lysianassidira Lowry & Myers, 2017

Superfamily Lysianassoidea Dana, 1849

Family Scopelocheiridae Lowry & Stoddart, 1997

Subfamily Scopelocheirinae Kilgallen & Lowry, 2015

Scopelocheirus Spence Bate, 1857

Callisoma O. G. Costa, 1838: 5 (nomen nudum)—A. Costa, 1851: 1 (homonym, Coleoptera).—Lilljeborg, 1865a: 33.—Lilljeborg, 1865b: 23.—Heller, 1866: 26.—Boeck, 1871: 101.—Boeck, 1872: 131.—G. O. Sars, 1890: 52.—Della Valle, 1893: 838.

Scopelocheirus Spence Bate, 1857: 138.—Stebbing, 1906: 61.—Chevreux & Fage, 1925: 54.—Stephensen, 1929: 64.—Schellenberg, 1942: 110.—Gurjanova, 1951: 241.—J. L. Barnard, 1969: 362.—Lincoln, 1979: 50.—Diviacco & Ruffo, 1989: 542.—Barnard & Karaman, 1991: 528, 434 (key), 454 (key).

Diagnosis. Mandible lacinia mobilis a stemmed, distally expanded, irregularly cusped blade; palp article 2 broadened. Maxilla 2 inner plate slightly longer than outer; outer plate without long distally barbed slender setae. Gnathopod 1 coxa margins diverging distally. Pereopod 5 slightly wider than long; basis greatly expanded posteriorly (after Kilgallen & Lowry, 2015).

Type species. *Scopelocheirus crenatus* Spence Bate, 1857.

Included species. *S. crenatus* Spence Bate, 1857, *S. hopei* (Costa *in* Hope, 1851), *S. polymedus* Bellan-Santini, 1985, *S. sossi* sp. nov.

Remarks. Until the revision of the scopelocheirid amphipods by Kilgallen & Lowry (2015), *Scopelocheirus crenatus* Spence Bate, 1857 was treated by many authors as a junior synonym of *S. hopei* (Costa *in* Hope, 1851). However, as these names have been recorded many times in the literature and appear common in the north-east Atlantic and Mediterranean, the result is a confused synonymy. As noted by Kilgallen & Lowry (2015) the issue is still not sufficiently resolved, as this will require an extensive, detailed study of materials from the type localities and known distributions of both species. This is beyond the scope of this study.

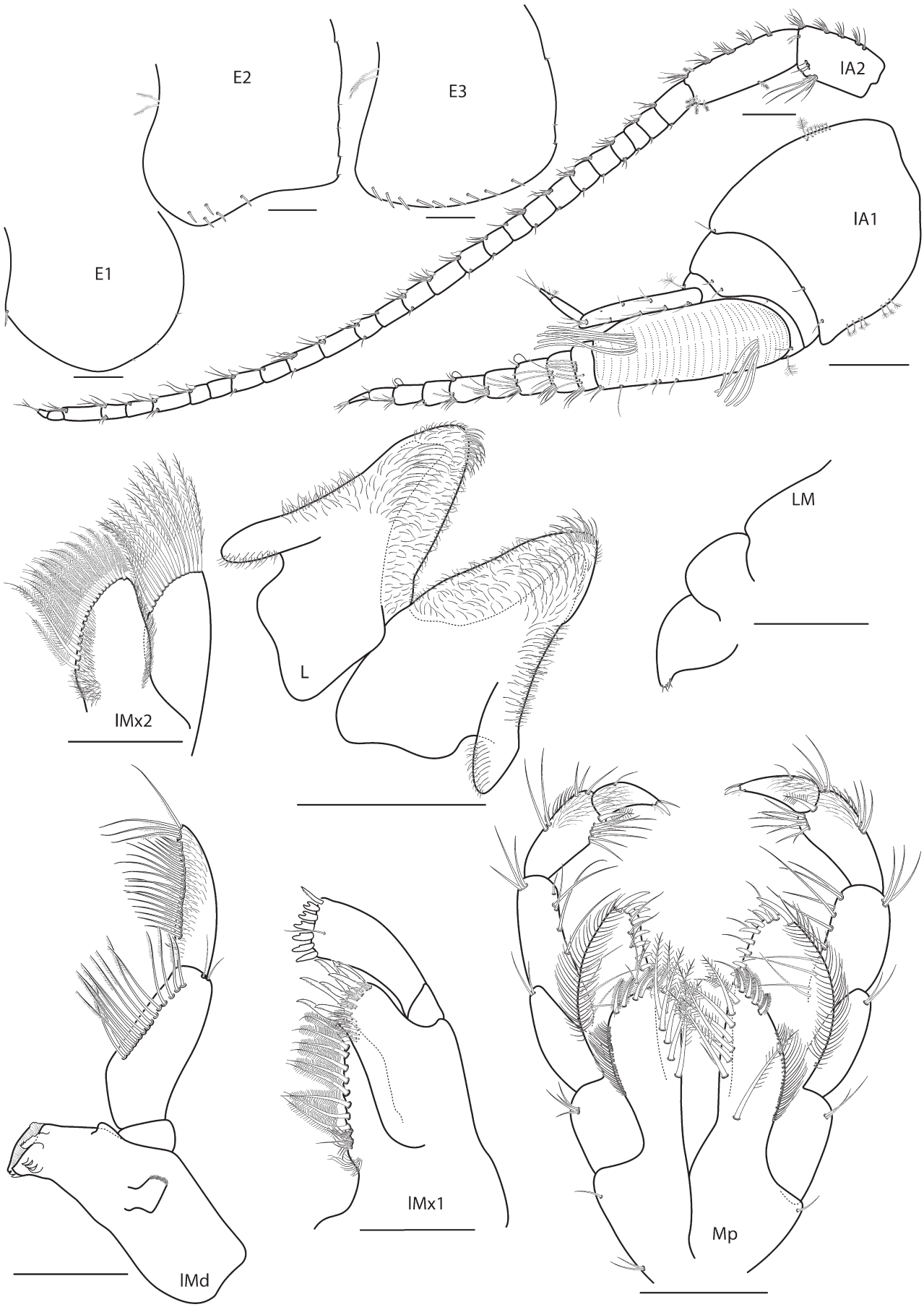

Figure 5. *Scopelocheirus hopei* (Costa *in* Hope, 1851), male, 5.9 mm, Kattegat (Denmark), scale bar 200 µm, Stn. PP46.

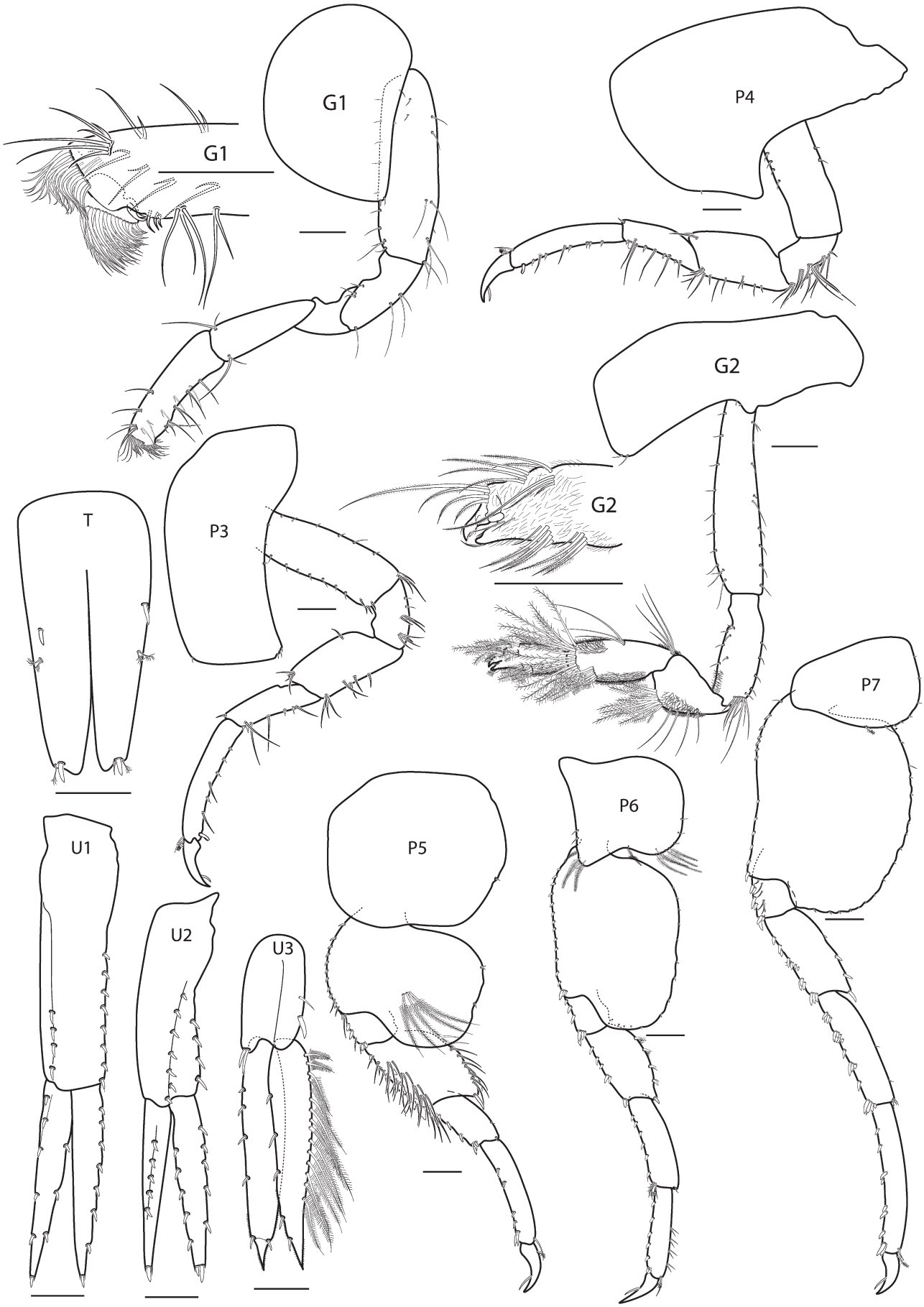

Figure 6. *Scopelocheirus hopei* (Costa *in* Hope, 1851), male, 5.9 mm, Kattegat (Denmark), scale bar 200 µm, Stn. PP46.

Scopelocheirus hopei (Costa *in* Hope, 1851)

Figs 3–6

Callisoma hopei Costa, 1851: 5–6, pl. 8, figs 1–2
Anonyx kroyeri Bruzelius, 1859: 45–46, pl. 2, fig. 7
Callisoma kroyeri.—Sars, 1890: 54–55, pl. 19, fig. 2.—Lilljeborg, 1865a: 33–34
Scopelocheirus hopei.—Stebbing, 1906: 62.—Stephensen, 1923: 15–16.—Chevreux & Fage, 1925: 55–56, fig. 39–40.—Stephensen, 1928: 79, fig. 12(20).—Stephensen, 1929: 64, fig. 16(47).—Oldevig, 1933: 42, fig. 2 on p. 41.—Schellenberg, 1942: 111, fig. 88.—Stephensen, 1942: 76.—Lincoln, 1979: 50, fig. 16.—Diviacco & Ruffo (*in* Ruffo, 1989): 544, fig. 372.—Kilgallen & Lowry, 2015: 9–12.—Zettler & Zettler, 2017: 80–83, figs. 47–49

Type locality. Mediterranean Sea, Gulf of Naples (Italy)

Material examined. Stn. PP46: Denmark, Kattegat, water depth 50 m; amphipod trap; 56.8492°N; 11.7498°E; salinity at bottom 33 psu, temperature at bottom 10°C, oxygen 4.25 ml/l, collected 27 Aug 2018; several hundred individuals, males and females. Stn. PP63: Denmark, Kattegat water depth 118 m; amphipod trap; 57.0451°N; 11.6441°E; salinity at bottom 33.5 psu, temperature at bottom 9°C, oxygen 4.0 ml/l, collected 29 Aug 2018; several hundred individuals, males and females.

Remarks. Although the material from the Kattegat evaluated here falls exactly within the range of variation of *Scopelocheirus hopei* (see Zettler & Zettler, 2017), a differentiation from *S. crenatus* Spence Bate, 1857 (and less critically also from *S. polymedus* Bellan-Santini, 1985) cannot be made. Even considering the arguments of Sars (1890), Diviacco & Ruffo (1989), and Kilgallen & Lowry (2015), we find the distinguishing features of the two latter to be ambiguous. *Scopelocheirus hopei* and *S. crenatus* co-occur in the North Atlantic and North Sea, and *S. hopei* and *S. polymedus* in the Mediterranean Sea. However, the latter is restricted to the bathyal and the others are more common on the shelf. It is very likely that many of the deeper records of *S. hopei*, particularly those from the Mediterranean region, are in fact misidentifications of *S. polymedus* and should be re-examined to confirm their identity (Kilgallen & Lowry, 2015). Two species have been genetically identified in the North Atlantic (see Fig. 11); *S. hopei* from the North Sea (Raupach *et al.*, 2015) and an undetermined *Scopelocheirus* sp. occurring around Iceland (Jażdżewska *et al.*, 2018). Unfortunately, no material from the Mediterranean Sea, the type locality of *S. hopei* and *S. polymedus*, has been analysed to date. We have identified the specimen collected in the Kattegat as *S. hopei* based on our own experience and high probability (see Zettler & Zettler, 2017), but until further research this cannot be consolidated, as mentioned above. Therefore, we provide here full illustrations of the entity from the Kattegat, to facilitate any further research on this issue.

Scopelocheirus sossi sp. nov.

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Figs 7–10

Holotype: Male, 6.6 mm, ZMB 34580, Namibia, Namib Desert Coast, 25.0000°S 14.3775°E, water depth 130 m, amphipod trap, Stn. M157_41, salinity at bottom 33.6 psu, temperature at bottom 10.5°C, oxygen 0.22 ml/l, collected 5 Sept 2019. **Paratypes**: Paratype 1, male, 6.6 mm, ZMB 34581, data same as holotype; Paratype 2, female, 7.6 mm, ZMB 34582, data same as holotype.

Other material examined. 18 individuals, ZMB 34583, data same as holotype; 20 individuals, ZMB 34584, Namibia, Namib Desert Coast, 25.0001°S 14.5611°E, water depth 107 m, amphipod trap, Stn. M157_43, salinity at bottom 34.9 psu, temperature at bottom 10.7°C, oxygen 2.93 ml/l, collected 6 Sept 2019.

Type locality. Namibia (Province Hardap) about 100 km west of Sossusvlei (Namib Desert), 25.0000°S; 14.3775°E, in 130 m water depth.

Etymology. The name "sossi" is the Latin genitive of "sossus" and is Nama for "no return" or "dead end" and refers to Sossusvlei, a salt and clay pan, located in the southern part of the Namib Desert, which is about 100 km east of the locus typicus.

Diagnosis. Lateral cephalic lobe weak triangulate. Eyes elongated oval. Slender shape of palpus of maxilla 1. Outer and inner plate of maxilla 2 subequal, both with feathered setae. Dorsal-anterior margin of segment 2 of mandible palp without setation. Coxae 1–4 lacking ventral setae. Basis of pereopod 5 wider than long with a brush of 8 or 9 feathered setae in the inner side. Clear longitudinal keel on basis of pereopod 5–7. Epimeral plate 2, ventral margin slightly concave with up to 6 setae anteroventrally, posteroventral corner rectangular. Uropods 1 and 2 sparsely spinose. Uropod 3, inner ramus reaching end of proximal article of outer ramus; inner ramus lined with plumose setae along medial margin.

Description. Based on male holotype, 6.6 mm. **Head**. *Head* lateral cephalic lobe weak triangulate, eyes elongated oval, of medium size. *Antenna 1* short. Peduncle almost as long as head; peduncular article 1 very stout, as long as wide, dorsal margin with a row of 8 palm-like setae, ventral margin with a row of palm-like spines; peduncular articles 2 and 3 very short. Primary flagellum short, 11-articulate, 2 times as long as peduncle; flagellar article 1 large, callynophore well developed. Accessory flagellum 0.5 times as long as primary flagellum, 3-articulate; article 1 as long as primary flagellar article 1, calceoli absent. *Antenna 2* longer than antenna 1, about half as long as body; peduncular articles 4 and 5 subequal in length; flagellum 28-articulate, calceoli absent. *Labrum* with epistome, slightly produced frontally, vaulted. *Mandible* incisor broad, cutting margin smooth and slightly convex, with blunt cusp on each side, 1 subacute tooth (left) and 3 acute teeth (right) on medial side. Lacinia mobilis on left, stemmed, expanded distally, with irregularly cusped blade. Palp attached midway, 3-articulate; article 2 longest, slightly swollen anteriorly, with oblique row of 15 setae distally; article 3 weakly falcate, 0.7 × as long as article 2,

Figure 7. Habitus photograph of *Scopelocheirus sossi* sp. nov., female, 6.2 mm, Namibia, Stn. M157_41.

with 17 setae along distal ⅔ of posterior margin. *Maxilla 1* inner plate narrowing distally, setose, with 10 plumose setae along medial margin and apex; outer plate with 10 toothed setae apically and with several setae submarginally; palp bi-articulate, distal article swollen distally, apical margin oblique, with 5 bi-dentate short setae and 1 mono-dentate elongate seta. *Maxilla 2* each plate broad and subequal in length; inner plate with row of 19 plumose setae along distal half of medial and apical margins; outer plate with row of 14 plumose setae apically. *Maxilliped* inner plate with mediodistal row of plumose setae, apex with 3 nodular setae; outer plate well developed, half of palp length, lined with 12 nodular setae, several simple setae, palp 4-articulate, article 2 the longest, article 4 about ⅔ of article 3, with short apical seta.

Pereon. *Gnathopod 1* of scopelocheirin form; coxal plate triangular; basis elongate, anterior and posterior margins straight, lined with 5–7 setae; ischium 0.4 × as long as basis; carpus elongate, 0.6 × as long as basis; merus half as long as ischium; carpus elongate, longer than ischium, 0.6 × basis; propodus subrectangular, slender, and longer than carpus, with dense tuft of stout setae covering the rudimentary dactylus. *Gnathopod 2* slender; coxa subrectangular; basis elongate with parallel anterior and posterior margin lined with few long and short setae; ischium elongate, 0.7 × as long as basis; merus 0.5 × as long as ischium, round posteriorly, with many short setae and 1 bundle of long plumose setae; carpus as long as ischium, anterior margin swollen, with several clusters of short setae, long plumose setae at anterodistal and posterodistal corner reaching mid-propodus; propodus oval, 0.6 × as long as carpus, with clusters of small setae and 6 bundles of plumose setae distally; dactylus fitting palm, minutely chelate. *Pereopod 3* stout; coxa subrectangular, similar to coxa 2, slightly curved; basis rectangular, elongate with few short and three longer setae; ischium 0.3 × as long as basis, anterior lobe weak, several long setae on posterior margin; merus expanded anteriorly, half as long as basis, several long setae on posterior margin, anterodistal corner weakly produced with bundle of setae; carpus slender, 0.8 × as long as merus, with simple and robust setae on posterior margin; propodus 2 × as long as carpus, lined with robust setae on posterior margin and few longer setae, with pair of locking setae posterodistally; dactylus falcate, 0.3 × as long as propodus. *Pereopod 4* coxa 4 much broader than other coxae, with well-developed posteroventral lobe, other articles similar to pereopod 3, though propodus shorter. *Pereopod 5* coxa large, rounded; basis with a weak longitudinal keel, broadly expanded, with a row of single robust spines along anterior margin, with a brush of 8 long plumose setae in middle of inner side; ischium 0.3 × as long as basis with few long and short setae on anterior margin, merus 2 × as long as ischium with several robust and some longer setae anteriorly; posterior expansion ending in lobe with row of 9 long setae and 1 apical spine; carpus 0.8 × as long as merus lined with clusters of spines anteriorly; propodus 2 × as long as carpus, with 4 clusters of paired spines along anterior margin and 1 posterodistal seta. *Pereopod 6* longer and more slender than pereopod 5; coxa subrectangular, smaller than coxa 5, with 7 plumose setae anteriorly, and 6 plumose setae posteroventrally; basis ovoid, 1.7 × as long as wide, with weak longitudinal keel, anterior margin rounded proximally and straight distally, bearing short robust setae, posterior margin broadly expanded, smooth, weakly crenulate, bearing 10 small setae, posterodistal end reaching almost the end of ischium; ischium short half as long as merus, l

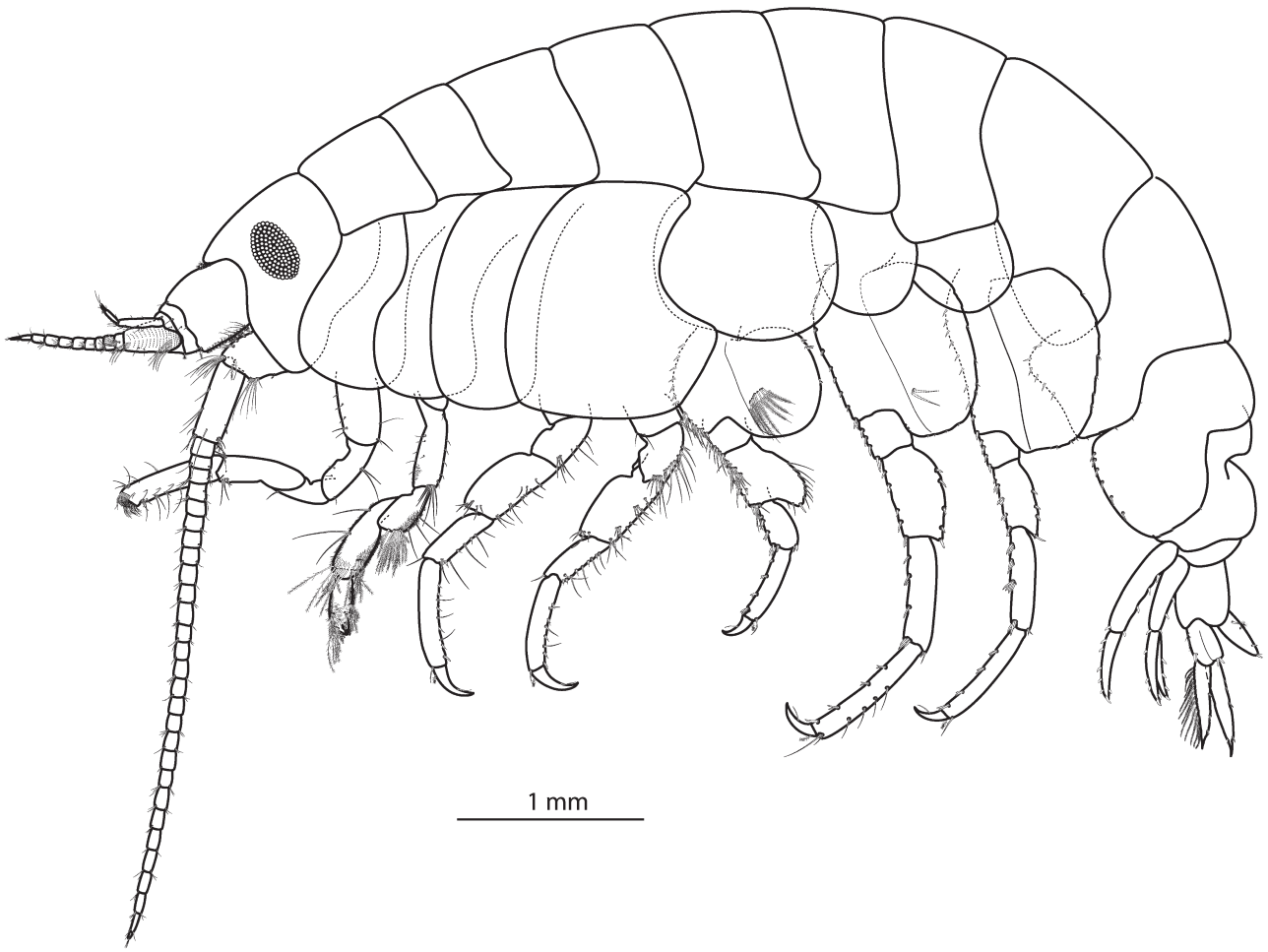

Figure 8. *Scopelocheirus sossi* sp. nov., holotype, male, 6.6 mm, Namibia, habitus, Stn. M157_41.

with 4 pairs of robust spines anteriorly; merus half as long as basis, slightly expanded posteriorly with several spines along the margins; carpus rectangular, elongate, 1.2 × as long as merus, with 4 pairs of spines anteriorly and 2 setae posterodistally; propodus linear, slightly longer than carpus, with single and paired robust setae on anterior margin and 4 simple long setae on posterior margin, posterodistal edge with 1 long spine; dactylus falcate, 0.2 × as long as propodus. *Pereopod 7* coxa rhomboid, with 3 plumose setae anteriorly; basis 1.4 times as long as wide, with weak longitudinal keel, anterior margin weakly concave armed with several small spines, posterior margin convex and crenulate with several small setae, posterodistal lobe obtuse, nearly as long as ischium; merus slender other articles similar to pereopod 6.

Pleon. *Epimeron 1* rounded, obtuse-angled anteroventrally with 1 spine. *Epimeron 2* subquadrate, concave ventrally, posterior margin crenulate, 6 spines anteroventrally. *Epimeron 3* rounded, posterior margin slightly crenulate, 6 spines on ventral margin. *Urosomite 1* with deep dorsal depression and mid-dorsal carina. *Uropod 1* peduncle longer than rami, peduncle with 6 robust setae on dorsolateral margin and 5 robust setae on dorsomedial margin; outer ramus with 6 lateral robust setae and 1 apical spine; inner ramus as long as outer ramus, with 2 medial and 2 lateral robust setae and one apical spine. *Uropod 2* as long as uropod 1; peduncle with 3 robust setae medially and 6 robust setae laterally on each dorsal margin; outer ramus with 5 lateral robust setae only and 1 apical spine; inner ramus as long as outer ramus, with 3 lateral and 2 medial robust setae and 1 apical spine. *Uropod 3* 0.8 × as long as uropod 2; peduncle with 1 pair of robust setae distally on each side and 2 long setae medially; outer ramus bi-articulate, basal article with 3 lateral setae and 2 terminal setae; inner ramus 0.8 × as long as outer ramus, reaching distal end of proximal article of outer ramus, with 3 lateral setae and row of plumose setae along medial margin. Telson longer than broad, cleft about 80%, each lobe with apical notch bearing 1 robust and 1 slender seta apically, with 2 or 3 robust setae and 1 pair of sensory setae dorsolaterally.

Female. (Paratype 2). Females in general very similar to males but slightly larger. Antenna 1 slightly shorter than in male; peduncular article 1 more slender; primary flagellum 8-articulate. Antenna 2 shorter than in male, reaching one-third of body length; flagellum 24-articulate. Oostegites present on pereopods 2–5.

Habitat. This new species occurred in water depths between 107 and 130 m on muddy sediments. The salinity ranged between 33.6 and 34.9 psu, the oxygen content in bottom water varied between 0.22 and 2.93 ml/l. The temperatures were about 10°C.

Distribution. Currently known only from the coast of Namibia.

Remarks. *Scopelocheirus sossi* sp. nov. can be separated from the Kattegat entity, herein identified as *S. hopei*, by

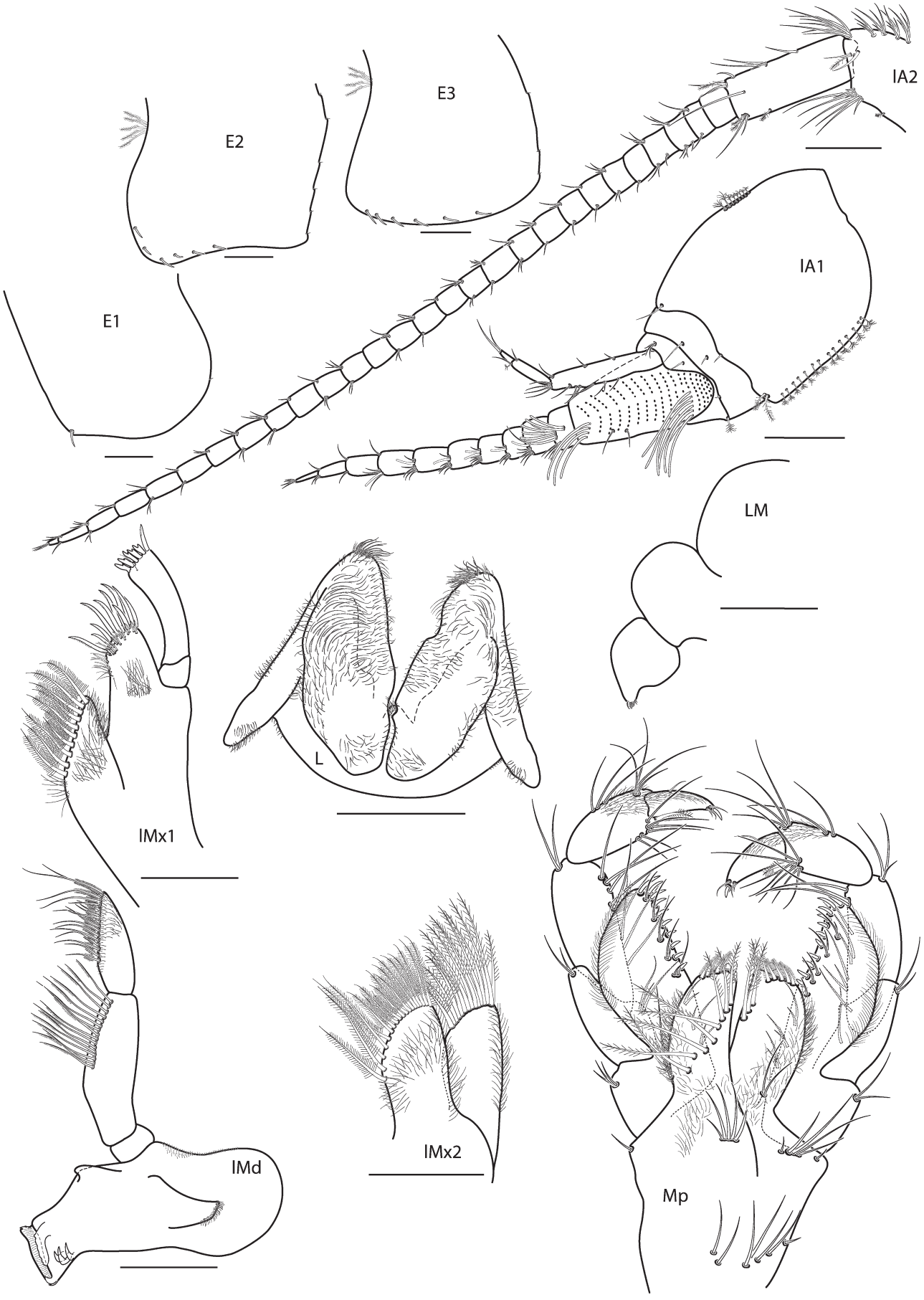

Figure 9. *Scopelocheirus sossi* sp. nov., holotype, male, 6.6 mm, Namibia, Stn. M157_41.

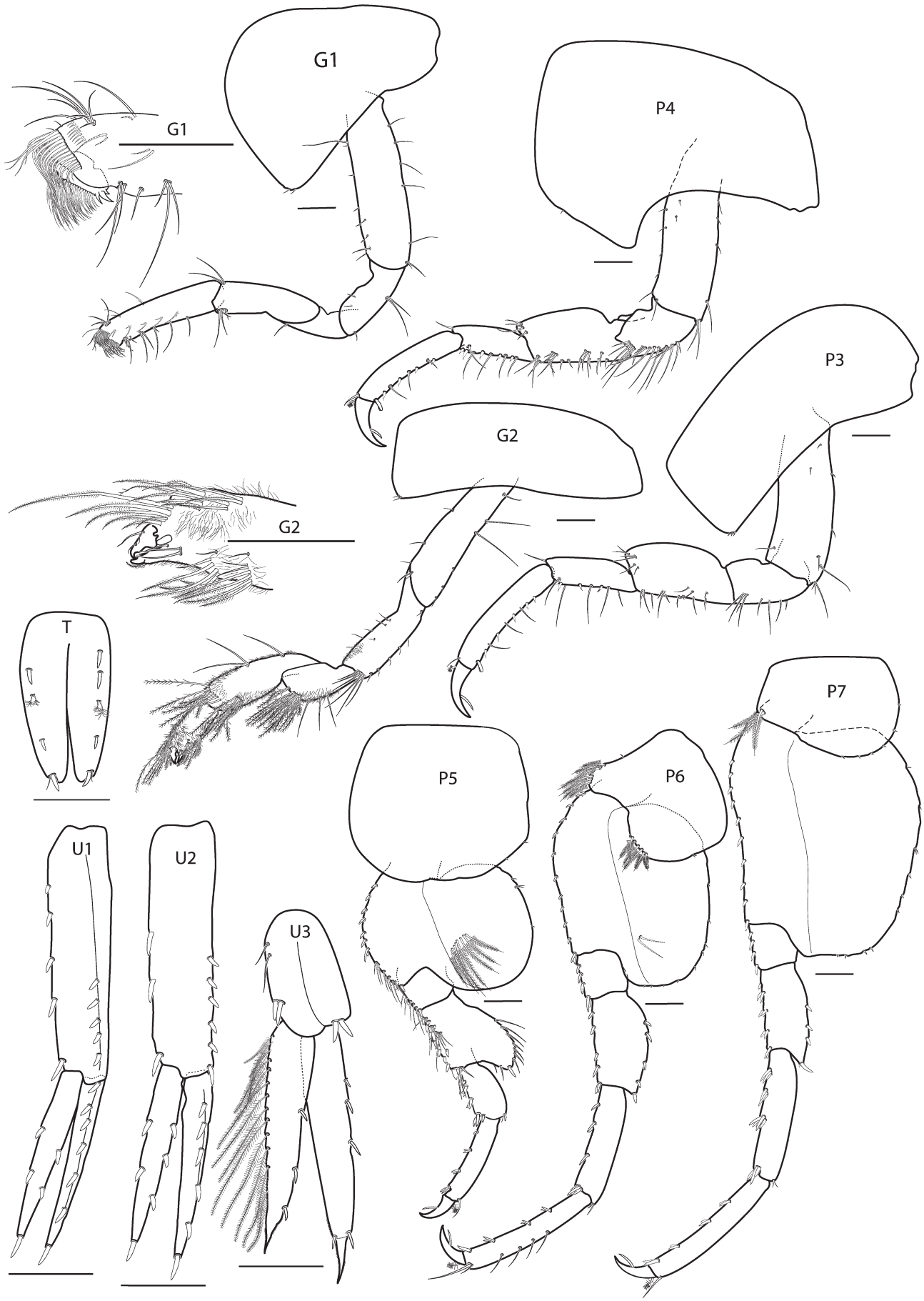

Figure 10. *Scopelocheirus sossi* sp. nov., holotype, male, 6.6 mm, Namibia, scale bar 200 µm, Stn. M157_41.

the following characters (*S. hopei* in brackets). Eyes small, 0.4 × height of head (larger, 0.5 × height of head); palp of maxilla 1 slender (broader); pereopod 5 basis with 8 or 9 plumose setae on medial surface (4 or 5); pereopod 5 merus expanded posterodistally (expanded along whole posterior margin); pereopods 5–7 basis with longitudinal keel as seen in *Aroui minusetosus* Jung, Coleman & Yoon, 2017 (keel absent); epimeron 3 ventral margin with six spines (nine spines); telson length 2 × width with 2 or 3 pairs of dorsal spines (length 2.2 × width with 1 pair of dorsal spines); body uniformly yellowish without pigment spots (body densely mottled with yellowish-orange pigment spots (in life sometimes with numerous brown spots)).

Genetics

A total of 586 aligned base pairs of the mitochondrial DNA COI fragment, and a total of 2,744 aligned base pairs of the nuclear 18S/28S rDNA of three specimens of *Scopelocheirus sossi* sp. nov. were sequenced. All three specimens of *Scopelocheirus sossi* sp. nov. possess identical haplotypes for the studied COI fragment as well as identical sequences for 18S and 28S fragments (Table 2). Blast searches revealed for all three sequences (COI, 18S, 28S) that there are no data conspecific with *S. sossi* sp. nov. in GenBank or in BOLD (Table 3). For COI, the uncorrected genetic distances between *S. sossi* sp. nov. and the congeneric species are equal to or greater than 19%.

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