

Mysid Subfamily Boreomysinae (Crustacea: Mysida: Mysidae) in the Southeast Australian Deep-sea

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ABSTRACT. The deep-water mysid crustaceans of Australia have been barely known. Recent explorations of RV *Investigator* (CSIRO) in the southeast Australian waters discovered a unique fauna. In this special study of the marine subfamily Boreomysinae (family Mysidae) in Australia, five species from both genera *Boreomysis* and *Neobirsteiniamysis* are reported, including two new species for science: *B. inopinata* sp. nov., *B. sibogae*, *B. sphaerops*, *B. urospina* sp. nov. and *N. inermis*. Among the members of the subfamily, only *B. sibogae* has been previously known from Australia. The genus *Neobirsteiniamysis* and its bipolar-amphitropical species *N. inermis* are firstly recorded in Australia. *Boreomysis inopinata* sp. nov. has additional spinules on the outer spine of the antennal scale, which are not found in other species of the subfamily. *Boreomysis urospina* sp. nov. has the longest first segment of the uropodal exopod, laterally terminated by three spiniform setae; and its uropodal endopod is armed with up to five medial spiniform setae, the largest number in the subfamily. This species is included in a newly established subgenus *Petryashovia* subgen. nov., which unites epi-mesopelagic boreomysines, lacking the rostral projection, having rather small ventrolateral lobes of the carapace, and the 1-segmented propodus of the pereopods. The subfamily and generic diagnoses are updated. Additionally, a fragment of the mtDNA COI gene was sequenced for most of the studied species.

Introduction

Systematic exploration of the Australian deep sea began in 2014 with the commission of RV *Investigator*. In 2015–2018, a series of marine research expeditions were conducted by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in the poorly known southeast Australian deep waters. Rich biological material was sampled onboard RV *Investigator* by a number of Australian and overseas researchers (O'Hara *et al.*, 2020; Gunton *et al.*, 2021). The mysid crustacean collection, housed at the Australian Museum (AM), which came to my disposal,

contained taxonomically unique material. In this paper I report the results of the work on the part of this collection, concerning the subfamily Boreomysinae Holt et Tattersall, 1905 (family Mysidae Haworth, 1825).

Members of the subfamily are the largest mysids (body length up to 85 mm) and are commonly considered exclusively deep-water oceanic organisms (Birstein & Tchindonova, 1958; Kathman *et al.*, 1986; Wittmann *et al.*, 2014). However, there has not been clear evidence of the species bathymetric separation (Hargreaves, 1997). The name Boreomysinae can be translated as “northern mysids” (Boreas was the god of the northern winds and winter in

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Greek mythology), after the genus *Boreomysis* G. O. Sars, 1869, established for *B. arctica* (Krøyer, 1861), found in the boreal waters of the Atlantic. Subsequently numerous species have been discovered all over the World Ocean, from the polar to the tropical regions. Being some of the most widely distributed groups of mysids (Holmquist, 1957), the subfamily can now be considered panoceanic. However, many species are known only from original discoveries.

Boreomysids are considered an ancient deep-water group (Petryashev, 1993b). Adapted to various degree of illumination in the deep sea, boreomysines show diverse specializations of the visual organs in the form of the degree of eye development and shape (Holt & W. M. Tattersall, 1906). They are also a primitive group due to the possession of the large number (seven pairs) of the oostegites, incubatory lamellae forming the brood pouch (Hansen, 1925), like petalophthalmids (family Pethalophthalmidae Czerniavsky, 1882), lophogastrids (order Lophogastrida Boas, 1883) and lepidomysids (family Lepidomysidae Clarke, 1961, of the order Stygiomysida Tchindonova, 1981); organic statoliths, like in another primitive mysid subfamily Rhopalophthalminae Hansen, 1910 (Ariani *et al.*, 1993; Wittmann *et al.*, 2014), and the division of the uropodal exopod into two segments, similar to petalophthalmids, rhopalophthalmines and siriellines (subfamily Siriellinae Czerniavsky, 1882) (Meland *et al.*, 2015). Molecular phylogenetic studies confirmed the old age and primitiveness of Boreomysinae and set them back to the early Mesozoic Era (c. 240 Mya), which made them the “living fossils” (Kou *et al.*, 2020).

Due to the damage during collection and their poor preservation, boreomysids have often been inadequately described. Together with considerable variation between sexes and ages, it caused difficulties in the identification and numerous subsequent synonymizations (W. M. Tattersall & O. S. Tattersall, 1951; Holmquist, 1957; Ii, 1964).

The subfamily has been classified into two genera, *Boreomysis* and *Neobirsteiniamysis* Hendrickx et Tchindonova, 2020, with 36 and 2 species, respectively. The two genera are also distinguished ecologically. The first one is pelagic, and the second is benthic (Tchindonova, 1981). Only one species, *B. sibogae* Hansen, 1910, has so far been recorded in the Australian waters. It was sampled from a fish stomach at 200 m depth off the Tasmanian coast (Fenton, 1986; Lowry & Stoddart, 2003). In this study, the presence of this species in Australia is confirmed, and additional four species, including two new to science, are described. One of the new species is assigned to the new subgenus *Petryashovia* subgen. nov. of the genus *Boreomysis*.

Taxonomic history of the subfamily Boreomysinae

Holt & W. M. Tattersall (1905) designated the subfamily Boreomysinae for the genus *Boreomysis*, having the uropodal exopods interrupted by a distinct, but incomplete suture, set with few spiniform setae not far from the base, and the seven pairs of oostegites, otherwise undistinguishable from the subfamily Leptomysinae Czerniavsky, 1882. In the time of the genus original description, the subfamilies have not yet been established for Mysidae. Zimmer (1909) expanded the diagnosis by including the well-developed male pleopods, two or three segmented tarsus of pereopods (dactylus plus

one or two propodal segments in the current terminology), with the unguis well-established, though thin. Hansen (1910), who did not accept most of the Mysidae subfamilies, established by Czerniavsky (1882), Norman (1892) and Holt & W. M. Tattersall (1905, 1906), yet accepted Boreomysinae. He considered important that the appendix masculina was somewhat knot-shaped or rudimentary, though bearing setae, and he also noted that male pleopods 2 and 3 had elongated exopod, being somewhat distally modified with shortened setae. In the key, he additionally mentioned that Boreomysinae had broad labrum, without process, and the telson had the cleft. In a later work (Hansen, 1925), he adopted terminology, dividing the pereopodal endopod into basis, preischium, ischium, merus, carpus and propodus. In Boreomysinae, the latter two segments remained separate, with the carpus, containing no muscle, being about as long as and slightly wider than the propodus, jointed by an oblique articulation; propodus containing *musculus flexor dactyli*, and its segments being divided by a transverse articulation. Banner (1948) noticed the somewhat reduced in size statocysts. W. M. Tattersall & O. S. Tattersall (1951) considered pereopod propodus as being 2- or 3-segmented (in fact, 1- or 2-segmented), probably because of its confusion with previously used term “tarsus”, which also included the dactylus.

Gordan (1960) expressed an idea of the possibility of erecting a suborder for boreomysines, which has never gained a support from other scholars. Birstein & Tchindonova (1962) mentioned the subfamily Boreomysini (sic). Jepsen (1965) reported the presence of the so called polyspinal appendices in boreomysines, which are not considered homologous to cercopods of other mysids, because of their more anterior position (Wittmann *et al.*, 2014).

Tchindonova (1979) proposed a new generic name *Birsteiniamysis* in a congress abstract, without reference to any species and description. Later, in extended proceedings of the same congress, she assigned three species names from *Boreomysis* and more presumably unknown species and subspecies to *Birsteiniamysis*, but still did not describe the genus or designate a type species (Tchindonova, 1981). In the same work, Tchindonova (1981) upgraded the status of the subfamily to the family level, Boreomysidae, on the basis of the presence of the seven oostegites and well-developed, biramous, multisegmented and multiarticulated male pleopods. Opinions on the rank of boreomysines have been divided since then. Curiously, the same conference was attended by Băcescu, and in his paper, published in the same proceedings (Băcescu, 1981), he refers to *Boreomysis inermis* (Willemoes-Suhm, 1874), which was included into *Birsteiniamysis* by Tchindonova in the same book. He also attributed it to Lophogastrida without an explanation. The staff of the Zoological Society of London (1985) noticed that no type species was designated for *Birsteiniamysis*.

Kathman *et al.* (1986) compared the morphology of major mysid groups and listed additional diagnostic characters of Boreomysinae (in subfamily rank): absence of the plumose setae at the telson apex, absence of the pleural plates, absence of the thoracopod propodus division (previously considered 2-segmented in some species), the maxilliped 1 carpopropodus (segment 6 in their terminology) not expanded, the labrum without posterior cleft, the antennal scale partially covered with setae, with distolateral spine.

Beliaev (1989) was the first to indicate that *Birsteiniamysis*

was a nomen nudum. In 1993, Tchindonova provided a diagnosis for again newly designated *Birsteiniamysis*, distinguished by the absence of eye pigmentation, the presence of the lateral concavity on the eyes, containing microfibrinous microstructures, the position of the visual elements in the proximal part of the eyestalk, the telson lateral margins being about as wide as or wider than its anterior part, and the poorly developed statocyst (Tchindonova, 1993). However, she did not fix a type species.

Petryashev (1993a) accepted the family rank. Ariani *et al.* (1993), in turn, used the subfamily rank in their study of the mysid statoliths, where they discovered that boreomysine statolith was organic (vs. mineral in most of other mysids). Such composition was found only in rhopalophthalmines, suggesting possible relation between the two subfamilies.

Meland (2002, 2003) followed Tchindonova's classification (Tchindonova, 1981), and the family Boreomysidae possessed the following new characters: the rostrum obtuse and the eyes normally developed. With reference to Meland (2002), Lowry & Stoddart (2003) also maintained the family rank. This tradition was continued by Petryashov (2004a, b, 2005b, 2009b).

In their molecular phylogenetic study, employing 18S rRNA sequences, Meland (2003) and Meland & Willassen (2007) found that Boreomysinae species formed a monophyletic clade, sister to Rhopalophthalminae (although this is not obvious from the trees), both rather basal within the order. The basal position of boreomysines went in line with primitive state of their marsupium and uropodal exopods. The latter had the suture at the base of the ramus, which is an autapomorphic feature. This additional character was not used by Tchindonova (1981) for the rank elevation. Based on the cladistic principles, not accepting paraphyletic taxa, Meland & Willassen (2007) also did not support the full family status for boreomysines, because retaining Boreomysidae would make Mysidae paraphyletic. The subfamily Boreomysinae was considered a part of the family Mysidae for the presence of the statocyst.

Petryashov (2014a) still used the family rank. In the same work, he mentioned that the type species of *Birsteiniamysis* was *Birsteiniamysis inermis*, unfortunately, neither providing a description of the genus, nor referring to Tchindonova (1993). According to the International Code of Zoological Nomenclature (Article 13.1), to be available, a name described after 1930, must be accompanied by a description or definition or a bibliographic reference to such statement (ICZN, 1999). The same year, Petryashov changed his opinion in favour of subfamily status (Petryashov, 2014b).

An updated definition of the subfamily came with the work by Wittmann *et al.* (2014). The new characters included: the antennal scale spine non-articulate, the penes well-developed and tubular, and the thoracopods normal.

Kou *et al.* (2020) made a molecular phylogenetic analysis of the major deep-water groups of mysids, based on three DNA gene fragments (one mitochondrial and two nuclear). The subfamily Boreomysinae was confirmed to be monophyletic, and the extant genera were estimated to be 242.7 million years old.

Hendrickx *et al.* (2020), instead of designating a type species and validating the name *Birsteiniamysis*, decided to give a new name, *Neobirsteiniamysis* Hendrickx *et al.* (2019). They provided a description, designated a type species, but published their work electronically

without ZooBank registration, required for availability by the Code (ICZN, 2012). The diagnosis largely incorporated Tchindonova's (1993) diagnosis, except that the eye visual elements inside the proximal part of the eye-stalk were found to be occasionally absent, clearly indicating that they dealt with the same taxon, described by Tchindonova. Correcting themselves, Hendrickx & Tchindonova (2020) registered their publication and made the name available.

Hendrickx *et al.* (2020), Hendrickx & Tchindonova (2020), and Hernández-Payán & Hendrickx (2020) preferred not to use a family group name at all, directly considering *Neobirsteiniamysis* part of Mysidae. Hernández-Payán & Hendrickx (2020) mentioned that the genus name *Neobirsteiniamysis* was a "nomen novum", which was not a replacement name for *Birsteiniamysis*, and originally the expression "gen. nov." was used in Hendrickx & Tchindonova (2020).

Material and methods

The material contains 28 samples from various deep-water localities in the southeast Australian coast, collected onboard RV *Investigator* in 2015–2018. Samples were originally fixed in 95% ethanol, making them also available for DNA analysis. Prior to that, certain specimens were photographed onboard immediately after sampling. After the preliminary identification, one or two specimens of each species were partly dissected, studied in detail, measured and illustrated using digital camera on a compound microscope. The remaining material was examined without dissection. One or two pereopods or a small piece of tissue from the abdomen from one or two specimens of each species was also detached for molecular analysis. The collection is deposited in the Australian Museum, Sydney (AM).

In the Taxonomy section, in addition to the synonymies, I also attempted to compile a complete index, mentioning all pages, where a name was used. Due to the vastness of the literature, the bibliography on the genus *Boreomysis* may be incomplete.

Measurements. Body length: from anterodorsal margin of carapace (tip of rostrum if present) to posterior margin of telson (terminal spiniform setae not included). Eye length: from cornea (if present) distal surface to proximal margin of stalk, dorsal view. Head width: between tips of ventrolateral processes of the carapace, dorsal view. Abdominal segment 6 length: from its dorsal posterior margin to the dorsal posterior margin of segment 5, not including posterolateral lobes (scutella paracaudalia), dorsal or lateral view. Telson length: from anterior margin to posterolateral margins, excluding terminal spiniform setae, dorsal or lateral view. Telson anterior width: between most distant points of anterior part. Telson posterior width: between outer posterior corners of terminal spiniform setae (outer if two or more). Telson lateral spiniform setae number: including terminal.

Molecular genetic analysis. The samples for the DNA work were digested with proteinase K for six hours in 60°C, and the total genomic DNA was extracted by the method of salt extraction (Aljanabi & Martinez, 1997). A fragment of the mitochondrial DNA COI gene was amplified and sequenced using the universal primers LCO1490 and HCO2198 (Folmer *et al.*, 1994). PCR amplifications were performed in 20 µL

volumes containing 1.25 U of DNA polymerase (ThermoFisher Scientific DreamTaq), 2 μ L DreamTaq buffer (containing 20 mM MgCl₂), 0.2 mM of each dNTP, 10 pmol of each primer and about 10 ng of genomic DNA. The protocol generally involved 3 min denaturation at 95°C, followed by five cycles of 30 s at 95°C, 30 s at 47°C and 45 s at 72°C, another 32 cycles of 30 s at 95°C, 30 s at 50°C and 45 s at 72°C and a final extension of 5 min at 72°C. Alternatively, 40 identical cycles with an annealing temperature of 52°C were used. PCR products were purified in a mixture, containing 1 μ L of termosensitive alkaline phosphatase (Thermo Scientific FastAP), 0.5 μ L of exonuclease I (ThermoFisher Scientific), and 5 μ L of template. The Sanger Sequencing reaction was made at Genewitz Germany GmbH. Sequences were edited in Geneious 11.1.5.

The final aligned COI segments had no length variation and were 614 bp long. The GenBank contained COI sequences of three species: *B. arctica* (MK803440), *B. nobilis* G. O. Sars, 1879 (MW680288) and *N. inermis* (MK803439), which I incorporated into the alignment for distance estimates. The entire dataset contained 10 sequences and was analysed in Mega 7.0.21 (Kumar *et al.* 2016). No stop codons were detected. The sequence relationships were inferred using Maximum Likelihood based on HKY+G model (best fit) and 1000 bootstraps. Distances between sequences were generated via Maximum Composite Likelihood approach with 1000 bootstraps and G = 0.2. Initial trees for the heuristic search were generated via Neighbour-Joining/BioNeighbour-Joining approach with Maximum Composite Likelihood, and the best topology selected with the highest log likelihood value. The final tree did not provide any supported phylogenetic resolution between the species, probably due to the incomplete number of taxa and deep interspecific divergence and was not included in the results. Sequences were deposited in the GenBank (see accession numbers in relevant species sections).

Abbreviations. *BPT*, Biological Processing Team; *4MBT*, 4 m beam trawl; *BES*, Brenke epibenthic sledge; *NBC*, Naturalis Biodiversity Center, Leiden, Netherlands.

Taxonomy

Mysida Boas, 1883

Mysidae Haworth, 1885

Boreomysinae Holt et Tattersall, 1905

Boreomysinae Holt & W. M. Tattersall, 1905: 130, 147; 1906: 45.—Zimmer, 1909: 45, 52, 130; 1933: 39.—Calman, 1909: 182.—Hansen, 1910: 4, 5, 9, 11, 24; 1925: 107, 110, 111; 1927: 23.—W. M. Tattersall, 1913: 869; 1939: 230; 1951: 3, 45.—Illig, 1930: 413, 557, 559.—Nouvel, 1943: 4, 6, 45, 64.—Banner, 1948: 361.—W. M. Tattersall & O. S. Tattersall, 1951: 26, 67, 126, 127.—O. S. Tattersall, 1955: 25, 66.—Birstein & Tchindonova, 1958: 279, 335.—Gordon, 1960: 304, 305, 307, 308, 311.—Ii, 1964: 15, 16.—Pillai, 1965: 1682, 1685, 1686.—Mauchline, 1980: 19, 39, fig. 5-2.—Murano & Krygier, 1985: 690.—Kathman *et al.*, 1986: 29, 37.—Ledoyer, 1989: 67; 1990: 40; 1995:

603.—Ariani *et al.*, 1993: 396, 401, 402.—Saltzman & Bowman, 1993: 325.—Müller, 1993: 22.—Brattegard & Meland, 1997: 77.—González *et al.*, 2003: 1263.—Meland & Willassen, 2007: 1084, 1085, 1090, 1092, 1095–1097, 1099, 1100; Meland *et al.*, 2015: 8, 12, 16, 18, 21.—Fukuoka, 2009: 406, 418.—Biju & Panampunnayil, 2011: 335.—San Vicente, Frutos & Sorbe, 2013: 769.—Wittmann, 2013: 392, 393, 399.—Sawamoto, 2014: 4.—Wittmann *et al.*, 2014: 200, 202, 217, 229, 233, 235, 250, 253, 270, 272, 288, 296, 320, 321, 332, 343.—Wittmann & Ariani, 2019: 2, 5.—Wittmann, 2020: 15.—Kou *et al.* 2020: 3, 4, 7, 9, 12. Boreomysidae.—Tchindonova, 1981: 26.—Staff of the Zoological Society of London, 1985: 398, 399.—Sirenko *et al.*, 1996: 347.—Meland, 2002, webpage; 2003: 12, 13, 14.—Lowry & Stoddart, 2003: 428.—Petryashov, 1993a: 90; 2004a: 125; 2004b: 132; 2005b: 957, 963, 967, 970; 2009b: 122, 124; 2014a: 186. Boreomysini (sic).—Birstein & Tchindonova, 1962: 62.

Type genus. *Boreomysis* G. O. Sars, 1869; by original monotypy.

Diagnosis. Pleomeres without pleural plates. Telson without spiniform setae in anterior part; with apical cleft. Appendix masculina present as bunch of setae on slight tubercle. Labrum without anterior spine; right lobe with inward-bent process. Antennal scale with smooth lateral margin, distally with non-articulated spine. Pereopod endopods rather similar, with pereopod 1 slightly stronger than others; carpus and propodus separated by oblique articulation; propodus internal articulation transverse. Oostegites, numbering seven, present on maxillipeds 2 and all six pereopods of females. Penes tubular. Female pleopods reduced to unsegmented plates. Male pleopods biramous; endopod 1 non-segmented; other endopods and all exopods multisegmented; endopods with movable pseudobranchial lobe; exopod 3, and sometimes also exopod 2 with thick and short setae on distal segments. Uropodal exopod with incomplete proximal suture, its first segment with distolateral spiniform setae; endopod not subdivided. Statolith organic, rather small.

Comparison. Subfamily Boreomysinae differs from all the subfamilies of Mysidae by 1) the presence of the seven pairs of oostegites (maximum four in other subfamilies; seven pairs are also found only in the families Petalophthalmidae, Lepidomysidae [order Stygiomysida] and order Lophogastrida), 2) the incomplete proximal suture on the uropodal exopod (complete and distal in Siriellinae and Rhopalophthalminae, and absent in the rest of subfamilies), 3) the absence of the cercopods, but the presence of the polyspinal appendices in nauplioid (should be studied on a wider set of taxa). Differs from the most Mysidae subfamilies by 1) the rudimentary appendix masculina (similar only in some Heteromysinae), 2) the presence of the inward-bent process on the right lobe of the labrum (similar only in some Erythropinae; this structure is also found in Lophogastridae and Gnathophausiidae of order Lophogastrida), 3) the modification of the male pleopod exopod 3, rarely also exopod 2 (similar only in Gastrosaccinae), 4) the statolith being organic, non-crystalline (the same only in Ropalophthalminae; other subfamilies with crystalline); 5) the presence of the distolateral spiniform setae on the uropodal exopod, segment 1 (similar only in Siriellinae).

Boreomysinae is most similar to the subfamilies Siriellinae and Rhopalophthalminae. From both subfamilies

it differs by the larger number of the oostegites (seven against three), and the telson having the deep cleft (only slight concavity in some Siriellinae). Out of these two subfamilies, Boreomysinae is more similar to Siriellinae, from which it is additionally distinguished by the absence of any spine on the labrum (present in Siriellinae), the absence of the paradactylary setae brush on the pereopodal endopods (present in Siriellinae), the organic vs. mineral statolith. It also differs from Rhopalophthalminae by the strong development of all pereopods (endopod of pereopod 6 reduced, with sexual dimorphism in Rhopalophthalminae), the presence of the penes (absent in Rhopalophthalminae), the complete absence of the pleural plates of the pleomers (present on the male pleomere 1 in Rhopalophthalminae), the non-segmented vs. 2-segmented uropodal endopod, the presence of the lateral spiniform setae on the uropodal exopod (absent in Rhopalophthalminae).

Habitat and Biology. Predominantly oceanic deep-water mysids. Being exclusively marine subfamily, it cannot though be considered purely oceanic, as certain members also inhabit seas, including inland (e.g., the Marmara Sea in the Mediterranean basin). The family cannot also be considered purely deep water as well. Certain species of the subgenus *Petryashovia* subgen. nov. have been found exclusively in the epi- and upper mesopelagic waters. Mostly stenobathic, but some species occasionally penetrate subsurface waters. Epi-mesopelagic, bathypelagic, or benthic bathyal. Micronektonic. Macroplanktonic. Feed on phyto- and zooplankton during vertical migrations (Mauchline, 1980).

Remarks. Considering both morphological and molecular evidence, Boreomysinae is clearly not related to Leptomysinae, which it was originally compared with. Currently it is not possible to unequivocally resolve the phylogenetic position of boreomysines. The question about their taxonomic rank, subfamily or family, also cannot be resolved by phylogenetic methods. The paraphyly of Mysidae, if boreomysids were considered a family, should not be an obstacle. The key criterion is the degree of morphological differentiation, and it is rather minor in boreomysids in comparison with other mysid subfamilies. At the current stage of our research, we know only one unique character in boreomysids (within Mysidae) concerning the presence or absence of organs. It is the number of oostegites in the females. Considering that its state is primitive, this character does not increase the uniqueness of the group. The second character, the degree of the articulation development in the uropodal exopods, is an intermediate stage of the exopod oligomerization in mysids,

making boreomysids an intermediate group. Finally, the third character, the presence of the polyspinal appendices in nauplioids, has not been studied in various groups, and its significance is still to be estimated. Hansen (1921) described the so called “dorsal organ” in three boreomysinae species, which he did not find in two inspected species of Mysinae. Taxonomic significance of this structure needs to be confirmed on a wider set of mysid taxa. Most of the species in the newly described *Petryashovia* subgen. nov. possess a clear additional segment on the antennal peduncle, which makes it 4-segmented. A reduced form of this segment is found in other members of the subfamily, particularly in the Australian species of *Boreomysis* and *Neobirsteiniamysis*, studied here. The structure of the antennal peduncle must be studied in other members of the family, as well as across the order. If all above mentioned features prove to be diagnostic for boreomysines, a full family status can be reconsidered. At the current stage of our knowledge the subfamily rank for Boreomysinae is more evident.

The pereopod propodus is not divided in *Neobirsteiniamysis* and *Boreomysis* (*Petryashovia*) subgen. nov., but consists of two subsegments in nearly all species of *Boreomysis* sensu stricto. Therefore, this character is not used in the subfamily diagnosis. In the newly discovered *B. (P.) urospina* sp. nov., which has only one segment in the propodus, the *musculus flexor dactyli* starts from about the distal third of the carpus (Fig. 9M), unlike species with the 2-segmented propodus, where the muscle is entirely within the propodus. Consequently, the taxonomic significance of this character for the subfamily is also reconsidered. Quite a number of the boreomysine species possess rather acute rostrum and partially reduced eyes. Hence, I exclude these characters from the earlier diagnosis as well. The suture of the uropodal exopod is not always at the base of the ramus. To be precise, it is set at the proximal half of the ramus, and, as it is discovered in *B. (P.) urospina* sp. nov., can also be almost at the half of the ramus. The latest definition of the subfamily (Wittmann *et al.*, 2014) did not contain some earlier characters, like the presence of the telson cleft, the structure of the appendix masculina, labrum, pereopod carpus and propodus, the presence of the spiniform setae on the proximal segment of the uropodal exopod. A revised diagnosis is proposed here, incorporating relevant, previously used characters.

Composition. Includes two genera: *Boreomysis* and *Neobirsteiniamysis*. Both of them can be found in the Australian waters.

Key to the genera of the subfamily Boreomysinae

- 1 Telson not broad in central part, narrower than in anterior part (Figs 1C; 4H,F; 5C). Eyes with cornea (cornea occasionally reduced, but always present), not concave (Figs 1A,B,G; 4A–D; 5A,B) *Boreomysis* G. O. Sars, 1869
- Telson broad in central part, as wide as or wider than in anterior part (Fig. 13B,E). Eyes without cornea, laterally concave (Figs 12A, 13A) *Neobirsteiniamysis* Hendrickx et Tchindonova, 2020

Boreomysis G. O. Sars, 1869

Boreomysis G. O. Sars, 1869: 330; 1879a: 8, 9; 1883: 34; 1885a: 11, 173, 177; 1885b: 54.—Czerniavsky, 1882: 56, 61, 69.—Hansen, 1887: 212; 1908: 100; 1910: 3–5, 7, 24, 25, 26, 28; 1921: 71; 1925: pl. 6; 1927: 22, 23, 24.—Perrier, 1893: 1026.—Stebbing, 1893: 269.—Faxon, 1893: 218.—Ortmann, 1894: 105–106.—Ohlin, 1901: 69, 70, 72, 90.—Gerstaecker & Ortmann, 1901: 619, 625, 643, 654, 666, 674, 680, 682, 683.—Zimmer, 1904: 427, 428, 429, 473, 486, 489; 1909: 45, 48, 52, 60, 66; 1914: 386.—Fowler, 1912: 540.—W. M. Tattersall, 1913: 869; 1939: 230; 1951: 45, 47.—Holt & W. M. Tattersall, 1906: 21, 22, 45.—Linko, 1908: 39, 41.—Illig, 1930: 413, 559–560.—Coifmann, 1937: 17.—Nouvel, 1943: 45, 71.—Banner, 1948: 352, 361, 362; 1954: 579, 580.—W. M. Tattersall & O. S. Tattersall, 1951: 67, 70, 127–128, 131, 269.—O. S. Tattersall, 1955: 4, 25, 66, 67.—Holmquist, 1956: 428, 429, 432, 442, 443, 445; 1957: 4, 9, 45, 49.—Birstein & Tchindonova, 1958: 279, 335, 348, 351.—Birstein & Tchindonova, 1962: 64.—Ii, 1964: 16, 282, partim.—Pillai, 1965: 1682, 1686, 1687.—Băcescu, 1971: 7.12; 1981: 38.—Elofsson & Hallberg, 1977: 177.—Mauchline & Murano, 1977: 49.—Mauchline, 1980: 9, 19, 226.—Tchindonova, 1981: 26.—Băcescu, 1981: 38.—Staff of the Zoological Society of London, 1985: 398, 399.—Hargreaves, 1985: 255–258.—Kathman *et al.*, 1986: 41, 103, partim.—Fenton, 1986: 33.—Ariani *et al.*, 1993: 401.—Müller, 1993: 22.—Saltzman & Bowman, 1993: 325, 330.—Petryashov, 1993a: 90, 103; 1993b: 71; 2004a: 125; 2005b: 963, 965, 967, 970; 2014a: 186; 2014b: 149.—Katağan & Kokataş, 1995: 396.—Ledoyer, 1995: 603, 615.—Hargreaves & Murano, 1996: 665.—Brattegard & Meland, 1997: 77.—Hargreaves, 1997: 52–62.—Brandt *et al.*, 1998: 4, 5.—Lowry & Stodart, 2003: 428, 429.—Meland & Willassen, 2007: 1096, partim.—Fukuoka, 2009: 419.—Jocque & Blom, 2009: 4, 17.—Biju & Panampunnayil, 2011: 335.—Wittmann *et al.*, 2014: 24, 207, 225, 228, 240, 245, 247, 253, 296, 332.—Ortiz *et al.*, 2017: 113.—Wittmann, 2020: 15.—Hendrickx *et al.*, 2020: 20.—Hernández-Payán & Hendrickx, 2020: 2.

Arctomysis Czerniavsky, 1882: 61, 69 (synonymized by Hansen, 1910: 3, 24).

Pseudanchialus Caullery, 1896: 368 (synonymized by W. M. Tattersall, 1951: 45).

Type species. *Mysis arctica* Krøyer, 1861, by original designation.

Diagnosis. Telson not broad in central part, narrower than in anterior part. Eyes with cornea, not concave.

Distribution and habitat. Cosmopolitan. Petryashov (2014a) considered its centre of diversity as Western Pacific. Epi-bathypelagic (0–6000 m).

DNA divergence. The mtDNA COI gene divergence between all the studied species of the genus *Boreomysis* was 16–84% of model corrected distance. The divergence between *Boreomysis* and *Neobirsteiniamysis* was 67–116%.

Remarks. The genus *Boreomysis* was described in detail by G. O. Sars (1869, 1879a) for two species, *B. arctica* (Krøyer, 1861) and *B. tridens* G. O. Sars, 1870. The genus was distinguished from other mysids (except *Petalophthalmus*) by the larger number of marsupial plates (seven against three). Additionally, it had long, natatory male pleopods (shared with several other subfamilies) and reduced statocyst. Hansen (1910) noticed that carpus was jointed with propodus via vertical articulation.

Numerous species have been described since then, but most of them rather inadequately, and already Holmquist (1957) suggested that the genus required a revision. Ii (1964) provided an updated diagnosis of the genus, although no other boreomysine genera were known at that time; and therefore, none of the characters counts to be diagnostic in comparison with *Neobirsteiniamysis*. Describing new species of *Boreomysis*, Ii could not cope with the amount of variation. Expressing the feeling that he could equally be able to merge them with other known species, Ii eventually decided to maintain their separateness not to cause future difficulties in identification. He was particularly skeptical concerning the use of eyes in diagnostics. The taxonomy of the genus has been outstandingly problematic (Mauchline, 1980).

After the description of *Neobirsteiniamysis* it appeared that the eye structure has been crucial in the separation of the genera. The eye shape is indeed variable with age of individuals, but adult specimens of the species of *Boreomysis* can often be rather clearly distinguished by this character. Certain species of a designated here *Petryashovia* subgen. nov. are distinguished above all by quite large eyes, with the cornea dominating over the stalk, lacking any traces the eye papilla. Thus, the structure of eyes does, in fact, play taxonomic role in the subfamily. I compose here a new generic diagnosis, which compares *Boreomysis* with *Neobirsteiniamysis*.

Composition. The genus *Boreomysis* contains 38 species, which I propose here to split into two subgenera, *Boreomysis* sensu stricto and *Petryashovia* subgen. nov. Members of both subgenera are found in the Australian waters.

Key to the subgenera of the genus *Boreomysis*

- 1 Anterior margin of carapace with distinct rostrum and large ventrolateral projections (Figs 1A,B; 4A,D; 5A,B). Pereopod propodus 2-segmented (except in *B. dubia* Coifmann, 1937) (Figs 2I, 3D, 4L, 6C) *Boreomysis* sensu stricto
- Anterior margin of carapace without distinct rostral projection, angular, apically blunt or rounded, with rather small, barely established ventrolateral projections (Fig. 8A–C). Pereopod propodus 1-segmented (Fig. 9M) *Petryashovia* subgen. nov.

Boreomysis (Boreomysis) G. O. Sars, 1869

Type species. *Mysis arctica* Krøyer, 1861.

Diagnosis. Anterior margin of carapace with distinct rostrum and large ventrolateral projections. Eyes with dorsolaterally flattened, oval, nearly rounded or occasionally reduced cornea. Pereopod propodus 2-segmented (except in *B. dubia*).

Distribution and habitat. Cosmopolitan. Epi-bathypelagic (0–6000 m).

DNA divergence. The mtDNA COI gene divergence between all the studied species of the subgenus *Boreomysis* sensu stricto was 16–54% of model corrected distance. The divergence between *Boreomysis* sensu stricto and *Petryashovia* subgen. nov. was 57–84%.

Composition. The subgenus *Boreomysis* sensu stricto includes 34 species (Table 1). Among them three species have so far been discovered in the Australian deep waters: *Boreomysis (Boreomysis) inopinata* sp. nov., *Boreomysis (Boreomysis) sibogae*, and *Boreomysis (Boreomysis) sphaerops* Li, 1964.

Key to the Australian species of the subgenus *Boreomysis* sensu stricto

- 1 Telson cleft without anterior fissure (Figs 1C,D; 4F–H) 2
 — Telson cleft with anterior fissure (Fig. 5C,E) *B. (B.) sphaerops* Li, 1964
- 2 Anterior margin of carapace with rounded lateral margins (Fig. 4D). Antennal scale rather broad, 3.3–4.2 times as long as wide; outer spine without additional spinules (Fig. 4D,I) *B. (B.) sibogae* Hansen, 1910
 — Anterior margin of carapace with angular lateral margins (Fig. 1B). Antennal scale rather narrow, 4.7–5.5 times as long as wide; outer spine with additional spinules (Fig. 1B,J,K,L) *B. (B.) inopinata* sp. nov.

***Boreomysis (Boreomysis) inopinata* sp. nov.**

urn:lsid:zoobank.org:act:A9FAD035-4065-4881-90DF-A7682862CD78

Figs 1–3

Etymology. The species name *inopinata* (adjective) is Latin for *unexpected*, which is the reference to the unexpectedly excessive armature on the distomedial spine of its antennal scale.

Holotype. Male (partly dissected), 31 mm, Tasmania, Punch's Hill, from 44°11'14"S 147°11'12"E to 44°11'02"S 147°11'23"E, 919–1086 m, 13 Dec 2018, coll. BPT, IN2018_V06_157 (here and in further cases: the voyage and station code), 4MBT (AM P.106632, GenBank OQ699908, voucher B15). **Paratypes.** 8 males, 28.5–32 mm, 1 subadult male, 12 subadult females, same as holotype (AM P.106633).

Additional material. Female (damaged), subadult female (damaged), off southern Tasmania, Huon Commonwealth Marine Reserve, from 44°10'17"S 147°10'59"E to 44°10'33"S 147°10'33"E, 1060 m, 09 Apr 2015, coll. BPT, S. J. Keable, M. A. McGrouther, IN2015_E02_010, beam trawl (AM P.106634, GenBank OQ699907, voucher B8); juvenile (broken), New South Wales, Central Eastern Commonwealth Marine Reserve, from 30°06'47"S 153°53'53"E to 30°06'58"S 153°52'01"E, 2634–2324 m, 06 Jun 2017, coll. BPT, L. E. Hughes, F. Köhler, E. K. Kupriyanova, IN2017_V03_087, BES (AM P.106635).

Diagnosis. Anterodorsal margin of carapace (Fig. 1A,B) with acutely pointed and upwards directed short rostrum, reaching about half of antennular peduncle segment 1, flanked by smoothly rounded angles. Telson (Fig. 1C,D) 1.14–1.29 times as long as last abdominal segment, 2.6–2.9 times as long as wide anteriorly and 0.55–0.60 times as

wide posteriorly as anteriorly. Telson lateral margins slightly concave in central part, with 54–60 spiniform setae arranged in series: numerous short alternated by about ten single long, and three or four terminal spiniform setae; longest terminal spiniform setae 0.06 of telson length and 1.1–2.0 of other terminal spiniform setae. Telson cleft 0.15–0.17 of telson length, without anterior dilatation, and with 51–60 rather long spinules. Eyes (Fig. 1A,B,G) moderate in size, pyriform, about 0.4 of head width; cornea oval, wider than, but not dominating over eyestalk; eye papilla small. Antennular peduncle (Fig. 1A,B,H,I) extending beyond half of antennal scale. Antennal scale (Fig. 1A,B, J–L) rather narrow, 4.7–5.5 times as long as wide; its distolateral spine secondarily armed with two to four spinules; apically with only slightly advanced distomedial angle, not exceeding beyond distolateral spine. Pereopod (Figs 2I, 3D) carpus with seven medial bunches; propodus 2-segmented. Pereopod 1 propodus segment 2 (Fig. 2I) rather long and slender, twice as long as segment 1. Only pleopod 3 exopod of male distally modified (Fig. 3G). Uropodal exopod (Fig. 1C,N) 4.5–5.8 times as long as wide, with two lateral spiniform setae nearly at one third of ramus length; its proximal segment 0.27–0.30 of ramus length. Endopod (Fig. 1N) with two or three medial spiniform setae.

Body length of males 28.5–32 mm.

Comparison. *Boreomysis (B.) inopinata* sp. nov. is uniquely distinguished from other species of the genus by the antennal scale distolateral spine secondarily armed with two to four spines. Otherwise, it is rather similar to *B. (B.) tridens* and differs from this species also by the smoothly rounded angles, flanking the rostrum (acutely pointed or occasionally blunt in *B. (B.) tridens*); the pereopod 1 propodus segment 2 being twice as long as segment 1 (shorter than segment 1 in *B. (B.) tridens*). Additionally, it may also differ by the



Figure 1. *Boreomysis (Boreomysis) inopinata* sp. nov., holotype, male, 31 mm, AM P.106632. (A) habitus, lateral; (B) head, dorsal; (C) posterior part of body, dorsal; (D) posterior part of telson, dorsal; (E) posterior margin of abdomen, lateral; (F) posterior margin of abdomen and proximal part of uropod (left side), ventral; (G) eye cornea, frontal; (H) antennular peduncle, medial; (I) male process of antennula, posterior; (J) antennular peduncle and scale, posterior; (K) distal part of antennular scale; (L) distolateral spine of antennular scale; (M) antennular peduncle, lateral; (N) uropod, ventral. Scales (mm): A, B = 10.0; C, E, F, N = 1.0; D, H, I, K, L (same scale as for K) = 0.5; G, J, M = 0.25.

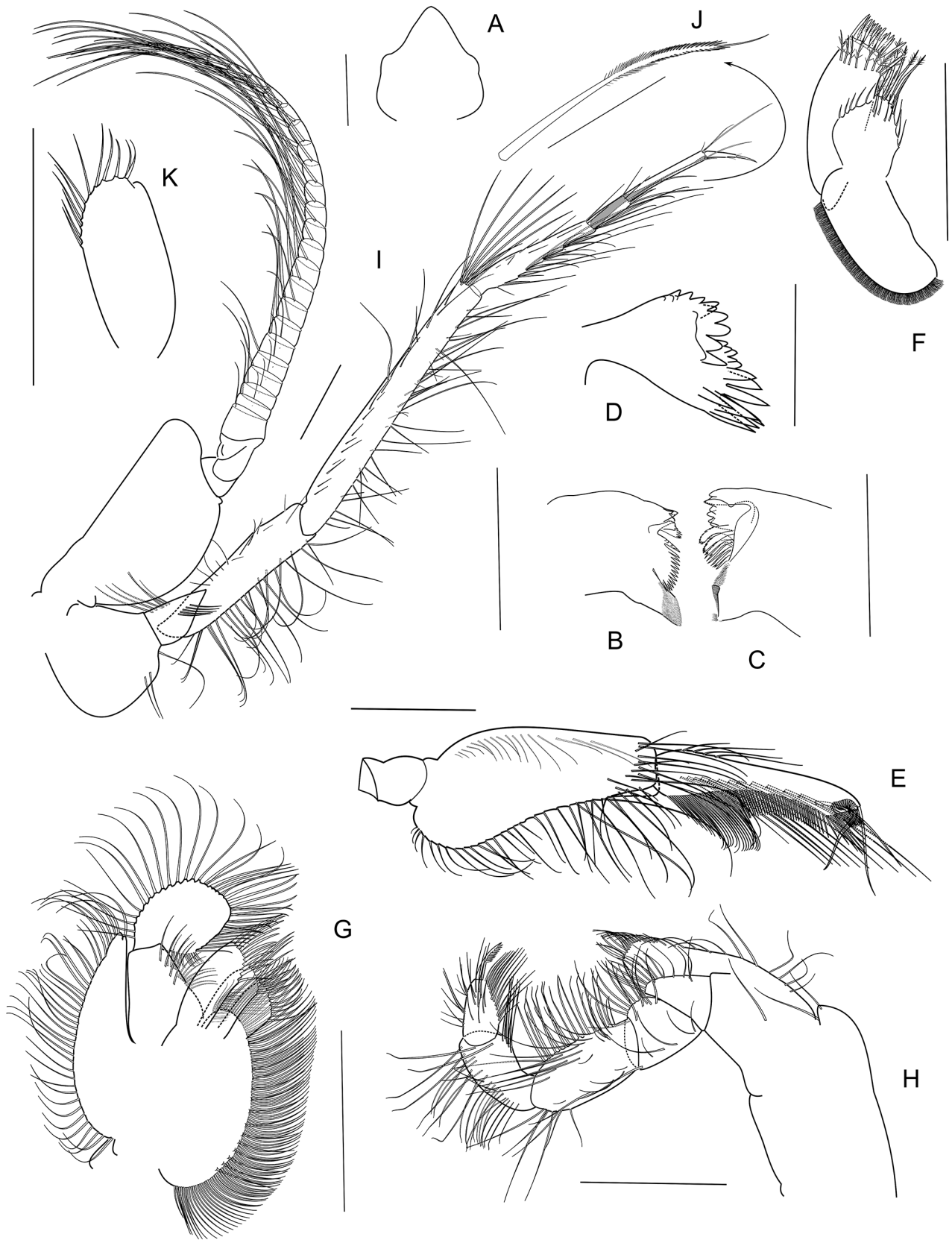


Figure 2. *Boreomysis (Boreomysis) inopinata* sp. nov., holotype, male, 31 mm, AM P.106632. (A) labrum, ventral; (B) right mandible, ventral; (C) left mandible, ventral; (D) right lacinia mobilis, ventral; (E) mandibular palp, posterior; (F) maxilla 1, posterior; (G) maxilla 2, posterior; (H) maxilliped 1 endopod, posterior; (I) pereopod 1 (with flexor muscle of dactylus in propodus), posterior; (J) serrated seta of pereopod 1 carpus; (K) penis, lateral. Scales (mm): A–C, E–I, K = 1.0; D = 0.1; J = 0.25.



Figure 3. *Boreomysis (Boreomysis) inopinata* sp. nov. (A–I) holotype, male, 31 mm, AM P.106632; (J) paratype, female, 32 mm, AM P.106633. (A) maxilliped 2 endopod, posterior; (B, C) serrated setae of maxilliped 2 carpopropodus; (D) pereopod 5 endopod (with flexor muscle of dactylus in propodus), posterior; (E) pleopod 1, posterior; (F) pleopod 2, posterior; (G) pleopod 3, posterior; (H) pleopod 4, posterior; (I) pleopod 5 (also showing endopod muscles), anterior; (J) pleopod 5, posterior. Scales (mm): A, D–J = 1.0; B, C = 0.25.

telson lateral margins having 54–60 spiniform setae (34–40 spiniform setae in *B. (B.) tridens*), and the telson cleft being 0.15–0.17 of the telson length (0.22–0.23 in *B. (B.) tridens*), which needs to be confirmed on larger material. There is a similarity in the shape of the carapace anterior margin with *B. (B.) sphaerops*; particularly in the presence of the lateral angles. However, *B. (B.) inopinata* sp. nov. has rather produced rostrum (short in *B. (B.) sphaerops*), the telson cleft lacking anterior dilatation (present in *B. (B.) sphaerops*), and the narrower antennal scale (4.7–5.5 times as long as wide against 4.1–4.5 in *B. (B.) sphaerops*).

Description of holotype male. Anterodorsal margin of carapace with acutely pointed and upwards directed rostrum, flanked by distinct, apically smoothly rounded angles; laterally without minute concavities; anteroventral lobes large, triangular, pointed. Posterolateral margins of abdominal segment 6 with blunt or apically rounded scutella paracaudalia. Telson 1.29 times as long as last abdominal segment; 2.6 times as long as wide anteriorly, and 0.6 times as wide posteriorly as anteriorly. Cleft 0.15 of telson entire length, with about 60 rather long spinules; anterior dilatation absent. Lateral margins slightly concave, with 58 spiniform setae, including four terminal, forming groups of short, alternated by one long spiniform seta.

Eyes moderate in size, slightly flattened dorsoventrally, with oval cornea, slightly wider than and about as long as stalk. Eyestalk papilla present, rather small. Antennular peduncle, segment 1 with large distal dorsomedial tubercle; segment 2 with two dorsal tubercles; outer tubercle with apical process; segment 3 with lateral posterodistal bunch of long plumose setae; outer flagellum ventrally inflated near basis, with numerous long fine setae. Antennal peduncle with lateral spine; peduncle segment 2 about as long as segment 1 and segment 3, distomedially with slight prominence; segment 3, distal margin broadened like collar. Antennal scale rather narrow, 5.5 times as long as wide, and about twice as long as antennal peduncle.

Labrum conical. Mandible: left corpus, processus incisivus and lacinia mobilis 5-cuspedate, pars centralis with eight serrated setae, pars praemolaris with fine setules, pars molaris with grinding plates and apical tuft of setules; right corpus, processus incisivus 3- or 4-cuspedate, lacinia mobilis with over 20 cusps, pars centralis with 14 spiniform setae, among them distal serrated, pars praemolaris with fine setules, pars molaris with serrated grinding plates. Mandibular palp segment 2 with rather long plumose setae set apart; segment 3 is 0.88 times as long as segment 2, with four lateral, fourteen anteromedial, about 25 long proximomedial and about 40 shorter distomedial setae. Maxilla 1. Outer ramus with nine posterior plumose setae, three of them grouped medially and two shifted to medial margin; apical spiniform setae serrated. Inner ramus with five lateral, five posterior, five medial and six apical long setae, three apical setae distally serrated, similar to those of maxilla 2 and maxilliped 1 endites. Maxilla 2. Exopod oval, 3.0 times as long as wide, about as long as endopod, with plumose setae on lateral and distal margins. Endopod segment 1 with about 12 anteromedial and four posteromedial setae; segment 2 is 1.5 times as long as wide, with lateral plumose setae and apical serrated setae; coxal endite notably prolonged, with dense marginal and sparse posteromedial setae; basal endites with strong serrated setae, similar to those of maxilliped 1 endites.

Maxilliped 1. Exopod 24-segmented. Coxa with two plumose medial setae. Basis without posterolateral group of plumose setae; endite rather long, barely reaching distal margin of ischium, with long setae of two types: thinner, longer and flexible, with setules, and thicker, shorter and stout, distally with rough serrations and spear-like apex. Preischium endite short, but well-established, compared to rather reduced ischium endite; both with long plumose setae. Merus longest segment, 2.2 times as long as wide, with long, plumose and serrated medial setae. Merus and carpopropodus with weakly setulose lateral setae. Carpopropodus 0.77 times as long as merus, with long, plumose anterolateral and serrated medial setae. Dactylus 0.65 of carpopropodus length, with numerous long, weakly setulose setae; its distomedial and posterior margins with serrated setae. Unguis strong, serrated, 0.67 of dactylus length.

Maxilliped 2. Exopod 26-segmented; its basal part with blunt distolateral angle. Endopod general proportions and setation pattern typical for subfamily. Carpopropodus distomedial part without concavity, with setae only slightly more robust and stronger serrated than other setae, without special modifications.

Pereopods. Exopod with 23 segments. Endopod 1. Preischium with six anterior and five posterior setae. Ischium 0.79 times as long as merus, with numerous long sparsely plumose setae on medial and short smooth setae on lateral margins. Merus with numerous long sparsely plumose setae on medial and lateral margins, and distolateral bunch of long plumose setae. Carpus with seven medial bunches of setae; each bunch containing one long straight and four to six shorter bent plumose setae, becoming stronger and more strongly serrated in distal bunches. Propodus 2-segmented, about as long as carpus; its muscle in both segments; segment 2 twice as long as segment 1, with smooth paracymbial setae. Unguis 0.77 times as long as dactylus. Other endopods. Preischium with four setae. Ischium 0.62 times as long as merus. Propodus segment 1 is 0.73–0.77 of segment 2; segment 1 and 2 together 0.81–0.87 times as long as carpus. Unguis 1.16–1.27 times as long as dactylus.

Penis with small posterodistal lobe; anterodistal margin with about 12 long setae. Pleopod 1 exopod with about 24 segments; endopod less than half as long as exopod, without separation on segments and with numerous long setae. Pleopod 2 exopod with about 26 segments; endopod slightly shorter than exopod, with about 23 segments. Pleopod 3 exopod with about 28 segments; its distal segments with shorter and stronger spiniform setae; endopod shorter than exopod, with about 21 segments, bearing unmodified setae. Pleopod 4 exopod with about 22 segments; endopod slightly shorter than exopod, with about 23 segments. Pleopod 5 exopod with about 23 segments; endopod slightly shorter than exopod, with about 21 segments. Uropodal exopod, proximal segment with two distolateral spiniform setae; endopod with three medial spiniform setae.

Variation. Eyestalk papilla from hardly visible, tubercle-like to quite large, prolonged. Pereopod exopod 23–29-segmented.

Distribution and habitat. Bathypelagic. Tasman Sea off the Australian coast at depth of 919–2634 m (Fig. 16).

Molecular characters. I was able to obtain mtDNA COI gene sequences from two specimens of *B. (B.) inopinata* sp. nov., collected from neighbouring localities in Tasmania.

The sequences were nearly identical, with 0.17% of divergence between them. They also showed relatively low, 16% distance to the sequence of *B. (B.) sphaerops*, compared to a much deeper, 33–49% distance to other species of the subgenus. The two species indeed have certain morphological similarity (see Comparison above), however, a more extensive taxon and gene sampling should reveal actual phylogenetic relationships.

Boreomysis (Boreomysis) sibogae Hansen, 1910

Fig. 4

- Boreomysis sibogae* Hansen, 1910: 25, plate II, fig. 3a–c.—W. M. Tattersall, 1913: 870; 1951: 51.—Nierstrasz & Brender à Brandis, 1923: 109.—Illig, 1930: 414, 560.—Nouvel, 1943: 56, 58.—W. M. Tattersall & O. S. Tattersall, 1951: 63.—O. S. Tattersall, 1955: 5, 11, 15, 20, 22, 25, 66, 68, 74.—Holmquist, 1956: 428, 438, 442–445, 447.—Gordan, 1957: 343.—Birstein & Tchindonova, 1958: 281, 287, 290, 337, 338, 342.—Ii, 1964: 8, 13, 18, 19, 42, 47–49.—Pillai, 1965: 1682, 1686, 1687, fig. 6 (after Hansen, 1910, plate II, fig. 3e).—Mauchline & Murano, 1977: 50.—Fenton, 1986: 12, 55, 167–170, 185, 186, 194, 255, 331, fig. 2–3 (after Hansen, 1910, plate II, fig. 3d).—Lancraft *et al.*, 1989: 227.—Müller, 1993: 29.—Petryashov, 1993a: 79, 81.—Ledoyer, 1995: 602, 603–605, fig. 1.—Hargreaves, 1997: 56.—Lowry & Stoddart, 2003: 430.—Sawamoto, 2014: 4.
- Boreomysis spinifera* Coifmann, 1937: 16, plate 5, fig. 8a–c, plate 8, fig. 8f, g.—W. M. Tattersall, 1939a: 206, 207, 232.
- [Non *Boreomysis spinifera*.—Holmquist, 1956: 432, 434, 439, 445–447, fig. 4.—Birstein & Tchindonova, 1958: 289].

Type material. Syntypes, male and 2 females, Indonesia, 03°20'S 127°22.9'E, coll. *Siboga*, stn 185 (NBC ZMA. CRUS.E.150021).

Material. Female (illustrated), 31 mm, Tasmania, Flinders Commonwealth Marine Reserve, from 40°27'47"S 149°24'54"E to 40°27'40"S 149°21'50"E, 4129–4131 m, 21 May 2017, coll. BPT, L. E. Hughes, F. Köhler, E. K. Kupriyanova, IN2017_V03_016, BES (AM P.101174); juvenile (rostrum illustrated), New South Wales, off Byron Bay, from 28°40'40"S 154°12'13"E to 28°42'57"S 154°11'20"E, 2591–2566 m, 07 Jun 2017, coll. same as previous, IN2017_V03_096, BES (AM P.106640); juvenile, same as previous (AM P.106641; GenBank OQ699905, voucher B6); subadult male (rostrum illustrated), 3 juveniles, New South Wales, off Bermagui, from 36°21'37"S 150°38'37"E to 36°19'24"S 150°39'01"E, 2835–2739 m, 27 May 2017, coll. same as previous, IN2017_V03_045, BES (AM P.106643); subadult male (telson illustrated), 2 juveniles, New South Wales, Central Eastern Commonwealth Marine Reserve, from 30°06'47"S 153°53'53"E to 30°06'58"S 153°52'01"E, 2634–2324 m, 06 Jun 2017, coll. same as previous, IN2017_V03_087, BES (AM P.106642); juvenile, New South Wales, Hunter Commonwealth Marine Reserve, from 32°34'38"S 153°09'39"E to 32°36'47"S 153°08'56"E, 2434–2480 m, 03 Jun 2017, coll. same as previous, IN2017_V03_076, BES (AM P.106645); juvenile, Tasmania, Bass Strait, from 39°33'07"S 149°33'11"E to 39°29'46"S 149°35'53"E, 4197–4133 m, 23 May 2017, coll. same as previous, IN2017_V03_030, 4MBT (AM P.106644); 2 juveniles, New South Wales, Central Eastern Commonwealth Marine Reserve, from 30°06'47"S 153°53'53"E to 30°06'58"S 153°52'01"E, 2634–2324 m, 06 Jun 2017, coll.

same as previous, IN2017_V03_087, BES (AM P.101188); 26 damaged specimens, Tasmania, Bass Strait, from 39°27'43"S 149°16'37"E to 39°27'54"S 149°14'46"E, 2774–2697 m, 22 May 2017, coll. same as previous, IN2017_V03_023, BES (AM P.101178); juvenile, same as previous (AM P.106639; GenBank OQ699906, voucher B10).

Diagnosis. Anterodorsal margin of carapace (Fig. 4A–D) with rather short, acutely pointed and upwards to forwards directed rostrum, reaching proximal part of antennular peduncle segment 1, flanked by nearly smoothly rounded margins, not forming angles. Telson (Fig. 4F–H) 1.1–1.2 times as long as last abdominal segment, 3.0–3.4 times as long as wide anteriorly and 0.53–0.61 as wide posteriorly as anteriorly. Telson lateral margins slightly concave in central part, with 36–60 spiniform setae arranged in 8–15 series: setae increasing in length within series, and three terminal spiniform setae; longest terminal spiniform seta 1.0–3.0 times as long as shorter medial ones. Telson cleft 0.20–0.25 of telson length, without anterior dilatation and about 85 rather long spinules. Eyes (Fig. 4A–D) large to moderate in size, broad, slightly flattened dorsoventrally, 0.33–0.37 of head width; cornea shorter and wider than, but not dominating over eyestalk; eye papilla small to relatively long. Antennular peduncle extending beyond half of antennal scale (Fig. 4A,D). Antennal scale (Fig. 4D,I) 3.3–4.2 times as long as wide; its distolateral spine not armed with additional spinules; apically with only slightly advanced distomedial angle, not exceeding beyond distolateral spine. Pereopod (Fig. 4L) carpus with seven medial bunches; propodus 2-segmented. Pereopod 1 propodus segment 2 is 1.6 times as long as segment 1. Uropodal exopod (Fig. 4K) with two lateral spiniform setae; its proximal segment 0.20–0.27 of ramus length. Endopod (Fig. 4L) with one or two medial spiniform seta or without them.

Body length 13–38 mm.

Comparison. *Boreomysis (B.) sibogae* is not known yet to have any unique characters in the genus, and its affinity cannot be clearly established as well. It seems to be most similar to *B. (B.) brucei* W. M. Tattersall, 1913, *B. (B.) californica* Ortmann, 1894, and *B. (B.) intermedia* Ii, 1964. *Boreomysis (B.) brucei* and *B. (B.) intermedia* are similar to the immature specimens of *B. (B.) sibogae*, and their taxonomic status is unclear (see Remarks). From *B. (B.) californica* it is distinguishable by the somewhat deeper telson cleft, which is 0.20–0.25 of the telson length (0.15–0.18 in *B. (B.) californica*), and the distal part of the antennal scale not produced beyond the outer spine (produced in *B. (B.) californica*).

Description of Australian specimens (adults). Anterodorsal margin of carapace with relatively short, acutely pointed and upwards directed rostrum, reaching proximal part of antennular peduncle segment 1, flanked by nearly smoothly rounded margins; laterally without minute concavity; anteroventral lobes triangular, pointed. Posterolateral margins of the abdominal segment 6 with apically rounded or pointed scutella paracaudalia. Telson 1.08–1.15 times as long as last abdominal somite and nearly reaching tip of uropodal endopods; 3.3–3.4 times as long as wide anteriorly, and 0.58–0.60 times as wide posteriorly as anteriorly. Telson lateral margins slightly concave in central part, with about 36–58 spiniform setae arranged in about 15 series of short, alternated by one long spiniform seta; longest terminal

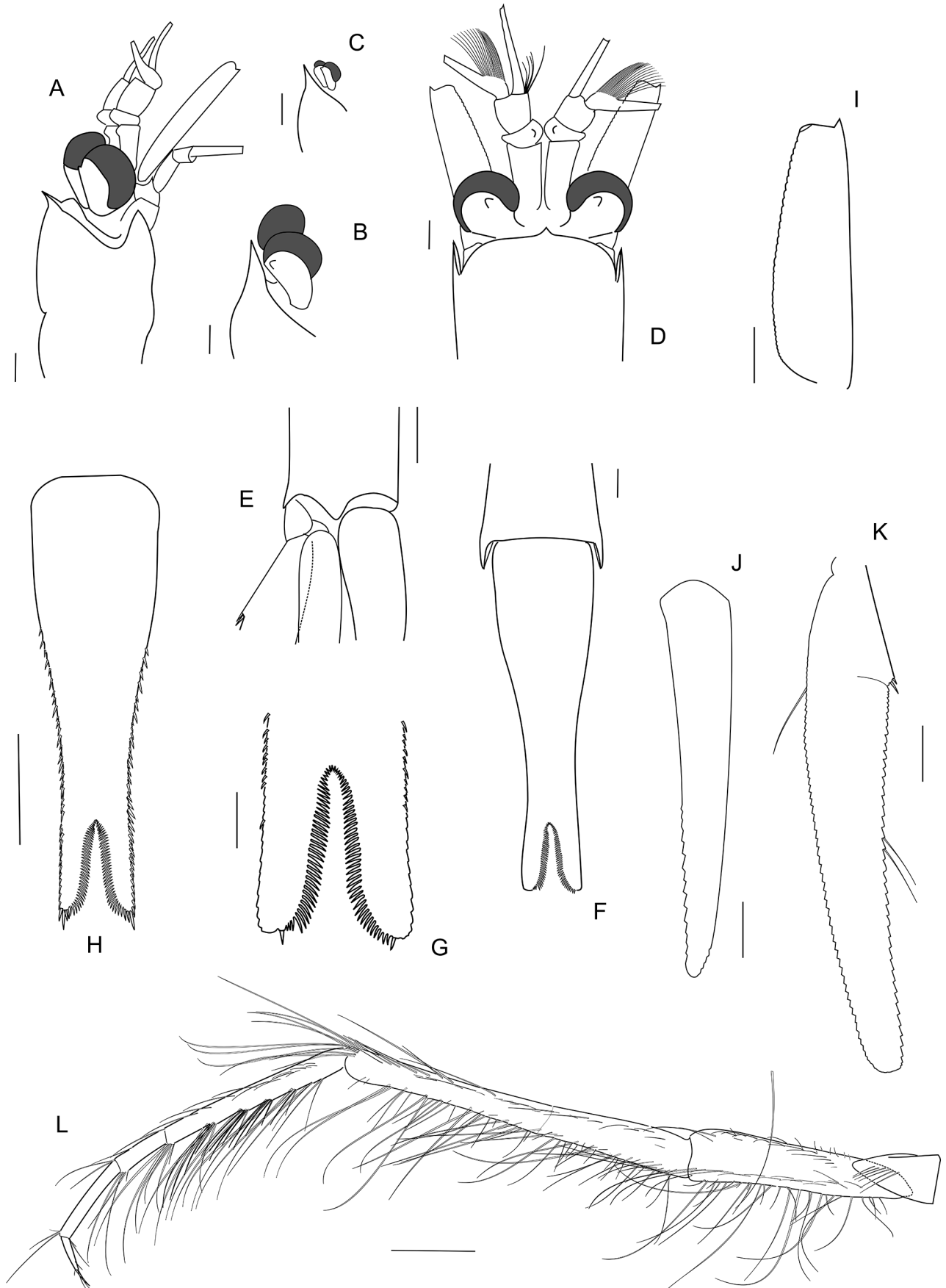


Figure 4. *Boreomysis (Boreomysis) sibogae*. (A, D–G, I–K) female, 31 mm, Tasmania, AM P.101174; (B) subadult male, New South Wales, AM P.106643; (C) juvenile, New South Wales, AM P.106640; (H) subadult male, New South Wales, AM P.106642. (A) head, lateral; (B) rostrum and eyes, lateral; (C) rostrum and eyes, lateral; (D) head, dorsal; (E) posterior margin of abdomen, lateral; (F) posterior margin of abdomen and telson (lateral spiniform setae not shown), dorsal; (G) posterior part of telson; (H) telson; (I) antennal scale; (J) uropodal endopod, ventral; (K) uropodal exopod (most of setae not shown); (L) pereopod 1 endopod, posterior. Scales (mm): 1.0.

spiniform seta 1.5–1.6 times as long as shorter medial ones. Cleft 0.22 of telson entire length, with about 85 spinules; dilatation absent.

Eyes of moderate size to relatively large from dorsal view, broader than long, slightly flattened dorsoventrally; cornea thinner and wider than, but not dominating over eyestalk. Eyestalk papilla present, short. Antennular peduncle segment 1 with distal dorsomedial tubercle; segment 2 with two dorsal tubercles, outer tubercle with apical process; segment 3 medially with seven setae and one posterodistal bunch of long plumose setae; outer flagellum ventrally inflated near basis, with numerous long fine setae. Antennal scale less than twice as long as antennular peduncle, 3.3–3.5 times as long as wide; apically with only slightly advanced distomedial angle, not produced beyond outer spine.

Mouthparts and maxillipeds similar to previous species.

Pereopods. Exopod with 23–27 segments; its basal part with rounded outer corner. Endopod 1. Preischium with six posterior setae. Ischium 0.64 times as long as merus, with numerous long sparsely plumose setae on medial and anteromedial margins, and shorter setae on lateral margin. Merus with numerous long sparsely plumose setae on medial and lateral margins, and distolateral bunch of long plumose setae. Carpus with seven medial bunches of setae; each bunch containing one long straight and two to four shorter bent plumose setae, becoming stronger and more strongly serrated in distal bunches. Propodus 2-segmented; its muscle in both segments; segment 1 is 0.62 times as long as segment 2; segment 1 and 2 together 0.73 as long as carpus; segment 2 with smooth paradactylary setae. Unguis 0.54 times as long as dactylus. Other endopods. Propodus segment 1 is 0.60 times as long as segment 2; segment 1 and 2 together 0.86 times as long as carpus. Unguis 0.76 times as long as dactylus.

Uropodal exopod about 6 times as long as wide, 1.4 times as long as endopod and 1.22 times as long as telson; its proximal segment 0.20–0.22 of ramus length, with two distolateral spiniform setae. Endopod with 0–1 medial spiniform setae.

Variation. The rostrum is rather variable in length and direction, depending on the age the specimens (Fig. 4A–D). It is relatively short and directed upwards in mature individuals. In the juveniles the rostrum is extended forward till the middle of the antennular peduncle segment 1. The eyes are wider in adults, with smaller papilla, compared to juveniles. In the antennal scale, the distal projection is occasionally slightly advanced beyond the outer spine in immature individuals. The adult specimens from the Gulf of Aden (Arabian Sea) are distinguished by the smaller size (13–14 mm against 28–38 mm in other parts of the range), the longer eye papilla and longer outer terminal spiniform setae of the telson (3.0 against 1.0–1.6 times as long as the shorter medial ones in other parts of the range). Possible taxonomic significance of this difference has to be studied on a larger material.

Distribution. The species was first described from the Banda Sea near Manipa Island in Indonesian waters (Hansen, 1910). Later it was collected from the Indian Ocean off Somali (Illig, 1930), the Gulf of Aden (Coifmann, 1937; W. M. Tattersall, 1939), the South and Mid-Atlantic Ocean (O. S. Tattersall, 1955; assigned with doubt), the Okhotsk Sea (W. M. Tattersall, 1951; Birstein & Tchindonova, 1958)

and in the North-West Pacific (Birstein & Tchindonova, 1958), Southern Indian Ocean (Ledoyer, 1989, 1995), in the Weddell Sea of the Southern Ocean (Lancraft *et al.*, 1989), and possibly also in the North-eastern Atlantic (Hargreaves, 1997). Birstein & Tchindonova (1958) considered *B. (B.) sibogae* the Pacific species, sporadically recorded in the Atlantic and Indian Oceans. If the records from the Atlantic, Indian and Southern Ocean are correct, the species definitely has a wider range. First collected in the Australian waters from a fish stomach in the Tasman Sea east of Tasmania (Fenton, 1986). In the current study its presence in Australia is confirmed by eight records all along the Tasman Sea coast (Fig. 16).

Habitat. Epi-bathypelagic. Found above the depths of 50–5000 m; in the Australian waters at depth of 200–4197 m. Parasitized by the dajid isopods *Streptodajus equilibrans* Nierstrasz et Brender à Brandis, 1923, which was sampled from the type specimens at the depth of 1536 m (Nierstrasz & Brender à Brandis, 1923).

Molecular characters. The two mtDNA COI gene sequences, one from the Tasmanian coast and another from the New South Wales, were 7.5% distant from each other, which is rather deep intraspecific differentiation within the Tasman Sea. *Boreomysis (B.) sibogae* was 43–54% distant from other species of the subgenus.

Remarks. The subadult specimens, originally shortly described by Hansen (1910), were not fully developed and had somewhat smaller eyes than the adult female from the Tasman Sea, which was at my disposal. Similarly, the subadults and juveniles in the Australian collection also had smaller eyes. *Boreomysis (B.) brucei* was originally considered to be closely related to *B. (B.) sibogae* (W. M. Tattersall, 1913), differing only by the longer rostrum and slightly advanced distal part of the antennal scale. It was described from two immature specimens. Birstein & Tchindonova (1958) also considered a possibility of *B. (B.) brucei* to be a variety of *B. (B.) sibogae*. Plausible unity of the two taxa was later expressed by Ii (1964). He also described *B. (B.) intermedia*, entirely based on small immature specimens, which looked like immature *B. (B.) sibogae* from the Australian waters, with prolonged rostrum and thinner antennal scales with somewhat produced distal part. Ii also considered *B. (B.) arctica* to be closely related to *B. (B.) sibogae*, with slightest possibility of them even being conspecific. However, *B. (B.) arctica* is more distant than *B. (B.) brucei*, *B. (B.) intermedia* and *B. (B.) sibogae* by the rostrum being always rather long with smoothly rounded lateral margins, having rather long telson and deep cleft, long and narrow antennal scale. The mtDNA lineages of *B. (B.) arctica* and *B. (B.) sibogae* were 50–54% distant from each other. Finally, Ii (1964) suggested that also *B. (B.) californica* may be close to *B. (B.) sibogae*. The difference is indeed rather small (see Comparison), but I will leave this question open for future. Ledoyer (1995) noticed that his previous record of *B. (B.) brucei* from the Southern Indian Ocean (Ledoyer, 1989) belonged to *B. (B.) sibogae*.

W. M. Tattersall (1939) mentioned that *B. (B.) sibogae* is also distinguished from other species by the great length of the first segment of the uropodal exopod. As I measured it in the Australian species and from illustrations of other species of the genus, I found it to be similar to the majority of them.

O. S. Tattersall (1955) synonymized *B. (B.) spinifera* Coifmann, 1937 with *B. (B.) sibogae*, which was not supported by Holmquist (1956) and Birstein & Tchindonova (1958), but supported by Ii (1964), Pillai (1965) and Fenton (Fenton, 1986; Fenton in Lowry & Stoddart, 2003). According to the original figures of Coifmann (1937), the small, 14 mm long, male had a rather short rostrum, small eyes with long papilla, the antennal scale 3.7 times as long as wide, the uropodal endopod with two spiniform setae, the telson cleft without dilatation, and the longest terminal spiniform setae of the telson about 3.0 times as long as the shorter medial ones. From the adults of *B. (B.) sibogae* they were only distinguished by the smaller size, longer eye papilla, and longer terminal spiniform setae. At the current stage of our knowledge this is indeed a rather small difference, and I tend to support the synonymization. According to the illustrations of Holmquist (1956), the specimens from the collection of Illig (1930), which she assigned to *B. (B.) spinifera*, had clear dilatation at the anterior part of the telson cleft. This is not characteristic either to *B. (B.) sibogae* or to *B. (B.) spinifera* in its original sense. Due to poor preservation of specimens it is not possible to assign them to any species. In my opinion, an immature specimen under the name *B. (B.) spinifera* in Birstein & Tchindonova (1958) probably belongs to *B. (B.) sphaerops* (see details in the remarks section about *B. (B.) sphaerops*).

The overall identity of *B. (B.) sibogae* and its various related taxa still remain rather confusing due to poor preservation of the specimens and wide morphological variation concerning the rostrum, eyes, antennal scales and uropods.

Boreomysis (Boreomysis) sphaerops Ii, 1964

Figs 5, 6

Boreomysis sphaerops Ii, 1964: 18, 19, 30, 32, 39, 44, 50–56, figs 11–13.—Müller, 1993: 29.

Boreomysis spinifera.—Birstein & Tchindonova, 1958: 289, fig. 15.

Type specimens. Ii (1964) based his description on a large series of specimens, from which a 23 mm male was designated as “type”, and should probably be treated as the holotype, Japan, Shizuoka Prefecture, Sagami Bay, an islet near Ajiro, 4 miles [ca 6.4 km] east of Hashima, 1000–0 m, 02 Apr 1938, haul No. E-12, vertical net (Ii’s collection No. 67b); and a 25 mm female was designated as “allotype”, same locality, 32 Mar 1938, haul No. E-4 (Ii’s collection No. 65). Status unknown.

Type locality. Japan, Shizuoka Prefecture, Sagami Bay, an islet near Ajiro, about 6.4 km east of Hashima.

Material. Female (subadult), 27 mm, New South Wales, off Byron Bay, from 28°40'40"S 154°12'13"E to 28°42'57"S 154°11'20"E, 2591–2566 m, 07 Jun 2017, coll. RV *Investigator*, BPT, L. E. Hughes, F. Köhler, E. K. Kupriyanova, IN2017_V03_096, BES (AM P.106636); male (subadult, rather damaged), 27 mm, juvenile, New South Wales, Central Eastern Commonwealth Marine Reserve, from 30°06'47"S 153°53'53"E to 30°06'58"S 153°52'01"E, 2634–2324 m, 06 Jun 2017, coll. same as previous, IN2017_V03_087, BES (AM P.106637); male subadult, same as previous (AM. P.106638; GenBank OQ699909, voucher B3).

Diagnosis. Anterodorsal margin of carapace (Fig. 5A,B) with rather short, acutely pointed and upwards directed rostrum, barely reaching proximal part of antennular peduncle segment 1, flanked by smoothly rounded angles. Telson (Fig. 5C,E) 1.2–1.3 times as long as last abdominal segment, 3.0–3.2 times as long as wide anteriorly and 0.47–0.52 as wide posteriorly as anteriorly. Telson lateral margins barely concave in central part, with 28–54 spiniform setae arranged in about 10 series: setae increasing in length within series, and three terminal spiniform setae; longest terminal spiniform seta flanked by one or two medial and one lateral spiniform setae, about half as long as central. Telson cleft 0.18–0.22 of telson length, with anterior dilatation and about 70–100 rather long spinules. Eyes (Fig. 5A,B) large from dorsal view, broad, slightly flattened dorsoventrally, about 0.4 of head width; cornea shorter and wider than, but not dominating over eyestalk; eye papilla small. Antennular peduncle extending beyond half of antennal scale (Fig. 5A,B). Antennal scale (Fig. 5A,B,F,G) 4.1–4.5 times as long as wide; its distolateral spine not armed with additional spinules; apically with only slightly advanced distomedial angle, not exceeding beyond distolateral spine. Pereopod (Fig. 6C) carpus with seven medial bunches; propodus 2-segmented. Pereopod 1 propodus segment 2 rather long and slender, about twice as long as segment 1. Uropodal exopod (Fig. 5C,D) with two lateral spiniform setae; its proximal segment 0.23–0.26 of ramus length. Endopod (Fig. 5O) with two or three medial spiniform setae.

Body length 27 mm (immature) in Australia (originally 21–25 mm, North-West Pacific).

Comparison. *Boreomysis (B.) sphaerops* is rather similar to *B. (B.) obtusata* G. O. Sars, 1883, from which it is distinguished by the presence of the anterior dilatation in the telson cleft (absent in *B. (B.) obtusata*), one of the lateral terminal spiniform setae of the telson being twice as long as the flanking ones (about equal in length in *B. (B.) obtusata*), the rather big eyes, which, when both directed forward, touching each other by lateral margins, extending in adult specimens beyond the head sides (not extending in *B. (B.) obtusata*), and by the shape of the eye cornea, which is rather distinctly narrow from the dorsal view, shorter than the eye stalk (about as wide as the stalk in *B. (B.) obtusata*). There is a similarity in the shape of the carapace anterior margin with *B. (B.) inopinata* sp. nov., particularly in the presence of the lateral angles. However, *B. (B.) sphaerops* has rather short rostrum (produced in *B. (B.) inopinata* sp. nov.), the telson cleft having the anterior dilatation (absent in *B. (B.) inopinata* sp. nov.), and the slightly wider antennal scale (4.1–4.5 times as long as wide against 4.7–5.5 in *B. (B.) inopinata* sp. nov.).

Description of Australian specimens. Anterodorsal margin of carapace with rather short, acutely pointed and upwards directed rostrum, not reaching proximal part of antennular peduncle segment 1, flanked by smoothly rounded angles; laterally without minute concavity; anteroventral lobes large, triangular, pointed. Posterolateral margins of the abdominal segment 6 with apically pointed scutella paracaudalia. Telson 1.2–1.3 times as long as last abdominal segment and nearly reaching tip of uropodal endopods; 3.2 times as long as wide anteriorly, and 0.52 times as wide posteriorly as anteriorly. Telson lateral margins barely concave in central

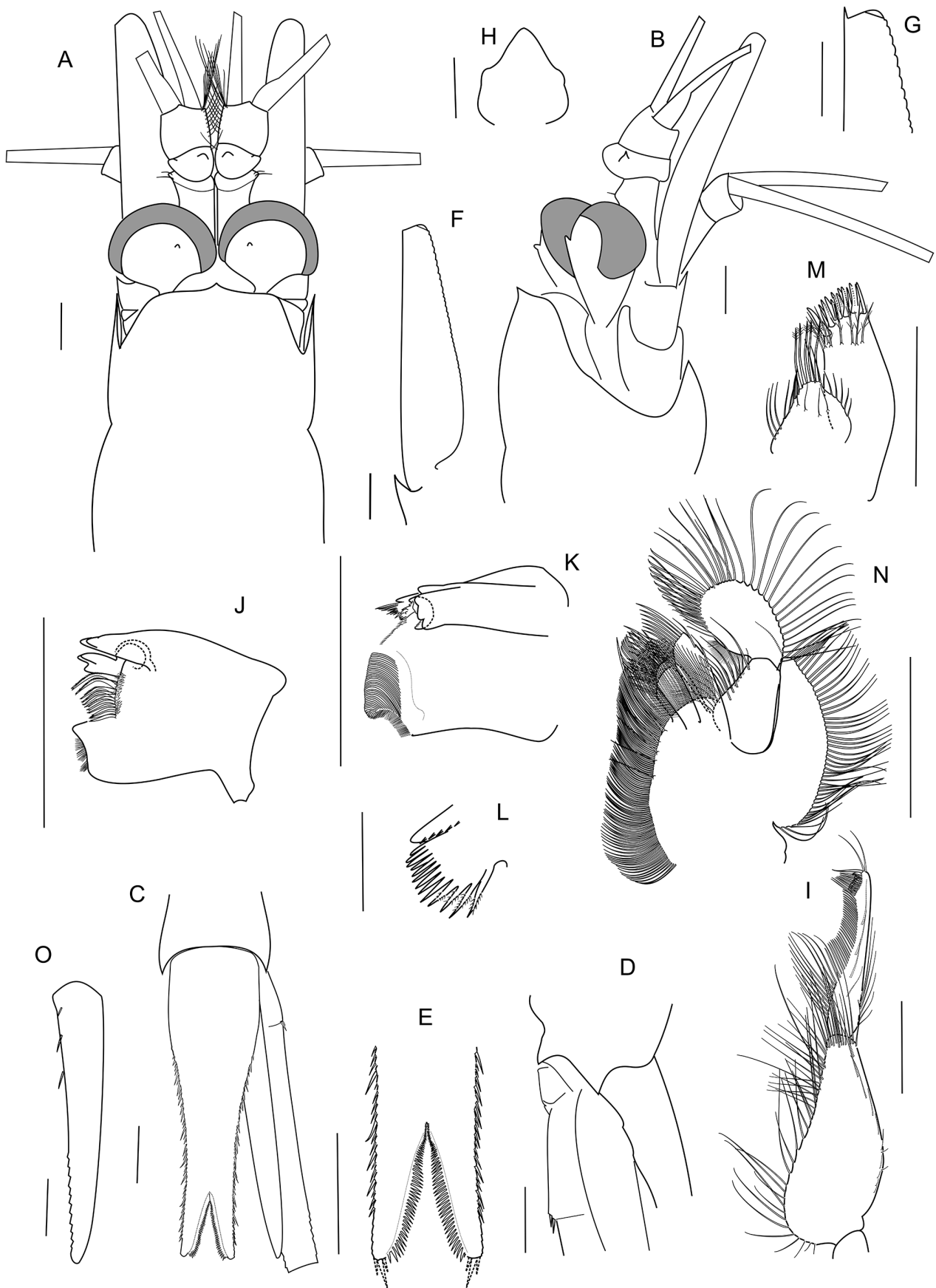


Figure 5. *Boreomysis (Boreomysis) sphaerops*. (A–F, H–N) subadult female, New South Wales, AM P.106636; (G) subadult male, New South Wales, AM P.106637. (A) head, dorsal (antennal scale spine missing); (B) head, lateral; (C) posterior part of abdomen with telson and uropods (setae not shown), dorsal; (D) posterior margin of abdomen, lateral; (E) posterior part of telson; (F) antennal scale (distolateral spine missing); (G) distal part of antennal scale; (H) labrum, ventral; (I) mandibular palp, posterior; (J) left mandible, ventral; (K) right mandible, dorsal; (L) pars centralis of right mandible; (M) maxilla 1, posterior; (N) maxilla 2, posterior. Scales (mm): A–K, M, N = 1.0; L = 0.25.

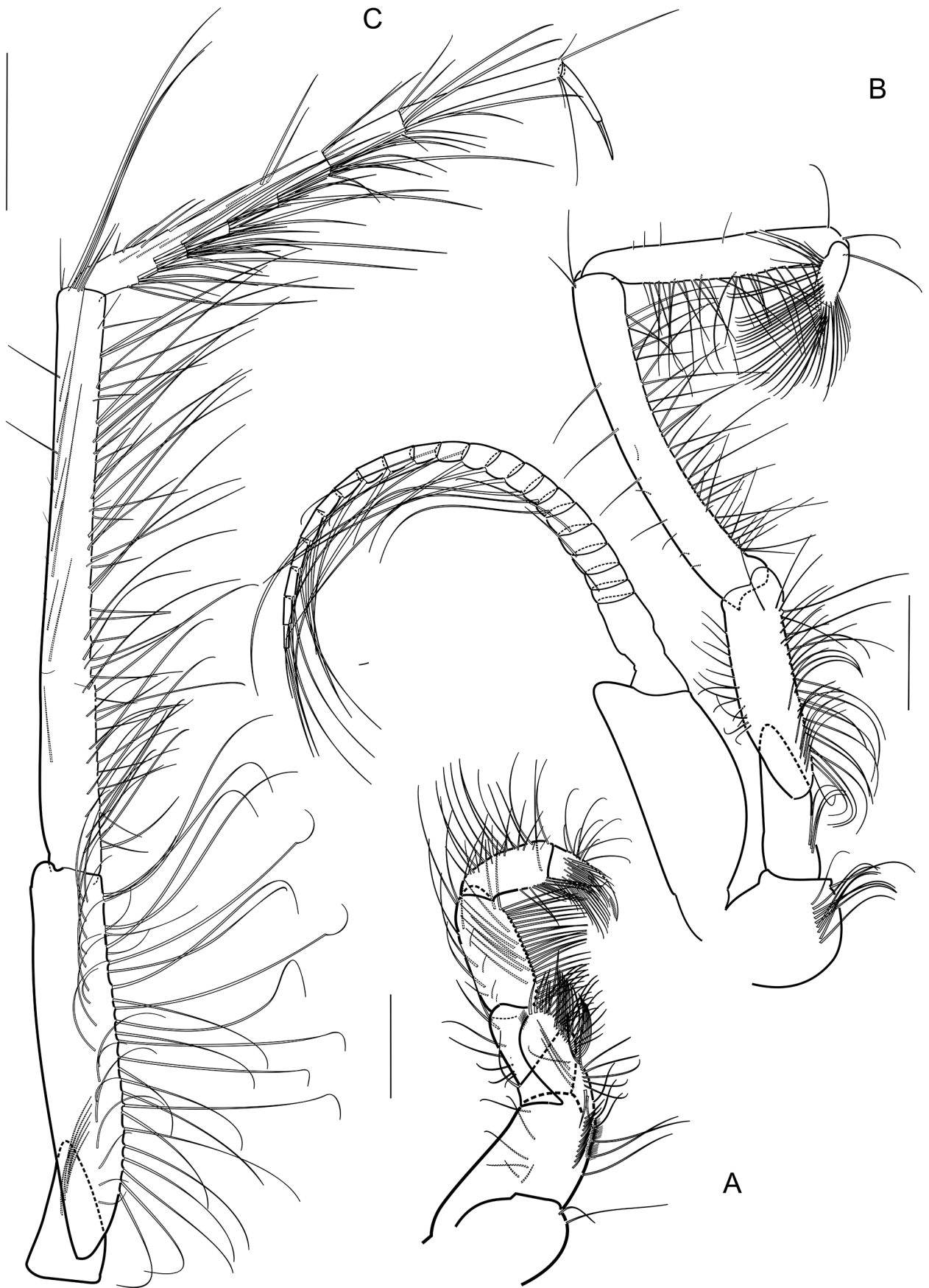


Figure 6. *Boreomysis (Boreomysis) sphaerops*, subadult female, New South Wales, AM P.106636. (A) maxilliped 1 endopod, posterior; (B) maxilliped 2, anterior; (C) pereopod 1 endopod, anterior. Scales (mm): 1.0.

part, with 53–54 spiniform setae arranged in about ten series: setae increasing in length within series, and three terminal spiniform setae; longest terminal spiniform seta 0.05 of entire telson length, flanked by one lateral and one medial spiniform setae, half as long as central. Cleft 0.20–0.22 of telson entire length, with 70–100 spinules; dilatation present.

Eyes large from dorsal view, broader than long, slightly flattened dorsoventrally; cornea narrower than eyestalk. Eyestalk papilla present, rather small. Antennular peduncle longer than half of antennal scale; segment 1 with distal dorsomedial tubercle; segment 2 with two dorsal tubercles, outer tubercle with apical process; segment 3 medially with seven setae and one posterodistal bunch of long plumose setae; outer flagellum ventrally inflated near basis, with numerous long fine setae. Antennal scale 4.1–4.2 times as long as wide; apically with only slightly advanced distomedial angle.

Labrum conical. Mandible: left corpus, processus incisivus and lacinia mobilis both 3-cuspedate, pars centralis with eleven serrated setae, pars praemolaris with fine setules, pars molaris with grinding plates and apical tuft of setules; right corpus, processus incisivus 4-cuspedate, lacinia mobilis with over 20 cusps, pars centralis with 14 spiniform setae, among them distal serrated, pars praemolaris with fine setae, pars molaris with serrated grinding plates. Mandibular palp segment 2 with rather long plumose setae, set apart proximally and dense distally; segment 3 is 0.81 times as long as segment 2, with five or six lateral, six anteromedial, about fifteen long proximomedial and about 30 shorter distomedial setae. Maxilla 1. Outer ramus with nine posterior plumose setae, three of them grouped medially and two shifted to medial margin, apical spiniform setae serrated. Inner ramus with seven lateral, four posterior, five medial and seven apical long setae, five apical setae distally serrated, similar to those of maxilla 2 and maxilliped 1 endites. Maxilla 2. Exopod oval, 2.5 times as long as wide, about as long as endopod, reaching its second segment, with plumose setae. Endopod segment 1 with about 14 anteromedial and four posteromedial setae; segment 2 is 1.6 times as long as wide, with lateral plumose setae and apical serrated setae. Coxal endite notably prolonged, with dense marginal and sparse posteromedial setae. Basal endites with strong serrated setae, similar to those of maxilliped 1 endites.

Maxilliped 1. Coxa with two plumose medial setae. Basis with posterolateral plumose setae; endite rather long, barely reaching distal margin of ischium, with long setae of two types: thinner, longer and flexible, with setules, and thicker, shorter and stout, distally with rough serrations and spear-like apex. Preischium endite short, but well-established, compared to rather reduced ischium endite; both with long plumose setae. Merus the longest segment, 2.2 times as long as wide, with long, plumose and serrated medial setae. Ischium and merus with weakly setulose lateral setae. Carpopropodus 0.75 times as long as merus, with long, plumose anterolateral and serrated medial setae. Dactylus 0.67 of carpopropodus, with numerous long, weakly setulose setae; its distomedial and posterior margins with serrated setae. Unguis strong, serrated, 0.63 of dactylus length.

Maxilliped 2. Exopod 23-segmented; its basal part with blunt distolateral angle. Endopod general proportions and setation pattern typical for subfamily. Carpopropodus

distomedial part without concavity, with setae only slightly more robust and stronger serrated than other setae, without special modifications.

Pereopods. Exopod with 23–26 segments; its basal part with rounded outer corner. Endopod 1. Preischium with seven posterior setae. Ischium 0.67 times as long as merus, with numerous long sparsely plumose setae on medial and anteromedial margins, and shorter setae in proximal part of lateral margin. Merus with numerous long sparsely plumose setae on medial and lateral margins, and a distolateral bunch of long plumose setae. Carpus with seven medial bunches of setae, each bunch containing one long straight and four to six shorter bent plumose setae, becoming stronger and more strongly serrated in distal bunches. Propodus 2-segmented; its muscle in both segments; segment 1 is 0.51 of segment 2; together 0.88 length of carpus; segment 2 with smooth paradactylary setae. Unguis 0.58 times as long as dactylus.

Other endopods. Preischium with four to seven setae. Ischium 0.51–0.62 times as long as merus. Propodus segment 1 is 0.56–0.73 of segment 2; together 0.83–0.95 times as long as carpus. Unguis 0.41–0.69 times as long as dactylus.

Uropodal exopod 6.3 times as long as wide, 1.26 times as long as endopod and 1.26 times as long as telson; its proximal segment 0.23 of ramus length, with two distolateral spiniform setae. Endopod with three medial spiniform setae.

Variation. The Australian specimens were distinguished by the larger number of the telson lateral spiniform setae (53–54) than in the Japan material (28–42). However, the Australian specimens were somewhat larger than the Japanese (see above the Body length section). Additionally, the Tasman Sea specimens differ from the North-West Pacific ones by the slightly more produced anterior margin of the antennal scale, reaching the tip of the outer spine (not reaching in the North-West Pacific) and the three against two medial spiniform setae of the uropodal endopod. I had only three immature and damaged specimens at my disposal, and a more extensive collection is necessary to confirm any special status of the Australian population.

Distribution and habitat. West Indo-Pacific species. Meso-bathypelagic. Originally described from the North-West Pacific off Japan at depth 600–1200 m (possibly also shallower due to vertical sampling) (Ii, 1964). An immature specimen, reported in the North-West Pacific by Birstein & Tchindonova (1958) at depth 0–4400 m, probably also belongs to this species. In this study, *B. (B.) sphaerops* is found in the Tasman Sea off New South Wales at depth 2324–2634 m (Fig. 16).

Molecular characters. The only COI sequence that I was able to obtain was 16% distant from *B. (B.) inopinata* sp. nov., to which it also shows some, albeit weak, morphological affinity (see Comparison above). Divergence from other species of the subgenus was 32–51%.

Remarks. Ii (1964) provided a rather detailed description and illustrations of *B. (B.) sphaerops* and compared it with *B. (B.) obtusata* as the most closely related species. An immature specimen, identified by Birstein & Chindonova (1958) as *B. (B.) spinifera*, most probably belongs to *B. (B.) sphaerops*.

Boreomysis (Petryashovia) subgen. nov.

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Etymology. The new subgenus name (defined as feminine) is dedicated to the crustacean biologist Victor Vladimirovich Petryashov (1956–2018). He studied taxonomy and biogeography of mysids and other groups of malacostracan crustaceans, and particularly contributed to the biogeographic division of the cold and moderate waters of the World Ocean, based on the distribution of mysids.

Type species. *Boreomysis megalops* G. O. Sars, 1872, by present designation.

Diagnosis. Anterior margin of carapace without distinct rostral projection, angular, apically blunt or rounded, and with rather small, barely distinguishable ventrolateral projections. Eyes with normal rounded cornea. Pereopod propodus 1-segmented.

Comparison. The subgenus *Petryashovia* subgen. nov. is distinguished from the subgenus *Boreomysis* s. str. by the absence of the distinct rostral projection on the anterior margin of the carapace and the rather reduced ventrolateral projections; and by the 1-segmented propodus, which is 2-segmented in nearly all members of the subgenus *Boreomysis* s. str., except *B. (B.) dubia*. All species of *Petryashovia* subgen. nov. have somewhat normally developed eyes with rounded cornea and their maxilliped 2 carpopropodus never develops any distal modifications (found in many species of *Boreomysis* s. str.). Additionally, all species, except *B. (P.) urospina* sp. nov., possess an additional segment on the antennal peduncle, which makes it clearly 4-segmented (instead of 3-segmented in *Boreomysis* sensu stricto). This segment is reduced to a slight prominence between segments 2 and 4 in *B. (P.) urospina* sp. nov., with some barely visible segment borders, like in the species of *Boreomysis* sensu stricto, which I was able to inspect. This character was mentioned by O. S. Tattersall (1955) for *B. insolita* O. S. Tattersall, 1955, and it is the same as in the type species *B. megalops*. A large 3rd segment in the 4-segmented antennal peduncle was also originally described by Pillai (1973) for *B. kistnae* Pillai, 1973. The significance of this structure needs to be checked in other species of the subfamily.

Distribution and habitat. The subgenus is found in both hemispheres, in the North Atlantic, Indian Ocean and South Pacific, and can probably be considered as bipolar-tropical. However, it has not been yet recorded from the Antarctic. All species have been collected at somewhat shallower localities, from epi- to mesopelagic zones, and have not been found in the bathypelagial. By this, the subgenus *Petryashovia* subgen. nov. is also probably ecologically distinct from *Boreomysis* s. str., which is reflected in the rather normal structure of the eyes, and probably also in the reduction of the dorsal and ventromedial projections of the anterior margin of the carapace, more strongly developed in the bathypelagic species of *Boreomysis* s. str. A question arises then for the future research, is *Petryashovia* subgen. nov. a primitive group or the shallow water boreomysines evolved from the deep water?

Composition. The subgenus *Boreomysis (Petryashovia)* subgen. nov. includes *Boreomysis (Petryashovia) megalops*

G. O. Sars, 1872, *Boreomysis (Petryashovia) kistnae* Pillai, 1973, *Boreomysis (Petryashovia) insolita* O. S. Tattersall, 1955, and *Boreomysis (Petryashovia) urospina* sp. nov. The latter species is recorded from the Australian seas.

***Boreomysis (Petryashovia) urospina* sp. nov.**

urn:lsid:zoobank.org:act:25C74221-0562-4508-BAF8-34BFD5CD5AEC

Figs 7–10

Etymology. Named for the excessive number of the spiniform setae on the uropods and the unique position of the spiniform setae of the uropodal exopod, shifted to the median part of the ramus. The name is an adjective after the New Latin (former Ancient Greek) prefix *uro-*, meaning *tail*, and as a part of *uropods*, and Latin *spina*, a *spine*.

Holotype. Male, 33 mm, Tasmania, Baseline 14, from 44°06'35"S 146°13'00"E to 44°06'09"S 146°11'49"E, 965–941 m, 06 Dec 2018, coll. RV *Investigator*, BPT, IN2018_V06_094, 4MBT (AM P.106628). **Allotype.** Female, 40 mm, same data as in holotype (AM P.106629).

Paratypes. 6 females, 35–40 mm, male, 35 mm, same data as in holotype (AM P.103318); 2 females, 37–40 mm, 2 subadult females, 35–36 mm, subadult male, 33 mm, male, 35 mm, male in two parts, female in two parts, juvenile, 28 mm, Tasmania, Punch's Hill, from 44°11'14"S 147°11'12"E to 44°11'02"S 147°11'23"E, 919–1086 m, 13 Dec 2018, coll. same as previous, IN2018_V06_157, 4MBT (AM P.103331); male, same as previous (AM P.106630; GenBank OQ699903, voucher B18).

Additional material. 2 females (1 broken), subadult female, 4 males, 33–35 mm, subadult male, Tasmania, off southern Tasmania, Huon Commonwealth Marine Reserve, from 44°10'17"S 147°10'59"E to 44°10'33"S 147°10'33"E, 1046 m, 09 Apr 2015, coll. RV *Investigator*, BPT, S. J. Keable, M. A. McGrouther, IN2015_E06_010, beam trawl (AM P.98102); 5 females, (1 female 40 mm), 5 males, 5 cephalothoraxes, same locality, date, collector and gear, from 44°10'49"S 147°10'19"E to 44°11'12"S 147°09'52"E, 1070 m, IN2015_E06_011 (AM P.98103); male, same as previous (AM P.106631, GenBank OQ699904, voucher B20); 2 males, 36 mm, 1 female, Tasmania, Central north, from 44°09'07"S 147°11'02"E to 44°09'14"S 147°12'22"E, 1000–1038 m, 27 Nov 2018, coll. RV *Investigator*, BPT, IN2018_E06_037, 4MBT (AM P.103329).

Type locality. South of Tasmania, from 44°06'35"S 146°13'00"E to 44°06'09"S 146°11'49"E at depth 941–965 m.

Diagnosis. Anterodorsal margin of carapace (Fig. 8A–C) angular, apically rounded or blunt, reaching proximal part of antennular peduncle segment 1, with nearly straight lateral margins, bearing minute concavity on each side. Telson (Fig. 8E,H,I) 1.04–1.4 times as long as last abdominal segment, 2.9–3.5 times as long as wide anteriorly and 0.55–0.60 times as wide posteriorly as anteriorly. Telson lateral margins nearly straight, with 22–26 nearly equal in size spiniform setae, though somewhat arranged in about ten series, slightly increasing in length within series, and four terminal spiniform setae; longest terminal spiniform seta flanked by two medial and one lateral spiniform setae, 0.25–0.45 as long as longest terminal. Telson cleft 0.16–0.20 of telson length,



Figure 7. *Boreomysis (Petryashovia) urospina* sp. nov., allotype, female, 40 mm, AM P.106629. Scale (mm): 10.0. Photographed by K. G. Holmes, with permission.

with about 40 to 60 rather long spinules. Eyes (Fig. 8A–D) large, nearly globular, 0.40–0.43 of head width; cornea dominating over eyestalk; eye papilla absent. Antennular peduncle not extending beyond half of antennal scale (Fig. 8D). Antennal scale (Fig. 8D, J) five times as long as wide; apically with only slightly advanced distomedial angle, not exceeding beyond distolateral spine. Antennal peduncle with slight medial prominence between segments 2 and 4; segment 3 nearly indistinguishable (Fig. 8J). Pereopod (Fig. 9M,N) carpus with six or seven medial bunches. Uropodal exopod (Fig. 8E) with three lateral spiniform setae; its proximal segment 0.42–0.45 of ramus length. Endopod (Fig. 8K) with three to five medial spiniform setae.

Body length of females 35–40 mm, of males 33–36 mm.

Comparison. *Boreomysis (P.) urospina* sp. nov. has several unique features for the subgenus: the carapace anterior margin has a minute concavity on its lateral sides, which is not known even among other species of *Boreomysis sensu lato*; the uropodal exopod is rather wide (less than five against eight to ten times as long as wide in other species of the subgenus), bearing three spiniform setae (one or two in other species), set nearly by the half length of the ramus (in proximal part in other species of even *Boreomysis sensu lato*), and the uropodal endopod is with three or five medial spiniform setae (one or two in other species). It is most similar to *B. (P.) megalops*, differing from it, in addition to the above mentioned unique characters, by the longer antennal scales (less than twice as long as antennular peduncle in *B. (P.) megalops*), modified male pleopods 3 (both pleopods 2 and 3 in *B. (P.) megalops*), and the telson having larger number of the terminal spiniform setae (four against two in *B. (P.) megalops*).

Description of holotype male. Anterodorsal margin of carapace angular, apically blunt; laterally with slight concavity at each side; anteroventral lobes small, triangular, pointed. Posterolateral lobes of abdominal segment 6 angular, apically blunt or rounded. Telson 1.04 times as long as last abdominal segment, 3.5 times as long as wide

anteriorly, and 0.57 times as wide posteriorly as anteriorly. Cleft 0.16 of telson entire length, with about 42 spinules. Lateral margins nearly straight, with 24 spiniform setae (partly broken) (including four terminal), forming about ten groups of increasing length; longest terminal spiniform seta 0.08 of entire telson length, flanked by one lateral (broken) and two medial spiniform setae, 0.45 of longest one.

Eyes large, almost rounded, with cornea dominating over eyestalk; eye papilla absent. Antennular peduncle segments 1 dorsally flat, with slight distolateral elevation, apically with a bunch of setae; segment 2 with triangular dorsal elevation, apically with a bunch of setae; segment 3 large, nearly quadrangular from dorsal view. Antennal peduncle, sympod with lateral spine; segment 2 significantly longer than segment 1; segment 3 reduced to a slight prominence, bearing setae; segment 4, distal margin not broadened. Antennal scale more than twice as long as antennular and antennal peduncles.

Labrum apically nearly rounded. Mandible: left corpus, processus incisivus and lacinia mobilis both 4-cusperate, pars centralis with six serrated setae, pars praemolaris with fine setules, pars molaris with grinding plates and apical tuft of setules; right corpus, processus incisivus, lacinia mobilis 10-cusperate, pars centralis with 12 spiniform setae, among them proximal serrated and distal smooth, pars praemolaris with fine setules, pars molaris with serrated grinding plates and apical spiniform setae. Mandibular palp segment 2 with rather long plumose setae, set apart; segment 3 is 0.90–0.95 times as long as segment 2, with four or five lateral, one anterior distomedial, about 25–30 long proximomedial setae and 45 shorter distomedial setae, its margins nearly parallel. Maxilla 1. Outer ramus with about seven posterior serrated setae, three of them grouped medially and three shifted to medial margin, apical spiniform setae serrated. Inner ramus with five lateral, seven medial and six apical long setae, three apical setae distally serrated, similar to those of maxilla 2 and maxilliped 1 endites. Maxilla 2. Exopod oval, 2.5 times as long as wide, about as long as endopod, with plumose setae. Endopod segment 1 with about 12 anteromedial and three

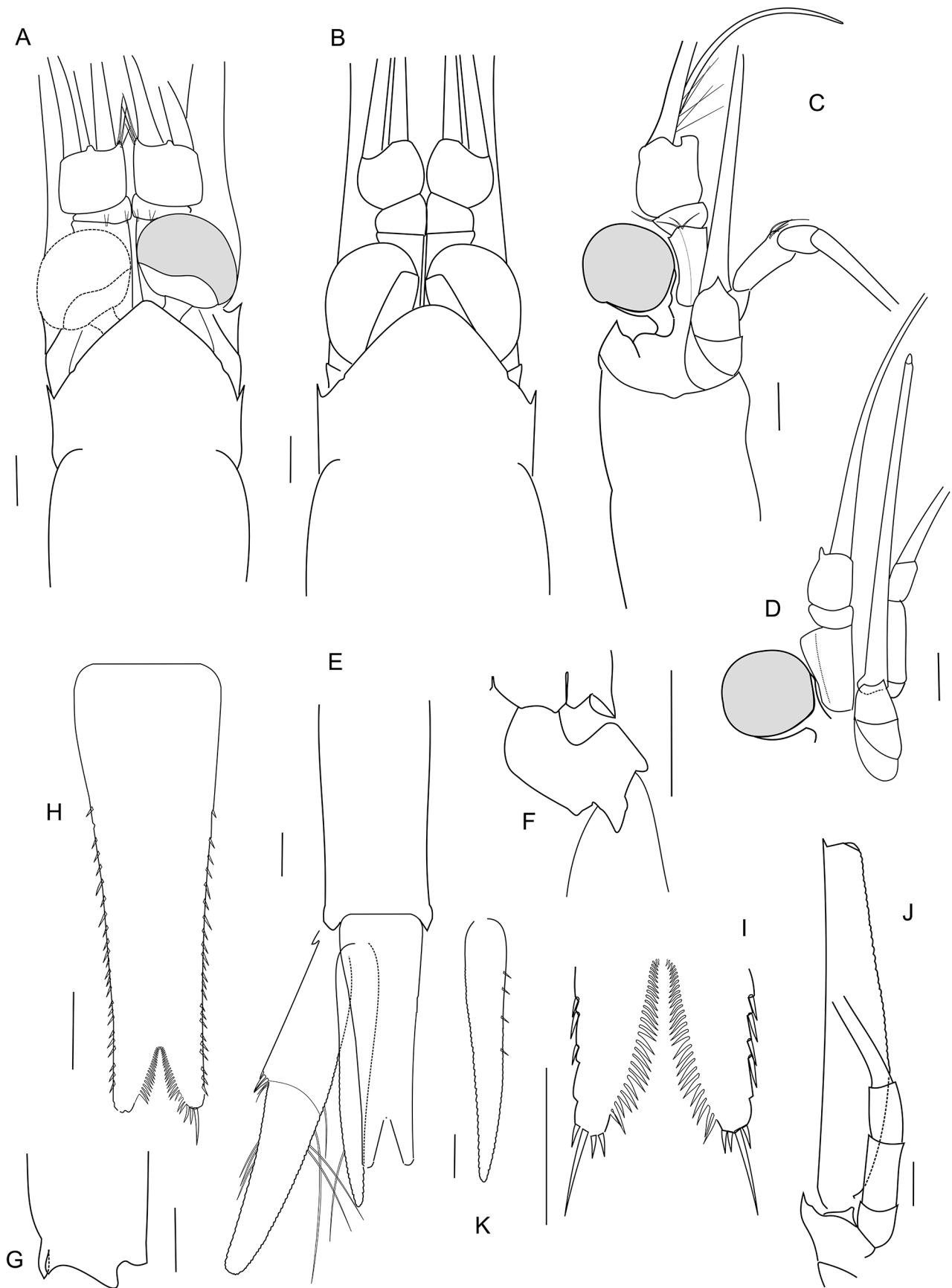


Figure 8. *Boreomysis (Petryashovia) urospina* sp. nov. (*A, C, E–H, J, K*) holotype, male, 33 mm, AM P.106628; (*B, D, I*) allotype, female, 40 mm, AM P.106629. (*A, B*) head, dorsal; (*C*) head, lateral; (*D*) head (carapace not shown), lateral; (*E*) posterior part of abdomen with telson and uropods (setae and spiniform setae mostly not shown), dorsal; (*F*) posterior margin of abdomen and proximal part of uropod (left side), ventral; (*G*) posterior margin of abdomen, lateral; (*H*) telson; (*I*) posterior part of telson; (*J*) antenna 2, ventral; (*K*) uropodal endopod, ventral. Scales (mm): 1.0.



Figure 9. *Boreomysis (Petryashovia) urospina* sp. nov., holotype, male, 33 mm, AM P.106628. (A) labrum, ventral; (B) mandibular palp, posterior; (C) right mandible, ventral; (D) left mandible, ventral; (E) maxilla 1, posterior; (F) maxilla 2, anterior; (G) maxilliped 1, anterior; (H) dactylar claw of maxilliped 1; (I) medial seta of maxilliped 1 basal endite; (J) maxilliped 2, anterior; (K) medial serrated seta of maxilliped 2 dactylus; (L) medial seta of maxilliped 2 carpopropodus; (M) pereopod 1 endopod, posterior; (N) pereopod 1 carpus, anterior; (O) medial setae of pereopod 1 merus; (P) medial seta of pereopod 1 carpus; (Q) paradactylary seta of pereopod 1; (R) penis, lateral. Scales (mm): A–G, J, M, N, R = 1.0; H, I, K, L, Q = 0.25; O, P = 0.5.

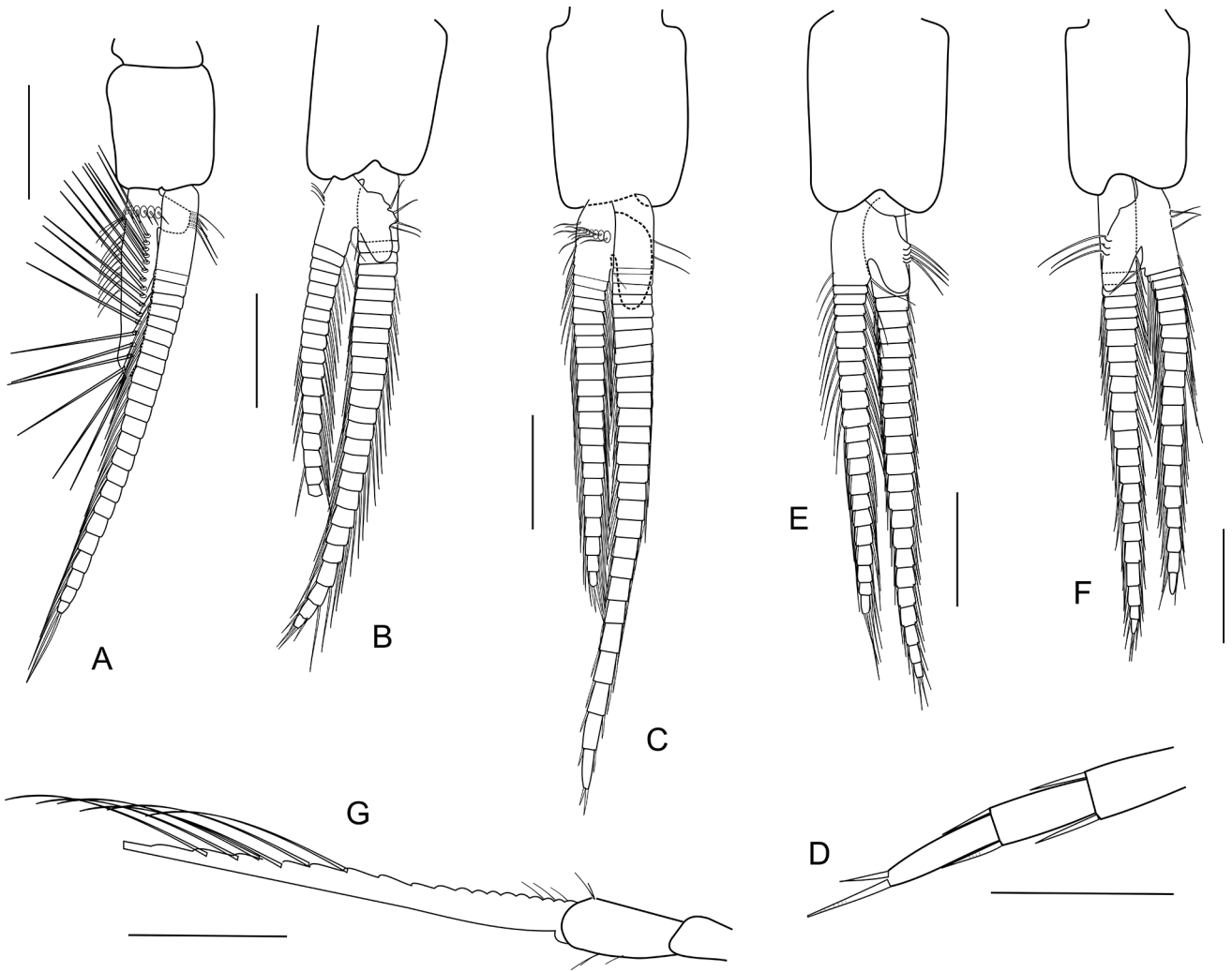


Figure 10. *Boreomysis (Petryashovia) urospina* sp. nov. (A–F) holotype, male, 33 mm, AM P.106628; (G) allotype, female, 40 mm, AM P.106629. (A) pleopod 1, posterior; (B) pleopod 2, anterior; (C) pleopod 3, posterior; (D) pleopod 3 distal part, posterior; (E) pleopod 4, anterior; (F) pleopod 5, anterior; (G) pleopod 5, anterior. Scales (mm): A–C, E–G = 1.0; D = 0.5.

posteromedial setae; segment 2 is 1.6 times as long as wide, with lateral plumose setae and apical serrated setae; coxal endite notably prolonged; basal endites with strong serrated setae, similar to those of maxilliped 1 endites.

Maxilliped 1. Coxa with two short, plumose medial setae. Basis with posterolateral group of five plumose setae; endite rather long, barely reaching distal margin of ischium, with long setae of two types: thinner, longer and flexible, with setules, and thicker, shorter and stout, distally with rough serrations and spear-like apex. Preischium endite short, but well-established, compared to rather reduced ischium endite; both with long plumose setae. Merus the longest segment, 2.0 times as long as wide, with long, plumose medial setae. Ischium and merus with few weakly setulose lateral setae. Carpopropodus 0.78 times as long as merus, with long, plumose lateral and serrated medial setae. Dactylus 0.56 of carpopropodus, with numerous long, weakly setulose setae; its distomedial and posterior margins with serrated setae. Unguis strong, serrated, 0.53 of dactylus length.

Maxilliped 2. Exopod with about 25 segments; its basal part with blunt distolateral angle. Endopod general proportions and setation pattern typical for subfamily. Carpopropodus distomedial part without concavity, with

setae only slightly more robust and stronger serrated than other setae, without special modifications.

Pereopod exopod with 23–30 segments. Endopod. Preischium with or without setae. Ischium and merus with numerous long sparsely plumose setae on medial margin. Ischium 0.52–0.65 times as long as merus; its medial setae rather long, set along entire margin; anteromedial setae shorter, in distal half; posterolateral setae rather short, along proximal 2/3. Merus setae along entire margins; medial, anteromedial and posterolateral setae rather long; anterolateral setae short; anteromedial margin also with group of serrated setae. Carpus with seven medial bunches of setae, each bunch containing one long straight and two (proximally) to eight (distally) shorter bent plumose setae, becoming stronger and more strongly serrated in distal bunches. Propodus 0.46–0.56 times as long as carpus with smooth paradactylary setae. Unguis 0.73–1.00 times as long as dactylus. Musculus flexor dactyli attached at about distal 1/3 of carpus.

Pleopods. Pleopod 1 exopod with about 25 segments; endopod less than half as long as exopod, without separation on segments and with numerous long setae. Pleopod 2 exopod with about 25 segments; endopod slightly shorter

than exopod, with about 20 segments. Pleopod 3 exopod with about 27 segments; its distal segments with shorter and stronger spiniform setae; endopod shorter than exopod, with about 20 segments, bearing unmodified setae. Pleopod 4 exopod with about 25 segments; endopod shorter than exopod, with about 20 segments. Pleopod 5 exopod with about 25 segments; endopod shorter than exopod, with about 20 segments.

Uropodal exopod with three distolateral spiniform setae. Endopod with four medial spiniform setae.

Description of female. Antennular peduncle, segment 3 smaller than in male, almost rounded. Marsupium with seven pairs of oostegites. All pleopods reduced to short setose plates, set on basal segment and coxa, increasing in length posteriorly. Uropodal exopod 4.7–4.8 times as long as wide, 1.17–1.3 times as long as endopod and 1.5 times as long as telson; its proximal segment 0.42–0.45 of ramus length.

Colour. Red (Fig. 7).

Distribution and habitat. Recorded only from the southern part of the Tasman Sea, south of Tasmania at depth of 919–1086 m (Fig. 16). This is the most deep-water species in the subgenus, found at the border between the meso- and bathypelagic zones.

Molecular characters. Two nearly identical sequences of *B. (P.) urospina* sp. nov. from Tasmanian coast were 0.5% distant from each other and 57–84% diverged from other species *Boreomysis*.

Neobirsteiniamysis Hendrickx et Tchindonova, 2020

Neobirsteiniamysis Hendrickx et Tchindonova, 2019 in Hendrickx *et al.*, 2020: 21 (unavailable, according to Hendrickx & Tchindonova, 2020)

Neobirsteiniamysis Hendrickx et Tchindonova, 2020: 1, 2.—Hernández-Payán & Hendrickx, 2020: 2.

Birsteiniamysis Tchindonova, 1979: 102; 1981: 26, 28; 1993: 153.—Staff of the Zoological Society of London, 1985: 398, 399 (as *Birsteiniamysis* Tchindonova, 1981; noticed absence of the type species).—

Beliaev, 1989: 189 (as *Birsteiniamysis* Tchindonova, 1981; first recognition as nomen nudum).—

Petryashov, 1993a: 93, 103, 104 (as *Birsteiniamysis* Tchindonova; without publication year); 1993b: 71 (as *Birsteiniamysis* Tchindonova, 1979); 2004a: 126 (as *Birsteiniamysis* Tchindonova, 1979); 2005b: 963, 970 (as *Birsteiniamysis* Tchindonova, 1981); 2009b: 125; 2014a: 187 (as *Birsteiniamysis* Tchindonova, 1979); 2014b: 149; Lowry & Stoddart, 2003: 428 (as *Birsteiniamysis* Tchindonova, 1981); Wittmann *et al.*, 2014: 332 (as *Birsteiniamysis* Tchindonova, 1981).

Nomen nudum.

Birsteiniamysis.—Hendrickx *et al.*, 2020: 19, 20.—Hendrickx & Tchindonova, 2020: 1.—Hernández-Payán & Hendrickx, 2020: 2. Referred to as unavailable name.

Type species. *Petalophthalmus inermis* Willemoes-Suhm, 1874; by subsequent designation (Hendrickx & Tchindonova, 2020).

Diagnosis. Telson rather broad in the central part, as wide as or wider than anterior part. Eyes without cornea, calyciform, with lateral concavity.

Distribution. Bipolar-amphitropical genus found in all oceans of the world. In the Antarctic, the genus is generally distributed circumpolarly. In the Pacific, it is mostly found along the South and North American continental slope, with a break in equatorial waters, and further along Aleutian Ridge towards the Okhotsk Sea and Kuril-Kamchatka trench. With the new findings the range of the genus is now extended to the Australian region.

Habitat. Bathyal-abyssal. Depth 700–7200 m. Visual apparatus adapted to low-light intensities (Elofsson & Hallberg, 1977).

Remarks. Specimens of this genus were first collected in the course of HMS *Challenger* Expedition in 1873 by Rudolf von Willemoes-Suhm, who included them into the genus *Petalophthalmus* Willemoes-Suhm, 1874 (Willemoes-Suhm, 1874, 1875, 1876a,b). Later, some new specimens were made a part of *Boreomysis* by G. O. Sars (1879b), and this was also the fate of Willemoes-Suhm's material (G. O. Sars, 1883). G. O. Sars (1885a) described the nervous system of *N. inermis*, and found that its mouthpart ganglion masses were rather primitively separated from each other by connectives (more condensed in other Mysida) (Wittmann *et al.*, 2014). The taxonomic significance of this variation has yet to be evaluated by the studies of the nervous systems across the order. Tchindonova (1993) described the concavity of the maxilliped 2 carpus only for *Neobirsteiniamysis caeca* (Birstein et Tchindonova, 1958). Although not so strongly developed, the concavity, with a number of modified setae, is also found in *N. inermis*, which was first discovered by G. O. Sars (1885a) and confirmed here. Since Elofsson & Hallberg (1977) discovered the pigmented cell layer in the eyes of *N. inermis*, the absence of the pigmentation can no longer serve as a diagnostic feature of the genus, and I exclude it from the update. With the exclusion of non-diagnostic characters, I updated here the diagnosis of *Neobirsteiniamysis* in comparison with *Boreomysis*.

Tchindonova (1993) proposed three informal groups within *Birsteiniamysis*: *Inermis* group, *Scyphops* group and *Caeca* group, probably indicating some additional differentiation within the species. She, however, did not clarify the meaning of her proposal.

Composition. The genus contains two species, *N. caeca* and *N. inermis*. Among them, only the latter is recorded in the Australian waters. Tchindonova (1981; also Beliaev, 1989, referring to Tchindonova, 1981) mentioned some undescribed species and subspecies of this genus from the Southern Ocean, and the case still waits for a resolution.

Neobirsteiniamysis inermis (Willemoes-Suhm, 1874)

Figs 11–15

Petalophthalmus inermis Willemoes-Suhm, 1874: xv, xix; 1876a: 575; 1876b: 588, 592. G. O. Sars, 1885a: 178, 179.

Petalophthalmus armiger Willemoes-Suhm, 1874: xiv (partim, female only); 1875: 41, 44, pl. 7, figs 1, 3–14 (partim, female only); 1876b: 588 (partim, female only).—Perrier, 1893: 1026 (partim, female only).

Boreomysis scyphops G. O. Sars, 1879b: 429–430; 1883: 34; 1885a: 12, 35, 172, 174, 178, 179, 184, plate



Figure 11. *Neobirsteiniamysis inermis*, female, 49 mm, Great Australian Bight, AM P.102493. Scale (mm): 10.0. Photographed by K. G. Holmes, with permission.

- 32, figs 10–20; 1885b: 56, plate 6, figs 1, 2; 1886: 14.—Filhol, 1885: 145.—Norman, 1886: 9; 1905: 10.—Hansen, 1887: 212; 1908: 99–100, fig. 1; 1910: 5, 25; 1921: 71; 1927: 22.—Stebbing, 1893: 268, 269.—Ortmann, 1894: 106.—Ohlin, 1901: 71, 73, 90.—Calman, 1901: 23; 1909: 173, 180.—Gerstaecker & Ortmann, 1901: 621, 654, 671, 672, 675, 677, 678, 681, 683.—Zimmer, 1904: 429, 433, 473, 480, 483, 484, 486, 488, figs 43–46; 1905: 149; 1909: 52, 57, figs 87–90.—Holt & W. M. Tattersall, 1906: 22.—Linko, 1908: 39, 41, 42.—Stephensen, 1918: 65.—Illig, 1930: 559.—Nouvel, 1943: 6, 46, 103; 1950: 4.—Zenkewitch, 1954: 82.—Elofsson & Hallberg, 1977: 169, 170, 174, 176, figs. 1A, 3A, 4–7.—Staff of the Zoological Society of London, 1985: 399.—Kathman *et al.*, 1986: 108.—Brattegard & Meland, 1997: 70, 78, 79.
- Boreomysis suhmi* Faxon, 1893: 218.
- Boreomysis distinguenda* Hansen, 1908: 100, fig. 2a–b; 1910: 5, 25; 1927: 22.—W. M. Tattersall, 1913: 866, 869.—Zimmer, 1927: 623.—Illig, 1930: 559.
- Boreomysis inermis*.—W. M. Tattersall, 1951: 8, 46–47.—O. S. Tattersall, 1955: 6, 19, 20, 22, 25, 67, 75.—Gordan, 1957: 342.—Holmquist, 1957: 9.—Birstein & Tchindonova, 1958: 279, 282–284, 335, 348–349, 350, fig. 9.—Birstein & Tchindonova, 1962: 62.—Ii, 1964: 8, 9, 13, 18–22, 32, 33.—Mauchline & Murano, 1977: 49.—Mauchline, 1980: 227, 235.—Băcescu, 1981: 36, figs A–D.—Kathman *et al.*, 1986: 25, 29, 108, figs a–e.—Laubitz, 1986: 15.—Lancraft *et al.*, 1989: 227.—Ledoyer, 1989: 67; 1990: 37, 40, 44; 1995: 602, 603.—Müller, 1993: 25.—Hargreaves, 1997: 54, 56, 59, 61, 63, 64.—Brandt *et al.*, 1998: 5, 6, 8.—De Jong-Moreau, Casanova & Casanova, 2001: 235, 236, 237, 238–240, figs 1A, B, E, 3A.—Meland & Willassen, 2007: 1086, 1091, 1100.—Castellani *et al.*, 2017: 479, figs. O–R.
- Not *Boreomysis inermis* Hansen, 1910: 11, 24, 26, 27, pl. II, fig. 4a–c.—Illig, 1930: 560.—Nouvel, 1943: 51.—Holmquist, 1956: 427–428, 442–443 (*Boreomysis hanseni* Holmquist, 1956).
- Birsteiniamysis inermis*.—Tchindonova, 1979: 102; 1981: 28–29; 1993: 153–155.—Staff of the Zoological Society of London, 1985: 398, 399.—Petrashev, 1989: 378, 382, 384, plate 15–1d; 1993a: 79, 93, 94, 102, 104, fig. 3–3; 1993b: 71, 75, figs 1, 2, 3; 2004a: 126, 140, 141, 142, fig. 1; 2004b: 132; 2005a: 10; 2005b: 963–964, 968, 970, figs 4 (6–11); 2009a: 98; 2009b: 125, fig. 2–1, 3–7, 8; 2014a: 184, 187; 2014b: 150, 151.—Sirenko *et al.* 1996: 349, 351.—Fukuoka, 2009: 418.—Wittmann *et al.*, 2014: 201, 217, 238, 241, 347, figs 54.5B, 54.14A, 54.24C, 54.25L.—Wittmann, 2020: 6.—Kou *et al.* 2020: 3, fig. 9.
- Birsteiniamysis inermis ochotskii* Tchindonova, 1981: 29, nomen nudum.—Staff of the Zoological Society of London, 1985: 398 (first mention as an undescribed subspecies).
- Birsteiniamysis scyphops*.—Tchindonova, 1981: 28–29 (removed there from synonymy).—Staff of the Zoological Society of London, 1985: 399.
- Boreomysis inermis peruana* Băcescu, 1981: 36, figs A–D, nomen nudum.
- Boreomysis scyphos*.—Ledoyer, 1989: 67; 1995: 603 (*lapsus calami*).
- Neobirsteiniamysis inermis*.—Hendrickx *et al.*, 2020: 21.—Hendrickx & Tchindonova, 2020: 2.—Hernández-Payán & Hendrickx, 2020: 2, 3, 11, 14, figs 1–10.

Type specimens. Probably lost.

Type locality. Southern Indian Ocean near Crozet Islands.

Material. Female, 49 mm, Southern Ocean, Great Australian Bight, 34°32'55"S to 34°34'27"S 129°36'07"E to 129°34'18"E, 3389–3540 m, 21 Apr 2017, coll. RV *Investigator*, BPT, A. Murray, F. Criscione, IN2017_C01_198, beam trawl (AM P.102493); subadult female, 38 mm, 2 juveniles, Bass Strait, 39°27'43"S to 39°27'54"S

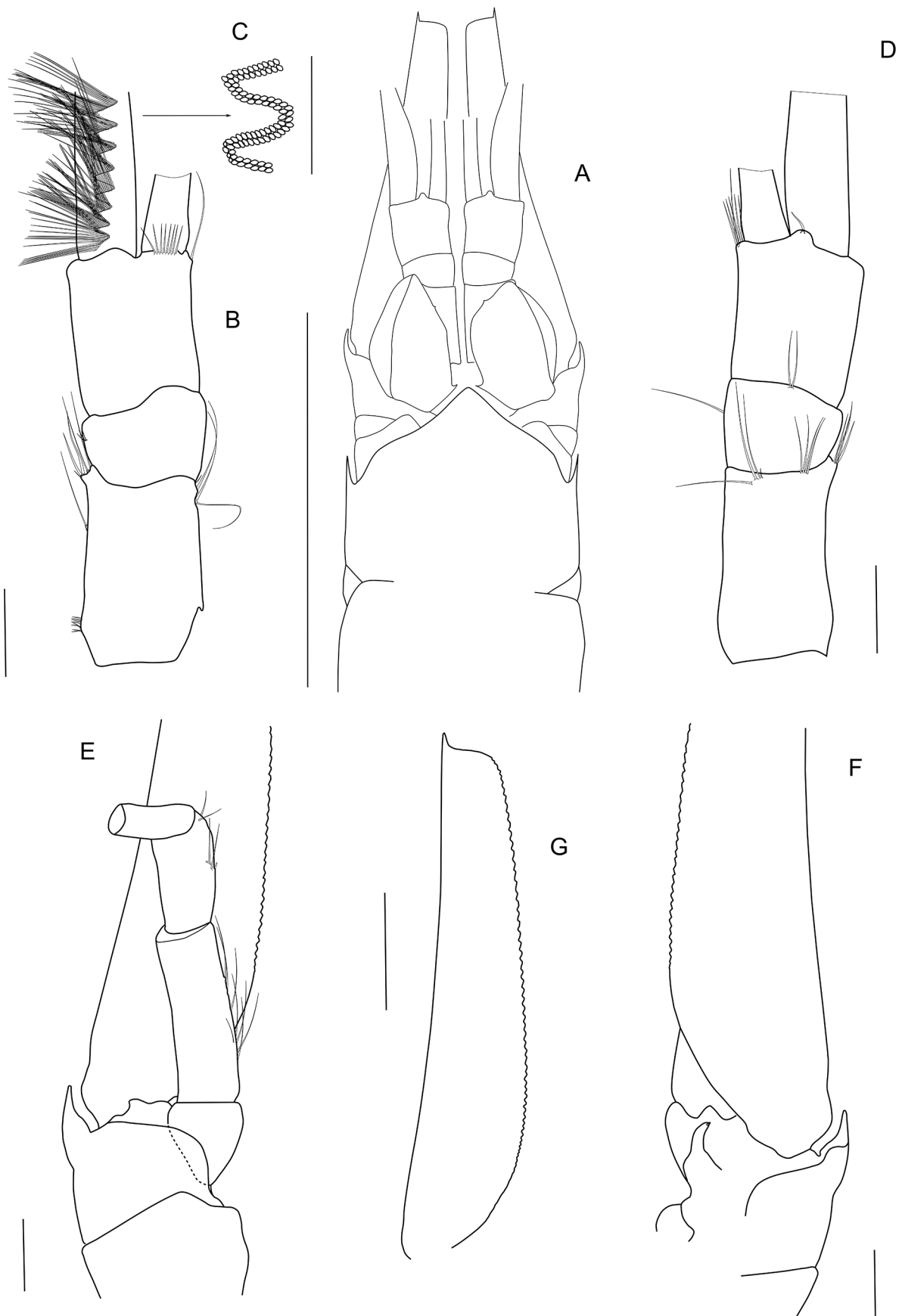


Figure 12. *Neobirsteiniamysis inermis*. (A–F) female, 49 mm, Great Australian Bight, AM P.102493; (G) subadult female, Bass Strait, AM P.106627. (A) head, dorsal; (B) antennular peduncle, ventral; (C) setae pattern on outer flagellum of antennular peduncle, ventral; (D) antennular peduncle, dorsal; (E) proximal part of antenna, dorsal; (F) proximal part of antenna, ventral; (G) antenna scale. Scale (mm): A = 10.0; B, D–G = 1.0; C = 0.5.

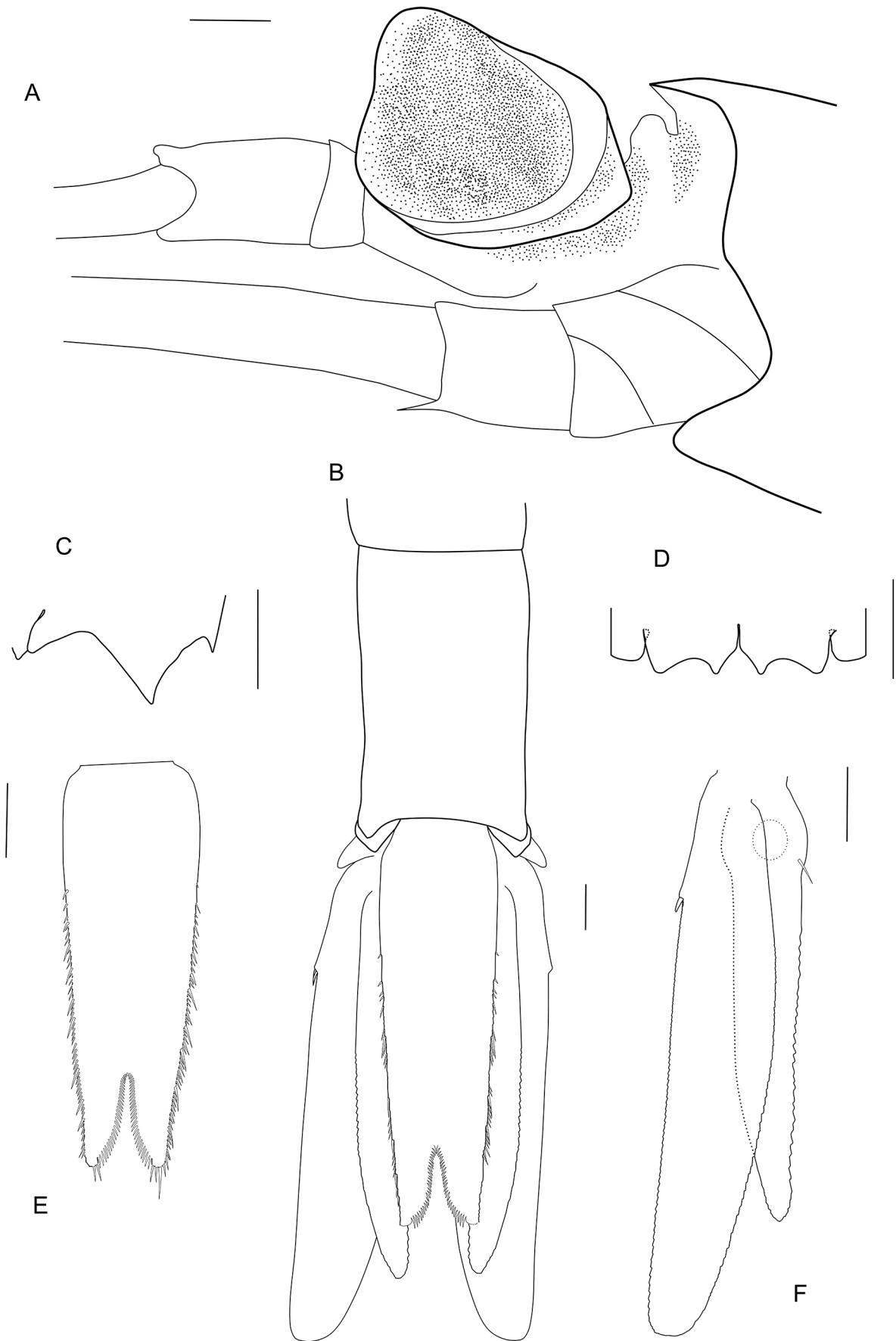


Figure 13. *Neobirsteiniamysis inermis*. (A–D, F) female, 49 mm, Great Australian Bight, AM P.102493; (E) subadult female, Bass Strait, AM P.106627. (A) head, lateral; (B) posterior part of body, dorsal; (C) posterior margin of abdomen, lateral; (D) posterior margin of abdomen, ventral; (E) telson; (F) uropods, ventral. Scale (mm): 1.0.

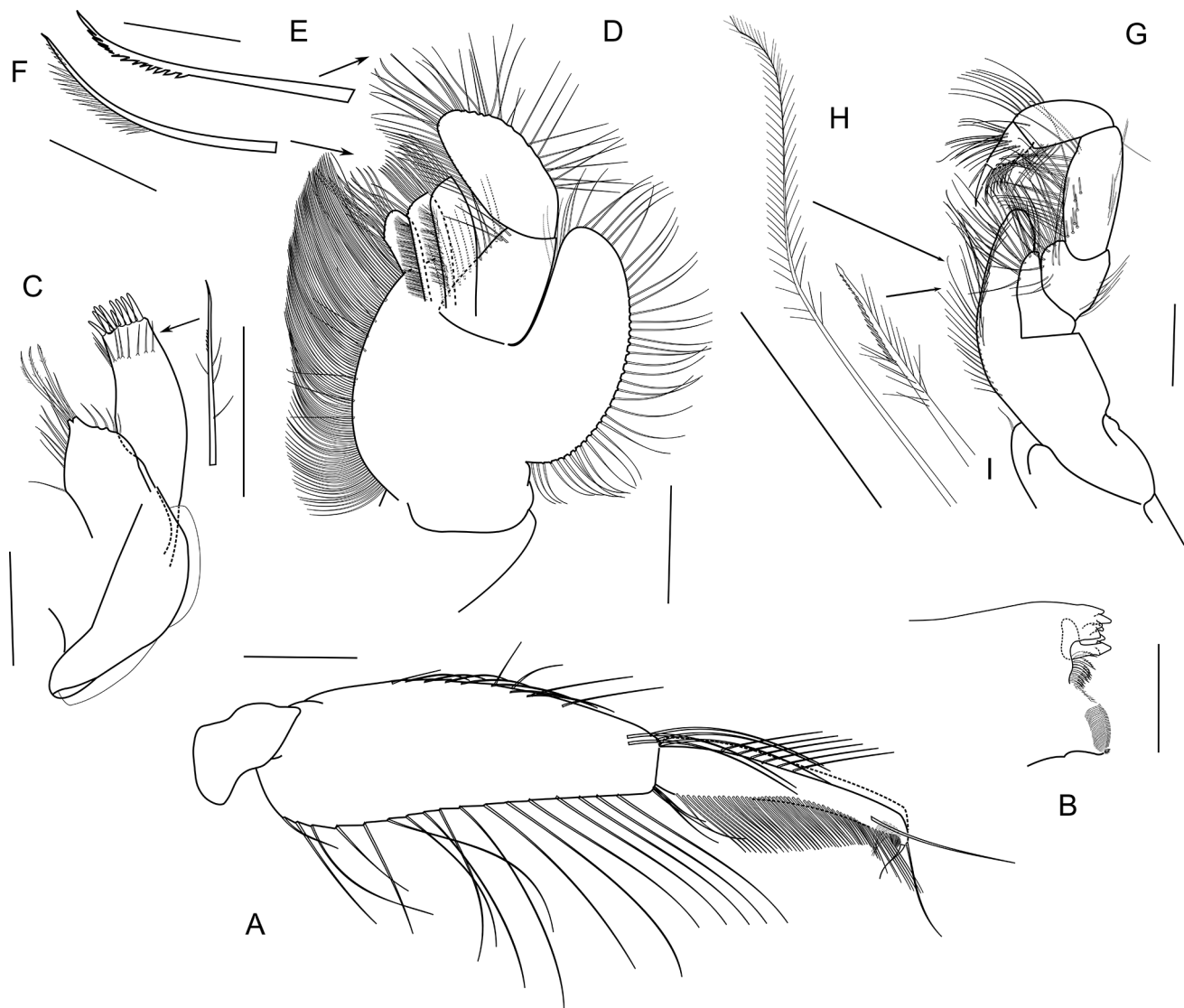


Figure 14. *Neobirsteiniamysis inermis*, female, 49 mm, Great Australian Bight, AM P.102493. (A) mandibular palp, posterior; (B) left mandible, dorsal; (C) maxilla 1, posterior; (D) maxilla 2, posterior; (E) apical serrated seta of maxilla 2 endopod; (F) apical seta of maxilla 2 endite; (G) maxilliped 1, anterior; (H) long plumose seta of maxilliped 1 basal endite; (I) short serrated seta of maxilliped 1 basal endite. Scale (mm): A, B, D, G–I = 1.0; C = 0.5; E, F = 0.25.

149°16'37"E to 149°14'46"E, 2774–2695 m, 22 May 2017, coll. RV *Investigator*, BPT, L. E. Hughes, F. Köhler, E. K. Kupriyanova, IN2017_V03_023, BES (AM P.106627).

Diagnosis. Telson (Fig. 13B,E) 2.3–3.8 times as long as wide anteriorly, its lateral margins nearly straight or slightly convex, with 35–59 spiniform setae, longer alternated by one to three shorter; cleft 0.16–0.25 of telson length, with convex margins, bearing 58–60 spinules. Eyes (Figs 11, 12A, 13A) reaching distal margin of antennular peduncle segment 1 or half of segment 2, laterally flattened, cup-shaped, with lateral hollow. Antennular peduncle (Figs 11; 12A,B,D; 13A) not reaching half of antennal scale; segment 3 is 1.5–3.0 times as long as segment 2. Antennal scale (Fig. 12A,G) 4.5–7.0 times as long as wide, apically truncated, with obtuse-angular distomedial corner. Antennal peduncle stretching beyond half of antennal scale. Uropods with exopod (Fig. 13B,F) rather wide, 4.3–5.3 times as long as wide; outer margin with one to three spiniform setae at 0.22–0.29 of ramus length. Uropodal endopod (Fig. 13F) with one to five spiniform setae.

Comparison. *Neobirsteiniamysis inermis* differs from *N. caeca* by the less transparent cuticle (rather thin and transparent in *N. caeca*); the less protruding eyes (reaching antennular peduncle segment 3 in *N. caeca*); the presence of the concavity on the eye lateral side (distally in *N. caeca*); the antennal scale being five to seven times as long as wide (four times as long as wide in *N. caeca*), with distomedial corner obtuse-angular (acute-angular in *N. caeca*); the antennular peduncle stretching beyond the half of the antennal scale (not reaching the half of the scale in *N. caeca*); the uropods slightly wider, with exopod 4.3–5.3 times as long as wide (5.6 times as long as wide in *N. caeca*), bearing spiniform setae at 0.22–0.29 of the ramus length (at 0.16 of the ramus length in *N. caeca*); the telson with nearly straight lateral margins (convex, almost rounded in *N. caeca*); the cleft 0.16–0.25 of the telson length, with convex margins (0.14, with straight margins in *N. caeca*).

Description of Australian specimens (females). Anterior margin of carapace angular apically rounded, not reaching



Figure 15. *Neobirsteiniamysis inermis*, female, 49 mm, Great Australian Bight, AM P.102493. (A) maxilliped 2, anterior; (B) distal part of maxilliped 2 endopod (only modified setae shown), anterior; (C–E) dactylar setae of maxilliped 2; (F) robust seta of maxilliped 2 carpopropodus; (G) pereopod 3, anterior; (H) dactylus of pereopod 3, anterior; (I) medial seta of pereopod 3 merus; (J) lateral seta of pereopod 3 merus; (K) medial seta of pereopod 3 carpus. Scale (mm): A, B, G = 1.0; C, E, F, I–K = 0.5; D, H = 0.25.

antennular peduncle, subapically slightly concave, dorsolaterally convex; laterally without minute concavity; anteroventral lobes large, triangular, apically rounded. Posterior margin of last abdominal segment, lateral lobes (scutella paracaudalia) triangular, apically pointed; ventrolateral lobes apically rounded; ventral lobes concave with blunt inner process. Telson 1.2–1.4 times as long as last abdominal segment, 2.3–2.9 times as long as maximum width, and 0.42–0.56 times as wide posteriorly as its largest width; lateral margins nearly straight, bearing about 45–57 spiniform setae, with longer alternated by groups of one to three shorter; longest terminal spiniform seta 0.07–0.08 of telson length; cleft 0.18–0.24 of telson length, with convex margins, bearing about 58–60 spinules.

Eyes large, laterally flattened, cup-shaped, with lateral hollow, almost square in lateral view, reaching half of antennular peduncle segment 2, 0.61 times as long as head width. Medially with concavity, flanked by keel, and dorsal papilla.

Antennula. Peduncle not reaching half of antennal scale, rather slender. Segment 1 slightly longer than segment 3; proximally with a group of about eight short lateral setae; distally with long setae: single lateral and three bunches, distolateral, distomedial and anterior. Segment 2 with lateral bunch of short setae, long medial seta and two long anterolateral setae. Segment 3 is 2.4 times as long as segment 2; distally with one long medial seta, anterior tubercle with short apical seta and a group of eight short posteromedial setae. Outer flagellum rather thick basally, with numerous long smooth ventral setae, arranged in pattern of double waving line.

Antenna. Sympod with lateral acute process; antennal cone small, spindleform. Peduncle segment 2 is 1.5 times as long as segment 3, each with groups of medial long setae. Antennal scale about 5 times as long as wide, apically truncated, with obtuse-angular distomedial corner and distolateral spine projecting beyond distal margin.

Labrum, proximal articulated lobes with numerous spinules. Mandible: left corpus, processus incisivus and lacinia mobilis both 5-cuspedate, rather similar, pars centralis with nine serrated setae, pars praemolaris with fine setules, pars molaris rather broad, with apical spinules; right corpus, processus incisivus and lacinia mobilis smaller than on left corpus, pars centralis with rather short, spine-like setae, pars praemolaris with fine setules, pars molaris rather narrow, with apical spinules. Mandibular palp segment 2 with rather long setae set apart, medial setae smooth, other setae with setules; segment 3 is 0.74 times as long as segment 2; with five lateral, one anterior distomedial and more than 50 long, densely set, medial setae; its margins nearly parallel. Maxilla 1. Outer ramus with ten posterior serrated setae, three of them grouped medially and three shifted to medial margin, apical spiniform setae smooth. Inner ramus with four lateral, ten medial and six apical long setae, four apical setae distally serrated, similar to those of maxilla 2 and maxilliped 1 endites. Maxilla 2. Exopod oval, 2.2 times as long as wide, about as long as endopod, with plumose setae. Endopod segment 1 with eleven anteromedial and four posteromedial setae, segment 2 is 2.2 times as long as wide, with lateral plumose setae and apical serrated setae; coxal endite notably prolonged; basal endites with strong serrated setae, similar to those of maxilliped 1 endites.

Maxilliped 1. Coxa with one short, plumose medial seta. Basis endite rather long, reaching proximal part of carpus,

with long setae of two types: thinner, longer and flexible, with setules, and thicker, shorter and stout, distally with rough serrations and spear-like apex. Preischium endite short, but well-established, compared to rather reduced ischium endite; both with long plumose setae. Merus the longest segment, 2.6 times as long as wide, with long, plumose medial setae. Ischium and merus with a few weakly setulose lateral setae. Carpopropodus 0.7 times as long as merus, distally with long, plumose setae on medial and lateral margins. Dactylus 0.56 of carpopropodus, proximally with numerous long, weakly setulose setae; its distomedial margin with about 12 serrated setae; distolateral strong, serrated seta near dactylary unguis. Unguis strong, serrated, 0.68 of dactylus length.

Maxilliped 2. Exopod basis with acute distolateral angle; flagellum, three proximal segments differentiated, two large and one small between them. Endopod with rather thin, prolonged segments, bearing numerous long medial setae. Preischium with seven setae. Ischium with small distomedial lobe. Carpopropodus 0.9 of merus length, with distomedial concavity, marked in its proximal part with five strong spine-like, apically thin setae; numerous setae around distal third. Dactylus with numerous setae around; its medial setae serrated, differentiated into thin long and short claw-like setae. Unguis smooth.

Pereopods. Oostegite of pereopod 3 reaching mid of merus. Exopod basis with smoothly rounded distolateral angle. Preischium with five or six long setae. Ischium and merus with numerous long medial, anteromedial and posterolateral plumose setae. Merus also with numerous long plumose lateral and anterolateral setae; its anteromedial setae distally converge to anterolateral angle. Carpus with nine anteromedial groups of long plumose setae and four or five single shorter lateral setae; anteromedial groups made of anterior row of curved setae, one or two medial rather long setae and single straight thinner seta. Propodus with smooth medial and long plumose lateral setae; four medial paradactylary setae long and finely serrated. Dactylus with one lateral seta, one anterodistal seta and a bunch of thin medial paraungual setae. Unguis rather strong. Length ratio between ischium, merus, carpus, propodus and dactylus (including unguis), respectively: 2.6–2.9 / 4.9–5.6 / 2.5–2.6 / 1.2–1.4 / 1.

Pleopods uniramous, increasing in length posteriorly. Uropodal exopod 1.6 times as long as last abdominal segment, 1.3 times as long as telson, 5.3 times as long as wide and 1.2–1.3 times as long as endopod. Uropodal exopod with one or two lateral spiniform setae at 0.22–0.25 distance from ramus base (ratio between segment 1 and 2 length 0.31–0.32). Endopod with one or two medial spiniform setae set apart.

Body length of female 49 mm (40–85 mm in other parts of the range). The largest species in the order (Mauchline & Murano, 1977).

Coloration uniformly red, crimson (Fig. 11) (previously also Elofsson & Hallberg, 1977).

Variation. In addition to variation of the diagnostic characters, mentioned above, the carapace anterior margin can be apically from rounded to acute with straight to concave lateral sides. Eyes from rather oblong and flattened dorsoventrally to relatively shortened and wide from lateral view. Băcescu (1981) reported the white colour of the

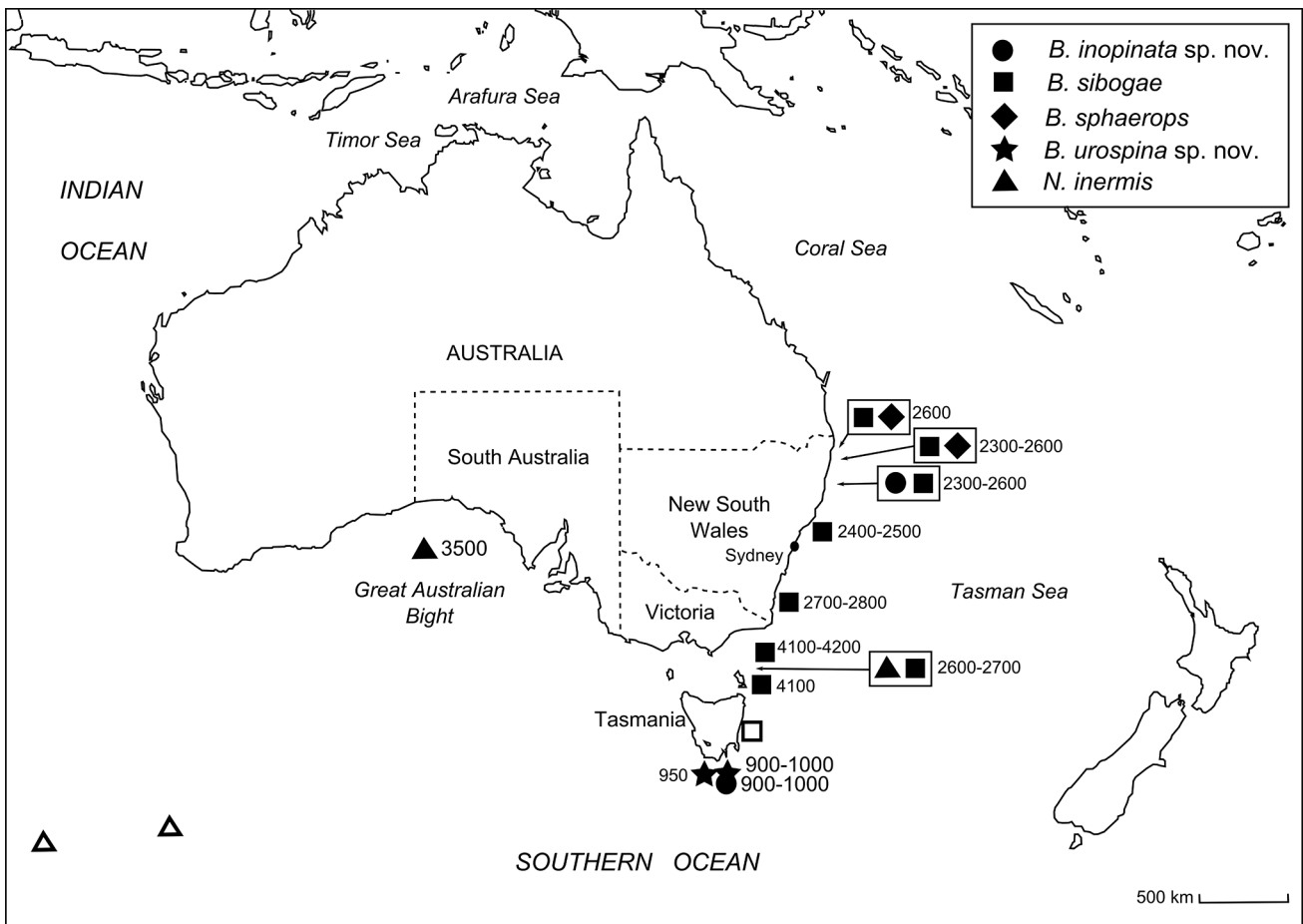


Figure 16. Records of the species of the subfamily Boreomysinae in Australia and adjacent waters (the white symbols indicate former records).

lateral hollow of the eyes in the specimens from the Peru-Chile Trench (normally red), which may have taxonomic importance. The maxilliped 2 propodus can be with or without the distomedial concavity. Geographical regularity in the variation has not been confirmed.

Molecular characters. I was not able to obtain the DNA from the Australian specimens. The GenBank holds the following gene fragments of *N. inermis* specimens from the North Atlantic: 18S rRNA (AM422482) (Meland & Willassen, 2007), mtDNA COI (MK803439), enolase (MK798080) and 28S rRNA (MK798060) (Kou *et al.* 2020). I incorporated the COI sequence into the analysis in this study.

Distribution. Bipolar-amphitropical species. Originally described from sub-Antarctic waters of the Indian Ocean and the tropical Atlantic and Southern Ocean (Willemoes-Suhm, 1874, 1875; Willemoes-Suhm, 1876a, 1876b; G. O. Sars, 1885a), it was later discovered in the North Atlantic (G.O. Sars, 1879b; Ohlin, 1901; Hansen, 1908; Hargreaves, 1997), Canary Basin (Nouvel, 1943), in Weddell Sea (W. M. Tattersall, 1913; Ledoyer, 1990) and Scotia Sea of South Atlantic (Lancraft *et al.*, 1989), East Pacific, West Pacific in Bering Sea and Okhotsk Sea (W. M. Tattersall, 1951), extended further north from the South Atlantic to South Georgia (O. S. Tattersall, 1955; Tchindonova, 1993), Arctic Polar Basin (Birstein & Tchindonova, 1958; Lomakina, 1964; Mauchline, 1986; Petryashov, 1993a, b, 2004a, 2009a; Hargreaves & Murano, 1996), the Pacific sector of

the Southern Ocean (Birstein & Tchindonova, 1962), Peru-Chile Trench (Băcescu, 1981), Southwestern Pacific near Macquarie Island and Southern Ocean near Balleny Islands (Tchindonova, 1993), near Kerguelen Island (Ledoyer, 1995), North-West Pacific off Japan (Fukuoka, 2009), and recently in the East Central Pacific off Mexico and in the Gulf of California (Hernández-Payán & Hendrickx, 2020). In the North Pacific, it is found along North American continental slope from the California Peninsula (17°N), further along Aleutian Ridge towards the Okhotsk Sea and Kuril-Kamchatka Trench (44°N) (Fukuoka, 2009). In the South Pacific, from the Peru-Chile Trench (8°25'S) and Sub-Antarctic Front to the Antarctic coast. In the Arctatlantic, from the Canadian Basin to the Canary Basin (O. S. Tattersall, 1955; Tchindonova, 1981; Petryashov, 2005a, 2014b). First time reported from the Great Australian Bight and Bass Strait (Fig. 16).

Habitat and feeding. Bathyal-abyssal (Birstein & Tchindonova, 1958; Petryashov, 1993b, 2004a, b) or bathyal-pseudoabyssal (Petryashov, 1989) species. Benthopelagic (Birstein & Tchindonova, 1958), bathypelagic (Petryashov, 1989), suprabenthic-bathypelagic (Hargreaves, 1997), benthic (Brandt *et al.*, 1998), nektobenthic (hyperbenthic) (Petryashov, 2004a, 2014b) or pelagic (De Jong-Moreau *et al.*, 2001) species. Depth 700–7200 m (Birstein & Tchindonova, 1958; Tchindonova, 1981; Ledoyer, 1995; Petryashov, 2005b). In Australian waters at 2696–3540 m. Stenothermal in the Arctic basin, found at temperatures of

–1°C to –0.7°C (Petryashov, 1989, 2004a), but generally eurythermal species, capable of living in the range between –1°C and 3.3°C (Petryashov, 2004a). In the North Atlantic found at temperature of –1.3°C to –0.7°C, over soft bottom (G. O. Sars, 1879a; Brattegard & Meland, 1997). In the North Pacific, at temperature of 1.7°C to 2.6 °C, over muddy and sandy bottom, occasionally with presence of rocks, and salinity 33.69–34.54‰ (Petryashov, 1993a). In the Arctic basin, at temperatures –0.88°C–+0.60°C and salinity 34.84–34.99‰, over muddy bottom, occasionally with presence of sand, clay or rocks (Petryashov, 1993b, 2004). Omnivorous species with phytophagous tendency: crustaceans and algae (De Jong-Moreau *et al.*, 2001). Relatively unabundant, <10 individuals per 1000 m³ (Hargreaves, 1997).

Remarks. Willemoes-Suhm (1874), in the letter to Carl von Siebold, written onboard HMS *Challenger*, provided rather short description of *Petalophthalmus armiger* Willemoes-Suhm, 1874, collected from the tropical Atlantic in 1873, and *P. inermis*, collected the same year off Crozet Islands in southern Indian Ocean and in 1874 in Southern Ocean. Both species had very peculiar eyes, not found in any other mysids. Simultaneously he sent a detailed account with proper descriptions and illustrations of *P. armiger* to the Linnean Society of London, which was published a year later (Willemoes-Suhm, 1875). He mentioned *P. inermis* again in two more reports he sent to the Director of the Civilian Scientific Staff, published posthumously (Willemoes-Suhm, 1876a, 1876b), as he suddenly died in the course of the Expedition. The name indicated the absence of the prehensile structure of the mandibular palp, characteristic for other *Petalophthalmus*, as well as for the males of *P. armiger*.

G. O. Sars (1879b), probably unaware of what species Willemoes-Suhm dealt with, described much in detail and well illustrated *Boreomysis scyphops* (currently a junior synonym of *N. inermis*), collected by the Norwegian North-Atlantic Expedition. He was the first to describe its uniform red body colour, the truncate antennal scale, pereopods and other features. Later, G. O. Sars (1883) received the *Challenger* material, as well as the notes and drawings of Willemoes-Suhm, but not the specimens of *P. armiger*, which, judging from Willemoes-Suhm's descriptions, was rather related, in his opinion, to *Boreomysis*. He also synonymized *P. inermis* from Southern Indian Ocean with *B. scyphops*, although the former was described earlier than the latter. Finally, G. O. Sars was able to obtain the male of *P. armiger* and in a more detailed report of his work (G. O. Sars, 1885a) recognized it as distinctly belonging to *Petalophthalmus*. The female, described and illustrated by Willemoes-Suhm (1875), was lost. He also noticed a special incurvation of the maxilliped 2 propodus (“gnathopod” in Sars' terminology), overlooked by subsequent authors. G.O. Sars was the first to study the nervous system of *N. inermis*, which has been described only for few mysid species.

Hansen (1887) assigned *P. armiger* female to *B. scyphops*. Faxon (1893) designated a new species for this female, *Boreomysis suhmi* Faxon, 1893. Then Hansen (1908) compared material on *B. scyphops* from the North Atlantic and the Southern Ocean, found difference in the structure of the eyes and antennal scales and described the latter specimens as *B. distinguenda* Hansen, 1908. The eyes of the Australian specimens in my disposal have rather square than oblong eyes, closer in this respect to the North Atlantic

specimens, originally described as *B. scyphops*. By this, I do not find a support for Hansen's distinction between the Northern and Southern Hemisphere species.

In his later work Hansen (1910) described another new species *B. inermis* Hansen, 1910, from the East Indies expedition, probably not associating *P. inermis* with *Boreomysis*. He also (Hansen, 1921) described so called “dorsal organ” in *B. scyphops*, which differed from other species of *Boreomysis*. I do not include its description into the diagnosis of *N. inermis*, as we do know yet its structure in *N. caeca*. [“in front of the gastric groove a moderately large and rather shallow depression, at the middle of which is seen a somewhat low, a little oval, rounded and very distinct protuberance with one to three minute pits”, Hansen, 1921, p. 71]

W. M. Tattersall (1951) confirmed the difference between *B. scyphops* and *B. distinguenda*, and proposed to return the original name *B. inermis* instead of *B. scyphops* from sub-Antarctic waters, *B. suhmi* and *B. distinguenda*. The name *B. scyphops* was maintained only for the North Atlantic and Arctic populations. He also noticed that Hansen's *B. inermis* turned out to be *B. rostrata* Illig, 1930. This was later described by Holmquist (1956) as *B. hanseni* Holmquist, 1956. O. S. Tattersall (1955) continued to treat *B. scyphops* and *B. inermis* separately, with the latter species distinguished by more quadrangular eyes with thicker marginal rim, following Hansen (1908).

Birstein & Tchindonova (1958) described *B. caeca*, closely related to *B. inermis*. This required an update of the diagnosis for *B. inermis*. According to them, the species differed by the structure of the cuticle, the eyes, the antennal scales and the uropods. Among other characters *B. inermis* had two (cf. one in *B. caeca*) spiniform setae on the uropodal exopod and endopod. One of the new Australian specimens, which I examined, had the same number of uropodal spiniform setae as in *B. caeca*, otherwise constructed typically for *B. inermis*. I therefore exclude these characters from the updated diagnosis. The authors also followed G. O. Sars' (1885a) view, considering the Southern and Northern Hemisphere populations of *B. inermis* conspecific.

Ii (1964) clearly separated *B. inermis* together with *B. scyphops* from other species of *Boreomysis* by the absence of ommatidia (considering them blind species), but he continued to distinguish the two species separately. He also considered that *B. rostrata orientalis* Ii, 1964, maybe nearer to *B. inermis* Hansen, 1910, than to its nominotypical subspecies (“variation” in his concept, p. 19, 23, 32, 33). The name *inermis* for the Hansen's taxon must be altered in his opinion (Ii, 1964), which was earlier done by Holmquist (1956), who described it as *B. hanseni*.

Elofsson & Hallberg (1977), in a specific study of the eye structure, actually found the thick pigment cell layer and large number of ommatidia behind it, as well as various optico-neural structures and muscles. The ommatidia lacked the dioptic structure. More details on the eye ultrastructure can be consulted in their paper. This work remained unnoticed, and the lack of eye pigmentation kept repeating as a character in keys and descriptions.

Tchindonova (1981) made a detailed study with the Antarctic and North Pacific material of *B. inermis*. She also had the South American collections at her disposal, but did not study them. Morphological differences between the populations of Northern and Southern Hemispheres

Table 1. A list of the genera, subgenera, and species of the subfamily Boreomysinae in the world fauna, including the new taxa described here.

Boreomysinae Holt et Tattersall, 1905
Boreomysis G. O. Sars, 1869
Boreomysis (*Boreomysis*) G. O. Sars, 1869
Boreomysis (*Boreomysis*) *acuminata* O. S. Tattersall, 1955
Boreomysis (*Boreomysis*) *arctica* (Krøyer, 1861)
Boreomysis (*Boreomysis*) *atlantica* Nouvel, 1942
Boreomysis (*Boreomysis*) *bispinosa* O. S. Tattersall, 1955
Boreomysis (*Boreomysis*) *brucei* W. M. Tattersall, 1913
Boreomysis (*Boreomysis*) *californica* Ortmann, 1894
Boreomysis (*Boreomysis*) *chelata* Birstein et Tchindonova, 1958
Boreomysis (*Boreomysis*) *curtirostris* Birstein et Tchindonova, 1958
Boreomysis (*Boreomysis*) *dubia* Coifmann, 1937
Boreomysis (*Boreomysis*) *fragilis* Hansen, 1912
Boreomysis (*Boreomysis*) *hanseni* Holmquist, 1956
Boreomysis (*Boreomysis*) *illigi* O. S. Tattersall, 1955
Boreomysis (*Boreomysis*) *incisa* Nouvel, 1942
Boreomysis (*Boreomysis*) *inopinata* sp. nov.
Boreomysis (*Boreomysis*) *intermedia* Ii, 1964
Boreomysis (*Boreomysis*) *jacobi* Holmquist, 1956
Boreomysis (*Boreomysis*) *latipes* Birstein et Tchindonova, 1958
Boreomysis (*Boreomysis*) *longispina* Birstein et Tchindonova, 1958
Boreomysis (*Boreomysis*) *macrophthalma* Birstein et Tchindonova, 1958
Boreomysis (*Boreomysis*) *microps* G. O. Sars, 1883
Boreomysis (*Boreomysis*) *nobilis* G. O. Sars, 1879
Boreomysis (*Boreomysis*) *obtusata* G. O. Sars, 1883
Boreomysis (*Boreomysis*) *oparva* Saltzman et Bowman, 1993
Boreomysis (*Boreomysis*) *pearcyi* Murano et Krygier, 1985
Boreomysis (*Boreomysis*) *plebeja* Hansen, 1910
Boreomysis (*Boreomysis*) *rostrata* Illig, 1906
Boreomysis (*Boreomysis*) *semicoeca* Hansen, 1905
Boreomysis (*Boreomysis*) *sibogae* Hansen, 1910
Boreomysis (*Boreomysis*) *sphaerops* Ii, 1964
Boreomysis (*Boreomysis*) *tanakai* Ii, 1964
Boreomysis (*Boreomysis*) *tattersalli* O. S. Tattersall, 1955
Boreomysis (*Boreomysis*) *tridens* G. O. Sars, 1870
Boreomysis (*Boreomysis*) *vanhoeffeni* Zimmer, 1914
Boreomysis (*Boreomysis*) *verrucosa* W. M. Tattersall, 1939
Boreomysis (*Petryashovia*) subgen. nov.
Boreomysis (*Petryashovia*) *insolita* O. S. Tattersall, 1955
Boreomysis (*Petryashovia*) *kistnae* Pillai, 1973
Boreomysis (*Petryashovia*) *megalops* G. O. Sars, 1872
Boreomysis (*Petryashovia*) *uospina* sp. nov.
Neobirsteiniamysis Hendrickx et Tchindonova, 2020
Neobirsteiniamysis *caeca* (Birstein et Tchindonova, 1958)
Neobirsteiniamysis *inermis* (Willemoes-Suhm, 1874)

were minimal (Tchindonova, 1981), and she removed *B. scyphops* from the synonymy, suggesting that each bipolar species could equally be considered either a widespread variable species or a sibling species, found in different hemispheres. In the absence of additional material she was not ready to make final decision. In the same work Tchindonova (1981) also corrected her earlier (Birstein & Tchindonova, 1962) misidentification of *B. scyphops* as *B. inermis*. She also mentioned a new subspecies *B. inermis ochotskii* Tchindonova, 1981, without providing a description. This was first noted by the staff of the Zoological Society of London (1985), and the name is to be considered nomen nudum.

Băcescu (1981) suggested that *B. inermis* from the Peru-Chile Trench “possibly” belongs to a separate subspecies, *B. inermis peruana*. He provided some characters and

mentioned “n. ssp.” after the subspecies name, but did not designate any type specimens (Băcescu, 1981, p. 36). According to the Code, Article 16.4.1 (ICZN, 1999), the type specimens do not have to be designated in the publication before the year 2000. However, the expression “possibly” makes his proposal conditional, i.e. with stated reservation (the Code Glossary), and, thus, unavailable, according to Article 15.1. By this, *Boreomysis inermis peruana* is a nomen nudum.

Ledoyer (1989, 1995) explicitly noted that the boreal form was not conspecific with *B. inermis*, but twice misspelt *B. scyphops* as *B. scyphos*. He was also, probably, unaware of *Birsteiniamysis*, designated for *B. inermis* by Tchindonova (1979, 1981, 1993). Designating informal groups for *B. inermis*, *B. scyphops* and *B. caeca*, Tchindonova (1993) also continued treating the first two as separate

species. Simultaneously, Petryashov (1993a) accepted the combination with *Birsteiniamysis*, but considered *B. scyphops* synonymic with *B. inermis*, though without specifications. Hargreaves (1997) also treated *B. inermis* and *B. scyphops* as synonyms, but Brattegard & Meland (1997) still distinguished *B. scyphops* separately from *B. inermis*.

De Jong-Moreau *et al.* (2001) made a SEM study of the mandibles, labrum, and paragnaths. Particularly interesting was the finding of pores surrounding the apical part of the mandibular processus molaris.

Meland & Willassen (2007) obtained the first DNA sequence of *B. inermis*, which they still considered a part of *Boreomysis*. Since the specimen came from the North Atlantic, the authors evidently treated *B. scyphops* as the synonym of *B. inermis*, although this was not explicitly indicated. This was a fragment of the ribosomal 18S rRNA gene. Later Kou *et al.* (2020) sequenced the 28S rRNA, enolase and the mtDNA COI gene fragments from the same North Atlantic material. They accepted the species position within *Birsteiniamysis*.

Hendrickx *et al.* (2020) first time used the species name in combination with a newly designated *Neobirsteiniamysis*. Hernández-Payán & Hendrickx (2020) discovered that *N. inermis* possessed plumose setae in the telson cleft. This primitive character is rather important and usually characterizes a subfamily or a genus in various other mysid groups. Its finding in boreomysines is an outstanding discovery. However, none of the specimens at my disposal possessed such setae, and this character still requires verification. The authors also reported considerable variation in the shape of the carapace and eyes among the specimens from East Central Pacific.

Biogeographic note

Conditional endemicity of *Boreomysis (Boreomysis) inopinata* sp. nov. and *B. (Petryashovia) urospina* sp. nov. in the Tasman Sea must be tested by further investigations in the Southern Hemisphere. In any case, both have close species in the Northern Hemisphere, *B. (B.) tridens* and *B. (P.) megalops*, respectively, which points to the historical transoceanic dispersal of the common ancestors and general connection of the deep-water fauna of the World Ocean. This is supported by the finding of *B. (B.) sibogae* and *B. (B.) sphaerops* in Australia, both known in the Northern Pacific; and *N. inermis*, a rare case of the bipolar-tropical species.

Deep-water mysids of the southeast Australia have different origin compared to the shallow-water mysids of this area. The latter are related to the tropical West Indo-Pacific fauna (Daneliya, 2021). The deep-water fauna has not been affected by the currents and general climate of the ocean surface, which provided relatively isolated favourable conditions for the existence and development of the ancient mysid subfamily Boreomysinae.

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