

Gastrosaccini mysids from Australia, with a description of a new species of *Haplostylus* and a key to species of the genus (Crustacea: Mysidacea)

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Abstract – Seven species of gastrosaccini mysids, one species of *Gastrosaccus* and six species of *Haplostylus*, are reported from the coastal waters of Australia, based on specimens deposited in the Western Australian Museum, Perth. Among them, one *Haplostylus* species from Western Australia is considered new and described as *H. tenuicaudus* sp. nov. The new species resembles the Australian congeners, *H. queenslandensis* (Bacescu and Udrescu, 1982), *H. udrescui* Greenwood *et al.*, 1991, *H. australiensis* Wooldridge *et al.*, 1992, and *H. dispar* Panampunnayil, 1997, but differs from all the related species by having the following characters: the telson is relatively more slender, length 3 times basal width, laterally armed with more than 10 spines, including the terminal spine, with the subterminal spine smaller than and placed close to the terminal spine; the exopod of the male third pleopod has the terminal segment consistently longer than the penultimate segment. A key to all known *Haplostylus* species is presented.

INTRODUCTION

Species of the genera *Gastrosaccus* and *Haplostylus* are common in tropical and subtropical coastal waters of the Atlantic and Indo-West Pacific regions. A total of 16 species, representing two species of *Gastrosaccus* and 14 of *Haplostylus*, have been reported from Australian waters, mainly based on specimens collected from the eastern coast (W.M. Tattersall 1940; Bacescu 1979; Bacescu and Udrescu 1982; Wooldridge and McLachlan 1986; Panampunnayil 1989, 1997; Fenton 1990; Greenwood *et al.* 1991; Wooldridge *et al.* 1992). Recent study by Panampunnayil (1997) disclosed the presence of five new species of *Haplostylus* from south-west Australia, but our knowledge of the group in the coastal waters of Western Australia is relatively scarce.

Recent studies of gastrosaccini mysids housed in the Western Australian Museum revealed seven species, representing one species of *Gastrosaccus* and six of *Haplostylus*. Among them, a species of *Haplostylus* from the shallow coastal waters of Western Australia is considered new, and reported here as *H. tenuicaudus* sp. nov. In this paper, all seven species are taxonomically discussed and a key to the genus *Haplostylus*, as yet still preliminary, is provided, based mainly on published data.

The total length is given in millimetres, measuring from the tip of the rostrum to the base of the terminal spine of the telson. All specimens examined in this study are deposited in the Western Australian Museum, Perth (WAM).

SYSTEMATICS

Subfamily GASTROSACCINAE

Genus *Gastrosaccus* Norman, 1868

Gastrosaccus sorrentoensis Wooldridge and McLachlan, 1986 Figure 1

Gastrosaccus sorrentoensis Wooldridge and
McLachlan, 1986: 129, figs 1-4.

Material Examined

Australia: Western Australia: 1 ♀ (9.8 mm),
Warnbro Sound, south of Perth, date unknown
(WAM 403-95).

Diagnosis

Rostrum moderately developed, subtriangular, shorter than broad (Figure 1a). Posterior margin of carapace fringed with spine-like filaments on almost entire margin and overlapping slit dorsolaterally (Figure 1b). Fifth abdominal somite with articulated posteromedial process (Figure 1c). Sixth abdominal somite with sharp transverse carinate swelling at anterior dorsal end. Telson armed laterally with 9 pairs of stout spines including terminal spine (Figure 1d). Endopod of uropod as long as, or slightly longer than exopod. Second segment of antennular peduncle armed with 2 stout spines (Figure 1a).

Distribution

Previously known only by the type specimens

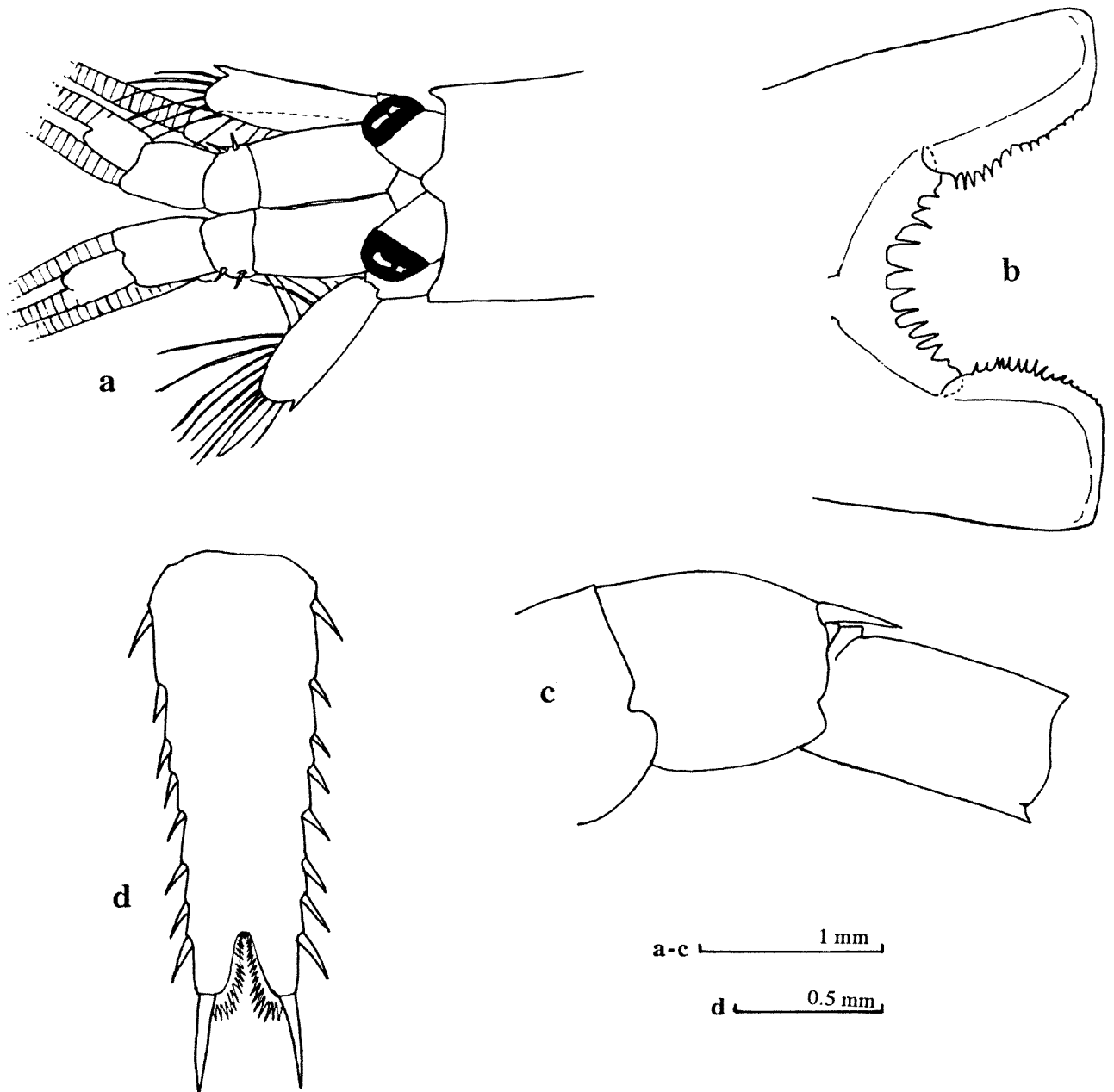


Figure 1 *Gastrosaccus sorrentoensis* Wooldridge and McLachlan, 1986, ♀ (9.8 mm) from Warnbro Sound, Western Australia: a, anterior part of body; b, posterior part of carapace; c, fifth and sixth abdominal somites; d, telson.

from Sorrento Beach near Perth, Western Australia (Wooldridge and McLachlan 1986). This is the second record of occurrence for the species.

Remarks

The Australian fauna is known to include two *Gastrosaccus* species, *G. sorrentoensis* from Western Australia and *G. daviei* Bacescu and Udrescu, 1982 from the east coast. The former species can be easily distinguished from the latter by the following particular characters: the posterior margin of the carapace is fringed with spine-like filaments and the fifth abdominal somite has an articulated posteromedian process.

Genus *Haplostylus* Kossman, 1880

Haplostylus indicus (Hansen, 1910)

Gastrosaccus indicus Hansen, 1910: 56, fig. 2a-r; W.M. Tattersall, 1911: 125; 1940: 331; fig. 2; 1951: 90; Delsman, 1939: 167; O.S. Tattersall, 1960: 169; 1965: 81; Ii, 1964: 254; Mauchline and Murano, 1977: 55 (in list); Wang and Liu, 1987: 212, fig. 4; Müller, 1993: 76.

Haplostylus indicus: Fenton, 1990: 444 (in list).

Material Examined

Australia: Queensland: 2 ♂ (6.7, 6.8 mm), 3 ♀

(all ca. 7.0 mm), Tangalooma, Moreton Is., 5 March 1973, coll. B. Griffiths (WAM 406-95).

Diagnosis

Rostrum subtriangular, shorter than broad. Posterior margin of carapace smooth, dorsolateral slit entirely fused, represented as fold-like line. Fifth abdominal somite smooth posteriorly. Sixth abdominal somite with obtuse, low transverse swelling at anterior dorsal end, elevating as high as level of posterior dorsal margin, thus dorsum delimited by deep groove in lateral aspect. Telson length (from anterior end to base of terminal spine) 2.9-3.1 times basal width, laterally armed with relatively short, somewhat narrowly spaced 8-11 spines, commonly 8-9, including terminal spine; lateral spines, at least in males, barely reaching base of subsequent spine in distal half, except for penultimate. Endopod of male second pleopod commonly uniarticulate. Endopod of male third pleopod rudimentary; exopod usually composed of 3 segments, first segment subequal to length of second, armed with 2 long lateral spines and large oval lobe, latter originating from a point which is basal 1/6-1/5 along length of basal segment; terminal spines moderately short, 1/8 as long as third segment, lash-like seta nearly straight, barbed.

Distribution

This species is recorded in the Indo-West Pacific: north of Madagascar (W.M. Tattersall 1911); India (Pillai, 1965); Philippine-Indonesian region (Hansen 1910; Delsman 1939; W.M. Tattersall 1951; O.S. Tattersall 1960, 1965); South China Sea (Wang and Liu 1987) Ryukyu Islands, south-western Japan (Hanamura 1997:704); New South Wales in Australia (W.M. Tattersall 1940).

Remarks

The specimens from Queensland were more or less damaged, but may be assigned to *Haplostylus indicus*. The terminal lash-like seta is consistently barbed in *H. indicus*.

This species is similar to the Australian congener *H. flagelliforma* Panampunnayil, 1997. However, the lateral spines of the telson in *H. indicus* is proportionately long and narrowly spaced, reaching the base of subsequent spine distally, as opposed to more sparsely placed spines, falling far short of that portion in *H. flagelliforma*.

Unlike the list by Panampunnayil (1997, table 1), the male third pleopodal exopod is composed of three segments in specimens from Queensland. The three segmented exopod is also common in the population of south-west Japan, with the basal segment being longer than the second, or nearly subequal length. Furthermore, it is noted for the

latter that the endopod of the male second pleopod is composed of 1 or 2 segments.

Haplostylus indicus also shows a close resemblance to *H. similis* Panampunnayil, 1997. For distinction of the two species, see "Remarks" under the latter species.

Haplostylus similis Panampunnayil, 1997

Figure 2

Haplostylus similis Panampunnayil, 1997: 1211, figs 5-8.

Material Examined

Australia: Western Australia: 3 ♂ (6.2-6.5 mm), Rottnest Is., 8 June 1962 (WAM 410-95); 1 ovig. ♀ (6.8 mm), Pt. Robinson, Nickol Bay, 30 August 1954 (WAM 414-95).

Diagnosis

Rostrum subtriangular, shorter than broad (Figure 2a). Posterior margin of carapace smooth, dorsolateral slit entirely fused, represented as fold-like line (Figure 2b). Fifth abdominal somite smooth posteriorly. Sixth abdominal somite with obtuse, low transverse swelling at anterior dorsal end, elevating as high as level of posterior dorsal margin, consequently dorsum delimited by moderately deep groove in lateral aspect (Figure 2c). Telson length 2.7-2.9 times basal width, laterally armed with rather long, narrowly spaced 10-14 spines including terminal spine, increasing length towards distally (Figure 2d). Endopod of male second pleopod 1 or 2 segmented (Figure 2e). Endopod of male third pleopod rudimentary; exopod composed of 3 segments, first segment subequal to length of second, laterally armed with 2 spines of subequal length and large, oval lobe, latter originating from a point which is basal 1/5-1/4 along length of basal segment; terminal spines moderately long, 1/6 as long as third segment, lash-like seta barbed (Figure 2f, g).

Distribution

Haplostylus similis has been recorded from south-west Australia (Panampunnayil 1997). The present occurrence from Nickol Bay suggest *H. similis* to be distributed along the entire coast of Western Australia.

Remarks

Haplostylus similis is one of the five species established recently by Panampunnayil (1997) from south-west Australia. This species is very closely allied to *H. indicus*, but can be distinguished by following features; 1) the telson of *H. similis* is proportionately shorter than that in *H. indicus*, being 2.7-2.9 times the length of basal width, as

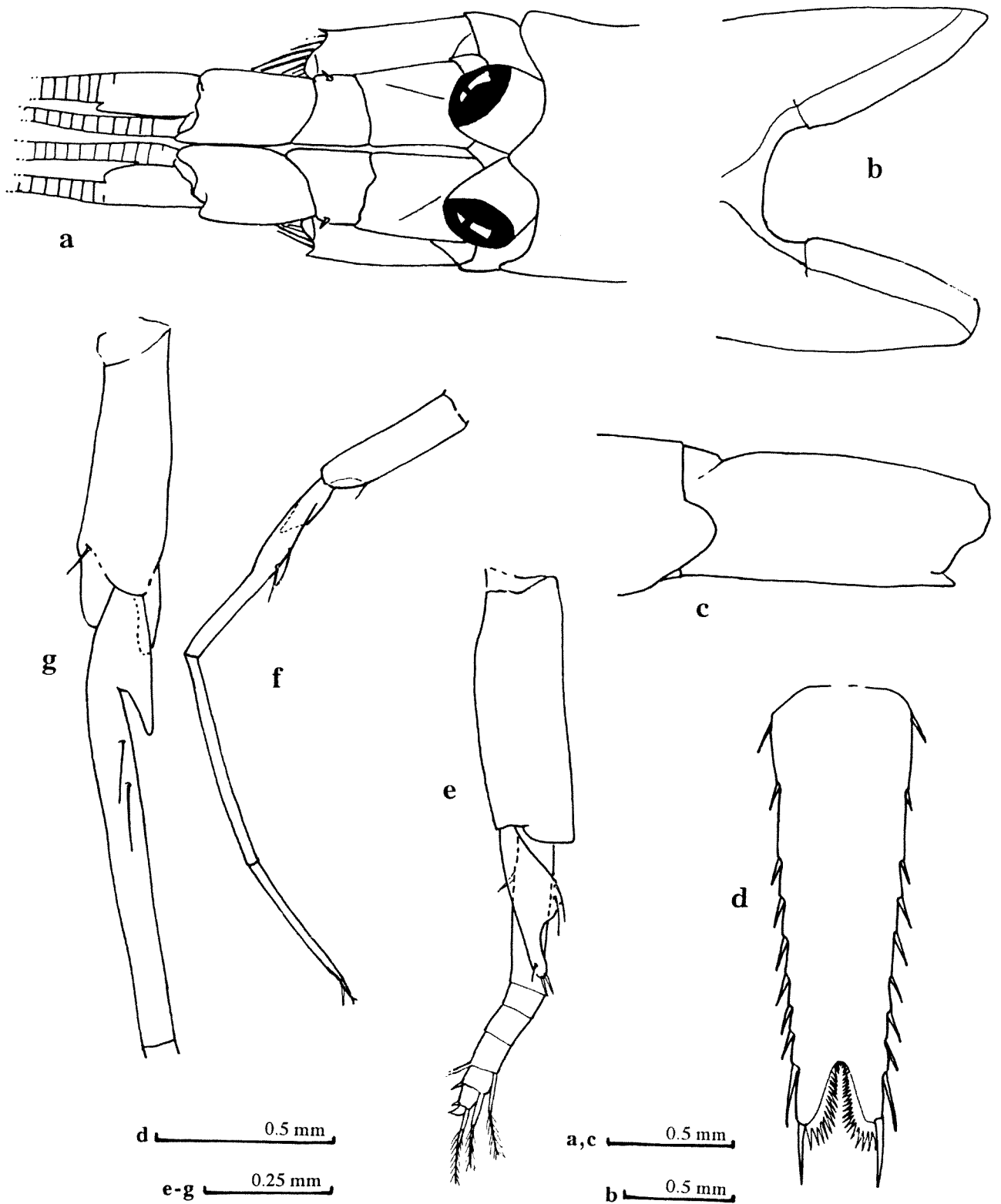


Figure 2 *Haplostylus similis* Panampunnayil, 1997, ♂ (6.5 mm) from Rottnest Is., Western Australia: a, anterior part of body; b, posterior part of carapace; c, sixth abdominal somite; d, telson; e, second pleopod; f, third pleopod; g, same as figure f, basal part enlarged.

opposed to 2.9 times or more, and 2) the terminal spines of the male third pleopodal exopod is slightly longer than that in the latter species (about 1/6 times length of the third segment vs 1/8). These characters distinguishing the two species, known to me, are rather minor and future study base on more specimens is strongly encouraged, together with those of *H. flagelliforma*.

***Haplostylus multispinosus* Panampunnayil, 1997**

Figure 3

Haplostylus multispinosus Panampunnayil, 1997: 1217, figs 9–12.

Material Examined

Australia: Western Australia: 2 ♂ (6.0, 6.6 mm), 1 ♀ (5.8 mm), end of Barrow Is., 2 September 1954, tide running (WAM 408–95).

Diagnosis

Rostrum subtriangular, with rounded apex, slightly shorter than broad (Figure 3a). Posterodorsal margin of carapace entire, dorsolateral slit fused, indicated as fold-like line (Figure 3b). Sixth abdominal somite with obtusely rounded transverse swelling at anterior dorsal end, elevating just above level of posterior margin, thus dorsum delimited by moderately deep groove in lateral aspect (Figure 3c). Telson length slightly less than 3 times basal width, laterally armed with somewhat narrowly spaced 10–13 spines including terminal spine; distomedial groove barely reaching base of antepenultimate spine (Figure 3d). Male second pleopod with 2 segmented endopod (Figure 3e). Endopod of male third pleopod rudimentary, exopod composed of 3 segments, first segment with 2 lateral spines, much shorter in proximal, and small triangular lobe present on lateral margin, originating from a point which is basal 1/3–4/9 along length of basal segment; terminal spines 1/4 length of distalmost segment, terminal lash-like seta barbed (Figure 3g, f).

Distribution

This species is known from south-west Australia (Panampunnayil 1997). This study exhibited that *H. multispinosus* is distributed on the entire coast of Western Australia.

Remarks

Haplostylus multispinosus shows the closest affinity to *H. pacificus* (Hansen, 1912). However, *H. multispinosus* is distinguished from *H. pacificus* by following characters: 1) the endopod of the uropod has 13–14 mesial spines in *H. multispinosus*, as opposed to 7–8 spines in *H. pacificus*; 2) the distomedial groove of the telson is proportionately

deep, reaching the base of the antepenultimate spine, in stead of extending the penultimate spine, and 3) the terminal segment of the male third pleopodal exopod is slightly narrowing in distal 1/6, with a lash-like seta markedly barbed, in contrast to that segment narrowing abruptly in distal 2/5–1/3, with a lash-like seta not barbed. In addition, *H. multispinosus* tends to have a larger number of spines on the lateral margin of the telson than in *H. pacificus* (10–13, commonly 12, spines, instead of 8–11, commonly 9–10).

***Haplostylus robustus* (Panampunnayil, 1989)**

Gastrosaccus robusta Panampunnayil, 1989: 1307, figs 1–27; Müller, 1993, p. 80.

Haplostylus tattersalli Fenton, 1990: 445, figs 1–13; Müller, 1993: 84.

Gastrosaccus sp. Dakin and Colefax, 1940: 132, figs 223 and 224.

Material Examined

Australia: Western Australia: 1 ♀ (ca. 9 mm, damaged by drying), Rottneest Is., 28 November 1945 (WAM 412–95).

Diagnosis

Rostrum obtusely produced anteriorly, shorter than broad. Posterior margin of carapace with reflexed lobe, derived by prolongation of lower part of typical dorsolateral slit. Fifth abdominal somite with sharp posteromedian process. Telson laterally armed with 6 stout spines including distal spine, penultimate spine placed dorsally rather than laterally and distinctly shorter than antepenultimate spine. Exopod of uropod noticeably shorter than endopod.

Distribution

Known only in southern Australia below 33°S (Dakin and Colefax 1940; Panampunnayil 1989; Fenton 1990). *Haplostylus robustus* appears to be numerous in the south-west Australian waters, as the species has reported often to produce swarms in surface waters (Panampunnayil 1989).

***Haplostylus queenslandensis*
(Bacescu and Udrescu, 1982)**

Figure 4

Gastrosaccus queenslandensis Bacescu and Udrescu, 1982: 83, fig. 3.

Haplostylus queenslandensis: Greenwood *et al.*, 1991: 520, figs 4–7; Müller, 1993: 84.

Material Examined

Australia: Queensland: 1 ♂ (7.3 mm), 2 ♀ (6.0,

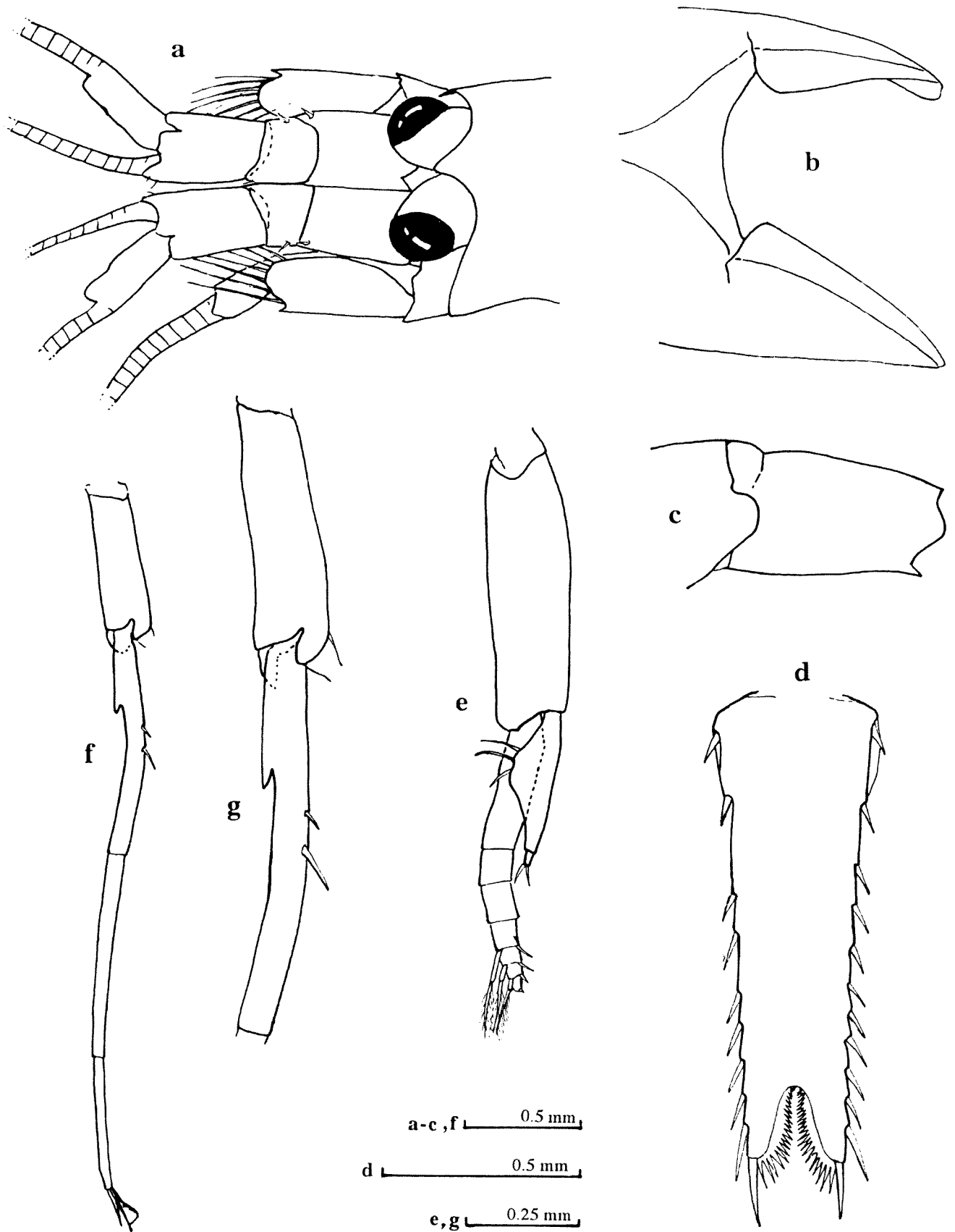


Figure 3 *Haplostylus multispinosus* Panampunnayil, 1997, ♂ (6.6 mm) from Barrow Is., Western Australia: a, anterior part of body; b, posterior part of carapace; c, sixth abdominal somite; d, telson; e, second pleopod; f, third pleopod; g, same as figure f, basal part enlarged.

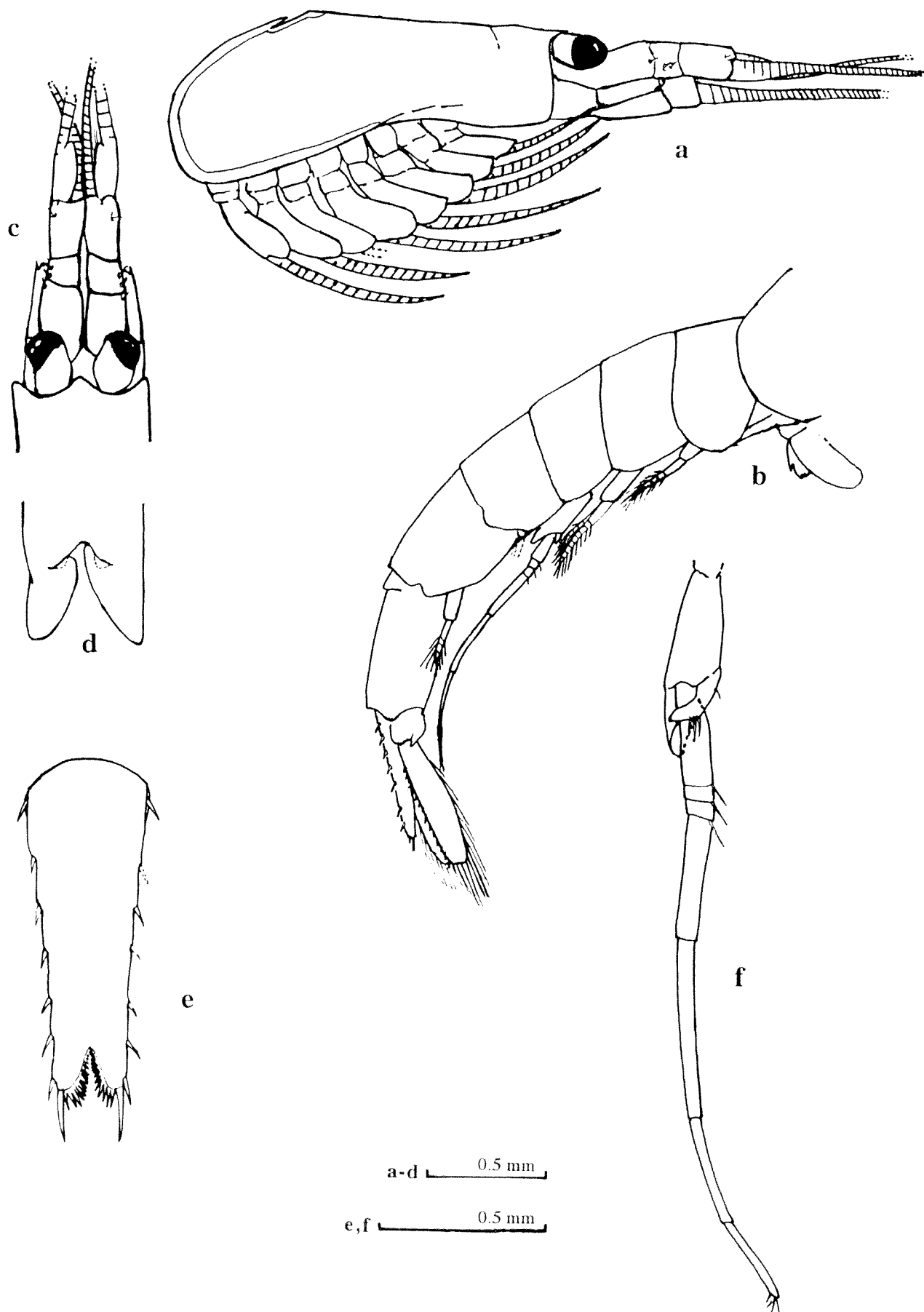


Figure 4 *Haplostylus queenslandensis* (Bacescu and Udrescu, 1982), ♂ (7.3 mm) from 73(3), Brisbane, Queensland: a, cephalothorax; b, abdomen; c, anterior part of body; d, posterior part of carapace; e, telson; f, third pleopod.

8.7 mm), 1 ovig. ♀ (6.5 mm), Stn 73(3), 9 August 1972 (WAM 416–95); 2 ♂ (4.2, 4.8 mm), 1 ♀ (damaged), 4 ovig. ♀ (6.5–6.7 mm), Deception Bay, Brisbane, 4 December 1972, coll. B. Griffiths (WAM 404–95); 1 ♂ (ca. 6.5 mm), 1 ♀ (damaged), Tangalooma, Moreton Is., 5 March 1973, coll. B. Griffiths (WAM 635–97, ex WAM 406–95); 1 ♂ (6.5 mm), 4 ♀ (7.3–ca. 9 mm), 1 ovig. ♀ (ca. 7.5 mm), 15 Aldershots (610), Fraser Is., date unknown, coll. B. Griffiths (WAM 407–95); 4 ♂ (all damaged), 8 ♀ (ca. 6.5–ca. 8.0 mm), 82(2) Toorbul, Brisbane, 7 November 1972, coll. B. Griffiths (WAM 405–95).

Diagnosis

Rostrum moderately developed, triangular, with rounded apex (Figure 4c). Posterior margin of carapace with reflexed large lobe, originating from lower part of typical overlapping slit at dorsolateral part (Figure 4a, d). Fifth abdominal somite without posteromedial process (Figure 4b). Sixth abdominal somite with transverse carinate swelling at anterior dorsal end (Figure 4b). Telson length 2.1–2.5 times basal width, laterally armed with 8–9 stout spines including distal spine, penultimate spine much shorter than terminal spine, both spines close-set to each other; distomedial groove 1/10–1/8 as long as telson (Figure 4e). Male pleopods all biramous: first endopod uniarticulate, exopod with 7 segments; second endopod with 6 or 7 segments, exopod 7 or 8 segments, third endopod uniarticulate, exopod with 7 segments, and laterally armed with 3 spines, subterminal segment longer than terminal segment (Figure 4f).

First pleopod of female biramous, exopod about 1/2 length of endopod. Second to fifth pleopods uniramous, rod-like shape.

Distribution

Previously known only from estuarine waters of central eastern coasts of Australia (Bacescu and Udrescu 1982; Greenwood *et al.* 1991)

Remarks

This species is closely allied to *Haplostylus dispar* Panampunnayil, 1997, but is distinguished from the latter in having the exopod of the third male pleopod composed of seven articles with three lateral spines, in contrast to having six segments with two lateral spines. The endopod of the male second pleopod is noticeably shorter than the exopod in *H. dispar*, while both rami are subequal in this species.

Haplostylus queenslandensis also resembles *H. australiensis* Wooldridge *et al.*, 1992 but differs from the latter in possessing the telson with the terminal and subterminal spines placed close together and the distomedial groove as shallow as 1/10–1/8 of telson length, as opposed to having the subterminal spine separated from the terminal one and the distomedial groove as deep as 1/6–1/5 (see also Wooldridge *et al.* 1992). Furthermore, *H. queenslandensis* is distinguished from *H. udrescui* by the subterminal spine being much smaller than the terminal one.

Haplostylus queenslandensis shows the closest affinity to *H. tenuicaudus* sp. nov. recorded from Western Australia. Distinguishing features separating the two species are discussed under the "Remarks" of the latter species.

Haplostylus tenuicaudus sp. nov.

Figures 5–8

Material Examined

Holotype

♂ (7.5 mm), Pt. Robinson, Nickol Bay, Western Australia, Australia, 30 August 1954, coll. K. Sheard (WAM 636–97, ex WAM 414–95).

Paratypes

Australia: Western Australia: 2 ♂ (7.3, 7.6 mm) and 3 ovig. ♀ (6.8–9.1 mm), data same as holotype (WAM 637–97, ex WAM 414–95); 2 ♂ (7.3, 7.5 mm),

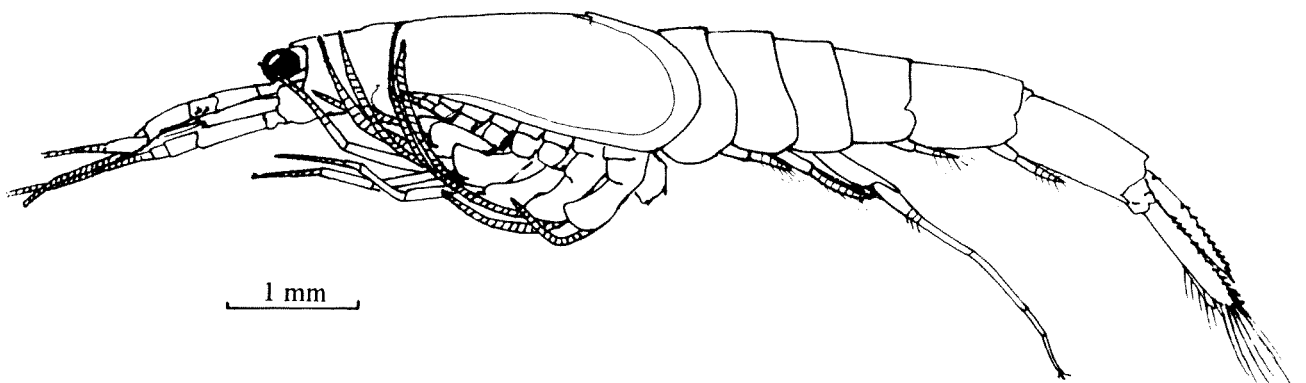


Figure 5 *Haplostylus tenuicaudus* sp. nov., holotype ♂ (7.5 mm) from Pt. Robinson, Nickol Bay, Western Australia.

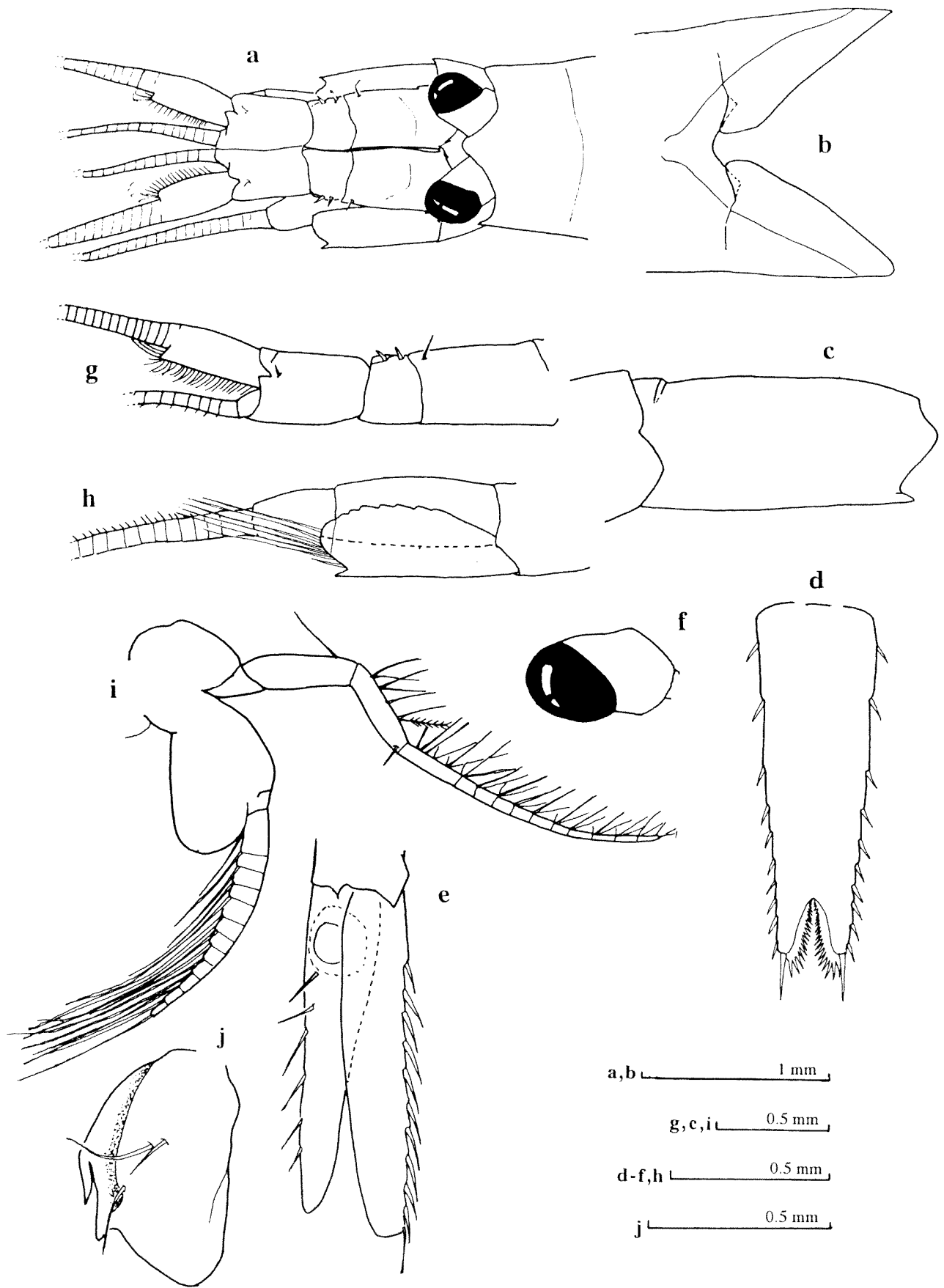


Figure 6 *Haplostylus tenuicaudus* sp. nov., holotype ♂ (7.5 mm) from Pt. Robinson, Nickol Bay, Western Australia: a, anterior part of body; b, posterior part of carapace; c, sixth abdominal somite; d, telson; e, uropod; f, eye; g, antennule; h, antenna; i, eighth thoracic limb; j, penis.

end of Barrow Is., 2 September 1954, tide running (WAM 638-97, ex WAM 408-95); 1 ♀ (4.5 mm) and 1 damaged ♂ abdomen, Nornalup, 24 October 1976 (WAM 402-95).

Diagnosis

Posterior margin of carapace with large reflexed lobe. Abdomen with fifth somite rounded on posterior margin. Telson about 3 times as long as basal width, laterally armed with 10-14 spines including terminal spine, subterminal spine placed approximate to terminal spine and much smaller than latter, distomedial groove shallow, being 1/10-1/8 length of telson. Third male pleopod with endopod uniarticulate, exopod normally composed of 7 segments (3 lateral spines), terminal segment shorter than penultimate, armed distally with 4 spines. First female pleopod with exopod small, scale-shaped, 1/5-2/3 as long as endopod, usually without terminal seta, rarely with moderately long seta.

Description

Body moderately robust, about 6.5-9.5 mm in adult (Figure 5).

Carapace with rostrum moderately developed, subtriangular, with rounded apex, lateral margin covering basal part of eyestalk (Figure 6a); posterolateral lobe covering first abdominal somite except for posterior part in males, slightly short in females; posterior margin deeply excavate dorsally, exposing last 2 thoracic segments, with reflexed large lobe as extension of lower margin of typical dorsolateral slit (Figure 6b). Pseudorostrum upturned distally and tapering.

Abdomen smooth, without hairs or folds (Figure 5). Fifth somite rounded posteriorly, without overhanging median process. Sixth somite 1.23-1.31 times as long as fifth, with transverse carinate swelling at anterior dorsal end (Figure 6c). Telson subequal in length with sixth abdominal somite, 2.8-3.1 (average: 3.0) times as long as basal width, laterally armed with 10-14 spines including terminal spine, sharp procurved process present at base of ventral margin; subterminal lateral spine placed close to terminal spine and noticeably shorter than latter; distomedial groove shallow, 1/10-1/8 length of telson, bearing more than 15 spines on mesial margins (Figure 6d). Exopod of uropod longer than endopod, laterally armed with 11-14 stout spines (Figure 6e). Endopod with 6-8 stout ventromesial spines (Figure 6e).

Eye with cornea well pigmented, as wide as eye stalk (Figure 6f). Antennular peduncle with first segment longest, about 3 times as long as second segment, armed with 1 seta distolaterally; second shortest, laterally armed with 2 stout spines; third segment about 2 times as long as second segment, armed with 1 spine near distodorsal part; outer

flagellum with oval lobe at base of mesial part in both sexes, slightly smaller in females (Figure 6g). Antennal scale reaching or slightly extending beyond end of second segment of antennular peduncle in males, while falling just short of that segment in females; distolateral spine falling far short of anterior margin of blade, suture present near distal end (Figures 5a, 6h).

Labrum and mouthparts as illustrated (Figure 7a-g).

Basal plates of exopods of second to fourth thoracic limbs with sharp distolateral spine (Figure 7g), entirely rounded in those of fifth to eighth limbs (Figure 6i). Endopod of eighth limb with carpo-propodus composed of 11-13 segments (Figure 6i).

Penis with sharp spine-like process at mid-length of posterior margin in addition to obtuse lobe at distolateral part, laterally armed with 3 spines (Figure 6j).

Male with biramous pleopods (Figure 8a-e). Endopod of first pleopod uniarticulate; exopod with 6-7 segments. Endopod of second pleopod with 6-7 segments; exopod 8-9 segments. Endopod of third pleopod uniarticulate, slightly curving outwardly, laterally armed with 4 setae; exopod long, with 7 normal segments of varying size, extending beyond end of sixth abdominal somite by slightly less than terminal segment, armed with 3 lateral setae and 4 distal setae; sympod with prominent semicircular distal lobe, longer than endopod, partly covering basal segment of exopod. Fourth and fifth pleopods similar in shape, endopod uniarticulate, exopod with 4 or 5 segments.

Female with first pleopod biramous, exopod small, 1/3-2/5 length of endopod, usually unarmed, rarely with terminal seta (Figure 8f). Second to fifth pleopods uniramous, rod-shaped (Figure 8g).

Distribution

Haplostylus tenuicaudus is known to be distributed in shallow-waters along the Western Australian coast. Along the north-west coast, this species co-occurs with *H. multispinosus*.

Remarks

This species is characterized by having a reflexed lobe at the posterior margin of the carapace and by the absence of a spine-like process on the fifth abdominal somite. These characters are shared with *H. queenslandensis* (Bacescu and Udrescu, 1982), *H. udrescui* Greenwood *et al.*, 1991, *H. australiensis* Wooldridge *et al.*, 1992, and *H. dispar* Panampunnayil, 1997, all known from Australia.

The telson with the small penultimate lateral spine placed approximate to the terminal spine readily distinguishes this species from *H. udrescui*

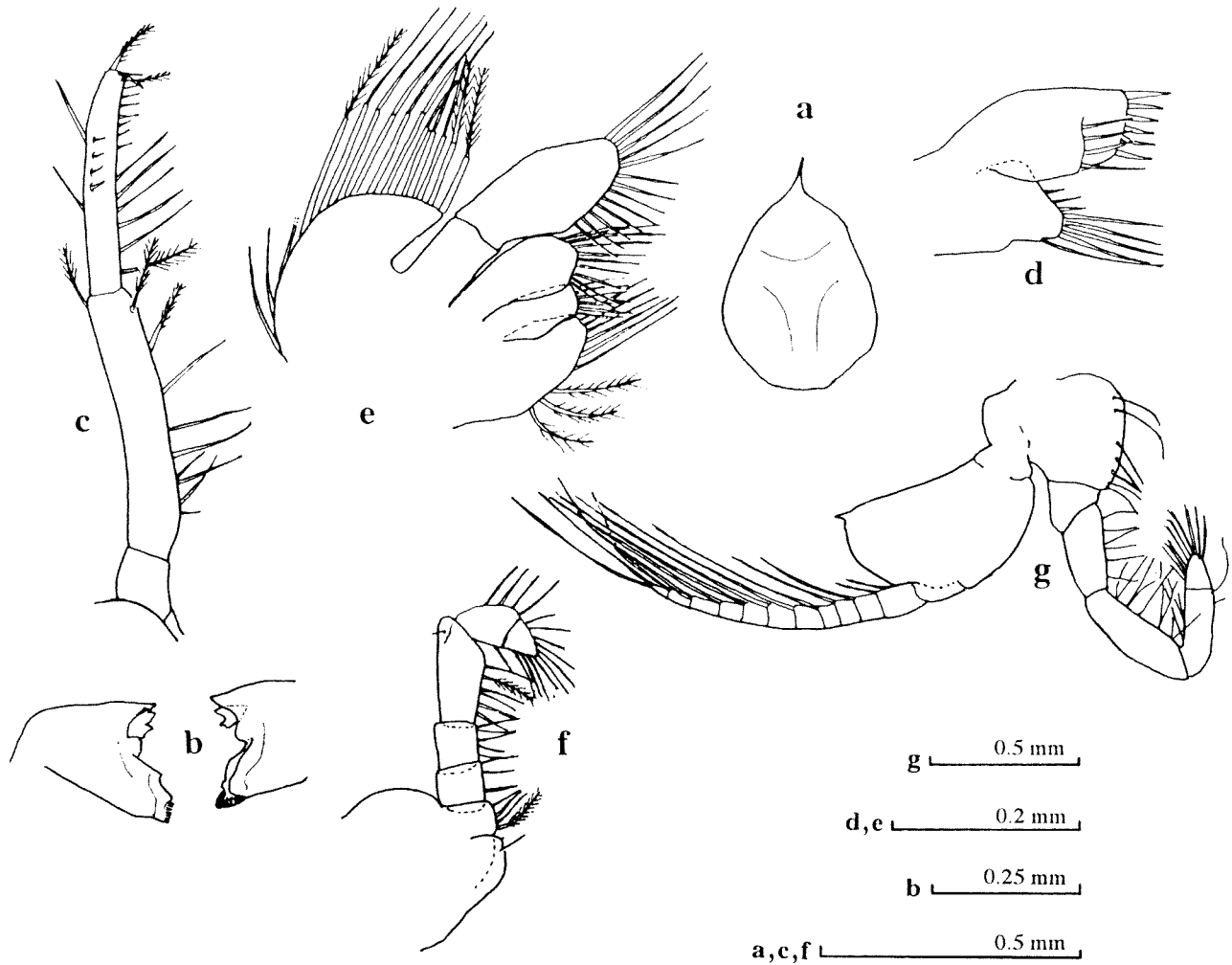


Figure 7 *Haplostylus tenuicaudus* sp. nov., holotype ♂ (7.5 mm) from Pt. Robinson, Nickol Bay, Western Australia: a, labrum; b, mandibles; c, mandibular palp; d, maxillule; e, maxilla; f, endopod of first thoracic limb; g, second thoracic limb.

and *H. australiensis*. Also, *Haplostylus tenuicaudus* differs from *H. queenslandensis* and *H. dispar* in having a more slender telson, being 2.8–3.1 times longer than the basal width, in contrast to less than 2.5 times, and the lateral margin armed with 11–14 spines instead of eight or nine. The exopod of the male third pleopod exhibits an unusual feature among the related species in having the distal segment consistently longer than the penultimate, while in other Australian congeners, the terminal segment is noticeably shorter than the penultimate. In females, the length of the first pleopodal exopod of the new species is less than 1/3 times the endopod, while it is 1/2 the length of the endopod in both *H. queenslandensis* and *H. dispar*.

Etymology

The name "*tenuicaudus*" is chosen to allude to the fact that the telson of the new species is proportionately more slender than that of the related species.

DISCUSSION

The genus *Haplostylus* is currently assigned to the species group of *Gastrosaccus* s.l. with a rudimentary or uniaarticulate endopod in the male third pleopod (*G. normani* group), following Fenton (1990), and subsequently Greenwood *et al.* (1991), Wooldridge *et al.* (1992) and Panampunnayil (1997).

Although this character shows a certain degree of consistency and also has practical convenience, it is still doubtful whether this separation reflects a natural monophyletic group. The usefulness of uni- or multiarticulation as a separating character is diminished by the presence of intermediate species having a two- or three-segmented endopod, such as *Gastrosaccus msangi* Bacescu, 1975 and *G. longifissura* Wooldridge, 1978, in which the second segments onwards are reduced considerably in size as compared with other species of *Gastrosaccus* s.s.

On the other hand, it is well known that several species attributable to *Haplostylus* have a reflexed

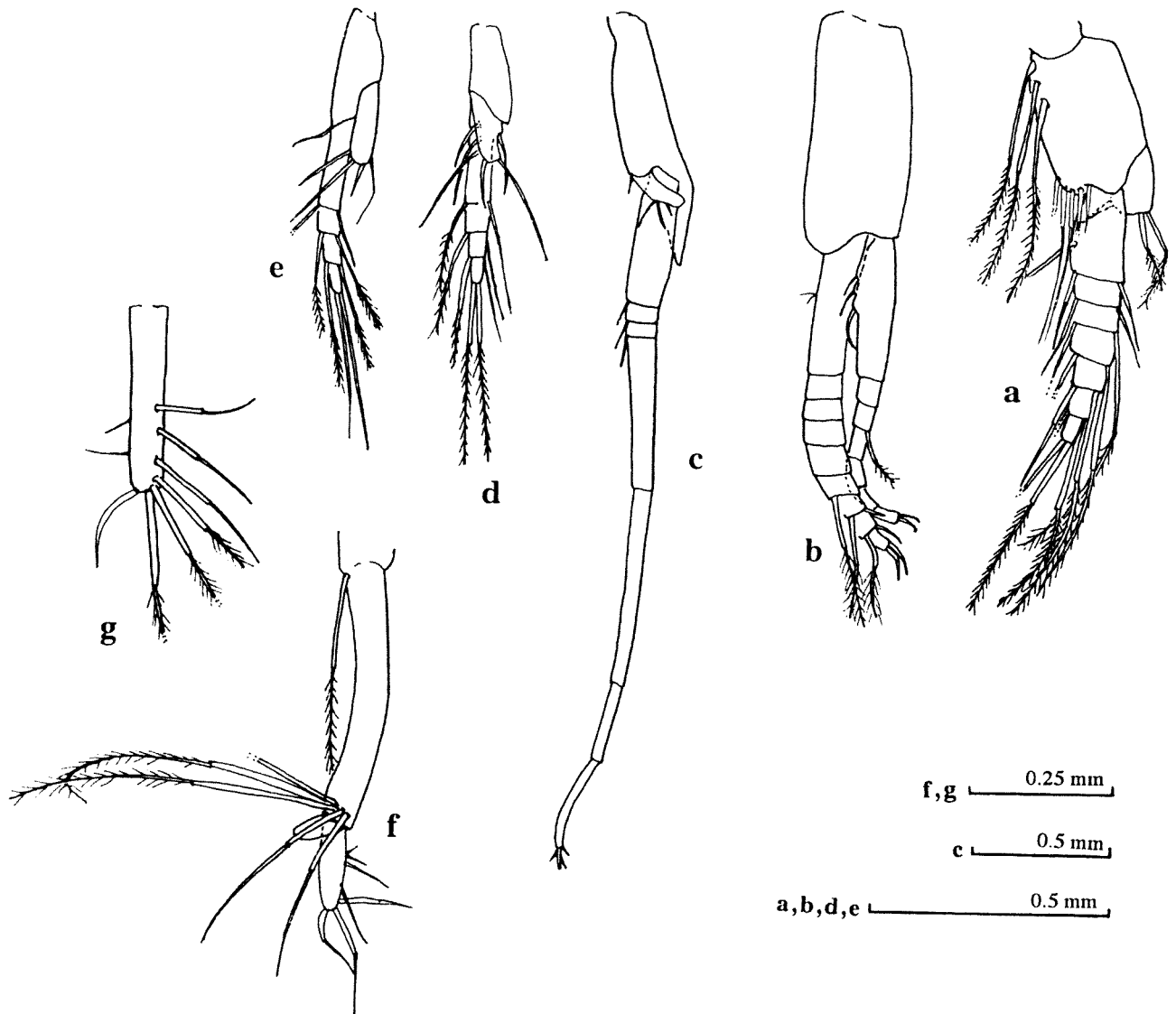


Figure 8 *Haplostylus tenuicaudus* sp. nov., holotype ♂ (7.5 mm) (a–e) and paratype ♀ (8.3 mm) (f,g) from Pt. Robinson, Nickol Bay, Western Australia: a, first pleopod of ♂; b, second pleopod of ♂; c, third pleopod of ♂; d, fourth pleopod of ♂; e, fifth pleopod of ♂; f, first pleopod of ♀; g, second pleopod of ♀.

lobe (or lappet) on the posterior margin of the carapace in addition to the typical overlapping slit on this margin, which is shared with related genera, such as *Archaeomysis*, *Bowmaniella*, *Eurobowmaniella*, *Iiella* and *Gastrosaccus* s.s. Regarding the reflexed lobe, two different types of lobes can be recognized on the basis of their origin. One type is derived from an extension of a part of the lobe above the typical dorsolateral slit (type 1), as represented in the Atlantic species (including the Mediterranean). Interestingly, a similar lobe is observed also in some species of *Gastrosaccus* (e.g. *G. sanctus*).

The other type is that formed by a prolongation of the lower lobe of the typical dorsolateral slit (type 2), as represented in Australian *Haplostylus* species. These facts indicate that the genus *Haplostylus* (and also *Gastrosaccus*) has a more complex phylogenetic nature than that has

currently recognized. Only revisional studies of the species of *Gastrosaccus* s.l. will resolve this difficulty. Until that time, I follow Fenton (1990) and the latest authors (Greenwood *et al.* 1991; Wooldridge *et al.* 1992; Panampunnayil, 1997).

The useful list of species of *Haplostylus* by Fenton (1990: Table 1) may be modified by the addition of *H. australiensis* Wooldridge *et al.*, 1992, *H. dispar* Panampunnayil, 1997, *H. flagelliforma* Panampunnayil, 1997, *H. multispinosus* Panampunnayil, 1997, *H. similis* Panampunnayil, 1997, *H. robustus* (Panampunnayil, 1989), *H. udrescui* Greenwood *et al.*, 1991, *H. uthupus* Panampunnayil, 1997, and *H. tenuicaudus* sp. nov., and also by deleting *H. tattersalli* Fenton, 1990 (= *H. robustus*). Consequently, the genus accommodates 24 species in the world oceans. A key, still preliminary, is presented, based on published data as well as incorporating the result of this study.

Key to species of the genus *Haplostylus*

(Species known from Australian waters are indicated with an asterisk)

1. Posterior margin of carapace more or less with extruding lobe, sometimes developed and reflexed anteriorly; typical overlapping slit (or cleft) present or absent 2
Posterior margin of carapace smooth except for, if present, typical overlapping slit (or cleft) 11
2. Posterior margin of carapace with small lobe, which is not reflexed anteriorly
..... *H. bacescui* Hatzakis, 1977
Posterior margin of carapace with large reflexed lobe 3
3. Reflexed lobe derived from extension of upper part of typical dorsolateral slit (type 1 lobe) .
..... 4
Reflexed lobe derived from extension of lower part of typical dorsolateral slit (type 2 lobe) .
..... 5
4. Reflexed lobe relatively small, length equal to width *H. lobatus* (Nouvel, 1951)
Reflexed lobe relatively long, about twice as long as width
H. magnilobatus (Bacescu and Schiecke, 1974)
5. Fifth abdominal somite with posteromedian process 6
Fifth abdominal somite without posteromedian process 7
6. Telson armed laterally with 6 stout spines, subterminal spine placed dorsally, distinctly shorter than terminal spine
..... **H. robustus* (Panampunnayil, 1989)
(= *H. tattersalli* Fenton, 1990)
Telson armed laterally with more than 7 spines, subterminal spine placed laterally, subequal to length of terminal spine
**H. brisbanensis* (Bacescu and Udrescu, 1982)
7. Distomedial groove of telson shallower than 1/8 of telson length, subterminal lateral spine placed close to terminal spine 8
Distomedial groove of telson as deep as 1/6–1/5 of telson length, subterminal lateral spine placed separately from terminal spine
..... **H. australiensis* Wooldridge *et al.*, 1992
8. Subterminal lateral telson spine subequal to length of terminal spine
..... **H. udrescui* Greenwood *et al.*, 1991
Subterminal lateral telson spine smaller than terminal spine 9
9. Telson comparatively long, length about 3 times basal width, armed with 10–14 lateral spines; terminal segment of male third pleopod longer than penultimate
..... **H. tenuicaudus* sp. nov.
- Telson comparatively short, length less than 2.5 times basal width, armed with 7–9 lateral spines; terminal segment of male third pleopod shorter than penultimate 10
10. Exopod of male third pleopod with 7 segments, armed with 3 lateral spines; endopod of male second pleopod as long as exopod **H. queenslandensis* (Bacescu and Udrescu, 1982)
Exopod of male third pleopod with 6 segments, armed with 2 lateral spines; endopod of male second pleopod much shorter than exopod
..... **H. dispar* Panampunnayil, 1997
11. Endopod of male third pleopod rudimentary or indistinct 12
Endopod of male third pleopod distinct uniaarticulate lobe 17
12. Rostrum well developed, longer than broad; endopod of male second pleopod with more than 3 segments; exopod of male third pleopod with 6 segments, without lateral projection on basal segment
..... *H. parvus* (Hansen, 1910)
Rostrum shorter than broad; endopod of male second pleopod with 1 or 2 segments; exopod of male third pleopod with 3 or 4 segments, with lateral lobe on basal segment 13
13. Basal segment of exopod of male third pleopod with short triangular lateral lobe, budding from a point which is basal 1/4–4/9 length along basal segment and falling short of base of proximal lateral spine 14
Basal segment of exopod of male third pleopod with long tube-like lateral lobe, budding from a point which is basal 1/6–1/5 length along basal segment and barely reaching base of proximal lateral spine 15
14. Endopod of uropod with 7 or 8 mesial spines; telson laterally armed with 8–11, somewhat sparsely placed spines and distomedial groove reaching level of base of penultimate spine; distal segment of male third pleopodal exopod abruptly narrowing in distal 2/5 and lash-like terminal seta smooth, not barbed
..... **H. pacificus* (Hansen, 1912)
Endopod of uropod with 13–14 mesial spines; telson laterally armed with 10–13 closely spaced, rather long spines and distomedial groove reaching level of distal third spine; distal segment of male third pleopodal

- exopod slightly narrowing in distal 1/6 and lash-like terminal seta barbed
 **H. multispinosus* Panampunnayil, 1997
15. Lateral spines of telson extremely sparsely placed, rather short, distal end falling far short of base of subsequent spine except for distal pair both in males and females
 **H. flagelliforma* Panampunnayil, 1997
 Lateral spines of telson not extremely sparsely placed, distal end reaching to overreaching base of subsequent spine in distal half 16
16. Telson length 2.7–2.9 times basal width, laterally armed with long, close-set 10–13 spines, increasing length towards distally, overlapping each other in males and females; terminal spines of exopod of male third pleopod comparatively long, about 1/6 times length of distal segment, terminal lash-like seta barbed
 **H. similis* Panampunnayil, 1997
 Telson length more than 2.9 times of basal width, laterally armed with moderately long, somewhat sparsely placed 8–12 spines, not overlapping each other at least in males; terminal spines of exopod of male third pleopod comparatively short, about 1/8 times length of distal segment
 **H. indicus* (Hansen, 1910)
17. Male second pleopod with endopod uniarticulate **H. estafricanus* Bacescu, 1973
 Male second pleopod with endopod multiarticulate 18
18. Sympod of male third pleopod without distinct distal lobe (or apophysis) 19
 Sympod of male third pleopod more or less with developed distal lobe (or apophysis)
 22
19. Either third or penultimate segment of exopod of male third pleopod slightly swollen near distal end, connected obliquely with subsequent segment 20
 Exopod of male third pleopod simple, tube-like except for distal segment, connected almost transversely with subsequent segment 21
20. Rostrum subacute with rounded apex; exopod of male third pleopod clearly composed of 5 segments .. **H. uthupus* Panampunnayil, 1997
 Rostrum acutely pointed distally; exopod of male third pleopod normally composed of 4 segments **H. bengalensis* (Hansen, 1910) (= *Gastrosaccus philippinensis* W.M. Tattersall, 1951)
21. Endopod of male second pleopod as long as exopod; terminal segment of male third pleopod distinctly swollen near distal end
 *H. parerythraeus* (Nouvel, 1944)
- Endopod of male second pleopod much shorter than exopod; terminal segment of male third pleopod not swollen near distal end *H. erythraeus* Kossman, 1880
22. Exopod of male third pleopod without lateral setae or spines except for terminal spines; rostrum well produced anteriorly, as long as or more than broad
 *H. pusillus* (Coifmann, 1937)
 Exopod of male third pleopod with 2–3 lateral setae or spines; rostrum less produced, much shorter than broad 23
23. Telson with subterminal lateral spine placed separately from terminal spine; penultimate segment of exopod of male third pleopod distinctly swollen distally
 *H. normani* (G.O. Sars, 1877)
 Telson with subterminal lateral spine placed close to terminal spine; penultimate segment of exopod of male third pleopod not swollen distally **H. dakini* (W.M. Tattersall, 1940)

To date, the genus *Haplostylus* exhibits the richest species diversity in the Indo-West Pacific region, with 19 of the 24 known species recorded there, suggesting that the area is a main evolutionary ground for the species which possess a rudimentary or uniarticulate endopod in the male third pleopod. No species of the genus has been collected from the western part of the Atlantic and the eastern Pacific Oceans.

The establishment of the new species *H. tenuicaudus* brings the total number of Australian species of *Gastrosaccus* and *Haplostylus* to 17, of which *G. daviei* Bacescu and Udrescu, 1982, and *G. sorrentoensis* Wooldridge and McLachlan, 1986 are the only two representatives of the genus *Gastrosaccus*. Of these species, the Western Australian fauna includes one *Gastrosaccus* species (*G. sorrentoensis*), and seven *Haplostylus* (*H. dispar*, *H. flagelliforma*, *H. multispinosus*, *H. robustus*, *H. similis*, *H. uthupus* and *H. tenuicaudus* sp. nov.).

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