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Hyperiid Amphipods (Crustacea: Amphipoda: Hyperiidea) Collected Recently from Eastern Australian Waters

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ABSTRACT. A taxonomic report on hyperiid amphipods collected during the period 1970-1977 from waters off New South Wales, and in 1989 from off Sydney and slightly north-east of Brisbane, is presented. The collection consists of sixty one species of which nineteen are new records for Australian waters. Taxonomic features of all of the latter, and some of the lesser known species, are illustrated. A brief diagnosis and a list of synonymies is given for each species and remarks on systematics to aid future identification and comments on taxonomic difficulties are provided where appropriate. Most of the species represent a tropical or warm-temperate fauna indicating the influence of warm-core eddies in the Tasman Sea.

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The hyperiid amphipod fauna of Australian waters has not received much attention in the past. Previous records of hyperiids, mainly from eastern Australia, are by Barnard (1931), Dakin & Colefax (1940), Stebbing (1888), Young & Anderson (1987), and Zeidler (1978). Watson & Chaloupka (1982) record a few species from Bass Strait. Very few of these papers provide a taxonomic treatment of the species studied and our knowledge of the Australian fauna is thus limited with identifications relying on the availability of a variety of, often difficult to obtain, literature concerning fauna from other parts of the world.

Previous to this study, seventy four species of hyperiids were known from Australian waters (Young & Anderson, 1987; Zeidler, 1978); nearly all records being from the shallower (less than 400 m) waters of eastern Australia. In most cases hyperiids were only collected as part of a general sampling program and it is thus likely that many more species will be added to the Australian fauna in the future. In particular there are very few plankton samples available from deep water (greater than 1000 m) which is the domain of most Physosomata which represent about one third of the world's fauna of about 240 species. Also opening and closing nets were rarely used so that information on the depth preference of species in Australian waters (and indeed worldwide) is very limited.

Since 1971, the New South Wales State Fisheries (now the Fisheries Division of the NSW Department of Agriculture) has been carrying out trawling surveys

along the coast of New South Wales, sometimes extending north to Queensland or south to Bass Strait using their research vessel the *Kapala*. On a few occasions plankton samples were collected resulting in a small but interesting collection of hyperiid amphipods.

The present paper is a report on the collections made between 1971 and 1977 (Appendix I) although most of the species have come from the 1971 and 1972 trawls when an Isaacs-Kidd midwater trawl was used. Also included in this study is a small collection made in 1989 from off Sydney by HMAS *Cook* and from slightly north-east of Brisbane by the CSIRO research vessel *Franklin* (Appendix I). The collection is significant for its faunal richness comprising 61 species of which 19 are new records for Australian waters including four belonging to the Lanceolidae, a family that has not previously been recorded from Australia. Most of the species are typical of a tropical or warm-temperate fauna and this is probably due to the influence of the warm-core eddies which frequent the eastern coast of Australia (Young & Anderson, 1987). The presence of some rare species such as *Vibilia caeca* Bulycheva, 1955 which has only been recorded in the literature on one other occasion (Vinogradov, 1956) and *Oxycephalus longipes* Spandl, 1927 which has not been recorded since the original description, together with the recognition of several species previously 'lost' in synonymy, indicates how little the Hyperiidea have been studied worldwide. This paper therefore adds significantly to the knowledge of the Australian fauna and the systematics of hyperiids in general.

Most species of hyperiids have a worldwide distribution, occurring in water masses having similar physicochemical properties. Thus, many species found in the northern hemisphere also occur in Australian waters and it is not unreasonable to expect that representatives of most of the world's fauna of hyperiids will eventually be found in Australian waters. With this in mind researchers should initially refer to Bowman & Gruner (1973) for diagnoses and keys to families and genera before proceeding with the local literature. Vinogradov *et al.* (1982) provide, apart from general information, keys to families, genera and most currently recognised species together with useful illustrations, but the text is in Russian and the publication is probably not readily available to most researchers. A key to Australian species is not given here but will be provided in a forthcoming publication on hyperiids from south-eastern Australia, which will also include many new records, some new species and an updated checklist of hyperiids from Australian waters. However, a brief diagnosis is given for each species to facilitate identifications, particularly of those not illustrated. A list of synonymies for each species is also provided but I have not given a full list of references or misidentifications as these would have added unnecessarily to the text.

The material on which this paper is based is deposited in the collections of the Australian Museum (AM); representative examples of some species have been deposited in the South Australian Museum (SAM). The systematic arrangement follows that of Bowman & Gruner (1973) with genera and species arranged alphabetically except for Brachyscelidae which I have recognised as a separate family closely related to *Eupronoe* (Pronoidae). Specimen length was measured along a lateral parabolic line drawn from the anterior extremity of the head through the middle of the body to the posterior limit of the telson. All species which are new records for Australian waters have been illustrated. The following abbreviations are used in the illustrations: A1, A2 = first and second antenna; G1, G2 = first and second gnathopod (or pereopod); P3-7 = third to seventh pereopod; Mxp = maxilliped; U1-3 = first to third uropod; Us = urosome including uropods and telson, and f and m are used to indicate female or male specimens.

SYSTEMATIC SECTION

Suborder HYPERIIDEA

Infraorder PHYSOSOMATA

SCINIDAE

Scina Prestandrea, 1833

Remarks. Species of *Scina* are generally found in deeper waters (greater than 200 m) (Vinogradov *et al.*, 1982) and since few plankton collections in deep water have been made in Australian waters there are few Australian records of this genus. Of the thirty six species currently recognised (Zeidler, 1990), only three have previously been recorded from Australia. Species of *Scina* can be difficult to distinguish but Wagler (1926) and Vinogradov *et al.* (1982) provide good illustrations and a revised key to the world species is given by Zeidler (1990).

Scina crassicornis (Fabricius)

Astacus crassicornis Fabricius, 1775: 415.
Hyperia cornigera Milne-Edwards, 1830: 387.
Clydonia gracilis Dana, 1853: 834, pl.55 fig.6a,b.
Tyro atlantica Bovallius, 1885: 14.
Tyro sarsii Bovallius, 1885: 15.
Scina edwardsi Garbowski, 1896: 103, pl.1 fig.2, pl.3 figs 19-33, pls 4-7, pl.8 figs 97-109.
Scina crassicornis var. *bermudensis* Shoemaker, 1945: 228, fig.31.

Material examined. 78 females (7.0 - 13.2 mm), 28 males (3.4-13.4 mm) from stations JP 71-2 (AM P39746 - 2 f, 4 m); JP 71-3 (AM P39747 - 50 f, 13 m; SAM C4205 - 10 f, 5 m); JP 71-4 (AM P39748 - 2 f); JP 71-7 (AM P39749 - 7 f, 3 m); JP 71-8 (AM P39750 - 6 f, 3 m) and JP 77-25 (AM P39751 - 1 f).

Diagnosis. Antenna 1 as long as body. Outer lobes of maxilliped about 3 times as long as wide, tapering for distal half to acute, rounded, point. Pereopods 1-7 with normal articles. Pereopod 5 a little longer than pereopod 6. Pereopod 7 slightly longer than half pereopod 6. Pereopod 5, article 2, both margins finely serrate, subequal in length to articles 3-7 combined, anterodistal projection reaching to first quarter of article 4; article 4, length subequal to article 5; article 6, length about one quarter article 5; dactyl a very small nail. Pereopod 6, dactyl long about half article 6, sometimes curved upwards. Pereopod 7, dactyl much shorter than that of pereopod 6 but longer than that of pereopod 5. Uropods 1 and 2, inner margins with fine serrations; exopods extremely short, spine-like.

Remarks. Many of the specimens in this collection had the long dactyl of pereopod 6 curved upwards, a feature I also found common among specimens from the western North Pacific Ocean (Zeidler, 1990) but not mentioned in the literature previously. Variation in the relative lengths of articles 4 to 6 of pereopod 6, similar to *S. curvidactyla* Chevreux, 1914, were also common. Similar variations in the relative length of segments of pereopods 5 to 7 have been noted by previous authors but are not considered to be of taxonomic significance (Hurley, 1956; Thurston, 1976; Brusca, 1978). Although *S. crassicornis* is most similar to *S. curvidactyla* it is easily distinguished from this and other species of *Scina* by the relatively short, feeble article 6 of pereopod 5 and by the relatively longer dactyl of pereopod 6. In most other *Scina* species the dactyls of pereopods 5 to 7 are of similar length.

Eleven ovigerous females ranging in size from 9.2 to 12.8 mm were captured in March (JP 71-3, 71-8).

Distribution. *Scina crassicornis* is a cosmopolitan species occurring approximately between the polar circles (Brusca, 1978). It was first recorded from Australian waters by Young & Anderson (1987).

Scina lamperti Vosseler

Fig.1

Scina lamperti Vosseler, 1901: 110-113, pl.9 figs 1-7.
Scina uncipes lamperti.–Wagler, 1926: 348-350, figs 13b,14.

Material examined. 2 females (4.4 and 6.2 mm) from station JP 71-7 (AM P39752).

Diagnosis. Antenna 1 about one third as long as body. Outer lobes of maxilliped two and one half times as long as wide, pointed terminally. Pereopods 3 and 4, article 6, posterodistal corner incised distally, approaching subchelate ending. Pereopod 6, length about two thirds pereopod 5 but a little longer than pereopod 7. Pereopod 5, article 2, both margins slightly serrate, distinctly longer than articles 3-7 combined, anterodistal projection extending slightly beyond article 3; article 4, length subequal to article 5; article 6, length about half article 5. Pereopods 5 and 6, dactyl a short nail. Pereopod 7, articles relatively thick with articles 4-6 wider than half length; dactyl blunt-ended with distinctive gland (?) duct. Uropods 1 and 2, inner margins with fine serrations (very fine for uropod 2); exopods very short, spine-like.

Remarks. *Scina lamperti* has not been recognised in recent times and has been considered a subspecies of *S. uncipes* Stebbing, 1895 (Wagler, 1926) or a synonym of *S. spinosa* Vosseler, 1901 together with *S. uncipes* and *S. spinosa affinis* Wagler, 1926 (Vinogradov *et al.*, 1982). Wagler (1926) recognised four subspecies amongst what he called "die *uncipes* - Gruppe": *S. uncipes uncipes*, *S. uncipes lamperti*, *S. spinosa spinosa* and *S. spinosa affinis*. The former two are similar in that the inner lobe of the maxilliped is only about one fourth as long as the outer lobes, pereopod 7 has very thick articles and the dactyl is blunt-ended with what appears to be a gland duct. The latter two are also similar but differ from the former two in that the inner lobe of the maxilliped is about half as long as the outer lobes, pereopod 7 has relatively thinner articles and the dactyl is a small curved nail without a gland (?) duct. Wagler's description of *S. u. lamperti* (a male) differs from Vosseler's (1901) original description in that the outer lobes of the maxilliped are less pointed and the second article of pereopod 5 is slightly shorter than articles 3 to 7 combined. The two specimens at hand however, agree in detail with Vosseler's description and are distinguished from other species of *Scina* by the following combination of characters: i) the inner lobe of the maxilliped is one fourth as long as the outer lobes; ii) the outer lobes of the maxilliped are pointed; iii) the sixth article of pereopods 3 and 4 are incised distally, approaching a subchelate ending; iv) the second article of pereopod 5 has only slightly serrated margins and is distinctly longer than articles 3 to 7 combined; v) the articles of pereopod 7 are relatively thick with articles 4 to 6 wider than half the length; vi) the dactyl of pereopod 7 is blunt-ended with a distinctive gland (?) duct. I believe that these characters combined with other minor features are sufficient to warrant the resurrection of *S. lamperti* as a valid species. *Scina uncipes*, although similar to *S. lamperti*, is readily distinguished by article 6 of pereopods 3 and 4 which is not incised distally (at most the posterior margin is slightly projected above the insertion of setae) and by article 2 of pereopod 5 which has strongly serrated margins and is distinctly shorter than articles 3 to 7 combined.

Scina uncipes most closely resembles *S. spinosa* and Stebbing (1904: 23), in a discussion of the genus, states, "*Scina spinosa*, Vosseler, 1901 found on a female specimen 3-5 mm long, 'perhaps not quite full-grown', should not, I think, be separated from *S. uncipes*, which I founded in 1895 on a male specimen 7.5 mm long". However, I regard the differences in the maxilliped and pereopod 7, already mentioned, as significant at the

specific level and for the moment, both species should be regarded as valid. As for *S. spinosa affinis*, this variety or subspecies, is just like *S. spinosa* as described by Vosseler (1901), except that the serrations on article 2 of pereopod 5 and on the inner margin of uropod 1 are less numerous and not as strong. I doubt that these features alone are of specific significance and that *S. s. affinis* can be distinguished from the normal variation found in *S. spinosa*. Shoemaker (1945), who had specimens with characters overlapping both *S. s. spinosa* and *S. s. affinis*, confirms this view.

Distribution. Vosseler (1901) recorded *S. lamperti* from the equatorial North Atlantic and Wagler (1926) from the Indian Ocean near the Seychelles. Other records are lost due to past synonymies with *S. uncipes*

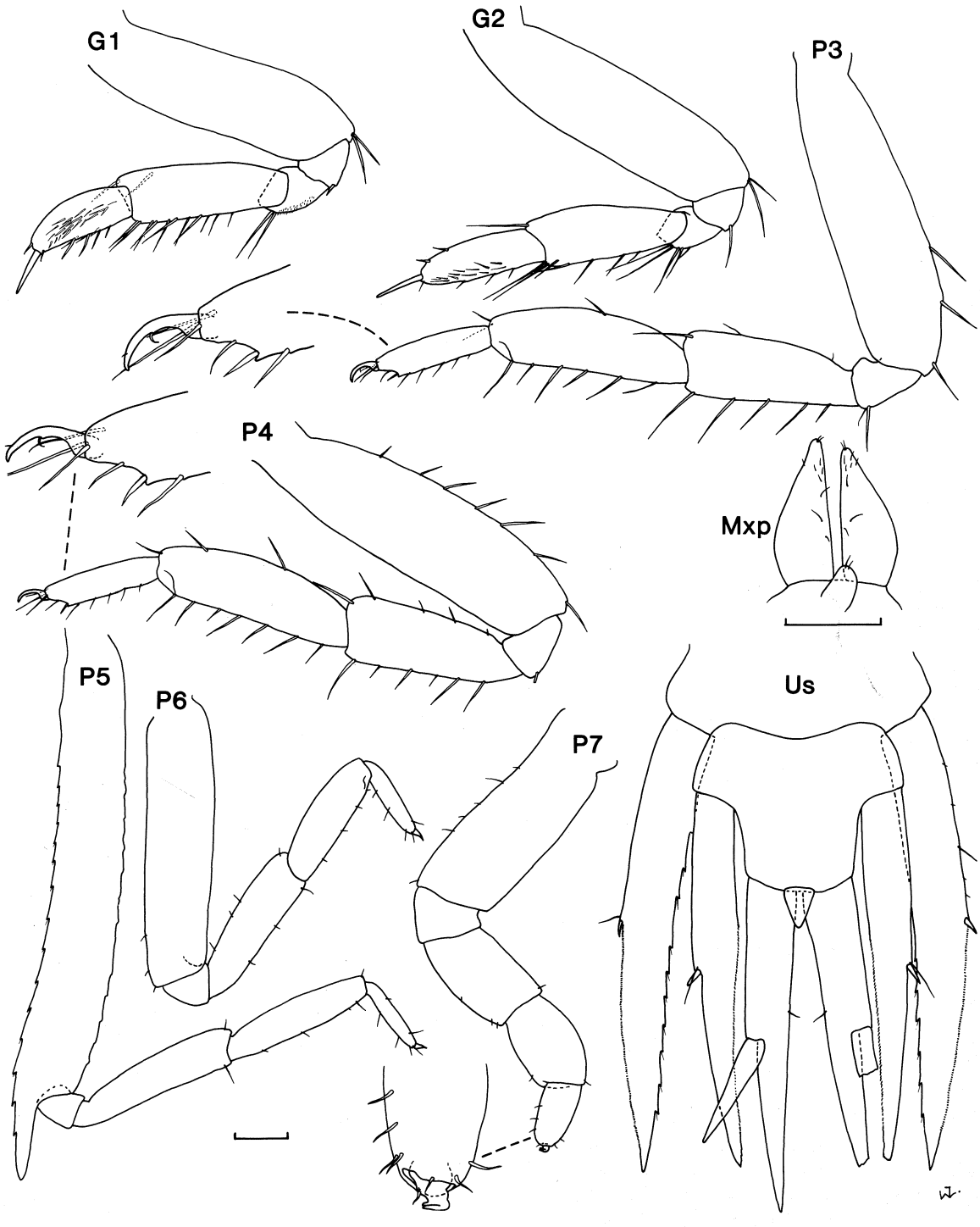

Fig.1. *Scina lamperti* Vosseler, female 6.2 mm (scales = 0.2 mm).

or *S. spinosa*. This is a new record for Australian waters.

LANCEOLIDAE

Lanceola Say, 1818

Remarks. Like the previous genus, species of *Lanceola* are usually found in deep water (1000-8000 m), but none have previously been recorded from Australian waters. Vinogradov *et al.* (1982) recognise twelve species and provide the only satisfactory key (in Russian), together with useful illustrations.

Lanceola loveni Bovallius

Fig.2

Lanceola loveni Bovallius, 1885: 6-7.
Lanceola aestiva Stebbing, 1888: 1309-1313 (part).

Material examined. 1 male (damaged, approximately 8 mm) from station JP 71-8 (AM P39753).

Diagnosis. Pereonite 7 and all pleonal segments with feeble, dorsal denticles. Pereopods 3-7 with very slender articles. Pereopod 4 subequal in length to pereopod 5 or slightly shorter; both about three quarters as long as pereopod 6. Pereopod 7, length slightly less than half pereopod 6. Pereopod 6 distinctly longer than pereon. Telson, length about half peduncle of uropod 3.

Remarks. The present specimen differs slightly from Bovallius' (1885) description in that pereopods 5 and 7 are relatively shorter in relation to pereopod 6. However, it is in total agreement with the figures given for this species by Shoemaker (1945). Characteristic features are the short telson and the relatively slender pereopods 3 to 6 with pereopod 6 being considerably longer than pereopod 4. *Lanceola loveni* is most similar to *L. serrata*, Bovallius, 1885, but in *L. serrata*, article 5 of gnathopod 1 is more expanded distally with a small anterior lobe partly overlapping article 6 and the

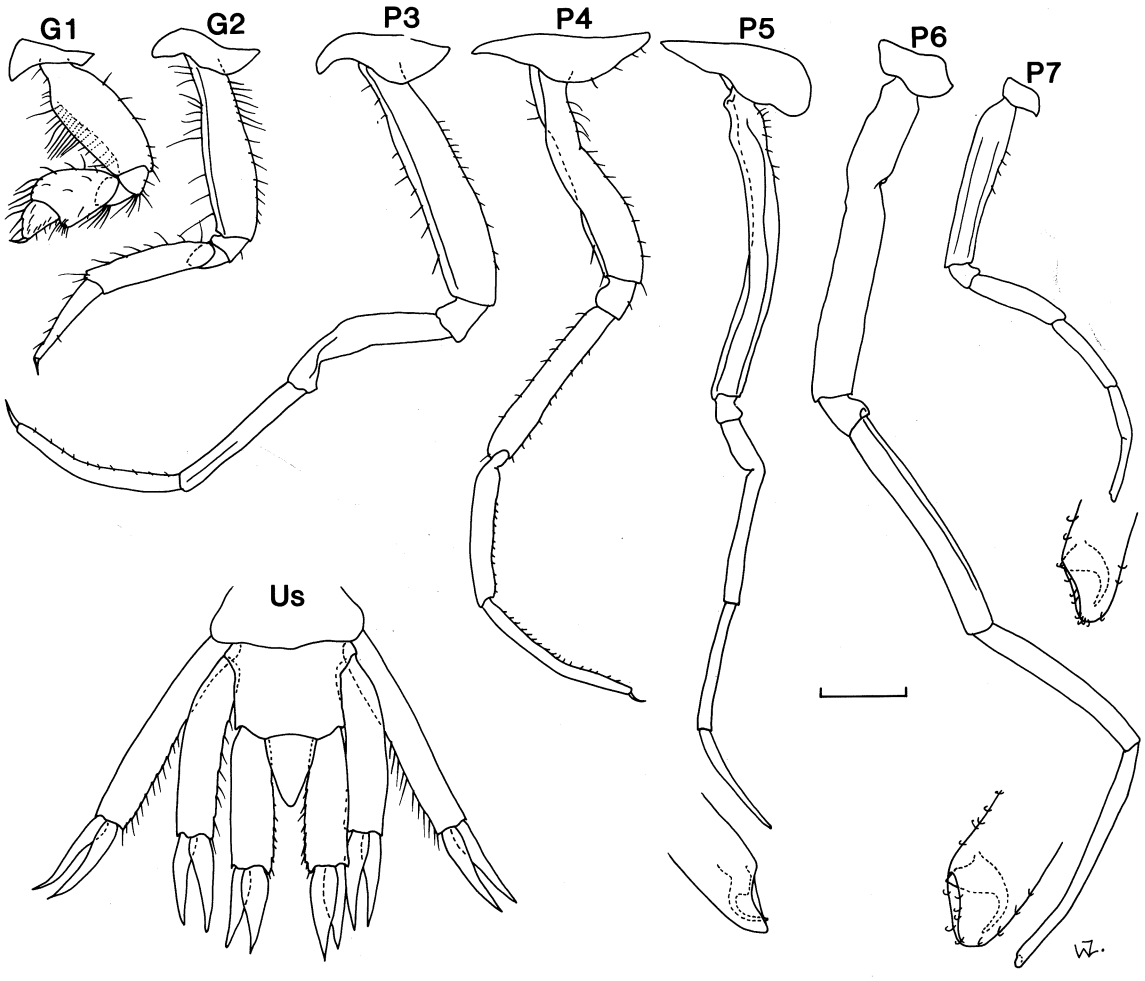

Fig.2. *Lanceola loveni* Bovallius, male approximately 8.0 mm (scale = 1.0 mm).

telson is much longer than half of the peduncle of uropod 3.

This species is usually found in depths greater than 1000 m (Vinogradov, 1957) and the present record from about 600 m is one of the shallowest reported (Thurston, 1976).

Distribution. North Atlantic and north-west Pacific but past confusion of this species with *L. aestiva*, Stebbing, 1888 (Thurston, 1973), may mean that it has a much wider recorded distribution. This is a new record for Australian waters.

Lanceola pacifica Stebbing

Fig.3

Lanceola pacifica Stebbing, 1888: 1302-1306, pls 151, 152.
Lanceola pacifica var. *robusta* Woltereck, 1909: 160.

Material examined. 5 females (damaged, approximately 18-27 mm) from stations JP 77-26 (AM P39754; 3 f) and JP 77-28 (AM P39755; 2 f) and 1 male (?) (7.5 mm) from station JP 71-7 (AM P39756).

Diagnosis. Pereon and pleon without dorsal denticles. Pereopod 4 slightly shorter than pereopod 5. Pereopod 5, length about two thirds pereopod 6. Pereopod 7, length about half pereopod 6. Pereopod 6 distinctly longer than pereon. Telson slightly longer than peduncle of uropod 3.

Remarks. Although the female specimens are damaged the material can readily be identified as *L. pacifica* and differs from Stebbing's (1888) description only in that the telson is more pointed. The immature male (?) also appears to be this species but the telson is just shorter than the peduncle of uropod 3. *Lanceola pacifica* is very similar to *L. sayana* Bovallius, 1885, but in *L. sayana* the head has a well-developed, although short, rostrum, especially in females, which is absent in *L. pacifica*.

Juveniles tend to occur in shallower depths (0-300 m) than adults (2000-4000 m) (Thurston, 1973) which is in line with the present findings.

Distribution. Widely distributed in tropical and

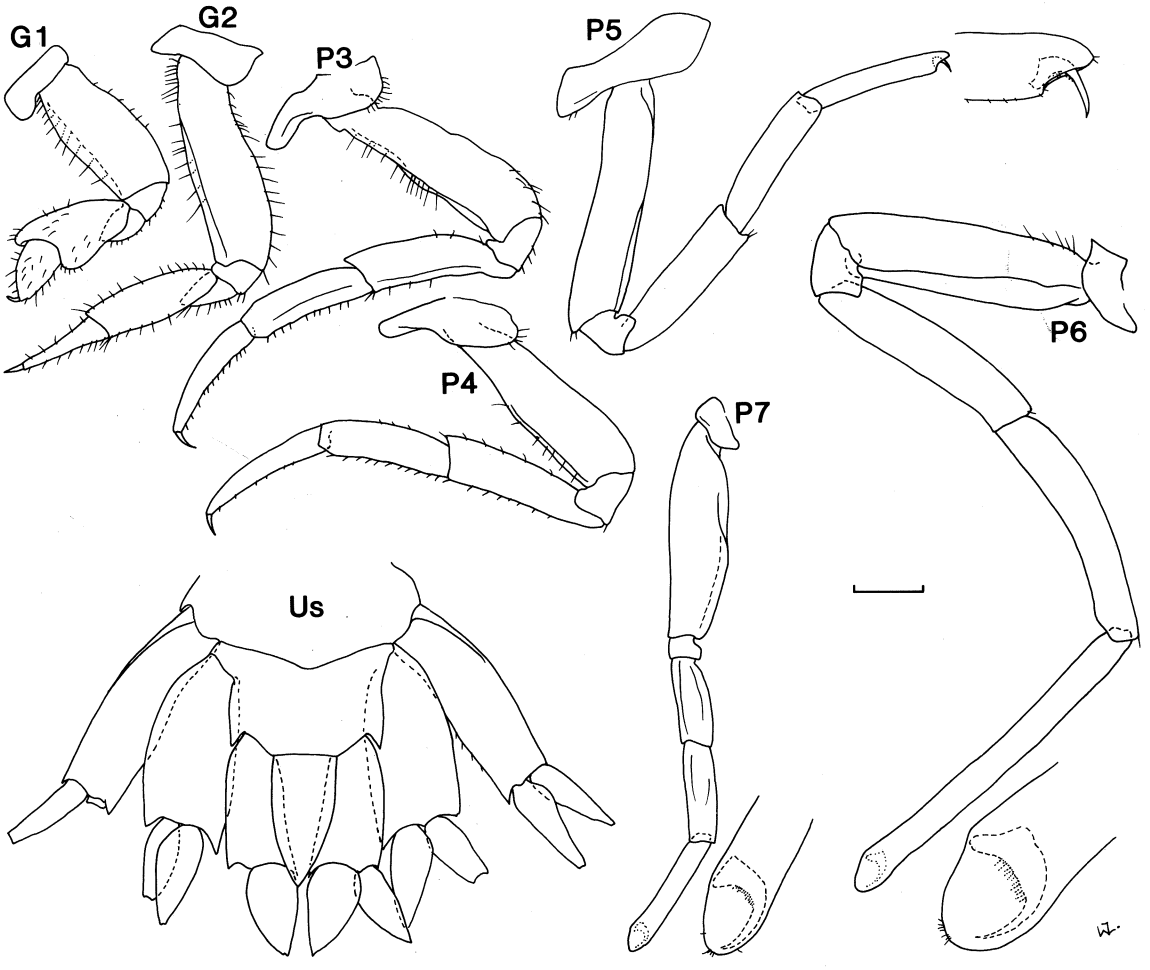

Fig.3. *Lanceola pacifica* Stebbing, female 27.0 mm from station JP 77-28 (scale = 1.0 mm).

temperate regions. This is a new record for Australian waters.

Lanceola sayana Bovallius

Fig.4

?*Lanceola pelagica* Say, 1818: 318.
Lanceola sayana Bovallius, 1885: 7, fig.1,1a,1b.
Lanceola sayana var. *longipes* Woltereck, 1909: 158-159, pl.6 figs 16,18b.
Lanceola sayana var. *typica* Woltereck, 1909: 158-159, pl.6 figs 17,18a.
Lanceola pelagica.–Shoemaker, 1945: 206, fig.14.

Material examined. 2 females (21.5 and 23.0 mm) from stations JP 77-19 (AM P39757) and JP 77-27 (SAM C4206).

Diagnosis. Pereon and pleon without dorsal denticles. Head with small hooked rostrum, more prominent in females. First antennae, distal articles fused. Pereopod 4 slightly shorter than pereopod 5. Pereopod 5, length about two thirds pereopod 6. Pereopod 7, length about half pereopod 6. Pereopod 6 distinctly longer than pereon. Telson slightly longer than peduncle of uropod 3.

Remarks. Unlike other species of *Lanceola*, *L. sayana* is frequently found in relatively shallow depths but is most common from 1000 to 2000 m extending to 3000 m (Vinogradov *et al.*, 1982). Apart from *L. pacifica*, *L. sayana* is also similar to *L. felina* Bovallius, 1885 and *L. intermedia* Vinogradov, 1960, but is most readily distinguished from these two species by antenna 1 in which the distal articles are fused and by the relative length of pereopod 6 which is much longer than the pereon.

Distribution. A widely distributed species including the Antarctic Ocean. It is a new record for Australian waters.

Megalanceola Pirlot, 1935

Remarks. Species of this genus are some of the largest hyperiids known with a total length of about 100 mm. They are usually found in deeper water (about 1000 m), but have not previously been recorded from Australian waters. *Megalanceola* is similar to *Lanceola* but is easily distinguished by the anteriorly bent nature of specimens and the relatively larger eyes. Only two species of *Megalanceola* are currently recognised (Vinogradov *et al.*, 1982). *Megalanceola remipes* (Barnard, 1932) can easily be distinguished from *M. stephenseni* (Chevreux, 1920), illustrated here, by pereopods 3 to 5 which have very wide articles, particularly articles 4 to 6.

Megalanceola stephenseni (Chevreux)

Fig.5

Lanceola sp. Stebbing, 1888: 1308, fig.27.
Lanceola stephenseni Chevreux, 1920: 4-7, figs 1-3.
Megalanceola terrae-novae Pirlot, 1935: 2, figs 1-4.

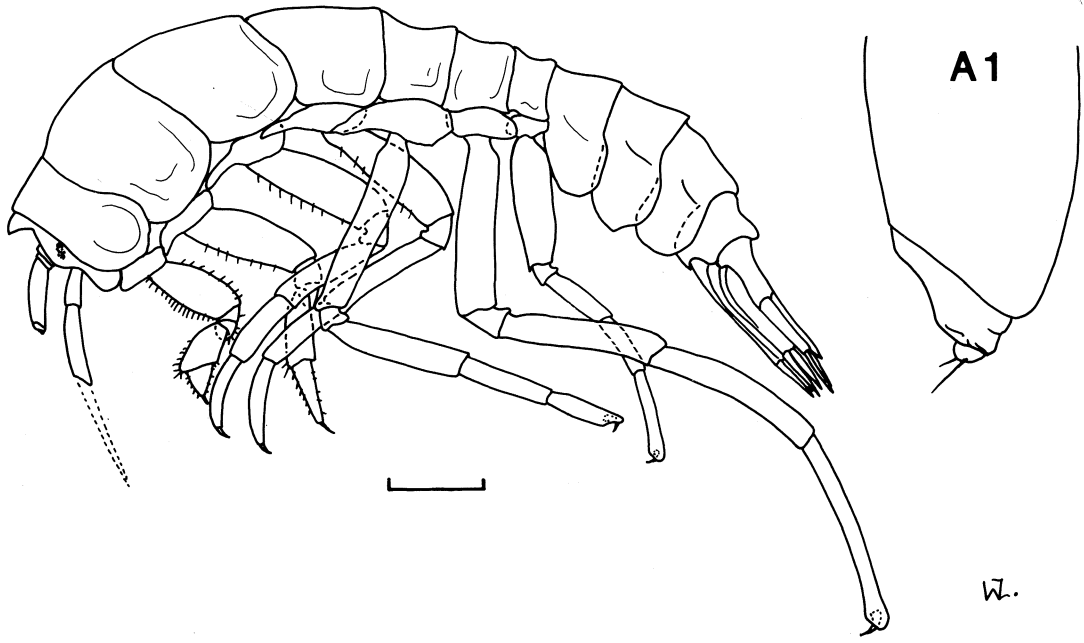

Fig.4. *Lanceola sayana* Bovallius, female 21.5 mm from station JP 77-19 (scale = 2.0 mm).

Material examined. 2 females (60 and 64 mm) from stations JP 77-26 (AM P39758) and F25 (AM P40876).

Diagnosis. Mandibular palp, article 2 distinctly longer than article 3. Gnathopods 1 and 2, articles 2-6 very setose. Pereopods 3-7 with slender articles. Pereopods 3 and 4, dactyl normal, not retractable.

Remarks. The present specimen agrees with the description and figures given by Chevreux (1920) and Pirlot (1939). It seems to be a rare species, judging by records in the literature.

Distribution. *Megalancoela stephenseni* has been recorded from near the Azores (Chevreux, 1920), near Newfoundland (Pirlot, 1935), near Bermuda (Shoemaker, 1945), from the "Southern Ocean" (Herring, 1981), and probably from the Banda Sea (Stebbing, 1888) according to Shoemaker. This is a new record for Australian waters.

Infraorder PHYSOCEPHALATA

VIBILIIDAE

Vibilia Milne-Edwards, 1830

Remarks. Species of *Vibilia* are very similar in gross morphology and, apart from a few distinctive species, most require expert knowledge for a correct identification and a revision of the genus is long overdue. Vinogradov *et al.* (1982) recognise 17 species and provide a useful key (in Russian).

Vibilia armata Bovallius

Vibilia armata Bovallius, 1887: 10.
Vibilia gracilis Bovallius, 1887: 9.
Vibilia gracilenta Bovallius, 1887: 9-10.
Vibilia erratica Chevreux, 1892: 32, figs 1-3.

Material examined. 2 males (8.4 and 8.8 mm) from station JP 71-3 (AM P39759).

Diagnosis. Pereon and pleon broad, robust. Pleonites with median ventral points. Antenna 1 shorter than head and first 2 pereonites; flagellum elongated, lanceolate, almost diamond shaped, ending in sharp point terminally. Gnathopod 2, anterior border of article 6 slightly produced; carpal process about as long as article 6. Pereopods 3-6, dactyls strong, length about half article 6. Pereopod 7, article 2 rectangular, slightly dilated posteriorly, two thirds as wide as long, length equivalent to articles 3-5. Lateral corners of last urosomite produced, partly overlapping peduncle of uropod 3. Uropod 3, peduncle distinctly longer than rami. Telson, triangular, pointed terminally.

Remarks. The combination of characters given in the diagnosis, particularly the shape of antenna 1 and the urosome, readily distinguish *V. armata* from all its congeners.

Distribution. Widely distributed in tropical and temperate regions. Previous records from Australian waters are by Barnard (1931), Guiler (1952), Watson & Chaloupka (1982), Young & Anderson (1987) and Zeidler (1978).

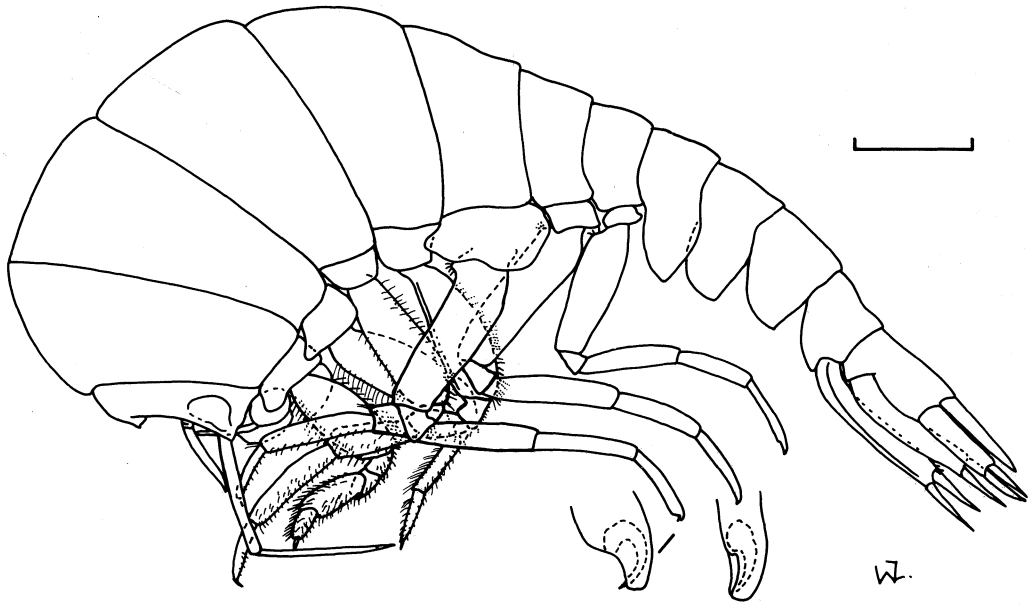

Fig.5. *Megalanceola stephenseni* (Chevreux), female 52.0 mm (scale = 5.0 mm).

Vibilia caeca Bulycheva

Fig.6

Vibilia caeca Bulycheva, 1955: 1050.

Material examined. 1 female (6.1 mm) from station JP 71-8 (AM P39760).

Diagnosis. Eyes absent. Pleon distinctly broader than pereon. Antenna 1 inserted midlaterally on head, as long as head and pereonites 1-3; flagellum elongate, lanceolate, excised on ventral margin for distal half. Gnathopod 2, carpal process almost as long as article 6. Pereopods 3-6, dactyls as long, or almost as long, as half article 6. Pereopod 7, article 2 rectangular, almost twice as long as wide with small, sharp, anterodistal projection and rounded posterodistal lobe overlapping article 3, length equivalent to articles 3-5. Lateral corners of last

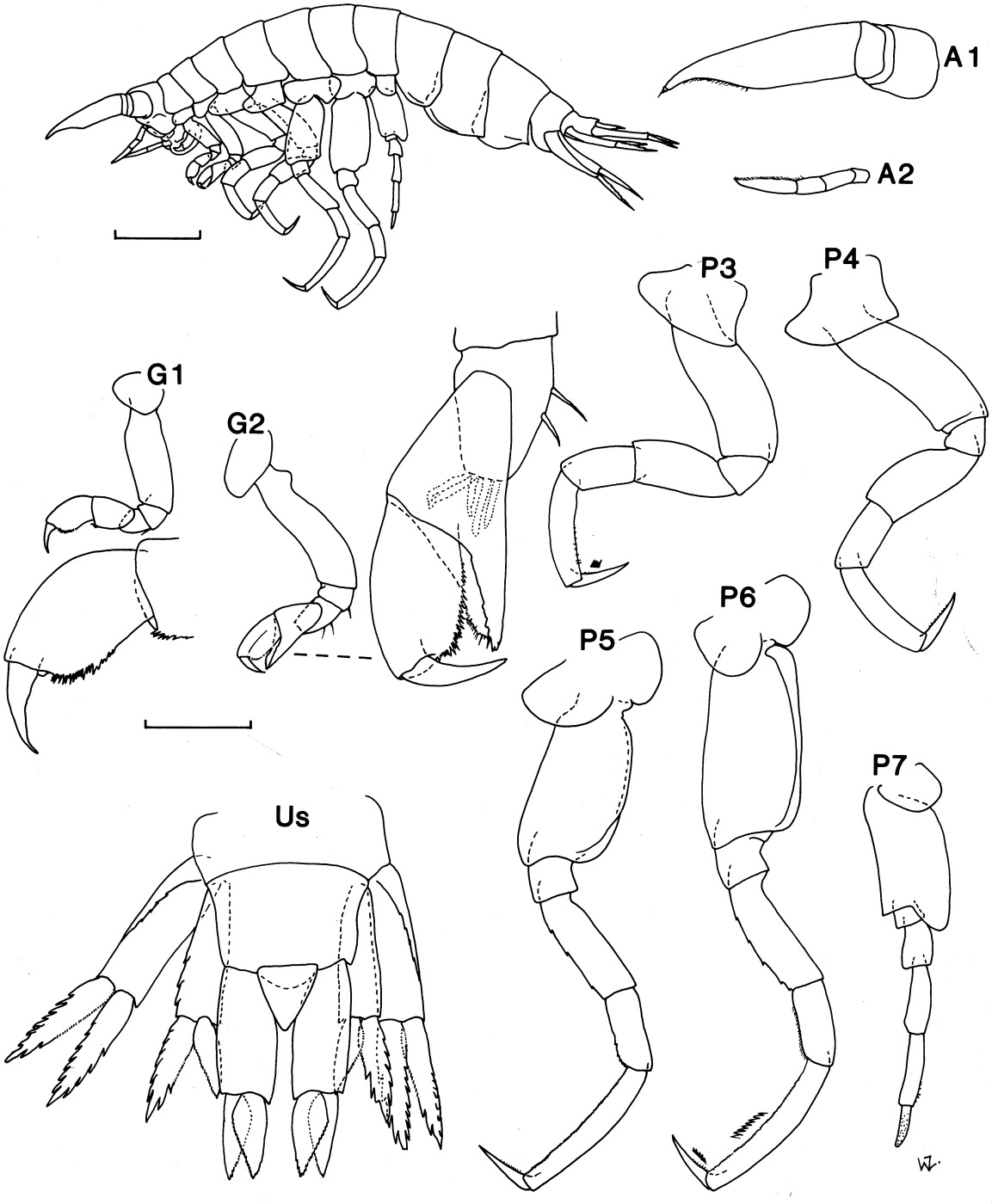

Fig.6. *Vibilia caeca* Bulycheva, female 6.1 mm (scales = 1.0 mm, 0.5 mm).

urosomite not produced. Uropod 3, peduncle distinctly longer than rami. Telson, triangular, pointed terminally.

Remarks. The present specimen agrees in detail with the description given for this species by Bulycheva (1955) and with the description and figures given by Vinogradov *et al.* (1982). *Vibilia caeca* most closely resembles *V. australis* Stebbing, 1888, but the absence of eyes is a unique feature amongst species of *Vibilia*.

Distribution. Previously it has only been recorded from the north-west Pacific Ocean (Bulycheva, 1955) and the western Bering Sea near the Kuril Islands (Vinogradov, 1956). It is a new record for the southern hemisphere and Australian waters.

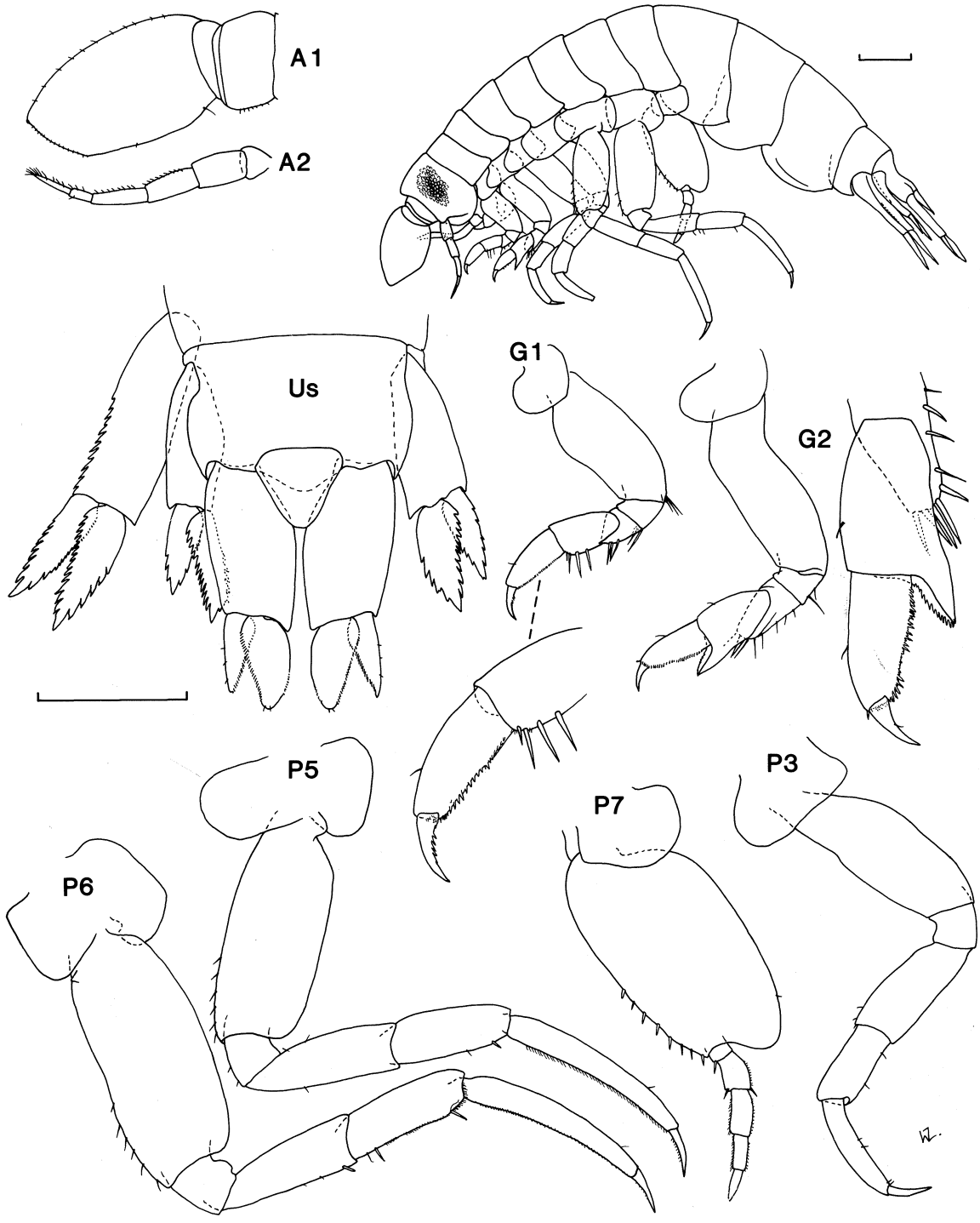

Fig.7. *Vibilia chuni* Behning & Woltereck, male 5.8 mm (scales = 0.5 mm).

Vibilia chuni Behning & Woltereck

Fig.7

Vibilia chuni Behning & Woltereck, 1912: 8-9, figs 7,8.
Vibilia hodgsoni Stewart, 1913: 251-253, pl.6 figs 1-6.

Material examined. 1 male (5.8 mm) from station JP 71-2 (AM P39761).

Diagnosis. Pereon and pleon broad. Antenna 1 shorter than head and first 2 pereonites; flagellum oval-shaped, ventral margin oblique for distal third. Gnathopod 2, carpal process about half length article 6. Pereopods 3-6, dactyls much shorter than half article 6, about one quarter article 6 for pereopods 5 and 6. Pereopod 7, article 2 rectangular, almost twice as long as wide, half as long again as articles 3-7 combined, with rounded margins and rounded posterodistal lobe overlapping article 3. Lateral corners of last urosomite produced, partly overlapping peduncle of uropod 3. Uropod 3, peduncle distinctly longer than rami. Telson, triangular, rounded terminally.

Remarks. A relatively rare species. Males have a second antenna with 6 or 7 articles as is usual in *Vibilia* but are further distinguished from females by the slightly larger eyes and by the inner ramus of uropod 3 which is broader and apically rounded.

The combination of characters given in the diagnosis, particularly the shape of antenna 1, the urosome and pereopod 7, readily distinguish *V. chuni* from all its congeners.

Distribution. Known from widely separated records in tropical and temperate regions. It is a new record for Australian waters although Tranter (1977) recorded it from the north-eastern part of the Indian Ocean off Western Australia.

Vibilia cultripes Vosseler

Fig.8

Vibilia cultripes Vosseler, 1901: 121-123, pl.11 figs 6-18.

Material examined. 1 male (11.4 mm) from station JP 71-3 (AM P39762).

Diagnosis. Pereon and pleon broad. Antenna 1, length equivalent to head and first pereonite; flagellum oval-shaped, distal margin rounded. Gnathopod 2, carpal process about two thirds length article 6. Pereopods 3-6, dactyls shorter than one quarter article 6. Pereopod 7, article 2 rectangular, about two thirds as wide as long, slightly longer than articles 3-5 with slight posterodistal lobe barely overlapping article 3; articles 5 and 6 with distinct, rounded anterodistal process; article 7 pointed with knife-like anterior margin. Lateral corners of last urosomite produced, partly overlapping peduncle of uropod 3. Uropod 3, peduncle about as long as inner ramus. Telson, rounded, almost circular.

Remarks. An uncommon species. It most closely resembles *V. longicarpus* Behning, 1913, but distinctive features are the form of gnathopod 2 and of pereopod 7 and the absence of a terminal tooth on the inner ramus of uropod 3 which is replaced by two, usually widely separated, teeth; particularly evident in males.

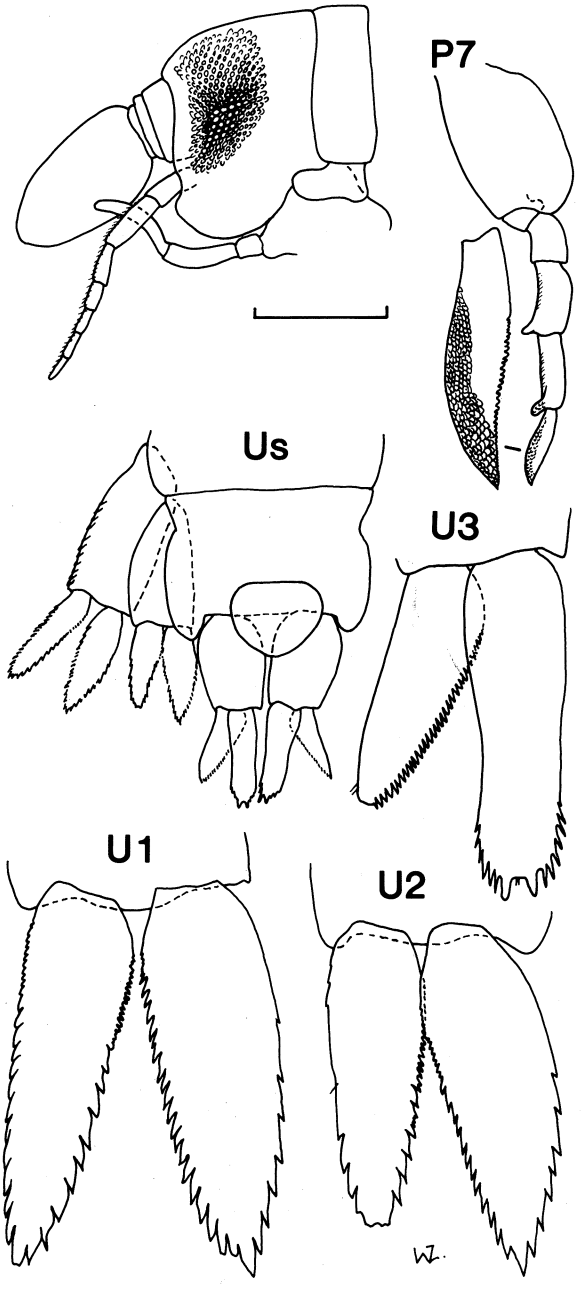

Fig.8. *Vibilia cultripes* Vosseler, male 11.4 mm. U1-3 from left (scale = 1.0 mm).

Distribution. Widely distributed in tropical and temperate regions, particularly the Atlantic. It was first recorded from Australian waters by Young & Anderson (1987).

Vibilia stebbingi Behning & Woltereck

Vibilia stebbingi Behning & Woltereck, 1912: 5-6, figs 1-3.

Material examined. 73 females (5.5-11.8 mm) and 35 males (5.0-9.8 mm) from stations JP 71-2 (AM P39763 - 36 f, 15 m; SAM C4207 - 10 f, 5 m); JP 71-3 (AM P39764 - 11 f, 7 m); JP 71-4 (AM P39765 - 2 f); JP 71-7 (AM P39766 - 9 f, 5 m); JP 71-8 (AM P39767 - 4 f, 2 m) and JP 72-23 (AM P39768 - 1 f, 1 m).

Diagnosis. Body distinctly broader in middle. Antenna 1 slightly shorter than head and first 3 pereonites; flagellum, dorsal and ventral margins parallel, distal margin oblique. Gnathopod 2, carpal process about half length article 6. Pereopods 3 and 4, dactyls about half length article 6. Pereopods 5 and 6, dactyls about one third length article 6. Pereopod 7, article 2 rectangular, almost twice as long as wide, slightly longer than articles 3-5 with small, sharp anterodistal projection and rounded posterodistal lobe overlapping article 3. Lateral corners of last urosomite not produced. Uropod 3, peduncle distinctly longer than rami. Telson, triangular, pointed terminally.

Remarks. *Vibilia stebbingi* seems to be closely related to *V. viatrix* Bovallius, 1887 and, in the shape of antenna 2 and the urosome, also resembles *V. antarctica* Stebbing, 1888. However, in both of these species the process of article 5 of gnathopod 2 is as long as article 6 and article 2 of pereopod 7 is of a slightly different shape, without a pointed, anterodistal process.

This was the most common species of *Vibilia* in the present collections. Young & Anderson (1987) also found this species to be very common in warm-core eddy J (Cresswell, 1983) off eastern Australia.

Two ovigerous females (6.6 and 10.2 mm) were captured in March (JP 71-8, 71-4).

Distribution. Widely distributed in tropical and temperate regions; particularly abundant when salp swarms occur (Dick, 1970). Despite its relative abundance in eastern Australian waters the first Australian record was by Young & Anderson (1987).

CYSTISOMATIDAE

Cystisoma Guérin-Méneville, 1842

Remarks. Specimens of *Cystisoma*, although large, are very fragile and rarely collected. In the past there was a tendency to describe new species almost every time another specimen was encountered and the genus is in need of revision. Vinogradov *et al.* (1982) recognise five species and provide the only useful key (in Russian).

Cystisoma pellucida (Willemöes-Suhm)

Fig.9

?*Cystisoma neptunus* Guérin-Méneville, 1842: 215, pl.1 fig.1.
Thaumatops pellucida Willemöes-Suhm, 1874: 634, pl.49 fig.1.
Cystisoma spinosum spec. B.–Stebbing, 1888: 1325-1329, pl.155.
Thaumatops longipes spec. B.–Bovallius, 1889: 47-52, pl.3 figs 2-4, 14.
Thaumatops parkinsoni.–Stephensen, 1918: 66-68, fig.29 (only in reference to *T. longipes* spec. B of Bovallius, 1889).

Material examined. 1 damaged male (?) (approximately 80 mm) from station JP 77-22 (AM P39769).

Diagnosis. Antenna 1 of female as long as head, expanded, diamond-shaped terminally. Mandible with 1 central spine, lateral spines absent. Oral spines, 4-6 pairs arranged in arched rows anteriorly to buccal mass. Pereopod 7 prehensile with small, curved dactyl, length of dactyl less than half maximum width article 6. Urosome (including uropods) distinctly longer than pleon. Uropods, exopodites about twice as long as endopodites with parallel sides and pointed, triangular terminal margin.

Remarks. *Cystisoma pellucida* is readily distinguished from all its congeners by the unusual form and length of the uropodal exopods; in all other species the exopods are lanceolate and rarely much longer than the endopods. The prehensile nature of pereopod 7 with its small dactyl is also a distinctive feature of this species.

Distribution. Known from widely separated records in tropical and temperate regions. It is a new record for Australian waters.

PARAPHRONIMIDAE

Paraphronima Claus, 1879

Remarks. This is the only genus in this distinctive family and currently consists of two species (Brusca, 1981). Although very similar in appearance, both species are readily separated by the characters given in the following remarks on *P. gracilis*

Claus, 1879.

Paraphronima crassipes Claus

Paraphronima crassipes Claus, 1879a: 7-8, pl.1 figs 6-9, pl.2 fig.10.
Paraphronima clypeata Bovallius, 1885: 11, fig.2.
Paraphronima pectinata Bovallius, 1887: 13-14.
Paraphronima cuivis Stebbing, 1888: 1337-1342, pl.157.

Material examined. 3 females (11.2, 11.6 and 16.6 mm), 2 males (7.5 and 9.8 mm) from stations JP 71-2 (AM P39770 - 1 m); JP 71-3 (AM P39771 - 1 f; SAM C4208 - 1 f) and JP 71-7 (AM P39772 - 1 f, 1 m).

Diagnosis. Head slightly longer than deep. Pereonites 1-4 approximately equal in width. Pleonite 1 with anterior margin nearly perpendicular to body. Pereopods 5-7, anterior margin of articles 3-6 with few or no spines (even under high magnification). Pereopod 7 only slightly shorter than pereopod 6.

Remarks. One ovigerous female (11.6 mm) was captured in March (71-7).

Distribution. Widely distributed in tropical and temperate regions. Previous records from Australian waters are by Barnard (1931), Guiler (1952), Sheard (1965) and Young & Anderson (1987).

Paraphronima gracilis Claus

Fig.10

Paraphronima gracilis Claus, 1879a: 7-8, pl.1 figs 4,5.
Paraphronima edwardsi Bovallius, 1885: 12.

Material examined. 1 male (4.0 mm) from station F 33 (AM P39503).

Diagnosis. Head slightly shorter than deep. Pereonites 1-2 much narrower than pereonite 3. Pleonite 1, anterior margin forms acute angle with body axis. Pereopods 5-7, anterior margin of articles 3-6 with several, small spines. Pereopod 7 only as long as articles 1-5 of pereopod 6.

Remarks. This species closely resembles the previous one and Hurley (1956) even suggested (but rejected) the idea that *P. crassipes* may be a later moult stage of *P. gracilis*; the former species tends to be larger and more robust than the latter. However, *P. gracilis* is readily distinguished by the presence of numerous spines on the anterior margins of pereopods 5 to 7, by the distinctly shorter pereopod 7 compared to pereopod 6, and by the shape of the pleonites, particularly pleonite 1 the anterior margin of which forms an acute angle with the body axis (almost perpendicular in *P. crassipes*). According to Brusca (1981), the spination of pereopods 5 to 7 and the shape of pleonite 1 are particularly reliable characters.

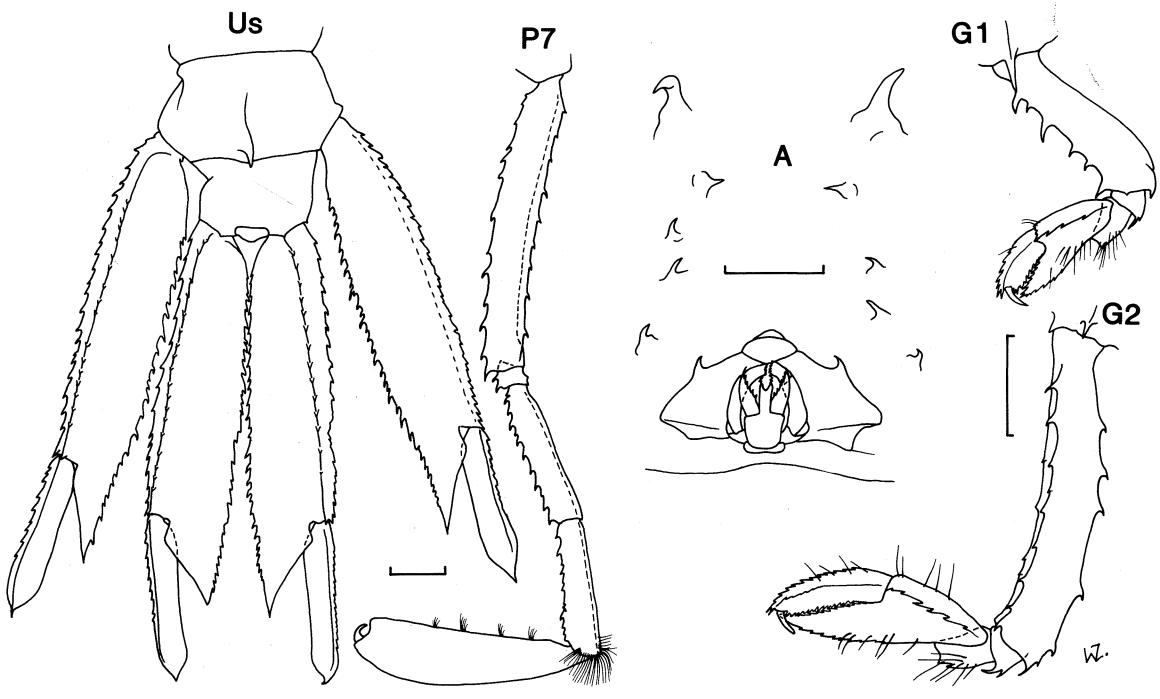

Fig.9. *Cystisoma pellucida* (Willemöes-Suhm), male approximately 80.0 mm. A, ventral part of head around buccal mass (scales = 2.0 mm).

Distribution. Widely distributed in tropical and temperate regions. It is a new record for Australian waters although Tranter (1977) recorded it from the north-eastern part of the Indian Ocean off Western Australia.

HYPERIIDAE

Hyperia Latreille, *in* Desmarest, 1823

Remarks. This genus has been revised by Bowman (1973) who provides a key and very useful illustrations for each species. Bowman recognised eight species, one of which, *H. antarctica* Spandl, 1927, is now regarded a synonym of *H. spinigera* Bovallius, 1889 (Thurston, 1977). More recently two additional species of *Hyperia* have been described; *H. bowmani* Vinogradov, 1976 and *H. curticephala* Vinogradov & Semenova, 1985.

Hyperia spinigera Bovallius

Fig.11

Hyperia spinigera Bovallius, 1889: 191-194, pl.10 figs 33-39.
Hyperia antarctica Spandl, 1927: 153-156, fig.2.

Material examined. 1 female (7.8 mm) from station JP 71-4 (AM P39773).

Diagnosis. Pleonite 1, posterior corner rounded. Pleonites 2-3 with small points midventrally. Pleonite 3 sometimes with strongly convex posterior margin. Antenna 1 of female digitiform, not slender as is usual in *Hyperia*. Mandibular palp articles subequal. Gnathopods 1 and 2, articles 2-4 with long setae on posterior parts of distal margins; article 6 with setae (sometimes long) on both margins. Gnathopod 1, posterodistal corner of article 5 rounded, not produced into carpal process, with setae of varying lengths, sometimes nearly as long as article 6. Gnathopod 2, carpal process short with long setae. Pereopods 3 and 4, article 2 with cluster of setae on posterodistal corner; articles 4-6, posterior margin with dense covering of short spinules (in typical *H. spinigera*). Pereopods 5-7 unarmed except for cluster of setae on anterodistal corner of article 2. Telson slightly longer than width at base, length slightly more than half peduncle, uropod 3.

Remarks. The present specimen most closely resembles *H. antarctica* Spandl, 1927 as described and figured by Bowman (1973), particularly in the form of uropod 3 and in that articles 5 and 6 of pereopods 3 and 4 are completely unarmed, even when viewed with high magnification. Thurston (1977) however, has shown that *H. antarctica* is merely a developmental form of *H. spinigera*. In addition to the above features, the present specimen also differs from typical *H. spinigera* in that the spines on the gnathopods are fewer in number and generally the ornamentation resembles that of *H. crassa* Bowman, 1973.

Distribution. Widely distributed in both northern and southern hemispheres. It is a new record for Australian waters although it has been recorded from New Zealand (Hurley, 1955) and Antarctic waters (Spandl, 1927; Hurley, 1960).

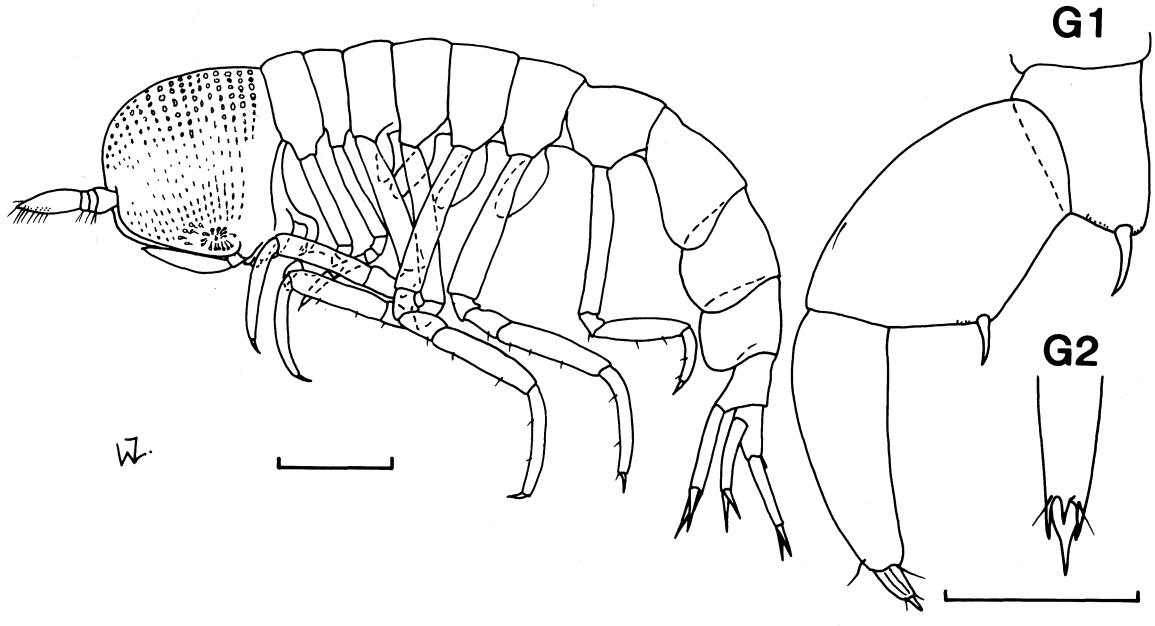

Fig.10. *Paraphronima gracilis* Claus, male 3.8 mm (scales = 0.5 mm, 0.1 mm).

Hyperioides Chevreux, 1900

Remarks. There are currently only two species in this distinctive genus of Hyperiidae, both are represented in the present collection. It has been revised by Bowman (1973), who provides illustrations for each species.

Hyperioides longipes Chevreux

Hyperioides longipes Chevreux, 1900: 143-145, pl.17 fig.2.
Hyperia sibaginis var. *longipes*.–Vosseler, 1901: 63.

Material examined. 1 male (3.5 mm) from station F 33 (AM P39502).

Diagnosis. Head nearly straight dorsally. Eye facets limited to dorsal part of head. Antenna 1 of female with 2 articles, length almost twice antenna 2. Gnathopod 2, carpal process reaching middle of article 6. Uropod 3, peduncle about twice as long as wide, slightly longer than exopod.

Remarks. This species is readily distinguished from its congener by the eye facets which are limited to the dorsal part of the head.

Distribution. It has been recorded from warm parts of all the world's oceans. First recorded from Australian waters by Bowman & McGuinness (1982) who found it to be relatively abundant off Western Australia, although Tranter (1977) recorded it from the north-eastern part of the Indian Ocean.

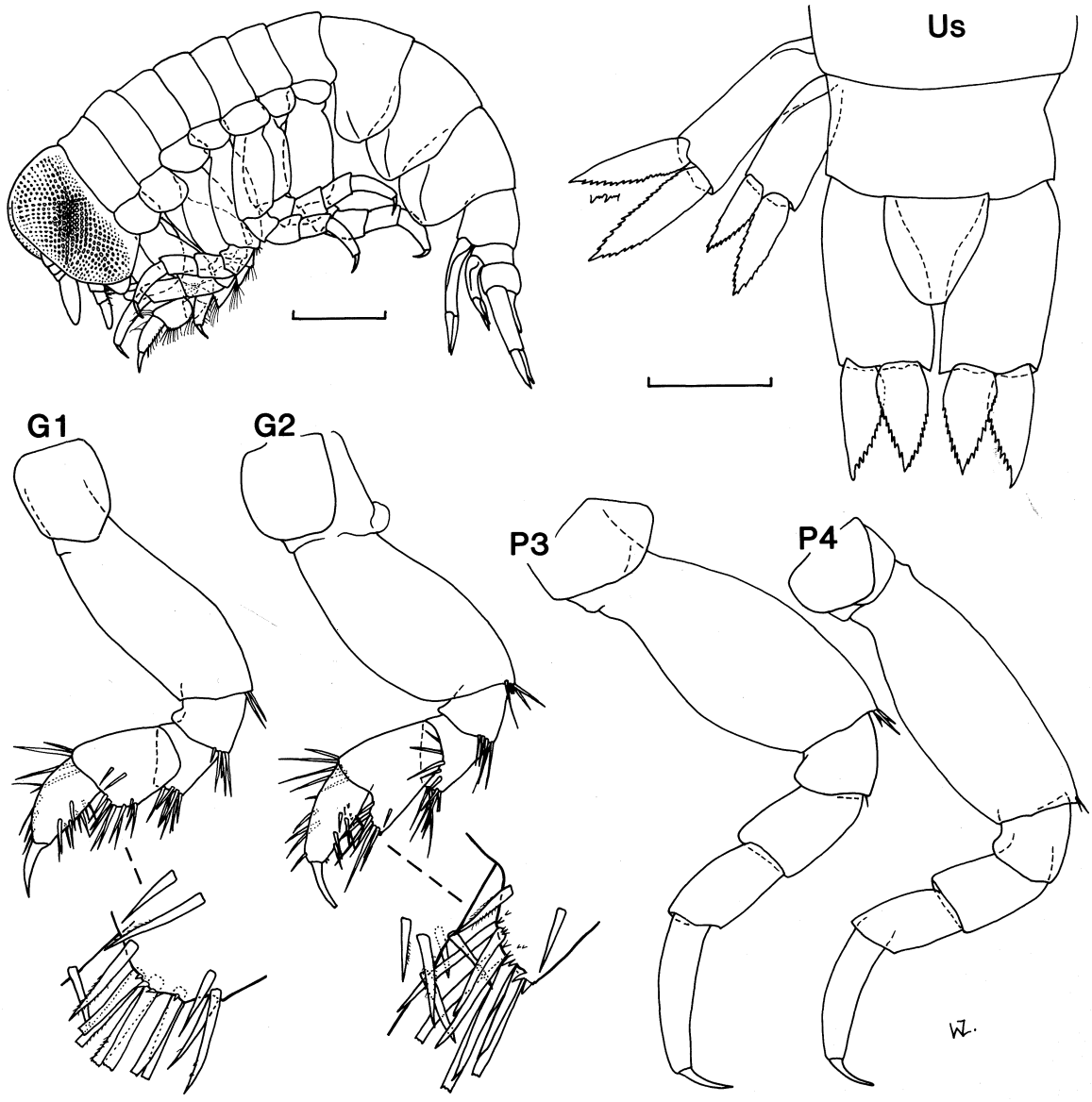

Fig.11. *Hyperia spinigera* Bovallius, female 7.8 mm (scales = 1.0 mm, 0.5 mm).

Hyperioides sibaginis (Stebbing)

Hyperia sibaginis Stebbing, 1888: 1379-1382, pl.165.

Material examined. 8 females (1.2-2.7 mm) and 14 males (2.4-3.9 mm) from stations JP 89-2 (AM P39774 - 4 f, 1 m) and JP 89-3 (AM P39775 - 4 f, 13 m).

Diagnosis. Head rounded dorsally. Eye facets cover dorsal and lateral parts of head. Antenna 1 of female with 3 articles, length slightly longer than antenna 2. Gnathopod 2, carpal process small, reaching to one quarter article 6. Uropod 3, peduncle length at least two and one half times width; exopod length about two thirds peduncle.

Remarks. One ovigerous female (2.7 mm) was captured in April (JP 89-2).

Distribution. Widely distributed and relatively common in tropical and temperate regions. Previous records from Australian waters are by Barnard (1931), Bowman & McGuinness (1982) and Zeidler (1978).

Hyperoche Bovallius, 1887

Remarks. Species of this genus are distinguished by the distinctly chelate gnathopods. Vinogradov *et al.* (1982) recognise seven species and provide the only useful key. However, the genus is in need of revision.

Hyperoche mediterranea Senna

Fig.12

Hyperoche mediterranea Senna, 1908: 159-168, figs 1-10, pl.1 figs 1,2.

Material examined. 1 male (5.6 mm) from station JP 72-23 (AM P39776).

Diagnosis. Epimeral plates with rounded margins distally. Gnathopod 1, article 4 posterodistal corner produced, almost reaching proximal margin of article 6. Gnathopods 1 and 2, dactyl attached terminally in normal manner; carpal process as long or slightly longer than article 6. Pereopods 3-7, all articles with covering of fine setae, especially articles 4-6. Telson length about half peduncle of uropod 3.

Remarks. *Hyperoche mediterranea* is readily distinguished by the form of the gnathopods and the posteriorly rounded epimeral plates. The only congener with rounded epimeral plates is *H. martinezi* (Müller, 1864) in which the posterodistal corner of article 4 of gnathopod 1 is only slightly produced.

Hyperoche mediterranea seems to be a shallow water species (Hurley, 1955) and this is supported by the present finding.

Distribution. A relatively rare species known from widely separated records in temperate regions but not yet recorded from the Indian Ocean. It is a new record for Australian waters although it has been recorded from New Zealand (Hurley, 1955).

Lestrigonus Milne-Edwards, 1830

Remarks. This genus has been revised by Bowman (1973) who provides a key and very useful illustrations for each species. Bowman recognised six species of which three are represented in the present collection. One other species, *L. macrophthalmus* (Vosseler, 1901), has previously been recorded from Australia (Zeidler, 1978).

Lestrigonus bengalensis Giles

Lestrigonus bengalensis Giles, 1887: 224-227, pls 6,7.
Hyperia dysschistus Stebbing, 1888: 1388-1391, pl.167.
Hyperia bengalensis.–Bovallius, 1889: 199-201.
Hyperia thoracica Bovallius, 1889: 233-236, pl.11 figs 37-41.
Hyperia gilesi Bovallius, 1889: 236-239.
Hyperia atlantica Vosseler, 1901: 67-70, pl.6 figs 5-15.

Material examined. 43 females (0.9-2.8 mm), 13 males (1.7-2.5 mm) from stations JP 89-2 (AM P39777 - 19 f, 1 m) and JP 89-3 (AM P39778 - 20 f, 8 m; SAM C4209 - 4 f, 3 m).

Diagnosis. Pereonites 1-5 fused in female, 1-4 fused in male. Gland cone in female produced anteroventrally, extending anterior to and overlapping epistome, with rounded apex; in male a rounded lobe produced ventrally. Gnathopod 1, article 2 with strong bulge on anterior margin, more pronounced in female; article 4 with 2 posterodistal spines; article 5 with 1 or 2 spines on posterior margin and 3 on carpal process; article 6 with single spine medially on anterior margin. Gnathopod 2 similar to gnathopod 1 except carpal process distinctly spoon-shaped and produced to about middle of article 6. Pereopods 3 and 4, articles 4 and 5 with single posterodistal spine; articles 5 and 6 with comb of spinules on posterior margin. Pereopod 5 of female and pereopods 5-7 of male, article 6 with comb of spinules on anterior margin. Pereopods 5-7, article 6 with straight anterodistal spine overlapping dactyl.

Remarks. This species is one of the most distinctive of the genus easily recognised by the number of fused pereonites. Females are generally more robust than other

species of *Lestrigonus* and the number of fused pereonites is constant throughout the size range (Zeidler, 1978). Males mostly have pereonites 1 to 4 fused, but in juveniles, pereonites 1 to 5 may be fused and in some very large specimens the suture of pereonite 4 may be almost complete. Males of all other species of *Lestrigonus* however, have pereonites 1 to 2 fused (sometimes 1-3 in juveniles) and cannot be confused with *L. bengalensis*.

Three ovigerous females were captured at the first station and four at the latter; all about 2.0 mm in length.

Distribution. Very common in tropical waters worldwide, tending to occur in coastal waters. Previous records from Australian waters are by Bowman & McGuinness (1982), Dakin & Colefax (1940 – as *Hyperia hydrocephala*), Sheard (1965), Stebbing (1888

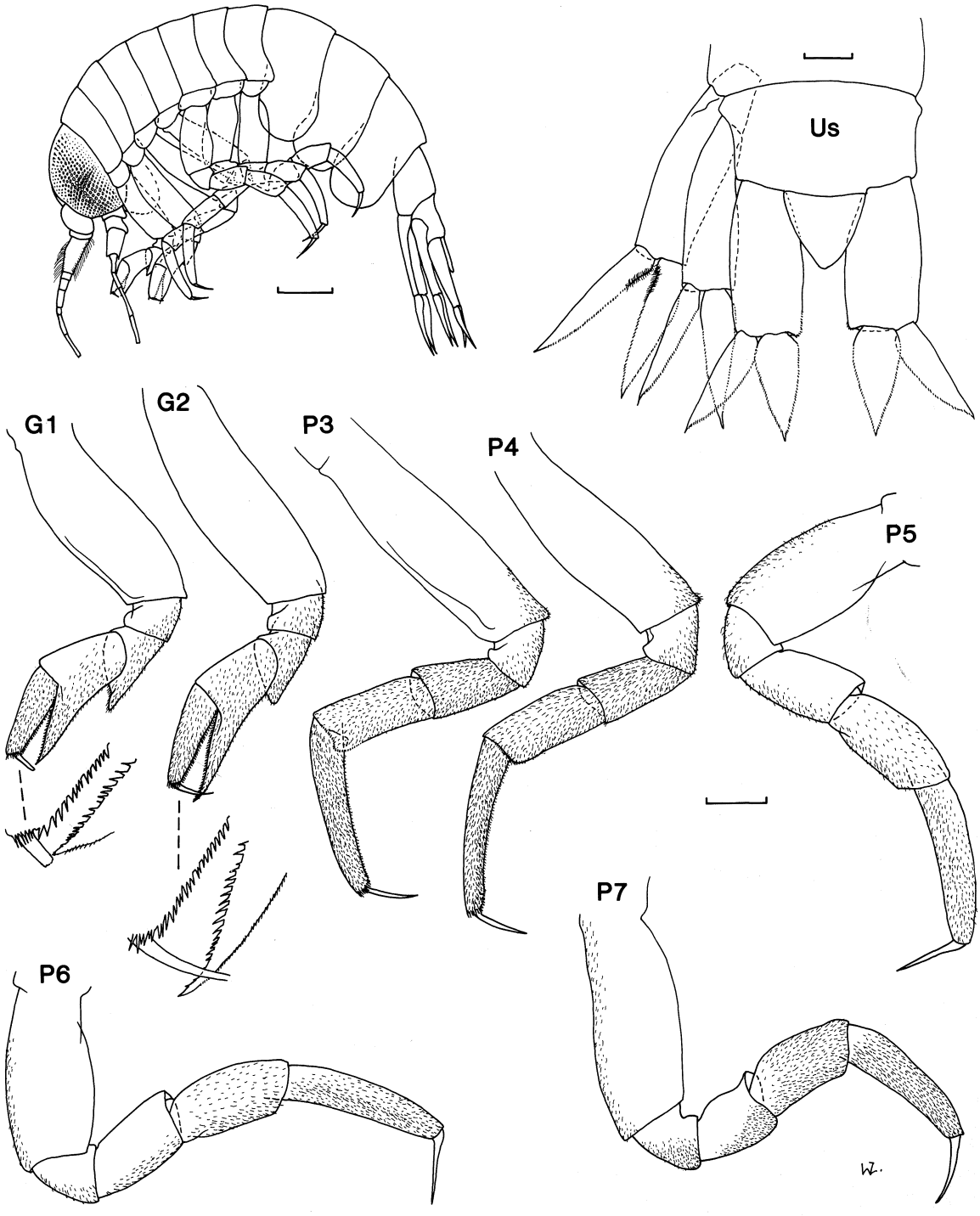

Fig.12. *Hyperoche mediterranea* Senna, male 5.6 mm (scales = 0.5 mm, 0.2 mm).

– as *Hyperia dysschistus*), Watson & Chaloupka (1982) and Zeidler (1978).

Lestrigonus crucipes (Bovallius)

Fig.13

Hyperia crucipes Bovallius, 1889: 225-228, pl.11 figs 14-25.

Material examined. 10 females (3.2-4.1 mm), 3 males (3.1, 3.8 and 4.5 mm) from station JP 72-23 (AM P39779 - 7 f, 2 m; SAM C4210 - 3 f, 1 m).

Diagnosis. Pereonites 1-3 fused in female, 1-2 fused in male. Gland cone obtuse, projecting obliquely anteroventrally; more produced in female than male. Gnathopod 1, article 4 with about 6 posterodistal spines; article 5 with 3 spines on posterior margin and 4 or 5

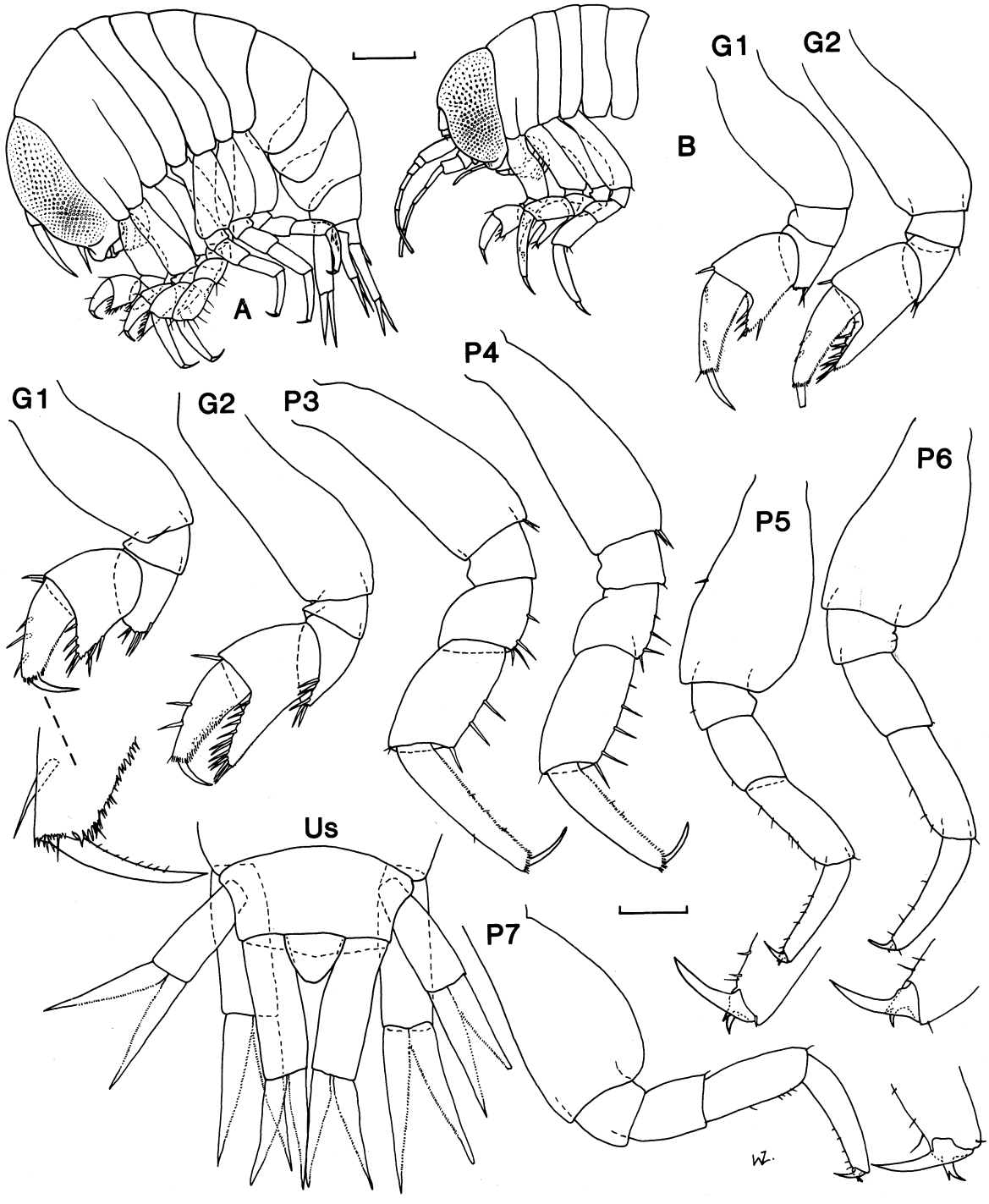

Fig.13. *Lestrigonus crucipes* (Bovallius). A, female 4.1 mm; B, male 4.5 mm (scales = 0.5 mm, 0.2 mm).

on carpal process; article 6 with 3 or 4 spines on anterior margin. Gnathopod 2, carpal process extended beyond midlength of article 6 and armed with several spines; article 6 with 2 or 3 spines on anterior margin. Pereopods 3 and 4, articles 4 and 5 with 3 or 4 spines on posterior margin; article 6 with close-set spinules on posterior margin. Pereopods 5-7, articles 5 and 6 with several short spines on anterior margin; article 6 produced distally into recurved, dentate hook overlapping dactyl medially.

Remarks. The present specimens agree with the description and figures given by Bowman (1973) except for the gnathopods which have the posterodistal corner slightly more produced, much like that illustrated by Bovallius (1889). An unusual feature of this species, which readily distinguishes it from all other congeners, is the recurved hook on the distal margin of article 6 of pereopods 5 and 7 which overlaps the dactyl on the medial side. In other features *L. crucipes* resembles *L. schizogeneios* (Stebbing, 1888), but in *L. schizogeneios* the gland cone is pointed and extends ventrally, nearly reaching the ventral margin of the buccal mass in males and extending just beyond in females; also the posterior margin of article 5 of pereopods 3 and 4 has only two spines.

All of the females were ovigerous.

Distribution. A relatively rare species known from a few records from warm regions of the Atlantic and Indian Oceans. It is a new record for Australian waters although Bowman & McGuinness (1982) recorded it in the north-eastern part of the Indian Ocean off Western Australia.

Lestrigonus schizogeneios (Stebbing)

Hyperia schizogeneios Stebbing, 1888: 1391-1394, pl.168.
Hyperia promontorii Stebbing, 1888: 1385-1387, pl.166B.
Hyperia zebui Stebbing, 1888: 1394.

Material examined. 1 female (2.4 mm) from station JP 89-2 (AM P39508).

Diagnosis. Pereonites 1-3 fused in female, 1-2 fused in male. Gland cone in female wedge-shaped, sharply pointed, extending beyond buccal mass; in male blunter, barely reaching ventral border of buccal mass. Gnathopod 1, article 4 with 2 or 3 posterodistal spines; article 5 with 2 spines on posterior margin and 3 or 4 on carpal process; article 6 with 2 or 3 spines on anterior margin. Gnathopod 2, carpal process produced to middle of article 6, armed with several spines; article 6 with 1 or 2 spines on anterior margin. Pereopods 3 and 4, article 5 with 2 spines on posterior margin; articles 5 and 6 with comb of spinules on posterior margin. Pereopods 5-7, articles 5 and 6 with comb of spinules on anterior margin. Pereopods 6 and 7 with simple spine on distal margin of article 6 overlapping dactyl medially.

Remarks. The number of fused pereonites can vary with maturity (Yang, 1960; Laval, 1968) and some specimens could then be confused with *L. bengalensis* or *L. macrophthalmus*. However, the wedge-shaped gland cone of *L. schizogeneios* is very distinctive and article 5 of pereopods 3 and 4 has two spines on the posterior margin (only one in *L. bengalensis* and *L. macrophthalmus*). The similarity of *L. schizogeneios* to *L. crucipes* has already been discussed under that species.

Distribution. Relatively common in tropical waters worldwide. Previous records from Australian waters are by Bowman & McGuinness (1982) and Dakin & Colefax (1940 – as *Hyperia promontorii*).

Themistella Bovallius, 1887

Remarks. Bowman (1973) revised this genus and considered it to be monotypic.

Themistella fusca (Dana)

Fig.14

Lestrigonus fuscus Dana,1853: 983, pl.67 fig.8a-c.
Hyperiella fusca.–Bovallius, 1887: 20.
Themistella steenstrupi Bovallius, 1887: 23.

Material examined. 1 ovigerous female (2.7 mm) from station JP 89-2 (AM P39780).

Diagnosis. Pereonites 1-5 fused in both sexes. Gland cone small. Gnathopod 1, article 4 with 3 posterodistal spines; carpal process about half length article 5 armed with 3 or 4 spines; article 6 with 1 spine on anterior margin. Gnathopod 2, carpal process extended beyond midlength of article 6 and armed with several spines; article 6 with 1 or 2 spines on anterior margin. Pereopods 3 and 4, articles 4 and 5 with 1 posterodistal spine. Pereopod 5 much longer than pereopods 6 and 7. Pereopods 6 and 7, dactyl with upward bend slightly distal to midlength. Telson very short, less than one quarter length peduncle of uropod 3.

Remarks. Bowman (1973) sorted out the past confusion concerning this species. The present specimen agrees in general with that figured by Bowman (1973) as *T. fusca* but differs slightly in that the suture of pereonite 5 is almost complete dorsally and the length of pereopod 7, relative to pereopod 6, is slightly shorter.

The relatively long pereopod 5, the short telson and the upward bend of the dactyls of pereopods 6 and 7 are characteristic features of this species.

Distribution. A relatively rare species, sparsely distributed in tropical waters of the world's oceans. First recorded from Australian waters (off North West Cape, Western Australia) by Bowman & McGuinness (1982).

PHRONIMIDAE

Phronima Latreille, 1802

Remarks. This genus has been adequately revised by Shih (1969) who also provides useful illustrations and a key to species. Additions and modifications have been made by Laval (1970) and Shih (1971a, 1971b, 1991)

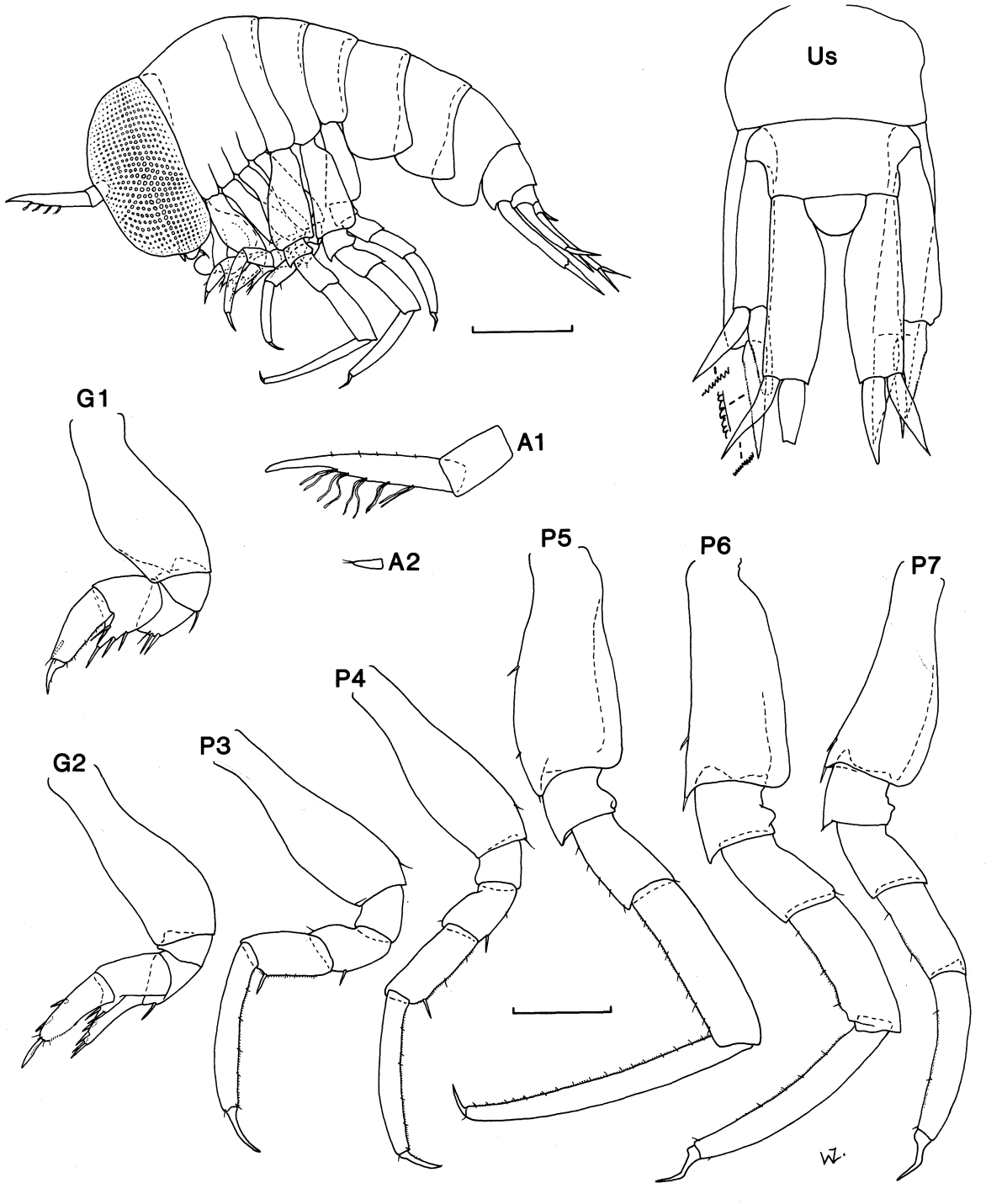

Fig.14. *Themistella fusca* (Dana), female 2.4 mm (scales = 0.5 mm, 0.2 mm).

resulting in the current recognition of ten species.

Phronima atlantica Guérin-Méneville

Phronima atlantica Guérin-Méneville, 1836: 7, pl.18 fig.1.

Material examined. 78 females (7.6-21.8 mm) and 1 male (7.0 mm) from stations JP 71-2 (AM P39781 - 4 f); JP 71-3 (AM P39782 - 51 f; SAM C4211 - 10 f); JP 71-4 (AM P39783 - 1 f); JP 71-7 (AM P39784 - 6 f); JP 71-8 (AM P39785 - 5 f); JP 72-23 (AM P39786 - 1 f) and JP 89-3 (AM P39510 - 1 m).

Diagnosis. Antenna 2 of male well developed with flagellum of 11-12 articles. Pereopod 5 longer than any other pereopod; articles 4 and 5 a little longer than wide; article 5, posterior margin evenly convex, anterior margin relatively straight, produced into large tooth almost extending beyond article 6 in females and a little further in males, distal margin with bifid tubercle, weaker than anterior tooth, with 4 or 5 tooth-like projections on posterior margin; article 6 extends well beyond anterior margin of article 5.

Remarks. Females of this species can be confused with *P. sedentaria* (Forskål, 1775) especially when dealing with juvenile specimens. However, in *P. sedentaria* the pleonites possess a posterodistal spinose process which is absent in *P. atlantica*. It may also be confused with juvenile *P. solitaria* Guérin-Méneville, 1836, which prior to Shih's (1969) revision, was considered to be a variety of *P. atlantica*. However, in *P. solitaria* the anterior margin of the carpus of pereopod 5 is distinctly convex just prior to the anterior tooth.

Distribution. A relatively common species widely distributed in tropical and temperate regions. Previous records from Australian waters are by Young & Anderson (1987) and Zeidler (1978).

Phronima colletti Bovallius

Phronima colletti Bovallius, 1887: 25.
Phronima diogenes Chun, 1889; 527-531, pl.3 figs 5,6.
Phronima gasti Dudlich, 1926: 134-137, figs 1-3.

Material examined. 2 females (8.8 and 10.2 mm) from station JP 71-8 (AM P39787).

Diagnosis. Antenna 2 of male well developed with flagellum of 12-13 articles. Pereopods 3 and 4 distinctly longer than pereopod 5. Pereopod 5, article 4 almost as wide as long with posterior bulge; article 5 rectangular with rounded posterior margin, almost as wide as long (wider in males), posteroproximal margin rounded, extended well above distal margin of article 4, anterior margin produced into large tooth extending beyond article 6, distal margin with bifid tubercle, much weaker than anterior tooth, with 3-4 tooth-like projections on posterior margin; article 6 does not extend beyond anterior margin of article 5.

Remarks. This species is closely related to *P. bucephala* Giles, 1887 but can most easily be distinguished from it by the form of pereopod 5. In *P. bucephala* article 4 is distinctly longer than wide and is not marginally overlapped posteriorly by article 5. Laval (1970) gives a full account of the differences between the two species. Males of *P. colletti* also closely resemble *P. pacifica* Streets, 1877, but in *P. pacifica*, article 4 of pereopod 5 is distinctly wider than long and article 5 is more trapezoid in shape.

Distribution. Widely distributed in tropical and temperate regions. Previous records from Australian waters are by Dakin & Colefax (1940), Sheard (1965) and Young & Anderson (1987).

Phronima curvipes Vosseler

Phronima curvipes Vosseler, 1901: 27-29, pl.3 figs 1-3.

Material examined. 2 females (9.9 and 11.6 mm) from stations JP 71-3 (AM P39788) and JP 72-23 (AM P39789).

Diagnosis. Antenna 2 of male well developed with flagellum of 7-9 articles. Pereopods 3 and 4 distinctly longer than pereopod 5. Pereopod 5, article 2, posterior margin reversed 'S' shape (more pronounced in females) with pointed posterodistal process; article 4 longer than wide in female, slightly wider than long in male, with distinct posterior bulge; article 5 in females, longer than wide with posteroproximal margin produced above distal margin of article 4, anterior margin produced into large tooth extending beyond article 6, distal margin with almost single (females) or bifid (males) tubercle, much weaker than anterior tooth, with 6-7 (females) or 4-5 (males), close tooth-like projections on posterior margin; article 6 just reaches (males) or extends beyond (females) anterior margin of article 5.

Remarks. Females of this species can resemble *P. solitaria* but are readily distinguished from this and other species of *Phronima* by the characteristic reversed 'S' curvature of the second article of pereopod 5. Males are most similar to *P. colletti* and *P. pacifica* but can be distinguished by the details in the shape of pereopod 5 and by the number of flagella articles of antenna 2 (see diagnoses).

Distribution. A relatively uncommon species widely distributed in tropical and temperate regions. First recorded from Australian waters by Young &

Anderson (1987).

Phronima pacifica Streets

Phronima pacifica Streets, 1877: 128-130.

Material examined. 7 females (3.3-10.4 mm), 3 males (7.2, 8.8 and 9.0 mm) from stations JP 71-2 (AM P39790 - 1 m); JP 71-3 (AM P39791 - 3 f, 1 m; SAM C4212 - 1 f, 1 m); JP 72-23 (AM P39792 - 1 f); F43 (AM P39500 - 1 f) and JP 89-3 (AM P39509 - 1 f).

Diagnosis. Antenna 2 of male well developed with flagellum of 15-17 articles. Pereopods 3 and 4 distinctly longer than pereopod 5. Pereopod 5, article 4 a little wider than long with strong posterior bulge; article 5 wider than long with posterior margin strongly dilated proximally and laterally, anterior margin produced into large tooth extending beyond article 6, distal margin with bifid tubercle, much weaker than anterior tooth with 4 or 5 tooth-like projections on posterior margin, of which, the first can be slightly isolated from the rest; article 6 just reaches (males) or extends slightly beyond (females) anterior margin of article 5.

Remarks. The female of this species is easily distinguished from its congeners by the shape of pereopod 5. Males closely resemble *P. colletti* and in the past have been confused with it (Shih, 1969). The similarity of males to *P. colletti* and also *P. curvipes* is discussed under those species.

Distribution. Widely distributed in tropical and subtropical regions. Previous records from Australian waters are by Sheard (1965), Young & Anderson (1987) and Zeidler (1978).

Phronima sedentaria (Forskål)

Cancer sedentarius Forskål, 1775: 95-96.
Gammarus sedentarius.–Schousboe, 1802: 11, figs 1-6.
Phronima sedentaria.–Latreille, 1803: 291.
Phronima custos Risso, 1816: 121, pl.2 fig.3.
Phronima borneensis Bate, 1862: 318, pl.51 fig.3.
Phronima novaezealandiae Powell, 1875: 294, pl.21 figs 1,2.
Phronima spinosa Bovallius, 1887: 25.
Phronima tenella Stebbing, 1888: 1354-1356, pl.161A.
Phronima affinis Vosseler, 1901: 20, pl.1 figs 12-16.

Material examined. 204 females (8.0-29.6 mm) from stations JP 71-2 (AM P39793 - 8 f); JP 71-3 (AM P39794 - 40 f; SAM C4213 - 10 f); JP 71-4 (AM P39795 - 3 f); JP 71-7 (AM P39796 - 31 f); JP 71-8 (AM P39797 - 10 f); JP 72-23 (AM P39798 - 3 f); K 72-07-01 (AM P39799 - 1 f); K 73-01-11 (AM P39800 - 2 f); K 74-05-01 (AM P 39801 - 10 f); JP 77-17 (AM P39802 - 3 f); JP 77-18 (AM P 39803 - 14 f); JP 77-19 (AM P39804 - 13 f); JP 77-25 (AM P39805 - 18 f); JP 77-26 (AM P39806 - 18 f); JP 77-27 (AM P39807 - 4 f); JP 77-28 (AM P39808 - 15 f); JP 89-2 (AM P39809 - 1 f).

Diagnosis. Antenna 2 of male, rudimentary. Pleonites with spinose posterodistal process. Pereopods 3 and 4 shorter than pereopod 5 in females, longer in males. Pereopod 5, articles 4 and 5 much longer than wide; article 5, anterior margin in females produced into large tooth extending well beyond article 6 in mature specimens, in males weakly developed, often shorter than carpal tubercle sometimes extending just beyond article 6 in mature females with 6 or 7 tooth-like projections on posterior margin; article 6 extended well past anterior margin of article 5 with median tubercle on anterior or dorsal margin in mature females.

Remarks. This was by far the most common species of *Phronima* in the present collections. Only one female from station JP 89-2 (April) was ovigerous.

The similarity of *P. sedentaria* to *P. atlantica* and *P. solitaria* is discussed under those species.

Distribution. A common species widely distributed in tropical and temperate regions. Previous records from Australian waters are by Guiler (1952), Shih (1969, Dana Stn 3663), Stebbing (1888) and Young & Anderson (1987).

Phronima solitaria Guérin-Méneville

Phronima solitaria Guérin-Méneville, 1836: 7, pl.18 fig.1.
Phronima custos Bate, 1862: 318, pl.51 fig.2.
Phronima megalodous Stebbing, 1888: 1353-1354, pl.162A.
Phronima atlantica var. *solitaria*.–Vosseler, 1901: 23, pl.2 fig.5.

Material examined. 4 females (15.4-19.2 mm) from stations JP 71-3 (AM P39810 - 2 f; SAM C4214 - 1 f) and JP 72-23 (AM P39811 - 1 f).

Diagnosis. Antenna 2 of male moderately developed with flagellum of up to 9 articles. Pereopods 3 and 4 shorter than pereopod 5 in females, longer in males. Pereopod 5, articles 4 and 5 much longer than wide; article 5, anterior margin in females produced into large tooth extending well beyond article 6 especially in mature specimens, in males weakly developed, sometimes shorter than carpal tubercle; distal margin with bifid tubercle in juvenile females and males, in mature females, single, projected beyond article 6 with 7-9 tooth-like projections on posterior margin; article 6 extended well past anterior margin of article 5 with very weak tubercle on anterior or dorsal margin.

Remarks. Prior to Shih's (1969) revision of the family, this species was considered to be just a variety

of *P. atlantica*. Although *P. solitaria* is very similar to *P. atlantica* and to *P. sedentaria* it is "easily distinguished from *P. atlantica* by the shape of the carpus of pereopod 5, and from *P. sedentaria* by the much larger length ratio of the 7th pereon segment to the 1st pleon segment" (Shih, 1969: 17).

Distribution. A relatively rare species known from widely separated records mainly in tropical regions. First recorded from Australian waters by Young & Anderson (1987).

PHROSINIDAE

Anchylomera Milne Edwards, 1830

Remarks. This distinctive genus is considered to be monotypic.

Anchylomera blossevillei Milne Edwards

Anchylomera blossevillei Milne-Edwards, 1830: 394.
Anchylomera hunterii Milne-Edwards, 1830: 394.
Hieraconyx abbreviatus Guérin-Méneville, 1836: 5, pl.17 fig.2,2a-f.
Cheiropristis messanensis Natale, 1850: 8, pl.1 fig.2.
Anchylomera purpurea Dana, 1853: 1001, pl.68 fig.9a-m.
Anchylomera thyropoda Dana, 1853: 1004, pl.68 fig.10.
Anchylomera antipodes Bate, 1862: 322-323, pl.51, figs 9,10.

Material examined. 457 females (3.0-8.3 mm), 235 males (6.5-9.1 mm) from stations JP 71-2 (AM P39812 - 13 f, 1 m); JP 71-3 (AM P39813 - 415 f, 212 m; SAM C4215 - 20 f, 20 m); JP 71-4 (AM P39814 - 1 f); JP 71-8 (AM P39815 - 1 f) and JP 72-23 (AM P39816 - 7 f, 2 m).

Diagnosis. Head globular. Pereonites 1 and 2 fused. Pereopods 3 and 4 subchelate. Pereopod 5 longer than any other pereopod with very broad articles; article 5, distal margin with short, rounded teeth forming perfect folding hand with article 6. Pereopod 6 prehensile with dilated article 5. Pereopod 7 reduced to basis and at least 2 additional articles, sometimes complete.

Remarks. This was the most abundant species of Hyperiidae in the collections. Many of the females were ovigerous, usually at about 7.0 mm (JP 71-2, 71-3, 71-4).

Distribution. A common, cosmopolitan species favouring tropical and temperate regions. Previous records from Australian waters are by Dakin & Colefax (1940), Sheard (1965), Stebbing (1888), Watson & Chaloupka (1982), Young & Anderson (1987) and Zeidler (1978).

Phrosina Risso, 1822

Remarks. This distinctive genus is considered to be monotypic.

Phrosina semilunata Risso

Phrosina semilunata Risso, 1822: 245.
Dactylocera nicaeensis Milne Edwards, 1830: 393.
Phrosina longispina Bate, 1862: 320-321, pl.51 fig.7.
Phrosina pacifica Stebbing, 1888: 1430.
Phrosina australis Stebbing, 1888: 1431.

Material examined. 76 females (4.0-22.4 mm), 6 males (6.3-6.7 mm) from stations JP 71-2 (AM P39817 - 3 f, 2 m); JP 71-3 (AM P39818 - 36 f, 1 m; SAM C4216 - 10 f, 1 m); JP 71-4 (AM P39819 - 1 f); JP 71-8 (AM P39820 - 12 f, 2 m); JP 72-23 (AM P39821 - 10 f); JP 77-19 (AM P39822 - 3 f) and JP 89-7 (AM P39507 - 1 f).

Diagnosis. Head produced into 2 sharp, triangular, rostral points. Pereonites 1 and 2 fused. Pereopods 3 and 4 subchelate with large tooth-like carpal processes. Pereopod 5 broader and longer than any other pereopod; article 5, anterodistal margin with large tooth-like processes forming folding hand with article 6; article 6, dactyl-like, much longer than article 5. Pereopod 6 similar but much smaller than pereopod 5. Pereopod 7 reduced to broad basis and sometimes 1 additional, tiny article.

Remarks. About 16 ovigerous females (at an early stage), all around 18 mm in length, were captured in March (JP 71-3, 71-4).

Distribution. A common, cosmopolitan species favouring tropical and temperate regions. Previous records from Australian waters are by Guiler (1952), Sheard (1965), Stebbing (1888), Watson & Chaloupka (1982), Young & Anderson (1987) and Zeidler (1978).

Primno Guérin-Méneville, 1836

Remarks. This genus has been revised by Bowman (1978) who recognised four species previously lumped as *P. macropa* Guérin-Méneville, 1836. Two additional species have since been recognised, one by Bowman (1985) and the other by Sheader (1986).

Primno latreillei Stebbing

Primno latreillei Stebbing, 1888: 1445-1447, pl.179A.

Material examined. 60 females (3.4-10.0 mm), 8 males

(3.8-6.2 mm) from stations JP 71-2 (AM P39823 - 11 f, 2 m); JP 71-3 (AM P39824 - 1 f); JP 71-7 (AM P39825 - 11 f, 2 m); JP 71-8 (AM P39826 - 20 f, 2 m; SAM C4217 - 5 f, 1 m); JP 72-23 (AM P39827 - 11 f, 1 m) and JP 89-2 (AM P39828 - 1 f).

Diagnosis. Head with short, pointed rostrum. Pereopod 5, article 2 almost 3 times as long as broad; article 5 with longer teeth on anterior margin nearly as long as article is wide, proximal tooth long. Pereopod 6, article 6 with smooth margins.

Remarks. The present material agrees with the description and figures given for *P. latreillei* by Stebbing (1888) and Bowman (1978) particularly in the shape of article 2 of pereopod 7. However, there is considerable variation in the relative length of article 2 of pereopod 7 compared to the remaining articles combined, ranging from slightly longer to about twice as long. This brings the specimens within the morphological range of the closely related species, *P. johnsoni* Bowman, 1978 which, at least in Australian waters, is probably synonymous with *P. latreillei*. Vinogradov *et al.* (1982) regard *P. johnsoni* as a junior synonym of *P. latreillei*.

Ten ovigerous females ranging in size from 4.6-10.0 mm were captured in March (JP 71-2, 71-7, 71-8) and August (JP 72-23).

Distribution. Difficult to ascertain due to past confusion with *P. macropa* but Bowman (1978) records it from the central North Pacific, south-east Gulf of Guinea, eastern Mediterranean and the Red Sea. Previous records from Australian waters are by Barnard (1931), Dakin & Colefax (1940), Guiler (1952 – as *Euprimno macropus*), Sheard (1965 – as *P. macropus*), Stebbing (1888), Watson & Chaloupka (1982), Young & Anderson (1987 – as *P. johnsoni*) and Zeidler (1978 – as *P. macropa*).

PRONOIDAE

Eupronoe Claus, 1879

Remarks. Species of *Eupronoe* are difficult to identify with certainty and the genus is in need of revision. Vinogradov *et al.* (1982) recognise four species and provide useful illustrations and a key (in Russian). However, they have not recognised *E. intermedia* Stebbing, 1888 as a species separate from *E. armata* Claus, 1879 (Tashiro, 1978).

Eupronoe armata Claus

Fig.15A

?*Pronoe brunnea* Dana, 1853: 1015, pl.69 fig.5.

Eupronoe armata Claus, 1879b: 28.

Eupronoe serrata Claus, 1887: 52, pl.14 figs 1-6 (plate captioned *E. armata*).

Material examined. 1 male (7.6 mm) from station JP 71-3 (AM P39829).

Diagnosis. Head, round in female, produced in male but with rounded tip. Body with dorsoventral, cuticular striations. Gnathopod 1, weakly subchelate; article 4 expanded distally, slightly wider than article 5· article 5 with rounded posterior margin, narrower distally than proximally (more expanded in male). Gnathopod 2 chelate; articles 4 and 5 about equal in width; carpal process rounded, extended one half to two thirds length article 6. Pereopod 5, article 2 with anterior margin slightly concave for distal two thirds. Pereopod 7, terminal article circular, about as wide as long.

Remarks. The present specimen agrees with the figures given for this species by Claus (1887). Judging from the available literature, females differ slightly from males in that article 5 of gnathopod 2 is much narrower proximally (e.g., Vinogradov *et al.*, 1982). This sexual dimorphism and the lack of adequate illustrations in the literature has led to past misidentifications. The record of *E. armata* by both Young & Anderson (1987) and Zeidler (1978) is probably *E. minuta* Claus, 1879 and is here discussed under that species.

Distribution. Reported from widely separated areas in the tropical and warm temperate Atlantic and Indian oceans (Tashiro, 1978). Previous records from Australia have been misidentifications.

Eupronoe intermedia Stebbing

Fig.15B,C

Eupronoe intermedia Stebbing, 1888: 1517-1519, pl.188.

Material examined. 5 females (4.4-4.8 mm), 6 males (4.2-5.3 mm) from stations JP 72-23 (AM P39830 - 3 f, 3 m; SAM C4218 - 1 f, 1 m); JP 89-3 (AM P39831 - 1 m); F19 (AM P39501 - 1 m) and F34 (AM P39505 - 1 f).

Diagnosis. Like *E. armata* except as follows. Head of female and male more pointed, ending in small beak. Gnathopod 2, article 5 slightly wider and longer. Pereopod 5, article 2 with anterior margin convex in females and straight or only slightly concave in males. Pereopod 7, terminal article oval, at least twice as long as wide.

Remarks. Tashiro (1978) demonstrated that, although closely related to *E. armata*, this is a distinct species. It is most readily distinguished from *E. armata* by the more pointed head which ends in a small beak and by

the elongate terminal segment of pereopod 7 (semicircular in *E. armata*). The male gnathopods agree with the illustrations given by Stebbing (1888) with article 5 of gnathopod 1 approaching that of *E. maculata* Claus, 1879. The female gnathopods are very similar to *E. armata*. As with the previous species a failure to appreciate the sexual dimorphism, combined with a lack of adequate illustrations in the literature, has led to past misidentifications.

This is the first time that this species has been recognised from Australian waters although I have re-examined the specimens identified as *E. maculata* by Zeidler (1978) and have concluded that they represent *E. intermedia*. The specimen of *E. maculata* illustrated

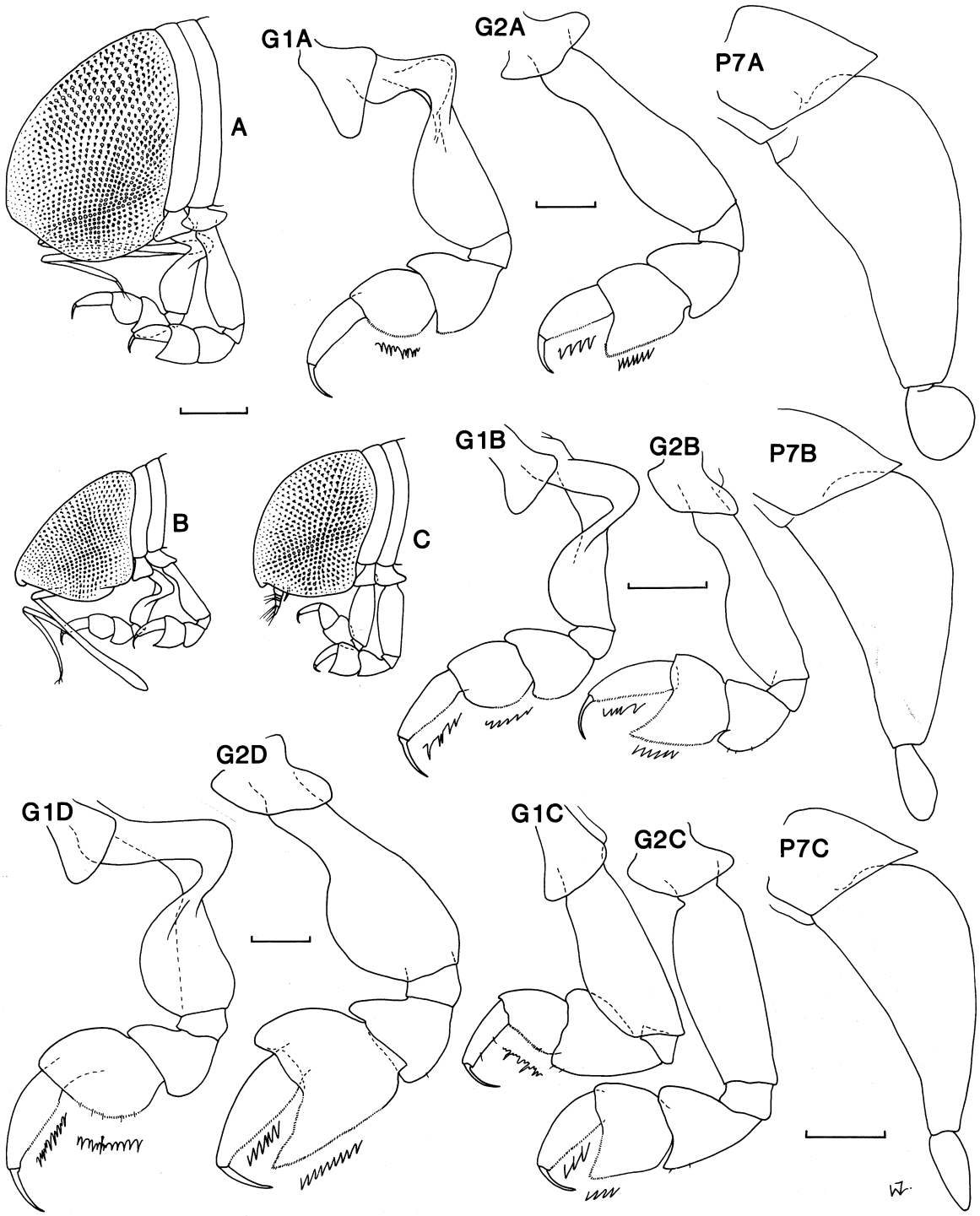

Fig.15. *Eupronoe* species. A, *E. armata* Claus, male 7.6 mm; B, *E. intermedia* Stebbing, male 5.3 mm from station JP 72-23; C, *E. intermedia*, female 4.8 mm from station JP 72-23; D, *E. maculata* Claus, male 9.7 mm (scales = 0.5 mm, 0.2 mm).

by Dakin & Colefax (1940) is also most likely this species.

One female from station F34 (May) was ovigerous.

Distribution. Tropical and warm temperate regions of the Atlantic Ocean, off South Africa and the Caribbean Sea (Tashiro, 1978).

Eupronoe maculata Claus

Fig.15D

Eupronoe maculata Claus, 1879b: 28.
Eupronoe inscripta Stebbing, 1888: 1510-1513, pl.187.

Material examined. 1 male (9.7 mm) from station JP 71-2 (AM P39832).

Diagnosis. Head, round in female, produced in male but with rounded tip. Body with dorsoventral, cuticular striations. Gnathopod 1 subchelate; article 4 expanded distally, distinctly narrower than article 5; article 5 expanded distally with relatively straight distal margin (slightly sloping with rounded posterodistal corner in male). Gnathopod 2 chelate; article 4 narrower than article 5; article 5 with anterodistal corner raised above, and slightly overlapping, article 6; carpal process almost as long as article 6. Pereopod 5, article 2 with convex anterior margin. Pereopod 7, terminal article oval, about twice as long as wide, sometimes slightly pointed terminally.

Remarks. The present specimen differs slightly from the illustrations given for this species by Claus (1887) in that the posterodistal process of article 5 of gnathopod 1 is more rounded, similar to that found in *E. armata* or *E. intermedia*. In females this process is usually more angular as illustrated by Bowman & Gruner (1973) and Vinogradov *et al.* (1982). *Eupronoe maculata* is best distinguished from the closely related species *E. intermedia* by gnathopod 1 in which article 5 is wider than article 4 and by gnathopod 2 in which the anterodistal process of article 5 extends almost to the limit of article 6.

Distribution. A relatively common species recorded from tropical and temperate regions. Previous records from Australia have been misidentifications (Dakin & Colefax, 1940; Zeidler, 1978) or the identification cannot be confirmed (Barnard, 1931; Sheard, 1965; Watson & Chaloupka, 1982).

Eupronoe minuta Claus

Fig.16

Eupronoe minuta Claus, 1879b: 28-29.
Eupronoe macrocephalata Bovallius, 1887: 41.
Eupronoe ornata Bovallius, 1887: 41.
Eupronoe pacifica Stebbing, 1888: 1513-1516.
Eupronoe atlantica Stebbing, 1888: 1519-1521.

Material examined. 1 ovigerous female (6.8 mm), 1 male (3.7 mm) from stations JP 71-4 (AM P39833 - 1 f) and F43 (AM P39834 - 1 m).

Diagnosis. Head of females large, rounded, as long as pereon; of males slightly pointed and smaller, as long as first 5 or 6 pereonites. Body with small semicircular cuticular markings. Gnathopod 1, article 4 expanded distally with small anterodistal and posterodistal lobe (larger in females) partly overlapping article 5; article 5 narrower than article 4 with small bulge on anterior margin and larger bulge on posterior margin (more distally in females) and straight distal margin. Gnathopod 2 chelate, article 4 similar to gnathopod 1 (especially of males); article 5 slightly wider than article 4, with anterodistal corner produced anteriorly to article 6, carpal process almost as long as article 6.

Remarks. The present specimen agrees with the figures given for the females of this species by Stephensen (1925) and Vinogradov *et al.* (1982). However, the gnathopods, particularly gnathopod 1, are quite unlike those illustrated for males of this species by Claus (1887), Chevreux & Fage (1925) and Stephensen (1925). According to Thurston (1976) large males agree with the illustrations of Claus but smaller specimens have gnathopod 1 closer to Stephensen's ?*E. minuta* (fig.56). Females on the other hand have gnathopod 1 more like the males when small, but become more like that illustrated here as the animal gets larger. However, I find it difficult to accept that in females article 5 of gnathopod 1 should become relatively smaller in size with growth. Whether or not those allometric changes actually take place cannot be determined here and require the examination of a large series of specimens, preferably from the same locality. If intermediate forms do not exist then the specimens as illustrated here may represent a species other than *E. minuta*.

I have re-examined the material identified as *E. armata* by Zeidler (1978) and all of the specimens agree with the illustrations of either Claus or Stephensen's ?*E. minuta*. The specimen of *E. armata* illustrated by Young & Anderson (1987) is like the present one and for the moment must be referred to *E. minuta*.

Eupronoe minuta is the only species of the genus with small semicircular sculpture markings on the body; the other four currently recognised species have quite distinct dorsoventral striations on the body and sometimes also on parts of the pereopods (Tashiro, 1978; Zeidler, 1978).

Distribution. Widely distributed in tropical and temperate regions. It is a new record for Australian waters although Stebbing (1888) recorded some specimens similar to *E. atlantica* (= *E. minuta*) from south of

Australia and Tranter (1977) recorded it from the north-eastern part of the Indian Ocean off Western Australia.

Parapronoe Claus, 1879

Remarks. This genus is in need of revision although the four currently recognised species (Vinogradov *et al.*, 1982) are more easily distinguished than species of *Eupronoe*.

Parapronoe campbelli Stebbing

Fig.17

Parapronoe campbelli Stebbing, 1888: 1522-1526, pl.189.

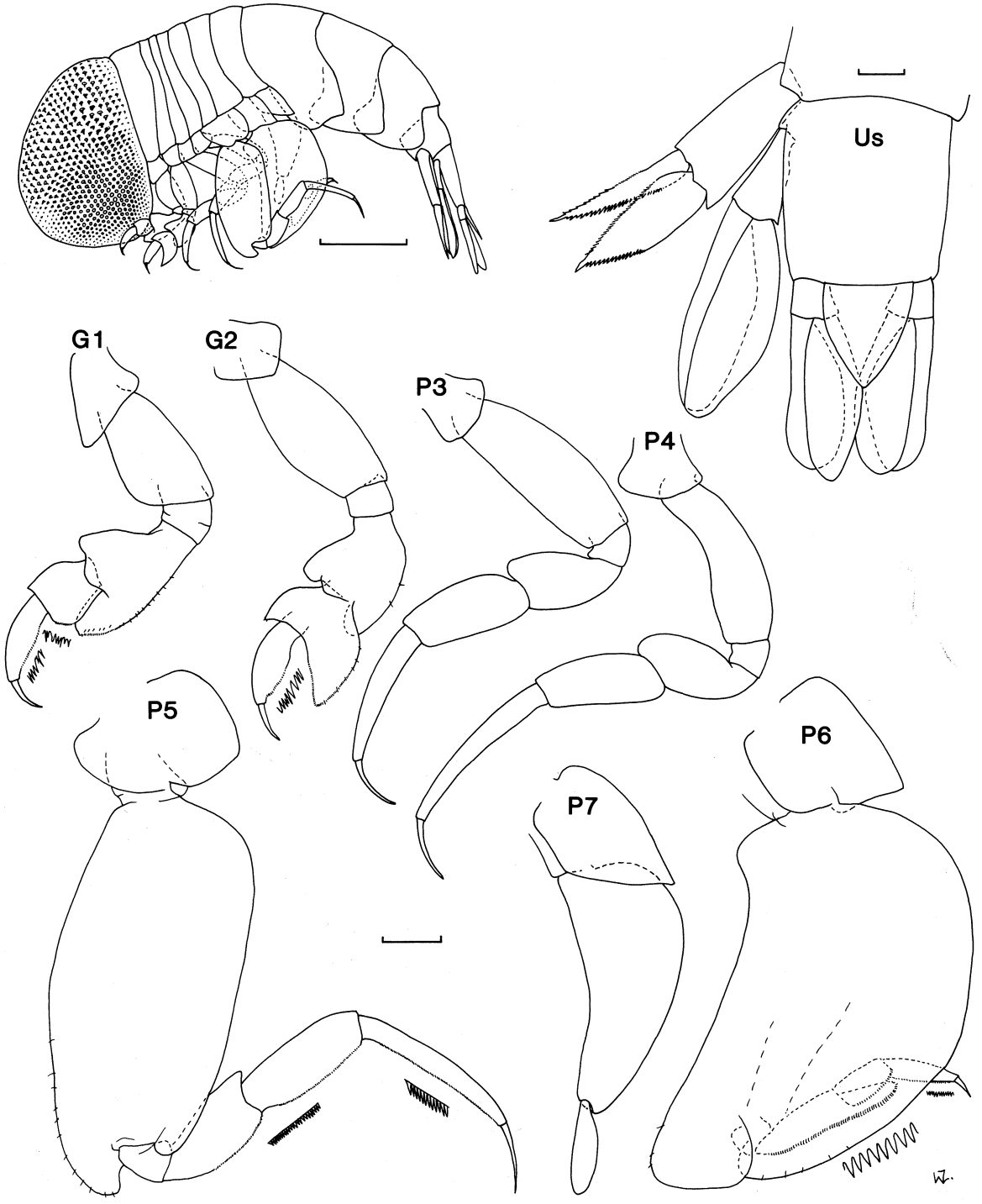

Fig.16. *Eupronoe minuta* Claus, female 6.8 mm (scales = 1.0 mm, 0.2 mm).

Material examined. 18 females (6.0-11.5 mm), 9 males (6.0-11.3 mm) from stations JP 71-2 (AM P39835 - 2 f, 2 m); JP 71-3 (AM P39836 - 6 f, 4 m; SAM C4219 - 2 f, 2 m); JP 71-4 (AM P39837 - 1 f); JP 71-7 (AM P39838 - 1 f); JP 71-8 (AM P39839 - 4 f); JP 72-23 (AM P39840 - 1 f, 1 m) and F33 (AM P39841 - 1 f).

Diagnosis. Head produced into rounded point in both sexes. Body with longitudinal cuticular pits or ridges. Epimeral plate 1 without posterodistal excavation. Gnathopod 1, article 5 with slightly convex posterior margin. Gnathopod 2, carpal process pointed, slightly longer than article 6. Pereopod 5, article 2 more than twice as long as wide. Uropod 3 rami lanceolate. Telson subequal in length to uropod 3, about three quarters length double urosomite.

Remarks. This species resembles *P. crustulum* and

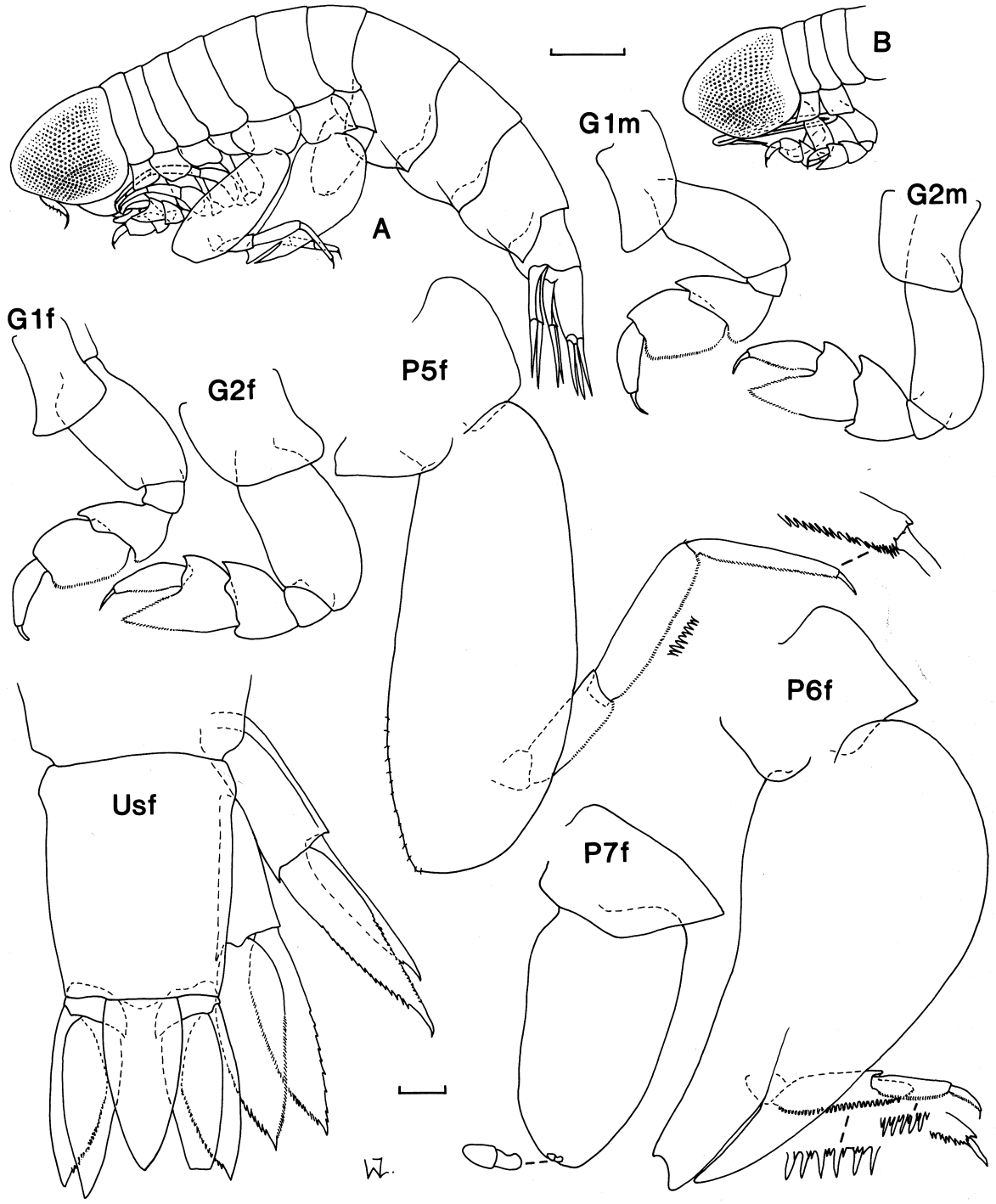

Fig.17. *Parapronoe campbelli* Stebbing, from station JP 71-3. A, female 10.7 mm; B, male 9.8 mm (scales = 1.0 mm, 0.2 mm).

in the past has been synonymised with it (e.g., Shoemaker, 1945). However, it is easily distinguished from all its congeners by the body markings which consist of longitudinal pits or ridges (circular in other species), the relatively more narrow second articles of pereopods 5 and 6 and in the females the head is not rounded but is pointed as in males. In addition, *P. crustulum* has a distinctive posterodistal excavation on the first epimeral plate (Fig.18), a feature which is not found in *P. campbelli*. The material illustrated by Young & Anderson (1987) as *P. crustulum* is regarded as a misidentification and represents this species.

This was the most abundant species of Pronoidae in the collections. Two ovigerous females (10.8 and 10.0 mm) were captured in March (JP 71-4 and 71-8).

Distribution. Difficult to ascertain due to past confusion with *P. crustulum* but it is probably widely distributed in tropical and temperate regions. It is a new record for Australian waters, although Tranter (1977) recorded it from the north-eastern part of the Indian Ocean off Western Australia.

Parapronoe crustulum Claus

Fig.18

Parapronoe crustulum Claus, 1879b: 31.
Parapronoe atlantica Bovallius, 1887: 42.
Parapronoe clausi Stebbing, 1888: 1526-1529, pl.190.
Parapronoe clausoides Stebbing, 1888: 1529-1530, pl.191.
Parapronoe similis Spandl, 1927: 219-220, fig.38.
Parapronoe stebbingi Spandl, 1927: 220-221, fig.39.

Material examined. 8 females (6.3-21.8 mm) from stations JP 71-2 (AM P39842 - 1 f); JP 71-4 (AM P39843 - 2 f); JP 71-7 (AM P39844 - 2 f; SAM C4220 - 1 f); JP 71-8 (AM P39845 - 1 f) and JP 77-18 (AM P39846 - 1 f).

Diagnosis. Head produced in males, more rounded in females. Body with circular, cuticular markings. Epimeral plate 1 with distinct posterodistal excavation. Gnathopod 1, article 5 with slightly concave posterior margin for distal half. Gnathopod 2, carpal process pointed, slightly longer than article 6. Pereopod 5, article 2 less than twice as long as wide. Uropod 3 rami lanceolate. Telson subequal in length to uropod 3, one half to two thirds length double urosomite.

Remarks. A distinctive character of this species is the concave posterior margin of article 5 of gnathopod 1, a feature particularly prominent in adults. In smaller specimens (e.g., AM P39842) this article has more convex margins and resembles *P. campbelli*. This character, often used in the past to separate the two species, is therefore unreliable. So too is the relative length of the telson to the double urosomite which in the present specimens is similar to that found in *P. campbelli* (about two thirds), whereas the illustrations of both Claus (1887) and Stebbing (1888) indicate a ratio of about one half.

Four ovigerous females (16.5-21.8 mm) were captured in March (JP 71.4, JP 71.7).

Distribution. A relatively uncommon species widely distributed in tropical and temperate regions. Previous records from Australian waters are by

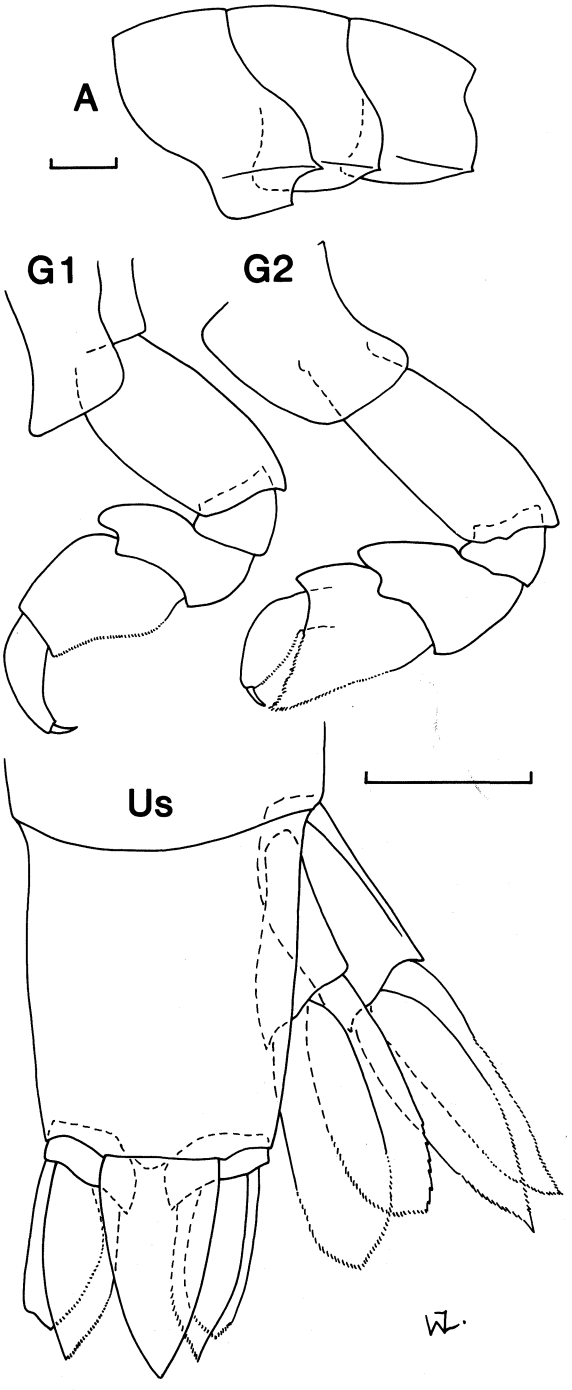

Fig.18. *Parapronoe crustulum* Claus, female 17.0 mm from station JP 71-8. A, lateral view of epimeral plates 1-3 (scales = 1.0 mm).

Guiler (1952) and Stebbing (1888 - as *P. clausi* and *P. clausoides*).

Parapronoe parva Claus

Parapronoe parva Claus, 1879b: 31.
Sympronoe parva Stebbing, 1888: 1533-1537, pl.192.
Sympronoe propinqua Stebbing, 1888: 1537, pl.193B.
Sympronoe var. *7-articulata* Stephensen, 1925: 162-163, figs 59-60.
Sympronoe anomala Shoemaker, 1925: 42-45, figs 14-15.
Sympronoe parva septemarticulata Pirlot, 1930: 33.

Material examined. 1 male (4.9 mm) from station JP 71-3 (AM P39847).

Diagnosis. Head produced in males, more rounded in females. Body with circular, cuticular markings. Epimeral plate 1 with small posterodistal excavation. Gnathopod 1, article 5 with straight or marginally concave posterior margin. Gnathopod 2, carpal process round, about half length article 6. Pereopod 5, article 2 less than twice as long as wide. Uropod 3, endopod oval-shaped, exopod bluntly pointed. Telson length about half uropod 3, about one quarter length double urosomite.

Remarks. This species is easily recognised by the form of the gnathopods and urosome. Stebbing (1888) erected the genus *Sympronoe* for this species and one other that he described as new at the time (now synonymous with *P. parva*). However, Semenova (1981), in describing a new species of *Parapronoe* (*P. elongata*) which had features in common with *Sympronoe*, concluded that the generic status of *Sympronoe* (considered monotypic) could not be maintained.

Distribution. Widely distributed in tropical and temperate regions. Previous records from Australian waters are by Barnard (1931), Young & Anderson (1987) and Zeidler (1978).

Pronoe Guérin-Méneville, 1836

Remarks. This relatively distinctive genus is considered to be monotypic.

Pronoe capito Guérin-Méneville

Pronoe capito Guérin-Méneville, 1836: 7, pl.17 fig.3.

Material examined. 1 female (12.4 mm) from station JP 71-3 (AM P39848), 1 male (11.6 mm) from station JP 71-2 (AM P39849).

Diagnosis. Antenna 2 of male short, folded only once or twice, unlike other Pronoidae. Gnathopods 1 and 2 simple with relatively broad articles, especially article 2 of gnathopod 1. Pereopod 5, article 2 not especially broad. Pereopod 6, article 2 oval, width about three quarters length. Uropods 2 and 3, endopod with rounded tip. Telson length about one third uropod 3.

Remarks. This species is easily distinguished by the gnathopods and by the unique structure of the second antennae of males.

Distribution. A relatively rare species, recorded mainly from tropical regions. It was first recorded from Australian waters by Young & Anderson (1987).

BRACHYSCELIDAE

Brachyscelus Bate, 1861

Remarks. This genus is in a state of considerable taxonomic confusion and a revision is long overdue. According to Madin & Harbison (1977) at least 17 species of *Brachyscelus* have been described but of these Vinogradov *et al.* (1982) recognise only four as valid. However, based on the present collection and published literature, I believe that *Brachyscelus* consists of at least five valid species. In trying to determine the specimens in the present collection I found it necessary to develop the following key which may be useful to others until a thorough revision of the genus is undertaken.

Key to the Species of *Brachyscelus*

1. Head round in males (like female); gnathopod 1, article 5 with anterodistal corner developed into feeble lobe; telson as long as wide 2

—— Head pointed in males; gnathopod 1, article 5 with anterodistal corner developed into distinct lobe partly overlapping article 6 (especially in mature specimens); telson longer than wide 3

2. Head length equivalent to first five segments of pereon or less; pereopod 6, anterior lobe article 2 with rounded distal margin; telson about as long as double urosomite ..... *B. globiceps* Claus

—— Head as long as pereon; pereopod 6, anterior lobe article 2 pointed; telson length about two thirds double urosomite ..... *B. macrocephalus* Stephensen

3. Pereopod 6, anterior lobe article 2 reaching well beyond article 3 with straight distal margin; double urosomite about as broad as long; uropod 3 with broad rami, particularly endopod ..... *B. crusculum* Bate

—— Pereopod 6, anterior lobe article 2 only reaching middle or limit of article 3 with round distal margin; double urosomite distinctly broader than long; uropod 3 with rami not especially broad 4

4. Gnathopods, article 5 with single row of large teeth; pereopod 7, articles 3-7 together equal in length to article 2; uropod 3, endopod slightly excised distally (as in *B. crusculum*); male antenna 2, article 5 very short ..... *B. rapax* Claus

—— Gnathopods, article 5 with large teeth interspersed with smaller ones; pereopod 7, articles 3-7 together shorter than article 2; uropod 3, endopod tapers gradually; male antenna 2, article 5 about half as long as article 4 ..... *B. rapacoides* Stephensen

Brachyscelus crusculum Bate

Fig.19

?*Orio zancleus* Natale, 1850: 12.
Brachyscelus crusculum Bate, 1861: 7-10, pl.2 figs 1-2.
Thamyris antipodes Bate, 1862: 335, pl.50 fig.4.
?*Thamyris lycaeoides* Claus, 1887: 60, pl.21 figs 1-2.
?*Thamyris mediterranea* Claus, 1887: 60, pl.15 figs 11-18.
Brachyscelus acuticaudatus Stebbing, 1888: 1555-1556, pl.197C.
Brachyscelus stebbingi Boone, 1935: 226-230, pls 67,68.

Material examined. 139 females (6.0-20.0 mm), 112 males (4.9-17.1 mm) from stations JP 71-2 (AM P39850 - 3 f, 3 m); JP 71-3 (AM P39851 - 94 f, 62 m; SAM C4221 - 20 f, 20 m); JP 71-4 (AM P39852 - 2 f, 5 m); JP 71-8 (AM P39853 - 4 f, 3 m); JP 72-23 (AM P39854 - 15 f, 8 m); JP 77-18 (AM P39855 - 1 f) and F19 (AM P39856 - 1 m).

Diagnosis. Head globular in females produced to rounded point in males. Antenna 2 of males, length terminal article slightly less than one third preceding article. Gnathopod 1, article 5 with anterodistal corner developed into lobe, partly overlapping article 6. Gnathopods 1 and 2, carpal process with large teeth with small serrations on margins. Pereopod 5, article 2, width almost twice length, with small anterodistal lobe partly overlapping article 3. Pereopod 6, article 2 with anterodistal lobe produced well beyond article 3, with straight distal margin. Double urosomite about as broad as long. Telson much longer than wide.

Remarks. In this species the head of males is pointed while that of females is rounded. However, recently moulted males, recognised by the antennae which are not fully developed, have a rounded head which becomes pointed later. Also the antennal pocket of the first gnathopods is not very noticeable in freshly moulted specimens but becomes deeper as the second antennae develop and the head becomes more pointed. These morphological changes during moulting and growth have probably contributed to past misidentifications of this and other species of *Brachyscelus*. Distinctive features of *B. crusculum* are: the shape of article 2, pereopod 6 which has a large anterodistal lobe with a straight distal margin and a smaller posterior lobe both of which almost cover article 3; the double urosomite which is about as long as it is broad, and the very broad endopod of uropod 3 which is especially broad in larger specimens.

Twenty of the females were ovigerous; most were captured in March (JP 71-3, 71-4), two in August (JP 72-23) and one in December (JP 77-18).

Distribution. A very common species, widely

distributed in tropical and temperate regions. Previous records from Australian waters are by Dakin & Colefax (1940), Guiler (1952), Sheard (1965), Young & Anderson (1987) and Zeidler (1978).

Brachyscelus globiceps (Claus)

Fig.20

?*Daira inaequipes* Dana, 1853: 993, pl.68 fig.5a-c.
Thamyris globiceps Claus, 1879b: 36-37.
Brachyscelus latipes Stebbing, 1888: 1550-1552, pl.197B.
Brachyscelus bovallii Stebbing, 1888: 1553-1555, pl.197A.

Material examined. 1 male (8.0 mm) from station JP 71-2 (AM P39857).

Diagnosis. Head globular in both sexes. Antenna 2 of males, length terminal article about one quarter preceding article. Gnathopod 1, article 5 with anterodistal corner developed into feeble lobe. Gnathopods 1 and 2, carpal process with large teeth with row of serrations or small teeth on margins. Pereopod 5, article 2, width two thirds length, without anterodistal lobe. Pereopod 6, article 3, with evenly rounded distal margin. Double urosomite, length about two thirds width. Telson about as long as wide.

Remarks. In this species the head of males is rounded like that of the females. It is very similar to *B. crusculum* but is most easily distinguished from it by the anterior lobe of article 2, pereopod 6 which is rounded and without a posterior lobe, and the double urosomite which is distinctly broader than long.

Distribution. A relatively rare species known from a few isolated records from the Arabian Sea (Barnard, 1937), Bermuda (Shoemaker, 1945), South West Africa (Barnard, 1932), Mediterranean (Stephensen, 1925), Zanzibar (Claus, 1879), Southern Pacific (Stebbing, 1888) and Great Barrier Reef (Barnard, 1931). The latter is the only previous record from Australian waters.

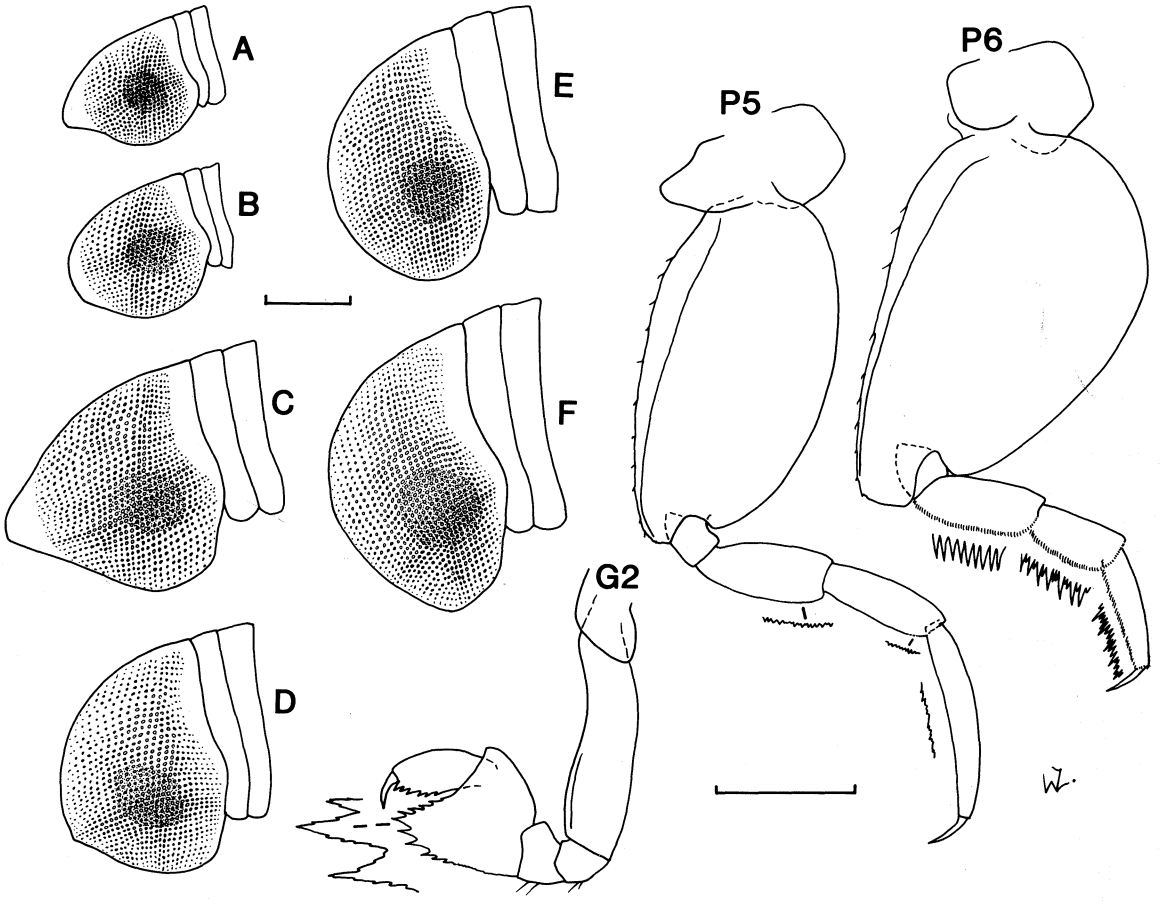

Fig.19. *Brachyscelus crusculum* Bate, variations in head shape. A, male 7.7 mm from station JP 72-23 with well-developed antennae; B, male 8.1 mm as above; C, male 17.0 mm from station JP 71-3 with well-developed antennae; D, male 11.9 mm from station JP 72-23, antenna with shortened and thickened articles (recently moulted); E, male 16.5 mm from station JP 71-3, antennae with shortened and thickened articles (recently moulted); F, female 16.8 mm from station JP 71-3. G2, P5, P6 from A (scales = 1.0 mm, 0.5 mm).

Brachyscelus rapacoides Stephensen

Fig.21

Brachyscelus rapacoides Stephensen, 1925: 179-180, figs 67-68.

Material examined. 1 male (5.9 mm) from station JP 72-23 (AM P39858).

Diagnosis. Head globular in females, produced to rounded point in males. Antenna 2 of males, length terminal article about half preceding article. Gnathopod 1, article 5 with anterodistal corner developed into distinct lobe, partly overlapping article 6. Gnathopods 1 and 2, carpal process with large teeth interspersed with 1 or 2 smaller teeth. Pereopod 5, article 2, width almost twice length, with very small anterodistal lobe. Pereopod 6, article 2 with anterodistal lobe produced to limit of

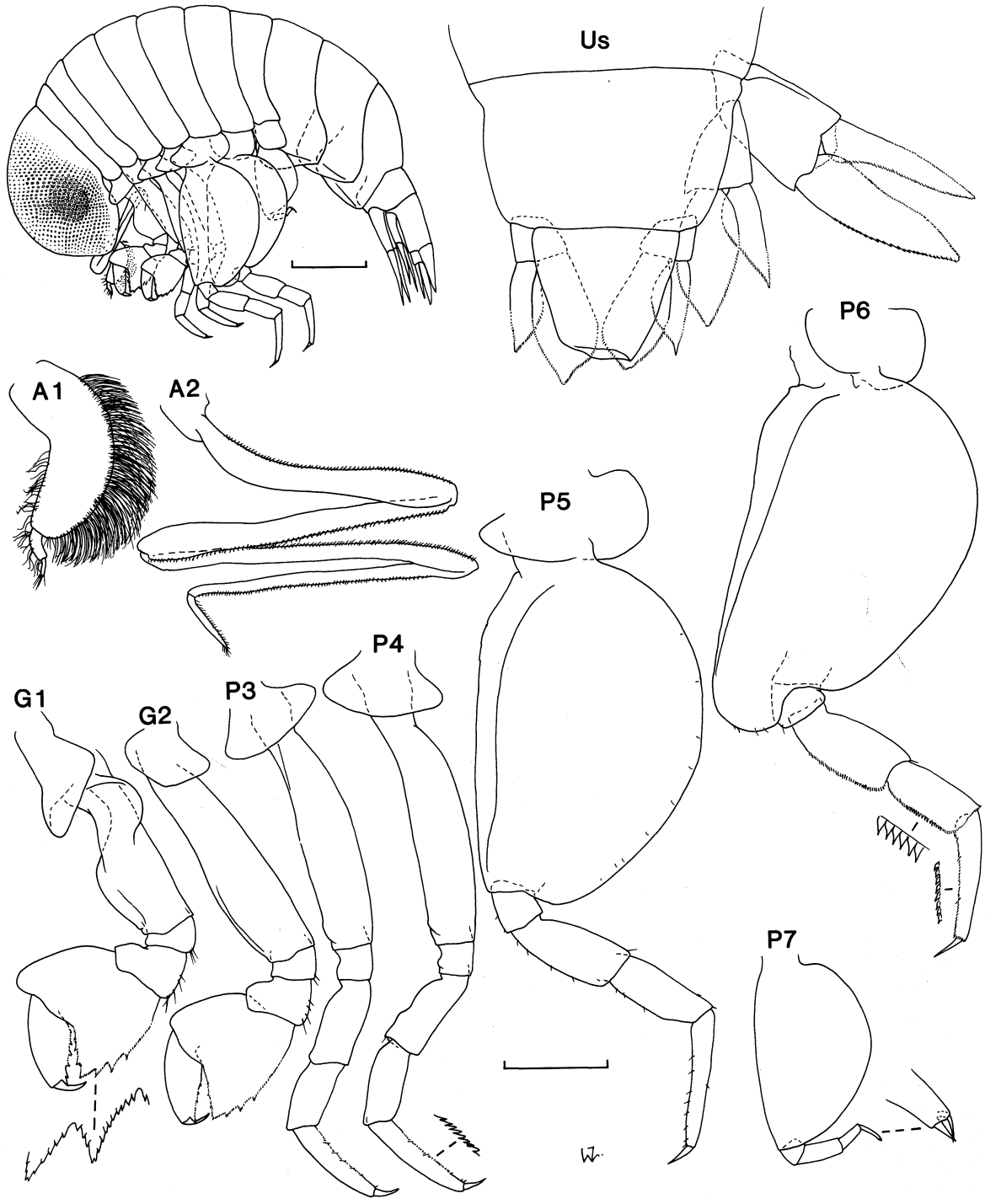

Fig.20. *Brachyscelus globiceps* (Claus), male 8.0 mm. A2 from right (scales = 1.0 mm, 0.5 mm).

article 3, with round, pointed distal margin. Double urosomite much wider than long. Telson much longer than wide.

Remarks. The present specimen agrees very well with the figures and description given for this species by Stephensen (1925). Vinogradov *et al.* (1982) consider it a synonym of *B. rapax* (Claus, 1879) but I believe that it is a valid species distinguished from *B. rapax* as illustrated by Claus (1887) by the following characters: i) male antenna 2, fifth article is about half as long as the fourth (very short in *B. rapax*); ii) gnathopod articles 5 and 6 have long teeth interspersed with one or two smaller ones (only serrations between large teeth in *B. rapax*); iii) pereopod 7, article 2 is much longer than remaining articles combined (about equal in *B. rapax*);

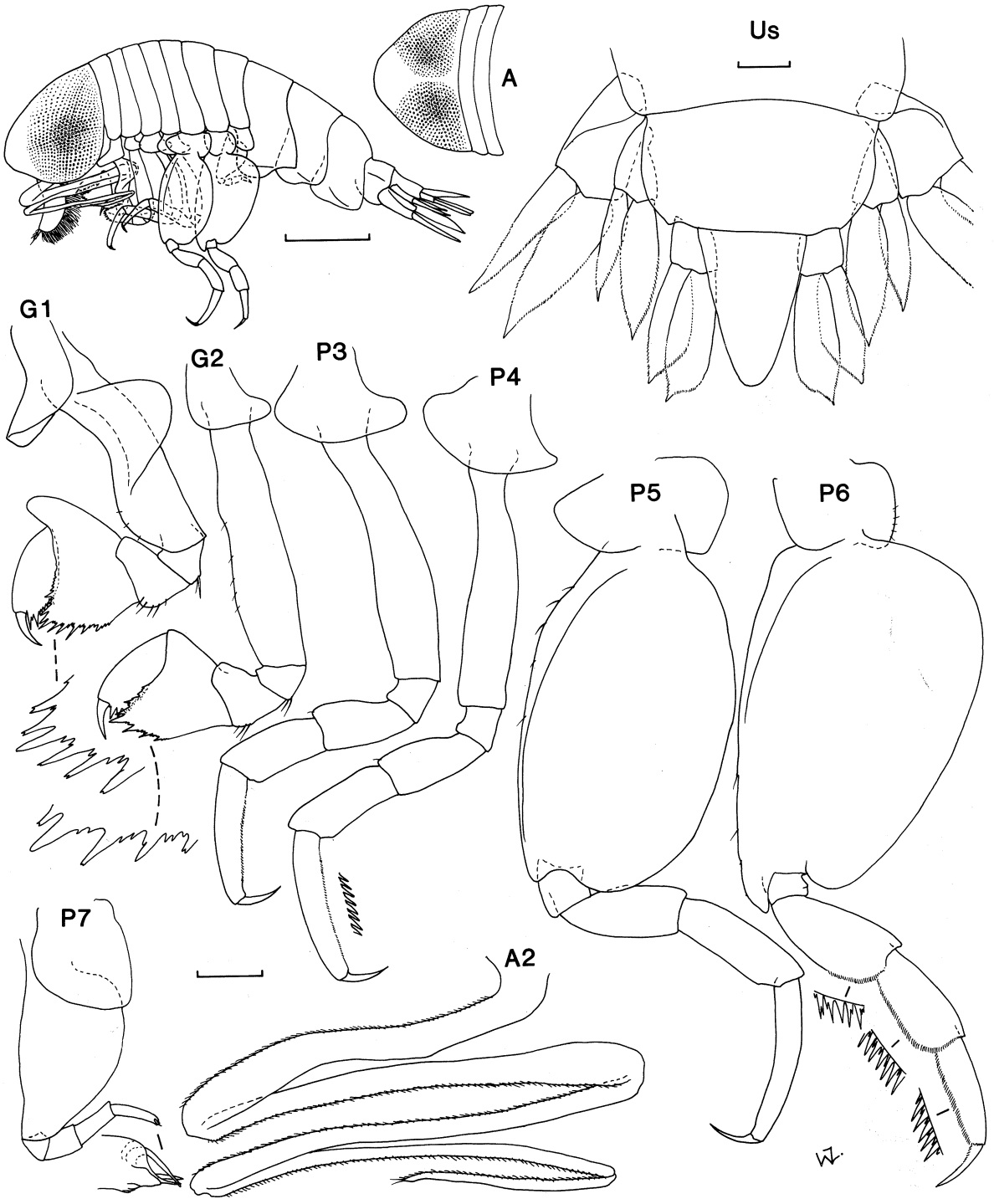

Fig.21. *Brachyscelus rapacoides* Stephensen, male 5.9 mm. A, dorsal view of head (scales = 1.0 mm, 0.2 mm).

and iv) telson is distinctly longer than wide (slightly longer than wide in *B. rapax*). The illustrations of *B. rapax* given by Vinogradov *et al.* (1982) appear to represent this species.

In the present specimen the eyes, when viewed dorsally, become widely separated anteriorly (Fig.21) unlike the previous two species in which the eyes are only separated by a narrow margin, almost to the tip of the rostrum. However, more material is required to determine whether or not this feature is of specific significance.

Distribution. Difficult to ascertain due to probably past misidentifications but according to Dick (1970) it is a rare species known from widely separated records in tropical and temperate regions. It is a new record for Australian waters although Vinogradov (1962) records it from south of Australia (45°26'S 125°52'E).

Euthamneus Bovallius, 1890

Remarks. This very distinctive genus is considered to be monotypic.

Euthamneus rostratus (Bovallius)

?*Daira debilis* Dana, 1853: 991, pl.68 fig.3.
Thamneus rostratus Bovallius, 1887: 31-32.
Thamneus platyrrhynchus Stebbing, 1888: 1558-1562, pl.198.
Thamneus recurvirostris Chevreux, 1900: 154-156, pl.18 fig.2.

Material examined. 2 females (3.9 and 7.9 mm), 1 male (7.1 mm) from station JP 72-23 (AM P39901).

Diagnosis. Head relatively small, with chisel-shaped rostrum. Body globular. Antenna 2, of males shorter than head, consisting of 4 articles arranged in zig-zag fashion. Pereopods 1-6 with numerous setae on distal articles. Gnathopods 1 and 2, carpal process with large teeth (like *Brachyscelus*). Pereopods 5 and 6, article 2 not markedly broadened. Telson slightly longer than wide, rounded terminally, distinctly shorter than uropod 3.

Remarks. This species is readily distinguished by the following suite of characters: the relatively small head with chisel-shaped rostrum; the dorsoventrally flattened globular body; the hexagonal markings on the surface of most appendages and the distinctive structure of the male second antenna. The second antenna of males is most unusual for Platysceloidea in that it consists of four shortened articles which are not folded under the head but arranged in a zig-zag fashion and together are much shorter than the head. In all other Platysceloidea, except Anapronoidae, at least some of the articles of the male second antenna are elongated and the entire appendage is neatly folded under the head and is much longer (often even when folded) than the head.

Whether or not this species should be placed in a separate family, based on the above characters, cannot be determined here but should it be warranted then Euthamneidae (Bovallius, 1890) should be resurrected.

Distribution. A relatively uncommon but widely distributed species known from records in tropical and temperate areas (Dick, 1970). The only previous record from Australian waters is by Stebbing (1888 – as *Thamneus platyrrhynchus*) from off Cape Howe (38°07'S 149°18'E).

LYCAEIDAE

Lycaea Dana, 1852

Remarks. This genus is in considerable taxonomic confusion and a thorough revision is needed to enable accurate specific determination. Harbison & Madin (1976) discuss some of the taxonomic difficulties and provide a provisional key to eight species. Of these, Vinogradov *et al.* (1982) recognise only three, but they regard one species, considered synonymous with *L. pulex* Marion, 1874 by Harbison & Madin (1976), as valid and include *Pseudolycaea pachypoda* Claus, 1879 and a new species described by Volkov.

Lycaea vincentii Stebbing

Lycaea vincentii Stebbing, 1888: 1563-1566, pl.199.

Material examined. 1 male (6.0 mm), 1 female (2.4 mm) from stations JP 71-8 (AM P39859 - 1 m) and JP 89-2 (AM P39860 - 1 f).

Diagnosis. Gnathopods 1 and 2, article 5 rectangular with sharp posterodistal projection; article 6, posterodistal corner produced below base of dactyl; articles 5 and 6 with small serrations on posterior and distal margins. Pereopods 3-6, dactyls relatively short, those of pereopods 3 and 4 one fifth to two fifths length article 6. Pereopod 7, article 2 length about 3 times articles 3-7 combined. Uropods 1 and 2, endopod not fused with peduncle. Uropod 1, exopod length slightly less than one third peduncle.

Remarks. In the past this species, like so many others, has been considered a synonym of *L. pulex*. However, Harbison (1976) and Harbison & Madin (1976) consider it a valid species. The present specimens are in agreement with the findings of these authors and with Stebbing's original description. They differ only in that article 6 of pereopod 5 has smooth margins as in *L. bovallioides* Stephensen, 1925 but the dactyl is very short, typical of *L. vincentii*.

Distribution. Common in tropical regions. Previous records from Australian waters are by Young & Anderson (1987) and Zeidler (1978).

OXYCEPHALIDAE

Calamorhynchus Streets, 1878

Remarks. This genus has been revised by Fage (1960) and is considered to be monotypic.

Calamorhynchus pellucidus Streets

Calamorhynchus pellucidus Streets, 1878: 285-286, pl.2 fig.5.
Calamorhynchus rigidus Stebbing, 1888: 1600-1602, pl.206.

Material examined. 1 female (15.0 mm) from station JP 71-2 (AM P39861).

Diagnosis. Head longer than pereon, produced into pointed rostrum, expanded into broad, lateral flanges. Gnathopods 1 and 2 chelate, articles 5 and 6 with serrations on posterior and distal margin. Pereopod 7 complete; article 2 slightly longer than articles 3-7 combined. Double urosomite more than 3 times as long as wide. Uropods with normal rami. Uropod 3 shorter than telson; endopod fused with peduncle.

Remarks. This species is easily recognised by the rostrum which is expanded into broad lateral flanges, a feature not found in any other species of Oxycephalidae.

Distribution. Although uncommon it is widely distributed in tropical and temperate regions. It was first recorded from Australian waters by Young & Anderson (1987).

Oxycephalus Milne Edwards, 1830

Remarks. This genus has been revised by Fage (1960), who recognised three species. To this should be added *P. longipes* Spandl, 1927. All four species were represented in the present collection. Vinogradov *et al.* (1982) provide the only satisfactory key to species.

Oxycephalus clausi Bovallius

?*Oxycephalus tuberculatus* Bate, 1862: 343, pl.54 fig.5.
Oxycephalus clausi Bovallius, 1887: 35-36.
Oxycephalus erythraeus Cecchini, 1929: 482-483, pl.2.
Oxycephalus mancinii Cecchini, 1929: 483-484, pl.3.

Material examined. 52 females (12.8-32.4 mm), 39 males (9.0-25.2 mm) from stations JP 71-2 (AM P39862 - 9 f, 10 m); JP 71-3 (AM P39863 - 14 f, 5 m; SAM C4222 - 5 f, 5 m); JP 71-4 (AM P39864 - 1 m); JP 71-7 (AM P39865 - 2 f); JP 71-8 (AM P39866 - 5 f, 9 m) and JP 72-23 (AM P39867 - 17 f, 9 m).

Diagnosis. Head a little longer than first 5 pereonites. Epimeral plates with sharp, medial spine on distal margin in addition to posterodistal corner. Gnathopods 1 and 2, article 5, anterodistal corner produced into sharp point, above article 6; carpal process and posterior margin of article 6 with irregular serrations. Pereopod 7, article 2 subovate, about as wide a long; distinctly longer than articles 3-7 combined. Double urosomite only slightly longer than wide. Telson slightly longer than uropod 3.

Remarks. *Oxycephalus clausi* is most readily distinguished from its congeners by the shape of the gnathopods and by the medial spine on the distal margin of the epimeral plates (in addition to posterodistal corner).

Two ovigerous females were captured in August (JP 72-23).

Distribution. A relatively common species widely distributed in tropical and temperate regions. Previous records from Australian waters are by Barnard (1931), Dakin & Colefax (1940), Sheard (1965), Young & Anderson (1987) and Zeidler (1978).

Oxycephalus latirostris Claus

Oxycephalus latirostris Claus, 1879b: 47.
Oxycephalus pectinatus Bovallius, 1887: 36.
Oxycephalus notabilis Spandl, 1924: 32.

Material examined. 1 male (16.5 mm) from station JP 71-8 (AM P39868).

Diagnosis. Head slightly shorter than pereon. Gnathopods 1 and 2, carpal process and article 6, cutting edges with separate row of closely packed, sharp spines. Pereopod 7, article 2 rhomboid, about as wide as long, slightly shorter than articles 3-7 combined. Double urosomite, width about three fifths length. Telson slightly longer than uropod 3.

Remarks. A distinctive feature of this species is the finely serrate ornamentation of the cutting edges of the chela (articles 5 and 6 of gnathopods 1 and 2) (see Pillai, 1966: 178).

Distribution. An uncommon species recorded mainly from tropical regions. It was first recorded from Australian waters by Young & Anderson (1987).

Oxycephalus longipes Spandl

Fig.22

Oxycephalus longipes Spandl, 1927: 181-182, fig.14.

Material examined. 1 ovigerous female (approximately 23 mm - rostrum damaged) from station JP 71-3 (AM P39869).

Diagnosis. Head about as long as pereon. Gnathopod 1, carpal process and article 6, cutting edges with series of sharp serrations. Gnathopod 2, cutting edges of chela with series of compact, rounded teeth. Pereopod 7, article 2 gradually narrowed distally, about twice as long as wide, as long as articles 3-7 combined; article 6 styliform, slightly longer than articles 3-5 combined. Double urosomite, width about three fifths length. Telson slightly shorter than uropod 3.

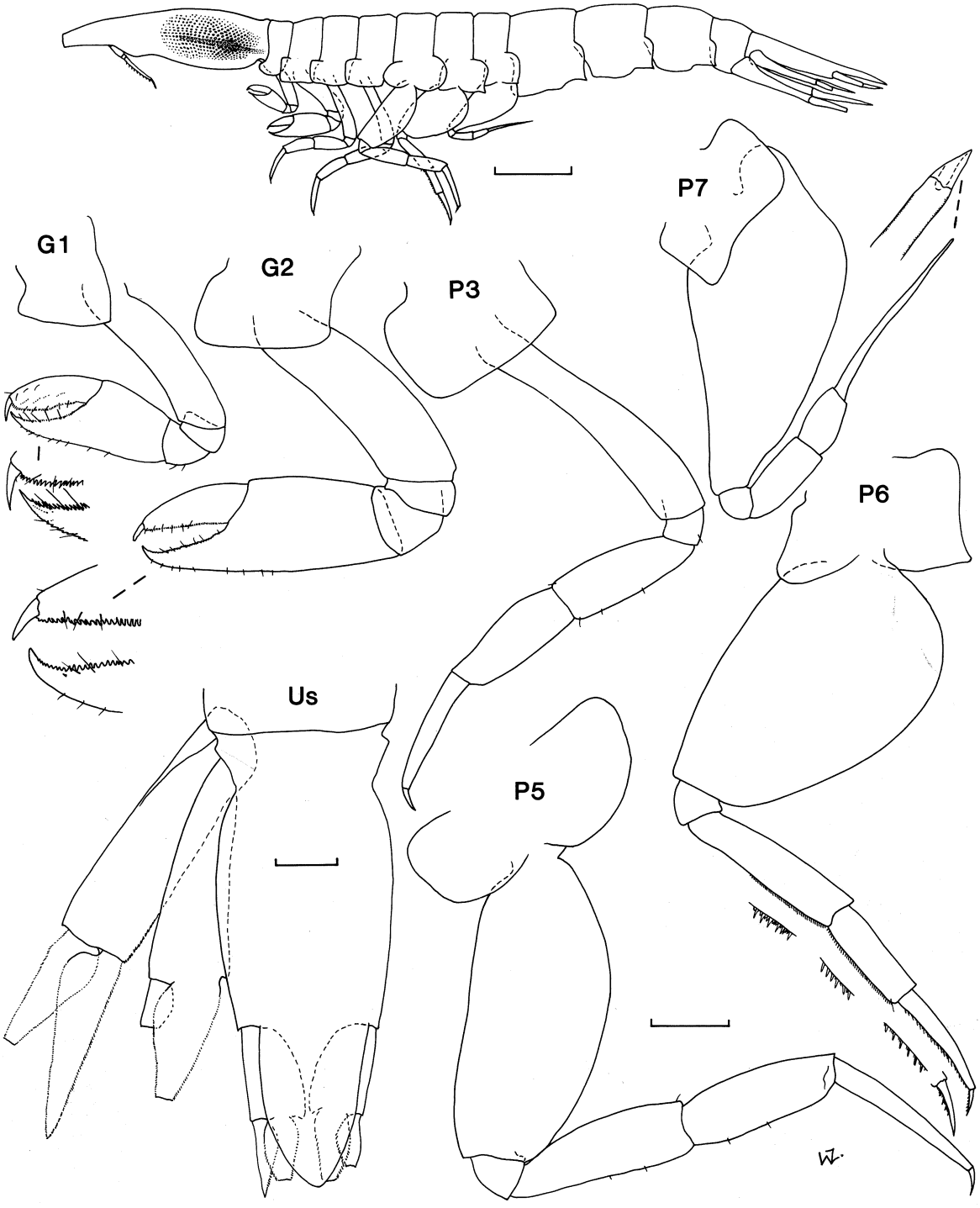

Fig.22. *Oxycephalus longipes* Spandl, female approximately 23.0 mm (scales = 2.0 mm, 0.5 mm).

Remarks. The present specimen is in perfect agreement with the figures and description given for this species by Spandl (1927). It has not been recorded in the literature since its original description and Fage (1960) makes no mention of it in his list of Oxycephalidae and proposed synonymies. It is possible that if collected in the past it may have been confused with other species of *Oxycephalus*, however, apart from the shape and ornamentation of the gnathopods, this species is readily distinguished by the extremely long, slender article 6 of pereopod 7.

Distribution. Spandl recorded it (one female) from the tropical Atlantic (5°27'N 21°41'W). It is a new record for Australian waters and the southern hemisphere.

Oxycephalus piscator Milne Edwards

Oxycephalus piscatoris Milne-Edwards 1830: 396.
Orio ornithorhamphus Cocco, 1832: 205.
Oxycephalus oceanicus Guérin-Méneville, 1836: 10, pl.18 fig.2.
Oxycephalus piscator Milne-Edwards, 1840: 100-101, pl.30 fig.10.
Ornithorhamphus coccoi Natale, 1850: 12, pl.1 fig.3.
Natalius candidissimus Costa, 1864: 88.
Oxycephalus bulbosus Streets, 1878: 280-281, pl.2 fig.2.
Oxycephalus similis Claus, 1879b: 47.
Oxycephalus edwardsii Thomson, 1883: 238, pl.12 figs 14-21.

Material examined. 1 male (14.2 mm) from station JP 71-3 (AM P39870).

Diagnosis. Head slightly shorter than pereon. Gnathopods 1 and 2, carpal process and posterior margin of article 6 with irregular serrations. Pereopod 7, article 2 rhomboid, slightly longer than wide; about as long as articles 3-7 combined. Double urosomite, width about three fifths length or slightly more. Telson slightly shorter than uropod 3.

Remarks. This species is very similar to *O. clausi* but is easily distinguished by the shape of the gnathopods and the lack of a medial spine on the distal margin of the epimeral plates.

Distribution. An uncommon but widely distributed species known mainly from tropical regions. It was first recorded from Australian waters by Young & Anderson (1987).

Rhabdosoma White, 1847

Remarks. Species of this genus are distinguished by the extremely slender, elongate body and the very long, needle-shaped rostrum. The genus has been revised by Fage (1960), who recognised four species and provides a key (in French), together with useful illustrations.

Rhabdosoma brevicaudatum Stebbing

Fig.23

Rhabdosoma brevicaudatum Stebbing, 1888: 1612-1615, pl.208.
Xiphocephalus brevicaudatus.–Bovallius, 1890: 118.
Rhabdosoma brachyteles Stebbing, 1895: 369-370, pl.55B.
Pseudanurus brevicaudatus.–Garbowski, 1895: 199.

Material examined. 2 females (approximately 24 mm - damaged) from station JP 72-23 (AM P39871).

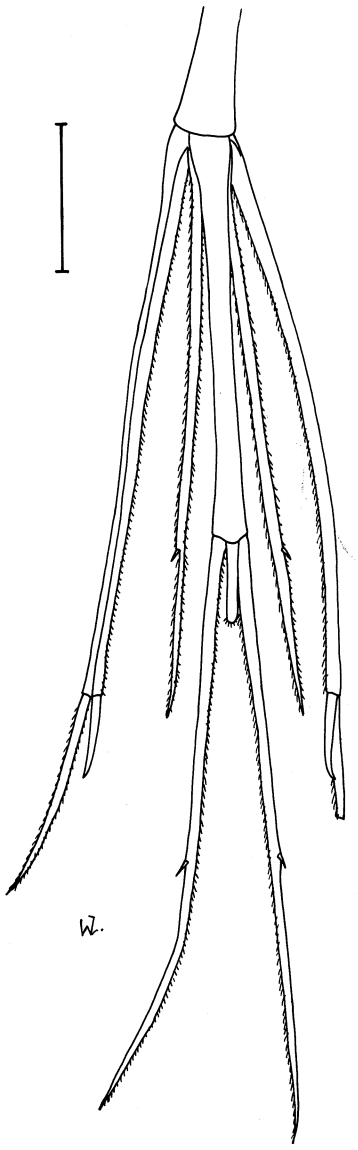

Fig.23. *Rhabdosoma brevicaudatum* Stebbing, uropoda and telson from female approximately 24.0 mm (scale = 1.0 mm).

Diagnosis. Both sexes with gills on pereonites 5 and 6. Gnathopods 1 and 2, carpal process sharp, extending just beyond article 6; article 6, posterodistal corner, rounded, slightly produced. Uropods 2 and 3, exopod rudimentary, length much less than half endopod. Telson rounded terminally, length much less than one quarter last urosomite, not reaching limit of uropod 2.

Remarks. This species is most similar to *R. minor* Fage, 1954 which also has a short telson. However, in *R. minor* the telson is relatively longer, equal in length to half the last urosomite and reaching the limit of uropod 2. One of the females is ovigerous.

Distribution. A relatively uncommon species recorded mainly from tropical regions. It is a new record for Australian waters.

Rhabdosoma whitei Bate

Rhabdosoma whitei Bate, 1862: 345-346, pl.54 fig.7.
Rhabdosoma investigatoris Giles, 1887: 219, pl.4.
Xiphocephalus lilljeborgi Bovallius, 1890: 118, pl.7 figs 1-20.
Rhabdosoma piratum Stebbing, 1895: 368-369, pl.55A.

Material examined. 3 females (48.2-57.0 mm), 2 males (damaged) from stations JP 71-3 (AM P39872 - 1 m); JP 71-8 (AM P39873 - 1 f) and JP 72-23 (AM P39874 - 2 f, 1 m).

Diagnosis. Females with gills on pereonites 2-6; males with gills on pereonites 5 and 6. Gnathopods 1 and 2, carpal process sharp, extending just beyond article 6; article 6, posterodistal corner rounded, slightly produced in females; that of gnathopod 1, of males, produced to middle of dactyl. Uropods 2 and 3, exopod well developed, length about two thirds endopod. Telson sharp terminally, length much longer than last urosomite, slightly longer than uropod 3.

Remarks. This species is similar to *R. armatum* (Milne-Edwards, 1840) but is easily distinguished from that species by the lack of an additional tooth-like process on the carpal process of gnathopod 1 and by the relatively well-developed exopods of uropods 2 and 3.

Distribution. A relatively common, widespread species, recorded mainly from tropical and subtropical regions. Previous records from Australian waters are by Barnard (1931), Dakin & Colefax (1940 – as *R. lilljeborgi*), Sheard (1965), Young & Anderson (1987) and Zeidler (1978).

Streetsia Stebbing, 1888

Remarks. This genus has been revised by Fage (1960) who recognised four species and provides a key (in French) together with useful illustrations. Pillai (1966) also provides a key together with illustrations of each species.

Streetsia challengeri Stebbing

?*Oxycephalus pronoides* Bovallius, 1887: 37.
Streetsia challengeri Stebbing, 1888: 1603-1606, pl.207.
Streetsia stebbingi Chevreux, 1900: 161, pl.18 fig.4.
Streetsia washingtoni Senna, 1902: 15, pl.2.
Streetsia sabauda Colosi, 1918: 218, pl.17 figs 5-9.
Streetsia gaussi Spandl, 1927: 184, fig.17.

Material examined. 32 females (8.4-42.8 mm), 10 males (11.6-33.1 mm) from stations JP 71-3 (AM P39875 - 9 f, 1 m); JP 71-4 (AM P39876 - 6 f, 2 m; SAM C4223 - 3 f, 1 m); JP 71-7 (AM P39877 - 6 f); JP 71-8 (AM P39878 - 7 f, 3 m) and JP 72-23 (AM P39879 - 1 f, 3 m).

Diagnosis. Body relatively slender. Head about as long as pereon and pleon. Gnathopod 1, article 5 about as wide as long, carpal process roughly serrated on distal and posterodistal margin, apical tooth slightly longer than others with distal orientation. Gnathopod 2, article 2, posterodistal corner expanded into triangular lobe in mature females; carpal process with sharp tooth produced beyond dactyl. Double urosomite, length almost twice width, distinctly shorter than telson.

Remarks. The present specimens have a cuticular pore on the epimeral plates similar to that found in *S. mindanaonis* (Stebbing, 1888). However, *S. challengeri* is easily distinguished from *S. mindanaonis* by the shape of the gnathopods and in mature females the posterodistal corner of article 2 of gnathopod 2 is expanded into a triangular lobe, a feature not found in any other species of *Streetsia*.

Thirteen ovigerous females were captured in March (JP 71-3, 71-4, 71-7, 71-8).

Distribution. A very common, widely distributed species recorded mainly from tropical regions. Previous records from Australian waters are by Guiler (1952), Sheard (1965) and Young & Anderson (1987).

Streetsia porcella (Claus)

?*Orio oxyahingus* Prestandrea, 1833: 10.
Oxycephalus porcellus Claus, 1879b: 48.
Streetsia intermedia Spandl, 1927: 188-190, figs 20,21.
Streetsia nyctiphanes Fage, 1934: 1631.

Material examined. 1 ovigerous female (16.0 mm) from station JP 71-3 (AM P39880).

Diagnosis. Body robust. Head as long or a little longer than pereon. Gnathopod 1, article 5 about as wide as long, carpal process roughly serrated on distal and posterodistal margin, apical tooth slightly longer than others with distal orientation. Gnathopod 2, article 5 quadrate, carpal process with sharp tooth produced beyond dactyl. Double urosomite slightly longer than wide, about three quarters length telson.

Remarks. This species is most similar to *S. challengeri* but is readily distinguished by the general body shape, the form of gnathopod 2 and by the relatively shorter double urosomite.

Distribution. An uncommon but widely distributed species recorded mainly from tropical regions. It was first recorded from Australian waters by Young & Anderson (1987).

Streetsia steenstrupi (Bovallius)

?*Oxycephalus longiceps* Claus, 1879b: 48.
Oxycephalus steenstrupi Bovallius, 1887: 37.

Material examined. 1 female, 1 male (approximately 12 mm - damaged) from station JP 71-8 (AM P39881).

Diagnosis. Body relatively slender. Head almost as long as pereon and pleon. Gnathopod 1, article 5 distinctly longer than wide, carpal process with relatively smooth margins covered in long setae, apical tooth orientated about 45° posteriorly to distal margin; article 6 with posterodistal corner produced partly overlapping dactyl. Gnathopod 2, carpal process with large tooth produced just beyond dactyl. Double urosomite, length almost twice width, slightly longer than telson.

Remarks. This species is most readily distinguished from all its congeners by the shape of gnathopod 1.

Distribution. A relatively rare species recorded mainly from tropical regions. Previous records from Australian waters are by Young & Anderson (1987) and Zeidler (1978).

PLATYSCELIDAE

Hemityphis Claus, 1879

Remarks. This genus is currently considered to be monotypic (Harbison *et al.*, 1977).

Hemityphis rapax (Milne Edwards)

Typhis rapax Milne Edwards 1830: 395.
Thyropus rapax.–Bate, 1862: 329.
Hemityphis tenuimanus Claus 1879b: 12-13.
Schizoscelus rapax.–Bovallius, 1887: 44.

Material examined. 2 females (5.7 and 5.8 mm), 1 male (7.0 mm) from stations JP 71-7 (AM P39882 - 1 m) JP 71-8 (AM P39883 - 1 f) and JP 72-23 (AM P39884 - 1 f).

Diagnosis. Antenna 2 of male, 2 distal articles longer than half preceding article. Gnathopod 1, carpal process with slightly serrated margins, extending to about half article 6; article 6, posterior margin with very fine serrations, almost smooth. Gnathopod 2, carpal process with slightly serrate margins, extending to about three quarters article 6; article 6, posterior margin with fine serrations. Pereopod 6, article 2 with small, curved fissure.

Remarks. This species is distinguished by the form of the gnathopods and pereopod 6 and is separated from the closely related genus *Platyscelus* on the basis of the second antennae of males in which the last two segments are more than half the length of the preceding segment. In *Platyscelus* these segments are much less than half the length of the preceding segment.

One ovigerous female (5.8 mm) was captured in March (JP 71-8).

Distribution. Widespread in tropical and warm temperate regions. The only previous record from Australian waters is by Stebbing (1888 – as *H. tenuimanus*).

Paratyphis Claus, 1879

Remarks. Species of *Paratyphis* are difficult to identify with certainty and the genus is in need of revision. Vinogradov *et al.* (1982) recognise four species and provide useful illustrations and a key (in Russian). Pirlot (1930) also provides a key to species (in French).

Paratyphis parvus Claus

Paratyphis parvus Claus, 1887: 40, pl.7 figs 13-21.
Paratyphis pacificus Stebbing, 1888: 1479-1480.

Material examined. 1 male (3.6 mm) from station JP 72-23 (AM P39885).

Diagnosis. Antenna 2 of male, 2 distal articles slightly longer than half preceding article. Gnathopod 1, article 5 with angular anterodistal and posterodistal corners (not rounded). Gnathopod 2, carpal process pointed with serrated margins, extending to about one third article 6. Pereopod 5, article 2 with notch on distal margin for insertion of following articles. Pereopod 6, article 2 with relatively small, crescent-shaped fissure.

Remarks. The best distinguishing character of *P. parvus* appears to be the form of the gnathopods. It is most similar to *P. maculatus* Claus, 1879 but in that species the carpal process of gnathopod 2 is very short and has smooth margins.

Distribution. A relatively rare species recorded from tropical and warm temperate regions. Previous records from Australian waters are by Young & Anderson (1987) and Zeidler (1978).

Platyscelus Bate, 1862

Remarks. This genus is in need of revision. Vinogradov *et al.* (1982) recognise four species and provide a key (in Russian) together with useful illustrations.

Platyscelus armatus (Claus)

Figs 24, 25

?*Dithyrus faba* Dana, 1852: 1010, pl.69 fig.3.
?*Platyscelus rissoinae* Bate, 1862: 329-330, pl.52 fig.9.
Eutyphis armatus Claus, 1879b: 10-11.
Eutyphis inermis Claus, 1887: 37.
?*Eutyphis forfex* Bovallius, 1887: 46.
Platyscelus armatus var. *inermis*.–Shoemaker, 1945: 255, fig.46.

Material examined. 2 females (5.9 and 17.4 mm) from stations JP 71-3 (AM P39886) and JP 71-7 (AM P39887).

Diagnosis. Epimeral plates with midlateral ridge folding against article 2 of pereopod 6. Gnathopod 1, carpal process with serrated margins almost as long as article 6; article 6, posterior margin serrated; articles 3-5 with long setae. Gnathopod 2 like gnathopod 1 but carpal process extended just beyond dactyl. Pereopods 3 and 4, article 6 with posterodistal corner slightly excavate. Pereopods 5 and 6, coxal plates with lateral process, larger on fifth (absent or reduced in juveniles). Uropod 3, exopod length distinctly greater than half endopod.

Remarks. This species is usually easily distinguished from its congeners by the lateral process on the fifth and sixth coxal plates. However, sometimes smaller specimens are found without these processes and in the past these have been considered a separate species or variety of *P. armatus* (Shoemaker, 1945). In the present collection the smaller specimen (Fig.25) not only lacks the lateral projections on the coxal plates but pereopod 7 has a full compliment of articles. Additional differences from the large specimen are as follows: i) gnathopod articles 5 and 6 are more coarsely serrate and article 5 is not as produced; ii) pereopod 5, article 2 is more rounded distally with a small notch near the insertion of article 3; and iii) pereopod 6, article 2 has a small notch near the posterodistal corner and articles 4 and 5 are more coarsely serrate. These differences are probably related to maturity rather than of specific significance as the two specimens are otherwise very similar. Variations in the number of articles of pereopod 7 amongst Platyscelidae have been observed by other authors (e.g., Barnard, 1937; Spandl, 1927) and Stephensen (1925) records a juvenile *Platyscelus* with pereopod 7 complete, similar to the present specimen. The number of articles of pereopod 7 is therefore not a good character alone to separate the families Platyscelidae and Parascelidae. The best distinguishing feature is the shape of the mouthparts which form a broad rounded cylinder in Platyscelidae and a sharp, pointed cone in Parascelidae.

The large specimen, captured in March, is ovigerous.

Distribution. A relatively rare species known from widely scattered records from tropical and warm temperate regions. It is a new record for Australian waters.

Platyscelus ovoides (Risso)

Typhis ovoides Risso, 1816: 122, pl.2 fig.9.
Typhis ferus Milne-Edwards, 1830: 395, pl.11 fig.8.
Platyscelus serratus Bate, 1862: 330-332, pl.52 figs 10,11.
Platyscelus intermedius Thomson, 1879: 244.
Eutyphis ovoides.–Claus, 1879b: 9.
Eutyphis globosus Claus, 1879b: 12.

Material examined. 24 females (6.3-16.0 mm), 19 males (6.3-14.6 mm) from stations JP 71-3 (AM P39888 - 10 f, 2 m; SAM C4224 - 4 f, 3 m); JP 71-4 (AM P39889 - 2 m); JP 71-7 (AM P39890 - 1 f, 1 m); JP 77-18 (AM P39891 - 1 f); JP 77-19 (AM P39892 - 1 f, 1 m); JP 77-26 (AM P39893 - 4 f, 10 m) and JP 77-28 (AM P39894 - 3 f).

Diagnosis. Body very globular. Gnathopod 1, carpal process with serrated margins, a little shorter than article 6; article 6, posterior margin serrated, anterior margin serrated for distal third; articles 4 and 5 with few long setae. Gnathopod 2 like gnathopod 1 but carpal process extended to limit of article 6. Uropod 3, exopod length distinctly less than half endopod.

Remarks. The globular shape of the body and the form of the gnathopods distinguish this species from its congeners.

Five ovigerous females (approximately 13 mm) were captured in March (JP 71-3) and December (JP 77-26).

Distribution. A widely distributed species, recorded mainly from tropical regions. First recorded from Australian waters by Young & Anderson (1987).

Platyscelus serratulus Stebbing

Eutyphis serratus Claus, 1879b: 11-12.
Platyscelus serratulus Stebbing, 1888: 1470-1471.
Platyscelus dubius Shoemaker, 1925: 51-54, figs 20,21.

Material examined. 3 females (5.1-16.7 mm), 1 male (15.0 mm) from stations JP 71-7 (AM P39895 - 1 m); JP 72-23 (AM P39896 - 2 f) and JP 77-25 (AM P39897 - 1 f).

Diagnosis. Gnathopod 1, carpal process with serrated margins, a little shorter than article 6; article 6, posterior margin serrated; articles 3-5 with very few, long setae. Gnathopod 2 like gnathopod 1 but carpal process extended to limit of article 6. Uropod 3, exopod length distinctly greater than half endopod.

Remarks. This species is very similar to *P. ovoides* but can be distinguished from it by the gnathopods which

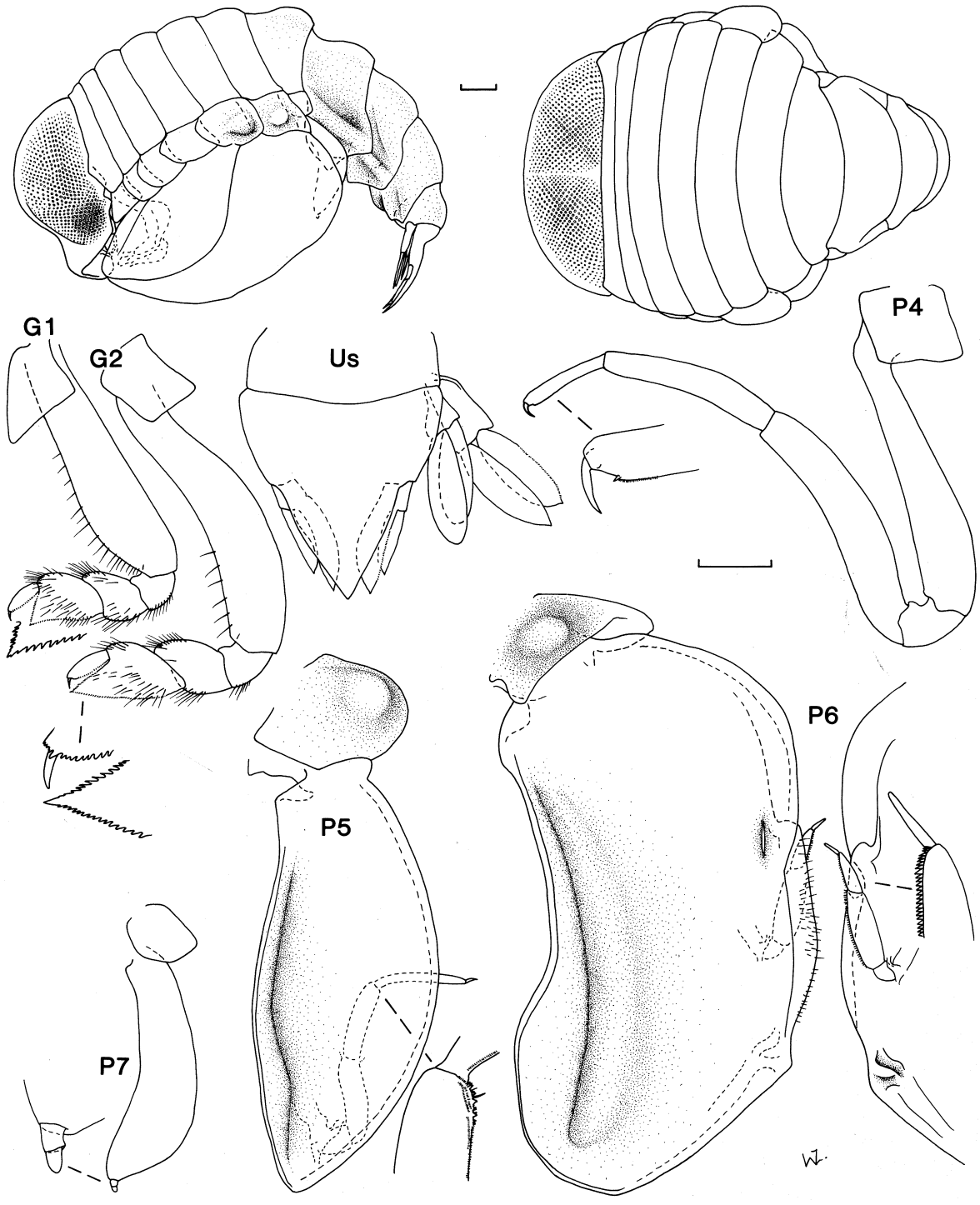

Fig.24. *Platyscelus armatus* (Claus), female 17.4 mm from station JP 71-3 (scales = 1.0 mm).

lack serrations on the anterior margin of article 6.

One ovigerous female (16.7 mm) was captured in December (JP 77-25).

Distribution. Widely distributed in tropical and subtropical regions. Previous records from Australian waters are by Watson & Chaloupka (1982), Young & Anderson (1987) and Zeidler (1978).

Tetrathyrus Claus, 1879

Remarks. Pirlot (1930) considers this genus to be monotypic and synonymises the six nominal species with *T. forcipatus* Claus, 1879 but Vinogradov *et al.* (1982) also recognise *T. arafurae* Stebbing, 1888 as a valid species based mainly on that species having uropods 2 and 3 with free endopods. However, during my studies

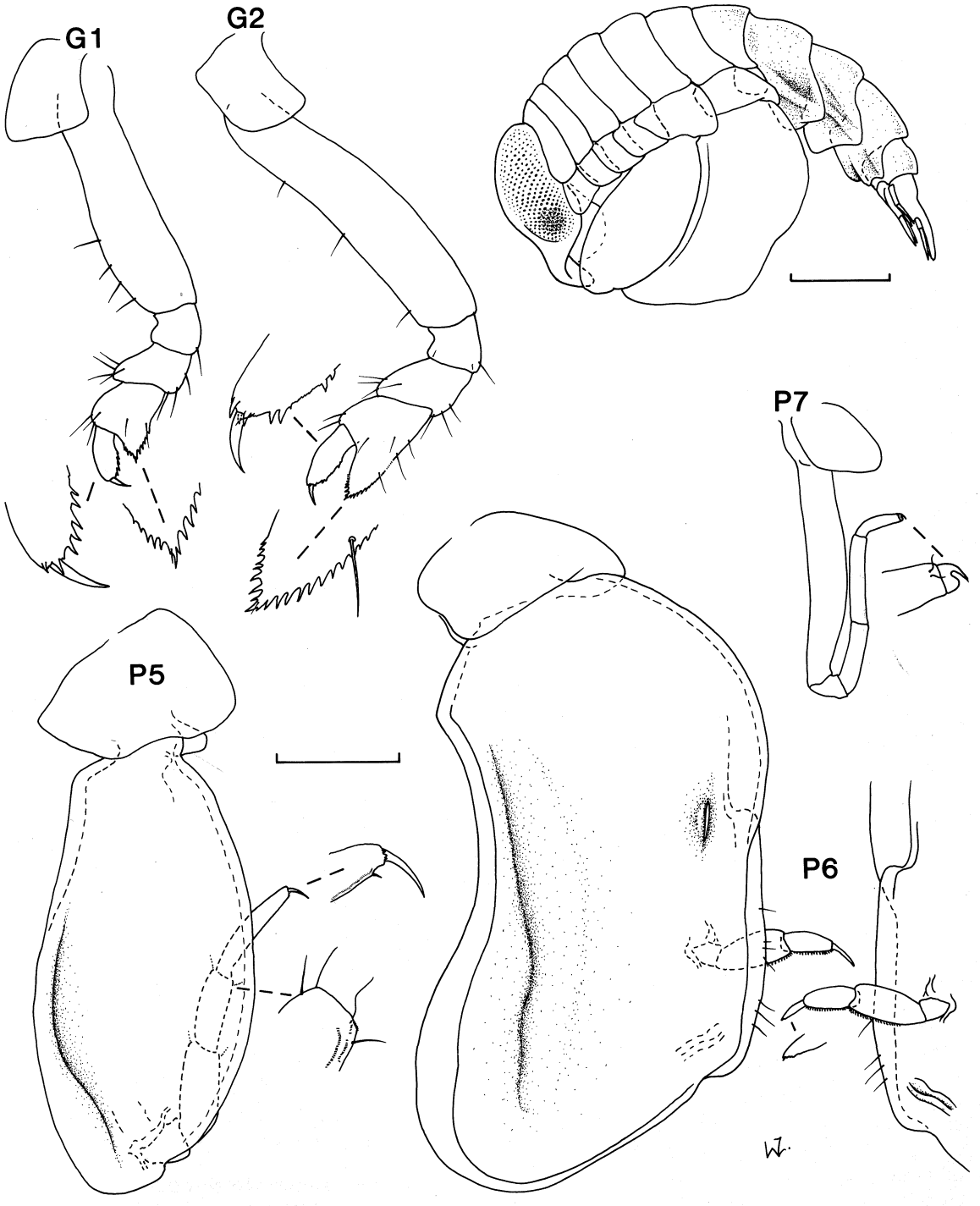

Fig.25. *Platyscelus armatus* (Claus), female 5.9 mm from station JP 71-7 (scales = 1.0 mm, 0.5 mm).

of *T. forcipatus* (Zeidler, 1978), I found the fusion of the endopod with the peduncle of uropod 2 to be variable and thus an unreliable character, although I never found a specimen in which the endopod of uropod 3 was free. The genus is thus in need of further revision in order to determine the number of valid species present.

Tetrathyrus forcipatus Claus

Tetrathyrus forcipatus Claus, 1879b: 14-15.
Tetrathyrus rectangularis Bovallius, 1887: 47.
Tetrathyrus inscriptus Bovallius, 1887: 48.
Tetrathyrus moncoeuri Stebbing, 1888: 1480-1483, pl.184.
Tetrathyrus sancti-josephi Shoemaker, 1925: 54, figs 22-24.

Material examined. 1 female (3.0 mm) from station JP 89-3 (AM P39898).

Diagnosis. Antenna 2 of male, 2 distal articles longer than half preceding article. Gnathopods 1 and 2, dactyl closing against concave distal margin of article 6. Pereopod 6, article 2 without fissure. Endopod of uropod 2 (usually) and uropod 3, fused with peduncle. Telson, length subequal to, or slightly shorter than, double urosomite.

Remarks. According to Vinogradov *et al.* (1982) *T. arafurae* can be distinguished from *T. forcipatus* by the following characters: i) pereopod 5, article 2 is distinctly more than twice as long as wide; ii) uropods 2 and 3, endopods are not fused with peduncle; and iii) the telson is distinctly longer than double urosomite.

Distribution. Relatively abundant in subtropical waters of the world's oceans. Previous records from Australian waters are by Barnard (1931), Dakin & Colefax (1940 – as *T. moncoeuri*), Stebbing (1888 – as *T. moncoeuri*) and Zeidler (1978).

PARASCELIDAE

Parascelus Claus, 1879

Remarks. Bowman & Gruner (1973) regard *Parascelus* a junior synonym of *Thyropus*. However, Vinogradov *et al.* (1982) make a case for removing *Parascelus* from the synonymy of *Thyropus*; *Parascelus* comprising those species in which article 2 of pereopod 6 is without a fissure. Until a much needed revision of the family is undertaken I have decided to recognise both genera. Harbison *et al.* (1977) provide a provisional key to the species of both genera (five species, all as *Thyropus*) but include *Parascelus parvus* Claus, 1879 which Vinogradov *et al.* (1982) regard as a synonym of *P. edwardsi* Claus, 1879.

Parascelus typhoides Claus

Parascelus typhoides Claus, 1879b: 19-20.

Material examined. 2 females (3.8 and 4.8 mm) from station JP 72-23 (AM P39899).

Diagnosis. Gnathopod 1 distinctly shorter than gnathopod 2. Gnathopod 1, article 2 longer than articles 3-7 combined; article 5, posterodistal and anterodistal corners produced into very short, rounded lobes. Pereopod 6, article 2 without fissure, only slightly narrowed for distal half; article 4, anterodistal corner produced, partly overlapping article 5. Uropods 2 and 3, exopod length slightly less than half endopod.

Remarks. *Parascelus typhoides* is very similar to *P. edwardsi*, the only other congener recognised by Vinogradov *et al.* (1982). The main difference appears to be in the shape of the basis of pereopod 6 which in *P. edwardsi* is distinctly narrowed for the distal half. In the present specimens the gnathopods and pereopod 6 tend to agree with available descriptions and figures of *P. typhoides* but the uropods are more like *P. edwardsi*.

The specimen described as *P. typhoides* by Zeidler (1978) has been re-examined and appears to resemble *P. edwardsi* more so than *P. typhoides*.

Regarding *P. similis* Stephensen, 1925, Vinogradov *et al.* (1982) consider it a synonym of *P. typhoides*. However, I believe that it is a species of *Thyropus* as Stephensen clearly describes and illustrates a fissure on the basis of pereopod 6, similar to that found in *T. sphaeroma* (Claus, 1879), but which is absent in both species of *Parascelus*.

Distribution. A relatively rare species, widely distributed in tropical and temperate regions. The only previous record from Australian waters (Zeidler, 1978) may be a misidentification of *P. edwardsi*.

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Mrs D. Lowery typed the manuscript.

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APPENDIX I

Station Collection Data

JP 71-2 Tasman Sea, 75 km east of Port Hacking, NSW (34°09'S 152°07'E - 34°20'S 152°05'E), 0-550 m in water of depth 2470-3110 m, 23 Mar. 1971, M. Gregory & J. Paxton (3 m Isaacs-Kidd midwater trawl).

JP 71-3 Tasman Sea, 75 km east of Port Hacking, NSW (34°10'S 151°59'E - 34°09'S 152°05'E), 0-60 m in water of depth 1810-2470 m, 24 Mar. 1971, M. Gregory & J. Paxton (3 m Isaacs-Kidd midwater trawl).

JP 71-4 Tasman Sea, 95 km east of Port Hacking, NSW (34°09'S 152°07'E - 34°14'S 152°14'E), 0-250 m in water of depth 2470-2560 m, 24-25 Mar. 1971, M. Gregory & J. Paxton (3 m Isaacs-Kidd midwater trawl).

JP 71-7 Tasman Sea, 95 km east of Port Hacking, NSW (34°10'S 152°16'E - 34°00'S 152°14'E), 0-350 m in water of depth 2743-2835 m, 25 Mar. 1971, M. Gregory & J. Paxton (3 m Isaacs-Kidd midwater trawl).

JP 71-8 Tasman Sea, 95 km east of Port Hacking, NSW (34°03'S 152°12'E - 34°14'S 152°14'E), approximately 600 m in water of depth 2380-2835 m, 25-26 Mar. 1971, M. Gregory & J. Paxton (3 m Isaacs-Kidd midwater trawl).

JP 72-23 Tasman Sea, 30 km east of Port Jackson, NSW (33°52'S 151°37'E), 18-55 m in water of depth 146 m, 10 Aug. 1972, J. Paxton & D. Griffin (3 m Isaacs-Kidd midwater trawl).

K 72-07-01 Tasman Sea, 45 km east of Port Hacking, NSW (34°00'S 151°43'E), 503 m, 6 Nov. 1972 (otter trawl).

K 73-01-11 Tasman Sea, east of Port Jackson, NSW, 73-110 m in water of depth 183-220, 2 July 1973, K. Graham (midwater trawl).

K 74-05-01 Tasman Sea, 50 km east of Port Kembla, NSW (34°28'S 151°29'E), 0-230 m in water of depth 1417 m, 22 July 1974, J. Paxton & K. Graham (midwater trawl).

JP 77-17 Tasman Sea, 90 km east of Broken Bay, NSW (33°33'S 152°18'E), 0-140 m in water of depth 2012 m, 12 Dec. 1977, D. Blake, H. Larson, A. Reynolds & J. Paxton (15 x 20 m Engel midwater trawl).

JP 77-18 Tasman Sea, 95 km east of Broken Bay, NSW (33°31'S 152°20'E), 0-900 m in water of depth 1830-2926 m, 12-13 Dec. 1977, J. Paxton *et al.* (15 x 20 m Engel midwater trawl).

JP 77-19 Tasman Sea, 100 km east of Broken Bay, NSW (33°29'S 152°25'E), 0-900 m in water of depth 1830-2743 m, 13 Dec. 1977, J. Paxton *et al.* (15 x 20 m Engel midwater trawl).

JP 77-22 Tasman Sea, 105 km east of Tuggerah Lake, NSW (33°23'S 152°37'E), 0-625 m in water of depth 2926 m, 13 Dec. 1977, J. Paxton *et al.* (15 x 20 m Engel midwater trawl).

JP 77-25 Tasman Sea, 95 km east of Tuggerah Lake, NSW (33°20'S 152°32'E), 0-350 m in water of depth 2377 m, 14 Dec. 1977, J. Paxton *et al.* (15 x 20 m Engel midwater trawl).

JP 77-26 Tasman Sea, 110 km east of Broken Bay, NSW (33°28'S 152°33'E), 0-1000 m in water of depth 4206 m, 14 Dec. 1977, J. Paxton *et al.* (15 x 20 m Engel midwater trawl).

JP 77-27 Tasman Sea, 74 km east of Port Jackson, NSW (33°53'S 152°02'E), 0-800 m in water of depth 1830 m, 14 Dec. 1977, J. Paxton *et al.* (15 x 20 m Engel midwater trawl).

JP 77-28 Tasman Sea, 93 km east of Wollongong, NSW (34°20'S 151°56'E), 0-800 m in water of depth 2926-3658 m, 14-15 Dec. 1977, J. Paxton *et al.* (15 x 20 m Engel midwater trawl).

JP 89-2 Tasman Sea, 90 km east of Port Jackson, NSW (33°50.9'S 152°15.9'E - 33°52.5'S 152°39.0'E), 0-1200 m, HMAS Cook, 28 Apr. 1989, J. Paxton *et al.*

JP 89-3 Tasman Sea, 125 km east of Port Jackson, NSW (33°52.5'S 152°39.0'E - 33°53.9'S 152°5.9'E), 0-1800 m, HMAS Cook, 27 Apr. 1989, J. Paxton *et al.*

JP 89-7 Tasman Sea, 100 km east of Cape Banks, NSW (33°58.9'S 152°19.3'E - 34°05.7'S 152°55.9'E), 0-3300 m, HMAS Cook, 29 Apr. 1989, J. Paxton *et al.*

F 19 Lord Howe Rise, Tasman Sea (29°24.57'S 160°08.73'E), epibenthic sled at 2000 m, R.V. Franklin Cruise 05/89, 4 May 1989, J.K. Lowry *et al.*

F 25 Lord Howe Rise, Tasman Sea (28°05.76'S 163°06.04'E), beam trawl at 1051 m, R.V. Franklin Cruise, 05/89, 5 May 1989, J.K. Lowry *et al.*

F 33 Lord Howe Rise, Tasman Sea (27°13.34'S 160°43.41'E), epibenthic sled at 1989 m, R.V. Franklin Cruise 05/89, 7 May 1989, J.K. Lowry *et al.*

F 34 Lord Howe Rise, east of Gifford Guyot, Tasman Sea (26°51.66'S 159°49.07'E), epibenthic sled at 2500 m, R.V. Franklin Cruise 05/89, 7 May 1989, J.K. Lowry *et al.*

F 43 Between Gifford Guyot & Britannia seamount, Tasman Sea (27°13.44'S 157°58.11'E), epibenthic sled at 2900 m, R.V. Franklin Cruise 05/89, 9 May 1989, J.K. Lowry *et al.*