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Deep-water Decapod Crustacea from Eastern Australia: Lobsters of the Families Nephropidae, Palinuridae, Polychelidae and Scyllaridae

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ABSTRACT. Twenty-three species of deep-water lobsters in the families Nephropidae, Palinuridae, Polychelidae and Scyllaridae are recorded from the continental shelf and slope off eastern Australia. Ten species and two genera have not been previously recorded from Australia. These are *Acanthacaris tenuimana, Projasus parkeri, Polycheles baccatus, P. euthrix, P. granulatus, Stereomastis andamanensis, S. helleri, S. sculpta, S. suhmi* and *Willemoesia bonaspei*. The deep-water lobster fauna of eastern Australia is compared with those of other Indo-Pacific areas. A key is given to all deep-water lobster species recorded from Australian waters.

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The deep-water lobster fauna of the Australian region first became known from collections made by the British *Challenger* Expedition (Bate, 1888), the 1911–14 Australasian Antarctic Expedition (Bage, 1938), the Commonwealth of Australia fishing experiments on the *Endeavour* (1909–1914); various local trawling excursions (e.g., Grant, 1905) and serendipitous catches by professional fishermen (e.g., McNeill, 1949, 1956). Knowledge of the fauna has increased greatly since then, especially as commercial fisheries interest and abilities have extended to greater depths. Surveys by Australia's CSIRO on the North West Shelf of Australia, prompted by interest in natural gas resources and potential commercial fisheries, have added many species to the known fauna. Similar surveys in north-east Queensland and New South Wales waters have produced an extensive by-catch of deep-water crustaceans. The deep-water fauna of southern Australia is as yet poorly known but extensive collections have been made by the Museum of Victoria on the continental shelf and slope of south-eastern Australia and Bass Strait.

This paper is the third of a series dealing with deep-water decapods taken by the New South Wales Fisheries Research Vessel *Kapala*, which has carried out trawling experiments along the coast of New South Wales since 1971. Previous papers dealt with brachyuran crabs (Griffin & Brown, 1976) and shrimps and prawns (Kensley, Tranter & Griffin, 1987). This paper also deals with material from the collections of the Queensland Museum and other Australian Museum material.

The present report gives an account of twenty-three species in four families: Nephropidae, Palinuridae, Polychelidae and Scyllaridae. Species of two other deep-water lobster families have been reported from Australia:

Neoglyphea inopinata Forest & de Saint Laurent, 1975, in the family Glypheidae, has been recorded from the Arafura Sea, off north-western Australia (Bruce, 1988b; Forest, 1989) and *Thaumastochelopsis wardi* Bruce, 1988a, in the family Thaumastochelidae, has been recorded from the Marian Plateau, Coral Sea, off north-eastern Australia (Bruce, 1988a).

Material is deposited in the Australian Museum, Sydney (AM) and the Queensland Museum, Brisbane (QM). Measurements given are carapace length (cl.) unless otherwise stated. For the Polychelidae the arrangement of spines along the lateral edge of the carapace is denoted as in this example: 5–6:3–4:7–8 meaning 5 or 6 spines in front of the anterior branch of the cervical groove, 3 or 4 between the anterior and posterior branches of the cervical groove and 7 or 8 behind the posterior branch of the cervical groove. For species of *Stereomastis* the arrangement of spines on the mid-dorsal carina of the carapace is denoted as in this example: 1,1,2,1 meaning two single, one pair, one single spine between the rostral spines and the cervical groove; and 2,2,2 meaning three sets of paired spines behind the cervical groove, including the widely spaced pair on the posterior margin. The terminology of Holthuis (1975) is used for the Nephropidae.

Family NEPHROPIDAE

Acanthacaris Bate, 1888

The genus contains two species, one of which is known from the Indo-West Pacific region. The genus has not previously been reported from Australian seas.

Acanthacaris tenuimana (Bate)

Phoberus tenuimanus Bate, 1888: 171.
Acanthacaris tenuimana.–Bate, 1888: pl. 21.–Holthuis, 1975: 752.–Hayashi & Ogawa, 1985: 220, fig. 1.–Macpherson, 1990: 293.–Holthuis, 1991: 28, figs 39b, 42.
Acanthocaris tenuimana.–Bate, 1888: pl. 22.
Acanthacaris tenuimanus.–Bruce, 1974: 303, figs 1,2.
Phoberus caecus sublevis Wood-Mason in Wood-Mason & Alcock, 1891: 197.–Alcock & Anderson, 1894: 161.–Anderson, 1896: 96.
Phoberus caecus tenuimanus.–Alcock, 1901: 156.–Alcock & McArdle, 1903: pl. 60.
Acanthacaris opipara Burukovsky & Musij, 1976: 1811, figs 1,2.
Phoberus brevirostris Tung & Wang, 1985: 379, fig. 1.

Material examined. One ovigerous female, cl. 157 mm, 1 male, cl. 119 mm, AM P38504, east of Brisbane, south-east Queensland, trawled, 700–900 m, W. Dall on MV *Valkyrie Voyager*, May 1988.

Remarks. There is only one first cheliped present, from the female specimen. The fingers are 1.7 times the length of the palm. The rostrum has one pair of small lateral spines just before the spine-like tip and 5 small anteriorly-projecting spines on the ventral surface of the distal half.

Distribution. Indo-West Pacific Ocean: Natal, Mozambique, Madagascar, Laccadive Islands, Japan, Philippines, South China Sea, Indonesia, eastern Australia, New Caledonia; 600–2161 m.

Metanephrops Jenkins, 1972

The genus contains 17 recent species, of which 15 are known from the Indo-West Pacific region. Five species have been recorded from Australian waters: *Metanephrops australiensis* (Bruce, 1966a) from north-western Australia (Bruce, 1966a; George, 1983; Carter *et al.*, 1983; Anon., 1984; Wallner & Phillips, 1988; Wassenberg & Hill, 1989); *M. boschmai* (Holthuis, 1964) from north-western and southern Australia (Holthuis, 1964); *M. neptunus* (Bruce, 1965a) from north-western Australia (George, 1983; Holthuis, 1991; Wadley & Evans, 1991); *M. sibogae* (de Man, 1916) from north-western and north-eastern Australia (Holthuis, 1991; Wadley & Evans, 1991) and *M. velutinus* Chan & Yu, 1991 from north-western Australia (George, 1983; Anon., 1984; Davis & Ward, 1984; Bremner, 1985; Wallner & Phillips, 1988; Wassenberg & Hill, 1989; all as *M. andamanicus* [Wood-Mason, 1892]) and from southern Australia (Chan & Yu, 1991).

Metanephrops sibogae (de Man)

Nephrops Sibogae de Man, 1916: 102, pl. 4 figs 18–18d.–Bruce, 1966b: 165 (key).
Metanephrops sibogae.–Jenkins, 1972: 163,171.–Holthuis, 1991: 65, figs 113c, 127b, 154.–Wadley & Evans, 1991: 36, unnumbered figs.

Material examined. Two males, cl. 58 mm and 38+ mm (rostrum broken), QM W11219, east of Murray Isles, Coral Sea, 9°50'S 144°11'E to 9°51'S 144°09'E, 460–464 m, *Gwendoline May*, 27 May 1983; 1 female, cl. 48+ mm (tip of rostrum broken) and 1 male, cl. 40 mm, QM W11725, east of Murray Isles, Coral Sea, 480 m, *Gwendoline May*, 28 May 1983; 1 male, cl. 77 mm, AM P45097, east of Cape York, Coral Sea, 10°29.81'S 144°01.38'E, beam trawl, 596–603 m, P. Hutchings & party on RV *Franklin*, 20 August 1988, stn FR0688–2.

Remarks. *Metanephrops sibogae* has until recently been known only from the type material, nine specimens from near the Kei Islands, Indonesia. Holthuis (1991) indicated additional collections from northern Australia, but without comment or description. Wadley & Evans (1991) recorded the species from north-western Australia. The present material agrees well with de Man's (1916) description and figure of *M. sibogae* except in a few points which support the very close relationship between *M. sibogae* and *M. boschmai* (Holthuis, 1964) from the Great

Australian Bight. Type material of *M. boschmai* has been examined and compared to the present Coral Sea material and the published description and figures of *M. sibogae*. The following points of difference/correspondence were noted:

1. *Metanephrops boschmai, M. sibogae* and the Coral Sea material all have a set of 3 spines behind the orbit (the supraorbital, postsupraorbital and postorbital spines in the terminology of Holthuis [1975]). Above the spines, *M. boschmai* has a patch of 1–4 very small spinules. These are absent in the Coral Sea specimens, but a similar patch of very small spinules occurs more posteriorly, between the cervical spine and the median carina. Neither of these patches of spinules is described or illustrated for *M. sibogae*.

2. *Metanephrops boschmai* has 4–7 spinules along the posterior margin of the cervical groove, between the cervical and hepatic spines. These are not present in *M. sibogae* or the Coral Sea specimens.

3. *Metanephrops sibogae* has 6–7 pairs of denticles along the medial carina of the branchial area, posterior to the pair of post cervical spines; *M. boschmai* has 3–5 pairs of denticles and the Coral Sea specimens have three pairs.

4. The sixth abdominal somite of *M. sibogae* has four spinules arranged as in the four points of a cross, i.e. one anterior median spinule, two submedian spinules behind this and one posterior median spinule (clearly seen in de Man, 1916, plate 4, figure 18). This arrangement of spinules is also found in the Coral Sea specimens, but in *M. boschmai* the anterior spinule is absent and there are often two, sometimes three, sub median pairs.

5. Holthuis (1964) suggested that *M. boschmai* differs from *M. sibogae* in that the greatest breadth of the scaphocerite is in the proximal half in *M. boschmai* but in the distal half in *M. sibogae*. Comparison of figure 1 of Holthuis (1964), plate 4, figure 18b of de Man (1916) and available material suggests that the differences in this character are so slight as to be not of specific value.

6. The dactylus of the third maxilliped is slightly broader in *M. boschmai* than in *M. sibogae* or the Coral Sea material.

7. The merus of pereopod 1 has, in *M. boschmai*, a distinct tooth in the middle of the inner margin, sometimes followed by one or more much smaller teeth. In *M. sibogae*, de Man (1916: 106) described the merus as having "usually 2 or 3, rarely 4 or 5, granules of the inner margin ... a little larger than the rest and more or less spiniform." The two larger males from the Coral Sea (QM W11219) have two and three (on the left and right respectively) slender spinules on the inner margin of the merus. The two smaller specimens each have only one first pereopod present, which have two similar spinules.

8. De Man (1916) recorded a sharp tooth on the inner margin of the carpus of pereopod 1 on both sides of one specimen and on the right side only of three other specimens (but not present on the specimen in figure 18 of plate 4). He referred to this spine as "an abnormality" and "the accidental spine". This strong tooth is present on both sides of the larger Coral Sea specimens and on the two first pereopods of the smaller specimens. It is absent in *M. boschmai*.

9. The Coral Sea specimens have a distinct tooth about the middle of the inner margin of the propodus of pereopod 1. In *M. sibogae* this margin is described as granulose and in *M. boschmai* it is quite smooth.

10. The propodus of pereopod 1 is relatively broader in *M. sibogae* and the Coral Sea specimens than in *M. boschmai*; in *M. sibogae* it is broadest at the level of articulation of the dactylus whereas in *M. boschmai* the broadest point is midway between the proximal end of the propodus and the articulation of the dactylus.

Distribution. Indo-West Pacific Ocean: Indonesia, northern Australia, Coral Sea; 260–480 m. It is possible that some of the material recorded as *M. boschmai* from the North West Shelf of Australia may be *M. sibogae*.

Metanephrops velutinus Chan & Yu

Nephrops andamanicus.–Holthuis, 1964: 71.
Metanephrops andamanicus (sensu Holthuis, 1964).–Jenkins, 1972: 162,171.–Chan & Yu, 1987: 184 (key).
Metanephrops andamanicus.–Carter *et al.*, 1983: 2, 4.–Anon., 1984: 46.–Davis & Ward, 1984: 42.–Bremner, 1985: 39, graphs 1,2, fig. 3.–Ward & Davis, 1987: 93.–Wallner & Phillips, 1988: 36, graphs 2, 3.–Macpherson, 1990: 294, figs 2c,d, 3c,d.
[?] *Nephrops andamanicus*.–de Man, 1916: 99, pl. 3 fig. 15.
Metanephrops velutinus Chan & Yu, 1991: 22 (key), 35, pls 2b, 4b, 6c, 8a,c,d.–Holthuis, 1991: 64 (key), 82, figs 121,160.–Wadley & Evans, 1991: 37, unnumbered figs.
Not *Nephrops andamanicus* Wood-Mason, 1892.

Material examined. One male, cl. 70+ mm (rostrum broken at mid-eye level), QM W11212, east of Murray Isles, Torres Strait, 9°51'S 144°26'E to 9°53'S 144°23'E, 480 m, trawled, RV *Gwendoline May*, 28 May 1983; 1 ovigerous female, cl. 67.5 mm, QM W14388, east of Murray Isles, Torres Strait, trawled, RV *Gwendoline May*, 28 May 1983.

Remarks. The cervical (or upper hepatic) spine is absent in both specimens; there is no branchial spine at the anterior end of the branchial carina; and the intermediate carinae are not granulose.

Distribution. Indo-West Pacific Ocean: Philippines, north-eastern and western to southern Australia (Torres Strait to Great Australian Bight); 238–702 m.

Nephropsis Wood-Mason, 1873

The genus contains 16 species, of which 10 are known from the Indo-West Pacific region. Six species have been previously recorded from Australian seas: *Nephropsis acanthura* Macpherson, 1990, from north-eastern

Australia (Macpherson, 1990) and western Australia (Macpherson, 1993); *N. holthuisi* Macpherson, 1993, from north-western Australia (Macpherson, 1993); *N. serrata* Macpherson, 1993, from north-western Australia (Wadley & Evans, 1991, as *Nephropsis* sp. 1; Macpherson, 1993); *N. stewarti* Wood-Mason, 1873, from north-western Australia (George, 1983; Wadley & Evans, 1991; Macpherson, 1993) and north-eastern Australia (Macpherson, 1993); *N. suhmi* Bate, 1888, from north-western Australia (Macpherson, 1993) and north-eastern Australia (Macpherson, 1990); and *N. sulcata* Macpherson, 1990, from north-western Australia (Macpherson, 1993) and north-eastern Australia (Macpherson, 1990; 1993).

Nephropsis acanthura Macpherson

Nephropsis acanthura Macpherson 1990: 302 (key), 311, figs 5d, 9d–f, 11a,b, 16d.–Holthuis, 1991: 32 (key), 35, fig. 61.–Macpherson, 1993: 55,64 (key).

Material examined. One male, cl. 30 mm, AM P39685, east of Cape Hawke, 32°08'S 153°09'E to 32°04'S 153°10'E, 1033–1080 m, 15 June 1989, FRV *Kapala*, stn K89-12-04; 2 males, cl. 42 and 44 mm, AM P40378, east of Newcastle Bight, 32°50'S 152°50'E, 1090–1134 m, 11 April 1989, FRV *Kapala*, stn K89-06-04; 1 female, cl. 36 mm, AM P40379, north-east of Port Hunter, 32°05'S 152°50'E, 1079–1097 m, 8 June 1989, FRV *Kapala*, stn K89-11-01; 1 female, cl. 42.5 mm, AM P40380, east of Port Hunter, 32°55'S 152°45'E, 1043–1061 m, 11 April 1989, FRV *Kapala*, stn K89-06-02; 1 male, cl. 52 mm, AM P40381, east of Port Hunter, 33°02'S 152°38'E, 896–960 m, 16 May 1989, FRV *Kapala*, stn K89-09-01; 1 female, cl. 37 mm, AM P39233, south-east of Port Hunter, 33°05'S 152°33'E to 33°04'S 152°36'E, 896–951 m, 5 May 1988, FRV *Kapala*, stn K88-08-08; 1 male, cl. 45 mm, AM P39234, south-east of Port Hunter, 33°07'S 152°33'E to 33°06'S 152°38'E, 1006–1080 m, 3 May 1988, FRV *Kapala*, stn K88-08-02; 1 female, cl. 41 mm, 1 male, cl. 45 mm, AM P39235, east of Broken Bay, 33°33'S 152°09'E to 33°35'S 152°08'E, 1022–1051 m, 19 December 1985, FRV *Kapala*, stn K85-21-04; 1 ovigerous female, cl. 52+ mm (rostrum broken), AM P39236, east of Broken Bay, 33°36'S 152°01'E to 33°32'S 152°05'E, 722–759 m, 25 September 1984, FRV *Kapala*, stn K84-16-04; 1 ovigerous female, cl. 42 mm, AM P40382, east of Broken Bay, 33°37'S 152°06'E, 990–1020 m, 17 October 1983, FRV *Kapala*, stn K83-13-01; 1 female, cl. 46 mm, AM P40383, east of Broken Bay, 33°37'S 152°07'E, 1024–1088 m, 18 May 1989, FRV *Kapala*, stn K89-09-07; 1 female, cl. 50 mm, AM P40384, east of Broken Bay, 33°45'S 152°03'E, 1005–1015 m, 11 October 1984, FRV *Kapala*, stn K84-18-07; 1 female, cl. 46+ mm (rostrum broken), AM P40385, east of Shoalhaven Heads, 34°50'S 151°15'E, 988–1015 m, 26 October 1983, FRV *Kapala*, stn K83-14-04; 1 male, cl. 48 mm, AM P44030, east of Ulladulla, 35°27'S 150°54'E, 1050–1105 m, 14 December 1988, FRV *Kapala*, stn K88-22-01; 1 male, cl. 43 mm, AM P39237, north-east of Batemans Bay, 35°32'S 150°51'E to 35°27'S 150°55'E, 988–1024 m, 4 August 1988, FRV *Kapala*, stn K88-14-04.

Remarks. Most of these specimens are considerably larger than the type specimens (16–36 mm) but agree well with Macpherson's description. The post supraorbital spines vary in number and position from none at all, to only one on either the right or left side, to two on each side.

Distribution. Indo-West Pacific Ocean: Madagascar, Philippines, north-western and eastern Australia, Tasman Sea, Coral Sea, Chesterfield Islands, New Caledonia; 720–1305 m.

Nephropsis holthuisi Macpherson

Nephropsis holthuisi Macpherson, 1993: 55, figs 1–3 (but not fig 3B), fig. 6B (erroneously as *N. serrata*).

Material examined. One male, cl. 40 mm, AM P44029, east of Terrigal, 33°33'S 152°10'E, 1080–1135 m, trawled, 31 August 1988, FV *Kapala*, stn K88-17-04.

Remarks. This specimen differs in some small ways from the type material, but is sufficiently similar to be included in the species. The rostrum is not horizontal but has a slight sinusoidal curvature. There are four (left) and three (right) small spines at the proximal end of the subdorsal carinae and the same number of small postsupraorbital spines. The antennal spines are about the same size as the supraorbital spines. Except for the lateral carina the carinae on the posterior carapace are not well developed. The pleuron of the second abdominal segment ends in a longer and sharper point than that of the holotype. The pleuron of the sixth abdominal segment ends in a short sharp double point. The coxal process on the second pereopod is bluntly pointed rather than rounded.

Distribution. Indo-West Pacific Ocean: north-western Australia (Ashmore Reef), eastern Australia; 900–1105 m.

Nephropsis suhmi Bate

Nephropsis suhmi Bate, 1888: 181, pl. 23 fig. 3, pl. 24 fig. 2.–Anderson, 1896: 96.–Ramadan, 1938: 125 (in part).–Macpherson, 1990: 302 (key), 306, figs 5b, 7d–f, 8c,d, 16b.–Holthuis, 1991: 35 (key), figs 60, 82.–Macpherson, 1993: 64 (key).

Nephropsis Suhmi.–Alcock, 1901: 158 (key), 163.–de Man, 1916: 97, 112 (key), 114.–Bouvier, 1917: 21 (key).–Balss, 1925: 208.

Material examined. One male, cl. 42.5 mm, AM P39699, Lord Howe Rise, western Tasman Sea, 27°39.8'S 161°46.3'E, beam trawl, 1423 m, J.K. Lowry *et al.* on RV *Franklin*, 6 May 1989, stn FR 0589-31.

Remarks. There are two postsupraorbital spines present on each side of the carapace. There is a well-developed spine on the anterior margin of pleura of abdominal segments 2 to 4 (as in the holotype), but not on segment 5 (as in Macpherson's material).

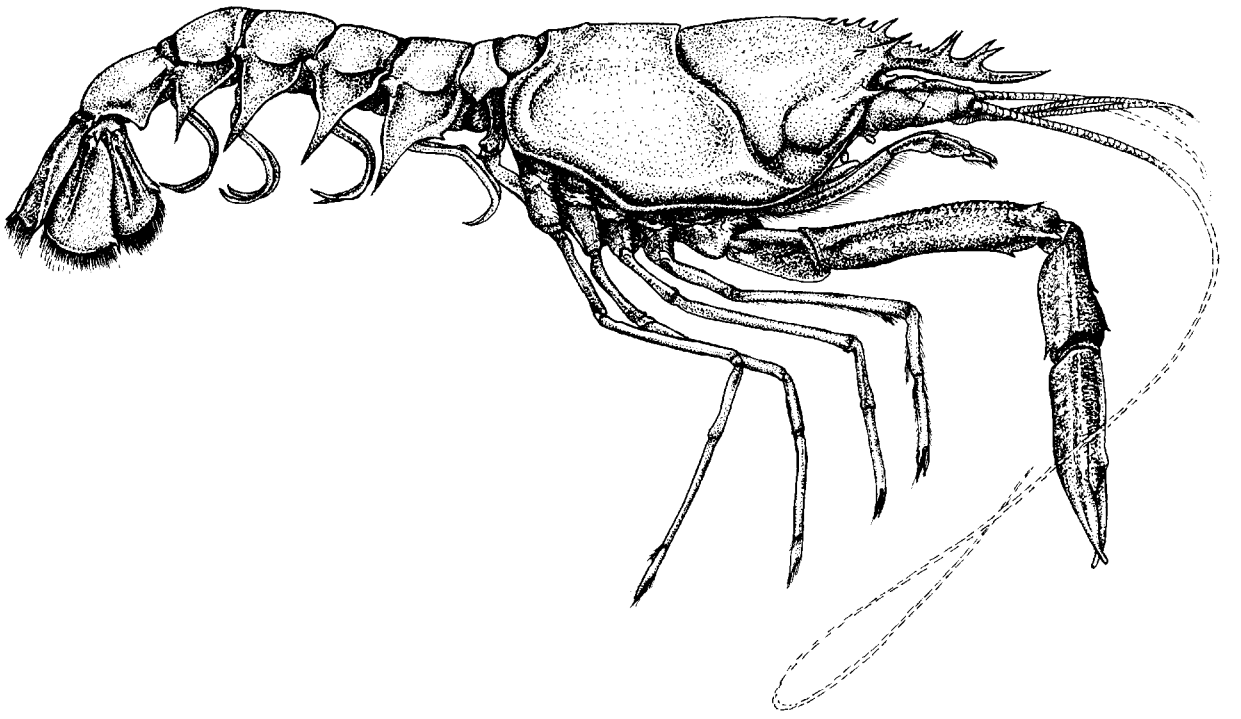

Fig. 1. *Nephropsis sulcata* Macpherson, male, cl. 38 mm, AM P20990, lateral view.

Distribution. Indo-West Pacific Ocean: Madagascar, Arabian Sea, Maldive Islands, Indonesia, north-western and north-eastern Australia, western Tasman Sea, New Caledonia; 786-2029 m.

Nephropsis sulcata Macpherson

Fig. 1

Nephropsis atlantica.–Wood-Mason & Alcock, 1891: 197, fig. 4.–Alcock, 1894a: 230.–Alcock & Anderson, 1894: 162.–Anderson, 1896: 96.–Alcock, 1901: 158 (key), 161.–Stebbing, 1902: 34.–Stebbing, 1910: 379.–Barnard in Gilchrist, 1918: 48.–von Bonde, 1932: 59.–von Bonde & Marchand, 1935: 6.–Barnard, 1950: 530, fig. 99b–e.–Barnard, 1964: 12.–Bruce, 1966c: 223.–Kensley, 1981: 29. (Not *Nephropsis atlantica* Norman, 1882).

Nephropsis sulcata Macpherson, 1990: 303 (key), 319, figs 13e–g, 14a,b, 15a,b, 16g.–Holthuis, 1991: 34 (key), 47, figs 58,84.–Macpherson, 1993: 64,65 (key).

Material examined. One female, cl. 39.5 mm, QM W14382, mid-eastern Queensland, 23°17'S 153°56'E, 732 m, trawled, M.V. *Southern Intruder*, 29 November 1983; 1 male, cl. 37.5 mm, QM W11394, mid-eastern Queensland, 24°30'S 153°30'E, 658 m, trawled, M.V. *Southern Intruder*, 2 October 1983; 1 ovigerous female, cl. 39 mm, AM P38495, east of Brisbane, south-eastern Queensland, 700–900 m, trawled, M.V. *Valkyrie Voyager*, May 1988; 1 male, cl. 38 mm, AM P20990, 1 male, cl. 26+ mm (rostrum broken), AM P20997, east of Broken Bay, 33°32'S 152°00'E to 33°38'S 152°04'E, 810 m, 19 August 1975, FRV *Kapala*, stn K75-05-05; 1 ovigerous female, cl. 45 mm, AM P19098, north-east of Port Jackson, 33°43'S 151°57'E to 33°40'S 151°59'E, 765 m, 6 December 1972.

Remarks. One specimen (39 mm female, AM P38495) has a third lateral spine on the right side of the rostrum, close to the base and about halfway between the second rostral spine and the supraorbital spine. This is also the only specimen in which the median rostral groove overreaches the anterior pair of rostral spines. In the other specimens the groove extends only to the base of the anterior pair of spines. There are 4 or 5 small spines at the proximal end of each subdorsal carina, between the supraorbital spine and the gastric tubercle. One specimen (45 mm female, AM P19098) has 2 additional small spines anterior to the largest spine which is level with the supraorbital spine. In all specimens the median and intermediate carinae are absent or very poorly defined; the lateral carina is strong. There is only one small spine on the anterior margin of the pleura of abdominal segment 2.

Colour. (Based on AM P20990) Posteromedian part of carapace and abdominal terga (pubescence) grey-green; rostrum, rostral and other spines, entire edge of carapace and abdominal pleura pale red, tips of all spines and tips of pleurae white; antennular and antennal flagella, maxillipeds, pereopods 2 to 5, all pleopods, uropods and distal portion of telson brilliant red; peduncles of antennae white; eye peduncles bright red with cornea white; chelipeds (pubescence) greenish-yellow with fingers of propodus reddish with white tips.

Distribution. Indo-West Pacific Ocean: southern Africa (Natal), south-western Indian Ocean (Madagascar), Laccadive Sea, South China Sea, Philippines, north-western and eastern Australia, Coral Sea, Chesterfield Islands, New Caledonia; 415–1115 m.

Family PALINURIDAE

Linuparus White, 1847

The genus contains three recent species, all of which occur in the Indo-West Pacific region. Two species have been previously recorded from Australian waters: *Linuparus sordidus* Bruce, 1965b, from north-western Australia (George, 1983; Wadley & Evans, 1991) and *L. trigonus* (von Siebold, 1924) from north-western Australia (George, 1983; Wadley & Evans, 1991), north-eastern Australia (Wassenberg & Hill, 1989) and south-eastern Australia (McNeill, 1949, 1953, 1956; Berry & George, 1972).

Linuparus sordidus Bruce

Linuparus sordidus Bruce, 1965b: 1, fig. 1A, pls 1, 2A, C.–Berry & George, 1972: 18 (key), 22.–George, 1983: 16,19 (key), 20.–Williams, 1986: 15, fig. 32.–Williams, 1988a: 64, unnumbered fig.–Chan & Yu, 1989c: 290, pl. 1A.–Holthuis, 1991: 111 (key), 113, figs 209a, 210a, 213.–Wadley & Evans, 1991: 29, unnumbered figs.

Material examined. Three females, cl. 71–87 mm, AM P44028, north-east of Danger Point, 28°02'S 153°57'E, 410 m, 1 June 1978, FRV *Kapala*, stn K78-09-02; 5 females, cl. 73–85 mm, AM P21667 to P21671, 1 male, cl. 62 mm, AM P21672, south-east of Clarence River, 29°41'S 153°45'E to 29°32'S 153°47'E, 399–406 m, 10 October 1975, FRV *Kapala*, stn K75-09-04.

Remarks. These specimens have all the features characteristic of *L. sordidus*, including colour: dirty-yellow brown except for the bright orange-red distal two thirds of the antennal flagella. Three specimens have a small secondary spinule on the medial slope of either the left or right supraorbital horn.

Berry & George (1972) used the presence of vestigial pleopods on the first abdominal segment to differentiate *L. somniosus* from *L. trigonus* and *L. sordidus*. In the present material one female (AM P21667) has on the right side a single reduced pleopod of a form different from that figured by Berry & George. In this specimen the antennular peduncle reaches barely as far forward as the tip of the antennal peduncle rather than extending well beyond.

There are no distinct dorsal spines on abdominal segments 2 or 3 and, except in the single male, no submedial spines on the sterna of abdominal segments 2 to 5. Ornamentation of the abdominal segments and sternum may vary with size of the animal.

Distribution. South China Sea, Taiwan, north-western and eastern Australia; 200–414 m.

Linuparus trigonus (von Siebold)

Palinurus Trigonus von Siebold, 1824: 15.
Palinurus trigonus.–De Haan, 1841: 157, pls 39,40.–Yamaguchi, 1993: 588.
Linuparus trigonus.–Holthuis, 1946: 121, pl. 11 figs i,j.–McNeill, 1953: 89.–McNeill, 1956: 53, unnumbered fig.–Bruce, 1965b: 13, fig. 1B, pl. 2B, D.–Holthuis, 1966: 264.–Prasad & Tampi, 1969: 79.–Holthuis & Sakai, 1970: 92, 114, pl. 6.–Berry & George, 1972: 18 (key), 21.–George, 1983: 17,18 (unnumbered fig.), 19 (key), 20.–Williams, 1986: 15, figs 7a, 31.–Williams, 1988a: 63, unnumbered fig. & photo.–Wassenberg & Hill, 1989: 161.–Holthuis, 1991: 111 (key), 114, figs 210b, 215.–Wadley & Evans, 1991: 30, unnumbered figs.–Ng, 1992: 184.–Yamaguchi & Baba, 1993: 238, figs 54A–C, pl. 5b,c.
Not *Linuparus trigonus*.–Barnard, 1950: 820 (= *L. somniosus* Berry & George, 1972).
Puerulus carinatus.–McNeill, 1949: 337, unnumbered fig. (Not *Puerulus carinatus* Borradaile, 1910).

Material examined. One female, cl. 64.5 mm, AM P17914, north-east of Wooli, 29°51'S 153°40'E to 29°58'S 153°38'E, 315 m, prawn trawl on sandy mud, 11 May 1971, FRV *Kapala*, stn K71-09-03; 1 female, cl. 99 mm, AM P44026, east of Newcastle, 32°53'S 151°59'E to 32°53'S 152°00'E, 71–73 m, 10 April 1990, FRV *Kapala*, stn K90-07-07; 1 female, cl. 47 mm, AM P44027, east of Long Reef, 33°45'S 151°30'E, 121–122 m, 19 March 1986, FRV *Kapala*, stn K86-06-07.

Colour. Bright red with yellow-brown patches.

Distribution. Western Pacific Ocean: Japan, Korea, China, Taiwan, Vietnam, Philippines, north-western and eastern Australia; 30–414 m.

Projasus George & Grindley, 1964

The genus contains two species, one of which is known from the Indo-West Pacific region. Adults of the genus have not previously been reported from Australian waters, though Webber & Booth (1988) reported a puerulus stage of *Projasus* sp. from east of Greenwell Point, New South Wales.

Projasus parkeri (Stebbing)

Jasus parkeri Stebbing, 1902: 39, pl. 7.–Stebbing, 1910: 375.–K.H. Barnard, 1950: 540.
Puerulus parkeri.–Holthuis, 1946: 110,148.
Projasus parkeri.–George & Grindley, 1964: 89, fig. 2.–George, 1976: 31.–Webber & Booth, 1988: 82, figs 1–3.–Melville-Smith, 1990: 314.–Holthuis, 1991: 158 (key), 159, figs 295b, 298.

Material examined. One female, cl. 53.5 mm, AM P45094, east of Newcastle, 33°30'S 152°10'E, 880 m, G. Harmer, 1992;

1 female, cl. 69.8 mm, 1 male, cl. 64.2 mm, AM P45096, east of Bermagui, 36°23'S 150°22'E, 820 m, J. Jarvis on FV *Josephine Jeen*, 3 December 1993; 1 male, cl. 63.2 mm, AM P41898, east of Eden, 37°35'S 150°21'E, 810 m, D. Bradbury on MV *Pacific Dynasty*, 25 May 1993; 1 male, cl. 64.4 mm, AM P45095, south-east of Gabo Island, 37°40'S 150°19'E, 730 m, M. Kelly on FV *Terrance Star*, 1 December 1993.

Remarks. These five specimens differ slightly from the South African material described by George (1976) and show much of the variation noted by Webber & Booth (1988) in their New Zealand material. In particular, the rostrum curves upward or is straight; the anterior margins of the supraorbital horns are almost straight in some specimens but slightly convex in others; the branchial spine row is curved in lateral view; the median carina of abdominal segment 1 varies from a distinct carina with a small sharp anterodorsally-directed tooth to almost absent with a very small blunt tooth; the median carina of abdominal segments 2 to 5 is low, blunt and anteriorly obtuse. There are two median spines on the posterior margin of the fifth sternal plate and no median posterior spine on the fourth abdominal segment. The 53.5 mm female (AM P45094) has two distinct teeth on the anterior margin of the first abdominal pleurite; the other specimens have 3–5 blunt granules.

The discovery of adult *Projasus parkeri* on the east coast of Australia makes it highly likely that the puerulus stage described by Webber & Booth (1988), as *Projasus* sp., is really that of *P. parkeri* as they suggested.

Distribution. Atlantic Ocean: south-west Africa; Indian Ocean: south-east Africa, St Paul Island; Pacific Ocean: south-eastern Australia, New Zealand; 370–880 m.

Puerulus Ortmann, 1897

The genus contains four species, all of which occur in the Indo-West Pacific region. Two species have been previously recorded from Australian waters: *Puerulus angulatus* (Bate, 1888), from north-western Australia (George, 1983; Wadley & Evans, 1991) and *P. velutinus* Holthuis, 1963, also from north-western Australia (Wadley & Evans, 1991).

Puerulus angulatus (Bate)

Panulirus angulatus Bate, 1888: 81, pl. 11 figs 2–4.
Puer angulatus.–Ortmann, 1891: 37.
Puerulus angulatus.–Calman, 1909: 442.–Balss, 1925: 203.–Holthuis, 1946: 110.–Holthuis, 1966: 267 (in part, part = *P. carinatus* Borradaile, 1910).–Berry, 1969: 247, pl. 1 fig. 2, pl. 2 fig. 2, pl. 3 fig. 2.–Harada, 1980: 244, figs 1,2.–Kensley, 1981: 30.–George, 1983: 16, 19 (key), 20.–Baba *et al.*, 1986: 155, 282, fig. 106.–Williams, 1986: 25 (key), fig. 59A.–King, 1988: 109.–Williams, 1988a: 111 (key), unnumbered figs.–Williams, 1988b: 315.–Chan & Yu, 1989a: 2, pl. 1.–Holthuis, 1991: 162, figs 300b, 301.–Wadley & Evans, 1991: 31, unnumbered figs.
Puerulus carinatus.–Ramadan, 1938: 133, figs 6,7. (Not *Puerulus carinatus* Borradaile, 1910).
Puerulus gracilis Kubo, 1939: 316, figs. 1,2.
Not *Panulirus angulatus*.–Alcock & Anderson, 1894: 166.–Alcock, 1901: 185. (= *Puerulus sewelli* Ramadan, 1938).
Not *Puerulus angulatus*.–de Man, 1916: 36, pl. 2 fig. 5. (= *P. velutinus* Holthuis, 1963).

Material examined. One male, cl. 35.8 mm, AM P34714, 2–3 km north-north-east of Raine Island, Queensland, 11°35'S 114°02'E, 275m, prawn trawl over sand, 12 February 1979, FNQ 79-31; 1 ovigerous female, cl. 43.4 mm, 1 male, cl. 43.2 mm, QM W14299, 17°33'S 149°52'E to 17°35'S 149°56'E, 302 m, P. Davie on RV *Soela*, 3 December 1985; 1 ovigerous female, cl. 48.9 mm, 1 male, cl. 40 mm, QM W14270, 17°39'S 150°10'E to 17°36'S 150°10'E, 225 m, P. Davie on RV *Soela*, 4 December 1985; 3 females, cl. 33.5, 37, 38 mm, QM W14383, 22°00'S 153°31'E, 270 m, MV *Southern Intruder*, 1 November 1983; 1 male, cl. 34.8 mm, QM W10163, 22°54.5'S 152°12.5'E, 351 m, CRAIGMIN Survey, 3 December 1980; 1 male, cl. 45.8 mm, QM W14384, 28°05'S 153°54'E, 270 m, P. Dutton on MV *Iron Summer*, 27 July 1982; 1 male, cl. 44.7 mm, QM W14374, 28°05'S, 275m, P. Dutton on MV *Iron Summer*, 27 September 1982; 1 female, cl. 47 mm, 2 males, cl. 24.5 and 38.5 mm, AM P39488, Britannia Sea Mount, western Tasman Sea, 28°18.48'S 155°38.62'E, 415 m, limestone and coarse coral sand bottom, J.K. Lowry & party on RV *Franklin*, 10 May 1989, stn FR0589-48; 1 female, cl. 21.7 mm, AM P26841, east of Wollongong, NSW, 192 m; 1 immature, cl. 13 mm, AM P30647 and 1 female, cl. 30.5 mm, AM P30754, 32 km east of Greenwell Point, NSW, 34°55'S 151°08'E, 373 m and 408 m, A. Bell, 16 July 1980.

Remarks. These specimens are generally in good agreement with the description of Holthuis (1966). They differ slightly in the following features: The supraorbital horns are only very slightly crenulate in most specimens and quite smooth in the 47 mm female (AM P39488). The tooth on either side of the anterior margin of the carapace, at the inner base of the supraorbital horn, is single, rather than bifurcate, in all specimens except the 47 mm female. The third tooth of the row between the supraorbital horns and the cervical groove is very small and in some specimens is present on one side only; it is slightly lateral to, and closely pressed against, the base of the second tooth; in a few specimens it is bifurcate or a second tiny tooth is also present. As reported by Berry (1969) for South African material, there is only one row of 4–5 teeth on the ventral surface of antennal segment 3.

Holthuis (1966: 270) mentions that in a 12 mm juvenile from the Philippines, the "epistome, instead of having a single median tooth which is directed forward, has two strong submedian spine-like teeth which are directed ventrally". In the present material the 13 mm juvenile (AM P30647) and the 21.7 mm female (AM P26841) have both the single median tooth and a blunt submedian tooth on either side of it. These two small specimens also have well-developed median spines on the thoracic sternum, and 1, 1, 2 and 3 spines at the base of pereopods 2, 3, 4 and 5 respectively, as in adults.

This series of specimens shows clearly that the size and sharpness of the spines on the abdominal median

keel decreases with increase in size of the animal. The abdominal profile of the 13 mm juvenile is almost identical to that of Bate's juvenile holotype, but in large adults the spines are reduced to a blunt ridge. The spines at the base of pereopods 2 to 5 are also much less sharp in larger specimens.

Colour. (of specimens AM P39488): overall appearance light orange; antennae uniformly light orange, not banded; anterior carapace mottled orange to translucent white, dark orange to red around bases of spines, tips of spines white; pereopods white; dark orange transverse bands on posterior of abdominal somites 1 to 6 and on abdominal carinae.

These colour notes were made from frozen material and colour photographs of that material. Of particular note is that the antennae are not banded. Berry (1969), Holthuis (1991) and Wadley & Evans (1991) have drawn attention to the banded red and white antennae of *P. angulatus*. It is possible that the banding was lost as a result of freezing but this seems unlikely since the remainder of the animal retained good colour. Morphologically, the specimens are unquestionably *P. angulatus*.

Distribution. Western Indian Ocean: Natal, Mozambique, Zanzibar, Somalia; Northern Indian Ocean: Nicobar Islands; Western Pacific Ocean: Japan, Philippines, Taiwan, New Guinea, north-western and eastern Australia, western Tasman Sea; 192–536 m.

Family POLYCHELIDAE

Polycheles Heller, 1862

The genus contains about sixteen species, of which nine are known from the Indo-West Pacific region and a further two from the north central Pacific Ocean. One species has been previously recorded from Australian waters: *Polycheles typhlops* Heller, 1862, from north-western Australia (George, 1983; Wadley & Evans, 1991).

Polycheles baccatus Bate

Polycheles baccatus Bate, 1878: 278.–de Man, 1916: 5 (list), 23 (key), 26, pl. 1 figs 4, 4a.–Bernard, 1953: 86.–Firth & Pequegnat, 1971: 39 (key), 41.–Chan & Yu, 1989b: 168, pl. 1C,D.

Polycheles baccata.–Bate, 1888: 131, fig. 32, pl. 14 fig. 1.–Sund, 1920: 226.

Material examined. One male, cl. 34.5 mm, QM W20794, 27°12.83'S 153°52.87'E, trawled, MV *Iron Summer*, R. Morton, 10 May 1983; 1 male (badly damaged), cl. 25 mm, AM P21766, north-east of Wooli, 29°52'S 153°43'E to 29°46'S 153°45'E, 505 m, 10 October 1975, FRV *Kapala*, stn K75-09-03; 1 female, 33.5 mm, AM P44749, south-east of Cape Byron, 28°37'S 153°50'E, 502 m, 19 August 1978, FRV *Kapala*, stn K78-17-21; 1 female, cl. 43 mm, AM P26649, east of Wooli, 29°51'S 153°43'E, 495 m, 23 August 1977, FRV *Kapala*, stn K77-13-10; 1 male, cl. 36.5 mm, AM P26549, east of Wooli, 29°52'S 153°43'E to 29°55'S 153°42'E, 495 m, 23 August 1977, FRV *Kapala*, stn K77-13-12; 1 ovigerous female, cl. 34.5 mm, AM P40372 and 3 ovigerous females, cl. 40, 40.5, 41.5 mm, AM P44748, north-east of North Solitary Island, 29°53'S 153°42'E to 29°50'S 153°43'E, 457 m, 26 April 1978, FRV *Kapala*, stn K78-06-07.

Remarks. The carapaces of these specimens are densely covered with fine and medium-sized granules. There are two rostral spines and immediately below these a conical tooth projects from the frontal wall of the carapace. The frontal border of the carapace bears spines or granules extending just beyond the internal angle of the orbit. In the smallest male (AM P21766) a strong, acute, flattened tooth forms the internal angle of the triangular orbital notch, the rounded external border of which is armed with five to seven spines.

The spine formula of the lateral edge of the carapace is 9–12:5:21–25. The spine forming the anterolateral angle of the carapace is larger than the following lateral spines and, like the others, is inwardly curved. The mid-dorsal carina (excluding rostral spines) comprises paired granules, two pairs anteriorly and several pairs posteriorly being larger than the others. The posterior edge of the carapace is armed with small spinules or raised granules. The gastro-orbital carina is composed of small spinules like those mid-dorsally and the superior branchial carina is marked by a line of raised granules. The two branches of the cervical groove are also marked by a series of raised granules.

The 25 mm male (AM P21766) corresponds more closely to de Man's (1916) description and figures of the *Siboga* material than to Bate's description and figures of the *Challenger* specimen of *P. baccatus*. De Man, however, pointed out several inaccuracies in Bate's description and figures.

Colour. (Based on AM P21766). Dorsal surface of the carapace and abdomen a rich burnt orange, area below lateral edges of carapace and lower half of the abdominal pleura white. Interspaces between abdominal segments as well as the grooves in abdominal terga also white. Second to fifth pereopods white, chelae of second and third pereopods pinkish red. Ischium of cheliped pinkish, colour continuing to proximal portion of merus; distal portion of merus, carpus and propodus burnt orange; joints between merus and carpus, carpus and propodus and tips of fingers whitish, giving a subtly banded appearance.

Distribution. Indo-West Pacific Ocean: Taiwan, Bali Sea, south-eastern Australia, Fiji; 350–916 m.

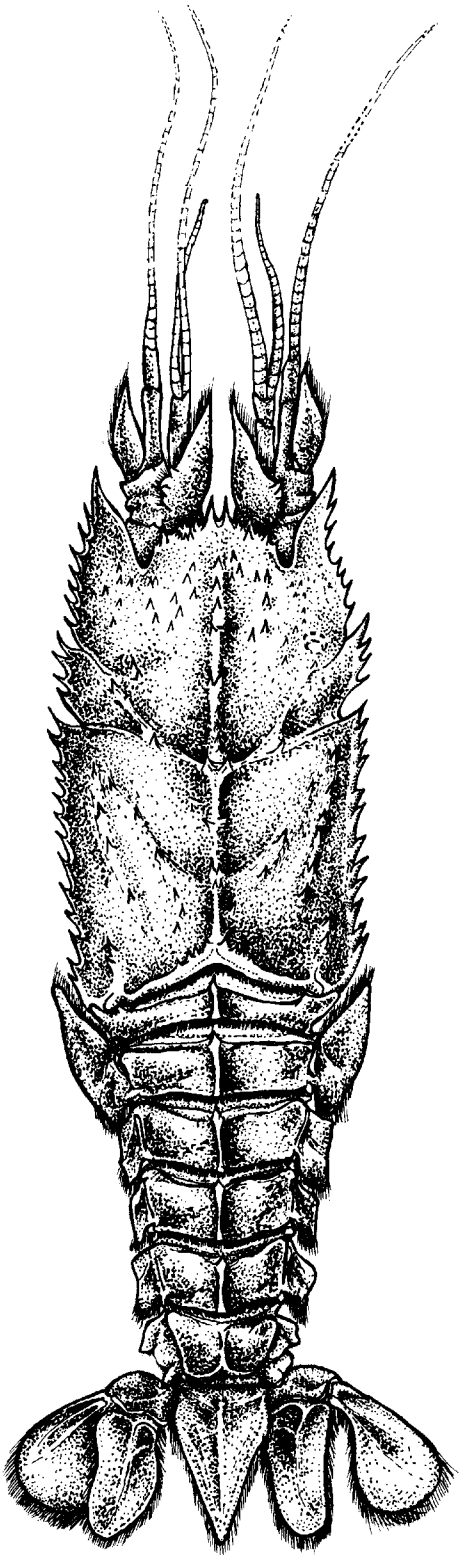

Fig. 2. *Polycheles euthrix* (Bate), male, cl. 39.7 mm, AM P17910, dorsal view.

Polycheles euthrix (Bate)

Figs 2,3

Pentacheles enthrix Bate, 1878: 280, pl. 13 figs 1–3 (erroneous spelling for *P. euthrix*).

Pentacheles euthrix.–Bate, 1888: 149, figs 33–36, pl. 17.–Sund, 1920: 226.

Polycheles euthrix.–de Man, 1916: 5 (list).–Bernard, 1953: 86.–Firth & Pequegnat, 1971: 39 (key), 45.

Material examined. Two females, cl. 35 and 36 mm, 1 specimen, cl. approx. 22 mm (very damaged), QM W14280, Coral Sea, 16°55'S 151°34'E, 880 m, P. Davie on RV *Soela*, 6 December 1985; 1 female, cl. 67 mm, 2 males, cl. 55 and 45 mm, QM W14321, 17°01'S 151°20'E, 800 m, P. Davie on RV *Soela*, 6 December 1985; 1 female, cl. 88 mm, QM W14816, 17°02'S 151°03'E, 700 m, P. Davie on RV *Soela*, 6 December 1985; 2 females, cl. 61 and 65 mm, 1 male, cl. 49 mm, QM W14300, 17°38'S 149°23'E to 17°34'S 149°23'E, 600 m, P. Davie on RV *Soela*, 3 December 1985; 1 male, cl. 21.7 mm, QM W14293, 17°30'S 149°00'E to 17°27'S 149°01'E, 900–908 m, P. Davie on RV *Soela*, 2 December 1985; 1 male, cl. 40 mm, QM W11464, 23°37'S 153°16'E, 590 m, MV *Southern Intruder*, 9 August 1983; 1 ovigerous female, cl. 71.4 mm, QM W20795, 27°13.52'S 153°53.46'E, 620 m, R. Morton on MV *Iron Summer*, 31 March 1983; 1 female, cl. 71.3 mm, QM W14336, 27°19.91'S 153°34.47'E, 600 m, MV *Iron Summer*, 10 May 1983; 1 ovigerous female, cl. 62.5 mm, QM W14286, 27°53.90'S 153°00.33'E, 560 m, R. Morton on MV *Iron Summer*, 30 March 1983; 1 female, cl. 55.8 mm, QM W14368, 27°55'S 154°01'E, 555 m, MV *Iron Summer*, 30 November 1982; 1 female, cl. 59.5 mm, QM W14273, 27°56'S 153°54'E, 590 m, S. Hyland on MV *Iron Summer*, 30 November 1982; 2 males, cl. 44.2 and 54 mm, QM W14363, 595 m, MV *Southern Intruder*, 25 April 1984; 1 female, cl. 55.5 mm, AM P44755, north-east of Point Danger, 27°55'S 154°03'E to 27°57'S 154°03'E, trawl, 549 m, 6 November 1978, FRV *Kapala*, stn K78-23-09; 3 females, cl. 30, 54.5 and 55 mm, and 1 ovigerous female, cl. 63 mm, AM P44752, east of Point Danger, 27°55'S 154°03'E to 27°57'S 154°03'E, trawl, 549 m, 6 November 1978, FRV *Kapala*, stn K78-23-09; 1 female, cl. 73 mm, AM P44750, 1 female, cl. 64.5 mm and 1 ovigerous female, cl. 63.5 mm, AM P44751, north-east of Point Danger, 28°02'S 153°59'E to 27°59'S 153°59'E, trawl, 549 m, 2 June 1978, FRV *Kapala*, stn K78-09-05; 3 females, cl. 46, 51 and 69.5 mm, 1 male, cl. 61.5 mm, AM P44754, north-east of Point Danger, 28°03'S 154°04'E to 28°01'S 154°04'E, trawl, 732 m, 6 November 1978, FRV *Kapala*, stn K78-23-08; 1 male, cl. 41 mm, AM P44753, east of Point Danger, 28°12'S 153°53'E to 28°09'S 153°53'E, trawl, 229 m, 2 November 1978, FRV *Kapala*, stn K78-23-05; 1 female, cl. 55.5 mm, 1 male, cl. 49 mm, AM P44756, east of Crowdy Head, 31°56'S 153°08'E to 31°52'S 153°16'E, trawl, 925 m, 9 December 1987, FRV *Kapala*, stn K87-24-05; 1 ovigerous female, cl. 52 mm, AM P39742, east of Hawkes Nest, 32°41'S 152°50'E, beam trawl, 713–796 m, 14 June 1989, FRV *Kapala*, stn K89-11-03; 1 ovigerous female, cl. 51 mm, AM P26754, 4 females (3 ovigerous), cl. 44.5, 47, 48 and 48.5 mm, AM P26755, 1 male, cl. 31 mm, AM P26753, east of Newcastle, 33°11'S 152°24'E to 33°09'S 152°25'E, demersal trawl, 732 m, 7 December 1977, FRV *Kapala*, stn K77-23-10; 1 male, cl. 39.7 mm, AM P17910, south-east of Port Stephens, 32°46'S

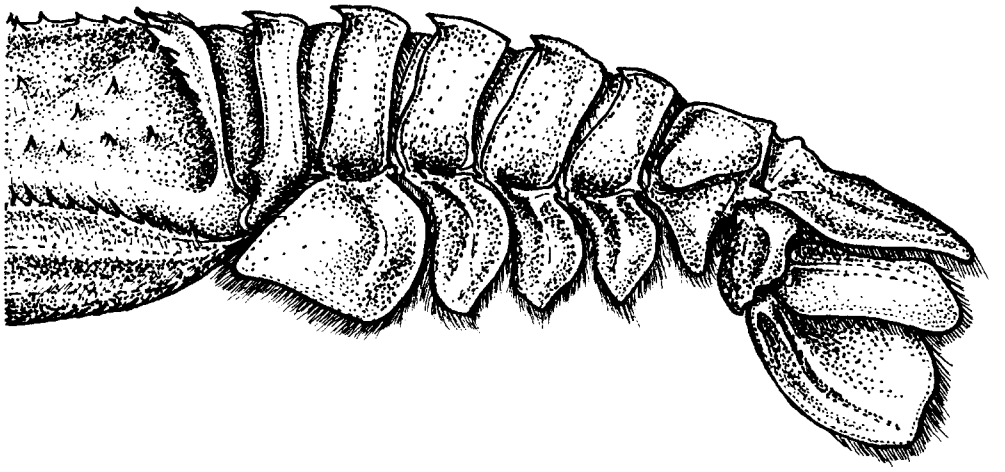

Fig. 3. *Polycheles euthrix* (Bate), male, cl. 39.7 mm, AM P17910, lateral view of abdomen.

152°46'E to 32°51'S 152°42'E, prawn trawl, sandy mud, 585–594 m, 7 May 1971, FRV *Kapala*, stn K71-09-01; 1 female, cl. 46.5 mm, AM P44757, east of Budgewoi, 33°11'S 152°25'E, beam trawl, 722–768 m, 12 April 1989, FRV *Kapala*, stn K89-06-05; 1 male, cl. 36.5 mm, AM P39743, east of Broken Bay, 33°34'S 152°05'E to 33°38'S 152°01'E, beam trawl, 814–832 m, 25 September 1984, FRV *Kapala*, stn K84-16-05.

Remarks. There are two rostral spines and, immediately below, a single small conical tooth projecting from the frontal wall of the carapace. The frontal border of the carapace is convex with 3 or 4 spines and several spinules on either side of the rostral spines. The 39.7 mm male (AM P17910) has 6 or 7 irregularly spaced spines on the frontal border. The orbital notch is subtriangular, the inner and outer borders confluent with the frontal margin, and a small sharp spine overhangs the inner border anteriorly.

The spinal formula of the lateral edges of the carapace is 7–9:3–5:13–16. In nearly all specimens there is some variation between the left and right margins. The spines of the mid-dorsal carina of the carapace (excluding rostral spines) vary from three single followed by two paired spines (1,1,1,2,2) to 1,1,1,2,1 to 1,1,2,2 to 1,1,2,1 before the cervical groove and two paired spines behind it. The posterior border of the carapace has several antrorse spines (one large and several smaller) on each side of the mid-dorsal carina.

The mid-gastric and branchial regions of the carapace bear scattered spines, spinules and granules which are not evident in Bate's figure. Sund (1920) remarked that in the *Challenger* material there was only one spine on the gastric region and none on the branchial regions. Whereas the *Challenger* specimens had only a single spine on the antero-external angle of the basal segment of the antennular peduncle, the present specimens have a small spinule as well as a spine. In one specimen (40 mm male, QM W11464) the spinule is bifid.

Distribution. Western Pacific Ocean: eastern Australia, Kermadec Islands, Fiji; 229–1152 m.

Polycheles granulatus Faxon

Figs 4,5

Polycheles granulatus Faxon, 1893: 197.–Faxon, 1895: 123, pl. 32 fig. 1, pl. 33 figs 2,2a.–Rathbun, 1906: 899, fig. 54.–Selbie, 1914: 23, pl. 3.–de Man, 1916: 5 (list).–Bouvier, 1917: 45, pl. 2 figs 7–14.–Barnard, 1950: 569.–Bernard, 1953: 86.–Zariquiey, 1968: 210.–Firth & Pequegnat, 1971: 40 (key), 47.–Wenner, 1979: 443.–Kensley, 1981: 29.

Pentacheles Beaumontii Alcock, 1894a: 236.–Alcock, 1901: 175.

Pentacheles beaumontii.–Alcock, 1894b: pl. 8 fig. 3.

?*Polycheles granulatus*.–Balss, 1925: 200.

Material examined. Two females, cl. 24.5 and 32.5 mm, AM P44910, Lord Howe Rise, western Tasman Sea, 28°05.76'S 163°06.04'E, beam trawl, coarse ooze and pumice, 1051 m, J.K. Lowry & party on RV *Franklin*, 5 May 1989, stn FR0589-25; 2 males, cl. 17.5 and 19 mm, AM P44909, Lord Howe Rise, western Tasman Sea, 28°44.08'S 161°54.59'E, beam trawl, pale grey ooze, 1325 m, J.K. Lowry & party on RV *Franklin*, 4 May 1989, stn FR0589-22; 4 females, cl. 23.5, 25.5, 30 and 39 mm, 2 ovigerous females, cl. 53 and 59.5 mm, 3 males, cl. 30, 32.5 and 39 mm, AM P44910, east of Diamond Head, 31°46'S 153°18'E to 31°46'S 153°19'E, 1005–1240 m, 21 June 1988, FRV *Kapala*, stn K88-12-03; 1 ovigerous female, cl. 50.5 mm, AM P44904, east of Crowdy Head, 31°56'S 153°08'E to 31°52'S 153°16'E, 485–925 m, 9 December 1987, FRV *Kapala*, stn K87-24-05; 2 ovigerous females, cl. 46.5 and 45.5 mm, 2 males, cl. 31.5 and 42 mm, AM P39721, east of Black Head, 32°01'S 153°10'E, 915–997 m, 15 June 1989, FRV *Kapala*, stn K89-12-05; 5 males, cl. 25, 36.5, 37.5, 45.5 and 46.5 mm, AM P39726, east of Black Head, 32°04'S 153°10'E, 1034–1079 m, 15 June 1989, FRV *Kapala*, stn K89-12-04; 1 ovigerous female, cl. 55.5 mm, AM P44907, east of Crowdy Head, 32°05'S 153°08'E to 32°02'S

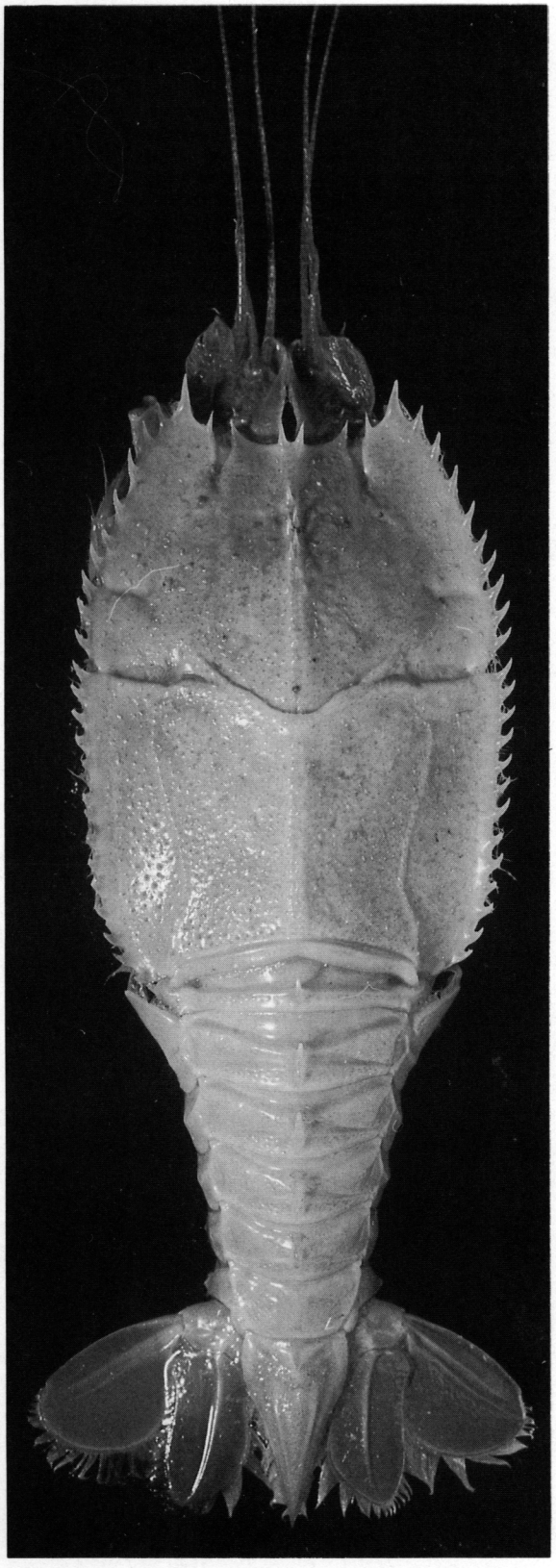

Fig. 4. *Polycheles granulatus* Faxon, male, cl. 32 mm, AM P25047, dorsal view.

153°10'E, 1025 m, 21 June 1988, FRV *Kapala*, stn K88-12-02; 2 females, cl. 52.5 and 62.5 mm, 1 male, cl. 49.5 mm, AM P44905, east of Cape Hawke, 32°06'S 153°08'E to 32°02'S 153°09'E, 1025–1080 m, 4 May 1988, FRV *Kapala*, stn K88-08-04; 3 females, cl. 41.5, 42.5 and 49.5 mm, AM P39724, east of Cape Hawke, 32°06'S 153°08'E to 32°02'S 153°09'E, 942–978 m, 2 November 1983, FRV *Kapala*, stn K83-15-02; 1 female, cl. 51.2 mm, 1 male, cl. 44.5 mm, AM P39719, east of Cape Hawke, 32°08'S 153°09'E to 32°04'S 153°10'E, 1066–1052 m, 18 July 1984, FRV *Kapala*, stn K84-10-04; 1 female, cl. 50.5 mm, 1 male, cl. 41.5 mm, AM P44906, south-east of Crowdy Head, 32°09'S 153°09'E to 32°05'S 153°09'E, 1066–1100 m, 21 June 1988, FRV *Kapala*, stn K88-12-01; 1 male, cl. 41.5 mm, AM P44901, east of Port Stephens, 32°43'S 152°51'E to 32°35'S 152°51'E, 914 m, 18 October 1983, FRV *Kapala*, stn K83-13-03; 1 female, cl. 49 mm, 1 male, cl. 39 mm, AM P39723, north-east of Newcastle, 32°50'S 152°48'E to 32°48'S 152°48'E, 945–990 m, 16 August 1988, FRV *Kapala*, stn K88-16-03; 3 males, cl. 31.5, 37 and 45 mm, AM P39720, north-east of Newcastle, 32°50'S 152°50'E, 1066–1052 m, 8 June 1989, FRV *Kapala*, stn K89-11-02; 1 female, cl. 40 mm, 3 males, cl. 24, 31.5 and 40.5 mm, AM P39722, north-east of Newcastle, 32°50'S 152°50'E, 1079–1097 m, 8 June 1989, FRV *Kapala*, stn K89-11-01; 1 ovigerous female, cl. 44.5 mm, AM P44902, east of Newcastle, 32°57'S 152°44'E to 32°54'S 152°46'E, 540–565 m, 19 October 1983, FRV *Kapala*, stn K83-13-04; 2 females, cl. 46 and 48 mm, 1 ovigerous female, cl. 51.5 mm, AM P39731, east of Newcastle, 32°59'S 152°42'E to 32°54'S 152°44'E, 988–960 m, 18 October 1983, FRV *Kapala*, stn K83-13-02; 1 ovigerous female, cl. 50.5 mm, 4 males, cl. 28, 38.5, 41.5 and 45.5 mm, AM P39725, east of Newcastle, 33°02'S 152°38'E, 896–960 m, 16 May 1989, FRV *Kapala*, stn K89-09-01; 4 females, cl. 23.5, 30, 46.5 and 47 mm, 1 ovigerous female, cl. 49 mm, 2 males, cl. 22 and 32.5 mm, 2 juveniles, cl. 17.5 and 18.5 mm, AM P44896, north-east of Broken Bay, 33°27'S 152°09'E to 33°25'S 152°11'E, 882–914 m, 8 December 1977, FRV *Kapala*, stn K77-23-13; 1 female, cl. 31 mm, AM P39729, north-east of Broken Bay, 33°28'S 152°12'E to 33°33'S 152°10'E, 1080–1135 m, 31 August 1988, FRV *Kapala*, stn K88-17-04; 1 female, cl. 52 mm, 1 male, cl. 43.5 mm, AM P44908, north-east of Broken Bay, 33°30'S 152°10'E, November 1992; 1 female, cl. 22 mm, 1 male, cl. 19 mm, AM P21062, east of Broken Bay, 33°32'S 152°04'E to 33°38'S 152°00'E, 822 m, 19 August 1975, FRV *Kapala*, stn K75-05-05; 1 male, cl. 24.5 mm, AM P39730, east of Broken Bay, 33°32'S 152°07'E, 732–795 m, 17 May 1989, FRV *Kapala*, stn K89-09-06; 2 females, cl. 30.5 and 32 mm, 1 ovigerous female, cl. 43.5 mm, 1 male, 41 mm, 1 juvenile, 23 mm, AM P26787, east of Broken Bay, 33°33'S 152°03'E, 905–914 m, 12 December 1977, FRV *Kapala*, no station number; 2 males, cl. 18.5 and 26 mm, 2 damaged specimens, cl. 18 and 19 mm, AM P38724, east of Broken Bay, 33°33'S 152°09'E, 1022–1051 m, 19 December 1985, FRV *Kapala*, stn K85-21-04; 1 ovigerous female, cl. 47 mm, AM P26811, east of Broken Bay, 33°35'S 152°00'E to 33°33'S 152°02'E, 823 m, 8 December 1977, FRV *Kapala*, stn K77-23-12; 1 male, cl. 32 mm, AM P25047, 1 female, cl. 19 mm, AM P25048, east of Broken Bay, 33°35'S 152°01'E to 33°32'S 152°03'E, 825 m, 20 December 1976, FRV *Kapala*, stn K76-24-03; 1 female, cl. 52.5 mm, AM P44898, east of Broken Bay, 33°36'S 152°06'E to 33°34'S 152°08'E, 914 m, 4 December 1979, FRV *Kapala*, stn K79-20-06; 1 female, cl. 24 mm, 1 juvenile, cl. 18 mm, AM P44899, south-east of Broken Bay, 33°39'S 152°06'E to 33°37'S 152°07'E, 990 m, 6 December 1979, FRV *Kapala*, stn K79-20-15; 1 male, cl. 18.5 mm, AM P26778,

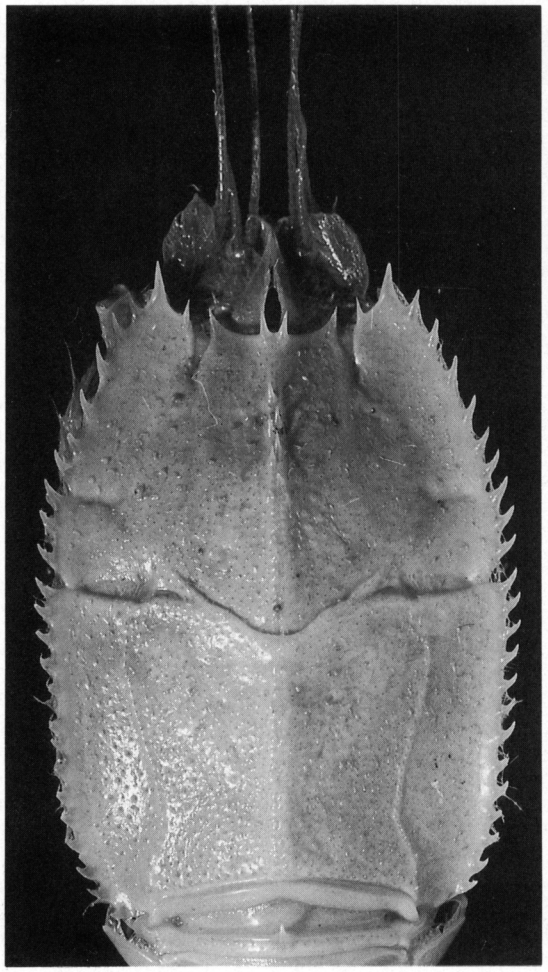

Fig. 5. *Polycheles granulatus* Faxon, male, cl. 32 mm, AM P25047, carapace.

south-east of Broken Bay, 33°40'S 151°56'E to 33°37'S 151°56'E, 732 m, 6 December 1977, FRV *Kapala*, stn K77-23-06; 2 females, cl. 24.5 and 30 mm, 1 male, cl. 23 mm, AM P39727, south-east of Broken Bay, 33°41'S 152°01'E, 805–869 m, 9 May 1989, FRV *Kapala*, stn K89-08-01; 1 female, cl. 41.5 mm, AM P38727, north-east of Long Reef Point, 33°43'S 152°03'E to 33°40'S 152°05'E, 1042–1070 m, 27 September 1984, FRV *Kapala*, stn K84-16-14; 1 female, cl. 23 mm, AM P20639, east of Long Reef Point, 33°44'S 151°55'E to 33°40'S 151°58'E, 720 m, 9 November 1972, FRV *Kapala*, stn K72-07-04; 1 male, cl. 32.5 mm, AM P44903, east of Long Reef Point, 33°44'S 151°57'E, 820–889 m, 11 February 1986, FRV *Kapala*, stn K86-01-07; 1 ovigerous female, cl. 59 mm, AM P39728, east of Long Reef Point, 33°45'S 152°00'E to 33°41'S 152°03'E, 969–1006 m, 1 November 1984, FRV *Kapala*, stn K84-20-03; 2 males, cl. 28.5 and 30 mm, AM P44897, east of Shoalhaven Bight, 34°55'S 151°13'E to 34°53'S 151°14'E, 823 m, 12 December 1978, FRV *Kapala*, stn K78-27-05; 1 female, cl. 31.5 mm, AM P44900, south-east of Point Hicks, 38°19'S 149°47'E to 38°17'S 149°49'E, 997–1017 m, 27 September 1983, FRV *Kapala*, stn K83-12-04; 1 female, 30.5 mm, AM P45098, off St Patricks Head, Tasmania, approx. 41°20'S 148°50'E, demersal trawl, 1100 m, K. Graham on FRV *Soela*, 12 July 1987, stn SO5/87/15.

Remarks. These specimens agree more closely with Alcock's description and figure (Alcock, 1894b, pl. 8, fig. 3) of *Pentacheles beaumontii* than with Faxon's (1895, pl. 33, figs 2, 2a) description and figure of *Polycheles granulatus* except that the scaphocerite is normally developed, as in *P. granulatus*. *Polycheles granulatus* appears very fragile and delicate. The carapace is somewhat ovate in shape with a finely granulate surface and lacks large spines except anteriorly on the medial carina and the lateral edges.

There are two strong rostral spines and a strong spine on both internal and external angles of the orbital notch. The orbital notch is relatively narrow and deep and the ocular peduncle has a spine on the anterior border.

The spinal formula of the lateral edge of the carapace is 7–9:3–4:13–17. The arrangement of spines along the mid-dorsal carina (excluding rostral spines) of the carapace varies from one to three single spines to two or three more or less paired spines, followed by smaller spinules or granules anterior to the cervical groove and paired low granules behind it. Only the superior branchial carina is obvious and is composed of minute spinulose granules. The posterior edge of the carapace is smooth.

Colour. (Based on AM P25047). Entire carapace, abdominal segments and telson light rose pink, spines tipped with white. Antennular and antennal flagella and peduncles, pereopods, pleopods, endopods and exopods of uropods a darker pink to red.

Distribution. Atlantic Ocean: south-west coast of Ireland, Spain, Madeira and Canary Islands, Azores, Nova Scotia, mid-Atlantic Bight, south-western Africa; Indian Ocean: Sri Lanka; Pacific Ocean: south-eastern Australia, western Tasman Sea, Hawaiian Islands; 347–2505 m.

Polycheles typhlops typhlops Heller

Figs 6–8

Polycheles typhlops Heller, 1862: 392, pl. 1 figs 1–6.–Kemp & Sewell, 1912: 23.–de Man, 1916: 2,6,24.–Bouvier, 1917: 35, pl. 2 figs 1–6.–Balss, 1925: 201, pl. 19 figs 12–14.–Bernard, 1953: 3,86.–Lewinsohn & Holthuis, 1964: 54.–Zariquiey, 1968: 209, fig. 86b.–George, 1983: 16,19 (key), 20.–Baba *et al.*, 1986: 156, 283, fig. 107.–Chan & Yu, 1989b: 166, pl. 1A,B.

Pentacheles Hextii Alcock, 1894a: 237.–Alcock, 1901: 172.–Alcock & Anderson, 1895: pl. 10 figs 2, 2a–c.

Polycheles typhlops typhlops.–Firth & Pequegnat, 1971: 39 (key), 51, fig. 7.–Wadley & Evans, 1991: 27, unnumbered figs.

Material examined. One male, cl. 49 mm, QM W11220, east of Murray Isles, Torres Strait, 9°50'S 144°11'E to 9°51'S 144°09'E, 460 m, Queensland Fisheries Service on *Gwendoline May*, 21 May 1983; 1 male, cl. 43.5 mm, AM P44911, south-east of Cape Byron, 28°37'S 153°50'E, 502 m, 19 August 1978, FRV *Kapala*, stn K78-17-21; 1 male,

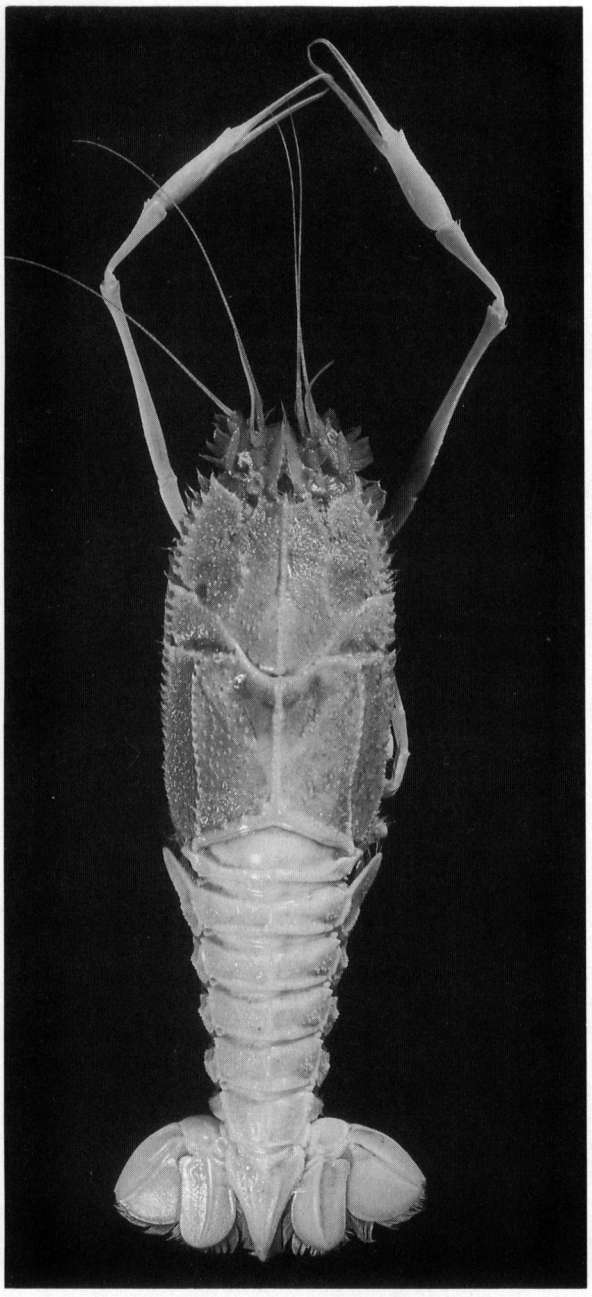

Fig. 6. *Polycheles typhlops typhlops* Heller, male, cl. 34.4 mm, AM P21799, dorsal view.

cl. 34.5 mm, AM P21799, north-east of Wooli, 29°52'S 153°43'E to 29°46'S 153°45'E, 503 m, 10 October 1975, FRV *Kapala*, stn K75-09-03; 1 male, cl. 39.5 mm, AM P20638, north-east of Broken Bay, 33°30'S 152°05'E to 33°26'S 152°08'E, 549 m, 5 October 1972, FRV *Kapala*, stn K75-02-08; 1 female, cl. 39 mm, AM P39741, east of Broken Bay, 33°34'S 151°57'E, 549–568 m, 10 September 1984, FRV *Kapala*, stn K84-15-02; 1 male, cl. 36 mm, AM P39740, east of Wollongong, 34°19'S 151°27'E to 34°24'S 151°24'E, 512 m, 19 July 1979, FRV *Kapala*, stn K79-08-12; 1 male, cl. 30.5 mm, AM P44912, east of Shoalhaven Bight, 34°42'S 151°15'E to 34°38'S 151°16'E, 613–640 m, 10 October 1984, FRV *Kapala*, stn K84-18-04; 1 male, cl. 26.8 mm, AM P20637, off New South Wales, 1971, FRV *Kapala*.

Remarks. *Polycheles typhlops* has been well described and figured by many authors. These specimens have the characteristic orbital notch described by Firth & Pequegnat (1971). The orbital peduncle has a sharp spine on the anterior edge. The carapace is long and narrow, its surface covered by minute spinules. Immediately below a single rostral spine, a conical tooth projects from the frontal wall of the carapace. The spinal formula of the lateral edges of the carapace is 7–9:5–6:24–26. The mid-dorsal carina is a line of irregularly spaced single, or posteriorly, paired spines anterior to the cervical groove and paired granules or occasionally spines behind the cervical groove. The posterior edge of the carapace is armed with several antrorse spines, two to three on each side of the mid-dorsal carina. The gastro-orbital carina is faint and comprises four antrorse spines or spinules; the superior branchial carina is marked by a line of 12–15 similar spines sometimes becoming smaller posteriorly. Other spines or spinules are located along the posterior branch of the cervical groove and on the branchio-cardiac carina.

Two subspecies are presently recognised: *Polycheles typhlops typhlops* Heller and *P. typhlops perarmatus* Holthuis (1952a). Firth & Pequegnat (1971) reported two intergrading forms which they termed "Form A" and "Form B" from the Gulf of Mexico and the Caribbean Sea. The east Australian males would be closer to Firth & Pequegnat's "Form B". They agree in having two to four spines on each side of the posterior border of the carapace, the second pleuron anteriorly obtuse (or right angled), tubercles on the edges of the pleura, 14–27 blunt tubercles on the edges of the terga, and strong spines on the cheliped. They differ from "Form B" in having only a partial third carina on the exopodites of the uropods and some spinules or small spines on the carina of the cervical groove. However, the two most important characteristics of the subspecies *P. typhlops perarmatus* are the rounded shape of the second pleuron and the great number of sharp spines on the edges of the terga. The east Australian specimens do not have these features and must be considered as *P. typhlops typhlops*.

Colour. (Based on AM P21799). Medial gastric and frontal region, scaphocerite and antennular peduncles, anterolateral edges and posterior border of carapace, cervical groove, mid-dorsal carina of carapace, carinae and granulate edges of abdominal terga bright orange. Remaining portions of carapace, abdominal terga and pleura white. Cheliped with proximal portion of merus white, distal third of merus and carpus orange. Upper surface of propodus and fingers orange, shading to pinkish white on underside and distal portions. All other pereopods white.

Fig. 7. *Polycheles typhlops typhlops* Heller, male, cl. 34.4 mm, AM P21799, carapace.

Distribution. Atlantic Ocean; Mediterranean Sea; Caribbean Sea; Gulf of Mexico; Indian Ocean; Western Pacific Ocean, western and eastern Australia; 183–2195 m.

Stereomastis Bate, 1888

The genus contains twelve species, of which nine are known from the Indo-West Pacific region. Two species have been previously recorded from Australian waters: *Stereomastis phosphorus* (Alcock, 1894) from north-western Australia (George, 1983; Wadley & Evans, 1991) and *S. nana* (Smith, 1884), also from north-western Australia (George, 1983).

Stereomastis andamanensis (Alcock)

Pentacheles andamanensis Alcock, 1894a: 233 (key), 239.–Alcock & Anderson, 1896: pl. 10 fig. 3.

Polycheles andamanensis.–Alcock, 1901: 167 (key), 169.–Bouvier, 1917: 35 (list).–Ramadan, 1938: 124.

Stereomastis andamanensis.–de Man, 1916: 4 (list), 8 (key), 16, pl. 1 fig. 2.–Bernard, 1953: 87.–Takeda & Hanamura, 1994: 31.

Material examined. One male, cl. 34.5 mm, AM P40367, Coral Sea, 10°34.28'S 144°13.33'E, beam trawl, 815–825 m, P. Hutchings & party on RV *Franklin*, 20–21 August 1988, stn FR0688-4; 1 male, cl. 22 mm, AM P40368, Lord Howe Rise, western Tasman Sea, 27°39.8'S 161°46.3'E, beam trawl, 1423 m, J.K. Lowry & party on RV *Franklin*, 6 May 1989, stn FR0589-31; 1 ovigerous female, cl. 43.5 mm, AM P40370 and 1 female, cl. 37 mm, AM P40371, Lord Howe Rise, western Tasman Sea, 27°59.3'S 162°48.6'E, beam trawl, coarse ooze with pumice, 1250 m, J.K. Lowry & party on RV *Franklin*, 5 May 1989, stn FR0589-27; 2 ovigerous females, cl. 38.5 and 40.5 mm, AM P40369, north-east of Tuncurry, 32°04'S 153°10'E, beam trawl, 1034–1079 m, 15 June 1989, FRV *Kapala*, stn K89-12-04; 1 ovigerous female, cl. 41.5 mm, AM P40373, north-east of Tuncurry, 32°06'S 153°08'E to 32°02'S 153°09'E, beam trawl, 1025–1080 m, 4 May 1988, FRV *Kapala*, stn K88-08-04; 1 ovigerous female, cl. 42 mm, AM P40374, north-east of Port Hunter, 32°50'S 152°50'E, 1079–1097 m, 8 June 1989, FRV *Kapala*, stn K89-11-01; 1 ovigerous female, cl. 39 mm, AM P40375, east of Port Hunter, 32°55'S 152°45'E, 1043–1061 m, 11 April 1989, FRV *Kapala*, stn K89-06-02; 1 female, cl. 44.5 mm, AM P40376, south-east of Cape Hawke, 33°26'S 152°14'E, 1134–1189 m, 10 May 1989, FRV *Kapala*, stn K89-08-02; 1 ovigerous female, cl. 44.5 mm, AM P40377, east of Broken Bay, 33°28'S 152°12'E to 33°33'S 152°10'E, 1080–1135 m, 31 August 1988, FRV *Kapala*, stn K88-17-04; 1 female, cl. 30.5 mm, AM P38725, off Shoalhaven Bight, 34°55'S 151°15'E to 34°51'S 151°17'E, trawl, 1170–1207 m, 2 August 1984, FRV *Kapala*, stn K84-11-09.

Remarks. The rostrum is bifid, the orbital notches broad V-shaped, with a single sharp spine at the internal orbital angle. The ocular peduncle has a short, laterally-directed spine on the centre of its anterior margin. There are two spines on the basal antennular segment, as in the type specimen. The posterior spine is about half the length of the anterior spine and usually hidden by fine setae. De Man (1916) found only a single spine on each side in the *Siboga* material, except in one small female.

The mid-dorsal carina of the carapace, behind the rostral spines, has spinal formula 1,1,2,1 before the cervical groove and 2,2,2 behind it. One specimen, a 44.5 mm ovigerous female (AM P40376), has a mid-dorsal spinal formula of 1,1,2,1,1,1. However, two of the three posterior spines are irregularly spaced and appear to be abnormal.

The spinal formula of the lateral edge of the carapace is 5–6:3–4:6–8. All specimens except one have five spines along the slightly sinuous sublateral ridge of the branchial region, as in the type specimen. De Man (1916) recorded seven or eight sublateral spines in most of the *Siboga* material.

The median carina of abdominal segments 1 to 5 is produced into a spine. The spine on segment 5 is slightly smaller than that on segment 4. The spine on segment 4 is smoothly curved, as in Alcock & Anderson's (1896) plate 10 figure 3a, rather than de Man's (1916) plate 1 figure 2a. The double carina of segment 6 is strongly nodular and united posteriorly by a taller nodule. There is a low, double-peaked nodule on the telson. The merus of the cheliped has one small spine about midway

Fig. 8. *Polycheles typhlops typhlops* Heller, male, cl. 34.4 mm, AM P21799, lateral view.

along the upper margin. Alcock (1894a) recorded two spines and de Man (1916) mentioned two to three. The lower margin has no spines but is finely spinulose on its distal half.

One specimen, a 34.5 mm male (AM P40367) differs from the other material in several small points. The left antennular basal segment has only one spine; the right has two spines, but the posterior one is larger than the anterior one; the spine on the ophthalmic peduncle is very short and blunt; there are seven spines on the sublateral ridge of the branchial region, which is not sinuous; there are no spinules on the posterior margin of the carapace. This specimen thus agrees with de Man's description of the *Siboga* material in aspects which differ slightly from the type specimen. It is interesting to note that this specimen is from the Coral Sea whereas the rest of the present material is from much further south, in the Tasman Sea.

Six of the specimens (AM P40371, P40373 to P40376) have a slender spine, arising between the bases of the two rostral spines, at the extreme anterior edge of the carapace. This spine is almost as long as, and projects at much the same angle as, the rostral spines. The other six specimens do not have such a spine and there are no intermediate forms. This subrostral spine is not the "small, obtuse tubercle" mentioned by de Man (1916: 19). Such a tubercle also occurs in all the present material. It is small and arises low down on the frontal wall of the carapace, unlike the prominent conical tooth of *S. phosphorus*. The subrostral spine of the present material seems to be the same as that described by Smith (1884: 15) in *S. nana*. *Stereomastis nana* is similar to *S. andamanensis* but can be distinguished from it by the absence of any spine on the internal orbital angle in *S. nana*. Also, in *S. nana* the large antrorse spine of the fifth abdominal segment is at least as large as the fourth, whereas in *S. andamanensis* the fifth spine is smaller than the fourth.

The six specimens with extra subrostral spine and three of those without (AM P38725, P40368 and P40370) have slender spinules, rather than granules, on the posterior border of the carapace. De Man (1916: 18) suggested that spinules occur in smaller specimens and granules in the larger specimens. However, in our material the specimens with spinules are ovigerous females and an adult male.

Distribution. Indo-West Pacific Ocean: Arabian Sea, northern Indian Ocean, Indonesia, Coral Sea, western Tasman Sea; 724–2000 m.

Stereomastis helleri (Bate)

Polycheles Helleri Bate, 1878: 277 (in part).
Polycheles helleri.–Bate, 1888: 138 (in part), pl. 14 fig. 2 (not female from station 170, pl. 15 fig. 1, = *S. kermadecensis* Sund, 1920).–Sund, 1920: 224.

Material examined. One male, cl. 19 mm, AM P40360, Coral Sea, 11°33.02'S 145°19.34'E, 1611–1584 m, P. Hutchings & party on RV *Franklin*, 22 August 1988, stn FR0688-11.

Remarks. This single specimen agrees well with Bate's (1888) description and figures of the small male type specimen. The rostrum is bifid, the orbital notches deep U-shaped; there is no spine on either side of the inner or outer orbital angle. The spine on the ophthalmic peduncle is strong and directed slightly laterally. There are two spines on the basal antennular segment. The mid-dorsal carina, behind the rostral spines, has spinal formula 1,1,2,1 before the cervical groove and 2,2,2 behind it. The posterior margin of the carapace has a series of low but distinct, regularly spaced granules. The spinal formula of the right lateral margin is 6:3:2–3, that is, on the margin posterior to the cervical groove the anterior and posterior teeth are distinct, but between these teeth there are indistinct granules, just as described by Bate. The left margin is damaged. The sublateral carinae of the branchial region are similarly armed, having five to six distinct spines interspersed, particularly in the middle, with indistinct granules. The most posterior spine is strongest, as noted by Bate.

Abdominal segments 1 to 5 have the median carina produced into an anteriorly projecting spine, that on segment 5 being the largest. The double carina of segment 6 is low, irregular, united posteriorly. There is a single low but long nodule on the anterior portion of the telson. The anterior margin of abdominal pleuron 2 is broadly rounded proximally, without any spine, but obliquely angled on its lower half. There are a few small blunt spinules on the posteroventral margin of pleura 3 to 6.

Both chelipeds are missing from the specimen.

This species is very similar to *S. nana* (Smith, 1884) from the Atlantic and eastern Pacific (Faxon, 1895), especially in the absence of a spine on the inner orbital angle and in the distribution of spines on the lateral margin of the carapace. The material from north-western Australia reported by George (1983) as *S. nana* is possibly *S. helleri*.

Distribution. South-west Pacific Ocean: north of Papua New Guinea, Coral Sea; 1611–1957 m.

Stereomastis phosphorus (Alcock)

Figs 9–11

Pentacheles phosphorus Alcock, 1894a: 240.–Alcock, 1894b: pl. 8 fig. 2.

Polycheles phosphorus.–Alcock, 1901: 167 (key), 168.–Rathbun, 1906: 898.–Kemp & Sewell, 1912: 24.–Bouvier, 1917: 35 (list).

Stereomastis phosphorus.–de Man, 1916: 4 (list), 15.–Bernard, 1953: 87.–Firth & Pequegnat, 1971: 64 (key), 68.

Stereomastis cf. *phosphorus*.–Wadley & Evans, 1991: 28, unnumbered figs.

Material examined. One juvenile, cl. 21 mm, AM P44919, Torres Strait, 10°34.28'S 144°13.33'E, beam trawl, 815–825 m, P. Hutchings & party on RV *Franklin*, 21 August 1988, stn FR0688-4; 1 male, cl. 30.5 mm, AM P44920, Torres Strait, 10°37.17'S 144°21.99'E, beam trawl, 990–1053 m, P. Hutchings & party on RV *Franklin*, 21 August 1988, stn FR0688-54; 1 female, cl. 61.7 mm, QM W14294, 23°40'S 153°56.9'E, 530 m, G. Smith on MV *Iron Summer*, 22 November 1982; 1 ovigerous female, cl. 50.5 mm, 3 males, cl. 41, 50 and 55.3 mm, QM W14355, south-east Queensland, 26°31'S 153°48'E, 570 m, G. Smith on MV *Iron Summer*, 13 December 1982; 1 ovigerous female, cl. 61.5 mm, QM W14328, 27°12.83'S 153°52.87'E, R. Morton on MV *Iron Summer*, 10 May 1983; 2 ovigerous females, cl. 50 and 70 mm, QM W14313, 27°13.00'S 153°52.53'E, 590 m, R. Morton on MV *Iron Summer*, 9 May 1983; 1 ovigerous female, cl. 50 mm, QM W14282, 27°13.52'S 153°53.46'E, 620 m, R. Morton on MV *Iron Summer*, 31 March 1983; 1 ovigerous female, cl. 70 mm, QM W14262, 27°13.69'S 153°54.93'E, 600 m, R. Morton on MV *Iron Summer*, 31 March 1983; 1 male, cl. 39.5 mm, QM W14381, 27°16'S 153°53'E, 540 m, G. Smith on MV *Iron Summer*, 13 August 1982; 1 male, cl. 51 mm (very damaged), QM W14344, 27°35.04'S 153°57.32'E, 545 m, R. Morton on MV *Iron Summer*, 31 March 1983; 1 ovigerous female, cl. 48 mm, QM W14367, 27°S 153°36'E, 540 m, P. Dutton on MV *Iron Summer*, 29 July 1982; 1 male, cl. 40 mm, QM W14323, 27°59'S 154°00.5'E, S. Hyland on MV *Iron Summer*, 4 December 1982; 1 ovigerous female, 61.9 mm, QM W14276, 27°59.37'S 154°00'E, R. Morton on MV *Iron Summer*, 31 March 1983; 1 female, 67.5 mm, QM W14352, 28°01'S 154°01'E, 580 m, S. Hyland on MV *Iron Summer*, 4 December 1982; 4 females, 24, 30.5, 33.5 and 34 mm, 3 ovigerous females, cl. 45.5, 53 and 53.5 mm, 2 males, cl. 26.5 and 48.5 mm, AM P44914, north-east of Point Danger,

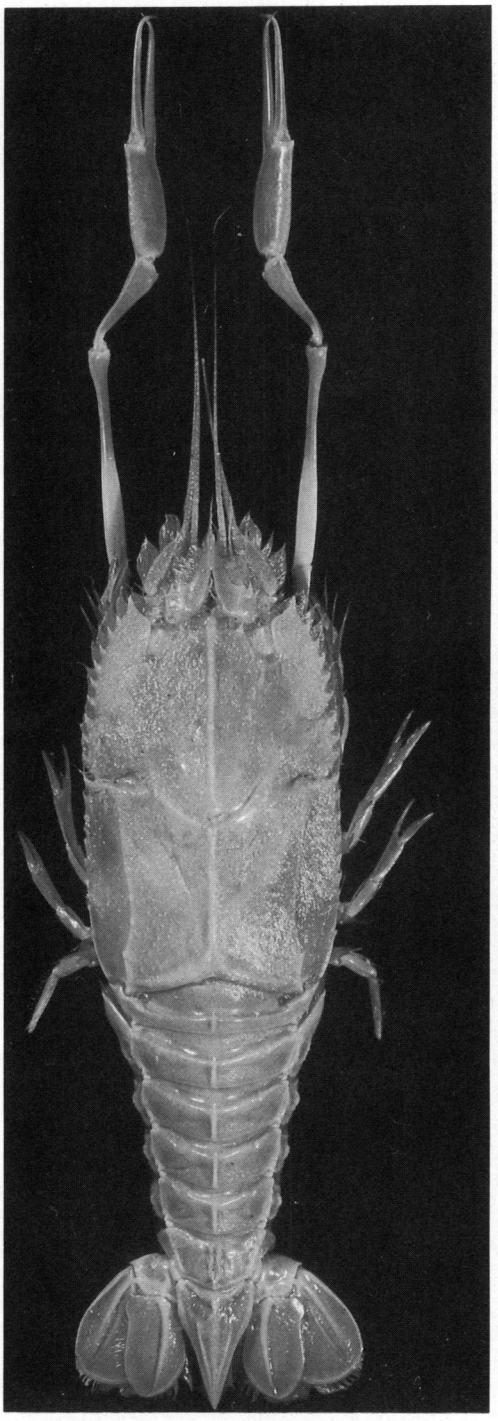

Fig. 9. *Stereomastis phosphorus* (Alcock), female, cl. 42.5 mm, AM P20664, dorsal view.

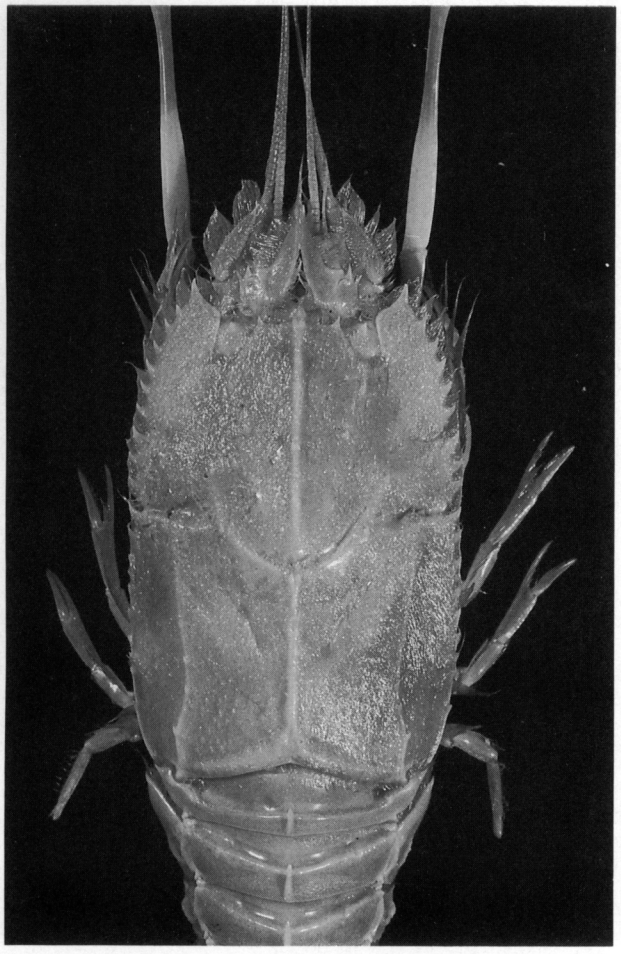

Fig. 10. *Stereomastis phosphorus* (Alcock), female, cl. 42.5 mm, AM P20664, carapace.

28°01'S 154°00'E, 548 m, 17 August 1978, FRV *Kapala*, stn K78-17-10; 1 female, cl. 49 mm, 1 male, cl. 42 mm, AM P44915, north-east of Point Danger, 28°03'S 154°04'E to 28°01'S 154°04'E, 732 m, 6 November 1978, FRV *Kapala*, stn K78-23-08; 1 female, cl. 54 mm, 1 ovigerous female, cl. 56 mm, AM P44913, east of Minnie Water, 29°45'S 153°45'E to 29°42'S 153°46'E, 505 m, 19 April 1978, FRV *Kapala*, stn K78-05-06; 1 female, cl. 49.5 mm, AM P39732, north-east of Wooli, 29°50'S 153°43'E to 29°48'S 153°44'E, 503 m, 25 April 1978, FRV *Kapala*, stn K78-06-02; 1 ovigerous female, cl. 70 mm, AM P21687, north-east of Wooli, 29°52'S 153°43'E to 29°46'S 153°45'E, 505 m, 10 October 1975, FRV *Kapala*, stn K75-09-03; 2 males, cl. 28.5 and 36.5 mm, AM P26554, north-east of Wooli, 29°53'S 153°42'E, 485 m, 23 August 1977, FRV *Kapala*, stn K77-13-12; 1 female, cl. 44.5 mm, 3 males, cl. 28.5, 34.5 and 38.5 mm, 2 juveniles, cl. 17 and 25 mm, AM P26804, south-east of Newcastle, 33°08'S 152°27'E to 33°10'S 152°24'E, 594 m, 7 December 1977, FRV *Kapala*, stn K77-23-09; 3 males, cl. 20, 29 and 35.5 mm, AM P26757, south-east of Newcastle, 33°11'S 152°24'E to 33°09'S 152°25'E, 732 m, 7 December 1977, FRV *Kapala*, stn K77-23-10; 1 male, cl. 31 mm, AM P44918, east of Budgewoi, 33°11'S 152°25'E, 722–768 m, 12 April 1989, FRV *Kapala*, stn K89-06-05; 1 female, cl. 30 mm, AM P20661, north-east of Broken Bay, 33°30'S 152°05'E to 33°26'S 152°08'E, 549 m, 5 October 1972, FRV *Kapala*, stn K72-05-08; 2 females, cl. 37.5 and 45 mm, AM P39733, east of Broken Bay, 33°32'S 152°07'E, 732–795 m, 17 May 1989, FRV *Kapala*, stn K89-09-06; 2 females, cl. 29.5 and 42.5 mm, 1 male, cl. 41.4 mm, AM P21065, east of Broken Bay, 33°32'S 152°04'E to 33°38'S 152°00'E, 823 m, 19 August 1975, FRV *Kapala*, stn K75-05-05; 1 female, cl. 31.5 mm, AM P39736, east of Broken Bay, 33°34'S 152°04'E to 33°31'S 152°06'E, 725 m, 4 December 1979, FRV *Kapala*, stn K79-20-04; 1 male, cl. 30 mm, AM P39734, east of Broken Bay, 33°34'S 151°57'E, 549–568 m, 10 September 1984, FRV *Kapala*, stn K84-15-02; 1 female, cl. 41 mm, 1 male, cl. 29.5 mm, AM P20663, between Broken Bay and Port Jackson, approx. 33°40'S 150°59'E, 594 m, 9 October 1972, FRV *Kapala*, stns K72-05-09 to 72-05-11; 1 female, cl. 29 mm, AM P44917, south-east of Broken Bay, 33°39'S 151°58'E, 636–647 m, 25 September 1984, FRV *Kapala*, stn K84-16-03; 2 females, cl. 29 and 41 mm, AM P26775, south-east of Broken Bay, 33°40'S 151°56'E to 33°37'S 151°56'E, 714–732 m, 6 December 1977, FRV *Kapala*, stn K77-23-06; 1 female, cl. 26 mm, 1 male, cl. 34 mm, AM P18985, south-east of Broken Bay, 33°43'S 151°55'E to 33°37'S 152°02'E, 775 m, 19 October 1972, FRV *Kapala*, stn K72-06-04; 2 females, cl. 27 and 43.5 mm, AM P18982, south-east of Broken Bay, 33°44'S 151°55'E to 33°40'S 151°58'E, 720 m, 9 November 1972, FRV *Kapala*, stn K72-07-04; 1 male, cl. 38 mm, AM P39735, east of Long Reef Point, 33°47'S 151°50'E to 33°45'S 151°52'E, 503–567 m, 19 May 1983, FRV *Kapala*, stn K83-01-08; 1 male, cl. 26 mm, AM P20662, east of Port Jackson, 33°50'S 150°50'E to 33°46'S 150°52'E, 594 m, 9 October 1972, FRV *Kapala*, stn K72-05-09; 1 male, cl. 41.5 mm, AM P18984, east of Port Jackson, 33°51'S 151°51'E to 33°45'S 151°55'E, 775 m, 19 October 1972, FRV *Kapala*, stn K72-06-03; 1 male, cl. 41.5 mm, AM P18019, east of Port Hacking, 34°11'S 151°36'E to 34°05'S 151°41'E, 720 m, 23 June 1971, FRV *Kapala*, stn K71-10-01; 1 ovigerous female, cl. 40 mm, AM P39737, east of Shoalhaven Heads, 34°50'S 151°15'E, 914–950 m, 10 October 1984, FRV *Kapala*, stn K84-18-03; 1 female, cl. 42.5 mm, AM P20664, east of Shoalhaven Bight, 34°54'S 151°11'E to 34°59'S 151°09°E, 732–805 m, 4 June 1975, FRV *Kapala*, stn K75-02-08; 1 male, cl. 28.5 mm, AM P44916, east of Shoalhaven Bight, 34°55'S 151°13'E to 34°53'S 151°14°E, 823 m, 12 December 1978, FRV *Kapala*, stn K78-27-05; 1 female, cl. 45.5 mm, 3 males, cl. 40, 43 and 45 mm, AM P39738, east of Beecroft Peninsula, 35°03'S 151°08'E, 695-768 m, 18 April 1989, FRV *Kapala*, stn K89-07-01.

Remarks. In most specimens the mid-dorsal carina of the carapace (excluding the rostral spines), has spinal formula of 1,1,2,1 in front of the cervical groove and 2,2,2 behind the groove, characteristic of the species. However, three specimens (AM P21687, P39738 and QM W13313), all large females, have four single spines in front of the cervical groove; they are otherwise good examples of *S. phosphorus*. The gastro-orbital carina is composed of three small spines in an oblique row; there are one or two spines mesially on the gastric region and a spine on the cervical groove at the junction of the two branches.

The cervical groove has a spine approximately midway along the posterior border and the superior branchial carina bears a few spines. The surface of the carapace is generally very pubescent. The east Australian specimens differ from Alcock's original description of *S. phosphorus*

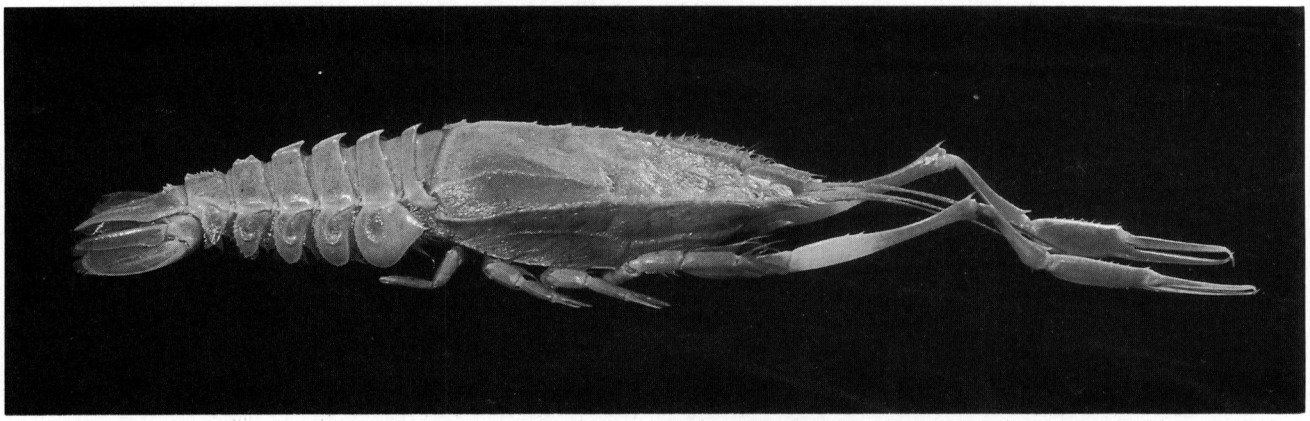

Fig. 11. *Stereomastis phosphorus* (Alcock), female, cl. 42.5 mm, AM P20664, lateral view.

in having two spines on the antero-external angle of the basal antennular segment instead of one, and nine to thirteen spines on the lateral edges of the carapace (behind the cervical groove) instead of six or seven. The spinal formula is thus 5–7:3–4:9–13. De Man's specimen of *S. phosphorus* from the *Siboga* Expedition differed similarly. The east Australian specimens also differ in having a conical tooth, quite large in some specimens, projecting from the frontal wall of the carapace but concealed by dense setae.

Colour. (Based on AM P20664 and P21065.) Uniformly rose pink except for some grey patches on branchial regions (extending up to the gastric regions) of the carapace. All pereopods rose pink. Ischium of cheliped rose pink; merus white on proximal half and rose pink distally; carpus, propodus and fingers rose pink, distal portions of fingers shading to white. Joints between merus and carpus, carpus and propodus, proximal portion of merus and tips of the fingers whitish.

Distribution. Indo-Pacific Ocean: Arabian Sea, Andaman Sea, Bay of Bengal, Gulf of Mannar, Laccadive Sea, Island of Rotti, western and eastern Australia, Hawaiian Islands; 101–1479 m.

Stereomastis sculpta (Smith)

Polycheles sculptus Smith, 1880a: 346, pl. 7.–Smith, 1880b: 270, figs 1–4.–Alcock, 1901: 168 (key), 170.–Stebbing, 1902: 36.–Hansen, 1908: 41.–Selbie, 1914: 11 (key), 18, pl. 2 figs 1–9.–Bouvier, 1917: 35 (key), 51, pl. 3 fig. 1.–Bouvier, 1925: 438, figs 11,12, pl. 7 fig. 1.–Barnard, 1964: 12.

Pentacheles sculptus.–Smith, 1882: 23, pls 3,4.–Smith, 1884: 358.–Smith, 1887: 650.–Alcock & Anderson, 1899: 289.

Stereomastis sculpta.–de Man, 1916: 7 (key), 8.–Calman, 1925: 18.–Barnard, 1950: 572, fig. 105d.–Kensley, 1968: 293.–Kensley, 1981: 29.–Wenner, 1979: 441.

Pentacheles spinosus Milne Edwards, 1880: 66.

Material examined. One ovigerous female, cl. 41.5 mm, AM P40363, north-east of Cape Hawke, 32°06'S 153°08'E to 32°02'S 153°09'E, 1025–1080 m, 4 May 1988, FRV *Kapala*, stn K88-08-04; 1 female, cl. 25.5 mm, AM P40364, north-east of Cape Hawke, 32°04'S 153°10'E, 1034–1079 m, 15 June 1989, FRV *Kapala*, stn K89-12-04; 2 females, cl. 23 and 49.5 mm, 1 male, cl. 27 mm, AM P40365, east of Broken Bay, 33°27'S 152°09'E to 33°25'S 152°11'E, 882–914 m, 8 December 1977, FRV *Kapala*, stn K77-23-13; 1 ovigerous female, cl. 54 mm, AM P40366, east of Shoalhaven Bight, 34°56'S 151°13'E to 34°53'S 151°14'E, 905–924 m, 11 April 1984, FRV *Kapala*, stn K84-04-09.

Remarks. The rostrum is bifid, the orbital notches broad U-shaped, with a single spine on the inner orbital angle. The anterior margin of the ocular peduncle bears only a minute, barely-discernible blunt spine. There are two spines on the basal antennular segment. The mid-dorsal carina of the carapace, behind the rostral spines, has spinal formula 1,2,1 before the cervical groove and 2,2,2 behind it. The posterior margin of the carapace is granular. The spinal formula of the lateral margins of the carapace is 6:3:7–8. There are five spines on the slightly sinuous sublateral ridge of the branchial region; the last spine is larger than the others.

The median carina of abdominal segments 1 to 5 is produced into a spine, that of the fourth segment being the largest. The double carina of segment 6 is low, smooth and united posteriorly. There is a single blunt nodule on the anterior portion of the telson. There is no spine on the anterior midpoint of the second abdominal pleuron.

The number of spinules on the upper margin of the cheliped merus varies. There are three in the 27 mm male, one in the 25.5 mm female, two in the 41.5 mm female and none in the 49.5 mm and 54 mm females. Both chelipeds of the 23 mm female are missing.

Faxon (1895) described a subspecies, *S. sculpta pacifica*, which differed in general shape of the carapace, the presence of a spine on the branchial region level with the second spine of the submarginal carina, a larger spine on the ophthalmic lobe and a slightly different shape to the second abdominal pleuron. In all these

respects, the east Australian material corresponds to the original description of the Atlantic form, rather than to the east Pacific subspecies.

Distribution. North and South Atlantic Ocean; Mediterranean Sea; Indo-West Pacific Ocean: Indonesia, eastern Australia; 457–2836 m.

Stereomastis suhmi (Bate)

Figs 12–15

Pentacheles Suhmi Bate, 1878: 278.
Stereomastis suhmi.–Bate, 1888: 154; figs 37,38; pl. 15 figs 3,4.–de Man, 1916: 5 (list).–Sund, 1920: 223.–Calman, 1925: 19, pl. 3 fig. 9.–Barnard, 1950: 574, fig. 105f.–Holthuis, 1952b: 78.–Bernard, 1953: 87.–Firth & Pequegnat, 1971: 63 (key), 72.
Polycheles suhmi.–Bouvier, 1917: 35 (list).

Material examined. One female, cl. 25 mm, AM P20640, south-east of Port Stephens, 32°46'S 152°46'E to 32°51'S 152°42'E, 585–576 m, 7 May 1971, FRV *Kapala*, stn K71-09-01; 1 male, cl. 21 mm, AM P26805, south-east of Port Hunter, 33°08'S 152°27'E to 33°10'S 152°24'E, 594 m, 7 December 1977, FRV *Kapala*, stn K77-23-09; 1 male, cl. 27.5 mm, 1 female, cl. 30.5 mm, AM P26756, south-east of Port Hunter, 33°11'S 152°24'E to 33°09'S 152°25'E, 732 m, 7 December 1977, FRV *Kapala*, stn K77-23-10; 1 female, cl. 28 mm, AM P20641, between Broken Bay and Port Jackson, 33°30'S 150°50'E to 33°50'S 152°03'E, 585 m, 9–10 October 1972, FRV *Kapala*, stns K72-05-09 to K72-05-11; 1 male, cl. 27.5 mm, AM P26771, south-east of Broken Bay, 33°40'S 151°56'E to 33°37'S 151°56'E, 732 m, 6 December 1977, FRV *Kapala*, stn K77-23-06; 1 male, cl. 19 mm, AM P39744, east of Long Reef Point, 33°47'S 151°10'E to 33°45'S 151°52'E, 503–567 m, 19 May 1983, FRV *Kapala*, stn K83-01-08; 1 male, cl. 28.5 mm, AM P40361, east of Port Jackson, 33°49'S 151°51'E to 33°45'S 151°52'E, 640 m, 30 April 1984, FRV *Kapala*, stn K84-06-01; 1 female, cl. 17 mm, AM P18996, north-east of Botany Bay, 34°00'S 151°43'E to 33°54'S 151°47'E, 720 m, 6 November 1972, FRV *Kapala*, stn K72-07-01; 1 female, cl. 25 mm, AM P25046, east of Wollongong, 34°24'S 151°25'E to 34°23'S 151°25'E, 720–756 m, 13 December 1976, FRV *Kapala*, stn K76-23-01; 1 female, cl. 39 mm, AM P38726, north-east of Shoalhaven Bight, 34°42'S 151°16'E to 34°38'S 151°18'E, 760–855 m, 3 December 1987, FRV *Kapala*, stn K87-23-03; 1 male, cl. 30.5 mm, 1 female, cl. 31.5 mm, AM P40362, east of Gerringong, 34°45'S 151°15'E, 732–786 m, 4 July 1989, FRV *Kapala*, stn K89-14-02.

Remarks. These specimens show little difference from Bate's (1888) description and figures of *Stereomastis suhmi*. There are two rostral spines and a sharp spine on the internal orbital angle. The orbital notch is smooth, subtriangular and deep; there is no spine at the external orbital angle.

The spinal formula of the lateral edge of the carapace is 4–6:2:8–10, most commonly 5:2:8. The spine forming the anterolateral angle of the carapace is larger than the following lateral spines and inwardly curved. The mid-

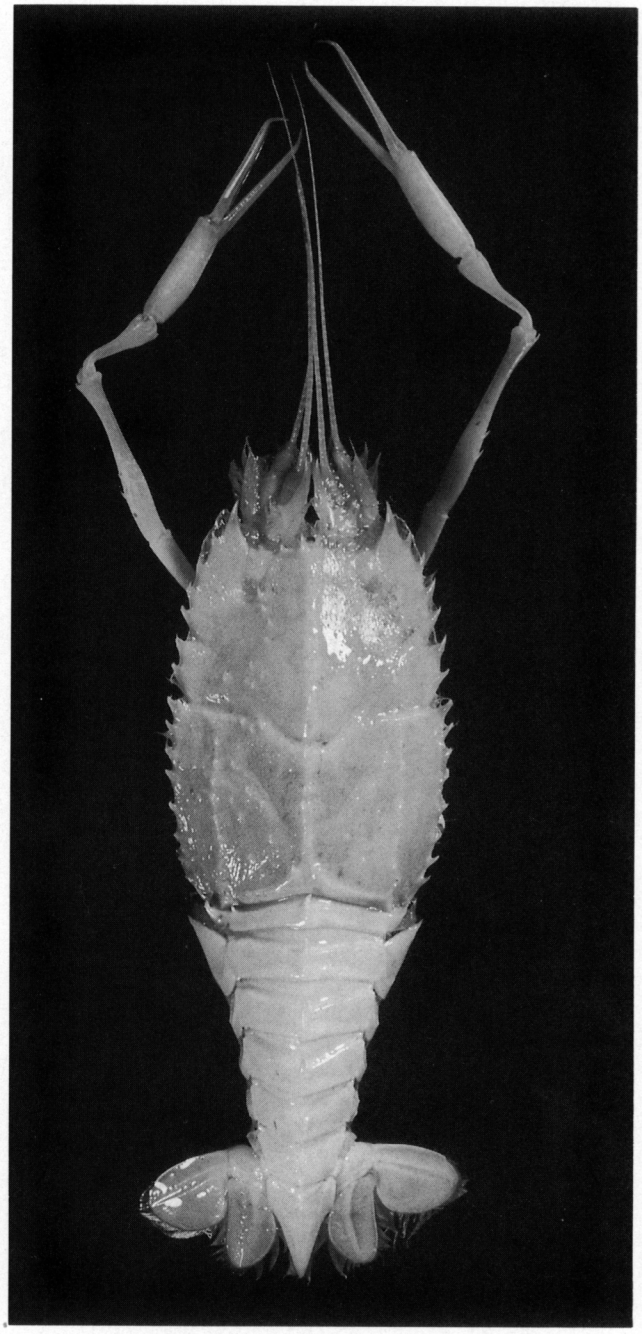

Fig. 12. *Stereomastis suhmi* (Bate), female, cl. 25 mm, AM P25046, dorsal view.

dorsal carina of the carapace (excluding the rostral spines) has a spine formula of 1,1,2,1 before the cervical groove and 2,2,2 behind the groove. Sund (1920) pointed out that the two small spines on the mid-dorsal carina behind the cervical groove, figured by Bate as single spines, are in fact paired in all of the *Challenger* type specimens. The crest of the posterior border of the carapace is granulate except for two spines, one on each side of the mid-dorsal carina.

The gastro-orbital ridge is formed by three or four small spines, the first the largest, in an oblique row

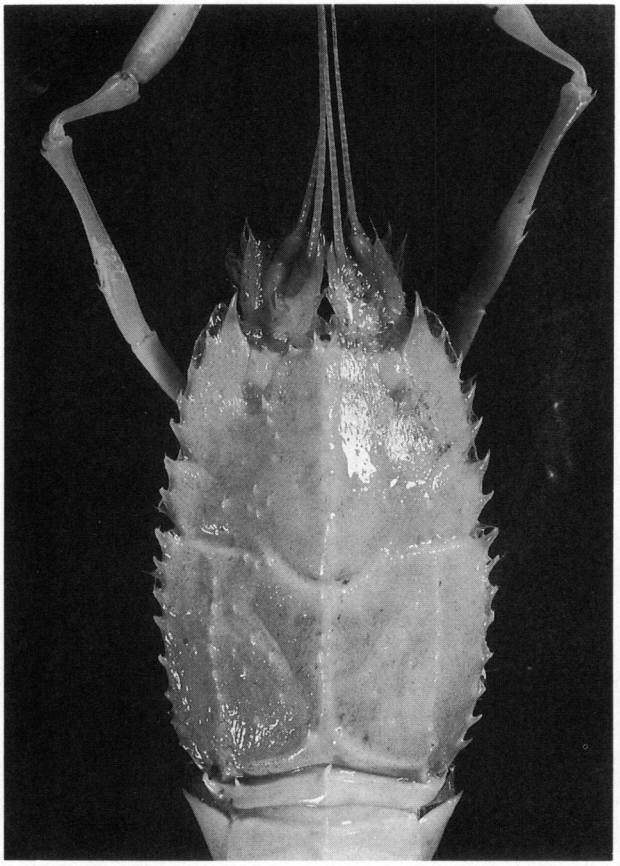

Fig. 13. *Stereomastis suhmi* (Bate), female, cl. 25 mm, AM P25046, carapace.

starting just behind the orbital notch; there is a cluster of spinules on the gastric region of the carapace as well as two or three small spinules laterally just behind the junction of the two branches of the cervical groove. The superior branchial carina is composed of seven to nine (most often eight) spinules.

The carina of abdominal segments 1 to 5 is produced into an antrorse spine; on segments 2 to 5 there is a cusp on the posterior part of the spine, low and smooth (seemingly worn) in some specimens, strong and sharp in others. The carina of the sixth segment is a double row of strong denticles. The telson has two strong denticles, one behind the other. The mid-anterior margin of the second abdominal pleuron is produced into a strong spine.

The merus of the cheliped has one or two fine spinules on the upper proximal margin.

One specimen, a 27.5 mm male (AM P26771), has three, rather than two, pairs of spines on the mid-dorsal carina. Two of the three pairs are very close together. In all other respects this specimen is a typical *S. suhmi*.

Colour. (Based on AM P25046). Carapace, abdominal segments and telson a uniform pale whitish pink; all spines of carapace and abdominal terga a darker rose pink. Endopods and inner three-quarters of exopods of

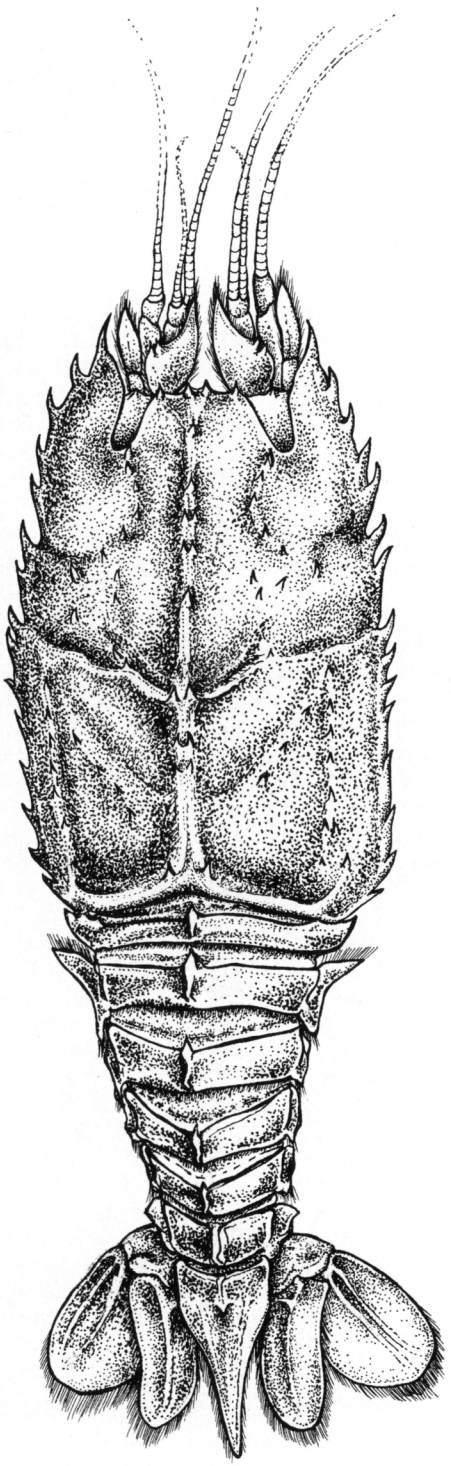

Fig. 14. *Stereomastis suhmi* (Bate), female, cl. 25 mm, AM P25046, dorsal view.

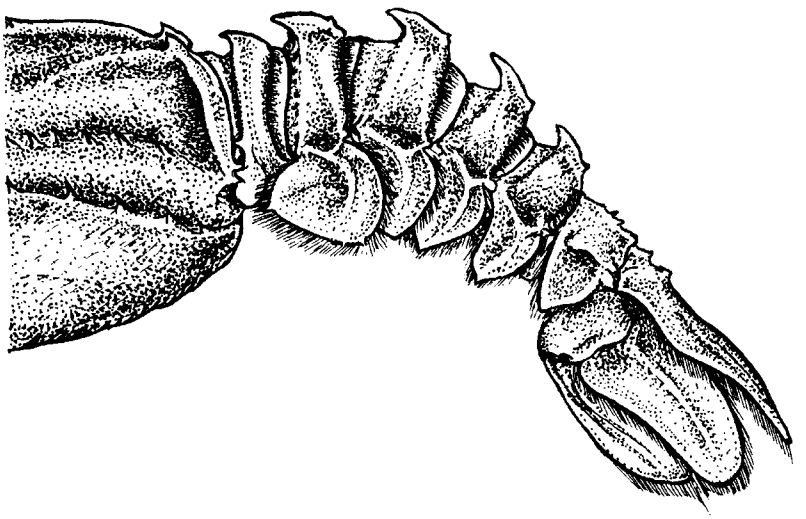

Fig. 15. *Stereomastis suhmi* (Bate), female, cl. 25 mm, AM P25046, lateral view of abdomen.

uropods whitish (almost transparent), entire outer edge of exopods trimmed in dark rose pink.

Ischium, anterior portion of merus and palm of propodus of cheliped pale, almost white; distal end of merus and carpus pale pink; fingers of cheliped also pale pink, fading to white at tips.

Distribution. South Atlantic Ocean: South Africa (Cape Point); western Pacific Ocean: south-eastern Australia; south-eastern Pacific Ocean: south-western coast of South America (west coast of Patagonia, coast of Chile); 293–2195 m.

Willemoesia Grote, 1873

The genus contains eight species, of which only one is known from the Indo-West Pacific region. One species, *Willemoesia leptodactyla* (Willemoes-Suhm, 1873) has been reported from Australia, but this material is shown here to be *W. bonaspei* Kensley, 1968.

Willemoesia bonaspei Kensley

Figs 16,17

Willemoesia leptodactyla. Bage, 1938: 9. (Not *W. leptodactyla* [Willemoes-Suhm, 1873]).

Willemoesia bonaspei Kensley, 1968: 294, figs 4, 5.–Kensley, 1981: 29.–Gore, 1984: 6 (table 2).

Material examined. One male, cl. 50 mm, total length 112 mm, AM P11316, south-west of Eyre Peninsula, South Australia, Great Australian Bight, 35°55.5'S 134°18'E, 3240 m, Station 13, Australasian Antarctic Expedition, 1911–1914, 24 February 1914.

Description. Although this specimen is not from eastern Australia it is included here because the single specimen described by Bage (1938) as *W. leptodactyla* is the only record of the genus from Australian waters and Bage's description of it was very brief.

Dorsal surface of carapace covered by numerous small, forwardly curved spinules. Rostral spine single, large (tip broken). Frontal margin of carapace produced, with a strong spine on internal orbital angle. Anterolateral angle of carapace formed by a large spine, the largest on the carapace; carapace in profile is slightly arched. Basal segment of antennular peduncle serrate along its medial edge, no spines or spinules on antero-external angle.

Spine formula of lateral edges of carapace 8–9:6:23–25. Spine formula of mid-dorsal carina (excluding the rostral spine) 1,1,1,2,1,1 before the cervical groove; irregularly paired spinules arranged irregularly behind groove, two or three slightly more prominent than others. Posterior edge of carapace smooth. Gastro-orbital carinae of carapace prominent and bearing spinules of the same kind as on rest of carapace. Superior branchial carina bearing 20–23 spines and spinules.

Abdominal terga smooth, with terga 2 to 4 bearing faint obliquely transverse grooves. All terga with a mid-dorsal carina; carinae of terga 1 to 4 culminating in an antrorse spine; spine of the fourth tergum reduced; dorsal surface of the first to third carinae slightly uneven; fifth carina a low blunt ridge; sixth carina a smooth hump. Surface of abdominal pleura smooth with weakly elevated curved ridges mesially; edges unarmed. Telson longer than uropods and sharply pointed. (Chelipeds missing from the specimen).

Remarks. Bate (1888) based his description of *W. leptodactyla* on a female specimen taken at *Challenger*

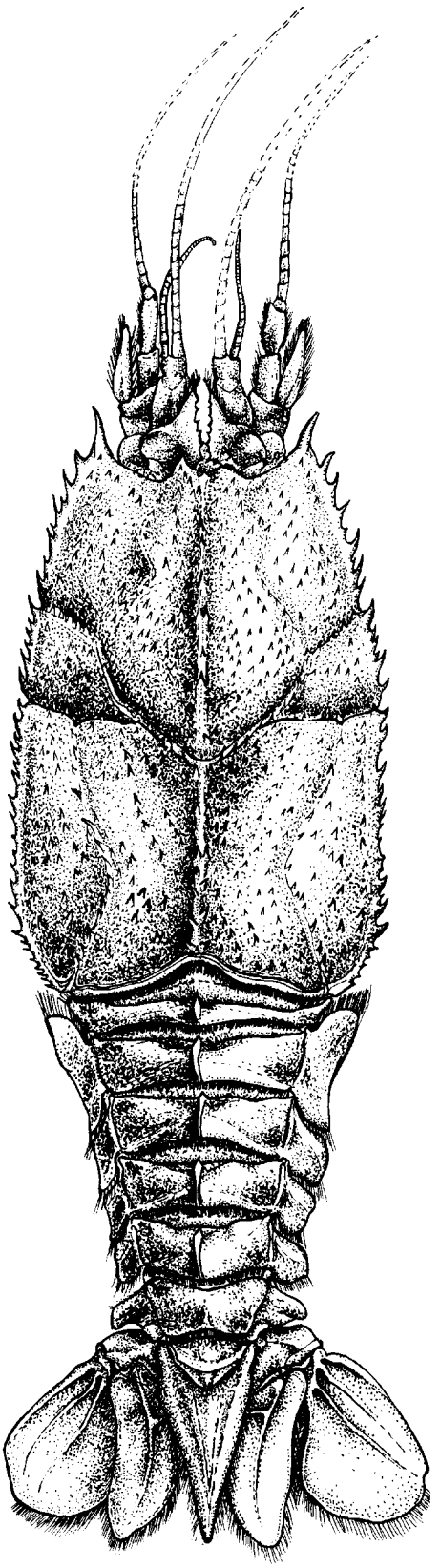

Fig. 16. *Willemoesia bonaspei* Kensley, male, cl. 50 mm, AM P11316, dorsal view.

station 13 (mid North Atlantic Ocean) and figured on plates 18 and 19C". Bate also briefly discussed what he called a "... decided variety of *Willemoesia leptodactyla*", a large male specimen collected at *Challenger* station 300 (off Valparaiso, south-east Pacific Ocean). The anterior portion of the dorsal carapace of this specimen is illustrated on plate 19 figure C (Bate, 1888). Sund (1920) made this specimen the type of a new species, *W. pacifica*. Kensley (1968) described *W. bonaspei* from off south-western South Africa. Bage's (1938) southern Australian specimen is clearly not *W. leptodactyla* but is very close to both *W. pacifica* and *W. bonaspei*. The overall length of the specimen, the finely spinulose dorsal surface, the number of spines on the lateral margins of the carapace, and the presence of tiny spines on the branchial ridge match both *W. pacifica* and *W. bonaspei*.

The shape of the frontal margin is more similar to that of *W. bonaspei* than to *W. pacifica*, especially the distinctly concave inner margins of the two large submedian spines. The spination of the mid-dorsal carina of the carapace fits to the range given for *W. bonaspei*, but not so well to that of *W. pacifica*. Sund (1920: 223) described the first abdominal somite of *W. pacifica* as having dorsally "a well-developed hook"; both *W. bonaspei* and Bage's specimen have a small forwardly-directed tooth.

This species is very close to *W. pacifica* and, as suggested by Kensley, may be found to be synonymous with it when more material becomes available.

Distribution. South-eastern Atlantic Ocean: west of Cape Point, South Africa; western Pacific Ocean: southern Australia; 2800–3520 m.

Family SCYLLARIDAE

Ibacus Leach, 1815

The genus contains six species, all known from the Indo-West Pacific region. Five species have been reported from Australia: *Ibacus alticrenatus* Bate, 1888, from western and north-western, eastern and southern Australia (Grant, 1905; George & Griffin, 1972; Holthuis, 1985; Wadley & Evans, 1991); *I. brucei* Holthuis, 1977, from eastern Australia (Holthuis, 1977, 1985); *I. ciliatus pubescens* Holthuis, 1960, from north-western Australia (Holthuis, 1985; Wadley & Evans, 1991); *I. novemdentatus* Gibbes, 1850, from western and north-western Australia (Phillips *et al.*, 1981; Holthuis, 1985); *I. peronii* Leach, 1815, from south-western, southern and south-eastern Australia (many authors, summarised in Holthuis, 1985).

Ibacus brucei has been taken in New South Wales waters by the FRV *Kapala*, but it has not been recorded below 190 m.

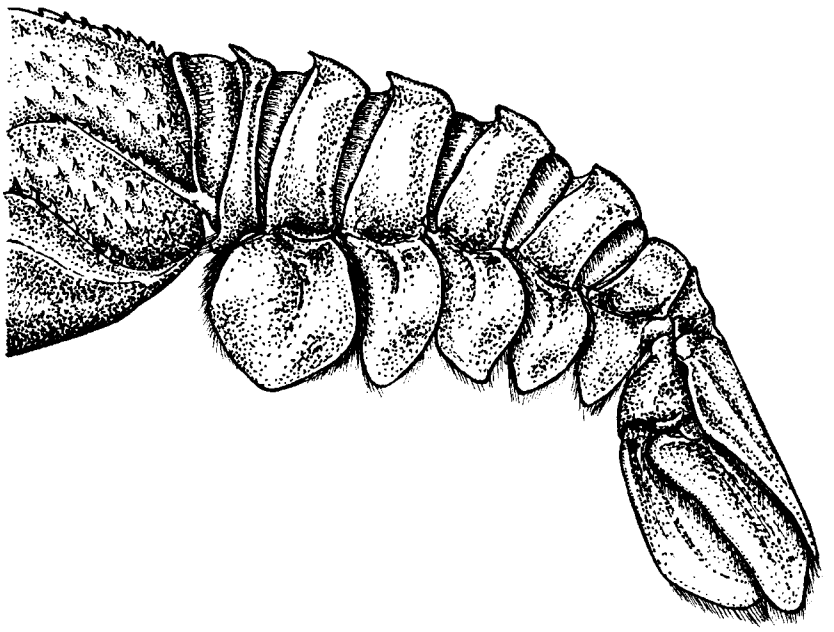

Fig. 17. *Willemoesia bonaspei* Kensley, male, cl. 50 mm, AM P11316, lateral view.

Ibacus alticrenatus Bate

Ibaccus alticrenatus Bate, 1888: 63, pl. 9 fig. 2.
Ibacus alticrenatus.–Powell, 1947: 37, fig. 184.–Dell, 1955: 148.–Yaldwyn, 1961: 3 (key).–Holthuis, 1985: 23 (key), 36, fig. 9.–Holthuis, 1991: 197 (key), 200, figs 376,382.
Ibacus alticrenatus septemdentatus Grant, 1905: 322, pl. 11 fig. 1.
Ibacus altricrenatus.–George & Griffin, 1972: 228.

Material examined. One ovigerous female, cl. 44 mm, 1 female, cl. 42 mm, 1 male, cl. 43 mm, AM P17911, east of Port Stephens, 32°46'S 152°42'E, 585–576 m, 7 May 1971, FRV *Kapala*, stn K71-09-01; 1 female, cl. 36 mm, AM P17908, north-east of Port Jackson, 33°41'S 151°55'E to 33°44'S 151°53'E, 540 m, 20 April 1971, FRV *Kapala*, stn K71-07-01; 4 females, cl. 37.5–43.5 mm, 3 males, cl. 25.5–37 mm, AM P18987, east of Port Jackson, 33°44'S 151°48'E to 33°48'S 151°45'E, 162 m, 10 August 1972, FRV *Kapala*, stn K72-02-13; 3 females, cl. 19–39 mm, 1 male, cl. 33.5 mm, AM P17964, south-east of Port Hacking, 33°15'S 151°25'E to 34°20'S 151°21'E, 261–279 m, 28 June 1971, FRV *Kapala*, stn K71-10-02; 1 male, cl. 33 mm, AM P17968, north-east of Jervis Bay, 34°56'S 151°06'E to 35°02'S 151°05'E, 300–297 m, 8 July 1971, FRV *Kapala*, stn K71-11-08; 1 male, cl. 16 mm, AM P19620, east of Port Jackson, 33°51'S 151°51'E to 33°15'S 151°55'E, 680 m, 19 October 1972, FRV *Kapala*, stn K72-06-03.

Remarks. *Ibacus alticrenatus* is well described and figured by Bate (1888) and Holthuis (1985).

Distribution. South-west Pacific Ocean: south-eastern Australia, New Zealand; 20–680 m, mainly between 175 and 540 m.

Scyllarus Fabricius, 1775

The genus contains about 40 species, 26 of which are known from the Indo-West Pacific region. Most are shallow-water species. One species, *Scyllarus mawsoni* (Bage, 1938), has been reported from deep water off south-eastern Australia.

Scyllarus mawsoni (Bage)

Arctus mawsoni Bage, 1938: 10, pl. 4 figs 2,2a.
Scyllarus mawsoni.–Hale, 1941: 272, pl. 3 figs 1,2.–Holthuis, 1946: 88.

Material examined. One ovigerous female, cl. 24.5 mm, 2 males, cl. 12 and 13 mm, AM P24397, AM P24396, north-east of Brush Island, 35°29'S 150°47'E to 35°32'S 150°45'E, 324 m, 8 June 1976, *Kapala*, K76-08-01; 4 females, cl. 17.5–18.5 mm, 1 male, cl. 15 mm, AM P25040, east of Brush Island, 35°30'S 150°45'E to 35°32'S 150°44'E, 324 m, 10 November 1976, FRV *Kapala*, stn K76-19-01; 2 females, cl. 15 and 17 mm, AM P25031, east of Brush Island, 35°32'S 150°45'E to 35°34'S 150°43'E, 270 m, 1 December 1976, FRV *Kapala*, stn K76-22-03; 1 ovigerous female, cl. 19 mm, AM P25043, 20 miles south of Lawrence Rocks, Portland, Victoria [approx. 38°21'S 141°36'E], 182–219 m, May 1976.

Remarks. Bage's (1938) original description of this species is very brief, and her figures do not show much detail. Hale (1941) made some additional comments and gave additional figures but the species is at present still inadequately described and figured. Dr Holthuis is dealing with this species in a forthcoming paper.

Distribution. South-west Pacific Ocean: south-eastern and southern Australia; 108–540 m.

Discussion

The lobster fauna comprises three groups: shallow-water tropical reef forms, especially species of *Panulirus* (spiny or rock lobsters); a variety of other species—mostly temperate shallow-water forms of palinurids and scyllarids; and a variety of deep-sea species. The twenty-three species reported here bring the total number of species of deep-sea lobsters known from Australia to thirty-five, increasing the known archibenthal fauna by ten species.

The deep-sea lobsters of Australia clearly constitute a typical archibenthal fauna, the genera represented and their zoogeographic affinities being essentially those found in the archibenthal lobster faunas of other regions. Twenty-five (71%) of the thirty-five species are contained in five (38%) genera (*Metanephrops, Nephropsis, Polycheles, Stereomastis* and *Ibacus*).

Of the 35 species recorded from Australia, 8 are known only from Australia; 19 from Australia and other Indo-West Pacific areas; 5 from Australia, the Indo-West Pacific and Atlantic Oceans; one from Australia, the Indo-West Pacific and North Central Pacific Ocean; one from Australia, the eastern Pacific and Atlantic Oceans; and one from Australia and the Atlantic Ocean. So far as it is known, the Australian deep-water lobster fauna is predominantly part of the general Indo-West Pacific fauna. Its outlying connections with the Atlantic Ocean are mostly via south-western Africa rather than via the eastern Pacific Ocean and southern South America.

Of the seven Australian species also known from the Atlantic Ocean, three (*Polycheles granulatus, P. typhlops* and *Stereomastis sculpta*) are geographically very widespread in both the Atlantic and Indo-West Pacific Oceans; the other four (*Projasus parkeri, Stereomastis nana, S. suhmi* and *Willemoesia bonaspei*) have a southern distribution, their Atlantic Ocean records all being from off south-western Africa. Only two of the eastern Australian deep-water lobster species (*Projasus parkeri* and *Ibacus alticrenatus*) are also found in New Zealand. The distribution of all reported Australian species is summarised in Table 1.

Key to species of lobsters recorded from Australian waters below 200 meters

(Based largely on keys provided in Holthuis [1991], Chan & Yu [1991] and Macpherson [1993])

1. Pereopod 3 chelate 2

—— Pereopod 3 not chelate 15

2. Pereopod 4 not chelate 3

—— Pereopod 4 chelate 25

3. Telson without spines. Eyes strongly reduced, without pigment. Chelipeds very unequal, the larger with fingers more than 4 times as long as palm ..... *Thaumastochelopsis wardi* Bruce

—— Telson with lateral and/or postlateral spines. Eyes well developed or reduced. Chelipeds equal or unequal, fingers less than 2 times as long as palm 4

4. Rostrum laterally compressed for most of its length, with dorsal teeth (ventral teeth present, lateral teeth absent). Carapace with branchiostegal spine. Lateral margins of telson with 6–12 spines ..... *Acanthacaris tenuimana* (Bate)

—— Rostrum dorsoventrally compressed, without dorsal teeth (ventral and lateral teeth present or absent). Carapace without branchiostegal spine. Lateral margins of telson with 3 or less small irregular spines 5

5. Scaphocerite absent. Carapace without postorbital spine. Abdominal sternites unarmed in both sexes. Second maxilliped without podobranch 6

—— Scaphocerite present. Carapace with distinct postorbital spine. Abdominal sternites 2 to 5 in male each with a sharp median spine. Second maxilliped usually with podobranch 11

6. Exopod of uropod with a diaeresis ..... *Nephropsis suhmi* (Bate)

—— Exopod of uropod without a diaeresis 7

7. Dorsal surface of telson with a well-developed spine ..... *Nephropsis acanthura* Macpherson

—— Dorsal surface of telson without a well-developed spine 8

8. Rostrum with two pairs of lateral spines ..... *Nephropsis sulcata* Macpherson

—— Rostrum with one pair of lateral spines 9

9. Abdominal somites with a median dorsal carina ..... *Nephropsis holthuisi* Macpherson

—— Abdominal somites without a median dorsal carina 10

10. Carapace with subdorsal carinae granular ..... *Nephropsis stewarti* Wood-Mason

—— Carapace with at least 3 with well-developed spines on each subdorsal carina ..... *Nephropsis serrata* Macpherson

11. Carapace smooth between the ridges and large spines 12

—— Carapace rather uniformly spinose 14

12. Chelae of first pereopods heavily ridged and spinulose ..... *Metanephrops velutinus* Chan & Yu

—— Chelae of first pereopods weakly ridged and finely granular 13

13. First pereopod with distinct spine in middle of inner margin of merus. Posterior margin of cervical groove with 4–7 spinules ..... *Metanephrops boschmai* (Holthuis)

—— First pereopod without a distinct spine in middle of inner margin of merus. Posterior margin of cervical groove smooth ..... *Metanephrops sibogae* (de Man)

14. Region of carapace between postrostral carinae heavily spinulose ..... *Metanephrops neptunus* (Bruce)

—— Region of carapace between postrostral carinae smooth *Metanephrops australiensis* (Bruce)

15. Antennal flagellum reduced to a single broad flat segment, similar to the peduncular segments 16

—— Antennal flagellum long, multi-articulate 20

16. Exopods of all maxillipeds with a multi-articulate flagellum. Carapace strongly depressed dorsoventrally. Lateral margin of carapace with deep cervical incision, without postcervical incision 17

—— Exopod of third and first maxilliped without a flagellum; flagellum of second maxilliped a single laminate segment. Carapace not strongly depressed dorsoventrally, rather high and vaulted. Lateral margin of carapace with shallow cervical and postcervical incisions ..... *Scyllarus* spp.

17. Merus of third maxilliped with ventral surface slightly concave, not swollen; inner margin sometimes crenulate but not with deep incisions 18

—— Merus of third maxilliped swollen; inner margin with deep incisions 19

18. Cervical incision wide, anterior margin forming posterior margin of anterolateral angle of carapace, thus no lateral margin between the anterolateral angle and the cervical incision. Carapace with 7–9 posterolateral teeth ..... *Ibacus alticrenatus* Bate

—— Cervical incision narrow, anterior margin reaching lateral margin some distance behind the anterolateral angle; toothed lateral margin present between the anterolateral angle and the cervical incision. Carapace with 11–13 posterolateral teeth ..... *Ibacus ciliatus pubescens* Holthuis

19. Anterior teeth of epistome directed forwards. Posterior branchial carinae of carapace straight or only slightly convex, lying in one line with anterior branchial carinae. Posterior incision of orbit without tubercle. Lateral margin of carapace with 8 (rarely 7) posterolateral teeth ..... *Ibacus novemdentatus* Gibbes

—— Anterior teeth of epistome directed ventrally. Posterior branchial carinae of carapace strongly convex, not lying in one line with anterior branchial carinae. Posterior incision of orbit with distinct tubercle. Lateral margin of carapace with 6 or 7 (rarely 8) posterolateral teeth ..... *Ibacus peronii* Leach

20. Epistome long, about 1/3 carapace length. Eyes on a median elevation of the cephalon ..... *Neoglyphea inopinata* Forest & de Saint Laurent

—— Epistome short, much less than 1/3 carapace length. Eyes not on elevation of the cephalon 21

21. Frontal horns fused to form a broad 2- or 4-spined median projection on anterior margin of carapace between the eyes. Antennal flagella straight, inflexible 22

—— Two distinct widely separated frontal horns present, with anterior margin visible between them. Antennal flagella flexible 23

22. Epistomal ridges coarsely granular, without an acute well-developed anterior tooth. Chitinous margin of male genital aperture with toothed median border and smooth lateral border ..... *Linuparus sordidus* Bruce

—— Epistomal ridges weakly granular, with an acute well-developed anterior tooth. Chitinous margin of male genital aperture toothed throughout its length ..... *Linuparus trigonus* (von Siebold)

23. Antennular plate distinct; a stridulating organ present. Carapace with median ridge behind the cervical groove; often with spines or tubercles but without submedian ridges 24

—— Antennular plate hardly, if at all, visible in dorsal view; stridulating organ absent. Carapace without a median ridge behind cervical groove; with 2 submedian ridges, each bearing a row of large, sharply pointed teeth or numerous spinules ..... *Projasus parkeri* (Stebbing)

24. Postorbital spine present. Median keel of carapace without teeth, with 6 postcervical and 6 intestinal tubercles. Tubercles on carapace low and mostly obscured by pubescence. Eyes large, much broader than long ..... *Puerulus velutinus* Holthuis

—— Postorbital spine absent. Median keel of carapace with 3–5 postcervical and 2–4 intestinal teeth. Tubercles on carapace distinct, not obscured by pubescence. Eyes small, longer than broad ..... *Puerulus angulatus* (Bate)

25. Frontal margin of carapace with 1 rostral spine 26

—— Frontal margin of carapace with 2 rostral spines 27

26. Anterior margin of carapace with deep V-shaped orbital notches divided into two parts by interlocking spines on the margins. Posterior margin of carapace spinose ..... *Polycheles typhlops* Heller

—— Anterior margin of carapace without deep orbital notches, with broad shallow non-spinose excavations. Posterior margin of carapace smooth ..... *Willemoesia bonaspei* Kensley

27. Lateral borders of carapace with more than 20 spines 28

—— Lateral borders of carapace with less than 20 spines 30

28. Posterior margin of carapace smooth ..... *Polycheles granulatus* Faxon

—— Posterior margin of carapace spinose 29

29. Anterior margin of carapace spinose between outer angle of orbital notch and anterolateral spine. Lateral margin of carapace, between postcervical groove and posterior margin, with 20–25 spines ..... *Polycheles baccatus* Bate

—— Anterior margin of carapace smooth, without spines, between outer angle of orbital notch and anterolateral spine. Lateral margin of carapace, between postcervical groove and posterior margin, with 13–16 spines ..... *Polycheles euthrix* (Bate)

30. Mid-dorsal carina of carapace, between rostral spines and cervical groove, with spine formula 1,1,2,1 31

—— Mid-dorsal carina of carapace, between rostral spines and cervical groove, with spine formula 1,2,1 ..... *Stereomastis sculpta* (Smith)

31. Dorsal carinae of abdominal segments 1 to 5 produced into an anteriorly projecting hook 32

—— Dorsal carinae of abdominal segments 1 to 4 produced into an anteriorly projecting hook ..... *Stereomastis phosphorus* (Alcock)

32. Anterior margin of carapace with small spine at inner angle of orbital notch ..... *Stereomastis andamanensis* (Alcock)

—— Anterior margin of carapace without spine at inner angle of orbital notch 33

33. Anteroventral margin of second abdominal pleuron broadly rounded ..... *Stereomastis nana* (Smith)

—— Anteroventral margin of second abdominal pleuron excavate ..... *Stereomastis helleri* (Bate)

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Table 1. Geographical distribution of Australian deep-sea lobsters. AO: Atlantic Ocean; IO: Indian Ocean; In: south-east Asia, from South China Sea to Indonesia; WA: western and western southern Australia; EA: eastern and eastern southern Australia; WP: western Pacific Ocean other than eastern Australia; CP: north-central Pacific Ocean; EP: eastern Pacific Ocean.

Geographic region:	AO	IO	In	WA	EA	WP	CP	EP
GLYPHEIDAE								
Neoglyphea inopinata	–	–	×	×	–	–	–	–
NEPHROPIDAE								
Acanthacaris tenuimana	–	×	×	–	×	×	–	–
Metanephrops australiensis	–	–	–	×	–	–	–	–
Metanephrops boschmai	–	–	–	×	–	–	–	–
Metanephrops neptunus	–	–	–	×	–	–	–	–
Metanephrops sibogae	–	–	×	×	×	–	–	–
Metanephrops velutinus	–	–	×	×	×	–	–	–
Nephropsis acanthura	–	×	×	×	×	×	–	–
Nephropsis holthuisi	–	–	–	×	×	–	–	–
Nephropsis serrata	–	–	–	×	–	–	–	–
Nephropsis stewarti	–	×	×	×	–	×	–	–
Nephropsis suhmi	–	×	×	–	×	×	–	–
Nephropsis sulcata	–	×	×	–	×	×	–	–
PALINURIDAE								
Linuparus sordidus	–	–	–	×	×	×	–	–
Linuparus trigonus	–	–	–	×	×	×	–	–
Projasus parkeri	×	×	–	–	×	×	–	–
Puerulus angulatus	–	×	×	×	×	×	–	–
Puerulus velutinus	–	–	×	×	–	–	–	–
POLYCHELIDAE								
Polycheles baccatus	–	–	×	–	×	×	–	–
Polycheles euthrix	–	–	–	–	×	×	–	–
Polycheles granulatus	×	×	–	–	×	×	–	–
Polycheles typhlops typhlops	×	×	–	–	×	×	–	–
Stereomastis andamanensis	–	×	×	–	×	–	–	–
Stereomastis helleri	–	–	–	–	×	×	–	–
Stereomastis phosphorus	–	×	–	×	×	–	×	–
Stereomastis nana	×	–	–	×	–	×	–	–
Stereomastis sculpta	×	–	×	–	×	–	–	–
Stereomastis suhmi	×	–	–	–	×	–	–	×
Willemoesia bonaspei	×	–	–	–	×	–	–	–
SCYLLARIDAE								
Ibacus alticrenatus	–	–	–	×	×	×	–	–
Ibacus ciliatus pubescens	–	–	×	×	–	–	–	–
Ibacus novemdentatus	–	×	×	×	–	×	–	–
Ibacus peronii	–	–	–	×	×	–	–	–
Scyllarus mawsoni	–	–	–	–	×	–	–	–
THAUMASTOCHELIDAE								
Thaumastochelopsis wardi	–	–	–	–	×	–	–	–