Memoirs of the Museum of Victoria 53(1): 31–41 (1992) 30 May 1992
https://doi.org/10.24199/j.mmv.1992.53.02

A NEW SPECIES OF *PAGURIXUS* (CRUSTACEA: DECAPODA: PAGURIDAE) FROM SOUTHERN AUSTRALIA

By S. W. Gunn[1] and Gary J. Morgan[2]

[1] Department of Crustacea, Museum of Victoria, Swanston Street, Melbourne, Victoria 3000, Australia
[2] Department of Aquatic Invertebrates, Western Australian Museum, Francis, Street, Perth, Western Australia 6000

Abstract

Gunn, S.W. and Morgan, G.J., 1992. A new species of *Pagurixus* (Crustacea: Decapoda: Paguridae) from southern Australia. *Memoirs of the Museum of Victoria* 53: 31–41.

Pagurixus handrecki sp. nov. is described from shallow inshore waters of Victoria, Tasmania, South Australia and south-western Western Australia. The species is recognisable by the lack of a distinct ventral row of setae on the ultimate segment of the antennular peduncle, the proportions and spination of the dactyli of percopods, ornamentation of the chelipeds and live colour.

Introduction

The pagurid genus *Pagurixus* Melin was recently reviewed by McLaughlin and Haig (1984). They recognised eight species with only one, *P. jerviensis* McLaughlin and Haig, occurring in Australia. The range of that species was given as south-eastern Australia; their material examined included specimens from Sydney to Jervis Bay, New South Wales, and from Lord Howe Island. Morgan (1990) tentatively recorded *P. boninensis* (Melin) from the Kimberley coast of north-western Australia.

Examination of collections in the Museum of Victoria, Melbourne (NMV) and South Australian Museum, Adelaide (SAM) by one of us (SWG) revealed an undescribed species of south-eastern Australian *Pagurixus*. Subsequently, specimens of this species were collected (GJM) from south-western Australia and lodged in the Western Australian Museum, Perth (WAM). Additional material has been lodged at the United States National Museum of Natural History, Smithsonian Institution (USNM), the Nationaal Natuurhistorisch Museum, Leiden (RMNH) and the Muséum national d'Histoire naturelle, Paris (MNHN). For comparison, all specimens of *P. jerviensis* held in the Australian Museum, Sydney, including the holotype, were examined.

Sizes of specimens are indicated by shield length (SL). The Marine Research Group of Victoria collected many of the specimens and is abbreviated as MRGV.

Pagurixus handrecki sp. nov.

Figures 1–4

Material examined. Holotype, Victoria, southern Port Phillip Bay, 7 m, sand and algae, 1986–1990, MRGV (stn SPPS 5), NMV J20520 (male, 2.9 mm).

Paratypes. Victoria, Bass Strait, off Lakes Entrance, 36 m, 15 Jun 1987, N. Coleman, NMV J20535 (1 male, 1.8 mm); eastern Bass Strait, between Barracouta oil rig and shore, 42 m, Nov 1987, N. Coleman, NMV J16854 (1 female); Shack Bay, Venus Bay, 12 m, rocks, 4 Mar 1982, C. Larson *et al.*, NMV J20536 (1 male, 2.1 mm); South Beach Road, Somers, intertidal, 28 Jan 1983, NMV J20522 (1 female, 2.8 mm); Flinders Reef, Western Port, intertidal, NMV J20523 (6 males, 3.4–2.5 mm, 1 female, 2.7 mm); Shoreham, 1902, NMV J20541 (2 males, 2.9 mm, 2.7 mm, 1 female, 2.5 mm); West Head, Flinders, intertidal rock pool, S. Fulton, NMV J16858 (2 males, 2.9 mm, 2.8 mm); Type locality, NMV J20530 (1 female, 2.4 mm, NMV J20543, 1 male, 2.3 mm); southern Port Phillip Bay, 6 m, sand and shell, 1986–1990, MRGV (stn SPPS 11), NMV J20521 (1 female, 2.0 mm), NMV J20526 (3 males, 2.3–1.9 mm), USNM (2 males, 2.7 mm, 1.5 mm, 10 females, 2.3–1.7 mm), NMV J20537 (1 female, 2.0 mm), RMNH (1 male, 2.4 mm, 1 female, 2.3 mm); southern Port Phillip Bay, 12 m, reef and algae, 1986–1990, MRGV (stn SPPS 7), NMV J20532 (1 male, 2.5 mm), NMV J20544 (1 male, 2.9 mm, 1 female, 1.7 mm); southern Port Phillip Bay, 10 m, sand and shell, 1986–1990, MRGV (stn SPPS 10), NMV J20542 (1 male, 2.3 mm, 1 female, 2.4 mm).

Tasmania, Ninepin Point, 3 m, *Macrocystis* holdfasts, 20 Mar 1988, G.C.B. Poore and H. Lew Ton, NMV J8582 (1 male, 1.8 mm, 2 females, 2.5 mm, 2.1 mm); SW of Randalls Bay, Garden Island Bay, 4 m, red algae, sponges and bryozoans, 19 Mar 1988, G.C.B. Poore and H. Lew Ton, NMV J8714 (2 females, both 1.6 mm); Peggs Beach Coastal Reserve, 2 km W of Port Latta, 2 m, sponges and red algae, 16 Mar 1988, G.C.B. Poore and H. Lew Ton, NMV J11444 (1 ovigerous female, 2.1 mm); Bicheno, E side of Waubs Bay, 11 m, reef, red and brown algae, 23 Mar 1988, G.C.B. Poore and H. Lew Ton, NMV J20529 (1

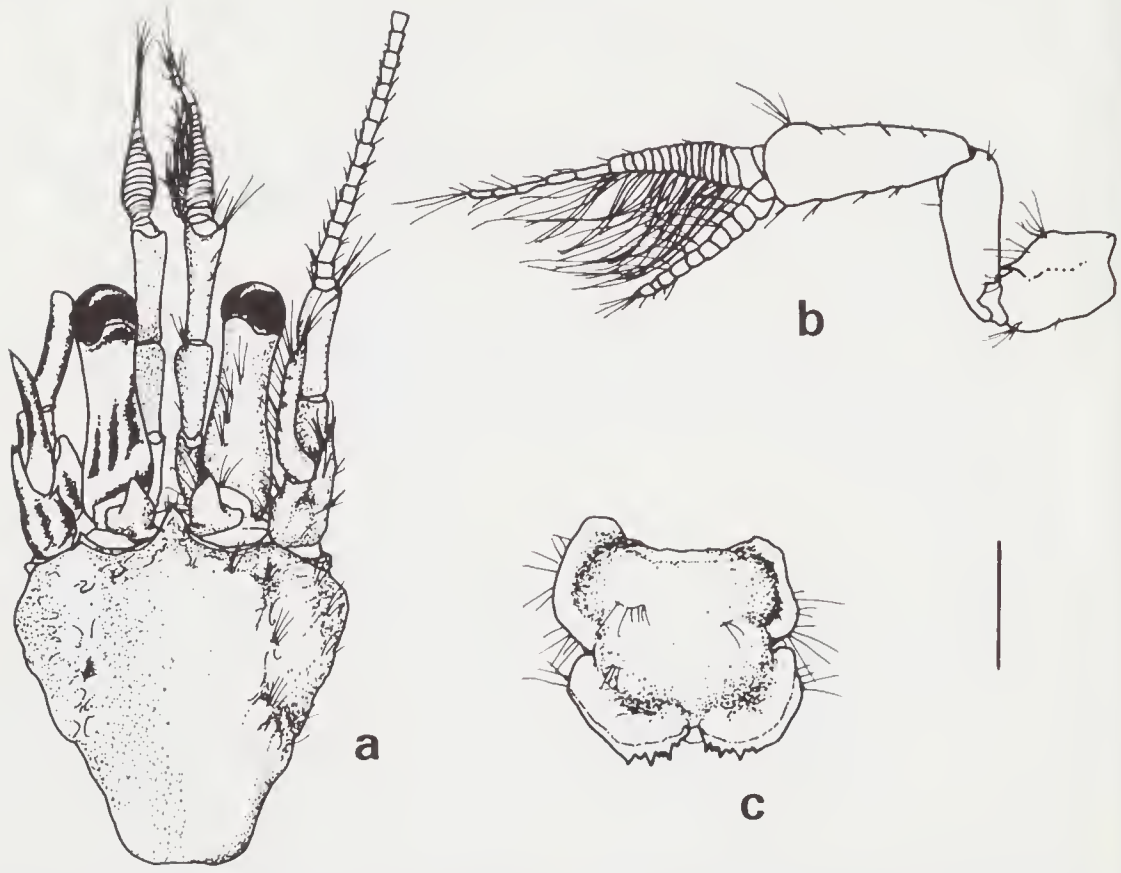

Figure 1. *Pagurixus handrecki* sp. nov., holotype male. A, dorsal view of shield and cephalic appendages, colour patterns on left side (setae omitted); B, lateral view of left antennule; C, dorsal view of telson. Scale = 1 mm (A), 0.63 mm (B), 0.5 mm (C).

male, 2.0 mm); 14 m, drift weed on sand, NMV J20547 (1 male, 2.0 mm); central Bass Strait, 9 km SSW of Three Hummock Island, 27 m, coarse sand, 2 Nov 1980, M. Gomon and G.C.B. Poore, NMV J20373 (2 males, both 2.1 mm; 3 n. mi. E of Babel Island, 40 m, 11 Oct 1984, SAM C4336 (1 male, 2.5 mm).

South Australia. Edinburgh, N of swimming pool, Yorke Peninsula, 1–5 m, SAM C4339 (1 ovigerous female, 2.1 mm); Stansbury jetty, Yorke Peninsula, 1-3 m, SAM C4340 (2 males, 2.7–2.0 mm, 1 female, 1.9 mm); Port Moorowie, Yorke Peninsula, 6 m, under rock, reef, 29 Mar 1986, SAM C4337 (1 male, 2.3 mm); Fanny Point, Boston Island, Eyre Peninsula, SAM C4338 (1 male, 2.7 mm); Kangaroo Reef off Maria Point, Boston Island, Eyre Peninsula, 3–8 m, sponge, 17 Feb 1988, SAM C4341 (1 male, 2.2 mm); SAM C4343 (1 male, 2.7 mm, 1 ovigerous female, 2.3 mm); Arno Bay jetty, Eyre Peninsula, SAM C4342 (1 male, 1.8 mm).

Western Australia. All Rottnest Island, collected by G.J. Morgan. Pocillopora Reef, 4 m, sand and rubble, 14 Jan 1991, WAM 39-91 (6 males, 1.8–1.1 mm, 12 females, 1.9–1.3 mm); Fish Hook Bay, 12 m, sand, rubble and weed, 19 Jan 1991, WAM 40-91 (2 males, 2.4 mm, 1.7 mm, 2 ovigerous females, both 2.1 mm); Little Salmon Bay, 2 m, coral and rubble, 20 Jan 1991, WAM 41-91 (1 male, 1.8 mm); Kitson Point, 6 m, coral and rubble, 23 Jan 1991, WAM 42-91 (1 male, 2.0 mm, 4 females 2.1–1.0 mm); Naney Cove, 15 m, 16 Jan 1991, WAM 43-91 (1 ovigerous female, 1.5 mm); Naney Cove, 9 m, rubble, 15 Jan 1991, MNHN Pg4869 (2 males, 2.1 mm, 2.0 mm, 5 females, 1.7–1.4 mm); North Point, 8 m, rubble, 22 Jan 1991, WAM 44-91 (2 males, both 1.3 mm, 4 ovigerous females, 1.6–1.4 mm); Kingston Reefs, 12 m, 21 Jan 1991, WAM 45-91 (1 male, 1.3 mm); Stark Bay, 4 m, 13 Jan 1991, WAM 46-91 (1 ovigerous female, 1.5 mm); Cathedral Rocks, 13 m, 15 Jan 1991, WAM 47-91 (2 males, 1.5 mm, 1.4 mm, 1 ovigerous female, 1.4 mm); Duck Rock, 5 m, sand and rock, 9 Jan 1991, WAM 20-91 (2 males, 2.2 mm, 1.8 mm, 4 females, 2.1–1.5 mm).

Description. Shield (fig. 1A) longer than broad; anterior margin concave; anterolateral margins

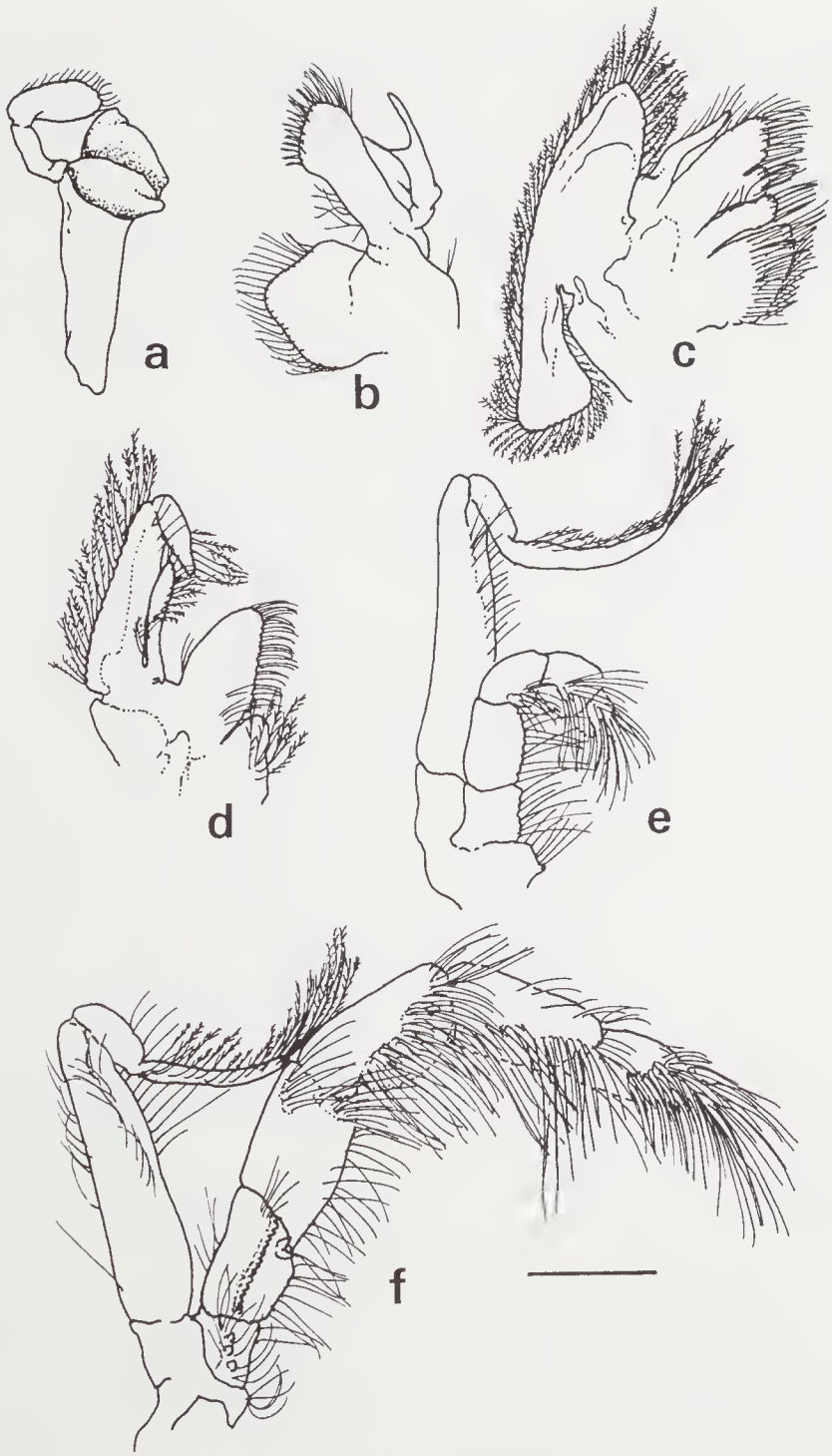

Figure 2. *Pagurixus handrecki* sp. nov., holotype male. A, C–F, mesial view of left mouthparts; B, mesial view of right mouthpart. A, mandible; B, maxillule; C, maxilla; D, first maxilliped; E, second maxilliped; F, third maxilliped. Scale = 0.5 mm.

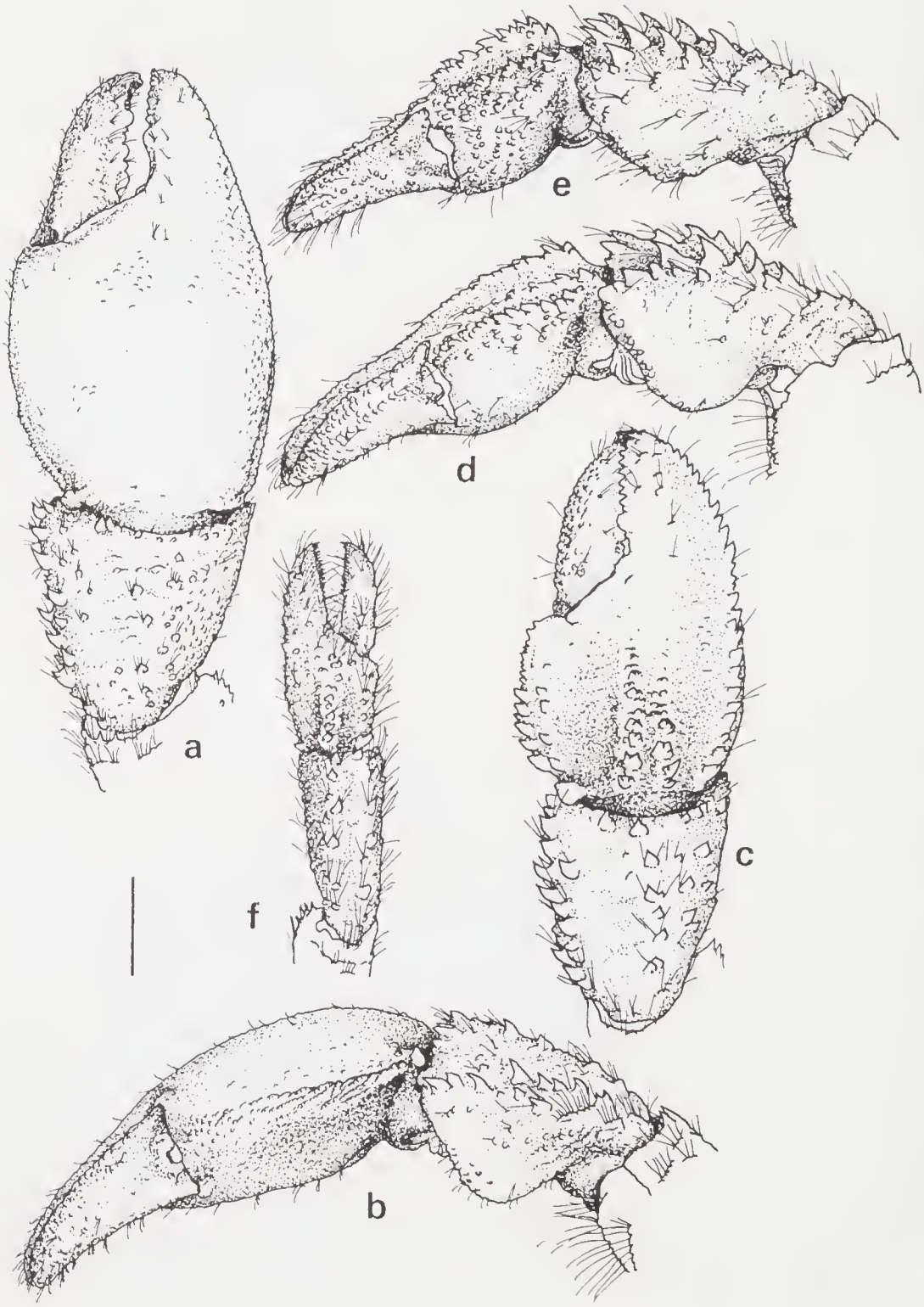
a
b
c
d
e
f

Figure 3. *Pagurixus handrecki*, sp. nov. A, B, F, holotype male; C–E, paratype females. A, dorsal view of male right chela and carpus; B, mesial view of male right chela and carpus; C, dorsal view of female right chela and carpus, SL 2.3 mm, NMV J20531; D, mesial view of female right chela and carpus (same specimen as C); E, mesial view of female right chela and carpus, SL 2.5 mm, NMV J20541; F, dorsal view of male left chela and carpus. Scale = 1 mm (A, B, F), 0.63 mm (C–E).

sloping; posterior margin truncate. Rostrum overreaching bases of ocular acicles; terminating in acute spinule. Lateral projections obtusely triangular with distinct marginal or submarginal spine.

Ocular peduncles about two-thirds length of shield, 3–4 times as long as maximum width, slightly inflated proximally and distally, dorsomesial row of tufts of setae; ocular acicles subtriangular, usually with small submarginal terminal spine, separated basally by basal width or slightly more than basal width of 1 acicle.

Antennular peduncles (fig. 1A, B) overreaching ocular peduncles by one-half to two-thirds length of ultimate segment. Ultimate segment with tuft of long setae at distal dorsolateral angle and scattered tufts of short setae on dorsal surface; ventral surface with row of 4 or 5 tufts of usually 2 short setae. Penultimate segment unarmed, with some scattered short setae. Basal segment with acute spine on lateral face distally and often spinule at distomesial angle.

Antennal peduncles shorter than antennular peduncles, overreaching ocular peduncles by about one-quarter length of ultimate segment. Fifth and fourth segments unarmed. Third segment with spine at ventrodistal margin. Second segment with distal dorsolateral angle produced and terminating in 3 or 4 spines, distal dorsomesial angle with 1 spine; segment with scattered setae. First segment with distal ventromesial angle produced with 1 small lateral spine; lateral margin bearing protuberance or spinule. Antennal acicle arcuate, terminating in small spine, mesial margin with row of long setae. Antennal flagellum moderately long, overreaching larger cheliped; articles with 4–6 short setae, mostly laterally and mesially, setae very short distally.

Mandible (fig. 2A) with at least 1 blunt cusp. Maxillule (fig. 2B) with internal lobe of endopodite well developed, bearing 1 terminal bristle; external lobe very produced, shallowly curving mesially. Maxilla (fig. 2C) with scaphognathite rather slender. First maxilliped (fig. 2D) with basal segment of exopodite slender and flagellum rather short; endopodite about two-thirds length of exopodite. Second maxilliped (fig. 2E) lacking distinguishing characters. Third maxilliped (fig. 2F) with 1, occasionally 2, accessory teeth; basis with 2–3 small teeth; merus unarmed. Sternite of third maxillipeds unarmed.

Right cheliped of males (figs 3A, B) moderately swollen, much larger than left. Dactylus slightly shorter than palm; cutting edge with large calcareous teeth for proximal two-thirds, small pectinate corneous teeth for distal third, terminating in calcareous tooth and slightly overlapped by fixed finger; dorsal surface very little elevated in midline, dorsomesial margin distinct only proximally; dorsal, mesial and ventral faces minutely granular. Palm approximately same length as carpus; dorsomesial margin clearly delimited by granular ridge for proximal two-thirds to three-quarters, becoming obsolete distally; dorsal surface minutely granular, dorsolateral margin crenulate; cutting edge of fixed finger with calcareous teeth; lateral, mesial and ventral surfaces of palm and fixed finger minutely granular, granules immediately ventral to mesial ridge often arranged in short diagonal rows. Chela with only scattered short setae. Carpus of similar length to merus, strongly inflated ventrally; dorsomesial margin with irregular row of strong spines and acute tubercles, as large distally as proximally; dorsal surface with scattered spines and acute tubercles sometimes forming very irregular row just lateral to midline, distal margin with varying number and size of spines; lateral, ventral and mesial surfaces minutely granular and with some short setae. Merus triangular in cross-section, with transverse ridges and short setae on dorsal margin; distodorsal margin usually with 1 or 2 spines, ventrolateral and ventromesial margins with row of spines or spinules and long setae. Cheliped spines usually largest on large specimens.

Right cheliped of females (figs 3C–E) considerably smaller and less massive than that of males. Dactylus subequal to palm in length, cutting edge with corneous teeth distally, calcareous proximally; dorsomesial margin moderately distinct proximally, obsolete distally, and bearing granules or acute, sometimes spinulose, tubercles; mesial face granular, with low tuberculate ridge along midline; dorsal and ventral

surfaces with scattered low protuberances. Palm distinctly shorter than carpus; dorsomesial margin clearly defined by row or rows (often elevated as a ridge) of acute or spinulose tubercles or spines, usually largest proximally; variable development of second row or ridge on dorsal surface lateral to dorsomesial ridge, sometimes slightly elevated and bearing low spines and tubercles, sometimes distinctly projecting and with pronounced spines and spinulose tubercles; surface between ridges minutely granular or with larger tubercles; dorsal surface of palm with ridge along midline bearing acute or spinulose tubercles and spines, ridge sometimes very projecting and with steep distal edge; median ridge becoming obsolete or abruptly terminating near base of fixed finger, then continuing as low elevation bearing some tubercles along finger; often second tuberculate or spinose ridge immediately lateral to median ridge, this second ridge sometimes fusing with median ridge or absent; remainder of dorsal surface of palm minutely granular or with scattered small acute and sometimes spinulose tubercles; lateral margin clearly limited by row of moderately large spines, smallest distally. Carpus similar in length to merus; dorsomesial margin with irregular row or rows of strong spines and usually second irregular row of strong spines just lateral to midline; dorsal surface between rows relatively smooth with some low granules or tubercles; distal margin with several spines; dorsolateral margin indistinct and curved, dorsolateral surface with numerous spines and acute and spinulose tubercles; ventral and mesial faces minutely granular. Merus with row of strong spines along ventrolateral margin, small spines or tubercles along ventromesial margin.

Left cheliped (fig. 3F) about three-quarters length of right, elongate, chela subrectangular in dorsal view, fingers spoon-shaped. Dactylus slightly longer than palm; cutting edge with row of narrow corneous teeth, terminating in corneous claw; dorsal surface punctate with scattered low protuberances or tubercles sometimes in irregular row along midline and scattered setae; dorsomesial margin poorly delimited, mesial face with some low protuberances or tubercles. Palm about one-half length of carpus; dorsal midline elevated, sometimes strongly so, armed with row of acute tubercles and spines, these largest proximally, and extending onto fixed finger as row of small tubercles; dorsomesial margin with row of small spines or tubercles, less prominent than median row; dorsolateral surface minutely granular or spinulose, strongly sloping to margin with irregular row of small tubercles; ventral surface with scattered tubercles or protuberances. Chela with sparse tufts of long setae. Carpus slightly shorter than merus; dorsomesial and dorsolateral margins each with row of stong spines and tubercles, usually smaller proximally; distodorsal margin with 1 or more strong spines; lateral, mesial and ventral surfaces with low tubercles and protuberances at bases of tufts of long setae; ventrolateral margin with row of small tubercles or spines distally. Merus with low protuberances at bases of tufts of short setae on dorsal margin; lateral and mesial faces with low tubercles and granules; ventromesial margin with some spinules and long setae, ventrolateral margin with row of strong spines.

Second (fig. 4A) and third (figs 4B, C) pereopods generally similar and not overreaching large cheliped. Dactyli subequal to propodi in length; slightly curved ventrally in lateral view, slightly twisted in dorsal view; ventral margins with row of 8 to 12 (rarely up to 14) strong corneous spines. Propodi longer than carpi, slightly more elongate on second than on third pereopods; ventral margins with 4 to 6 corneous spines or spinules. Carpi shorter than meri; dorsal surfaces with low protuberances at bases of setal tufts; distodorsal angles with spine (sometimes small). Meri longer on second than on third pereopods; with low protuberances at bases of setae on dorsal and ventral margins; second pereopods with spine at distolateral angles, sometimes with additional spine or spinule proximally. Ischium much longer on third than on second pereopods. Pereopods bearing sparse tufts of rather long setae. Sternite of third pereopods (fig. 4D) with anterior lobe subrectangular, anterior margin with long setae.

Females with paired gonopores.

Telson (fig. 1C) with posterior lobes separated by strong median cleft; terminal margins approximately straight or shallowly oblique, left and right posterior lobes each with 2 to 4 moderately stong terminal spines and 2 to 6 spinules; lateral margins unarmed.

Colour (*in life*) Shield (fig. 1A) predominantly cream, often with darker areas or mottling, with scattered red chromatophores; often 2 red spots lateral to midline. Ocular peduncles cream or white with short longitudinal red or red-brown stripes subproximally and red annuli distally and proximally. Corneas with silvery sheen. Ocular acicles white with red chromatophores. Antennular peduncles with distal segment

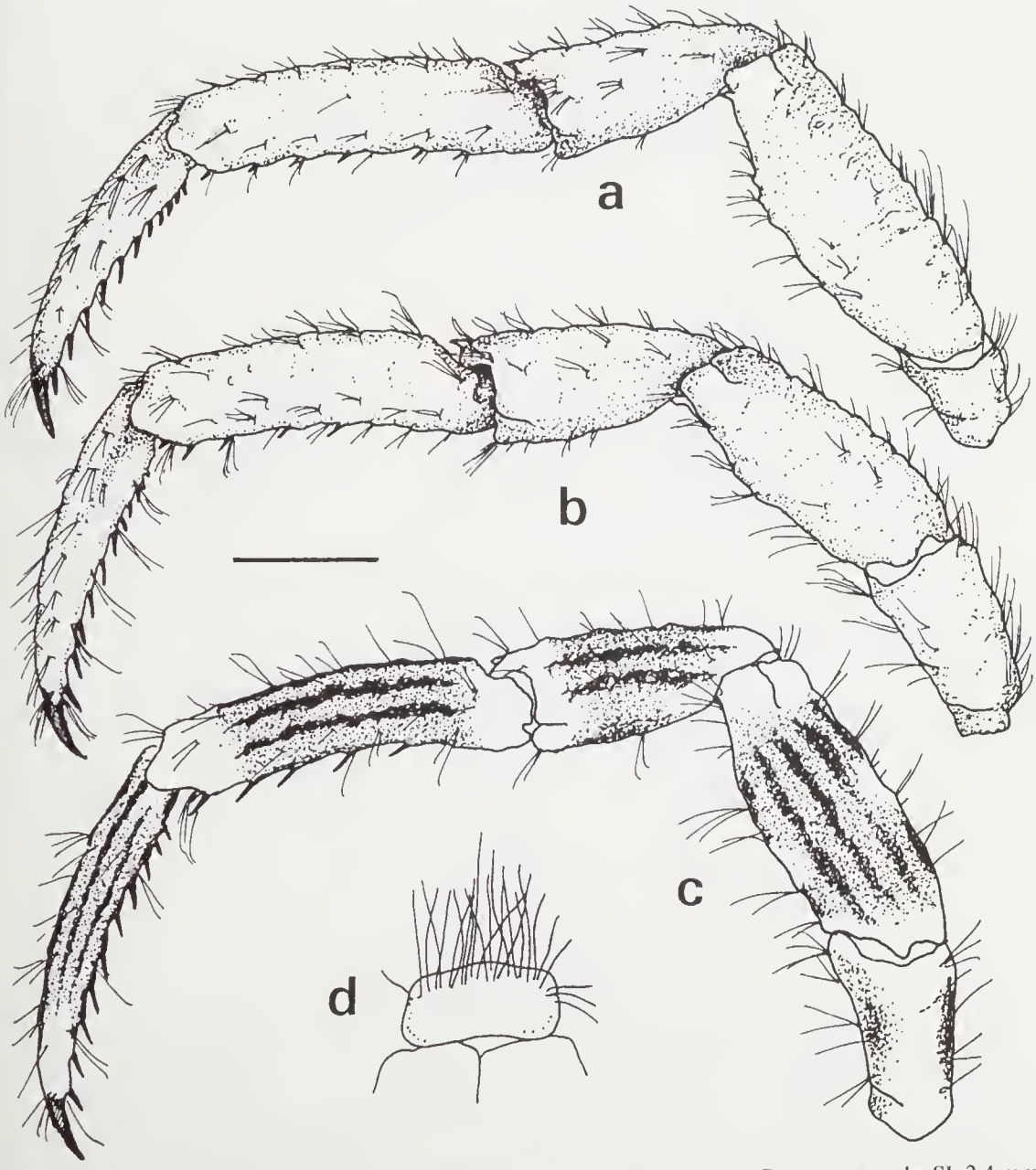

Figure 4. *Pagurixus handrecki*, sp. nov. A, B, D, holotype male NMV J20520; C, paratype male, SL 2.4 mm, WAM 40-91. A, lateral view of second pereopod; B, lateral view of third pereopod; C, lateral view of third pereopod showing colour pattern; D, anterior lobe of sternite of third pereopods. Scale = 1 mm (A, B), 0.8 mm (C), 0.5 mm (D).

orange for proximal quarter to third, purple distally; subdistal segment orange. Flagella orange. Antennal peduncles cream with some red or red-brown stripes and patches on most segments and acicles. Flagella pale brown with some segments paler and with white distomesial spots, these spotted segments becoming more spaced distally. Right cheliped with dactylus and fixed finger cream, palm with pink or grey tinge; often some red dots on propodus especially along proximal margin and at articulation with dactylus; carpus and merus darker, mottled with pale

Table 1. Characters distinguishing *Pagurixus handrecki* sp. nov. and *P. jerviensis* McLaughlin and Haig.

	P. handrecki	*P. jerviensis*
Dactyli of pereopods 2 and 3	Subequal in length to propodus (fig. 4A–C)	Shorter than propodus (fig. 6A, B)
	8–14 ventral spines (fig. 4A–C)	7–10 ventral spines (fig. 6A, B)
Palm of right cheliped of male	Distinct mesial ridge for two-thirds to three-quarters palm length (fig. 3B)	Mesial ridge only proximally (fig. 5B)
Carpus of right cheliped of male	Several variable spines on distal margin, usually large dorsomesial spines (fig. 3A)	Few spinules or tubercles on distal margin, dorsomesial spines poorly developed (fig. 5A)
Palm of right cheliped of female	Dorsomesial ridge and ridge lateral to this bearing strong spines or tubercles and not defining flattened facet (fig. 3C–E)	Dorsomesial ridge and ridge lateral to this poorly spinose and defining rather smooth dorsomesial facet (fig. 5C, D)
	Median ridge strongly produced, usually strongly spinose (fig. 3C)	Median ridge more weakly produced, usually weakly spinose (fig. 5C)
Carpus of right cheliped of female	Irregular row of large spines lateral to midline (fig. 3C)	Low spinules and tubercles lateral to midline (fig. 5C)
Palm of left cheliped	Median ridge more produced than dorsomesial ridge (fig. 3F)	Median and dorsomesial ridges subequal (fig. 5E)
Ocular peduncles	Length 3–4 times maximum width (fig. 1A)	Length 2–3 times maximum width (McLaughlin and Haig, 1984: fig. 6a)
Live colour	Dark reddish longitudinal stripes on ocular peduncles and pereopods (figs 1A, 4C)	Diffuse dark bands on pereopods

brown, 3 or 4 diffuse red-brown longitudinal stripes dorsally and laterally on merus and more faintly on carpus proximally. Left cheliped darker than right; fingers with cream tips, remainder medium brown; palm pale brown, median ridge darker; carpus and merus with distinct longitudinal red-brown stripes. Second and third pereopods (fig. 4C) with distinct longitudinal red or red-brown stripes on paler pink background; dactylus cream distally, other segments cream distally and proximally. Tailfan white with red chromatophores. Females generally darker than males, with colour pattern of both chelipeds similar.

Etymology. Named after Mr Clarrie P. Handreck, secretary of the Marine Research Group of Victoria, in recognition of his considerable contribution to the knowledge of the coastal fauna of Victoria.

Distribution. South-eastern Australia from Lakes Entrance, Victoria, west to South Australia and southwestern Western Australia, including Tasmania. Intertidal to 42 m.

Remarks. Pagurixus handrecki is the third species of the genus recorded from Australian waters. Table 1 lists characters that distinguish *P. handrecki* from *P. jerviensis* which ranges from Tuggerah Lakes north of Sydney south to Mallacoota in eastern Victoria. On the basis of available specimens, it appears that *P. handrecki* is a smaller species than *P. jerviensis*. The largest specimen of the former has a shield length of 3.4 mm, and most specimens are considerably

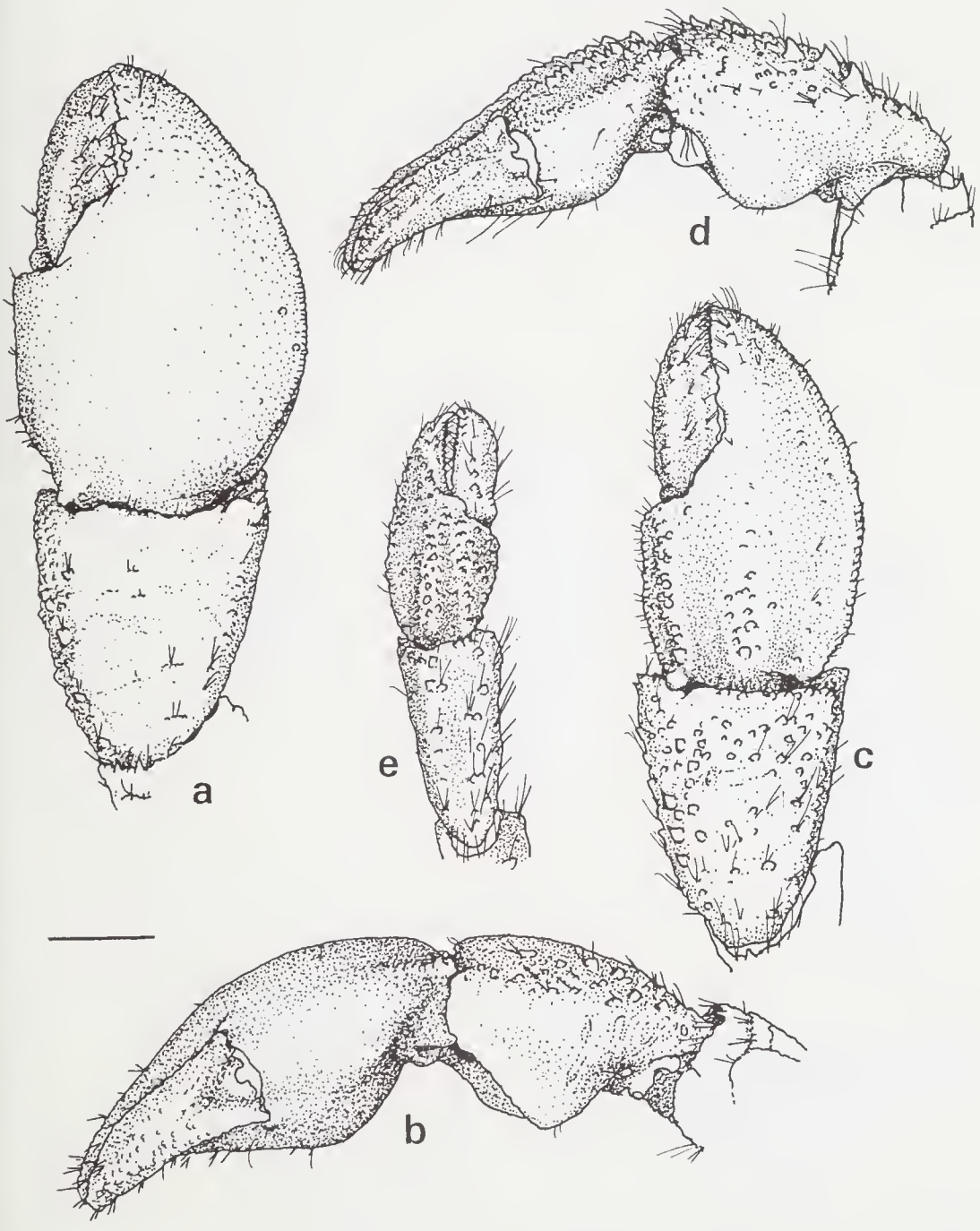

Figure 5. *Pagurixus jerviensis* McLaughlin and Haig. A, B, E, holotype male, AM P33836; C, D, female, SL 3.4 mm, AM P7152. A, dorsal view of male right chela and carpus; B, mesial view of male right chela and carpus; C, dorsal view of female right chela and carpus; D, mesial view of female right chela and carpus; E, dorsal view of male left chela and carpus. Scale = 1 mm.

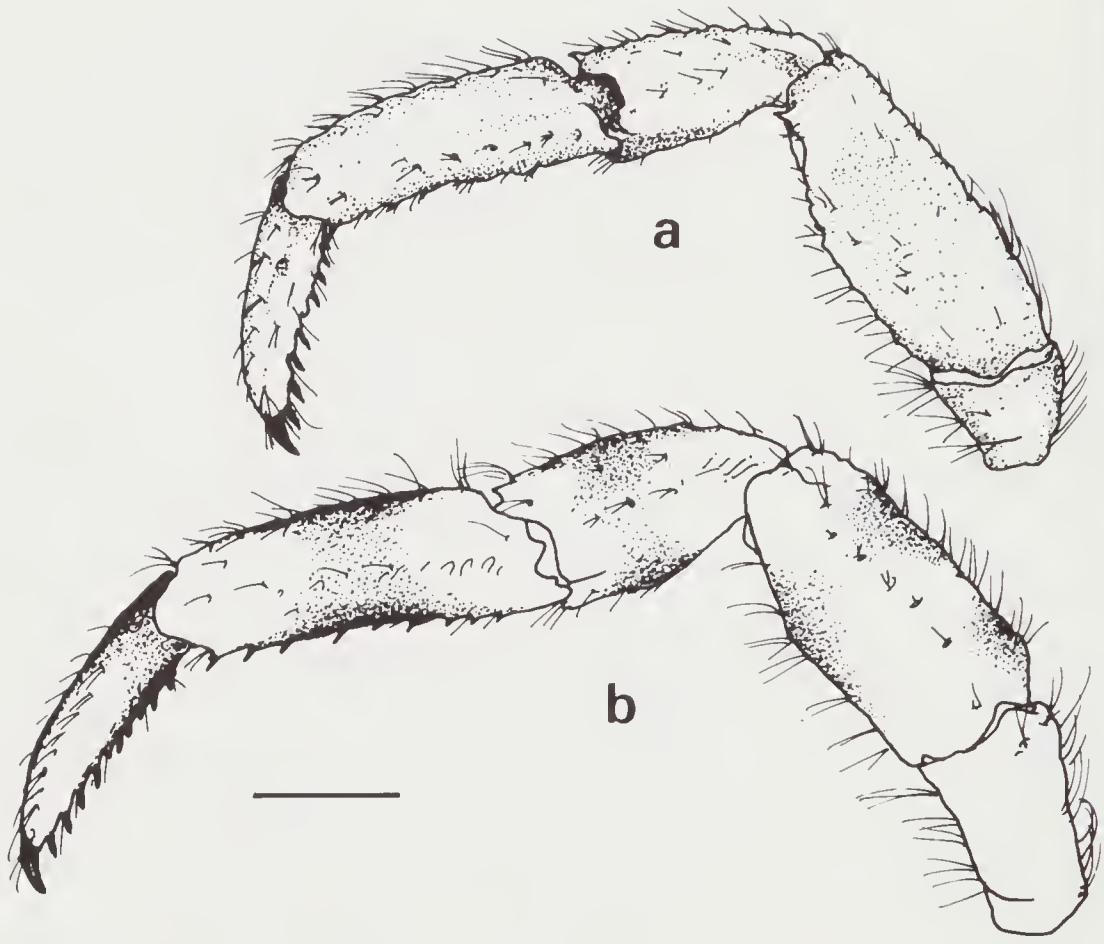

Figure 6. *Pagurixus jerviensis* McLaughlin and Haig. A, lateral view of second pereopod of holotype; B, lateral view of third pereopod showing colour pattern (preserved) of male, SL 3.2 mm, AM P7152. Scale = 1 mm.

smaller, while the latter grows to at least 4.3 mm. In both species, adult males are larger than females.

McLaughlin and Haig (1984) divided *Pagurixus* into two groups on the basis of presence or absence of a distinct row or rows of setae on the ventral margin of the ultimate segment of the antennular peduncles. *Pagurixus handrecki* has several short setae or tufts of two setae along this margin and presumably falls into the group lacking distinct rows. The condition of *P. handrecki* appears to be closest to that of *P. anceps* (Forest). The ventral surface of the antennular segment in *P. jerviensis* was described by McLaughlin and Haig as "naked" but in fact there are 3 to 5 short setae present on most specimens, including the holotype. The absence of distinct setal rows distinguishes *P. handrecki* from *P. boninensis* (Melin), *P. festinus* McLaughlin and Haig, *P. maorus* (Nobili) and *P. tweediei* (Forest).

Descriptions and illustrations by Forest (1956) and McLaughlin and Haig (1984) indicate that all congeners have stouter ocular peduncles than those of *P. handrecki,* the closest species in this respect being *P. anceps* and *P. laevimanus* (Ortmann). In combination, the ornamentation of the chelipeds and the shape and spination of the dactyli of second and third pereopods also separate *P. handrecki* from other species. Colour was noted for only four species by McLaughlin and Haig (1984) and then usually for preserved material. Of these, *P. maorus* is most similar to *P. handrecki* in colour, both having reddish longitudinal stripes on the pereopods, but in the former, the stripes are more numerous. The colours of *P. handrecki* are dis-

tinctly different from the other three species: *P. anceps, P. hectori* (Filhol) and *P. jerviensis.*

Pagurixus *handrecki* is similar in size to *P. tweediei, P. maorus* and *P. boninensis*, is smaller than *P. hectori* and *P. jerviensis* and larger than *P. anceps, P. laevimanus* and *P. festinus* (Forest, 1956; McLaughlin and Haig, 1984). Females of *P. handrecki* were ovigerous at shield lengths as small as 1.3 mm. Of 34 females collected from Rottnest Island, Western Australia, in January 1991, 28 (82%) were ovigerous.

Acknowledgements

We thank the staff of the museums who assisted by making material available on loan: Mr Robin Wilson (NMV), Ms Karen Gowlett-Holmes (SAM) and Dr Penny Berents (AM). Dr Gary Poore (NMV) and Dr Patsy McLaughlin (Shannon Point Marine Center) offered constructive criticism and advice during the study and on the manuscript. Thc Marine Research Group of Victoria provided many of the Victorian specimens.

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