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FOUR NEW SPECIES OF THE FAMILY OPHELIIDAE (POLYCHAETA) FROM SOUTHERN AUSTRALIA

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HARTMANN-SCHRÖDER, G. & PARKER, S. A. 1995. Four new species of the family Opheliidae (Polychaeta) from southern Australia. *Records of the South Australian Museum* **28**(1): 1–12.

Recent examination of specimens of *Euzonus*, *Ophelia*, *Ophelina* and *Travisia* (Polychaeta: Opheliidae) in the South Australian Museum revealed a previously undescribed species in each genus: *Euzonus zeidleri* sp. nov., *Ophelia bulbibranchiata* sp. nov., *Ophelina longicirrata* sp. nov. and *Travisia oksae* sp. nov. The previous report of *Travisia forbesii* Johnston, 1840 from Victoria is referred to *T. oksae* sp. nov. *T. oksae* sp. nov. is known from South Australia and Victoria, the other three from South Australia only. *Euzonus zeidleri* sp. nov. represents the first record of its genus for Australia

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The family Opheliidae is widely distributed in the seas of all climatic zones from the polar regions to the tropics, and from shallow waters to abyssal depths. Most members of the family live as deposit-feeding burrowers in various types of sediment.

Six genera and 15 named species of opheliids have so far been reported from Australia (mainly from southern Australia and New South Wales): *Armandia* Filippi, 1861: *A. maculata* (Webster, 1884), *A. intermedia* Fauvel, 1902, *A. secundariopapillata* Hartmann-Schröder, 1984, *A. bilobata* Hartmann-Schröder, 1986; *Ophelia* Savigny, 1818: *O. ashworthi* Fauvel, 1917, *O. dannevigi* Benham, 1916, *O. elongata* Hutchings & Murray, 1984, *O. multibranchia* Hutchings & Murray, 1984, *Lobochesis* Hutchings & Murray, 1984: *L. bibrancha* Hutchings & Murray, 1984, *L. longiseta* Hutchings & Murray, 1984; *Ophelina* Örsted, 1843: *O. breviata* (Ehlers, 1913)[1], *O. gigantea* (Rullier, 1965); *Polyophthalmus* Quatrefages, 1850: *P. pictus* (Dujardin, 1839); *Travisia* Johnston, 1840: *T. lithophila* Kinberg, 1866, *T. olens* Ehlers, 1897 (Day & Hutchings 1979, Hutchings 1982, Hutchings & Murray 1984, Hartmann-Schröder 1980, 1984, 1985, 1986). A further species, *Travisia forbesii* Johnston, 1840, has been reported from Victoria (Poore *et. al.* 1975), but the specimens proved, upon examination, to have been misidentified (see below under *T. oksae* sp. nov.). A seventh genus, *Euzonus* Grube, 1866, has to date been reported in Australasia only from New Zealand (*E. otagoensis* Probert, 1976).

MATERIALS AND METHODS

The present study is based largely on material in the South Australian Museum, *viz.* specimens of *Ophelia* and *Ophelina* obtained at Pearson Island in June 1973, a large series of *Travisia* from upper Spencer Gulf collected by E. Oks of the South Australian Fisheries Department in 1985–1987, and a large series of *Euzonus* collected at Reevesby Island in the Sir Joseph Banks Group in 1985 and 1986 by the junior author. This new material was augmented by a loan of *Travisia* from the NMV. Comparative material of previously described species included the four (of six) syntypes of *Ophelia ashworthi* in the SAM, and from the ZMH the syntypes of *Euzonus furciferus* (Ehlers, 1897), and the specimens of *T. forbesii*. The subfamilial and generic classification follows Hartmann–Schröder (1971).

Measurements are in millimetres, made with an eyepiece graticule. Drawings were executed with the aid of a camera lucida on a Zeiss microscope. Abbreviations of institutions mentioned are: AM, Australian Museum, Sydney; BMNH, Natural History Museum, London; NMV, Museum of Victoria, Melbourne; NTM, Northern Territory Museum, Darwin; SAM, South Australian Museum, Adelaide; USNM, National Museum of Natural History, Washington DC; ZMH, Zoological Museum, Hamburg. Material is deposited in the AM, NTM, SAM, USNM and ZMH.

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* Shane Parker died on 21 November 1992.

[1] Listed as *Ophelia breviata* by Day & Hutchings (1979:129)

SYSTEMATICS

Family OPHELIIDAE Malmgren,1867
Subfamily OPHELIINAE Malmgren, 1867

Genus *Euzonus* Grube, 1866

Euzonus zeidleri sp. nov.
(Figs 1–5)

Types (all collected on Reevesby Island, South Australia, by S. A. Parker, measurements for paratypes are of length of longest specimen in each sample).

Holotype: Haystack Bay, 20.i.1986, SAM E2145; length 28 mm, width (at thorax) 3.5 mm.

Paratypes (276 specimens): Haystack Bay, 21.i.1985, SAM 2146(36), 23 mm; Haystack Bay, 31.i.1985, SAM E2147(58), 22 mm; McCoy Bay, 22.i.1985, SAM E2148(36), 31 mm; McCoy Bay, 31.i.1985, SAM E2149(2), 19 mm; Haystack Bay, 20.i.1986, SAM E2150(73)/ZMH: P20816(6)/ USNM 169135 (4)/AM W21745 (4)/ NTM W6421–424(4), 27 mm, Haystack Bay, 22.i.1986, SAM E2151(14), 35 mm, Haystack Bay, 30.i.1986, SAM E2152(9), 28 mm; Haystack Bay, 1.ii.1985, SAM E2153(26), 24 mm.

Other material examined

Euzonus furciferus (Ehlers, 1897): syntypes, Punta Arenas, Strait of Magellan, ZMH: V4869(7); Itanhan, Brazil, ZMH: P15144(1); Santos, Brazil, ZMH: P15421(4); Zapallar, Chile, ZMH: P15124(1).

Diagnosis

A *Euzonus* with bifurcate branchiae (character of subgenus *Thoracophelia* Ehlers, 1897 *sensu* Hartman 1956), with body formula 12a + 20b + 6a (*i.e.* branchiae occuring on setigers 13–32); all branchiae bifurcate; branches of branchiae subequal, superior one bearing 1–2 small pinnae; setae on segments 1–36; pygidium relatively large, broad, lacking elongated terminal (ventral) cirrus, 6–9 lateral cirri on each side.

Description

Body fusiform, 38 segments, 36 setigers, total length 9–35 mm; divided into three distinct regions: cephalic (prostomium and two setigers), thoracic (eight setigers) and abdominal (26 setigers and two asetigerous segments). All segments annulated. Prostomium with small apical point; eyes absent; nuchal pits present (Fig. 1). Thoracic region inflated, delimited from cephalic region by pronounced constriction, delimited from abdomen by thick, smooth lateral glandular ridges. Abdominal region comprising two prebranchial, 20 branchiate and six postbranchial segments (body formula thus 12a + 20b + 6a, see Tebble 1952). Last two asetigerous abdominal segments with close-set longitudinal furrows. Pygidium wide at base, broadly rounded at tip, not tapering to an elongated ventral cirrus; dorsal anal cirri disposed in a V over pygidium, 6–9 on each side (Fig. 5). Abdominal region bearing deep longitudinal midventral and lateral grooves, former continuing to pygidium, latter becoming shallower beyond last branchiate setiger (32nd).

Branchiae on setigers 13–32, bifurcate, branches subequal, superior branch bearing 1–2 small pinnae distally on dorsal surface (Fig. 2–4).

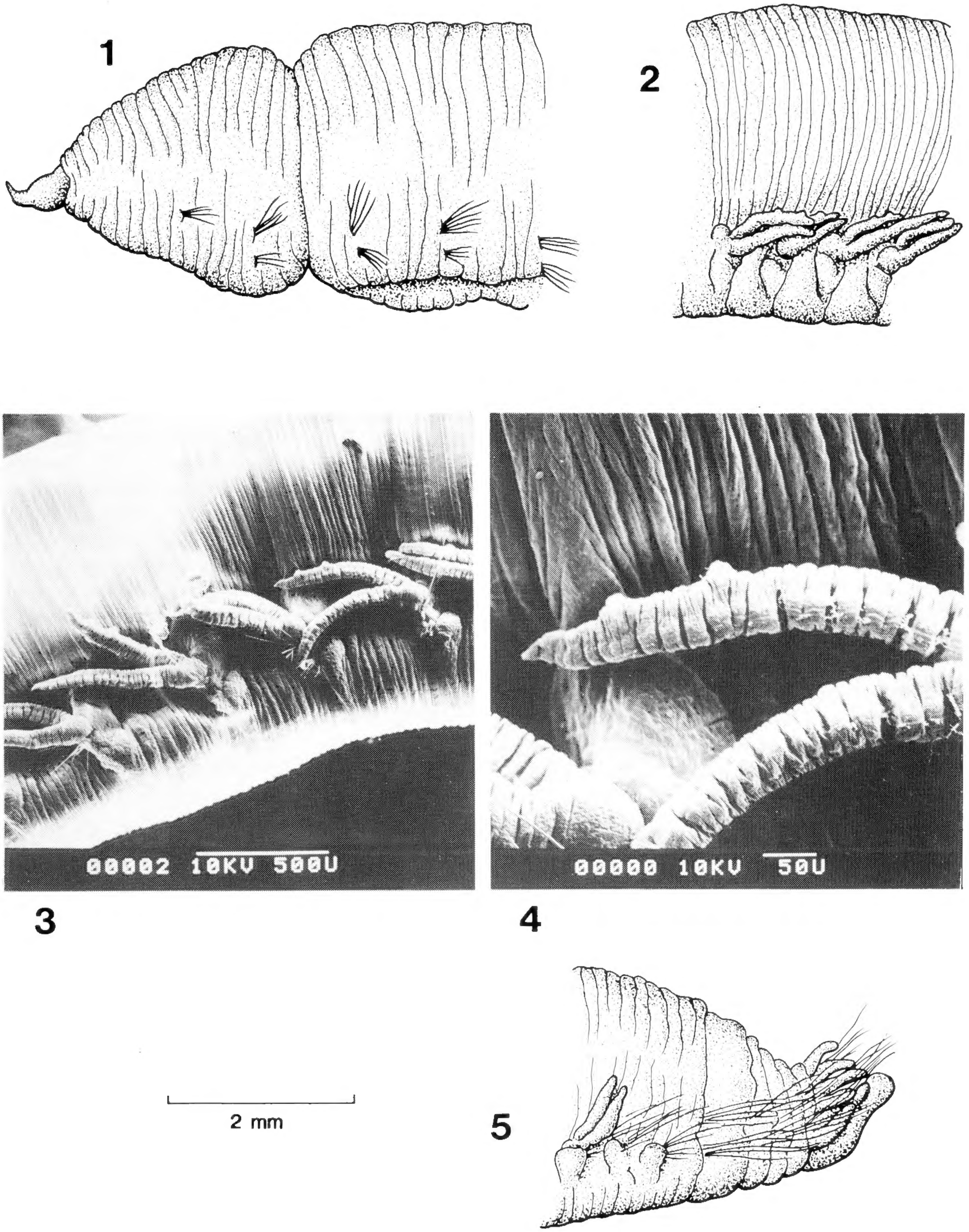
Parapodia barely or not visible, lobes immersed in surrounding tissue, from which bundles of setae appear to arise directly. Notosetae and neurosetae simple, capillary, 6–25 and 6–30 setae per bundle respectively, on segments 1–36. Neurosetae shorter than notosetae of same setiger, except on setigers 34–36, where they increase to a subequal length; also, setae of setdgers 34–36 markedly longer than those of preceding setigers, tending to curve and spread conspicuously (Fig.5).

Colour of individuals in life bright red, especially at anterior end.

Comparisons with other species

Eleven species have been described to date (Rozbaczylo & Zamorano 1970, Probert 1976). Of these, six fall in the subgenus *Thoracophelia* Ehlers, 1897, *sensu* Hartman 1956, having the branchiae bifurcate rather than trifurcate or pectinate: *E. furciferus* (Ehlers, 1897, type species of *Thoracophelia*), *E. mucronata* (Treadwell, 1914), *E. williamsi* (Hartman, 1938), *E. profundus* Hartman, 1967, *E. otagoensis* Probert, 1976 and *E. heterocirrus* Rozbaczylo & Zamorano, 1970.

Within this group, *E. zeidleri* sp. nov. is most similar to *E. furciferus* of South America, the only member of the subgenus with a body formula of 12a + 20b + 6a, *i.e.* twelve abranchiate anterior segments, 20 branchiate segments and 6 posterior abranchiate segments. The closest species geographically, *E. otagoensis* of New Zealand, differs in having a body formula of 14a + 18b + 6a. From *E. furciferus*, *E. zeidleri* differs in possessing 1–2 small pinnae on the superior branch of the branchiae (absent in *E. furciferus*),



FIGURES 1–5. *Euzonus zeidleri* sp. nov. **1**, anterior end, lateral view; **2**, segments from middle of body, lateral view (setae omitted); **3**, median body region showing branchiae; **4**, branchiae, detail; **5**, posterior end, lateral view (all of paratype ZMH: P–20816).

the last two segments asetigerous (last one asetigerous in *E. furciferus*), last 3–4 segments not telescoped together as in *E. furciferus*, pygidium relatively large, broad, bluntly rounded at tip, not small and tapering to elongated ventral cirrus as in *E. furciferus*, and 6–9 dorsal cirri on each side *vs* 4 on each side in *E. furciferus*.

Etymology

We name this species in honour of our colleague Wolfgang Zeidler, South Australian Museum, who led the 1985 and 1986 collecting trips to the Sir Joseph Banks Group.

Distribution and ecology

Euzonus zeidleri is known only from Haystack Bay and McCoy Bay, two quartz-grain surf-beaches on the eastern, weather side of Reevesby Island, Sir Joseph Banks Group, South Australia, where it was collected in damp sand of the lower and middle intertidal, within a spade's depth of the surface. Both beaches squeaked underfoot, and thus belong to the type known as singing beaches (for a discussion of this phenomenon, apparently produced by the shearing of the well-sorted, well rounded quartzgrains under pressure, see the account of Squeaky Beach, Victoria by Beasely 1972).

Subsequent to the discovery of *E. zeidleri*, S.A P. sought the species in other exposed sandy beaches, *e.g.* on Younghusband Peninsula and at Cape Jaffa, Boatswain's Point and Robe, south-eastern South Australia. None of these contained *E. zeidleri*, and none squeaked underfoot; all were of silicate rather than quartzgrains. In answer to our enquiry, Dr P. K. Probert (*in litt.* 11.iii.1992) confirmed our suspicion that the type locality of *Euzonus otagoensis* Probert, 1976 (Allan's Beach, Otago Peninsula, New Zealand) was a singing beach. It thus seems possible that the occurence of *E. zeidleri* and *E. otagoensis* (and perhaps other species of the genus) coincides with that of singing beaches, with their characteristic well-sorted, well-worn quartzgrains.

E. zeidleri was more abundant at Haystack Bay than at McCoy Bay; at the latter locality the quartzgrains averaged larger but were equally rounded. The only other macroscopic species observed in these beaches were the cosmopolitan marine acanthodriline oligochaete *Pontodrilus litoralis* (Grube, 1855; first South Australian record) and a minute enchytraeid oligochaete; these were collected at Haystack Bay, from less damp sand of the upper subtidal.

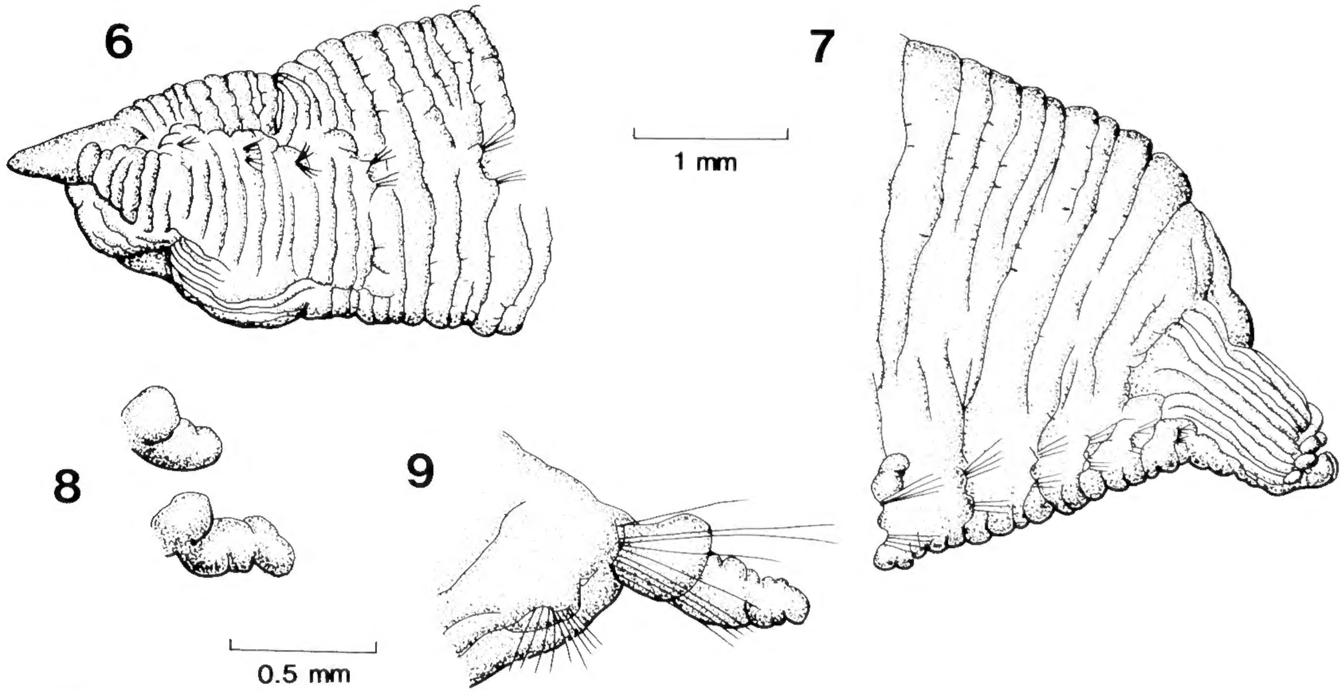
Genus ***Ophelia*** Savigny, 1818

Ophelia bulbibranchiata sp. nov.
(Figs 6–9)

Types

Holotype: Pearson Island, Investigator Group, South Australia, 26.vi.1973 (?coll.), SAM E1604, 30 setigers, length 30 mm, width 4 mm.

Paratypes: Same data as holotype: SAM



FIGURES 6–9. *Ophelia bulbibranchiata* sp. nov. **6**, anterior end, lateral view; **7**, posterior end, lateral view; **8**, first branchia from anterior segment; **9**, parapodium from middle of body.

E1605(3), 30 setigers, length 2–27 mm; ZMH: P20667(1), 30 setigers, length 30 mm.

Other material examined

Ophelia ashworthi Fauvel, 1917; 'St Vincent and Spencer Gulfs', South Australia, SAM E306 (four syntypes).

Diagnosis

An *Ophelia* 24–33 mm long with 30 setigers (including 10 prebranchial and 5 postbranchial), 15 pairs of simple, bulbous-based branchiae, 7–9 small and two large anal papillae; posterior dorsolateral ridges absent.

Description

Body club shaped, divided into anterior region of nine setigers and a posterior region of 21 setigers; a faint constriction between setigers 2 and 3. Prostomium small, conical, with small nuchal organs basally. No eyes visible. All segments annulate, those of anterior region somewhat areolate (Fig. 6); last five to six segments decreasing in size. Lateral furrows and a ventral furrow from setiger 11. Posterior segments lack dorsolateral ridges. Branchial fenestrations absent. Pygidium cylindrical with longitudinal folds or furrows, bearing seven to nine small dorsal and lateral anal papillae and two large ventral papillae (Fig. 7). First bundle of setae very small, easily overlooked, in region of mouth (Fig. 6). Subsequent parapodia with short, broadly rounded, postsetal lobes (Fig. 9). Setae capillary, notapodial slightly longer than neuropodial but nowhere obviously long. Fifteen pairs of branchiae from setiger 11 to setiger 25. Branchiae short, with bulbous bases, latter largest in middle branchiae (Fig.8–9). Nephridial pores not visible.

Comparisons with other species

O. bulbibranchiata sp. nov. is unique among the known species of the genus in possessing bulbous bases to the branchiae.

Species of *Ophelia* with a similar number of setigers to *O. bulbibranchiata* (30) are *O. multibranchia* Hutchings & Murray, 1984 (27), *O. peresi* Bellan & Picard, 1965 (29), *O. celtica* Amoureux & Dauvin, 1981 (29), *O. elongata* Hutchings & Murray, 1984 (30), *O. bipartita* Monro, 1936 (31), *O. dannevigi* Benham, 1916 (32) and *O. ashworthi* Fauvel, 1917 (32). Of these, *O. peresi*, *O. celtica* and *O. bipartita* have not been recorded in Australia. For differences see Table l.

Etymology

The epithet *bulbibranchiata* (L.), refers to the bulbous shape of the basal part of the branchiae, unique in the genus.

TABLE 1. Comparison of *Ophelia bulbibranchiata* sp. nov. with other species of the genus with similar number of setigers

	Number of setigers	size in mm	number of prebranchial segments	number of postbranchial segments	pairs of branchiae	shape of branchiae	anal papillae	posterior dorsolateral ridges
O. multibranchiata	27	4-6	7	3	17	simple	10 small ones	absent?
O. peresi [1]	29	1~12	10	4	15	simple	12 small ones	absent
O. celtica [1]	29	30-45	10	3	16	simple	12 small + 2 large ones	absent
O. elongata	30	4-7	8	6	16	simple	10 small ones	present
O. bipartita [1]	31	63	9	5	17	simple	16 small + 2 large ones	present
O. dannevigi	32	20	10	3	19	simple	16 small + 2 large ones	absent?
O. ashworthi	32	?	10	2	20	bifurcate	several small + 1 large one	absent?
O. bulbibranchiata	30	24-33	10	5	15	bulbous base	7-9 small + 2 large ones	present

[1] no records from Australia

Distribution and ecology

Known only from the type series obtained at Pearson Island, eastern Great Australian Bight in 1973. No notes on depth or habitat accompany the specimens.

Subfamily OPHELININAE Hartmann-Schröder, 1971

Genus *Ophelina* Örsted, 1843

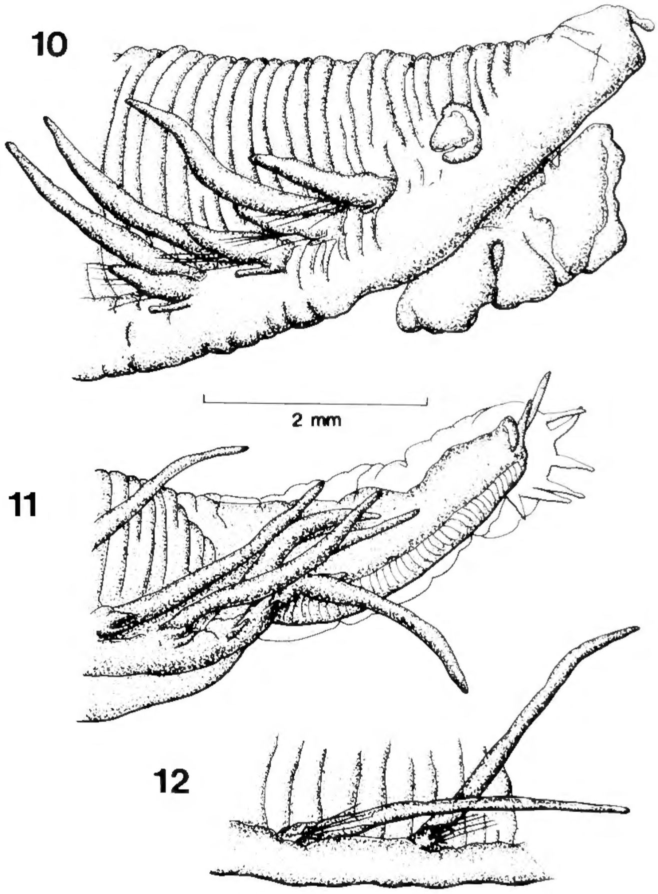
Ophelina longicirrata sp. nov.
(Figs 10–12)

Types

Holotype: Pearson Island, Investigator Group, South Australia, 26. vi. 1973 (?coll), SAM E1606, 41 setigers, length 52 mm, width 3.0 mm.

Other material examined

Ophelina breviata (Ehlers, 1913): holotype, ZMH: V8583, Kaiser-Wilhelm-II-Land, Antarctica, P190559(10), P19728(3), Antarctica; ZMH V9548(2), Bass Strait, ZMH: V11871(1), Port Lockray, New South Wales (Augener 1927: 215, at 37°05'S, 150°05'E).



FIGURES 10–12. *Ophelina longicirrata* sp. nov. **10**, anterior end, lateral view; **11**, posterior end, lateral view (cuticulum lifted away from underlying tissue through fixation); **12**, parapodia and branchiae of segments 34 and 35.

Diagnosis

A large *Ophelina* (52 mm long), with 41 setigers, long cirriform presetal lobes on anterior parapodia, long ventral cirri, anal tube cylindrical.

Description

Body fusiform, 41 setigers. Prostomium conical, longer than wide at base, with oblong palpode (Fig. 10). Proboscis a folded bag. No eyes visible. Nuchal organs slightly protruded, nuchal slits probably horseshoe-shaped. Segments strongly annulate. Anal tube cylindrical, annullate, only half width of last segments and as long as 5–6 last segments together. Anal opening ventroterminal, with 11 lanceolate anal papillae and a ventral cushion that may be base of a lost unpaired cirrus (Fig. 11). Presetal lobes of anterior parapodia long, cirriform, half as long as the branchiae on setiger 2, decreasing in size to setiger 12. From setiger 26, presetal lobes rounded-conical, with digitate extension of same length as ventral cirrus (Fig. 10–11). Ventral cirrus of setiger 1 small, filiform, increasing in size to setiger 14, thence of same length as presetal lobe (Fig. 11–12). Setae nowhere obviously long. Branchiae long, cirriform to filiform, overlapping on dorsum, absent only from setiger 1.

Comparisons with other species

Species of *Ophelina* with a cylindrical anal tube and cirriform presetal lobes are *O. hachaensis* Augener, 1934 and *O. fauveli* (Caullery, 1945), neither of which has been reported from Australia. *O. longicirrata* sp. nov. is much larger than *O. hachaensis*, with fewer setigers (52 mm, 41 setigers, *vs* 9 mm, 48 setigers), longer ventral cirri[1], and anal tube equal to the last 5–6 segments (*vs* the last 3–4 in *O. hachaensis*). *O. fauveli* has only 31 setigers and a length of 20 mm. The anal tube of both species is much shorter than that of *O. longicirrata*.

Besides *O. longicirrata*, two other species of *Ophelina* have been reported from Australia, *O. breviata* (Ehlers, 1913) of Bass Strait, New South Wales and Antarctica and *O. gigantea* (Rullier, 1965) of Queensland. *O. breviata* differs from *O.*

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[1] Augener (1934) misinterpreted the long presetal lobe of *O.hachaensis* as a ventral cirrus.

longicirrata by its smaller size (28 setigers, 29 mm length). In *O. breviata* the branchiae are absent from the first and the last four segments, the posterior four segments are very short, and the presetal lobes are rounded rather than filiform. *O. gigantea* differs from the new species (and from all the other species discussed) in having the anal tube not cylindrical but spoon-shaped, open ventrally for the whole of its length. It is also larger (62–64 mm), with more setigers (65–68).

Etymology

The epithet *longicirrata* (L.) refers to the long cirriform ventral cirri.

Distribution and ecology

Known only from the unique holotype obtained at Pearson Island, eastern Great Australian Bight in 1973. No notes on depth or habitat accompany the specimen.

Subfamily TRAVISIINAE Hartmann-Schröder, 1971

Genus *Travisia* Johnston, 1840

Travisia oksae sp. nov.
(Figs 13–19)

Travisia forbesi: Poore, Rainer, Spies & Ward (*non* Johnston), 1975: 29, 56 (Port Phillip Bay, Victoria); Day & Hutchings (*non* Johnston), 1979: 129 (*pars*, Victoria).

Types

Holotype: Station 2, 32°35'04"S, 137°46'08"E, upper Spencer Gulf, South Australia 6 m, medium sand, coll. E. Oks, S. Aust. Fisheries Dept. xi.1985, SAM E2701, 27 segments, 24 setigers, length 15 mm, width 5.5 mm (moderately contracted).

Paratypes: (52 specimens, all collected by E. Oks, upper Spencer Gulf, 1985–1987): Station 2, SAM E2702 (4, in same sample as holotype) (27, 25, 20.5), SAM E2703(2) (27, 24, 12), SAM E2704(1) (26, 24, 8), SAM E2705(1) (26, 26, 5); Station 3, SAM E2706(1) (26, 25, 5), SAM E2707(4) (26, 24, 7), SAM E2708(6) (23, 20, 3), SAM E2718(1) (27, 24, 11); Station 4, SAM E2709(1) (26, 24, 4); Station 5, SAM E2710(3) (25, 25, 4.5); Station 6, SAM E2711(2) (26, 25, 9.5), SAM E2712(7)/USNM 169136 (1)/AM W21746 (1)/(26, 24, 9.5); Station 7, SAM E2713(1) (27, 25, 24); Station 8, SAM E2714(2) (27, 24, 19), ZMH: P20668(1) (27, 25, 19); Station 9, SAM E2715(1) (26, 22, 4.9), SAM E2716(7)/NTM W6425(1) (27, 24, 16.5), SAM E2717(1) (26, 23, 6), ZMH: P20669(3) (27, 24, 155) (figures in parentheses after each sample refer to the number of segments, number of setigers and total length of the largest individual in the sample).

Other material examined

T. oksae sp. nov.: Victoria: Port Phillip Environmental and Benthic survey: Stn 974, 13.x.1971, NMV F60027(2), 60028(5), 60029(3) (Poore *et al.* 1975, under *T. forbesi*) Western Port Environmental Study: Stn 1704, NMV F60035(2), Stn 1722, NMV F60033(5), 60037(2), 60043(3), Stn 1723, NMV F60030(1), 60040(8), Stn 1724, NMV F60036(1), 60039(3), 60044(1), Stn 1727, NMV F60041(1), Stn 1731, NMV F60042(1), Stn 1733, NMV F60031(1), Stn 1735, NMV F60034(2), 60038(3) (ix. 1973, i. 1974).

T. olens Ehlers, 1897: syntypes, Punta Arenas, Chile, ZMH: V4865(7), 4866(4), 4807(20), 4868(1); Punta Arenas, ZMH: V11937(1), ZMH: PE1031(6); South Georgia, ZMH: V11877(1); Antarctica, ZMH: P19085(9); Exmouth Gulf, Western Australia, ZMH: P16892(1) (Hartmann-Schröder 1980: 74).

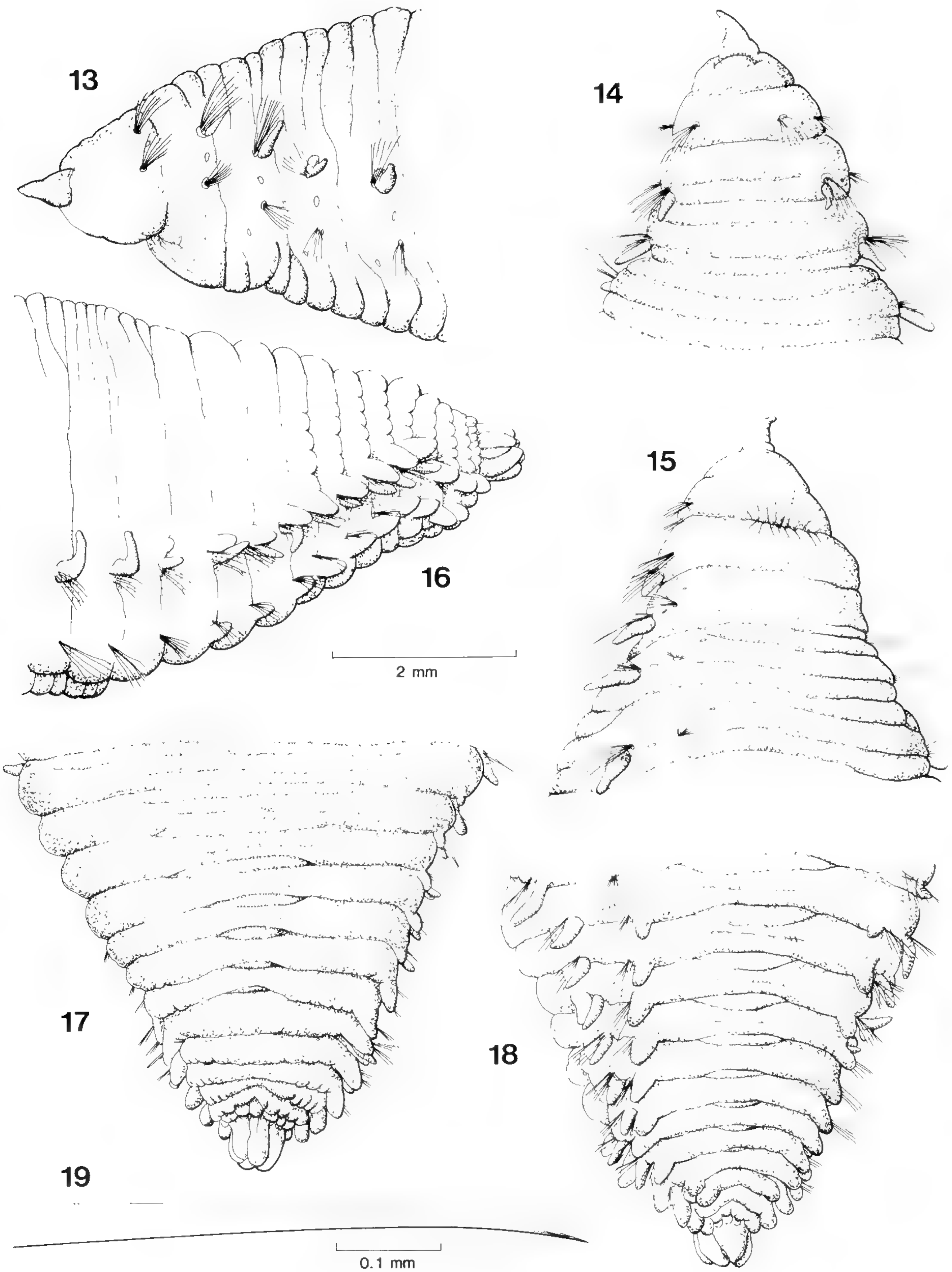
T. forbesi Johnston, 1840: North Sea, ZMH: V9190(5); Bay of Kiel, Baltic Sea, ZMH: P19241(22); Bohuslan, Sweden, ZMH: V5355(4); Tromso, Norway, ZMH: V7576(4), ZMH: PE1021(1); Spitzbergen, ZMH: PE1023(1); Jan Mayen, ZMH: V7527(1); Franz-Joseph-Land, ZMH: PE1025(4); Murman Coast, ZMH: V1439(2).

Diagnosis

A *Travisia* with 23–27 segments and 20–25 setigers, notopodial lobes from segment 15, neuropodial lobes from segment 16, and setae smooth, bilimbate.

Description

Body fusiform, 23–27 segments, 20–25 setigers, length 3–24 mm. Prostomium small conical, pointed, with small nuchal organs at base. First two segments faintly biannulate dorsally, lacking annulations ventrally. Segment 3 triannulate dorsally, biannulate ventrally (Figs 13–15). Segments 4–19 triannulate dorsally and ventrally, the annulations more and more restricted to the median part of dorsum and venter towards the posterior end of body (Figs 16–18). Segments 20–22 dorsally and segments 22–24 ventrally biannulate again; last five segments dorsally and last three segments ventrally lacking annulations.



FIGURES 13–19. *Travisia oksae* sp. nov. **13**, anterior end, lateral view; **14**, anterior end, dorsal view; **15**, anterior end, ventral view; **16**, posterior end, lateral view; **17**, posterior end, dorsal view; **18**, posterior end, ventral view; **19**, seta.

Posterior margin of the last nine segments with more or less obvious crenulations dorsally (Figs 16–17). Segment 27 very small and short. Anus terminal, encircled by seven blunt lobes (Figs 16-18). Entire surface of body (except the branchiae) covered with small pustules. Lateral parapodial region of body slightly swollen from segment 13 to end of body, expanding from parapodial region to near mid-dorsal and mid-ventral region in more posterior segments (Figs 16–18).

Fourteen anterior–most parapodia without lobes (Figs 13–15). Segment 15 with pair of minute notopodial lobes, above the bundle of notosetae; notopodial lobes increasing to ovoid lobes and still present on small last segment. Neuropodial lobes below neurosetae start on segment 16, similar in shape and size to notopodial lobes, but missing on segments 26 and 27 (Figs 16–18).

Bundles of notosetae and neurosetae from segment 1 to segment 24; last three segments usually asetigerous (though setae occur up to last segment in at least one specimen, in sample SAM E2710). Notosetae and neurosetae may be of different length within a bundle, otherwise similar, smooth and bilimbate (Fig. 19).

Branchiae simple, cirriform, present from segment 2 to 23 (Figs 13–15, 18). Lateral organ a small pit between bundles of notosetae and neurosetae. Nephridial pores present on segments 3–14, very conspicuous on segments 7–14 (Figs 13, 15).

Comparisons with other species

Species of *Travisia* with a similar number of setigers to *T. oksae* sp. nov. (22–29) are *T. forbesii* Johnston, 1840, *T. olens* Ehlers, 1897, *T. antarctica* Hartman, 1967, *T. brevis* Moore, 1906, *T. chiloensis* Kükenthal, 1887, *T. kerguelenensis* McIntosh, 1885 and *T. doellojuradoi* Rioja, 1944. Of these, only *T. olens* has been authentically reported from Australia (see above).

The species appearing most similar to *T. oksae* is the Arctic-boreal *T. forbesii* (23–26 segments, 22–25 setigers). It is identical to the former in the annulations of the segments, in the origins and shape of the notopodial and neuropodial lobes and the presence of nephridial pores on segment 3–14. It differs in being on average larger (11–32, *vs* 3–14 mm) and in having the setae minutely hirsute (*vs* smooth and bilimbate in *T. oksae*).

Also similar to *T. oksae* is *T. olens* from New Zealand, Western Australia and South Africa, which differs in being larger (up to 72 mm) with a greater average number of segments and setigers (27–32 segments, 23–29 setigers, *vs* 23–27 and 20–25), in having the neuropodial lobes present (though small) from segment 1, becoming larger from about segments 12–15 (*vs* present from segment 16 only in *T. oksae*), and in having the setae minutely hispid. The reports of *T. forbesii* from South Africa and New Zealand by Ehlers (1904, 1907, 1908) were referred to *T. olens* by Augener (1922). By their descriptions, Day's

TABLE 2. Details of stations at which *Travisia oksae* sp. nov. was collected.

Survey	Station	Lat.(S)	Long (E)	Depth(m)	Quartzgrain size
1	2	32°35'04"	137°46'08"	6	medium
	3	32°37'17"	137°46'00"	12	medium
	4	32°40'00"	137°45'28"	13	medium
	5	32°42'20"	137°47'26"	15	medium/coarse
	6	32°45'00"	137°50'00"	16	coarse
	7	32°47'18"	137°49'12"	15	coarse
	8	32°47'18"	137°50'00"	11	coarse
	9	32°50'00"	137°49'00"	17	coarse
2	974	38°16.3'	144°44.7'	5	
3	1704	38°16.12'	145°24.52'	12	
	1722	38°16.23'	145°15.45'	9	
	1723	38°17.07'	145°14.86'	14	
	1724	38°18.56'	145°14.72'	18	
	1727	38°21.17'	145°15.93'	9	
	1731	38°25.83'	145°19.28'	8	
	1733	38°23.09'	145°27.31'	10	
	1735	38°21.60'	145°30.59'	9	

1. Upper Spencer Gulf Benthic Survey (South Australia)
2. Port Phillip Environmental and Benthic Survey (Victoria)
3. Western Port Bay Environmental Study (Victoria)

(1961, 1967) records of *T. forbesii* from South Africa are also referable to *T. olens*.

In *T. antarctica* (28 segments, 24 setigers), notopodial and neuropodial lobes are not mentioned, nor are there any figures by which one might ascertain whether they are present; the setae are described as 'long, slender and capillary'; the annulations of the segments are different (the first 16–17 segments are triannulate, followed by six biannulate segments, whereas in *T. oksae* segments 4–19 are triannulate followed by three biannulate segments); and each segment is crossed by circlets of papillae, "resembling closely strung beads". *T. brevis* (26–27 segments, 24–25 setigers) differs by its hirsute setae and by the nephridial pores being situated on segments 7–25. *T. chiloensis* (27 segments, 24 setigers) has two pairs of notopodial and neuropodial lobes starting at segment 20 or 21. In *T. kerguelenensis* (23–27 segments, 21–23 setigers) segments 4–18 are biannulate; there are no triannulate segments; the posterior margins of the posterior 5–6 segments are strongly crenulated or lobed. *T. doellojuradoi* differs from *T. kerguelenensis* only by its deep purple colour when alive (black in alcohol).

Apart from *T. olens* and *T. oksae*, the only other *Travisia* recorded from Australia is *T. lithophila* Kinberg, 1866, known by two specimens (47, 48 mm) from New South Wales (Kinberg 1866, Hutchings & Murray 1984). This species differs from all the above in its greater number of setigers (44, 53); its notopodial and neuropodial lobes begin on setiger 12, and as in *T. olens* its setae are finely hispid.

Etymology

Named after Ene-mai Oks, collector of the type series.

Distribution and ecology

Travisia oksae is so far known from three areas of sheltered coastal waters in southern Australia: upper Spencer Gulf, South Australia (eight stations from 32°35'S to 32°50'S, in medium to coarse sand at 5–17 m), Port Phillip Bay, Victoria (a single station, 974, just inside entrance, in sand at 5 m) and Western Port Bay, Victoria (eight stations, all in sand).

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REVISION OF THE PENNATULACEAN GENUS *SARCOPTILUS* (COELENTERATA: OCTOCORALLIA), WITH DESCRIPTIONS OF THREE NEW SPECIES FROM SOUTHERN AUSTRALIA

GARY C. WILLIAMS

WILLIAMS, G. C. 1995. Revision of the pennatulacean genus *Sarcoptilus* (Coelenterata: Octocorallia), with descriptions of three new species from southern Australia. *Records of the South Australian Museum* **28**(1): 13–32.

The pennatulacean genus *Sarcoptilus* Gray, 1848 from southern Australia and New Zealand is revised. Three previously named species assignable to the genus are reassessed and two of these are described from recently collected material. One of these three taxa is here recognized as valid (*S. grandis* Gray, 1848), one is relegated to synonymy (*S. roseum* Broch, 1910), while the validity of the third is questionable at present (*S. bollonsi* Benham, 1906). In addition, three new species are described (*Sarcoptilus nullispiculatus*, *S. rigidus*, and *S. shaneparkeri*), making a total of five species known—four considered valid taxa from southern Australia and one of questionable validity from New Zealand. A dichotomous key to the species is included as well as a complete list of all pennatulacean species presently known to occur in southern Australia.

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During the 1980's and early 1990's, a relatively large collection of pennatulacean coelenterates was collected from southern Australia. From this work as well as the literature, nineteen species of sea pens are here recorded as occurring in southern Australia and New Zealand (see Table 1). Five species of *Sarcoptilus* (family Pteroeididae) are here treated from southern Australia and New Zealand. *Sarcoptilus grandis* Gray, 1848 is a relatively well-known member of the southern Australian fauna. The other two described species assignable to the genus have up until now been poorly known (*Sarcophyllum bollonsi* [Benham, 1906] and *S. roseum* [Broch, 1910]). The latter is here considered synonymous with *S. grandis*, while the former is of questionable validity. In addition, three new species are also described. Southern Australia is here defined as the continental shelf region of southern Western Australia, South Australia, Victoria, Tasmania, and southern New South Wales (i.e. the southern coastal waters extending from Perth to Newcastle). The genus seems to be geographically restricted to between 31° and 48° south latitude in Australia and possibly New Zealand.

Sarcoptilus Gray, 1848 is differentiated from related genera by having siphonozooids restricted to a conspicuous swollen pad at the intersection of the dorsal margin of each polyp leaf with the dorsal edge of the rachis, the absence of spiculiferous rays in the polyp leaves, a well developed axis extending throughout most of the length of the colony, and the presence of mesozooids on the distal/ventral portion of the rachis. *Sarcophyllum* Kölliker, 1869 is considered synonymous with *Sarcoptilus* by Williams (in press).

Gray (1848) and Benham (1906) described new species of sea pens referable to the genus *Sarcoptilus* from Australia and New Zealand, respectively. Broch (1910) and Briggs (1915) identified and described several pennatulacean species from southern Australian coastal waters. Utinomi and Shepherd (1982) briefly reviewed the shallow-water sea pens of southern Australia. Their work represents the only previously published survey of the regional pennatulacean fauna.

To date, material representing the following pennatulacean taxa have been collected from the coastal waters of Western Australia, South Australia, Victoria, Tasmania, New South Wales, and New Zealand, and are housed in the collections of several institutions (see below): *Sarcoptilus*, *Gyrophyllum* and *Pteroeides* (Pteroeididae); *Pennatula* (Pennatulidae); *Sclerobelemnon* (Kophobelemnidae); *Funiculina*

TABLE 1. Pennatulaceans from southern Australia and New Zealand.

Species	Distribution & Depth (m)	References
Anthoptilum grandiflorum	SA/VIC/NSW/TAS (392–1157)	present work
Funiculina quadrangularis	SA/TAS(520–597)	present work
Gyrophyllum sibogae	TAS (520)	present work
Halipteris willemoesi	TAS (520)	present work
Pennatula fimbriata	possibly Australia	von Kölliker, 1872 as *Leioptilus grayi*; Batie, 1972
Pennatula phosphorea	SA/TAS(436–636)	present work
Pteroeides elegans	NSW (40–110)	Briggs, 1915
Pteroeides hymenocaulum	WA (11–12)	Broch, 1910
Pteroeides multiradiatum	SA (40–50)	Utinomi & Shepherd, 1982
Pteroeides sp.	NZ (0–5)	present work
Ptilosarcus sinuosus (probably synonymous with *Pennatula fimbriata*)	possibly Australia	Batie, 1972
Sarcoptilus bollonsi	NZ (73)	Benham, 1906 & 1907
Sarcoptilus grandis	WA/SA/V/NSW (10–146)	Gray, 1860; Briggs, 1915, Utinomi & Shepherd, 1982; present work
Sarcoptilus nullispiculatus	SA/V/NSW (18)	Utinomi & Shepherd, 1982; present work
Sarcoptilus rigidus	WA (depth?)	present work
Sarcoptilus shaneparkeri	WA/SA (6–18)	Utinomi & Shepherd, 1982; present work
Sclerobelemnon schmeltzi	NSW (40–110)	Briggs, 1915
Umbellula sp.	NZ (449–4066)	present work
Virgularia gracillima	NZ (18–20)	von Kölliker, 1880; Dendy, 1896; Benham, 1907.
Virgularia gustaviana	WA/SA (depth?)	Utinomi & Shepherd, 1982; present work
Virgularia mirabilis	SA/VIC(depth?)	Utinomi & Shepherd, 1982

(Funiculinidae); *Anthoptilum* (Anthoptilidae); *Halipteris* and *Virgularia* (Virgulariidae); and *Umbellula* (Umbellulidae). The material, much of it recently collected, originates mainly from Perth, Albany, Great Australian Bight, Spencer Gulf, Gulf St Vincent, several localities off Victoria, New South Wales, and Tasmania, as well as the South Island of New Zealand.

The material (including types) used in this study is deposited at the South Australian Museum, Adelaide (SAM); Western Australian Museum, Perth (WAM); New Zealand Oceanographic Institute (NZOI), Wellington; and the California Academy of Sciences—Department of Invertebrate Zoology and Geology, San Francisco (CASIZG). Terminology used in the present work conforms to that of Bayer, Grasshoff, and Verseveldt (1983).

All figures in the present work are by the author.

KEY TO THE SPECIES OF *SARCOPTILUS*

1 — Sclerites absent altogether.. *S. nullispiculatus* sp. nov

— Sclerites present, mostly relatively densely distributed..2

2 — Basal region of peduncle without robust otolith-like sclerites.................. *S. shaneparkeri* sp. nov.

— Basal region of peduncle with numerous robust otolith-like sclerites in the interior, 0.2–1.2 mm long..4

3 — Colonies stiff and rigid. Polyp leaves thick,

swollen, and turgid, fan-shaped to rectangular or trapezoidal, <6 mm in length. Total colony length <120 mm............................*S. rigidus* sp. nov.

— Colonies flexible to limp. Polyp leaves flattened or thin, not turgid, semi-circular to kidney-shaped, up to 45 mm in length. Total colony length up to 350 mm........*S. grandis* Gray, 1848

SYSTEMATIC ACCOUNT

Family PTEROEIDIDAE Kölliker, 1880

Sarcoptilus Gray, 1848

Sarcoptilus Gray, 1848: 45 (in part). Gray, 1860: 23 (in part).

Sarcophyllum Kölliker, 1869: 224. Leuckart, 1872: 280.

Kükenthal & Broch, 1911: 441. Kükenthal, 1915: 117.

Pteroeides Balss, 1910: 60 (in part).

Diagnosis

Colonies feather-like and stout. Bilateral symmetry throughout length of rachis. Axis extends throughout entire length of colony, and round in cross secton. Polyp leaves present and conspicuous, rounded on margins, mostly kidney-shaped or fan-shaped. Polyp leaves without rays. Autozooids congested on distal margin of polyp leaves. Anthocodiae small, retractile into their basal protuberances. Siphonozooids restricted to swollen pads at base of each polyp leaf where the polyp leaves join rachis. Proximal surfaces of polyp leaves devoid of siphonozooids. Mesozooids usually present on distal ventral portion of rachis in a single longitudinal row or scattered. Sclerites smooth, not three-flanged. Spindles or rods of polyp leaves do not form rays; long needles absent. Rods or flattened rods present in the rachis. Small ovoid or biscuit-shaped plates or rods may occur in peduncle.

A genus of five species: southern Australia (four valid species) and New Zealand (one species of questionable validity).

TABLE 2. Table of comparative characters for the genus *Sarcoptilus*

Species	Colour (In alcohol)	Peduncular Sclerites	Maximum Length (mm)	Polyp Leaf Shape	Polyp Leaves Per Side
S. bollonsi (based on the original description)	pale reddish	large calcareous bodies in the interior	155	sickle or fin-shaped	30
S. grandis	cream-white to pale yellow or rose	ovoid finger-biscuits, rods or spindles, & otolith-like forms	350	semi-circular, kidney-shaped, or crescent-shaped	32–36
S. nulli-spiculatus	apricot to pale orange	absent	74	semi-circular, or fin-shaped	18–30
S. rigidus	cream-white	robust spindles & otolith-like forms	117	fan-shaped, rectangular to trapezoidal	22–26
S. shane-parkeri	blue-grey	stout rods & minute ovals	120–180	triangular or fin-shaped to semi-circular	22–38

Sarcoptilus bollonsi (Benham, 1906) new comb.

Sarcophyllum bollousi Benham, 1906: 66 (misspelling—originally named for Captain Bollons of the Government steamship 'Hinemoa').

Sarcophyllum bollonsi Benham, 1907: 193.

Remarks

I have not been able to locate the type specimen for this species and I do not know of any specimens that can be identified as *Sarcoptilus bollonsi*. The species is known only from the descriptions of Benham (1906, 1907), and apparently has not been collected since. From Benham's descriptions, it is very difficult to distinguish this species from *Sarcoptilus grandis*. In my opinion, the descriptions and figures are not detailed enough to distinguish the species. I therefore have not included it in the key to the species of *Sarcoptilus*.

At least two specimens of a species of pteroeidid sea pen closely resembling *Pteroeides dofleini* (Balss, 1909) (see d'Hondt, 1984: 18) have recently been collected from near the type locality of *Sarcoptilus bollonsi* from 0–5 metres depth by the New Zealand Oceanographic Institute (NZOI O840 and NZOI Q97). These specimens superficially resemble members of the genus *Sarcoptilus*. It is possible that the two taxa may be confused.

It is necessary to examine type material of *Sarcoptilus bollonsi* in order to make a sound assessment of its taxonomic status.

Distribution

New Zealand (southwestern coast of the South Island). Recorded only from the type locality at Doubtful Sound in 73 metres of water.

Sarcoptilus grandis Gray, 1848

(Figs 1–5)

Sarcoptilus grandis Gray, 1848: 45. 1860: 23. 1870: 25. Utinomi & Shepherd, 1982: 209.

Sarcophyllum australe Kölliker, 1870: 229. 1872: 186. Hickson, 1890: 140. Thomson & Mackinnon, 1911: 694.

Sarcophyllum grande Kölliker, 1880: 2. Balss, 1910: 60. Kükenthal & Broch, 1911: 441. Briggs, 1915: 93. Kükenthal, 1915: 118.

Sarcophyllum roseum Broch, 1910: 117. Kükenthal, 1915: 118, 120. ***syn. nov.***

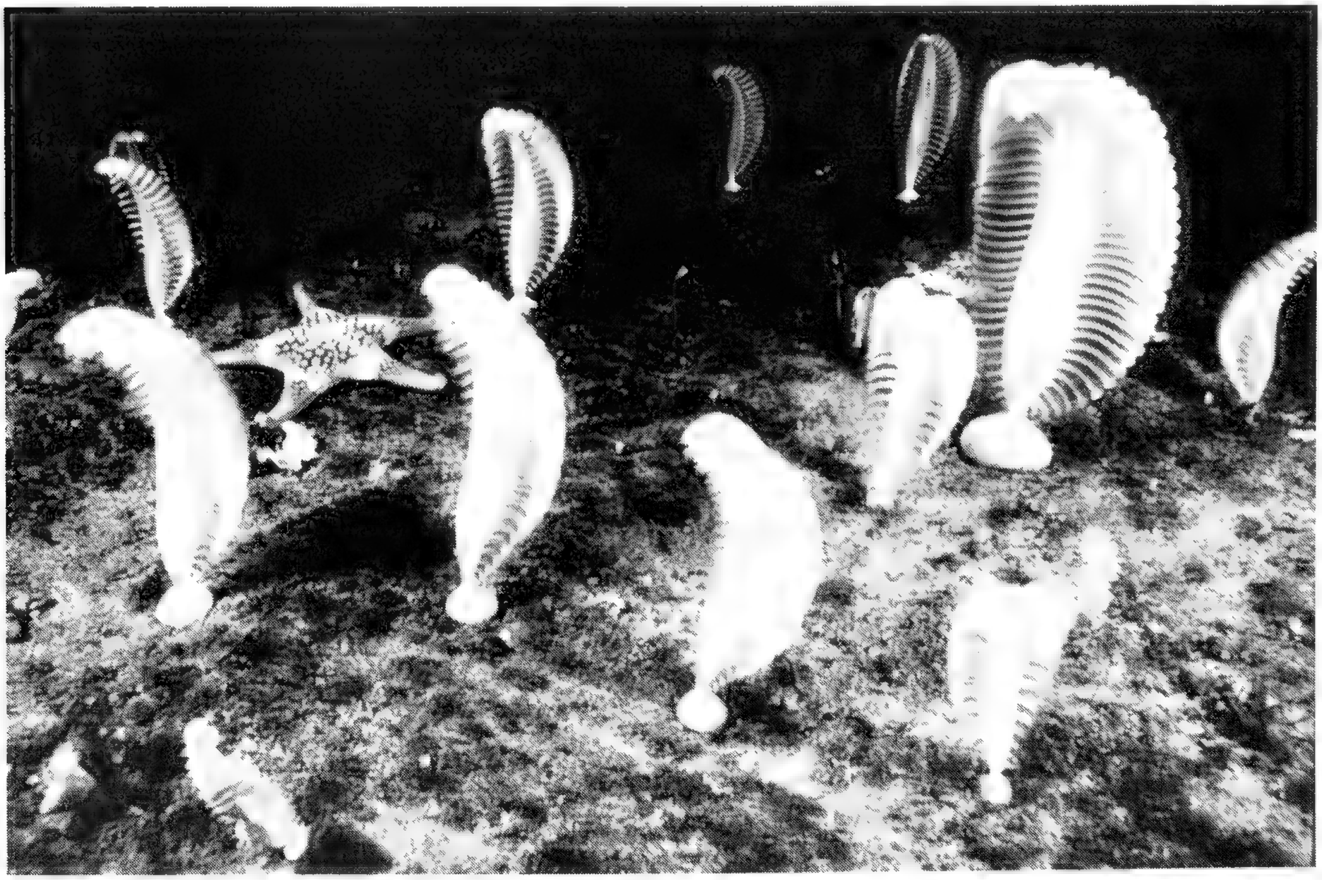

FIGURE 1. *Sarcoptilus grandis*. Underwater photograph of several living sea pens. Photograph: Fred Bavendam.

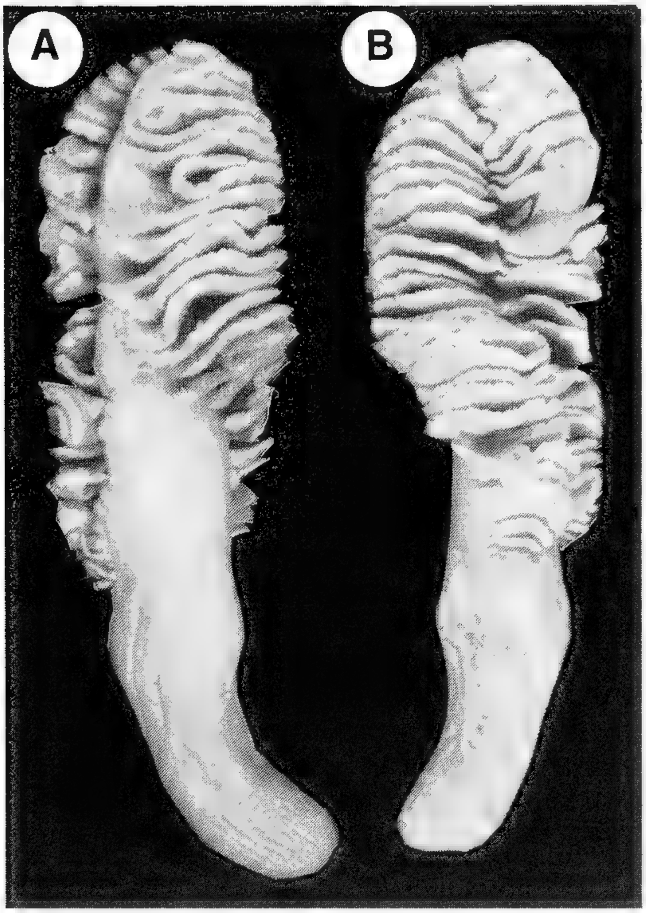

FIGURE 2. *Sarcoptilus grandis*. Photographs of a single specimen, 170 mm in length (SAM H11919). **A**, Dorsal view; **B**, Ventral view.

Material

South Australia: SAM–10931 (H195), Great Australian Bight, Ceduna District (32°24'S, 133°30'E), 49 metres depth, 23 August 1973, P. Symonds (collector), 2 specimens. SAM–H11919 (H771), Great Australian Bight, near Ceduna (32°24'S, 133°24'E), 26 October 1973, P. Symonds (collector), 1 specimen. SAM–H11920 (H774), Spencer Gulf: 15 km S of Cowell, Stn 10X (34°0'S, 136°56'30"E), 28 September 1981, (N.A. Carrick (collector), 1 specimen. SAM–H11922 (H785), Gulf St Vincent, Adelaide District: Hallett's Cove, 1 specimen. CASIZG–088073, Spencer Gulf, ca 1.5 Nm NW of Point Riley (33°52'S, 137°35'E), 20–25 metres depth, FV Kara George (prawn trawler), 14–15 December 1988, K. L. Gowlett-Holmes and P. Briggs (collectors), 5 specimens. CASIZG–088074, Gulf St Vincent, Adelaide, 4 miles SW of end of Outer Harbour, 12 metres depth, 27 June 1965, P.D. Mitchell (collector), 2 specimens. CASIZG–091432, Gulf St Vincent, Port Noarlunga Beach, 20 January 1964, Mr. Castleton (collector), 1 specimen. **Western Australia:** WAM–65–59, King George Sound, just outside entrance to Oyster Harbour, 4.6 metres depth, 7 January 1959, 1 specimen. WAM–68–59, Albany, Emu Point Channel, 4.6 metres depth, 15 January 1959, 1 specimen. WAM–707–91, Western Australia, Albany, Oyster Harbour ca 6 metres depth, 17 July 1965, E. P. Hodgkin (collector), 1 specimen. WAM–517–88, Esperance, between Sandy Hook Island and Cape LeGrande, 31–35 metres depth, 23–25 June 1986, A. Longbottom on LFBE 'Triumph' (collector), 1 specimen. WAM–67–59, Albany, Emu Point Channel, 4.6 metres depth, 15 January 1959, 1 specimen. WAM–706–91, Albany, Middleton Beach, beached after storm, 5–7 August 1984, V. Milne (collector), 8 specimens. **Tasmania:** SAM–H–13071, Port Davey, Bathurst Channel, S Point of Sarah Channel, 10–12 metres depth, 3 April 1993; W. Zeidler, K. L. Gowlett–Holmes, F. A. Bavendam (collectors), 4 specimens. SAM–H13072, Port Davey, Bathurst Channel, 6–10 metres depth; W. Zeidler, K. L. Gowlett-Holmes, F. A. Bavendam (collectors), 2 specimens.

Description

Specimens examined range in length from 115–350 mm. Additional material in South Australian Museum collection measured by Shane Parker (late Curator of Lower Marine Invertebrates) ranges between 165 and 325 mm in length. Rachis comprises 50–72% of total colony length. Polyp leaves semi-circular or kidney-shaped (usually 25–50 mm in length and up to 30 mm in width), relatively thin (mostly 2–4 mm thick), and number approximately 32–36 per side. Autozooids are small, conical in shape, and congested in several rows (usually 10–15) that form a band along the distal margin of each polyp leaf, extending to approximately 5 mm down each side of a particular leaf. Each autozooid approximately 1.0 mm in length and 0.6 mm in width. Siphonozooids restricted to swollen pad at border between base of each polyp leaf and rachis. Each pad ovoid to elliptical/oblong in shape and approximately 7 mm long by 4 mm wide. Each siphonozooid minute (approximately 0.07 mm in diameter). Siphonozooids highly congested and cover surface of each pad. In addition, mesozooids present on distal/ventral region of rachis. These circular in shape, approximately 0.6 mm in diameter and are either congested in several indistinct longitudinal rows or disposed more sparsely in a single or double longitudinal row. Retracted mesozooids have minute slit-like aperture, 0.12 mm in length. Sclerites of polyp

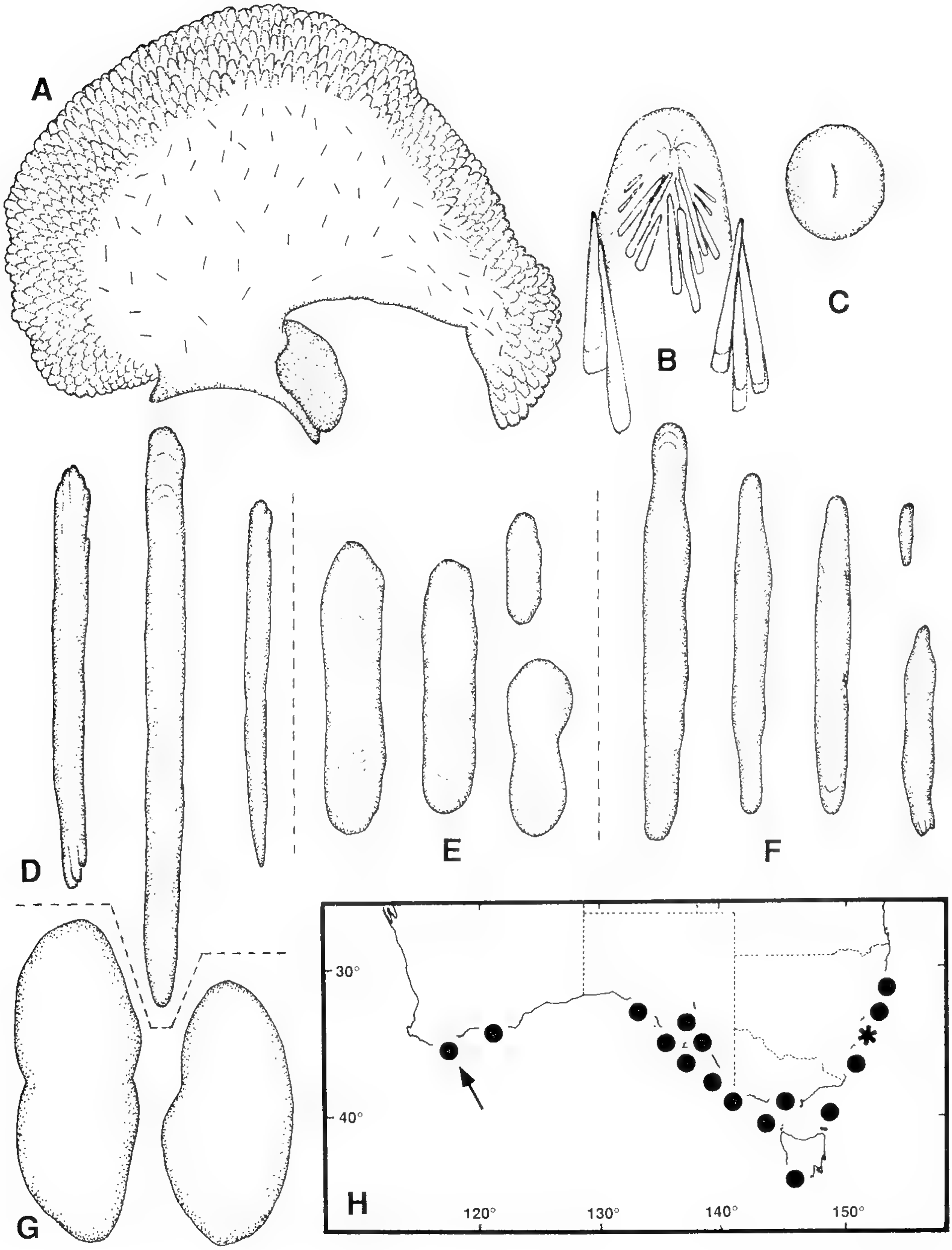

FIGURE 3. *Sarcoptilus grandis.* **A**, Upper surface of a single polyp leaf (39 mm in length), with basal siphonozooid pad; **B**, A single autozooid, maximum width 0.7 mm; **C**, View from above of a single mesozooid, 0.6 mm in diameter; **D**, Polyp leaf sclerites, 1.15 mm. 0.48 mm, 1.25 mm; **E**, Sclerites from the surface of the peduncle, 0.19 mm, 0.17 mm, 0.07 mm, 0.12 mm; **F**, Sclerites from the interior of the upper and middle portions of the peduncle, 0.28 mm, 0.23 mm , 0.21 mm, 0.17 mm, 0.55 mm; **G**, Sclerites of the interior of the lower portion of the peduncle, 1.1 mm, 0.87 mm; **H**, Map showing distribution of the species: ✱ = type locality, ● = other collecting stations; arrow shows type locality of *Sarcophyllum roseum.*

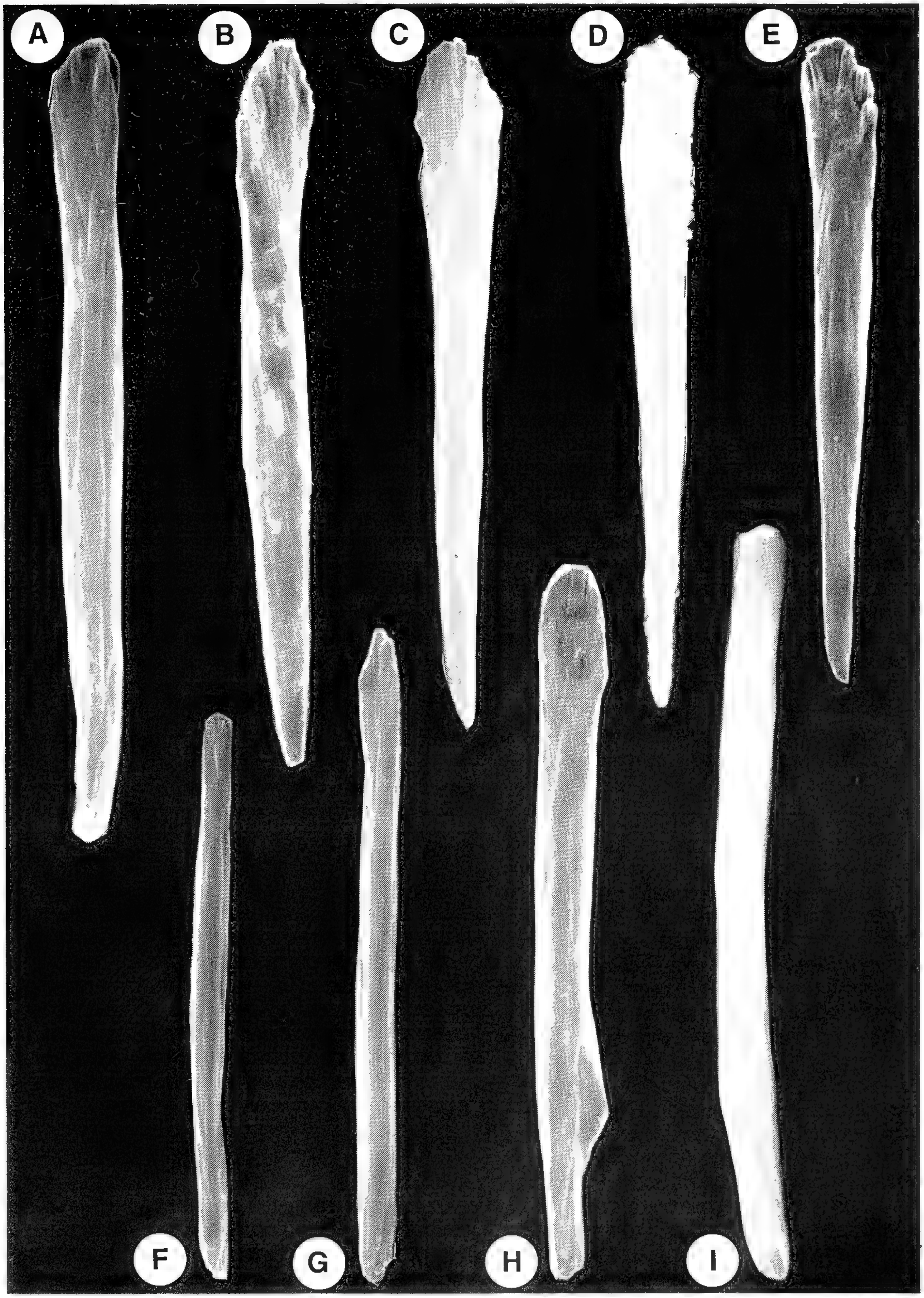

FIGURE 4. *Sarcoptilus grandis*. Scanning electron micrographs of polyp leaf sclerites. **A**, 1.01 mm; **B**, 0.91 mm; **C**, 1.05 mm; **D**, 1.02 mm; **E**, 0.82 mm; **F**, 1.23 mm; **G**, 0.66 mm; **H**, 1.10 mm; **I**, 0.85 mm.

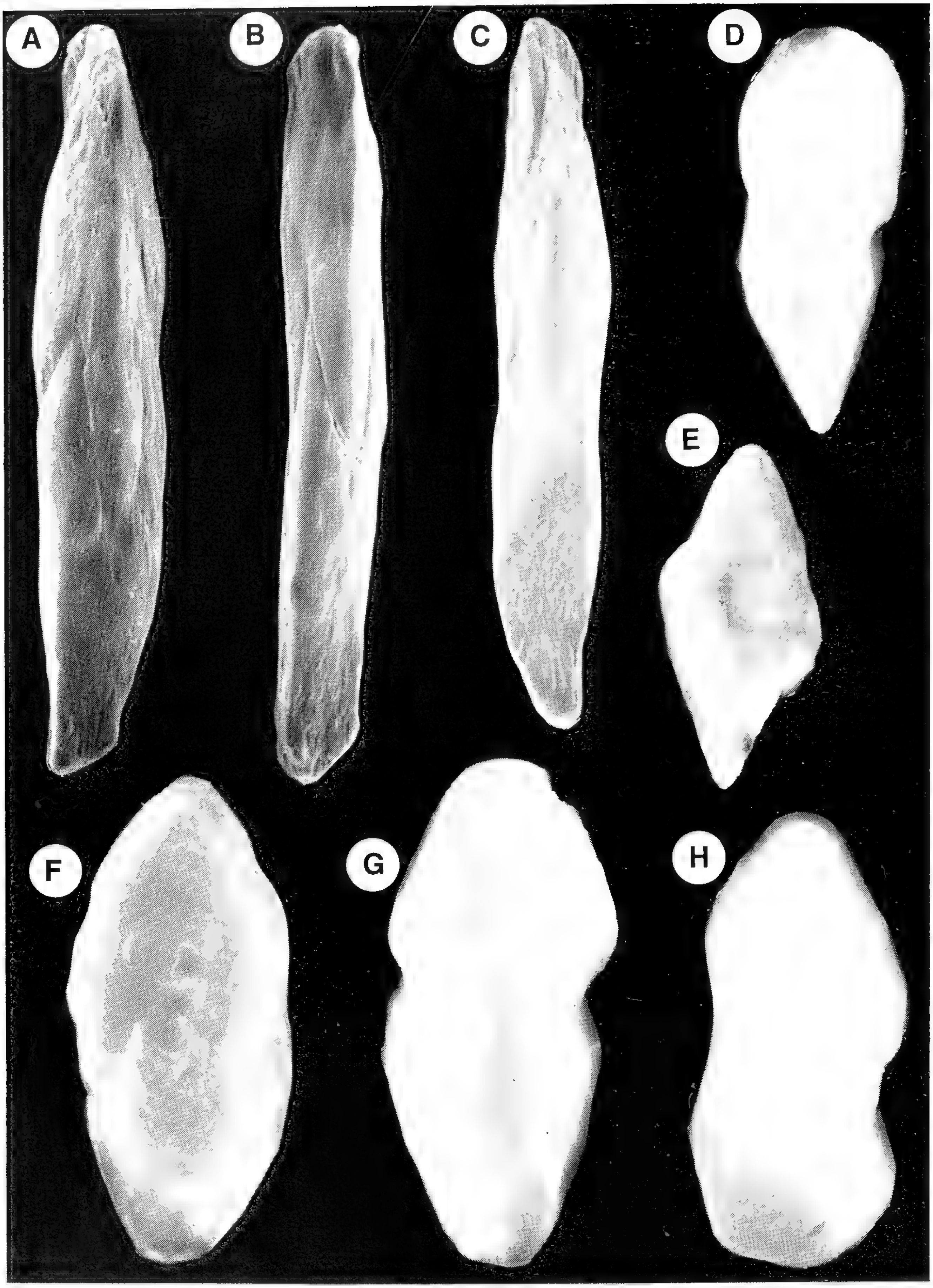

FIGURE 5. *Sarcoptilus grandis*. Scanning electron micrographs of peduncular sclerites. A–C, Sclerites from the interior of the upper and middle portion of the peduncle. **A**, 0.57 mm; **B**, 0.76mm; **C**, 0.53 mm. D–H, Sclerites from the interior of the basal portion of the peduncle; **D**, 0.85 mm; **E**, 0.74 mm; **F**, 1.05 mm; **G**, 0.77 mm; **H**, 0.58 mm.

leaves smooth slender rods or spindles (0.38–1.35 mm in length). Many of these slightly clavate, being enlarged at one end and tapering to a pointed opposite end. Polyp leaf sclerites distributed relatively densely in portion containing autozooids, and very sparse or absent on proximal faces of polyp leaves. Sclerites of surface of polyp leaves often form short lines between groups of autozooids in radiating fashion. Autozooids contain sclerites that either run parallel to longitudinal plain of each autozooid or converge to form inverted 'V' bordering each autozooid. Sclerites of peduncle are of three distinct types—small ovoid fingerbiscuits (0.06–0.19 mm in length) common throughout the surface, stout rods and spindles (0.17–0.76 mm in length) in interior of upper and middle portions of peduncle, and large robust otolith-like forms (0.20–1.1 mm in length) in interior of lower portion near base. Colour in life off-white, orange, or rose; cream or tannish-white preserved in alcohol.

Distribution

Southern Australia (Vicinity of Albany, Western Australia to at least as far as the Manning River/Cape Hawke region, New South Wales); 4.6–146 metres in depth. Utinomi and Shepherd (1982: 211) state the range as being from the Great Australian Bight to southern Queensland. This is by far the most common and widespread species in the genus. Collecting stations for the species come from Briggs (1915), Gray (1860, 1870), Kölliker (1870, 1872, 1880), Hickson (1890), Thomson and MacKinnon (1911), as well as from a large number of recently acquired lots in the collections of the Western Australian Museum, the South Australian Museum, and the California Academy of Sciences. The maximum depth record is reported by Briggs (1915: 94) from King Island, Bass Strait. The type locality was not recorded in the original description by Gray (1848: 45) but only later by Gray (1860: 23 and 1870: 25) as Sydney, Australia.

Discusssion

I have unfortunately not been successful in locating the type specimen of *Sarcophyllum roseum* Broch, 1910 for comparison. However, after having examined a large number of specimens of *Sarcoptilus* from a wide geographic scope, I here conclude that *Sarcophyllum roseum* should be considered as a junior synonym of *Sarcoptilus grandis*. In my opinion, the minor morphological variance observed in *Sarcophyllum roseum*, which was used by Broch to distinguish his species from Gray's, can certainly be accommodated by the range of variation in *Sarcoptilus grandis*. Included in the specimens examined for the present study are several from Broch's type locality (Albany, Western Australia), which agree well in virtually all respects with his original description.

The four characters used by Broch (1910: 121) to distinguish the species are as follows: (1) rachis polyps—forming a long row or plate in *S. grandis* vs a simple or double row in *S. roseum*; (2) the autozooid region of the polyp leaves—in which this polyp zone is wide with numerous sclerites on both sides of the leaf in *S. grandis* vs narrow with sclerites only on the under surface of the leaf in *S. roseum*; (3) the sterile surface of the polyp leaf—with numerous sclerites in *S. grandis* vs no sclerites in *S. roseum*; and (4) length of sclerites from the surface of the rachis and peduncle—rachis sclerites <0.7 mm long and peduncle sclerites <0.4 mm long in *S. grandis* vs <0.5 mm and <0.2 mm respectively in *S. roseum*. These are all variable characters that show gradations between specimens and hence cannot be used to justify the differentiation of two species. An example that contradicts Broch's distinction is a specimen from King George Sound (WAM – 65–59), which has the rachis mesozooids disposed in a plate as in *S. grandis*, but is without sclerites in the sterile portion of the polyp leaf as in *S. roseum*. I conclude that *Sarcophyllum roseum* and *Sarcoptilus grandis* are morphologically indistinguishable and therefore conspecific.

Apparently a substantial amount of variation is present in the size of the peduncular sclerites. Kükenthal (1915: 119) recorded sclerites from the interior as large as 4.5 mm in length, and those from the surface up to 0.4 mm long.

Sarcoptilus nullispiculatus sp. nov.

(Figs 6, 7A,B)

?*Sarcoptilus* sp. Utinomi & Shepherd, 1982: 211.

Material

Holotype. SAM–H10929A, South Australia: Gulf St Vincent, Adelaide District, Port Stanvac, 18 metres depth, D. Cooper (collector), 1 whole specimen.

Paratype. SAM–H10929B, same data as holotype, 1 whole specimen.

Other material studied. SAM–H10929C, same data as holotype, 1 whole specimen.

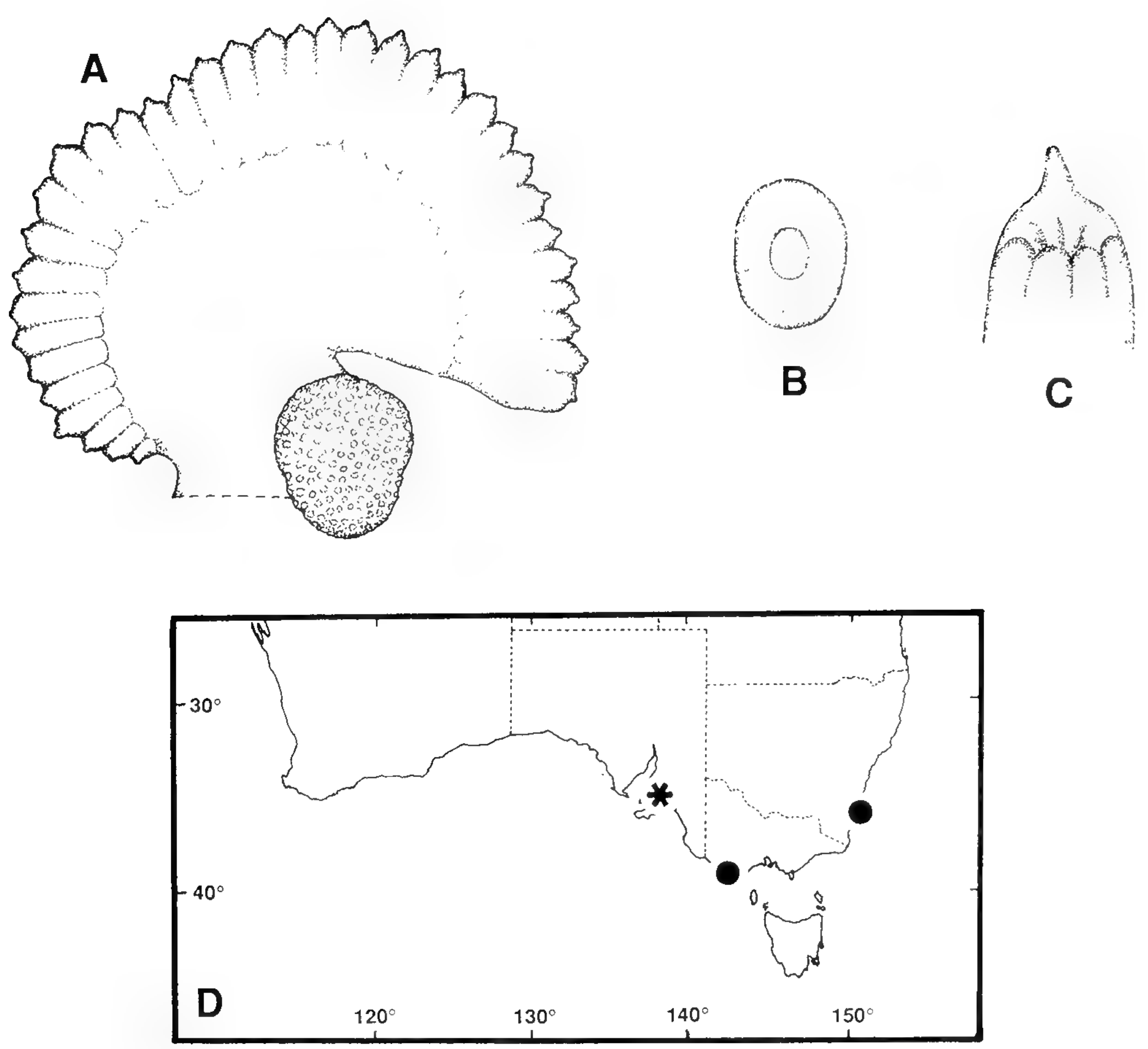

FIGURE 6. *Sarcoptilus nullispiculatus*. **A**, Lower surface of a single polyp leaf (6 mm in length), with siphonozooid pad; **B**, View from above of a single mesozooid, 0.45 mm in length; **C**, Distal portion of a single autozooid, 0.6 mm in width; **D**, Map showing distribution of the species; ✱ = type locality, ● = localities reported by Utinomi and Shepherd (1982) for *Sarcoptilus* sp.

Diagnosis

Colonies under 75 mm in length, slender and limp. Rachis and peduncle roughly equal in length. Polyp leaves 18–30 per side, fin-shaped to semi-circular, <7 mm in length. Autozooids in 1–2 rows, 25–36 per leaf. Siphonozooids restricted to circular pads at dorsal base of each leaf. Single longitudinal row of up to 20 mesozooids present on ventral/distal surface of rachis. Sclerites absent altogether. Colour orange or pale-salmon in alcohol.

Description

The three specimens examined range in length from 58–74 mm. Holotype is 68 mm long while paratype is 74 mm in length. Colonies are slender and flaccid. Rachis comprises 47–58% of total colony length. Dorsal side of rachis has a medial longitudinal groove for its entire length. Polyp leaves number 18–30 per side, fin-shaped to semi-circular, each leaf up to 7 mm in length. Autozooids disposed in one or two rows along distal margin of each leaf, and number approximately 25–36 autozooids per leaf. Each autozooid 0.4–0.6 mm in diameter. Most autozooids have a single non-spiculated, flexible, nipple-like protuberance projecting distally from their apices. Siphonozooids contained on circular to ovoid pads, 1.5 mm in diameter, on the dorsal base of each polyp leaf adjacent to lateral margin of rachis. Each siphonozooid approximately 0.07 mm in diameter. In addition, a single medial row of 10–20 mesozooids present on distal/ventral portion of rachis, each mesozooid 0.20–0.45 mm

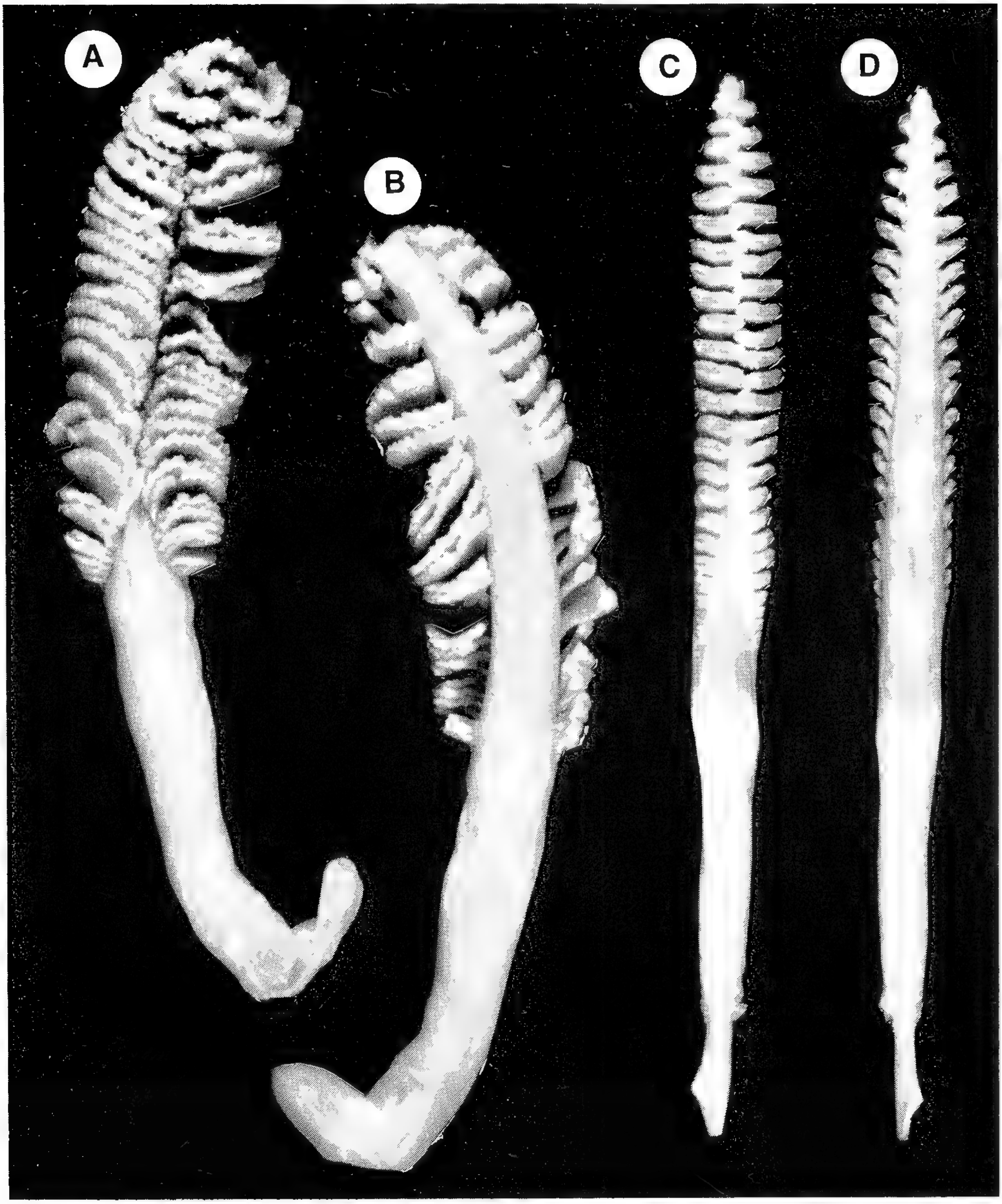

FIGURE 7. Photographs of holotypes. A,B. *Sarcoptilus nullispiculatus*. **A**, Ventral view; **B**, Dorsal view. C,D. *Sarcoptilus rigidus*; **C**, Ventral view; **D**, Dorsal view.

in diameter. Sclerites apparently absent altogether from all parts of colonies. Colour throughout apricot-orange to pale orange in alcohol.

Etymology

The specific epithet is derived from the Latin, *nullus* = not any or none, and *spiculum* = a point or dart; in reference to the lack of sclerites in this species.

Distribution

Southern Australia (Gulf St Vincent, South

Australia, and possibly Pt Fairy, Victoria to Jervis Bay, New South Wales—as reported by Utinomi & Shepherd, 1982); 18 metres in depth. Type locality is Gulf St Vincent, South Australia.

Discussion

This species is differentiated from other members of the genus by a complete lack of sclerites. It is likely that *Sarcoptilus* sp. of Utinomi and Shepherd (1982) is conspecific with this species. Even though they do not mention the lack of sclerites in this species, their description agrees in all other aspects with the present material.

Sarcoptilus rigidus sp. nov.

(Figs 7C,D, 8, 9)

Material

Holotype. WAM–363–31, Western Australia: vicinity of Perth: Cottesloe Beach, 1 whole specimen.

Paratype. WAM–364–31, same data as holotype.

Other material studied. WAM–714–91, Western Australia: Albany: Middleton Beach, beach drift, 10 August 1991, S. Bolton (collector), 1 specimen.

Diagnosis

Colonies stiff and rigid, dart-shaped. Polyp leaves thick and turgid, fan-shaped to rectangular or trapezoidal; <6 mm in length; 22–26 leaves per side of rachis. Autozooids in single row of 25–30 per polyp leaf. Several mesozooids scattered on ventral distal extremity of rachis. Siphonozooid pad conspicuous and kidney-shaped. Peduncular sclerites: robust spindles in upper part (0.25–0.42 mm long) and robust, ovoid, otolith-like bodies (0.3–1.2 mm long) in lower part. Colour in alcohol uniformly cream-white or bicoloured with rachis grey and peduncle cream-white.

Description

Specimens examined dart-shaped, markedly stiff and rigid, 65–117 mm in length. Holotype is 80 mm long and paratype 65 mm in length. Peduncle makes up approximately 38–43% of total length. Axis extends throughout entire length of each specimen. Polyp leaves thick and turgid, fan-shaped to rectangular or trapezoidal with rounded corners, 3–6 mm in length. 22–26 polyp leaves per side. Autozooids completely retractile and disposed in single row at distal margin of each polyp leaf, generally 25–30 per polyp leaf. Each retracted autozooid has slit-like aperture, perpendicular to plane of polyp leaf. This aperture surrounded by slightly ovoid ring-like basal swelling without teeth. Siphonozooids contained on swollen, more-or-less elliptical to kidney-shaped pads at dorsal base of each polyp leaf, adjacent to lateral margin of rachis. Each siphonozooid pad approximately 1.5–3.0 mm in length, while an individual siphonozooid is approximately 0.1 mm in diameter. In addition, several mesozooids scattered on distal ventral extremity of rachis, each approximately 0.3–0.5 mm in diameter. Upper and lower surfaces of polyp leaves densely or sparsely ornamented with sclerites that are mostly longitudinally disposed in parallel. Sclerites of polyp leaves slender elongate rods and spindles, 0.3–1.3 mm in length. Many of these faintly longitudinally grooved, some rounded on ends while others angled and obliquely truncate at ends. Sclerites of rachis similar to those of polyp leaves, sparsely distributed. Sclerites of upper portion of peduncle smooth robust spindles, 0.25–0.42 mm in length. These tapered to rounded on ends and often slightly constricted in middle. Lower part of peduncle contains ovoid otolith-like bodies, 0.3–1.2 mm in length. Most of these robust with rounded ends, and many somewhat constricted in middle. Colonies vary in colour in alcohol from bicoloured—rachis grey with peduncle cream-white, to monochromatic—entirely cream-white.

Etymology

The specific epithet is derived from the Latin *rigidus* = stiff or rigid; in reference to the rigid and turgid nature of the colonies of this species.

Distribution

Western Australia (Perth and Albany); shallow sublittoral (depth range unknown). This species is known from only three specimens collected at two localities. The type locality is Perth, Western Australia.

Discussion

This species differs markedly from other members of the genus by its remarkably rigid form and conspicuously turgid polyp leaves. The only other species containing similar otolith-like sclerites in the peduncle is *Sarcoptilus grandis*.

The density of spiculation on the polyp leaves varies greatly from very dense (and covering the entirety of both surfaces) in the holotype and paratype, to very sparse in the specimen from

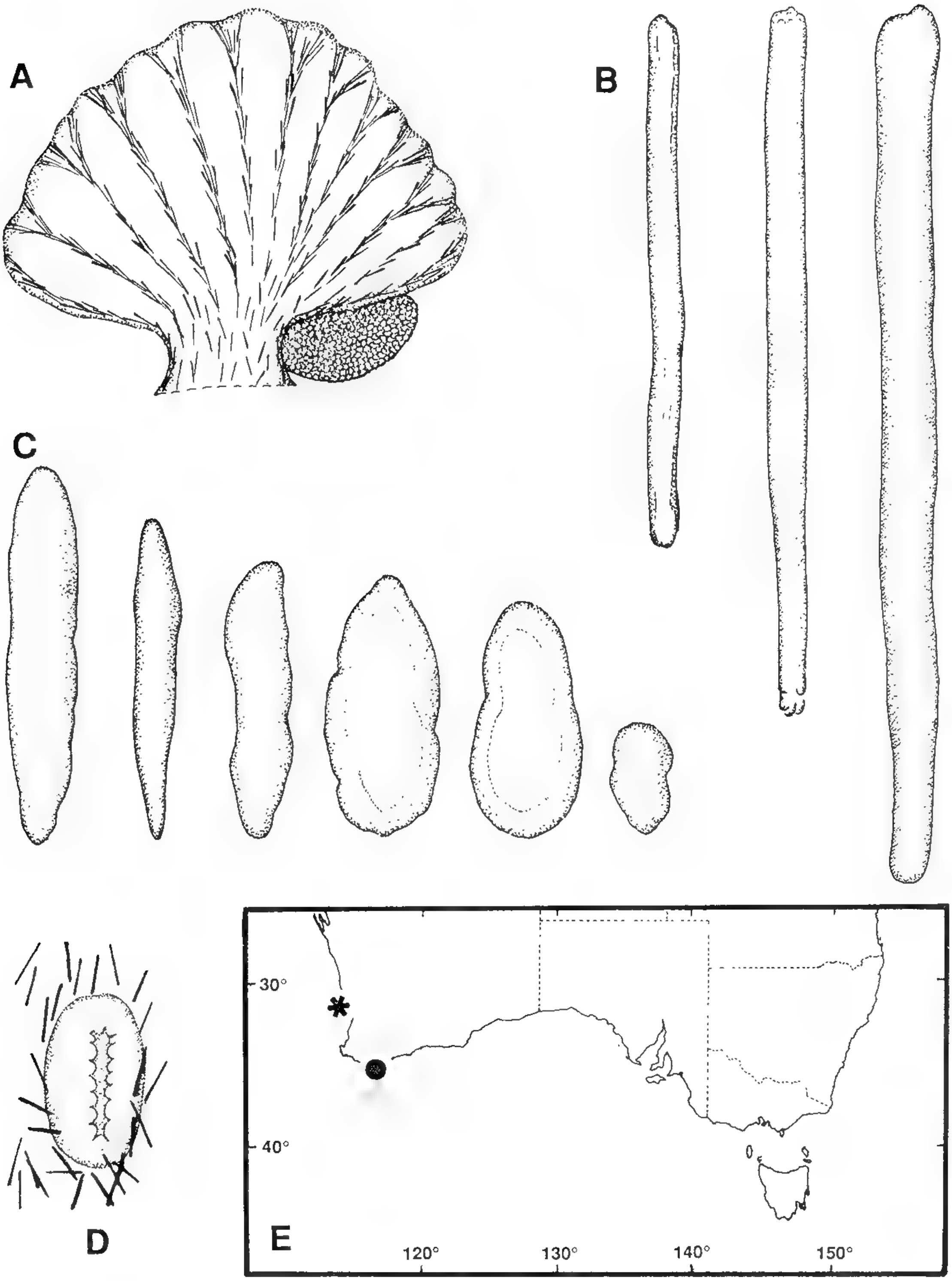

FIGURE 8. *Sarcoptilus rigidus*. **A**, Ventral view of a single polyp leaf (4 mm in length), with siphonozooid pad; **B**, Polyp leaf sclerites, 0.95 mm, 1.30 mm, and 0.40 mm in length; **C**, Peduncular sclerites, 0.27 mm, 0.42 mm, 0.35 mm, 1.2 mm, 1.0 mm, and 0.5 mm in length; **D**, View from above of a single autozooid, 0.27 mm in length; **E**, Map showing distribution of the species: ✱ = type locality; ● = other locality.

Albany, in which only a few sclerites are scattered in the distal margin of each leaf just below the autozooids.

Sarcoptilus shaneparkeri sp. nov.

(Figs 10–13)

Scytalium sp. Utinomi & Shepherd 1982: 209.

Material

Holotype. SAM–H10923A, South Australia: upper Spencer Gulf: 1.6 km E of Douglas Point, 17 metres depth, May 1988, N. Holmes (collector), 1 whole specimen.

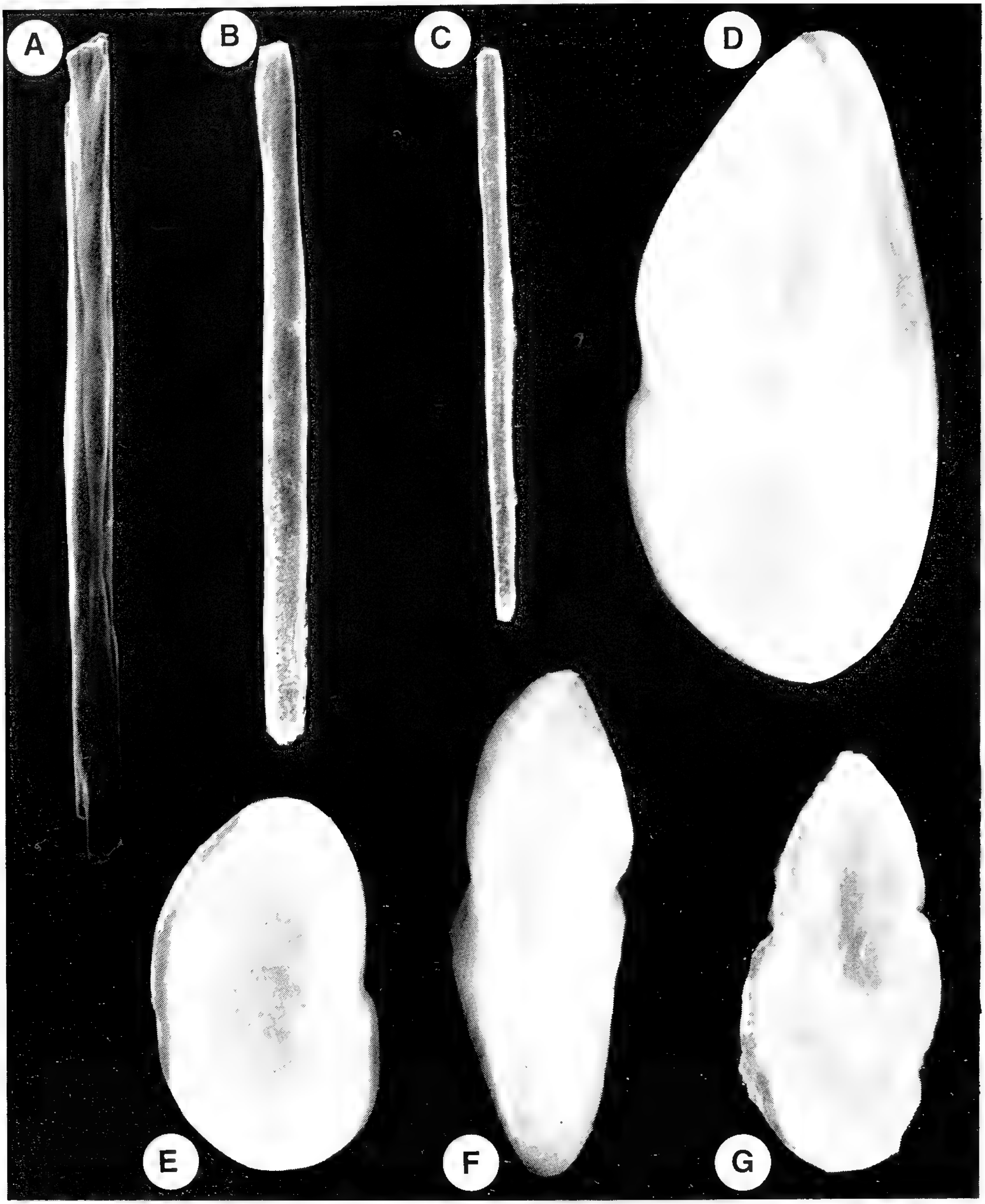

FIGURE 9. *Sarcoptilus rigidus*. Scanning electron micrographs. A C, Sclerites of the polyp leaves. **A**, 0.99 mm; **B**, 0.33 mm; **C**, 0.41 mm. D–G; Sclerites of the peduncle. **D**, 0.77 mm; **E**, 0.54 mm; **F**, 0.73 mm; **G**, 0.86 mm.

Paratype. SAM–H10923B, same data as holotype, 1 whole specimen.

Other material studied. **South Australia:** SAM–H10922, upper Spencer Gulf, 1.6 km E of Douglas Point (Kinhill Survey Station 3A), 17 metres depth, May 1988, N. Holmes (collector), 11 specimens. SAM–H10924, upper Spencer Gulf: 1.6 km E of Douglas Point (Kinhill Survey Station 3A), 17 metres depth, May 1988, N. Holmes (collector), 1 specimen. SAM–H10926,

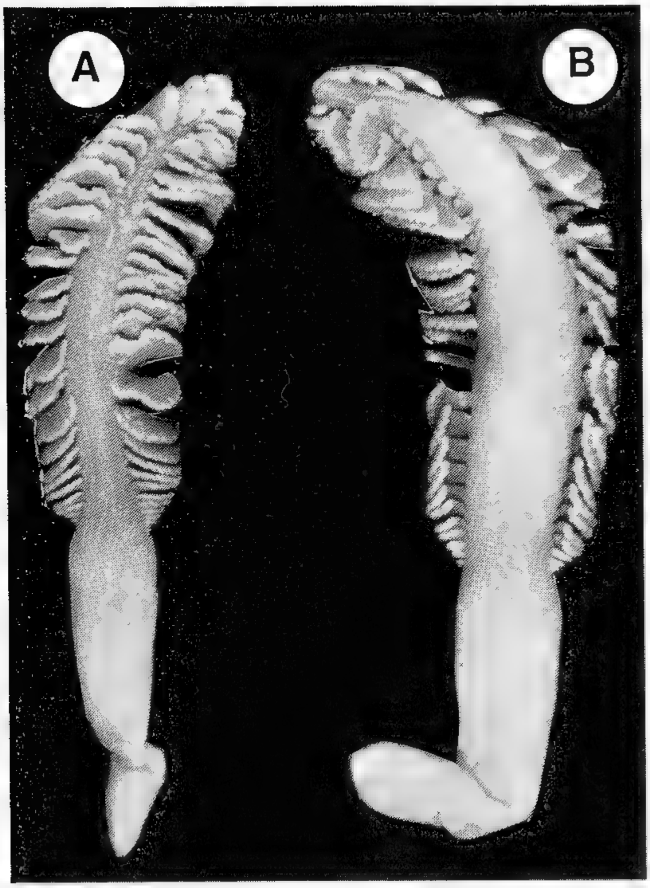

FIGURE 10. *Sarcoptilus shaneparkeri*. Photographs of holotype. **A**, Ventral view; **B**, Dorsal view.

upper Spencer Gulf: 1600 m E of Douglas Point; 27 June 1988, N. Holmes (collector), 3 specimens. SAM–H11842, Spencer Gulf, 22 km S of Port Augusta, 10 metres depth, 3 February 1983, R. Henderson (collector), 1 specimen. SAM–H10918, Spencer Gulf between Douglas Point and Mambray Creek, 15–18 metres in depth, June 1987, N. Holmes (collector), 1 specimen. SAM–H10920, Spencer Gulf between Douglas Point and Mambray Creek, 15–18 metres depth, June 1987, N. Holmes, 2 specimens. SAM–H10921, upper Spencer Gulf, 1.6 km E of Douglas Point, 15 metres depth, 5 May 1988, N. Holmes, 1 specimen. SAM–H10917, upper Spencer Gulf, S of Redcliff Point, 15 metres depth, 9–11 April 1980, 2 specimens. SAM–H10916, upper Spencer Gulf, Port Germein Bay, 6 metres depth, February 1980, N. Holmes (collector), 1 specimen. SAM–H10919, upper Spencer Gulf near Redcliff, 15 metres depth, 17 November 1980, S.A. Shepherd (collector), 1 specimen. SAM–H 10927, Gulf St Vincent, Adelaide District, Seacliff, 15 metres depth, 12 May 1990, N. Holmes (collector), 4 specimens. SAM–H10925, upper Spencer Gulf, 1.6 km E of Douglas Point (Kinhill Survey Station 3A), 17 metres depth, May 1988, N. Holmers (collector), 1 specimen. SAM–H10928, Kangaroo Island, Penneshaw, 14 metres depth, 3 August 1971, J. Kroezen (collector), 2 specimens. **Western Australia:** WAM–709–91, North Mole, Fremantle Harbour, 25 November 1983, S. Slack Smith/L. Marsh/J. Watson/C. Bryce (collectors), 5 specimens. WAM–707–91B, Albany, Oyster Harbour, ca 6 metres depth, 17 July 1965, E.P. Hodgkin (collector), 1 specimen.

Diagnosis

Maximum length 180 mm. Polyp leaves thin, triangular or semi-circular to kidney-shaped, 22–38 pairs of polyp leaves. Polyp zone of each leaf with autozooids in 1 or 2 rows, at least autozooids 20 per row. Retracted autozooids with single basal tooth composed of converging sclerites. Several mesozooids scattered or in a single longitudinal row on ventral distal extremity of rachis. Peduncular sclerites mostly elongate biscuit-shaped rods, 0.11–0.17 mm long. Colour mostly bicoloured: rachis dark blue-grey or brownish-grey with peduncle cream to orange. Monochromatic orange form less common.

Description

Specimens examined range in length from 60–180 mm. Holotype 108 mm in length while paratype 100 mm long. Length of peduncle constitutes 45–55% of total length of single specimen. Rachis may contain deep longitudinal medial groove along entire length of its dorsal side. 22–38 pairs of polyp leaves, which are thin and variable in shape: from deltoid/fin-shaped to semicircular or kidney-shaped, mostly 8–13 mm in length. Retractile autozooids arranged usually in one or two rows along distal margin of each polyp leaf, with 20–35 autozooids per row. Distal tip of each autozooid has single tooth, which is small, blunt to pointed, and triangular in shape. This polyp tooth projects over top of each retracted autozooid. Siphonozooids densely-crowded on small roughly circular pad, situated on dorsal base of each polyp leaf, adjacent to rachis. Each pad ca 1.7 mm in diameter, and single siphonozooid ca 0.1–0.2 mm in diameter. In addition, 10–28 mesozooids present on distal ventral portion of rachis, usually in single longitudinal row or sometimes randomly scattered. These vary from 0.23–0.50 mm in diameter. All three forms of polyps contain scattered sclerites in polyp walls. Sclerites of polyp leaves and surface of rachis are mostly slender rods and spindles, 0.22–0.93 mm in length. Those of polyp leaves sparsely to densely-set in longitudinal rows between the

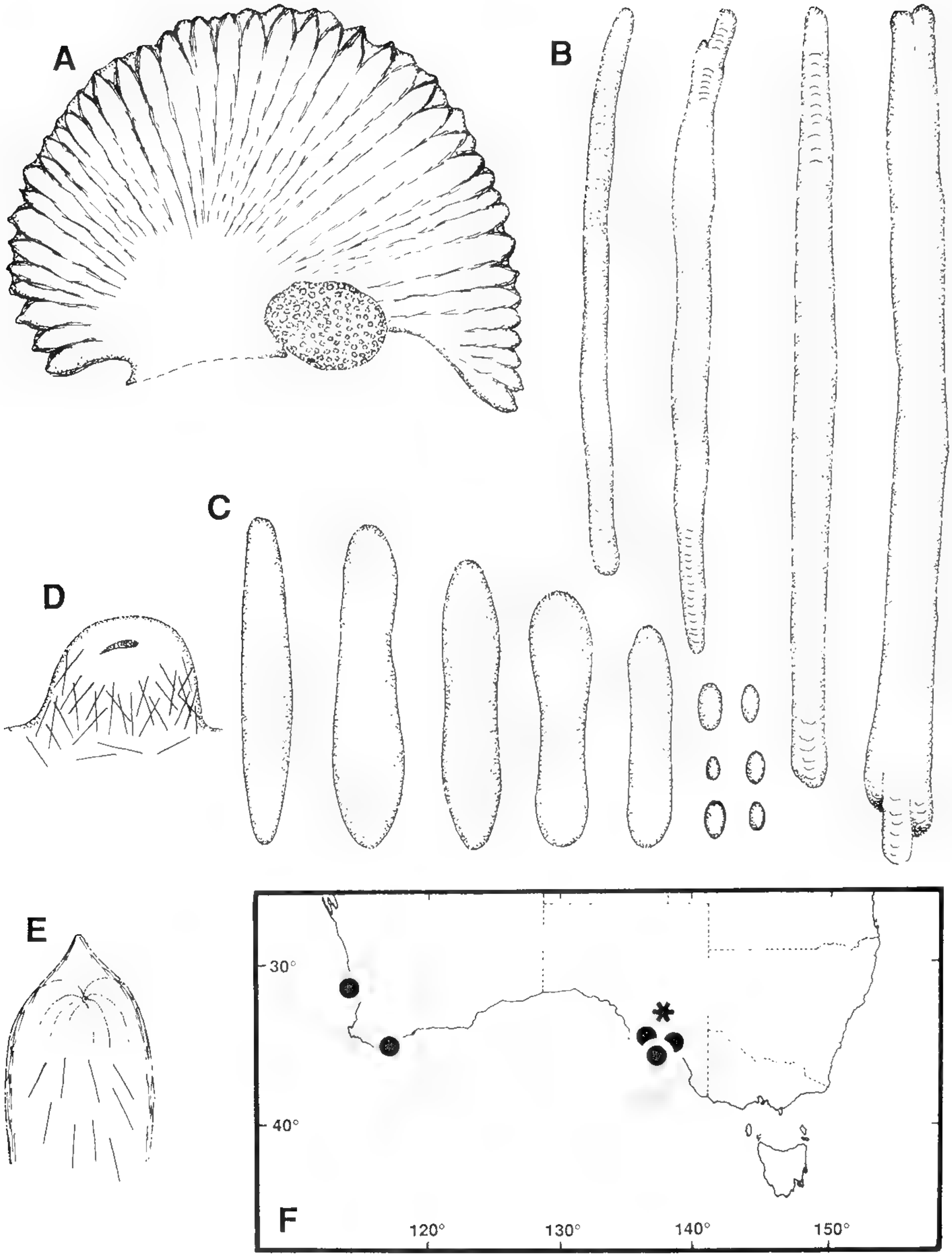

FIGURE 11. *Sarcoptilus shaneparkeri*. **A**, Ventral view of a single polyp leaf (13 mm in length), with siphonozooid pad; **B**, Sclerites of the polyp leaves and rachis, 0.33 mm, 0.48 mm, 0.58 mm, and 0.64 mm in length; **C**, Sclerites of the peduncle, elongate forms are 0.19 mm, 0.18 mm, 0.17 mm, 0.15 mm, and 0.13 mm in length, minute ovals are 0.01–0.02 mm in length; **D**, Lateral view of a single mesozooid, 0.43 mm in length; **E**, Distal portion of a single autozooid, 0.45 mm in width; **F**, Map showing distribution of the species: ✱ = type locality, ● = other localities.

autozooids, as well as being sparsely-scattered obliquely over face of each autozooid just below peristome. Longitudinal rows extend over most of surfaces of both sides of each polyp leaf and radiate outward toward distal margin from base of each leaf. Two adjacent longitudinal rows converge at distal apex of each autozooid to form single inverted V-shaped polyp tooth. Some of sclerites forming tooth blunt and somewhat flattened at distal end. Sclerites from surface of rachis and peduncle arranged mostly longitudinally and in parallel, with a few obliquely

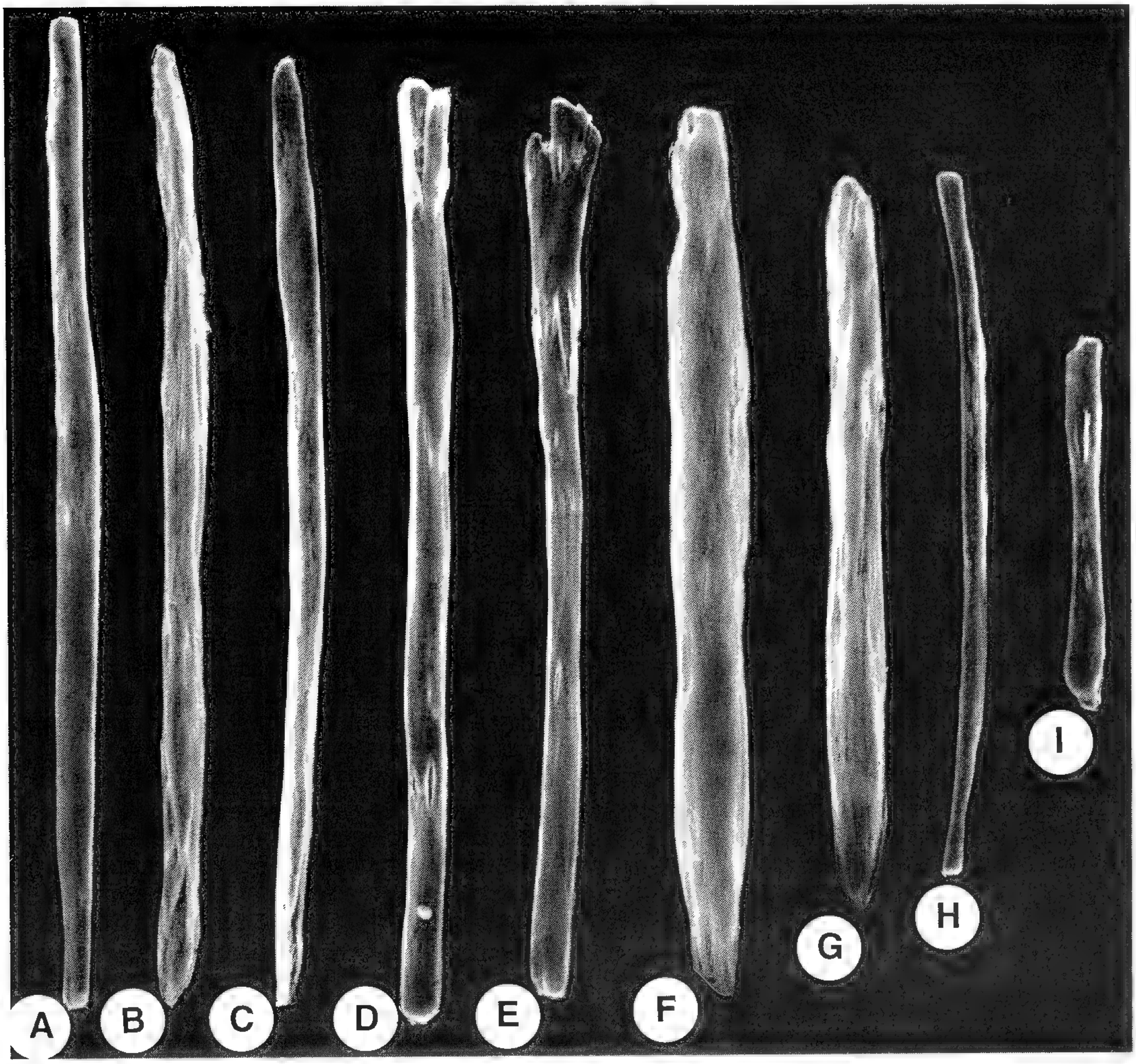

FIGURE 12. *Sarcoptilus shaneparkeri*. Scanning electron micrographs of polyp leaf sclerites. **A**, 0.62 mm; **B**, 0.60 mm; **C**, 0.59 mm; **D**, 0.39 mm; **E**, 0.93 mm; **F**, 0.27 mm; **G**, 0.30 mm; **H**, 0.44 mm; **I**, 0.23 mm.

disposed. Sclerites of surface of peduncle of two distinct kinds—stout smooth rods, sometimes slightly constricted in middle, with rounded ends (0.11–0.17 mm in length and 0.02–0.03 mm in width), and numerous minute ovals (0.01–0.02 mm on length). Sclerites of interior of rachis and peduncle very sparse or apparently lacking. Colour in alcohol of rachis and polyp leaves varies from dark bluish-grey to brownish-grey or violet-grey (rarely orange), contrasting with peduncle which is yellowish-white or pale-orange. Sclerites are colourless.

Etymology

This species is named for Shane A. Parker, late Curator of Lower Invertebrates at the South Australian Museum. Shane originally suggested that the southern Australian pennatulacean fauna be studied. In addition, he supplied on loan much of the essential material for study. Without his interest, enthusiasm, and good humour, this project would not have been possible.

Distribution

Southern Australia (Fremantle Harbour and Albany, Western Australia; Spencer Gulf, Gulf St Vincent, and Kangaroo Island, South Australia); 6–18 metres in depth. This species is apparently locally common in shallow-water of protected embayments, on silty bottom or in hollows of coarse sand between seagrass beds. The type locality is the upper Spencer Gulf, South Australia.

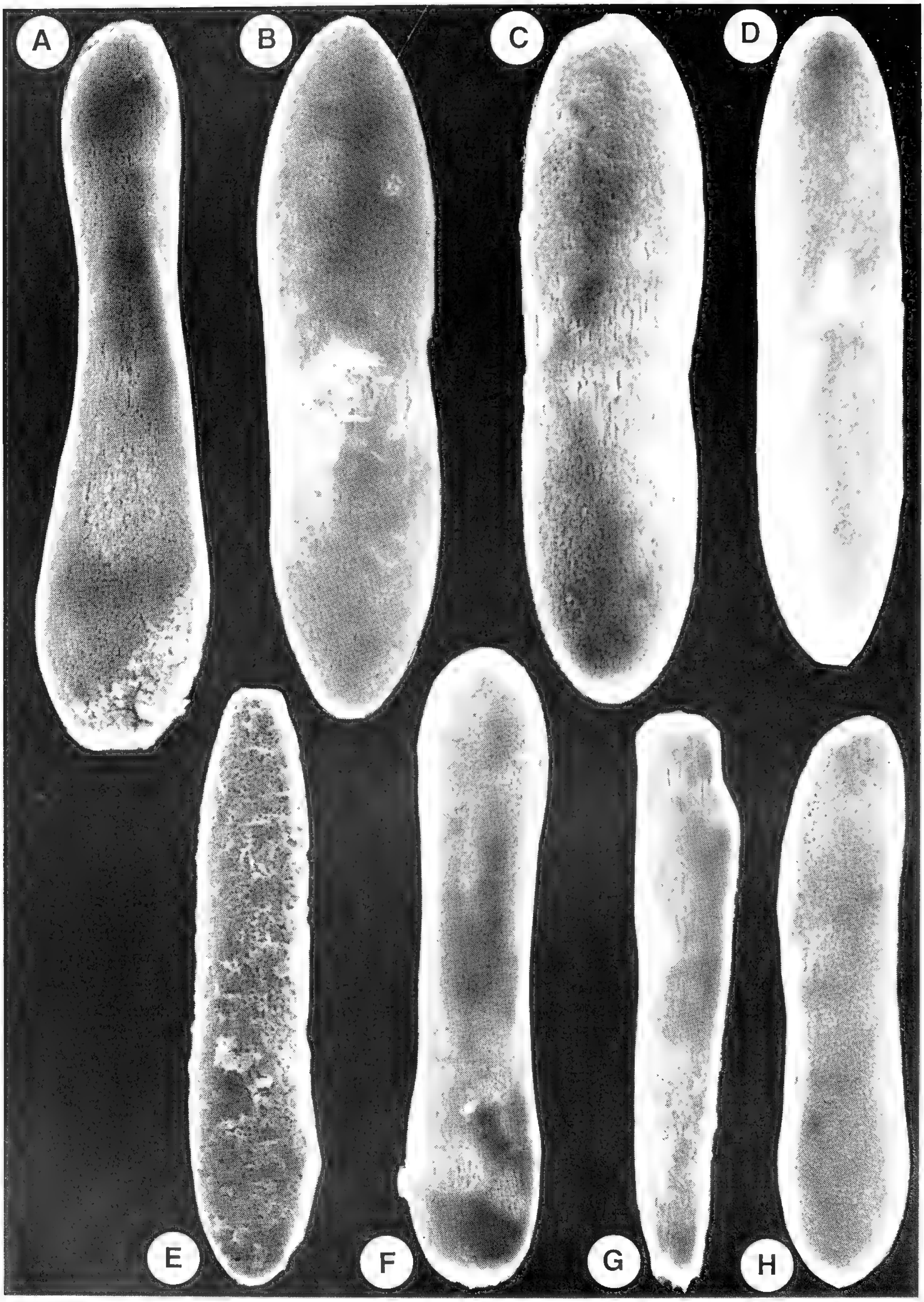

FIGURE 13. *Sarcoptilus shaneparkeri*. Scanning electron micrographs of peduncular sclerites. **A**, 0.15 mm; **B**, 0.15 mm; **C**, 0.10 mm; **D**, 0.14 mm; **E**, 0.13 mm; **F**, 0.14 mm; **G**, 0.12 mm; **H**, 0.12 mm.

Discussion

Utinomi and Shepherd (1982: 208–209) incorrectly identified this species as an undetermined species of *Scytalium*. Members of the genus *Scytalium* have sclerites that are exclusively oval-shaped plates and the siphonozooids are arranged only on the rachis between the polyp leaves. In *Sarcoptilus*, the sclerites are spindles or rods and the siphonozooids are mostly situated on circular pads at the dorsal base of each polyp leaf.

There is a considerable amount of variability observed in this species. Members of the South Australian populations do not exceed 120 mm in length, while those from Western Australia are markedly larger—up to 180 mm in length. The arrangement and amount of spiculation on the polyp leaves varies considerably—from very sparse to very dense. In some specimens, the proximal portion of each polyp leaf is devoid of sclerites. The amount of development of the terminal polyp tooth is also variable—being conspicuous in most members of the South Australian populations, and less strongly developed in others, particularly the specimens from Western Australia. The amount of spiculation present in the surface of the rachis and peduncle is variable—relatively sparse in some to dense in others.

Observations

This species is preyed upon by arminacean nudibranch molluscs (presumably *Armina* sp.) (S. A. Parker, pers. comm.). Many of the specimens observed have the ventral margins of the polyp leaves devoid of polyps—showing signs of being partially eaten.

The following notes on colour, written by S.A. Parker, were found with five specimen lots: (SAM–H10922)—'Colours shortly after collection: stalks bright orange to pale orange, rachis brownish olive to light orange-brown; leaves dark olive-grey-brown; autozooids pale orange to brownish-cream, siphonozooids pale orange'; (SAM–H10923A Holotype and 10923B Paratype)—'Colours shortly after collection: stalk pale apricot-buff, rachis & leaves dull leaden grey with slight brownish tinge; autozooids very pale greyish white to off-white. Siphonozooid pads pale greyish white'; (SAM–H10927)—'Lobes violet-grey, stem creamy-orange'; (SAM–H10928)—'Colour in life: orange'; (SAM–H10925)—'Colours shortly after collection: stalk bright orange, rachis leaves & siphonozooids paler; autozooids whitish orange'. The bicoloured grey/cream form is apparently the most common form and is present throughout the range of the species. The less common monochromatic orange form has only been encountered in upper Spencer Gulf and Kangaroo Island (South Australia) and Albany (Western Australia).

CONCLUSIONS

Three species were previously assignable to the pennatulacean genus *Sarcoptilus*: *S. grandis* as the type species, with *Sarcophyllum bollonsi* and *Sarcophyllum roseum* transferable to the genus. This revision adds three new species (*S. nullispiculatus*, *S. rigidus*, and *S. shaneparkeri*), one synonymy (*Sarcophyllum roseum* as a junior synonym of *Sarcoptilus grandis*), and one new combination (*Sarcoptilus bollonsi*), establishing a total of five species for the genus (four valid species in southern Australia and one species of questionable validity in New Zealand (*S. bollonsi*)).

ACKNOWLEDGMENTS

I am grateful to Shane Parker, late Curator of Lower Marine Invertebrates at the South Australian Museum in Adelaide, for originally suggesting the study of the southern Australian pennatulacean fauna and for kindly lending the material used in this study.

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FOLLOWING THE TRACKS OF EDGAR WAITE IN NEW GUINEA FOR THE PACIFIC ARTS SYMPOSIUM IN ADELAIDE

BARRY CRAIG

CRAIG, B. 1995. Following the tracks of Edgar Waite in New Guinea for the Pacific Arts Symposium in Adelaide. *Records of the South Australian Museum* **28**(1): 33–52.

The Fifth International Symposium of the Pacific Arts Association, held in Adelaide during 1993, provided an opportunity for the South Australian Museum to reforge links with New Guinea and the islands of the Bismarck Archipelago, established through the visit there by Edgar Waite as Museum Director 75 years earlier. This paper describes, in narrative style, the author's experiences during a fieldtrip made to collect relevant artefacts and data and to organise dance performances for the Adelaide Symposium.

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In 1918, Edgar Waite, the Director of the South Australian Museum, undertook a collecting expedition to New Guinea and the islands of the Bismarck Archipelago (Hale 1956: 115–16). Waite was accompanied by Augustus C. Davis who previously had been a Protector of Natives in New Ireland and was familiar with the area to be covered by the expedition. The former German territory had come under Australian military control following on the declaration of war in 1914, and by 1918 it was only just reopening to other interests. The Bismark Archipelago was not well represented in the Museum's collections and until this opportunity arose, natural history and ethnographic collections would have had to have been purchased through traders such as Richard and Phoebe Parkinson and, even earlier, through 'Queen' Emma and Thomas Farrell, as did the Australian Museum in Sydney (Thomsett 1993: 13).

Waite was first and foremost a naturalist, not an ethnographer (Jones 1992). As was common in the late nineteenth and early twentieth centuries though, museum collectors were generalists when in the field and Waite collected a wide range of natural science specimens and ethnographic material. Although Waite did not stay in any one place long enough to begin to obtain systematic cultural information, he did make many serendipitous observations. In a sense, everything was new and unfamiliar, so everything was worth a comment. His ethnographic data has to be treated with caution nevertheless.

Today the visitor to the Pacific Gallery of the South Australian Museum can see a representative sample of the ethnographic material collected by Waite and Davis, presented in a manner that must differ little from the way it was first displayed in 1919 (see 'New Museum Exhibits', *The Register*, September 13, 1919). The manner of display (Fig. 1) is only a slight improvement on the renaissance 'Cabinets of Curiosities'. The major points of interest are the carved figures and masks made for the series of funerary rituals called *malangan* in New Ireland, and a rare mask from the Sulka people of Wide Bay, East New Britain (Fig. 15).

The South Australian Museum has never had a specialist Curator for its Foreign Ethnology collections. The Pacific collections (including Melanesian material) comprise the largest component of these. Adelaide has arguably the second most significant collection of Pacific material in the country. In 1992, the Anthropology Division of the South Australian Museum offered to host the Fifth International Symposium of the Pacific Arts Association. It seemed to this author that the Symposium could present an opportunity for demonstrating what could be done by the Museum to upgrade its Pacific Gallery and the collections, and data about those collections, on which the Gallery is based.

It was decided that the projects should be joint ventures with the Papua New Guinea National Museum in the case of the Sulka component and with the New Ireland Provincial Government in the case of the New Ireland component. Chris Issac, Acting Director of the J. K. McCarthy Museum in Goroka, a branch of the PNG National Museum, who had been one of my staff when I was Curator at the PNG National Museum, would act as my colleague for the Sulka Project. He himself is Sulka, from the village of Guma on the

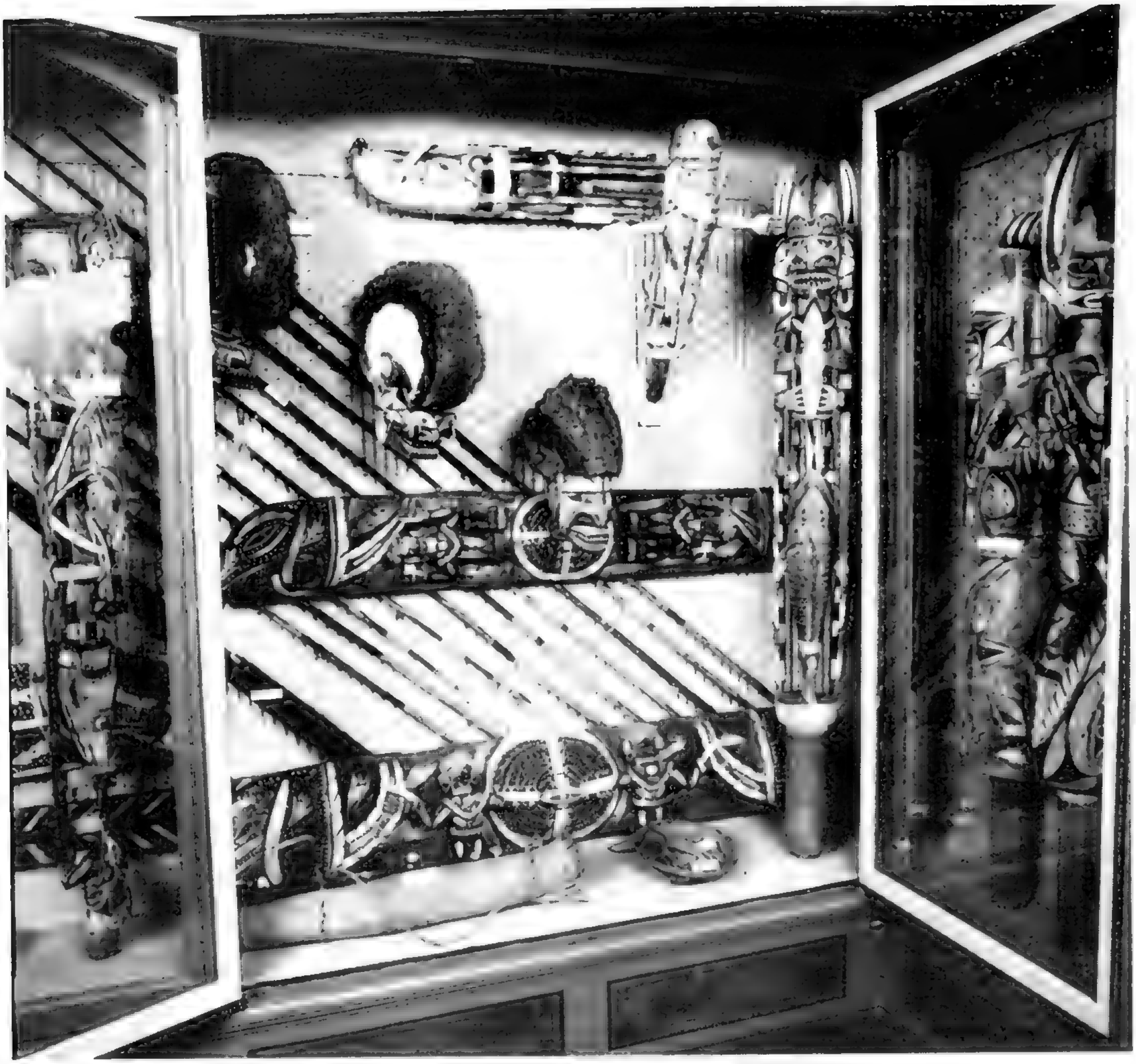

FIGURE 1. New Ireland *malangan* collected by Edgar Waite in 1918, on display in the Pacific Gallery of the South Australian Museum (Photo by Trevor Peters, SAM).

south-eastern shore of Wide Bay, East New Britain. In 1982, he was part of the team from the PNG National Museum which collected a magnificent *hemlaut* mask, several *susu* and other masks, and dance wands, clubs and shield from the Sulka. This team consisted of myself, Chris Issac and Rowena Hill[1] who was the Conservator at the PNG National Museum at that time. Chris Issac also worked with George Corbin of the City University of New York in his 'Salvage Art History' project among the Sulka in 1983 (Corbin 1990).

At the South Pacific Festival of Arts held in Cook Islands in 1992, Susan Cochrane[2] had met Noah Lurang, New Ireland Provincial Cultural Officer. She suggested he would be an ideal person to involve in the New Ireland component of the project. He was an experienced high school teacher, was articulate about the *malangan* culture of New Ireland and able to perform masked dances associated with the *malangan* rites.

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[1]. Rowena Hill documented the materials used in the construction of the masks and dance wands and later carried out a detailed study of materials and techniques relevant to the masked rituals of the Sulka and Sulkanised Mengen of Wide Bay. This material has been presented as a Masters thesis to the Department of Sociology and Anthropology at the University of Queensland. She has also recorded, and had translated, a corpus of songs relating to the dancing of the masks (see Hill 1982; Craig 1993a).

[2]. Co-ordinator of the Pacific Arts Symposium in Adelaide.

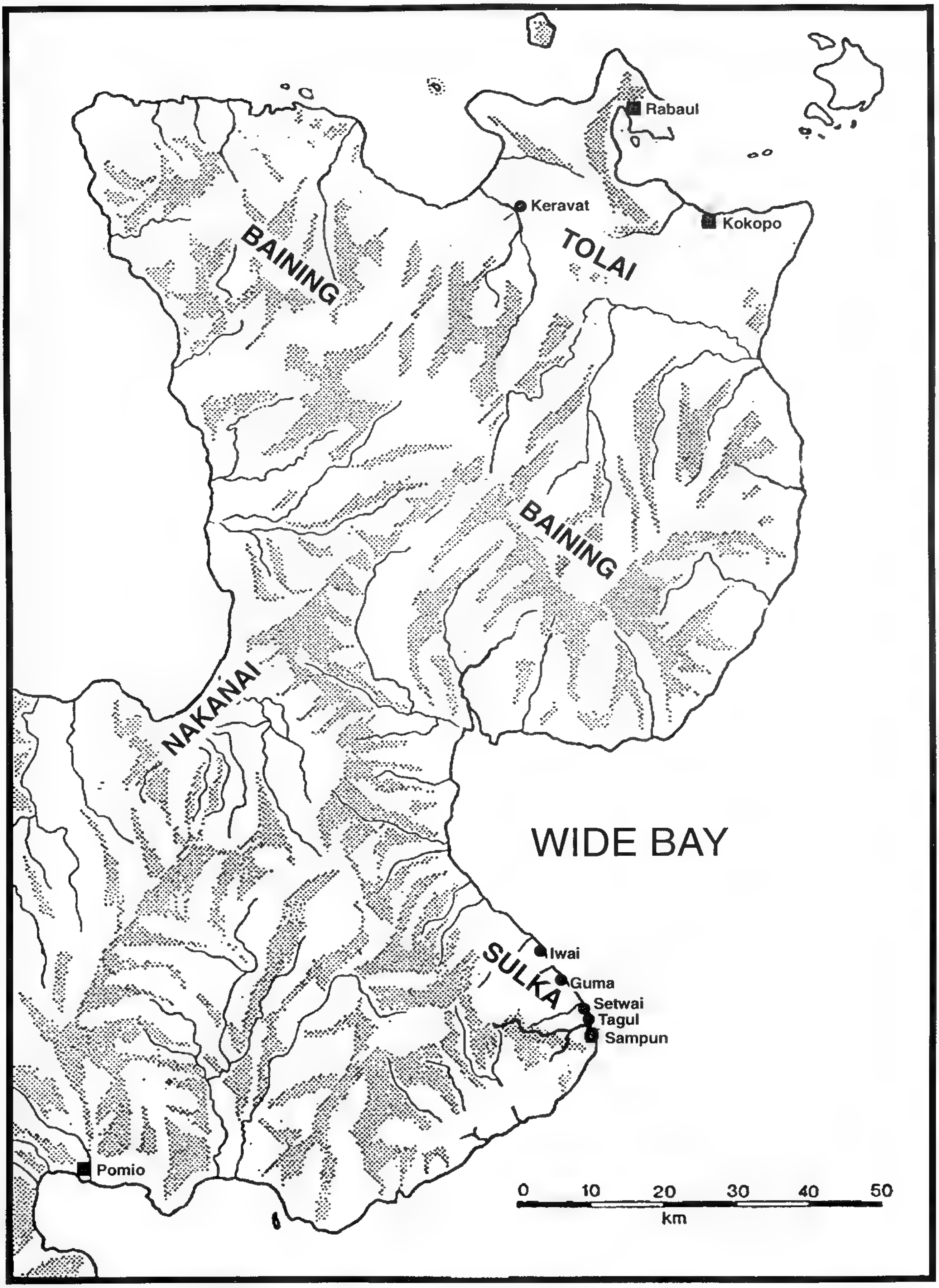

FIGURE 2. Map showing Sulka area, Wide Bay, East New Britain Province, Papua New Guinea.

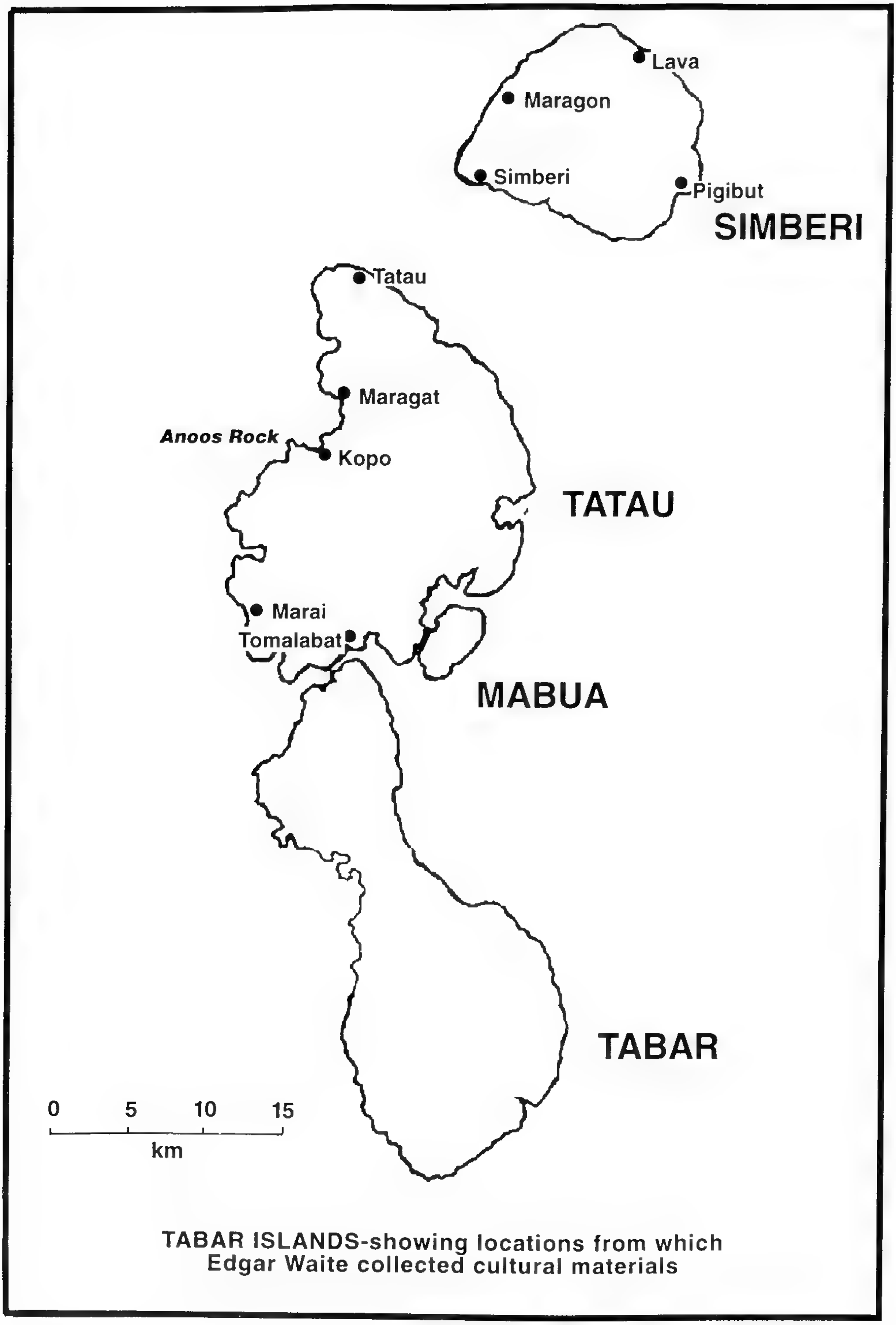

FIGURE 3. Map showing Tabar Islands, New Ireland Province, Papua New Guinea.

At first, it was hoped that funding would be received early enough to commission a copy of the South Australian Museum's rare Sulka *hemlaut* mask, obtained in 1919 and designed to be danced by two men simultaneously. Funding was not confirmed until November 1992, which did not provide sufficient time for a copy to be constructed. However, the performance of mask dancing associated with the initiation of boys and girls is common over the New Year period among the Sulka, allowing an opportunity to record performances and to purchase some of the masks before they were destroyed. It is normal practice to destroy the masks shortly after their performance.

In the case of New Ireland, we proposed to obtain at least two *tantanua* masks,[3] used in *malangan* performances, to place opposite the *tantanua* masks collected by Waite in 1918. *Malangan* performances are rare, but as New Irelanders no longer destroy the *tantanua* masks afterwards, there would be a good chance of being able to buy some.

The fieldwork was not intended merely as a collecting exercise. It was intended to identify two New Irelanders and two Sulka men who would be prepared to travel to Adelaide for the Pacific Arts Symposium and perform the masked dances. The masks would then be set up opposite their much older counterparts in the Pacific Gallery to demonstrate the continuity of these masking traditions and the re-establishment of the relationship between the South Australian Museum and these communities in Papua New Guinea.

A secondary purpose evolved at the last moment. A few days before I was due to depart for Papua New Guinea, I was handed a photocopy of Waite's handwritten journal of his New Guinea expedition. I resolved to follow Waite's footsteps, as much as possible in the short time I had[4], clarifying any obscurities in his journal (Waite 1918) and obtaining photographs and data that related to the locations visited by Waite.

THE NEW IRELAND COMPONENT

Originally I intended to go to the Sulka area first, and I arranged to arrive in Papua New Guinea in mid-December. In the meantime, Chris Issac established that the people in his village of Guma, on the south-east shore of Wide Bay (Fig.2), were planning masked performances for early January. I therefore changed the itinerary and went first to New Ireland. I had previously informed Noah Lurang that I would be arriving in New Ireland about 7th January and could not get through on the telephone to inform him of the change of plans. When I got to Kavieng, the capital of New Ireland Province, I found that he had taken the opportunity to return to his village on the island of Tatau (one of the Tabar group of islands) over the Christmas–New Year period.

It happened that Waite's main area of activity had been the north-west coast of New Ireland and the Tabar group of islands to the north of New Ireland (Fig. 3). Thus to find Noah I would be following Waite's travels of 75 years earlier. I had the peculiar sensation of simultaneously existing in two streams of time—being with Waite from June to August 1918, and looking for Noah in December 1992.

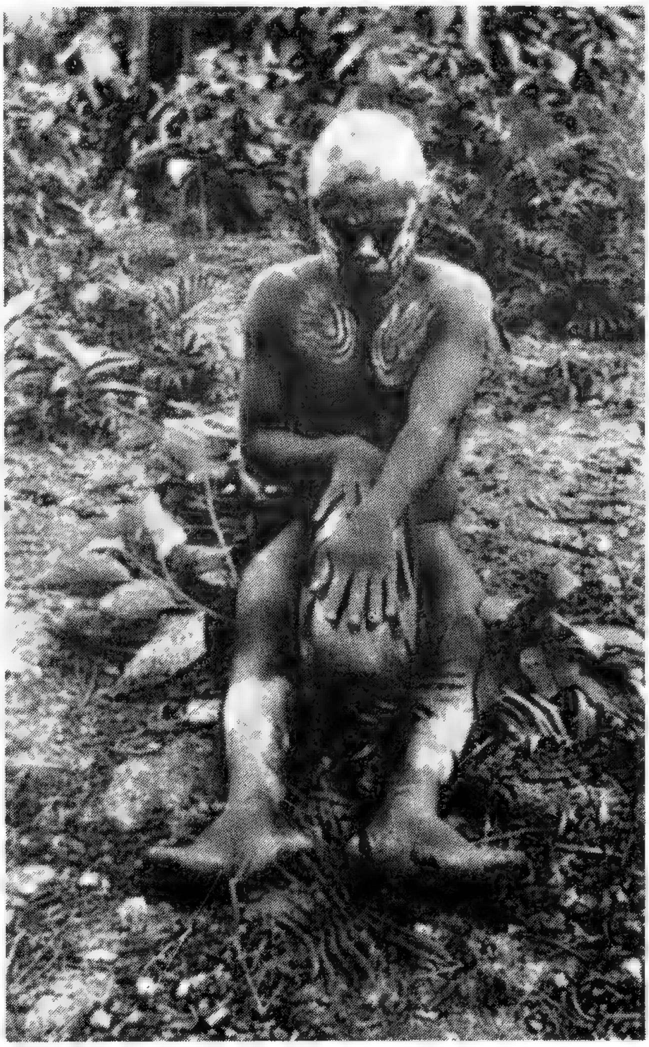

FIGURE 4. Youth demonstrating use of 'friction drum' (*lunuat*), photographed by Waite on 2nd July 1918 at Lemusmus, south coast of New Ireland.

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[3] For illustrations of this type of mask, see Helfrich 1973: Abb.1–45.

[4] Six weeks for the whole exercise, including two weeks in New Ireland Province.

The first place I wanted to visit was Lakurafanga. Waite had spent several days at Lakurafanga Plantation, from 27th June till 5th July 1918, as a guest of the manager Mr Ostram, a Finn. With Ostram's place as his base he explored caves nearby to collect bats and narrowly escaped death when he slipped into a small hole in the roof of a deeper cave (Waite 1918: 21–22). My informants suggested that the caves were most likely those they call Ling-saksavak.

Waite walked across New Ireland to Lemusmus on the south-west coast where Mr Hetreich, a sailor and marine artist, had a small plantation. Hetreich gave Waite a friction-drum (*lunuat*) for the collections; these are still being carved and used today and at Kavieng on the way out I was able to purchase one for the Museum. The *lunet* is held between the legs, and the moistened palms of the player's hands are rubbed towards the body over the 'tongues' of the drum to create a shrill vibrating sound. These are played by men only, in connection with funeral rituals, so it is hardly surprising that when Waite tried to get a girl to demonstrate its use for a photograph, she declined (ibid.: 30). He was subsequently able to find a youth who demonstrated its use (Fig. 4).

FIGURE 5. Shark catching equipment held by Sialis of Munun village, Simberi Island, Tabar Group, New Ireland Province. The 'propeller' float is called *kat* and the rattle is called *sorkuoi* (Photo by B. Craig, 27th December 1992).

Back at Lakurafanga, Waite bought shark-catching equipment. This consists of a rope noose with a propeller-shaped float attached (Fig. 5). The shark is 'called' by rattling a rattan ring of coconut shells and the noose is slipped over the shark's head as it surfaces next to the caller's canoe. When the noose tightens and the shark submerges, the propeller is dragged down through the water and exhausts the shark, which is then pulled to the canoe and clubbed to death. A film, 'Shark Callers of Kontu', was made in 1982 by Dennis O'Rourke showing how sharks are caught this way.

During his time in this area, Waite collected, purchased and was given a wide range of material, including birds, insects, reptiles, and a meteorite (gift of Rev. Peekel of the Catholic Mission at Lemakot—ibid.: 25), as well as ethnographic items (Fig. 6). Among the latter were many fine figures and masks associated with *malangan* funeral rituals. So great was his interest in these carvings that he was soon nicknamed 'Masta bilong faiawud' (master belong firewood) (Jones 1992; Craig 1994) because normally the *malangan* carvings were burnt after the rituals were completed.

I had been advised to stay with Lapaseng Meli and his wife Tangalabo at Sali village, located on the Boluminski Highway about sixty kilometres from Kavieng. I explained to my hosts that I was interested in seeing the site of Ostram's house and talking with anyone who might have been there when Waite visited in 1918. Tangalabo brought me to the house of a very old man named Pasa Atunais (Fig. 7), of the village of Lakurafanga. Pasa rose feebly from his bed for the interview; he was about 90 years old and blind now but able to recall that when he was a teenager a white man travelled along Boluminski's road collecting things like snakes, caterpillars, butterflies and artefacts. As it turned out, Pasa was the only person alive today who could recall seeing Waite, although a few others who were infants in 1918 had been told stories of the man's collecting activities.

FIGURE 6. Masks and spears collected and photographed by Waite on 5th July 1918 at Lunapai village, north coast of New Ireland. Most of these items are currently on display in the Pacific Gallery, South Australian Museum.

I was taken to the site of Ostram's house but all that remained were two concrete house stumps and a concrete water tank, bullet-scarred from straffing during the Second World War.

From Lakurafanga, Waite and his assistant Davis sailed to the Tabar Islands on a pinnace owned by Van der Ghynste, manager of Kopo Plantation at Maragat Bay on the island of Tatau. They took ten hours to get there. I travelled by a different route. I took leave of my gracious hosts and continued along the coast to Konos, where I stayed overnight. From Konos, the journey to Tatau Island takes just over two hours by outboard-powered, fibreglass 'banana' boat. The sea between New Ireland and Tabar was relatively calm; there are times when rough seas challenge the nonchalance of the Tabar Islanders and even they prefer to wait for calmer weather.

Van der Ghynste was nicknamed 'Masta Sak-sak' and his pinnace was christened the 'Sak-sak'. Waite reports (ibid.: 22): 'Vanderghinste grows a beard. When the war broke out he said he would not shave until it was over, so they call him sac sac, which means grass (grown on the chin).' In fact, sak-sak means 'sago'. The son of the Simberi Islander who worked on Van der Ghynste's boat supplied another interpretation, explaining that 'Masta Sak-sak was so named because, whenever all other food supplies ran out, he had his labourers go into the bush and prepare sak-sak (sago) to feed himself and the plantation workers.'

Waite and Davis used the Kopo plantation house of Van der Ghynste as a base to explore the islands and add to the already large collections. Waite's journal records: 'Obtained various articles, at different villages, including an old Malagan, estimated to be over 80 years old. For this and a shark float I paid 2 Pounds, for a pig net One Pound' (ibid.: 43).

Upon arrival at the village of Tatau on the north-west corner of Tatau Island, I was taken to the house of Noah Lurang but he had gone off into the bush. Melenga Lembiang attached himself to me and suggested we go look for Noah. Some hours later we met on a mountainside and I was immediately sure that Noah was the perfect choice for Provincial Cultural Officer and would provide a most impressive performance at the Pacific Arts Symposium. Over the next two weeks, we worked together closely and he introduced me to Edward Salle, the best carver in the 'traditional' (early twentieth century) style. These were the two men who would be invited to the conference in Adelaide. I later bought a small figure, called

FIGURE 7. Pasa Atunais of Lakurafanga village, north coast of New Ireland. Pasa remembered collecting insects for Waite as a teenager in 1918 (Photo by B. Craig, 21st December 1992).

walik (Fig. 8), from Edward and it is now on display opposite the old figures collected by Waite.

After a short while, Waite decided to visit Simberi Island, the northern-most of the three major islands of Tabar. Masta Sak-sak took him and Davis across the passage between Simberi and Tatau, the sea so rough that they almost turned back. They landed at Simberi village and walked north along the west coast past Willie Pettersson's plantation to his brother Carl Pettersson's plantation at Maragon Bay. We followed Waite's route and at Simberi village I was shown a *malangatsak* figure with outstretched arms carved by Tames (Thomas) Litir, which I purchased the next day for the South Australian Museum (Fig. 9). We left Simberi and walked north. My guides were able to take me to Willie Pettersson's grave, marked by cordyline plants in a grove of coconuts and wild ginger undergrowth.

Carl Pettersson was known as Charles among the Europeans in New Ireland, as Sali among the Tabar Islanders, and as 'The King of Tabar' in Swedish newspapers (Regius 1993). He had a common law wife named Shindu from Tiripats on the island of Tabar. When Waite arrived, she had just had her sixth child by Sali. Waite

FIGURE 8. Figure called *walik*, carved by Edward Salle of Tatau village, Tatau Island, Tabar Group, New Ireland Province (Photo by B. Craig, 24th December 1992). Purchased for South Australian Museum, Accession number A.74145, and currently on display in the Pacific Gallery of the Museum.

FIGURE 9. Figure called *malangatsak*, carved by Tames (Thomas) Litir of Simberi village, Simberi Island, Tabar Group, New Ireland Province; Tames is at left (Photo by B. Craig, 26th December 1992). Purchased for South Australian Museum, Accession number A.74141, and currently on display in the Pacific Gallery of the Museum.

FIGURE 10. Charles Petterssen, his Tabar Island wife Shindu, and their six children, photographed in Swedish national costume by Waite on 12th July 1918 at Petterssen's plantation, Maragon, on the west coast of Simberi Island, Tabar Group, New Ireland Province.

photographed the family with Pettersson and Shindu in Swedish national dress (Fig. 10). I was able to record brief histories of each of the children and I met Uto, an elderly woman who had been the wife of Sali's third child, Hans (called Anis by the villagers). I was shown the site of Sali's house; nothing but an old gnarled fruit tree remained from those times, everything else being completely obliterated by the Japanese, decay and forest regrowth.

Waite and his host Sali took the opportunity to investigate a turtle-breeding ground on tiny Marwui Island off the west coast of Simberi. They discovered a nest and counted 155 eggs in it. Waite then set out to walk around the northern half of Simberi Island to Pigibut where Meyer, a German plantation manager, lived. Following Waite's trail, we were overtaken by darkness and slept the night at Lava. Next day, at Munun, I met Sialis, one of the last of the shark-callers on Tabar Islands, and photographed the propeller-like float and the coconut shell rattle (Fig. 5).

We walked on to Pigibut and there we saw Meyer's house—the outside walls had been renewed but the concrete stumps, the timber frame and floor were said to be all original. The house had been obtained by Kennecott Mining Company to provide a base for gold exploration and they had added a large kitchen, mess hall, bunkhouses, workshop and separate office to the old building. Although this company had been gone for only a couple of years, the motorbikes, tractors and other vehicles were rusted through, looking as though they had been there for decades.

Waite stayed overnight and reported (ibid.: 59): 'G. M. gave me several things and natives brought others which we purchased. I paid G. Meyer 13 shillings for Bird of Paradise coins: five, two and one mark.' A number of *malangan* carvings on display at the South Australian Museum are labelled 'Pigibut'. Waite was supposed to be picked up at Pigibut by Masta Sak-sak but the seas were too rough. The boat retreated to a safe anchorage at Katatar on the south coast and Waite continued walking, thus circling the island.

Returning to Van der Ghynste's plantation at Kopo on Tatau Island, Waite decided to go by outrigger canoe and on foot to Klett's plantation at Tomalabat, overlooking the narrow passage between Tatau and Tabar to the south. On the way, he collected marine animals among the mangroves and visited 'Anus [Anoos] Rock'.

Anoos Rock is not marked on the maps and I assumed it was a mountain inland from Maragat Bay. However, I was able not only to locate it on the southern tip of Maragat Bay but also recorded the story of an old man named Lome who had been insulted by his wife and went into seclusion on the coral limestone rock in protest. Every day he was seen sitting in the sun on a rock wall he had built and he ignored the pleading of the villagers to return. He refused to eat, wasted away and eventually died. His bones, and the wall he built, are said to remain to this day.

I hired a boat to follow Waite's path along the west coast of Tatau. We called in at Maragat Bay and visited the site of Kopo Plantation but there was no sign that there had ever been a house there. I was taken to Anoos Rock and shown the bones of Lome.

Further south, we came ashore again and slipped and slid along a very muddy track to get to the old site of Marai village on a ridge-top. Waite recorded: 'At a village, Marai, on the summit, I had a "cooler" [juice of the *kulau* or green coconut], the boy climbing the coconut tree without the usual ankle strap' (ibid.: 60). The site now is completely unrecognisable as having been a village. Cement grave markers had been erected there during the late 1970s but were already overgrown.

We returned to our boat and continued south to Tamalabat and I photographed the view south to correspond to a panorama Waite had sketched in his diary. We then left in the late afternoon with insufficient time to return to Tatau village before dark and insufficient fuel. We came ashore five kilometres short of the village and poled the boat in the shallow water inside the reef for two hours to get there.

The night before I was due to return to New Ireland, I arranged to record a series of songs appropriate to the masks to be 'danced' in Adelaide at the Symposium. Dancing a mask without the rhythm of the garamut and the appropriate songs would be an absurdity. After a few trials, with the elderly Joel Pitsia as lead singer, and a master drummer to beat the slit-drum, the group provided an hour of fine singing. They asked me to play the recording back to them to ensure it was satisfactory.

Also a master weaver, Joel Pitsia specialised in constructing the woven *malangan* called *worwora* and in making the various masks called *ngeis* which are not carved but constructed of fibrous materials. I bought three of his small *worwora* and it was agreed that Noah and Edward would bring to the Symposium not only two *tantanua* masks and two carved *wanis* masks (with the intricately-carved 'ear' panels) but also a number

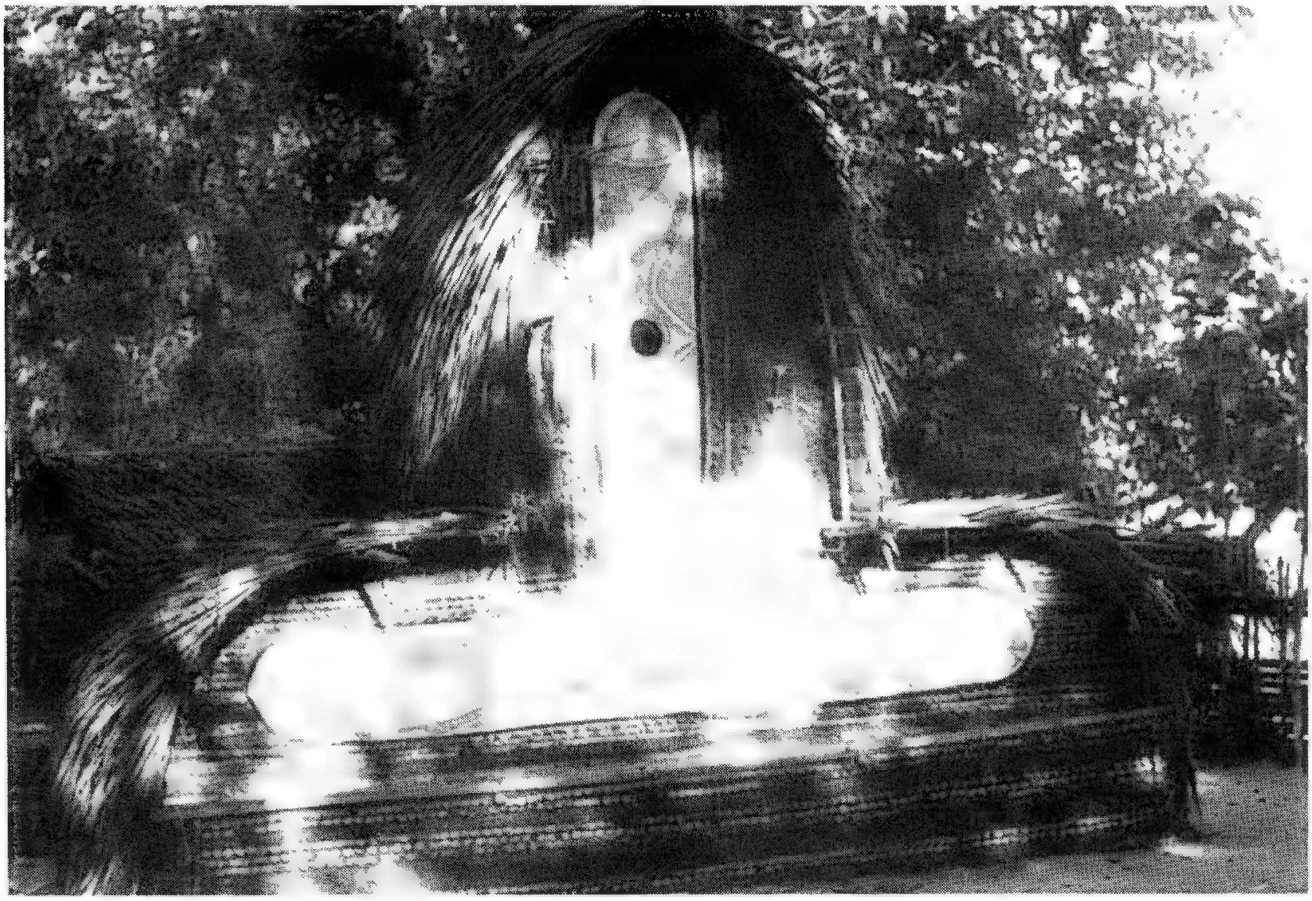
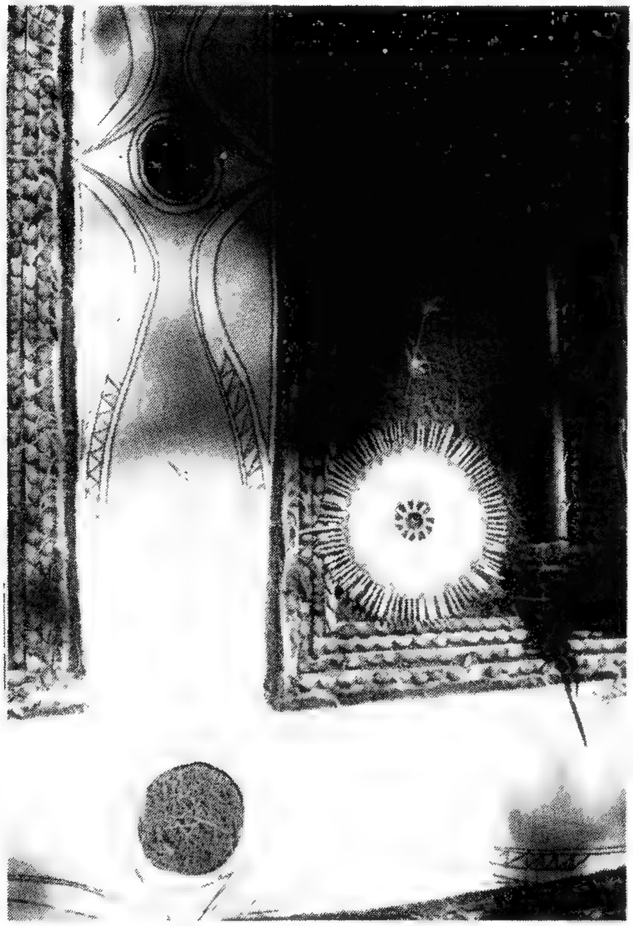


FIGURE 11 a, b. Malangan display structure (*mi-rorou-si-mi-matbu*), with *wowora* disc malangan on right, Tatau village, Tatau Island, Tabar Group, New Ireland Province (Photo by B. Craig, 24th December 1992).



of *ngeis,* to be made by Pitsia.[5] Whereas *tantanua* and *wanis* masks are usually represented in collections of New Ireland material, the *worwora* and *ngeis* are much rarer because they are ephemeral, so I was pleased to be able to add them to the Museum's collections (Fig. 11a, b).

There had been rough weather for a week but during this night the wind dropped, the sky cleared and the voices of the group singing the songs for the masks seemed to bring calm to the sea. Our trip the next morning was uneventful, except that we reached Konos on New Ireland with barely a spoonful of fuel left in the tank. By then I had come to trust the ability of my friends to cope with their environment—not necessarily always to get it right, but to deal with problems with humour and resourcefulness.

They had taken me along the paths trod by Waite 75 years before and provided information that immensely enriched his brief diary entries. It

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[5] For illustrations of these types of masks, see Helfrich 1973. Taf. XII, Abb. 47, 51, 58–64 (*wanis*); Taf. X, Abb. 114–19 (*ngeis*).

was a pleasure in April to show Noah Lurang and Edward Salle first hand the material Waite brought back from these islands and to return their people's hospitality to me. Edward was also able to provide a great deal of information about the carvings Waite had collected.

During the Symposium, Noah presented the South Australian Museum with one of the *wanis* masks (Fig. 12) as a gift from the clan leader, Joel Pitsia; Noah gave two shell rattles and the two slit-drum beaters used during the performance of the *wanis* masks at the Symposium's opening ceremony. The other masks were purchased. From the above account, it is clear what the South Australian Museum got out of the exercise; and those who attended the Symposium benefitted immensely from the performance of the *wanis* and from the explanation of the various types of masks provided by Noah and Edward in a more academic context later in the day. What Noah perceived to be the benefits is best reported by quoting his letter to the South Australian Museum's Director, dated 29th April 1993:

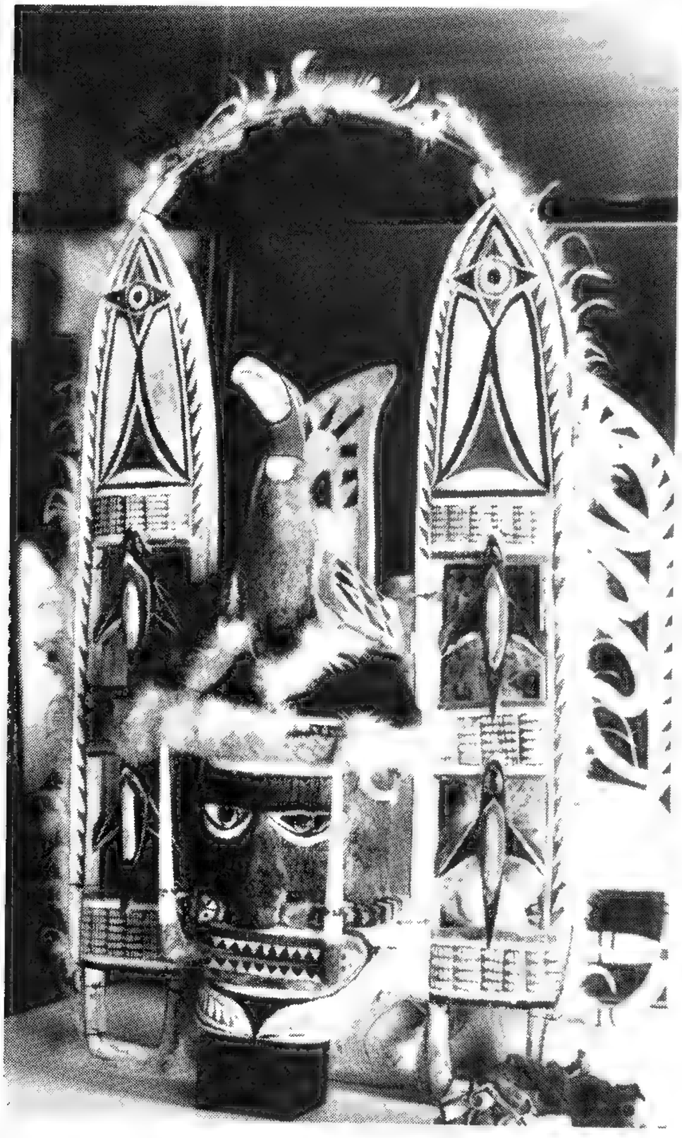

FIGURE 12. Mask (*wanis-si-mi-chur-bangbang*) brought to Adelaide for performance at the Opening Ceremony of the 5th International Pacific Arts Symposium in April 1993. This mask was carved by Edward Salle of Tatau village, Tatau Island, Tabar Group, New Ireland Province. It was presented as a gift to the South Australian Museum by Noah Lurang, New Ireland Provincial Cultural Officer, on behalf of Joel Pitsia, Kuk clan leader, Tauvoi hamlet, Tatau village; Accession number A.74146. It is currently on display in the Pacific Gallery of the Museum (Photo by Trevor Peters, SAM).

FIGURE 13. Sulka *hemlaut* mask, constructed by John Telko and others, being danced at an initiation ceremony, Guma village, Wide Bay, East New Britain Province. Design on underside of 'umbrella' represents a rainbow (*akrei*) (Photo by B. Craig, 9th January 1993).

> It's been a wonderful time we had together over at Adelaide and I wish to express how much I and the other guys have enjoyed the Symposium. The most satisfying thing about this event was the exposure which has broadened our scope on international events and issues, and of course the opportunity for give and take [at the] gatherings. To me, this was a great thing.
>
> Since New Ireland has again made another significant contribution to your collection, especially with the gift of the *wanis* (WANIS-SI-MI-CHUR

> BANGBANG) with two bundles of shells strung together as rattles and two short lengths of cane to beat the garamut, I would ask the museum to honour this with respect and favourable consideration in the future. I don't mean that the gift was an investment, no; but that maybe one day the Tatau people may build a small culture house to exhibit their *malangans*; the museum could become invaluable in this way by assisting somehow.
>
> To me the gift was an expression of good co-operation and a better working relationship and of course respect for one another. I hope this understanding will prevail in years to come.

Noah's letter is an expression of the importance of reciprocity. Activities which are expressions of Melanesian reciprocity may appear to be the same as what Westerners call 'investment' but as Noah has pointed out, there are differences. In our culture, an investment is made to obtain a 'return'. Melanesian reciprocity is a cyclical rather than linear phenomenon. It was initiated between the South Australian Museum and New Ireland by Waite but was in hiatus for some 75 years. Noah's hope is that the cycle has been reactivated and will not be allowed to lie dormant again for such a long time.

The Sulka, New Britain Component

I flew from Kavieng to Rabaul to meet Chris Issac and we purchased supplies for our stay in his village. Guma is situated on the southern shores of Wide Bay; the high mountains of southern New Ireland are discernible on a clear day from high ground behind the village. Waite did not visit this area but obtained the spectacular Sulka mask from Major H. Balfour Ogilvy who was an officer of the military administration in New Britain (Gash & Whittaker 1975: Plate 392).

The normal means for getting to Wide Bay and points further south on the east coast of New Britain is by small diesel-powered tugs which function as passenger ferries, carry supplies in to villages, missions and administrative centres, and carry out copra and cacao.

The Sulka, and their culturally alike (but linguisticly distinct) Mengen neighbours to the south-east, are gardeners inhabiting a narrow coastal fringe, fishing from small outrigger canoes, hunting in the hinterland and raising pigs for ceremonies such as those for which the *hemlaut* and *susu* masks are danced. They obtain

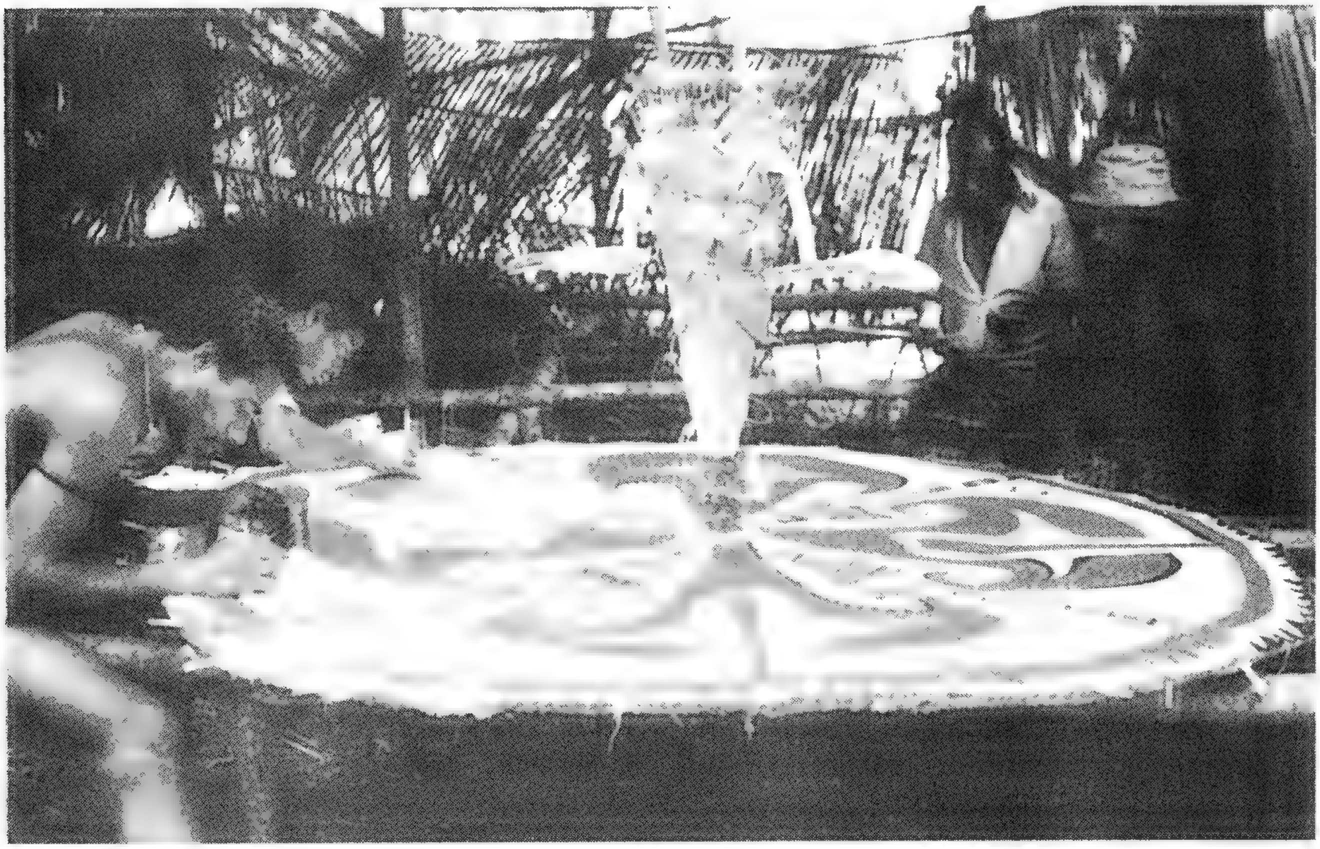

FIGURE 14. Sulka *hemlaut* mask, under construction by John Telko and others, for an initiation ceremony at Guma village, Wide Bay, East New Britain Province. Design on underside of 'umbrella' represents tips of fern leaves (*priau*) (Photo by B. Craig, 7th January 1993). This mask was purchased for the South Australian Museum (Accession number A.74139) and was danced by John Telko at the Opening Ceremony of the 5th International Pacific Arts Symposium in April 1993. It is currently on display in the Pacific Gallery of the Museum.

some cash by harvesting copra and cacao from their many small plantations. A variety of trees produce nuts and fruits in abundance and the chewing of betel nut is universal—more common than smoking tobacco. Life is so pleasant in the villages that the older men have to exert considerable pressure to get the young men to go to Rabaul to do occasional business.

The trip takes about 10 hours to Guma and we arrived after dark. We were put ashore in a three-metre dinghy and Chris's family made us welcome. The next day we were taken to a hut a few hundred metres up behind the village where a dozen young men were preparing two *hemlaut* masks for performance in a couple of days' time. I photographed the completion of one of the masks, which involved the delicate sewing of strips of flattened pith to a rattan armature, and the painting of the designs on the conical headpiece and underside of the 'umbrella' form on top of the masks. One of the designs, parallel bands of colours spiralling towards the centre of the 'umbrella', is named *akrei* (rainbow); the other is named *priau* (tip of fern leaf) (Figs. 13, 14). I later discovered the name of the design on the *hemlaut* in the South Australian Museum (Fig. 15): *a hevotek kalogu* (claws of a freshwater cray). These interpretations are visual metaphors and may be connected to clan totems but only a long-term study would be likely to elucidate their full cultural significance.

I realised I was going to have considerable difficulty deciding which mask I would choose for the performance in Adelaide—one was sculpturally more interesting but the other had a more interesting design on the underside of its 'umbrella'. I was also concerned about how to select the two men who would be invited to come to Adelaide to dance the mask. It was a relief to learn that the mask and the men had already been chosen, on the basis of messages between Chris and me and between Chris and his relatives in the village. This clearly indicated that the project had the understanding and enthusiastic support of the men of the village. Similarly, the price asked for the mask was kept at a modest amount, meant to compensate those men who had assisted to make the mask but who had not been chosen to go to Adelaide.

FIGURE 15. Sulka *hemlaut* mask of a rare type called *lopela*, designed to be danced by two men simultaneously. This mask was obtained by Waite in 1919 from Major H. Balfour Ogilvy, whom he had met on his New Guinea Expedition in 1918. This mask (Accession number A.7416) has been on display in the Pacific Gallery of the South Australian Museum for several decades. The design on the underside of the 'umbrella' represents claws of a freshwater crayfish (*hevotek kalogu*). Exact provenance, and photographer, are not known.

There was to be an afternoon performance of mask dancing at the village of Tagul, two hours walk south-east along the coast from Guma. We set out early in the afternoon, the sounds of the sea on our left and of the wind in the coconuts on our right. As we approached the village of Tagul through a tunnel of trees, we could hear the drumming and singing that accompanies the performance of the *hemlaut* masks. We crossed a creek, ascended sharply and there, coming toward us from the large crowd gathered at the centre of the village, was the first of three *hemlaut* being danced that day: an apparently gigantic figure shrouded in green palm leaves wearing a red conical structure supporting a two-metre diameter 'umbrella' painted on the underside with curving flower-like forms.

I followed the *hemlaut* into the preparation area behind the village and ran into a line of eleven *susu* masks getting ready to make their appearance. A senior initiate rushed to head off the maskers and berated them soundly for failing to await their cue. His abuse in Mengen, assuring an uncomfortable reward for a premature performance, was punctuated with the English emphatic: 'Honest to God!' In due course they were given a signal and the masks moved in solemn procession into the village (Fig. 16), their shiny green palm-leaf body-shrouds swaying in unison to the drumming of a group of singing women.

The ceremonies in which *hemlaut* and *susu* are danced are primarily for the initiation of boys and girls, the boys being circumcised and the girls having their noses pierced. The school holidays over Christmas–New Year are therefore the period in which the masks are most likely to be danced.

They are danced also for funerals, marriages and other special events. In 1982 I witnessed the induction of a Sulka man, Joe Quintaip, into the Franciscan priesthood. This ceremony commenced as a Catholic service presided over by the Archbishop of Rabaul and ended with traditional masked dances which included a *hemlaut* performance. The masked performances were doubly appropriate as Joe Quintaip's ordination was considered by his relatives as both an initiation and a death—initiation into the knowledge and rituals of the Church and a death to normal village life.

The *hemlaut* for that occasion was designed to illustrate a Christian story and since the ceremony was conducted soon after Christmas, the theme chosen was Bethlehem. Accordingly, beneath the two metre diameter umbrella-like form characteristic of the *hemlaut* mask, an elaborate woven sculpture was created representing Mary, Joseph and two angels kneeling around the baby Jesus lying in a manger.

At Tagul, on this trip in 1993, I was most fortunate to observe another complex *hemlaut* mask, this time with a traditional Sulka story represented beneath the 'umbrella' (Fig. 17). This was the story of the two brothers named Noot, a younger brother who lived in the hills and an older brother who lived by the sea:

> The younger brother was always coming to the older brother's place and seducing the women. This made the older brother so angry that he captured a lot of men of his own village and tied them by hands and feet to poles and contemplated cooking and eating them. But it didn't look right so he released the men and instructed them to bring pigs to take their place. They had a big feast but this attracted the younger

FIGURE 16. Procession of Sulka *susu* masks, Tagul village, Wide Bay, East New Britain Province (Photo by B. Craig, 7th January 1993). Two of these masks were purchased for the South Australian Museum (Accession numbers A.74135, 74136) and are currently on display in the Pacific Gallery of the Museum.

FIGURE 17. Sulkanised Mengen *hemlaut* mask being danced at Tagul village, Wide Bay, East New Britain Province (Photo by B. Craig, 7th January 1993). This mask has a woven sculpture beneath the 'umbrella', representing the legend of two ancestral brothers named Noot.

> brother again and this time he seduced the older brother's wife. The older brother began to plot his younger brother's death. He commenced the building of a men's house which required a very deep hole for a carved and painted centrepost and lured his younger brother into the hole, then dropped the post into it, but the younger brother escaped by following his dog, which had dug a tunnel out of there. Then the older brother held a feast and invited the younger brother, intending to kill him with a wooden club but the younger brother sent an animated wooden likeness of himself and again escaped death.
> The two brothers then fought with slings and fire and the younger brother took the older brother's wife and flew away, some say in an aeroplane to a great land in the south, to become the ancestor of the white people (B. Craig ms.).

The mask I saw danced at Tagul consisted of a central figure representing the older brother Noot holding up the 'umbrella', surrounded by a representation of a man trussed up on a pole with a trussed pig opposite, and an oval men's house, with a tall food storage bin in front, opposite the younger brother's dog.

The structure of the 'Bethlehem' and 'Noot' masks were the same: a central figure surrounded by four significant elements of the story. The other *hemlaut* masks danced at Tagul that day also exhibited this four-part structure, though the sculptural elements were simpler petal-like forms or merely suggested by the design on the underside of the 'umbrella'[6]. But there is more to these masking traditions than their forms: for example, the songs that accompany their display and performance. Rowena Hill, Conservator at the PNG National Museum in 1982, recorded several and had them translated (Hill 1982: 98–107). This is a song to accompany a *hemlaut* mask:

> A woman gave birth to a snake; her husband took her to a magic reef where there lived a spirit called *kot*. When the snake came out from her belly his tongue was red and forked and [he] covered the

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[6]. I was struck by the similarity of these designs to those of mandalas when, in September 1994, the South Australian Museum hosted a group of Tibetan Buddhist monks who demonstrated the 'sand-painting' of a *Mandala for Peace*. They set up their space immediately in front of the old Sulka *hemlaut* mask in the Pacific Gallery but missed the opportunity to allow onlookers to draw the comparisons by covering up the case in which the Sulka mask was displayed

> whole woman, wrapping himself around her like the underneath of the 'umbrella' mask.

A song to accompany the dancing of the *susu* masks:

> A man was standing on top of a hill overlooking a village called Indaru when he heard an echo, bouncing from a cliff, of a woman singing. Out of the waterfall came her two sons; they were as beautiful as a pair of cockatoos.
> They were sitting on top of the cliff, one on each side of the waterfall. The man saw them both and as he fixed his gaze they merged into the white flowing waterfall and kept flowing and flowing.
> The *susu* mask is dancing like a flower blowing in the wind. Its skirt like leaves is swinging to and fro. The mask is like the flower dancing on the stem.

One song which seems to be concerned with the pan-human problem of communication between men and women laments:

> A woman was standing on top of a hill, and on her face she wore a mask of [white] lime and plant juice. When I tried to talk to her she refused to speak and stood there facing the setting sun. When I approached her she started to cry; I felt sorry for her and started to cry in sympathy. Suddenly she disappeared and I did not know what to do or say.

The rather magisterial and fearsome appearance of the masks is belied by the sensitivity and imagery of many of these songs.

After arranging to purchase two of the *susu* masks for the South Australian Museum, and for the 'Noot' mask to be put aside for consideration by the PNG National Museum (the masks are normally destroyed soon after performance), we commenced our walk back to Guma. I fell into step with the Provincial Minister for Education, who is Sulka, and he assured me that the Provincial Government is fully supportive of such projects as the one we were engaged upon, providing that there is full agreement among the villagers and that the PNG National Museum is supportive.

It rained heavily next morning and this prompted the information that someone can be commissioned to cause rain in order to spoil a feast. Rain can be induced by placing stones, carved as human heads, in a river and stopped by taking them out. Another method is to saturate a knotted rope with the juices of a particular plant and then to spray the juices around by whirling the rope vigorously; the spell is cancelled by undoing the knots in the rope. The fear of rain being brought on to spoil a feast is also common among the New Irelanders.

That afternoon Chris and I went to the bush shelter where the masks were being made for the performance in Guma village. I continued photographing the painting of the masks, and the preparation of two masks called *keipa*. The *keipa* mask is a simple cap of woven vine or rattan with eyes painted on it and the usual body-covering of palm leaves. They are sometimes referred to as 'whipping masks', as the wearers burst in while the women are dancing during the first afternoon of the festivities and lash those who are to receive the food piled up in the middle of the village for distribution. These masks are also used to ensure a prompt supply of food to the young men who are constructing and preparing the masks in the bush shelter.

I was invited to offer myself as a recipient of the attentions of the *keipa* masks that afternoon but managed to convince my hosts that I needed to make good use of my cameras during the event. Sometimes the notion of 'participant observation' becomes distinctly uncomfortable!

After the whipping episode, the women returned to their singing and in due course a man stood in front of the heaps of tubers and pork and called one-by-one the names of the recipients of the food. Within a half hour the space had been cleared and the food distributed to individual households.

At midnight I recorded an hour and a half of singing and dancing. The men were clustered around a painted sapling, something like the European maypole, drumming and singing, with a line of women circling them clockwise. Off to one side a line of women and girls in traditional dress sang separate songs. There were quite lengthy pauses in the singing with some experimental drumming and voice-testing as catalysts for what appeared to be an impromptu selection of songs from a widely known corpus. Chris told me that some of the songs are in a very old language that few people, if any, understand; that other songs are metaphoric or contain oblique references to the real meanings; and that others can be made up on the spot—an opportunity for creativity. The singing and dancing continued until dawn.

Next day the *hemlaut* masks were completed and the palm-leaf body shrouds attached. The shroud is in two parts—one attached to the lower rim of the mask itself on a rigid frame and the other on a flexible frame is worn by the dancer suspended from shoulder straps. This enables the mask to undergo amazing transformations in size. When the masker crouches, the shroud diminishes, concertina fashion, to about a metre in height and the mask appears to be short and fat; when the masker leaps into the air, the shroud extends fully two metres in height and the mask appears gigantic. West African maskers use the same device to achieve identical effects.

The introductory women's songs, to call the masks, began about 3.30pm and, shortly after, the first of the *hemlaut* masks was led into the village by a crowd of singing men. When the mask reached the men's house at the other end of the village where a young lad awaited circumcision, the group of singing men stood back from the *hemlaut* and allowed it to perform in a clear space while they continued drumming and singing; then it left—all over in about ten minutes. There was a hiatus and eventually the women's group recommenced singing and drumming, calling the second *hemlaut*. It was led in by the men and when the space was cleared for its solo performance, the mask was danced in sequences where it was tilted 90° to the vertical to allow a clear view of the design on the underside of the 'umbrella'—a standard procedure during performance. The crowd applauded the performance. Then the two little girls who were undergoing initiation were publicly presented, followed by the circumcision of the lad in the men's house. The *hemlaut* continued dancing around the men's house and the men crowded around whistling, yelling and singing, and banging on the corrugated iron covering part of the roof of the house so that the whole house shook, to drown out the cries of fear and pain from the boy. Men were drumming vigorously inside the house as well. At about five o'clock in the afternoon, dishes of cooked food were brought and placed in palm leaves in front of the men's house and a squealing pig was secured to a pole and carried off. The second *hemlaut* departed from the village only to reappear later and attempt to intimidate a crowd of children. Cooked pork was distributed amongst the cooked tubers and then women came with their dishes to collect their portions.

That evening Chris relayed several criticisms of the *hemlaut* performances. The first masker was inexperienced and failed to 'show the writing', ie. the underside of the 'umbrella', adequately. The second masker was much better but made a mistake by leaping up into the air during the second song when he shouldn't have. Apparently everybody laughed at that; I had heard them laughing but thought it was excitement.

In general, it was felt that the whole thing was too rushed and should have taken place over four, rather than two, days. The first day—when the *keipa* masks whip the receivers of food—is called *elaton*. The second stage, called *mselor*, should take place three months later, to allow time to get all the food ready; this requires the women to perform their songs whilst the food is set out in heaps for distribution. The third stage, *elonpik*, should occur the next day; the women perform again and the food is distributed to those invited to the feast; the initiated men are invited to eat in the bush shelter where the masks are being prepared. On the final day, *kamit*, the masks are danced as described above.

According to pre-colonial traditions, everybody went through three stages of initiation. For males this involved circumcision as boys, then the wearing of the masks as youths, and finally teeth-blackening (rarely performed these days). Girls may have their ears and noses pierced at their first initiation, but I was unable to discover what actions, if any, were performed at the second stage (which I assumed was first menses) and at the third, which was when they were of marriagable age[7]. The feast for circumcision and nose-piercing is called *pam-o-wlongtuk*.

On the evening of the eighth day of my stay at Guma, the boat arrived to take us and the masks to Rabaul. When darkness fell, the *hemlaut* was brought down to the beach and taken out to the boat in the dinghy. The smaller masks had been packed in cardboard boxes. The boat's crew had ensured there were no women or children on board and we lowered the canvas awnings around the deck to protect the *hemlaut* from sea spray and to ensure the mask would not be seen by women and children when we arrived in Rabaul in the morning. Women and children are expected to regard the masks as spirits, not as manufactured items worn by men, which is why they are normally destroyed after their performance.

We departed at 7.15 pm and the journey was uneventful. We arrived at 5.15 am and had to wait a couple of hours before the wharf was clear of women and children and we could safely transfer the *hemlaut* to a lock-up shed. I spent the rest of the day and part of the next buying materials for a large plywood crate, building the crate, securing the masks inside and having it trucked out to Airniugini's cargo shed at the airport to await the Dash-7 cargo plane scheduled for Tuesday. Chris and I flew to Port Moresby on Sunday, passing over an active volcano on the western side of New Britain. The volcanoes around Rabaul, which were to erupt in spectacular fashion during 1994, were quiescent.

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[7]. Such matters are not likely to be told to a male enquirer.

On Monday morning I received a call from Rabaul saying the crate was too large for the plane. Even though I had built it within the dimensions provided by Airniugini staff in Rabaul, they had forgotten the requirement for walk space from the front of the plane to the rear. I had to get back on a plane for Rabaul that afternoon to take the crate apart and remove the masks, which I then completely covered in yellow plastic to disguise their nature. Next morning I supervised the loading of the disassembled crate and the masks, ensuring there was walkspace through the cargo hold. On arrival in Moresby, we unloaded the masks and crate into a hired truck and transferred them to the PNG National Museum where I arranged for fumigation and space to reassemble the crate and repack the masks.

Discussion

Airniugini sponsored the airfares of myself, Chris Issac, the four New Guinea dancers and the airfreight of the collection through to Sydney, thus saving a considerable amount of expense. Even so, the non-salary field expenses for the six-week trip amounted to around $6 000 and freight from Sydney to Adelaide, internal airfares and accomodation for the four dancers, the purchase of additional masks brought to the Symposium by the New Ireland dancers, and the installation of the material in the Pacific Gallery added about another $5 000. Nevertheless, for the $11 000 spent, Symposium delegates were treated to two magnificent demonstrations of masked performances, the cultural significance of the masks were explained by indigenous spokespersons and a radical upgrade of two small sections of the Pacific Gallery became possible. The objects, photographs and information obtained in New Ireland and New Britain constitute a major additional resource linked to existing collections of objects, photographs and written material held by the Museum. The possibility of collaborative exercises involving Anthropology and Natural History researchers is also indicated, especially in relation to the ethnographic and natural history specimens collected by Waite in New Ireland and Tabar Islands.

One unforeseen outcome was the generation of a debate about the motivations, ideology and ethics of the whole exercise, including the Pacific Arts Symposium itself (Chance & Zepplin 1993; Zepplin 1993; Craig 1993b; Fergie 1994). For example, Zepplin writes accusingly that:

> Cultural objects and customs of the Pacific remain appropriated within the intrepid, pith-helmeted domains of anthropology, archaeology and natural history museums (read: exotic, alien and boringly impenetrable)—the authorised exposition of the Other (1993: 15).

Although it is not apparent to the visitor in the Pacific Gallery, the South Australian Museum is committed to a program of consultation and involvement of indigenous people with the cultural material held in this institution. This has been the major strategy in relation to Australian Aboriginal material for at least a decade now. The exercise I have described is one model for what might be done in relation to the non-Aboriginal cultural material. The stimulation of debate about the success and propriety of the outcomes of the opportunistic exercise I have described need not be read as a threat, but rather as an indication that we are moving in the direction of relevance to contemporary concerns and have not run aground in the shoals of nineteenth century attitudes and values.

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'A SPECIAL INDUCEMENT': THE ESTABLISHMENT OF THE *RECORDS OF THE SOUTH AUSTRALIAN MUSEUM*.

PHILIP JONES

JONES, P. G. 1995. 'A special inducement': the establishment of the *Records of the South Australian Museum*. *Records of the South Australian Museum* **28**(1): 53–59.

The first edition of the *Records of the South Australian Museum* was published on 24 May, 1918. While the journal has been published continuously for seventy-six years, the South Australian Museum was nevertheless one of the last major Australian museums to launch its own scientific journal. The delay was not due to any dilatoriness on the part of its staff in producing scientific papers; it reflects instead the enduring success of the colony's first scientific journal, the *Transactions of the Royal Society of South Australia*. The crucial role of Edgar Waite in the establishment of the *Records* is documented in this paper.

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Histories of colonial museums have generally overlooked the role of scientific journals in marking the transition to what Bassala has described as 'the final phase of a struggle to attain an independent scientific tradition' (quoted in Moyal 1976: 4). These journals were crucial for the professional legitimation of colonial science. In Britain and Europe, scientific journals had evolved from the reports produced of their meetings by the academies, which had in turn arisen from the Renaissance universities. In colonial Australia, this long process was compressed into little more than twenty or thirty years. Adelaide's Philosophical Society for example, was formed in 1853, just seventeen years after the colony's foundation. It played a major part in the foundation of the South Australian Museum, and reconstituted as the Royal Society of South Australia, produced the colony's first scientific journal, the *Transactions of the Royal Society*, in 1878. This pattern was mirrored in the other Australian colonies (Inkster & Todd 1986: 111).

In their attempts to represent the gamut of scientific endeavour, the journals of the scientific academies and museums defied a trend towards greater specialisation which had accompanied the rapid increase in the volume of scientific journals during the nineteenth century (Thornton & Tully 1971: 277–93). To a large degree, museum journals have retained this eclectic character today.

Apart from Adelaide, the major Australian museums of Sydney, Melbourne and Brisbane had all founded their museum journals by the turn of the century. The *Records of the South Australian Museum* celebrated seventy-five years of continuous publication in 1994, but while it is one of the longest running museum journals, it was founded considerably later than its sister publications. The delay does not imply a relative scientific immaturity or lack of independence in Adelaide; cultural dependence upon Britain was at least as high in other capitals. The historian of science Ian Inkster has argued that:

> Australian scientists remained peripheral to the cultures of both the mother country and the colony. They were spatially distant from Britain, but mentally isolated from the provincial centres in which they lived and worked (quoted in Sheets-Pyenson 1988: 14).

Adelaide was among the first Australian centres to focus upon the issues of building indigenous collections and regulating the unimpeded flow of natural history and ethnographic specimens out of the country (Kohlstedt 1984a; 1984b). Together with the Canterbury Museum, the South Australian Museum was also one of the first in Australasia to establish an international reputation for particular indigenous collections, notably ethnology and palaeontology (Sheets-Pyenson 1988: 100).

The relatively late foundation of the South Australian Museum's *Records* can be attributed to the very close relationship which its scientists, and those of the University of Adelaide, had with the Royal Society of South Australia. The Society's office holders were drawn principally from the Museum and the University during the decades of the 1880s, 1890s and 1900s, the years in which an independent museum publication might otherwise have arisen. The network of Adelaide's scientific and cultural institutions and individuals was extremely tight, both physically and socially. The proximity of the main institutions and their libraries on North Terrace fostered the growth of overlapping and complementary scientific relationships. The South Australian Museum's role, particularly in the fields of zoology and ethnology, was that of a 'keystone' institution, at least until the establishment of the University's Chair of Zoology (1922), the Department of Entomology at the Waite Institute (1927) and the Division of Animal Nutrition, CSIRO (1929) (Edmonds 1986: 207). Moreover, the siting of Adelaide's Museum, Library, Art Gallery, and University on the one city block was unparalleled elsewhere in the country. Inkster's model of 'mental isolation' does not seem suited to turn-of-the-century Adelaide.

The Museum's Director from the 1880s to the First World War was Professor Edward Stirling, himself a founder of the University of Adelaide Medical School and a Royal Society office holder. His own prestigious award as a Fellow of the Royal Society in London was made principally because of his publications on Australian zoology and palaeontology which appeared in the Society's *Transactions*. Stirling considered that the journal was more than adequate to serve the needs of his staff and the colony during this period. Stirling's University colleague and fellow Museum Committee member, the geologist and zoologist Professor Ralph Tate, used the *Transactions* as his forum to remind readers of Adelaide's capacity as an independent centre of research. The British Museum itself, he stated, 'owes to us some of its knowledge of the natural history of the colonies' (Tate 1878).

Tate made these remarks in the 1878 inaugural edition of the *Transactions*, for which he appears to have been largely responsible. Tate played a large role in reinvigorating natural science in South Australia at this time:

> From his arrival in 1876 Ralph Tate, professor of natural science at the new university, the whole status of the Adelaide [Philosophical] society was changed, new rules were drawn up, and publication was put on a sound and permanent basis by the foundation of a regular journal. Scientific contributions came in abundantly for the first time and soon exchanges were arranged with societies around the world (Inkster & Todd 1988: 114).

For the following forty years the Royal Society's journal remained the principal outlet for scientific publications in South Australia. Through a period in which the Museum was only beginning to establish its collections and its scientific expertise, the Royal Society, like others around the country,

> provided a nucleus around which young scientific communities could grow and mature. They had attracted a broad-based audience for science and had established comunication links within and beyond Australia (Inkster & Todd 1988: 115).

In the meantime, the early years of the *Transactions* were uncertain. The journal relied upon the subscription of members with a matching government grant and for several years it was published irregularly. This fact prompted the Museum's Director of the early 1880s, Wilhelm Haacke, to consider the publication of a scientific journal under the auspices of the Museum itself. The proposed journal would:

> contain notices of new species of the Australian fauna, anatomical monographs thereof, and notices of new modes of mounting and preserving specimens and apparatus thereof.[1]

Haacke, who had been appointed to his post from the State Museum of Jena in Germany, went so far as to propose a publisher—the firm of N. Engelmann of Leipzig, Germany. The South Australian Museum Committee instructed him to make further enquiries as to the costs of printing and publishing a journal, but by November 1884 Haacke had resigned and no further action was taken. That year also saw the Museum's official amalgamation with the Public Library and the Art Gallery under a new Act; this factor alone would have lowered the chances of a new, independent museum publication being developed.

The *Transactions* provided a convenient and prestigious outlet for the publications of Museum staff. Edward Stirling led the way as the Museum's Director, maintaining an active publication record in the *Transactions* and encouraging its use by other natural scientists and ethnologists. During 1909 Stirling received a request from the Perth Museum for a South Australian Museum publication and he placed the matter before his Committee for consideration. Their conclusion was that any independent publication by the Museum staff would 'seriously affect' the Royal Society.[2] This consideration influenced any discussion concerning a scientific journal for the following eight years.

The catalyst for a renewed debate was the retirement of Edward Stirling from the directorate

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[1] Minutes of the Museum Committee, 9 January, 1883. GRG19/364/1883, p.119, State Records Office, Adelaide.

[2] Minutes of the Museum Committee, 8 September, 1909. GRG19/364/1909, p.181, State Records Office, Adelaide.

FIGURE 1. Edgar Ravenswood Waite, Museum Director 1914–1928, who was successful in convincing the Museum Committee to recommend to the Board that the Museum should issue its own scientific journal.

at the end of 1912 after thirty-one years of service, and his replacement during April 1914 by Edgar Waite (Fig. 1), previously Director of the Canterbury Museum (Jones 1992).

Waite brought with him considerable experience as an editor and contributor to scientific publications. During his early career as Curator of the Leeds Museum in England he had edited the Museum's journal *The Naturalist*. He had been an active contributor to the Australian Museum's *Records* while Assistant Curator of Zoology, and had gone on to found and edit the *Records of the Canterbury Museum* in 1907. Waite was conscious that the South Australian Museum lagged behind other states in not publishing a journal, but the *Transactions* continued to serve his staff well. In fact, the average length of each issue of the *Transactions* steadily increased during the period after 1910: 257 pages in 1911, 273 in 1912, 496 in 1913, 528 in 1914 and 892 in 1915. This in itself helped to focus the debate on the need for an independent museum journal.

Waite first raised the issue of a scientific journal for the consideration of the Museum Committee in his Director's Report of 1 November 1916. A Sub-Committee was established to examine his proposal and immediately encountered a familiar obstacle. The main concern was that there had been 'a long standing idea that the Museum Officers are compelled to supply original matter for publication to the Royal Society of South Australia only'.[3] Unable to find any evidence of any formal obligation of Museum staff to publish in the *Transactions*, the Chairman of the Public Library, Museum and Art Gallery Board asked the Royal Society for clarification. The Society's Secretary, W. P. Gill, confirmed that no formal obligation existed.[4]

This obstacle overcome, Waite was in a position to advance the argument. He did so in a lengthy formal proposal to the Board, dated 10 January, 1917:

> The covert suggestion previously made and now definitely formulated is that the S.A. Museum issue a scientific publication to be devoted to the research work of the staff, including records of the expeditions, descriptions and illustration of objects in the Museum, occasional notes and the work of outside investigators dealing with Museum material. The publication to be edited by the Museum Director, to be issued at no stated intervals, but when material to form a part is available, a suitable number of such parts to form a volume.[5]

Waite stressed the benefits of an independent scientific publication devoted to the Museum, noting that an alternative suggestion had been made for the launch of a publication representing 'all the ramifications' of the composite institution, the Public Library, Museum and Art Gallery.[6] He advanced five main arguments for an independent publication. It would firstly relieve the pressure on the *Transactions* which was forced to publish unreasonably large volumes. It would enable the Museum Library to benefit from receiving publications in exchange from other scientific institutions. These publications would be 'precisely the kind of literature required for Museum use'. Thirdly, in Waite's view a scientific

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3. J. R. G. Adams to W. J. Sowden, 6 December, 1916. Docket no.103/1917/3737, State Records Office, Adelaide.
4. J. R. G. Adams to W. J. Sowden, 7 December, 1916; T. Gill to General Secretary, Public Library, Museum and Art Gallery, 15 December, 1916. Docket no.103/1917/3748; 22524, State Records Office, Adelaide.
5. 'Proposals of the Museum Director', 10 January, 1917', Docket no.103/1917, State Records Office, Adelaide.
6. This suggestion appears to have been made by the Board's Chairman. Docket no.103/1917, State Records Office, Adelaide.

journal would raise the status of the Museum:

> An individual may become quite famous locally but unless he publishes the results of his labours he will never be widely recognised and the same is true of an Institution. The more widely known a Museum becomes, the better the opportunities for exchange and of attracting experts to examine and report upon special collections or subjects.

Fourthly, Waite stressed the fact that without a scientific journal, the South Australian Museum was significantly out of step with other Australasian museums; it was the only museum in the region which was in a position to publish a scientific journal, but did not. Brisbane, Sydney, Melbourne and Perth Museums in Australia, and Wellington and Canterbury in New Zealand, all published their journals, as did the 'principal Museums in other British Colonies ... and most Foreign Museums'. Waite's final point was that the journal would provide a 'special inducement' for Museum staff to publish their researches 'in a publication with which they were so closely associated'. This, he considered, 'would prove a stimulus for diffident or indifferent workers', but added diplomatically '(I may here be thinking of the future)'. Perhaps one of Waite's most potent arguments though, was stated almost as an afterthought:

> At present no new species can, for example, be constitutionally published until December of any one year, when the volume of the Royal Society of South Australia appears; and recognising this, the Museum Committee recently authorised the publication of new records, out-side the pages of the Society.[7]

These arguments seemed convincing but Waite was immediately countered by his authoritative Curator of Insects, Arthur M. Lea. A prolific author of scientific papers, Lea contrasted the advantages of a Royal Society, as against a Museum, publication. His conclusion was that the latter still offered the best and most dependable forum for Museum publications and that the Royal Society's library could not be bettered by the Museum's. Lea's forthright letter to Waite ended:

> The scientific workers in South Australia are insufficient in numbers to justify two publications dealing with practically the same subjects.[8]

The Museum Committee met on 31 January, 1917, the day following Lea's letter, and decided that:

> consideration of the question of altering the existing arrangements whereby scientific papers by Museum Officials are published in the Transactions of the Royal Society of South Australia be deferred until after the European War.[9]

Waite was resigned to this setback and continued with plans for the publication by the Royal Society of the first illustrated catalogue of South Australian fish species. It appears to have been his specialised requirements for printing illustrations to this catalogue which finally caused the Museum Committee to reconsider Waite's suggestion for a museum journal. Events took a sudden turn. Waite's diary entry for Thursday, 18 September, 1917 recorded that:

> the Committee will recommend that a publication be issued by the Museum, my figure of £100 annually being accepted as a basis.[10]

Two days later the matter was dealt with by the full Board of the Public Library, Museum and Art Gallery. Waite recorded the result:

> Board granted me the £25 requested for preparing drawings of fishes and approved my suggestion to issue a Museum "Bulletin". I am to draw up necessary details as size and general "get up". My present idea is for No.1 to contain my review of Aust. Typhlopidae [Fig. 2], Notes on Fishes by McC [McCulloch] and W. [Waite] and possibly a catalogue of Australian lizards now being prepared by Zietz.[11]

The funds for the journal were to be drawn from the Museum's share of the Morgan Thomas Bequest Account, which had been invested in securities since its establishment in 1903. At this early stage, the 100 pounds set aside for the *Records* represented about one-tenth of the annual income derived from the Museum's share of the bequest (Hale 1956: 75, 136).

It was considered necessary by the full Board of Governors to mark their shift in publishing policy in a letter to the Royal Society. The Board's letter contained a hint of apology,

> gratefully acknowledging its indebtedness to the society for making it possible for so many years through the medium of its Journal to place before the public the results of the scientific research of its Museum officers. The benefit possibly may have been of a mutual character, but the Board is sensible of the fact that hitherto the expense of publishing at its own expense was not possible.

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[7] 'Proposals of the Museum Director', 10 January, 1917, Docket no.103/1917, State Records Office, Adelaide.

[8] A.M. Lea to E. R. Waite, 30 January, 1917, Docket no.103/1917, State Records Office, Adelaide.

[9] 'Scientific Publications by Museum Officers', 1 February, 1917, Docket no.103/1917, State Records Office, Adelaide.

[10] Waite, E. R. Diary no.64, 18 September, 1917. AA356, Anthropology Archives, South Australian Museum, Adelaide.

[11] Waite, E. R. Diary no.64, 21 September, 1917. AA356, Anthropology Archives, South Australian Museum, Adelaide.

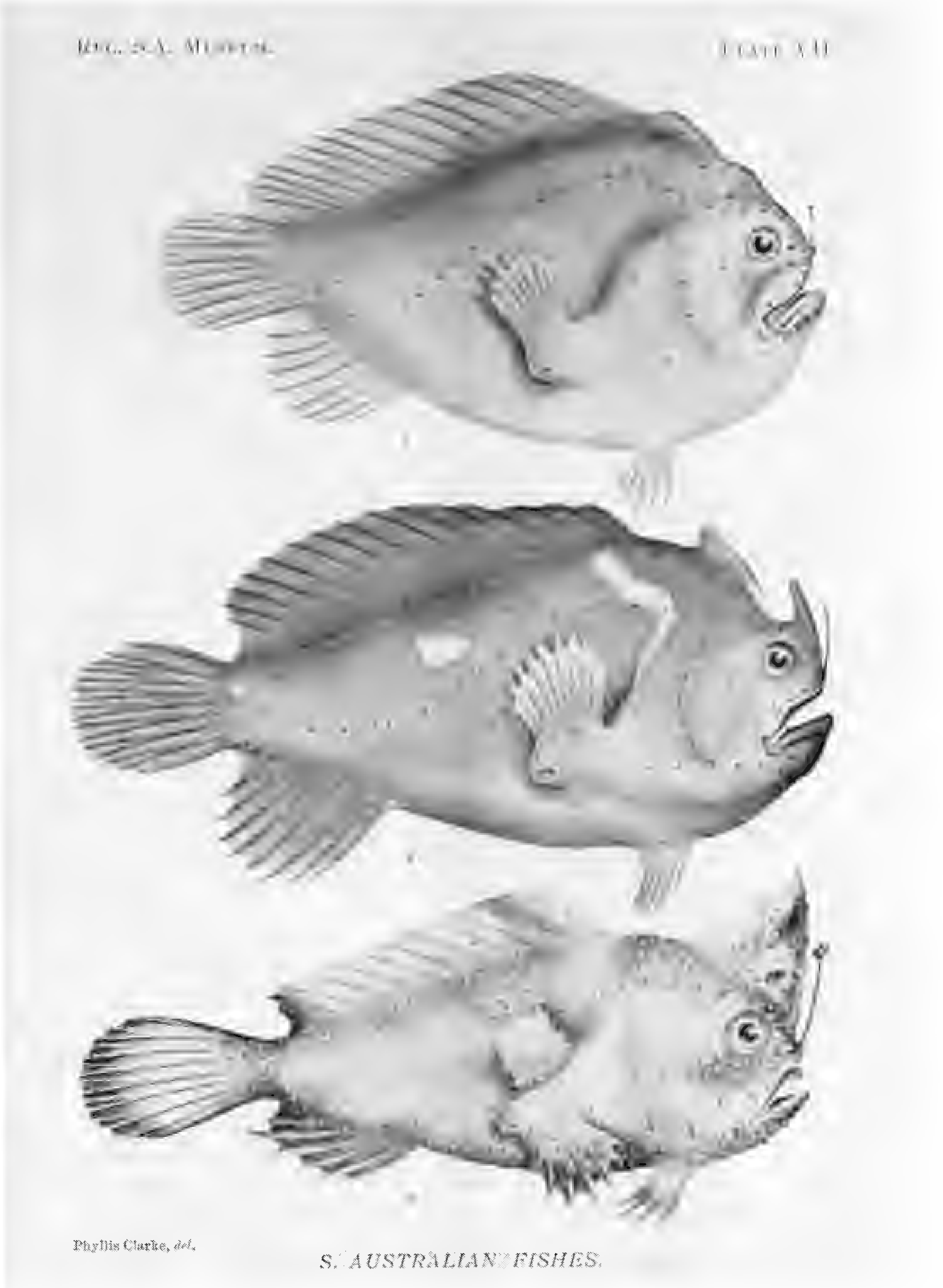

FIGURE 2. A copy of Plate VII from McCulloch and Waite, Some New and Little-known Fishes from South Australia, *Records of the South Australian Museum*, Volume 1(1).

> The Board still hopes, however, that it may continue to offer for publication in the Transactions of the Royal Society of S.A. papers that will be regarded as acceptable.[12]

Such deference was irritating to Waite, who was conscious of the Museum's historic role in providing the core of the *Transactions*' scientific publications. The careful reference to 'mutual benefit' was insufficient for him, as revealed by his private journal entry, following the Museum Committee meeting which drafted the letter:

> Howchin said that the Roy. Soc. would not in future print Museum material & got a vote of thanks passed to the Soc. for publishing the Museum papers in the past, nothing said as to the value of the Museum contribution to the Society!![13]

By early 1918 Waite had established the 'size, style, type, etc.' for the new journal, and had been able to assemble material for the inaugural issue. He estimated its cost at ninety pounds. He also prepared a statement for the Museum Committee, of which Stirling was now the Chairman, outlining the character of the new publication. It was

> to be devoted to research work of the Museum Staff, including records of expeditions, descriptions and illustrations of objects in the Museum or the property of others, occasional notes, and the work of outside investigators, dealing with Museum Material ... The publication is to be edited by the Museum Director and to be issued in parts at intervals when sufficient matter is available: a suitable number of such parts to form a volume.[14]

An order was subsequently placed with the Adelaide printers Hassell and Son, and by April 14th Waite had corrected the first proofs. Two weeks later he received the news that the opportunity for a collecting expedition to the south-west Pacific had arisen. Progress on the journal was now urgent, as Waite's diary entry for May 2nd reveals: 'Now pushing on "Museum Records" in case I have to go away'.[15]

The ensuing six week period was a race against time for Waite, with various administrative duties to finalise, as well as final arrangements for the journal. He pressured Hassells to publish as soon as possible; finally they were able to produce the inaugural issue of the *Records*, together with offprints, on the morning of June 24th, 1918 (the official publication date was recorded as May 24th). At 4.30pm that June afternoon Waite left by train to Melbourne, en route to his disembarkation for the Pacific islands expedition. The Museum's Annual Report was written aboard ship near Hinchinbrook Island, and posted from Cairns.

The first issue of the *Records* contained significant scientific contributions to the fields of ichthyology and entomology. Contributions to other branches of natural science and to anthropology followed in the remaining three issues of the first volume, published between 1918 and 1921. Waite was a prominent contributor to this and subsequent volumes. His catalogue of South Australian fishes, prepared with McCulloch for the first issue, was subsequently reprinted in 1923 as one of the first Handbooks of the Flora and Fauna of South Australia. Another prominent contributor to the early issues of the *Records* was Arthur Lea, whose strong advocacy of the *Transactions* had presented a major obstacle to Waite's initiative. Lea contributed a major summary of South Australian coleoptera to the first four parts of the *Records*.

The *Records of the South Australian Museum* enjoyed a decade of healthy activity under Waite's editorship until his sudden death in 1928. The mantle then passed to Herbert Hale and eventually to Norman Tindale, who took the journal through to the 1960s. Waite's model for the journal as a forum for the publication of the 'research work of Museum staff' has been largely adhered to throughout its history, although the work of 'outside investigators' has become more prominent in recent decades. At the close of the first decade, three volumes of the *Records* had been published, comprising sixty-seven papers, of which forty-one had been prepared by members of the Museum staff. The remaining papers, by external researchers, dealt with material in the Museum collections (Hale 1956: 136).

As a scientist who had published widely in both hemispheres before his arrival in Adelaide, Waite did not perceive or impose any restriction on the journal's geographical scope. In spite of this, the journal naturally achieved a South Australian focus. Waite's eclecticism informed the journal's scientific trajectory through the 1920s and beyond. Flute-player, theatre-goer, motor-cycle rider, aquarium-keeper, Waite published in several branches of natural history as well as in anthropology. With Edward Stirling too ill to

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[12] J. R. G. Adams to the Hon. Secretary, Royal Society of South Australia. 18 February, 1918, Docket no.103/1917, State Records Office, Adelaide.

[13] Waite, E. R. Diary no.64, 6 February, 1918. AA356, Anthropology Archives, South Australian Museum, Adelaide.

[14] E. R. Waite to Museum Committee, 31 January, 1918, Docket no.103/1917, State Records Office, Adelaide.

[15] Waite, E. R. Diary no.64, 2 May, 1918. AA356, Anthropology Archives, South Australian Museum, Adelaide.

complete his paper on the Aboriginal toas acquired from the missionary J. G. Reuther, Waite became the paper's co-author and supervised its 1919 publication in the *Records*' second Part. Thus from the first volume, the journal represented the main branches of scientific and cultural investigation at the South Australian Museum. Tindale's era strengthened this cross-disciplinary representation; he published strongly in entomology, anthropology and, following his 1929 Devon Downs excavation, in archaeology.

The *Transactions of the Royal Society* did not suffer the decline which might have been anticipated. The revitalisation of South Australian academic and research zoology which occurred during the 1920s assured the Society of a continuing flow of papers. Museum scientists continued to publish in the *Transactions* as well, a trend which has continued until the present.

After three-quarters of a century the five main benefits which Waite predicted would flow from the Museum's publication of its own scientific journal all appear to have been realised. The pressure on the *Transactions* was relieved, Museum staff were offered a ready inducement to publish, the scientific status of the Museum was enhanced and it was placed on a par with its sister institutions. Most tangibly, the Museum's library benefited from a series of exchanges made possible by the production of the *Records*. Hundreds of periodicals have been received in direct exchange for the twenty-seven volumes of the *Records* published since 1918. These volumes have contained more than 670 scientific papers, shortly to be listed in a published cumulative index assembled by Stan Edmonds (in prep.).

It is worth noting that the impetus for the establishment of the *Records* came from the vigorous efforts of Edgar Waite, newly arrived in Adelaide. His impact on the publishing program of the South Australian natural science community can be likened to that of Ralph Tate a generation earlier. Both were accomplished natural scientists with eclectic interests, extensive publishing experience and strong connections with national and international scientific communities. Both succeeded in reshaping the public face of scientific research in South Australia.

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REVISION OF THE HALIPLIDAE (COLEOPTERA) OF THE AUSTRALIAN REGION AND THE MOLUCCAS.

BERNHARD J. VAN VONDEL

VONDEL, B. J. VAN, 1995. Revision of the Haliplidae (Coleoptera) of the Australian region and the Moluccas). *Records of the South Australian Museum.* **28**(1): 61–101.

The Haliplidae of the Australian region and the Moluccas are revised. Fifteen species are recognized, of which *Haliplus wattsi*, *Haliplus hydei*, *Haliplus storeyi* and *Haliplus timmsi* are described as new. A key to the species is provided and distribution maps are given. Types of most species have been studied. Lectotypes have been designated for *Haliplus signatipennis* Régimbart and *Haliplus oberthuri* Guignot. *Haliplus nicholasi* Watts is considered a junior synonym of *Haliplus ferruginipes* Régimbart and *Haliplus nigrolineatus* Wehncke a junior synonym of *Haliplus testudo* Clark.

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Recently Watts (1988) revised the Australian Haliplidae. He recognized eight species, of which four were described as new. Because there are a few more species outside Australia, but belonging to the Australian faunal region, it seemed useful to me to treat and illustrate these species together with the Australian ones. Furthermore I would like to propose some additions to Watts' revision.

This revision treats the species present in Australia, New Guinea, Seram and New Caledonia. No Haliplidae are known from the other islands in the region or from New Zealand.

METHODS

The methods used are those of Vondel (1991). The terms used are explained in Figs 1 and 2.

MATERIAL

Material from the region, especially outside Australia, is usually rare in the collections of the institutions listed below. Expeditions by Michael Balke and Lars Hendrich to West New Guinea, very successful in collecting various water beetles, did not produce Haliplidae. Manfred Jäch could collect only one *Haliplus* during his recent water beetle expedition to the Central Moluccas (Ambon, Seram).

Data on ecology are seldom present on labels. According to Lawrence *et al.* (1987: 322) Australian Haliplidae are algal-feeders and bottom-dwellers and are usually found in lentic fresh water, which in general also applies to most non-Australian members of this family.

The material I had access to originates from the following institutional and private collections:

ANIC	– Australian National Insect Collection, Canberra, Australia.
BMNH	– Natural History Museum, London, UK.
BPBM	– B. P. Bishop Museum, Honolulu, Hawaii, USA.
CNCI	– Canadian National Collections, Ottawa, Ontario, Canada.
CV	– Collection B. J. van Vondel, Hendrik-Ido-Ambacht, The Netherlands.
CW	– Collection Dr C. H. S. Watts, Adelaide, South Australia, Australia.
ISNB	– Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium.
MCZC	– Museum of Comparative Zoology, Cambridge, Massachusetts, USA.
MNHN	– Muséum National d'Histoire Naturelle, Paris, France.
MUNC	– Memorial University of Newfoundland, St. John's, Canada.
MVMA	– Museum of Victoria, Abbotsford, Victoria, Australia.
NHMV	– Naturhistorisches Museum, Vienna, Austria.
QMBA	– Queensland Museum, South Brisbane, Queensland, Australia.
QPI	– Queensland Department of Primary Industries, Mareeba, Queensland, Australia.
RMNH	– Nationaal Natuurhistorisch Museum, Leiden, Netherlands.

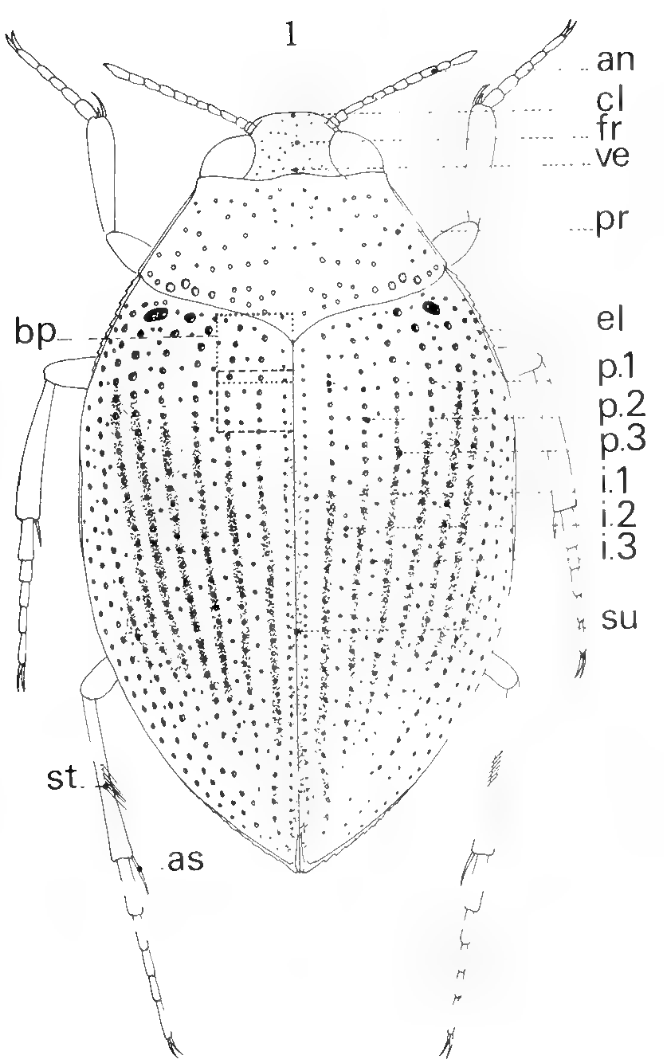


FIGURE 1. *Haliplus wattsi*, dorsal view: an, antenna; as, apical spur; bp, location of basal punctures, illustrated for each species; cl, clypeus; el, elytron; fr, frons; i.1, i.2, i.3, etc, interval 1, 2, 3 etc; pr, pronotum; p.1, p.2, p.3, etc., primary puncture-row 1, 2, 3 etc; st, setiferous striole; su, suture; ve, vertex.

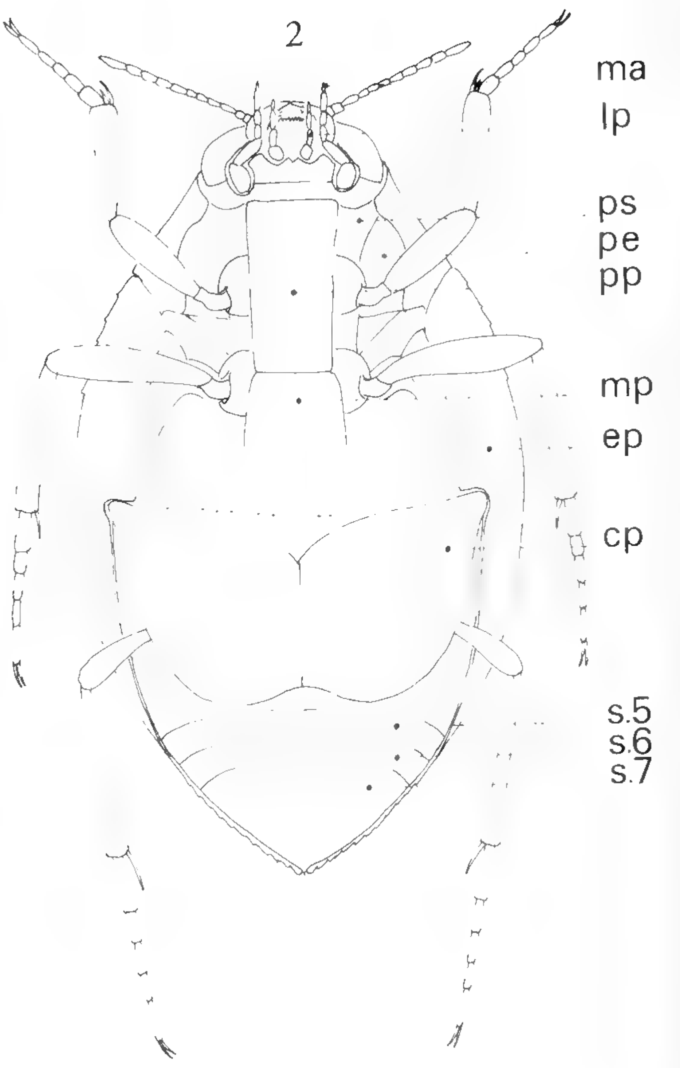


FIGURE 2. *Haliplus wattsi*, ventral view: cp, metacoxal lobe (or coxal plate); ep, elytral epipleuron; mp, metasternal process; pe, proepisternum; pp, prosternal process; ps, prosternum; s.5, s.6, s.7, sternite 5, 6, 7 (last sternite).

SAMA – South Australian Museum, Adelaide, South Australia, Australia.

SMFD – Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt am Main, Germany.

UQIC – University of Queensland, Brisbane, Queensland, Australia.

UZMH – Zoological Museum, Helsinki, Finland.

ZMUC – Zoological Museum, Copenhagen, Denmark.

SYSTEMATIC SECTION

The Haliplidae are represented in this region by only one genus: *Haliplus* Latreille. The genus *Haliplus* is divided into six subgenera, of which three occur in the Australian region. Guignot (1935a) erected the subgenus *Phalilus* for *H. oberthuri*. Guignot (1955) assigned *H. bistriatus*, *H. fuscatus* and *H. gibbus* to the subgenus *Neohaliplus* Netolitzky (1911).

The remaining species belong to the subgenus *Liaphlus* Guignot (1928).

The species below assigned to the subgenera *Phalilus* and *Neohaliplus* seem to form a group having a combination of characters, which is so far not found outside the Australian region. Most characteristic of the species in this group is the lack of genal lines behind the eyes while all other world Haliplidae have one or two genal lines. The type-species of *Neohaliplus*: *Haliplus lineatocollis* (Marsham) has two genal lines. Further study, based on a worldwide survey, is needed to determine if the Australian species indeed belong to *Neohaliplus*, as they show strong differences with the palaearctic species of *Neohaliplus*. The species in the subgenus *Liaphlus* have two genal lines. Representatives of *Liaphlus* in the presently used context are spread worldwide, but according to Beutel & Ruhnau (1990) there is, so far, no evidence for the monophyly of this subgenus.

The Australian subgenera in their present context can be distinguished by the following characters:

1 — Pronotum with basal plicae (Fig. 3), right paramere of male without apical digitus (Fig. 14)..2
— Pronotum without basal plicae (Fig. 70), right paramere of male with apical digitus (Fig. 78)...*Liaphlus*
2 — Last abdominal sternite with medial ridge (Fig. 10, 22)...*Phalilus*
— Last abdominal sternite without medial ridge...*Neohaliplus*

After the examination of about 390 specimens, including types of all species except *Haliplus ferruginipes* Régimbart and *Haliplus bistriatus* Wehncke, I recognize the following species:

Haliplus oberthuri (*Phalilus*) Guignot, 1935b
Haliplus storeyi (*Phalilus*) **sp. n.**
Haliplus hydei (*Neohaliplus*) **sp. n.**
Haliplus fuscatus (*Neohaliplus*) Clark, 1862
Haliplus gibbus (*Neohaliplus*) Clark, 1862
Haliplus bistriatus (*Neohaliplus*) Wehncke, 1880
Haliplus australis (*Liaphlus*) Clark, 1862
Haliplus wattsi (*Liaphlus*) **sp.n.**
Haliplus testudo (*Liaphlus*) Clark, 1862
  Haliplus nigrolineatus Wehncke, 1883. **syn. n.**
Haliplus signatipennis (*Liaphlus*) Régimbart, 1891
Haliplus ferruginipes (*Liaphlus*) Régimbart, 1891
  Haliplus nicholasi Watts, 1988. **syn. n.**
Haliplus alastairi (*Liaphlus*) Watts, 1988
Haliplus timmsi (*Liaphlus*) **sp. n.**
Haliplus stepheni (*Liaphlus*) Watts, 1988
Haliplus sindus (*Liaphlus*) Watts, 1988

KEY TO THE SPECIES OF HALIPLIDAE OF THE AUSTRALIAN REGION AND THE MOLUCCAS

1 — Pronotal base usually with longitudinal plicae. Between plicae strongly impressed (Fig. 3). Prosternal process posteriorly strongly impressed in middle (Fig. 7)...2
— Pronotal base without longitudinal plicae (Fig. 70). Prosternal process not strongly impressed in middle (Fig. 74)...8
2 — Last abdominal sternite with strong longitudinal ridge or keel...3
— Last abdominal sternite without ridge or keel.......4
3 — Pronotal plicae absent or hardly recognizable (Fig. 15), base of pronotum strongly and coarsely punctured. Last sternite with clearly visible ridge in posterior half, which is hardly visible in lateral view (Figs 22, 23).........................*Haliplus storeyi*
— Pronotal plicae long and strongly bent (Fig. 3), base of pronotum moderately punctured. Last sternite with strong ridge, which is also clearly visible in lateral view................*Haliplus oberthuri*
4 — Pronotal plicae long, base of elytral puncture-row 5 strongly grooved...5
— Pronotal plicae short and straight, base of elytral puncture-row 5 at most slightly grooved..............6
5 — Pronotal basal plicae straight at base and anteriorly hardly curved. Pronotum basally and anteriorly at most vaguely darkened (Fig. 27). Elytron with vague, hardly interrupted, dark lines on primary puncture-rows. Metasternal process in middle with dense hairy punctures (Fig. 31). Male: protarsal claws clearly unequal in length (Fig. 30); left paramere without recognizable solid digitus and without hairs on apex (Fig. 34); penis narrow, tip slightly widened, inner side gradually curved to top (Fig. 35)..................................*Haliplus hydei*
— Pronotal basal plicae curved and strongly bent inwards before base. Pronotum distinctly darkened along base and along anterior edge (Fig. 57). Elytron with distinct interrupted dark lines on primary puncture-rows. Metasternal process in middle without dense hairy punctures (Fig. 61). Male: protarsal claws equal in length (Fig. 60); left paramere with solid digitus (sometimes wide and then not always clearly recognizable) with hairs on top (Fig. 64 or 67); penis wider in middle or nearly parallel, inner side abruptly bent before top (Fig. 65 or 68).........................*Haliplus bistriatus*
6 — Females.................*Haliplus fuscatus* or *H. gibbus*
— Males...7
7 — Penis very narrow (Fig. 45).........*Haliplus fuscatus*
— Penis broad (Fig. 55)....................*Haliplus gibbus*
8 — Pronotum with longitudinal dark mark in middle.9
— Pronotum with dark mark at most anteriorly......10
9 — Secondary punctures on elytron weak and sparse. Anterior elytral margin at most weakly serrate (Fig. 97). Specimens from New Guinea..*Haliplus signatipennis*
— Secondary punctures on elytron very strong and dense, almost as strong as primary punctures. Anterior elytral margin clearly serrate (Fig. 106). Specimens from Seram.......*Haliplus signatipennis*
10 — Uniformly yellow-brown. Pronotum with lateral margins serrate (Fig. 147). Prosternal process impressed in middle (Fig. 151).....*Haliplus sindus*
— Elytron usually with dark marks or stripes, but at least with darkened punctures. Pronotum with lateral margins not serrate. Prosternal process not impressed in middle...11

11 — Elytral puncture-row 5 basally ending in deep transverse impression (Fig. 118)......................12

— Elytral puncture-row 5 basally at most with few punctures standing close together or more or less confluent..14

12 — Elytron with dark band along base reaching to puncture-row 5 (Fig. 136). Pronotum with or without anterior dark mark (Fig. 136).................. ....*Haliplus stepheni*

— Elytral base at most with dark mark near puncture-row 4. Pronotum without marks.........13

13 — Metasternal process flat, at most with some strong punctures on both sides close to each other (Fig. 122). Elytron with secondary punctures near base of primary row 5 strong, basal punctures of primary row 6 strong. Elytron usually with well defined maculation (Fig. 118)...*Haliplus alastairi*

— Metasternal process with clear pit on both sides (Fig. 131). Elytron with secondary punctures near base of primary row 5 weak. Basal punctures of primary row 6 weak. Elytron usually with interrupted dark lines, which are rarely connected by vague marks (Fig. 127)...........*Haliplus timmsi*

14 — Elytron with extensive maculation, base broadly darkened to puncture-row 5 (Fig. 112)................. ....*Haliplus ferruginipes*

— Elytron without extensive maculation, base not distinctly darkened..15

15 — Proepisternum strongly and densely, sometimes even coarsely punctured. Prosternal process usually slightly but gradually widening anteriorly, not clearly narrowed before coxae (Fig. 83). Last sternite with strong punctures on most of its surface. Male: left paramere with small solid digitus (Fig. 85)............................*Haliplus wattsi*

— Proepisternum at most weakly punctured in anterior part. Prosternal process slightly narrowed before coxae, more or less sinuate, anteriorly about as wide as posteriorly. Last sternite with moderately strong to weak punctures on about apical half...16

16 — Elytron usually without dark stripes on primary puncture-rows, only punctures darkened (Fig. 70). Row of secondary punctures along suture very dense and in irregular row, elytral interval 2 with complete row of secondary punctures, interval 4 with sparser puncture-row. Metasternal process with lateral rows of strong punctures, which usually lie in slight impression (Fig. 74). Male: left paramere with small solid digitus (Fig. 76)..*Haliplus australis*

— Elytron with continuous or hardly interrupted dark stripes on primary puncture-rows (Fig. 88). Row of secondary punctures along suture dense and in regular row, interval 2 with about 6–12 punctures and interval 4+6 only anteriorly with a few punctures. Metasternal process with clear lateral impressions (Fig. 92). Male: left paramere without solid digitus (Fig. 94).....*Haliplus testudo*

DESCRIPTION OF SPECIES

Haliplus oberthuri Guignot
(Figs 3–14)

Haliplus oberthuri Guignot, 1935a: 165. Lectotype ♂ (here designated) 'N. Caled.; TYPE; Det. Dr Guignot, *Haliplus* sg. *Phalilus oberthuri* Guign., type; *bistriatus* Fauvel' [Marais de l'anse Vata près Nouméa] (MNHN)[examined]

Haliplus bistriatus; sensu Fauvel 1883: 335, nec Wehncke 1880. [Misidentification]

Haliplus bistriatus; Guignot 1935a: 36, 1935b: 164; Watts 1988: 25.

Haliplus oberthuri; Guignot 1955: 290.

Diagnosis

This species is easy to distinguish from other species with pronotal plicae by the strong ridge on last sternite.

Description

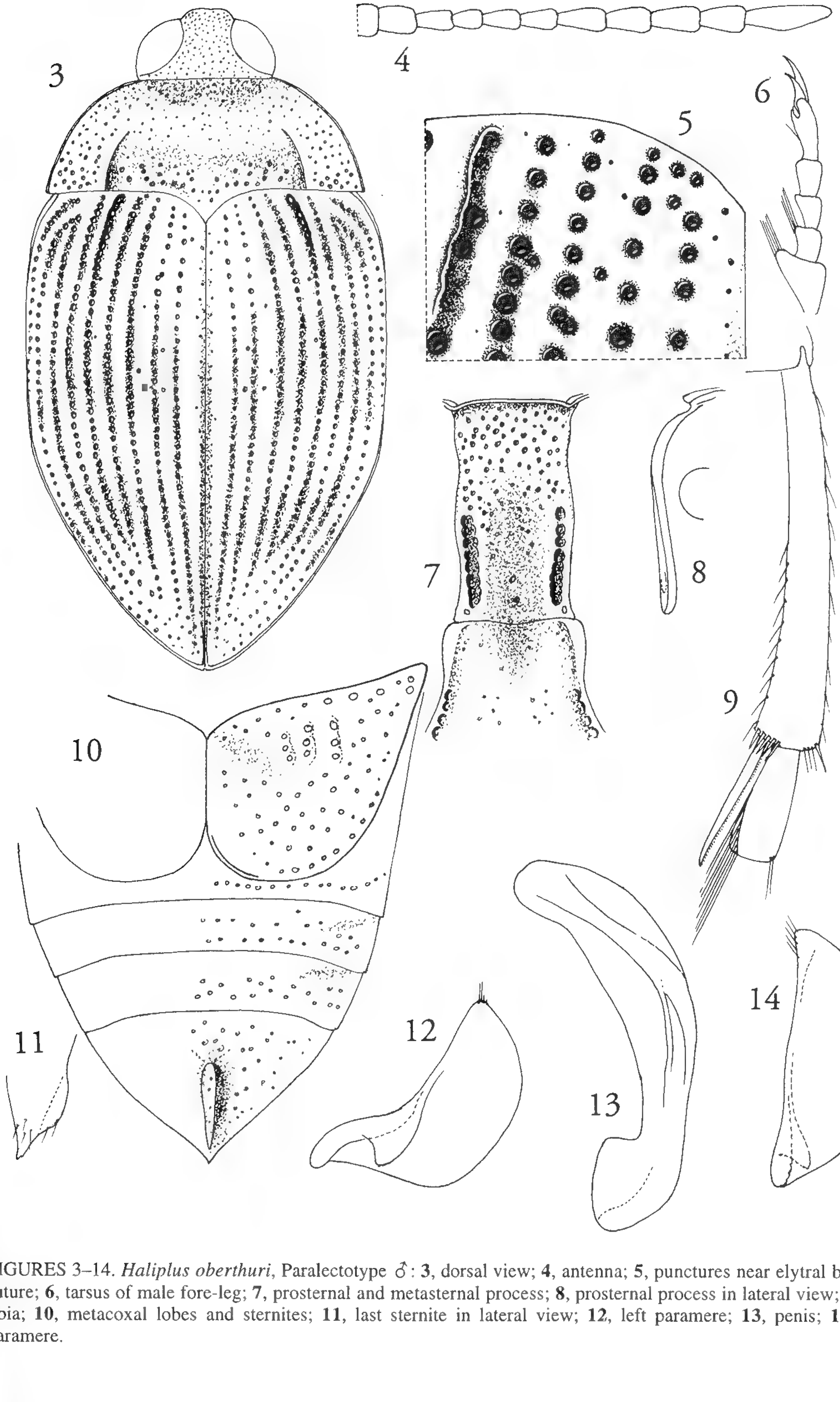
Length 3.0–3.3 mm, width 1.6–1.9 mm. Body broad, parallel in middle (Fig. 3).

Head: Yellow-red, antenna yellow (Fig. 4), palpi yellow, maxillary palpus with last segment more than half length of penultimate segment. Punctation anteriorly dense, sparser on vertex. Distance between eyes 1.2x width of one eye.

Pronotum: Yellow-red, dark blotch along anterior margin. Lateral border strongly convex, finely margined, front corners strongly bent downwards. Base wider than base of elytra, long curved plicae at base reaching over half length of pronotum, strongly impressed between plicae. Punctation on disc dense, strong basally (Fig. 3).

Elytra: Yellow-red, dark lines on primary puncture-rows 1+2 interrupted between dark punctures in basal part, on rows 3–7 continous, on rows 8+9 widely interrupted (Fig. 3). Primary punctures except in basal part of row 1+2 very dense and strong. About 45 punctures in row 1. Basal 6–10 punctures of row 5 confluent, forming clear plica. Secondary punctures very sparse and usually very small. All punctures darkened except in unstriped parts of outer rows. Suture apically briefly margined. Laterally completely margined, margin in middle hidden from above.

Underside: Body yellow-red; legs yellow-red, darkened towards coxae; elytral epipleura yellow, reaching sternite 5, strongly punctured in anterior and posterior part. Prosternal process wide and irregularly parallel-sided, strongly impressed in



FIGURES 3–14. *Haliplus oberthuri*, Paralectotype ♂: **3**, dorsal view; **4**, antenna; **5**, punctures near elytral base and suture; **6**, tarsus of male fore-leg; **7**, prosternal and metasternal process; **8**, prosternal process in lateral view; **9**, hind tibia; **10**, metacoxal lobes and sternites; **11**, last sternite in lateral view; **12**, left paramere; **13**, penis; **14**, right paramere.

apical half, strong punctured grooves on marginal ridges, densely and strongly punctured on anterior half, clearly margined on anterior edge (Fig. 7, 8). Metasternal process with lateral ridges, formed by row of strong punctures, strongly impressed towards apical part, very sparsely and weakly punctured (Fig. 7). Metacoxal lobes widely rounded at apical part, finely margined on apical corner, punctures fairly strong and dense, in central part some coarse punctures (Fig.10). Punctures on sternite 5+6 not forming clear row, last sternite with strong ridge in middle (Fig.10, 11). Hind tibia without setiferous striole, longer tibial spur clearly longer than first tarsal segment (Fig. 9).

Male: Pro- and mesotarsomeres 1–3 widened, tarsomere 1 more dilated ventrally, only tarsomeres 1+2 with sucker hairs on ventral side. Protarsal claws unequal in length (Fig. 6), mesotarsal claws slightly unequal in length. Penis and parameres as in Figs 12–14.

Biology

The type material is found in a marsh (Fauvel 1883: 335).

Distribution (Fig. 153)

New Caledonia. Australia: Queensland. The specimen I have seen labelled 'New Zealand, N. Cal.' is obviously mislabelled.

Material examined: New Caledonia: 1 ♂, lectotype; 1 ♂, N.elle Caledonie, Noumea, ex coll. Gambey, R. Oberthur ded., paratype, *Haliplus* (*Phalilus*) *oberthuri* Guignot (MNHN); 1 ♂, Coll. E. Witte, Australien; 1 ♂, Coll. E. Witte, *bistriatus*, N. Cal., N. Seeland [obviously mislabelled](SMFD). Australia: 1 ♀, Yungaburra, Q., Atherton Tab., Harvard Exp. Darlington, *Haliplus stepheni* ms.nom, det. C. Watts (MCZC); 1 ♂, Bne [Brisbane], *H. fuscatus* Clark, *Haliplus stepheni ms.nom*, det. C. Watts 84 (CV); 1 ♂, unlabelled (QMBA).

***Haliplus storeyi* sp.n.**

(Figs 15–26)

Type material: ♂ Holotype: Australia, N.T., 6 km E. Humpty Doo, 9.ii–4.iii.1987, R. I. Storey, *Haliplus bistriatus* Wehncke, det. C. Watts 87, T.12700 (QMBA); Paratypes: 5 ♀, same data as holotype (3 in QPI, 2 in CV).

Diagnosis

This species differs from other species with pronotal plicae by the ridge on last sternite and from *H. oberthuri* by the faintly impressed pronotal plicae and its smaller size.

Description

Length 2.4–2.5 mm, width 1.2–1.3 mm. Body broad, parallel in middle (Fig. 15).

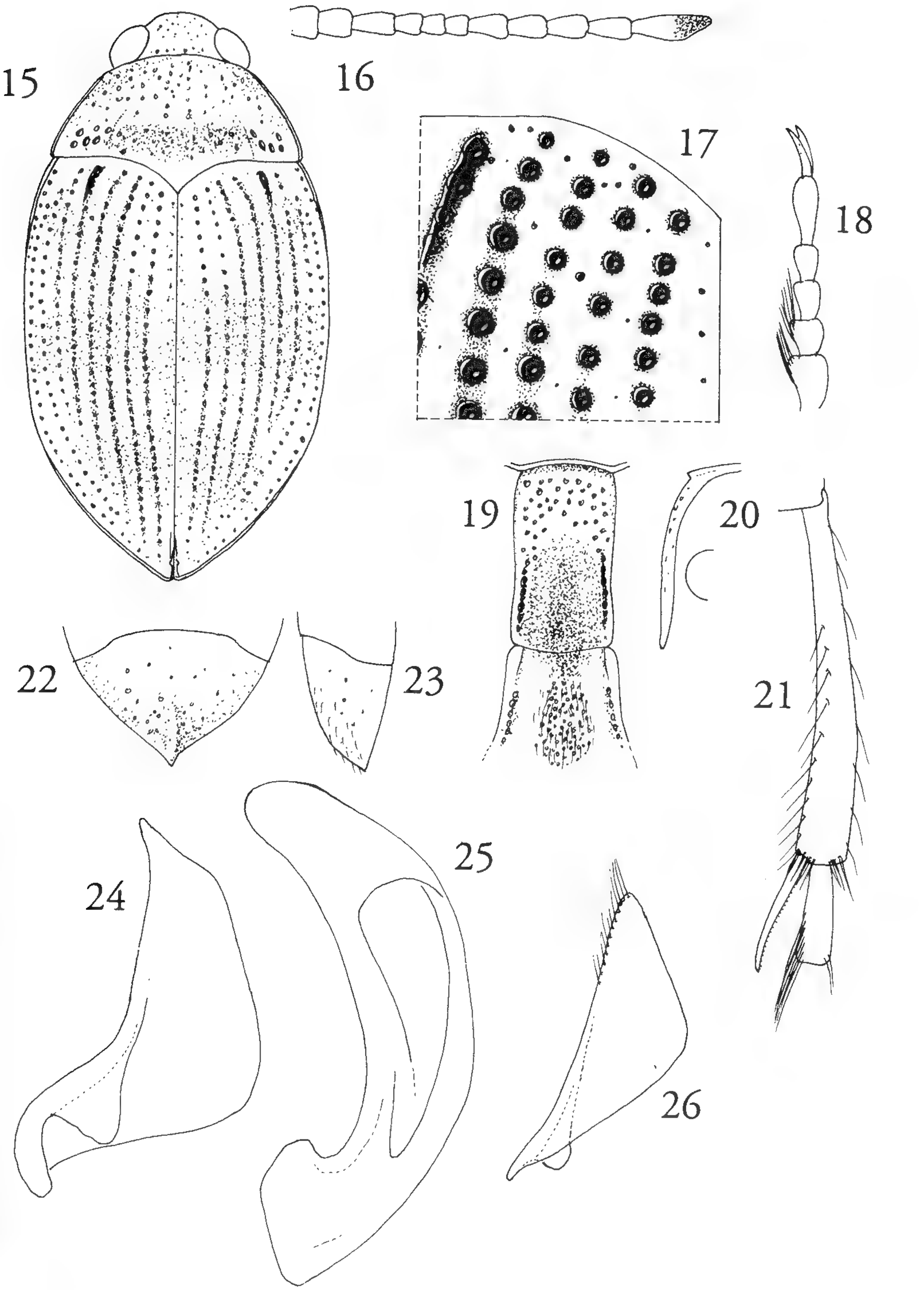
Head: Yellow-red, weakly punctured. Antenna yellow, distal half of last segment darkened (Fig. 16), palpi yellow, maxillary palpus with last segment about half length of penultimate segment. Distance between eyes 1.5x width of one eye.

Pronotum: Yellow-red to yellow-brown. Lateral borders strongly convex, finely margined, front corners strongly bent downwards, hind corners rectangular to slightly rounded. Long plicae at base hardly visible or usually absent. Strongly impressed along base. Moderately strongly, along base strongly, densely and in hind corners coarsely punctured (Fig. 15).

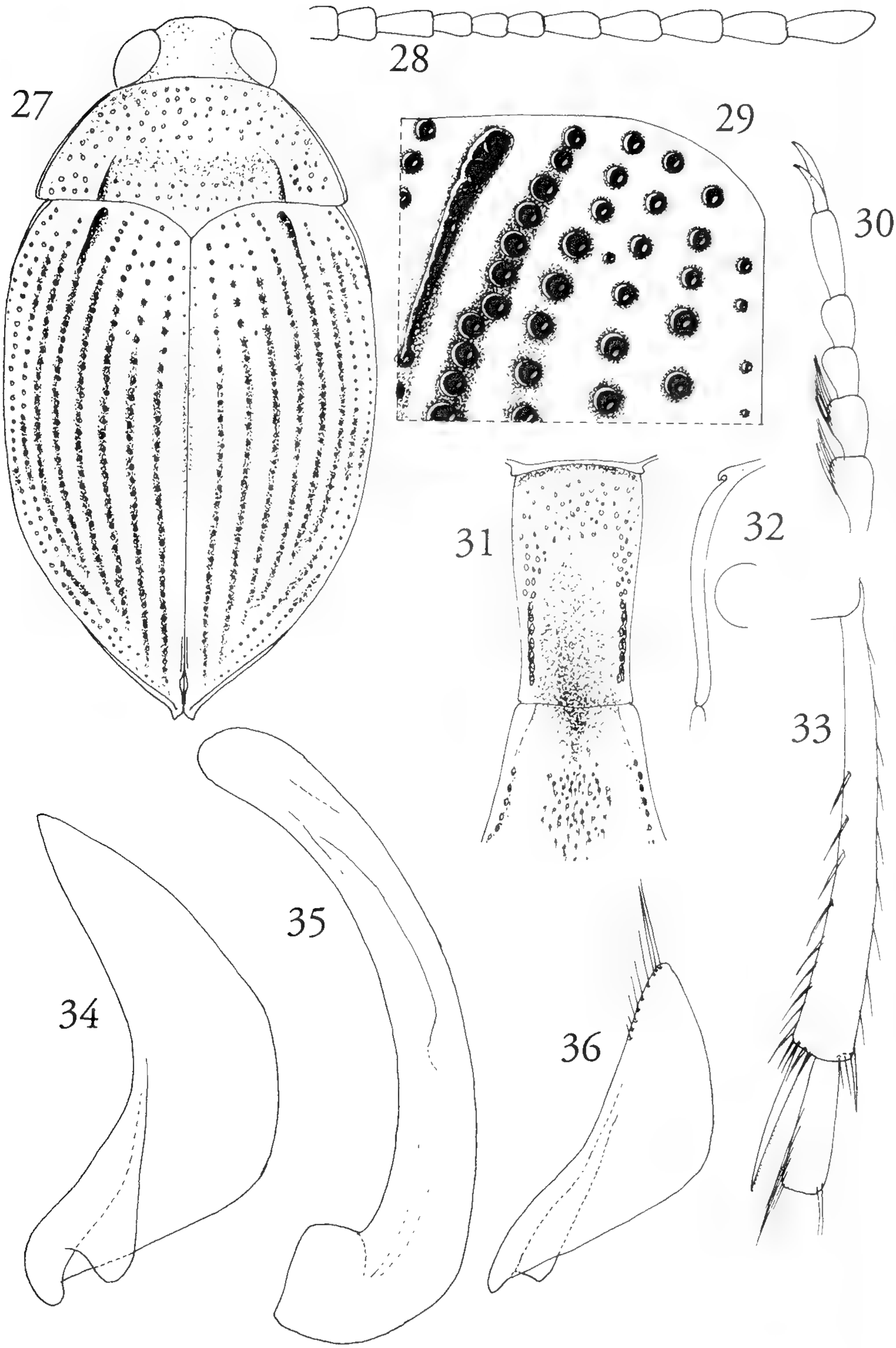
Elytra: Yellow-red to yellow-brown, vague transverse maculation in middle and in apical part (Fig. 15). Primary punctures strong and moderately dense. About 29 punctures in row 1. Basal 6–7 punctures of row 5 confluent, forming clear plica. Secondary punctures sparse and usually very small along suture, almost absent on intervals. All punctures darkened except in parts of outer rows. Apical part of suture shortly margined and with blunt dorsal tooth. Completely margined, margin in middle invisible from above.

Underside: Body yellow-brown to brown, elytral epipleura yellow-brown, reaching sternite 5, with strong puncture-row in posterior part and two strong rows in anterior part. Legs yellow-red to yellow-brown, slightly darkened towards coxae. Prosternal process wide and parallel-sided, strongly impressed in apical half, strong punctured grooves on marginal ridges, densely and strongly punctured on anterior half, clearly margined on anterior edge (Figs 19, 20). Metasternal process with lateral ridges, formed by row of strong punctures, only impressed anteriorly, very densely punctured and hairy in middle (Fig. 19). Metacoxal plates not reaching sternite 5, widely rounded at apical part, clearly margined along posterior edge, punctures fairly strong. Fine punctures on sternite 5+6 not forming clear row, last sternite with keel in apical half, strongly punctured (Figs 22, 23). Setiferous striole on dorsal face of hind tibia on about half length, longer tibial spur longer than first tarsal segment (Fig. 21).

Male: Pro- and mesotarsomeres 1–3 widened, tarsomere 1 more dilated ventrally, only



FIGURES 15–26. *Haliplus storeyi*, Holotype ♂: **15**, dorsal view; **16**, antenna; **17**, punctures near elytral base and suture; **18**, tarsus of male fore-leg; **19**, prosternal and metasternal process; **20**, prosternal process in lateral view; **21**, hind tibia; **22**, last sternite; **23**, last sternite in lateral view; **24**, left paramere; **25**, penis; **26**, right paramere.



FIGURES 27–36. *Haliplus hydei.*, Holotype ♂; **27**, dorsal view; **28**, antenna; **29**, punctures near elytral base and suture; **30**, tarsus of male fore-leg; **31**, prosternal and metasternal process; **32**, prosternal process in lateral view; **33**, hind tibia; **34**, left paramere; **35**, penis; **36**, right paramere.

tarsomeres 1+2 with sucker hairs on ventral side. Protarsal claws equal in length (Fig. 18). Penis and parameres as in Figs 24–26.

Biology

Unknown

Distribution (Fig. 155)

Only known from Humpty Doo, Northern Territory, Australia.

Haliplus hydei **sp.n.**

(Fig. 27–36)

Type-material: Holotype ♂: Cardstone, Qld, 17–23.ii.1966, K. Hyde, *Haliplus bistriatus* Wehncke det. Watts, ANIC No. 111 (ANIC). Paratypes: 10 ♂, 11 ♀, Same data as holotype (17 in ANIC, 4 in CV); 1 ♂, Cardstone, 32 km S. of Ravenshoe, Q, 17.38S, 145.29E, 14.ii.1968, K. Hyde (ANIC); 3 ♂, 1 ♀, Australia, N. Qld, Pinnarendi Stn, 60 km W. of Mt Garnet, 7.ii.1989, D. Heiner (3 in QPI, 1 in CV).

Diagnosis

This species can be distinguished from *H. bistriatus*, *H. fuscatus* and *H. gibbus* by the pronotal plicae, being long and straight at base and male with clearly unequal protarsal claws.

Description

Length 2.7–3.0 mm, width 1.4–1.6 mm. Body oval, parallel to subparallel in middle (Fig. 27).

Head: Yellow-red to yellow-brown, weakly punctured. Antenna yellow (Fig. 28). Palpi yellow to yellow-brown. Distance between eyes about 1.2–1.6x width of one eye.

Pronotum: Yellow to yellow-brown, strongly impressed base between long, curved to almost straight plicae (Fig. 27). Lateral borders finely margined, hind corners rectangular to slightly rounded. Anterior half densely punctured; front and hind corners strongly punctured; basal depression weakly punctured.

Elytra: Yellow-brown to yellow-red. Vague dark hardly interrupted stripes on primary puncture-rows, slightly darkened along middle part of suture. Primary punctures dense and moderately strong, about 40 punctures in row 1. Basal 6–8 punctures of row 5 in clear longitudinal impression (Fig. 29). Puncture-row 7+8 not reaching base, but united just behind base. All punctures darkened except parts of row 8+9. Sparse secondary puncture-row along suture. At most some single secondary punctures on intervals. Central base flat to weakly impressed. Completely margined, margin in middle invisible from above.

Underside: Yellow to yellow-red, slightly darker on prosternal and metasternal process. Legs yellow to yellow-red, slightly darkened towards coxae. Elytral epipleura yellow, reaching to middle of sternite 5, with uncoloured punctures, strong dense puncture-row on narrowed posterior part. Prosternum anteriorly clearly margined. Prosternal process nearly parallel, anteriorly wider than posteriorly, in middle strongly impressed in posterior 2/3, anterior edge strongly margined, lateral ridges with groove formed by row of coarse punctures, anterior part densely and coarsely punctured, in posterior impression unpunctured (Figs 31, 32). Metasternal process diverging posteriorly, anteriorly impressed in middle, weakly to moderately strongly punctured, in middle usually slightly hairy, laterally with fine plicae formed by punctures (Fig. 31). Metacoxal lobes not reaching sternite 5, weakly and sparsely punctured near suture, stronger and denser punctured in lateral part. Sternite 4–6 with posterior irregular puncture-row. Last sternite especially on apex stronger punctured. Metatibia without setiferous striole on dorsal face, but posteriorly with kind of fine ridge on inner side, longer tibial spur about as long as first tarsal segment (Fig. 33).

Male: Pro- and mesotarsomeres 1–3 widened, tarsomere 1 more dilated ventrally, only tarsomeres 1+2 with sucker hairs on ventral side. Protarsal claws clearly unequal in length (Fig. 30). Penis and parameres as in Figs 34–36.

Biology

Unknown.

Distribution (Fig. 155).

Only known from North East Queensland.

Haliplus fuscatus Clark

(Figs 37–46)

Haliplus fuscatus Clark, 1862: 401. Holotype ♀, no data [Clark gives Adelaide as locality] (BMNH) [examined].

Haliplus fuscatus; Zimmermann 1920: 308; 1924: 141; Watts 1985: 27, 1988: 27; Lawrence *et al.* 1987: 322.

Remarks

I failed to find reliable characters to distinguish between females of *H. fuscatus* and *H. gibbus*. As the holotype of *H. fuscatus* is a ♀, I am not sure whether I have correctly associated it with males which are treated here as *H. fuscatus*.

Both species have more or less the same distribution. It is distinctly possible that the holotype of *H.fuscatus* and the lectotype of *H.gibbus* are conspecific, in which case at least the ♂ specimens here treated as *H. fuscatus* should belong to an undescribed species.

Diagnosis

This species is closely related to *H. gibbus* as evidenced by general similarity, although the male has a different penis, which is very narrow in *H. fuscatus*.

Description

Length 2.4–3.2 mm, width 1.2–1.8 mm. Body oval, but parallel to subparallel in middle (Fig. 37).

Head: Yellow-brown to brown-red, sparsely punctured. Antenna yellow, last segment slightly darker (Fig. 38). Palpi yellow to yellow-brown. Distance between eyes about 1.3x width of one eye.

Pronotum: Yellow-brown to brown-red, basally strongly impressed and vaguely darkened between short straight plicae, anteriorly with vague transverse mark. Lateral borders finely margined, hind corners rounded (Fig. 37). Strongly and moderately densely punctured, in basal depression only few sparse punctures.

Elytra: Yellow-brown to brown-red. Vague markings on primary puncture-rows, along suture and usually on intervals in posterior half and along base to puncture-row 4 (Fig. 37). Primary punctures dense and moderately strong, 25–35 punctures in row 1. Basal 4–5 punctures of row 5 not in clear longitudinal impression, but at most a little confluent (Fig. 39). Puncture-row 7+8 not reaching base, but united just behind base. All punctures darkened except parts of row 8+9. Stria (sometimes vague) along anterior 1/3 and posterior 1/5 of suture. Fine secondary punctures along suture and usually very fine punctures on most of intervals. Surface with very fine, hard to recognize micropunctuation in both sexes. Body outline in posterior half a little bulbous and there margin not visible from above. Central base weakly impressed. Completely margined.

Underside: Brown-red, darker on prosternal and metasternal process. Legs yellow-brown, slightly darkened towards coxae. Elytral epipleura yellow, reaching to middle of sternite 5, with uncoloured punctures, only a few punctures on narrowed posterior part, two puncture-rows on anterior part weak and about equal in strength. Prosternum anteriorly clearly margined. Prosternal process parallel, in middle strongly impressed in posterior 3/4, curved anterior edge strongly margined, laterally with narrow groove formed by row of coarse punctures, weakly punctured (Fig. 41, 42). Metasternal process diverging posteriorly, anteriorly impressed in middle, weakly punctured, laterally with fine plicae formed by punctures (Fig. 41). Metacoxal lobes not reaching sternite 5, weakly and sparsely punctured near suture, a little stronger punctured in lateral part. Sternite 4–6 posteriorly with very fine irregular puncture-rows. Last sternite weakly punctured. Metatibia without setiferous striole on dorsal face, longer tibial spur about as long as first tarsal segment.

Male: Pro- and mesotarsomeres 1–3 widened, tarsomere 1 more dilated ventrally, only tarsomeres 1+2 with sucker hairs on ventral side. Protarsal claws equal in length (Fig. 40). Metatarsal claws short and strongly bent. Penis and parameres as in Figs 44–46.

Female: Metatarsal claws long and almost straight.

Biology

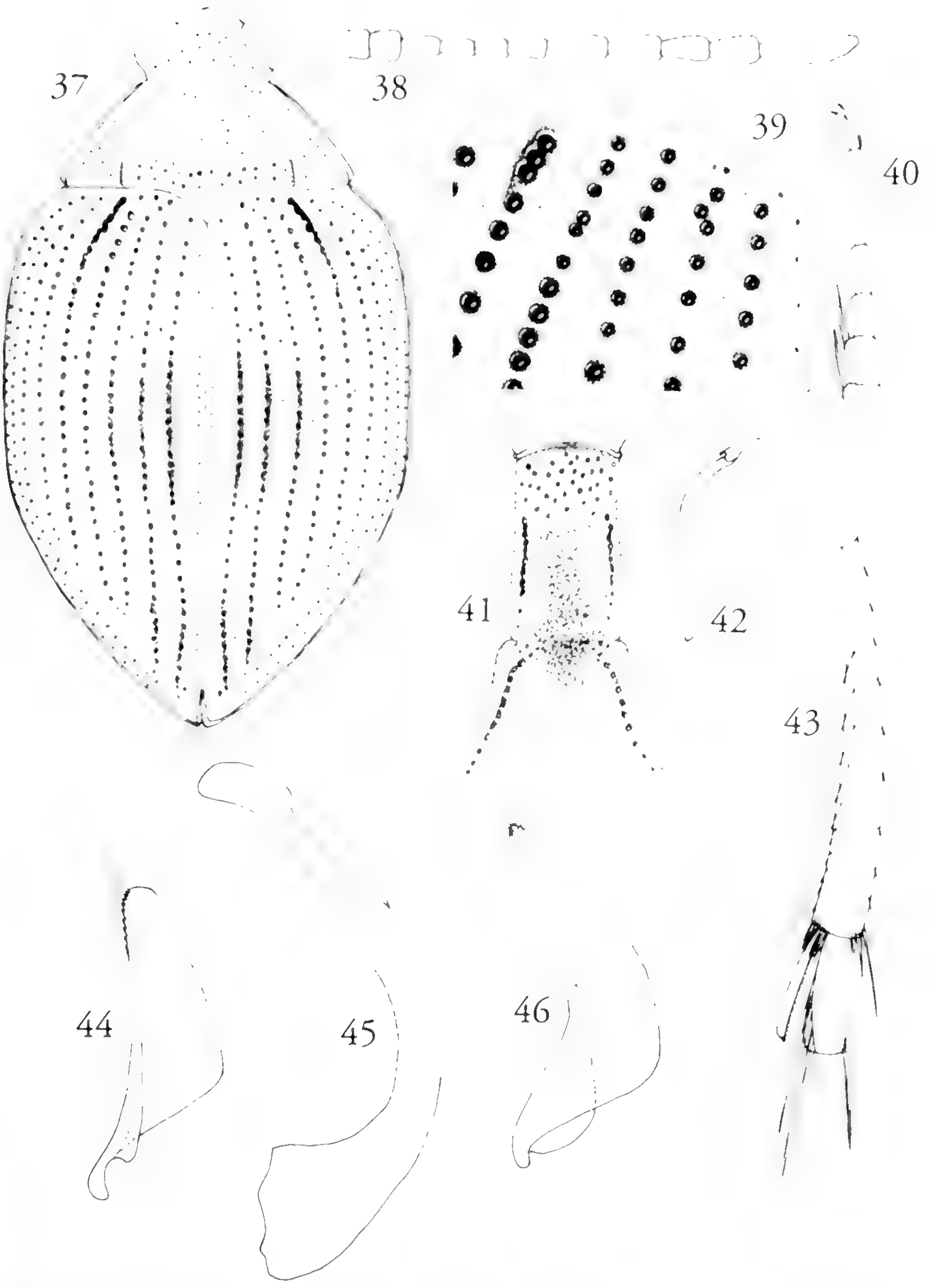
This species occurs in swamps, temporary ponds, rivers and lakes. A specimen was found in a trout stomach. It is attracted to light.

Distribution (Fig. 157)

West Australia, South Australia, Victoria, New South Wales ?(no males known), Queensland.

Material examined (identification based on ♂): Australia: West Australia: 1 ♂, 1 ♀, Bickley Swp, Rottnest Isl., x.1959, D.E. (CW, SAMA); 1 ♂, 1 ♀, Bulldozen, Rottnest Isl., W.A., x.1958, D.E. (CW); 1 ♂, Rottnest Isl., Salmon Swp, x.1958, D.E.; 1 ♀, Rottnest Isl., Barkers Swp, x.1959., D.E. (SAMA); 1 ♀, W.A., Rottnest Isl, x.1931, Harvard Expedition Darlington (MCZC); South Australia: holotype ♀ (BMNH); Victoria: 1 ♂, 5 ♀, Vic. Eildon Weir, ix.1943, F. E. Wilson (5 in MVMA, 1 in CV); 1 ♂, Wyperfield Nat. Park, Lowan Track, 35.35S, 142.05E, light trap, 16.xi.1973. S. Misko, *Haliplus fuscatus* Clark det. T. A. Weir 1987 (ANIC); Queensland: 1 ♂, 4 ♀, C. Qld, L. Galilee, 20.i.1983, Timms (SAMA).

Females of *H. fuscatus* or *H. gibbus* : Australia: South Australia: 1 ♀, Parra Wirra, ix.1969, C.W. (SAMA); Victoria: 1 ♀, Eilham, C. Oke; 1 ♀, Birchip; 2 ♀, Carrum, 29.xii.1920, C. Oke; 1 ♀, Coliban R., Trentham, F. E. Wilson; 1 ♀, E.



FIGURES 37–46. *Haliplus fuscatus*. **37**, Holotype ♀; **38–46**, ♂, Rottnest Island: **37**, dorsal view; **38**, antenna; **39**, punctures near elytral base and suture; **40**, tarsus of male fore-leg; **41**, prosternal and metasternal process; **42**, prosternal process in lateral view; **43**, hind tibia; **44**, left paramere; **45**, penis; **46**, right paramere.

Moorabool R., 4 km W. Ballan, 10.vi.1976, Neboiss; 1 ♀, Howitt coll.; 1 ♀, Clarkfield, 1.ix.1-937, F. E. Wilson (MVMA); 1 ♀, Clarkfield, 4.xi.1941, A. D. Butcher, ex trout stomach (CV); 1 ♀, Dimboola, 36.27S, 142.02E, 22.x.1983, J. C. Cardale, at light (ANIC); 1 ♀, Ringwood, *Haliplus gibbus* Clark, *Haliplus fuscatus* det. C. Watts 84; 1 ♀, *Haliplus gibbus* Clk, Howitt Coll. (MVMA); New South Wales: 1 ♀, Forest Reefs (MCZC); 1 ♀, Bogan R., J. Armstrong (SAMA); 1 ♀, Willanora Bridge, 11 km N. of Mossgiel, 33.16S, 144.34E, dry swamp, 21.xii.1970, at light, Britton, Misko & Pullen (ANIC); 1 ♀, Barrenbox Swamp, interior N.S.W., 24.x.1979, Fields (ZMUC); Federal state unknown: 1 ♀, Sandham, x.1935 (ANIC);

Haliplus gibbus Clark
(Figs 47–56)

Haliplus gibbus Clark, 1862: 400. Lectotype ♂ (designated by Watts, 1988), 'S. Aust., Bakewell 59/24' (BMNH)[examined].

Haliplus gibbus; Zimmermann 1920: 308; 1924: 142; Watts 1985: 27, 1988: 26; Lawrence *et al.* 1987: 322.

Remarks

See remarks under *H. fuscatus*.

Diagnosis

This species closely resembles *H. fuscatus*, from which the male can be distinguished by the penis, which is broader in *H. gibbus*. I am not able to distinguish the females.

Description

Length 2.4–3.2 mm, width 1.2–1.6 mm. Body oval, but parallel to subparallel in middle (Fig. 47).

Head: Yellow to yellow-brown or yellow-red, sparsely punctured. Antenna yellow, last segment darker (Fig. 48). Palpi yellow to yellow-brown. Distance between eyes about 1.3x width of one eye.

Pronotum: Yellow to yellow-brown, strongly impressed base slightly darkened between straight plicae, which are 1/4 to 1/3 of length of pronotum, anteriorly usually slightly darkened. Lateral fine margins narrowed anteriorly, hind corners rounded. Anterior half densely punctured, front and hind corners coarsely punctured, in basal depression row of strong punctures (Fig. 47).

Elytra: Yellow-brown to yellow-red. Dark marks on parts of primary puncture-rows, along suture and along base to puncture-row 5 and on intervals. Primary punctures dense and moderately strong, about 30 punctures in row 1. Basal 3–4 punctures of row 5 in weak longitudinal impression (Fig. 49). Puncture-row 7+8 not reaching base, but united just behind base. All punctures darkened except parts of row 8+9. Stria along apical part of suture, sparse row of weak secondary punctures along suture. No discernible secondary punctures on intervals, except a few large ones. Central base flat to weakly impressed. Completely margined.

Underside: Yellow to yellow-red, slightly darker on prosternal and metasternal process. Legs yellow to yellow-red, slightly darkened towards coxae. Elytral epipleura yellow, reaching to middle of sternite 5, with uncoloured punctures. Prosternum anteriorly clearly margined. Prosternal process parallel, in middle strongly impressed in posterior 2/3, anterior edge strongly margined, laterally with groove formed by row of coarse punctures, anterior part densely and coarsely punctured, in posterior impression only weakly punctured (Fig. 49). Metasternal process diverging posteriorly, anteriorly impressed in middle, moderately strongly punctured, laterally with plicae formed by punctures (Figs 51, 52). Metacoxal lobes not reaching sternite 5, weakly and sparsely punctured near suture, stronger and denser punctured in lateral part. Sternite 4–6 at most with a few very fine punctures. Last sternite with only a few very fine punctures, very short fine keel on apical point. Metatibia without setiferous striole on dorsal face, longer tibial spur about as long as first tarsal segment (Fig. 53).

Male: Pro- and mesotarsomeres 1–3 widened, tarsomere 1 more dilated ventrally, only tarsomeres 1+2 with sucker hairs on ventral side. Protarsal claws equal in length (Fig. 50), metatarsal claws short and strongly curved. Penis and parameres as in Figs 54–56.

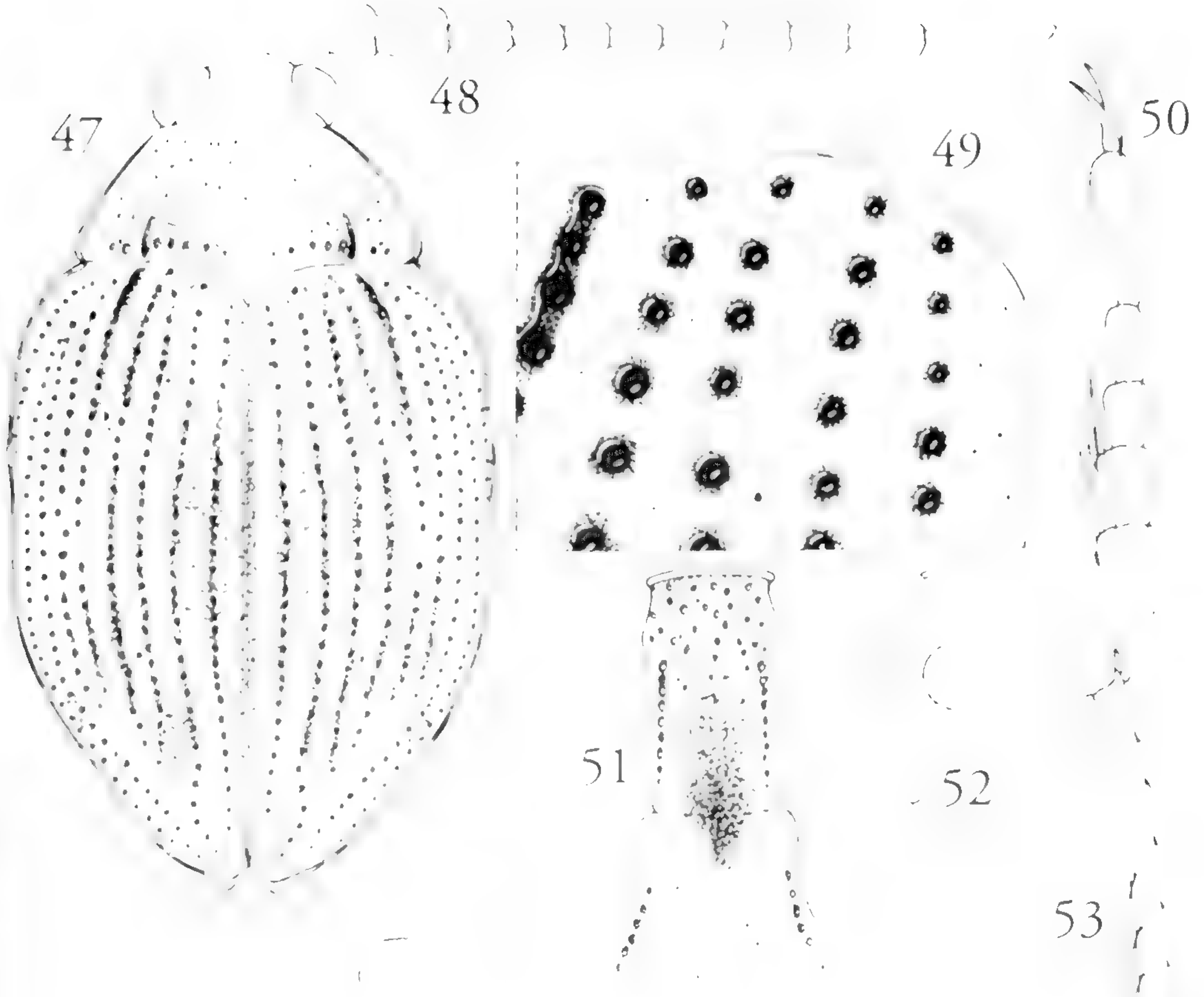
Female: Metatarsal claws long and hardly curved.

Biology

This species occurs in swamps, temporary ponds and rivers and has been collected from submerged vegetation at the margin of slow moving streams (Watts, pers. comm.).

Distribution (Fig. 158)

Western Australia, South Australia, Victoria, Tasmania, New South Wales ? (no males known from this state).



FIGURES 47–56. *Haliplus gibbus*, Lectotype ♂: **47** dorsal view, **48**, antenna, **49**, punctures near elytral base and suture; **50**, tarsus of male fore-leg, **51**, prosternal and metasternal process, **52**, prosternal process in lateral view; **53**, hind tibia, **54**, left paramere; **55**, penis; **56**, right paramere.

Material examined (identification based on ♂): Australia: West Australia: 1 ♂, Armadale, vii.1960. D.E. (SAMA); 2 ♂, 1 ♀, Picton Junction, Swamp near Ferguson R., 30.xi.1965, Britton & Uther Baker (2 in ANIC, 1 in CV); 1 ♂, 7 km E. of Wuranga, xi.1981, K. & E. Carnaby (ANIC); 1 ♂, Bridgetown, 8.xi.1931, Australia Harvard Expedition, Darlington (MCZC); South Australia: lectotype ♂ (BMNH); 2 ♂, 2 ♀, Williamstown, ix.1961. C. Watts (SAMA); Victoria: 2 ♂, E. Pomborneit, 24 km ESE Camperdown, temporary pond, viii.1978–ii.1979, P. S. Lake (ANIC); 1 ♂, 1 ♀, E. Vic., Yarra Riv., Warburton, F. E. Wilson; 2 ♂, 1 ♀, Newhill Res., x.1945, F. E. Wilson (MVMA); Tasmania: 1 ♂, 2 ♀, Launceston, 8.vi.1948 (ANIC); 1 ♂, Launceston (QMBA); 2 ♂, Launceston; 1 ♂, 3 ♀ (MVMA); 1 ♂, 1 ♀, Launceston (ISNB); Federal state unknown: 3 ♀ syntypes (BMNH); 4 ♂ [no locality] (MVMA); 1 ♂, 1 ♀, Sandham, Goudie [?], x.1935 (MVMA, CV).

Haliplus bistriatus Wehncke
(Figs 57–69)

Haliplus bistriatus Wehncke, 1880: 75. Type-material: Not located. In the Wehncke collection in MNHN one ♂ is present originating from Brisbane. In the description, however, Adelaide is mentioned as type-locality.

Haliplus bistriatus sensu Fauvel 1883, nec Wehncke 1880. [Misidentification].

Haliplus bistriatus; Fauvel 1883: 335; Zimmermann 1920: 304; 1924: 71; Guignot 1935a: 36; 1935b: 164; Watts 1985: 27, 1988: 25; Lawrence *et al.* 1987: 322.

Diagnosis

This species can be distinguished from *H. fuscatus* and *H. gibbus* by the long curved pronotal plicae, from *H. hydei* by the basally curved pronotal plicae and the metasternal process not covered with dense hairy punctures and from *H. oberthuri* and *H. storeyi* by the smooth last sternite. Most males can be distinguished from those of related species by the solid digitus on top of the left paramere.

Description

Length 2.5–3.4 mm, width 1.2–1.6 mm. Body oval, parallel to subparallel in middle (Fig. 57).

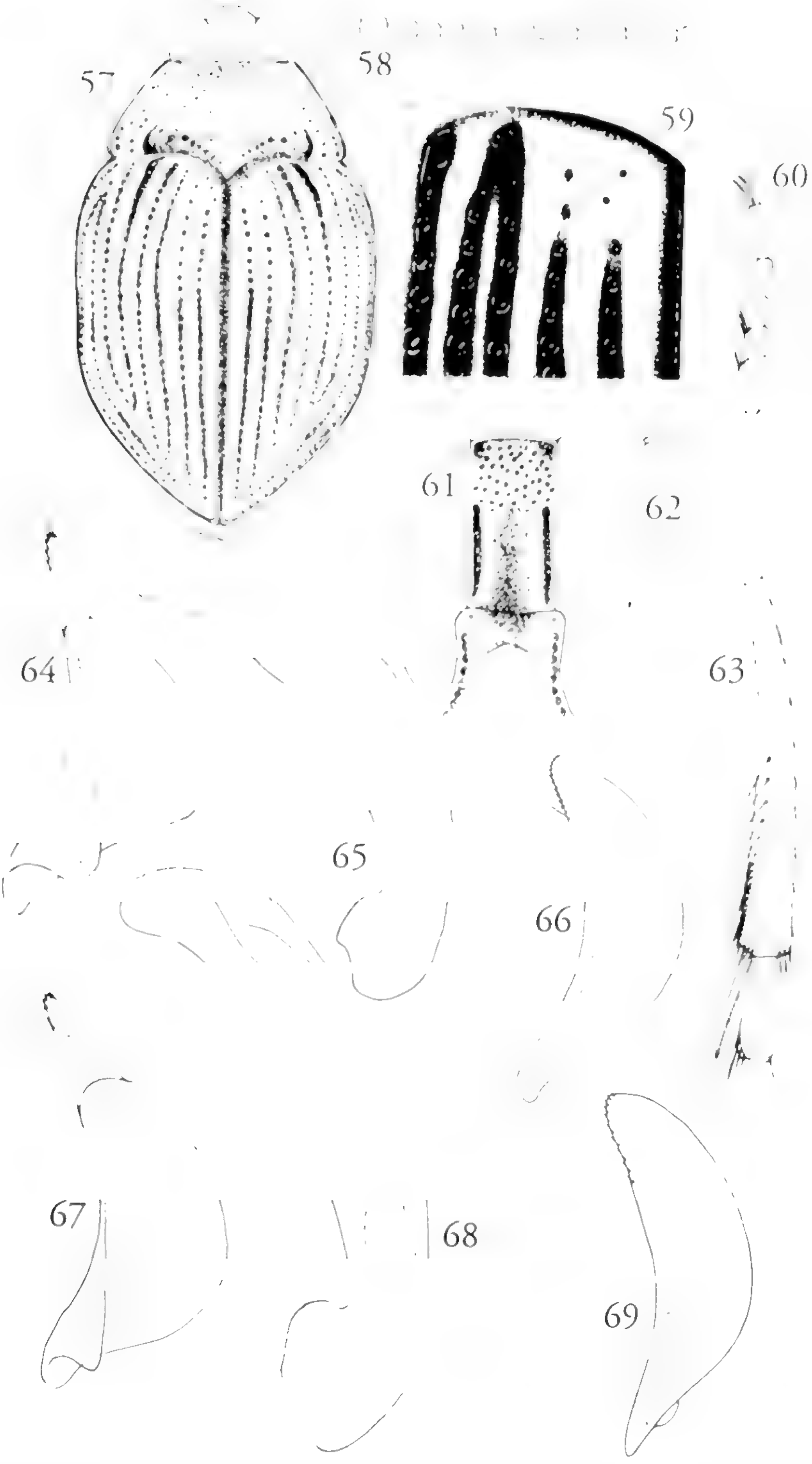
Head: Yellow to yellow-brown or yellow-red, sparsely punctured. Antenna yellow, last segment darker (Fig. 58). Palpi yellow to yellow-brown. Distance between eyes about 1.2x width of one eye.

Pronotum: Yellow to yellow-brown, strongly impressed base narrowly darkened between long curved plicae, anteriorly with dark central mark. Lateral borders finely margined, hind corners rounded. Anterior half densely punctured, front and hind corners coarsely punctured, in basal depression only a few sparse punctures (Fig. 57).

Elytra: Yellow-brown to yellow-red. Dark interrupted stripes on primary puncture-rows, darkened along suture and along base to puncture-row 5. Primary punctures dense and moderately strong, about 35 punctures in row 1. Basal 6–8 punctures of row 5 in clear longitudinal impression. Puncture-row 7+8 not reaching base, but united just behind base. All punctures darkened except parts of row 8+9. Stria along anterior 1/3 and posterior 1/5 of suture. No discernible secondary punctures on intervals. Central base flat to weakly impressed. Completely margined.

Underside: Yellow to yellow-red, slightly darker on prosternal and metasternal process. Legs yellow to yellow-red, slightly darkened towards coxae. Elytral epipleura yellow, reaching to middle of sternite 5, with uncoloured punctures, strong dense puncture-row on narrowed posterior part. Prosternum anteriorly clearly margined. Prosternal process parallel, in middle strongly impressed in posterior 2/3, anterior edge strongly margined, laterally with groove formed by row of coarse punctures, anterior part densely and coarsely punctured, in posterior impression only weakly punctured (Figs 61, 62). Metasternal process diverging posteriorly, anteriorly impressed in middle, moderately strongly punctured, laterally with fine plicae formed by punctures, longitudinal and oblique backwards directed sutural lines visible in middle (Fig. 61). Metacoxal lobes not reaching sternite 5, weakly and sparsely punctured near suture, stronger and denser punctured in lateral part. Sternite 4–6 with posteriorly irregular puncture-row. Last sternite especially on apex stronger punctured. Metatibia without setiferous striole on dorsal face, but posteriorly with kind of fine ridge on inner side, longer tibial spur about as long as first tarsal segment (Fig. 63).

Male: Pro- and mesotarsomeres 1–3 widened, tarsomere 1 more dilated ventrally, only tarsomeres 1+2 with sucker hairs on ventral side. Protarsal claws equal in length (Fig. 60). Penis and parameres as in Figs 64–69. Left paramere with solid digitus (Fig. 64 or 67).



FIGURES 57–69. *Haliplus bistriatus*, **57–66**, Brisbane; **67–69**, Mt Mulligan: **57**, dorsal view; **58**, antenna; **59**, punctures near elytral base and suture; **60**, tarsus of male fore-leg; **61**, prosternal and metasternal process; **62**, prosternal process in lateral view; **63**, hind tibia; **64**, left paramere; **65**, penis; **66**, right paramere; **67**, left paramere; **68**, penis; **69**, right paramere

Biology

Specimens have been attracted to light in places in open forest.

Distribution (Fig. 154).

Queensland and northern part of Western Australia.

Material examined: Australia: Queensland: 1 ♂, Brisbane, Sharp, Dr Guignot visit 1939 (MNHN); 2 ♂, Caloundra, Qld, 24.iii.1963, C. Watts (CW); 2 ♀, unlabelled (QMBA); 2 ♀, Bne [Brisbane?], *H. testudo* Clark, *Haliplus stepheni ms.nom* det C.Watts 84 (QMBA, CV); 1 ♂, 1 ♀, N. Qld, 21 E. Mareeba, 21.i.1991, at light, R. I. Storey (QPI, CV); 1 ♀, Brisb[ane], Howitt Coll.; 1 ♂, unlabelled, Howitt Coll. (MVMA); 1 ♂, NQ., Mt Spec., ii.1971, J. G. Brooks, *Haliplus stepheni ms.nom.* det. C. Watts 84 (ANIC); 2 ♂, 5 ♀, nr Mt Mulligan, 31.i.1991, Larson & Halfpap (MUNC); Western Australia: 1 ♀, CALM Site 13/4, 12 km S. of Kakumburu Mission, 14.25S, 126.38E, 7–11.vi.1988, T. A. Weir, at light, in open forest (ANIC).

Haliplus australis Clark
(Figs 70–78)

Haliplus australis Clark, 1862: 400. Lectotype ♀ (designated by Watts, 1988), *H. australis* Clark [yellow label], B.M., Type [white round label with red margin], Lectotype [white round label with blue margin], LECTOTYPE Female, *Haliplus australis* Clark 1862, selected by C. Watts, 1984. (BMNH)[examined].

Haliplus australis; Zimmermann 1920: 303; 1924: 141; Watts 1985: 27, 1988: 23; Lawrence *et al.* 1987: 322.

Haliplus testudo; Watts 1985: 27, 1988: 23.

Remarks

Watts (1988) considered this species to be a junior synonym of *H. testudo*. After examination of type material of both names I regard them as separate species.

Diagnosis

Males of *H. australis* have a solid digitus on the apex of the left paramere, while *H.testudo* lacks such a digitus. The penis of *H. testudo* is more curved towards the tip. The elytra of *H. australis* usually have no dark stripes on puncture-rows, while *H. testudo* have well developed dark stripes on elytral puncture-rows.

Description

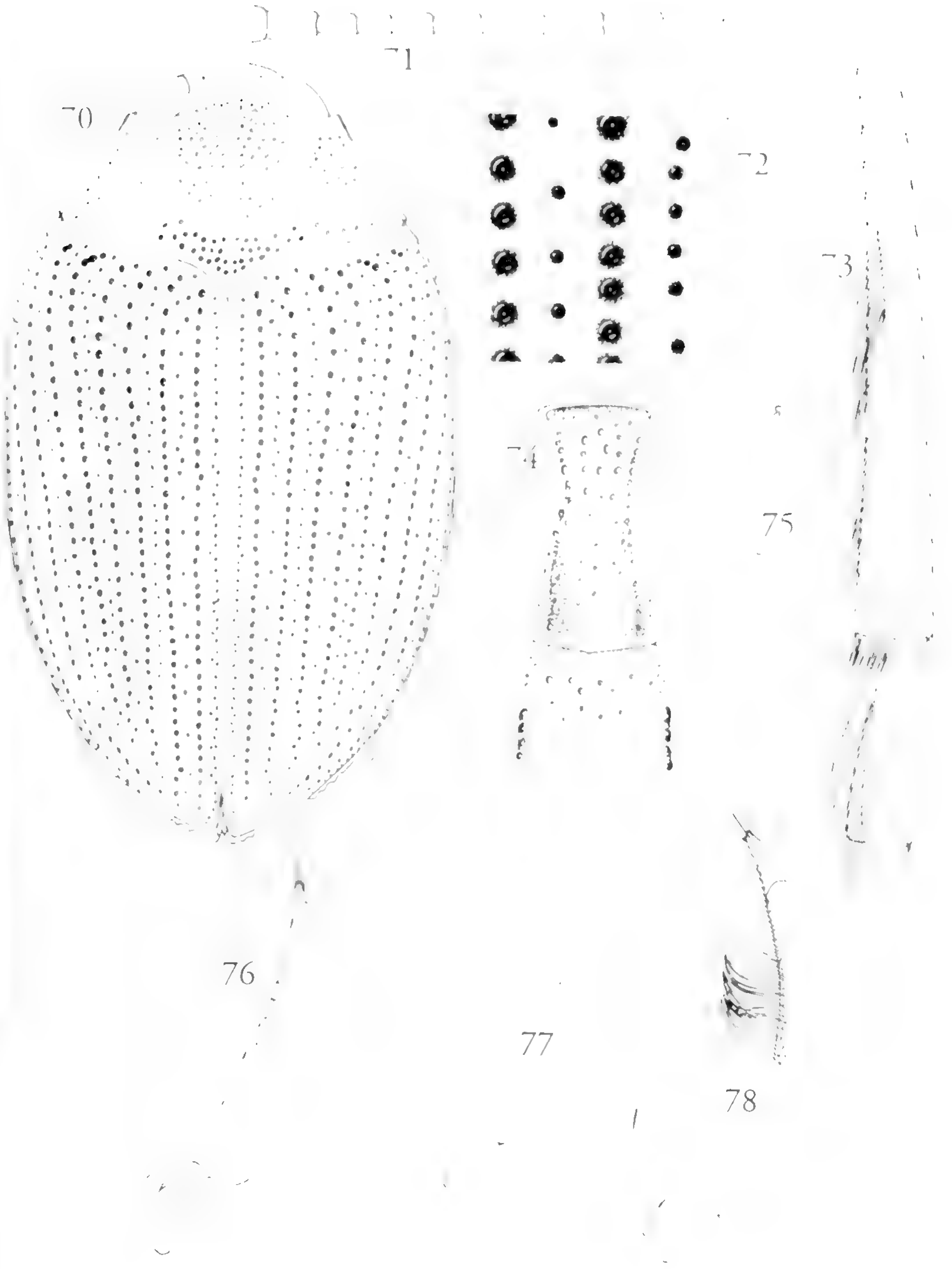
Length 3.7–4.1 mm, width 2.1–2.3 mm. Body wide oval, widest just in front of middle (Fig. 70).

Head: Yellow to yellow-brown, vertex slightly darker, weakly and sparsely punctured, on vertex a little stronger punctured. Antenna yellow (Fig. 71). Palpi yellow, last segment small, 1/3x length of penultimate segment. Clypeus finely margined anteriorly. Distance between eyes 1.3–1.6x width of one eye. Eyes usually partly covered by pronotum.

Pronotum: Yellow to yellow-brown, moderately strongly and densely punctured along base and in middle of anterior part, otherwise weaker and sparser punctured, punctures in central part of base and anterior part darkened. Punctures not stronger than elytral punctures. Anterior margin a little protruding between eyes, posterior margin slightly impressed in middle. Lateral borders straight, finely margined.

Elytra: Yellow without maculation, only suture narrowly brown, punctures darkened but darkening rarely forming continous lines. Primary punctures strong and dense, about 48 punctures in row 1. All punctures with clear hole in middle. Puncture-row 1–7 not much differing in strength, row 8 clearly weaker, row 9+10 very weak and hardly darkened. Distance between row 10 and 9 and between row 9 and 8 clearly more than between row 8 and 7. First three basal punctures of row 5 confluent. Secondary punctures strong, dense and partly doubled in sutural row on interval 1, dense in interval 2, 3, 5 and 7, less dense in interval 4, in interval 6+8 only a few punctures in basal and posterior part, in posterior part of interval 9 continous dense row of weak punctures, in row 10 a few weak punctures in central part. Completely margined, anteriorly with about seven very weak flat teeth, in apical part with about twelve small sharp teeth.

Underside: Yellow to yellow-brown, elytral epipleura yellow with uncoloured punctures. Legs yellow to yellow-brown, slightly darkened towards coxae. Prosternal process parrallel-sided, slightly narrowed in central part, along both margins impressed in posterior half, anterior edge clearly margined, strongly punctured along margins and with a few punctures in middle part (Figs 74, 75). Prosternum strongly punctured and anteriorly finely margined. Proepisternum at most weakly punctured in anterior part. Metasternal process flat in middle, strong punctures on both sides partially confluent, more or less forming short impressions, which do not reach anterior margin, otherwise weakly punctured (Fig. 74). Metacoxal lobes fairly



FIGURES 70–78. *Haliplus australis*, **70–75**, Lectotype ♀; **76–78**, Paralectotype ♂: **70**, dorsal view; **71**, antenna; **72**, punctures near elytral base and suture; **73**, hind tibia; **74**, prosternal and metasternal process; **75**, prosternal process in lateral view; **76**, left paramere; **77**, penis; **78**, right paramere.

strongly punctured, in sutural area weaker punctured. Outer protarsal claws of males seem to have tooth on inner margin. Setiferous striole on dorsal face of hind tibia about 1/8x length of tibia (hard to see), it looks like there is on inner margin another setiferous striole over apical half, longer tibial spur about 2/3x length of first tarsal segment (Fig. 73).

Male: Pro- and mesotarsomeres 1–3 widened and with sucker hairs on ventral side. Penis and parameres as in Figs 76–78. Left paramere with small solid digitus (Fig. 76).

Biology

Specimens occur in rivers and ponds and have been found in trout stomachs. Watts (pers. comm.) found specimens in a well shaded woodland pond that dries out completely in summer.

Distribution (Fig. 159)

Australia: South Australia, Victoria, Queensland.

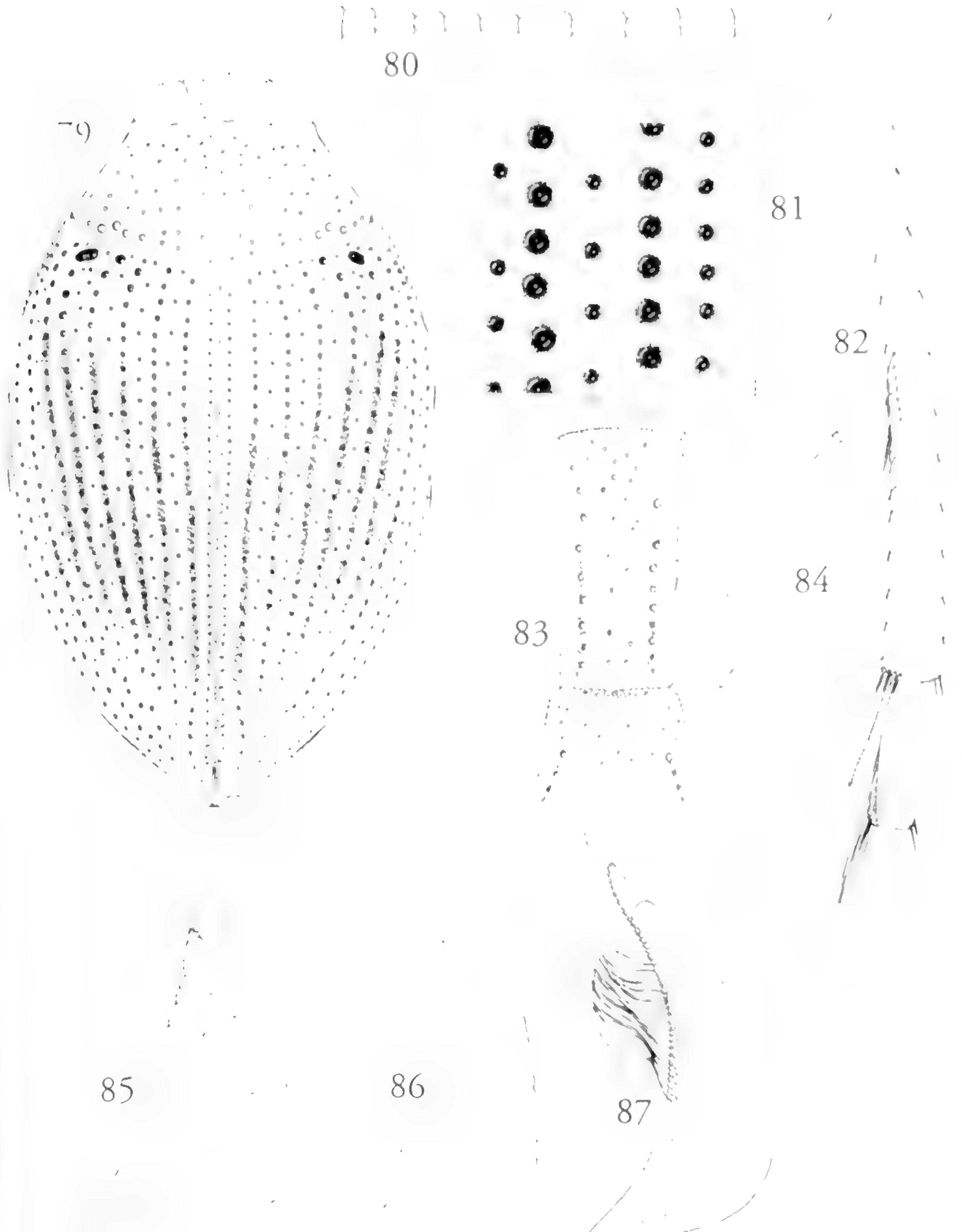
Material examined: Australia: Federal state unknown: Lectotype ♀ (BMNH); 2 ♂, 3 ♀, Howitt coll. (MVMA); Queensland: 1 ♀, 1 ♂, Glen Valley, ii.1951, VI-, F. E. Wilson (CW); South Australia: 2 ♂ syntypes, S. Australia, S.s., 67–56, *H. australis* Clark, Australia (BMNH); 1 ♂, 2 ♀, Chain of Ponds, 4.xii.1989, C.W. (CW); 1 ♂, Cheltenham, 20.iii.1925 (MVMA); Victoria: 1 ex., Flowerdale, 22.i.1968, R. E. Parrott (CNCI); 2 ♂, Jamieson, 20.iv.1943, F. E. Wilson; 1 ♀, Yarra Riv., Melgrove, 4.i.1952, F. E. Wilson; 2 ♂, 6 ♀, Glenmaggie, Weir, iv.1957, F. E. Wilson; 1 ♂, 1 ♀, Lake Wendourec, ii.1945, F. E. Wilson; 2 ♂, Eildon Weir, ix.1943, F. E. Wilson; 1 ♂, Melbourne, Howitt coll. (MVMA); 1 ♂, Clarkfield, 31.x.1942, A. D. Butcher, Ex trout stomach (CV); 1 ♂, E. Vic., Cann Riv., 28.i.1967, G. Monteith (UQIC).

Haliplus wattsi sp.n.
(Fig. 79–87)

Type-material: ♂ holotype, 'Homehill, Qld, 7.iv.1963, CW.' (CW). Paratypes: 1 ♂ and 1 ♀, on same pin as holotype; 2 ♂, same data as holotype (CW, CV); 1 ♂, Bandenberg, Queensland, 31.iii.1963, CW, *H. testudo* det. C. Watts, 1991; 1 ♂, 25 km. N. Coen, Queensland, 29.ix.1984, C. Watts (CW); 1 ♂, Australia, N. Q., Koombaloomba, 10.i.1962, E. B. Britton, B.M. 1962–153, At light (BMNH); 1 ♂, Nov. Holl.d., Rockkompt [?], Daniel (MNHN); 1 ♀, unlabelled, T12706; 1 ♂, Tambourine Mountain, Jan. 1898, C.J. Wild, *Haliplus alastairi* ms.nom. det C. Watts, T12707 (QMBA); 1 ♀, S.E. Qld, Atkinson's Lagoon, 13 km N.W. Lowood, 10.ix.1978. J. King, *Haliplus testudo* Clark det. C. Watts 1987; 1 ♂, 1 ♀, N. Qld, Mc Ivor River, 40 ml. N. of Cooktown, 7.v.1970, G. B. Monteith, *Haliplus testudo* Clark, det. C. Watts 1987 (UQIC); 1 ♀, N. Qld, Iron Range, Cape York Pen., 28.iv–1.v.1968, G. B. Monteith, *Haliplus testudo* Clark, det C. Watts 1987 (CV); 1 ♀, N. Qld, Homestead, Silver Plains, Via Coen, 11.xii.1964, G. B. Monteith, *Haliplus testudo* Clark Det. C. Watts 1987 (UQIC); 1 ♂, 2 ♀, N. W.A., Kununurra, 22.xii.1991–6.i.1992, R. I. Storey; 1 ♂, 4 ♀, N. Qld, 10 km S. of Laura, 4.iii.1992, at light, J. Hasenpusch; 1 ♀, N. Qld, Tolga, 27.i.1987, J.D. Brown, light trap, *Haliplus testudo* Clark, det. C. Watts 1987; 1 ♂, Qld, 21 km S. Mareeba, 22.i.1991, R. I. Storey; 1 ♂, N. Qld, Cow Bay, N. of Daintree, 25.i–7.ii.1984, I.C. Cunningham, *H.testudo* C. Watts det. 1987; 1 ♂, N. Qld, 7 km NE of Tolga, Feb. 1988, Storey & De Faveri, light trap, *Haliplus testudo* Clark det. C. Watts 1988; 1 ♂, N. Qld, 7 km NE of Tolga, MAR. 1987, Storey & De Faveri, light trap, *H.testudo* Clark det C. Watts 1987; 2 ♂, 2 ♀, N.T., 6 km E. Humpty Doo, 9.ii–4.iii.1987, R. I. Storey (QPI); 1 ♂, Papua, Loloki, c. 10 m. N. of Pt. Moresby, 19.iii.1965, Stn No. 205, M. E. Bacchus, B.M. 1965–120 (BMNH); 1 ♀, Cardstone, Qld, 17–23.ii.1966, K. Hyde, *Haliplus testudo* Clk det. C. Watts; 1 ♀, S. of Charleville, Q., 9.v.1973, M.S. Upton, *Haliplus testudo* Clk det. C. Watts; 1 ♂, Katharine N.T., at light, 9.ii.1968, J. A. L. Watson, *Haliplus testudo* Clk det. C. Watts; 1 ♂, Coastal Plain Rsch. Station, C.S.I.R.O. nr Darwin, N.T., at light, ix.1966, E. C. B. Langfield (ANIC); 1 ♂, Cahills Crossing, N.T., East Alligator River, 12.26S, 132.58E, 2.v.1973, E.G. Matthews, at light, *Haliplus ?australis* Clark, det T. A. Weir, 1980, *Haliplus testudo* Clk det. C. Watts; 1 ♂, N.T., 6 km E. Humpty Doo, 9.ii–4.iii.1987, R. I. Storey; 1 ♀, N. Qld, 7 km NE of Tolga, Feb. 1988, Storey & De Faveri, light trap, *Haliplus testudo* Clark det. C. Watts 1988; 1 ♂, N. Qld, 10 km S. of Laura, 4.iii.1992, at light, J. Hasenpusch; 1 ♂, N. W.A., Kununurra, 22.xii.1991–6.i.1992, R. I. Storey (CV); 1 ♀, Queensland, 160 km S. of Cooktown, 500 m, 28.i.1964, J. Sedlacek (BPBM); 1 ♂, 1 ♀, Qld, Port Douglas, 8.i.1991, D. Larson; 2 ♂, Qld, 5 km S. of Mareeba, 15.i.1991, Larson (MUNC).

Diagnosis

This species can easily be distinguished from



FIGURES 79-87. *Haliplus wattsi*, Holotype ♂: **79**, dorsal view; **80**, antenna; **81**, punctures near elytral base and suture; **82**, hind tibia; **83**, prosternal and metasternal process; **84**, prosternal process in lateral view; **85**, left paramere; **86**, penis; **87**, right paramere.

H. australis and *H. testudo* by the proepisternum being strongly and densely or even coarsely punctured. It can also be distinguished from *H. testudo* by the absence of dark stripes on the basal area of the elytra, the prosternal process usually being wider anteriorly than posteriorly, the uncoloured pronotal anterior punctures, the weakly serrate or nearly smooth apical elytral margin and in the male the penis not being gradually curved to the top and the left paramere having a solid, sometimes very small, digitus.

Description

Length 3.4–3.6, width 1.9–2.1 mm. Body oval, widest behind shoulders, strongly tapering behind middle (Fig. 79).

Head: Yellow-red, darkened near antennae, moderately strongly punctured. Antenna yellow to yellow-red, first two segments brown (Fig. 80). Palpi yellow-brown, last segment twice as long as penultimate segment. Distance between eyes 1.3–1.5x width of one eye. Eyes partly covered by pronotum.

Pronotum: Yellow to yellow-red, moderately densely and strongly punctured, base with a few stronger punctures opposite elytral puncture-row 5. Lateral border straight, finely margined, margin not reaching front corner. Base a little impressed opposite elytral puncture-row 3–5.

Elytra: Yellow to yellow-red, suture and puncture-rows darkened in posterior 2/3, sometimes connected by vague marks. Primary puncture-rows dense and moderately strong, 35–40 punctures in row 1, anterior part of first 2 rows weaker, basal 2 or 3 punctures of row 5 usually wide and confluent. Row 9 very dense and impressed in middle. Secondary punctures along suture relatively strong and as dense as primary punctures, sparser but still strong on intervals, except on hardly punctured or unpunctured interval 6+8. All punctures darkened, except some in lateral rows, and with hole in middle. Complete margin not always visible from above, anteriorly serrate, posteriorly weakly serrate or sinuate.

Underside: Yellow-red to yellow-brown, some darkening near prosternal and metasternal process. Elytral epipleura yellow, almost reaching last sternite, with strong weakly darkened punctures. Legs yellow-red, femur and coxa brown to dark-brown. Prosternum margined anteriorly, strongly and densely punctured. Proepisternum strongly and densely or even coarsely punctured. Prosternal process slightly to clearly gradually diverging anteriorly, laterally grooved in especially posterior half, anterior edge clearly margined, moderately strongly punctured (Figs 83, 84). Metasternal process flat to slightly elevated in middle, weakly punctured, laterally with a few confluent punctures (Fig. 83). Metacoxal lobes not reaching sternite 5, moderately strongly, near suture weaker punctured. Sternites strongly punctured, last sternite with very short fine ridge on apical point. Setiferous striole on dorsal face of hind tibia about 1/6x length of tibia, longer tibial spur about 3/4x length of first tarsal segment (Fig. 82), claws at most 1/2x length of last tarsal segment.

Male: Pro- and mesotarsomeres 1–3 slightly widened and with sucker hairs on ventral side. Penis and parameres as in Figs 85–87. Left paramere with small solid digitus (Fig. 85). Penis dorsally dilated (Fig. 86).

Biology

Specimens have been found in rivers and are attracted to light.

Distribution (Fig. 161).

Australia: Queensland, Northern Territory, northern part of Western Australia. Papua New Guinea.

Haliplus testudo Clark
(Figs 88–96)

Haliplus testudo Clark, 1862: 400. Lectotype ♀ (designated by Watts, 1988), 'lectotype [white round label with blue margin], type [white round label with red margin], 67–56, *H. testudo* Clark, Australia, Lectotype female, *Haliplus testudo* Clark, 1862, selected by C. Watts 1984'. [2 ♀♀ on card, right one marked as type]. (BMNH)[examined].

Haliplus australis sensu Watts 1985, nec Clark 1862. [Misidentification]

Haliplus nigrolineatus Wehncke 1883: 145. **syn.n.**

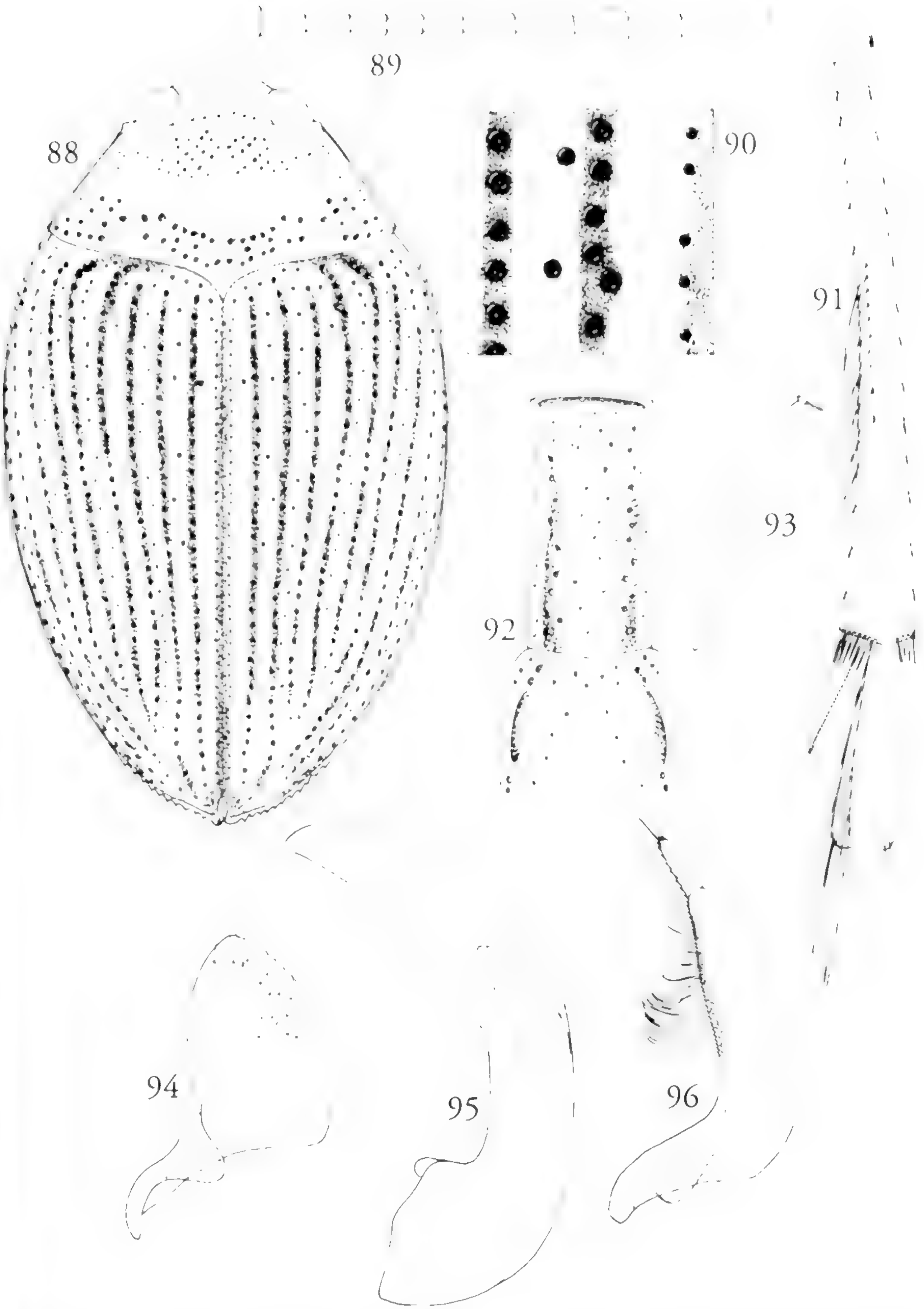
Haliplus testudo; Zimmermann 1920: 316, 1924: 141; Watts 1985: 27, 1988: 23; Lawrence *et al.* 1987: 322.

Haliplus australis; Watts 1985: 27, 1988: 23.

Remarks

Watts (1988) regarded this species as a senior synonym of *H. australis*. I consider the two species to be distinct, because of morphological differences in penis and left paramere (see also remarks under *H. australis*).

In the course of my study of the Neotropical



FIGURES 88–96. *Haliplus testudo*, **88–93**, Lectotype ♀; **94–96**, Sydney: **88**, dorsal view; **89**, antenna; **90**, punctures near elytral base and suture; **91**, hind tibia; **92**, prosternal and metasternal process; **93**, prosternal process in lateral view; **94**, left paramere; **95**, penis; **96**, right paramere.

Haliplidae I examined a syntype of *Haliplus nigrolineatus* Wehncke from Uruguay and concluded that it is conspecific with *H. testudo*. This is obviously a case of mislabelling (further treatment in the revision of the Neotropical Haliplidae)

Diagnosis

This species can be distinguished from *H. australis* by the presence of dark stripes on the basal area of the elytra, the prosternal process usually not being wider anteriorly than posteriorly, the coloured pronotal anterior punctures, the clearly serrate apical elytral margin and in the male the penis being gradually curved to the top and the left paramere not having a solid digitus. It can distinguished from *H. wattsi* by the proepisternum being hardly punctured.

Description

Length 3.5–4.0 mm, width 1.9–2.2 mm. Body oval, widest just in front of middle (Fig. 88).

Head: Yellow to yellow-brown, weakly punctured, on vertex stronger punctured, clypeus not margined anteriorly. Antenna yellow to yellow-brown (Fig. 89). Palpi yellow to brown, last segment 1/3x length of penultimate segment. Distance between eyes 1.5–1.7x width of one eye. Eyes partly covered by pronotum

Pronotum: Yellow-brown, strongly punctured in central anterior area, along base and near lateral margins; transverse area in middle almost unpunctured, most punctures darkened. Lateral borders slightly convex, finely margined. Slight or no impression in front of base.

Elytra: Yellow-brown, black lines on primary puncture-rows continous or sometimes weakly interrupted. Suture darkened, most of base narrowly darkened to puncture-row 5 or 6. Primary punctures moderately strong and dense, about 35 punctures in row 1. Interval 9+10 not much wider than interval 8. Puncture-row 9+10 with separated black punctures except in apical part where short lines may be present. First three or four basal punctures of row 5 confluent. Secondary punctures moderately strong, sometimes as strong as primary ones, sutural row continuous with about 40–45 punctures, 7–10 punctures in interval 2, about 16 in interval 3, interval 4 with only about 4 punctures near base; interval 5,7+9 with sparse row, interval 6,8+10 at most with some punctures in basal area. Completely margined. Shoulders weakly serrate, apical part with about 14 short teeth.

Under side: Yellow-red to yellow-brown, legs yellow-brown to brown, darkened near coxae. Elytral epipleura yellow, reaching to sternite 7. Prosternum margined anteriorly, sparsely punctured. Prosternal process parallel, hardly narrowed near coxae, on both sides with strong groove over almost its total length formed by strong punctures, anterior margin with clear ridge, elsewhere weakly and very sparsely punctured (Figs 92, 93). Metasternal process flat, on both sides an almost continous groove formed by strong punctures, elsewhere weakly and sparsely punctured (Fig. 92). Metacoxal lobes strongly and not very densely punctured, near suture weaker punctured. Setiferous striole on dorsal face of hind tibia weak, about 1/5x length of tibia, longer tibial spur 1/2–2/3x length of first tarsal segment (Fig. 91).

Male: Pro- and mesotarsomeres 1–3 widened and with sucker hairs on ventral side. Penis and parameres as in Figs 94–96. Left paramere without solid digitus (Fig. 94).

Biology

This species is found in rivers and in lentic fresh water and is attracted to light.

Distribution (Fig. 160)

Australia: South Australia, Victoria, New South Wales, Queensland, Northern Territory. The specimen I have seen from Sumatra is obviously mislabelled.

Material examined: South Australia: 1 ♂, 1 ♀ (ANIC); 2 ♂, 5.ii.1908, C. French (MVMA); Victoria: 3 ex., Melbourne (ANIC); 1 ♀, Vic., Yarra Riv., Mellgrove, 4.i.1952, F. E. Wilson; 12 ♀, Vic., Jamieson, 20.iv.1943, F. E. Wilson; 1 ♂, 1 ♀, Victoria, Melbourne; 1 ♀, Victoria, Howitt Coll. (MVMA); 5 ♂, 2 ♀, Vic., Moorobool R., iv.1932 & iv.1951, F. E. Wilson (6 in MVMA, 1 in CV); New South Wales: 2 ♂, Surr. Sydney, N.S.W., Nikitin 1958 (ISNB); 1 ♀, N.S.W., Hornsby, 22.vii.1931, Harvard Exp. Darlington (MCZC); Queensland: Lectotype ♀; paralectotype ♀ (on same card as lectotype) (BMNH); 1 ♀, Caloundra, 21.iii.1963, C. Watts (CW); 2 ex. Nov. Holl.d, Cape York (MNHN); 1 ♀, Queensland, Biggenden, 22.i.1975. H. & A. Howden (CNCI); 2 ♀, Queensland (MVMA); 1 ♀, N. Qld, 11 km WSW of Petford, 3/4.iv.1988, R. I. Storey, at light; (QPI); 2 ♂, N. Qld, 7 km NE of Tolga, ii.1988, R. I. Storey & De Faveri, light trap (QPI, CV); 1 ♀, Queensland, Bundaberg, 31.iii.1963, C.Watts; 1 ♂, Queensland, Gin Gin, 2.iv.1963, C.Watts (CW); 1 ♀, Q., Brisbane, N. Pine R., 6.iii.1932, Harvard Exp. Darlington (MCZC); 1 ♂, Ashgrove, 2.v.1931, H. Hacker; 1 ♂, 1 ♀, N. Pine R., 10.iv.1933, H. Hacker; 2 ♂, Brisbane, x.1892, C. Wild (QMBA); 1 ♂, N. Qld, Split Rock, 14 km S. of Laura, 23/26.vi.1975, C. Monteith (CV); 1 ♂, Brisbane (QMBA); 1 ♀, Q., Highvale, 8.ix.1965, B. Cantrell (UQIC); 1 ♂, Qld, Brisbane, 2.viii.1964, B. Cantrell (UQIC); 3 ex., Catherine Cr. nr Collins Weir, 20.ii.1990; 22 ex., nr Mt Mulligan, 31.i.1991, Larson & Halfpap (MUNC); Northern Territory: 1 ♂, Goose Lagoon, 16.10S, 136.1E, 11 km SW by S of Borroloola, 17.iv.1976, at light, J. E. Feehan (ANIC); 1 ♀, N.T., Horn Islet, Pellew Group, 25/31.i.1968, B. Cantrell (UQIC); Federal state unknown: 1 ex. (ANIC); 1 ex. without data; 1 ex. Nov. Holl. ex Museo Thorey (MNHN); 1 ♂, 1 ♀, Australia, coll. Wager (ISNB); 7 ♂, 5 ♀, Howitt coll.; 1 ♂, 1 ♀, unlabelled; 1 ♂, C. G. Oke (MVMA); 1 ♀, unlabelled (QMBA). — Indonesia: 1 ♀, Fort de Kock, Sumatra, 920 m., 1925, E. Jacobsen, *Haliplus pulchellus* det. A. Zimmermann [obviously mislabelled](ISNB). — Uruguay: 1 ♂, Montevideo, syntype *Haliplus nigrolineatus* Wehncke [obviously mislabelled](MNHN).

Haliplus signatipennis Régimbart
(Figs 97–111)

Haliplus signatipennis Régimbart, 1891: 979. Lectotype ♀ (here designated), '♀; N.Guinea mer., Rigo, luglio 1889, L.Loria; *signatipennis* Rég.; Museo Civ. Genova; Museum Paris, coll. Maurice Régimbart 1908' (MNHN) [examined].

Haliplus signatipennis; Régimbart 1899: 187; Zimmermann 1920: 316; 1924: 141; Watts 1988: 23.

Diagnosis

This species can be distinguished from other species in the region by the longitudinal dark mark on the pronotum.

Remarks

The specimen collected on Seram (Figs 106–111) is differing from the typical form in the secondary puncture-rows being almost as strong and dense as primary puncture-rows. As this only known specimen from Seram is a female it is not clear if it represents a separate species.

Description

Length 3.4–3.7 mm, width 1.9–2.1 mm. Body oval, parallel behind sligthly protruding shoulders (Fig. 97).

Head: Red-brown to brown, darkened near antennae. Weakly punctured. Antenna yellow-brown to yellow towards end, first five segments not longer than wide (Fig. 98). Palpi yellow-brown, last segment very short, about 1/4x penultimate segment. Distance between eyes 1.1–1.2x width of one eye.

Pronotum: Yellow-brown, large dark longitudinal mark in middle. Impressed basally, opposite elytral puncture-row 5–7 with strong, posteriorly well bordered impression. Moderately strongly and densely punctured, near hind corners a few widened punctures. Laterally not margined.

Elytra: Yellow-brown, very extensive dark maculation along base, suture and on intervals. Completely margined, no clear serration. Interval 2 slightly impressed. Primary puncture-rows moderately strong, about 32 punctures in row 1, row 4–7 stronger than adjacent rows. Secondary punctures along suture dense and moderately strong (Fig. 99), secondary puncture-rows on all intervals, on interval 9 behind central dark mark very dense row of secondary punctures. All punctures darkened and with hole in middle.

Underside: Red-brown to dark brown. Elytral epipleura yellow-brown, reaching to sternite 6. Legs yellow-brown (tarsus) to dark brown (femur). Prosternal process sinuate in anterior part and close to apex, anterior edge margined, laterally with clean grooves, in anterior third part moderately strongly punctured, in posterior 2/3 weakly punctured (Figs 101, 102). Metasternal process flat with lateral impressions, weakly punctured (Fig. 101). Metacoxal lobes not reaching sternite 5, moderately strongly, near suture weaker punctured. Sternite 5+6 with dense irregular puncture-rows, last sternite moderately strongly punctured, apical point with short ridge.

Setiferous striole on dorsal face of hind tibia about 1/5x length of tibia, longer tibial spur about 4/5x length of first tarsal segment (Fig. 100).

Male: Pro- and mesotarsomeres 1–3 widened and with sucker hairs on ventral side. Penis and parameres as in Figs 103–105.

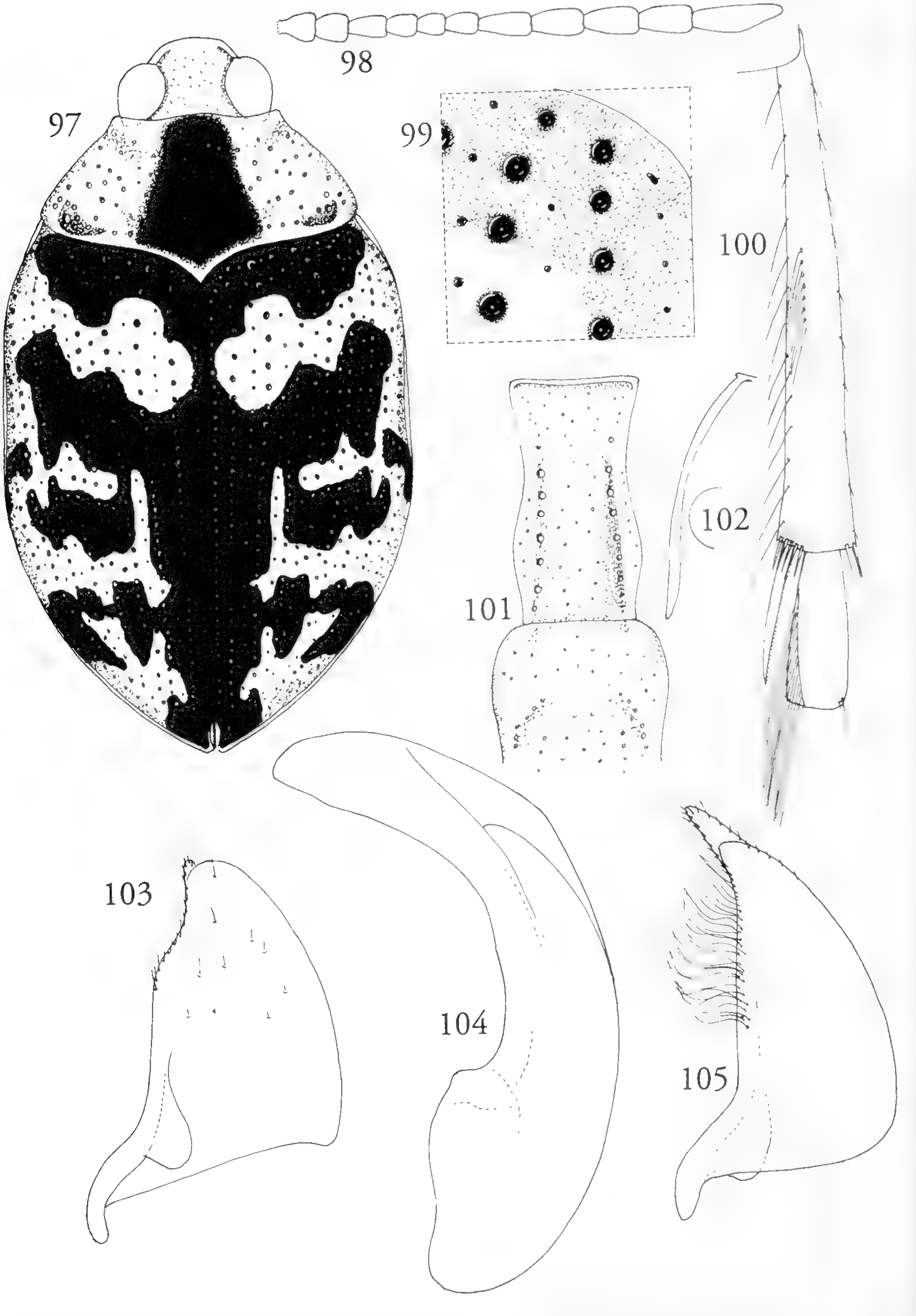
Biology

Specimens are collected in a stock pond, in a Sago swamp and in bomb craters.

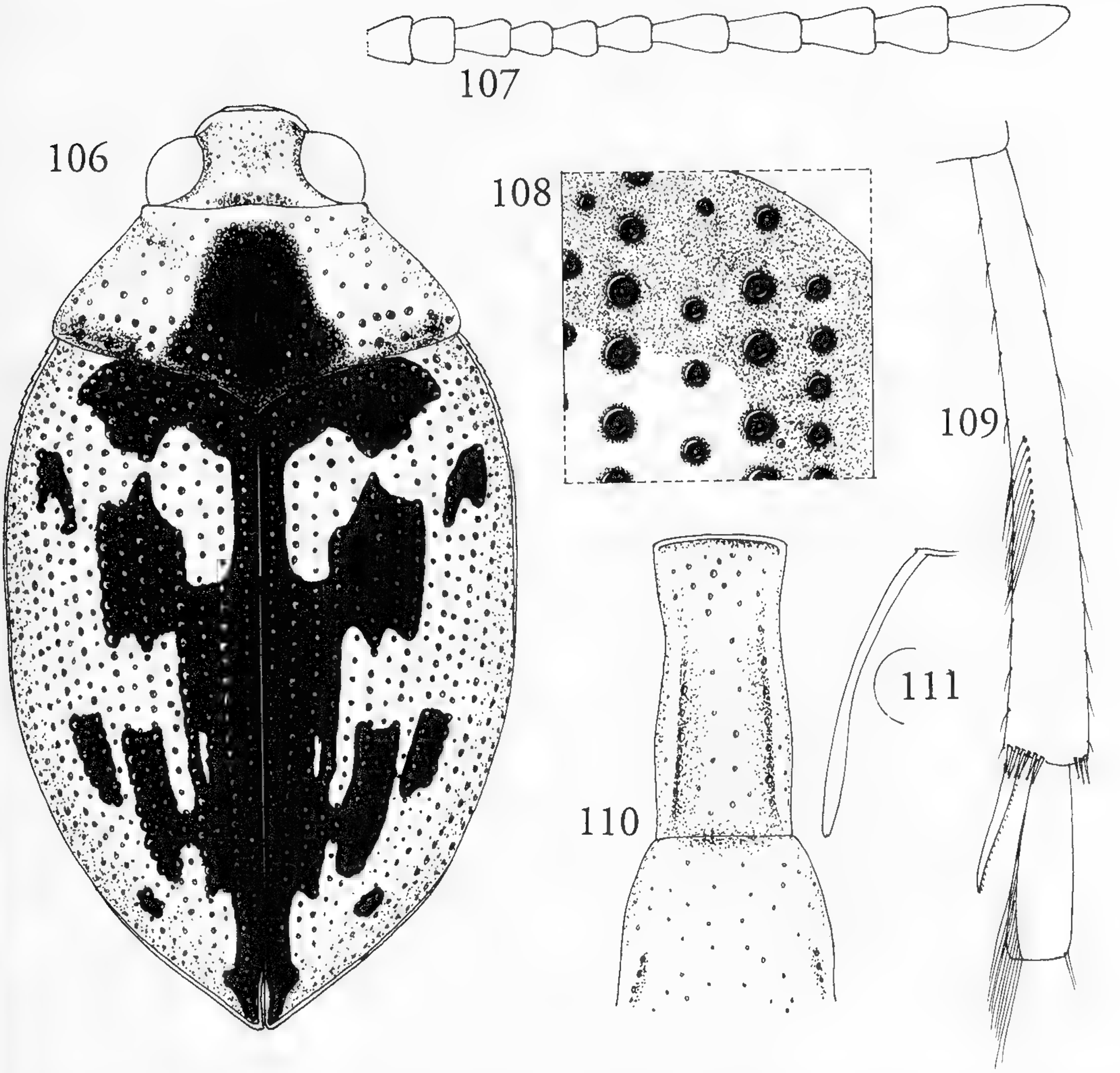
Distribution (Fig. 162)

Papua New Guinea. Indonesia: Seram.

Material examined: Papua New Guinea: Lectotype ♀ (MNHN); 3 ♂, 1 ♀, Madang, 5 km N. Alexishafen, sago swamp, 9.iii.1991; 1 ♂, Madang, 2 km W. Alexishafen, bomb craters, 1.iv.1991; 2 ♂, Ramu Vlly, Brahman Mission,



FIGURES 97–105. *Haliplus signatipennis*, **97–102**, Lectotype ♀; **103–105**, ♂ from Ramu Vlly: **97**, dorsal view; **98**, antenna; **99**, punctures near elytral base and suture; **100**, hind tibia; **101**, prosternal and metasternal process; **102**, prosternal process in lateral view; **103**, left paramere; **104**, penis; **105**, right paramere.



FIGURES 106–111. *Haliplus signatipennis*, ♀ from Seram: **106**, dorsal view; **107**, antenna; **108**, punctures near elytral base and suture; **109**, hind tibia; **110**, prosternal and metasternal process; **111**, prosternal process in lateral view.

stock pond, 17.iv.1991, Larson; 1 ♂, 1 ♀, Madang, Brahman Mission, 21 & 27.vi.1991, D. & M. Larson (MUNC). Indonesia: 1 ♀, Seram nr Wahai, leg. Jäch 1989 (NHMV).

Haliplus ferruginipes Régimbart
(Figs 112–117)

Haliplus ferruginipes Régimbart, 1891: 979. The type material (Papua New Guinea, Rigo) could not be found in Genoa (MCSN), where it should be, nor in Paris (MNHN).

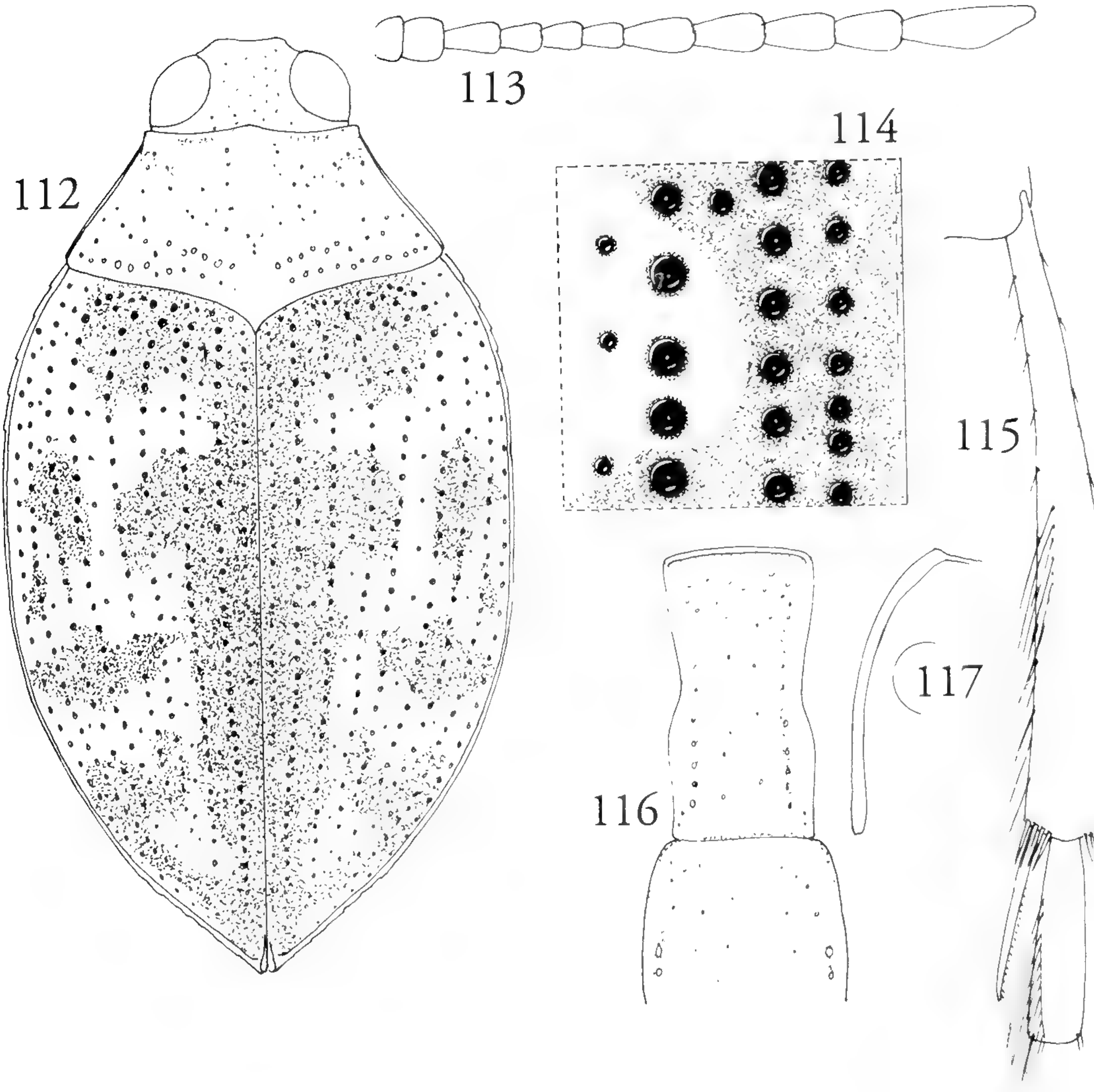
Haliplus nicholasi Watts, 1988: 23. Holotype ♀, 'Townsville, Qld Feb. 1972, T. Ingeldew, T–10793' (MVMA) [examined] **syn. n.**

Haliplus ferruginipes; Zimmermann 1920: 305; 1924: 142; Watts 1988: 23.

Remarks

A specimen from Merauke, New Guinea is considered to belong to this species as it matches the description of *H. ferruginipes*, although its length is 3.0 mm opposed to 3 4/5 mm as mentioned in the description. This specimen also resembles very much the types of *H. nicholasi*.

Although both species are only known from females making checking of male aedaegi



FIGURES 112–117. *Haliplus ferruginipes*, Holotype ♀ of *Haliplus nicholasi*: **112**, dorsal view; **113**, antenna; **114**, punctures near elytral base and suture; **115**, hind tibia; **116**, prosternal and metasternal process; **117**, prosternal process in lateral view.

impossible, I consider *H. ferruginipes* and *H. nicholasi* conspecific.

Diagnosis

This species can be distinguished from related species by the widely darkened elytral base in combination with puncture-row 5 not impressed basally.

Description

Length 3.3–3.6 mm, width 1.8–1.9 mm. Body oval, widest in middle (Fig. 112).

Head: Yellow-brown to yellow-red, anteriorly near antennae darkened, moderately strongly punctured. Antenna (Fig. 113) and palpi yellow-red to yellow-brown. Distance between eyes about 1.5x width of one eye.

Pronotum: Yellow-red, strongly punctured, on disc slightly weaker and sparser punctured, base slightly impressed. Lateral borders margined, margins narrowed anteriorly and hardly reaching front corner. Hind corners a little rounded.

Elytra: Yellow-red to yellow-brown, extensive dark confluent maculation along base to puncture-row 6, along suture to at least puncture-row 1 and on intervals. Primary puncture-rows moderately strong and dense, about 30 punctures in row 1, basal punctures of row 5 not in an impression.

Puncture-row 7+8 strong and a little impressed in middle, united to one row long before reaching base. Secondary punctures along suture nearly as strong as primary row 1 (Fig. 114), sparse but strong secondary punctures on interval 2, 3, 5, 7+9; interval 4, 6+8 unpunctured. All punctures darkened and with hole in middle. Completely margined, weakly and sparsely serrate in anterior part and weakly sinuate in apical part.

Underside: Yellow-red to yellow-brown, slightly darkened near prosternal en metasternal process, tarsi and tibia yellow-brown, femora brown. Elytral epipleura yellow with strong uncoloured punctures, reaching to sternite 6. Prosternal process sinuate in middle and just before apex, anteriorly finely margined, lateral puncture-rows in slight impression, in anterior half strongly punctured, in posterior half in middle sparsely punctured (Figs 116, 117). Prosternum anteriorly weakly margined. Metasternal process flat, moderately strongly but sparsely punctured, a few lateral punctures usually in slight impression (Fig. 116). Metacoxal lobes not reaching sternite 5, strongly punctured, near suture weakly punctured. Sternite 5+6 with strong and dense transverse puncture-row. Sternite 7 sparsely punctured, bulbous in lateral view, short clear ridge on apical point. Setiferous striole on dorsal face of hind tibia about 1/5x length of tibia, longer apical spur about 3/4x length of first tarsal segment (Fig. 115).

Male: unknown

Distribution (Fig. 156)

Australia: Northern Territory, northern part of Queensland. Papua New Guinea. Indonesia: West New Guinea.

Material examined: West New Guinea: 1 ♀, S. Neth. New Guinea, Merauke, sea level, 1.iv.1955, L. D. Brongersma (RMNH). Australia: 1 ♀ holotype of *Haliplus nicholasi* Watts (MVMA); 1 paratype ♀ [not ♂ as label suggests], Homehill, Qld, 7.iv.1963, C.W., *Nicholasi* C. Watts 1984; 2 paratypes ♀, Cairns, Qld, 16.iv. 1963, C.W., *nicholasi* C. Watts 1984 (SAMA); 1 ♀, N.T., 6 km E. of Humpty Doo, 9.ii–4.iii.1987, R. I. Storey, *Haliplus nicholasi ms.nom* Det. C. Watts 1987 (QPI).

Haliplus alastairi Watts
(Figs 118–126)

Haliplus alastairi Watts, 1988: 24. Holotype ♂, 12°36'S 132°52'E Magela Creek, N.T. 1 km NNW of Mudginbarry HS. 25.v.1973, Matthews & Upton (ANIC).

Remarks

Part of the material Watts (1988) considered to belong to this species, belongs to a new species, *Haliplus timmsi*, described in this revision.

Diagnosis

This species can be distinguished from the related *H. timmsi* by the flat metasternal process of *H. alastairi* opposed to the metasternal process pitted on both sides of *H. timmsi*.

Description

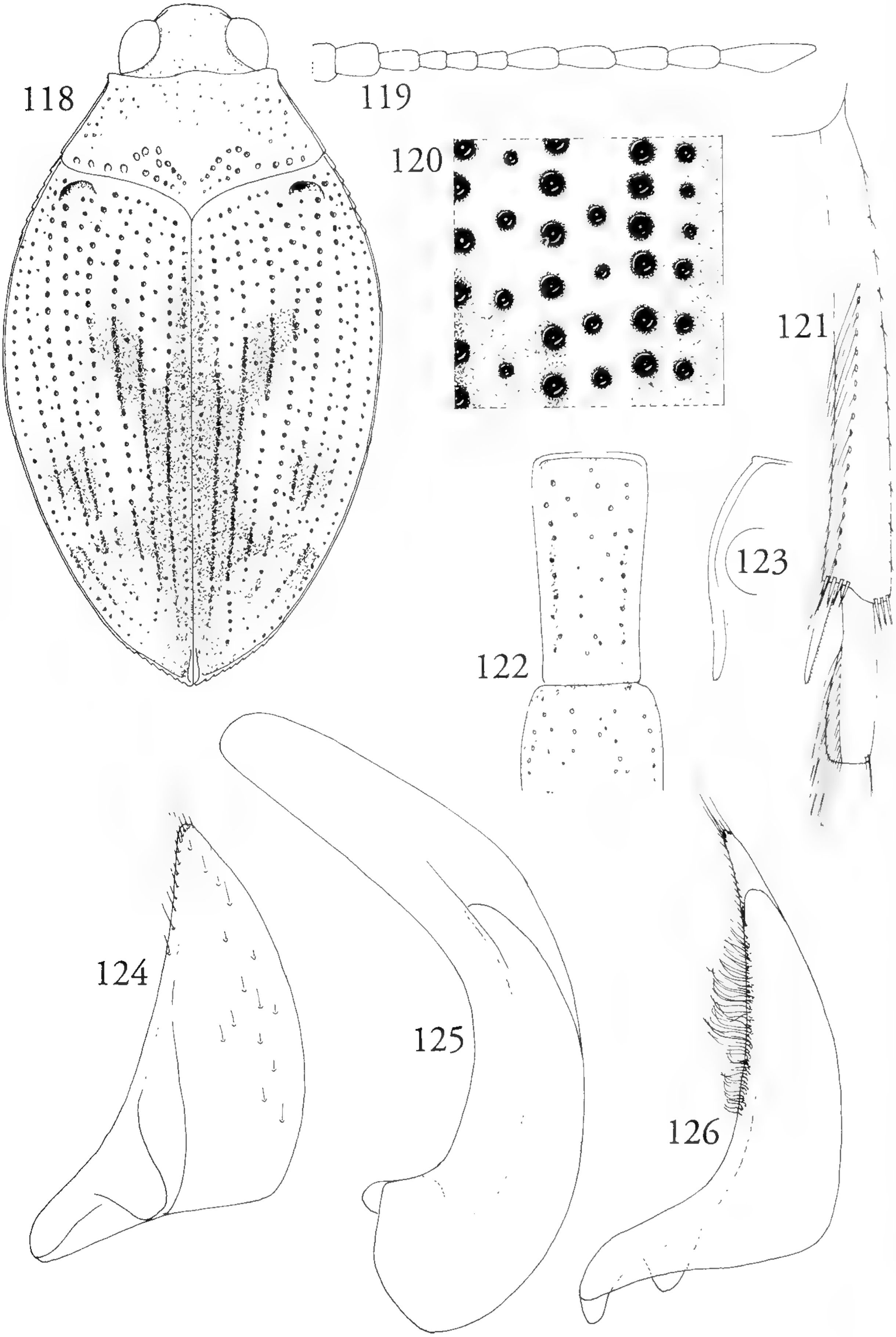
Length 3.0–3.6 mm, width 1.7–2.0 mm. Body oval, widest behind shoulders, clearly tapering in apical 1/3 part (Fig. 118).

Head: Yellow-brown, clypeus and frons weakly punctured, posterior part of vertex moderately strongly punctured. Antenna yellow to yellow-brown, fourth segment shorter than adjacent segments (Fig. 119). Palpi yellow, last segment about 1/2x length of penultimate segment. Distance between eyes 1.4–1.7x width of one eye.

Pronotum: Yellow-brown. Moderately strongly punctured, basal punctures opposite elytral puncture-row 4+5 slightly stronger and lying in transverse impression. Base hardly impressed. Lateral borders weakly margined, margin narrowed anteriorly and not reaching front corner. Anterior edge slightly protruding in middle.

Elytra: Yellow-brown with distinct dark markings. Darkened along most of suture and on parts of intervals, darkening on parts of puncture-rows. Primary puncture-rows moderately strong, first three rows weaker and denser than others, about 42 punctures in row 1. Row 5 abruptly bent outwards and ending in an inwards directed strong transverse impression, row 6 basally strong. Sutural row of secondary punctures about as strong as primary row 1 (Fig. 120). Secondary punctures near basal impression of primary row 5 strong. Sparse row of secondary punctures in interval 2, 3, 5+7. Interval 4, 6+8 with only a few punctures in anterior part. Completely margined, shoulders and apical margin serrate.

Underside: Yellow-brown to dark brown. Elytral epipleura yellow to yellow-brown, reaching to sternite 5. Legs yellow-brown to dark brown. Prosternum anteriorly margined, strongly, but not densely punctured. Prosternal process flat, nearly parallel, slightly narrowed just before apex, slightly diverging anteriorly, anterior edge margined, posteriorly weakly punctured, anteriorly stronger punctured (Figs 122, 123). Metasternal process flat with on each side some strong punctures, elsewhere weakly punctured (Fig. 122).



FIGURES 118–126. *Haliplus alastairi*, Holotype ♂: **118**, dorsal view; **119**, antenna; **120**, punctures near elytral base and suture; **121**, hind tibia; **122**, prosternal and metasternal process; **123**, prosternal process in lateral view; **124**, left paramere; **125**, penis; **126**, right paramere.

Metacoxal lobes not reaching sternite 5, moderately strongly to weakly punctured towards suture. Sternite 5+6 moderately, but especially laterally densely punctured. Sternite 7 fairly weakly punctured. Setiferous striole on dorsal face of hind tibia on posterior 2/3, longer tibial spur half as long as first tarsal segment (Fig. 121).

Male: Pro- and mesotarsomeres 1–3 widened and with sucker hairs on ventral side. Penis and parameres as in Figs 124–126.

Biology

Specimens were attracted to UV light placed in open forest.

Distribution (Fig. 163)

Australia: Northern part of Western Australia, Northern Territory, Queensland.

Material examined: Western Australia: 1 ♀, N. W.A., Kununurra, 22.xii.1991–6.i.1992, R. I. Storey (CV); 1 ♂, CALM-site 13/4, 12 km S. of Kalumburu Mission, 14.25S, 126.38E, 7–11.vi.1988, T. A. Weir, open forest (ANIC); Northern Territory: holotype ♂; 1 ♀ paratype Katherine, 9.ii.1968, at light, J. A. L. Watson (ANIC); 2 ♀, N.T., Grotty Pond, Newry Stn, 8.ii.1986, M. Tyler, M. Davies & G. Watson (SAMA); 1 ♂, Arnhem Land, Maningrida, 5 m., 16.iii.1961, J. L. Gressitt, light trap (BPBM); 2 ♂, 1 ♀, N.T., Horn Islet, Pellew Group, 25/31.i.1968, B. Cantrell (UQIC, CV); 1 ♀, N.T., 6 km E. of Humpty Doo, 9.ii–4.iii.1987, R. I. Storey (QPI); Queensland: 2 ♂ [on label indicated as ♀♀], Cairns, B. Allen (SAMA); 1 ♂, Q., Cairns,. Darlington (MCZC); 1 ♀, N. Qld, Iron range, Cape York Pen., 28.iv–4.v.1968, G. Monteith (UQIC); 1 ex., Cairns, C. J. W., PARATYPE *Haliplus alastairi* Watts 1984, T.11164 (QMBA); 1 ♂, N. Qld, Weipa, 15/16.iii.1989, G. Dickinson, at UV light (CV); 2 ♀, N. Qld, 10 km S. of Laura, 4.iii.1982, at light, J. Hasenpusch (QPI); 1 ♂, 1 ♀, Cardstone, 4–16.i.1968, K. Hyde, paratype; 1 ♀, Cook Town, N.Q., i.1971, G.B., paratype; 1 ♀, King River, 14.30S, 143.20E, 22.vi.1968, F. Parker, paratype (ANIC); 1 ♂, Qld, nr Mt Mulligan, 31.i.1991, Larson & Halfpap (MUNC); Federal state unknown: 1 ♂, Australia or Tasmania, Ploson [?], Mackay (MNHN).

Haliplus timmsi sp.n.

(Figs 127–135)

Type material: Holotype ♂, Lake Buchanan, Qld, 21.30S/45.50E, B. Timms, 25.ix.1953, PARATYPE *Haliplus alastairi* C. Watts 1984 (SAMA). Paratypes: 4 ♀, N. T., Grotty Pond, Newry Stn, 8.ii.1986, M. Tyler, M. Davies & G. Watson, *Haliplus alastairi* sp.nov. det. C. Watts '86 (SAMA); 1 ♂, 1 ♀, N. Qld, Pinnarendi Stn 60 km W. of Mt Garnet, 7.ii.1989, D. Heiner (QPI, CV); 1 ♂, 2 ♀, N. Qld, 10 km S. of Laura, 4.iii.1992, at light, J. Hasenpusch (2 in QPI, 1 in CV); 3 ♂, 9 ♀, N. Qld 7km NE of Tolga, ii.1988, Storey & De Faveri, light trap (12 in QPI, 1 in CV); 1 ♀, N. Qld, 7 km NE of Tolga, iii.1987, Storey & De Faveri, light trap (QPI); 1 ♂, 1 ♀, 11 km WSW of Petford, 3/4.iv.1988, R. I.Storey, at light (QPI, CV); 1 ♂, Katharine, N.T., at light, 9.ii.1968, J. A. L. Watson, *Haliplus* sp.nov. det. T. A. Weir, paratype *Haliplus alastairi* C. Watts 1984 (ANIC); 1 ♂, 2 ♀, Edge Hill, N.Q., ii.1954, G.B. (2 in ANIC, 1 in CV).

Remarks

Some paratypes of *Haliplus alastairi* Watts belong to this new species.

Diagnosis

This species can be distinguished from the related *H. alastairi* by the metasternal process being impressed on both sides.

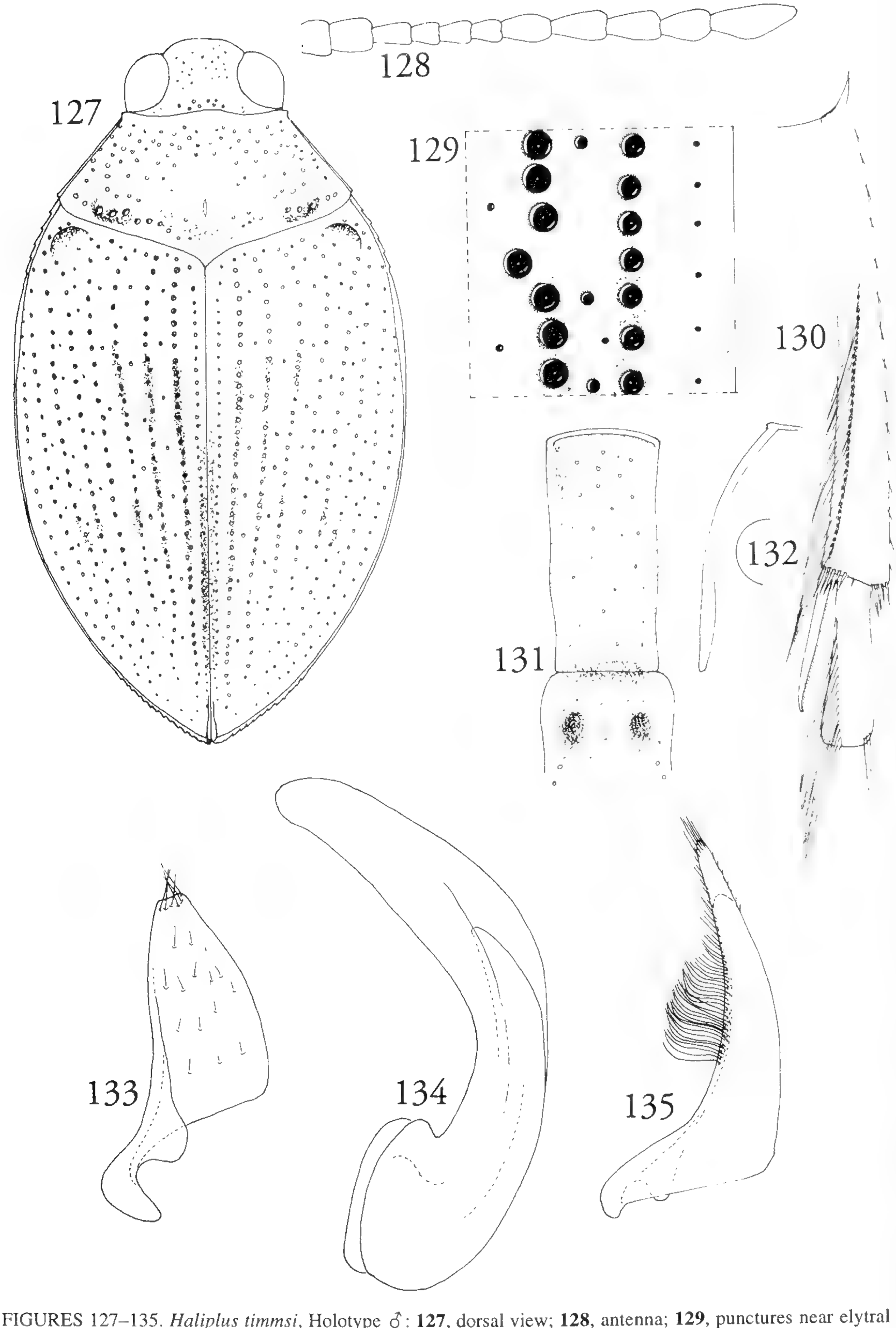
Description

Length 3.0–3.6 mm, width 1.7–2.0 mm. Body oval, widest behind shoulders, clearly tapering in apical 1/3 part (Fig. 127).

Head: Yellow-brown, clypeus and frons weakly punctured, posterior part of vertex moderately strongly punctured. Antenna yellow to yellow-brown, fourth segment shorter than adjacent segments (Fig. 128). Palpi yellow, last segment about 1/2x length of penultimate segment. Distance between eyes 1.5–2.0x width of one eye.

Pronotum: Yellow-brown. Moderately strongly punctured, basal punctures opposite elytral puncture-row 4+5 slightly stronger, base with clear impression. Lateral borders weakly margined, margin narrowed anteriorly and not reaching front corner. Anterior edge slightly protruding in middle.

Elytra: Yellow-brown. Darkened along most of suture, darkening on parts of puncture-rows, or rarely with marks connecting puncture-rows. Primary puncture-rows moderately strong, first three rows weaker and denser than others, about 42 punctures in row 1. Row 5 abruptly bent outwards and ending in an inwards directed strong transverse impression. Row 6 basally weak. Sutural row of secondary punctures weak. Sparse row of secondary punctures in interval 2, 3, 5+7.



FIGURES 127–135. *Haliplus timmsi*, Holotype ♂: **127**, dorsal view; **128**, antenna; **129**, punctures near elytral base and suture; **130**, hind tibia; **131**, prosternal and metasternal process; **132**, prosternal process in lateral view; **133**, left paramere; **134**, penis; **135**, right paramere.

Interval 4, 6+8 with only a few punctures in anterior part. Secondary punctures near basal impression of row 5 weak. Completely margined, shoulders and apical margin serrate.

Underside: Yellow-brown to dark brown. Elytral epipleura yellow to yellow-brown, reaching to sternite 5. Legs yellow-brown to dark brown. Prosternum anteriorly margined, strongly, but not densely punctured. Prosternal process flat, nearly parallel, slightly narrowed just before apex, slightly diverging anteriorly, anterior edge margined, posteriorly weakly punctured, anteriorly stronger punctured (Figs 131, 132). Metasternal process flat with on each side small very deep impression, weakly punctured (Fig. 131). Metacoxal lobes not reaching sternite 5, moderately strongly to weakly punctured towards suture. Sternite 5+6 moderately, but especially laterally densely punctured. Sternite 7 fairly weakly punctured. Setiferous striole on dorsal face of hind tibia on posterior 2/3, longer tibial spur almost as long as first tarsal segment (Fig. 130).

Male: Pro- and mesotarsomeres 1–3 widened and with sucker hairs on ventral side. Penis and parameres as in Figs 133–135.

Biology

Specimens were attracted to light.

Distribution (Fig. 164)

Australia: Queensland, Northern Territory.

Haliplus stepheni Watts
(Figs 136–146)

Haliplus stepheni Watts, 1988: 25. Holotype ♀, Australia, N.T., Humpty Doo, 6 km E., 9.ii–4.iii.1987, R. I. Storey (SAMA)[examined].

Diagnosis

This species can be distinguished from related species by the combination of a darkened elytral base and elytral puncture-row 5 with a strong transverse impression on base.

Description

Length 2.8–3.0 mm, width 1.5–1.6 mm. Body long oval, widest in middle (Fig. 136).

Head: Yellow, weakly punctured. Antenna (Fig. 137) and palpi yellow. Last segment of maxillair palpus about half length of penultimate segment (Fig. 139). Last segment of labial palpus about 2/3x length of penultimate segment (Fig. 140). Distance between eyes 1.5–1.6x width of one eye.

Pronotum: Yellow to yellow-red, usually dark blotch on anterior central part. Moderately strongly punctured, basally opposite elytral puncture-row 4 transverse impression, surrounded by strong punctures, lateral borders slightly concave, margined except near front corner, margin stronger posteriorly.

Elytra: Yellow to yellow-red, distinct dark maculation consisting of: black suture reaching secondary row 1 or in apical part reaching to primary row 1, black band along base to puncture-row 5, marks confluent with suture on disc and in posterior part, large marks in anterior, in central and in posterior part. Primary punctures strong and with clear central hole, about 28 punctures in row 1, basal punctures of row 5 in strong impression. Punctures in row 1+2 less strong than in row 3–6 or 7. Secondary punctures usually strong, generally restricted to odd intervals. All punctures darkened. Lateral sides margined, slightly constricted in posterior part, serrate in anterior part (about 7 teeth) and in posterior part (about 7 teeth).

Underside: Yellow to yellow-brown, legs yellow to brown towards coxae. Elytral epipleura yellow, reaching sternite 6, in anterior part with strong darkened punctures. Prosternum margined anteriorly, strongly punctured. Prosternal process about parallel-sided, sligthly narrowed near coxae, grooved along both sides, strongly and densely punctured, clearly margined anteriorly (Fig. 142, 143). Metasternal process flat or slightly elevated in middle, grooved along both sides, weakly punctured (Fig. 142). Metacoxal lobes moderately strongly, near suture weaker punctured, not reaching posterior margin of sternite 4. Sternite 5+6 posteriorly with complete puncture-row, sternite 7 with a few punctures in apical part. Setiferous striole on dorsal face of hind tibia about 1/3x tibia-length, longer tibial spur 2/3x length of first tarsal segment (Fig. 141).

Male: Pro- and mesotarsomeres 1–3 widened and with sucker hairs on ventral side. Penis and parameres as in Figs 144–146.

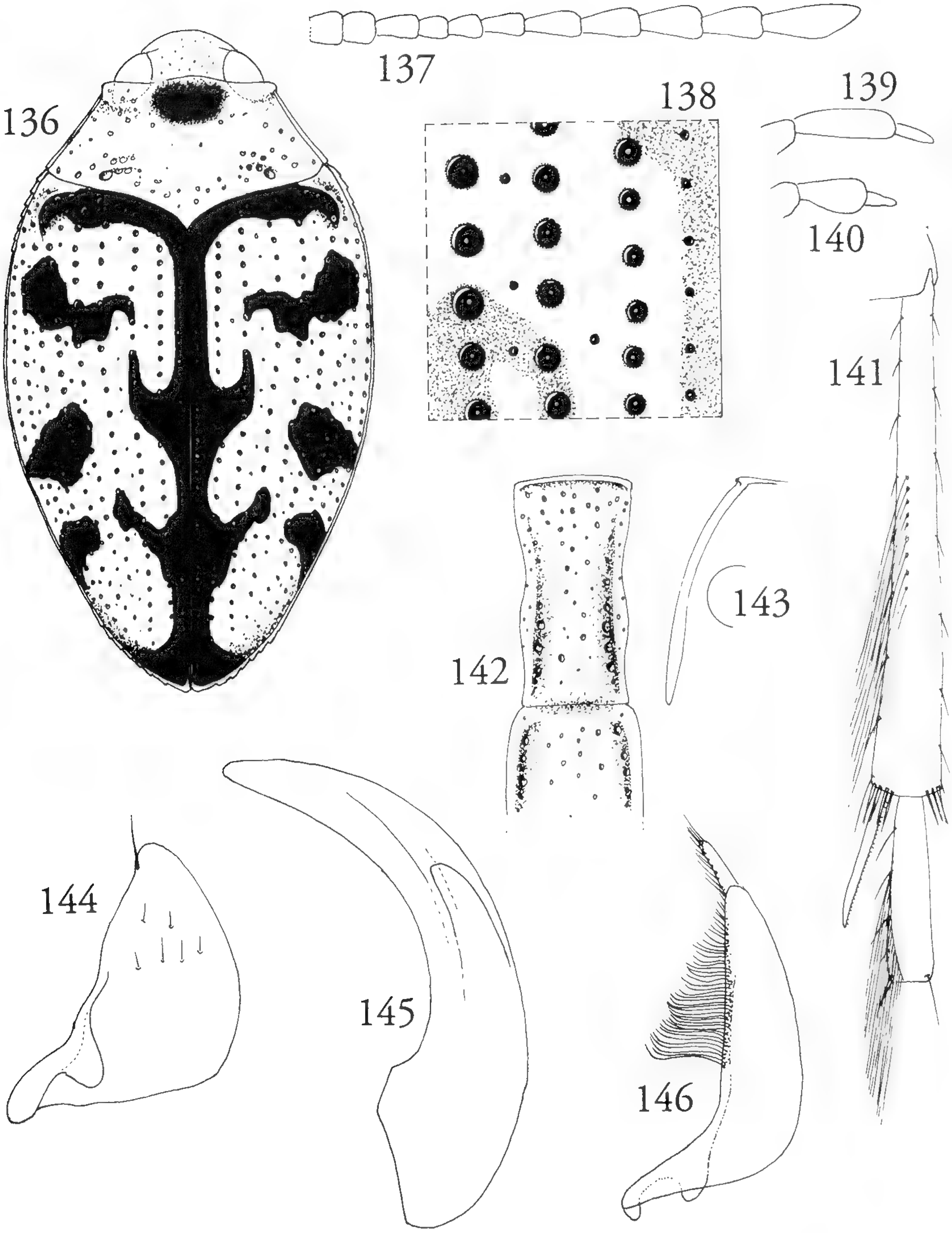
Biology

Specimens were collected in a creek and were attracted to light.

Distribution (Fig. 162)

Australia: Western Australia, Northern Territory, Queensland.

Material examined: Western Australia: 1 ♂, N. W.A., Kununurra, 22.xii.1991–6.i.1992, R. I.



FIGURES 136–146. *Haliplus stepheni*, **136-143**, Holotype ♀; **144–146**, Paratype ♂: **136**, dorsal view; **137**, antenna; **138**, punctures near elytral base and suture; **139**, maxillair palpus; **140**, labial palpus; **141**, hind tibia; **142**, prosternal and metasternal process; **143**, prosternal process in lateral view; **144**, left paramere; **145**, penis; **146**, right paramere.

Storey (CV); Northern Territory: Holotype ♀ (SAMA); 8 paratypes with same data as holotype (1 ♂ in CW; 4 ♂, 3 ♀ in QPI); Queensland: 1 ♀, N. Qld, 11 km WSW of Petford, 3/4.iv.1988, R. I. Storey, at light (QPI); 2 ex. Gunshot Ck, 13 km WNW of Heathlands, 11.43S, 142.26E, 18.iii.1992, at light, D. C. F. Rentz (ANIC, CV); 1 ♀, Qld nr Mt Mulligan, 31.i.1991, Larson & Halfpap (MUNC).

Haliplus sindus Watts
(Figs 147–152)

Haliplus sindus Watts, 1988: 22. Holotype ♀, Qld Bentinck Is. 'Ninyilki' 6 June 1963. P. Aitken, N. B. Tindale. (SAMA)[examined].

Diagnosis

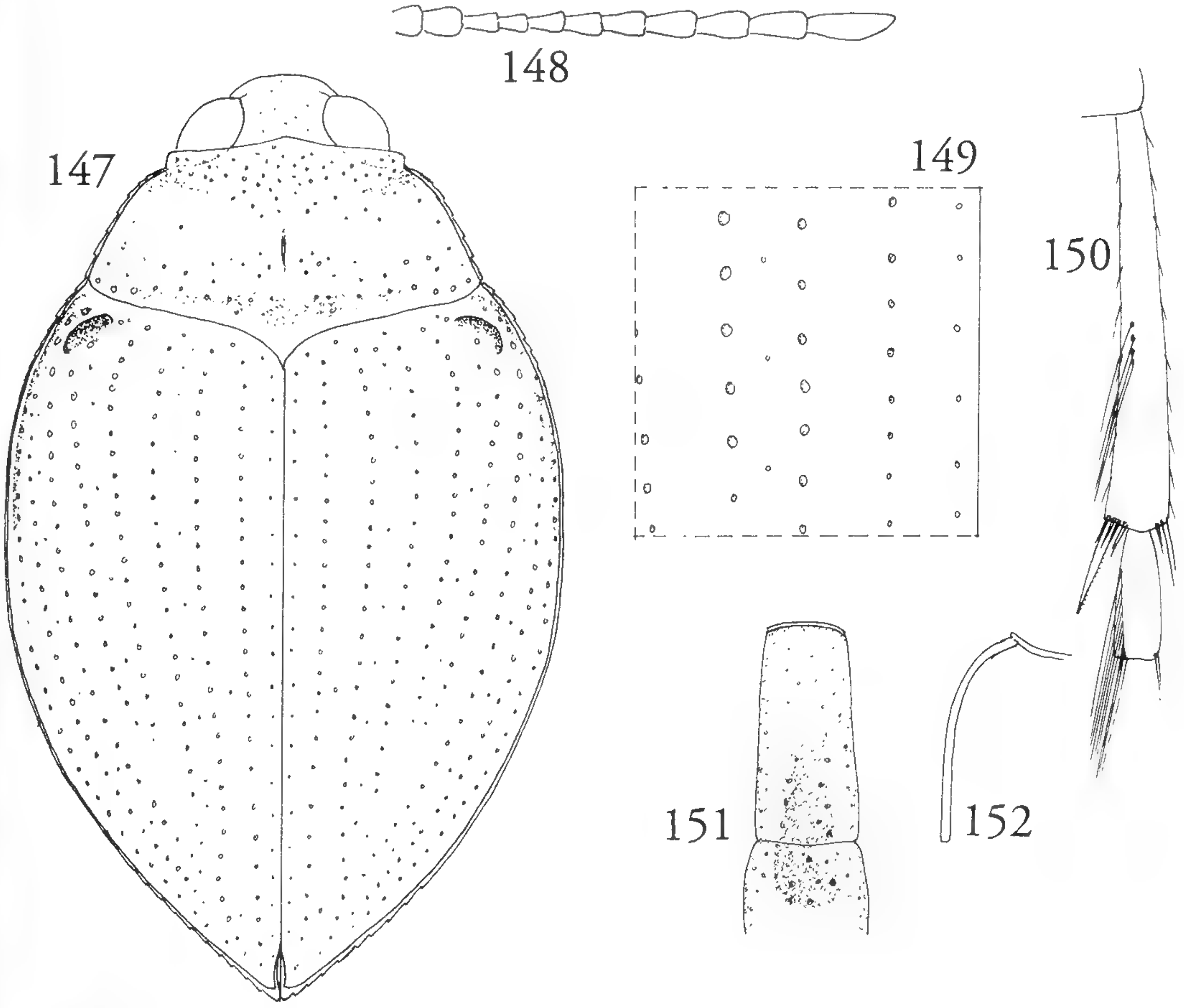
This species is easy to distinguish from others in the region by its small size and the serrate lateral margins of pronotum.

Description

Length 1.7–2.2 mm, width 1.1–1.3 mm. Body oval, strongly tapering posteriorly, widest in front of middle (Fig.147).

Head: Yellow to yellow-red, weakly and sparsely punctured. Antenna (Fig. 148) and palpi yellow. Last segment of maxillair palpi 1/3x length of penultimate segment. Last segment of labial palpi almost as long as penultimate segment. Distance between eyes 1.4–1.5x width of one eye.

Pronotum: Yellow to yellow-red, weakly punctured, in anterior central part more strongly and densely punctured, base impressed. Lateral borders slightly convex, anteriorly bent inwards, lateral margins clearly serrate, not reaching anterior corner (Fig. 147).



FIGURES 147–152. *Haliplus sindus*, Holotype ♀: **147**, dorsal view; **148**, antenna; **149**, punctures near elytral base and suture; **150**, hind tibia; **151**, prosternal and metasternal process; **152**, prosternal process in lateral view.

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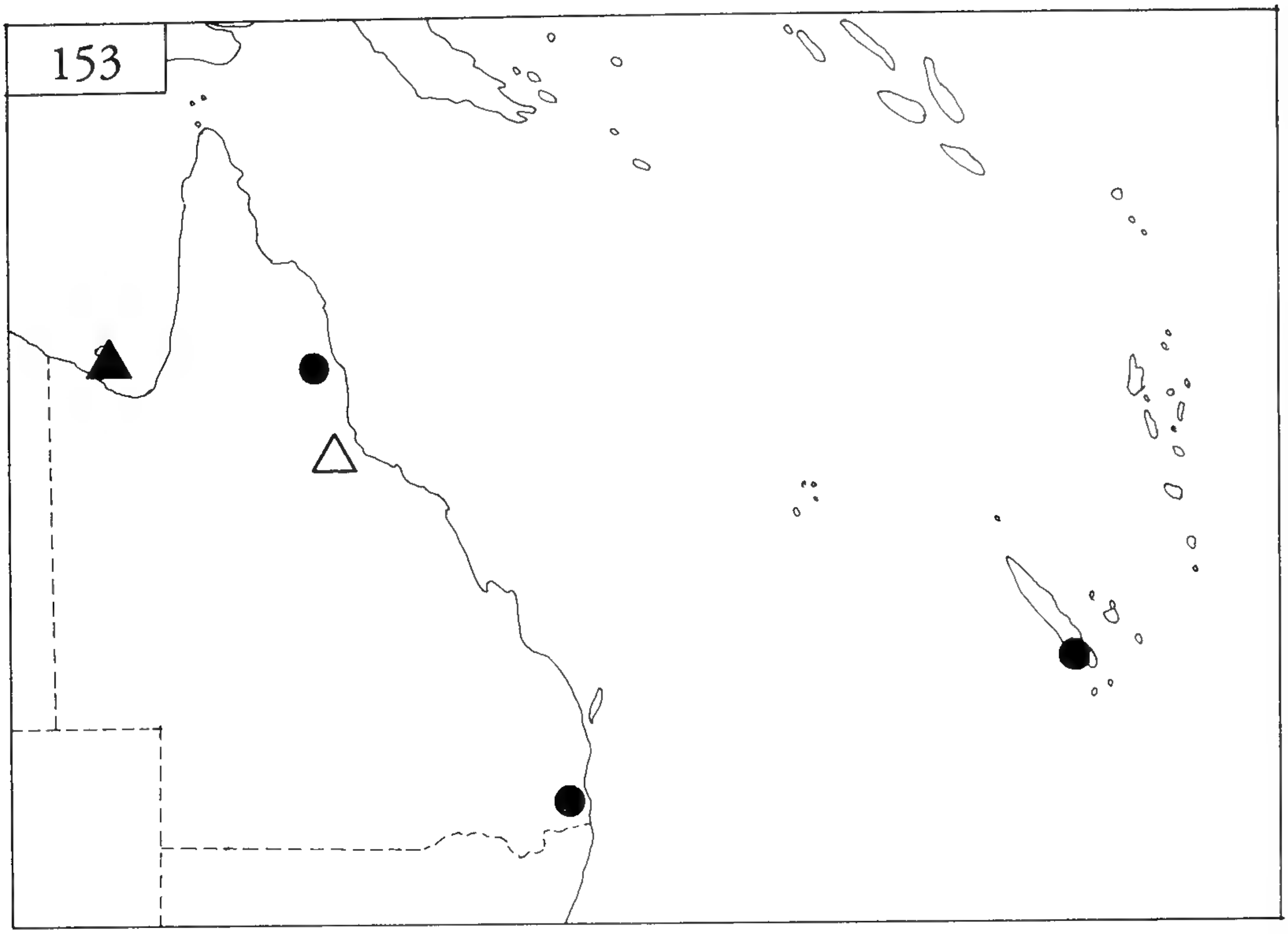

FIGURE 153. Distribution of *Haliplus oberthuri* (dots) and *Haliplus sindus* (triangle, black: examined; open: unexamined paratype).

154

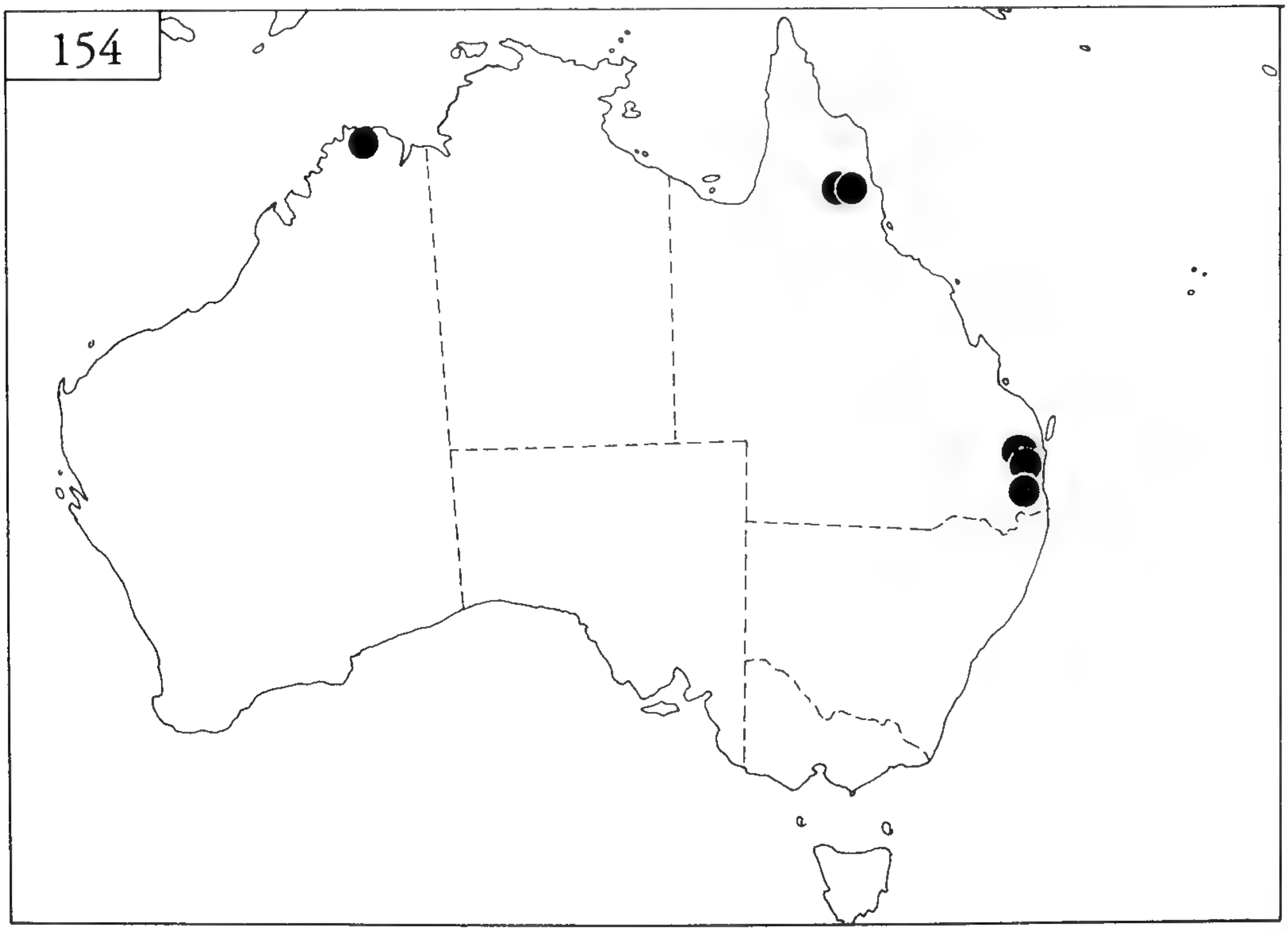

FIGURE 154. Distribution of *Haliplus bistriatus*.

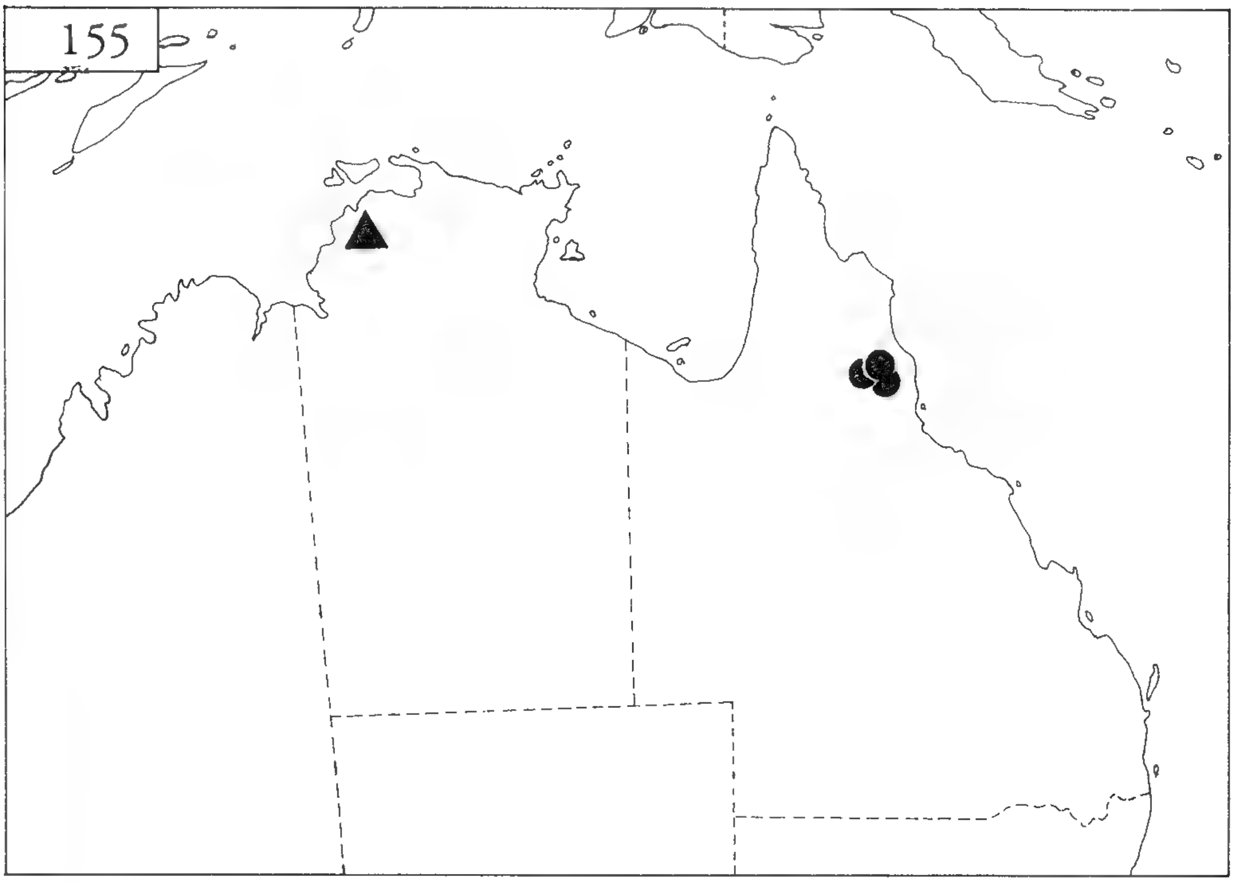

FIGURE 155. Distribution of *Haliplus hydei* (dots) and *Haliplus storeyi* (triangle).

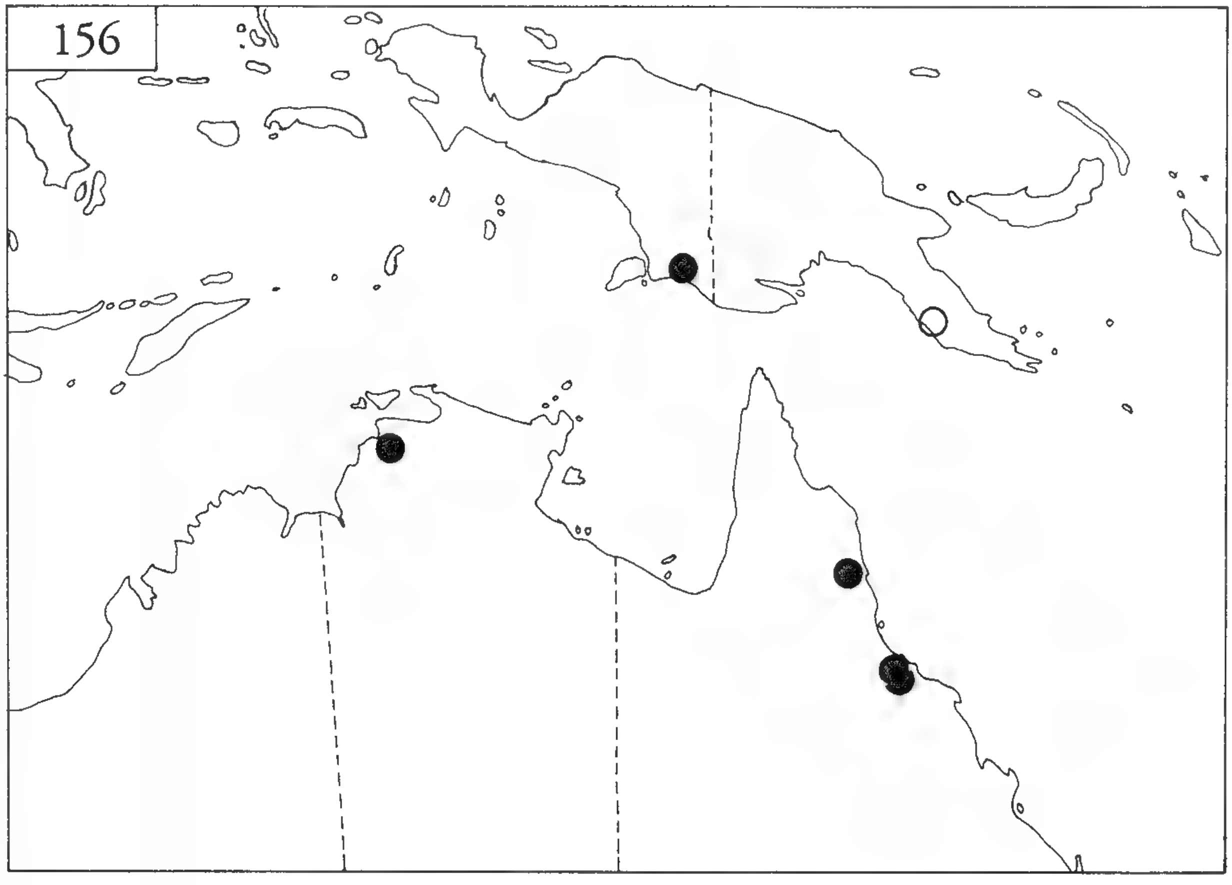

FIGURE 156. Distribution of *Haliplus ferruginipes*. (Dot: examined, circle: not examined type.)

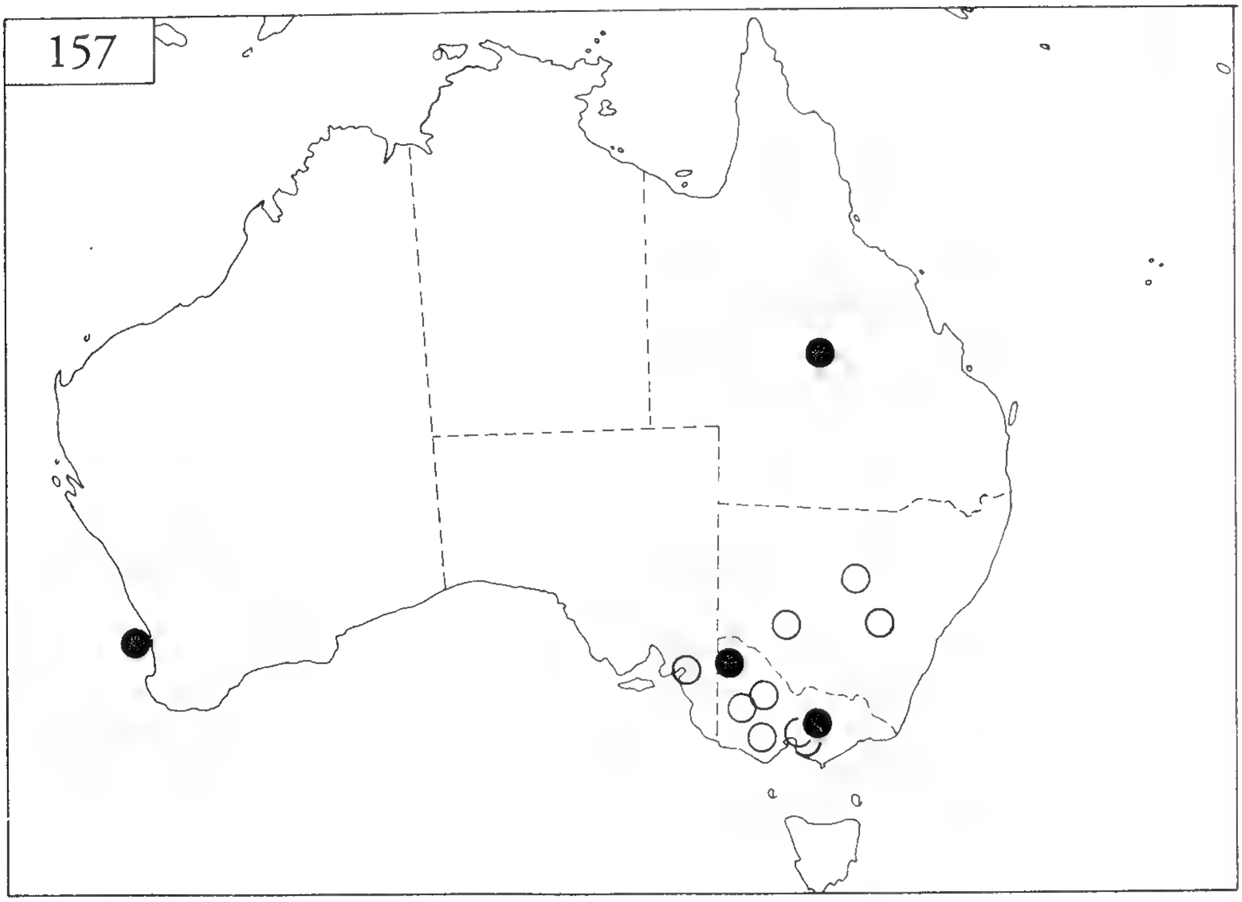

FIGURE 157. Distribution of *Haliplus fuscatus* (dots: males; circles: females of *H. fuscatus* or *H. gibbus*).

FIGURE 158. Distribution of *Haliplus gibbus* (dots: males; circles: females of *H. gibbus* or *H. fuscatus*).

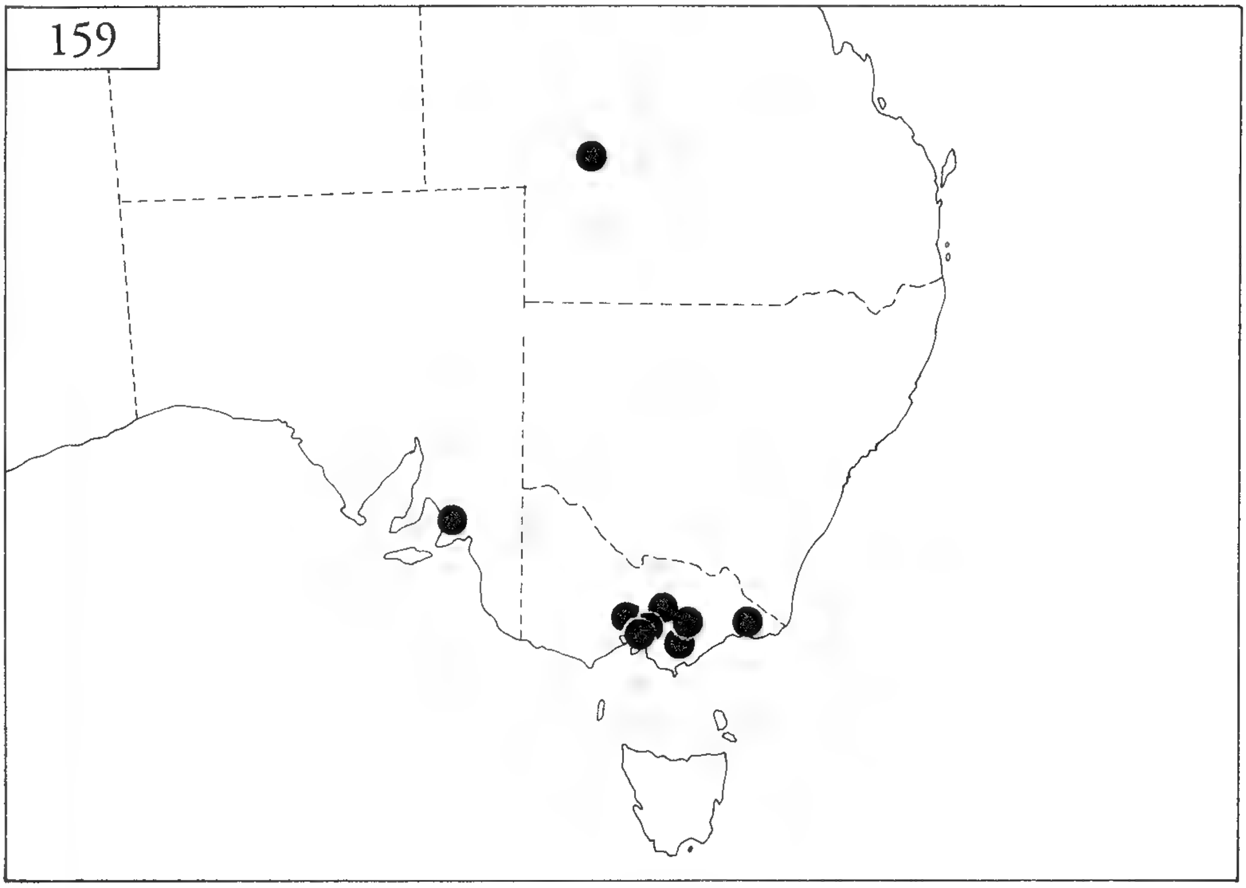

FIGURE 159. Distribution of *Haliplus australis*.

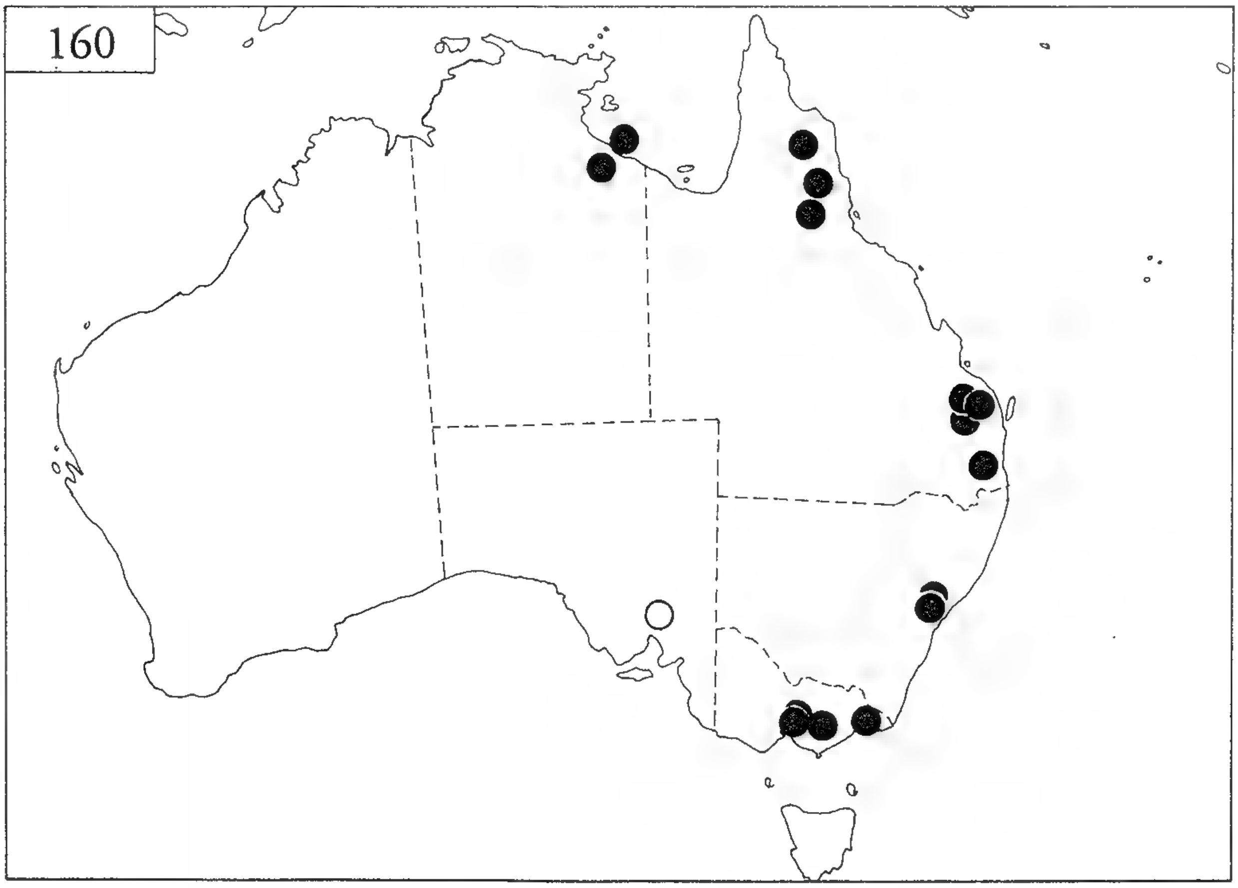

FIGURE 160. Distribution of *Haliplus testudo* (dots: locality known; circle: specific locality in S.A. unknown).

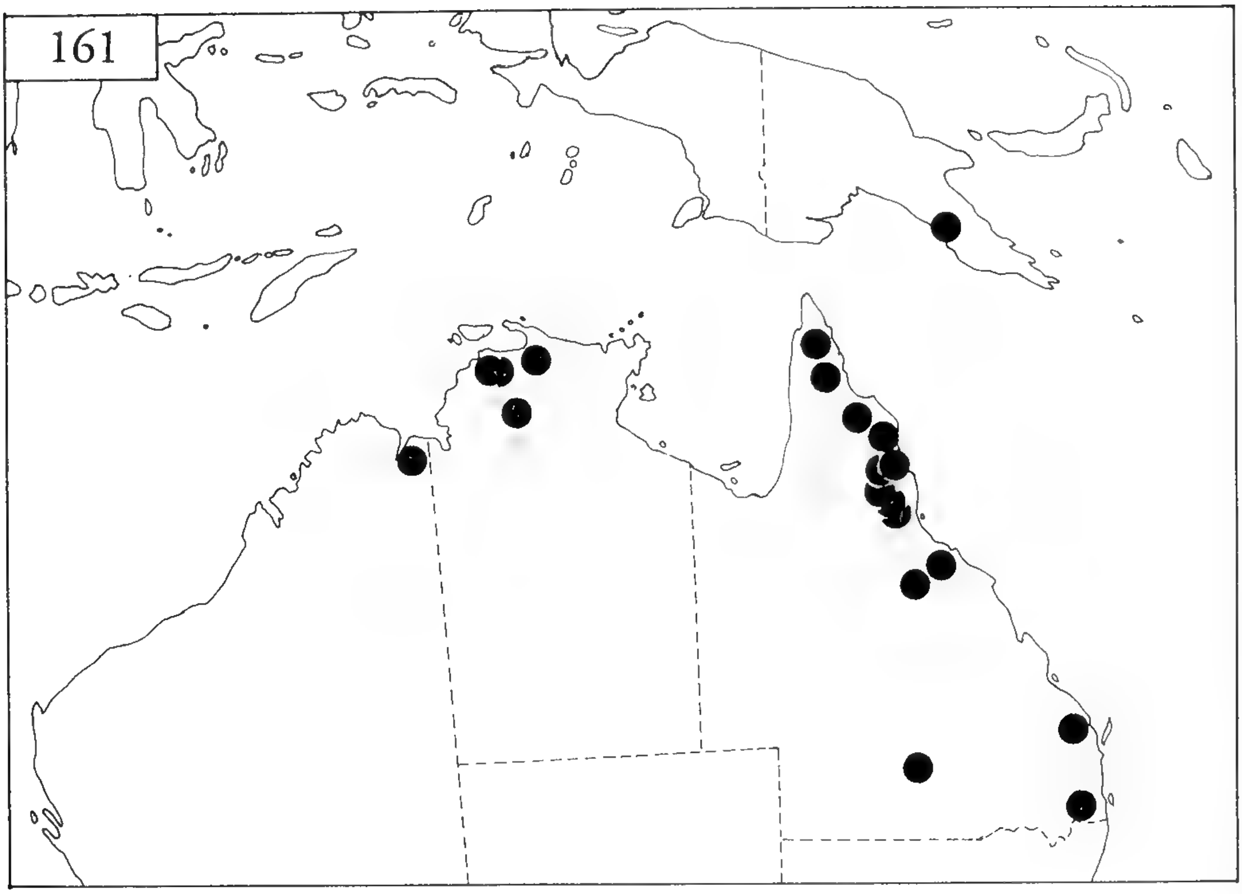

FIGURE 161. Distribution of *Haliplus wattsi*.

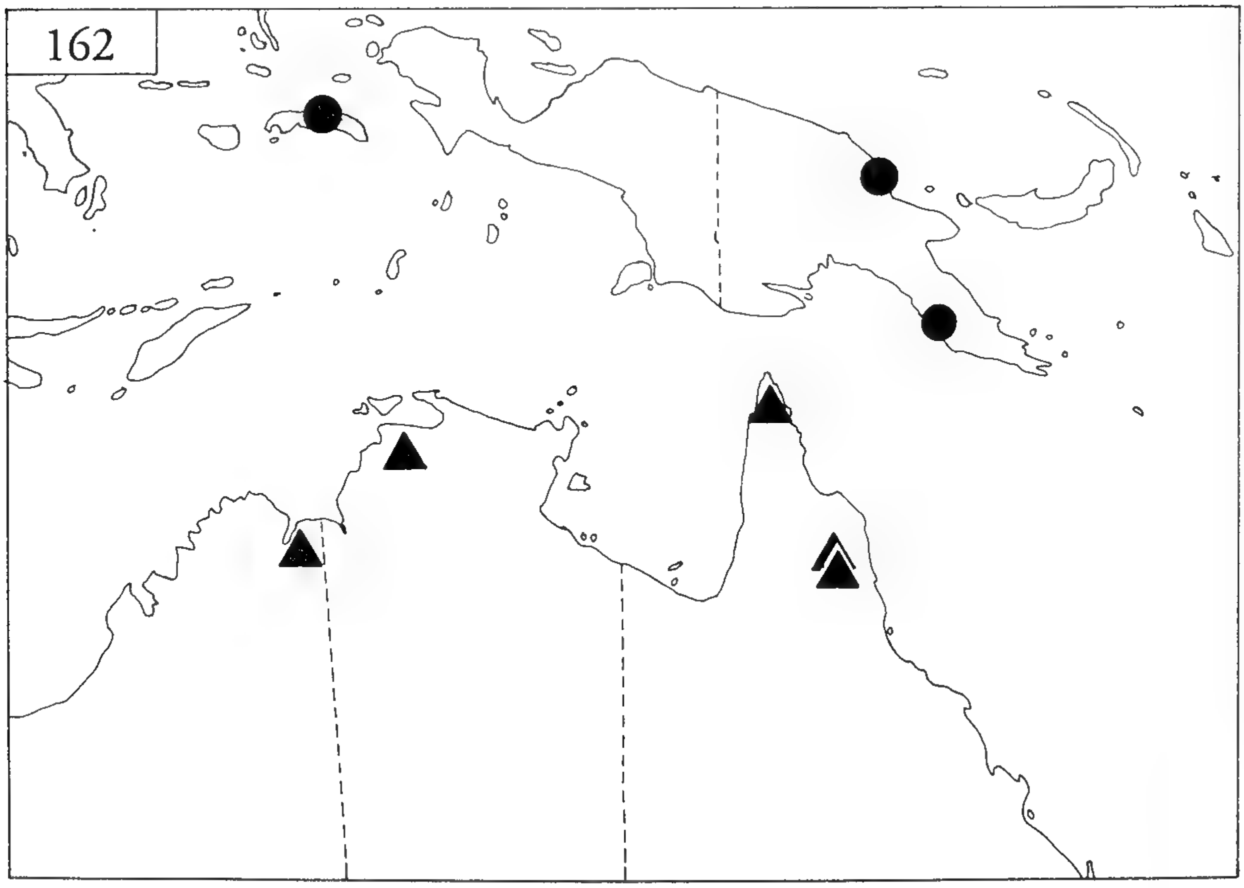

FIGURE 162. Distribution of *Haliplus signatipennis* (dots) and *Haliplus stepheni* (triangles).

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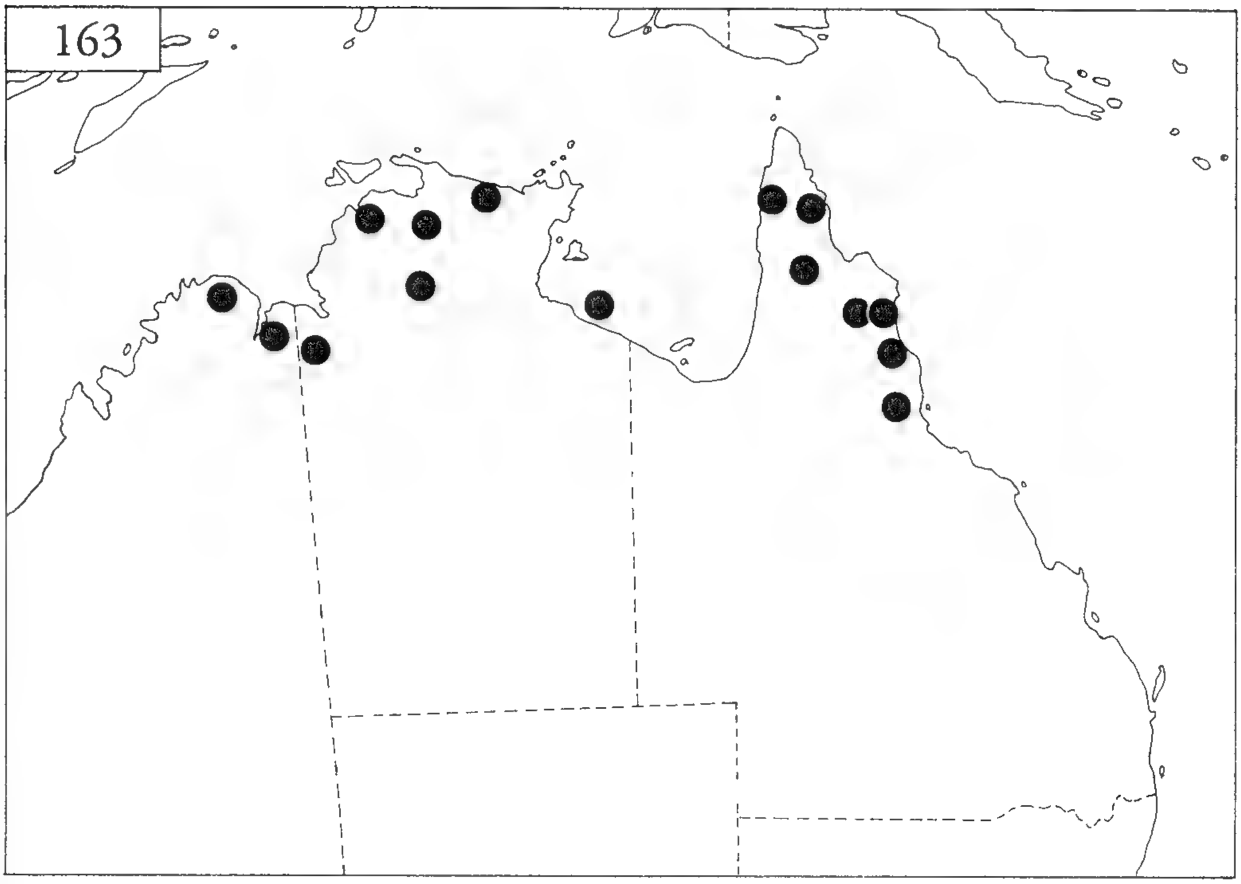

FIGURE 163. Distribution of *Haliplus alastairi*.

164

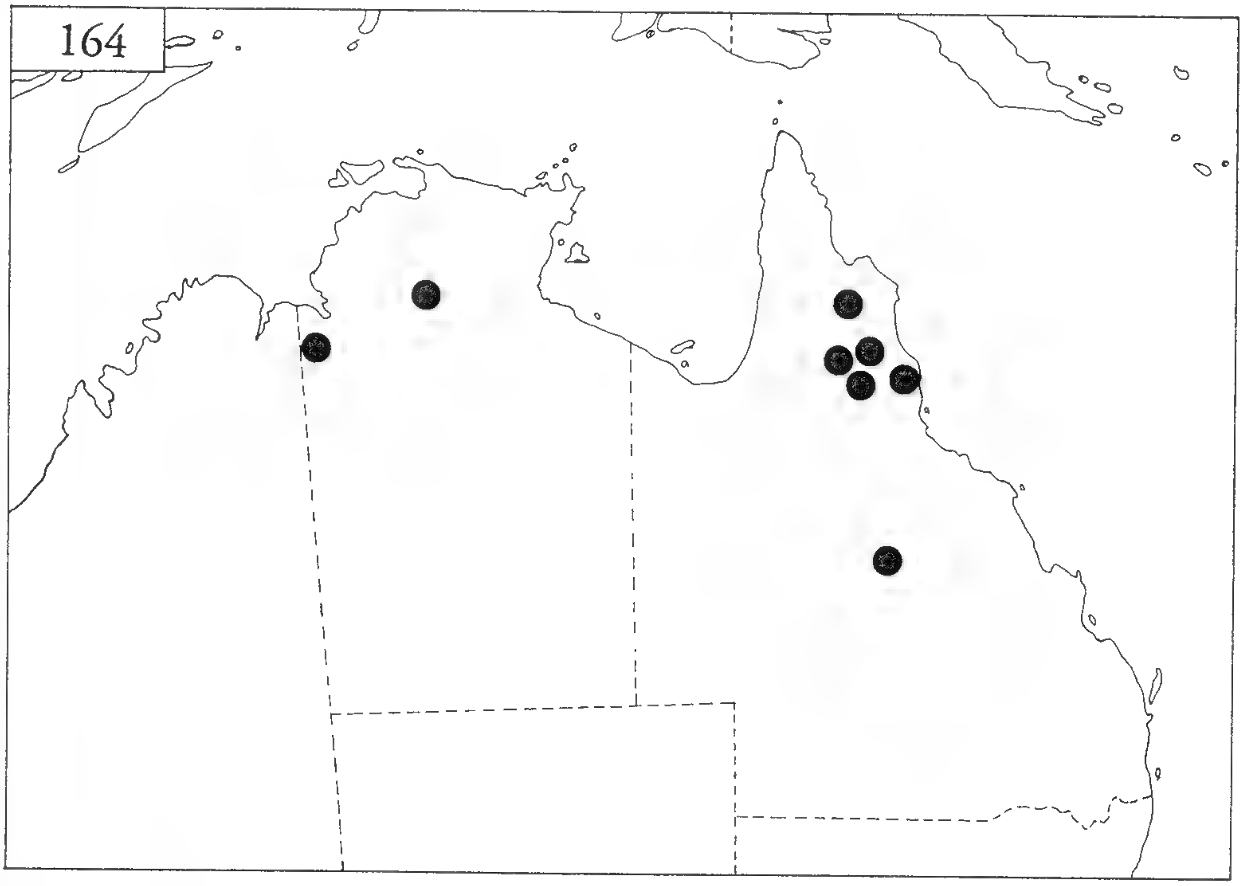

FIGURE 164. Distribution of *Haliplus timmsi*.

Elytra: Yellow to yellow-red. Primary punctures weak and sparse, row 1+2 not as strong as row 3–7, base of row 5 ending in transverse strong impression, about 25 punctures in row 1. Secondary punctures scattered and almost restricted to odd intervals, sutural row almost as strong, but not as dense as primary row 1 (Fig. 149). Punctures not darkened. Interval between puncture-row 8 and 9 slightly elevated in anterior part. Lateral sides margined and clearly serrate near shoulders and near apex.

Underside: Yellow to yellow-red, elytral epipleura yellow to yellow-red, legs yellow-red to yellow-brown, slightly darkened near coxae. Elytral epipleura reaching end of sternite 5. Prosternum completely margined anteriorly, not or hardly punctured. Prosternal process parallel-sided, slightly wider posteriorly, anterior edge margined, slightly impressed in posterior half, weakly punctured, stronger punctures in impression (Figs 151, 152). Metasternal process hardly wider than prosternal process, clearly impressed anteriorly, moderately strongly punctured (Fig. 151). Metacoxal lobes reaching to end of sternite 4, sparsely punctured, punctures weaker towards suture. Sternite 5+6 with complete puncture-rows, sternite 7 completely, but sparsely punctured. Setiferous striole on dorsal face of hind tibia short, with about 3 punctures, both tibial spurs about 2/3x length of first tarsal segment (Fig. 150).

Male: unknown

Distribution (Fig. 153)

Only known from type localities in Queensland: Bentinck Island (holotype) and Homehill (unexamined paratype).

Material examined: Only holotype ♀.

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I am very grateful to Dr C. H. S. Watts (Adelaide, SAMA) for his very valuable help and to Dr D. J. Larson (St. John's, MUNC) and Dr O. Biström (Helsinki, UZMH) for critical comments.

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MOLLUSC TYPE SPECIMENS IN THE SOUTH AUSTRALIAN MUSEUM. 6. ADDITIONS AND CORRECTIONS TO PART 1 (CEPHALOPODA AND SCAPHOPODA) AND PART 3 (POLYPLACOPHORA).

K. L. GOWLETT-HOLMES & W. ZEIDLER

GOWLETT-HOLMES, K. L. & ZEIDLER, W. 1995. Mollusc type specimens in the South Australian Museum. 6. Additions and corrections to Part 1 (Cephalopoda and Scaphopoda) and Part 3 (Polyplacophora). *Records of the South Australian Museum* **28**(1): 103–111.

This paper lists the recent additions made to the South Australian Museum's type collections of Chitons (Zeidler and Gowlett, 1986) and Cephalopoda (Zeidler and Macphail, 1978). Since publication of these type lists type material of twelve taxa of Polyplacophora and nine taxa of Cephalopoda have been added to the Museum's collections. Further additions to type material of species listed previously, changes in type status and nomenclature are also noted, reflecting the importance of the mollusc collection in the South Australian Museum.

K. L. Gowlett-Holmes and W. Zeidler, South Australian Museum, North Terrace, Adelaide, South Australia 5000. Manuscript received 18 October 1994.

There have been several important additions to the collections since the first publication in the series (Zeidler & Macphail, 1978) cataloguing the mollusc type specimens in the South Australian Museum (SAM). One of the most significant additions since then has been some historical cephalopod types described by S. Stillman Berry in 1921 and 1932, which until recently had been thought lost. These were found amongst Berry's vast collection, most of which was bequeathed to the Santa Barbara Museum of Natural History upon his death on 9 April 1984 (Hochberg, 1985), except for the cephalopod collection, which was left to the Smithsonian. Dr Clyde Roper subsequently curated Berry's cephalopod material and returned the specimens to the South Australian Museum in 1986. Two of the types had been out on loan for 65 years!

Other additions have resulted from subsequent work on the collections, donations from other workers and nomenclatural changes, reflecting the importance of the mollusc collection in the South Australian Museum. The types of 9 taxa of cephalopods and 12 taxa of Polyplacophora have been added to the SAM collections. There have been changes to the status or additions to the types of 7 taxa of Polyplacophora listed previously (Zeidler & Gowlett, 1986). There have been no additions to the gastropod families catalogued to date; Conidae (Zeidler, 1985), Marginellidae (Hewish & Gowlett-Holmes, 1991), Cypraeidae, Triviidae and Ovulidae (Gowlett-Holmes & Zeidler, 1993). In the following list species are arranged alphabetically in families under the original name at the time of description. In the Polyplacophora, specimens are dry unless otherwise indicated, and are listed as 'entire' when the articulated valves and girdle are present or as 'entire with animal' when the animal is also present.

Other abbreviations used in the text are as follows; AM = Australian Museum, Sydney. BMNH = The Natural History Museum, London (formerly British Museum, Natural History). LACM = Los Angeles County Museum of Natural History, California. MNHN = Museum National dHistoire Naturelle, Paris. NMNZ = Te Papa Tongarewa Museum of New Zealand, Wellington (formerly National Museum, New Zealand). NMV = Museum of Victoria, Melbourne (formerly National Museum of Victoria). QM = Queensland Museum, Brisbane. RSM = Royal Scottish Museum, Edinburgh. SBMNH = Santa Barbara Museum of Natural History, California. SEM = Scanning Electron Micrograph. USNM = National Museum of Natural History, Smithsonian Institution, Washington, DC. WAM = Western Australian Museum, Perth.

Class POLYPLACOPHORA

Family ABYSSOCHITONIDAE

Genus ***Ferreiraella*** Sirenko, 1988

Ferreiraella caribbensis Sirenko, 1988
Zool. Zh. **67**(12): 1778–81, figs 1, 2.

Paratype: D18762, one specimen with animal in spirit, with anterior and two median valves disarticulated, dredged in 6740–6780 m, Cayman Trench, Caribbean Sea [19°39'N, 76°37'W], RV 'Ac. Kurchatov', Stn 1267, collected by L. Moskalev, 24–5 March, 1973.

Note: Donated to SAM collections by B. I. Sirenko, St Petersburg, Russia. The holotype and additional paratypes are in the Academy of Sciences, St Petersburg, Russia.

Family ACANTHOCHITONIDAE

Genus *Acanthochites* Risso, 1826

Acanthochites kimberi Torr, 1912

Trans. R. Soc. S. Aust. **36**: 167, pl. 6, figs 5a–f.

= *Acanthochitona kimberi* (Torr, 1912).

Syntype: D17586, entire specimen with animal, from Aldinga, near Adelaide, South Australia, collected by W. J. Kimber, date of collection unknown.

Note: An additional syntype to the series listed by Zeidler and Gowlett (1986) found recently in the collections. Specimen with small label 'TYPE 59', typical of other Torr type specimens. Present status according to Kaas and Van Belle (1980).

Genus *Acanthochiton* Gray, 1821 em. Iredale, 1915

Acanthochiton mayi Ashby, 1922

Trans. R. Soc. S. Aust. **46**: 12, pl. 3, figs 1a–b.

= genus uncertain

Syntypes: D12799, five median valves, in 100 fm (183 m), 7 miles east of Cape Pillar, and from Schouten Island, Tasmania, collected by W. L. May, 18 Dec. 1907 (Cape Pillar). D17942, one median valve, in 60 fm (110 m), off Port Arthur, Tasmania, collected by W. L. May, date of collection unknown.

Note: May Collection No. 260A. Type status was not indicated on the original labels, but there is no doubt that these are the specimens that Ashby (1922) examined, and may include the valve he illustrated. Ashby states that one syntype was lodged with the Tasmanian Museum, but Turner and Dartnall (1971) do not list this specimen, and we have been unable tolocate it there. Kaas and Van Belle (1980) place this species in the genus *Notoplax*, but it does not fit into this genus as defined by Gowlett-Holmes (1991), and its current generic status is uncertain.

Genus *Acanthochitona* Gray, 1821

Acanthochitona saundersi Gowlett-Holmes & Zeidler, 1987

Trans. R. Soc. S. Aust. **111**(2): 111–4, figs 1, 2.

Holotype: D16699, entire specimen with animal, from on edge of granite slope, under sand, in 8 m, in cove off northwest point of East Franklin Island, Nuyts Archipelago, South Australia, collected by K. L. Gowlett, 20 July, 1983.

Paratypes: D16698, one specimen in spirit, disarticulated, valves and SEM stub of radula in dry collection, from on granite ledge, under sand, in 6 m, on inside of reef off southwest side of East Franklin Island, Nuyts Archipelago, South Australia, collected by K. L. Gowlett, 18 July, 1983. D17441, two entire specimens with animals, from on smooth rock under sand, in 12 m, on Far West Bottom, Tiparra Reef, Spencer Gulf, South Australia, collected by K. L. Gowlett, 13 May, 1982. D17475, one entire specimen with animal in spirit, from on granite fragment in sand pocket on reef, in 7 m, off Point Gilbert, Port Moorowie, Waterloo Bay, Yorke Peninsula, South Australia, collected by N. J. C. Holmes, 29 March, 1986.

Genus *Notoplax* Adams, 1861

Notoplax lancemilnei Gowlett-Holmes, 1988

Trans. R. Soc. S. Aust. **112**(4): 169–71, figs 1–3.

Paratype: D18436, entire specimen with animal in spirit, trawled by F. R. V. 'Kapala' in 439 m, off Wollongong, New South Wales [34°21–19'S, 151°23–25'E], collected by K. Graham, 13 December, 1978.

Note: Holotype in AM (C151130).

Family CHITONIDAE

Genus *Chiton* Linnaeus, 1758

Chiton (Rhyssoplax) kimberi Ashby, 1928

Trans. R. Soc. S. Aust. **52**: 170, pl. 12, figs 10–12.

= *Rhyssoplax kimberi* (Ashby, 1928)

Holotype: D12392, eight disarticulated valves, fragments of girdle, plus radula mounted on slide, from Capricorn Group, Queensland, collected by W. J. Kimber, date of collection unknown.

Note: This species was listed by Zeidler and Gowlett (1986). The three median valves listed there as presumed lost have now been located.

The two lots have been combined and registered under the one number, as the pieces all belong to the one specimen, the unique holotype.
This species was listed by Kaas and Van Belle (1980) as *Chiton (Rhyssoplax) kimberi*, but *Rhyssoplax* is now considered a valid genus (Bullock, 1988).

Chiton tulipa alfredensis Ashby, 1928
Proc. Malac. Soc. **18**(2): 87, pl. 8, figs 19–21.
= *Rhyssoplax tulipa* (Ashby, 1928)
Holotype: D10983, two slides, each with a piece of what appears to be a single radula, from Port Alfred, South Africa, collected by W. H. Turton, date of collection unknown.
Note: This material most likely belongs to the holotype listed by Zeidler and Gowlett (1986). This species was listed by Kaas and Van Belle (1980) as *Chiton (Rhyssoplax) tulipa*, but *Rhyssoplax* is now considered a valid genus (Bullock, 1988).

Family ISCHNOCHITONIDAE

Genus *Ischnochiton* Gray, 1847

Ischnochiton (Lepidozona) asthenes Berry, 1919
Lorquinia **2**(6): 47.
= *Callistochiton asthenes* (Berry, 1919)
Paralectotype: D10404, entire specimen, from White's Point, Los Angeles County, California, United States of America, collected by A. G. Smith, 14–18 July, 1916.
Note: This specimen was listed by Zeidler and Gowlett (1986) as a paratype, but as the primary type selection was made in a later paper (Berry, 1919b) than the original description, it is a lectotype, and the specimen in SAM is a paralectotype. Lectotype (34389) and additional paralectotypes (34390–2) in SBMNH.

Ischnochiton crebristriatus Cochran, 1988
Proc. R. Soc. Vic. **100**(1): 1–7, figs 1–4, tables 1, 2.
Holotype: D18405, entire specimen with animal, from on rocks and pebbles under sand, in 8 m, inside reef, southwest side of East Franklin Island, Franklin Islands, Nuyts Archipelago, South Australia, collected by K. L. Gowlett, 13 April, 1983.
Paratypes: D11774, one entire specimen with animal (crushed), from Port Willunga, near Adelaide, South Australia, collected by E. Ashby, date of collection unknown. D14482, one entire specimen with animal, from Arno Bay, Eyre Peninsula, South Australia, collected by B. J. Weeding, date of collection unknown. D16568, three entire specimens with animal, from on granite rocks under medium to coarse sand, in 10 m, big break north of islands, Franklin Islands, Nuyts Archipelago, South Australia, collected by K. L. Gowlett, 21 July, 1983. D16569, one entire specimen with animal, from on rock under sand, in 15 m, rise inshore of big break north of islands, Franklin Islands, Nuyts Archipelago, South Australia, collected by K. L. Gowlett, 24 February, 1983. D16570, two specimens, one entire with animal, one entire specimen and radula, from on smooth granite and pebbles under sand, in 6–11 m, between West Franklin Island and Seal Island, Franklin Islands, Nuyts Archipelago, South Australia, collected by K. L. Gowlett, 25 February, 1983. D16571, one specimen in spirit with posterior and two median valves disarticulated, radula and part of girdle on SEM stubs in dry collection, with same locality data as holotype, collected by P. Aerfeldt. D16572, three entire specimens with animals, with same collection data as holotype. D16573, one specimen with animal, with anterior, one median and posterior valves disarticulated, from edge of granite slope under sand, in 8 m, in cove, northwest point of East Franklin Island, Franklin Islands, Nuyts Archipelago, South Australia, collected by K. L. Gowlett, 20 July, 1983. D16574, two entire specimens with animals, from on granite rock under sand, in 6 m, inside cove west end of Seal Island, Franklin Islands, Nuyts Archipelago, South Australia, collected by K. L. Gowlett, 17 July, 1983. D18406, one entire specimen with animal, from near Port Hughes, Moonta Bay, Yorke Peninsula, South Australia, collected by B. J. Weeding, Jan. 1932.

Ischnochiton hewitti Ashby, 1931
Ann. S. Afr. Mus. **30**(1): 33–4, pl. 5, figs 50–53.
= *Ischnochiton bergoti* (Velàin, 1877)
Syntype: D10997, entire specimen, and radula mounted on slide, from Table Bay, Cape Town, South Africa, collector and date of collection unknown.
Note: Zeidler and Gowlett (1986) list this specimen as the holotype, but noted that it was probably only a paratype. However, as Ashby (1931) did not designate a type and used a series of specimens in the description, this specimen is a syntype. Current status according to Kaas and Van Belle (1990).

Ischnochiton (Chartoplax) nubilus Cochran, 1993

Proc. R. Soc. Vic. **105**(1): 51–4, figs 1, 2.

Holotype: D11728, entire specimen with animal, dredged from Gulf St Vincent, South Australia, collected by J. C. Verco, date of collection unknown.

Paratypes: D15127, one entire specimen, and radula on slide, dredged in 20 m, from off Brighton, near Adelaide, South Australia, collected by M. J. Tilbrook, 8 June, 1968. D17592, one entire specimen with animal in spirit, from on pebble in sand, in *Posidonia* seagrass, in 3 m, 150–200 m offshore of northwest point of Reevesby Island, Sir Joseph Banks Group, South Australia, collector W. Zeidler, 13 January, 1984. D17593, one specimen with animal in spirit, anterior, two median and posterior valves disarticulated, one valve, radula and part of girdle on SEM stubs in dry collection, from on pebbles in sand, in sparse *Posidonia* seagrass, in 3–6 m, off northwest point of Marum Island, Sir Joseph Banks Group, South Australia, collected by W. Zeidler and K. L. Gowlett-Holmes, 23 January, 1986.

Note: The holotype (D11728) is also the paralectotype of *Ischnochiton (Stenochiton) pallens* Ashby, 1900, also listed here. The slide of paratype D15127 contains two radulae, one of which is from the paratype, the other is from a non-type specimen (D14928).

Ischnochiton (Stenochiton) pallens Ashby, 1900

Trans. R. Soc. S. Aust. **24**: 86, pl. 1, figs 1a–e, g.

= *Ischnochiton (Chartoplax) purus* Sykes, 1896

Lectotype: D978, five disarticulated median valves and anterior valve, from Gulf St Vincent, South Australia, dredged by J. C. Verco, date of collection unknown.

Paralectotype: D11728, entire specimen with animal, with same collection data as lectotype.

Note: Zeidler and Gowlett (1986) incorrectly listed these specimens as holotype and paratype, following Cotton and Godfrey (1940) and Cotton (1964). However, Ashby (1900) did not designate a type for this species, although he labelled the specimens 'type' and 'co-type'. Cotton & Godfrey (1940) by listing D978 as a holotype, actually designated the lectotype by inference of holotype (ICZN Article 74(a & b)).

The paralectotype (D11728) is also the holotype of *Ischnochiton (Chartoplax) nubilus* Cochran, 1993, also listed here.

Genus *Juvenichiton* Sirenko, 1975

Juvenichiton komandorensis Sirenko, 1975

Zool. Zh. **54**(10): 1445–7, fig. 2.

Paratypes: D18761, two entire specimens with animals, from on *Constantinea subulifera* (a red alga), in 15 m, Cape Fedoskin, Bering Island, Commander Islands, Bering Sea, Russia, collected by B. I. Sirenko, 23 September, 1973.

Note: Donated to SAM collections by B. I. Sirenko, St Petersburg, Russia. The holotype and additional paratypes are in the Academy of Sciences, St Petersburg, Russia.

Genus *Particulazona* Kaas, 1993

Particulazona milnei Kaas, 1993

Basteria **57**: 127–30, figs 1–14.

Holotype: D18930, disarticulated and dissected, most valves and girdle fragments in vials, girdle and valve fragments on SEM stubs, girdle fragments and radula on slides, from on mangrove roots, Frances Bay, Darwin, Northern Territory, collected by M. J. Tilbrook, 22 July, 1954.

Note: Type unique.

Genus *Stenochiton* Adams and Angas, 1864

Stenochiton pilsbryanus dilatus Iredale & Hull, 1924

Aust. Zool. **3**: 287, pl. 36, fig. 11.

= *Stenochiton pilsbryanus* (Bednall, 1897)

Syntype: D18766, entire specimen with animal, from on blades of seagrass, Lucky Bay, 25 miles east of Esperance, Western Australia, collected by A. F. B. Hull, date of collection unknown.

Note: From the K. L. Milne Collection. Originally labelled as a paratype, but Iredale and Hull did not designate a holotype, so all type specimens constitute a syntype series. An additional syntype is in WAM (11658). Present status according to Kaas and Van Belle (1994).

Family LEPIDOPLEURIDAE

Genus *Lepidopleurus* Risso, 1826

Lepidopleurus badius Hedley & Hull, 1909

Rec. Aust. Mus. **7**: 260, pl. 73, figs 1, 2.

= *Leptochiton badius* (Hedley & Hull, 1909)

Paratype: D12532, one entire specimen with animal, from Long Reef, near Narrabeen, New South Wales, collector and date of collection unknown.

Note: The other lot (D10668) listed by Zeidler and Gowlett (1986) as possible paratypes of this species, has since been confirmed not to represent type material.

Family MOPALIIDAE

Genus *Placiphorina* Kaas and Van Belle, 1994

Placiphorina gowlettholmesae Kaas & Van Belle, 1994

'Monograph of Living Chitons **5**: 341–3, fig. 138, map 39.

Holotype: D18837, entire specimen with animal in spirit, from under stones embedded in silty black sand, in 6–15 ft (2–4.5 m), Batu Belah (approximately 4 km west of Amed), Bali, Indonesia, collected by K. L. Gowlett-Holmes and W. Runti, 18 September, 1990.

Paratypes: D18838, one disarticulated specimen, and 9 entire specimens with animals in spirit, from under rocks embedded in silty black sand, in 6–10 ft (2–3m), at site of MV 'Liberty' shipwreck, Tulamben, Bali, Indonesia, collected by K. L. Gowlett-Holmes, 8 September, 1990.

Note: Additional paratypes with same data as D18838 are in the Nationaal Natuurhistorisch Museum, Leiden, Netherlands(RMNH 9357). The slides of the girdle and radula mentioned by Kaas and Van Belle (1994) have not been deposited in SAM.

Family SCHIZOCHITONIDAE

Genus *Schizochiton* Gray, 1847

Schizochiton polyops Iredale & Hull, 1926.

Aust. Zool. **4**: 271, pl. 38, figs 16, 17, 19–21.

= *Schizochiton incisus* (Sowerby, 1841).

Syntypes: D18767, two entire specimens, from Howick Island, Queensland, collected by A. F. B. Hull, date of collection unknown.

Note: From the K. L. Milne Collection. Originally labelled as paratypes, but Iredale and Hull did not designate a holotype, so all type specimens constitute a syntype series. Additional syntypes should exist in the AM and NMV, but none are listed by Smith and Robertson (1970) or Boyd and Phillips (1985), or in the computer printout of Polyplacophoran types in AM. Present status according to Kaas and Van Belle (1980).

Family XYLOCHITONIDAE

Genus *Xylochiton* Gowlett-Holmes and Jones, 1992

Xylochiton xylophagus Gowlett-Holmes & Jones, 1992

J. Malac. Soc. Aust. **13**: 38–43, figs 1–5.

Paratypes: D18770, three specimens, two entire with animal, one specimen disarticulated, in spirit, radula on SEM stub in dry collection, dredged in 1075–1100 m, on large waterlogged log of *Coriaria arborea* (Tree Tutu), off White Island [37°23.7'S, 171°39.5–36.6'E], east of North Island, New Zealand, collected by the U.S.S.R. FV 'Kalinovo', Stn BS 924 (K01/019/81), 23 November, 1981.

Note: The holotype (M.100855) and additional paratypes (M.74996, M.84251, M.86822, M.92446) are in NMNZ. Additional paratypes are in RSM (NMSZ 1991055), USNM (860288), BMNH (1991145), AM (C168568), MNHN and LACM (2280).

Class CEPHALOPODA

Family IDIOSEPIIDAE

Genus *Idiosepius* Steenstrup, 1881

Idiosepius notoides Berry, 1921

Rec. S. Aust. Mus. **1**(4): 361–2, chart 11, fig. 67.

Holotype: D17495, complete male specimen in spirit, from Goolwa, South Australia, collected by A. Zeitz, date of collection unknown (Berry Collection No. SSB 719).

Note: Paratype female in USNM (SSB 720).

Family SEPIOLIDAE

Genus *Neorossia* Boletzky, 1971

Neorossia leptodons Reid, 1991

Bull. Mar. Sci. **49**(3): 797–806, figs 14d, 24–28, tables 23,24, appendix 1d.

Paratypes: D18632, one complete female in spirit, trawled in 130 m, approx. 80 nautical miles south–southwest of St Francis Island, Nuyts

Archipelago, South Australia, [33°42'S, 132°25'E] FV 'Merindah Pearl', collected by M. Jubb, 12 August, 1988. D18724, one complete female in spirit, trawled in 1000 m, approx. 120 nautical miles southwest of Cape Adieu, Great Australian Bight, South Australia, [33°58'S, 131°22'E], FV 'Saxon Progress', collected by D. Wheenan, Nov. 1989. D18725, one complete male in spirit, same collection data as D18724. D18726, three complete males in spirit, same collection data as D18724.

Note: Holotype (F57504) and additional paratypes are held in NMV, and additional paratypes are held in AM.

Family SEPIADARIIDAE

Genus *Sepiadarium* Steenstrup, 1881

Sepiadarium austrinum Berry, 1921

Rec. S. Aust. Mus. **1**(4): 354–5, chart 10.

Holotype: D17493, complete male specimen in spirit, from Gulf St Vincent, South Australia, collected by A. Zeitz, September, 1885 (Berry Collection No. SSB 716).

Paratype: D17494, complete female specimen in spirit, same collection data as holotype (Berry Collection No. SSB 718).

Note: Paratype in USNM (SSB 717).

Sepiadarium nipponianum Berry, 1932

Philippine J. Sci. **47**(1): 42–6, pl. 1, figs 2–5.

Paratype: D17496, complete specimen in spirit, from Sagami Bay, Japan, collector M. Sasaki, 10 April, 1918 (Berry Collection No. SSB 725).

Note: Holotype in USNM (SSB 724).

Family OCTOPODIDAE

Genus *Eledone* Leach, 1817

Eledone palari Lu & Stranks, 1991

Bull. Mar. Sci. **49**(1–2): 73–85, figs 1–6.

Paratypes: D18721, one male and one female, both complete in spirit, trawled in 157 m, east of North Stradbroke Island, Queensland, [27°35'S, 153°50'E], FV 'Iron Humphrey', collected by M. Potter, 2 July, 1981, (ex NMV F57531).

Note: Holotype (F57849) and additional paratypes in NMV, additional paratypes in AM, WAM and QM.

Genus *Octopus* Lamarck, 1798

Octopus berrima Stranks & Norman, 1993

Mem. Mus. Vic. **53**(2): 355–61, figs 3, 6–11.

Paratype: D18775, dissected male specimen in spirit, dredged off Mordialloc, Port Phillip Bay, Victoria, [38°02'S, 145°05'E], FV 'A. B. Hunter II', 25 September, 1984 (ex NMV F52510).

Note: Holotype (F67132) and additional paratypes in NMV and an additional paratype in AM.

Octopus bunurong Stranks, 1990

Mem. Mus. Vic. **50**(2): 462–4, figs 3a–f.

Paratypes: D17983, one complete male specimen in spirit, from reef, rubble, sand and *Posidonia* seagrass, in 6 m, Partney Shoal, west of Partney Island, Sir Joseph Banks Group, South Australia, collected by W. Zeidler and N. J. C. Holmes, 21 January, 1986. D17986, one complete male specimen in spirit, from 50 m offshore of Marino Rocks, near Adelaide, South Australia, collected by R. Browne, 28 January, 1982.

Note: Holotype (F53223) and additional paratypes in NMV.

Octopus kaurna Stranks, 1990

Mem. Mus. Vic. **50**(2): 460–2, figs 2a–f.

Paratypes: D13283, one complete immature male specimen in spirit, from off Brighton, near Adelaide, South Australia, collected by W. G. Hollis, September, 1937. D16195, one female specimen in spirit, and radula on slide, from off Glenelg, near Adelaide, South Australia, collected by A. E. Robb, 29 March, 1949.

Note: Holotype (F24494) and additional paratypes in NMV.

Octopus warringa Stranks, 1990

Mem. Mus. Vic. **50**(2): 457–60, figs 1a–f.

Paratype: D15219, complete female specimen in spirit, from off Maria Island, Tasmania, [42°40'S, 148°28'E], RV 'Discovery', BANZARE Stn 113, 23 March, 1931.

Note: This specimen was originally identified as *Robsonella australis* (Hoyle, 1885) by Dell (1959). Holotype (F57444) and additional paratypes in NMV, and an additional paratype in AM.

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REVISION OF THE AUSTRALASIAN GENERA *AGRAPHYDRUS* REGIMBART, *CHASMOGENUS* SHARP AND *HELOCHARES* MULSANT (COLEOPTERA: HYDROPHILIDAE)

C. H. S. WATTS

WATTS, C. H. S. 1995. Revision of the Australasian genera *Agraphydrus* Régimbart, *Chasmogenus* Sharp and *Helochares* Mulsant (Coleoptera: Hydrophilidae). *Records of the South Australian Museum* **28**(1) 113–130.

The Australian and New Guinean members of the Hydrophilid genera *Agraphydrus*, *Chasmogenus* and *Helochares* are revised and redescribed. A key to the genera and species is given. Fourteen species are recognised of which six are described as new: *H. (Hydrobaticus) marreensis; H. (Hydrobaticus) percyi; H. (Hydrobaticus) anthonyae; H. (Hydrobaticus) thurmerae; H. (Hydrobaticus) loweryae;* and *H. (Hydrobaticus) dalhuntyi. H. (Hydrobaticus) australis* Blackburn is synonymised with *H. (Hydrobaticus) tristis* Macleay. *H. (Hydrobaticus) luridus* W. Macleay is resurrected from synonymy with *H. tristis* W. Macleay.

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The three genera under discussion are small aquatic Hydrophilidae belonging to the tribe Hydrophilini, subtribe Acidocerina, which are characterised by lack of a sternal keel, head not strongly deflexed, middle and hind tibiae without swimming hairs, maxillary palpi larger than antennae and with pseudobasal segment, straight or curved, with convexity on inside, and the mesosternum without projecting longitudinal laminae. Until recently they were all included in the genus *Helochares* Mulsant, 1844 but were reinstated as full genera in the extensive revision of the Hydrophiloids by Hansen (1991).

As well as Australia and New Guinea, species of *Helochares* are widespread in both the old and new world, *Chasmogenus* Sharp, 1882 in Neotropical, Oriential and Palearctic regions and *Agraphydrus* Régimbart, 1903 in East Africa, Southern Asia and Japan.

D'Orchymont (1925, 1939, 1943) revised *Chasmogenus* and *Helochares*, including all the Australian and New Guinean species then known. The genera and various subgenera of the group are readily recognised but within them the species are difficult to distinguish. D'Orchymont noted that in *Chasmogenus* the characters of the aedeagus are the only reliable means of separating species. I have found this to be true for several *Helochares* species also.

Specimens of *H. (Hel.) foveicollis* (Montrouzier, 1860) and *C. nitescens* Fauvel, 1883 are often mistaken for species of *Enochrus* Thomson, 1859 but can be separated by the maxillary palps having the pseudobasal segment bent inwards in *Helochares* and *Chasmogenus* rather than outwards as in *Enochrus*. *Helochares* and *Chasmogenus* also lack the simple protuberance in the ventral midline in front of the mesocoxae present in *Agraphydrus*.

Within *Helochares*, eleven of the twelve Australian species belong to the subgenus *Hydrobaticus* W. MacLeay, 1871, which is readily recognised by its strongly punctate surface with distinct striae or rows of punctures on elytra. All but one species (*H. anchoralis* Sharp, 1890) are endemic to the region and only two are known from both New Guinea and Australia. In contrast, the subgenus *Helochares* lacks strong sculpture and is represented, in Australasia, by a single species which is also widespread in South-east Asia and the Pacific Islands. The single Australasian species of *Agraphydrus* and *Chasmogenus* are tropical with a wide distribution in South-east Asia as well as Australasia.

Most species in the group are tropical but one *H. (Hyd.) tristis* Macleay, 1871, is common in southern Australia and another *H. (Hyd.) tenuistriatus* Régimbart, 1908 is found only in the south-west of Western Australia.

All species are inhabitants of shallow still water or slow moving well-vegetated streams. Females of *H. (Hyd.) tristis* are often taken with a large white coloured eggmass attached to the ventral surface of the abdomen. The larvae of *H. tristis* and *C. nitescens* have been described by Anderson (1976) but I know of no studies of the ecology of any Australasian species.

Hansen (1991) provides a comprehensive taxonomic discussion of these genera, including detailed generic description and phylogenetic analysis.

The collections from which specimens were examined are listed under the following abbreviations:

AM	Australian Museum, Sydney
ANIC	Australian National Insect Collection
BELG	Institut royal des sciences Naturelles de Belgique, Bruxelles
BM(NH)	Natural History Museum, London
CW	Private collection of author
FIELD	Field Museum of Natural History, Chicago
MNHN	Museum National d'Histoire Naturelle, Paris
NMV	Museum of Victoria
NTM	Northern Territory Museum
QDPIM	Queensland Department of Primary Industries, Marreba
QM	Queensland Museum, Brisbane
SAMA	South Australian Museum, Adelaide
UQIC	University of Queensland Insect Collection, Brisbane
WAM	Western Australian Museum, Perth

SYSTEMATICS

The genera *Agraphydrus*, *Chasmogenus* and *Helochares* can be separated from other Hydrophilids by the following characters: Head not strongly deflexed; scutellum not, or not much longer than its basal width; meso- and metatibia without swimming hairs. Antennae with eight or nine segments, maxillary palpi elongate, longer than antennae, last segment shorter than penultimate. Mesosternum without projecting carina in midline. Meso- and metasterna without a continuous keel. Elytra not strongly carinate. Curved basal joint of maxillary palpus with convexity at front.

Generic and subgeneric diagnoses are given in the key. More extensive generic diagnoses are given by Hansen (1991).

KEY TO AUSTRALASIAN SPECIES OF *AGRAPHYDRUS* RÉGIMBART, *CHASMOGENUS* SHARP AND *HELOCHARES* MULSANT

1 — Small size (< 3 mm); head predominantly black; pronotum and elytra yellow-brown; elytra sparsely punctured, punctures not in stria. Male genitalia relatively simple; aedeagus divided into upper and lower sections (Figs 13 & 14) .... *Agraphydrus coomani* d'Orchymont

— Not with above combination of characters 2

2 — Black. Elytral striae virtually lacking, at most reduced to a few lines of serial punctures..3

— Predominately brown. Each elytron with 10 complete striae. *Helochares*, subgenus *Hydrobaticus*....................................4

3 — Smaller (< 5.0 mm). Sutural stria strongly impressed in at least apical half of elytra. Dorsal surface weakly punctured, punctures on head smaller than eye facets, subobsolete on scutellum ....*Chasmogenus nitescens* Fauvel

— Larger (> 6.0 mm). No sutural stria. Dorsal surface with well marked punctures, those on head larger than eye facets. Scutellum with sharply impressed punctures ....*Helochares sensu stricto* *H. foveicollis* (Montrouzier)

4 — Punctures on pronotum of uniform size except for small punctures close to front margin (Fig. 18)..............................8

— Punctures on pronotum of two sizes (Fig. 19)...5

5 — Numerous large punctures on front of head, particularly laterally, not greatly different in size and density to those on rest of head.....................................6

— Punctures on centre of head small, with only a few scattered larger ones, larger and more numerous laterally and on back half of head (Fig. 17). Large and small punctures on pronotum and in elytral interstriae very different in size (Fig. 19) ....*H. clypeatus* Blackburn

6 — Strial punctures close, often confluent and tending to form grooves, interstrial areas raised towards apex accentuating grooves (Fig. 23). (Punctures on elytron margin

strong at front grading to weak apically.) Male genitalia as in Fig. 5...*H. luridus* Blackburn

— Strial punctures for most part not confluent and not forming grooves except toward apex to slight degree in some specimens (Fig. 22)..............................7

7 — Male genitalia as in Fig. 4. Most of the smaller interstrial punctures more than ½ diameter of larger ones ....*H. tenuistriatus* Régimbart

— Male genitalia as in Fig. 3. Most of the smaller interstrial punctures less than $^1/_3$ diameter of the larger ones (Fig. 20) ....*H. tristis* Macleay

8 — Punctures on head smaller than size of eye facets. (Serial punctures relatively small, confluent, forming grooves. Body size 5.5–6.2 mm.) Flanges of elytra with large punctures much larger than those in interstriae. Only known from New Guinea ....*H. anchoralis* Sharp

— Punctures on head larger than eye facets (except in *H. anthonyae*, a species with serial punctures on elytral disc not confluent). Punctures on flanges of elytra, other than in *H. tatei*, a much smaller species (body size 3.4–4.8 mm), usually smaller than those in adjacent interstriae..9

9 — Interstrial punctures at base of elytra (and often over rest of elytra as well) large, equal in size to the serial punctures which are also relatively large ....*H. marreensis* sp. nov.

— Interstrial punctures on elytra smaller than those in elytral stria (Fig. 21). Punctures in elytral stria also tend to be small (large in *H. tatei*)...10

10 — Punctures on head and pronotum very large, most about a quarter puncture width apart or less (Fig. 18). Number of punctures along midline of pronotum more than 30. Flattish species with elytra broadly and weakly flanged, somewhat truncate apically. Body length relatively large (> 4.8 mm) ....*H. percyi* sp. nov.

— Punctures on head and pronotum small to medium, many separated by half puncture width or more (except in some *tatei*). Punctures on pronotum larger laterally. Number of punctures along midline of pronotum 20–40...............11

11 — Number of punctures along midline of pronotum around 25. Punctures in elytral striae as large or larger than those on pronotum, interstrial punctures tend to increase in size laterally even prior to lateral fringe. Interstrial punctures between stria 8 and 9 usually in single line. Body length relatively small (<4.8 mm)..*H. tatei*

— Number of punctures along midline of pronotum around 35. Other characters usually not as above..........................12

12 — Strial punctures in inner few rows diminish in size down apical declivity. (Distance between stria apically greater than 2 puncture widths apart. Surface of elytra towards apex has a very flat appearance)........*H. anthonyae* sp. nov.

— Strial punctures in apical quarter, apart from last few, do not diminish in size and may even increase in size...........13

13 — Lateral stria with 30 or fewer punctures. (Strial punctures relatively large.) ....*H. thurmerae* sp. nov.

— Lateral stria with more than 30 punctures ....*H. loweryae* sp. nov. ....or *H. dalhuntyi* sp. nov.

Agraphydrus Régimbart

Type species: Agraphydrus punctatellus Régimbart, 1903, Madagascar. Designation by monotypy.

Agraphydrus coomani (d'Orchymont)

Helochares (Agraphydrus) coomani
d'Orchymont, 1927

Description (number examined 51)

Length 1.4–2.6 mm. Narrowly oval, head broad in front giving it a blunt-nosed appearance. Yellow-brown. Head black except laterally in front of eyes, disc of pronotum and elytra variably darker, tips of maxillary palpi black, underside dark brown except for yellow-brown appendages. Front of head broadly and weakly concave, sparsely covered by weakly impressed small punctures. Pronotum and elytra weakly reticulate, sparsely covered with small weakly impressed punctures, those on elytra more strongly impressed laterally. A number of barely traceable lines of serial punctures on each elytron. Maxillary palpi relatively short and stout, apical segments a little larger than penultimate, basal segments a little larger than apical. Rugose portions of femur covering all but about apical quarter. Tibia with several rows of strong spines. Metacoxae and abdominal segments quite densely covered by well marked punctures, much stronger and denser than those on dorsal surface. Apical sternite weakly notched apically. Midline of metacoxae shining apically. Midline of metasternum very weakly and broadly ridged.

Male: Protarsi and claws a little stouter than in female; claws on protarsi more strongly recurved than in female. Aedeagus as in Figs 13 and 14.

Types

Holotype: Not located in d'Orchymont collection BELG. Type locality, Lactho near Hoa Binh, Tonkin, Vietnam.

Distribution (Australasian only)

Northern Territory

Cooper Creek, ANIC; 14 km NW Cape Crawford, ANIC; McArthur River, ANIC; Pine Creek, CW; Yuendumu, CW.

Queensland

16°28'S, 144°46'E, ANIC; Bushy Creek, Julatten, ANIC; Charters Towers, CW; 75 km Cooktown, ANIC; Mary Creek, ANIC; Mossman, Mt Lewis Road, ANIC; Mulgrave, ANIC.

New South Wales

Armadale, CW; Cabbage Tree Creek, ANIC.

Western Australia

Millstream, ANIC; 5 km SE Millstream, ANIC.

Papua New Guinea

Kokoda, BELG

Remarks

This small species is relatively common in collections from northern Australia. These specimens agree well with d'Orchymont's detailed description and with specimens, I take to be of this species, from Lenggong Malaya Peninsula in SAMA. There is a male specimen in BELG mounted on a card with genitalia extruded labelled as 'Papua: Kokoda 1 200 ft. VIII. 1933. L. E. Cheesman, B.M. 1933–577', 'Paratype', 'Borona laevigata, M. J. Balfour-Browne det'. 'A. d'Orchymont, det., *Helochares* (*Agraphydrus*) *laevigatus*. J. Balf.-Browne'. I can find no reference in the literature to this name and assume it is an unused name.

Chasmogenus Sharp, 1882

Type species: *Chasmogenus fragilis* Sharp, 1882, Central America; designation by monotypy.

Chasmogenus nitescens (Fauvel)

Philydrus nitescens Fauvel, 1883
Enochrus nitescens (Fauvel, 1883); Knisch 1924
Helochares (Crephelochares) nitescens (Fauvel, 1883); d'Orchymont 1939

Description (number examined 161)

Length 2.5–5.0 mm. Narrowly oval. Black. Clypeus, edges of pronotum, lateral margins of elytra often reddish, appendages testaceous. Front edge of head broadly and shallowly concave, a weak notch in front margin of head in some specimens. Dorsal surface with small weakly impressed well-separated punctures. In addition a few larger punctures in row across front of head and between front edges of eyes and pronotum with two fields of larger punctures on either side of midline towards front and a field of a few larger ones on each side in middle; each elytron with three or four ill-defined rows of well separated large serial punctures. Each elytron with sharply impressed sutural stria in apical half to three quarters, diverging somewhat toward front close to suture apically. Scutellum lacking punctures or with a few weak ones. Maxillary palpus long, slender, apical segment about two-thirds length of penultimate, first and second segments subequal. Femur with rugose portion covering all but small portion near apex. Coxal plates seemingly impunctate, but rugose and moderately covered with setae rather as on femurs, bare shiny area in midline apically. Abdominal sternites similarly sculptured; a well-developed but relatively low metasternal keel present. Apex of apical abdominal segment with small notch. Aedeagus as in Fig. 15, although there is considerable variation among the specimens examined.

Types

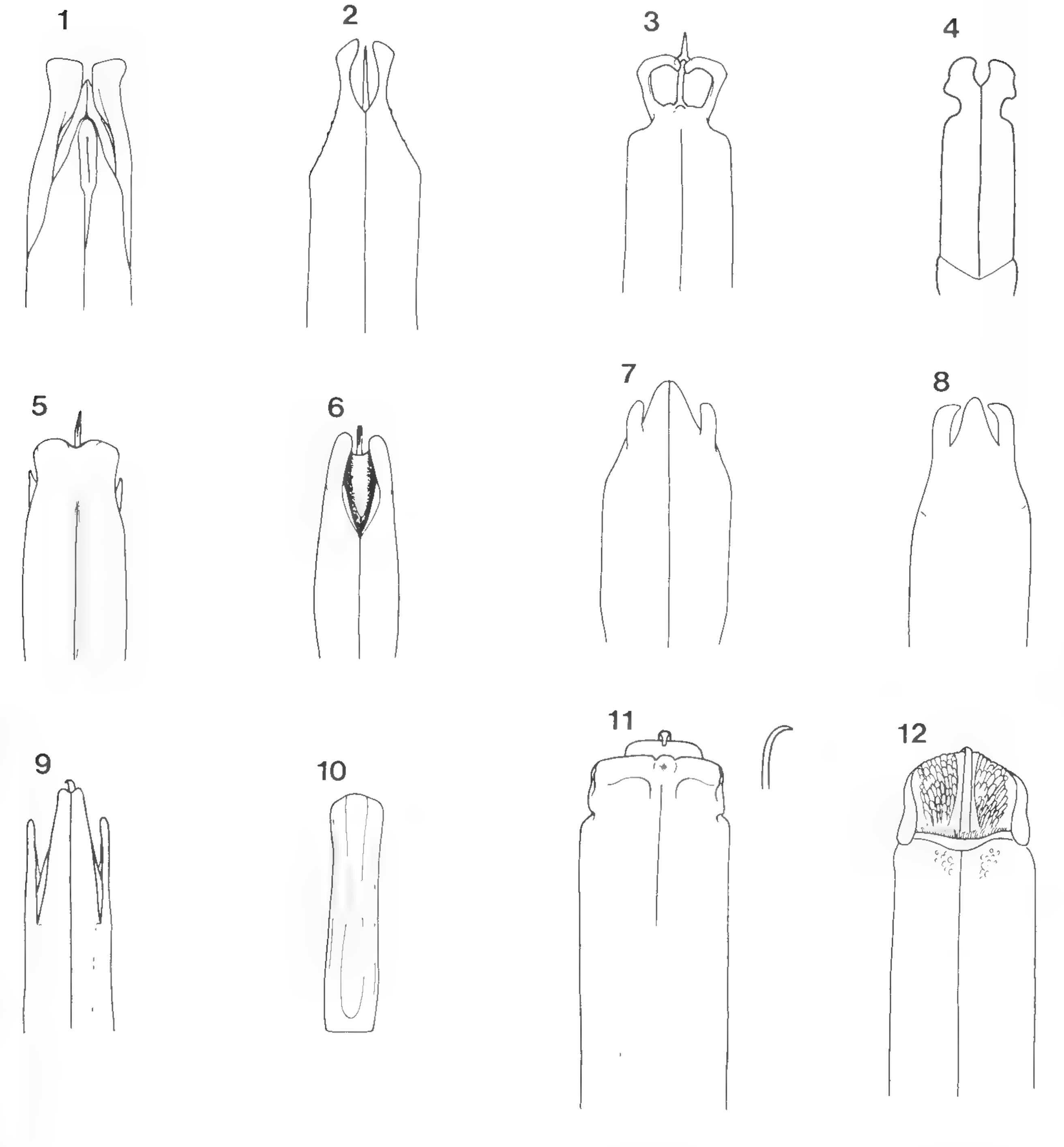
Lectotype male: 'Anse Vata – marass d'eau douce – août – savés, 'Nouvelle Caledonie', bearing original det label. 'Philhydrus nitescens Fvl', in BELG, herein designated.

Paralectotypes: 3, – same data as lectotype, in BELG, herein designated.

Distribution

Northern Territory

Black Point, Coburg Pen., ANIC; Katherine, ANIC; 8 km N Mt Cahill, ANIC; 19 km NE by E



FIGURES 1–16. Tip of aedeagus. All are ventral views except for additional dorsal (12) and lateral (14) views of species as follows; **1** *H. anthonyae*; **2** *H. clypeaus*; **3** *H. tristis*; **4** *H. tenuistriatus*; **5** *H. luridus*; **6** *H. tatei*; **7** *H. loweryae;* **8** *H. dalhuntyi*; **9** *H. thurmerae;* **10** *H. percyi*; **11** *H. anchoralis*; **12** *H.anchoralis*; **13** *A. coomani*; **14** *A. coomani*; **15** *C. nitescens*; **16** *H. foveicollis*.

Mt Cahill, ANIC; Nourlangie Creek, ANIC; 6 km SW by S, Oenpelli, ANIC.

Queensland
Ayr, ANIC; 5 ml [8 km] N Bloomfield River, ANIC; Cairns, BELG; Cape Tribulation, ANIC; 3 km S by W Cooktown, Mission Beach, ANIC; Giru, ANIC; Hann River, N. Laura, QDPIM; Innisfail, ANIC; 7 km NE Innisfail, ANIC; Mt Webb National Park, ANIC; Townsville, ANIC; 3 km ENE Mt Tozer, ANIC; 9 km ENE Mt Tozer, ANIC; 11 km ENE Mt Tozer, ANIC; 5 km W by N Rounded Hill, ANIC; 9 km SE Yeppoon, ANIC.

New South Wales
Yuragin, NP, ANIC.

Papua New Guinea
Lae, BMNH; 7 ml [11 km] Lae-Bulolo Road, BMNH; Gusap Markham Valley, ca 90 ml [145 km] W of Lae, BMNH.

Remarks
I have examined type material of *C. abnormalis* (Sharp, 1890), *C. simulator* (Kuwert, 1922), *C. livicornis* (Kuwert, 1889), *C. ferrugatus* (Régimbart, 1903) and *C. nigritulus* (Régimbart, 1903) and consider the Australian specimens to differ from all of these. This appears to be the only *Chasmogenus* in Australia.

Helochares Mulsant, 1844

Helochares Mulsant, 1844
Hydrobaticus W. Macleay, 1871
Neohydrobius Blackburn, 1898

Type species: Hydrobaticus: *Hydrobaticus tristis* W. Macleay, 1871, Gayndah, Queensland; designation by d'Orchymont (1943). *Helochares*: *Dytiscus lividus* Forster, 1771, Europe. *Neohydrobius*: *Philhydrus burrundiensis* Blackburn, 1890, Northern Territory, Australia; designation by Blackburn (1890).

Subgenus *Helochares*

Helochares (Helochares) foveicollis (Montrouzier)

Stagnicola foveicollis Montrouzier, 1860
Philhydrus burrundiensis Blackburn, 1890; syn. nov. *Neohydrobius burrundiensis* (Blackburn, 1890), Blackburn 1889; syn. nov. *?Helochares atropiceus* Régimbart, 1903
Helochares (Helochares) foveicollis (Montrouzier, 1860); Knisch 1924; d'Orchmont 1943
Helochares (Helochares) burrundiensis (Blackburn, 1890); Knisch 1924; syn. nov.

Description (number examined 356)
Length 6.1–8.2 mm. Broadly oval. Black. Front edge of head, margins of pronotum, lateral margins of elytra and apical portions of appendages testaceous. Front edge of head sinuate. Head and pronotum with small to medium sized (for genus) punctures, well impressed, separated by about width of a puncture. Punctures on side of head a little stronger and denser. Punctures on elytra same size or somewhat smaller than those on pronotum and a little sparser, particularly towards sides and apex. A sparse row of serial punctures traceable in about middle of each elytron and another weaker row near lateral margin. Maxillary palpus long, slender, second segment largest, apical segment about two-thirds length of middle one. Femur with rugose portion covering all but small portion near apex. Coxal plates sparsely and weakly punctured, covered in moderately impressed fine reticulation. Sternites shiny, covered with relatively sparse, small setose punctures; apex of apical sternite with small notch. Weak to well developed metasternal keel, highest apically.
Male: Aedeagus as in Fig. 16. Protarsi enlarged. Claws on protarsi strongly recurved, inner one with large scale-like vertical expansion at its base; claw on mesotarsi similar in shape but not quite as developed.
Female: Protarsi about two-thirds size of male's, claws simple; mesotarsi a little smaller than in male, claws simple.

Types
P. burrundiensis: Syntypes: 1 in BM(NH) 'T 2769' 'Philhydrus burrundiensis, Blackb.' with BM(NH) Type and Blackburn coll 1910–236 labels. 1 'NT, N. Territory', `Neohydrobius burrundiensis Blackb., Co-type', in SAMA, 1 'Philhydrus burrundiensis, Bl'. Co-type, in SAMA.

I am uncertain of the status of these types. The BM(NH) specimen is without locality label but is mounted on a card with a black 'T' and a red number in typical Blackburn style and carries the species label in Blackburn's handwriting. I have little doubt that this was meant as the holotype.

The first presumed syntype in SAMA fits Blackburn's style, except for his use of *Neohydrobius* as the generic name which was not described until nine years later by Blackburn (1898). The second presumed syntype in SAMA bears a single label not in Blackburn's hand. At some stage this specimen was remounted upside down. In his 1898 publication, Blackburn mentions original specimens. I am inclined to believe that all three specimens are part of the original series and that the two SAMA specimens were re-examined and relabelled when Blackburn described *Neohydrobius*. I nominate the BM(NH) specimen as lectotype and the two SAMA specimens as paralectotypes.

S. foveicollis: Not located. The type is supposedly in the Bedel Collection in MNHN but cannot be found there or in other collections in MNHN (Y. Cambefort in litt.). A specimen in MNHN from New Caledonia appears identical to Australian specimens and it is on this basis that I synonymise the species. d'Orchymont (1943) came to the conclusion, based on very limited material, that the two forms were very close and probably conspecific.

H. atropiceus Régimbart. Syntypes. 2 in MNHN seen. This New Guinean species appears to me to be very similar if not conspecific with *H. foveicollis*. According to d'Orchymont (1943) it is a junior synonym of *H. taprobanicus* (Sharp, 1890) from Ceylon and differs from *H. foveicollis* by its sculpture and male genitalia. I have not, however, looked closely at these non-Australasian forms and prefer to leave the question of whether or not they are conspecific open at the moment.

Distribution

Northern Territory

3.2 km S Adelaide River, ANIC; Alligator River, MV; Black Point, Coburg Pen., ANIC; Borroloola, ANIC; 22 km WSW Borroloola, ANIC; 5 km NNW Cahills Crossing, ANIC; 8 km ESE Cape Crawford, ANIC; Cooper Creek, ANIC; Darwin, SAMA, CW; 96.5 km S Darwin, ANIC; Edith River, ANIC; Elcho Island, ANIC; Holmes Jungle, ANIC; Horn Islet, Pellew Group, UQIC; Humpty Doo, QDPIM; Katherine, ANIC; Koongarra, ANIC; Magela Creek, ANIC, SAMA; Mataranka, ANIC; McArthur River, ANIC; Melville Island, ANIC; 10 km E by N Mt Cahill, ANIC; Nabarlek Dam, ANIC; Nourlangie Creek, SAMA; Pine Creek, CW; Rimbija Island, ANIC; Roper River, ANIC; South Alligator River, ANIC; Tindal, ANIC.

Queensland

Ayr, ANIC; Bamaga, ANIC, UQIC; Bentinck Is., SAMA; Burnett River, ANIC; Cairns, SAMA; Cape Tribulation, QM; Cardstone, ANIC; Carnarvon Range, AM; Clermont, AM; 19.3 km WNW Cooktown, ANIC; 40 km N Cooktown, ANIC; 50 km N Cooktown, QM; Cow Bay, QDPIM; Darwin, CW; E Alligator, AM; Green Hills, ANIC; Home Hill, CW; 7 km N Hope Vale Mission, ANIC; Innisfail, AM, SAM; Iron Range, ANIC, AM; 15 km W Irvinebark, ANIC; Kirrama, ANIC; 75 km NW of Laura, QDPIM; Mackay, MV; 80 km S Mackay, UQIC; Mission Beach, UQIC; Mornington Is. Mission, SAMA; 5 km ESE Mt Finnigan, ANIC; 9 km ENE Mt Tozer, ANIC; 3 km NE Mt Webb, ANIC; Mutchilba, MV; 8 km S of Putty, ANIC; Renilworth State Forest, UQIC; 5 km W by N Rounded Hill, ANIC; 40 mile Scrub, ANIC; Shiptons Flat, ANIC; South Johnstone, QDPIM; 15 km WNW South Johnstone, QDPIM; Stewart Range, BELG; Strathmore Stn., QDPIM; Toowoomba, ANIC; Townsville, CW, FIELD, MV, QDPIM; 9.6 km SSE Yeppoon, ANIC.

New South Wales

2.4 km E Freshwater River, AM; Kyogle, AM; Valery, ANIC.

Australian Capital Territory

Black Mountain, ANIC.

Western Australia

4 km SSW Cape Bertholet, ANIC; Derby, WAM; Fitzroy Crossing, ANIC; 161 km E Kununurra, ANIC; Mitchell Plateau, ANIC; Wyndham, UQIC.

Papua New Guinea

1.6 km S Morehead, ANIC; Rouku, Western District, ANIC.

Noumea

Noumea, MNHN.

Remarks

Very distinct from other Australasian *Helochares*, by its size, shiny black colour and virtual lack of elytral stria.

Subgenus **Hydrobaticus** W. Macleay, 1871

Helochares (Hydrobaticus) anchoralis Sharp

Helochares anchoralis Sharp, 1890

Helochares crenatus expansus Knisch, 1921, 1924; d'Orchymont 1943
Helochares (Hydrobaticus) anchoralis expansus Knisch, 1921; d'Orchymont 1943

Description (number examined 7)

As for *H. tristis* except as follows. Length 5.5–6.2 mm. Upper surface shiny, reddish brown with scattered, ill-defined darker areas near border of head and Y suture outlined in black. Head uniformly covered in small-medium sized moderately dense punctures; pronotal punctures of uniform size, small for genus, separated from each other by their own diameter or a little less, a few larger setiferous setae in one line towards front on each side; serial punctures of elytra confluent, small, those at base about same size as those on pronotum, somewhat larger towards apex and laterally; interstrial punctures numerous, moderately dense, smaller than those in stria; area between elytron edge and most lateral striae densely covered in large punctures, the more lateral ones as large or larger than those in adjacent striae. Elytron flanged. Striae form deep grooves laterally and apically but interstrial areas flat. Aedeagus as in Figs 11 and 12.

Distribution

Papua New Guinea

Finisterre Mts, Budemu, ca 1220m, BMNH; Gusap Markham Vale, 145 km W of Lae, BMNH; Lae-Bulolo Road, BMNH; 11 km Lae-Bulolo Road, BMNH; Port Moresby, BMNH.

Remarks

I have not seen the types of either *H. anchoralis* Sharp, or *H. c. expansus* Knisch, and rely on d'Orchymont (1943) for my identification of this species. The series of specimens in the BMNH agree with Sharp and d'Orchymont's descriptions, and with the aedeagus illustrated by d'Orchymont. Among Australasian *Hydrobaticus* with uniform punctation, the species is distinctive by being large and relatively flat with broad elytral flanges and the punctures on the head smaller than the size of the eye facets. Outside New Guinea the species is widespread in South East Asia from Ceylon (type locality) to the Philippines. The type locality of *H. c. expansus* Knisch is given only as New Guinea.

Helochares (Hydrobaticus) anthonyae sp. nov.

Description (number examined 76)

As for *H. tristis* except as follows. Length 4.5–5.8 mm. Yellow-brown. Front and rear of head, Y suture on head, portions of pronotum, serial punctures on elytra and often a quite extensive area on disc of elytra darker. Punctures on head moderate in size and density, somewhat smaller towards front in middle; punctures on pronotum of uniform size, moderately sized, separated from each other by their own diameter or slightly less; strial punctures well impressed, not confluent, not forming grooves, at least twice size of those on pronotum, becoming progressively smaller in apical quarter of elytron; interstrial punctures very small, much smaller than strial punctures except towards apex where the serial punctures are much reduced in size. Sides of pronotum and elytra with fine reticulation giving mat finish. Edges of elytra not or only very weakly flanged.

Types

Holotype male: 'New Guinea: Morobe Dist., c 7 ml [11 km] Lae-Bulolo Rd. 30.xii.1964', 'Stn No. 120', 'M.E. Bacchus, BM 1965–120', in BM(NH).
Paratypes: 9 in BM(NH); 2 in SAMA; 2 in CW; all with same data as holotype

Distribution

Northern Territory

Nourlangie Creek, ANIC.

Papua New Guinea

Lae, BMNH; 7 mls [11 km] Lae-Bulolo Road, BMNH; 90 mls [145 km] W. of Lae; Mt Lamington, BMNH; Okapa, E. Highlands District, BMNH.

Remarks

Apart from the distinctive aedeagus (Fig. 1), separated from other *Helochares*, particularly *H. loweryae*, *H. dalhuntyi* and *H. thurmerae*, by characters given in key. A New Guinean species known from only one Australian specimen from the Northern Territory

Helochares (Hydrobaticus) clypeatus (Blackburn)

Hydrobaticus clypeatus Blackburn, 1891
Helochares (Hydrobaticus) clypeatus (Blackburn, 1890); Knisch 1924; d'Orchymont 1943

Description (number examined 377)

As for *H. tristis* except as follows. Length 5.1–7.2 mm. Some ill-defined dark patches on elytra.

Punctures on front of head fine, with a few much larger ones (Fig. 17); punctures on rear of head, pronotum and elytra of two sizes, the smaller similar to those on front of head, the larger much larger, in approximately equal numbers except on elytra where they are smaller and more numerous; large punctures on pronotum often separated by less than their diameter (Fig. 19); serial punctures a little larger, often confluent and forming shallow grooves. Interstrial areas virtually flat apically. Aedeagus as in Fig. 2.

Types

Holotype female: 'T 3434NT', 'Hydrobaticus clypeatus, Blackb.' in BM(NH).

Distribution

Northern Territory

1 km NE of Cahills Crossing, East Alligator River, ANIC; Berry Springs, ANIC; Bessie Spring, ANIC; Coastal Plains Research Station, CSIRO, Darwin, ANIC; Cooper Creek, ANIC; 16 km E of Daly River, SAMA; Howard Springs, ANIC; 10 km N Jabiru, QDPIM; Kakadu NP, NTM; Kapalga, QM; Koongarra, ANIC; Manton Reservoir, NTM; 19 km NE by E Mt Cahill, ANIC; 2 km N of Mudginbarry HS, ANIC; Nourlangie Creek, ANIC; Oenpelli, ANIC; Simpson Gap, ANIC.

Queensland

Atherton, ANIC; Ayr, ANIC; 8 km N Bloomfield River, ANIC; Boar Pkt Road, ANIC; Brisbane, CW, UQIC; Brookfield, QM; Caloundra, CW; Cape Tribulation, CW; Cairns, ANIC, CW, SAMA; Cape Flattery Road, QDPIM; Cardstone, ANIC; Cardwell, ANIC; Carungra Creek, QM; Cooloola, QM; Cow Bay, QDPIM; Emerald, QDPIM; Flinders Island, SAMA; Fraser Island, ANIC; Home Hill, CW; Gayndah, UQIC; Groomeri, UQIC; Hann River N of Laura, QDPIM; Hann River, 73 km NW Laura, ANIC; Helenvale, ANIC; Hope Vale Mission, ANIC; Innisfail, CW; Kuranda, ANIC, SAMA; Lam. Nat. Pk, UQIC; 75 km NW Laura, QDPIM; Mareeba, QDPIM; McIlwraith ANIC, QDPIM; 16 km S Miriam Vale, UQIC; Mission Beach, UQIC; Mossman, ANIC; Mourilyan, ANIC; 3 km NE Mt Webb, ANIC; North Pine River, UQIC; Nth Stradbroke Island, UQIC; 11 km WSW Petford, QDPIM; Petrie, UQIC; 15 km NW of South Johnstone, QDPIM; Tinaroo Dam, QDPIM; Tolga, QDPIM; 7 km N Tolga, QDPIM; Townsville, ANIC; Upper Mulgrave River, UQIC; Walkamin, QDPIM; 40 km S of Weipa, QDPIM; 80 km N Weipa, NMV; Woodford, UQIC.

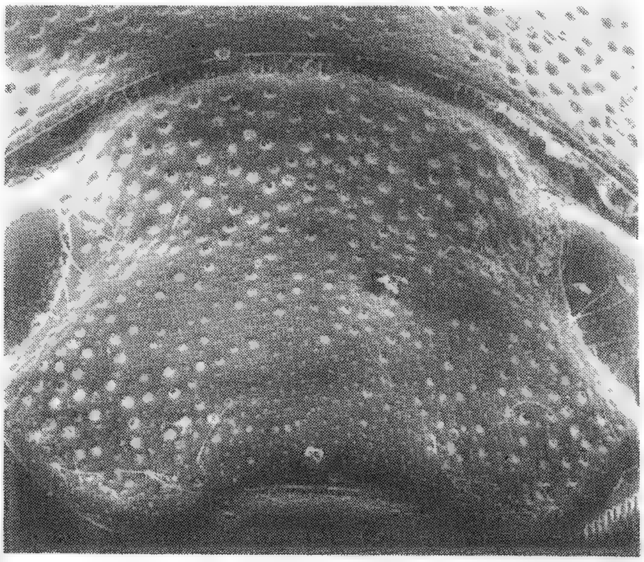


FIGURE 17. Head of *H. clypeatus*.

New South Wales

Coffs Harbour, UQIC; Congo, ANIC; Kyogle, FIELD; Lansdowne SF, ANIC; 8 km W of Port Macquarie, ANIC; 18 km W of Uki, ANIC; Valery, ANIC; Windsor, ANIC; Wootton, ANIC.

Western Australia

Carson Escarpment, ANIC.

Remarks

A distinctive species best recognised by the form of punctation on the upper surface in which the large and small punctures are very different in size (Fig. 19). This character is difficult to describe in a key but once recognised is readily used. The sparsity of large punctures on the front portion of the head (Fig. 17) is usually a reliable character but does not separate all *H. clypeatus* from all *H. tristis*.

Helochares (Hydrobaticus) dalhuntyi sp. nov.

Description (number examined 30)

As for *H. tristis* except as follows. Length 4.2–5.5 mm. Oval. Dark testaceous; patches of lighter colour on upper surface particularly laterally and at bases of elytra, palpi and tarsi lighter. Front margin of head deeply and widely concave. Punctures on head and pronotum uniformly sized, small for *Helochares*, separated by less than own diameter in most cases, somewhat larger laterally; punctures in elytral interstriae numerous (Fig. 21), much smaller than those on pronotum, a row of larger seta-bearing punctures inwards from striae six; punctures in stria variably confluent, deeply impressed, much larger than those on pronotum. Aedeagus as in Fig. 8.

Types

Holotype male: right hand specimen of two mounted on card, 'Dalhunty River, Qld, 1/10/83, C. Watts', in SAMA.

Paratypes: 1, mounted upside down on same card as holotype in SAMA; 3, mounted on same card, same data as holotype, in CW; 1, 'Captain Billy Creek, CW', in CW.

Distribution

Queensland

Captain Billy Creek, CW; Dalhunty River, CW; East Claudie River, UQIC; Iron Range, ANIC, AM, UQIC; 2 km NNE Mt Tozer, ANIC; 3 km ENE Mt Tozer, ANIC; 6 km ENE Mt Tozer, ANIC; 8 km E by N of Mt Tozer, ANIC; 9 km ENE Mt Tozer, ANIC; 11 km ENE Mt Tozer, ANIC.

Northern Territory

Darwin, CW; Roderick Creek, Gregory NP, NTM.

Remarks

Helochares dalhuntyi is difficult to separate from *H. loweryae* except by the aedeagus. The punctation of the upper surface is stronger than in all but a few *H. loweryae*, but I have been unable to reliably quantify this difference.

Helochares (Hydrobaticus) loweryae sp. nov.

Description (number examined 25)

As for *H. tristis* except as follows. Length 4.4–5.5mm. Oval. Light testaceous; patches of darker colour on dorsal surface. Front margin of head deeply and widely concave. Punctures on head and pronotum uniform in size, small for genus, separated by about own diameter or less in most cases, only slightly larger laterally; punctures in elytral interstriae numerous, much smaller than those on pronotum, a row of large setose punctures inwards from stria 6; interstriae sub-obsolete apically, on shoulders and between lateral-most striae; punctures in stria separate, deeply impressed, much larger than those on pronotum, larger towards sides than on disc; lateral punctures on elytra small but well impressed, larger than those in adjacent interstriae. Aedeagus as in Fig. 7.

Types

Holotype male: 'Mt Lamington, N.E. Papua, 1300 to 1500 feet, C. J. McNamara', in SAMA.

Paratypes: 1, 'New Guinea: Morobe Dist., Lae-Bulolo Rd, 30.xii.1964'. 'Stn. No. 131', in BM(NH). 1, 'New Guinea: Morobe Dist., Gusap, Marthany Valley, c. W. of Lae. 22–30.i. 1965'. 'M.E. Bacchus, BM 1965–120'. 'Stn. No. 166', in BM(NH). 1, 'New Guinea: Morobe Dist., c. 7 ml Lae-Bulolo Rd. 30.xii.1964'. 'Stn. No. 120'. 'M.E. Bacchus, BM 1965–120', in BM(NH). 1, 'New Guinea: Morobe Dist. Herzog Mts., Vagau. c. 4,000 ft 4–17.i.1965'. 'M. E. Bacchus, BM 1965–120', in CW.

Distribution

Northern Territory

Darwin River Reservoir, NTM; Holmes Jungle, ANIC; Howard Springs, CW, NTM.

Papua New Guinea

Bulolo, BM(NH); Kokoda, BM(NH); Morobe District, BM(NH); Mt Lamington, SAMA; Lae-Bulolo Road, BM(NH); 5 km Lae-Bulolo, BM(NH); 11 km Lae-Bulolo, BM(NH); 145 km W. of Lae, BM(NH); Vagav, Herzog Mts, BM(NH).

Remarks

The specimens from the Northern Territory differ from typical specimens by having somewhat stronger interstrial punctures and having the lateral 'wings' of the aedeagus (Fig. 8) more separate from the centre piece than in New Guinea specimens. Close to *H. dalhuntyi* and difficult to separate from it other than by the shape of the aedeagus. Most specimens can be separated by the different strength of the dorsal punctation but this is difficult to use unless specimens of both species are available. The Northern Territory specimens appear intermediate in this regard.

Helochares (Hydrobaticus) luridus (W. J. Macleay)

Hydrobaticus luridus W. J. MacLeay, 1871

Description (number examined 144)

As for *H. tristis* except as follows. Length 3.5–5.4 mm. Larger punctures usually smaller than those of *H. tristis*, serial punctures usually confluent over most of elytra forming quite strong grooves, interstrial areas towards apex of elytra and laterally weakly ridged, ridging effect accentuated by relatively deeply indented striae; lateral punctures around elytron get progressively smaller towards apex where they are usually less than one quarter diameter of those towards front corner of elytron (Fig. 23). Aedeagus as in Fig. 5.

Types

Holotype, ?sex. 'Hydrobaticus luridus McL.W. Gayndah' 'K1924' with small circular red label and red Holotype label, in AM.

Distribution

Northern Territory

16°02'S, 130°23'E, NTM; 16°07'S, 130°24'S, NTM; 16°07'S, 130°25'E, NTM; Sth Alligator River, QM; Cooper Creek, ANIC, SAMA; Fergusson River, ANIC; Gregory NP, NTM; Howard Springs, ANIC; Humbert River, NTM; Humpty Doo, QDPIM; Junction of Arnhem Hwy. and Oenpelli Road, NTM; Oenpelli Road, NTM; Kakadu, NTM; Katherine, SAMA; Larrimah, QM; 13 km S Lawn Hill Stn., QM; McArthur River, ANIC; 19 km E by N of Mt Cahill, ANIC; 19 km WSW Mt Cahill, ANIC; 19 km NE by E Mt Cahill, ANIC; 12 km NNW Mt Cahill, SAMA; 2 km N Mudginbarry HS, ANIC; Nabarlek Dam, ANIC; 18 km E by N of Oenpelli, ANIC; Renner Springs, CW; Tennant's Creek, NMV; 12 km NNE Victoria River Downs, ANIC.

Queensland

Annan River, ANIC; Ayr, ANIC; Barron Falls, ANIC; Brookfield, QM; 29 km S Burketown, QM; Burnett River N of Eidswald, ANIC; Cardstone, ANIC; Cairns, ANIC, Charleville, ANIC; 25 km N Coen, CW; Cooktown, ANIC, CW; 40 km N Cooktown, ANIC; Cunnamulla, AM, SAMA; Daintree, ANIC; Dalby, SAMA; Dipperu, QM; Ellery Creek, NMV; Gayndah, SAMA; 12 km SE Gympie, NMV; Innisfail, QM; Iron Range, UQIC; Laura, CW; 73 km NW by W Laura, ANIC; 75 km NW Laura, QDPIM; Little Laura River, QM; Mary Creek, ANIC; McIlwraith Range, CW; 34 km S Mirian Vale, ANIC; Mossman, ANIC, SAMA; Mt Garnet, CW; 3 km ENE Mt Tozer, ANIC; 14.5 km W Paluma, ANIC; 11 km NSW Petford, QDPIM; Rockhampton, SAMA; Rocklea, QM; 15 km NNW South Johnstone, QDPIM; Station Creek, ANIC; Strathmore Station, QM; Tolga, QM; 7 km NE Tolga, QDPIM; Townsville, AM.

New South Wales

Valery, ANIC.

Western Australia

Carson Escarpment, ANIC; Kalumburu, ANIC; Mitchell Plateau, ANIC; 5 km SE Pago Mission, FIELD.

Remarks

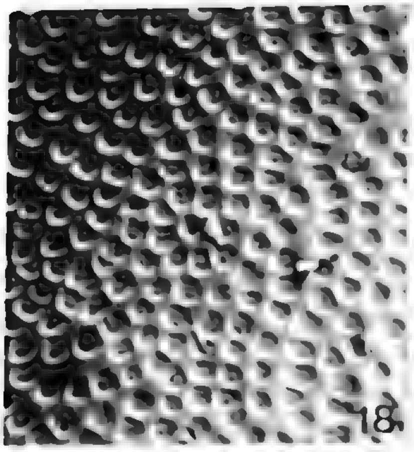
The distinctive aedeagus (Fig. 5) is the only reliable character separating *H. luridus* from *H. tristis*. Over most of its range *H. tristis* has no trace of elytral ridging or indented stria, which are almost always a feature of *H. luridus*. Unfortunately it is in the area of distributional overlap in southern Queensland that the two species are hardest to separate since most *H. tristis* from this area have quite well marked apical ridging and grooving on elytra. The character used in the key—small lateral punctures at apex of elytron in *H. luridus*—appears to work, but is often difficult to see clearly and, at best, is a subjective character.

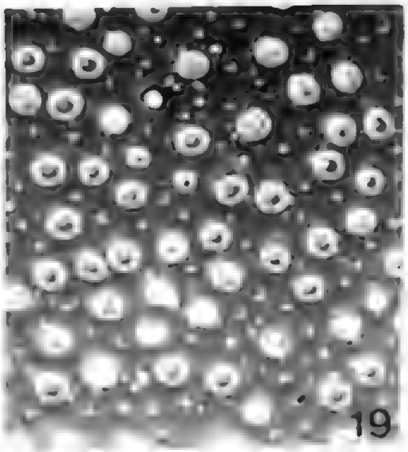
H. luridus was synonymised with *H. tristis* by Knisch (1924), Zaitzev (1908) and by d'Orchymont (1943). These species are very similar, but readily differentiated by the aedeagus. The holotypes of both species are from Gayndah in southern Queensland where both species are known to occur. Both types are fragile and I think females. I have not attempted to dissect them. The type of *H. luridus* is paler and is almost identical to a male specimen of the northern species from Gayndah in SAMA. The type of *H. tristis* is darker and agrees in diagnostic features with the southern form.

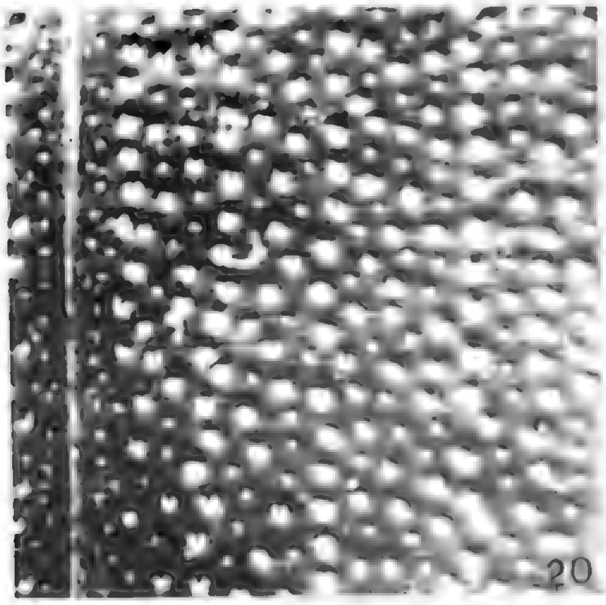
Helochares (Hydrobaticus) marreensis sp. nov.

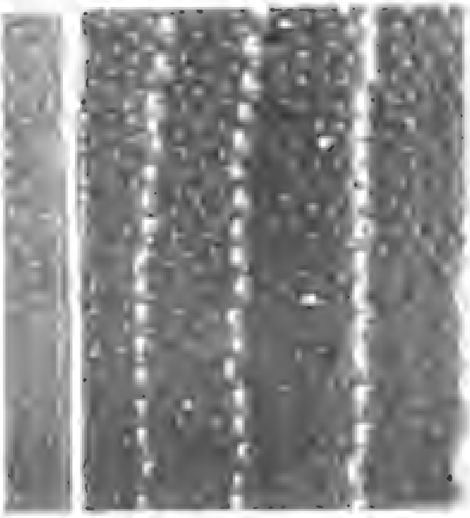
Description (number examined 147)

As for *H. tristis* except as follows. Length 4.0–5.4 mm. Elongate, reddish-brown including clypeus. Darker markings on head and pronotum vague and often absent, elytra rather evenly speckled brown and reddish-brown or, in some examples, with linear dark lines. Punctures on head numerous, dense, large at base, grading to quite small in front; punctures on pronotum even, moderately large, most separated by less than their diameter, particularly towards sides; punctures in interstriae numerous, strong, those at base near suture about same size as those on pronotum, becoming smaller towards rear and sides of elytra; strial punctures almost confluent, weakly impressed, same size or slightly smaller than those on pronotum and base of elytron. I have been unable to distinguish the aedeagus from that of *H. tatei* (Fig. 6).









FIGURES 18–23. **18** Pronotal disc of *H. percyi*; **19** Pronotal disc of *H. clypeatus*; **20** Portion of elytral disc of *H. tristis*; **21** Portion of elytral disc of *H. dalhuntyi*; **22** Tip of elytron of *H. tristis*; **23** Tip of elytron of *H. luridus*.

Types

Holotype male: '12°23'S 132°56'E, 7 km NW by N of Cahills Crossing, East Alligator River, NT, 27.v.73, E.G. Matthews', in SAMA.

Paratypes: 3, '12°26'S 132°56'E, Cahills Crossing, NT, East Alligator River, 29.v.73, at light, E.G. Matthews', in SAMA; 2, '12°48'S 132°42'E, Nourlangie Creek, NT, 8 km N of Mt Cahill, 21.v.73, at light, E.G. Matthews', in SAMA; 2, '12°25'S 132°58'E, 1 km N of Cahills Crossing, NT, East Alligator River, 7.vi.73, Upton and Feeham', in ANIC; 2, '12°46'S 132°39'E, 12 km NNW of Mt Cahill, NT, 15.vi.73, Upton and Feeham', in ANIC; 1, '12°23'S 132°56'E, 7 km NW by N of Mt Cahills Crossing, East Alligator River, NT, 9.vi.73, Upton and Feeham', in ANIC; 3, 'Forbes, NSW, 15.iii.63, E.W.', in CW.

Distribution

Northern Territory

16°02'S, 130°23'E, NTM; Adelaide River, ANIC; Baroalba Creek Springs, ANIC; 13 km SW Borroloola, ANIC; 30 km NE by E Borroloola, ANIC; 1 km N Cahills Crossing, SAMA, ANIC; 5 km NNW Cahills Crossing, ANIC; 7 km NW by N Cahills Crossing, SAMA, ANIC; Cahills Crossing, SAMA, ANIC; Cooper Creek, SAMA, ANIC; Daly River, ANIC, NMV; Fogg Dam, NTM; Howard Springs, CW; 10 km N Jabiru, QDPIM; Junction of Arnhem Hwy and Oenpelli, NTM; Katherine, ANIC; Koongarra, ANIC; McArthur River, ANIC; 13 km N Mt Cahill, SAMA; 9 km N by E Mudginbarry HS, ANIC; 6 km SW by S Oenpelli, ANIC, SAMA; Renner Springs, SAMA; Tindal, ANIC; U.D.P. Falls, NTM; 30 km N Wauchope, ANIC.

Queensland

Bunya Mountains, ANIC; 16 km S Miriam Vale, UQIC; Crystal Creek, ANIC; Cunnamulla, QM, SAMA; Dalby, QM, SAMA; 68 km East Roma, QM; 96 km E Hughenden, UQIC; Julia Creek, CW; Marina Plains, QDPIM; 16 km S Miriam Vale, UQIC; Musgrave HS, ANIC; Nocundra, ANIC; Normanton, SAMA; Silver Plains, UQIC.

New South Wales

Canowindra, VM; Forbes, CW; Gilgandra, CW; Moree, SAMA; Mt Kaputar, ANIC.

Victoria

Lake Hattah, ANIC, QDPIM; Wyperfield National Park, ANIC.

Western Australia

3 km S Coulomb Pt, ANIC; Fitzroy Crossing, ANIC; Kununurra, ANIC; Lennard River Xing, WAM.

South Australia

Marree, SAMA.

Remarks

An elongate, parallel sided species with strong interstrial punctures which, over most of elytra, are as large as the strial punctures. Uniquely, among Australasian species at least, the aedeagi of *H. marreensis* and *H. tatei* are so similar that I have not been able to distinguish them. The two species are readily separated by the punctation of the upper surface which is much stronger in *H. marreensis*, and the presence of more than one row of punctures in interstriae 7–8 and 9–10 in *H. marreensis* compared to a single row in *H. tatei*.

Helochares (Hydrobaticus) percyi sp. nov.

Description (number examined 101)

As for *H. tristis* except as follows. Length 4.8–6.0 mm. Oval, rather flattened. Yellow-brown. Clypeus darker, extreme sides of pronotum and elytra lighter. Punctures on head and pronotum large, dense, of uniform size (Fig. 18), those at sides of pronotum and head slightly larger and closer together; interstrial punctures small to medium, dense, uniform in size; serial punctures nearly confluent, deep, larger than punctures on pronotum. Interstrial areas weakly ridged near apex and laterally. Aedeagus as in Fig. 10.

Types

Holotype male: 'Boar Pkt.Rd., N.Q. 2 12.70 J.G. Brooks', in ANIC.

Paratypes: 1, 'Boar Pkt.Rd., N.Q. 1/70 J.B.' 'J.B.B. 27' J.G. Brooks. Bequest, 1976, in ANIC; 1, 'Boar Pocket Road, ca 8 km N of Gillies Hwy, Qld 21.ii.70, at light, J. G. Brooks', ANIC; 2, 'McIlwraith Rng., Weather Stn., N. Qld, 23/7/82, C. Watts', in SAMA.

Distribution

Northern Territory

Adelaide River, ANIC.

Queensland

Atherton, QDPIM; Brisbane, UQIC; Cardstone, ANIC; Cairns, CW; Eidsvold, ANIC; Emu Vale, UQIC; 8 km N of Gillies Highway, ANIC; 12 km

SE Gympie, NMV; 37 km SSE Ingham, ANIC; Iron Range, UQIC; Jimboomba, ANIC; Julatten, UQIC; Kenilworth State Forest, AM; Koombaloomba, BM(NH); Kuranda, ANIC; 18 km W Mareeba, QDPIM; McIlwraith Range, Weather Stn., CW; 117 km NW by W Laura, ANIC; Mossman, ANIC; Mt Finnigan, ANIC; Mt Spec, ANIC; Oxley Creek, QM; Palmerston National Park, ANIC, UQIC; 24 km W of Paluma, ANIC; Nth Pine River, QM; Sth Pine River, QM; 32 km S of Ravenshoe, ANIC; 15 km WNW South Johnstone, ANIC; Tolga, QDPIM; Wilson's Peak, UQIC.

New South Wales

Armadale, CW; Blue Mountains, ANIC; Canterbury, SAMA; Coffs Harbour, UQIC; 12 km N Eccleston, NMV; 9 km SW Gloucester, NMV; Hastings River, ANIC; Nepean River, ANIC; Salisbury, UQIC; Taree, ANIC; 18 km W of Uki, ANIC; Wahroonga, ANIC.

Australian Capital Territory

Black Mountain, ANIC.

Western Australia

Carson Escarpment, ANIC.

Remarks

A broad flat species with large close-packed punctures on pronotum (Fig. 18). Many specimens have broad, weakly-flanged elytra often distinctly truncated at apex. A wet area species common in north Queensland but present as far south as the Blue Mountains and the Australian Capital Territory.

Helochares (Hydrobaticus) tatei (Blackburn)

Hydrobaticus tatei Blackburn, 1896
Helochares (Hydrobaticus) tatei (Blackburn, 1896), Knisch 1924; d'Orchymont 1943

Description (number examined 483)

As for *H. tristis* except as follows. Length 3.4–4.8 mm. Elongate oval, elytra variegated light and dark-brown. Head and pronotum quite densely covered with large well impressed punctures, a little larger laterally, most punctures on pronotum separated by less than half their widths; interstrial punctures on elytra fine, numerous, those in interstriae 7-8 and 9-10 (ignoring short innermost stria) arranged in single loose row; strial punctures large, much larger than punctures on pronotum, mostly confluent, deeply impressed, forming strial grooves, interstrial area flat. Aedeagus as in Fig. 6.

Types

Syntypes: One, in NMV mounted on a card labelled 'Reedy Ck.' and bearing labels, 'Cent. Aust. Coll. Horn. Exp. Pres. 7.94', 'Hydrobaticus tatei, Blackb', in addition it has a modern red label with 'Type' printed on it; two specimens on the same card on which is written 'T Co-type 5484 Palm Ck.' in Blackburn's hand and labelled 'Hydrobaticus tatei Blackb.' in SAMA; One specimen labelled '5484 Palm Ck, Hydrobaticus tatei Blackb. co-type' in SAMA; ten specimens in NMV mounted two to a card on each of which is written 'Palm Ck.' in Blackburn's hand; two of these are labelled 'Cent. Aust. Coll. Horn. Exp. Pres. 7.97' and 'Hydrobaticus tatei Blackb. det. by Blackb.', one pair bears only the locality label, another only the species label and the last pair has no label. All are clearly from the same series as the other syntypes.

Since the use of 'T' to denote his Holotypes was a normal practice of Blackburn's. I consider the specimen in SAMA so labelled to be the specimen intended by Blackburn as the Holotype. I nominate it as the lectotype and all the other specimens mentioned above as paralectotypes.

Distribution

Northern Territory

Adelaide River, BELG, ANIC; Berry Springs, ANIC; 33 km SW Borroloola, ANIC; 7 km NW by N of Cahills Crossing, East Alligator River, ANIC; Cahills Crossing, East Alligator River, ANIC; Coastal Plains Station, ANIC; Cooper Creek, ANIC; Darwin, BELG, CW; Fogg Dam, ANIC, NTM; Howard Springs, CW, NTM; Huckitta, ANIC, SAMA; Humpty Doo, ANIC; Jim Jim Creek, ANIC, SAMA; Junction Arnhem Hwy and Oenpelli Road, NTM; Kakadu N P, NTM; Katherine, ANIC; Koongarra, ANIC; Magela Creek, ANIC; Manton Reservoir, NTM; McArthur River, ANIC; 16 km E by N of Mt Cahill, ANIC; Mt Gilruth, QM; 9 km N by E of Mudginbarry HS, ANIC, SAMA; Nourlangie Creek, ANIC; 18 km E by N. of Oenpelli, ANIC; 4,8 km S Renner Springs, SAMA; South Alligator R., ANIC, QM; 6.5 km W Timber Creek, SAMA.

Queensland

Archer River, ANIC; Archer Bend, CW; Boggy Creek, ANIC; 25 km N, Coen, CW; NW by W. Laura, East Claudie River, UQIC; 60 km S, Coen, CW; Colosseum Creek, 16 km S Miriam Vale, UQIC; Cooktown, ANIC; Dalhunty River, CW; Hann River, 73 km S of Coen N. CW; Hann River, 110 km S of Coen N. NMV; Iron Range, UQIC; Mornington Island Mission, SAMA; 3 km ENE Mt Tozer, ANIC; Musgrave, ANIC; Normanton, SAMA; Rockhampton, ANIC.

New South Wales

32 km SSW Bourke, SAMA; Whitton, SAMA.

Western Australia

21°31.55 S., 119°06.57 E, WAM; Beverley Springs, WAM; Behn River, SAMA; 172 km SSE of Carnarvon, ANIC; Carson escarpment, ANIC; Charnely River, 40 km N, Beverley Springs, WAM; Dampier Island, FIELD; Drysdale River, ANIC; Milstream, ANIC, WAM; Mitchell Plateau, ANIC, FIELD; 8 km NNE Mt Broome, WAM; Murchinson River, ANIC; 5 km S, Pago Mission, FIELD; Woodstock Station, WAM.

South Australia

Arkaroola Creek, SAMA; Brachina Creek, SAMA; Mt Chambers Gorge, CW, SAMA; 16 km E Curdimurka, SAMA; Eringunda Valley, SAMA; Salt Creek, SAMA; Wilpena Pound, SAMA.

New Caledonia

Grotte de Ninain Rev Poya, SAMA.

Remarks

Resembles *H. (H.) marreensis* in its narrow shape and similar male genitalia. *H. tatei* can be separated from this species by having interstrial punctures much weaker than those in adjacent striae and having only one row of punctures in interstriae 7–8 and 9–10. As far as I know this is the first record of this species from New Caledonia.

Helochares (Hydrobaticus) tenuistriatus Régimbart

Helochares tenuistriatus Régimbart, 1908
Helochares (Hydrobaticus) tenuistriatus Régimbart, 1908; Knisch 1924; d'Orchymont 1943.

Description (number examined 9)

As for *H. tristis* except as follows. Length 5.2–6.5 mm. Oval. Distinctly reddish, upper surface with darker markings. Front margin of head broadly concave. Punctures on head and pronotum of two sizes, smaller ¼–½ diameter of larger which are separated by about their own diameter, slightly larger laterally; punctures on elytron rather similar in size, with strial punctures relatively small and weak and not much larger than larger interstrial punctures, which in turn are often not much larger than smaller interstrial punctures; interstrial punctures not confluent, not forming grooves or ridges. Aedeagus as in Fig. 4.

Types

Syntypes, in MNHN. Type locality, Mongers Lake, North Subiaco, Perth, Western Australia; 1, from same series in WAM. Lectotype not designated.

Distribution

Western Australia

Busselton, CW; Bunbury, AM; Camel Lake, WAM; King George Sound, AM; Mogumber, WAM; North Lake, Fremantle, FIELD; Ravensthorpe, ANIC; Swan River, ANIC; SAMA; Swan View, ANIC.

Remarks

Separated from *H. tristis* by the distinctive reddish hue and the comparative uniformity of punctures on the elytra. The aedeagus is distinctive. In the relatively few specimens I have seen there is no hint of elytral grooves or ridges as in some *H. tristis* and virtually all *H. luridus*. Although I saw the types many years ago they are temporarily unavailable and I have relied on my notes and descriptions by Régimbart and d'Orchymont and the illustration of the aedeagus given by d'Orchymont to identify this species. I have not designated a lectotype due to the unavailability of the Paris specimens.

Helochares (Hydrobaticus) thurmerae sp. nov.

Description (number examined 15)

As for *H. tristis* except as follows. Length 3.8–5.0 mm. Reddish-yellow; rear of head, front of pronotum, serial punctures and other areas of upper surface darker. Punctures on head subequal, small for subgenus, separated by half to one times their diameters, somewhat smaller towards front; punctures on pronotum a little denser and stronger than on head; strial punctures on elytra well impressed, much larger than those on pronotum, separate but close to each other, those on disc somewhat smaller than elsewhere including apical declivity; interstrial punctures of uniform size, much smaller than those on pronotum, moderately

impressed, those of lateral fringe larger. Elytra weakly flanged. Aedeagus as in Fig. 9.
Male: Protarsi and claws a little stouter than in female.

Types
Holotype male: 'New Guinea: Morobe Dist., Gusap, Markham, Valley c. 90 ml W. of Lae, 1,000 ft 27–30.i.1965'. 'M.E. Bacchus, BM, 1965–120'. 'Stn. No. 166', in BM(NH).
Paratypes: 4, in BM(NH); 1, in CW; 1, in SAMA, same data as Holotype.

Distribution

Papua New Guinea
Gusap Markham Valley, 145 km W of Lae, BM(NH); Lae, BMNH; 11 km Lae-Bulolo Rd., BM(NH).

Remarks
Known only from a relatively small area of New Guinea. Apart from the aedeagus, *H. thurmerae* can be separated from the rather similar *H. loweryae* and *H. dalhuntyi* by the strial punctures being larger and fewer than in those species.

Helochares (Hydrobaticus) tristis Macleay

Helochares tristis Macleay, 1871
Hydrobaticus australis Blackburn, 1888; syn. nov.

Description (number examined 250)
Length 3.8–6.1 mm. Oval, widest behind centre of elytra. Yellow-brown. Clypeus, back of head, markings in central panel of pronotum and much of underside darker. Front margin of head shallowly and widely concave. Head and pronotum densely covered with punctures of two sizes, in approximately equal numbers, larger much larger than smaller; punctures denser, larger and more numerous laterally. Elytra similarly punctured (Fig. 20), with, in addition, ten more or less distinct lines of serial punctures; lateral band of punctures on elytron continues strongly to apex. Serial punctures same size or larger than larger interstrial punctures. Pronotum and elytra weakly flanged. Maxillary palpi elongate, first and second segments subequal in length, apical somewhat shorter. Femur with rugose portion covered with short setae, covering all but small portion of apex of femora. Underside rugose punctate. Sternites with covering of short setae; apex of apical sternite broadly notched, notch with row of stout setae along margin practically filling up area of notch.
Male: Maxillary palpi, tarsi and tarsal claws slightly stouter than in female. Aedeagus as in Fig. 3.

Types
H. tristis: Holotype, ?sex 'Hydrobaticus tristis Mcl. W. Gayndah' 'K19621' with small circular red label and red Holotype label, in AM.
H. australis: Syntypes: two male specimens mounted on same card, under the left hand specimen is the number 410 & 'T'. The pin has the following labels; BM(NH) Type label, 'Blackburn coll. 1910–236', 'Hydrobaticus australis Blackb.', in Blackburn's hand, in BM(NH); one labelled '410, Port Lincoln Blackburn, Hydrobaticus australis Blackb., co-type' in SAMA; two mounted on same card labelled '410, Port Lincoln Blackburn, Australis Blackb.' in SAMA (there is an empty card labelled '410' on same pin). I nominate the left hand specimen in the BM(NH) below which is written '410 T' as the lectotype, and the remaining syntypes as paralectotypes. Synonymy is based on examination of types.

Distribution

Northern Territory
Ayers Rock, UQIC; 80 km W Mt Olga, WAM; 160 km W Mt Olga, WAM; Vaughan Springs, CW.

Queensland
Brisbane, UQIC; Brookfield, QM; Cunnamulla, QM; Dalby, QM; Goomeri, UQIC; Green Island, WAM; Jimboomba, ANIC; Malanda, CW; 16 km S Miriam Vale, UQIC; Stanthorpe, BELG, UQIC; Tambourine Mt., QM.

New South Wales
Blowering Dam, ANIC; Cooma, ANIC; 23 km NNE Coonabarabran, ANIC; 15 km S Condobolin, ANIC; Culcairn, ANIC; Deniliquin, ANIC; Forbes, CW; Forest Reefs, SAMA; Kitty's Creek, ANIC; Macleay River, ANIC; Muswellbrook, ANIC; Native Dog, ANIC; Sydney, BELG, NMV; Yanco Creek, ANIC.

Australian Capital Territory
Acton, ANIC; Canberra, ANIC; Gungahlin, ANIC; 3 km NW Tharwa, ANIC.

Victoria

Alexandra, NMV; Anakie, NMV; Avoca, NMV; 11 km NNW Ballan, ANIC; Ballarat, ANIC; Birchip, NMV, UQIC; Dandenong Range, NMV; 34 km E Echuca, ANIC; Ferntree Gully, NMV; Grampians, UQIC; Healesville, CW, NMV; Inglewood, NMV; Iona, ANIC; L. Colac, NMV; L. Punrumbeti, NMV; Lake Hattah, NMV; Latrobe River, NMV; Lilydale, SAMA; Maffra, NMV; 8 km SW Maffra, ANIC; Melbourne, NMV, UQIC; Mitta Mitta River, NMV; Mordialloc, NMV; Mornington, UQIC; Natya, NMV; Preston, NMV; Sea Lake, UQIC; Goudie, UQIC; 13 km SE Shepparton, ANIC; Stawell, CW; Suggar Buggar, NMV; Tynong, NMV; Morwell, ANIC; 4 km W Violet Town, ANIC; Wartook, NMV; Whittlesea, NMV.

Tasmania

Asbestos Range NP, ANIC; East Tamar, SAMA; Launceston, SAMA; Hobart, BELG, NMV, SAMA.

South Australia

Adelaide, CW; Blanchetown, SAMA; Chain of Ponds, CW; 13km N Ernabella, FIELD; Everard Ranges, SAMA; Flinders Ranges, CW; Gawler, SAMA; Gawler Ranges, SAMA; Mannum, CW; Mt Barker, SAMA; Murray River, NMV; Olary, ANIC; Scorpion Springs C.P., SAMA.

Western Australia

8 km S Giles, WAM; Gill's Pinnacle, WAM.

Remarks

Elytra are usually smooth (except for punctures) (Fig. 22) but in some specimens, particularly from more northern localities, the strial punctures are confluent towards apex forming grooves, and in some the interstrial areas are ridged accentuating the grooving in a way very similar to *H. luridus*. This species appears to be replaced in south-west Western Australia by *H. tenuistriatus*, a slightly larger species recognisable by its uniform reddish colour and strong interstrial punctures. *H. tristis* is sympatric with *H. luridus* in southern Queensland. The difference between these two species is discussed under *H. luridus*.

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Without the support of a professional infrastructure this work would have been impossible. I thank the curators of the collections listed earlier for allowing me to examine specimens in their care; Ms D. Churches, Ms R. Cherrington and Mrs V. Wade typed the manuscript; Ms J. Thurmer drew the figures of the male genitalia; Ms J. Forrest took the SEM photographs; Mrs M. Anthony ferreted out obscure references and Dr E. Matthews much improved the manuscript. I thank them for their help in what are perhaps the less exciting aspects of scientific endeavours but nevertheless necessary ones.

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THE KAMPTOZOAN *PEDICELLINA WHITELEGGII* JOHNSTON & WALKER, 1917 AND OTHER PEDICELLINIDS IN AUSTRALIA AND NEW ZEALAND

K. WASSON

WASSON, K. 1995. The kamptozoan *Pedicellina whiteleggii* Johnston & Walker, 1917 and other pedicellinids in Australia and New Zealand. *Records of the South Australian Museum* **28**(2): 131–141.

Colonies of the kamptozoan (entoproct) *Pedicellina whiteleggii* are ubiquitous in the low intertidal and shallow subtidal zones of southern Australia and New Zealand. This species has been known under a variety of names, but can be distinguished from other pedicellinids by a suite of traits including longitudinal rows of conspicuous oblong cells on each tentacle, and a tall, narrow, particle-covered larva. *Pedicellina whiteleggii* is re-described and illustrated, and compared to all other pedicellinids reported from the waters around Australia and New Zealand. *P. whiteleggii* is a senior synonym of *P. hispida* and appears to be very similar to a number of other pedicellinids reported from these waters. However, *P. whiteleggii* is clearly distinct from three other species (*P. cernua, P. compacta* and *P. pyriformis*) known from Australia and New Zealand. The distribution of all these pedicellinids is discussed, and the importance of larval traits in kamptozoan taxonomy is emphasised.

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Members of the phylum Kamptozoa (Entoprocta) have rarely been studied in Australia and New Zealand. There are about twenty published reports on the kamptozoan fauna of these regions, and only a few of these have involved detailed taxonomic investigations (Hastings 1932, Johnston & Angel 1940, Ryland 1965).

Examination of museum collections revealed that only one pedicellinid species is common in the shallow waters of Australia and New Zealand. This species, *Pedicellina whiteleggii* Johnston & Walker, 1917, accounts for most of the museum specimens of *Pedicellina* from these waters. Published records and museum labels refer to these specimens under various names, but a suite of distinctive traits unites them. The ubiquitous nature of this species on these southern seashores was reinforced by field collections which indicated that colonies were present on many low intertidal and shallow subtidal substrata at all sites surveyed.

The purpose of this report is to unify these various specimens under one name, *Pedicellina whiteleggii*, and to justify this unification by describing the configuration of traits which characterises members of this species. This re-description of *P. whiteleggii* is followed by a brief review of all other pedicellinids known from Australia and New Zealand.

MATERIALS AND METHODS

I examined all pedicellinid kamptozoans from localities around Australia and New Zealand deposited in the collections of the South Australian Museum (SAM), the Australian Museum (AM), the Museum of Victoria (NMV), the Museum of Tropical Queensland (MTQ), the Otago Museum (OM), the Portobello Marine Laboratory of the University of Otago (PML), and the British Natural History Museum (BMNH). Apparently no other museums contain collections of pedicellinids from Australia or New Zealand.

I collected live pedicellinids from the low intertidal or shallow subtidal zone at Fairlight, Port Jackson, New South Wales; Aldinga Reef, Gulf St. Vincent, South Australia; Pukerua Bay, North Island, New Zealand; and Aquarium Point, Otago Harbour, South Island, New Zealand. At each site, about one hour was devoted to collecting various living and non-living substrata from sheltered habitats under rocks or overhangs. These substrata were then examined under a stereomicroscope to detect pedicellinid colonies. This two step method of searching revealed that at each site pedicellinids were present on about 5–10% of the substrata collected.

SYSTEMATICS

Phylum KAMPTOZOA Cori, 1929
(= Entoprocta Nitsche, 1870)

Order COLONIALES Emschermann, 1972

Sub-Order STOLONATA Emschermann, 1972

Family PEDICELLINIDAE Hincks, 1880

Genus *Pedicellina* Sars, 1835

Pedicellina whiteleggii Johnston & Walker, 1917 (Figs. 1–4).

? *Pedicellina sp.* MacGillivray, 1887: 221, no fig.

Pedicellina cernua (Pallas, 1774) *sensu* Whitelegge, 1889: 293, no fig.

Pedicellina whiteleggii Johnston & Walker, 1917: 60, fig. 14; Stach 1937: 374, no fig.

Pedicellina hirsuta Jullien, 1891 *sensu* Johnston & Angel, 1940: 227, figs. 38–42.

Pedicellina hispida (from New Zealand) Ryland, 1965: 197, fig. 5.

Gordon, 1972: 510, fig. 3.

non *Pedicellina cernua* (Pallas, 1774):57, fig. 10 in plate 4.

non *Pedicellina hirsuta* Jullien, 1891:13, no fig.

non *Pedicellina hispida* (from Europe) Ryland, 1965:200, fig. 8.

Etymology

Johnston & Walker (1917) named this species *Pedicellina whiteleggii* to honour Thomas Whitelegge, who had earlier collected colonies of the same species from the Port Jackson area. Whitelegge in 1883 became the first cataloguer of marine invertebrates at the Australian Musuem, and held that position until 1908. Whitelegge contributed greatly to the characterisation of the invertebrate fauna of the region, and was one of few Australians to report the presence of kamptozoan species on these seashores.

Type

Johnston & Walker provided two syntypes (SAM E942 and E943) of this species. I now designate SAM E942 as the lectotype; SAM E943 thereby becomes a paralectotype.

Type Locality

Johnston & Walker (1917) indicate that the types of *Pedicellina whiteleggii* were collected under stones in the intertidal zone at Port Jackson, NSW. They list both Middle Harbour and Watson's Bay as collection sites, and do not specify at which of these two localities the types were taken.

Material Examined

South Australia: Port Willunga, intertidal, 25.iii.1944, SAM L709; Outer Harbour, 0.5 m, R.G. Chittleborough, 2.v.1951, SAM L710; Point Turton Jetty, Yorke Peninsula, 3–4 m, K. Gowlett-Holmes, 2.iv.1994, SAM L711; Aldinga Reef, Gulf St. Vincent, 1–2 m, S.A. Shepherd & K. Wasson, 18.ii.1995, SAM L712; Aldinga Reef, Gulf St. Vincent, 1–2 m, S.A. Shepherd & K. Wasson, 18.ii.1995, personal collection of K. Wasson.

New South Wales: Port Jackson, intertidal, T. H. Johnston & M. J. Walker, SAM E942 & E943 (syntypes); Port Jackson, intertidal, T. H. Johnston & L. M. Angel, SAM BANZARE collection; Port Stephens, intertidal, T. H. Johnston, SAM L708; Port Stephens, intertidal, AM U672 & U673; Rose Bay, Port Jackson, AM U880; Long Reef, Sydney, intertidal, P.A. Hutchings & W.F. Ponder, 16.xi.1970, AM W22254; Port Kembla Harbour, 1 m, J. Watson, NMV F77075; Fairlight, Port Jackson, intertidal, K. Wasson & Aust. Mus. Party, 15.ii.1995, AM W22255.

Victoria: Little Henty Reef, near Apollo Bay, 2.5–8.0 m, C. Handreck, 5.ii.1994, NMV F76892.

North Island, New Zealand: Pukerua Bay, intertidal, S. O'Shea & K. Wasson, 28.i.1995, PML reference collection.

South Island, New Zealand: Cemetery Bay, Otago Peninsula, intertidal, E. Batham, 4.v.1961, PML reference collection (*P. hispida* holotype); Cemetery Bay, Otago Peninsula, intertidal, E. Batham, 4.v.1961, BMNH 1964.2.8.5 (*P. hispida* holotype); Cemetery Bay, Otago Peninsula, intertidal, E. Batham, 4.v.1961, BMNH 1964.2.8.25; Cemetery Bay, Otago Peninsula, intertidal, E. Batham, 10.xii.1962, OM Iv2010/ A.64:9 (*P. hispida* paratype); Cemetery Bay, Otago Peninsula, intertidal, E. Batham, 10.xii.1962, BMNH 1964.2.8.6; Aquarium Point, Otago Peninsula, intertidal, M. Barker & K. Wasson, 4.ii.1995, PML reference collection; Aquarium Point, Otago Peninsula, intertidal, M. Barker & K. Wasson, 4.ii.1995, personal collection of K. Wasson.

Diagnosis

Stolon narrower than stalk; stolonic septa of variable thickness, but often very delicate; stalk quite thick, about three times as long as calyx;

stalk and calyx hispid; calyx wide and somewhat asymmetrical in side view; 16–36 tentacles, usually 20–24; tentacular membrane high; axial rows of large cells on abfrontal surface of tentacles, conspicuous as glistening bands in living zooids; larva small, tall and narrow, often densely coated with particles.

Description

Colony: A colony of *Pedicellina whiteleggii* resembles those of most other pedicellinids, with a network of stolons creeping on the substratum, from which the zooids arise at regular intervals (Fig. 1a). The stolons, stalks and calyces are translucent beige. New buds are formed at the

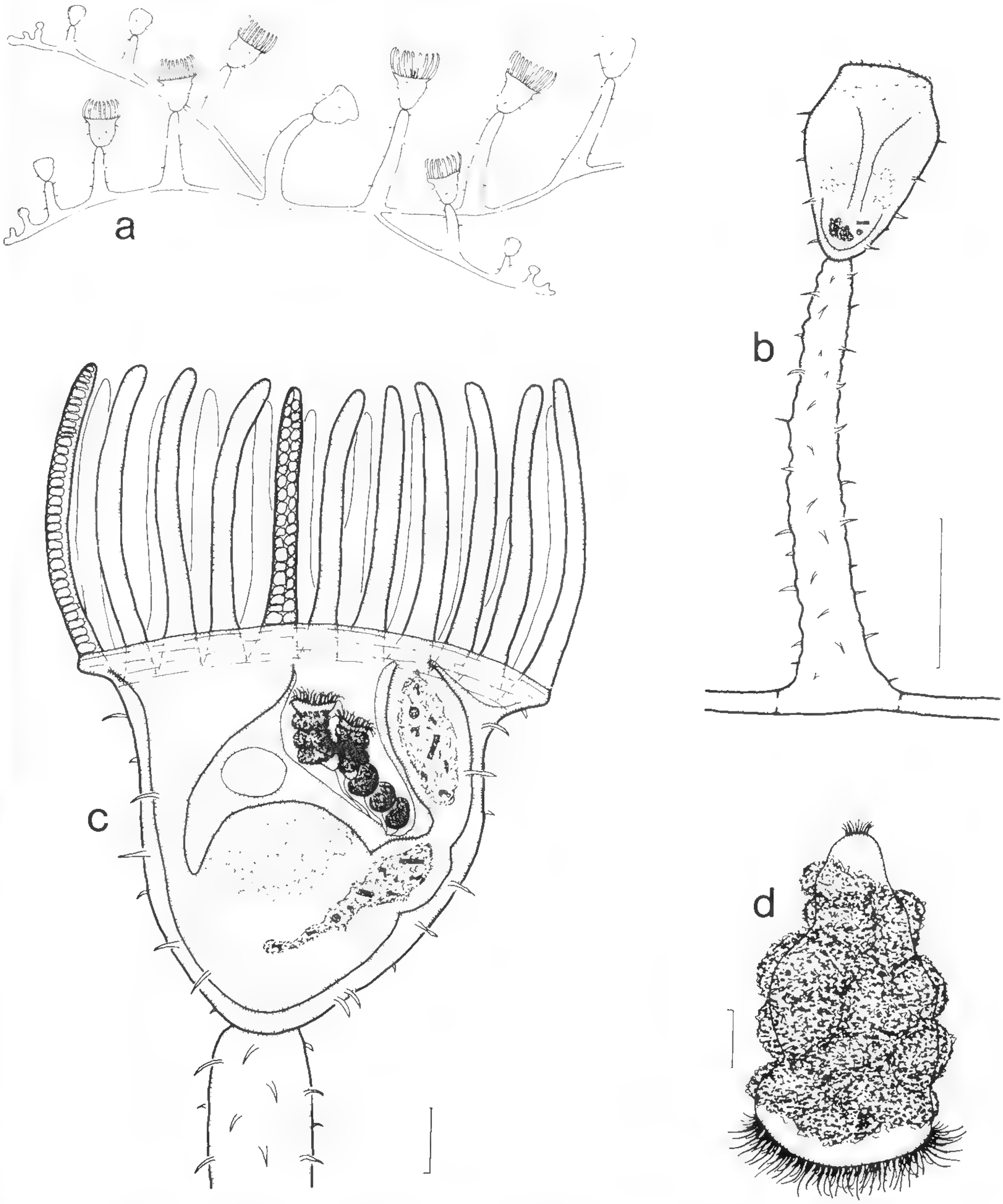

FIGURE 1. *Pedicellina whiteleggii*. **a**. part of a colony. Scale bar=1000 µm. **b**. zooid with a contracted male calyx in frontal view. Scale bar=500 µm. **c**. expanded female calyx in side view, with brooded larvae. The conspicuous rows of cells are shown on two tentacles only. Scale bar=100 µm. **d**. particle-coated larva. Scale bar=20 µm.

base of older zooids, and remain connected by a basal stolon. Calyces are deciduous, as in other stolonate kamptozoans, and at any time about 10% of the zooids in a colony are in the process of regenerating calyces that have been shed.

FIGURE 2. Two *Pedicellina whiteleggii* zooids (from Long Reef, NSW). Calyces are contracted and fixed, in side view. scale bar=200 µm.

Stolon: The stolon is always considerably narrower than the upright stalk (Table 1). The inter-zooidal stolonic distance varies within populations, but is often quite short, resulting in a high density of zooids (20–30 zooids/cm^2) on the substratum.

The septa which delineate stolon segments bearing zooids ("fertile" segments) from segments without zooids ("sterile" segments) are often unusually delicate and are sometimes so inconspicuous that they cannot be distinguished even by careful examination of the appropriate portion of the stolon. The stolonic septa in *P. whiteleggii* appear to vary in thickness even within the same colony, ranging from distinct, fairly strong septa to extremely faint or even absent septa. This sort of septal variation is not typical of other pedicellinid species, in which the septa are either always present and conspicuous, as in *P. cernua*, or always absent, as in *P. pyriformis*.

Stalk: The stalk in *P. whiteleggii* is thicker and sturdier than those of many other pedicellinid species (Figs. 1b; 2). As in other pedicellinids, the stalk is highly muscular, and living colonies are characterised by the active bending motions of the zooids' stalks. Contracted zooids, which have been preserved unrelaxed, sometimes appear to have annulate stalks.

Stalk length varies within a population, but typically the stalk is about 1.2–1.6 mm long, which is about three times as long as the calyx is high (Table 1). The stalk tapers in width from base to apex (Table 1). The stalk is invariably hispid, ornamented everywhere with cuticular spines (Figs. 1b; 2). The spines are often hook-shaped, down-curved with broad bases and narrow tips. Spine size and density vary within a population; some stalks may be sparsely covered with small spines while others are densely covered with long spines.

Calyx: The calyx is laterally compressed, being much wider in side view (Fig. 1c) than in anterior (Fig. 1b) or posterior view (Table 1). In side view, the calyx is broad and somewhat asymmetrical due to a slight aboral bulge. This bulge and the resulting asymmetry are variable within a population, and occasionally are rather pronounced.

The calyx is invariably hispid. While the size and density of calycal spines vary within populations, they are generally similar to those on the zooid's stalk.

The tentacles are extended directly above the calyx parallel to the stalk (Fig. 1c) rather than

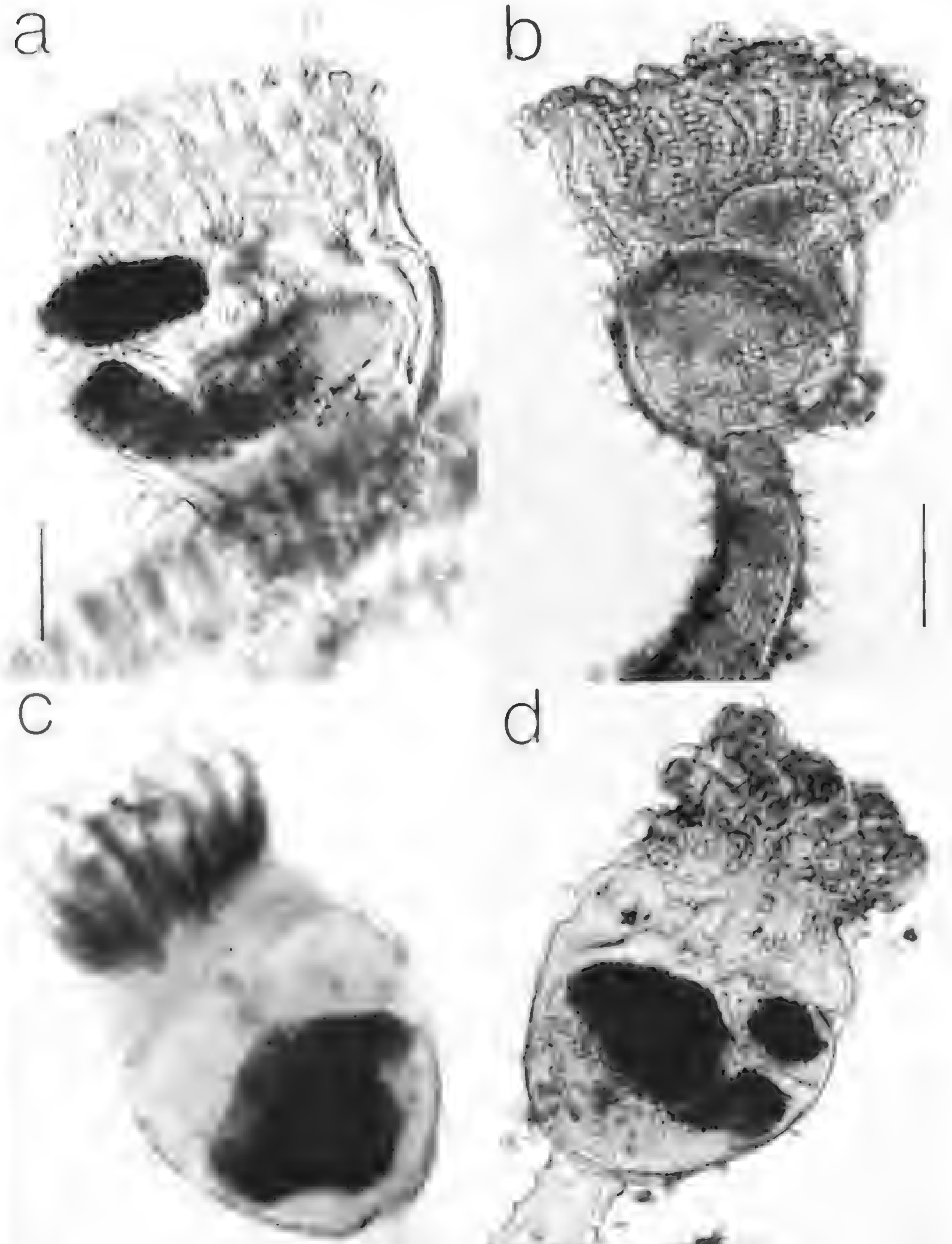

FIGURE 3. *Pedicellina whiteleggii* calyces. **a**. contracted, fixed, female calyx (from Rose Bay, NSW) in side view. **b**. contracted, live, immature calyx (from Aldinga Reef, SA) in side view. **c**. semi-contracted, live, male calyx (from Portobello, NZ) in frontal view. **d**. semi-contracted, live, immature calyx (from Fairlight, NSW) in side view. Scale bar=100 µm in a–d.

TABLE 1. Dimensions of zooidal components of *Pedicellina whiteleggii*. All measurements are given in micrometers.

Dimension	Average (adult)	Observed Range
CALYX HEIGHT (calyx base to tentacular membrane)	600	400–760
CALYX DEPTH (in side view)	500	300–600
CALYX WIDTH (in anterior or posterior view)	350	220–450
TENTACULAR MEMBRANE HEIGHT (region of conspicuous circular musculature)	75	60–85
TENTACLE NUMBER	20–24	16–36
CALYX HEIGHT/STALK LENGTH	1:3	1:2–1:4
STALK LENGTH (stolon to base of calyx)	1400	720–2600
APICAL STALK WIDTH (at calyx)	130	110–180
MID-STALK WIDTH (in middle)	160	120–280
BASAL STALK WIDTH (just above stolon)	240	160–340
STOLON WIDTH	90	60–120
FERTILE SEGMENT LENGTH	400	240–600
STERILE SEGMENT LENGTH	300	100–600
LARVAL HEIGHT (prototroch to apical organ)	150	130–200
LARVAL WIDTH (in side view)	75	60–100

tilted anteriorly as in some other pedicellinid species. The tentacular membrane is high, and in contracted calyces the tentacles appear to be deeply infolded. When living colonies are examined under reflected light, conspicuous pale yellow axial bands glisten on the tentacles. At higher magnification these bands appear to consist of two longitudinal rows of large, oval cells, on the abfrontal surface of each tentacle. (Figs. 1c; 3b; 3c; 3d). These large cells may have a glandular function. This tentacular organisation is an unusual and distinctive feature of *P. whiteleggii* which has not been previously recorded.

The shape and size of the digestive tract and its components vary somewhat with state of anaesthetisation. The mouth leads into a typical wide oral funnel which narrows into a tubular esophagus. The stomach is large, often somewhat triangular in appearance, wider on top than near the base (Fig. 3a). The intestine is a broad cylinder which narrows abruptly at the rectum. The rectum is quite broad, and sometimes widens towards the anus. The anal cone often extends obliquely, but may be folded down horizontally in a contracted calyx or extended up vertically in a fully relaxed animal.

Sexual Reproduction: Sexual reproduction probably occurs year-round. In very mature colonies, 80–90% of calyces have testes or ovaries. Since colony boundaries could not be determined, it was impossible to determine whether colonies are gonochoric or hermaphroditic. Calyces contain gonads of only one sex, and thus appear to be gonochoric, although the possibility of sequential hermaphroditism cannot be excluded. Testes are similar to those of other kamptozoans in appearance and location: large white sacs packed with sperm, lying on either side above the stomach (Fig. 1b). Females have relatively large ovaries for a kamptozoan, located in the same position as the testes (Fig. 1c). About 12–16 embryos are clustered in a thin-walled, flexible brood chamber. The embryos seem unusually small and numerous.

The larva is relatively small (Table 1), tall and very narrow in frontal and side view (Figs. 1d; 4a; 4b). The surface of the swimming larva is densely coated with particles of apparently external origin which appear beige under reflected light and dark under transmitted light. Particles sometimes cover even larvae which are still retained in the brood chamber. Perhaps sticky secrections coat the larval surface, attracting and retaining particles. The outline of the prototroch is roughly circular when viewed from below. The larval foot and frontal organ are highly reduced or absent. As in other kamptozoans, the larval body is quite contractile.

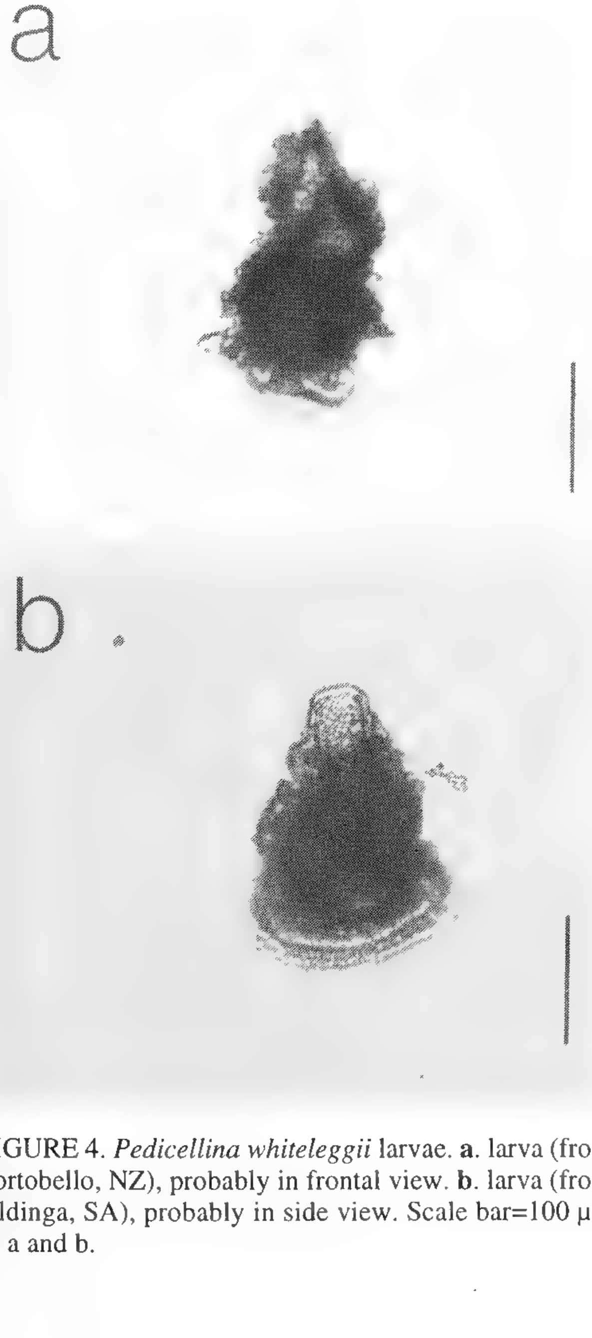

FIGURE 4. *Pedicellina whiteleggii* larvae. **a**. larva (from Portobello, NZ), probably in frontal view. **b**. larva (from Aldinga, SA), probably in side view. Scale bar=100 µm in a and b.

The form of the larva in *Pedicellina whiteleggii* is very distinctive and differs from that of other pedicellinids in which the larva is known. In both *P. cernua* and *P. nutans* the larva is much larger and much wider in side view, and has a well-developed foot and frontal organ (Nielsen 1971). While the larva of *P. whiteleggii* differs markedly from those of some of its congeners, it bears a striking resemblance in its proportions and in the dense particulate covering to the 'type A' larva described for the barentsiid *Barentsia gracilis* from European waters (Nielsen 1971). The *B. gracilis* 'type A' larva also lacks a foot and has a reduced frontal organ.

Newly settled larvae are found on or near adult colonies, suggesting that in this species, as in many or all other kamptozoans, larval settlement is gregarious.

Habitat

Colonies of *Pedicellina whiteleggii* generally occur on living substrata, including algal holdfasts, sponges, hydroids, serpulid polychaete tubes, oyster shells, erect and encrusting bryozoa, and ascidians. The most common hosts seem to be serpulids, encrusting bryozoans, and solitary ascidians. Occasionally, colonies may also grow directly on protected rock surfaces.

This pedicellinid occurs in sheltered places, such as under stones or in deep overhangs, and grows in fouling communities of hydroids, ascidians, and bryozoans. The material examined for this study was collected primarily from the low intertidal zone, with only a few specimens collected subtidally at a few meters depth. This species' distribution may well extend into far deeper water; it should be sought by examination of appropriate substrata collected by SCUBA or dredging.

Distribution

South Australia (Gulf St. Vincent; Yorke Peninsula), New South Wales (Port Jackson; Port Stephens; Port Kembla), Victoria (Lady Julia Percy Island; Little Henty Reef), and New Zealand (Goat Island Bay; Pukerua Bay; Otago Peninsula).

Pedicellina whiteleggii *and its synonyms*

Three reports of pedicellinids from New South Wales and Victoria roughly match the description of *P. whiteleggii*, but the animals are not well described or figured in these texts. MacGillivray (1887) merely noted *Pedicellina sp.* from Port Phillip Heads without providing descriptive information or a figure; but since *P. whiteleggii* is common at that locality, his report may well be of this species. Whitelegge (1889) listed *Pedicellina cernua* from Sydney Harbour, again without a description or figure, but Johnston & Walker (1917) synonymised his material with *P. whiteleggii*. Stach (1937) identified *P. whiteleggii* from Lady Julia Percy Island off the Victorian coast, and since Johnston & Angel (1940) examined other collections he had made and found his identifications of *P. whiteleggii* correct, I also infer that his material was indeed *P. whiteleggii*.

Ryland (1965) described a new species, *Pedicellina hispida*, from New Zealand, based on three colonies growing on brachiopods in Otago Harbour, New Zealand. Examination of the types of *P. hispida* revealed that it closely matches *P. whiteleggii*: a narrow stolon with inconspicuous septa, hispid stalk and calyx, somewhat asymmetrical calyx with a high tentacular membrane. The sizes and proportions of the zooids also agree with those of *P. whiteleggii*. Live colonies I collected from Otago Harbour were clearly the same as Ryland's *P. hispida* based on zooid structure and calyx morphology. In the fresh material, I noted the rows of large tentacular cells glistening yellow under reflected light, and the tall, particle-covered larva, both characteristic of *P. whiteleggii*. These traits, taken together, justify the synonymy of Ryland's *P. hispida* from New Zealand with *P. whiteleggii*. Gordon (1972) identified a kamptozoan from the North Island of New Zealand as *P. hispida* Ryland. Based on the figure, this kamptozoan was probably also *P. whiteleggii*.

Ryland (1965) also identified colonies from Europe as *P. hispida*, but the calyces in these colonies are glabrous, while those of *P. whiteleggii* are always hispid. The tentacle and larval structure of the European colonies is not known, and so their status is uncertain. Because of this uncertainty and because their localities are so distant from Australia and New Zealand, I have excluded the European specimens of *P. hispida* from the list of synonyms of *P. whiteleggii*.

In 1940, Johnston & Angel synonymised *P. whiteleggii* Johnston & Walker with *P. hirsuta* Jullien. This decision reflected a general trend then to consider all the world's pedicellinids as variations of one species, *Pedicellina cernua* Pallas. Cori (1936) suggested that *P. whiteleggii* Johnston & Walker might be *P. cernua var. hirsuta*, described by Jullien (1891) as *P. hirsuta* from Tierra del Fuego. Although Cori had apparently never seen either Jullien's or Johnston's material, Johnston & Angel (1940) were nevertheless swayed by Cori's authoritative opinion. While they did not believe *P. whiteleggii* was a variety of *P. cernua*, they compromised by synonymizing it with *P. hirsuta*. Jullien's (1891) description of *P. hirsuta* is sketchy and there are no illustrations. The type material (Muséum National d'Histoire Naturelle, Paris) consists of five dried zooids on natural substratum (Bry–2177) and a slide mount of five other zooids (Bry–39), of which four are recently budded, tiny zooids at the stolon tip. My examination of this type material suggested that this species, while resembling *P. whiteleggii* in general shape and in the hispid stalk and calyx, is distinct from it. Based on these ten poorly preserved zooids, *P. hirsuta* has a wider stolon that is hispid in places, which contrasts with the narrow, glabrous stolon of *P. whiteleggii*. The stalk tapers less in *P. hirsuta* than in *P. whiteleggii*, and the spines on the *P. hirsuta* types are longer and denser than is typical for *P. whiteleggii*. Most conclusively, the tentacles of the type specimens did not contain the conspicuous large cells found in *P. whiteleggii*. The larval form of *P. hirsuta* remains unknown, because the only sexual mature zooids in the type specimens were male. Since there is no evidence for synonymy with *P. hirsuta* Jullien, *P. whiteleggii* now reverts back to its original 1917 name.

Other pedicellinids from Australia and New Zealand

***Pedicellina compacta* Harmer, 1915**: This species was reported from the Great Barrier Reef by Hastings (1932). Her material (BM 1932.4.20.93) and additional colonies I collected in Rowes Bay, Townsville, Queensland (MTQ G21264) are certainly referable to Harmer's *P. compacta* (BM 1916.8.23.33–34) from the Aru Islands (Indonesia). *P. compacta* apparently replaces *P. whiteleggii* as the ubiquitous coastal species in tropical and sub-tropical waters. *P. compacta* has much smaller zooids than *P. whiteleggii*, with total zooid height (stalk and calyx together) averaging 600–800 µm. The stolon is extremely narrow (30–40 µm) and the stolonic septa are much more conspicuous than in *P. whiteleggii*. The stalk tapers much less between base and apex, and is proportionately shorter, typically one to two times as long as the calyx is high. The stalk is very muscular and mobile. The proportionately big calyx (but still only about 300 µm high!) is narrower in side view than in *P. whiteleggii*; it is not as compressed laterally. The calyx and tentacles show a slight anterior tilt absent in *P. whiteleggii*, and there are only about 12–16 tentacles. The calyx and stalk are covered by filiform, cylindrical, extremely long spines that are completely different from the shorter, thicker, hook–like spines of *P. whiteleggii.*

Pedicellina pyriformis **Ryland, 1965**: This exquisite species forms the tallest and densest colonies known for any pedicellinid. It was described by Ryland (1965) from the Otago Peninsula. I have examined his material (PML reference collection; OM Iv2008–9/A.64:7–8) as well as a colony collected by K. Gowlett-Holmes (SAM PH 0008) from Tasmania. The stolon is very much wider than in *P. whiteleggii* and is completely non–septate. The stalk is listed by Ryland as being about 2 mm long, but a colony from Otago deposited at PML after his study was completed has stalks reaching an astonishing 5–6 mm. The stalk tapers only very slightly from base to apex, and both calyx and stalk are glabrous. The triangular calyx is much less laterally compressed than in *P. whiteleggii*, and is not asymmetrical in side view. The calyx is typically 600–700 μm high, but in some cases attains a height of 1 mm. The gut is also distinctive: the stomach is compact and triangular, and the intestine and the rectum are long and narrow, the latter extending within an anal cone high into the tentacular crown. The gut has empty spaces around it rather than filling the calyx as in most other pedicellinid species.

Pedicellina grandis **Ryland, 1965**: This species was described from one colony from Otago Harbour. This colony (PML reference collection; OM A.64:6) resembles *P. whiteleggii* in general form. The stolon is narrow and the septa inconspicuous; the stalk and calyx are hispid. The main difference between *P. grandis* and *P. whiteleggii* appears to be quantitative: some *P. grandis* zooids have considerably longer stalks than do *P. whiteleggii* zooids. Ryland (1965) also noted that the tentacles in semi–contracted calyces form a distinctive conical cap, but this trait appears to vary with the state of zooidal relaxation. Further examination of the tentacle structure and larval form of this species may reveal further distinguishing features which separate the two species, or, on the other hand, that *P. grandis* is synonymous with *P. whiteleggii*, and that its longer stalks can be attributed to habitat or age differences.

Pedicellina pernae **Ryland, 1965**: This species from Otago is distinguished from *P. whiteleggii* by its somewhat smaller size and a glabrous or only sparsely hispid calyx. Ryland (1965) noted that the calyx was more asymmetrical than that of *P. hispida* (=*P. whiteleggii*), but my examination of the types (PML reference collection; OM Iv2011/A.64:10) revealed that the calyx shape falls within the range of variation of *P. whiteleggii*. Ryland (1965) himself noted that this species lacks really distinctive features. Collection of living material and examination of tentacle structure and larval form could reveal whether this is indeed a different species than *P. whiteleggii.*

Pedicellina cernua **(Pallas, 1774)**: This cosmopolitan species occurs mainly in bays and harbours. Kirkpatrick (1890) found this species in Port Phillip, Victoria. Chittleborough (1952) reported *P. cernua* from a community of primarily introduced species at Port Adelaide and Outer Harbour, South Australia, and it is probably present in other harbours in Australia and New Zealand. Kirkpatrick's (BM 1888.5.17.24) and especially Chittleborough's material (SAM L713–718) have many features which distinguish the cosmopolitan *P. cernua* from the indigent *P. whiteleggii*. The stolonic septa in *P. cernua* are more clearly visible. The stalk is narrower and tapers more gradually from base to apex. The stalk is hispid, and the spines longer than in *P. whiteleggii*, although this feature is variable. The calyx of *P. cernua* is wider in side view, almost as wide as high, and its aboral bulge and consequent asymmetry are more pronounced. The tentacles in *P. cernua* are tilted anteriorly. The tentacles lack axial rows of large cells, although there is dark green granular pigmentation in the tentacles of some zooids. The tentacular membrane is not so high as in *P. whiteleggii*. A more striking difference is the consistent absence of spines from the calyx. The rectum in *P. cernua* generally appears narrower and extends higher into the tentacular crown than in *P. whiteleggii*. The brood chamber of *P. cernua* is lobulate, while that of *P. whiteleggii* is not. As already discussed, the larva of *P. cernua* differs from that of *P. whiteleggii* in being larger, wider in side view, in having a well–developed foot and frontal organ, and in lacking a dense particulate covering (Nielsen 1971).

DISCUSSION

Knowledge of pedicellinids from Australia and New Zealand is rather limited. This is certainly not because the animals are rare or hard to find; only a few hours in the field turned up many colonies at every site I visited.

The diversity of Australian and New Zealand pedicellinids is low. There appears to be one ubiquitous coastal pedicellinid (*P. whiteleggii*) in colder waters and another (*P. compacta*) in warmer regions, one cosmopolitan species in harbours (*P. cernua*), and one other distinctive species (*P. pyriformis*) in southern areas. Other unreported and perhaps undescribed species will surely be found in unexplored habitats (e.g. deeper water) or unsurveyed regions (e.g. Western Australia). In Northern Europe, which has been much better surveyed for kamptozoans, there is also a low diversity of pedicellinids; only one or two common species and a few rare ones. It is difficult to compare the species diversity of pedicellinids from Australia with other regions, since the pedicellinid fauna of most parts of the world has not been characterised.

The distributions of the pedicellinids found in Australia and New Zealand seem fairly large. *Pedicellina pyriformis*, known only from Otago and Tasmania, appears to have the most limited range, but this rare species may yet be found in other areas. The distribution of *P. whiteleggii* includes much of New Zealand and southern Australia, but its western and southern limits are not known. *P. compacta* is found from Indonesia to Queensland. And *P. cernua* has been reported from all over the world. Only more thorough taxonomic surveys will delineate these ranges more adequately.

The taxonomy of pedicellinids (and of tiny, soft–bodied creatures in general) always poses challenges because of the apparent paucity of morphological characters. Historically, kamptozoan taxonomy has been based on adult traits. Larval form has been largely ignored (but see Nielsen 1971), although since all kamptozoans brood, and most are reproductive year–round, larvae are usually easy to obtain. Larvae can also be examined in well–preserved museum specimens. In this study, a distinctive larval form enabled museum and the field material in Australia and New Zealand to be united under one name, and helped to separate *Pedicellina whiteleggii* from *P. cernua*. In the future, pedicellinid taxonomy would be strengthened by inclusion of larval traits in species descriptions.

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MYTH AS HISTORY? THE NGURUNDERI DREAMING OF THE LOWER MURRAY, SOUTH AUSTRALIA

PHILIP A. CLARKE

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The ethnographic record of Aboriginal mythology in the Lower Murray cultural region of South Australia provides a number of accounts which describe the activities of the main 'Dreaming' ancestor, Ngurunderi. Rather than attempting to standardise the cultural data, this diversity is used here to examine Aboriginal perceptions of the landscape that reflect differing world views. Although the literature acknowledges the important religious dimension of these creation myths, the socio-political dynamics have hitherto generally been dismissed. This paper demonstrates that it is part of the essential nature of mythology, and its associated site-related data, to be flexible and constantly altered and appended. Here is a study of cultural geography, which considers both the material and non-material aspects of Aboriginal cultural construction of the landscape.

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INTRODUCTION

In pre-European Australia, Aboriginal people perceived the social and physical aspects of their world to be closely interwoven. They believed that their spirit ancestors had imbued the landscape with social relevance, and had thereby humanised it. The southern Australian ethnographic literature generally distinguishes between myths that focused on events said to have occurred during the 'Dreaming' or 'Dreamtime', when the main 'creation' took place, and those that concern the period afterwards. The 'Dreaming' in the Lower Murray region was referred to as the *Kulhal* or *Gulal* (Berndt 1940: 170; Berndt & Berndt 1981: 229). Ronald and Catherine Berndt record that the *Kalalwu* or *Kalalal* reportedly meant 'long ago' (Berndt & Berndt 1993: 75, 242). Mythology gained from enlightenment through actual dreams was termed *pekeri* (Berndt & Berndt 1993: 213, 214). The Dreamtime represents an Aboriginal English gloss of a range of meanings. The 'Dreaming' can loosely be defined as the whole body of mythology in Aboriginal Australia that provides some insight into significant cultural events. The form of 'history' that the Dreaming provides is generally portrayed in the popular literature as a monolithic entity, without the possibility of revision or reinterpretation. Under this model, adhered to by both Aboriginal people and some early scholars, such history (or 'tradition') is not changed, only forgotten. Here I follow the work of Kolig (1984 [1981]), Myers (1986), and Sutton (1988), and take a more flexible view of Aboriginal Dreaming, showing it to be a text that reflects the dynamism of culture.

This paper follows the argument put forward in a previous work that mythology provides an image of the dynamic aspects of cultural relationships to landscape (Clarke 1991a: 66–69). Here, the development of tradition is treated as a constant process of re-evaluation of the links between present and past. In this context, I begin by considering the variations occurring within a major creation myth, that of Ngurunderi. As discussed by Maddock (1976) in reference to myths in northern Australia, the local variations form a universe of discourse in which their owners collectively determine what is in common to them all, and through which new possibilities are introduced. The differing versions are not just answers to varied life situations, but are put forth by Aboriginal people as responses to each other. I demonstrate how this process continued in the Lower Murray, under the new socio-political dynamic of post-European colonisation, creating a proliferation of 'new' versions of important myths. The cultural geography concept of the 'cultural landscape' considers the physical and perceptual elements of landscape that are absorbed by other,

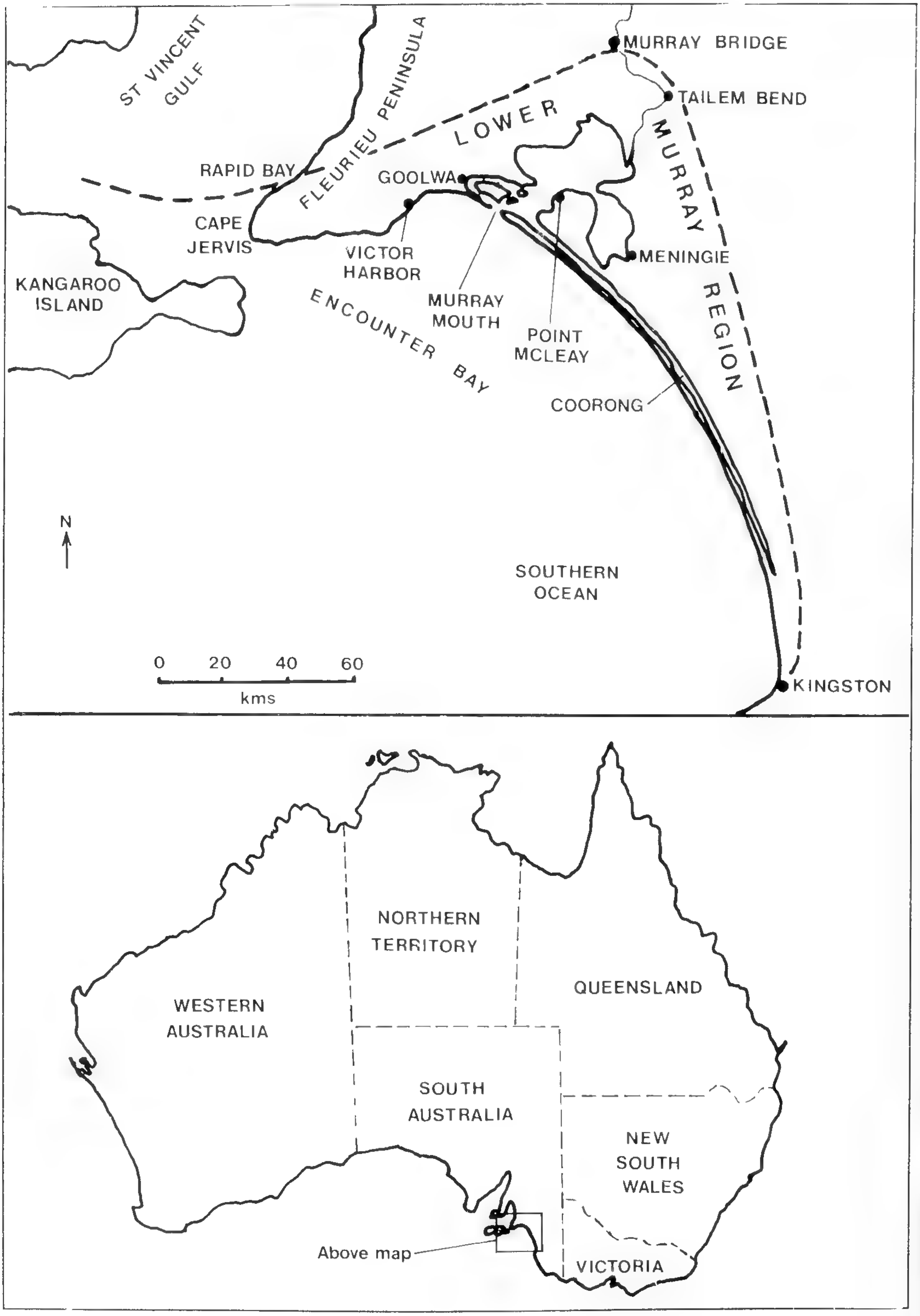

Figure 1. The Lower Murray cultural region.

usually successive, cultural groups. It is useful here to provide a framework of evaluating continuity.

The Lower Murray cultural region may be defined as the area bounded by Rapid Bay in the west, across to the southern side of Murray Bridge, and south to Kingston (Fig.1). It takes in the southern part of the Fleurieu Peninsula, all of Encounter Bay, Lake Alexandrina and Lake Albert, and the Coorong. In the early years of European settlement this region was noted by several observers to be relatively culturally homogeneous in relation to neighbouring groups that differed in language, custom and material culture (Meyer 1843: vi; 1846 [1879: 185]; Cawthorne 1844 [1926: 1]; Mathews 1898: 336–343). Rather than comprising a few large units that past scholars have labelled as 'tribes', it is better to treat the Lower Murray people in the early years of European settlement as a more numerous series of extended family units, headed by several politically active people who led by their coercive powers over others (Clarke 1994, Chapter 2). These land-owning units were descent groups tracing their origins to particular locations of mythological significance in their territory. In most parts of Australia, these places are usually termed 'sacred sites' (Berndt 1970; Myers 1986: 50, 51, 134–136). An individual's connection to the Dreaming provided the basis of his or her identity. Marriage and trade relationships helped the Lower Murray groups maintain a high degree of social and cultural cohesion. Because of a number of factors, the Ngarrindjeri people have retained their regional and cultural distinctiveness up to the present (Jenkin 1979; Hemming 1988; Hemming *et al* 1989; Clarke 1994). Due in part to the close proximity of this region to Adelaide, the Aboriginal people from the Lower Murray continue to have a major role in Aboriginal affairs in South Australia.

Contact Between Europeans And Aboriginal People

Aboriginal groups in South Australia were influenced by Europeans long before official settlement in 1836. The first significant effect of European settlers on South Australian Aboriginal populations was probably the introduction and spread of smallpox from eastern Australia, reaching the Lower Murray along the river system in two waves sometime between 1814 and 1820, and between 1829 and 1831.[1] In the mythology of the Lower Murray, smallpox is linked with the ancestral spirit, Kulda, who came from the Southern Cross constellation foretelling death (Tindale 1931–34: 251, 252; 1937: 111, 112; 1941: 233, 234). The devastation this brought to indigenous populations, and the effect upon their culture, can only be guessed at.

The activities of whalers and sealers, operating chiefly out of Bass Strait, and their effect upon the southern Aboriginal populations, warrant a mention here. These men, some of whom were dwelling on Kangaroo Island as early as 1819, lived outside colonial control then based in Tasmania (Clarke 1990 MS; 1994: 192–203). They periodically raided the mainland for Aboriginal women to serve as labourers and wives. Some of these Kangaroo Island men had trading relationships with mainland Aboriginal groups, in particular those in the Lower Murray region. Therefore it is likely that most southern South Australian Aboriginal people had some knowledge of Europeans before official settlement in 1836, even if only indirectly, and had rationalised this incursion within their own cosmological views. With the range of contacts discussed above, both indirect and direct, we must acknowledge that the early southern South Australian ethnographies, however skilfully obtained, do not provide strictly pre-European accounts of Aboriginal society.

Since official settlement by Europeans in South Australia in 1836, Aboriginal people in the southern agricultural districts have gradually become marginalised in respect to land. During the nineteenth century, Aboriginal people in the Lower Murray worked as fishermen, shepherds, and as labourers to bring in the harvest (Clarke 1994, Chapter 6). By the early twentieth century, most were forced into living at mission stations governed under restrictive legislation. Due primarily to the break-up of the pastoral stations in the region at this time, Aboriginal hunting and gathering activities were chiefly restricted to the Coorong area where Aboriginal reserves and vacant crown land still existed (Clarke 1994, Chapter 8). For this reason, contemporary knowledge of the landscape retained by Aboriginal people relates mainly to the southern parts of the Lower Murray region. A broader Aboriginal cultural identity formed from the social environment of enforced interaction between formerly separate groups from throughout South Australia. Aboriginal people started identifying themselves more according to mission settlements, rather than as territorial-based descent groups. Since the 1960s, when many of the legal restrictions were removed, Aboriginal people have moved into rural town centres in the Lower Murray, with a large number of Ngarrindjeri people living in Adelaide (Inglis 1961; Gale 1969; 1972; Gale & Wundersitz 1982; Schwab 1988).

The detailed recording of Aboriginal culture in the Lower Murray starts with the German missionary Meyer who was active in the Encounter Bay region during the late 1830s and early 1840s (1843; 1846). During the 1870s the writings of Taplin, based at the mission of Point McLeay on the southern shore of Lake Alexandrina, focused the attention of northern hemisphere scholars upon the Ngarrindjeri.[2] Nineteenth century missionary records are to some extent balanced by the recordings of Penney (1840–43 [1991: 1–107]), Cawthorne (1844 [1926]), Moorhouse (1843 [1990]; 1846), Angas (1847a; 1847b), and Wyatt (1879). During this century, various anthropologists such as Brown (1918), Tindale (1930–52; 1931–34; 1934–37; 1935; 1937; 1938; 1938–56; 1941; 1981; 1987; Tindale & Mountford 1936; Tindale & Pretty 1980), Harvey (1939; 1943), and the Berndts (Berndt 1940; Berndt & Berndt 1993) have studied this Aboriginal culture. The attention that these scholars have directed towards the Lower Murray has meant that it is ethnographically one of the best described regions in southern Australia.

NGURUNDERI: AN ABORIGINAL DREAMING OF THE LOWER MURRAY

The mythology of Ngurunderi touches upon most aspects of Aboriginal life. Preeminent in the anthropological record of the Lower Murray, he is a major 'spirit creator' credited with shaping the region's topography and distinctive culture. The myth provides an explanation of the landscape, not only the formation of features such as The Bluff at Victor Harbor and the course of the Murray River, but the distribution and characteristics of particular plant and animal species. For example, Ngurunderi's actions were thought to have resulted in the present distribution of the pigface plant, an important food resource (Tindale 1931–1934, vol.1: 186; Berndt 1940: 179; Berndt & Berndt 1993: 226). Another illustration of his perceived creative powers was to give the bony bream fish its numerous fine bones (Education Department of South Australia 1990: 56–58). His body parts are represented in the landscape; his legs form the Sir Richard and Younghusband Peninsulas at the Murray Mouth for instance (Berndt & Berndt 1993: 13; Clarke 1994: 114, 115). Thunder was regarded as Ngurunderi's voice, rainbows showed him urinating (Taplin 1874 [1879: 58]). Customs attributed to Ngurunderi's law include the prohibition of young male initiates eating certain types of Murray cod, considered to be 'Ngurunderi's fish' (Tindale 1934–1937, vol.2: 39). He and his son Matamai are also credited with introducing mortuary rites to the Lower Murray people, involving smoking the dead (Tindale 1934–1937, vol.2: 51; Berndt 1974: 26, 27; Berndt & Berndt 1993: 227, 228). Through association with Ngurunderi and Matamai, desiccated bodies were considered to be sacred objects, at least until the rites were completed.

Ngurunderi was perceived to have power over both the living and the dead. Taplin records a discussion with an Aboriginal man, Captain Jack:

> He thinks death to arise from sorcery when caused by sickness, but to be by the special interposition of Nurundere when caused by spear or waddy wounds. He says Nurundere invented the waddy and spear and boomerang, and wimmera [sic.] and plonggee [small club] long ago. And it appears that they regard him as a sort of war-god (Taplin Journals, 20 October 1859).

To die as the result of injuries due to fighting was considered by the Lower Murray to please Ngurunderi (Taplin Journals, 19 January 1860). It was believed that after death, Ngurunderi guided the souls of Lower Murray people to the 'Lands to the West'. Here they would live in huts around him. The Raminyerar considered that they would reside in Ngurunderi's hut, with other descent groups in neighbouring shelters (Meyer 1846 [1879: 206]).

Episodes of the Ngurunderi creation epic were acted out during dances. Taplin recorded that one night:

> Two of their songs in particular attracted my attention. One was called "The Nurundere", and is about God ... [It] began with a low chant as if they were chanting Latin. However, all through the piece they say the same words over and over again, then the chant rose higher and higher with beat of the tartengk a native drum, then it sank again and the men's voices broke in shouting in time to the chant and brandishing the weapons with tartengk. Then the shrill treble of the women broke in like an imploring vociferation in answer to the shouts of the men. These ceased, and the whole concluded with a loud chant to the beat of the tartengk and drum. The latter piece was to slower time, and was very plaintive and wild (Taplin Journals, 30 June 1859).

The passage of Ngurunderi through the

territories of certain descent groups during the Dreaming had perceived implications for Lower Murray marriage relationships (Turner 1980: 6). This mythology was so much a part of the Lower Murray cultural system that to a large degree an individual's possession of detailed knowledge concerning it helped locate that person within particular parts of the region.

From descriptions of the myth that stress warfare, Ngurunderi appears to have had special significance to men. Nevertheless, he was of much wider importance as the creator of Lower Murray culture. In contrast to more northerly regions the available accounts of Aboriginal ceremonial life in the Lower Murray indicate that there was a large degree of sharing of knowledge between men and women. Tindale (1934–1937, vol.2: 223) states that in the Lower Murray some old women were allowed at the *Narambi* secret initiation ceremonies. Women were given a say at major meetings, and were considered to have had a *miwi* (spirit) as strong as a man's (Berndt & Berndt 1993: 71, 285). The extreme separation of the male and female realms appears to be a distinctive characteristic of the Central Australian region.[3] Elsewhere, such as in parts of the Lake Eyre Basin, women participated in many of the same ceremonies as men.[4] Similarly, in the Lower Murray region Aboriginal women had traditional authority, being the partners of men in tribal lore (Berndt 1981: 181, 182; 1982: 50). This is not to say that women and men did not have differing perspectives on some aspects of cultural knowledge. Generally, only younger people would have been excluded from secret-sacred categories of information.

The southern Aboriginal ethnographies show considerable variation in mythology, even from within linguistically and culturally similar areas.[5] In the South Australian region of the Murray Basin, there are creation accounts for the river that variously involve the different mythic heroes Nurelli, Ngurunderi, Korna and Thukabi.[6] There are even major variations within the records of Nurelli and Ngurunderi, particularly in relation to sites. In the case of the complex of mythology associated with Ngurunderi, it has been argued that the variations were simply accounted for by each Ngarrindjeri group only knowing in most detail that segment of the Ngurunderi epic relating to their own area (Hemming 1988). Contrary to this approach, which attempts to reconcile cultural differences, I argue that the diversity of these beliefs, many in direct opposition to others, can be explained in terms of the dynamic relationship people had with the landscape. Local knowledge generates alternative sites where certain events were perceived to have taken place, therefore producing distinct versions.

The existence of many versions of the Ngurunderi myth provides further evidence that the 'tribe' model of Aboriginal social structure as used by Tindale in his southern South Australian ethnographic work, is too simplistic.[7] For example, in his treatment of the Tjilbruke mythology of the Fleurieu Peninsula, Tindale selectively garnered segments of myth from various informants from the Lower Murray and Adelaide regions into one form recognised by the 'Kaurna tribe' (Tindale 1987; Clarke 1991a). But by doing this he effectively produced yet another variation, one that would never have been elicited from a single Aboriginal source. It is more productive to treat this variation in the ethnography as a pre-European characteristic of the body of knowledge that 'explained' the world. In spite of the apparently confusing number of creation accounts, there are some common elements of the mythology within the Lower Murray region that distinguish it culturally from surrounding regions.

For the Aboriginal groups of the Lower Murray, the main creator of the landscape is generally recorded in the ethnographic literature as Ngurunderi, or one of the many linguistic variations of the term.[8] The different versions of the Ngurunderi mythology generally fall into two categories – those that have a coastal bias, and those that emphasise the inland aspect of the Murray River.[9] The former versions were chiefly recorded from coastal groups away from the river in the western and south-western side of the Lower Murray, the latter from Lower Lakes people on the north-eastern end near the entrance of the Murray River into Lake Alexandrina. I will now describe this variation.

Amongst the earliest recorded myths in southern South Australia was a Ngurunderi account recorded by Penney in 1844 from the Encounter Bay people, concerning the formation of the Lower Murray landscape.[10] In this version, Ooroondooil (= Ngurunderi) was the first great spirit to wake. Three or four other beings later woke, some complaining that they were hungry and cold. Ooroondooil told one spirit to make a fish, and he taught them how to cook it. He made the lesser spirits go off to collect firewood, water and other necessary items. Ooroondooil then sent the spirits away to lands he was creating. Ooroondooil himself went westwards where he first made the 'Big Murray people' (Coorong groups), and then the groups further west. After teaching the Lower Murray people their customs, he left, swimming to other lands in the west. Two of his wives drowned while trying to follow him, becoming the Pages Islands of the Backstairs Passage. Ooroondooil created Kangaroo Island, and then went further west where he was believed to have still lived. In a variation of this account, Ooroondooil had three wives who drowned when, due to their curiosity, they tried to reached Kangaroo Island from the mainland.[11]

In another Encounter Bay version of the Ngurunderi mythology recorded by Meyer from the Raminyerar descent group, several important mythological events had already taken place before his arrival (Meyer 1846 [1879: 205, 206]). In this rendering Ngurunderi was a large and powerful man with two wives and several children. On one occasion his wives fled from him. He chased them along the southern Fleurieu Peninsula coastline and while doing so created many of the geographic features there. He finally caught the women and beat them, but they escaped again. This time he tired of chasing them and ordered the sea to flow and drown them. They became rocks a few metres from the shore that can be seen at low tide.[12] After he had transformed the landscape, Ngurunderi was said to have gone west. One of Ngurunderi's sons who was accidentally left behind found his way to the land 'towards the west' by catching hold of a line thrown by Ngurunderi, which was attached to his testicles. In this account, the creation of new rivers, hills and other features ceased after Ngurunderi left the Lower Murray.

The versions of Ngurunderi recorded from the Lake Alexandrina descent groups vary in much of the detail from those of Encounter Bay. In one account from the Lake area obtained by George Taplin, there were once three great hunters, Ngurunderi, Nepeli and Waiyungari.[13] As evidence for their hunting prowess, numerous salt lagoons around Lake Alexandrina were considered to have been created by Nepeli and Waiyungari while pegging out fresh kangaroo skins, thus denuding these places of grass.[14] On one occasion, Ngurunderi and his sons drove an enormous Murray cod, Pondi, down the Darling and Murray Rivers to Piltangk, on the southern shore of Lake Alexandrina. Here they obtained the assistance of Nepeli. They eventually caught Pondi near Raukkan. Ngurunderi tore it into pieces, throwing each fragment back into the water, and thus creating different species of fish. The fish-making episode differs from the Encounter Bay mythology, where this is performed at a salt water locality by another spirit named Pungngane (Meyer, 1846 [1879: 202]). Ngurunderi had four children by two wives. Once, while camping at Tulurrug (Pelican Point), two of his children strayed into the eastern scrub and were lost. Ngurunderi's two wives later fled and Ngurunderi followed them to Encounter Bay where, seeing them in the distance, he drowned them by making the waters rise. He then searched up the Coorong for his two lost children and came across them after he fought and killed a sorcerer at Salt Creek. Ngurunderi later left the lower landscape for Wyirrewarre, the Sky World, taking his children with him. Although recorded as a myth, Taplin clearly considered the possibility that 'creators' such as Ngurunderi were once actual people. For example, he refers to Ngurunderi as a 'deified chief' (1874 [1879: 58]). To Taplin, myths were corrupted versions of history.

In the Lower Lakes district, away from the sea, the creation of the Lakes was given greater emphasis. Angas provides a version in which the two wives of Oorundoo (= Ngurunderi) 'proved untractable [sic], and ran away from their lord; and to punish this unwarrantable behaviour on their part, Oorundoo very properly made two lakes to drown them, which correspond with the lakes Alexandrina and Albert' (Angas 1847a: 96, 97; see Fig. 2 of this paper). Another version, possibly derived from Angas and Europeanised, states:

> The Murray dragon, Oorundoo, first caused that great river to flow. Having fallen out with his two wives, who must have been dragonesses of a huge size, and not accustomed to water exercise, that Blue Beard of New Holland constructed two lakes, at present known as lakes Victoria [= Alexandrina] and Albert, so that he might effectually drown his partners, who had actually attempted to elope from him with somebody else.[15]

Thus there are accounts of the creation of Lake Albert and Lake Alexandrina that contain elements similar to those of the Ngurunderi mythology as recorded at Encounter Bay. However, these versions makes the mythology more relevant to descent groups such as the Piltinyerar, living in the Lower Lakes and Murray River region, by giving prominence to places contained within their own mythic landscape.

The most detailed published description of the Ngurunderi myth is provided by Ronald Berndt, chiefly from his main Lower Murray informant, Albert Karloan, a Yaraldi-speaker of the Manangki descent group.[16] Like other accounts

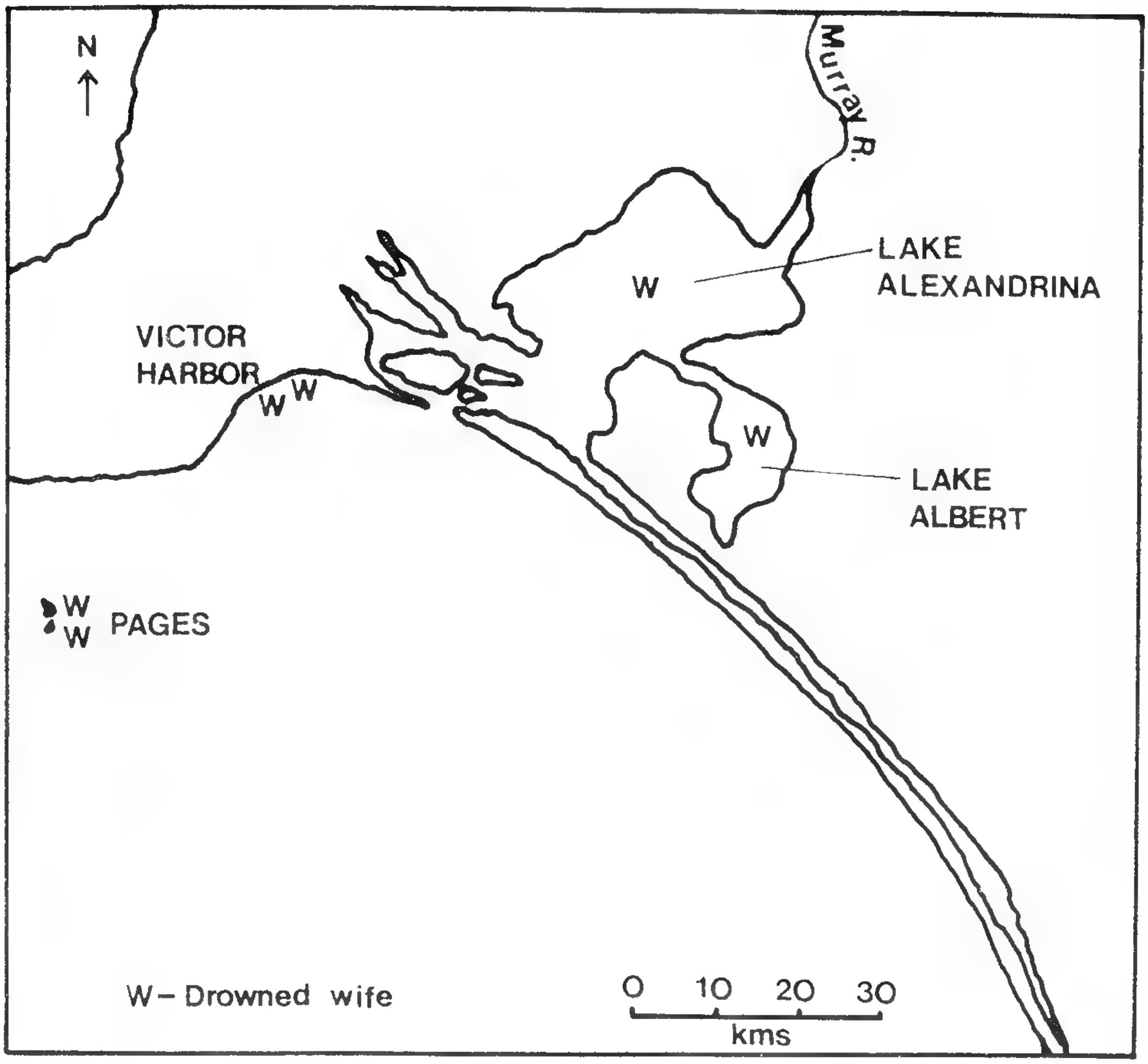

Figure 2. The wife-drowning sites of the Ngurunderi myth, showing inland and coastal variation.

published by anthropologists, he focuses on the cosmological and creation aspects of the mythology. In this version, Ngurunderi pursued the giant Murray cod Pondi down the previously narrow bed of the Murray River. As the cod was chased, it widened the river to its present width. With each sweep of the tail Pondi created a swamp. When Pondi escaped into Lake Alexandrina Ngurunderi called out to his brother in-law, Nepeli, to spear the cod. Nepeli speared it near Raukkan (Point McLeay), dragging the fish to a submerged sandbank to wait for Ngurunderi. Upon reaching Nepeli, Ngurunderi cut up the fish into many small pieces. Each portion became a different species of fish as it was thrown back into the water. In a later episode of this long account, Ngurunderi's two wives broke a food taboo and fled across the Lake Albert country, heading down the Coorong. Ngurunderi followed and near Blackford, which is inland from Kingston, he came across a sorcerer with whom he quarrelled.[17] Ngurunderi killed him and burnt his body which formed the Granites near Kingston. Ngurunderi went back along the Coorong, eventually crossing the Murray Mouth and moving along the southern Fleurieu Peninsula coast. He created many of the landscape features along the way. Ngurunderi finally found his wives crossing to Kangaroo Island and drowned them by making the seas rise. The bodies of the wives became The Pages islands. Ngurunderi then ascended to the Sky World, Waieruwar, via Kangaroo Island.[18]

Tindale provided other accounts of the Ngurunderi mythology.[19] His main published version was distilled from recordings he obtained from many Aboriginal people with varying backgrounds, including the Maraura of the Upper Murray cultural region, the Ngaralta and Nganguruku of the Mid-Murray, and down-river to the Lower Murray groups such as the Portaulun, Jarildekald (= Yaraldi), Ramindjeri and the Tanganekald (= Tangani). It is interesting to view Tindale's printed version of this mythology compiled this century, in the light of the considerable variation in the earlier records. Not only did Tindale standardise the name of Ngurunderi, he appears to have chosen particular accounts of episodes over others with which they would have conflicted. Although very similar in its general outline to Berndt's recorded version, Tindale's explanation of some events, such as what happened to Ngurunderi's canoes, does not fit Berndt's account. However, both Berndt and Tindale shared the same Yaraldi-speaking informant, Albert Karloan.

The discussion indicates that there were many versions of the Dreamtime events within the Lower Murray region which reflected local biases. This suggests that the sites Aboriginal people insert into their accounts of the Dreaming are 'places' upon which are built both local and broader regional identities. The term 'place' refers to a humanistic concept within human geography that focuses upon the culturally determined values of particular parts of the landscape (Relph 1976; Buttimer 1980). Places are fusions of human and natural order and are the significant centres of the experiences people have of the world. They can evoke a sense of belonging to a social group and provide a sense of group identity. It is likely that some Lower Murray people, as elsewhere in Australia, even inserted themselves into the 'Dreaming' accounts of the landscape they experienced.

Age and perhaps gender were other factors in determining what mythological details were known by individuals, and what emphasis they were given. The Dreaming therefore reflects some socio-political aspects of Aboriginal life. This is consistent with the Dreaming epics recorded from other parts of Australia (Myers 1986: 60; Berndt & Berndt 1989: xxvi). Although on one level this appears to contradict the cultural homogeneity of the region, the early mythology is nevertheless unified to some extent through being organised according to salt water and fresh water accounts, with some elements linking all. The proliferation of 'creation' versions are not the result of recorder or informant error, but the product of different versions of the 'cultural landscape' itself.

Ngurunderi And Links With The Broader Landscape

The incorporation of new elements from an altered socio-political environment after European colonisation is reflected in recorded Aboriginal mythology. In the Lower Murray, Aboriginal mythology was modified as people embraced Christianity. For instance, Ngurunderi was taken by the Lower Murray people as a suitable interpretation of the concept of 'God' being taught to them by early missionaries (Taplin Journals, 25 June 1859; 22 September 1859). For some contemporary Ngarrindjeri people, this linkage is once again perceived and articulated by them. One young adult told me in 1988 'Ngurunderi is like Jesus. God gave Ngurunderi to the people. God spoke to the people through Ngurunderi.' Several older informants claim that the reason that the graves in the Point McLeay cemetery are arranged with head towards the west is so that the dead person's spirit can go in the direction of Ngurunderi. In the South East region in 1934, a Meintangk Aboriginal man, Alf Watson, claimed that Ngurunderi had warned the Aboriginal people about the coming of Europeans and their destruction of the environment when he said 'Beware of *puruki* (ants)' (Tindale, 1934–1937, vol.2: 57; 1938: 20). The syncretism of tradition is illustrated in an account of Aboriginal people on the Point McLeay Mission in the 1880s who reportedly laid bodies on a Christian-style cross for a short time before being placed on a pre-European-type burial platform.[20] It is clear that a blend of their own practices with new elements has been integral to the constant development of tradition. Old beliefs and customs are made more relevant to contemporary situations through this process.

The Ngurunderi myth complex contains references to areas outside the Lower Murray. Many of these connections may have been made after European settlement, when Aboriginal people from diverse cultural areas were forced into living at the same locations, such as fringe-camps and mission stations. For instance, Taplin noted the belief that two warriors from Ngurunderi's group returned to the Upper Murray, but were never heard of again (1874 [1879: 61]). Furthermore, in the Ngaiawang mythology of the Upper Murray, the two wives of Ngurunderi were said to be the Bakindji sisters involved in the eagle and crow myth epic of the Upper Murray/Darling district (Tindale 1939: 259). In the Mid-Murray region there is mention of Wurranderra—an 'Aboriginal Moses', who reportedly came later than the main creative ancestor, Noreela, to lead forth many northern tribes to the rich waters of the Murray, in the process giving them law and customs.[21] Although Wurranderra is given a secondary creative role in this account, it is possible that the name is a poor European rendering of the word Ngurunderi. Due to the similarity of this description with that of the Lower Murray ancestor, Ngurunderi, and the likely linguistic similarity, it seems probable that this was an aspect of Mid-Murray mythology given greater prominence by the Lower Murray people. Whether knowledge of the Ngurunderi mythology was widespread in Mid-Murray regions before European colonisation is not known. It is possible that Aboriginal people there incorporated this Ngurunderi-type account during historic times on the basis of having heard it from Lower Murray people they had met.

According to Taplin's informants two other young men from Ngurunderi's group had taken a party south along the Coorong, establishing themselves in the Lower South East near Mount Gambier (Taplin 1874 [1879: 62]). Another version, obtained from Alf Watson by Tindale in 1934, acknowledged Ngurunderi and his two nephews as 'creators' for areas inland from Kingston, involving places such as Mount Benson and Cape Jaffa (Tindale 1934–1937, vol.2: 58–60). All these places are outside the Lower Murray cultural region. Therefore, although particular episodes of the Ngurunderi myth, as told by the Lower Murray people, were chiefly confined to their own territories, this mythology did provide links to other cultural regions. In the last half of the nineteenth century, the large ceremonial gatherings where initiations were held involved Aboriginal people from throughout the Lower Murray, as well as people from places outside the cultural region, such as from Murrundi (Moorunde) on the Murray River, and the Rufus and Darling River area (Taplin Journals, 24 November 1859; 12 May 1860; 6–10 & 27 August 1860; 17 March 1862). The last recorded initiation sequence of ceremonies which included Lower Murray people took place from 1879 to 1882 at Matanga (Metang) south of Mannum, and involved people from the Victorian and New South Wales part of the Murray River, as far away as the Darling River Junction at Wentworth (Berndt & Berndt 1993: 166, 167). At these large heterogenous gatherings, revised explanations of the cosmos could have been achieved to make the pre-existing mythology more relevant to all regions.

Some recorded versions of myth reveal innovations which, because of their wide areal coverage across major cultural divisions, suggest post-European origins. A version of the Ngurunderi epic recorded in 1936 from Clarence Long, a Tangani-speaker from the Coorong, involves range of localities from Mount Gambier in the lower South East to the Adelaide district.[22] In this example one of Ngurunderi's sons travelled south and was chased by a 'big devil' named Mirka, who emerged from the Blue Lake. The son fled north along the Coorong and across the Mount Lofty Ranges to Willunga, forty kilometres south of Adelaide. Ngurunderi, who saw them approach, attacked and wounded Mirka at Red Ochre Cove.[23] The congealing blood of the 'devil' formed a rich red ochre deposit at this place, now part of an Adelaide outer suburb. Mirka fled back to the Mount Gambier district, his dripping blood creating other ochre outcrops.

The existence of this broader account is probably best explained in terms of post-colonial Aboriginal people gaining extensive geographical knowledge through participation in early agricultural activities throughout the colony, such as shearing and harvesting.When Aboriginal people from the Lower Murray region encountered mythologies concerning a different landscape, it is likely that they drew close comparisons with their own creation beliefs. Through this process, Ngurunderi may have assumed the identity of mythical ancestors in new areas. The possession by Aboriginal people of knowledge concerning key points in the landscape, however short the experience with them, imparts a sense of authority over their environment. Mythological sites, as 'places', reflect both the political and social dimensions of the relationship Aboriginal people have with the landscape.

In 1935 Tindale recorded an unpublished version of Ngurunderi from an Aboriginal man named Spender, who had descent connections to both the Adelaide and Lower Murray regions. In his journal, Tindale wrote:

> Ngurunderi came from east to Cape Jervis; he chased his two wives who were sisters; they swam towards Kangaroo Island; he killed them and turned them into the Sisters islands (the Pages). Ngurunderi landed on Kangaroo Island beside a sheoak tree. He went to the western end of the island and threw his spear out into the water. It made some islands there (he [Spender] had only heard about them). Ngurunderi then crossed the sea, manner not defined, and came to Corny Point. From Corny Point he entered the sea and swam to "Cotton Island" which is off Tumby Bay. He landed on the island and, at low tide, walked over the shallows to the mainland. He changed his name (name forgotten [by Spender]) and travelled to the west (Tindale 1935 MS: 45).

This version links several distinct cultural regions across southern South Australia.

Another example of adaptation was provided by Lola Cameron-Bonney, who defined herself as a Coorong Aboriginal person with family connections to western Victoria, and by Ronald Bonney, who had links from the Lower Murray to the South East and Victorian regions.[24] They gave a variation of the Ngurunderi epic that appears to have been influenced by the New Testament. In this version, Ngurunderi travelled to an Aboriginal camp in western Victoria and found that people there were starving. He left, returning half a day later with fish and bread for the camp. The fish were of a type not found there. From here, Ngurunderi then went back into South Australia. Accounts such as these indicate that Aboriginal people often make links, through the 'discovery' of myth, between their own cultural area and the new places they find themselves, as part of extending their 'cultural landscape'.

For most of this century knowledge of Ngurunderi within the Aboriginal community was retained almost exclusively by a few elderly people who still had some understanding of pre-European beliefs and customs. It was part of what has been defined as 'memory culture' (Berndt 1974: 22, 25; Tonkinson in Berndt & Berndt 1993: xix). Portrayals of Aboriginal mythology in the popular literature have helped keep Ngurunderi at the forefront of public knowledge of Aboriginal beliefs concerning the 'Dreaming'.[25] During the early 1980s much site-related information could still be gathered concerning historic Aboriginal sites, but not so with the creation myth information, as it had increasingly become less relevant to Aboriginal people who were experiencing the landscape in new ways (Clarke 1994, Chapter 7). Many localities of previous mythological significance were no longer visited by Aboriginal people, who increasingly lived at missions, working-class urban areas of Adelaide, and fringe-camps, from the early twentieth century to the 1960s. The emergence of Point McLeay (or Raukkan as Aboriginal people call it) as a 'place' that connected all Ngarrindjeri people through a shared mission history became a key element of Aboriginal identity in Lower Murray.

The Ngurunderi mythology was rejuvenated in the late 1980s, partly through the South Australian Museum adopting this mythology as the basis of its Lower Murray cultural exhibition, and also through the coverage which the Education Department of South Australia gave it in its Aboriginal studies curriculum (Hemming 1988; Hemming & Jones 1989; Education Department 1990; 1991). The video, 'Ngurunderi: a Ngarrindjeri Dreaming', was produced as an introduction to the Ngurunderi exhibition in the South Australian Museum.[26] This relatively recent activity has had a major impact upon the portrayal of Lower Murray culture. The modern promotion of Ngurunderi has therefore gained much impetus from forces external to the Aboriginal community. With the increasing voice that Aboriginal people are having in heritage issues, coupled with a renewed focus by them on the past culture, Ngurunderi is once again a prominent figure, albeit a standardised one from the many accounts available.

DREAMING AS REALITY

As a number of researchers have pointed out, myth is defined by Western tradition in two main contradictory ways (Kirk 1973: 8; Berndt & Berndt 1989: 1). Myth is firstly construed as an invented or fictitious story. In this sense, myth is a false and trivial belief. This definition is often used by those, possessing the ideology of a dominant culture, who seek to define what they consider to be the 'superstitions' of historically subordinate cultures. The second concept of myth describes it as a 'traditional' belief or a reflection of a culture, and allows for less emphasis on evaluating its true/false aspects. As an expression of a culture myth has been well explored by social science. Durkheim (1915) considered myth as one of the essential elements of religious life, representing the way in which society portrays humanity and the world. Malinowski (1948) developed this further, seeing the prime function of myth to be the recording and validating of cultural institutions. Kirk has pointed out that a problem with these interpretations is that not all myths are closely associated with ritual or religious practices (1973: 11, 12). Some myths appear quite secular although they still reflect deeply rooted cultural values.

Although Aboriginal myth provides explanations of the world, the analogy of Aboriginal myth with a European notion of history as a systematic and linear record of past events is confusing. The Aboriginal English use of 'history' to mean the 'Dreaming' in some regions of Australia provides non-Aboriginal people a further source of misunderstanding. Myth can, in some contexts, be regarded as an Aboriginal version of history, but it is much more. Levi-Strauss (1966; 1977; 1978) considered all myths, when correctly understood, to be speculative, or problem reflecting. He recognised that myth provided a view of the world that can be constantly explored and modified by culture. It follows that a particular myth can mean different things to different people, with many equally valid versions. Many myths have varying layers of meaning (Berndt & Berndt 1989: 3). They are not static constructs that withstand empirical testing, but, as the Lower Murray evidence suggests, are able to incorporate new elements with ease. Baker maintains that the Dreaming 'straddles European distinctions between politics and religion' (1989: 110). Following Hiatt (1975) and Sutton (1988), I argue that history, as it is perceived by Western Europeans, and Dreaming mythology as perceived by Australian Aboriginal people, may have similar functions in their respective cultures, but are nevertheless not synonymous.

The "places" highlighted in the myths are tangible points that linked people with the Dreaming. These focal points in the mythic landscape helped provide Aboriginal people with a local identity. Berndt claims that "there is no religion without sites or without a concept of "landedness" (1970: 53). As the nature of the cultural relationship with the land changed, such as through European intrusion, new sequences of myth were "discovered" or developed so as to validate it. Geographic information concerning other parts of southern Australia were appropriated by myth-makers. Ngurunderi's tracks coincided with the spread of Ngarrindjeri people across the land. When Aboriginal movement patterns became more restricted by government agencies in the early twentieth century, Aboriginal cultural identity became more closely aligned to mission and fringe-camp sites. Both myth and tradition adapted to fit new cultural landscapes.

CONCLUSION

The variation described for the Lower Murray mythology does not represent the poor recording of a standard account. Rather, as a whole it represents a symbolic text through which differing relationships that people have with the landscape are articulated. In the early years of European settlement, there were many distinctive accounts of Ngurunderi throughout the Lower Murray region, reflecting its importance in explaining the country. Thus the myths reflect the existence of differing perceptions of the cultural landscape itself. The perceptual world reflects the perceived relationships between people. Places featured in the mythology are tangible elements which help give authority to particular world views. Aboriginal people, like other cultural groups, draw meaning from the landscape.

Through the partial collapse of pre-European systems, the spread of Lower Murray people in southern South Australia resulted in the Ngurunderi mythology becoming significant for a much broader landscape. When these people moved outside their region, the feats of the different ancestors they encountered when socialising with other groups were sometimes reassigned to Ngurunderi. As a dynamic record of the past, in relation to the present, the Ngurunderi myth complex has been a vehicle for Aboriginal people to investigate and restate their own identity. Today, this spirit ancestor remains as a symbol of the Lower Murray as a cultural region. This myth is symbolic of a regaining of the past, albeit through the agency of museum displays and videos rather than through the earlier context of ceremonial gatherings at particular important sites. The construction of mythology has not been restricted to a time long before European invasion, but has existed as a continuing process of the development of tradition up until the present.

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ENDNOTES

[1] Smallpox was introduced into Australia on several occasions, probably initially in the north by Malays (Cleland 1966: 155, 156). One outbreak reached Port Jackson in 1789. The occurrence of the disease in the Lower Murray in about 1830 was part of a later wave. See accounts provided by Teichelmann & Schurmann (1840, pt 2: 34) and Gell (1842 [1904: 99]) for the Adelaide region, and by Hahn (1838–1839 [1964: 129]) for Hahndorf, Mount Lofty Ranges area. In the Lower Murray and the South East regions, the disease is documented by Angas (1847a: 123), Taplin (1879: 45), Taplin (Journals, 25 June 1861), McCourt & Mincham (1977: 68, 69; 1987: 148), and Jenkin (1979: 28–30). Similar records exist for the Darling area (Newland 1889: 1) and for Victoria (Dawson 1881: 60; Bulmer 1887: 31). Stirling (1911), Berndt (1989: 64), and Berndt & Berndt (1993: 292) comment on the timing of these waves.

[2] Taplin (1874 [1879]; 1879) uses the term 'Narrinyeri' (= Ngarrindjeri). See Darwin (1890), Ratzel (1896), and Durkheim (1915) as examples of scholarly interest in 'primitive' Aboriginal culture from the Lower Murray region.

[3] For accounts of the distinct separation of ceremonial knowledge between the sexes in Central Australia see Bell (1983: 182–228), and Payne (1989: 47–49). These authors refute that either gender possessed 'inferior' sacred knowledge – just that they were somewhat different and expressed within their own realms.

[4] Hercus (1989: 105, 106), Jacobs (1989: 90) blames an

external system controlled by non-Aboriginal people for having constructed a lesser role for women in land-related issues in relatively recent times.

[5] The same variation is found in other parts of Australia, such as Arnhem Land (Berndt & Berndt 1989: 389–407).

[6] Nurelli has also been recorded as Noreele (Eyre, 1845, vol.2: 356). Berndt (1974: 27) equates Nurelli from the Mid–Murray with Nepeli of the Lower Murray. Korna (= Corna) was a creation being recorded by Penney from the Encounter Bay region (Clarke 1991b: 96–98). Thukabi was an ancestral turtle who created the river and lakes when leaving the land for the sea (Clarke 1994: 114).

[7] Peterson (1976) summarises the 'tribe' debate. Berndt (1959) provides a critique of the application of 'tribe' theory in the Western Desert region.

[8] Many recorders of the name Ngurunderi, apparently did not hear the initial 'Ng'. For example, he is recorded as 'Runderudie' (*Register*, 1 June 1885) and 'Narrundi' (*Register*, 21 June 1909). It is also possible that the 'Ng' is a later introduction. In 1894, an Aboriginal man, Jacob Harris, spelled Ngurunderi as 'Noorondourrie' (J. Harris letters, D6510(L)13, Mortlock Library, Adelaide). Similarly, Parker (1936) recorded this as 'Nar-oong-owie'. Nevertheless, Ngurunderi is the standard orthography now in general use (Berndt 1940; Tindale 1974: 64, 133; Hemming 1988; Hemming & Jones 1989; Education Department of South Australia 1990; Berndt & Berndt 1993). Unless the rendering of Ngurunderi is greatly altered by the sources cited, I will use Ngurunderi as the standard term.

[9] See Meyer (1846 [1879: 205, 296]), and Tindale (1934–37: 51, 293, 294; 1930–32: 102–105, 117–121) for Encounter Bay interpretations of the Ngurunderi mythology. Accounts by G. Taplin (*Register*, 30 January 1862; 1874 [1879: 55–62]; 1879: 38, 39), F. Taplin (*Register*, 24 April 1889), Ramsay Smith (1930: 17, 173, 182–184, 216, 250, 317–331), Tindale (1934-37: 284–292, 295, 296; 1930–52: 120), and Berndt (1940) are concerned more with the inland areas of the Lower Murray. Versions of Ngurunderi from the Coorong/South East region are recorded by Tindale (1931–34: 182, 183, 185; 1934–37: 30–37, 57–60). An unlocalised version appeared in the *Register*, 2 December 1893. Generalised treatments of this myth are given by Tindale & Pretty (1980: 48–50), Hemming (1988), and Hemming & Jones (1989).

[10] This version is given by R. Penney (as 'Cuique') (*South Australian Magazine*, November 1843, vol.2: 331–336). Cawthorne (1844 [1926: 25, 26]), and Gill (1909: 98, 99) cite Penney without reference.

[11] Account from the 'Herald of Kapunda', in the *Register*, 4 September 1872.

[12] In a photograph taken by Ransay Smith (c.1920), these rocks are shown to be the two largest boulders in the shallow water near the site of the Bluff Whaling Station (AA263, Acc.no: 2126, AP2971, Anthropology Archives, S.A. Museum).

[13] Taplin (1874 [1879: 55–62]). The Taplin Journals (18 December 1861, 10 November 1862) have an outline of the Ngurunderi epic involving 'Noorunderee' and 'Neppelle' chasing a 'giant fish' off from Tipping (Point Sturt). The standard spelling of 'Nepeli' and 'Waiyungari' used here is taken from Berndt & Berndt (1993).

[14] Tindale (1930–52: 188–191; 1935) recorded the feats of Waiyungari and Nepeli from a Yaraldi–speaker named Frank Blackmoor. Other versions are given by G. Taplin (*Register*, 30 January 1862; 1879, p.56). F. Taplin (*Register*, 24 April 1889), and Berndt & Berndt (1993: 228–230). A similar account by Laurie (1917, citing Hackett) appears to have in error replaced 'Nepeli' with 'Nurundie'. The original manuscript (in a notebook titled 'Narrung Alpha', August 1915—personal collection of L. Padman) from which Laurie probably copied his version refers only to a 'mighty man', with no reference to 'Nurundie'. Meyer (1846 [1879: 201, 202]) gives a related version that has 'Pungngane' instead of Nepeli.

[15] Bonwick (1870: 204). The account of the wives attempting to elope with someone else bears more relation to the Waiyungari account, than that of Ngurunderi (see endnote 14). The description of the main characters as 'dragons' appears to be a poetic introduction by Bonwick.

[16] Berndt (1940), and Berndt et al (1993: 13–16, 229–223, 433–441). Tindale's work with Karloan remains largely unpublished (Tindale, 1934–37, vol.3: 284–292, 295, 296).

[17] The inclusion of Blackford was probably a recent introduction. Blackford is a farming property where several Aboriginal families in the South East region have lived. It is now managed by the Aboriginal Lands Trust, and leased out by local Aboriginal people.

[18] Before Aboriginal people were able to perceive Kangaroo Island as an isolated land mass, it is likely that this place itself represented the 'Land of the West' where souls go. Its role as a stepping stone to the Sky World is possibly a modification brought about by Aboriginal experience commencing during the occupation of the island by European sealers during the early nineteenth century. One of the Ngarrindjeri names for this previously uninhabited island was 'Ngurungaui', reportedly meaning the dead spirit 'is departing to travel along the track of Ngurunderi' (Berndt 1940: 181).

[19] Tindale published the 'Story of Ngurunderi' in the *Advertiser*, 16 May 1936. His main Coorong informant used in this account was Clarence Long (Tindale 1931–34: 182, 183, 185; 1934–37: 30–36, 223). Tindale & Pretty (1980: 48–50) give an outline of the composite account earlier developed by Tindale.

[20] *Register*, 1 June 1885.

[21] Bellchambers (1931: 112, 125) recorded the Noreela myth from a Mid-Murray Aboriginal man named Natone (Nettoon). Although Noreela is female, there appears to be a close linguistic similarity of the name with the male spirit, Nurelli.

[22] Tindale (1981–34: 182, 183, 185; *Advertiser*, 16 May 1936). See discussion of this myth by Clarke (1991a: 68).

[23] The importance of Red Ochre Cove, in the post-contact situation, is indicated by the record of Lower Murray people from Point McLeay Mission, travelling to Noarlunga to obtain initiation ochre in 1860 (Taplin Journals, 12 September 1861). Tindale calls this place Putawatang (Tindale, 1934–37: 154). Berndt & Berndt (1993: 20, 23, 117, 129, 234, 312, 446) record this site as Mulgali or Putatang.

[24] Account received during South East fieldwork by S. Hemming and P. Clarke in the mid to late 1980s.

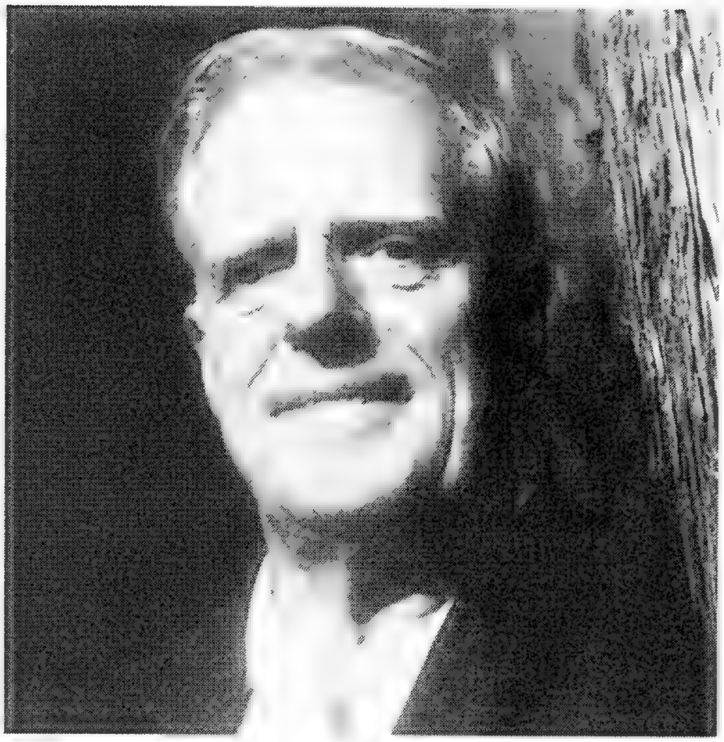
[25] Ramsay Smith (1930: 182–184, 317–331), Parker (1936), Mountford & Roberts (1969: 20–25; 1971: 34, 35), and Reed (1980: 64–72).

[26] 'Ngurunderi: a Ngarrindjeri Dreaming' was produced by the South Australian Film Corporation and the South Australian Museum. It has appeared several times on national television. Hemming (1988) discusses the making of this video.

OBITUARY

NORMAN B. TINDALE

12 October 1900 – 19 November 1993



In 1967 at the age of sixty-six, and after a professional career of forty-nine years spent in the service of the South Australian Museum, Norman Barnett Tindale received an honorary doctorate from the University of Colorado. Among the voluminous manuscripts bequeathed by Tindale to the South Australian Museum is a collection of thirty-nine letters written by colleagues and peers from around the world in support of this award. As more than one letter observed, that such an award was being contemplated by an American university did not reflect well upon the lack of initiative of Australian institutions in this respect. Tindale was eventually honoured with a doctorate by the Australian National University in 1980. But none of those letter writers, assessing the contribution of an anthropologist and scientist in the twilight of his career, could have predicted that Tindale would continue to publish and undertake research for another quarter of a century.

Tindale was an early starter as well as a late finisher. He had already published thirty-one papers on entomological, ornithological and anthropological subjects before receiving his Bachelor of Science degree at the University of Adelaide in March 1933. These papers joined a further 100 papers published during his employment at the South Australian Museum, an average output of three papers each year, mostly published in refereed journals. In this sense he was an outstanding product of the British institutional science tradition—trained on the job, self-educated and judged by scientific contributions rather than degrees. That the Australian expression of this tradition also reflected a perennially meagre budget commitment to science on the part of state governments and a general lack of public support in most intellectual areas may have been apparent to Tindale, but was rarely dwelt upon. There was work to do.

Tindale was born in Perth on 12 October, 1900, the eldest of four children. His parents were committed members of the Salvation Army and in 1907 the family travelled to Tokyo, Japan, where his father took up a position as an accountant with the Salvation Army mission operating in China. Tindale's personal and professional life was marked by turning points; this was the first. He grew up with a good knowledge of German and French, as for several years these were the only languages taught in the small private school which he attended with the children of diplomats. One of Tindale's close school friends was Gordon

Bowles, later to become Professor of Anthropology at Syracuse University as well as a colleague in wartime Intelligence work. But Tindale spent most time with the children of Japanese neighbours, speaking street Japanese, playing in the semi-rural suburbs of Tokyo (still a largely feudal city), and exploring the countryside nearby. It was these rambles, and resultant trips to Tokyo's Imperial Museum, which introduced Tindale to the world of natural history and to entomology in particular. Through the Museum, his father's library, and his own experience of Japanese customs, Tindale gained a taste for anthropology.

But by the time that the Tindales left Japan during August 1915 to settle first in Perth and by February 1917, in Adelaide, Norman had no doubt that he would pursue a career as a natural scientist. Butterfly and moth collecting had become his passion and he explored the possibility of gaining a job at the South Australian Museum. Aware of a possible impending vacancy there, he took up a position as a library cadet at the Adelaide Public Library in May 1917 working alongside another young cadet, the future nuclear scientist Mark Oliphant. More than thirty years later, Tindale encountered Oliphant again, in the Top Secret area of the Washington's Pentagon, emerging from a section labelled 'Manhattan Project'.

A few months after taking up his cadet's position Tindale lost the sight of one eye in an acetylene gas explosion while assisting his father with 'limelight' photographic work. The accident dulled none of Tindale's enthusiasm or ambition. Just before the explosion he had begun to read Alfred Wallace's 'Travels on the Amazon and Rio Negro'; a few days after the explosion he took it up once more and wrote in his diary: 'My mind seems made up about following such a life as his. I hope to take him as my model' (Tindale ms.). In January 1919 he finally secured a Museum position as Entomologist's Assistant under the mercurial Arthur M. Lea. He later recalled that Lea told him, 'Tindale, you'll never make a blind entomologist, but you might make a blind anthropologist!'. Both seemed possible to the young scientist.

The next turning point in Tindale's career came when he received permission in 1921 to undertake an extended field trip to Groote Eylandt in the Gulf of Carpentaria. The opportunity arose through Tindale's family background in missionary activity. This had brought him into contact with the Church Missionary Society of Australia and Tasmania, which was extending its mission work from a base at Roper River to Groote Eylandt. Tindale was engaged by the Society for twelve months to assist in the establishment of a home on Groote Eylandt for half-caste children from the mainland. He was to be given time to collect for the South Australian Museum which would purchase his specimens at the completion of the trip. At this stage no Aboriginal objects from the island were preserved in any museum. Tindale's Director, Edgar Waite, recognised the ethnographic potential of the expedition and directed the young entomologist to visit the doyen of Australian anthropologists, Baldwin Spencer, at Melbourne's National Museum, for advice. Spencer's advice was simple; to follow the directions for field observation laid out in 'Notes and Queries in Anthropology' (he gave Tindale his own copy) and to keep a field journal with a daily record under every circumstance, even if the following day's events invalidated a previous entry. Spencer also introduced Tindale to the Geographic I method of language transcription, the basis for Tindale's unique collection of more than 150 parallel vocabularies across Aboriginal Australia.

Tindale followed Spencer's advice to the letter and gathered a remarkable collection of ethnographic data and more than 500 artefacts from Groote Eylandt and Roper River during his twelve months in the field. This was the longest period to that date spent by a scientist in the company of Aboriginal people. During that expedition Tindale's main informant, a Ngandi man named Maroadunei, introduced the young scientist to the concept of bounded tribal territories, 'beyond which it was dangerous to move without adequate recognition' (Tindale 1974: 3). Yet Tindale went to Groote Eylandt and the Roper as a naturalist, and returned as one. The crucial shift in his career took place well after his return to Adelaide, when his synthesis of anthropological data for publication made him aware of the openings and challenges which the new field offered. In particular, when Edgar Waite insisted that Tindale remove tribal boundaries from a map of Groote Eylandt and the adjacent mainland being prepared for publication in the Museum's Records, maintaining that nomadic Aborigines could not occupy defined territories, Tindale realised that a new paradigm in ways of regarding and describing Aboriginal Australia was sorely needed.

The Groote Eylandt expedition revealed Tindale's remarkable appetite for fieldwork.

Taken together, his dozens of field trips amounted to more than seven years of his professional career spent in the field, an average ratio of nearly two months of every year. A colleague later observed that Tindale was never quite himself back at the office, and it required very little to entice him out once more. But it was in the field, exposed to the nuances and implications of the natural and cultural environment which he regarded as the unrestricted object of his study, that Tindale came into his own. His broad-based training enabled him to undertake this task confidently and to weave together the diverse strands of natural and human science. Trained in geology (a Pleistocene Stratigraphy course at the University of Adelaide) under Douglas Mawson, geography under Grenfell Price and heavily influenced by the publications of Wallace, it was axiomatic that Tindale would adopt a strongly ecological approach to his field observation and collecting. This approach was greatly reinforced by his contact with Aboriginal people for whom the distribution and habits of plant and animal species were crucial data. Tindale's bibliography reflects this great diversity of interest and its complementary character, particularly in the case of his geological papers which overlap with those discussing Pleistocene archaeology, or his entomological or botanical papers which overlap with interests in linguistics or material culture.

Looking back on Tindale's career it is possible to discern half a dozen research paths which he followed, converging and diverging but persisting across several decades until his death. Few specialists would attempt to emulate such a course today; in Tindale's time, as his colleague and friend Joseph Birdsell put it later, it represented the 'proper breadth of interest'.[1] In entomology, his first love, Tindale selected the study of the Hepialidae, one of the most primitive of the moth families; in geology his particular interest became the study of Pleistocene shore-lines and Tindale was to become recognised as one of the 'foremost workers on the Pleistocene geology of Australia' (Daily 1966). In linguistics as in broader anthropological studies his object was to gather sufficient data to scientifically describe variation in Aboriginal culture and society across the country. The same applied to his physical anthropological surveys. More focused studies, such as an investigation of initiation practice, Western Desert art and mythology, or the detailed description of a coastal and riverine society, followed from this survey data. In archaeology, informed by his geological and ecological training, Tindale's object was to establish the broad canvas on which more specific applied or theoretical investigations could be painted. Tindale's field trips became the testing ground for this tumult of ideas and theories against a background of wide reading in each area and constant rapport with colleagues, nationally and internationally.

The tracks connecting these paths were often of equal interest. For example, Tindale's interest in the primitive Hepialidae led him into the palaeontological field, linking with his geological and anthropological interests. He eventually discovered and described *Eoses*, considered to be the most ancient fossil lepidopteran (of Triassic age), through a careful examination of the Mt Crosby fossil beds in Queensland. So much for a blind entomologist. Likewise, Tindale's expertise in the Lepidoptera field brought him into contact with scientists and administrators charged with eradicating or controlling insect pests, and with the issue of satisfactorily managing Australia's national parks. Tindale was appointed in 1958 as a member of the national Committee on National Parks and Reserves of the Australian Academy of Science and made active contributions to the growing debate about conservation issues. His input to South Australian legislation on National Parks, enacted during 1966, was also considerable. Through such connections he also became a founding member of South Australia's National Trust committee. As chairman of the Trust's Nature Preservation Committee, Tindale could take much credit for the preservation of the internationally known glacial pavements at Hallett Cove. He was able to doubly underline their significance through his geological expertise with ancient shorelines and through his careful documentation of the massive 'Kartan' Aboriginal stone tools associated with this particular locality.

Tindale's life was full of such connections. The most striking, yet least known, was the use which he made of his intimate knowledge of the Japanese language. At the outbreak of the Second World War Tindale's attempt to enlist in the Australian army was thwarted by his damaged eyesight. With Japan's later entry into the war his value to military intelligence operations was soon recognised; he and his brothers, together with his old friend Gordon Bowles, were among the few

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[1] This phrase forms the title for the Masters thesis written by Tindale's grand-daughter Karen Walter, dealing with Tindale's early career (Walter 1988). I am grateful to her for the opportunity to use data contained in this thesis for this survey of Tindale's life.

Australians fluent in Japanese. During 1942 Tindale joined the R.A.A.F. and was assigned the rank of Wing Commander in England before being transferred to the Pentagon to advise on strategic bombing. There he headed the military intelligence unit charged with deciphering Japan's military codes and with ascertaining the origin and volume of production of munitions and spare parts. Tindale and his small unit spent time combing through the wreckage of crashed Japanese aircraft. They intensively analysed this debris in a laboratory established at his initiative near Brisbane. Through metallurgical and serial number analysis and by deciphering the company marks found on different components Tindale obtained remarkably accurate data on production figures and Japanese shortages of critical alloys. Professor W. V. MacFarlane later wrote: 'this somewhat esoteric complex of knowledge of language, ability to associate minute and apparently unrelated fragments of information to induce patterns of understanding, and to deduce consequences, has been characteristic of his work amongst Aboriginals from every part of the continent and its surrounding islands' (MacFarlane 1966).

Tindale eventually achieved two breakthroughs which altered the course of the war in the Pacific. Both are still unknown to the wider public. He was instrumental in cracking the Japanese aircraft production code system, which gave the Allies reliable information as to Japanese air power. More importantly, he and his unit deciphered the Japanese master naval code. Another commander in U.S. military intelligence later wrote that the success of the attack 'upon the homeland of Japan was more effectively measured through the work of Tindale and his group than through any other source of intelligence we had available at the time' (Brown 1966). This fact was established through the Strategic Bombing survey undertaken in Japan after the war.

Just as extraordinary was Tindale's application of his special skills of detection in halting the only enemy attack on the continental United States—the fire-bombing of the Pacific North-West which occurred for a twelve-month period during the war. The attacks caused many forest fires and killed several civilians. Tindale examined the shattered remains of the balloon carriages which transported these bombs from Japan and established not only the rate of their production, but their points of manufacture and release. With this information those sites were bombed and destroyed, ending this form of attack.

Tindale was reluctant to talk about this momentous phase in his career, believing himself, even as late as 1989, to be bound by the wartime British Official Secrets Act. He continued his practice of keeping a daily journal throughout the war period but restricted his observations to natural history and anthropology. He found time to record anthropological detail and collect artefacts during his 'special duties' in New Guinea and the Solomon Islands. During spare moments in America he studied and reorganised the Australian osteological collection at the Smithsonian Institution and even discovered a new species of Lepidoptera (*Sthenopis darwinii*) in Tennessee.

Tindale's entomological career may have been overshadowed by his anthropological achievements but he never lost contact with this first love. This was so in a direct sense; his desk invariably contained a jar of insects or an open file on the subject. On field trips his days usually ended with an examination of the evening's haul of moths and insects caught in his portable light-trap. The same routine was observed, particularly during summer months, at his Blackwood home, overlooking the lights of Adelaide. Both in Adelaide and in retirement in Palo Alto he made his own carefully chamfered wooden boxes for Lepidoptera specimens. But Tindale's entomology did not simply consist of collection and description. As with his anthropological studies, he became interested not only in questions of geographical variation but in origins and early stages, as well as in specific issues of ecology.

Tindale had begun collecting and classifying butterflies in Japan at the age of ten. His professional entomological studies began during his Groote Eylandt expedition of 1921–22. Concentrating upon the Lepidoptera and the Orthoptera on his return, Tindale undertook revisions during the later 1920s of the Australian Mantidae (mantids) and Gryllotalpidae (mole crickets), regarded for decades afterwards as standard works in this field. But it was his interest in the more primitive Lepidoptera, specifically the Hepialidae, which established Tindale's long-standing international reputation as an entomologist. I. F. B. Common observed that Tindale's revision of the Hepialidae family 'represented a new critical phase in the study of Australian Lepidoptera' (Common 1966). Until the Second World War it was the only major revision of the fauna which had taken the male genitalia into account, and thereafter placed the classification of the Hepialidae on a firm footing.

This detailed revision, published in several papers over a period of thirty-two years from 1932 to 1964, provided the basis for ecological studies leading to more effective control of several *Oncopera* species, for example, which are serious pests of high-yielding sown pastures.

Tindale became a world authority on the hepialid moths, a notable achievement considering the difficulties which they present to researchers. In acknowledging this, H. K. Clench of the Carnegie Museum observed that the moths are often rare, and with brief flight periods, difficult to collect in adequate numbers for study; their characters are cryptic and, because of their ancient origins, their distribution poses additional problems for the investigator who requires an intimate knowledge of them across their entire world distribution (Clench 1966). Patiently amassing material and data over several decades, visiting museums throughout the world and collecting in as many regions and environments as possible, Tindale acquired this knowledge and earned the respect of his entomological colleagues. He discovered and described many geographical races of moths, some species, and many life histories, carefully analysing the events which he considered were responsible for each situation. In John Calaby's words, his entomological studies became 'much more than mere descriptions of animals' (Calaby 1966). His attention to the evolutionary implications of his data was of great importance to the much broader fields such as speciation patterns and the general evolutionary history of the Australian fauna as a whole.

As noted, Tindale's entomological work often connected with his anthropological studies. His interest in the Hepialidae and Cossidae was particularly apposite here, since many of them have wood-boring larvae used as food by Aborigines. Several of his papers addressed this subject, providing a vivid example of his attention to the ecological contexts which sustained human and animal life throughout Australia. Already inclined to an ecological approach, Tindale was given great encouragement through his association with the University of Adelaide-based Board for Anthropological Research, and in particular its chairman, J. B. Cleland. The Board undertook annual expeditions during the university's August vacations of the late 1920s and the 1930s with the primary object of recording series of physiological and sociological data relating to Aboriginal groups which had experienced little sustained contact with Europeans. Cleland ensured that these data were recorded within an ecological frame, encouraging Board members to note aspects of geology, flora and fauna. Tindale applied this general approach to the study of Aboriginal territoriality, relating particular groups to specific environments through a range of careful observation, backed up by ethnographic and archaeological evidence. He developed this approach thirty-five years before territoriality and ecology (or even Australian anthropology itself) became voguish fields.

As the Board expeditions progressed during the 1930s Tindale began to correlate his data in ways which few anthropologists had previously done. He collected and documented artefacts with a strong awareness of how their manufacture reflected necessities dictated by the environment and opportunities to manipulate or exploit that environment. Over the years the careful accumulation of such detail resulted in important papers on material culture and the Australian environment, such as his 1976 publication on the *Panara* or seed-milling technology of the Central Australian grasslands. During the 1930s he paid particular attention to the documentation of social, as well as technological, processes, and was encouraged by other Board members to master the arts of sound and film recording. Tindale first attempted ethnographic film-making during his expedition with Herbert Hale to Queensland's Princess Charlotte Bay in 1926–27. Films made at Hermannsburg (1929), MacDonald Downs (1930), Cockatoo Creek (1931), Mt Liebig (1932), Mann Range (1933), the Diamantina south of Birdsville (1934, assisted by H.K. Fry) and Warburton Range (1935, assisting Stocker) followed. Of these, his Mann Range sequence, four reels comprising 'A Day in the Life of the Pitjandjara [sic]' remains the most compelling. Tindale cleverly edited sequence from dramatic footage shot over a period of several weeks to construct a 'typical' day in the nomadic existence of the Pitjantjatjara as they travelled from water to water through the Mann Ranges. Wax cylinder recordings of ceremonies and song cycles were made separately by Tindale on each of these expeditions; in many cases they represent the only surviving record of their kind.

Tindale's concern was not to preserve an account of culture for its own sake, but to document in sufficient detail to enable further analysis by others. 'Making a useful record' was a phrase he often used, applying it equally to his compilation of 150 parallel vocabularies as to his descriptions of manufacture and use of spears, spear-throwers, dishes, stone tools, resin, hair string, and other essential items of desert life. An artefact could be collected, together with examples of raw materials used in its manufacture, and the process could be filmed. All processes and observations and linguistic terms were recorded meticulously in note form, together with the genealogies and backgrounds of the makers or participants, from whom further mythological detail could be elicited through crayon drawings on brown paper which he distributed and later carefully annotated.

The sound recordings made by Tindale during the 1930s have still not been properly studied. As with film, he continued to make these vital records of Aboriginal life well into the 1960s, in central and northern Australia. On his return to active fieldwork after the war Tindale adopted reel-to-reel tape recorders instead of the wax cylinder machine and began experimenting with colour film. Willing to adopt any worthwhile advance in technology during his working life, Tindale nevertheless stopped short of the computer age. His voluminous shoe-box card files on Aboriginal place names and language terms and his own indexed journals provided a ready entree into most of his research areas.

Tindale's particular duty during the Board expeditions was to note the identities, social and totemic background and genealogical relationships of Aboriginal people. This responsibility provided him with the structure and discipline required to complete his apprenticeship as an anthropologist. In the first place, it brought him directly into contact with Aboriginal people as individuals on a one to one basis. His calm and straightforward manner, leavened with an easy humour but sharpened by an incisive and enquiring approach, elicited data with a minimum of fuss. Aboriginal people remembered Tindale with respect and affection years after his visits. The genealogical exercise also gave Tindale an appreciation of the kinship network as the generative basis of Aboriginal society, in all its different forms across the continent. But in contrast to the social anthropologists trained in the British tradition who were beginning to graduate under Radcliffe Brown and Elkin during the 1930s, genealogies represented far more to Tindale than 'samples upon which to hang kinship terminology' (Birdsell 1966). In the detail recorded by him, they provided concrete evidence of the relationship between individuals, sites and Dreaming sequences.

Additionally, and with major implications for his later research, Tindale's genealogies enabled him to develop a demographic record of Aboriginal Australia as a whole. As with his ambitious work on documenting tribal boundaries and territories, the continental scale of this undertaking was rarely even considered as a possibility by his contemporaries. Tindale first undertook applied demographic studies through his analysis of the Tasmanian Aboriginal descendants of Bass Strait. Published in 1953, the study remained for many years the best total community demographic study in Australia.

The field of population dynamics was almost unknown within Australia when Tindale undertook his Tasmanian study. He was to make a major contribution to it, particularly through his diachronic analysis of the Bentinck Island Kaiadilt people. In a series of papers Tindale demonstrated the effective isolation for approximately 3 500 years of this self-contained population of about 120 people. Through meticulous use of the genealogical method he documented a pre-contact population crash which reduced the island's population by more than 40%. In collaboration with the serologist Roy T. Simmons, and the micro-evolutionist Joseph Birdsell, Tindale demonstrated that the Bentinck Islanders represented a classic case of founder effect, described by Birdsell as the 'most important remaining portion of the Sewell Wright Effect' (Birdsell 1966). Due to the small numbers in the original emigrant ancestors of the Kaiadilt, their descendants differ from mainland Australian Aborigines in some genetic properties as much as do major racial groups from each other in other parts of the world.

Tindale's awareness of the potential of this field was stimulated through his time in the United States during 1936–1937. Following his award of a 1936 Carnegie Research Fellowship (to be followed by a second in 1959), Tindale spent several months studying Australian ethnographic material and lecturing in Europe and the United States. Apart from meeting Birdsell, who became a lifelong friend, Tindale made other friends and contacts in America to the extent that, following the death of his first wife Dorothy during 1969, he was readily able to adjust to life there. Meetings with the environmentally-oriented anthropologists Alfred Kroeber and Earnest A. Hooton, the serologist Carl Sauer, and the geographer T. Griffith Taylor were especially influential, confirming Tindale's anthropological development along lines increasingly distinct from those promoted by social anthropologists emerging from the University of Sydney. In particular, Tindale's meeting with Kroeber at Berkeley refocused his commitment to mapping the tribal distribution throughout Australia, in order to provide a firm basis for the study of culture traits. At Harvard Earnest Hooton further supported this approach, seeing the importance of a well-documented distributional template for the anthropometric and serological studies which he proposed as a project to Tindale and his favoured student, Joseph Birdsell. The result of these meetings shifted the course of South Australian, and Australian, anthropology.

Hooton's influence enabled one of the most ambitious anthropological surveys every undertaken in Australia, jointly funded by the University of Adelaide and Harvard University. During an eighteen month period through 1938–39, Tindale led a data-gathering expedition supported by Birdsell and accompanied by their wives as secretaries and research assistants. The team travelled by road to almost every Aboriginal settlement and mission throughout eastern, southern and south-western Australia. The object was to undertake a comprehensive survey of the Aboriginal population in its interaction with the non-Aboriginal population, several generations after first contact had occurred. As on the previous Board expeditions, the pair gathered an immense range of physiological and sociological data, measuring, blood-sampling, photographing and interviewing more than 3 000 individuals. The project was completed under Birdsell's leadership and with Tindale's active participation during the years 1952–54, when north-western Western Australia and parts of the Northern Territory were surveyed and some earlier ground retraced, resulting in the survey of a further 2 000 individuals. For Tindale and Birdsell, the 1938–39 expedition represented the beginning of a firm friendship and a working partnership which spanned the next half-century.

The photographic and genealogical records was also to serve another, unforeseen purpose, making Tindale's name familiar to many thousands of Aboriginal people across the country decades later. The establishment of the Aboriginal Family History Project at the South Australian Museum during the 1980s made these records accessible to the descendants of those contacted by Tindale and Birdsell during the 1938–39 and 1952–54 expeditions. Tindale lived long enough to appreciate the impact which this historical record was to make upon the lives of Aboriginal people.

Birdsell's detailed genetic studies of Australian Aborigines (discussed elsewhere in this volume) derived from data first gathered during the 1938–39 expedition. Much of this work was directed towards establishing the thesis, still controversial, that Aborigines had arrived in Australia in three chronologically, and physically, distinct groups. It was Tindale and Birdsell's hypothesis that the first of these groups, ultimately stranded in Tasmania by rising sea levels, were represented on the mainland by the 'negrito' population in the 'ecological refuge zone' of the Queensland rainforest near Cairns. This group was contacted and studied by the pair during the 1938–39 expedition. Tindale furthered his interest in genetics, eventually publishing the first systematic study of gene flow for any simple human population. His 1953 paper in 'Human Biology', based upon his massive genealogical data for the Australian continent, remains a classic.

For Tindale, the 1938–39 expedition enabled him to interview many of the last Aboriginal individuals with knowledge of the group structures and territories of those regions of Australia overtaken by settlement and pastoralism. Combining this primary data with that drawn from manuscripts and secondary sources, he was able to realise his long-standing ambition to prove that Aboriginal groups did relate territorially to distinct regions that could be successfully mapped. His tribal map of Australia, first published in 1940 and revised in 1974 together with his encyclopaedic catalogue of Aboriginal tribal groups, was radical in its fundamental implication that Australia was not *terra nullius*—decades before the Mabo judgement made it a national issue. As importantly, both the 1938–39 and 1952–54 expeditions (the latter accompanied by Tindale only until 1953), resulted in several hundred sheets of genealogical data and more than 6 000 well-documented photographs of Aboriginal people.

If Tindale warmed to any particular Aboriginal group among the hundreds encountered by him during his career it was undoubtedly the Pitjantjatjara. He and the physical anthropologist Cecil Hackett spent almost three months in their company during 1933, observing initiation ceremonies and the minutae of daily life as family groups split and reformed during their travels through the Mann Ranges. Using camels, Hackett, Tindale and their European guide Alan Brumby accompanied the group as 'virtual parasites', making a detailed and unique record of a society on the brink of decisive change. As well as film and sound records, closely documented artefacts and genealogies, Tindale prepared the first detailed vocabulary of the Pitjantjatjara language.

He had further opportunities to learn from these people during field trips to the region during the 1950s and 1960s.

If Tindale warmed to any particular Aboriginal individual during his career it was undoubtedly the Tangane man, Milerum (Clarence Long). Tindale subsequently wrote an entry on Milerum in the 'Australian Dictionary of Biography' (Tindale 1986), detailing the coincidence of Milerum's first contact with Europeans, at the age of six, with Tindale's mother's family, inland from South Australia's Coorong. After 1931 Milerum assisted Tindale by recording a substantial corpus of song in his native Tangane and related languages, and participated in intensive site recording throughout the Coorong and Lakes region. In this Tindale was assisted by the social anthropologist H. K. Fry, who had already given Tindale informal training in anthropological theory. At the time of his death, perhaps Tindale's greatest unfinished work was an ethnographic study of the Coorong region as seen through the eyes of Milerum. Much of this data was gathered during Milerum's extended visits to the South Australian Museum, during which he became a 'resident' artefact maker until his death in 1941.

By the late 1930s Tindale's fieldwork had taken him to every geographic and cultural zone of Aboriginal Australia. His 1921–22 fieldwork in tropical Australia was complemented by a ten week expedition to Flinders Island and Princess Charlotte Bay on Cape York during early 1927 in the company of a museum colleague, Herbert Hale (later Director). Tindale's first, successful experiments with ethnographic film-making occurred during this expedition. He made further expeditions to the tropics during the 1938–39 expedition, and in 1960 and 1963, visiting Mornington and Bentinck Islands and the government settlement at Palm Island. In temperate Australia, Tindale undertook numerous trips to the Coorong, the Lower Murray, the south-east of South Australia and Yorke Peninsula, particularly during the 1930s, and to south-western Western Australia during 1968. His arid zone studies began in late 1924 when he and Herbert Hale worked among the Wailpi and Adnjamathanha people of the Flinders Ranges. This expedition also provided Tindale's first introduction to Aboriginal rock carvings and to the iconography of Central Australia. It also provided a solid basis of comparison for his analyses of rock art of southern South Australia, also undertaken during these early decades. From 1928 Tindale's experience of Central Australia grew rapidly. He was a participant on the Board for Anthropological Research Expeditons to Koonibba (1928), Hermannsburg (1929), MacDonald Downs (1930), Cockatoo Creek (1931), Mt Liebig (1932), Mann Ranges and Ernabella (1933), Diamantina River (1934), and the Warburton Range (1935). During 1934 and 1951 he made individual expeditions to Ooldea. A further Board for Anthropological Research expedition to Yuendumu during 1951 signalled the end of these large, team surveys. Tindale's Central Australian fieldwork was completed with expeditions to the north-west of South Australia in 1957 and 1966, Haast Bluff (also 1957) and the Rawlinson Ranges in Western Australia during 1963.

Tindale's participation in the 1929 Hermannsburg expedition provided him with his first close encounter with desert people and their social system. The eight members of the expedition party travelled on the first train to arrive in Alice Springs from Adelaide and reached Hermannsburg at the height of a scurvy epidemic precipitated by the worst Central Australian drought this century. The medical members of the expedition diagnosed the condition and treated it successfully. Perhaps through this solicitude, and the obvious numerical congruence, each of the eight men was assigned a 'skin' name corresponding to the eight sub-class terms used by the northern Aranda groups. Tindale was given the brown hawk totemic affiliation, *erukalandja*, and was designated as 'Mbitjana' (*Tjampatjimpa*) skin, a classification which he was able to apply to himself in all subsequent dealings with Central Australian Aborigines.

On the day of Tindale's official retirement from the South Australian Museum he set out with his old friend, the American folklorist, amateur archaeologist and accomplished bibliographer John Greenway, on an expedition to Koonalda Cave on the Nullarbor Plain. It was fitting that this expedition, colourfully chronicled by Greenway (1973), had archaeology as its theme. Tindale's career had been characterised by the relentless search for origins which archaeology expresses as a discipline. From the 1920s Tindale's geological studies under Mawson had trained him to interpret the stratigraphy of an archaeological site and he was the first in Australia to use sea-level changes for dating purposes. As Edmund Gill expressed it, Tindale's archaeological work was remarkable for the fact that he studied sites from 'a number of points of view—anthropologic, geologic and palaeologic'

(Gill 1966). This form of analysis at archaeological sites near Adelaide such as Fulham, Pedler's Creek (Moana) and the South Para River had prepared him for his crucial role in Australia's first truly scientific archaeological excavation, undertaken during 1929 at Devon Downs near Swan Reach on the Murray River.

Tindale's emphasis on stratigraphy led him to posit a model of culture succession in Australia, based entirely upon local critieria rather than adopting European models as had been accepted by most other Australian archaeologists. Before Devon Downs, Australian archaeology did not exist as a discipline, largely because it was assumed that Aboriginal people were relatively recent arrivals. Tindale's meticulous excavation established not only that Aboriginal people had lived for several millennia in the Murray valley, but demonstrated that their strategies for subsistence had altered in response to environmental change. He showed how stone tools, animal bones and cultural remains could be used to piece together a previously untold story about Australia's past. His foresight in preserving charcoal samples against the predicted development of C^{14} dating has received scant recognition. Nevertheless, critics of Tindale's construction of an Australian cultural chronology based on his Devon Downs, Tartanga and Noola Rockshelter excavations, together with his classification of the large 'Kartan' implements, acknowledge the precision of his work and the quality of his data.

Tindale's precise work habits, particularly when applied to the documentation of field collections, have ensured that several thousand Aboriginal artefacts, whether archaeological or ethnographic, may be interrogated by future researchers. Struck by the apocryphal anecdote related to him in the British Museum of a worker who had become unhinged and burnt a large number of collection records, Tindale determined that this would never befall his institution. His careful practice of inscribing each artefact with inked locality data was followed for many years. Many of his specimens are also figured and described in his journals over a collecting period of almost half a century.

These journals, Tindale's collected specimens, and the entire range of his publications, sound recordings, films, photographs, genealogies, crayon drawings, maps and other illustrations will remain as this tireless worker's legacy. The lasting significance of this data lies neither in its bulk nor its scope, but in the fact that it was gathered with a focused goal in mind, to describe the diversity of an entire people before transformation by European contact. Tindale was well aware that his attempt to do this, as symbolised by his 1974 map of 'Aboriginal Tribes of Australia' and its accompanying compendium, would never be fully acceptable and that, indeed, its chances of acceptance would diminish as more and more scholars entered the field. Nevertheless, when he began his task in the 1920s, the number of practising anthropologists in Australia could be counted on the fingers of one hand, and he believed in his ability to complete the task, although he once confided in this author that he didn't have time to die until about 2020.

A side of Tindale's career which his many achievements tend to obscure is that concerned with his role as a public servant. Tindale represented the public face of anthropology in South Australia for almost half a century. He pronounced upon controverial issues and developments in the 'Advertiser' and other Adelaide newspapers, gave lectures and radio talks, and answered innumerable public enquiries about Aboriginal place names, archaeological finds and so on. Tindale had been a founding member of the Anthropological Society of South Australia during 1926 and he continued to participate in its activities and administration. His advice was directly sought by government upon such issues as the creation of a reserve for Pitjantjatjara people in South Australia's north-west during the 1930s, and the policy issues arising out of his survey of what had become known as the 'half-caste problem', documented during the 1938–39 expedition. Tindale also found time to apply his anthropological expertise and experience of other museums to new exhibits. He undertook a full-scale renovation of the Museum's Pacific Gallery shortly after his return from war service during 1946. He superintended the construction of an Indonesian Hall during 1952–54 (since dismantled) dealing with the cultures and history of the Asian-Pacific region., and periodically made important changes to the Museum's long-standing Aboriginal display in the Stirling Gallery. His role as an 'expositor of science' (Day 1966) was best exemplified perhaps by his co-authorship of three popular children's books on the subject of indigenous peoples. 'The First Walkabout' (1954, Longmans), written with H. A. Lindsay, was awarded a prize for the best Australian children's book of the year in 1955. Another successful historical novel, 'Rangatira. A Polynesian Saga', also co-written with Lindsay, was published in 1959 (Rigby), followed by a factual illustrated children's book, 'The Australian Aborigines' (1971, Lloyd O'Neill), co-written with his daughter Beryl. Tindale was a committed bibliophile, but as a user, rather than an owner. His own extensive reference library was often annotated and full of bookmarks. His early exposure to the Adelaide Public Library collection enabled him to save many important reference works marked for the discard pile; these are now incorporated within the South Australian Museum library. Tindale was a great advocate for binding library volumes. He served as honorary libarian to the Royal Society of South Australia from 1952 to 1966, as its Secretary during 1935 and as President during 1949.

There is no doubt that Tindale had developed formidable skills as an administrator and policy-maker during his long career. It was unfortunate that Herbert Hale's postponement of his own retirement made it impossible for Tindale to be considered as an applicant for the job of Director at the South Australian Museum. Tindale acted in this position from 1959 until 1960, having spent the previous year as Visiting Professor of Anthroplogy at the University of California in Los Angeles. The lack of opportunity in Adelaide made the decision to take further American academic postings easier. Tindale spent terms as Visiting Professor of Anthropology at the University of Colorado from 1966–67 and from 1970–71, and a further term at UCLA from 1967–68.

This academic recognition in America, where Tindale gained a widespread reputation among students and fellow academics for his lecturing skills, culminated in the University of Colorado's award to him of an honorary doctorate during 1967, the result of John Greenway's initiative. Australian recognition was less forthcoming. Through Professor Derek Freeman Tindale was awarded a Research Fellowship to the Australian National University during 1973, in company with his long-term colleague and friend Joseph Birdsell. This posting enabled him to complete the final details for his major work, 'Aboriginal Tribes of Australia: Their Terrain, Environmental Controls, Distribution, Limits, and Proper Names', a compendium of data dealing with every known Aboriginal group in Australia. Often criticised, both at the level of detail and for its controversial definition of 'tribe', the book and accompanying maps remain incontrovertibly as a classic work of Australian anthropology.

Tindale was awarded the Verco Medal of the Royal Society of South Australia during 1956, the Australian Natural History Society Medallion during 1968 and the John Lewis Medal of the Royal Geographical Society of Australasia during 1980. During that year also, Tindale was awarded his second honorary doctorate, by the Australian National University. By this time though, Tindale had made his home in America. His wife of forty-five years, Dorothy May, had died of leukemia during 1969. She had accompanied him, together with the Birdsells, across Australia on the 1938–39 Harvard-Adelaide expedition, and had encouraged an appreciation of anthropology in their two children, Anthony and Beryl. In 1970 Tindale married an old family friend, Muriel Nevin, whom he had first met in Honolulu during his 1936 Carnegie Fellowship visit to America. Apart from occasional research trips to Australia and butterfly collecting trips elsewhere in North America, they continued to live at Palo Alto near Stanford University in Muriel's small timber house, bursting at the seams with his research materials, library, and butterfly specimens. An adjacent shed provided more storage space and a workbench for constructing his neat wooden butterfly boxes.

While Tindale relished the relative seclusion of his retirement in the United States, he was never aloof from family or friends. It became almost standard for Australian anthropologists and linguists visiting America to adjust their itineraries to take in a side-trip to discuss points and issues with 'Tinny'. A boyish sense of humour, a readiness to engage with researchers on their own terms, and an enthusiasm for new information sustained him through accidents and episodes of ill health from his mid-80s. He impressed all visitors during his later years with the same qualities recorded by earlier colleagues—an indefatigable commitment to making an enduring record of Aboriginal life before the transformations wrought by European contact. His career's output of several books and nearly 200 scientific papers on anthropology, geology and entomology were used as working texts for future papers; he did not preserve bookshelf copies of any of his publications. By 1989 he knew that he would not complete his Milerum book, nor several other projects. Unfazed, he scaled his work programme back and supplied data for Aboriginal place names to the South Australian Department of Lands. He was never happier nor more animated than when confirming a new detail and putting it on the record for others to use.

Tindale remained an Honorary Associate of the South Australian Museum until his death, an association which spanned more than seven decades. During this time all of his former colleagues had left the scene and he observed the gap between museum and academic anthropology develop, widen, but then, encouragingly, begin to close. His letters to the Museum were like those from someone who has stayed away in the field too long: they were always completed with the touching epigram, 'Please give greetings to all those who remember me'. During 1993 Tindale received unofficial confirmation of the award of Officer in the Order of Australia; this was presented posthumously, to his widow Muriel. But the South Australian Museum Board's 1993 decision to name a public gallery in his honour may have meant most to him—a 'museum man' to the last.

The last word, and most cogent summary of Tindale's achievements, rests with an old friend and scientific colleague, Professor W. V. MacFarlane, writing in support of Tindale's honorary doctorate from the University of Colorado:

> It is not common in our time to find men with the skills and insights which Mr Tindale has shown through his active and productive life. He is basically a scientist, while skills with language and human relations fit him for anthropology. His special interests in entomology, geology and botany broadened the scope of his ethnographic studies. As the use of film, tape, carbondating and blood grouping came into anthropological work he readily made use of these for the data that they could bring towards his final synthesis of the cultural history of the Aboriginals in time and space. In addition, Mr Tindale has shown throughout his work a tolerance, humility, honesty and adaptability which made it easy for him to find collaborators amongst both black and white men. (MacFarlane 1966)

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This bibliography is arranged chronologically under four headings: Ornithology and Botany (10 entries), Geology and Palaeontology (11 entries), Entomology (42 entries), and Anthropology (135 entries).

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OBITUARY

JOSEPH B. BIRDSELL

30 March 1908 – 5 March 1994

Joseph B. Birdsell was born in South Bend, Indiana on 30 March, 1908 and died in Santa Barbara, California on 5 March, 1994. Known as 'Jo' to his colleagues and friends, Birdsell spent his academic years mostly at the University of California, Los Angeles, where he taught from 1947 to his retirement as Professor of Anthropology in 1974. His scholarly life as a physical/biological anthropologist started with a Ph.D. from Harvard in 1941 where he was trained by Hooton, Boyd and later influenced by Clyde Kluckhohn. His work and publications spanned five and a half decades of fieldwork in Australia, teaching at UCLA and writing on a broad range of subjects. Two valuable retrospective commentaries are available on his work. A volume of essays in his honor appeared in 1981, and Shanklin's and Mai's (1981) article provides an overview of his life and an appraisal of his conceptual work. Birdsell (1987) himself, also offered discussion of major intellectual influences on his scholarly growth in a general review which appeared about eight years ago.

For those of us who had Jo as a teacher, the experience conveyed the power of his ability to relate empirical facts to model building to understanding how evolution operates as a broad orchestration of Darwinian principles in micro-evolutionary changes, and to the analyses of issues as diverse as race, racism and population ecology. This obituary discusses Birdsell's contribution to the study of the Australian Aboriginal, his overall impact on biological anthropology and the kinds of influences which his writings have had on the field, and finally my own personal reflections on the man and his ideas.

Birdsell's fieldwork and publications on the Australian Aboriginal were always linked with his colleague Norman B. Tindale. It was Tindale through Hooton who brought up the idea for Birdsell to work in Australia in 1938, the start of the first Harvard-Adelaide joint venture. It was during this two year period that Birdsell and Tindale collected a vast range of data from blood samples to phenotypical features on a broad spectrum of Aboriginal populations from Queensland to Tasmania and Western Australia. Later, in the early 1950s, both scholars carried out two more years of fieldwork which focused on the Kimberley and the northwest part of Australia. The Birdsell–Tindale collaboration, which lasted for nearly fifty years, permitted each scholar to develop a diversity of theoretical and empirical concerns about which they could exchange ideas and mutually play off one another. Birdsell's commitment to empirically grounded theory represents a lifelong development which is initially apparent in his 1941 dissertation from Harvard and continues through to his recent massive 455 page volume which summarises more of his empirical findings an Australia (Birdsell 1993).

Birdsell's contributions to the biological analysis of Aboriginal Australians covers three areas: the trihybrid theory of origin, the issue of dating Homo sapiens' first entrance to continental Australia, and a focus on the continental level of evolutionary developments. Prior to Birdsell's analysis, the overwhelming view was that the Australian Aboriginal was a single, homogeneous population which spread throughout the continent, and the dating indicated recent human arrival in Australia possibly as recently as 5 000 to 6 000 years ago. Furthermore, most of the physical anthropology of Australia stressed only local and regional developments in the fossil record. Birdsell saw the problem along broader continental perspectives which related the particular to the whole of Australia and also compared the Australian situation to population processes in southeast Asia, East Asia and Africa.

In identifying the problem of origins as one of micro-evolutionary differences related to differential ecological and population forces, Birdsell argued that the category 'Australoid' was simply wrong and should be abandoned. In his writings in the 1940s and also in his 1993 volume, Birdsell claimed that Australia was inhabited by three waves of population expansion: the Barrinean wave with Negritic features similar to some southeast Asian populations, the Murrayian wave with affinities to Ainu-like groups (the original inhabitants of Japan), and the Carpentarians with Veddoid features. The trihybrid hypothesis addressed the concern that the previous Australoid categorisation embraced significant internal variation thus blurring micro-evolutionary processes as well as other hypotheses of internal migration within Australia.

While proposing the trihybrid theory as it related to broader processes within the Asian context, Birdsell also speculated that early man arrived in Australia at least 35 000 years ago if not earlier. In the 1940s when Birdsell suggested this early inhabitation of Australia, his claim was anathema to most scholars in Australia. There were no C14 dates, very few fossil remains and the commonly accepted scholarly idea was that humans entered Australia only 6 000 years ago.

Both of these opinions made Birdsell and his views totally unacceptable to biological anthropologists and comparative anatomists in Australia. When I arrived in Sydney in 1966 to start fieldwork in the Centre, I was asked by many academicians at the University of Sydney and elsewhere what had stimulated my interest in Australia. Although I had a Ph.D. from the University of Chicago based on fieldwork among the Mandaya of southeast Mindanao, Philippines, it was Jo Birdsell who had whetted my intellectual appetite for working in Australia. When I mentioned Birdsell's name, I was simply laughed at, no one took Birdsell seriously. This attitude held for most Australian Aboriginal scholars (except for W. E. H. Stanner). Late in the summer of 1966/1967, I met A. A. Abbie at Amata in the Musgrave Ranges. When Abbie heard me talk about Birdsell as pivotal to my working in Australia, he quickly and quietly walked away. However, by 1974 when C14 dating indicated that 30 000 B.P. was plausible for the earliest date of human entrance into Australia, Birdsell and Tindale were honored with a conference held in Canberra, and Birdsell was asked to spend a year at the Australian National University. Yet, by the late 1970s, even Birdsell's estimates were viewed with caution, since C14 dates had pushed human entrance back to 45 000 to 50 000 B.P.

Birdsell's early speculations and visions were based on a well developed idea of population genetics combined with migration theory which stressed the rapidity by which early hominoid forms could move from South and East Africa to the Asian mainland. These interests indicated that Birdsell saw local and regional changes and developments from a broader continental and even global perspective. Birdsell's (1951) lengthy article on the peopling of the Americas applied the same perspective by attempting to extrapolate what could be said about the Americas from Asia. To this day, most of his generalisations have been validated, with subsequent archaeological research supporting his early speculations, just as they did within the Aboriginal Australian context. C14 dates from the Bering Straits, as well as those from the extreme tip of South America, add credence to his early 'educated speculations'.

Although Birdsell's lifelong interest in Australia was well anchored in the history of physical and biological anthropology in the United States, his intellectual aim even as early as the 1940s was to forge the foundations of the new systematics from biology and genetics to physical anthropology, where for decades the dominant concern was primarily taxonomic and phenotypical analysis which had no bearing on ideas of evolutionary biology. This new paradigm meant that physical and anthropologists had to turn to the works of Mayr, Dobzhansky, Haldane, Simpson and Fisher as they established a true and vital evolutionary basis for the study of human populations. But of all the evolutionary biologists who were critical to the new physical anthropology, it was Sewall Wright's writings which had the greatest impact on how Birdsell understood micro-evolutionary processes and the extent to which population genetics related to broader evolutionary forces. Birdsell's fifty-five years of analysis and writing all addressed the multi-facets of evolutionary issues and Mendelianism as Wright envisioned the problem, and Birdsell's comprehensive 1993 volume is dedicated to Wright.

As a biological anthropologist representing the new systematics in biology, Birdsell's writings represent a broad range of interests covering population genetics, primate studies, racial analysis, environmental regulation among hunting and gathering populations, analysis of the paleontological records along spatial axioms, and the rigorous application of modeling to understanding population processes and diachronic changes. The application of population genetics to human societies was most problematic when Birdsell first entered academia. Fruit flies and controlled populations were ideal to ascertain how evolutionary forces worked in a population, but the human scene, even hunting and collecting societies, was too complex and variable as a unit of analysis. Jo saw the problem as one which required both a strict conceptual definition of population and a realisation that certain evolutionary processes simply could not be limited to the population *per se*. Thus, his use of genetic space and gene flow models was the beginning of cline analysis in small populations in which spatial models on a regional or continental scale were necessary for understanding microlevel changes. Furthermore, Birdsell's investigation of international drift and mutational processes among western desert Aboriginal groups was among the first direct application of Sewall Wright's (1931, 1939, 1978) theories to human populations. Until Birdsell's analysis, genetic drift has been employed as a factor only if no other evolutionary process could explain the observed variation. Also following Mayr (1942), Birdsell pioneered in understanding the dynamics of the founder effect among small human societies. Systematics in biology reached a new plateau when Birdsell took their insights and re-thought the genetic basis of human societies.

In 1953, Bartholemew and Birdsell published a pivotal and now classic article on protohominids. Although this analysis was not empirical, it established the agenda in regard to how comparative primate studies should be approached. By establishing a baseline from data on non-human mammals and comparing this with hunting and gathering societies, the authors created a framework of the biological and minimal cultural attributes which protohominids must have expressed. Over the past four decades, primate studies have filled in the empirical foundations through field studies, and, Birdsell's plea for integrating population genetics and social ecology resonates in each particular case study. Even the interest in vocal behaviour is found in this central piece, and the past three decades again demonstrate the clarion call of this highly creative and venturesome kind of thought.

Birdsell's form of ecological analysis, especially in analysing the Australian data, indicated that certain demographic and environmental regulations were present. Spacing mechanisms, both spatial and demographic, were essential in determining how hunters and gatherers survived. A number of his papers, the most general one being in the 'Man the Hunter' (1968) volume, set forth the essential dynamics of spacing, one of which was preferential female infanticide. Infanticide is common in hunting and gathering societies, however, the stress on preferential female infanticide must be revised and questioned as a universal feature among such societies (see Yengoyan, 1981). Nevertheless, it was Birdsell's direction and thinking along such lines that has stimulated reconsideration of such issues. Birdsell's stress on population characteristics (fertility, fecundity, mortality rates, morbidity, population control, the population pyramid, rates of in-migration and out-migration) was based on the assumption that demographic variables are the connecting link between environmental factors (eg rainfall) and social organisation/structure. This type of ecological analysis was markedly different from Julian Stewart's idea of cultural ecology, and in most respects avoided the pitfalls of Stewart's conception of the culture core.

His interest in population dynamics was not limited to the Australian case. His 1953 paper drew the connection between mean annual rainfall and Aboriginal population densities in Australia, and his analysis has been duplicated in other areas of the world such as the Great Basin in the western United States. In my opinion, Birdsell's most original and creative thinking about paleontological issues was published in 1957. By working through various models of population dispersion and the effects of how and when a population buds off from a parental population into unoccupied lands, Birdsell first asked the question: 'how fast could early man occupy continental Australia?' Using a relatively conservative assumption that populations would double in each generation when entering unexploited territories, Birdsell concluded that early man could have spread throughout Australia (and Tasmania) within a period of 7 000 years, which in evolutionary terms is virtually nothing. From this framework, Birdsell asked how fast would the Intrinsic Rate of Increase (IRI) be from South/East Africa through the Middle East, India, Southeast Asia and to Australia? He concluded that the time differential would have been from 22 000 to 25 000 years, which again is an evolutionary split-second. Thus, the old idea that isolation and slow population growth were barriers to human expansion had to be dismissed simply from what is known of population and demographic processes. This particular paper has led to a rethinking of the whole fossil-man story, and the picture is still far from complete, but the essential parameters were set forth by Jo in his usual insightful way, a mix of good empirical observations combined with a creative and fertile approach to problems. Without this essential creativity, palaeontologists simply could not analyse their data productively, even if the fossil record were nearly complete.

Birdsell's collaboration with Carleton Coon and Stanley Garn (1950) represents the first major break in the study of race and racial formation. Under Hooton and other physical anthropologists throughout the first five decades of this century, the notion of race was based on a set of phenotypical features which could be measured and compared, but these features had little or no adaptive utility. Thus, Hooton conceived a race as a cluster of non-adaptive features based primarily on forces of inheritance, although virtually nothing was known about inheritance and genetic transmission. While the distribution of blood type alleles was known to manifest different proportions according to race, as a taxonomy, racial classification was dealt with in a virtually non-biological way.

The Coon, Garn and Birdsell approach moved away from gross phenotypical contrasts and stressed race as a continuing historical process of adaptation to particular broad environmental forces. Furthermore, race was treated as a micro breeding unit through which one could show how various markers are transmitted as specific genetic features which ideally can be related to gene frequencies. It was on the level of local Mendelian populations or breeding units that race manifested and expressed evolutionary processes. In the 1940s, these ideas were highly important, since for the first time they moved the study of racial formation to specific environmental and biological parameters which acted selectively with the genotypoe as well as certain phenotypical features.

My initial contact with Jo Birdsell was in 1956 when I enrolled in the Department of Anthropology as the first year graduate student at ULCA. Coming in with only three undergraduate anthropology courses meant that virtually everything I encountered was new, exciting and challenging, and during my two years at ULCA I took Jo's undergraduate courses as well as his seminars. Jo's style of lecturing was inspiring to all his students in that he conveyed a deep knowledge of the subject matter combined with an openness of ideas which provoked students to challenge him on the spot. Above all, he insisted that we work through ideas and clusters of data in a method in which "educated speculation" emerged as a means of seeing new problems derived from older and possibly less interesting issues. It was in these seminars that we had a chance to work through various ideas which he was developing and which soon appeared in the journals.

Furthermore, a few of us worked for him tabulating his data from his first field trip to Australia as well as his last one in the early 1950s. Clyde Wilson, Robert Littlewood and I spent hours in the late afternoons, evening and sometimes on the weekends tabulating all the findings on a single variable. It was this experience which brought forth Jo's insistence that incorporating maximum biological, social and interactional data on a genealogical grid was the most essential strategy in dealing with a vast range of data. His genealogies were impressive, and, being a neophyte, I was always wondering what it meant and where was it going. Thus he was a gifted teacher, one who was articulate beyond expectation, one who knew his subject matter, and one who knew how to think about his data in a venturesome and creative way. At the same time we all sensed that his broad and bold thinking would culminate in a work which was readily approachable. In 1972 Birdsell published a textbook titled 'Human Evolution', a book which has since gone through various editions. Reading Jo's textbook is equivalent to hearing vintage Birdsell in person. Ideas abound on the pages, the case studies and data are fascinating, and his ability to convey a broad spectrum of issues, concerns and doubts in an engaging way express an intellectual love of his subject matter that never waned.

Two different styles of Jo's pedagogy should be noted. First was his insistence that empiricism was fundamental to what biological anthropologists must set forth as theories or as hypotheses. Models and the craft of modeling were based on empirical knowledge, but Birdsell always felt that empiricism could only take one so far. There are some limits to explanation and interpretation intrinsically due to a lack of information, but the wisdom and experience that students received from him were that one need not be curtailed and/or limited by empiricism. Educated speculations were as valid as pure empirical information, and in most cases the speculations were more interesting and led to a discussion of new problems and future kinds of research.

Second was Jo's insistence on examining problems, issues and debates in a different and unique way. Here Jo would ask what an event, thing, theory or strategy could not be. By focusing on conditions which either empirically and/or logically could not be the case, we were forced to imagine the range of all possibilities, even if some of these simply could not occur. In each case, the feasibility of the occurrence of an event or thing compelled seminar participants to show the empirical basis and/or logic relating to the presence and absence of factors. In contemporary philosophy this form of analysis is called counterfactual thinking, and it has had an important effect on the way that philosophical and logical arguments are crafted. Birdsell understood this form of thought well before it came into vogue. Nearly four decades after that two year experience with Jo, the impact of his thought and the way he saw problems is still central to my own work.

After finishing an MA at UCLA in 1958, I moved on to the University of Chicago to pursue my doctorate in social anthropology. For the following thirty to forty years, Jo and I were in communication on various Australian matters, especially every time I returned from Australia.

It goes without saying that he will be sorely missed by his friends and former students. The experience of his seminars, of seeing him craft an argument, either on paper or verbally, and the kind of deep probing which he asked of himself and his students will all be missed. Those of us who experienced the man hold him in deep appreciation and are much in his debt, for there will never be another 'Jo' in our midst.

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THE WATER SKINKS (LACERTILIA: *EULAMPRUS*) OF VICTORIA AND SOUTH AUSTRALIA

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HUTCHINSON, M. N. & RAWLINSON, P. A. 1995. The water skinks (Lacertilia: *Eulamprus*) of Victoria and South Australia. *Records of the South Australian Museum* **28**(2): 185–207.

The taxonomy, biology and distribution of the Victorian and South Australian water skinks of the *Eulamprus quoyii* species-complex are reviewed. A lectotype is designated for *Scincus vittatus* Quoy & Gaimard, 1824. Five taxa are recognised: *E. quoyii* Duméril & Bibron from the lower Murray River valley and Mt Lofty Ranges, *E. heatwolei* Wells & Wellington from warm temperate eastern Victoria and the Fleurieu Peninsula, *E. kosciuskoi* Kinghorn from alpine northeastern Victoria and *E. tympanum* Lönnberg & Andersson, the latter with two subspecies, *E. t. tympanum* (including *E. herseyi* Wells & Wellington, 1985), widespread through cool temperate habitats and *E. t. marnieae* ssp. nov., restricted to the stony rises east and north of Lake Corangamite where its survival is threatened by habitat degradation.

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The water skinks form a group of closely related medium sized to moderately large (SVL to 118 mm) Australian lygosomine scincid lizards that inhabit the margins of watercourses throughout the coastal drainage systems of eastern and southeastern Australia (excluding Tasmania). Water skinks are conspicuous, active diurnal heliotherms (Spellerberg 1972b) which readily use water as a refuge, swimming on and under the surface (Daniels & Heatwole 1990).

Traditionally these lizards have been placed in *Sphenomorphus*, either as a subgenus of the catchall *Lygosoma* (Smith 1937) or, following Loveridge (1934) and Mittleman (1952), as a full genus. Recent Australian usage (Cogger 1992, Greer 1989, 1992) has recognised the paraphyletic nature of *Sphenomorphus* (see Greer 1979a, Greer & Parker 1967) by employing the long-disused name *Eulamprus* Fitzinger (type species *quoyii*) for the larger Australian viviparous '*Sphenomorphus*', including the *E. quoyii* complex. As yet there has not been a rigorous phylogenetic assessment of this assemblage, but Shea & Peterson (1985) and Greer (1989, 1992) discuss some potentially useful characters which indicate that *Eulamprus* is at least more likely to be a natural unit than the much larger and obviously heterogeneous assemblage represented by *Sphenomorphus*, and it is provisionally accepted in this paper.

The first described member of this group was Quoy & Gaimard's (1824) *Scincus vittatus*, the 'Scinque à flancs noirs', from the Sydney region. Duméril & Bibron (1839) redescribed the species using the replacement name *Gongylus (Lygosoma) quoyii*, and as *Lygosoma* or *Sphenomorphus quoyii*, the water skink has become a familiar and relatively well-studied eastern Australian lizard (e.g. King 1964, Veron 1969, Spellerberg 1972a–d, Daniels 1987).

Early workers in Victoria and South Australia (Lucas & Frost 1894, Waite 1929) were familiar with a lizard they referred to as *Lygosoma quoyii*, although specimens from southern Australia do not conform in all respects to the east coastal populations. Two new water skink taxa were described during the early part of this century, *Lygosoma tympanum* from near Melbourne (Lönnberg & Andersson 1913) and *Hinulia quoyii kosciuskoi* from Mt Kosciusko (Kinghorn 1932). Loveridge (1934), in spite of some uncertainty, synonymised *kosciuskoi* with *tympanum*, treating the latter as a southern and highland subspecies of *quoyii*. Worrell (1963) recognised *tympanum* as a full species, distinct from *quoyii*, but did not query the synonymy of *tympanum* and *kosciuskoi*.

Rawlinson (1969) reported that *tympanum* and *kosciuskoi* were distinct species, and that both were distinct from *quoyii*, the three being collectively referred to as the *Sphenomorphus*

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[1] Peter Rawlinson died in April 1991. His unpublished studies of type material and his taxonomic insights form the basis of this paper.

quoyii species complex. He also reported a fourth, undescribed member of the complex, referred to as the 'Warm Temperate' form of *S. tympanum.* The data on which Rawlinson's conclusions were based were not presented at the time but these conclusions have become widely used (Cogger *et al.* 1983).

Five species of water skinks are recognised by Cogger (1992). In addition to *Eulamprus quoyii, E. tympanum* and *E. kosciuskoi, E. heatwolei* Wells & Wellington (1984) is applied to New South Wales populations of Rawlinson's 'Warm Temperate' form of *E. tympanum* (Shea & Peterson 1985, Cogger 1992) while *E. leuraensis* Wells & Wellington (1984) is applied to the Blue Mountains population formerly referred to *E. kosciuskoi.*

Shea & Peterson (1985) have summarised data pertinent to New South Wales water skink populations but variation in the southerly parts of their distributions is not well documented and the distributions themselves are not mapped with sufficient resolution in Cogger's books. Much of what is known, including the taxonomic distinctiveness of *tympanum* from *quoyii* and in turn of *heatwolei* from *tympanum* stems from unpublished work of the second author. In addition, a hitherto unreported, morphologically distinctive population of water skinks has been found in central southwestern Victoria. The purpose of this paper is to stabilise the nomenclature, document the distinguishing features and geographic distribution of the four described water skinks in Victoria and South Australia, and to describe the newly discovered Victorian form.

MATERIALS AND METHODS

The specimens on which this study is based are primarily those of the Museum of Victoria (NMV) and the South Australian Museum (SAMA). Except where indicated, specimen descriptions are based only on Victorian and South Australian specimens. Other Museum abbreviations used here (following Leviton *et al.* 1985) are: AMS, Australian Museum, Sydney; BMNH, Natural History Museum, London; MNHN, Muséum Nationale d'Histoire Naturelle, Paris; NHRM, Naturhistoriska Riksmuseet, Stockholm; NMW, Naturhistorisches Museum, Vienna.

Head shield terminology used in this paper is illustrated in Figure 1. Supraciliaries were counted to the last scale in contact with both the upper palpebrals and the supraoculars. Presuboculars are the scales between the posterior loreal and the subocular supralabial. The postsubocular scale row is formed by the series of scales beginning on the orbital margin of the postsubocular supralabial and running dorsally to the posterior supraciliary. The last infralabial was difficult to distinguish from adjacent scales when the mouth was closed; it was identified here as the last scale contacting the ventral margin of the last supralabial. Scale counts were made using standard criteria (e.g. Greer 1982). Shea & Peterson (1985) employed a different method for counting paravertebral scales than the one used here: they stopped the count at the level of the anterior edge of the hind limb, whereas we followed Greer (1982) in taking the counts posteriorly to the first scale posterior to a line level with the posterior edge of the hind limb held at right angles to the body. This count estimates the number of scales overlying the trunk vertebrae (including the sacrals). Measurements of snout–vent length (SVL), tail length and hind limb length (HLL) were made to the nearest millimetre using a ruler. Head width (HW, measured across temporal jaw muscle bulge) and head length (HL, measured from snout to anterior edge of ear opening) were measured using dial calipers to the nearest 0.1 millimetre. Size at sexual maturity was estimated from smallest female with enlarged ova or male with enlarged testes. Osteological data were obtained primarily from the water skink skeletal collection assembled by S. J. Tilley, now in the collection of the Museum of Victoria.

SYSTEMATICS

SCINCIDAE Gray, 1825
LYGOSOMINAE Mittleman, 1952

Eulamprus Fitzinger, 1843

A group of lygosomines belonging to the *Sphenomorphus* Group (Greer, 1979b), sharing the derived features of moderately expanded palatal rami of the pterygoids and viviparous reproduction, but lacking the derived character states of other members of this Group. Within this genus, the *E. quoyii* species group shares four derived character states: third pair of chin shields separated by five smaller scales; inguinal fat bodies absent; distal supradigital scales in a single row; subdigital lamellae grooved, divided basally (after Greer 1989).

Other features shared by all species in the complex are as follows. Nasals separated medially. Supranasal and postnasal scales absent.

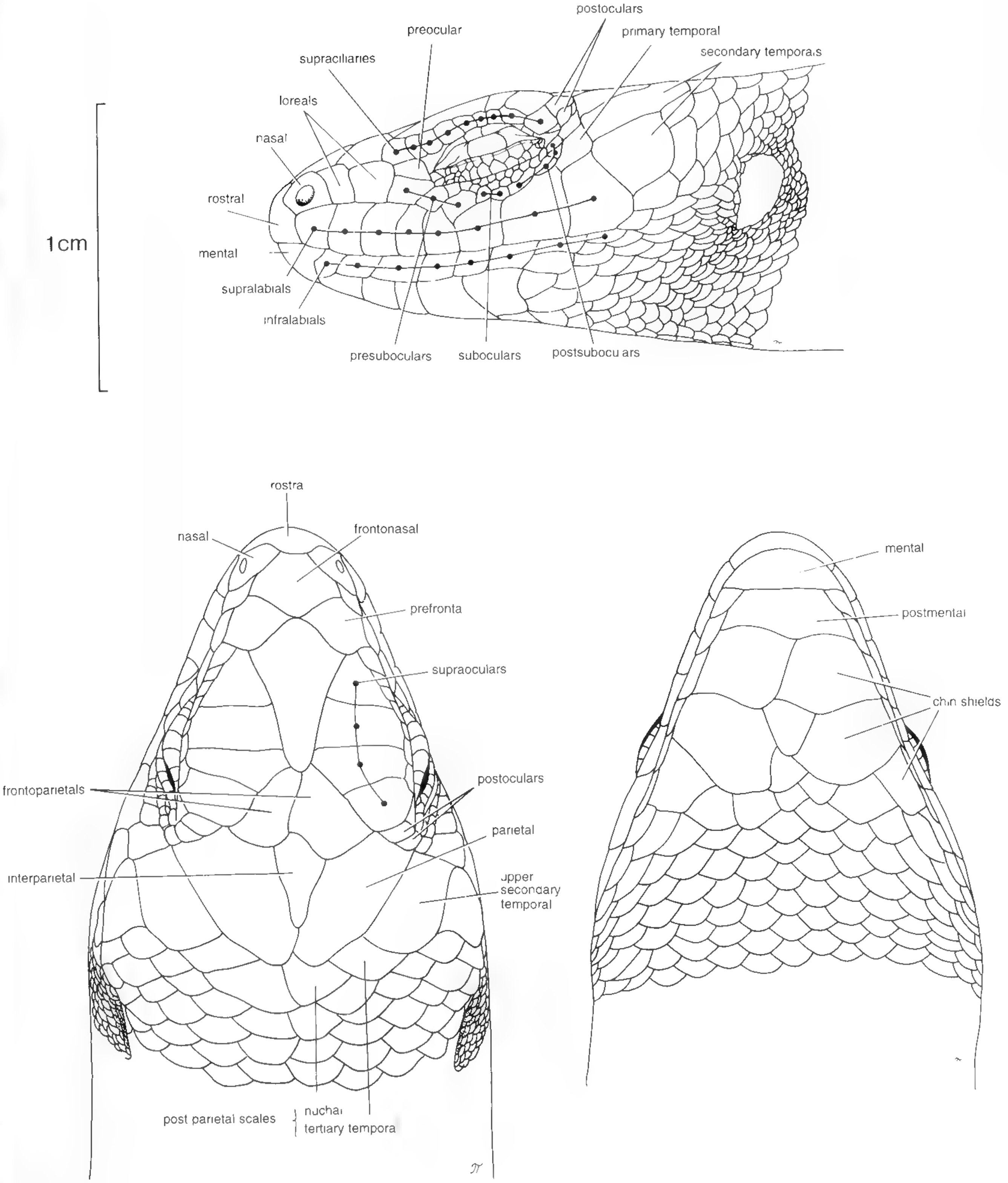

FIGURE 1. Head of a water skink (*Eulamprus t. tympanum*; NMV D50716) showing head shield nomenclature used in this paper.

Two subequal loreals. A single preocular. Lower eyelid scaly. Three presuboculars, the third penetrating downwards in front of the subocular supralabial. Two or three subocular scales. Four supraoculars, the first three (rarely first two) contacting the frontal. Two or three postoculars lie between the posterior supraciliary and the parietal; the dorsalmost and often the largest of these could be regarded as a small fifth supraocular, and its designation as a postocular here is arbitrary, reflecting traditional treatment of these species (e.g. Cogger 1992) as having only four supraoculars. Frontoparietals paired; interparietal distinct. Primary temporal small, variable intraspecifically, sometimes scarcely distinct from postsubocular scales. Upper secondary temporal longer than deep, contacting lateral margin of parietal scale and bordered below by single lower secondary temporal which is deeper than long; upper temporal may be divided by a vertical suture and lower by a horizontal suture in a minority of specimens. First pair of chin shields in broad median contact; second pair separated by a single scale. Ear opening large, three-quarters the size of the eye, its margin smooth-scaled and without projecting auricular lobules. Median pair of preanals much larger than lateral preanals.

Water skinks show ontogenetic variation in two significant scale characters. In the *Sphenomorphus* Group, each parietal is usually bordered along its posterior margin by a transversely enlarged nuchal (medially) and along its lateral margin by the upper secondary temporal and an additional large scale intercalated between the nuchal and the upper secondary temporal. Most adult water skinks, the alpine species excepted, lack this scale morphology, having instead four or five variably enlarged and often obliquely oriented and asymmetrically arranged scales filling the gap between the upper secondary temporal on each side. Neonates (Fig. 2), however, have the more common lygosomine arrangement of two transversely aligned nuchals. Positive allometric growth of the upper secondary temporal relative to the parietal appears to crowd the post-parietal scales in adults. Water skinks as subadults and adults have smooth body scalation but neonates have all dorsal and lateral body, tail and limb scales keeled, with up to four low keels or pustules on each dorsal scale producing a wavy trailing edge. The scales become smooth and cycloid as the carination is lost at a snout vent length of about 40–45 mm.

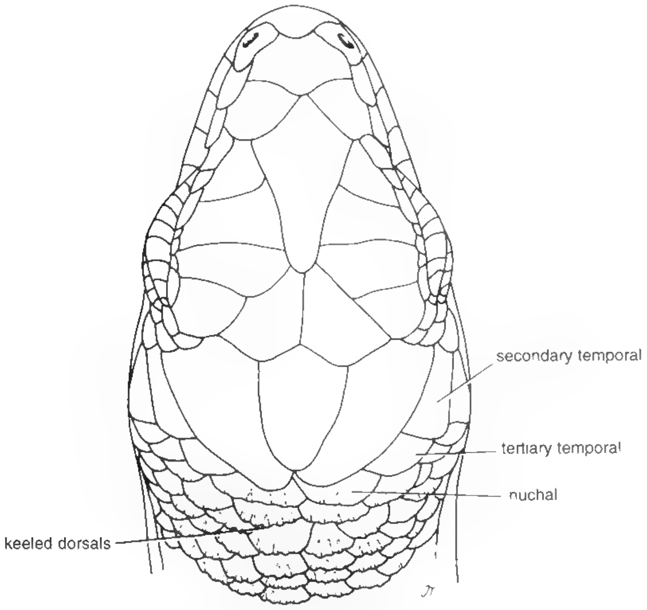

FIGURE 2. Head and forebody of a neonate water skink (*Eulamprus t. tympanum*; NMV D13654). showing the arrangement of post-parietal scales (compare to Fig. 1) and the keeled dorsal body scales present in juveniles but lost early in ontogeny.

Presacral vertebrae 26. Phalangeal formula of manus and pes 2.3.4.5.3 and 2.3.4.5.4 respectively. Postorbital bone present, intraspecifically variable in dorsal exposure from elongate and extending to the supratemporal fenestra to greatly reduced and restricted to the region of thejugal articulation. Supratemporal fenestra large. Ectopterygoid without or with variably developed palatal process which may extend to the palatine, excluding the pterygoid from the infraorbital vacuity. Hemipenis elongate with deep distal bifurcation. Iris of eye black, indistinguishable from pupil in life.

The water skinks show slight sexual dimorphism in proportions, females reaching a slightly larger SVL and males having relatively longer limbs and larger heads. Within species, dimorphism becomes more obvious with increasing body size. Both sexes attain sexual maturity at similar sizes.

Eulamprus quoyii (Duméril & Bibron, 1839)

(Figs 3–4)

Scincus vittatus Quoy & Gaimard, 1824: 178. Lectotype (designated herein): MNHN 7112, Neutral Bay, Port Jackson, New South Wales, F. Péron. (Junior homonym of *Scincus vittatus* [= *Mabuya vittata*] Olivier, 1804).

Gongylus (Lygosoma) quoyii Duméril & Bibron, 1839: 728. Lectotype (Wells & Wellington 1985): MNHN 7113, Neutral Bay, Port Jackson, New South Wales.

Eulamprus quoyii Fitzinger, 1843: 22.

Hinulia quoyii Gray, 1845: 70.

Hinulia gastrosticta Günther, 1875: 11. Lectotype (Wells & Wellington 1985): BMNH 1946.8.15.34 'Queensland', purchased from G. Krefft.

Lygosoma (Hinulia) quoyii Boulenger, 1887: 230.

Sphenomorphus quoyi Barbour, 1914: 204.

Sphenomorphus quoyii quoyii Loveridge, 1934: 349.

Lygosoma (Sphenomorphus) quoyi Smith, 1937: 220.

Eulamprus gastrostictus Wells & Wellington, 1984: 93.

Types

As the oldest available name relating to this group of lizards, Duméril & Bibron's (1839) *Gongylus (Lygosoma) quoyii* must be confidently allocated before other names can be applied. Five syntypes used by Duméril & Bibron are still identifiable in the MNHN collection, four of which are members of the *E. quoyii* species complex, the fifth (7114) being a specimen of the Asian species *Scincella reevesi.* Of the remaining four, two (7112–13) were collected by Péron and are identified by the MNHN as syntypes of *Scincus vittatus* Quoy & Gaimard. Both have a colour pattern which includes well-developed narrow pale dorsolateral lines, matching the figure provided by Quoy & Gaimard (1824) and the description of Duméril & Bibron (1839). The remaining syntypes, 2976 (Port Macquarie, J. Verreaux) and 2977 (Nouvelle Hollande, Lesson et Garnot) are conspecific with 7112 and 7113. Examination of the types thus confirms that the current taxonomy is correct in applying the name *quoyii* to the east-coastal Australian member of the complex. One of Quoy & Gaimard's syntypes, 7113, SVL 105 mm, was designated by Wells & Wellington (1985) as the lectotype of *Gongylus (Lygosoma) quoyii* Duméril & Bibron, 1839. This specimen is not in good condition, the mouth and neck being badly mutilated; however there is no doubt of its specific identity . The other syntype, 7112, is in excellent condition and would have been a better choice. It is hereby designated as the lectotype of *Scincus vittatus* Quoy & Gaimard, 1824.

Four syntypes of Günther's *Hinulia gastrosticta* are in the collection of the Natural History Museum, London (BMNH 1946.8.4.99 and 1946.8.15.34–36) and two more identified as 'Typus' are in the NMW (16656:1–2). All six are conspecific with the lectotype of *Gongylus (Lygosoma) quoyii,* confirming the correctness of Boulenger's (1887) synonymisation of *gastrosticta* with *quoyii.* One of the BMNH syntypes, 1946.8.15.34 (at 101 mm SVL, the largest of the four), was designated as lectotype of *Hinulia gastrosticta* Günther, 1875, by Wells & Wellington (1985) who gave no reason for resurrecting the species from synonymy, nor did they provide any distinguishing features. We here return *gastrosticta* to the synonymy of *quoyii.*

Diagnosis

A large water skink (adults reaching over 110 mm snout–vent) with sharply-defined narrow pale yellow dorsolateral stripes but without a black vertebral stripe.

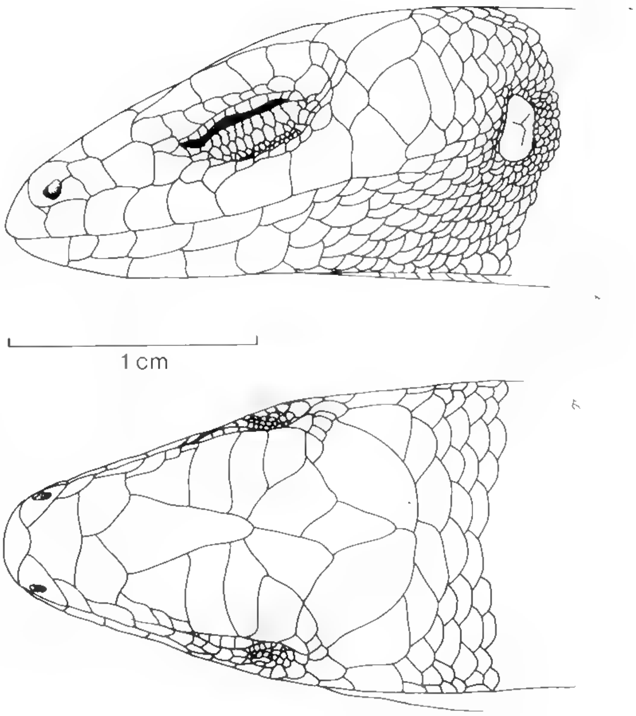

FIGURE 3. Head shields of *Eulamprus quoyii* (SAM R33009).

Description

36–42 (x̄ 39.3, n = 36) longitudinal scale rows at midbody. Paravertebral scales 74–88 (x̄ 79.7, n = 36), no larger or only slightly broader than adjacent dorsals. Subdigital laellae on fourth toe 24–32 (x̄ 27.4, n = 35), most with a median groove and those at the base of the toe divided.

Prefrontals usually broadly contacting (narrowly separated in 4 out of 36). Interparietal elongate, approximately one and a half times as long as wide, but never separating parietals. Each parietal bordered posteriorly by one to three nuchal scales and laterally by the upper secondary temporal. Supraciliaries 9–12 (x̄ 9.7, mode 9); first to third or fourth forming decreasing series, next three to five smallest, last two larger, usually penetrating dorsally each side of the fourth supraocular. Supralabials 7–8 (mode 7), fifth or sixth subocular. Infralabials 7–10 (modes 8 and 9), first and second always and third sometimes in contact with (single) postmental.

Premaxillary teeth usually 9 (n = 9); single specimens each with 7 and 8.

Dimensions (of adults, n = 32). SVL 82–112 mm (x̄ 94.9 mm). HW 11.2–17.2 mm. HL 17.3–24.9 mm. HL/HW 1.36–1.68, (x̄ 1.53). HW/SVL 0.118–0.177 (x̄ 0.146). HLL 31–43 mm. HLL/

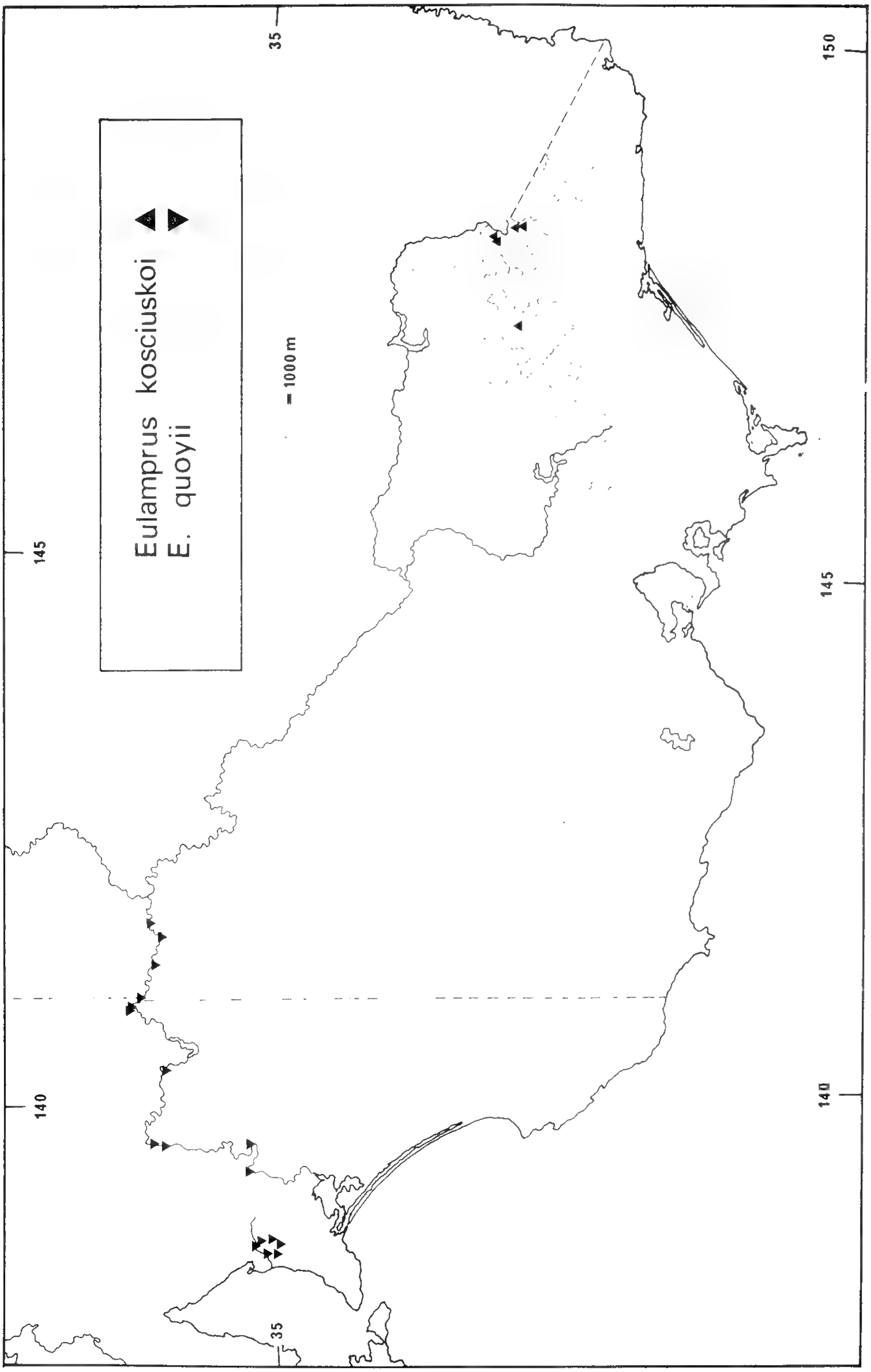

FIGURE 4. Distribution of *Eulamprus quoyii* and *E. kosciuskoi* in Victoria and South Australia.

SVL 0.333–0.464 (x̄ 0.401). Tail length/SVL (n = 8) 1.71–1.89 (x̄ 1.80).

Colour (in preservative) light to medium brown on the dorsal surface of the head, body, tail and limbs. Dorsum of head and body with a few irregularly scattered flecks. Limbs brown with irregular black bars. A narrow, well-defined pale yellow dorsolateral stripe runs from the supraciliaries posteriorly to half way along the back, whence it breaks up and fades before reaching the hips. This stripe often margined medially by a narrow black line. Upper lateral zone black, the colour extending anteriorly to the ear opening. Two to three uneven series of pale dots (each covering one to two scales) overlie the black. Temporals and posterior supralabials usually obscurely spotted with darker pigment. Lower lateral zone greyish-yellow with black flecks tending to align along scale rows to form weak barring. In adults of both sexes infralabials, chin shields and throat pale to dark grey, spotted with cream, the spotting smaller and arranged in longitudinal lines on the throat. Juveniles and subadults lack this pattern, having instead uniform greyish-yellow throat colouring. Underside yellowish white with fine black dots.

In life the colour is similar to that in preservative.

Distribution

The Murray River from its junction with the Darling downstream to about Tailem Bend, South Australia (Fig. 4). A disjunct population occurs in the Mt Lofty Ranges. Extralimitally the species occurs along the Darling River and along the east coast of Australia from Cairns, Qld, south to about Jervis Bay, New South Wales.

Ecology

Eulamprus quoyii is only found adjacent to water, living beside permanent lakes, swamps and billabongs or on the banks of perennial streams, typically being observed on logs or rocks emerging from the water's edge. It appears to have colonised this part of its range by expansion over the Great Divide into the headwaters of the Darling system, and along its course to the Murray. This species thus extends into a climatically unsuitable (arid) environment by restricting its activity to the mesic riparian corridors (Littlejohn & Rawlinson 1971).

Aspects of the ecology of *E. quoyii* have been examined by Veron (1969), Spellerberg (1972b–d), Daniels (1987) and Daniels & Heatwole (1984, 1990), all studies relating to humid, warm temperate, east coastal populations.

Females ovulate late October–November, with litter size (oviducal eggs) ranging 2–5 (x̄ 4.0, n = 5) in Murray Valley and Adelaide Hills specimens. Testes are enlarged between April and August, and regress over spring to a minimum in November–January. The species is viviparous, the young being born during January and February. Mating has been recorded by Veron (1969) as occurring in spring.

Discussion

This species is the type of Fitzinger's genus *Eulamprus*, and Gray's *Hinulia* (Mittleman, 1952), and featured in several early studies of lizard anatomy (Siebenrock, 1892, 1895, Busch 1898). More recently it has been subjected to a variety of anatomical and physiological studies (King 1964, Daniels 1985, Daniels, Heatwole & Oakes 1987, Daniels, Oakes & Heatwole 1987).

Eulamprus quoyii is much the largest of the species in the *E. quoyii* complex, with a mean adult SVL of 95 mm and a maximum of 118 mm (extralimitally), both values being roughly 15 mm greater than the corresponding values for the next largest species (*E. heatwolei* and *E. tympanum*). It shares with *E. heatwolei* the most gracile proportions seen in the group, with the longest extremities and slenderest head.

Distribution in the area considered is limited to the Murray River valley and three west-flowing river systems (Torrens, Sturt and Onkaparinga) of the adjacent Mt Lofty watershed. The grey and cream mottled throat pattern is more weakly developed in Mt Lofty populations compared with the Murray Valley populations, suggesting slight differentiation of the two. In this feature, the Mt Lofty populations are more similar to the east coast New South Wales populations in which throat patterning is also weakly developed or absent.

Eulamprus tympanum tympanum (Lönnberg & Andersson, 1913)

(Figs 1, 5)

Lygosoma tympanum Lönnberg & Andersson, 1913: 9. Holotype: NHRM 3094 'neighbourhood of Melbourne', Victoria.

Sphenomorphus quoyii tympanum (part) Loveridge, 1934: 350.

Sphenomorphus tympanus Mittleman, 1952: 31.

Sphenomorphus tympanum (part) Worrell, 1963: 53.

Sphenomorphus tympanum Cool Temperate Form, Rawlinson, 1969: 119.

Eulamprus tympanum Wells & Wellington, 1984: 94.

Eulamprus herseyi Wells & Wellington, 1985: 29. Holotype: AMS R111949 (formerly AM Field Series 16791), Dora Dora National Park Proposal Area near Albury, New South Wales.

Type Specimens

The holotype of *Lygosoma tympanum*, NHRM 3094, is in good condition and clearly identifiable as belonging to the 'Cool Temperate Form' of Rawlinson (1969). The anterior margin of the ear opening is pale, the throat and chin are smudged with grey and there is no trace of a pale post-supraciliary streak. Midbody scales are in 37 rows. The specimen is immature, with a SVL of 46 mm. The appearance of the specimen is consistent with the collection data–'said to have been collected in the neighbourhood of Melbourne, July 1911'.

Wells & Wellington (1985) failed to differentiate *Eulamprus herseyi* from its congeners. Their purported diagnosis merely listed a number of scalation and meristic parameters none of which, either individually or collectively, differentiates *E. herseyi* from *E. heatwolei, E. tympanum* or even *E. quoyii*. The only exception is the supposed five supraoculars. The holotype does have five supraoculars on the right side due to an abnormally divided first supraocular but the normal count of four is present on the left side and the specimen is otherwise a typical *E. tympanum*. Wells & Wellington define their genus *Eulamprus* (restricted to the *quoyii* complex) as having four supraoculars, although two of the three species they described, *E. heatwolei* and *E. herseyi*, were said to have five. Possibly the small scale at the posterior end of the supraoculars (see above, p. 187) is responsible for this inconsistency.

Diagnosis

A water skink lacking any trace of longitudinal dorsal striped pattern, with a pale anterior margin to the ear opening, usually 42 or fewer midbody scale rows and without transversely oriented dark dorsal markings.

Description

36–44 ($\bar{x}$ 39.2, n = 116) longitudinal scale rows at midbody. Paravertebral scales 68–89 ($\bar{x}$ 75.3, n = 116), scarcely broader than adjacent dorsals. Subdigital lamellae on fourth toe 18–29 ($\bar{x}$ 22.4, n = 109), most with a median groove and those at the base of the toe divided.

Prefrontals separated (freq. 0.45) or in point to moderately broad contact. Interparietal elongate, approximately twice as long as wide, but usually not separating parietals (frequency of separation 0.11). Each parietal bordered posteriorly by one to three nuchal scales and laterally by the upper secondary temporal. Supraciliaries 8–10 (> 3 > rest. Supralabials 6–9 ($\bar{x}$ 7.1, mode 7, n = 40), fourth, fifth or sixth subocular. Infralabials 6–9 ($\bar{x}$ 7.5, mode 7, n = 40), first and second in contact with (single) postmental.

Premaxillary teeth usually 8 (n = 9), less often 9 (n = 4) or 7 (n = 1).

Dimensions (adults, n = 90). SVL 66–93 mm ($\bar{x}$ 81.7). HW 10.0–14.6 mm. HL 14.7–19.9 mm. HL/HW 1.27–1.59 ($\bar{x}$ 1.43). HW/SVL 0.137–0.168 (x 0.151). HLL 26–36 mm. HLL/SVL 0.311–0.449 ($\bar{x}$ 0.379). Tail length/SVL (n = 26) 1.40–1.83, $\bar{x}$ 1.58.

Colour (in preservative) light to very dark brown on the dorsal surface of the head, body, tail and limbs, immaculate or with few to numerous irregular black flecks. No suggestion of a pale dorsolateral stripe. Tail with dark flecks better developed laterally than dorsally; limbs overlain by heavy black network. Upper lateral zone black, the colour usually fading to brown on the temples. Several uneven series of widely spaced pale dots (each covering only a single scale) overlie the black. A pale horizontal streak runs posteriorly from the dorsal rim of the ear opening and is continuous with the pale anterior edge of ear opening. Lower lateral zone pale grey, lightly dotted with pale yellow and dark grey, less often with weak black barring. Chin and throat light to dark grey in most populations, sometimes with darker smudges. Otway Ranges specimens sometimes with black throats. Remainder of underside yellowish white, sometimes immaculate but usually with black markings which may occur as small dark flecks or as black pigment concentrated along the edges of scale rows, forming thin lines.

In life the general colour is similar in most populations. Ventral colour of Otway Ranges specimens usually bright yellow.

Distribution

The Great Dividing Range, continuous from the New South Wales border to about Ballarat, extending south from the Divide into southern Gippsland. Disjunct populations occur around the Pyrenees, Grampians and Otway Ranges and far southwestern Victoria and southeastern South

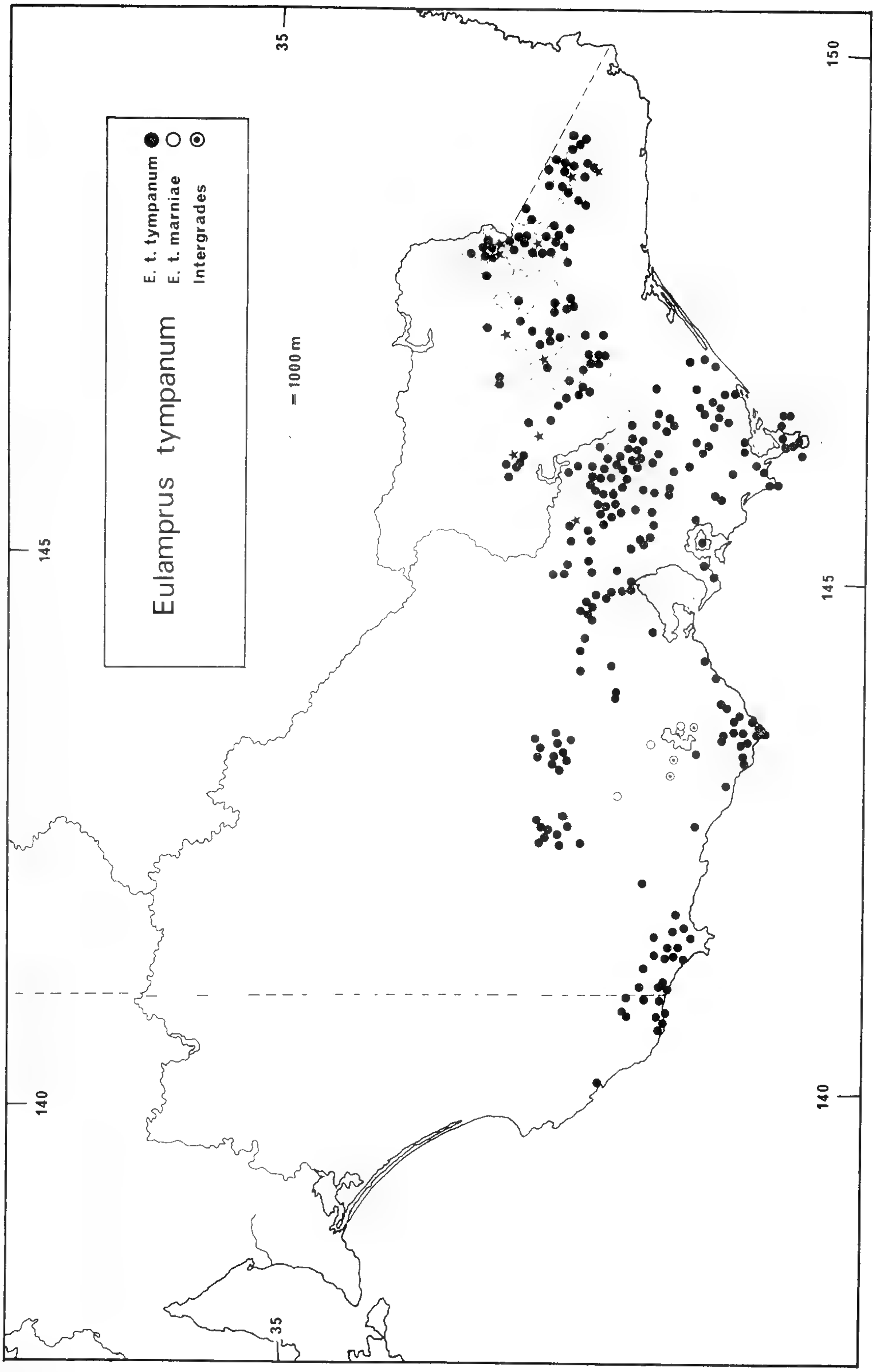

FIGURE 5. Distribution of *Eulamprus tympanum* in Victoria and South Australia. The stars denote localities where *E. heatwolei* and *E. t. tympanum* have been collected in syntopy.

Australia (Fig. 5). Extralimitally the species extends northward along the Great Dividing Range as far as the Blue Mountains, west of Sydney, New South Wales.

Ecology

Aspects of the ecology of *E. t. tympanum* have been covered by Rawlinson (1969, 1971, 1974), Spellerberg (1972b–d), Pengilley (1972), Tilley (1986), Brown (1991) and Schwarzkopf (1992). It is a diurnal and heliothermic skink, restricted to the margins of water courses only in the lower rainfall portions of its range (e.g. the northern and western margins of Melbourne). Over much of cool temperate southeastern Australia, *E. t. tympanum* is a widespread forest-dwelling species. In montane forests in eastern Victoria, the Australian Capital Territory and southern NSW this is one of the most commonly encountered reptile species. Activity is generally centred around rotting fallen logs and stumps which are used as perches for thermoregulation and the cavities of which are used for shelter (Mather 1978, Tilley 1986). Tilley's study demonstrated that the species is probably non-territorial, has low juvenile survivorship but potentially long-lived adults, females living for up to 13 years and males to 11. Brown (1991) found that this species is a generalised invertebrate carnivore, taking only a small proportion of plant matter in its diet.

Females ovulate late October–November, with litter size (oviducal eggs) ranging 2–6 ($\bar{x}$ 4.5, n = 16). Testes are enlarged between April and August, and regress over spring to a minimum in November–January. The species is viviparous, the young being born during January and February. The time of mating has not been recorded. Rawlinson (1974) stated that *E. tympanum* mated in autumn, with overwintering of sperm by females. This latter conclusion was drawn directly from the above mentioned observations of the testicular cycle coupled with the belief that testicular enlargement ought to be correlated with male sexual activity. However, as Greer (1989) noted, both *E. quoyii* (Veron 1969) and *E. heatwolei* (Pengilley 1972) are known to mate in spring even though, like *E. tympanum*, they have a testicular maximum in late autumn–winter. Observational data are needed to establish the time of mating for *E. tympanum*.

Discussion

Eulamprus tympanum is most obviously different from the other water skinks in having a broader head relative to body size than the other species. In body and limb proportions it is intermediate between the gracile *E. quoyii* and *E. heatwolei* and the dumpy *E. kosciuskoi*.

The nominate subspecies shows little geographic variation even though several western populations appear to be isolated from one another. Local trends include larger scales and a greater development of linear black ventral markings in Otway Ranges specimens and longer tails and smaller body scales in Grampians specimens. A general trend is for rock-dwelling, streamside populations to have a greater development of black dorsal flecking than log-dwelling, forest populations.

Eulamprus tympanum marnieae subsp. nov.

(Figs 5–7)

Eulamprus tympanum ssp. nov. Cogger *et al.* 1993: 107.

Types

HOLOTYPE: NMV D52921, adult male, 5.5 km E. of Dreeite, Victoria, 38°11'S, 143°34'E, P. A. Rawlinson; P. Robertson and M. Hutchinson, 1 November, 1979.

PARATYPES: 30 specimens, all from Dreeite area. D49377, D49385–92, D52912–20, D52922–52926, D52955–56, D53977–80, D62035 (see appendix for details of localities).

Diagnosis

A water skink distinguished from all other members of the *E. quoyii* species complex by the very small midbody scales (usually in 43 or more rows, versus usually 42 or fewer), the black dorsal markings arranged as short irregular transverse bars, and bold ventral pattern of black longitudinal bars on a bright yellow (in life) background.

Description

40–48 ($\bar{x}$ 44.8, n = 36) longitudinal scale rows at midbody. Paravertebral scales 76–95 ($\bar{x}$ 84.4, n = 36), no larger or only slightly broader than adjacent dorsals. Subdigital lamellae on fourth toe 20–26 ($\bar{x}$ 22.9, n = 36), most with a median groove and those at the base of the toe divided.

Prefrontals separated (freq. 0.47) or in point to moderately broad contact. Interparietal elongate, approximately twice as long as wide, and almost or actually (0.19) separating parietals. Each parietal bordered posteriorly by one to three nuchal scales and laterally by the upper secondary temporal. Supraciliaries 7–9 ($\bar{x}$ 8.0); first to third forming decreasing series, next three smalles, last two larger, usually penetrating dorsally each side

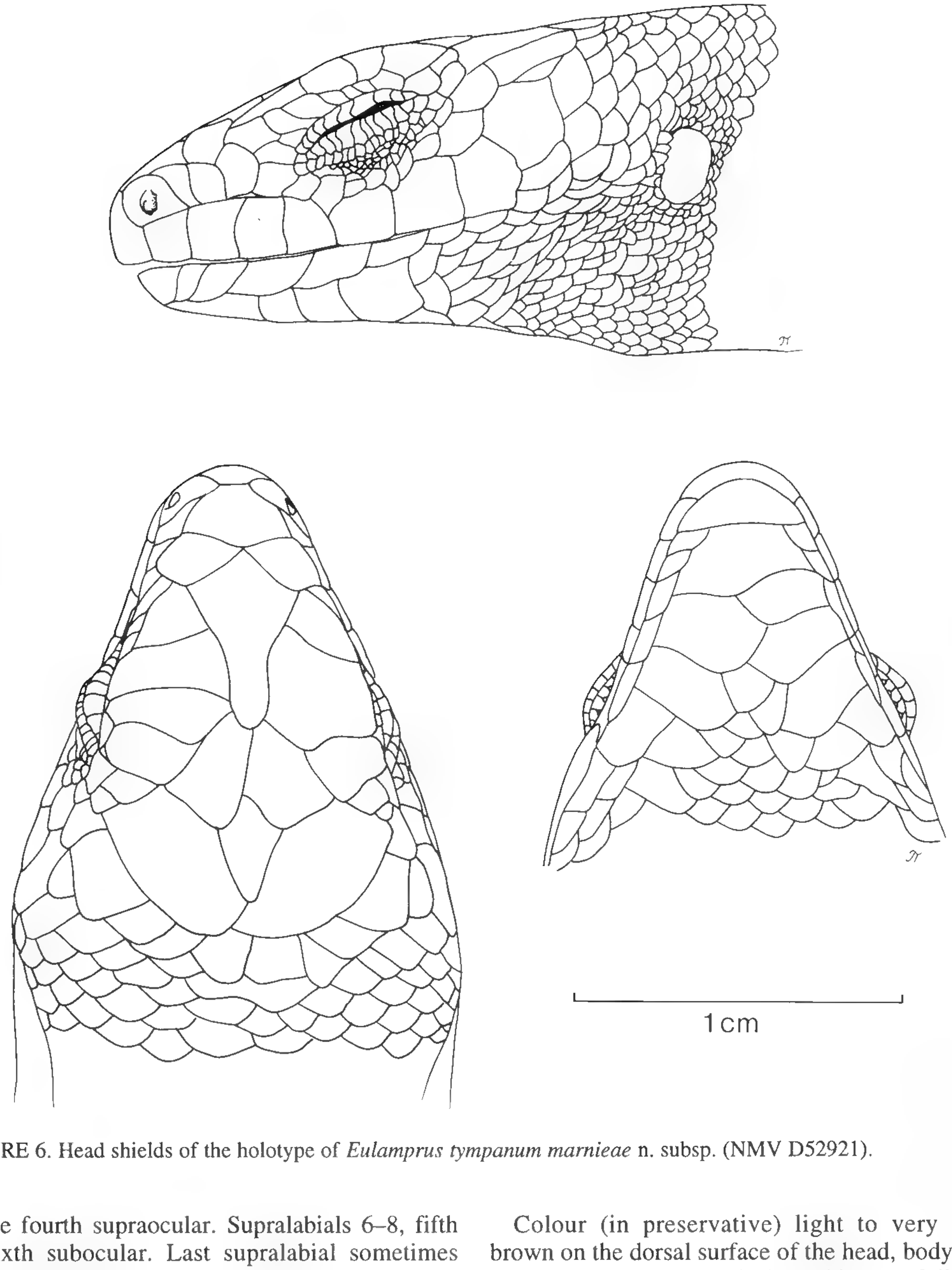

FIGURE 6. Head shields of the holotype of *Eulamprus tympanum marnieae* n. subsp. (NMV D52921).

of the fourth supraocular. Supralabials 6–8, fifth or sixth subocular. Last supralabial sometimes horizontally divided (n = 2) to give the count of six. Infralabials 7–9, first and second in contact with (single) postmental.

Premaxillary teeth 8 (n = 3).

Dimensions (adults, n = 27). SVL 72–97 mm. HW 10.4–15.7 mm. HL 15.3–20.6 mm. HL/HW 1.32–1.50 ($\bar{x}$ 141). HW/SVL 0.132–0.171 ($\bar{x}$ 0.141). HLL 27–36 mm. HLL/SVL 0.323–0.420 ($\bar{x}$ 0.368). Tail length/SVL (n = 6) 1.52–1.72 ($\bar{x}$ 1.63).

Colour (in preservative) light to very dark brown on the dorsal surface of the head, body, tail and limbs, overlain by black markings as follows: head shields with irregularly scattered flecks; back with numerous irregular patches, generally laterally expanded to form transverse bars, some contacting the black upper lateral zone; tail with closely-spaced transverse wavy bars better developed laterally than dorsally; limbs overlain by heavy black network. Upper lateral zone black, the colour extending anteriorly to the eyes. One or two uneven series of widely spaced pale dots

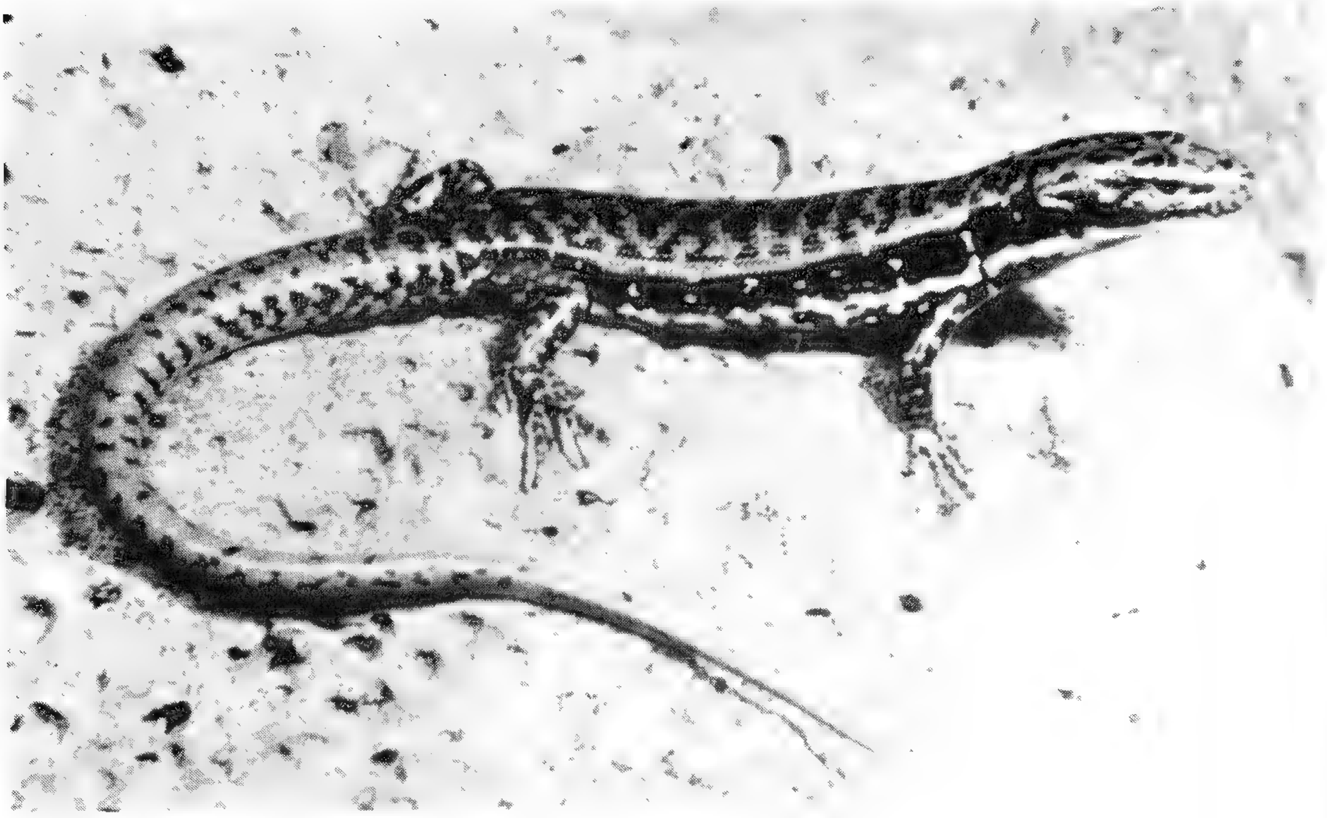

FIGURE 7. Live paratype female of *Eulamprus tympanum marnieae* (NMV D53980) (photo: M. Hutchinson).

(each covering two or three scales) overlie the black, including a whitish temporal spot and a horizontal streak running posteriorly from the dorsal rim of the ear opening and continuous with its pale anterior edge. Dorsal margin of upper lateral black colouring with jagged projections, with a pale spot in the notches between the projections. Lower lateral zone greyish yellow with irregular black barring. Anteriorly to the axilla, the lower lateral zone resolves itself into a midlateral pale stripe. Chin shields white spotted with black. Throat grey-white with large blackish patches laterally which form the ventral margin of the midlateral pale stripe. Underside yellowish white with black pigment forming interrupted longitudinal black patches.

In life the general colour is similar but suffused with yellowish. The dorsal ground colour is frequently bright brassy and the underside of the belly, limbs and tail is bright yellow.

Features of Holotype

Midbody scale rows 47. Paravertebral scales 78. Subdigital lamellae under fourth toe 23. Supralabials 7/8. Infralabials 7/8. Supraciliaries 7/7. Anomalies of scalation include a supernumerary anterior chin shield on the left side and three loreals also on the left side. SVL 80 mm. Tail length 133 mm (1.66 SVL). HLL 33 mm (0.413 SVL). HW 13.0 mm (0.163 SVL). HL 18.0 mm. HL/HW 1.38. Testes regressing.

Etymology

Named for Marnie Lincoln Rawlinson.

Distribution

Rocky outcrops and drystone walls on the northern margins of the basaltic 'stony rises' east and north of Lake Corangamite, southwestern Victoria (Fig. 5). An outlying population occurs beside Lake Bolac to the northwest.

Ecology

A diurnal, evidently heliothermic skink, normally observed perched on a rockpile or fence. Unlike other water skinks this is an extremely shy lizard, fleeing to cover even when a human observer is tens of metres distant and seldom coming into open view while being watched. Like other water skinks, *E. t. marnieae* will dive into water and swim submerged to escape pursuit, but most individuals are observed away from standing water and take refuge in deep gaps in rockpiles. Favoured localities combine remnant arboreal vegetation (notably *Hymenanthera*, Violaceae), deeply fissured basaltic rock piles and permanent or ephemeral swamps. Its habitat in summer can appear very arid compared with the areas inhabited by its relatives, but in winter the terrain is extensively flooded, with almost all depressions and low-lying areas holding water, and it seems likely that the deep rock piles favoured by this subspecies provide cool and humid refuges even during the dry summer months.

Specimens have been collected between the end of winter and mid-summer and in late autumn. Females ovulate late October–early November, with recorded litter size (oviducal eggs) ranging 2–6 (x̄ 4.3, n = 21). Males with enlarged testes have been collected in April and September, with testes regressing in October–November and completely regressed in January. Viviparity is the mode of reproduction in all other water skinks for which mode is known (not confirmed for *E. leuraensis*) so it is highly probable that *E. t. marnieae* is also viviparous. Birth would be expected to occur in January, reinforced by the collection date of the smallest individual in the series, a juvenile (D53977, SVL 39 mm) collected on 24–25 January.

Discussion

The subspecies is known from three populations, each slightly differentiated (see Table 1). Aside from the type population described above, series have been collected from 8 km S of Lismore, Vic., (NMV D36075–084) and from Lake Bolac (D52600–01, D52901–09). The Lismore series is notable for its higher paravertebral counts (up to 98), high frequency of separation of the parietals by the interparietal (8 out of 10) and for a relatively high incidence of division of the last supralabial (4 out of 10). The Lake Bolac specimens are darker, with less yellow pigmentation in life, have the highest midbody scale counts (up to 53), high frequency of separated parietals (7 out of 11) and a common scalation abnormality, fusion of the last two supralabials (5 out of 11).

This taxon is readily distinguished from other water skinks by its small scales and bold dorsal pattern, and the initial conclusion on discovering this form was that it represented a new species. However, subsequent collections suggest that it intergrades with typical *E. tympanum*. North and west, relatively arid conditions provide a barrier between the two; no water skinks have been found in the arc running from between Lake Bolac and the Pyrenees east to about Rokewood and southeast to about Winchelsea. However, to the south and southwest, typical *E. tympanum* is more continuously distributed and specimens from Cororooke (south of Dreeite) and from north of Camperdown (Kariah and Lake Colongulac) are intermediate in colour pattern and scalation between typical *tympanum* and *marnieae* (Table 1).

Such populations have become taxonomically problematic with the recent acceptance of the inadequacy of the old subspecies concept (Collins 1992, Frost *et al.* 1992). The overuse of 'subspecies' to arbitrarily name geographically isolated but undifferentiated populations or to artificially partition continuous or clinal variation has devalued the term, but there remain cases such as the present in which a relatively consistent phenotype confined to a specified geographic area appears to be genetically continuous with adjacent

TABLE 1. Comparison of Victorian populations of *Eulamprus tympanum*. Colour pattern characters scored are: **1**, black transverse dorsal bars present; **2**, black longitudinal ventral bars present; **3**, lateral margins of throat black; **4**, pale lateral flecks cover more than a single scale.

Population (n)	MBSR (x)	PVS (x)	Colour pattern characters 1	2	3	4
E. t. marnieae						
Dreeite area (36)	44.8	84.4	+	+	+	+
8 km S of Lismore (10)	48.4	92.9	+	+	+	+
Lake Bolac (11)	51.1	85.0	+	+	+	+
Intermediate						
Camperdown area (5)	41.0	79.6	–	+	+	–
Cororooke (3)	40.7	77.3	+/–	+	+	–
E. t. tympanum						
Pirron Yallock (2)	39.0	80.0	–	–	–/+	–
Otway Ranges (30)	37.5	73.1	–	–/+	–/+	–
Grampians (30)	40.7	77.0	–	–	–/+	–
Pyrenees–Mt Macedon (26)	39.5	76.8	–	–	–	–
Eastern Victoria (30)	39.3	74.6	–	–	–	–

but phenotypically and geographically discrete populations (Frost & Hillis 1990). In the case of the water skinks reticulate evolution probably occurs at least on the southern margins of the distribution of *marnieae*. The possibility exists of introgression of genes beyond the limits of any putative hybrid zone, suggested by an increase in midbody scale counts south to north moving away from the contact with *tympanum*. To combine the two simply as a binomial *E. tympanum* would bury this most distinctive population, while to recognise *marnieae* as a full species would be to imply an evolutionary independence which is denied by the circumstantial evidence available. Further specimens and biochemical genetic data would illuminate the degree of gene flow currently occurring and would reveal the degree to which the intermediate populations are acting as a bridge or barrier to gene flow; should the latter be established, elevation of *marnieae* to full species status would logically follow. The fact is, however, that such data will be difficult to obtain due to the general difficulty of locating any water skinks in the highly modified intergrade areas.

Eulamprus t. marnieae inhabits a geographically peculiar Victorian landform, technically part of the Newer Volcanics, a region of extensive late Tertiary sheet basalt lava flows, and colloquially known as the 'stony rises'. The 'rises' are basalt ridges and boulder heaps left by the collapse of lava tunnels. The area supports other distinctive herpetofauna, including a small-scaled, speckled form of *Pseudemoia entrecasteauxii* (Hutchinson & Donnellan 1992) and a green morph of the normally brown treefrog, *Litoria ewingii* (Hero *et al.* 1991).

Within its limited geographic range this subspecies occurs only patchily, with only one large colony known. Most of the area in which the species probably once occurred has been extensively modified, with total clearing of vegetation for grazing and continuing demolition of drystone walls and removal of boulders for 'mossy rock' landscape gardening. These processes show no signs of ceasing and the subspecies must be regarded as threatened. The Lismore population was probably wiped out during the rock clearing activities that produced the specimens.

Eulamprus kosciuskoi (Kinghorn, 1932)

(Figs 4, 8)

Lygosoma (Hinulia) quoyii kosciuskoi Kinghorn, 1932: 359. Holotype: AMS R4654, Mt Kosciusko, New South Wales.

Sphenomorphus quoyii tympanum (part) Loveridge, 1934: 350.

Sphenomorphus kosciuskoi Mittleman, 1952: 26.

Sphenomorphus tympanum (part) Worrell, 1963: 53.

Eulamprus kosciuskoi Wells & Wellington, 1984: 93.

Types

The specimens forming the type series, a holotype, AMS R4654, and four paratypes (AMS R558–9, R4832 and R5061), are clearly identifiable as belonging to the southern population. They have a light colour pattern, with weakly marked head and clear light ground colour between the black vertebral and dorsolateral stripes. The dark upper lateral zone does not extend to the ventrolateral area. Midbody scales are in 31–34 rows[2]. The holotype has 34 midbody scale rows, 19 subdigital lamellae and a SVL of 76 mm.

Diagnosis

A small water skink (largest adult 86 mm snout-vent) distinguished from all but *E. leuraensis* by the presence of a black vertebral stripe. Said to differ from *E. leuraensis* by its paler dorsal colouring (including weakly marked head), broader paravertebral stripes and pale-spotted black lateral pattern stopping at the midlateral level rather than extending to the ventrolateral angle of the trunk (Shea & Peterson, 1985).

Description

30–34 ($\bar{x}$ 32.3, n = 37) longitudinal scale rows at midbody. Paravertebral scales 58–68 ($\bar{x}$ 63.6, n = 32), slightly broader than adjacent dorsals. Subdigital lamellae on fourth toe 18–23 ($\bar{x}$ 20.5, n = 32), most with a median groove and those at the base of the toe divided.

Prefrontals moderately separated to broadly contacting (frequency of separated prefrontals 0.38); an azygous 'interprefrontal' sometimes present (frequency 0.16). Interparietal elongate, approximately twice as long as wide, usually (frequency 0.71) separating parietals. Each parietal bordered posteriorly by two moderately

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[2] Shea & Peterson (1985) gave the range for this series as 32–35, but obtained the same average across all five, 32.2, as we did.

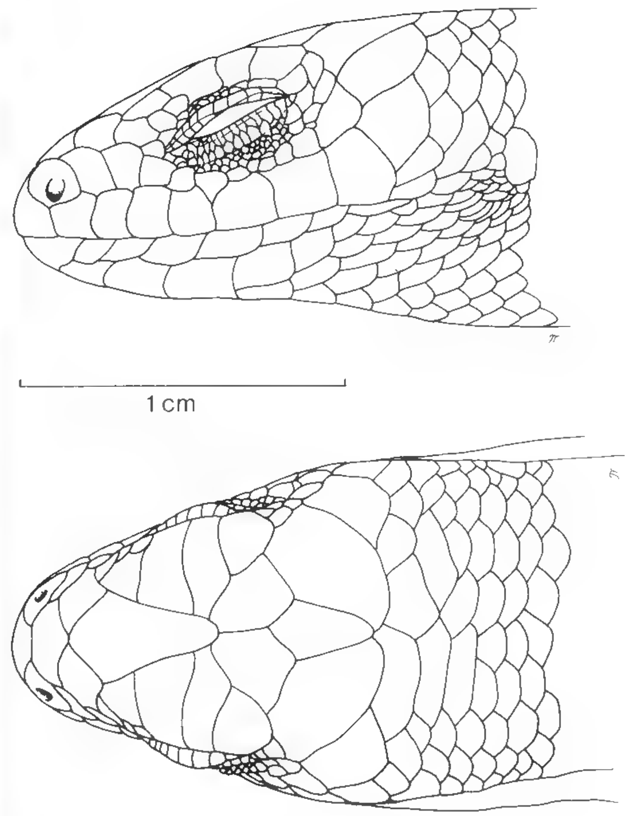

FIGURE 8. Head shields of *Eulamprus kosciuskoi* (NMV D42202).

expanded nuchal scales and laterally by a large upper secondary temporal. Supraciliaries 7–9; size 1 > 2 = last > 3 > rest. Supralabials 6–7 (mode 7), fourth or fifth subocular. Infralabials 7–8 (mode 7), first and second in contact with (single) postmental.

Premaxillary teeth 8 (n = 2) or 9 (n = 2).

Dimensions (of adults, all females, n = 13). SVL 66–74 mm (x̄ 70.6). HW 9.2–10.9 mm. HL 13.8–15.4 mm. HL/HW 1.40–159 (x̄ 1.49). HW/SVL 0.129–0.152 (x̄ 0.140). HLL/SVL 0.292–0.361 (x̄ 0.326). Tail length/SVL (for individuals > 50 mm SVL, n = 8) 1.07–1.25 (x̄ 1.17).

Colour (in preservative) light brown on the dorsal surface of the head, body, tail and limbs. Back with a black vertebral stripe running from the nape to the base of the tail. A narrow yellow dorsolateral stripe runs from the supraciliary region to the base of the tail, becoming less brightly coloured. This stripe edged medially by a wider black stripe. Black upper lateral zone, commencing at the ear and breaking up on the tail, with three to four series of yellowish dashes or dots, tending to align longitudinally on adjacent scale pairs. A horizontal streak runs posteriorly from the top of the ear opening and is continuous with the pale anterior margin of the ear. Tail with regularly spaced blackish lateral blotches. Limbs brown mottled with black. Lower lateral zone greyish with black spots, the pattern continuing across the belly. Infralabials, chin, throat and remainder of underside greyish white with scattered black spots.

In life the general colour is similar but overlain by a yellow–green opalescent gloss.

Distribution

Davies Plains–Mt Cobberras area and the Bogong High Plains, Victoria (Fig. 4). The southern, typical populations of this species are confined to the Snowy Mountains of New South Wales and the adjacent alpine areas of Victoria. A second morphologically distinct group of populations occurs in the Barrington Tops region and on the New England Plateau (Shea & Peterson, 1985).

Ecology

The Snowy Mountains–Victorian High Plains populations of this species have a restricted habitat, being found only in subalpine to alpine bogs and sluggish creek margins, the habitats being characterised by being perennially wet, cool and densely vegetated at ground level. Coventry & Robertson (1980) and Mansergh (1982) briefly describe the habitat of this species at Davies Plains and Mt Cope, respectively.

We have no explanation for the absence of males in this sample, and their under-representation in the samples of *E. heatwolei* and *E. tympanum*. Certainly those females that are pregnant are more catchable than non-pregnant females or males, but excluding pregnant females still leaves a deficiency of males. Further study of wild populations could determine whether there is a sex ratio bias against males, or whether behavioural attributes of the sexes make males harder to collect.

Most specimens have been collected during late January, at which time about half of the females (5) have full term young, while the rest (6) contain no young or enlarged ova. A single adult female collected in December contains advanced embryos, while a single adult female collected in February is non-breeding. At present it is not possible to say whether the females without young in January had just given birth or had not bred that year, but this would be worth exploring in view of the fact that females of the Tasmanian alpine skinks (*Niveoscincus*) only breed every second year (Greer, 1982, Hutchinson *et al.* 1989). Litter size is 2–4 (x̄ 3.2).

Discussion

Shea & Peterson (1985) noted that the topotypic (Mt Kosciusko area) population of *E. kosciuskoi* is more similar to *E. leuraensis* than is the New England population, suggesting some intermediacy, but maintained the specific distinctness of the latter taxon. In fact, where one draws the line between populations depends upon the character chosen; if colour pattern, then most Snowy Mountain–Victorian and New England *E. kosciuskoi* are more similar to each other than either is to *E. leuraensis,* while if limb proportions and head and body scalation are considered, then the new England *E. kosciuskoi* stand apart. Moreover, the more melanised individuals in the Victorian sample approach the description of *E. leuraensis* in that the head is heavily black-flecked, the laterodorsal black stripes are broader and leave little dorsal ground colour showing and the midlateral pattern extends ventrally to the lower lateral area. It appears therefore that no absolute distinctions separate any populations formerly referred to *E. kosciuskoi.* It is evident from comparison with other water skink populations that degree of dorsal melanisation can be labile in water skinks and that isolated populations can undergo shifts in scale count frequencies. The situation of *E. tympanum* discussed above also shows that much greater qualitative differences in colour pattern and scale size are not necessarily indicative of independently evolving entities (species).

Allopatric populations are a problematic group, even if one discards the increasingly unpopular biological species concept (BSC, e.g. Frost & Hillis 1990). Recent debate on the North American fauna (Collins 1991, 1992, Montanucci 1992, Van Devender *et al.* 1992, Frost *et al.* 1992) highlights the differing views that can exist concerning populations which until recently most authors would have identified as subspecies, more for convenience than as a positive expression of the degree of historical independence. Further consideration of the status of *E. leuraensis* is beyond the scope of this study, but the appropriate taxonomic treatment for the alpine water skink populations could stand further analysis.

Eulamprus heatwolei Wells & Wellington, 1984

(Figs 9, 10)

Sphenomorphus tympanum Warm Temperate Form, Rawlinson, 1969: 119.

Eulamprus heatwolei Wells & Wellington, 1984: 93. Holotype: AMS R116967 (formerly AM Field Series 27987), Macquarie Rivulet, just east of Robertson, New South Wales, R. W. Wells, 20 October, 1982.

Sphenomorphus heatwolei Shea & Peterson, 1985: p. 144.

Type Specimen

The holotype of *Eulamprus heatwolei*, AMS R116967, is in moderate condition, with the tail almost broken and is clearly identifiable as belonging the 'Warm Temperate Form' of Rawlinson (1969). Wells & Wellington (1984) purported to diagnose the species by listing the attributes of the holotype, but only aspects of the colour pattern description are unique to *heatwolei.* Our observations on the holotype disagree with those of Wells and Wellington (in square brackets) in several significant respects. Midbody scale rows 40 [38]. Tail regenerated, so subcaudal count [73] irrelevant. Supraoculars 4 [5]; first supraocular on left fragmented, with two abnormal small scales contiguous with the supraciliary row. Postnasal scales absent [said to be present]. One [2] preocular, if the lower of two antorbital scales is regarded, as here, as the first presubocular. Supraciliaries 10/9 [6]. Adpressed limbs strongly overlap, the fourth toe of the hind foot reaching about the level of the elbow [adpressed limbs just fail to meet]. Other important points not mentioned in the type description are throat colouring, the chin shields being heavily edged with black and the throat grey with four irregular blackish longitudinal bars, and size, the snout–vent length being 71 mm.

Diagnosis

A water skink lacking longitudinal dorsal stripes, most similar to *E. tympanum,* but differing in its longer appendages, pale post-supraciliary streak, black anterior edge of the tympanic opening and immaculate venter (bright yellow in life).

Description

36–44 ($\bar{x}$ 39.9, n = 73) longitudinal scale rows at midbody. Paravertebral scales 69–89 ($\bar{x}$ 77.5, n = 73), scarcely or not broader than adjacent dorsals. Subdigital lamellae on fourth toe 23–29 ($\bar{x}$ 25.1, n = 73), most with a median groove and those at the base of the toe divided.

Prefrontals in point to broad contact (freq. = 0.32). Interparietal elongate, approximately twice as long as wide, but seldom separating parietals

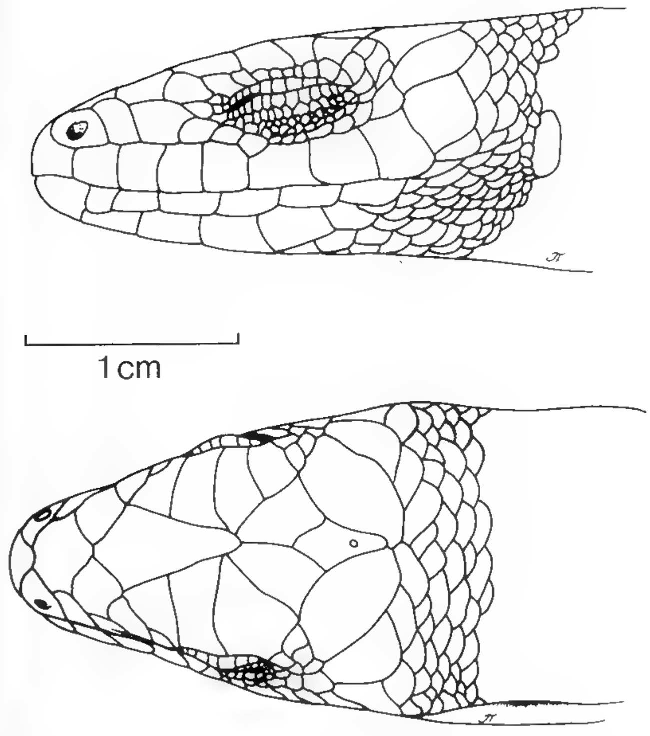

FIGURE 9. Head shields of *Eulamprus heatwolei* (SAM R38610).

(3 out of 73 scored). Each parietal bordered posteriorly by one to three nuchal scales and laterally by the upper secondary temporal. Supraciliaries 7–11 ($\bar{x}$ 9.1, mode 9); size 1 > 2 = last > 3 > rest. Supralabials 7–9 (mode 7), fifth or sixth subocular. Infralabials 6–9 (mode 8), first and second in contact with (single) postmental.

Premaxillary teeth usually 9 (n = 8), less often 8 (n = 3).

Dimensions (of adults, n = 47). SVL 74–101 ($\bar{x}$ 84.3). HW 10.1–14.0 mm. HL 16.3–20.7 mm. HL/HW 1.42–168 ($\bar{x}$ 1.51). HW/SVL 0.126–0.162 ($\bar{x}$ 0.143). HLL 30–36 mm. HLL/SVL 0.327–0.439 ($\bar{x}$ 0.379). Tail length/SVL (n = 13) 1.58–1.92 ($\bar{x}$ 1.76).

Colour (in preservative) light to very dark brown on the dorsal surface of the head, body, tail and limbs. Head shields with irregular black flecks. A paler brown streak, suggesting the start of a pale dorsolateral stripe, runs posteriorly from the supraciliary region to the neck. Back usually with numerous irregular black flecks; immaculate in very few specimens (those from the Murray River, both Victorian and South Australian). Tail with black, closely-spaced wavy bars laterally; limbs overlain by wavy black bars. Upper lateral zone black, the colour extending over the temporals and eye to the loreals. Several uneven series of pale dots (each covering only a single scale) overly the black. A pale horizontal streak runs posteriorly from the dorsal rim of the ear opening; anterior edge of ear opening black. Lower lateral zone greyish with black scales forming irregular vertical or backward-sloping bars or a black reticulum. Chin and throat white, most populations with black edges on chin shields and elongate black blotches on the throat. Remainder of underside yellowish white, immaculate.

In life the general colour is similar but suffused with yellowish. The dorsal ground colour is frequently brassy and the underside of the belly, limbs and tail is bright yellow..

Distribution

Eastern Victoria, west to about the Goulburn River (Fig. 10). Absent from higher elevations along the Great Dividing Range. An isolated record from Great Western (Victoria) and a disjunct group of populations on the lower Fleurieu Peninsula, South Australia, from Deep Creek to the northern shore of Lake Alexandrina. Extralimital in eastern New South Wales north to the New England plateau.

Ecology

This species is very similar in habits to *E. quoyii,* being mostly restricted to creek margins. Most populations of this species favour rocky substrates, but the species does occur along muddy river banks, notably the Murray in north–central Victoria and at its mouth in South Australia. Its reproductive characteristics appear similar to those of *E. quoyii*, with similar ovarian and testicular cycles. Litter size among the specimens examined ranged 2–4 ($\bar{x}$ 3.3, n = 9).

The distributions of *E. heatwolei* and *E. t. tympanum* are complementary to a remarkable degree; although the distributions abut and interdigitate throughout eastern Victoria there are few places (a total of ten) where specimens have been collected in syntopy (indicated by stars in Figs. 5 and 10). Syntopy generally occurs along stream valleys where *E. heatwolei* can extend along the warm valley floor to contact *E. tympanum* populations inhabiting the cooler, elevated valley slopes. In East Gippsland, the aspect of a section of stream channel can determine the species present, with north facing slopes occupied by *E. heatwolei* while south-facing slopes are occupied by *E. t. tympanum.* Meandering watercourses may show an alternation of species (A. J. Coventry, pers. comm.) depending on the degree of shading. No

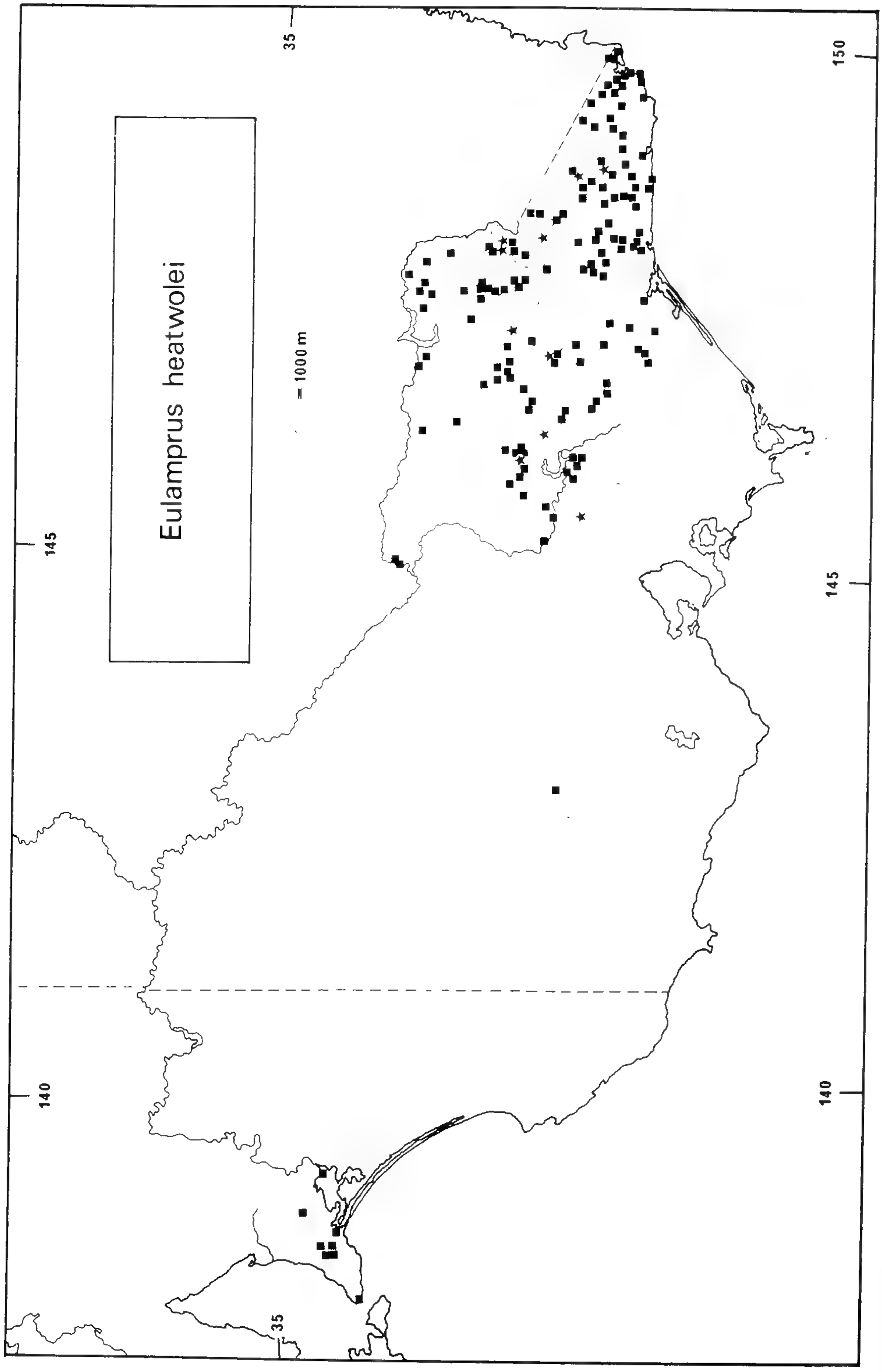

FIGURE 10. Distribution of *Eulamprus heatwolei* in Victoria and South Australia. The stars denote localities where *E. heatwolei* and *E. t. tympanum* have been collected in syntopy.

studies have yet been directed to determining the degree to which competition or the documented physiological differences (Spellerberg, 1972b,c) determine range limits in these two species.

Discussion

The type locality of *E. heatwolei,* Robertson, New South Wales, is adjacent to this region so that as yet the species is not certainly recorded from other parts of Australia. Cogger (1992) mapped the species as far south as the New South Wales-Victoria border. For many years workers have used Rawlinson's informal taxonomy to distinguish two species level taxa, the 'Cool Temperate' and 'Warm Temperate' forms of *Eulamprus* (as *Sphenomorphus*) *tympanum* (e.g. Spellerberg 1972b–d, Rawlinson 1974, Jenkins & Bartell 1980). The forms have been distinguished mainly on ventral colouring, as well as dorsal head colour pattern and proportions. Examination of the holotype of *E. heatwolei* and other New South Wales specimens shows that they do not differ from the Victorian 'Warm Temperate Form'. Accordingly, the concept of *E. heatwolei* is expanded to include these populations.

Shea & Peterson (1985) listed variation within this species based on Blue Mountains area specimens only. Their data are similar to ours, with slightly higher midbody scale counts ($\bar{x}$ 40.8) and maximum snout–vent length a little less (92 mm).

South Australian populations of this species are geographically remote from the main eastern Australian populations, and are restricted to only a few known sites. The terminus of the Murray River on the northern margin of Lake Alexandrina supports a colony living immediately adjacent to the water on eroding banks next to cleared grazing land. On the lower Fleurieu Peninsula *E. heatwolei* is confined to a few perennial rocky streams which retain some streamside vegetation. In spite of their isolation, these populations differ little from the continuous populations of eastern Victoria and New South Wales. Body scales are small, with midbody scale counts restricted to the upper half of the total range of variation seen in the species as a whole (midbody scale rows 40–44, $\bar{x}$ 41.5 in South Australia), and higher paravertebral counts (74–89, $\bar{x}$ 80.2, versus 69–82, $\bar{x}$ 76.4 in Victoria). The South Australian colonies appear vulnerable to habitat changes. At Lake Alexandrina changes in Murray River flow, either decreases leading to drying out or increases causing erosion of the banks, may destroy local populations. In the rocky streams of the Fleurieu Peninsula, modification of the banks, with either clearing of the vegetation or silt build-up reducing exposed rocks, is likely to be deleterious.

A KEY TO THE *EULAMPRUS* OF VICTORIA AND SOUTH AUSTRALIA

1 – Pale yellow dorsolateral line runs from behind the eye to at least the posterior one-third of the trunk 2
– No pale yellow dorsolateral line 3

2 – A black vertebral stripe .... *E. kosciuskoi*
– No black vertebral stripe .... *E. quoyii*

3 – Dark dorsal markings arranged as irregular transverse bars; usually more than 42 midbody scale rows .... *E. t. marnieae*
– Dark dorsal markings (if present) in the form of small black flecks; usually fewer than 43 midbody scale rows 4

4 – Anterior margin of ear opening black; belly in life immaculate bright yellow, most intense under chest and groin; throat white with black patches .... *E. heatwolei*
– Anterior margin of ear opening cream; belly in life pale yellow to greenish yellow (bright yellow striped with black in some Otway Ranges specimens) with or without black flecks; throat light to dark grey, with or without darker grey smudges .... *E. t. tympanum*

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APPENDIX

Specimens examined.

Eulamprus heatwolei.

New South Wales: AMS R116967, Macquarie Rivulet, just E of Robertson (Holotype).

Victoria: MV D552, Great Western, 37°09'S 142°52'E; D2286, Wangaratta, 36°21'S 146°19'E; D34392, 5.6 km N.E. of Wodonga, 36°10'S 146°51'E; D34488, Nug Nug, Ovens River, 1.6 km. W. of Myrtleford, 36°39'S 146°43'E; D 34541–48, Poddys Creek, 24.1 km. W. of Cann River, 37°36'S 148°54'E; D34549, 14.5 km N. of Nariel, 36°18'S 147°50'E; D 34550, Still Creek, 30.6 km S.E. of Eildon, 37°25'S 146°09'E; D34551, 12.9 km S. of Sardine Creek, 37°31'S 148°40'E; D34552, 16 km E. of Orbost, 37°41'S 148°35'E; D34553, 24.1 km N. of Orbost, 37°34'S 148°34'E; D34554, Snowy River, Tulloch Ard Gorge, 37°16'S 148°19'E; D34560–62, Goulburn River, 16 km S.E. of Seymour, 37°08'S 145°16'E; D36839, Lake Tali Karng, 37°33'S 146°47'E; D36841, 2nd last crossing of Wellington River, Lake Tali Karng Track; D36842, 9.7 km N. of Culloden on Dargo River, 37°41'S 147°08'E; D36843, Wangareta [=Wangaratta], 36°22'S 146°19'E; D36844–45, 14.5 km N. of Stockdale, 37°40'S 147°11'E; D36846–48, 16.1 km N.N.W. of Stockdale, 37°39'S 147°06'E; D36849–53, 5.6 km E. of Wodonga, 36°09'S 146°52'E; D36854–55, 19.3 km S.W. of Walwa, 36°05'S 147°34'E; D36856, 0.4 km. E. of Genoa, 37°28'S 149°36'E; D42564–86, Sheepwash Lagoon, 37°10'S 145°32'E; D56624, Seven Creeks, Goorum Falls, 36°54'S 145°35'E; D57154, Two Mile Creek, 13.4 km N.N.W. of Picolo, 35°59'S 144°56'E; D57164, Ovens River, Naughtons Bend, 14.3 km N.W. of Peechelba, 36°06'S 146°08'E.

South Australia: MV D34467–68, 3.2 km. E. of Myponga; D34487, D36880, Hindmarsh Falls, 35°27'S 138°35'E; D34555–56, D34559, Angas River, Strathalbyn, 35°16'S 138°54'E; D34558, Currency Creek, 35°27'S 138° 46'E. SAMA R2878, Tapanappa Rocks, 35°38'S 138° 15'E; R3018, Deep Creek, 35°36'S 138°15'E; R13436A–B, Withers Creek, tributary of Deep Creek, 35°38'S 138°15'; R17074, 1 km S of Mount Compass, 35°22'S 138°38'E; R18572–73, Tower of Babel, Inman Valley, 35°28'S 138°33'E; R24077, Lake Alexandrina [north shore], 35°24'S 139°19'E; R38557, Hindmarsh Falls, 35°27'S 138°35'E; R38610–12, North shore of Lake Alexandrina at exit of Murray River, Nalpa Stn, 35° 24'S 139° 20'E.

Eulamprus kosciuskoi.

New South Wales: AMS R558–59, R4654, R5061, Mt Kosciusko (Types of *Lygosoma (Hinulia) quoyii kosciuskoi*)

Victoria: MV D42060, Charlies Creek, Davies Plains Track, 36°17'S 147°59'E; D42075, Charlies Creek, Davies Plains Track, 36°17'S 147°59'E; D42110, Charlies Creek, Daveys Plain Track, 36°17'S 147°59'E; D42201–02, Charlies Creek, Davies Plains Track, 36°17'S 147°59'E; D42203, King Plain, Davies Plains Track, 36°39'S 148°04'E; D 47513–15, Davies Plains, 36°17'S 147°59'E; D47539–49, D47589–90, D47654–59, Davies Plains, 36°17'S 147°59'E; D48557, The Playgrounds, Mt. Cobberras, 36°52'S 148°09'E; D55111, Mt. Cope area, 36°56'S 147°17'E; D55630, Rocky Plains, 36°56'S 148°10'E; D56465–66, 1 km E. of Mt. Cope, 36°56'S 147°17'E; D59849, The Playgrounds, Mt. Cobberras, 36°52'S 148°09'E.

Other: AMS R4832, no data ('Tonga', in error).

Eulamprus quoyii.

New South Wales: MNHN 2976, Port Macquarie; 7112–3, Neutral Bay, Port Jackson. (Types of *Gongylus (Lygosoma) quoyii)*.

Victoria: MV D1352, D1372, No other data; D13871, Lindsay River, Berribee Station, 34°0'S 141°0'E; D34326–31, Murray River, 6.4 km W. of Lock No.9; D39078–79, Potterwalkalgee Creek, 34°08'S 141°23'E; D39080–81, Murray River & Potwatagee [=Potterwalkalgee] Creek junction, 34°08'S 141°23'E; D39085, Potterwalkalgee Creek, 34°08'S 141°23'E; D56882–83, Potterwalkalgee Creek, 5 km E. of Neds Station corner, 34°08'S 141°23'E; D61906, Dedman Creek, 13 km W. of Horseshoe Lagoon, Wallpolla Island, 34°08'S 141°42'E.

South Australia: MV D5297, Purnong, 34°51'S 139°38'E; D34282–83, Kingston [on Murray]; D34284–89, Torrens River Gorge, 34°52'S 138°46'E; D 39070–71, Cattambal, Torrens River Gorge. SAMA R2393A–B, Sturt River, Eden, 35°01'S 138°36'E; R2874, Mylor, 35°03'S 138°46'E; R2889, Bridgewater, 35°00'S 138°46'E; R11177, Torrens Gorge, 34°53'S 138°44'E; R13481, just N of Sinclair Flat, River Murray, 34°15'S 139°38'E; R13482, Waterfall Gully, 34°57'S 138°41'E; R18519, Glenforslan Ranch, 34°15'S 139°39'E; R22306–07, Sturt Creek, FlagstaffHill area, 35°02'S 138°32'E; R33009, Monoman Creek, Chowilla, 33°56'35"S 140°52'45"E; R33350, Clarendon, 35°07'S 138°38'E; R33782, Punkah Island, Chowilla Stn, 33°57'45"S 140°57'45"E; R37931, Scott's Lagoon, 8.5 km S of Morgan, 34°07'S 139°40'E; R38017, Lake Garnett, 20 km NE of Mannum, 34°53'S 139°31'E.

Other: MNHP 2977 'Nouvelle Hollande' (Syntype of *Lygosoma quoyii*). BMNH 1946.8.4.99, 'Kangaroo Island, S.A.' (in error); 1946.8.15.34–35, 'Queensland'; 1946.8.15.36, 'Australia'; (Types of *Hinulia gastrosticta*). NMW 16656:1–2, 'Kangaroo Island' (in error) (Types of *Hinulia gastrosticta*).

Eulamprus tympanum tympanum.

New South Wales: AMS R111949, Dora Dora National Park proposal area, 35°55'S 147°35'E (Holotype of *Eulamprus herseyi*).

Victoria: NHRM 3094, Neighbourhood of Melbourne (Holotype of *Lygosoma tympanum*). MV D11881–11883, Gellibrand River, 38°31'S 143°32'E; D12207–12216, Gellibrand, 38°31'S 143°32'E; D 13642–13645, Mt. Sabine 38°47'S 147°19'E; D13653–13654, Gellibrand River 38°31'S 143°32'E; D14056–14065, Dellys Dell 37°12'S 142°32'E; D15594, Near Halls Gap, 37°08'S 142°31'E; D17571, Gellibrand River 38°32'S 143°32'E; D33424, Junction of Mairs Track & Syphon Road, 37°11'S 142°20'E; D33491, 3 km S. of Ben Nevis, 37°15'S 143°12'E; D33492–33493, 4.8 km N. of Mt. Cole, 37°17'S 143°16'E; D33500, Grampian Ranges, 37°07'S 142°26'E; D33874, 14.5 km S. of Elmhurst, 37°18'S 143°15'E; D35846, Syphon Road, 37°10'S 142°20'E; D35847, Moora Hut, 34°14'S 142°26'E; D35848–35849, 3.2 km W. of Pirron Yallock, 38°21'S 143°23'E; D3579, Back River Bridge, 8 km W. of Bentleys Plains, 37°14'S 147°49'E; D35794, 12.9 km E. of Moutys Hut; D35795, Ridge over Nuniong Plains, 37°08'S 147°57'E; D35798–800, 3.2 km W. of Cape Horn, 38°44'S 143°34'E; D35802, Great Ocean Road, 3.2 km W. of Apollo Bay, 38°46'S 143°37'E; D 35806, D35808–09, Dargo High Plains, 37°06'S 147°09'E; D35830–33, D35835–39, Lake Mountain road, 6.8 km. from Cumberland road, 37°31'S 145°52'E; D35852–35854, Matlock road, 54.7 km N. of Noojee, 37°24'S 146°0'E; D35855–35856, Matlock road, 37 km N. of Noojee, 37°34'S 146°0'E; D35857, Big River Camp, 37°32'S 145°57'E; D35858–35859, 51.5 km N. of Noojee, 37° 26'S 146° 0'E; D35860–35861, 24 km N. of Noojee, on Matlock Road, 37°41'S 146°0'E; D35862, 66 km N. of Noojee on Frenchmans Spur road, = 29 km E. of Big R. camp,37°32'S 145°57'E; D35863, Wartook, 37°02'S 142°21'E; D35864, 13.7 km N.W. of Peterborough, 38°30'S 142°45'E; D35865, Lake Wartook, 37°05'S 142°27'E; D35866, 4.8 km N. of Tyers, 38°06'S 146°28'E; D35867, 4 km N. of Streiglitz, 37°50'S 144°11'E; D35868, Badger Ck., Healesville, 37°34'S 145°35'E; D35869, Memorial Gardens, Mt. Macedon, 37°22'S 144°35'E; D35870–35871, 8.8 km E. of Marysville, 37°31'S 145° 50'E; D35872, 21 km S.E. of Cumberland Junction 37°42'S 146°04'E; D35881, Fyans Creek, 61 km. N. of Dunkeld, 37°05'S 142°34'E; D35891, Wartook Reservoir, 37°05'S 142°27'E; D35985, Chimney Pot Gap, 37°24'S 142°18'E; D 35985, D35987–90, Chimney Pot Gap, 37°24'S 142°18'E; D35993, Lake Wartook, 37°05'S 142°27'E; D36001, Blanket Bay, 38°49'S 143°35'E; D36002, 8 km N. of Cape Horn, 38°39'S 143°37'E; D36018–36028, 8 km N. of Cape Horn, 38°39'S 143°37'E; D36063–36067, 3.2 km W. of Cape Horn, 38°44'S 143°34'E; D36092–36093, Enfield, 12.8 km S. of Ballarat, 37°45'S 143°47'E; D36173, Lake Wartook, 37°05'S 142°27'E; D36307–36309, Mt. Sabine, 38°38'S 143°44'E; D39399, Mt. William, 37°13'S 144°48'E; D39401–39406, 4 km S. of Ben Nevis fire tower, 37°16'S 143°12'E; D39407, Lake Wartook, Grampian Road 37°05'S 142°27'E; D47759, 4 km W.S.W. of Enfield, 37°45'S 143°45'E; D47760, 3 km W. of Enfield, 37°45'S 143°45'E; D47804–47807, Glenisla Shelter, Victoria Range, 37°09'S 142°15'E; D47808, Mt. William, 37°13'S 144°48'E; D47915, 0.5 km N. of Mt. Langi Ghiran, 37°17'S 143°08'E; D48690, Nowhere Creek, 37°07'S 143°17'E; D48691, Mt. Avoca, 37°06'S 143°21'E; D48709–11, 5 km N.E. of Glenlofty, 37°05'S 143°15'E; D50183–50185, 1 km S. of Mt. Lonarch, 37°16'S 143°21'E; D50257–58, 4 km W. of Mt. Buangor, 37°18'S 143°11'E; D50716–19, Mt. Avoca, 37°06'S 143°21'E; D50951–52, 1 km S.W. of Mt. Sabine, 38°38'S 143°43'E; D50966, Mt. Sabine 38°37'S 143°44'E; D56657, Hopkins Falls, 38°20'S 142°37'E.

South Australia: SAMA R11263, Sect. 123, Hund. of Young, County Grey, 37°43'S 140°45'E; R12400, Southernmost point, Sect. 123, Hund. of Young, County Grey, 37°43'S 140°46'E; R12982, NW of Port Macdonnell, 37°59'S 140°33'E; R13076, SW of Mount Gambier, 37°54'S 140°41'E; R14123, N of Mount Gambier, 37°44'S 140°50'E; R14868, SE of Mount Gambier, 37°55'S 140°57'E; R15163A–B, Sect. 391, Hund. of Caroline, 37°58'S 140°51'E; R16826A–C, Rivoli Bay, 37°32'S 140°06'E; R17889, 5 km N of Wandilo siding, 37°41'S 140°44'E; R19082–83, N of Mount Gambier, 37°42'S 140°46'E; R23890, R23952, Woolwash Creek near Port Macdonnell, 38°03'S 140°45'E; R23926, 10 km NW of Port Macdonnell, 38°00'23"S 140°36'11"E.

E. t. tympanum x marnieae intergrade specimens.

Victoria: D39412, 16 km N. of Camperdown, 38°01'S, 143°09'E; D52910–11, 1.5 km N. of Kariah, 38°10'S, 143°13'E; D56721, 11.5 km NNE of Camperdown, 38°08'S, 143°12'E; D56802, 4.5 km E (100°) of Bookar, Lake Colongulac, 38°10'S, 143°10'E; D56803, 4.6 km ESE (105°) of Cororooke, 38°10'S, 143°32'E; D56804, D56878, 3.4 km SE (130°) E of Cororooke, 38°17'S, 143°33'E.

Eulamprus tympanum marnieae

Victoria: HOLOTYPE: NMV D52921, 5.5 km E. of Dreeite, Victoria, 38°11'S, 143°34'E, P. A. Rawlinson & M. Hutchinson, 1 November, 1979.

PARATYPES: 5.5 km E. of Dreeite: D49377, D49391–92, P. A. Rawlinson & M. Hutchinson, 1 September 1977; D52912–20, D52922–529266, P.A. Rawlinson & M. Hutchinson, 30 October and 1 November, 1979; D62035, M. Hutchinson & S. Donnellan, September, 1986. 5 km E of Dreeite, 38°11'S, 143°34'E, D52955–56, G. Brown, 9 November 1979; D53977–80, G. Brown, 25 January, 1980. Dreeite, Taits Road, 38°11'S, 143°31'E: D49385–87, M. Hutchinson & G. Ingram, 26 August 1977; D49388–90, P. A. Rawlinson & M. Hutchinson, 1 September 1977.

REFERRED SPECIMENS: D36075–84, 8 km S. of Lismore, 38°01'S, 143°20'E, S. Hosgood, 16 April, 1963; D52600–01, Lake Bolac, near caravan park, 37°44'S, 142°52'E, M. Hutchinson & G. Brown, 23 February 1978; D52901–09, Lake Bolac, near caravan park, 37°44'S, 142°52'E, P. A. Rawlinson & M. Hutchinson, 31 October 1979.