

## Description of three new species of gobioid fishes from southern Australia, with a key to the species of *Cochleoceps*

J. Barry Hutchins\*

### Abstract

Three new species of clingfishes are described: *Cochleoceps viridis* from Western Australia, *C. bicolor* from Victoria, South Australia, and Western Australia, and *C. orientalis* from New South Wales. *Cochleoceps viridis* closely resembles *C. spatula* (Günther), from South Australia and Western Australia, differing mainly in the shape of the snout and dentition. Although the other two new species are similar in appearance to each other, they can easily be distinguished by differences in colouration and snout shape. Both can be separated from *C. bassensis* Hutchins on the basis of differences in colouration, maximum size, and head shape.

### Introduction

The clingfish genus *Cochleoceps* consists of small fishes (to 60 mm SL) which inhabit shallow reef and weed areas along the coastline of Australia's southern half. Hutchins (1983) stated that the genus appeared to consist of five species which could be divided into three groups on the basis of body shape and configuration of the cephalic pores. Only two of these species are currently described, *Cochleoceps spatula* (Günther, 1861) and *C. bassensis* Hutchins, 1983. The purpose of this paper, therefore, is to provide descriptions for the remaining species. A key to the genus is also included.

The methods used follow Hutchins (1983). The material examined is housed at the following institutions: Australian Museum, Sydney (AMS), Museum of Victoria, Melbourne (NMV), Natural History Museum, London (BMNH), South Australian Museum, Adelaide (SAM), and Western Australian Museum, Perth (WAM).

### Systematics

#### Key to the species of *Cochleoceps*

- 1a. Body slender, width between pectoral bases 6 or more in SL (Figure 1); 6 preoperculomandibular pores (Figure 2); head and body without red spotting in life ..... 2
- 1b. Body more robust, width 5 or less in SL; 4-5 preoperculomandibular pores; head and body covered with many moderately sized to very small red spots in life ..... 3
- 2a. Snout long, generally longer than wide, length 2.8-3.1 in head length; posterior nostril positioned anterior to eye; lower jaw without large forward-projecting incisors ..... *C. spatula* (Günther, 1861)

\*Department of Aquatic Vertebrates, Western Australian Museum, Francis St, Perth, Western Australia 6000.

- 2b. Snout relatively short, wider than long (Figure 2), length 3.3-3.5 in head length; posterior nostril behind anterior margin of eye (Figure 2); lower jaw with 4-6 large forward-projecting incisors . . . . . *C. viridis* sp. nov.
- 3a. Head large, length 2.4-2.5 in SL, with prominent triangular-shaped snout; 5 preoperculomandibular pores; head and body covered with moderate-sized red spots in life, those on dorsal surface more oval shaped; dorsal surface without blue cross bars; maximum length 60 mm . . . . . *C. bassensis* Hutchins, 1983.
- 3b. Head relatively smaller, length 2.7-3.6 in SL, snout small (Figure 5); 4 preoperculomandibular pores (Figure 6); head and body in life covered with small, close-packed red spots, never oval in shape, with numerous blue to purplish cross bars on dorsal surface; maximum length 30 mm SL . . . . . 4
- 4a. Dorsal surface with about 12 narrow blue cross bars, those on body continued down sides (Figure 5); snout relatively wide and long, length 3.2-3.6 in head length; anal fin base relatively long, length 5.6-7.0 in SL . . . . . *C. bicolor* sp. nov.
- 4b. Dorsal surface with numerous blue to purplish markings, tending to form short, rather irregular and often poorly-defined cross bars (Figure 8), those on body not continued down sides; snout relatively narrow and short, length 3.7-4.1 in head length; anal fin base relatively short, length 6.8-8.4 in SL . . . . . *C. orientalis* sp. nov.

***Cochleiceps viridis* sp. nov.**

Figures 1-3, 4a; Table 1

*Cochleiceps* species 1 — Hutchins, 1983: 37, 40, and 45.

**Holotype**

WAM P.26604-015, 39 mm SL, Emu Point, King George Sound, Western Australia, trawled from *Posidonia* beds in 2-3 m, J.B. Hutchins *et al.*, 15 April 1980.

**Paratypes**

32 specimens from Western Australia, 14-40 mm SL (unless otherwise designated, all specimens at WAM): P.26604-009, 6 specimens, 30-36 mm SL (35 mm specimen cleared and stained), taken with holotype; P.26622-004, 5 specimens, 29-33 mm SL, Rottneest Island, trawled at 0.5-2 m, J.B. Hutchins, 16 June 1980; P.26455-011, 5 specimens, 14-21 mm SL, Geographe Bay, J. Scott, 25 December 1977; P.28267-003, 7 specimens, 23-27 mm SL, Carnac Island, trawled at 3-4 m, J.B. Hutchins and N.O. Sinclair, 10 February 1984; P.28280-004, 2 specimens, 33 mm SL, Israelite Bay, trawled in 0.5-2 m, J.B. Hutchins, 1 April 1984; P.28288-003, 39 mm SL, Israelite Bay, trawled at 1-2.5 m, J.B. Hutchins, 6 April 1984; AMS I.31830-001, 2 specimens, 24-27 mm SL, Rottneest Island, trawled in 1-2 m, J.B. Hutchins, 6 April 1991; BMNH 1991.9.12:9-10, 2 specimens, 26-27 mm SL, same data as for previous entry; NMV 9559, 2 specimens, 26-30 mm SL, same data as for previous entry.

**Table 1.** Measurements (mm) and counts of the holotype and selected paratypes of *Cochleoceps viridis*

	Holotype	WAM P.26604-009	WAM P.26622-004	Paratypes				
	WAM			WAM	WAM	WAM	WAM	WAM
	P.26604-015			P.26622-004	P.26604-009	P.26622-004	P.28267-003	P.26455-011
Standard length	39	36	33	30	28	23	19	
Head length	12	11	11	10	9.1	8.1	6.9	
Head width	6.9	5.9	6.3	5.7	5.4	5	4.6	
Body depth	3.9	3.1	3.6	2.8	3	2.4	2	
Body width	5.6	5.1	5.2	4.2	4.2	3.8	2.9	
Snout length	3.6	3.3	3.2	2.9	2.7	2.3	2	
Eye diameter	2.3	2.2	2.1	1.9	1.9	1.7	1.4	
Interorbital width	2.6	2.4	2.3	2.3	2	1.7	1.4	
Snout to origin of dorsal fin	30	28	25	22	22	18	14	
Snout to anus	28	24	23	20	19	16	13	
Caudal peduncle length	4.2	3.3	4	2.9	3.4	3.1	2.5	
Caudal peduncle depth	1.6	1.6	1.5	1.4	1.3	1	0.8	
Caudal fin length	6.4	6.7	6.5	6.1	5.3	4.5	3.4	
Ventral disc length	7.9	7.5	6.7	6	5.3	4.7	3.4	
Ventral disc width	4.9	5	5.1	4.1	4.3	3.3	2.7	
Dorsal base length	5.4	3.7	3.7	3.9	3.3	2.2	1.7	
Anal base length	5	5.6	4.4	4.4	4	2.4	2	
Dorsal fin ray count	6	4	4	4	4	3	4	
Anal fin ray count	5	5	5	5	6	4	5	
Pectoral fin ray count	17	18	18	17	19	19	19	



Figure 1. *Cochleoceps viridis* sp. nov., paratype, WAM P28288-003, 39 mm SL, dorsal view (photographed just after capture).

### Diagnosis

This species is distinguished from all other Australian gobiesocids by the combination of its slender form, ventral disc with papillae on all four regions, subopercular spine absent, six preoperculomandibular pores, and greatly enlarged forward-projecting incisorlike teeth in the lower jaw. *Cochleoceps viridis* closely resembles *C. spatula*, the two easily being separated by differences in snout shape, position of the nostrils, and dentition (see Key to Species above).

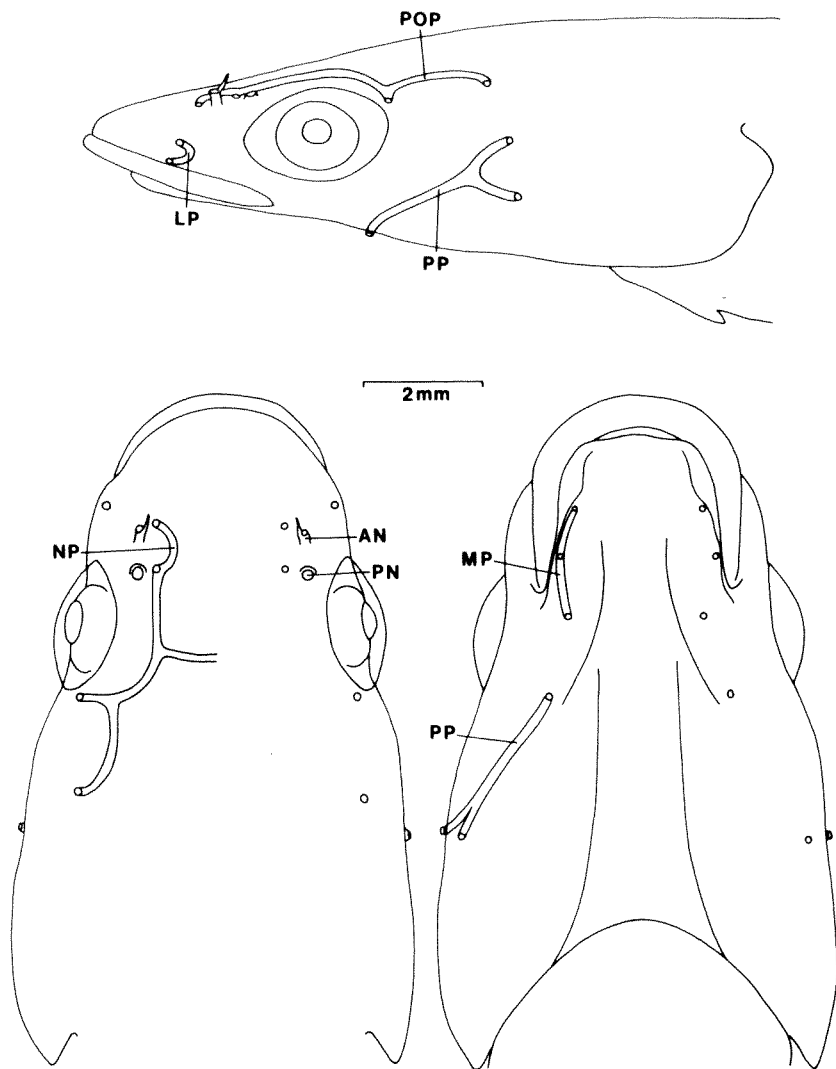
### Description

Measurements and counts of the holotype and selected paratypes are presented in Table 1. The following counts and proportions in parentheses represent the ranges for the paratypes when they differ from those of the holotype.

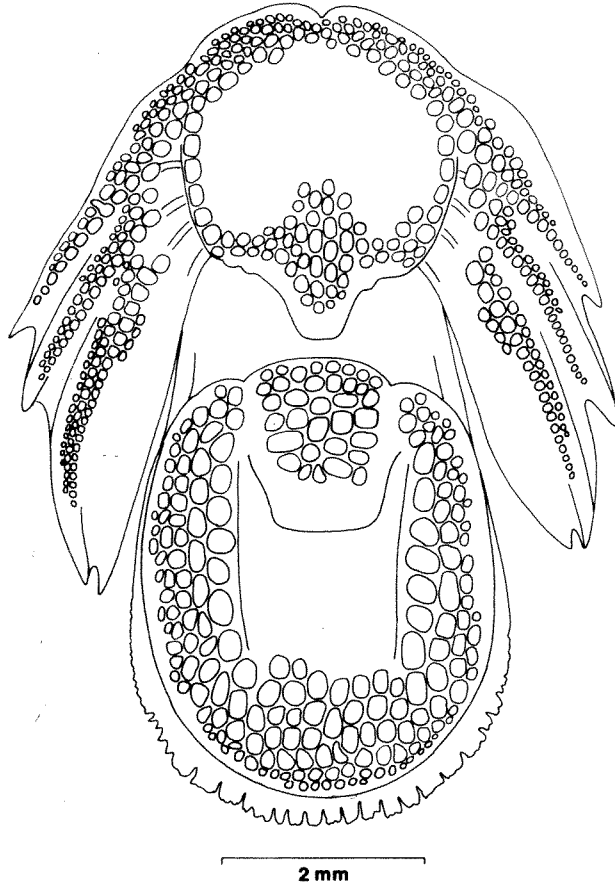
Dorsal fin rays 6 (3-6, average 4); anal fin rays 5 (4-6, average 5); pectoral fin rays 17 (17-19); pelvic fin rays I, 4; segmented caudal fin rays 9-11 (from cleared and stained material); vertebrae 32-33 (from cleared and stained paratypes); branchiostegals 6.

Body elongate, subcylindrical (moderately depressed anteriorly, tapering to a compressed caudal peduncle), depth 10 (9.2-11.6) and width 7.0 (6.1-7.1), both in SL; caudal peduncle moderately long, depth 2.6 (2.1-3.1) in its length; head flat, depressed, length 3.3 (2.8-3.3) in SL and head width 1.7 (1.5-1.9) in its length; snout moderately long and wide (wider than long), somewhat truncate in dorsal view, rounded anteriorly, length 3.3 (3.3-3.5) in head length; nostrils moderate in size, tubular, posterior one much shorter than anterior one; posterior nostril on or behind line joining anterior margins of eyes; anterior nostril with simple narrow triangular flap on posterior portion of rim, flap reaching about half way to posterior nostril when folded rearwards; eye moderately large with prominent clear cornea, diameter 5.2 (4.8-5.3) in head length, equal to or slightly smaller than bony interorbital width (4.6 [4.3-4.9] in head length).

Skin smooth and scaleless, usually covered by thick mucus layer; lateral line sensory system consists of moderately sized open pores and minute papillae, former found only on head (Figure 2); each pore has short tubular opening slightly longer than thickness of



**Figure 2.** Diagram of the cephalic pore system of *Cochleocephalus viridis* sp. nov., WAM P.26604-009, 36 mm SL (pores represented by open circles, the underlying canals on one side outlined by solid lines), lateral, dorsal and ventral views. (Abbreviations: AN, anterior nostril; LP, lacrimal pore canal; MP, mandibular pore canal; NP, nasal pore canal; PP, preopercular pore canal; PN, posterior nostril; POP, postocular pore canal).



**Figure 3.** Ventral sucking disc of *Cochleocephalus viridis* sp. nov., WAM P.28288-003, 39 mm SL, showing arrangement of papillae (ventral view, anterior end facing top of page).

mucus layer, and associated with canal in underlying bone (outlines of canals indicated in Figure 2); total of 12 pores on each side of head consisting of two lacrymal pores, two nasal pores, two postocular pores, and six preoperculo-mandibular pores (three pores associated with preopercle and three with mandible); papillae arranged in longitudinal series laterally on body, others scattered on head (all papillae difficult to detect).

Gill opening wide, membranes joined across isthmus, but not attached to it; upper attachment of gill membrane opposite first or second pectoral fin ray; upper attachment of pelvic fin membrane opposite 11th (10th-13th) pectoral fin ray; upper attachment of axial dermal flap opposite ninth (eighth-ninth) pectoral fin ray; ventral disc double, moderate in size, length 4.9 (4.8-5.6) and width 8.0 (6.5-8.0), both in SL; papillae on all four regions of disc, arranged as in Figure 3 (some papillae missing in holotype, particularly in region B).

Mouth inferior, upper lip projecting well forwards of lower lip; rear corner of mouth below anterior quarter of eye; lip fold on lower jaw not continued across symphysis; teeth in upper jaw small, conical, lateral teeth uniserial, expanding to 4-5 series anteriorly to form a tooth patch on either side of symphysis; teeth in lower jaw similar, except three anterior teeth on each side of symphysis greatly enlarged, incisor-like, projecting forwards horizontally; palatine and vomerine teeth absent; gill filaments on first three gill arches, absent on fourth; gill rakers 4-5, short and conical.

Bases of dorsal and anal fins short, lengths 7.2 (7.2-11.2) and 7.8 (6.4-9.6) respectively, both in SL; base of dorsal fin generally shorter than and originating posterior to anal fin (specimens with more rays in dorsal fin than in anal fin may have a longer dorsal base which originates in advance of anal fin); dorsal and anal fin rays short, subequal to base of respective fin; urogenital opening located just anterior to anal fin origin, well behind rear margin of ventral disc; genital papilla prominent.

Subopercle present, forming terminal bone posteriorly on side of head, not spine-like; dorsal postcleithral bone rather narrow (Figure 4a), reaching as high as eighth pectoral fin ray; cleithral, pelvic and ventral postcleithral bones shaped as in Figure 4a.

Colour of holotype in alcohol: overall pale yellowish brown.

Colour when fresh (based on colour transparencies of live individuals underwater and freshly collected material): ground colour apple green to pale green, and more rarely a translucent white; head and body with many minute brown spots forming either irregular longitudinal lines with short, broader cross bars on midline of back or a prominent reticulate pattern; golden yellow spots and blotches usually incorporated in above pattern, but fading on death; small pale blotches occasionally on dorsal and lateral surfaces; translucent colour form usually with some indistinct green blotching on dorsal surface and greyish brown blotching laterally; fin rays of similar colour to overall body colour; after death, and especially after preservation, all markings become more reddish pink.

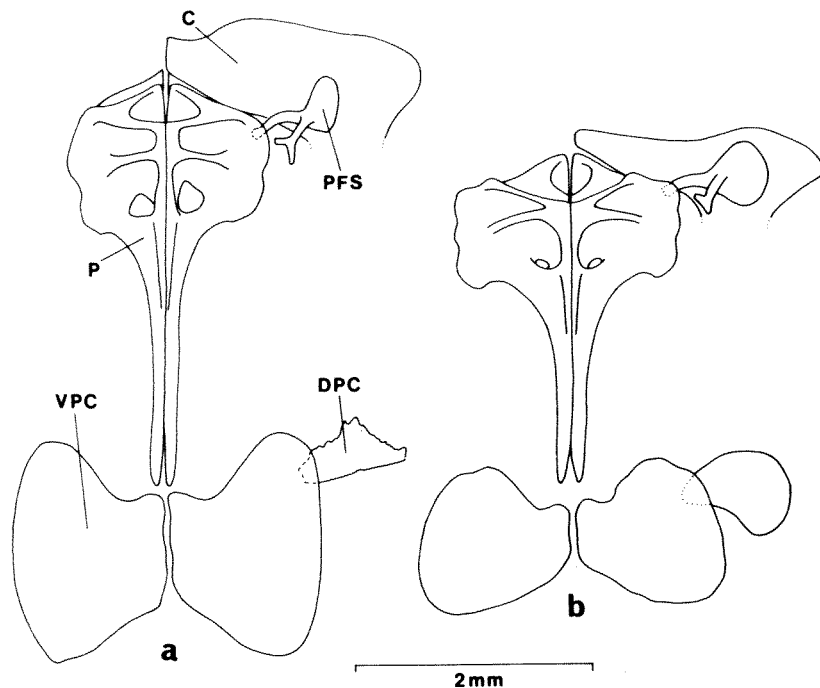
#### Distribution

*Cochleocephalus viridis* is known only from south-western Western Australia, from Israelite Bay (33°37'S, 123°53'E) at the western extremity of the Great Australian Bight to Rottneest Island off Perth.

#### Remarks

*Cochleocephalus viridis* has been collected by bottom trawl from *Posidonia* seagrass beds at depths of 1-5 m, sometimes in association with *C. spatula*. The two are easily distinguished by the length of the snout, the snout being noticeably shorter in *C. viridis* (wider than long versus longer than wide in *C. spatula*, see Hutchins 1983, Figure 2). In addition, *C. viridis* possesses greatly enlarged, forward projecting incisors in the lower jaw, a feature lacking in *C. spatula*.

Many of the osteological features of *Cochleocephalus viridis* are shared by *C. spatula*, especially regarding the shape and positioning of the pelvis, postcleithral bones, pelvic fin spine, cleithrum, maxillary, palatine, and ectopterygoid. Other members of the genus



**Figure 4.** Pelvis and associated bones (ventral view, anterior end facing top of page) of a, *Cochleoiceps viridis* sp. nov., WAM P.26604-009, 35 mm SL; and b, *C. bicolor* sp. nov., WAM P. 26608-025, 20 mm SL (for clarity, all pelvic fin rays and some bones from left side omitted from each illustration; also, anterior portion only of right cleithrum shown). (Abbreviations: C, cleithrum; DPC, dorsal postcleithrum; P, pelvis; PFS, pelvic fin spine; VPC, ventral postcleithrum).

differ considerably, particularly with respect to the last five bones. Furthermore, an undescribed species at present included in an undescribed genus tentatively referred to as Genus A (Hutchins, in press), shares many of the osteological features of *C. spatula* and *C. viridis*. However, like the other two currently undescribed members of Genus A, it possesses a prominent subopercular spine, a feature lacking in all species of *Cochleoiceps*. In spite of the latter character, this new species has more in common with *C. viridis* and *C. spatula* than do any of the other present members of *Cochleoiceps* (*bassensis*, *bicolor* sp. nov., and *orientalis* sp. nov.). However, the relationships between the three species considered to belong to Genus A are presently obscure due to the shortage of material. Further studies now in progress may show that a redefinition of generic limits is necessary.

This species is named *viridis* after its predominantly green colouration.

**Additional material examined.**

WAM P.30262-001, 9 specimens, 24-30 mm SL, Rottneest Island, Western Australia, trawled at 1-2 m, J.B. Hutchins, 6 April 1991.



*Cochleocephalus bicolor* sp. nov.

Figures 4b, 5-7; Table 2

"Clingfish" — Hutchins, 1979: 7, Figure.; Scott *et al.*, 1980: Figure.

*Cochleocephalus* species 2 — Hutchins, 1983: 44-46.

*Cochleocephalus* species — Hutchins and Thompson, 1983: 20 and 76, Figure; Hutchins and Swainston, 1986: 32 and 123, Figure; Hutchins, 1991, 627, Figures.

**Holotype**

WAM P.28522-002, 22 mm SL, Flinders Island, off Cape Leeuwin, Western Australia, rotenone at 12-13 m, J.B. Hutchins *et al.*, 18 April 1985.

**Paratypes**

22 specimens, 13-30 mm SL (unless otherwise designated, all specimens from Western Australia): WAM P.25763-002, 13 mm SL, Sandy Hook Island, Archipelago of the Recherche, by hand from the ascidian *Pyura spinifera* at 27 m, J.B. Hutchins, 8 April 1977; WAM P.26608-025, 20 mm SL (cleared and stained), Cheyne Beach, rotenone at 15 m, J.B. Hutchins *et al.*, 19 April 1980; WAM P.28293-007, 4 specimens, 15-21 mm SL, Lucky Bay, east of Esperance, rotenone at 5-7 m, J.B. Hutchins, 12 April 1984; WAM P.28300-003, 4 specimens, 18-21 mm SL, Lucky Bay, east of Esperance, rotenone at 11-12 m, J.B. Hutchins, 16 April 1984; WAM P.28296-007, 7 specimens, 14-26 mm SL, Mondrain Island, Archipelago of the Recherche, rotenone at 5-6 m, J.B. Hutchins *et al.*, 13 April 1984; WAM P.28265-001, 30 mm SL, off Parker Point, Rottnest Island, by hand at 22 m, J. Keesing, 4 February 1984; AMS I.31831-001, 17 mm SL, Lucky Bay, rotenone at 10 m, J.B. Hutchins *et al.*, 11 April 1984; BMNH 1991.9.12:11, 18 mm SL, same data as previous specimen; NMV A.2829, 29 mm SL, Flinders Island, South Australia, R. Kuitert, 29 March 1982; SAM F.6986, 28 mm SL, American River, Kangaroo Island, South Australia, by hand, N. Holmes, 11 December 1985.

**Diagnosis**

This species is distinguished from all other Australian gobiesocids by the combination of its small size (to 30 mm SL), ventral disc with papillae on all four regions, subopercular spine absent, four preoperculomandibular pores, and unique colouration. It differs from the similarly shaped *C. orientalis* sp. nov. (see following description) by differences in colouration, snout shape, and length of the anal fin (see Key to Species above).

**Description**

Measurements and counts of the holotype and selected paratypes are presented in Table 2. The following counts and proportions in parentheses represent the ranges for the paratypes when they differ from those of the holotype.

Dorsal fin rays 5 (4-6, average 6); anal fin rays 6 (5-6, average 5); pectoral fin rays 23 (21-23); pelvic fin rays 1, 4; caudal fin rays 10; vertebrae 31 (from radiographs and cleared and stained material); branchiostegals 6.

Body somewhat robust, moderately depressed anteriorly, tapering to compressed caudal peduncle, depth 5.4 (4.8-6.7) and width 4.3 (3.9-4.6), both in SL; caudal peduncle short but obvious, depth 0.9 (0.9-1.2) in its length; head moderately wide, length 3.1 (2.8-3.6) in SL and head width 1.2 (1.2-1.4) in its length; snout short, somewhat triangular when viewed from above, rounded anteriorly, length 3.2 (3.2-3.6) in head

**Table 2.** Measurements (mm) and counts of the holotype and selected paratypes of *Cochleoceps bicolor*

	Holotype			Paratypes		
	WAM	WAM	NMV	WAM	WAM	WAM
	P.28522-002	P.28265-001	A.2829	P.28296-007	P.28300-003	P.28300-003
Standard length	22	30	28	26	21	18
Head length	7	8.3	8.7	8.2	6.5	6.5
Head width	5.7	6.8	7.3	6.5	4.6	4.5
Body depth	4.1	4.5	4.8	5.4	3.5	3.1
Body width	5.1	6.7	6.8	6.6	4.9	3.9
Snout length	2.2	2.3	2.5	2.3	1.9	1.8
Eye diameter	1.9	2.6	2.5	2.3	2.1	1.8
Interorbital width	2.2	2.7	2.3	2.4	1.5	1.4
Snout to origin of dorsal fin	16	22	21	20	15	13
Snout to anus	13	19	17	17	13	11
Caudal peduncle length	1.8	2.2	2.5	2.3	2.1	2
Caudal peduncle depth	2.1	2.4	2.7	2.3	1.8	1.8
Caudal fin length	4.8	5.4	6.1	5.6	—	4
Ventral disc length	6.4	7.9	7.5	7.4	5.9	5.6
Ventral disc width	5.6	6	7.4	6.2	4.9	4.3
Dorsal base length	3.1	4.3	4.5	3.9	3	2.5
Anal base length	3.7	4.3	5	3.9	3.1	2.8
Dorsal fin ray count	5	5	6	5	6	6
Anal fin ray count	6	6	6	5	6	6
Pectoral fin ray count	23	23	21	22	22	21

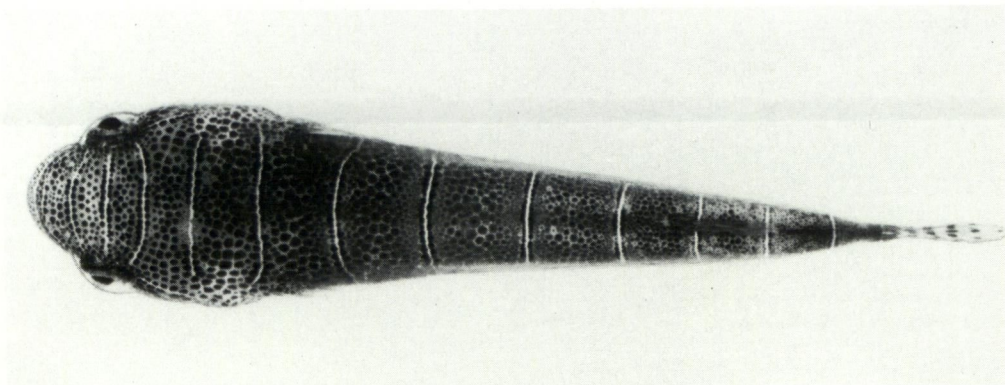


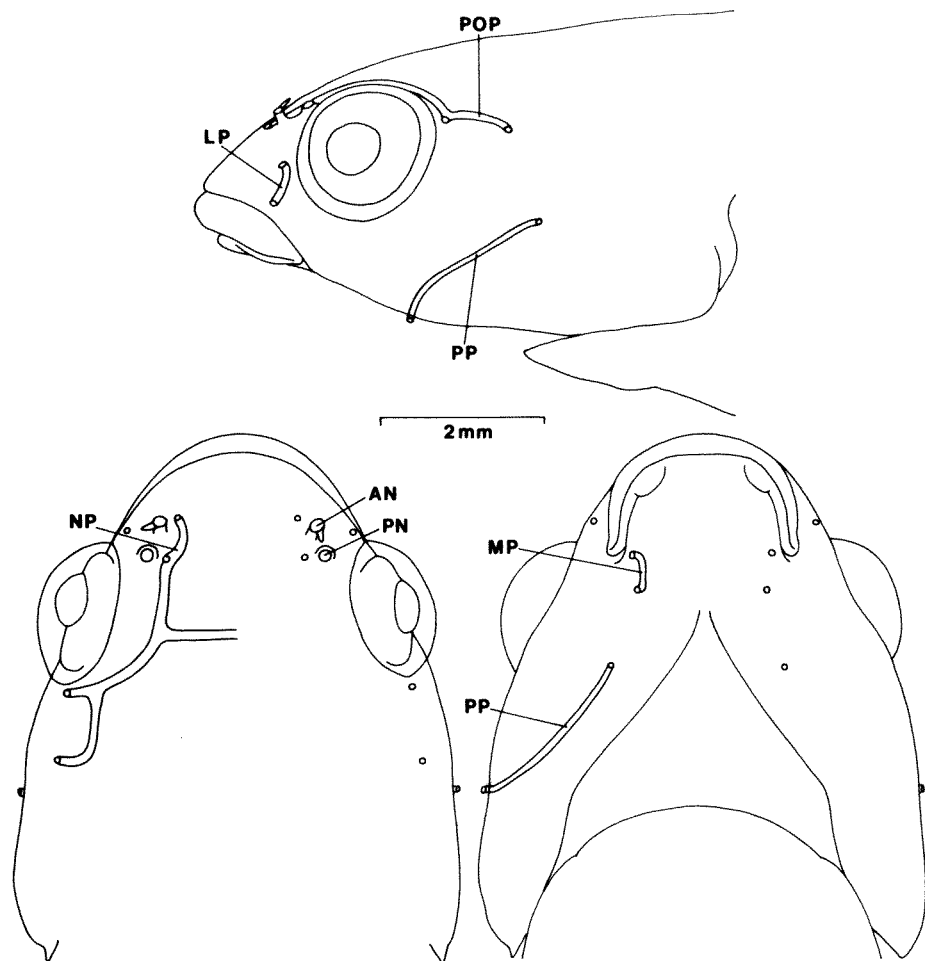
Figure 5. *Cochleoceps bicolor* sp. nov., holotype, WAM P.28522-002, 22 mm SL, dorsal view (photographed just after capture).

length; nostrils moderate in size, tubular, posterior one shorter than anterior one; posterior nostril behind anterior margin of eye, anterior nostril just in front of eye, latter with a simple narrow triangular flap on posterior portion of rim, flap reaching about one third to two-thirds to posterior nostril; eye moderately large, diameter 3.7 (3.1-3.7) in head length, almost equal to bony interorbital width (3.2 [3.1-4.6] in head length).

Skin smooth and scaleless, usually covered by thick mucus layer; lateral line sensory system consists of moderately sized open pores and minute papillae, former found only on head (Figure 6); each pore with short tubular opening slightly longer than thickness of mucus layer, associated with canal in underlying bone (outlines of canals indicated in Figure 6); 10 pores on each side of head, two lacrymal, two nasal, two postocular, and four preoperculo-mandibular pores (two pores associated with preopercle, two with mandible); papillae arranged in two longitudinal series laterally on body, others scattered on head (difficult to detect).

Gill opening wide, membranes joined across isthmus but not attached to it; upper attachment of gill membrane opposite first or second pectoral fin ray; upper attachment of pelvic fin membrane opposite 15th (12th-15th) pectoral fin ray; upper attachment of axial dermal flap opposite sixth (sixth-seventh) pectoral fin ray; ventral disc double, moderately large in size, length 3.4 (3.2-3.8) and width 3.9 (3.8-5.0), both in SL; papillae on all four regions of disc, arranged as in Figure 7 (some disc papillae lost in holotype and some paratypes).

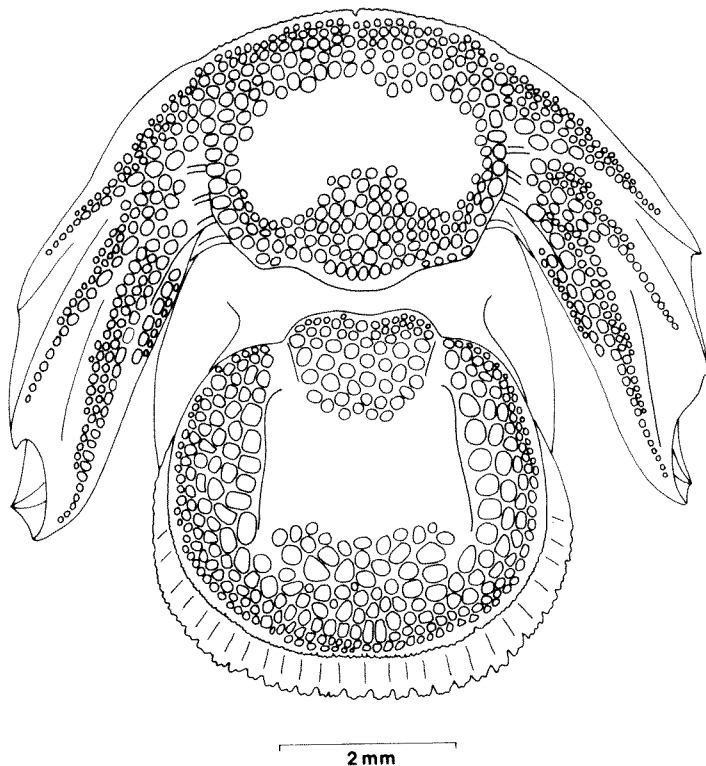
Mouth inferior, upper lip projecting noticeably forwards of lower lip; rear corner of mouth below anterior margin of eye; lip fold on lower jaw not continued across symphysis; teeth in upper and lower jaws small, conical, with acute posteriorly curving tips; outermost teeth uniserial, close-packed, encompassing band of 1-3 irregular rows of somewhat smaller, more widely spaced teeth (anterior teeth in lower jaw projecting further forwards than those in upper jaw); palatine and vomerine teeth absent; gill



**Figure 6.** Diagram of the cephalic pore system of *Cochleoceps bicolor* sp. nov., holotype, WAM P.28522-002, 22 mm SL, (pores represented by open circles, the underlying canals on one side outlined by solid lines), lateral, dorsal and ventral views. (Abbreviations as for Figure 2).

filaments on first three gill arches, absent on fourth; gill rakers on second gill arch 8-9, moderately long, conical, and finely pointed.

Bases of dorsal and anal fins short, lengths 7.1 (6.2-7.2) and 5.9 (5.6-7.0) respectively, both in SL; dorsal fin generally originating above origin of anal fin; dorsal and anal fin rays moderate in length, anterior 1-2 longest, about equal to base of respective fin; urogenital opening located about one-third to midway between posterior margin of ventral disc and anal fin origin; genital papilla prominent.



**Figure 7.** Ventral sucking disc of *Cochleoceps bicolor* sp. nov., NMV A.2829, 28 mm SL, showing arrangement of papillae (ventral view, anterior end facing top of page).

Subopercular element present, forming terminal bone posteriorly on side of head, not spinelike; dorsal postcleithral bone rather large, shaped as in Figure 4b, reaching as high as tenth pectoral fin ray; cleithral, pelvic and ventral postcleithral bones shaped as in Figure 4b (cleithrum without prominent forward-projecting flange near symphysis).

Colour of holotype in alcohol: overall pale yellowish brown.

Colour when fresh (based on colour transparencies of live fish underwater and freshly collected material): ground colour pale yellowish brown to pinkish brown, head and body covered with many very small to minute, closely packed reddish spots (Figure 5), those on posterior portion of body normally more dusky in colour, producing a distinctly bicoloured appearance; 12-15 narrow iridescent blue bars across dorsal surface, those on body continued down sides (1-3 additional bars radiate out posteriorly and anteriorly from margin of eye); reddish spots adjacent to blue bars usually more dusky, forming darker margins to cross bars; fins hyaline, with indications of reddish spotting, particularly on caudal where spotting forms about five distinct cross bands; iris reddish.

**Distribution**

*Cochleocephalus bicolor* ranges from Port Phillip Bay in Victoria to Lancelin (31°01'S, 115°20'E) in Western Australia. Its presence in Victoria is based on a single individual photographed at Portsea Pier, Port Phillip Bay.

**Remarks**

*Cochleocephalus bicolor* inhabits areas of rocky reef, usually occurring on sponges and ascidians where it sets up "cleaning stations" for the purpose of removing skin parasites from other species of fish (see Hutchins 1991 for a more detailed account of the natural history of this species). It is capable of undergoing reasonably rapid colour changes to match the colour of its substrate (by increasing or decreasing the size of the closely packed spots on its head and body).

The differences between this species and both *Cochleocephalus spatula* and *C. viridis* were discussed in the previous species account. In addition, it differs from *C. bassensis* and *C. orientalis* sp. nov. (described below) by having bright blue bars almost completely encircling its body, a character lacking in the latter two species. The features separating it from *C. orientalis*, however, are only slight (differences in colouration, snout shape, and length of anal fin base [see Key to Species]). Furthermore, although the ranges of these two species are separated by Bass Strait, they share the same ecological niche (both are specialised fish cleaners, see above). This may suggest that the two are only subspecifically distinct; however, the morphological differences referred to above indicate that the two forms must have been separated for a considerable period of time (see Hutchins 1987, for information on the formation of allopatric species pairs in the Bass Strait region). Therefore, they are here afforded full specific recognition.

This species is named *bicolor* with reference to its two-tone body colouration (reddish anteriorly, dusky posteriorly).

**Additional material examined.**

WAM P.26005-009, 2 specimens, 12-21 mm SL, Mondrain Island, Archipelago of the Recherche, rotenone at 10-13 m, 13 March 1978; P.26616-002, 17 mm SL, Rottneest Island, Western Australia, rotenone at 8 m, 7 June 1980; P.28519-003, 15 mm SL, Cape Naturaliste, Western Australia, rotenone at 6-7 m, 13 April 1985.

***Cochleocephalus orientalis* sp. nov.**

Figure 8; Table 3

*Cochleocephalus* species 3 — Hutchins, 1983: 44-45.

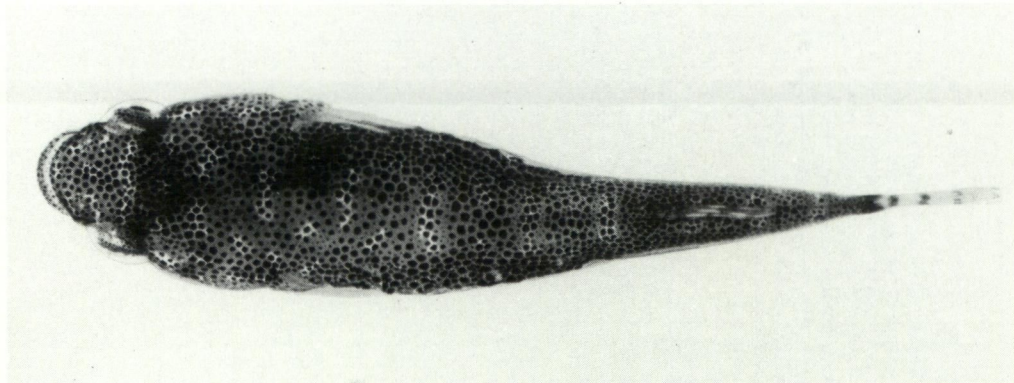
*Cochleocephalus* species — Hutchins and Swainston, 1986: 32 and 123, Figure; Hutchins, 1991: 633.

**Holotype**

WAM P.27103-001, 22 mm SL, Big Island, off Wollongong, collected from the ascidian *Pyura spinifera* by hand at 10 m, J.B. Hutchins, 3 February 1981.

**Paratypes**

5 specimens, 19-23mm SL (all specimens from New South Wales): AMS I.21975-001, 19 mm SL, The Haven, Terrigal, K. Handley, 26 February 1977; NMV A.2830, 23 mm SL, Montague Island, New South Wales, R. Kuitert, 15 September 1981; WAM P.27103-002, 3 specimens, 21-23 mm SL (one cleared and stained), collected with holotype.



**Figure 8.** *Cochleoceps orientalis* sp. nov., holotype, WAM P.27103-001, 22 mm SL, dorsal view (photographed just after capture).

### Diagnosis

A species of *Cochleoceps* closely resembling *C. bicolor* (described above), but differing in colouration, snout shape, and length of anal fin base (see Key to Species).

### Description

Measurements and counts of the holotype and selected paratypes are presented in Table 3. The following counts and proportions in parentheses represent the ranges for the paratypes when they differ from those of the holotype.

Dorsal fin rays 5 (5-6, average 5); anal fin rays 5(4-6, average 5); pectoral fin rays 21(21-23); pelvic fin rays 1,4; caudal fin rays 10; vertebrae 30-31 (from radiographs and cleared and stained material); branchiostegals 6.

Body somewhat robust, moderately depressed anteriorly, tapering to compressed caudal peduncle, body depth 5.9 (4.8-6.6) and width 4.7 (3.9-4.6), both in SL; caudal peduncle short but obvious, depth 1.1 (0.7-1.1) in its length; head moderately depressed, length 3.1 (2.7-3.1) in SL and head width 1.4 (1.2-1.4) in its length; snout short, somewhat triangular when viewed from above, rounded anteriorly, length 3.7 (3.7-4.1) in head length; nostrils moderate in size, tubular, posterior one shorter than anterior one; posterior nostril behind anterior margin of eye, anterior nostril just in front of eye, latter with simple narrow triangular flap on posterior portion of rim, flap reaching about one third to two-thirds to posterior nostril; eye moderately large, diameter 3.5 (3.4-3.7) in head length, almost equal to bony interorbital width (3.5 [3.5-4.3] in head length).

Skin smooth and scaleless, usually covered by thick mucus layer; lateral line sensory system consists of moderately sized open pores and minute papillae, former found only on head; each pore with short tubular opening slightly longer than thickness of mucus layer, associated with canal in underlying bone; 10 pores on each side of head, two lacrymal, two nasal, two postocular, and four preoperculomandibular pores as in *Cochleoceps bicolor* (see Figure 6); papillae arranged in two longitudinal series laterally on body, others scattered on head (papillae difficult to detect).

**Table 3.** Measurements (mm) and counts of the holotype and selected paratypes of *Cochleoceps orientalis*

	Holotype		Paratypes		
	WAM	NMV	WAM	WAM	AMS
	P.27103-001	A.2830	P.27103-002	P.27103-002	I.21975-001
Standard length	22	23	21	19	19
Head length	7	7.7	6.9	6.5	7.1
Head width	5.1	6.4	5.2	4.5	5.5
Body depth	3.7	4.4	3.2	3.2	4
Body width	4.7	5.9	4.8	4.1	4.7
Snout length	1.9	2	1.7	1.7	1.9
Eye diameter	2	2.2	2	1.9	1.9
Interorbital width	2	2	1.8	1.5	1.7
Snout to origin of dorsal fin	16	17	16	15	14
Snout to anus	14	14	13	12	12
Caudal peduncle length	1.9	1.9	1.8	1.8	1.3
Caudal peduncle depth	1.7	2.5	1.9	1.8	2
Caudal fin length	4.9	5.1	4.1	4	—
Ventral disc length	5.9	6.2	5.7	5.5	5.4
Ventral disc width	5.2	5.9	4.7	4.5	5
Dorsal base length	2.8	3.8	2.9	2.9	2.9
Anal base length	3	3.3	2.5	2.7	2.8
Dorsal fin ray count	5	5	5	6	5
Anal fin ray count	5	4	5	5	6
Pectoral fin ray count	21	22	23	22	23



Gill opening wide, membranes joined across isthmus but not attached to it; upper attachment of gill membrane opposite first or second pectoral fin ray; upper attachment of pelvic fin membrane opposite 13th (13th-14th) pectoral fin ray; upper attachment of axial dermal flap opposite eighth pectoral fin ray; ventral disc double, moderately large in size, length 3.7 (3.5-3.7) and width 4.2 (3.8-4.5), both in SL; papillae on all four regions of disc, arranged as in *Cochleocephs bicolor* (see Figure 7).

Mouth inferior, upper lip projecting noticeably forwards of lower lip; rear corner of mouth below anterior quarter of eye; lip fold on lower jaw not continued across symphysis; teeth in upper and lower jaws small, conical, with acute posteriorly curving tips; outermost teeth uniserial, close-packed, encompassing band of 1-3 irregular rows of somewhat smaller, more widely spaced teeth (anterior teeth in lower jaw projecting further forwards than in upper jaw); palatine and vomerine teeth absent; gill filaments on first three gill arches, absent on fourth; gill rakers on second gill arch 8-9, moderately long, conical, and finely pointed.

Bases of dorsal and anal fins short, lengths 7.9 (6.1-7.2) and 7.3 (6.8-8.4) respectively, both in SL; dorsal fin generally originating above anal fin, or slightly in advance; dorsal and anal fin rays moderate in length, anterior 1-2 longest, about equal to base of respective fin; urogenital opening located about one-third to mid way between posterior margin of ventral disc and anal fin origin; genital papilla prominent.

Subopercle present, forming terminal bone posteriorly on side of head, not spine-like; dorsal postcleithral bone shaped like those of *Cochleocephs bicolor* (Figure 4b), reaching as high as tenth pectoral fin ray; cleithral, pelvic and ventral postcleithral bones shaped like those of *C. bicolor* (see Figure 4b).

Colour of holotype in alcohol: overall pale yellowish brown.

Colour when fresh (based on colour transparencies of freshly collected material): ground colour pale yellowish brown to pinkish brown, head and body covered with many very small to minute, closely packed reddish spots (Figure 8); iridescent blue to purplish markings on head and body, tending to form short, rather irregular and often poorly-defined cross bars on back, those on body not continued down sides (one bar joins eyes across interorbital space); short wavy blue line from posterior margin of eye directed obliquely across cheek; some blue spots on dorsal surface of head and along side of body, latter sometimes forming a wavy blue line; reddish spots adjacent to blue bars occasionally somewhat darker, forming dark margins to cross bars; fins hyaline, with indications of reddish spotting, particularly on caudal where spotting forms about 3-4 distinct cross bands; iris reddish.

### Distribution

*Cochleocephs orientalis* is found only in New South Wales, ranging from Seal Rocks (32°28'S 152°32'E) to Montague Island (36°15'S 150°14'E). It has also been reported once from Western Port in Victoria (R. Kuitert, pers. comm.) but this requires confirmation (other fish species endemic to Australia's east coast have infrequently strayed as far west as Western Port).

### Remarks

*Cochleocephs orientalis* occurs in similar habitats to *C. bicolor*. Like the latter species, *C. orientalis* also sets up "cleaning stations" on ascidians and sponges for the purpose of removing skin parasites from other species of fish.

The similarities between *Cochleocephs orientalis* and *C. bicolor* have been discussed in the account of the latter species.

This species is named *orientalis* with respect to its geographical distribution.

### Acknowledgements

Specimens were kindly provided on loan by M.F. Gomon (NMV), J. Leis (AMS), and C.J.M. Glover (SAM). Colour transparencies of clingfishes were made available by R.H. Kuitert and N. Holmes for which I am very grateful. I would also like to thank two anonymous referees for their comments on the manuscript. K. Smith (WAM) provided technical assistance.

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# Guide to Authors

## Subject Matter

Reviews, observations and results of research into all branches of natural science and human studies will be considered for publication. However, emphasis is placed on studies pertaining to Western Australia. Full length papers should not normally exceed 30 typed pages. Short communications should not normally exceed three typed pages and this category of paper is intended to accommodate observations, results or new records of *significance*, that otherwise might not get into the literature, or for which there is a particular urgency for publication. All material must be original and not have been published elsewhere.

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Authors are advised to follow the layout and style in the most recent issue of the *Rec. West. Aust. Mus.* including headings, tables, illustrations and references.

The title should be concise, informative and contain key words necessary for retrieval by modern searching techniques. Names of new taxa must not be included. An abridged title (not exceeding 50 letter spaces) should be included for use as a running head.

An abstract must be given in full length papers but not short communications, summarizing the scope of the work and principal findings. It should normally not exceed 2% of the paper and should be suitable for reprinting in reference periodicals. Contrary to Recommendation 23 of the International Code of Zoological Nomenclature it may include names of new taxa.

Footnotes are to be avoided, except in papers dealing with historical subjects.

The International System of units should be used.

Numbers should be spelled out from one to nine in descriptive text; figures used for 10 or more. For associated groups, figures should be used consistently, e.g. 5 to 10, not five to 10.

Spelling should follow the *Concise Oxford Dictionary*.

Systematic papers must conform with the International Codes of Botanical and Zoological Nomenclature and, as far as possible, with their recommendations.

Synonymies should be given in the short form (taxon, author, date, page) and the full reference cited at the end of the paper.

## Manuscripts

The original and two copies of manuscripts and figures should be submitted to the Editorial Committee, c/- Publications Department, Western Australian Museum, Francis Street, Perth, Western Australia 6000. They must be in double-spaced typescript on A4 sheets. All margins should be at least 30 mm wide. Tables plus headings and legends to illustrations should be typed on separate pages. The desired positions for insertion of tables and illustrations in the text should be indicated in pencil. Tables should be numbered consecutively, have headings which make them understandable without reference to the text, and be referred to in the text.

High quality illustrations are required to size (13.5 cm x 18 cm) or no larger than 32 cm x 40 cm with sans serif lettering suitable for reduction to size. Photographs must be good quality black and white prints, 13 cm x 18 cm (5 inches x 7 inches). If scale line and lettering are required on photographs *do not* place directly on to print. They should be positioned on a clear paper or film overlay. Scale must be indicated on illustrations. All maps, line drawings, photographs and graphs, should be numbered in sequence and referred to as Figure/s in the text and captions. Each must have a brief, fully explanatory caption.

In papers dealing with historical subjects references may be cited as footnotes. In all other papers references must be cited in the text by author and date and all must be listed alphabetically at the end of the paper. The names of journals are abbreviated according to *World List of Scientific Periodicals*. The use of 'unpublished data' or 'personal communication' is discouraged.

## Processing

Papers and short communications are reviewed by at least two referees and acceptance or rejection is then decided by an editorial committee.

The senior author is sent two sets of galley proofs (one to be retained) and one set of page proofs which must be returned promptly.

The senior author will receive fifty free offprints of the paper. Additional offprints can be ordered at page proof stage.

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