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Description of a new plesiopid fish from south-western Australia, with a discussion of the zoogeography of *Paraplesiops*

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Abstract

Paraplesiops sinclairi sp. nov. is described from six specimens from the Archipelago of the Recherche and Lancelin. It is distinguished from the other members of *Paraplesiops* by the combination of a low lateral line count (29-32) and smooth preopercular margin. The historical events leading to the current distribution of the genus are also discussed.

Introduction

Members of the plesiopid fish genus *Paraplesiops* are cryptic, cave-dwelling species of rocky and coral reefs in temperate and subtropical Australia. A recent revision of the genus (Hoese and Kuiter 1984) recognised four species, *P. bleekeri* (Günther) and *P. poweri* Ogilby from eastern Australia, *P. meleagris* (Peters) from western and southern Australia, and *P. alisonae* from southern Australia. During a recent zoogeographic study of southern Australia's reef-fish fauna, I collected specimens of all four species, in addition to three specimens of a new species from south-western Australia. A search of the collections at the Western Australian Museum produced three additional specimens of the undescribed species. From this total of six specimens, five are from the Archipelago of the Recherche at the western end of the Great Australian Bight, and one is from Lancelin to the north of Perth. The purpose of this paper is to describe the new species, and examine its relationships with the other members of *Paraplesiops*. The zoogeography of the genus is also discussed.

Counts and measurements follow Hoese and Kuiter (1984). The material examined is housed in the Western Australian Museum, Perth (WAM) and the Australian Museum, Sydney (AMS).

Systematics

Paraplesiops sinclairi sp. nov.

Figures 1 and 2; Tables 1 and 2

Holotype

WAM P.28298-008, 108 mm SL, Lucky Bay, east of Esperance, Western Australia (34°00'S, 122°14'E), collected with rotenone at 24 m from coral, J.B. Hutchins et al., 15 April 1984.

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Paratypes

Five specimens from Western Australia, 45-122 mm SL (unless otherwise designated, all at WAM): P.9257-001, 45 mm SL, Lancelin Island, R.J. McKay, March 1958; P.26006-001, 2 specimens, 122 mm SL, Mondrain Island, Archipelago of the Recherche (off Lucky Bay), rotenone at 13 m from coral, J.B. Hutchins, 19 March 1978; P.28298-020, 112 mm SL, collected with holotype; AMS I.25709-001, 119 mm SL, collected with holotype.

Diagnosis

This species is distinguished from all other members of *Paraplesiops* by the combination of a low upper lateral line count (29-32) and a smooth preopercular margin. *P. poweri* has a similar lateral line count but is separable in having a prominently denticulated margin to the preoperculum.

Description

Measurements and counts of the holotype and 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 XII,10; anal fin rays III,10; pectoral fin rays 18 (17to18); longitudinal scale count 32 (32 to 34); upper lateral line and lower lateral line scale counts 29 (29 to 32) and 12 (11 to 14) respectively; lower gill rakers 11 (11 to 12); vertebrae 10+16=26.

The following measurements are expressed as percentages of SL. Head length 38.0 (35.2-37.7); snout length 7.2 (6.9-8.0); maxilla length 18.5 (17.6-19.3); orbit diameter 10.2 (9.8-12.7); interorbital width 5.9 (4.9-6.3); body depth 37.0 (33.3-36.9); pectoral fin length 29.6 (28.6-32.0); length of longest pelvic fin ray 40.7 (37.0-40.2); length of longest dorsal fin ray 29.6 (29.5-32.8); caudal fin length 34.3 (31.9-36.6).

Head and body moderately compressed; jaws equal anteriorly, maxilla reaching to well behind eye in adults, only slightly behind in juvenile; edge of preoperculum entire; head with small close-set pores on non-scaly surfaces except on maxilla, upper and lower lips and throat. Scales on head cycloid, moderately large in size, those on cheek mostly embedded but usually 1-3 vertical rows exposed, and about two-thirds of operculum with exposed scales; body scales mostly ctenoid, although those above upper lateral line, anterior to dorsal fin, and on breast cycloid. Predorsal scales extend forward to above dorsal extremity of preoperculum, ending well short of eye; 1-3 scale rows along base of dorsal and anal fins. Dentition in upper and lower jaws composed of an outer series of relatively strong conical teeth enclosing a band of smaller teeth, band widest at symphysis of jaws; V-shaped band of small teeth on vomer, and narrow band of similar teeth on each palatine; tongue with a relatively narrow, oblong patch of small teeth aligned longitudinally.

Dorsal spines increasing in length posteriorly, posteriormost noticeably shorter than first soft dorsal ray; spinous dorsal integument moderately incised, swollen

Table 1 Measurement in mm and counts of types of *Paraplesiops sinclairi*

	Holotype	Paratypes				
	WAM P.28298-008	WAM P.26006-001	WAM P.26006-001	AMS I.25709-001	WAM P.28298-020	WAM P.9257
Standard length	108	122	122	119	112	45
Head length	41	46	43	43	42	16
Orbit length	11	13	12	12	12	5.7
Snout length	7.8	9.8	8.5	8.2	8.5	3.2
Maxilla length	20	23	22	23	21	7.9
Suborbital width	2.6	3.5	3.0	2.9	2.8	0.7
Fleshy interorbital width	6.4	7.7	6.9	6.9	6.8	2.2
Body depth at pelvic origin	40	45	43	43	39	15
Pectoral fin length	32	39	35	34	34	14
Pelvic fin length	44	47	46	44	45	18
Caudal fin length	37	44	43	38	41	–
Longest dorsal ray	32	36	37	39	36	–
Pectoral fin count	18	18	18	17	17	18
Longitudinal scale count	32	33	34	32	32	32
Upper lateral line scale count	29	32	32	30	30	31
Lower lateral line scale count	12	14	11	12	13	12
Predorsal scale count	7	7	7	7	6	7
Transverse scale count	12	13	14	14	14	14
Oblique cheek scale rows	2	2	1	3	1	3
Lower gill raker count	11	12	11	11	11	–

at spine tips; fourth or fifth last dorsal and anal rays longest, extending posteriorly to a point level with midlength of caudal fin, or slightly behind; first two soft dorsal and anal rays undivided, others branched; all pectoral fin rays branched, except uppermost and lowermost 1-2 rays simple; all four soft rays of pelvic fin branched, anteriormost deeply forked.

Colour of fresh holotype (from a colour transparency): head blackish brown with numerous iridescent dark blue spots; a black to iridescent blue blotch, roughly circular in shape and somewhat larger than eye, on ventral region of operculum; dark iridescent blue line on suborbital curving posteriorly around margin of eye to end a short distance behind midpoint of eye's posterior border; ventral margin of gill membranes dark iridescent blue; body dark brown with scale centres a paler brown, particularly on lower sides; indications of seven dark cross bars, last on caudal base; dorsal, anal and caudal fins blackish brown with numerous small dark spots on caudal and posterior portions of dorsal and anal fins; swollen tips of dorsal and anal spines dark iridescent blue, with a similarly coloured line along dorsal and ventral margins of soft dorsal and anal fins respectively; pelvic fin brownish black with several dark iridescent blue streaks; pectoral fin yellow.

Colour of holotype in alcohol: generally similar to fresh coloration, but all blue markings black. The paratypes are similarly coloured, with the exception of the smallest specimen. After many years in preservative, it is now dark brown overall with a few dark spots on the head. The large blackish blotch on the preoperculum is particularly prominent.

Figure 1 *Paraplesiops sinclairi*, holotype, 108 mm SL.

Distribution

Paraplesiops sinclairi is known only from south-western Australia, from the Archipelago of the Recherche (34°08′S, 122°15′E) to Lancelin (31°00′S, 115° 19′E).

Remarks

Paraplesiops sinclairi has been collected with rotenone only from moderate-sized colonies of the coral *Turbinaria* species. Both collection sites in the Archipelago of the Recherche were in water of moderate depth (13-24 m), and isolated from nearby rocky reefs by an open expanse of sandy bottom. Numerous collections made with rotenone from *Turbinaria* colonies in rocky reefs in the same area failed to produce additional specimens. This species is probably more abundant in Western Australian waters than the present small number of specimens seems to indicate, as isolated coral colonies in sandy areas have rarely been sampled.

This species was originally recorded for Western Australia as *Paraplesiops* species (Hutchins and Thompson 1983) on the basis of two specimens collected in

1978 from Mondrain Island in the Archipelago on the Recherche. Although never examined, these specimens were included as non-type material in the original description of *Paraplesiops alisonae* (Hoese and Kuiter 1984) because of a painting in the former paper. However this illustration was based on a colour transparency of a specimen from South Australia (WAM P.27136-005), which is in fact the true *P. alisonae* and not conspecific with the Mondrain Island material. The subsequent collection in 1984 of more specimens of the latter species (herein described as *P. sinclairi*), and the publication of a review of the genus (Hoese and Kuiter 1984), resulted in the discovery of this error. Therefore, *P. alisonae* must now be removed from any faunal lists of Western Australian fishes.

This species is named *sinclairi* in memory of Mr Nick Sinclair who, while a member of the Western Australian Museum's Department of Ichthyology, was involved in the collection of the holotype and two paratypes.

Relationships

A summary of the main differences among the species of *Paraplesiops* is presented in Table 2. This indicates that *P. sinclairi* is most closely related to *P. poweri* (characters 1, 8, 10, 12, 21 and 23), and that *P. meleagris* has more features in common with *P. bleekeri* than with any other member of the genus (characters 1, 4, 7, 12, 21, 22, and 25). *P. alisonae* appears to be the most specialised species due the number of unique features it possesses (characters 1, 2, 3, 5, 6, 11, 12, 13, 14, 15, 17, and 24). When these relationships are compared with the known distribution of *Paraplesiops* (Figure 2), the most obvious feature is the ranges of the two groups of apparent species pairs, *P. poweri* and *P. sinclairi*, and *P. bleekeri* and *P. meleagris*. One species of each pair is found on the east coast of the continent, whereas the other occurs allopatrically on the west coast and at least part of the south coast. The species considered to be the most specialised, *P. alisonae*, occupies the southernmost range. In a recently completed study of the patterns of reef fish distribution in Australia's southern half (Hutchins, in preparation), numerous examples of species pairs with similar distributions to the above were found. Furthermore, some species pairs were joined by a related but more southerly distributed species at or near the southern limits of their distirbutions. Table 3 lists several of these examples. However, phylogenetic analyses of many of the taxa concerned are not presently available, so the apparent close relationships, as indicated in Table 3, must be considered here as only tentative. Nevertheless, the apparent similarity in the patterns of distribution indicate that *Paraplesiops* and the examples mentioned above probably share the same zoogeographic history.

A summary of past events that helped shape the present patterns of distribution of southern Australia's shallow water marine fauna was presented by Knox (1980). During the Tertiary, Australia had a climate ranging from tropical to subtropical. Sea temperatures reached a maximum during the mid-Tertiary, and declined during the late Tertiary to reach a minimum in the Quaternary.

Table 2 A comparison of the species of *Paraplesiops*
Data from Hoese and Kuiter 1984 have been incorporated.

No. Character	*alisonae*	*bleekeri*	*meleagris*	*poweri*	*sinclairi*
1. Number of undivided soft rays in dorsal and anal fins	4-5	0-1	0-1	1-2	1-2
2. Number of lateral line scales posterior to dorsal fin	1-3	0	0	0	0
3. Scales on bases of dorsal and anal fins	No	Yes	Yes	Yes	Yes
4. Number of predorsal bones	2	3	3	2	2
5. Shape of tooth patch on tongue	large, oval	narrow, oblong	narrow, oblong	narrow, oblong	narrow, oblong
6. Dorsal spine count	11 (rarely 12)	12 (rarely 11)	12 (rarely 11)	12	12
7. Longitudinal scale count	32-39	39-45	37-52	32-38	32-35
8. Upper lateral line count	34-38	34-40	34-43	28-32	29-32
9. Lower lateral line count	12-16	11-14	12-21	9-13	11-14
10. Predorsal scale count	15-20	20-29	10-24	7-12	6-7
11. Lower gill raker count	9-11	13-15	11-15	11-13	11-12
12. Longest dorsal ray (% of SL)	21.7-25.4	39.5-51.9	27.0-56.6	29.3-43.1	29.5-32.8
13. Caudal fin length (% of SL)	23.2-28.4	32.6-40.5	29.2-44.3	35.3-38.9	31.9-36.6
14. Pelvic fin length (% of SL)	26.4-33.8	39.4-48.9	34.2-45.4	38.4-50.6	37.0-40.7
15. Body depth (% of SL)	26.4-32.2	32.6-38.9	34.0-43.3	35.6-44.4	33.3-36.9
16. Preopercular margin	smooth	smooth	smooth	denticulate	smooth
17. Pores on snout	none	few	many	many	many
18. Pores on mandible	few, in clusters	many, in clusters	many	many	many
19. Scales on cheek	mostly exposed	mostly exposed	mostly imbedded	mostly imbedded	mostly imbedded
20. Number of body bars in life	9-10	4-5	8-9	8-9	8-9
21. Blue spots on body	few	many, restricted	many, widespread	none	none
22. Dark posterior band to dorsal, anal and caudal fins of juvenile	no	yes	yes	no	no
23. Large dark spot on operculum ventrally	no	no	occasionally	yes	yes
24. Number of vertebrae	27	26	26	26	26
25. Maximum lengths (mm SL)	115	224	245	129	122

Temperatures then rose progressively to the present level. Species inhabiting the east and west coasts of the continent dispersed northwards with falling sea temperatures and southwards with rising temperatures, whereas species on the south coast were forced to move to one or both the east and west coasts with falling temperatures, and redispersed to the south coast with rising temperatures. Knox drew attention to the fluctuating sea levels and sea temperatures during the Quaternary ice age, and the part these played in the separation of wide pread species into allopatric populations, and eventually into distinct species. Other workers have provided some examples of species pairs in the fish fauna of southern Australia that were presumed to have evolved from ancestral species split into two populations by the emergence of the Bass Strait land bridge (for example, Dartnell 1974; Collette 1974).

It is conceivable that ancestral species of *Paraplesiops* were separated into allopatric populations by events such as described above, eventually achieving reproductive isolation to form closely related species. The separation of the forerunners of *P. bleekeri* and *P. meleagris*, for example, from a common ancestral species widely distributed across southern Australia is easily explained, after noting the present day ranges of these two species (Figure 2), by fluctuations of sea levels and sea temperatures in the Bass Strait area during a period of glacial

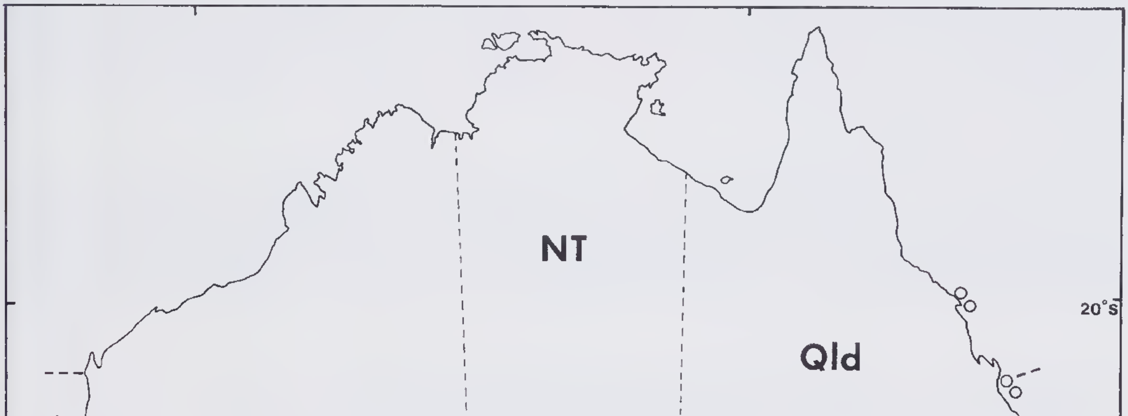
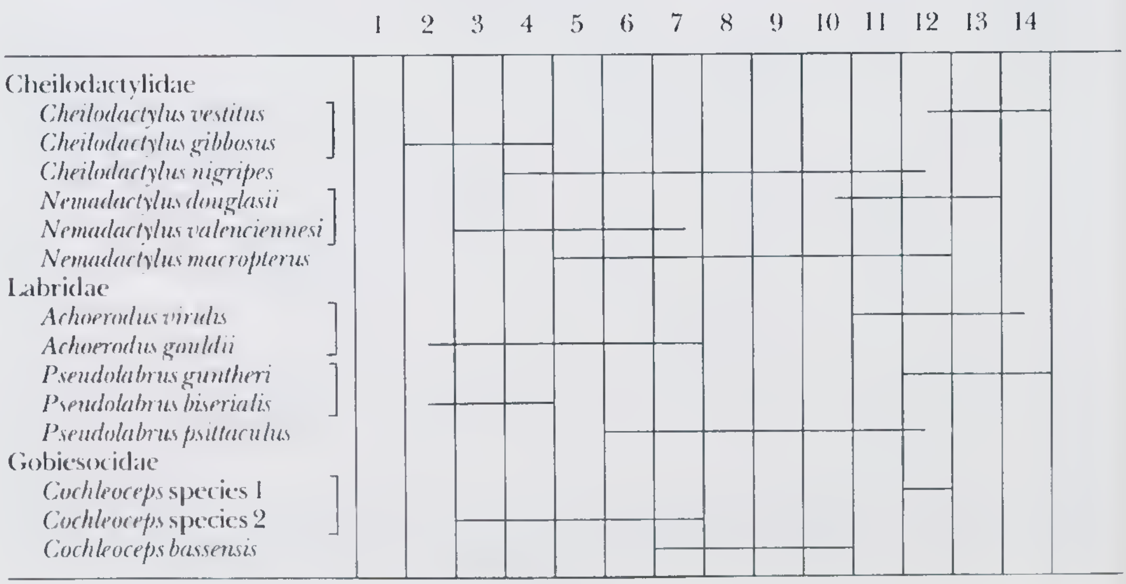


Figure 2 Map of Australia showing recorded localities for the species of *Paraplesiops*. Regions 1-14 (from Hutchins, in preparation) are employed in Table 3.

activity. However, the splitting of the presumed common ancestor of *P. poweri* and *P. sinclairi* is more difficult to explain. These two species are currently widely separated (Figure 2), and any possible explanation involving the geographic isolation of a widespread species into two allopatric populations could just as easily be based on a northern Australian connection as a southern one. Some workers believe that in the late Quaternary, numerous subtropical species were able to extend their ranges into tropical areas when sea temperatures decreased during a period of glacial activity (Randall 1981). Perhaps the common ancestor of *P. poweri* and *P. sinclairi* experienced such a dispersal, ranging across northern Australia only to be separated into an eastern and western population by the subsequent interglacial. These populations have since achieved reproductive isolation but, because they have been isolated only a relatively short period of time, are still very similar morphologically and ecologically. I favour this hypothesis as against one involving a southern connection due to the lack of evidence supporting the presence at any time in the past of large plate corals, the preferred habitat of the above two species, across the southern Australian coastline (Kendrick, pers. comm.).

In contrast to the above discussion on the evolution of species pairs, the history of the most specialised species, *P. alisonae*, appears to have involved a much earlier separation from the main *Paraplesiops* line. The subsequent long period of isolation resulted in the evolution of its many unique characters. Based on its present distribution, *P. alisonae* may have evolved in the Tasmanian/Victorian

Table 3 Distribution of some fish species found in Australia's southern half
Numbers refer to the regions illustrated in Figure 2
Brackets indicate presumed species pairs



region of southern Australia due to the different environmental conditions that are experienced there in contrast to the rest of Australia (this phenomenon is currently occurring in *P. meleagris*, where the Victorian population differs significantly from the South Australian and Western Australian population - see Hoese and Kuiter 1984).

The present distributions of the species of *Paraplesiops* are mostly dependent on the climatic conditions of the present interglacial (the commencement of the next glacial, for example, would greatly affect these ranges). Another factor is the availability of preferred habitat. The southernmost limits of the coral-dwelling *P. poweri* and *P. sinclairi* are probably determined by the presence or absence of large plate corals (the Solitary Islands off Coff's Harbour on the north coast of New South Wales, and the Archipelago of the Recherche off Western Australia's south coast). The lack of shallow rocky reefs in eastern Victoria between Cape Conran and Wilson's Promontory has probably contributed to this area being at or near the southern limit of *P. bleekeri* and the eastern limits of *P. alisonae* and *P. meleagris*.

Additional Material Examined
(unless otherwise designated, all at WAM)

Paraplesiops alisonae: P.27136-005, paratypes, 3 specimens, 72-107 mm SL, Victor Harbour, South Australia, 28 March 1981; P.27578-001, 2 specimens, 55-100 mm SL, mouth of Tamar River, Tasmania, 20 March 1982.

Paraplesiops bleekeri: P.27099-014, 216 mm SL, Port Hacking, New South Wales, 28 January 1981.

Paraplesiops melagris (all from Western Australia): P.4178, 88 mm SL, Lancelin Island, 21 November 1957; P.25251-012, 140 mm SL, Rottnest Island, 9 April 1975; P.26532-002, 73 mm SL, Geographe Bay, 27 December 1978; P.26614-013, 192 mm SL, Rottnest Island, 6 January 1980; P.26616-012, 74 mm SL, Rottnest Island, 7 June 1980; P.27587-005, 64 mm SL, Long Island, Houtman Abrolhos, 16 April 1982; P.27590-001, 170 mm SL, Dick's Island, Houtman Abrolhos, 17 April 1982; P.27949-007, 44 mm SL, Jurien Bay, 9 April 1983; P.28293-020, 73 mm SL, Lucky Bay, east of Esperance, 12 April 1984.

Paraplesiops poweri (all from Queensland): AMS IA.874-876, 3 specimens, 84-97 mm SL, Whitsunday Passage, no other data; AMS I.18258-001, 129 mm SL, Moreton Bay, November 1973; AMS I.19347-002, 100 mm SL, Great Keppel Island, July 1973; P.27065-003, 3 specimens, 31-51 mm SL, Bargara, 3 December 1980.

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