

## The distribution of Australian cave fishes

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### INTRODUCTION

Worldwide only 84 species of fish are known to occur in hypogean waters with 13 instances of two species and three instances of three species occurring in sympatry (Proudlove 1997; G.S. Proudlove, pers. comm. 1999). Two species of blind cave fish are known from Australia, namely the Blind Gudgeon, *Milyeringa veritas* Whitely, 1945 (Perciformes: Gobiidae) and the Cave Eel, *Ophisternon candidum* (Mees, 1962) (Synbranchiformes: Synbranchidae). They are found in sympatry on the Cape Range peninsula of northwestern Australia. Both species are listed as endangered under Western Australian fauna legislation. This note presents the known occurrence of these cave fishes and includes a major range extension of *M. veritas* to Barrow Island.

Two primary sources deal with the distribution of the stygofauna (obligate subterranean aquatic species) on the Cape Range peninsula (Mees 1962; Humphreys and Adams 1991). In 1959 Mees (1962) collected widely along the west coast of the peninsula but found stygofauna only in Milyering (C-24: Australian Karst Index number), Kudamurra Well (C-25) and Tantabiddi Well (C-26) and recorded *M. veritas*, *O. candidum* and *Stygiocaris* spp. (Decapoda: Atyidae). Humphreys and Adams (1991) compiled the distributional data then available but recorded no further taxa of stygofauna. An unpublished report (Humphreys 1994) provided further distributional records and information on the habitat, feeding and associated stygofauna.

### Distribution of cave fishes

The known occurrences of the two species are shown in Figure 1. Only at C-26 (Tantabiddi Well, location 4 in Figure 1) does *O. candidum* occur in the apparent absence of *M. veritas* (the site 'South of Yardie Creek' in Table 1 is of unknown status). The area shown in Figure 1 has been sampled widely for stygofauna (Pesce *et al.* 1996: Fig. 29) and all the available access points have been sampled in the northern part of the Cape Range peninsula and Barrow Island (W.F. Humphreys, unpublished). In addition, the lower Robe and Fortescue River aquifers, on the mainland opposite Barrow Island, that contain elements of the Cape Range and

Barrow Island stygofauna have been sampled widely (W.F. Humphreys, unpublished).

The number of sites from which *M. veritas* has been recorded has increased steadily over time (Table 1: bottom line) and there is still an upward trend in comparable data for *O. candidum*. However, a number of access sites have been lost in the interval from infilling (Table 1; C-361, AB5, Site D), drying (C-282, C-362) or siltation (C-23), and a number of sites are close to planned developments (C-25, AB5), are within periurban areas (C-23, C-27, C-105, C-282, C-361, C-452, C-495, WC 15, WC 44), or in an unmanaged military area (C-28, C-506, C-507). While there has been a significant extension of the range of *M. veritas* to Barrow Island, the inclusive known range of the two species on the Cape Range peninsula has not increased since 1991 (Humphreys and Adams 1991), but there has been considerable infilling of the distribution. These additional sites have markedly increased the known range of habitats and water types inhabited by the fishes.

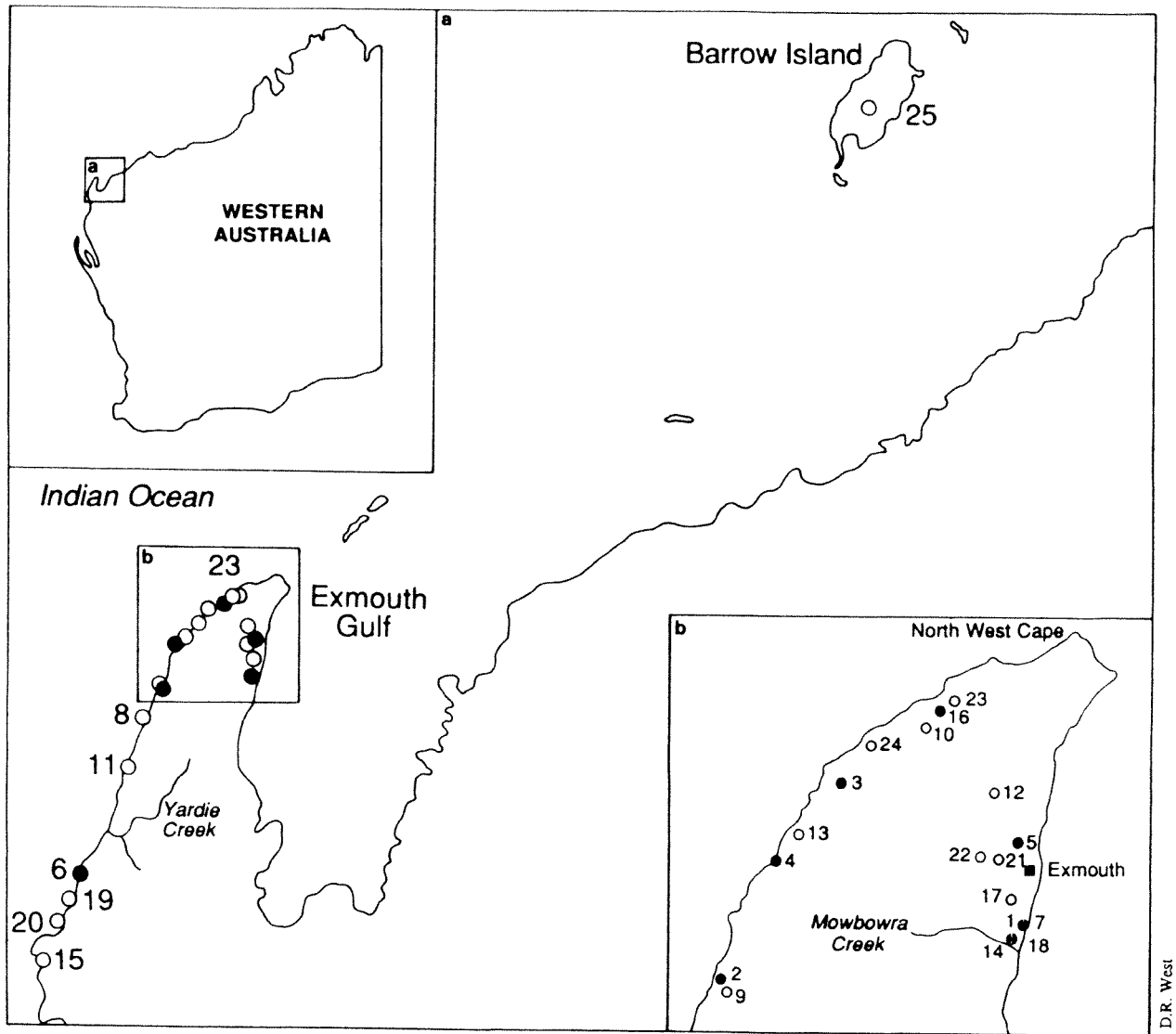
The fishes are now known to be part of a rich stygofaunal community (Table 1; Bradbury and Williams 1997; Humphreys in press a) that contains a number of eco-geographic relicts and phyletic relicts with tethyan affinities (Humphreys 1993, 1994, in press a; Knott 1993; Danielopol *et al.* in press), including the only member of the class Remipedia (Yager and Humphreys 1996) and the order Thermosbaenacea (Poore and Humphreys 1992) in the southern hemisphere with closest affinities with fauna found in caves on either side of the North Atlantic.

The fishes are found close to the coast and up to 4.3 km inland in a predominantly anchialine system, namely there is a fresh to brackish water lens overlying a seawater wedge (Allen 1993) that is affected by marine tides (Yager and Humphreys 1996; Humphreys in press b). *Milyeringa veritas* occurs in waters ranging from fresh to seawater and has been sampled from caves at water depths up to 33 m, from anchialine pools, from wells and from bores in which the water table was up to 50 m below the ground surface. Numbers of *M. veritas* seen in caves vary from few to about 100. *Ophisternon candidum* has been seen in wells and caves, usually singly, occasionally in pairs, and on

**Table 1** The known occurrence of the blind cave fish on the Cape Range peninsula and Barrow Island. a, recorded in Humphreys and Adams (1991); b, from field notes of American Museum of Natural History; Station 60, 5 April 1969; c, 1993; d, samples (WAM: P.5863.001) were collected from Neds Well in 1963 but it has not contained water since at least 1987. e, new well south of Yardie Creek (Allen 1982). Commonwealth of Australia land controlled by the Royal Australian Navy (RAN) or the Royal Australian Airforce (RAAF). CRNP, Cape Range National Park. Most of the pastoral wells were located on or adjacent to traditional watering places and a number of the caves were also traditional watering places. <sup>1</sup> Mees (1962); <sup>2</sup> Humphreys and Adams (1991) <sup>3</sup> Humphreys (1994).

Index #		<i>M.</i> <i>veritas</i>	<i>O.</i> <i>candidum</i>	Notes
1	C-23	ab	b	Cave. Not seen for many years, heavy siltation from former gravel pit draining through cave, feral tropical aquarium fish. Exmouth.
2	C-24	ac	ac	Former pastoral well. Type locality of <i>Milyeringa veritas</i> . CRNP
3	C-25	ac	ac	Former pastoral well. Type locality of <i>Stygiocaris stylifera</i> Holthuis, <i>S. lancifera</i> Holthuis, and <i>Metacyclops mortoni</i> Pesce, De Laurentiis and Humphreys (Copepoda: Cyclopidae). CRNP
4	C-26	—	a	Former pastoral well. Type locality of <i>Ophisternon candidum</i> . CRNP.
5	C-27	ac	ac	Cave with pump installed. RAN.
6	C-28	ac	—	Anchialine cave. Type locality of <i>Lasionectes exleyi</i> Yager and Humphreys (Remipedia), <i>Danielopolina kornickeri</i> Danielopol, Baltanás and Humphreys (Ostracoda: Halocyprida), and <i>Halicyclops longifurcatus</i> Pesce, De Laurentiis and Humphreys (Copepoda: Cyclopidae). — endangered community. RAAF bombing range.
7	C-105	c	a	Cave in former gravel pit now draining through C-23. Exmouth.
8	C-149	a	—	Former pastoral well. CRNP.
9	C-215	ac	—	Cave. Type locality of <i>Halosbaena tulki</i> Poore and Humphreys (Thermosbaenacea). CRNP
10	C-273	ac	—	Former pastoral well. Crown Land.
11	C-274	ac	b	Former pastoral well. CRNP.
12	C-282	d	—	Former pastoral well. Recorded 1963, now long dry. Type locality of the genus <i>Nedsia</i> Barnard and Williams (Amphipoda: Melitidae). RAN.
13	C-332	c	—	Anchialine pools; only natural site known for <i>Grandidierella</i> sp. nov. (Amphipoda: Aoridae).
14	C-361	a	a	Former pastoral well now filled in. Exmouth.
15	C-362	ac	—	Former pastoral well, now dry. Leasehold, Ningaloo Pastoral Station.
16	C-414	c	c	Tidal cave. Crown Land.
17	C-452	c	—	Cave. In Exmouth townsite — endangered community; only known locality for six species of terrestrial troglobites.
18	C-495	c	c	Cave. Exmouth.
19	C-506	—	—	Anchialine pools. RAAF bombing range.
20	C-507	—	—	Anchialine pools. RAAF bombing range.
South of Yardie Creek		—	e	Well. Location unknown, no specimen.
21	WC 15	—	—	Water production bore. Water Corporation Exmouth Borefield.
22	WC 44	c	—	Water production bore. Water Corporation Exmouth Borefield.
23	AB5	—	—	Seismic uphole. Crown Land.
24	Site D	—	—	Seismic uphole. Crown Land.
25	L8	—	—	Old water bore. Type locality of <i>Nedsia sculptilis</i> Bradbury & Williams (Melitidae) and of the genus <i>Bogidomma</i> Bradbury & Williams (Bogidiellidae). A-class Reserve, active oilfield.

Total sites now (in 1962<sup>1</sup>, 1991<sup>2</sup>, 1994<sup>3</sup>) — *Milyeringa veritas* 25 (2, 11, 18) — *Ophisternon candidum* 11 (2, 6, 11)



**Figure 1** The distribution of blind cave fishes in Australia. Filled circles denote *Ophisternon candidum*. *Milyeringa veritas* is present at all locations denoted by open or filled circles except location 4 (Tantabiddi Well).

only one occasion with three together. Many of the cave fish sites are also type localities (Table 1) for other cave restricted species, some of which are prey of the fish (Humphreys and Feinberg 1995).

The population of *M. veritas* — nor *Stygiocaris stylifera* Holthuis — is not genetically uniform and there is evidence of restricted gene flow on the peninsula (Humphreys and Adams 1991). Hence, the presence of the fauna within Cape Range National Park does not in itself provide an adequate representation of the genetic diversity of the fish, nor does it adequately represent their habitat diversity.

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