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Short communication

First New Zealand record of the Australian bridled goby, *Arenigobius bifrenatus* (Pisces: Gobiidae)

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Abstract *Arenigobius bifrenatus* (Kner 1865) is a burrowing coastal and estuarine goby from temperate areas of Australia. One specimen was captured from the Whangateau Harbour, north-eastern New Zealand, on 1 April 1998, constituting the first record of this species from New Zealand. Further intensive beach seining at Pollen Island, within the Waitemata Harbour (Auckland), yielded two further specimens which were females in breeding condition. We suggest that the species is an adventive, and its presence in northern New Zealand waters is the result of accidental transport in shipping ballast water.

Keywords *Arenigobius bifrenatus*; ballast water; estuary; Gobiidae; new New Zealand record

INTRODUCTION

Three species of goby have previously been recorded from mainland New Zealand (Paulin et al. 1989). *Gobiopsis atrata* (Griffin 1933) is a New Zealand endemic found on silty areas of rocky reefs from

North Cape to Stewart Island (Paulin & Roberts 1992), and is the only species regularly found outside estuaries. *Acentrogobius lentiginosus* (Richardson 1844) and *Favonigobius lateralis* (Macleay 1881) are common in Northland estuaries and beaches (McKenzie 1984; authors' pers. obs.). The latter is also common in Australian estuaries (Neira et al. 1992). Two further gobiid species, *Eviota* sp. and *Priolepis psygmophilia* Winterbottom & Burrige 1993, occur within the New Zealand region but are endemic to the subtropical Kermadec Islands (Francis 1996). In the present paper, we report the capture of three specimens of *Arenigobius bifrenatus* (Kner 1865) from north-eastern New Zealand. The species is common on sand and silt bottoms of estuaries and coastal bays of southern Australia (Hutchins & Swainston 1986; Kuitert 1993; Gomon et al. 1994), but has not previously been recorded outside Australia.

OBSERVATIONS

On 1 April 1998 a single specimen of *Arenigobius bifrenatus* (Fig. 1) was captured in a 5 mm mesh seine net on a silt layer overlying deep anoxic mud in the Whangateau Harbour, north-western Hauraki Gulf (36° 19' S, 174° 46' E). The capture site was a small channel c. 10 m from dense mangrove (*Avicennia marina*) stands, and at low spring tide was c. 0.5 m deep. The specimen was male, 76 mm standard length (SL, preserved) and is registered in the collection of the Museum of New Zealand (NMNZ P. 35224). Two further specimens (91 mm SL, NMNZ P. 35935; 85 mm SL, NMNZ P. 35936) were captured on 8 October 1998 and 11 December 1998 respectively, by seining a muddy mangrove channel at Pollen Island (36° 52' S, 174° 40' E) within Auckland's Waitemata Harbour. The latter specimens were female. Identification was confirmed by comparison with the original description of the species by Kner (1865), and descriptions and illustrations by Hutchins & Swainston (1986), Kuitert (1993), and Gomon et al. (1994).

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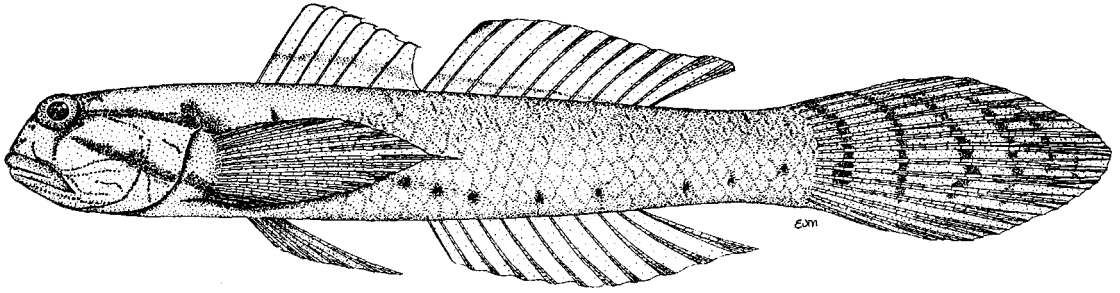


Fig. 1 *Arenigobius bifrenatus* (Kner 1865), 76 mm standard length, NMNZ P.35224, 0.5 m depth, Whangateau Harbour, north-eastern North Island, New Zealand. Illustration by E. Mackay.

Description

D VI, I+10–11; A I+10 (last ray divided to base); V I+5; P 16–18; C 15–16 (segmented); Vertebrae 10+15 (vertebral counts taken from radiograph). Body cylindrical. Snout blunt; eyes large, and close together dorsally; origin of pectorals under posterior margin of operculum; caudal oval and elongate; 7th pectoral ray extended into a filament; pelvics united into cup-shaped disc with branched rays; origin of pelvics covered by a loose sheath of skin; scales cycloid on belly and dorsally to second dorsal origin; posterior lateral scales peripheral ctenoid (*sensu* Roberts 1993), large (width 3.4 mm at caudal peduncle); head and predorsal region naked. Morphometric measurements are given in Table 1 (measurements in 70% EtOH, taken using vernier calipers).

Colour In life, body colour light brown; two oblique dark bands originating on head below eye, the upper degenerating into diffuse purplish brown blotches from the pectoral to caudal peduncle; a

black stripe arising at the pectoral insertion and running along lower body before breaking into small black spots above anal fin; dorsal fins with a horizontal dark band near the base; dark blue mark on membrane distally between first and second rays of D2; iridescent irregular blue blotches along flanks; three or more approximately vertical bands on upper caudal.

Arenigobius bifrenatus is separated from the closely related *A. frenatus* by the absence of dark spots on the top of the head, elongate caudal fin, 35–42 vertical scale rows on body (cf. 28–35), and the presence of the black band arising from the pectoral fin breaking into dark spots posteriorly (Gomon et al. 1994).

Remarks

Arenigobius bifrenatus is easily diagnosed by its distinctive coloration, elongate fins, and the terminal filaments of the pectorals. The overall body form is

Table 1 Morphometric measurements for *Arenigobius bifrenatus* (after preservation) collected from Whangateau Harbour (NMNZ P.35224) and Waitemata Harbour (NMNZ P.35935; NMNZ P. 35936), north-eastern New Zealand. (SL = standard length.)

Specimen:	NMNZ P. 35224		NMNZ P. 35935		NMNZ P. 35936	
	mm	%SL	mm	%SL	mm	%SL
Total length	99	–	115	–	112	–
Standard length	76	–	91	–	85	–
Head length	16.0	21.05	23.0	25.27	21.0	24.71
Body depth	13.5	17.76	16.0	17.58	13.5	15.88
Snout length	4.0	5.26	6.7	7.36	5.1	6.00
Orbit diameter	4.5	5.92	5.3	5.82	5.2	6.12
Interorbital width	1.5	1.97	1.9	2.09	1.6	1.88
Upper jaw length	7.4	9.74	8.5	9.34	7.9	9.29
Length to dorsal origin	22.0	28.95	28.0	30.77	25.6	30.11
Length to anal origin	39.7	52.23	49.4	54.28	45.2	53.18
Length to pelvic origin	19.0	25.00	25.3	27.80	23.1	27.18
Least depth of caudal peduncle	8.3	10.92	10.0	10.99	8.6	10.12

typical of burrowing gobies, with its blunt snout and eyes situated high on the head. It should be noted that our counts of the segmented caudal rays differ from the count (18) given by Gomon et al. (1994), who may have inadvertently included one or more of the conspicuous procurent rays. Additionally, Larson & Hoese (1996) listed both species of *Arenigobius* into the genus *Amoya* without comment or analysis, but because this change has not been formally taxonomically justified we retain the former name for this paper. The capture of the specimens over soft mud is consistent with reports of its preferred habitat in Australia (Hutchins & Swainston 1986; Gill & Potter 1993; Gomon et al. 1994). The maximum length of *A. bifrenatus* is given by Kuitert (1993) and Gomon et al. (1994) as 150 mm total length (TL). The New Zealand specimens were medium size adults (99, 115, and 112 mm TL), exhibiting the pointed caudal fin and bright coloration of sexually mature individuals (Hutchins & Swainston 1986; Gomon et al. 1994). Examination of the viscera showed that the females captured from Waitemata Harbour were gravid.

The mechanism by which these specimens arrived in New Zealand waters is unknown, but they may have been transported across the Tasman Sea during their planktonic larval phase by the prevailing East Australian Current, and thence southward by the East Auckland Current (Francis & Evans 1993; Francis 1996). However, surveys of goby larvae in estuaries of Western Australia (Neira et al. 1992) found that over 80% of *A. bifrenatus* larvae were captured in upper estuaries, with very few (1.9%) found in lower estuaries. The distribution of *A. bifrenatus* in Australia is cool to warm temperate (Hutchins & Swainston 1986), so it seems more likely that the present specimens were transported directly from mainland Australia, rather than via subtropical surface water. Given this and the apparently estuary-dependent larval stage of this species, we suggest that *A. bifrenatus* may have been recently introduced to New Zealand as larvae via ballast water from shipping. In terms of the number of vessels arriving, the Waitemata Harbour is the busiest New Zealand port for international shipping (Nelson 1995). The main shipping lane for vessels approaching Auckland passes c. 15 km from the entrance to the Whangateau Harbour, although large ships occasionally pass closer than this (authors' pers. obs.). Should large vessels exchange ballast water en route to Auckland, it is possible that fish species expelled with the ballast could reach shallow coastal waters, especially given that water

depths in this area are generally less than 60 m. Extensive fish sampling in the Whangateau Harbour by McKenzie (1984) in the early 1980s did not capture any specimens of *A. bifrenatus*, increasing the possibility that the specimen captured there was a recent arrival.

Blennioid fishes, particularly those from harbours, are hardy enough to survive ocean crossings in ballast tanks (see reviews by Carlton 1985, 1987). Populations of two species of New Zealand triplefin, *Forsterygion lapillum* and *F. varium* (Tripterygiidae), now established in Victoria and Tasmania respectively, are thought to have been introduced via ballast water (M. Lockett, Museum of Victoria pers. comm.). Cranfield et al. (1998) compiled adventive marine species known in New Zealand to date, using the criteria of Chapman & Carlton (1994) to test for adventism. Observations to date indicate that the present record fulfills at least five of these criteria (sudden appearance, association with human mechanisms of dispersal, disjunctive distribution, inadequate natural dispersal mechanisms, and isolation from related species). Other criteria related to associations with other adventive species and the local distribution and spread of *A. bifrenatus* cannot be addressed until other localities are searched for specimens.

The capture of two gravid females at the same site suggests that *A. bifrenatus* could establish a breeding population within at least one New Zealand harbour, and become naturalised in other north-eastern New Zealand estuaries. Little is known of the biology of *A. bifrenatus* (M. McGrouther, Australian Museum pers. comm.), therefore the likelihood of detrimental impacts on native biota caused by this introduction cannot yet be gauged. This record documents *A. bifrenatus* as the first adventive marine fish species (excluding deliberate introductions) to establish itself in New Zealand waters (Cranfield et al. 1998).

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