

Day's goby, *Acentrogobius dayi* Koumans, 1941 (Pisces: Gobiidae) in the desert Sawa Lake, south-west Baghdad, Iraq

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Three adult specimens of the fish species Acentrogobius dayi were collected from Sawa Lake, south-west of Baghdad, Iraq. The current report represents the first record of A. dayi from Sawa Lake and from other inland water bodies of Iraq.

Keywords: new record, Iraq, underground water, shrimp, fish

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INTRODUCTION

Several types of water bodies such rivers, streams, marshes, natural lakes and man-made lakes are found in Iraq. Among the natural lakes of Iraq, Sawa Lake stands out as an unusual lake both in terms of its structure and its geological formation. Sawa Lake lies between longitudes 44°59'29.01" and 45°01'46.61", and latitudes 31°17'43.10" and 31°19'49.79", about 240 km south-west of the capital, Baghdad, in the western desert of Iraq. It is a land-locked water body with the following dimensions: circumference, 12.257 km; maximum length, 5.13 km; maximum width, 1.936 km at the centre; and minimum width, ~0.5 km at its south-eastern end (Awadh & Muslim, 2014). The lake is 18–16 m above sea level and ~2–5 m above the adjacent ground level (Jamil, 1977).

Sawa Lake is located between stable and unstable shelves of the western Iraqi desert (Ditmar, 1972; Al-Sa'di, 2010), and was originally formed as a result of several tectonic faults, which occurred sometime during the Quaternary period 2.5 million years ago (Naqash *et al.*, 1977; Al-Muqdad, 2003).

The lake is structured from three geological formations, including: the Rus Formation (early Miocene), the Dammam Formation (early to late Miocene) and the Euphrates Formation (early Miocene) (GEOSURV, 1983). The Dammam Formation is considered to be a very important structure, as it contains significant ground water resources, which are important for both drinking water supplies and for agriculture. The formation extends over the north-west of the Arabian Peninsula, from Saudi Arabia and Kuwait to the west of Iraq, and leaks to the surface along the fault area as springs (Jassim & Goff, 2006). The lake has no tributary entry of surface water (Jamil, 1977; Naqash *et al.*, 1977), its water is highly alkaline (pH 8.5), rich in nutrients and mesohaline, with a salinity of about 18 ppt (Jamil, 1977).

Sawa Lake is not rich in aquatic organisms. Although there are some algae species (Mohammad, 2005), the phytoplankton

community is dominated mainly by diatoms (Hassan *et al.*, 2006). The lake supports only one species of brackish water gastropod, *Pomatiopsis tryon*, and only two species of fishes, *Aphanius dispar* and *Planiliza abu* (Ahmed *et al.*, 2008; Awadh & Muslim, 2014).

Gobies (Gobiidae) represent one of the largest families of fishes in the acanthomorph group. The family contains at least 1763 species belonging to 170 genera, with many more species yet to be described (Eschmeyer & Fong, 2015). Gobies are found worldwide, in marine, estuarine and freshwater habitats (Thacker & Roje, 2011). The genus *Acentrogobius* contains only five species: *Acentrogobius viridipunctatus*, *Acentrogobius dayi*, *Acentrogobius decaryi*, *Acentrogobius simplex* and *Acentrogobius therezieni* (Larson & Wright, 2003).

In the present paper, we report on the presence of Day's goby *Acentrogobius dayi* in Sawa Lake. This record is considered important because it not only represents the first record of a marine fish species from a land-locked lake in Iraq, but also a first record of *Acentrogobius dayi* for the marine fish fauna of Iraq.

Three adult specimens of Day's goby were observed, photographed *in situ* and collected by the fourth author during a scuba diving survey of Sawa Lake during 2014 (Figure 1). The specimens were encountered at a depth of 18 m amongst salt rocks containing several crevices of various sizes and were observed living in association with *Palaemon* shrimp species. Two of the specimens were deposited in the fish collections of the Smithsonian Institution, USA (USNM 435345) and the third, in the fish collections of the Marine Science Centre, University of Basrah, Basrah, Iraq (MSCUB).

RESULTS

SYSTEMATICS

Order PERCIFORMES

Family GOBIIDAE

Genus *Acentrogobius* Bleeker, 1874

Acentrogobius dayi Koumans, 1941

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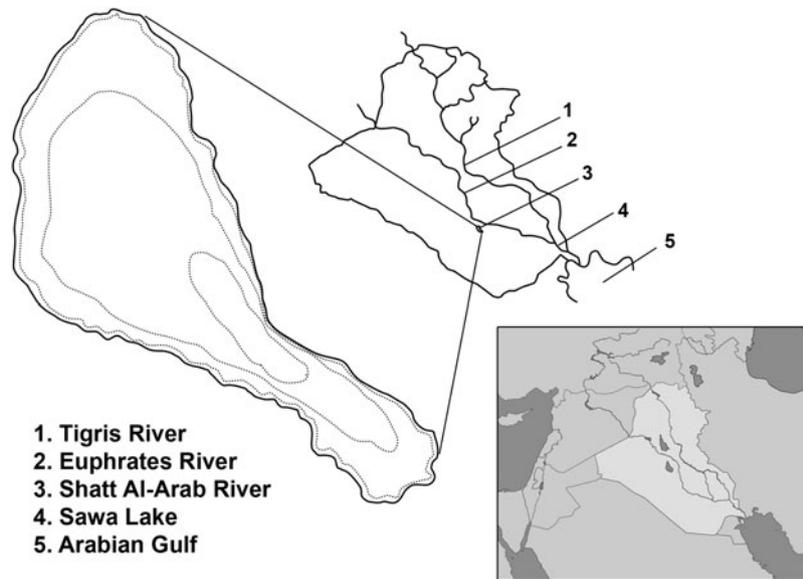


Fig. 1. Locality of *Acentrogobius dayi*, Sawa Lake, south-west of Baghdad, Iraq (after Sissakian, 2000).



Fig. 2. *Acentrogobius dayi*, USMN 435345, 108 mm total length.

MATERIALS EXAMINED

USNM435345, 2: 77.2 mm and 108.0 mm total length (TL); and MSCUB, 1: 88 mm TL, Sawa Lake, south-west of Baghdad, western desert, Iraq, $31^{\circ}18'35.75''N$ $45^{\circ}00'23.98$ E, depth 18 m, 2014 (Figure 2).

DESCRIPTION

Body elongated with large head. Mouth directed upward. Gill opening reaching midpoint of the orbit. Villiform teeth in jaws and small canine teeth in the outer row. Canine teeth on the corner of the lower jaw. Round caudal fin. Pelvic fin fused to form a well-developed disc. Cheeks with two rows of papillae commencing at the corner of the mouth. Caudal fin rounded and shorter than head. First dorsal fin originates near the posterior end of the pectoral fin. Second dorsal fin originates a little anterior to the origin of anal fin. Body with large ctenoid scales posteriorly and small cycloid scales anteriorly. Head with no scales and embedded scales on top of operculum. Body greyish in colour with dark brown bands on its lower sides. Dark band behind eye. Pale, blue-green spots on the sides of body. Morphometric and meristic data are presented in Table 1.

REMARKS

The range of TL in the present specimens (77.2–108.0 mm) is within the maximum range quoted for *Acentrogobius dayi* (110 mm) by Randall (1995) and Froese & Pauly (2015), albeit smaller than that quoted by Ghanbarifardi & Malek (2007) for specimens obtained from the Arabian Gulf coasts of Iran (109 mm TL), and larger than the specimen collected by Rahimian & Pehpuri (2006) (70 mm TL). The description of the present specimens agrees with the description provided by Mutsaddi & Bal (1974), Randall (1995), Rahimain & Pehpuri (2006) and Ghanbarifardi & Malek (2007). No other species within the genus *Acentrogobius* is known to occur in the Arabian Gulf area (Froese & Pauly, 2015).

Acentrogobius dayi is distributed in the Western Indian Ocean, from the Arabian Gulf to Pakistan (Froese & Pauly, 2015), and the Mumbai region of India (Mutsaddi & Bal, 1974). Within the Arabian Gulf area, it has been reported from Kuwait (Randall, 1995; Bishop, 2003), Saudi Arabia and Pakistan (Randall, 1995). Coad (1991) reported the presence of *Acentrogobius dayi* from Basrah, but it was originally recorded by Koumans (1941) from Fao, south of Iraq. Although the present records of *Acentrogobius dayi* are not strictly from Iraqi marine waters, it seems reasonable to list it

Table 1. The morphometric measurements and meristic counts for *Acentrogobius dayi* specimens collected from Sawa Lake, Iraq. All of the meristic values, except for longitudinal scale rows, and pelvic- and pectoral-fin rays, are based on radiographs. AP, number of anal-fin pterygiophores preceding the first hemal spine.

Morphometrics	Measurements (mm)
Total length	77.2–108
Standard length	62.3–86
Head length	18.9–24.7
Pelvic-fin length	12–17.8
Pectoral-fin length	13.1–22.9
Head width	13.9–14.6
Snout length	5–6
Jaw length	7.3–9.3
Interorbital width	3.1–4.1
Nape width	10.5
Body depth	13.1–15.1
Predorsal length	22–29.2
Prepelvic length	18–23.8
Preanal length	39–54.7
Meristic counts	No.
First dorsal fin	VI
Second dorsal fin	I/9–I/10
Anal-fin rays	I/9
Longitudinal scales	46–54
AP	2–3
Vertebrae	10 precaudal + 16 caudal
Pectoral-fin rays	17R + 18L
Pelvic-fin rays	I/5R + I/5L

among the marine fish fauna of Iraq considering its previously known presence in nearby marine waters of the Arabian Gulf.

The occurrence of *Planiliza abu* in Sawa Lake most likely resulted from the transfer of acclimated individuals of this species to Sawa Lake for aquaculture purposes seven years ago. Alternatively, it is possible that *P. abu* might have reached Sawa Lake prior to their deliberate introduction in

2008 from the nearby lakes, such as Al-Tharthar Dam Lake and Razzazh Lake (Epler *et al.*, 2001), via waters of the Euphrates River running through aquifers within the Euphrates Formation. Either way, it now seems that *P. abu* has become established in the Sawa Lake (Ahmed *et al.*, 2008; Awadh & Muslim, 2014). The latter scenario may also explain the presence of *Aphanius dispar* within Sawa Lake (Ahmed *et al.*, 2008).

The water of Sawa Lake originates from two sources. Firstly, the Euphrates aquifers that run through the Euphrates Formation carry freshwater; and secondly, the Dammam aquifers that run through the Dammam Formation carry brackish water (Dincer *et al.*, 1974; Mukhopadhyay *et al.*, 1996). Both of these aquifer systems are from the Euphrates River and the Arabian Gulf near Saudi Arabian coasts, respectively (Milton, 1967; Dincer *et al.*, 1974; Al-Ruwaih, 1995).

The presence of *Acentrogobius dayi* in Sawa Lake could be explained by either one of two possibilities: (1) the species may have gained entrance via the Dammam aquifers with the water from the Arabian Gulf at recharge points on the Saudi coasts, or (2) it was accidentally introduced along with other fish species for aquaculture purposes. Since *Acentrogobius dayi* is a small marine species, it seems unlikely that it could have gained access to Sawa Lake via ~430 km of an underground brackish water aquifer system. Consequently, it seems more likely that it was accidentally introduced with other fish species for aquaculture purposes.

Although *Acentrogobius dayi* has not previously been recorded from Sawa Lake, this may simply be due to the lack of appropriate ichthyological investigation methodologies. Previous investigations were mainly concerned with the lake's geology (Jamil, 1977; Naqash *et al.*, 1977; Awadh & Muslim, 2014). The current ichthyological investigation was the first time that scuba diving and specimen collection was included. The use of appropriate fish sampling methodologies such as scuba diving and underwater photography has already repudiated the presumed rarity of several species in other



Fig. 3. *Acentrogobius dayi* inside small crevice at the bottom of the lake, watching *Palaemon* shrimp at the entrance of the hole, ready for a sudden attack (photo by Thomas Pohl).

water bodies within the area (Jawad *et al.*, 2010), including the current first records of *Acentrogobius dayi* from Sawa Lake. Indeed, the present records of *Acentrogobius dayi* from Sawa Lake represent a significant contribution to the study of zoogeographical patterns within this area of Iraq.

In the current investigation, underwater photography revealed that *Acentrogobius dayi* may live in association with a species of shrimp (Figure 3), tentatively identified as *Palaemon elegans* (Sammy De Grave, personal communication). *Palaemon elegans* is known to have been introduced to Lake Abu-Dibic (Holthuis & Hassan, 1975). This lake is fed by the Euphrates River and the water of this river enters the aquifers of the Euphrates Formation, which in turn feed Sawa Lake. It is also possible that aquatic birds may have inadvertently introduced the shrimp species into Sawa Lake. Although many aquatic organisms living in the land-locked lakes that are surrounded by areas of non-suitable terrestrial habitats lack the capacity to disperse naturally by themselves to neighbouring water bodies, it has been shown that water birds can be important vectors in facilitating their widespread distribution (Figueroa & Green, 2002; Green *et al.*, 2008).

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