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REDISCOVERY OF THE BIGMOUTH STREAM GOBY, *PSEUDOGOBIOPSIS OLIGACTIS* (ACTINOPTERYGII: GOBIIFORMES: GOBIONELLIDAE) IN SINGAPORE

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INTRODUCTION

The bigmouth stream goby, *Pseudogobiopsis oligactis* (Bleeker), is one of at least eight species of gobioid fishes in Singapore that are known to inhabit freshwater habitats (Larson & Lim, 2005). It has a moderately slender, cylindrical body; two dorsal fins; a round caudal fin; pelvic fins fused into a disc; 22–25 scales in lateral series; 6–10 predorsal scales; preopercular pores present; scales on upper part of body with narrow blackish margins; side of body with five elongate dark brown blotches along the middle and five black spots below; side of face with three blackish streaks; caudal fin and second dorsal fin with a series of fine brownish bars; mature males with depressed head and enlarged jaws, first dorsal fin with first spine longest and usually produced into a filament. It is known to attain a maximum size of 46 mm standard length (SL) and is distributed throughout the Indo-Malayan Archipelago from Thailand to Indonesia (Larson & Lim, 2005; Larson, 2009).

Pseudogobiopsis oligactis was last collected in Singapore in 1964 (and not 1959 as reported in Larson [2009]; see collection data for ZRC 1225 and ZRC 1274), at the outlet streams of the MacRitchie and Lower Peirce Reservoirs. In the early 1990s, despite intensive surveys of the streams in the Central Catchment Nature Reserve (Ng & Lim, 1997), this species was not collected (Ng & Lim, 1996) and was feared to have become locally extinct. Its apparent disappearance was suspected to be resource competition by *Rhinogobius giurinus* (Rutter), the alien Oriental stream goby (Larson & Lim, 2005; Larson et al., 2008).

In Nov.2010, a large series of *Pseudogobiopsis oligactis* (Fig. 1) was collected in a stream that feeds the Lower Seletar Reservoir. This prompted a closer examination of some small gobies collected from the Bedok and Poyan Reservoirs (in 2007), which also turned out to be *Pseudogobiopsis oligactis*. The rediscovery and present status in Singapore of this species is documented and discussed in this article.

Fig. 1. *Pseudogobiopsis oligactis* collected from stream near Lorong Banir in Nov.2010 (ZRC 52097): male of 29.8 mm SL (top) and female of 19.4 mm SL (bottom). (Photographs by: Tan Heok Hui).

MATERIAL AND METHODS

Most of the fish cited in this article were caught with push nets of a rectangular metal frame of 60 × 40 cm, covered with netting material with mesh size of 1 × 1 mm. Fish specimens were fixed in 10% formalin (v/v) for about a week, and then transferred to 75% ethanol (v/v) for long-term preservation at the Zoological Reference Collection (ZRC) of the Raffles Museum of Biodiversity Research (RMBR), National University of Singapore. Sizes of the fish are quoted in millimetres (mm); either in standard length (SL), from tip of snout to base of tail; or in total length (TL), from tip of snout to tip of caudal fin.

OBSERVATIONS

Pseudogobiopsis oligactis was recently collected in a stream that drains from the north-eastern corner of the Nee Soon Swamp Forest and feeds the Lower Seletar Reservoir. The gobies were found in the section of the stream that flows directly under the Seletar Expressway (Fig. 2). A total of 77 specimens (ZRC 52097: 53 examples; and ZRC 53097: 24 examples) ranging from 14.0–21.8 mm SL, were collected on 25 Nov.2010 by Tan Heok Hui, Glendon Ong, and Yvonne Kwang. Subsequently, 31 examples of between 13.7–19.3 mm SL (ZRC 53096) were obtained from the same locality by Yvonne Kwang on 12 Dec.2010. The habitat is a small and shallow but fairly exposed stream with fast-flowing water and a lateritic substrate with rocks and concrete debris. Other gobioid fish species caught at the same site include the marbled gudgeon, *Oxyeleotris marmorata*, and the Oriental stream goby, *Rhinogobius giurinus*, the latter species in much lower numbers than *Pseudogobiopsis oligactis*.

This initiated a closer examination of some small gobies recently collected from the Poyan and Bedok Reservoirs by Ng Heok Hee and others. Two specimens (ZRC 51119: 16.8–16.9 mm SL) were collected from the Poyan Reservoir on 11 Sep.2007. Three examples (ZRC 50927: 15.5–18.2 mm SL) were obtained from the Bedok Reservoir on 9 Jan.2007. Although these fish are relatively small, and most likely immature, the presence of preopercular pores identified them as *Pseudogobiopsis oligactis*. Figure 3 shows the present distribution of *Pseudogobiopsis oligactis* in Singapore.

Fig. 2. Stream near Lorong Banir where specimens of *Pseudogobiopsis oligactis* were collected recently. (Photograph by: Tan Heok Hui).

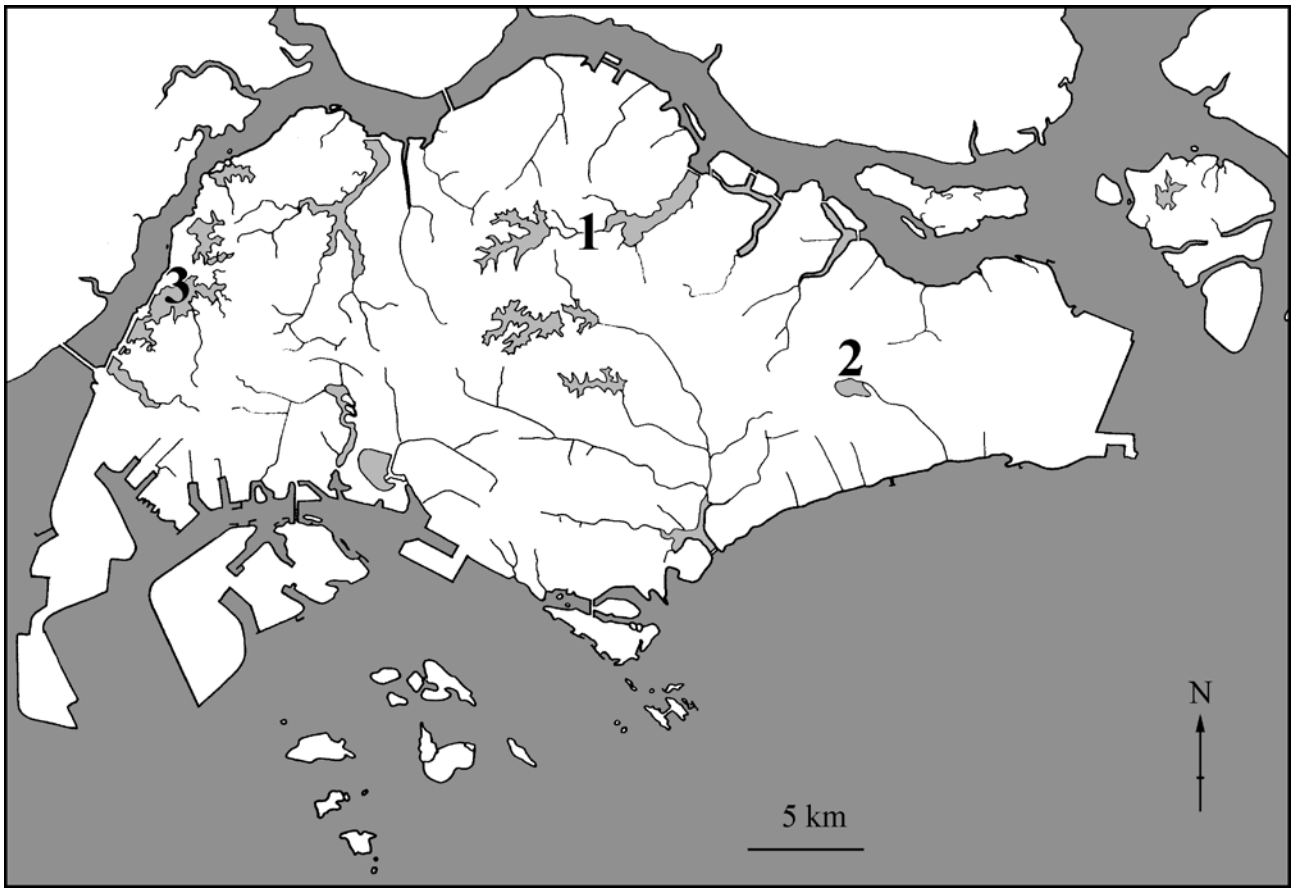

Fig. 3. Present distribution of *Pseudogobiopsis oligactis* in Singapore: 1, stream between Upper and Lower Seletar Reservoirs; 2, Bedok Reservoir; 3, Poyan Reservoir.

DISCUSSION

The bigmouth stream goby, *Pseudogobiopsis oligactis*, is presently known from three sites in Singapore from specimens collected in 2007 and 2010. This species was last known from Singapore 43 years ago. The present rediscovery refutes the supposition that the species had become nationally extinct (Ng & Lim, 1996, 1997; Larson & Lim, 2005; Larson et al., 2008; Larson, 2009).

Larson et al. (2008) suspected that *Rhinogobius giurinus* may be partly responsible for the decline and apparent disappearance of *Pseudogobiopsis oligactis* and *Eugnathogobius siamensis* in Singapore. Having found only *Rhinogobius giurinus* from surveys conducted in the Central Catchment Nature Reserve in the mid-1990s, Ng & Lim (1997) declared the two native species nationally extinct. The widespread alien *Rhinogobius giurinus* was thought to have ecologically out-competed the two native gobies. It may be possible that the native gobies had gone into a decline when *Rhinogobius giurinus* first became established, possibly in the 1970s when it was first collected, but they did not totally disappear. In fact, at Upper Seletar Reservoir where a large series of *Pseudogobiopsis oligactis* was recently collected, *Rhinogobius giurinus* was also found, but in smaller numbers.

Another possibility is that the local populations of *Pseudogobiopsis oligactis* could have been augmented by individuals transported via raw water from Johor Bahru, Malaysia, through pipes that lead to the reservoirs in the Central Catchment Nature Reserve (Ng & Tan, 2010). This, however, does not explain the presence of those specimens collected at Bedok and Poyan Reservoirs. We believe that individuals from these localities could have been in there all along.

The natural habitat of *Pseudogobiopsis oligactis* seems to be exposed and sunlit waterways with clean, flowing water over a sandy or clay substrate. In Singapore, Johnson (1973; as *Stigmatogobius poicilosoma*) found it to be common in the (Central Catchment Nature Reserve) reservoirs and in open-country streams. In Peninsular Malaysia, Herre (1940; as *Vaimosa perakensis*) observed that these gobies live in swift, hill streams flowing into Lake Chenderoh, but occurred in large numbers in the lake along its shores, around submerged trees and stumps, in grassy bays, and shallow inlets with leaf litter on the substrate. Since its preferred habitat is not in shaded areas, it was not likely to be directly affected by the loss of forest cover.

The life cycle of *Pseudogobiopsis oligactis* is poorly known. Many freshwater gobies are diadromous—living and spawning in freshwater, but their larval stages are spent in saline waters at estuaries or at sea. However, *Pseudogobiopsis oligactis* is capable of completing its life cycle in freshwater. In Peninsular Malaysia, it has flourished under land-locked conditions since the early 1920s in the Chenderoh and Temengor Lakes in Perak, as well as in the small rocky hill streams that feed into the lakes (Herre, 1940, as *Vaimosa perakensis*; Zakaria-Ismail & Lim, 1995; see Comparative Material). Similarly in Singapore, the dam that created the MacRitchie Reservoir was constructed in 1902 (Alfred, 1966), but specimens were obtained from the reservoir in 1939 and 1959 (see Comparative Material). The stream at Upper Seletar Reservoir, from where the recent large series of *Pseudogobiopsis oligactis* was collected, flows into the Lower Seletar Reservoir. This stream has not been linked to the sea since the 1980s (Ng, 2011). However, we cannot discount the possibility of *Pseudogobiopsis oligactis* entering both Bedok and Poyan Reservoirs via the outflow canals, which are linked to the sea.

Pseudogobiopsis oligactis bears a strong resemblance to the Siam stream goby, *Eugnathogobius siamensis* (Fowler), and both species are difficult to distinguish from each other without close examination under the microscope. *Eugnathogobius siamensis* has a round head with no preopercular pores and the rear portion of the oculoscapular canal over the preopercle is absent (Fig. 4b). *Pseudogobiopsis oligactis* is distinguished by having a relatively depressed head with preopercular pores, and the posterior portion of the oculoscapular canal over the preopercle is present (Fig. 4a) (Larson & Lim, 2005, as *Pseudogobiopsis siamensis*; Larson, 2009). The nomenclature adopted here follows the taxonomic revision by Larson (2009). Both species were formerly classified in the subfamily Gobionellinae of the family Gobiidae. Following Thacker (2009), the subfamily has been elevated to become the family Gobionellidae.

In Peninsular Malaysia, both *Pseudogobiopsis oligactis* and *Eugnathogobius siamensis* are known to be sympatric at least in the Endau basin (Ng & Tan, 1999, as *Pseudogobiopsis oligactis* and *Pseudogobiopsis siamensis*) and the Sedili basin (pers. obs.). We have not collected the two species together in Singapore, but *Eugnathogobius siamensis* was obtained at the Sungei Whampoa outlet of MacRitchie Reservoir in 2005, where *Pseudogobiopsis oligactis* was obtained in 1964. In the 1950s or 1960s, *Eugnathogobius siamensis* was collected in the Sungei Seletar drainage basin where the large series of *Pseudogobiopsis oligactis* was recently collected (see Comparative Material). We do not know how the two species are segregated ecologically, but we suspect it may be due to their life histories. *Pseudogobiopsis oligactis* can complete its life cycle in freshwater, a feat which *Eugnathogobius siamensis* may not be capable of. The latter species has not been found under land-locked conditions. It is highly likely that the larvae of *Eugnathogobius siamensis* may require a mandatory period of life in saline water.

COMPARATIVE MATERIAL

Pseudogobiopsis oligactis (historical material from Singapore identified by Alfred [1966] as *Stigmatogobius poicilosoma*, corrected as *Pseudogobiopsis oligactis* by Larson [2009]) — MacRitchie Reservoir: ZRC 1049, 10 ex. (15.6–26.5 mm SL), coll: S. H. Chuang, 4 Nov.1959; ZRC 1298, 2 ex. (29.0–32.4 mm SL), coll: unknown, 1939. Sungei Whampoe outlet of MacRitchie Reservoir: ZRC 1225, 6 ex. (20.2–28.6 mm SL), coll: T. Oates, 2 Jan.1964. Sungei Kallang outlet of Lower Peirce Reservoir: ZRC 1274, 9 ex. (21.5–32.6 mm SL), coll: E. R. Alfred, 3 Jan.1964. Small stream on north side of (Lower) Peirce Reservoir: ZRC 7597, 1 ex. (25.7 mm SL), coll: D. S. Johnson, 1 Jul.1963.

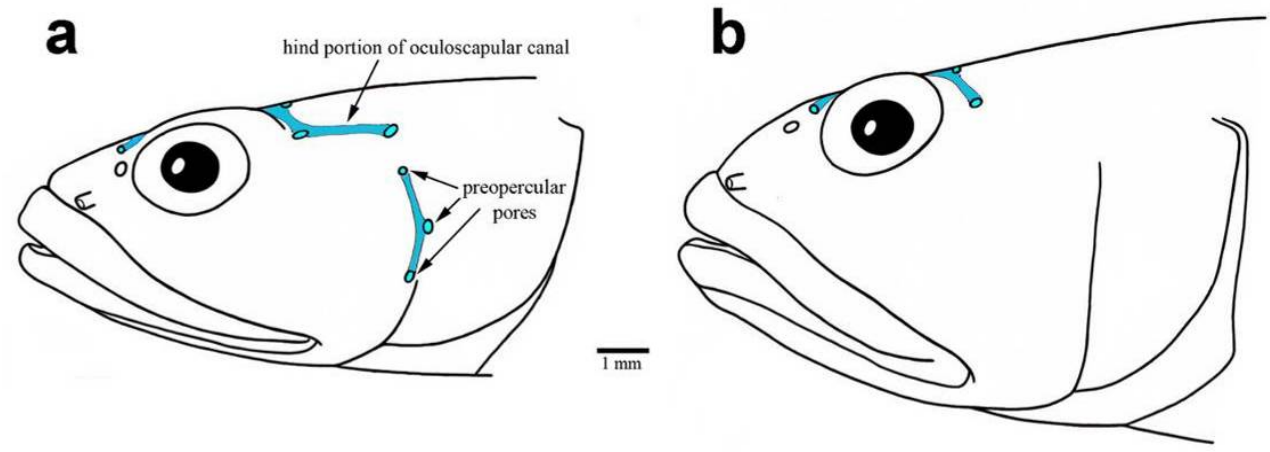

Fig. 4. Lateral head views: a, *Pseudogobiopsis oligactis*. Note the depressed head, and the presence of preopercular pores and hind portion of the oculoscapular canal. b, *Eugnathogobius siamensis*. (Drawings adapted from Larson [2009: Figs. 18, 25]).

Pseudogobiopsis oligactis from extra-limital localities — Malaysia: Penang Island, Telok Bahang, coastal stream between Kampung Nelayan and Sungai Tukun: ZRC 34474, 12 ex. (13.7–29.8 mm SL), coll: K. Lim, 17 Aug.1993. Malaysia: Perak, Temengor Lake south of Banding, Sungai Halong: ZRC 35262, 28 ex. (11.0–49.0 mm SL), coll: H. H. Tan, K. Lim & S. H. Tan, 1–2 Nov.1993. Malaysia: Perak, 2 km after Raban, stream feeding Chenderoh Lake: ZRC 39551, 4 ex. (32.6–37.0 mm SL), coll: H. H. Tan et al., 19 Nov.1995.

Eugnathogobius siamensis — Singapore: Sungei Seletar at 'low tide': ZRC 7592, 1 ex. (26.8 mm SL), coll: D. S. Johnson, circa 1950s to 1960s. Singapore: Sungei Seletar at Nee Soon: ZRC 7601, 1 ex. (34.1 mm SL), coll: D. S. Johnson, circa 1950s to 1960s. Singapore: Sungei Whampoa outlet of MacRitchie Reservoir: ZRC 50271, 3 ex. (15.7–19.0 mm SL), coll: H. H. Tan & K. Lim, 2005.

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