NATURE IN SINGAPORE 2009 **2:** 9–12
Date of Publication: 8 January 2009

THE RAINBOW MUD SNAKE, *ENHYDRIS ENHYDRIS* (SCHNEIDER) [REPTILIA: SQUAMATA: HOMALOPSIDAE] IN SINGAPORE

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INTRODUCTION

According to Tweedie (1983: 99), Iskandar & Colijn (2001: 90), and Murphy (2007: 113–122), the rainbow mud snake, *Enhydris enhydris* (Schneider) is described as follows: It is a piscivorous, freshwater snake with a distinctly small head, stout body, and a relatively long tail. Its upperparts are grey or olive with a brown stripe along each side of the back, and a cream or yellow stripe low on each side over the lowest three rows of dorsal scales, and separated from the belly by a narrow blackish line. The head is brown above with a pair of pale brown lines continuous with dorso-lateral body stripes which converge and join on the snout whose upper labials are yellow. Its underside is white or yellow with a blackish median line or row of dots. The colour pattern may be variable: some individuals have a dark greyish, mid-dorsal stripe, while others have a red dorso-lateral stripe on each side of the mid-line. Some have a uniformly red belly while others have a blackish blotch on each ventral scale. There are 21 scale rows over the mid-body, 153–174 ventral scales, eight upper labials with the 4th touching the eye. The internasal scale is single, and touches the loreal scale, and there are two pairs of chin shields with the second pair longer than the first. This mildly venomous species is known to attain a total length of 1.3 m (88.2 cm from snout to vent), with the females tending to be larger. It is common, and widely distributed from Pakistan, across India to Indochina, the Malay Peninsula, Sumatra, Borneo, Java, and Sulawesi.

The presence of rainbow mud snake in Singapore was reported by Boulenger (1912: 160), and de Rooij (1917: 182) as *Hypsirhina enhydris*. Subsequent records by Sworder (1923: 66), Gyi (1970: 92), and Tweedie (1983: 99), all refer to the sole specimen (BMNH 160.68) from Singapore in the British Museum (presently The Natural History Museum) in London. Although the species was not recorded since, Baker & Lim (2008: 169) still regard its status in Singapore as indeterminate. In this article, we report on the rediscovery of this aquatic snake in Singapore, and comment on its local status.

SPECIMEN DETAILS

A freshly dead snake of about 90 cm total length was found crushed, most likely by vehicles, along Neo Tiew Road on the morning of 13 Apr.2008, by Vilma D'Rozario. The specimen was not collected. From the photographs (Figs. 1–3), its general morphology, and colour pattern clearly agree with those of the rainbow mud snake, *Enhydris enhydris*, and is a large specimen.

At the Sungei Buloh Wetland Reserve, Johnny Chew photographed a section of a striped snake among some floating vegetation in the pond at the reserve's entrance, between 1500 and 1600 hrs on 13 Sep.2008. We do not have permission to reproduce the photograph here, but we have studied the image and identified the subject as *Enhydris enhydris*.

DISCUSSION

Murphy (2007: 118–119) observed that the rainbow mud snake "uses relatively shallow freshwater environments with muddy substrates and can be found in and around urban areas, [and] it seems to thrive in disturbed habitats". He noted that "[t]he success of *E. enhydris* in disturbed environments and its more or less uniform morphology across its broad geographic range suggest this species may have expanded its range recently, and this […] may have been assisted by humans as they developed rice cultivation and sophisticated water management systems to flood rice paddies". According to Tweedie (1983: 99), the rainbow mud snake is common in the northern states of Peninsular

Fig. 1. Rainbow mud snake, *Enhydris enhydris* roadkill, about 90 cm in total length from Neo Tiew Road. (Photograph by: Vilma D'Rozario on 13 Apr.2008).

Fig. 2. Dorsum of midsection of roadkill snake from Neo Tiew Road. (Photograph by: Vilma D'Rozario).

Malaysia where much of the low-lying areas are dedicated to paddy cultivation. There are Peninsular Malaysian specimens in the Zoological Reference Collection (ZRC) of the Raffles Museum of Biodiversity Research, National University of Singapore, collected from paddy fields and adjacent peat swamps in north Selangor, as well as from Pulau Tioman, but none from further south.

There are remnant patches of original freshwater swamp forest in Singapore that appear to be suitable habitat for the rainbow mud snake. Such habitats are found in the Central Catchment Nature Reserve, the Western Catchment Area, and Pulau Tekong. To date, however, the puff-faced water snake, *Homalopsis buccata* (Linnaeus) is the only homalopsid found in these (Baker & Lim, 2008: 111; personal observation).

Assuming that the rainbow mud snake did indeed occur naturally in Singapore, a remnant population could have survived in the protected forested areas of the nearby Western Catchment Area. The recent records could be the descendents of these survivors. Still, it is not possible to prove conclusively that the species is native. A species that thrives as a human commensal is unlikely to have remained hidden or overlooked for over a century. With its preference for open marshy environments, the rainbow mud snake would have continued to thrive in the wake of deforestation. Instead, none was ever reported until now.

We propose that the rainbow mud snake is not native to Singapore. As with many specimens collected for museums in the 19th century, the original specimen is likely to have been purchased from traders, and imported from neighbouring areas. The two recent specimens have all been found, not in a forest habitat, but in an agrotechnology farming area heavily impacted by human activities. These snakes could have been accidentally introduced there with ornamental marsh plants, concealed among the root mats, possibly from Peninsular Malaysia. They may even be descendents of such introduced stocks.

Fig. 3. Ventrum of posterior section and tail of the roadkill individual from Neo Tiew Road. (Photograph by: Vilma D'Rozario).

Another species, *Enhydris indica* (Gray), has been reported from Singapore, based on a specimen at the Dublin Museum in Ireland (Smith, 1930: 60; Tweedie, 1983: 102). *Enhydris indica* is distinguished from *Enhydris enhydris* in having 19 rows of dorsal scales at midbody, dark brown upperparts with yellowish patches on sides. Barely anything is known of this elusive snake, but it has been collected from a jungle stream. This species is known for certain only from Peninsular Malaysia, in the states of Selangor, and Perak (Tweedie, 1983: 102; Murphy, 2007: 126). The Singapore record of *Enhydris indica* is regarded as dubious (Murphy, 2007: 126; Baker & Lim, 2008: 169), but appropriate habitats for the species are available on Singapore Island, and it is possible that the specimen did occur here.

The two recent records of the rainbow mud snake are from the north-western corner of Singapore Island. Apart from patches of mangrove forest along the shores, the area had been thoroughly cleared and presently occupied by fish farms, vegetable farms, plant nurseries, a frog farm, and a crocodile farm, as well as large areas of wasteland vegetation, and open freshwater marshes around the Kranji Reservoir, and within the Sungei Buloh Wetland Reserve. With the availability of suitable habitats, the rainbow mud snake is likely to thrive in this area. Although the species has aquatic habits, it often leaves the water, presumably to reach other water bodies as evidenced by the roadkill individual. Therefore, its eventual spread to other parts of Singapore should not be unexpected.

CONCLUSION

The rainbow mud snake, *Enhydris enhydris*, was rediscovered in Singapore, at the north-western part of the island, after 96 years. However, the localities of the present records suggest that the snakes are of introduced stock, possibly imported with ornamental plants.

ACKNOWLEDGEMENTS

We thank Ben Lee (Naturetrekker) for sharing the photograph by Johnny Chew with us. Celine Low was the first to identify the roadkill as an *Enhydris* species, and thus alerted us to its significance.

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