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A RECORD OF THE BANDED FILE SNAKE, *ACROCHORDUS GRANULATUS* (REPTILIA: SQUAMATA: ACROCHORDIDAE) IN A FRESHWATER HABITAT IN SINGAPORE

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INTRODUCTION

The family Acrochordidae (file snakes), consists of three extant species distributed over the tropical regions of the eastern Indian Ocean and the western Pacific. They are the Arafura file snake (*Acrochordus arafurae* McDowell), the elephant trunk snake (*Acrochordus javanicus* Hornstedt), and the banded file snake (*Acrochordus granulatus* (Schneider)). These snakes feed on fish. They are non-venomous, and have not been recorded to bite humans. Fishermen have been recorded to handle them routinely without being bitten (Wall, 1921).

File snakes are characterised by loose-hanging skin with small, rough scales, which allow the snakes to hold fish while swallowing (Lillywhite, 1991). These snakes have valved nostrils on top of their snouts, and various physiological characteristics adapted for an aquatic environment (Lillywhite, 1991). However, all three species occupy disparate aquatic habitats, ranging from exclusively freshwater to mainly marine (Lillywhite, 1991; Sanders et al., 2010). Although *Acrochordus javanicus* was recorded in the past, *Acrochordus granulatus* is the only species that is extant in Singapore (Lim & Lim, 1992; Baker & Lim, 2008).

Acrochordus granulatus is also known as the little file snake because it is the smallest in the genus, reaching a maximum length of about 1 m, while the other two species may be between 1.7–2.0 m long (Lillywhite, 1991). *Acrochordus granulatus* has a prominent central skin fold, and a laterally compressed tail (Lillywhite, 1991; Cox et al., 1998). Unlike the other two species, *Acrochordus granulatus* also has a sublingual salt gland (Lillywhite, 1991), which allows it to live in full-strength sea-water (Dunson & Dunson, 1973). Throughout its range across the eastern Indian Ocean and the western Pacific, *Acrochordus granulatus* occurs in coastal marine habitats (Cox et al., 1998; Baker & Lim, 2008). However, a few populations are known from freshwater lakes in the Philippines and New Guinea (Dunson & Dunson, 1973; McDowell, 1979).

Acrochordus granulatus has been recorded from marine and estuarine localities all around Singapore Island (Ng & Sivasothi, 1998; Baker & Lim, 2008). These places include Chek Jawa at Pulau Ubin, Changi Beach, a kelong off Simpang, Sungei Mandai mangrove forest, Sungei Buloh Wetland Reserve, Lim Chu Kang mangrove forest, Tuas, Pulau Sudong, Pulau Semakau, as well as Siglap, Telok Kurau, and Tanjong Katong [Tan, 2008; Yeo, 2008; Zoological Reference Collection (ZRC), Raffles Museum of Biodiversity Research (RMBR), National University of Singapore records]. Recently some individuals of *Acrochordus granulatus* were obtained from the Lower Seletar Reservoir, a body of freshwater in the northern part of Singapore Island. They represent the first known records of this species from a freshwater habitat in Singapore.

DETAILS OF RECORDS

According to an entry posted in Dec.2004 on an angling community page (Fishingkaki.com, 2004) in Singapore, a file snake was caught with hook and line by a recreational angler at Lower Seletar Reservoir on 7 Dec.2004. The photograph on the entry, which is not available for publication here, shows a specimen of about 60 cm long, almost uniformly pinkish-brown with indistinct dark bands. It has the characteristically small head and baggy appearance of the banded file snake. The report claims that the snake was taken on artificial lure.

On 25 Feb.2009, one adult female *Acrochordus granulatus* of 85 cm snout-vent length and 95 cm total length was obtained from Lower Seletar Reservoir. This specimen was found tangled in a gill-net that was set on the previous day, near a canal leading out of the reservoir, along its south-western shoreline (Fig. 1). The net was found cast on the shore, likely by illegal fishermen. The snake was kept in an aquarium of freshwater, but it died on 13 Mar.2009. During preservation, it was found to be gravid with ten embryos, eight of which were preserved in ethanol. Both snake and embryos were deposited in the ZRC with the catalogue number ZRC 2.6808.

Fig. 1. The adult *Acrochordus granulatus* that was caught in a gill-net at Lower Seletar Reservoir (ZRC 2.6808).

On 17 Apr.2009, two individuals of *Acrochordus granulatus* were discovered in a gill-net set at a location close to where the first specimen was found, at Lower Seletar Reservoir. Both were of adult size, approximately 80–90 cm in total length. One specimen, dead and badly decomposed, was discarded. The other was released back into the reservoir.

DISCUSSION

Although predominantly a coastal snake, *Acrochordus granulatus* is known from freshwater habitats in the Philippines and New Guinea (Dunson & Dunson, 1973; McDowell, 1979). In Papua New Guinea, this species is found in freshwater in the inland Murray Lake, the Fly-Stricklands river system, and the Sepik River. It appears to be absent in drainages with waterfalls, and these structures seem to prevent *Acrochordus granulatus* from migrating inland, rather than it having difficulty adapting to freshwater (McDowell, 1979). The individuals recorded from the Philippines were from two freshwater lakes located on Luzon island — Laguna de Bay (2.3 mM Cl) and Lake Taal (11.8 mM Cl) (Dunson & Dunson, 1973). In the past, these lakes were directly linked to the sea, until volcanic eruptions and geological changes resulted in both currently having only one river outflow each (International Lake Environment Committee Foundation, 1999). The individuals collected from these lakes could have been descended from marine populations that adapted to the changes in the lakes after the major changes, or could have entered the lake via the connecting rivers. There do not seem to be other records in these or other Philippine lakes, although it has been commonly collected from mangrove forest and other marine habitats around the Philippines (Dunson & Minton, 1978; Ferner et al., 2000).

Lower Seletar Reservoir was created by damming the mouth of the former Sungei Seletar in the 1980s. It is separated from the Johor Straits by a 700 m-long dam. On the western end of this dam are tidal gates that allow excess water to be discharged from the reservoir into the sea. The localities where the three individuals of *Acrochordus granulatus* were recorded from are about 3.5 km inland from the dam.

It is highly likely that Lower Seletar Reservoir's population of *Acrochordus granulatus* originated from marine populations in the surrounding coastal habitats. Similar to the individuals collected from the Philippine lakes, these could have been descended from marine populations that were trapped in the reservoir after the dam was built almost three decades ago, and then subsequent generations adapted to the gradual lowering of water salinity.

Another possibility is that individuals may have entered the reservoir through the tidal gates, or even by crawling over the dam. Despite their aquatic habit and apparent clumsiness on land owing to their baggy bodies, *Acrochordus granulatus* has been observed resting out of water on mud lobster mounds, and captive ones have been known to escape from uncovered receptacles of water and crawling long distances on dry floors (K. K. P. Lim, pers. comm.). However, four traffic lanes, and a granite bund (a distance of approximately 50 m) would seem to make this overland dam crossing an extremely daunting task for this snake.

As *Acrochordus granulatus* has been kept as a pet (Lillywhite, 1996), it is possible that the individuals in the Lower Seletar Reservoir were introduced intentionally from the discarding of unwanted animals. However, this is extremely unlikely for *Acrochordus granulatus* does not feature prominently in the pet trade (Zimmerman, 1993). The establishment of a thriving population requires more than the random abandonment of two or three individuals.

That ZRC 2.6808 was found to be gravid is proof that *Acrochordus granulatus* is capable of breeding in freshwater. Despite its water parameters conforming to freshwater conditions [222 mS cm^{-1}, and freshwater values range from 0−800 mS cm^{-1} (Waterwatch Australia Steering Committee, 2002)], the water in Lower Seletar Reservoir has an average pH of 8.0 (Public Utilities Board, 2011). The hard and alkaline environment probably enables this marine reptile to successfully adapt to low salinity waters.

CONCLUSIONS

It is likely that there is an established population of *Acrochordus granulatus* in the Lower Seletar Reservoir. This population could have originated from land-locked individuals trapped there since the estuary was dammed. It could also consist of individuals migrating into the reservoir from the sea from time to time owing to the proximity of the reservoir to the sea. The suitable water conditions of the reservoir also allow the species to thrive there.

Other coastal reservoirs in Singapore also are potential habitats for populations of *Acrochordus granulatus* adapted to freshwater conditions. The presence of this harmless, native species in the relatively new reservoir environments can be viewed as a positive development, as opposed to the deliberate introduction of non-native fauna (Yeo & Chia, 2010).

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