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REDISCOVERY OF GREATER MOUSE DEER, *TRAGULUS NAPU* (MAMMALIA: ARTIODACTYLA: TRAGULIDAE) IN PULAU UBIN, SINGAPORE

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INTRODUCTION

The greater mouse deer, *Tragulus napu*, is one of the world's smallest ungulates with a standing shoulder height of 300–350 mm (Francis, 2008) and a head-body length of 500–600 mm (Corbet & Hill, 1992). Francis (2008) described the animal as having an upper pelage coarsely mottled orange-buff, grey-buff and blackish with variation in intensity of colouration between individuals. Its underparts are white, usually without brown stripes on the belly. There is a pattern of brown and white markings on the upper chest and underside of the neck, typically with a triangular white stripe in the centre that is bordered by dark brown stripes and two separate diagonal white stripes on each side—one originating near the chin and in the middle of the throaTragulus.

Tragulus napu can be differentiated from the largely sympatric lesser mouse deer, *Tragulus kanchil*, based on several external differences—namely the number of throat stripes (five on the former, three on latter), the absence of brown stripes on the belly (usually present in *Tragulus kanchil*), the visibility of the nape line and mottling of the under parts (Meijaard & Groves, 2004; Francis, 2008).

The greater mouse deer is a true forest species feeding on fallen fruits, leaf shoots and other vegetation (Medway, 1983; Francis, 2008). The range of *Tragulus napu* extends from Myanmar, Thailand, Peninsular Malaysia and also to Sumatra, Borneo and Palawan (Philippines) (Francis, 2008).

Fig. 1. Typical throat pattern of *Tragulus kanchil* ZRC.4.4820 (left), and *Tragulus napu* ZRC.4.4752 (right). Numbered lines 1–5 show the number of throat stripes in both species—three in *Tragulus kanchil,* five in *Tragulus napu*.

Records of the species in Singapore are from specimens deposited in the Zoological Reference Collection (ZRC), Raffles Museum of Biodiversity Research (RMBR), National University of Singapore that were collected from Changi (ZRC.4.4732), Kranji (ZRC.4.4748, 4.4749), and Pulau Ubin (ZRC.4.4750) in the 1908, 1923, and 1921, respectively. Based on the absence of subsequent specimens or sightings, Yang et al. (1990) suggested that *Tragulus napu* "has probably become extinct" in Singapore and that the only remaining mouse deer in Singapore was the lesser mouse deer, *Tragulus kanchil,* in the Bukit Timah and Central Catchment Nature Reserves.

On 2 Feb.2006, the RT received a sighting report of a mouse deer by Mohd Azahar (National Parks Board [NParks] staff) on Pulau Ubin at about 0930 hours. At the time, since mouse deer were believed to be extinct on Pulau Ubin, the record could not be confirmed owing to lack of corroboration.

DETAILS OF SIGHTINGS

In Sep.2008, a new mammal study was initiated in Pulau Ubin that included observation studies along a series of line transects. Paul Chen and MC made an unconfirmed sighting of a mouse deer on 23 Sep.2008 at 2220 hours. At the time, the sighting was discounted owing to the possibility of the misidentification of a juvenile pig (*Sus scrofa*), as the latter is relatively common on the island.

The first confirmed sighting of the species took place in Pulau Ubin on 22 Nov.2008 at 2030 hours by the MC, Andrew Tay, Celine Low, and Vilma D'Rozario. Although photographs were taken, none were considered sufficiently diagnostic of the species (Fig. 2). More individuals were sighted later that night, and on subsequent surveys in early Dec.

On 17 Dec.2008 at 2220 hours in the area managed by the Outward Bound Singapore, Pulau Ubin, Celine Low took the first photograph (Fig. 3) that included an unobscured view of the pelage of the animal's chest and neck, allowing a conclusive identification of the species. The animal was estimated to have a head-body length of 500 mm. This was followed by additional photographs, including one by Chan Kwok Wai on 21 Feb.2009 (Fig. 4), which showed the distinctive chest and neck markings clearly.

Fig. 2. One of a group of three mouse deer sighted on 22 Nov.2008 in Pulau Ubin. (Photograph by: Celine Low).

Fig. 3. *Tragulus napu* at the Outward Bound Singapore site on 17 Dec.2008. (Photograph by: Celine Low).

Fig. 4. *Tragulus napu* showing the distinctive neck and chest markings on 21 Feb.2009. (Photograph by: Chan Kwok Wai).

As of 4 March 2009, 100 sightings were recorded on Pulau Ubin and several more images of the species were captured via remote camera traps (Figs. 5, 6). The sitings were distributed across the island and clustered in both Western and Eastern forest fragments. During surveys, *Tragulus napu* individuals were sighted throughout the night at distances ranging from 3–30 m and usually seen foraging or resting on the forest floor.

Prior to this study, recent records of the fauna on Pulau Ubin were from casual sightings by naturalists between 1988–1995—published in The Pangolin, a publication of the Nature Society (Singapore), from vertebrate surveys by the Nature Society (Singapore) in 1993 (Subaraj, 1995) and the NParks from 1999 to 2001 (National Parks Board, unpublished). The 1993 project comprised of four night surveys and small mammal traps. The NParks project consisted of two to three line transects per night over 13 nights from 1999–2001. No mouse deer were recorded by either project.

Lim Chor Gan, a 65 year-old resident who has lived on the island all his life, last sighted greater mouse deer towards the end of 2008. Although he could not state specific dates, Lim said that he had seen napu (*Tragulus napu*) in recent years but never before the turn of the century (C. G. Lim, pers. comm.). Interviews and casual conversations between the first author with more than 15 villagers and ex-residents of the island revealed no other report of the presence of mouse deer on the island prior to the study. However, discussion with more villagers may be required to reconfirm this.

Several factors may have prevented the species from being detected during past faunal surveys on the island. These factors include their secretive behaviour, small population size, and survey design. Lekagul & McNeely (1988) noted that even where they are numerous, mouse deer are seldom seen because of their secretive habits in dense forest. Therefore, the current study may have benefitted from a greater sustained survey effort (survey nights × number of transects) of 40 night surveys within seven months, covering one to four transects per survey. Even though the very first survey during the study resulted in the unconfirmed sighting of a greater mouse deer on 23 Sep.2008, it took a further 13 surveys before the confirmed sighting on 22 Nov.2008 was established. This shows that a sustained survey effort was essential for detecting the species. An improvement in lighting technology could have also contributed to the sighting of the species as LED torches and headlamps were used in conjunction with older incandescent torches, compared with the almost exclusive use of incandescent torches in the past.

The rediscovery of *Tragulus napu* in Pulau Ubin may also be owed to the recovery of its forest habitat and population, which was facilitated by the closure of granite quarries, and the resettlement of many villagers during the last decade. At the peak of granite quarrying on the island, there were eight active quarries and 3,000 people living on the island. That number has dropped since, with the last quarry closed in 1999 (Tan & Lee, 2007). Today, there is estimated to be less than 100 households left on the island. Also, villagers abandoned their farms as they were relocated to Singapore Island. Through time, succession turned these abandoned farms into secondary vegetation (Sha, 2002), increasing the habitat area available to the mouse deer. Hence, it could be possible that the increase in habitat area and food resources, coupled with the reduced nocturnal anthropogenic activity facilitated the recovery or re-establishment of the population of *Tragulus napu*. The sighting of an adult with a juvenile on 6 Jan.2009 (Fig. 5) is proof that a breeding population exists. Also, the absence of traditional large predators such as tigers and leopards in Pulau Ubin (Yang et al., 1990) has reduced predation pressure on the mouse deer, thus allowing the population to recover more quickly.

Unlike the amphibious water chevrotain (*Hyemoschus aquaticus*), of the same family found in Africa, the swimming ability of *Tragulus napu* has not been well-documented other than one anecdotal account by Ridley (1895) of a mouse deer crossing a forest stream. However, Meijaard et al. (2009) recently reported that the greater mouse deer has been observed swimming, with one observed spending about 60 minutes underwater in a river and staying fully submerged for more than five minutes. Hence, there is a possibility that the current population in Pulau Ubin was from mouse deer that swam to the island from Johore, Malaysia, possibly forced out of their forest habitats that were cleared for developing plantations or the Tanjong Puteri Golf Resort north of Pulau Ubin.

Another possibility is that the animals are survivors of the animal trade that were released on the island. Chasen (1925) stated that "very large numbers of mammals were imported into Singapore for trade purposes" and that "individuals frequently escaped". Furthermore, it was noted that mouse deer were often traded at markets in Singapore (Ridley, 1895; Kloss, 1918). However, released or escaped individuals tend to be few and more localised, and unless a large number of released mouse deer were able to breed and spread quickly, they are unlikely to be successful in establishing a population. To our knowledge, eight greater mouse deer that were released in one of Singapore's nature reserves in 1999 as part of a reintroduction programme have not been recorded since. Also, the NParks, which has been managing the island since 1995, had not carried out any reintroduction exercises. Hence, the wide distribution of the species in both forest fragments across the island and with a fairly large population (Chua, 2009) in the western forest fragment suggest that the theory of a released or escaped population may not be as likely.

DISCUSSION

Although it is difficult to conclusively determine the origin of the population of *Tragulus napu* on Pulau Ubin without

Fig. 5. Adult and juvenile *Tragulus napu* on 6 Jan.2009. (Photograph by: Marcus Chua).

Fig. 6. Two mouse deer foraging in tall secondary forest in Pulau Ubin on 22 Dec.2008. (Photograph by: Marcus Chua).

DNA fingerprinting studies, it is likely that *Tragulus napu* on Pulau Ubin represents a latent or immigrant population that re-established itself over time. Future DNA studies on the Ubin mouse deer population would be important in shedding light on their origin in this regard.

While the resurgence of *Tragulus napu* may suggest that the species may have recovered from the habitat-damaging activities of the past, the future of *Tragulus napu* on Pulau Ubin remains uncertain as they are still faced with several threats to their survival.

Owing to the use of the island as a recreational park and for outdoor adventure, human disturbance is a constant pressure. Night activities and unregulated night walks are especially a cause for concern as they may affect the activity cycle of the animals and force them to retreat further into the forest, thereby reducing their usable habitat and range on the island. The species' supposed value as a delicacy also opens up the possibility of poaching. The discoveries of illegal animal traps on Pulau Ubin are a case in point that the danger posed by poaching is very real (Sumathi, 2007). Hence, a species survival plan supported by the public that is part of a greater integrated concept and management plan for the island is crucial to ensure protection of the greater mouse deer population from the threats they may face.

Overall, this striking rediscovery of the greater mouse deer highlights the importance of rigorous surveying of the biodiversity of Singapore and indicates that we can be hopeful about nature conservation on Pulau Ubin. The next step would be to gather more information about the abundance and distribution of the greater mouse deer, and to establish a species conservation plan to protect the species.

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