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COMMUNICATION

DUSKY LANGURS *TRACHYPITHECUS OBSCURUS* (REID, 1837) (PRIMATES: CERCOPITHECIDAE) IN SINGAPORE: POTENTIAL ORIGIN AND CONFLICTS WITH NATIVE PRIMATE SPECIES

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Dusky Langurs *Trachypithecus obscurus* (Reid, 1837) (Primates: Cercopithecidae) in Singapore: potential origin and conflicts with native primate species

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Abstract: The introduction of exotic species can have detrimental effects on local populations via factors such as resource competition and new threats from disease. Singapore has three native species of non-human primates: Sunda Slow Loris *Nycticebus coucang*, Long-tailed Macaque *Macaca fascicularis*, and Raffles' Banded Langur *Presbytis femoralis*. Over the past few months, several non-native Dusky Langurs *Trachypithecus obscurus* were observed in Singapore. We document our observations, compile reports from social media, and attempt to assess the potential impacts on local primates. Whenever Dusky Langurs were encountered, we recorded the date, time, GPS coordinates, group demographics, and behaviour, including interactions with native primates. We also monitored sighting reports of Dusky Langurs posted on local major Facebook groups from 30 December 2019 to 31 January 2020, and privately messaged the person(s) for more information. On 31 August 2019, three Dusky Langurs were seen near a residential area in the northern part of Singapore, and two to three individuals were reported on 14 subsequent occasions. During one encounter on 18 January 2020, an adult male Long-tailed Macaque chased a group of Dusky Langurs from a feeding tree. The next day the same group of Dusky Langurs chased a group of 11 Banded Langurs from another feeding tree. The Dusky Langurs appeared to be healthy and wild, indicating that they may have swum across the Johor Strait and/or traveled on the Johor-Singapore Causeway from Malaysia. Further monitoring of these Dusky Langurs will be required to assess their impact on local primates.

Keywords: Colobine, dispersal, exotic, impacts, macaque.

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Author contribution: All authors contributed equally to the study design, field work, data analysis and writing of article.

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INTRODUCTION

Singapore is home to three species of non-human primates—Sunda Slow Loris *Nycticebus coucang*, Long-tailed Macaque *Macaca fascicularis fascicularis*, and Raffles' Banded Langur *Presbytis femoralis*. While the population size of the Sunda Slow Loris in Singapore is unknown, it is considered nationally Critically Endangered (Lim et al. 2008) and globally Vulnerable (Nekaris & Streicher 2008). The Long-tailed Macaque population has an estimated 1,800–2,200 individuals (Riley et al. 2015) and is not facing immediate threats to survival (Ong & Richardson 2008). The Raffles' Banded Langur is nationally Critically Endangered (Lim et al. 2008) and is also considered Critically Endangered globally given its small population size (60 individuals in Singapore and 250–300 individuals in Malaysia), and a recent recommendation to elevate it from subspecies to species (Ang et al. 2020).

In addition to these primate species, sightings of others have been reported in Singapore over the years. Some sightings were attributable to pet abandonment or illegal ownership of primate pets. For example in 2004 an African Vervet Monkey *Chlorocebus pygerythrus* was repatriated to Zambia after being kept as a pet in Singapore (ACRES 2004), and in 2018, five South American marmosets were found abandoned in public areas in Singapore (Channel NewsAsia 2018). Other sightings may have been arrivals from nearby areas. On 19 February 2008, a single adult Dusky Langur *Trachypithecus obscurus obscurus* was observed at Kent Ridge forest in southern part of Singapore, but its origin and subsequent fate were unknown (Yeo & Lim 2013). In 2015, a Southern Pig-tailed Macaque *Macaca nemestrina* was rescued from a car workshop and later rehomed in Malaysia (AsiaOne 2015).

Many primates are able to swim, and there have been instances of other animals reaching Singapore in this way; for example Malayan Tapir likely swam across the straits from Malaysia into Singapore (Chew 2016). To the north of Singapore, the Malaysian state of Johor is home to the non-human primates resident in Singapore, as well as Dusky Langur, Southern Pig-tailed Macaque, and Malaysian White-handed Gibbon *Hylobates lar lar*. To the south of Singapore on the Indonesian islands of Bintan and Batam are found Sunda Slow Loris, Long-tailed Macaque, Bintan Pale-thighed Langur *P. siamensis rhionis*, and Silvered Langur *T. cristatus cristatus*.

Over the past few months several Dusky Langurs have been observed in Singapore. Here we document our observations, compile reports from social media,

and attempt to assess the potential impacts of Dusky Langurs on local primates.

MATERIALS AND METHODS

At 10.30h on 31 August 2019, staff of the National Parks Board (NParks) of Singapore were informed by a member of public that a group of Dusky Langurs was seen at 891B Woodlands Drive 50 in the northern part of Singapore. NParks staff, including the last author, went to the location at 12.35h to observe the Dusky Langurs until 19.15h that evening. The next day NParks received further information about the location of what was presumably the same group of langurs from members of the public.

On 30 December 2019, we were alerted to a photograph of Dusky Langurs in Singapore which was posted in a Facebook group (Nature Society Singapore). In order not to alarm the public regarding the presence of a non-native primate species before verifying the sighting, we did not publicly seek for observations on social media platforms. Instead, we monitored sighting reports of Dusky Langurs posted on local major Facebook groups (Birds, Insects and Creatures of Asia; Nature Society Singapore; Wildlife of MacRitchie & Central Catchment) from 30 December 2019 to 31 January 2020, and privately messaged the person(s) for more information.

As part of an ongoing research project on Raffles' Banded Langurs in Singapore, we conducted field observations on weekdays and weekends within the Central Nature Reserve. Whenever Dusky Langurs were encountered, we recorded the date, time, GPS coordinates, group demographics (number of individuals, sex, and age group), and behaviour, including interactions with native primate species.

RESULTS

A total of three Dusky Langurs with at least one male (Image 1) were seen at 891B Woodlands Drive 50. The Dusky Langurs were sighted on trees that were very close to high-rise housing buildings, and spent most of their time between 12.35h and 19.15h on trees. On two occasions, the Dusky Langurs used a building ledge, roof of a covered walkway (Image 2), and/or the ground to get to another tree due to the lack of connectivity between trees. On a separate occasion at 19.10h, one Dusky Langur descended from a tree to drink water from a

drain (Image 3). This langur was wary of its surroundings and bolted back up the tree when humans approached, and only came back down to continue drinking when people left. Throughout the entire duration of the observation, the Dusky Langurs stayed within 150m of the location of the initial sighting. On the next day, the same group was sighted by members of the public at 556 Woodlands Drive 53 at 08.52h, 50 Woodlands Drive 16 at 10.20h, and 580 Woodlands Drive 16 at 14.17h (Table 1). It appeared that the langurs were travelling south-east from the initial sighting on 31 August 2019 (Image 4).

Subsequently, there were no records of Dusky Langurs until 30 December 2019, where a photo of a group appeared on social media (Facebook). The sighting happened at Thomson Nature Park in the central part of Singapore within the Central Nature Reserve, but details such as the time and number of langurs could not be obtained. Two days later, another sighting was reported in Thomson Nature Park. Subsequently, we encountered a pair of langurs, an adult male (Image 5a) and a subadult male (Image 5b), five times in January 2020 (Table 1). Based on photographs, both belonged to the group that was initially seen in Woodlands. The absence of a third individual (Image 5c) after 1 September 2019 could mean it died or otherwise left the group.

On 18 January 2020 at 17.20h, a member of the public reported a sighting of two Dusky Langurs at Upper Peirce Reservoir Park, which is adjacent to Thomson Nature Park, feeding on Saga *Adenantha pavonina* leaves. Sometime later, a group of at least three Long-tailed Macaques approached, and an adult male began chasing the langurs away from the tree (Image 6a). Both species acted aggressively by baring teeth (Image 6b), but no loud calls were heard during the encounter and the langurs moved away. On the next day in Thomson Nature Park we observed a group of 11 Raffles' Banded Langurs feeding on Saga seeds (Image 7). At 16.15h, two Dusky Langurs appeared and chased after the banded langurs. Alarm calls were exchanged and the Banded Langurs scattered out of sight. The Dusky Langurs then took over the Saga tree, although feeding was not observed. The following day at 08.12h, we observed the same pair of two Dusky Langurs (facially identified using photographs) at Thomson Nature Park, 203m (measured on Google Earth) from the site of encounter with the banded langurs a day earlier. As the dusky langurs sighted in both Woodlands and Thomson Nature Park have been identified to be the same group, this would mean that the Dusky Langurs travelled from the northern part to the central part of Singapore in approximately



Image 1. Three Dusky Langurs, with at least one male, at 891B Woodlands Drive 50.



Image 2. Two Dusky Langurs jumping to a building ledge from the roof of a covered walkway.



Image 3. A Dusky Langur on the ground, checking out its surroundings in between bouts of drinking from a drain, at 891B Woodlands Drive 50.

four months between 31 August 2019 and 30 December 2019.

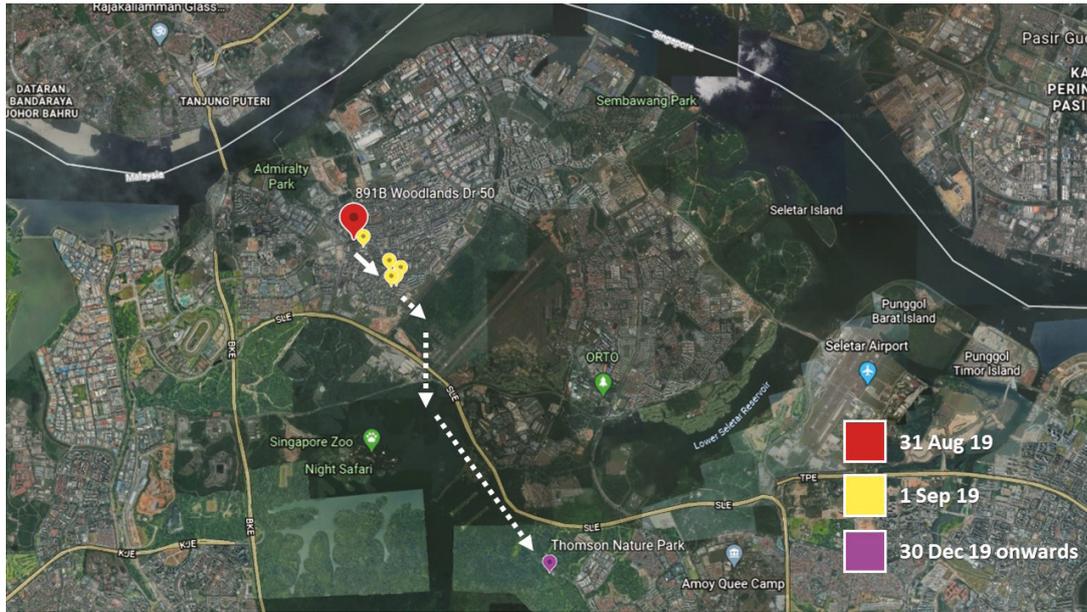
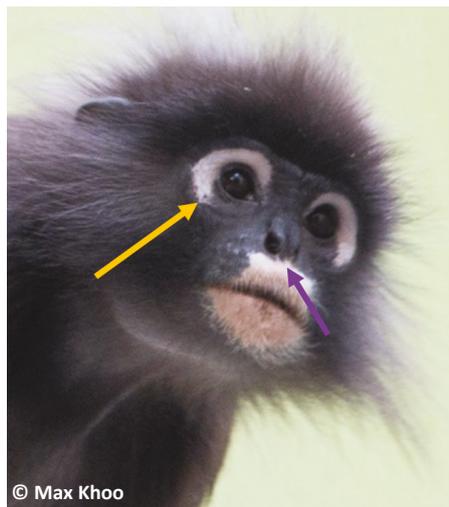
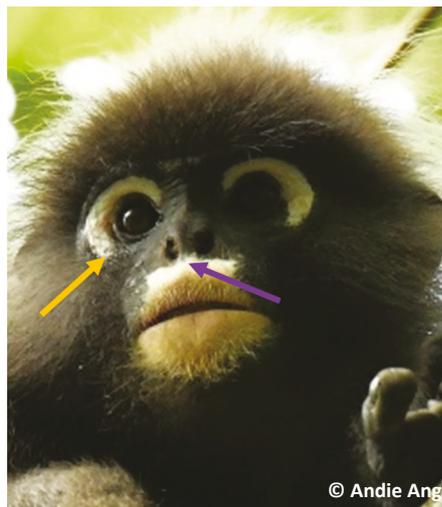


Image 4. Initial sightings of Dusky Langurs and a possible route of movement to the latest reported sightings. Image by Max Khoo (edited on Google Earth).



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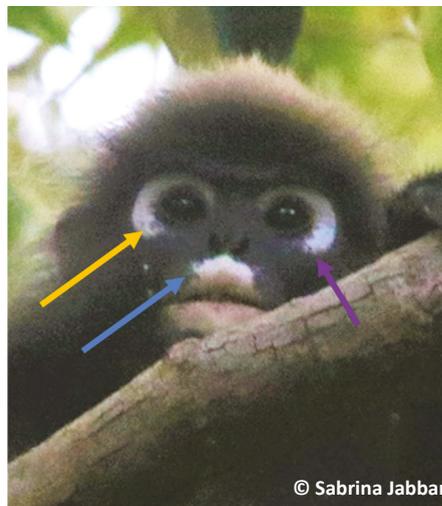


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Image 5a. The same adult male Dusky Langur in Woodlands (left) and Thomson Nature Park (right).



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Image 5b. The same subadult male Dusky Langur in Woodlands (left) and Thomson Nature Park (right).



Image 5c. The third Dusky Langur individual that was sighted in Woodlands on 31 August 2019 but was no longer sighted subsequently.

DISCUSSION

Dusky Langurs, especially the orange-colored infants are a popular pet in the illegal wildlife trade and are often sold within and outside Malaysia (The Straits Times 2019). These individuals often do not survive till adulthood, as they are kept in poor conditions (e.g., cages) and are not fed their natural diet (Mariani Ramli pers. comm. 11 February 2020). The Dusky Langurs sighted at Woodlands and Thomson Nature Park appeared to be healthy, wary of humans, and adapting well to the local wild habitat. The pair who remained in Thomson Nature Park were an adult and subadult. This indicates that these langurs were unlikely pet releases or escapees, and may have entered Singapore by land over the Johor-Singapore Causeway at Woodlands (960m), and/or by water by swimming across the Johor Strait from Malaysia to Singapore (750m). Many primates, including Dusky Langurs are known to be able to swim (Zainol et al. 2019). Silvered Langur *Trachypithecus cristatus*, a closely-related species to the Dusky Langur, have been observed swimming in the sea next to Indonesia's Bintan Island (Supplementary Video). Like most other quadruped mammals, langurs use the dog-paddle style to swim, i.e., with each diagonal pair of

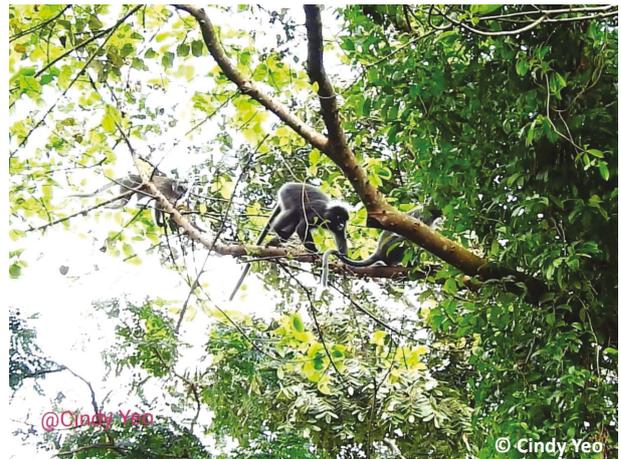


Image 6a. An adult male Long-tailed Macaque chasing two Dusky Langurs.



Image 6b. An adult male Long-tailed Macaque baring teeth at an adult Dusky Langur male.

limbs moving alternately through the water directly beneath their body (Dagg & Windsor 1972; Gabbatiss 2017). Moreover, Asian colobine primates like Dusky Langurs often exhibit male dispersal when they reach subadult-hood. Given this, along with the initial sighting of the Dusky Langurs at Woodlands being very close to Johor, it is plausible that the Dusky Langurs may have come from neighbouring Malaysia.

Dusky Langurs and Raffles' Banded Langurs are known to be sympatric in a number of forests in Peninsular Malaysia (states of Johor and Pahang) (see Roos et al. 2014; Ang & Baker 2019) but Dusky Langurs are not known to be native in Singapore (Raffles 1821). While the two species have evolved sympatrically and partitioned resources in the same habitat in Peninsular

Table 1. Sightings of Dusky Langurs in Singapore.

Date	Time	No. of individuals	Location	Observer(s)
31.viii.2019	10.30h	3	891B Woodlands Drive 50	Member of public
31.viii.2019	12.35–19.15 h	3	891B Woodlands Drive 50	Bryan Lim, and authors
01.ix.2019	-	3	10 Woodlands Drive 50	Member of public
01.ix.2019	08.52h	3	556 Woodlands Drive 3	Member of public
01.ix.2019	10.20h	3	50 Woodlands Drive 16	Member of public
01.ix.2019	14.17h	3	580 Woodlands Drive 16	Member of public
01.ix.2019	Afternoon	3	576 Woodlands Drive 16	Member of public
30.xii.2019	-	-	Thomson Nature Park	Gerald Lim (Facebook)
01.i.2020	17.45h	2	Thomson Nature Park	Ian Siah, Ethan Siah, Raphael Siah, Cheryl Goh (Facebook)
03.i.2020	08.00h	2	Thomson Nature Park	Authors
07.i.2020	08.36h	2	Thomson Nature Park	Authors
18.i.2020	17.20h	2	Upper Peirce Reservoir Park	Cindy Yeo (Facebook)
19.i.2020	16.15h	2	Thomson Nature Park	Authors, Rahayu Oktaviani, Alice Early, Steve Early, Katherine Kim, Uriana Argeros
20.i.2020	08.12h	2	Thomson Nature Park	Authors
22.i.2020	17.40h	2	Old Upper Thomson Road	Authors



Image 7. Raffles' Banded Langur adult female feeding on *Saga Adenantha pavonina* seeds on 19 January 2020.

Malaysia during the Pleistocene (Ang et al. 2020), the sympatric occurrence of Dusky Langurs and Raffles' Banded Langurs in Singapore is novel. On one occasion in Thomson Nature Park, although there were only two Dusky Langurs, they displayed aggressive territorial behaviour toward the native and Critically Endangered Raffles' Banded Langurs and displaced them from a food resource. As the Raffles' Banded Langurs are naturally

more shy and are smaller in body size than the Dusky Langurs, displacement of Raffles' Banded Langurs from within their home range by Dusky Langurs may occur given that the two langur species share similar food resources as primarily folivores. As such, further monitoring is required to ascertain if the presence of Dusky Langurs is negatively impacting the Raffles' Banded Langur in Singapore in the short term and long term.

The Long-tailed Macaques and Dusky Langurs are also sympatric in forests of Peninsular Malaysia (Bernstein 1967; Johns 1986; Ruslin et al. 2019). The diet of both species overlaps to a lesser extent as compared to the Dusky Langur and Raffles' Banded Langur, with the Long-tailed Macaque being primarily frugivorous, and the Dusky Langur being primarily folivorous but with a large part of their diet being fruits and seeds as well (Johns 1986; Sha & Hanya 2013). It has been hypothesized that Dusky Langurs can switch to feeding on leaves to avoid competition, while Long-tailed Macaques could shift to eating anthropogenic foods (Ruslin et al. 2019). Along with Long-tailed Macaques being comparably more assertive in defending their resources, the impacts of Dusky Langurs on Long-tailed Macaques can be expected to be lower as compared with the impacts on Raffles' Banded Langurs. The observation of the adult Long-tailed Macaque that chased away the two Dusky Langurs at Upper Peirce Reservoir Park on the feeding tree further illustrates the ability of Long-tailed Macaques to

defend food resources.

Non-native species can present risks to native biodiversity through the transmission of diseases (Hatcher et al. 2012). The introduction of parasites and pathogens can have serious implications at a population level due to a lack of immunity in the new hosts (Peeler et al. 2011). Islands are also highly vulnerable to the impacts of non-native species as the native biodiversity have often evolved in isolation without diseases that are found on continents (IUCN 2018). Additionally, introduced species can present detrimental effects to local biodiversity if it is able to hybridize with closely-related local species. In primates, hybridization at both the genus and species levels have resulted in speciation at the population level (Zinner et al. 2011) but hybrids may outcompete native species at a local level (see Oliveira & Grelle 2012). In the subfamily Colobinae, to which the Dusky Langur and Raffles' Banded Langur belong, there has been evidence of multiple hybridization events such as with the genera *Trachypithecus* and *Semnopithecus* (Roos et al. 2011). More recently, there have been two separate hybridization events of the Francois' Langur (*T. francoisi*) and White-headed Langur (*T. leucocephalus*) (Liu et al. 2013). As for the Dusky Langur and the Raffles' Banded Langur, there have been no records of hybridization in Peninsular Malaysia where both species are sympatric. As such, hybridization may not be an issue between these two species. It is unlikely for the Dusky Langur and the Long-tailed Macaque to hybridize given that both species belong to different subfamilies.

Non-native species introduced into an existing ecosystem can disrupt local biodiversity and environment in the form of resource competition, disease transmission, hybridization, among others. Even though the two Dusky Langur males will not be able to establish a population in Singapore in the long-term (unless further dispersals happen), it is nonetheless vitally important to continue monitoring efforts on the Dusky Langurs and the native biodiversity so as to assess their impacts and to devise measures to minimize the risks. If it is assessed to be necessary to translocate the Dusky Langurs out of Singapore and back to their native habitat, proper and ethical protocols must be followed (e.g., the IUCN Guidelines for Reintroductions and Other Conservation Translocations; IUCN SSC 2013). Among other requirements, it is important to determine the most likely source of the Dusky Langurs by doing genetic analyses, to ensure that the health and safety of the Dusky Langurs are not compromised during the translocation process, and to select a suitable destination habitat that is under legal protection for the

long-term survival of the langurs.

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