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PrimaTourism: Preliminary Study on Activity Budget of Dusky leaf monkey *Trachypithecus obscurus obscurus* in Bukit Soga Perdana, Batu Pahat, Johor.

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Abstract. Dusky leaf monkey, *Trachypithecus obscurus* distributed throughout Peninsular Malaysia are currently under threats by agricultural land conversion, habitat fragmentation, pet trade and other anthropogenic development. Bukit Soga Perdana, Batu Pahat, Johor is an island forest surrounded by urban development and the populations are highly fragmented here. PrimaTourism is an alternative way to conserve primate species through the means of wildlife tourism. Thus, the aim for this study is to obtain the daily activity budget of *T. obscurus* in Bukit Soga Perdana to serve as foundation for PrimaTourism activities. Scan sampling method was employed in this study from November 2017 to February 2018 and a total of nine category of behaviours were recorded. Results indicated that *T. obscurus* spent most of the time moving, followed by feeding, resting, vocalization, agonistic and allomothering. These behaviours are largely influenced the surroundings such as presence or absence of humans. This study provide the first report on daily activity budget of dusky leaf monkey in Bukit Soga Perdana, not only to understand the behaviour of the species, but also as foundation to initiate PrimaTourism in the area.

1. Introduction

Trachypithecus obscurus, dusky leaf monkey is locally known as *lotong celak*, *lotong mata puteh* or *cengkong* due to their unique physical characters, the white patches around their eyes [1, 2]. *T. obscurus* is a species under subfamily Colobinae consisting of 11 subspecies, *T. o. obscurus*, *T. o. corax*, *T. o. flavicauda*, *T. o. halonifer*, *T. o. carbo*, *T. o. styx*, *T. o. phayrei*, *T. o. shanicus*, *T. o. smithi*, *T. o. seimundi* dan *T. o. sanctorum* that are distributed from Peninsular Malaysia to as far as Myanmar [3]. This classifications however contradict with fewer subspecies as proposed by Groves [4] and Roos et al., [5]. *T. obscurus* have different pelage coloration, on top of their body, pelage is brown, grey or black, and their bottom body is usually darker than on top [4,5].

The dusky leaf-monkey is a folivorous species, but also consumes fruit and flowers. Young leaves constitute a high proportion (52%) of the diet for this species [6]. Fruit consumed tends to be unripe [7]. Dusky leaf-monkeys will feed in the emergent trees, which is higher than other sympatric langurs [8,9,10,11]. During the day, the main group splits up and forms smaller foraging groups [12]. The dusky leaf-monkey prefers to forage in the main canopy and the emergent layer of the forest [13]. During feeding this species will sit on large branches and boughs [13]. This species will spread foraging activity throughout the day so as not to overload their digestive processes that remove plant toxins and process leaf matter efficiently [7]. Daily activity budget is an important part of animal behaviour study that can be defined by the collection of data about the behaviour and activities of primates for one whole day

[14]. Notable previous study was daily activity budget of *T. o. halonifer* was conducted in Penang Botanical Garden, Malaysia in addition of characterizing their habitat and canopy use [1].

Bukit Soga is a green lung of Batu Pahat town [15] covered with highland dipterocarp forest with rich diversity in flora and fauna and comprises of several type of water bodies which are small stream, temporary ponds, and lakes [16]. This important forest is surrounded by heavy industrial activities such as textiles, electronics, plastic [15,16] and other environmentally alarming industries. Surprisingly, this green lung also support a fragmented groups of *T. obscurus* in the area. However no study have ever been conducted to understand the behaviour of this species in the area. The area are also frequented by visitors from the larger area of Batu Pahat town making it viable to be developed as PrimaTourism product. We define PrimaTourism as a form of responsible visit to natural or artificial areas to observe, learn and appreciate primates in which it significantly contributes to sustainable conservation of primates. We believe in order to develop a sustainable PrimaTourism product, we need to understand the evolutionary, ecology and behavioural data of targeted species of primates to develop the content for interpretation and story-telling by nature guides. Thus, this study aims to determine the daily activity budget of *T. obscurus* in Bukit Soga Perdana as foundation to develop PrimaTourism product in the future.



Figure 1. *Trachypithecus obscurus obscurus* in Johor

2. Methodology

2.1. Study Site

This study was conducted in Bukit Soga Perdana, Batu Pahat, Johor (latitude: 1° 51' 00", longitude: 102° 56' 00"). Bukit Soga Perdana with size of 49.3 ha recreational forest is located within a forest reserve and is located approximately 5 km from Batu Pahat City Centre. A few other forest areas located within its proximity includes Gunung Banang, Bukit Payung, and Bukit Inang [15]. Observation were carried out along existing trails for visitors as it will be more suitable to be exploited as PrimaTourism product in the future. The study area largely involved the entrance of Bukit Soga Perdana as the species are easily spotted, and will usually disappear into the highland forest when observation were made from trails going up Bukit Soga Perdana.

2.2. Experimental Design and Data Analysis

We conducted data collection from November 2017 to February 2018 for four full days each week, two days during weekdays and two days during weekend. This is due to high traffic of visitors to Bukit Soga Perdana during weekend and we want to ensure we can normalize the differences arising from increasing interactions between dusky leaf monkey and visitors. Observation were carried out starting from 0700 hours to 1800 hours taking into accounts the weather condition [17]. Once the dusky leaf monkeys are spotted, they were followed as long as possible until dawn [17]. The time of the activity performed and its location of sleeping tree and core trees and were noted and marked by GPS and using built-in GPS of NIKON P510. Daily activity budgets were calculated by averaging the individuals number in the scan sampling to the percentages of activity studied [17].

3. Results

A total of nine behaviours were recorded throughout the observations (figure 2, 3 and 4). Moving dictate the largest time spent by *T. obscurus* in their daily activity budget (43.80%), allocating as much as 64.7% in November 2017, 58 % in December 2017, 46.03% in January 2018 and 44.55% in February 2018. This is followed by resting (20.0%) defined by the behaviour of the dusky leaf monkey having no activity except for resting at particular site, with 24.7% in November 2017, 26.4% in December 2017, 21.25% in January 2018 and 24.89% in February 2018 recorded. Expectedly, feeding is one of the important element in dusky leaf monkey's daily activity budget, as high as 21.17% in November 2017, 3.46% in December 2017, 25.97% in January 2018 and 10.75 % in February 2018. The significant declines in feeding observed during December can largely be attributed to bad weather conditions, raining almost every day throughout the months, thus reducing our data collections.

Playing behaviour observed are comparable to feeding behaviour, as much as 20% in November 2017, 14.71% in December 2017, 7.42% in January 2018 and 16.55% in February 2018. Taking into account reduced observational hours during December, especially morning and evening (specifically feeding time), the budget allocation presented here might not depict the overall budget allocation by *T. obscurus*. Grooming behaviour (8.5%) portrayed increasing trend every month, 8.23% in November 2017, 9.52% in December 2017, 9.78% in January 2018, and 13.86% in February 2018. Other behaviour observed were fighting (1.3%), allomothering (0.9%) and vocalization (0.8%). Due to elusive behaviour of *T. o. obscurus* in Bukit Soga Perdana, often retreated to highland forest here, except during feeding at the hill of Bukit Soga Perdana, no mating behaviour were recorded during four months of observation.

4. Discussion

T. o. halonifer in Penang botanical garden spends 23% of their time moving [1] as compared to this study which recorded almost twice at 43.80%. This may well suggests that *T. o. obscurus* in Bukit Soga remains as semi-wild population and not habituated to presence of visitors despite high traffic of visitors frequently using Bukit Soga Perdana as recreational areas. Although it is interesting to note that Penang Botanical Garden which are also frequented by visitors for recreational purposes is an open landscape as compared to hilly forest of Bukit Soga Perdana which might offer better retreat areas for the dusky leaf monkey. Study in Sabangau forest, Kalimantan, indicated that *Presbytis rubicunda* spend only 14.2% for travelling in their activity budget. This however was observed in undisturbed forest [18] with less human disturbance as compared to Bukit Soga Perdana and Penang Botanical Garden.

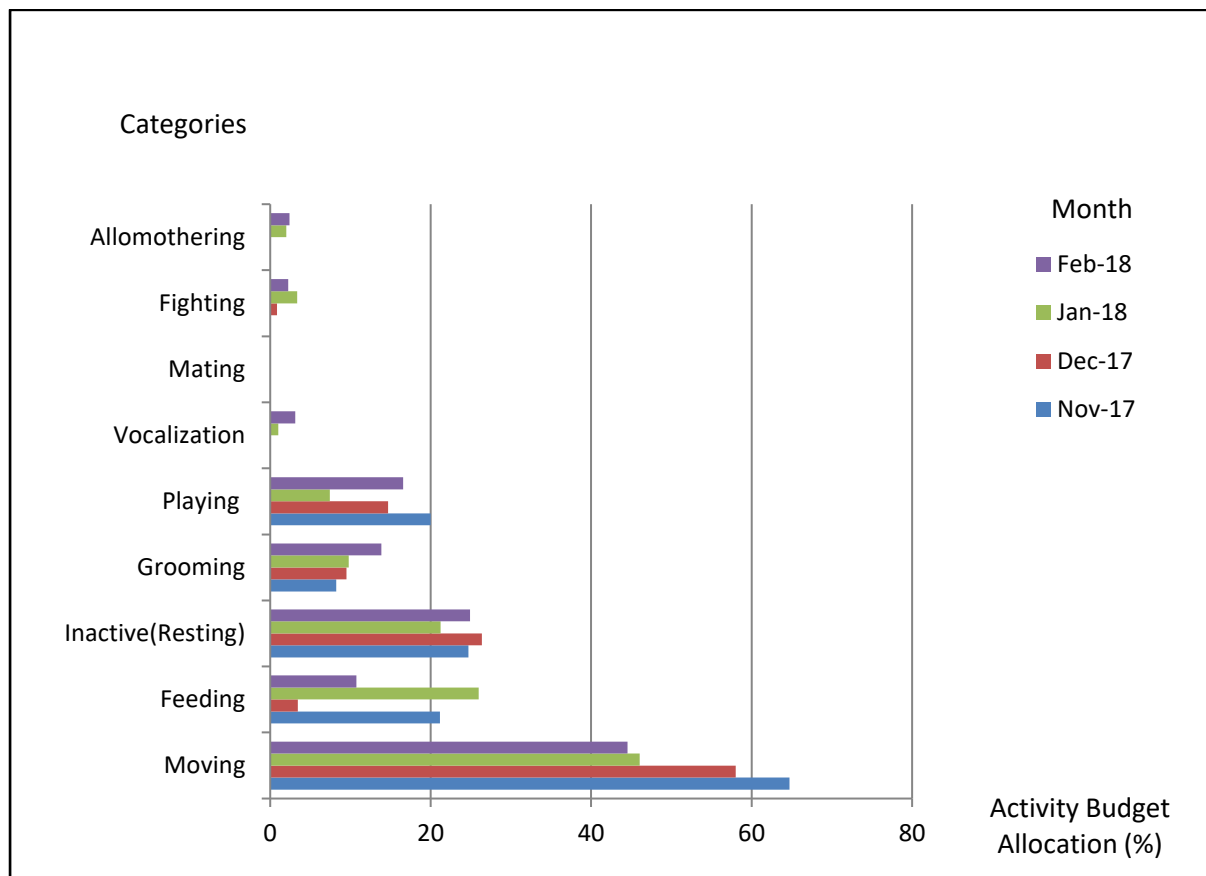


Figure 2. Activity Budget of *T. o. obscurus* in Bukit Soga Perdana, Batu Pahat, Johor from November 2017 to February 2018.

T. o. halonifer population in Penang Botanical Garden allocate 39% of their daily activity budget for feeding throughout the day, while *P. rubicunda* in Sabangau spend 29.3% for feeding. *T. o. obscurus* in Bukit Soga Perdana however were recorded to spend only 12.6% which was significantly lower as compared to others. *T. o. obscurus* in UKM Bangi Campus, were observed during the same months from November 2013 to January 2014, but indicated almost four times feeding behaviour (40.81%) [18]. We believe seasonal variations played a role here aside from higher sighting hours and frequently spotted dusky leaf monkey populations in UKM as compared to populations in Bukit Soga Perdana which are easily threatened by visitors and researchers [17]. Food quality might also played a role in feeding time in Bukit Soga Perdana which make an interesting future study for the populations here.

Rapid loss of habitat and habitat fragmentation such as Bukit Soga Perdana are driving forces that can significantly threaten the sustainability and survivability of dusky leaf monkey [1]. Mitigating habitat fragmentation impacts is not an easy task for conservation biologist as it requires a lot of information about the nature of the fragmented areas, the information on species living in the fragmented area and many other information. The juvenile of this species are also highly traded as pets among Malaysian and without understanding the behavior and ecology of this species, they almost certainly will die immediately. All these issues can easily be related to lack of awareness on the importance of dusky leaf monkey's role in ecosystem as well as awareness on importance of wildlife conservation.

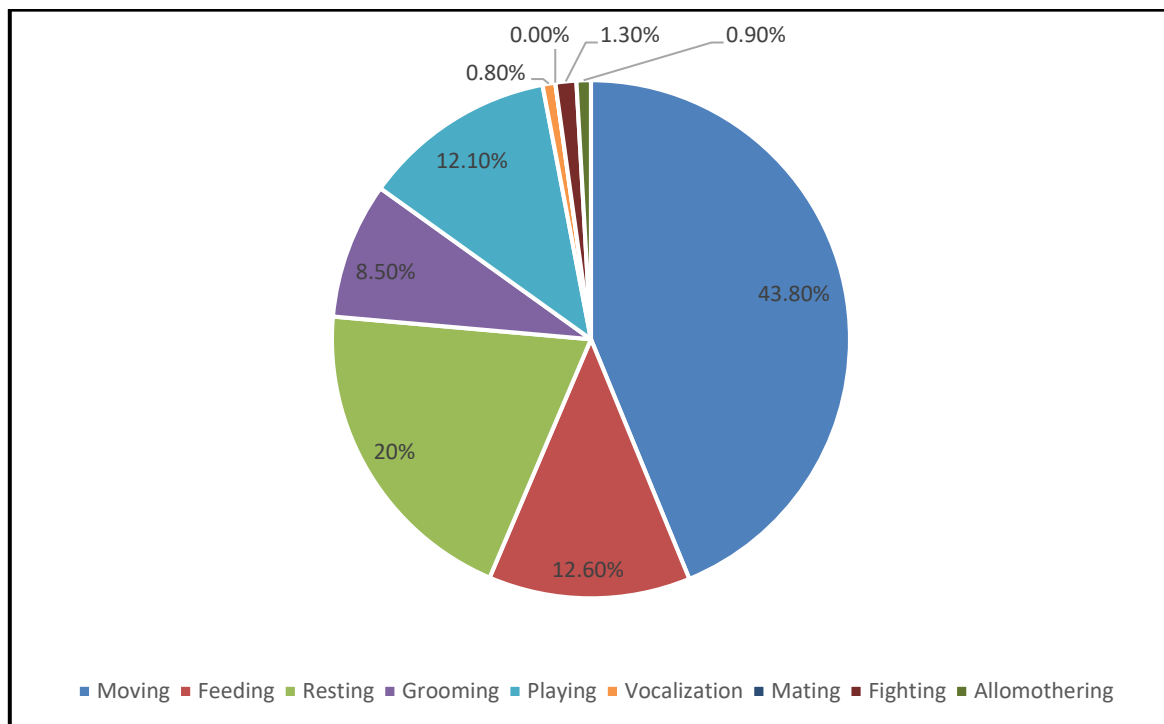


Figure 3. Summary of Activity Budget for *T. o. obscurus* in Bukit Soga Perdana, Batu Pahat, Johor from November 2017 to February 2018.

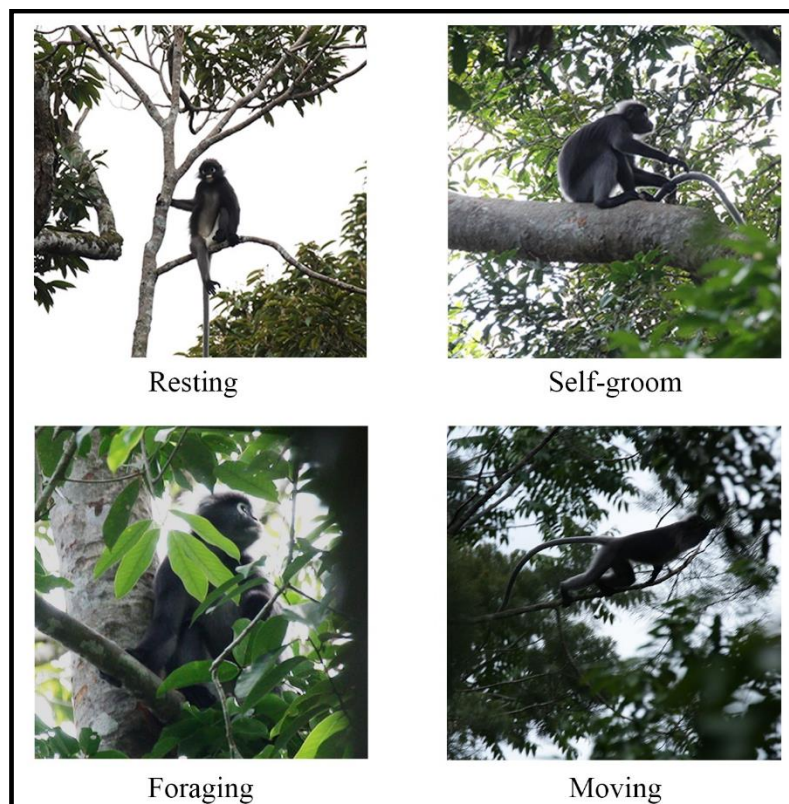


Figure 4. Categories of behaviour exhibited by *T. o. obscurus*

Understanding the behaviour of dusky leaf monkey in this area are important foundation to initiate PrimaTourism activities in Bukit Soga Perdana. Being the green lung of Batu Pahat town and with high number of visitors, PrimaTourism may serve as educational and conservation tools to ensure the sustainability of this highly fragmented populations in the area. Future study are suggested to focus on feeding ecology of this species in Bukit Soga Perdana, as well as intensive activity budget analysis. It

will also be beneficial to determine the taxonomic position of this species, confirming the subspecies assigned and exploring the evolutionary history [19,20,21,2] as content for PrimaTourism activities.

5. Conclusion

Dusky leaf monkey in Bukit Soga Perdana exhibited a slightly different patterns of activity budget as compared to previous study of the species in Malaysia. This is due to seasonal variations and sighting hours between these studies. However, we have successfully reported the first study on activity budget of *T. o. obscurus* in Bukit Soga Perdana Batu Pahat Johor. This will be the foundation of future studies and more importantly development of PrimaTourism in this green lung of Batu Pahat.

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