Diversity and Distribution of Primates in the Gunung Basur Permanent Forest Reserve

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Abstract. This paper presents data regarding the diversity, population density, and distribution of primate species within the Gunung Basur Permanent Forest Reserve (GBPFR). The survey was conducted from the 3rd–8th of November in 2019, covering 7 survey locations (Terang Pump House, Suda Intake, Renyok 1 Intake, Renyok 2 Intake, Renyok 3 Intake, Long Intake, and Long 2 Intake) within the reserve. A total of 36 hours was spent to perform random sampling observations. The focus of this survey was to identify diurnal primate species. A total of 5 species (Symphalangus syndactylus, Hylobates agilis, Presbytis siamensis, Trachypithecus obscurus, and Macaca nemestrina), belonging to the families Hylobatidae and Cercopithecidae, were observed during the survey period. The density of Trachypithecus obscurus was high at the study site, with 60 individuals identified, followed by Symphalangus syndactylus, with 45 individuals, Presbytis siamensis, with 39 individuals, Hylobates agilis, with 20 individuals, and Macaca nemestrina with only 3 individuals. Two of the identified species are classified as Totally Protected (Symphalangus syndactylus and Hylobates agilis), whereas the other 3 species (Macaca nemestrina, Presbytis siamensis, and Trachypithecus obscurus) as classified as Protected, according to the Wildlife Conservation Act 2010 (Act 716). According to the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, 2 species (Symphalangus syndactylus and Hylobates agilis) are considered to be Endangered, 2 species (Presbytis siamensis and Trachypithecus obscurus) are considered to be Near Threatened, and Macaca nemestrina is listed as Vulnerable. The data gathered from this study is crucial for designing a wildlife conservation plan for this reserve.

1. Introduction

Malaysia is blessed with an immense number of wildlife species and has been recognised as one of 17 ‘megadiverse’ countries [1]. In Malaysia, among the estimated 361 mammal species, 25 species are primates, from 9 genera in 5 families, including Lorisidae, Tarsiidae, Cercopithecidae, Hylobatidae, and Hominidae. Of these, 12 species and 6 genera can be found in Peninsular Malaysia, whereas 15 species and 8 genera can be found in Malaysian Borneo. Of the primate species in Malaysia, 9 have been listed by the IUCN Red List as Endangered or Critically Endangered, 7 have been listed as Vulnerable, 4 have been listed as Near Threatened, 2 were not evaluated, and 1 has been listed as of Least Concern [2].

Based on the IUCN Red List categorisation, described above, over 90% of all primates in Malaysian are threatened with extinction, primarily due to the following: i) land-use changes resulting...
in habitat loss, degradation, and fragmentation; ii) hunting, trapping, and illegal trade; and iii) human–primates conflicts associated with development and infrastructure, including road kills (accidental mortality) [2].

Due to the continuous decline in primate populations and the lack of understanding regarding the recent distribution of primates in Peninsular Malaysia, the documentation of the populations and distributions of primates is urgently necessary, especially within the Protected Area and Forest Reserves. A species with a small population is more likely to become extinct earlier than species with large populations, and species distribution is an important component of population genetics. Thus, data regarding the population and distribution of endangered animals are crucial for wildlife ecology and can be used to determine priority areas for conservation [3]. Mapping and modelling species distribution has become increasingly important for a variety of management and decision-support purposes [4].

A short primate survey was conducted during the Pergau Scientific Expedition in 2019, which was organised by the Tenaga Nasional Berhad Research (TNBR), between November 3 and November 8, 2019, at the Gunung Basur Permanent Forest Reserve (GBPFR). The primary objectives of the survey were as follows: i) to identify and record the presence of diurnal primate species located at the GBPFR; ii) to estimate the population of each primate species found at the study sites; and iii) to assess the local conservation status of each primate species.

2. Methods

2.1 Study Site
The GBPFR, with a forest cover of approximately 40,613 ha was pronounced to be a production forest (PF) in 1989 [14]. The focus survey sites included 7 water intakes: Terang Pump House, Suda Intake, Renyok 1 Intake, Renyok 2 Intake, Renyok 3 Intake, Long Intake and Long 2 Intake (Figure 1).

2.2 Sampling and Data Collection
The survey method deployed in this study was random sampling, which covered the left and right sides of the roadside or baseline (the roads that connect every water intake in the GBPFR). Direct observation was used to record data in real-time [5]. Several basic pieces of equipment were used for this study, such as a digital single-lens reflex (DSLR) camera to capture pictures of species and record videos or sound, global positioning system (GPS), binoculars to detect species, and datasheets, for recording purposes. An approximate total of 36 hours was spent collecting direct observation data, ranging from 5–7 hours each day (early morning and late evening). The observations occurred between 06:30–10:30 and 16:30–19:30, each day. Observations included listening to great calls in the mornings and sighting, for gibbons (Hylobatidae) and listening and monitoring during the early morning and late evening for Cercopithecidae. The list of species and the number of individuals (for each primate species) identified at each study site represent the diversity, distribution, and abundance of each primate species inhabiting the GBPFR.

2.3 Data Analysis
The sighting and vocalising location data were tagged and recorded, using GPS, to obtain coordinates. ArcMap Version 10.6.1 was used to plot the distribution of individuals, families, groups, and species identified during this survey. The calculation for gross population density estimation per km$^2$ for each species was performed using the following formula:

\[ D_i = \frac{n_i}{A} \]

\[ n_i = \text{number of identified individuals} \]

\[ A = \text{the total area} \]
Figure 1. The locations of trails and water intakes (Source: TNBR).

3. Results

3.1 Diversity and Distribution
Figure 2 shows the distribution of 5 primate species, including *Trachypithecus obscurus* (5 groups), *Symphalangus syndactylus* (13 family groups), *Presbytis siamensis* (5 groups), *Macaca nemestrina* (1 group), and *Hylobates agilis* (8 family groups). The estimated numbers of sighted individuals for each primate species are as follows: *Hylobates agilis* = 20 individuals, based on sightings and calls; *Symphalangus syndactylus* = 45 individuals, based on sightings and calls; *Trachypithecus obscurus* = 60 individuals, based on sightings only; *Macaca nemestrina* = 3 individuals, based on sightings only; and *Presbytis siamensis* = 39 individuals, based on sightings only. The numbers provided are based solely on the survey conducted during this study period. The gross population density estimation is presented in Table 1.
Figure 2. The distribution of five primate species within the Gunung Basur Permanent Forest Reserve.

Figure 3. Example of primates observed at study sites; (a) *Trachypithecus obscurus* (b) *Presbytis siamensis* (c) *Symphalangus syndactylus*.

Table 1. Population density estimate (per km$^2$) for each primate species observed at the study sites.

| Species                  | Total Research Area | Sighting/ Vocal (individual) | Population density per km$^2$ |
|-------------------------|---------------------|------------------------------|-------------------------------|
| *Symphalangus syndactylus* | 84.4 km$^2$        | 45                           | 0.53                          |
| *Hylobates agilis*      |                     | 20                           | 0.24                          |
| *Presbytis siamensis*   |                     | 39                           | 0.46                          |
| *Trachypithecus obscurus* |                    | 60                           | 0.71                          |
| *Macaca nemestrina*     |                     | 3                            | 0.04                          |
3.2 Conservation Status
Table 2 shows the 5 primate species (Symphalangus syndactylus, Hylobates agilis, Presbytis siamensis, Trachypithecus obscurus, and Macaca nemestrina) that were identified at during the survey period, which represented 2 primate families, Hylobatidae and Cercopithecidae. In the Hylobatidae family, 2 species were identified, Symphalangus syndactylus and Hylobates agilis. Both of these species are considered to be Totally Protected under Act 716 and are classified as Endangered on the IUCN Red List [6,7]. On the Red List of Mammals for Peninsular Malaysia, Symphalangus syndactylus is listed as Endangered, whereas Hylobates agilis is listed as Vulnerable [8].

In the Cercopithecidae family, 3 species were identified, Presbytis siamensis, Trachypithecus obscurus, and Macaca nemestrina. The first 2 species are listed as Near Threatened on the IUCN Red List [9,10] and the Red List of Mammals for Peninsular Malaysia [8]. In contrast, Macaca nemestrina is considered Vulnerable on the IUCN Red List [11] and is listed as Least Concerned on the Red List of Mammals for Peninsular Malaysia [8]. All of the Cercopithecidae species identified in this survey are considered to be Protected under the Wildlife Conservation Act 716.

Table 2: The conservation statuses of the five identified species identified at water intakes in the GBPFR.

| Scientific Name            | Common Name               | IUCN Red List | Red List of Mammals for Peninsular Malaysia | WCA 716 |
|---------------------------|---------------------------|---------------|--------------------------------------------|---------|
| Symphalangus syndactylus  | Siamang                   | EN            | EN                                         | TP      |
| Hylobates agilis          | Black-handed Gibbon       | EN            | VU                                         | TP      |
| Presbytis siamensis       | White-thighed Surili      | NT            | NT                                         | P       |
| Trachypithecus obscurus   | Dusky Leaf Monkey         | NT            | NT                                         | P       |
| Macaca nemestrina         | Pig-tailed Macaque        | VU            | LC                                         | P       |

*EN - Endangered, NT - Near Threatened, LC - Least Concerned, TP - Totally Protected, P - Protected

4. Discussion
4.1 Diversity, Distribution and Density
A previous study performed at Gunung Stong State Park (GSSP) (Kelantan Darul Naim Preliminary Management Plan), reported the identification of 6 primate species, including 1 nocturnal sighting of Nycticebus coucang [12]. One species was sighted by Badrul Munir & Melnick [13] and 5 species were reported by Ahmad Zafir et al. [14]. Some differences exist between data from previous findings and this recent study. Macaca fascicularis were spotted by Ahmad Zafir et al. [14] in Gunung Stong State Park, but no signs of the species were found in the GBPFR area. However, all other species found in this study were also identified in Gunung Stong State Park, demonstrating that this region is dominated by similar species, as Gunung Stong State Park and the GBPFR are close to each other.

*Hylobates agilis* is rarely observed because this species lives in small family groups in the tall dipterocarp forests [15], which may explain why family groups of the species were rarely observed in this study, as most previous records have been based on calls. *Symphalangus syndactylus* lives sympatrically with other gibbons, such as the white-handed gibbon and the black-handed gibbon, in Sumatera and Peninsular Malaysia [16]. This sympatric behaviour can be observed in the GBPFR, where both Symphalangus syndactylus and Hylobates agilis were spotted in the same area.
4.2 Conservation Status and Plan

The presence of endangered species is an important indicator that an area must be conserved. Previous studies have suggested that *Hylobates agilis* is distributed to the border between Perak, Kedah and Kelantan State [7]. The species distribution is restricted to a specific region, from the Mudah river in the north to the Perak and Kelantan rivers in the south [15]. Due to this limited distribution, any areas inhabited by this species should be conserved, including the GBPFR. The presence of other endangered primate species, such as *Symphalangus syndactylus* or Siamangs, also supports the conservation of the GBPFR. Many reports have suggested that both species may act as seed dispersal agents, due to their feeding characteristics [17]. Seed dispersal is very important for thriving forest ecosystems, and further detailed studies on the relationship between ecology and the behaviours of these two species remain necessary in the future.

5. Conclusion

This survey provides basic information regarding the diversity, population density, and distribution of primate species within the GBPFR. Although this survey should be considered preliminary and was limited to the central section of this reserve, this basic information is crucial for the future management of wildlife, not only in this reserve but also in other reserves, such as Gunung Stong State Park and Royal Belum State Park. The presence of endangered species, such as *Symphalangus syndactylus* and *Hylobates agilis*, also strengthens the importance of preserving this forest reserve. However, more primate studies must be performed in the future to cover more areas within the reserve and to identify additional groups of primate species. A more comprehensive survey can be used to develop a more conclusive primate management plan, not only for this reserve but also for other protected areas and forest reserves in Peninsular Malaysia.

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References

[1] Mittermeier, R. A., Robles-Gil, P. & Mittermeier, C. G. (1997). Megadiversity. Earth’s Biologically Wealthiest Nations. CEMEX/Agrupacion Sierra Madre. Mexico City.
[2] Lappan, S. & Ruppert, N. 2019. *CAB Reviews*. 14: 1-10.
[3] Bernard, H., Bili, R., Matsuda, I. & Hanya, G. 2016. *Tropical Conservation Science*. 9: 1-11
[4] Aspinall, R. J., Burton, G. & Landenburger, L. 2019. Mapping and Modeling Wildlife Species Distribution for Biodiversity:http://mmc2.geofisica.unam.mx/cursos/gest//Articulos/Geostatistics/Mapping%20and%20Modeling%20Wildlife%20Species%20Distribution%20for%20Biodiversity%20Management.htm. Downloaded on 23 January 2020.
[5] Aguiar, L. & Moro-Rios, R. 2009. *Zoologia*. 26 (4): 587–593.
[6] Nijman, V. & Geissman, T. 2008. *Symphalangus syndactylus*. The IUCN Red List of Threatened Species 2008: e.T39779A10266335.https://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T39779A10266335.en. Downloaded on 23 January 2020.
[7] Geissmann, T. & Nijman, V. 2008. *Hylobates agilis*. The IUCN Red List of Threatened Species 2008: e.T10543A3198943.http://dx.doi.org/10.2305/IUCN.UK.2008. RLTS.T10543A3198943.en. Downloaded on 20 December 2019.
[8] PERHILITAN. 2017. Red List of Mammals for Peninsular Malaysia Version 2.0. Kuala Lumpur. Department of Wildlife and National Parks (PERHILITAN) Peninsular Malaysia.

[9] Nijman, V., Geissman, T. & Meijaard, E. 2008. *Presbytis siamensis*. The IUCN Red List of Threatened Species 2008: e.T18134A7668889. https://dx.doi.org/10.2305/IUCN.UK.2008.2.LTS.T18134A7668889.en. Downloaded on 23 January 2020.

[10] Boonratana, R., Traeholt, C., Brockelmann, W. & Htun, S. 2008. *Trachypithecus obscurus*. The IUCN Red List of Threatened Species 2008: e.T22039A9349397. https://dx.doi.org/10.2305/IUCN.UK.2008.2.LTS.T22039A9349397.en. Downloaded on 23 January 2020.

[11] Richardson, M., Mittermeier, R.A., Rylands, A.B. & Konstant, B. 2008. *Macaca nemestrina*. The IUCN Red List of Threatened Species 2008: e.T12555A3356892. https://dx.doi.org/10.2305/IUCN.UK.2008.2.LTS.T12555A3356892.en. Downloaded on 23 January 2020.

[12] Maseri, N. M., Mohd-Ros, A. H. & Suksuwan, S. 2006. *WWF Malaysia*.

[13] Badrul Munir, M. Z. & Melnick, D. J. 2005. Genetic variation of Gunung Stong Banded Leaf-Monkey (*Presbytis melalophos*) Based on DNA Sequences. In: Shaharuddin Mohamad Ismail, Dahalan Hj.Taha, Abdullah Sani Shafie, Jalil Md. Som, I.Faridah-Hanum & A. Latiff (eds.). 2005. Taman Negeri Gunung Stong, Kelantan: Pengurusan, Persekitaran Fizikal, Biologi dan Sosio-Ekonomi.Jabatan Perhutanan Semenanjung Malaysia, Kuala Lumpur.

[14] Ahmad Zafir A. W., Johanssen, A. K., Darmaraj M. R., Ansel, O., Sharma, D. S. K. & Suksuwan, S. 2005. Camera trapping and Observations of the Larger Animals in West Kelantan Forest Complex. In: Shaharuddin Mohamad Ismail, Dahalan Hj.Taha, Abdullah Sani Shafie, Jalil Md. Som, I.Faridah-Hanum & A. Latiff (eds.). 2005. Taman Negeri Gunung Stong, Kelantan: Pengurusan, Persekitaran Fizikal, Biologi dan Sosio-Ekonomi.Jabatan Perhutanan Semenanjung Malaysia, Kuala Lumpur.

[15] NRE. Malaysia’s 5th report to the convention on biological diversity. 2014. Ministry of Natural Resources and Environment Malaysia (NRE), Putrajaya.

[16] Shepherd C. R and Shepherd L. A. 2017. A Naturalist Guide to The Primates of Southeast Asia: East Asia and the Indian Sub-continent. John Beaufoy Publishing.

[17] Lee, S. S., Norsham, S. Y., Boon, K. S. & Chua, L. S. L. 2002. Journal of Tropical Forest Science, 14 (2): 234-263.

[18] Norashikin, F., Sarah, A. & Latiff, A. 2015. The Malaysian Forester, 78 (1&2): 49-60.