

Observations on Vertebrates at Padang Chong Forest Reserve, Perak

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Abstract . Observations on wildlife especially on arboreal and nocturnal species can generate important information especially in a forest reserve. Therefore, observations using binoculars (daytime) and torchlight (night) at Padang Chong Forest Reserve (PCFR) were carried out during five sessions in the months of June until November

Despite their richness in faunal diversity, tropical rainforest in Peninsular Malaysia are being destroyed and degraded at an alarming rate due to anthropogenic activities such as urbanization and conversion into agricultural fields [8]. Rapid urbanization and the accompanying increase road networks have also placed pressure on its biodiversity. Such networks require tradeoffs in land use and lead to forest fragmentation. The emergence of forest fragmentation creates concern for conservationist as the process disrupts the structure and spatial continuity as it reduces original forested area, increases edge formation, and isolates remaining forest [2].

Edge formation in a forest area alters the abiotic factors (physical conditions, more direct sunlight, higher soil temperatures, differences in humidity, and increased wind exposure) as well as changes in the biological characteristics near the margin edge of the patch, often called as an edge interior effect [4]. Resulting in less stable habitats and alteration of species richness and composition in comparison to that of the interior habitats, therefore should be considered as two distinct habitats [5]. Edge formation provides habitat for species that prefer edge habitats, while species with particular habitat requirements will be pushed further into the interior habitat where the characteristics of forest remain aged. When these species being pushed into the now smaller interior habitat, the competition for limited resources and niches will be increased.

Malaysia has introduced an initiative called Central Forest Spine (CFS) to create more expansive forested areas through ecological corridors that connect fragmented forests in Peninsular Malaysia. One of the ecological corridors recognized within the northern parts of Peninsular Malaysia are Padang Chong Forest Reserve (PCFR) and Sungai Kuak Forest Reserve (SKFR). PCFR represent Bintang Hijau forest complex and SKFR represent Main Range forest complex were identified as Primary Linkages 4 (PL4), where the priority is to re-establish a connection between the Bintang Hijau forest complex and the Main Range forest complex [6].

The Bintang Hijau forest complex is almost entirely separated from the Main Range forest complex by the Kuala Kangsar main road, a wide stretch of agriculture land (mostly rubber), and scattered human settlements including Gedik Lengong towns along the road [6]. In addition, there are scrubland cleared land and rubber plantations within this corridor. Along a narrow stretch of the Gerik-Huluan road, the PCFR extends all the way to the main road. To the east of the main road, there is still (logged over) state land forest remaining between the main road and SKFR on the Main Range forest complex. Therefore, connecting and securing this PL4 is essential to maintain forest connectivity across the northern section of the Main Range forest complex and the Bintang Hijau forest complex.

Unfortunately, there is no available baseline data and information in the scientific literature regarding vertebrates species in PCFR. Thus, this study aims to document the presence of vertebrates species within PCFR and compare vertebrates species richness between the forest edge and forest interior. Therefore, with the insight on vertebrates species inquiry in PCFR, this study could supply baseline and essential information to the decision makers, especially the state or local authorities in formulation of appropriate and effective management strategies for PCFR and also for this ecological corridor.

2. Materials and Methods

2.1. Study Site

Perak, which located in the north-western part of Peninsular Malaysia are considered as the second largest state in Peninsular Malaysia. The state is surrounded by Kedah state

(from the North) Kelantan and Pahang (from the East) and Selangor (from the South). The total land area of Perak covers approximately 2.11 million ha. Perak has a total forested area of 1.01 million ha (48.13% of the state land area). An area of 988,604 ha (97.6%) of the forested area in Perak has been gazetted as a Permanent Forest Reserve, which scattered among 77 forest reserves [8]. This survey focuses on one of the forest reserve in Perak, namely Padang Chong Forest Reserve (PCFR) which located in Pengkalen Hulu Perak, Perak. This study also focuses specifically on compartment 12 as suggested by the Forestry Department of Hulu Perak due to their suitability habitat for the taxa that are focuses on in this survey.

2.1.1. Habitat Characteristics

PCFR is a secondary forest which is classified as a production forest type [11]. This forest reserve is a combination of lowland dipterocarp forest and hill dipterocarp forest, with also some part of sympodial growth bamboo that may thrive as a result of past logging activities or other disturbances. With an area of 1,134 ha, this forest reserve mainly consists of steep topography. PCFR have mostly close canopy closure on the interior of the forest, while some parts with open canopy such as on the edge of the forest, near edge of the forest and on the river flow pathway. In addition, the main activities surrounding PCFR are the cultivation of rubber trees, human settlements, and a stretch of the Gerik-Pengkalen Hulu mainroad.

2.2. Sampling Technique

Surveys were conducted during five sessions from the months of June to November 2022. Each session comprises five conservative days that are allotted for this observational survey. In this study, the forest was categorized into two, namely, P1 - 500m from the forest edge (N 05 41'03.4", E 101 01'11.0") and P2 - 1000m from the forest edge (N 05 41'19.1", E 101 00'58.0) (Figure 1). One line transect was established with 1000m distance from the forest edge and divided into two distance category, which 0m to 500m distance from the forest edge was considered as forest edge, while in 500m to 1000m considered as forest interior.

The study of vertebrates was conducted through direct observation methods by four to five observers which slowly walked along the transect line. All vertebrates sighting or calling was recorded and identified using various field guides accordingly [9, 10, 11, 12, 13]. surveys were done during fair weather (no heavy winds and rain)

2.2.1. Mammals

Direct observation was carried out along the transect line by using binoculars 8 x 40 and canon DSLR cameras during the day and night, in order to record the diurnal and nocturnal active mammals. Footprints, scratch marks, feces droppings and salt licks of potential mammals have also been recorded and photographed if found in the study area. All mammal's species sighting was recorded in Zoology datasheet and species identification was done by referring to mammal's field guide [9].

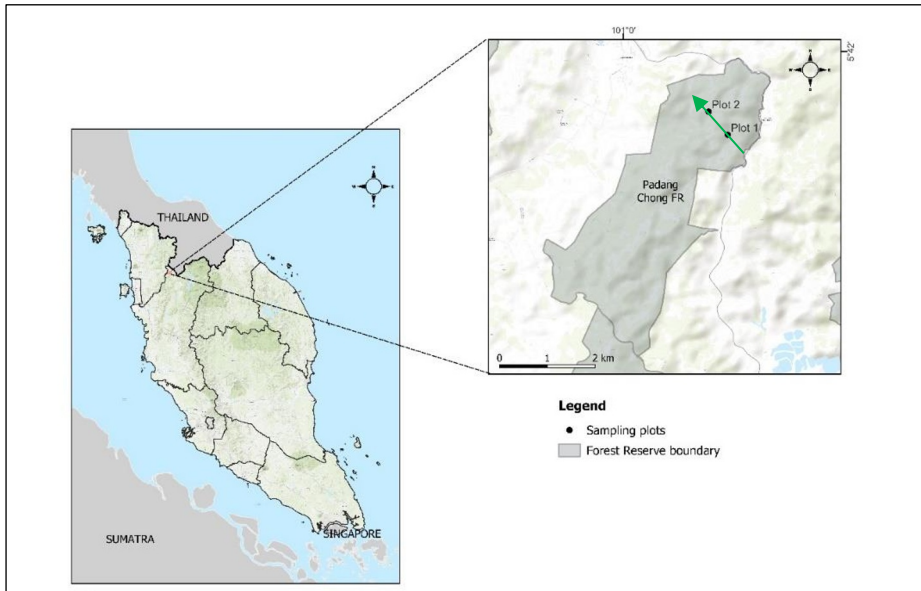


Figure 1. Locations of Line Transect at point 500m (Plot 1) and Line Transect at point 1000m (Plot 2).

2.2.2. Avifauna

Survey of avifauna were carried out twice a day, from 7.30 a.m. to 11.30 a.m. and from 4.30 p.m. to 7.00 p.m. This observation was carried out along transect line by using binoculars 8 x 40 and picture were taken using canon DSLR camera for further reference and identification purposes. Avifauna sighting were recorded in Zoology datasheet and species identification was done by referring to bird's field guides [10, 11].

2.2.3. Herpetofauna

Active observation technique was conducting the transect line under the rock on the tree, and near water bodies. Two days of research was done on each survey session with time was set for two to three hours during the day and night respectively. This to maximize the probability of recording both diurnal and nocturnal herpetofauna species. Morning session was done for two hours from 9.00 a.m. to 11.00 a.m., while night session was done for three hours from 8.00 p.m. to 11.00 p.m. with headlamps was used to aid visibility in dark. All species sighted were photographed using a Canon DSLR camera and recorded in Zoology datasheet for further reference and identification purposes. Identification of herpetofauna species was done by referring to herpetofauna field guides [12, 13].

2.3. Vertebrate Checklist

A preliminary checklist of the vertebrate's species was prepared together with their conservation status globally and protection status nationally that will be based on IUCN Red List of Threatened Species and Wildlife Conservation Act (2010) respectively. This preliminary checklist was prepared from the findings of the inventory that has been carried out throughout the survey sessions.

3. Results and Discussion

Overall, 65 species from 41 families of vertebrates were recorded and documented in these surveys (Table 1-3). Among these avifauna recorded the highest species observed with 42 species from 23 families followed by herpetofauna with 14 species from 11 families and mammals with nine species from seven families. Cercopithecidae and Nyctolatidae recorded as the most dominant mammal's families in PCFR with each contribute 22% (two species) of total mammal's species observed. In contrast, mammal's families of Cynocephalidae, Felidae, Lorisidae, Mustelidae and Suidae were represented by single species (11%) respectively. Of these, Cynocephalidae represented by a Flying Lemur (*Galeopterus variegatus*), Felidae consist of Leopard Cat (*Prionailurus bengalensis*) and Lorisidae comprise of Greater Slow Loris (*Nycticebus coucang*) are sighted during the night time as they are nocturnal active species. In addition, Mustelidae represented by Oriental Small Clawed Otter (*Aonyx cinereus*) are observed in the small river flow near the forest edge.

Among the avifauna families, Columbidae and Corvidae are the most dominant families with four species (10%) each, followed by Cisticolidae, Megalaimidae and Picidae that contribute three species (7%) each, while families of Bucerotidae, Dicaeidae, Dicruridae, Estrildidae, Meropidae, Muscicapidae and Phasianidae recorded with two species (5%) each (Figure 2). In contrast, another 11 families of avifauna were represented by only a single species (2%) respectively. Of these, only one species of Phasianidae which is Great Argus (*Argusianus argus*) are not sighted or observed throughout the survey but found traces such as fallen feathers on the forest floor and also its calling.

Among 14 species of herpetofauna, five species from five families belong to amphibians. All five amphibian families were represented by a single species (20%) respectively. In the other hand, another nine species from nine families of herpetofauna are belong to reptiles. In term of reptile families, the most dominant in PCFR are Colubridae, Geoemydidae and Scincidae with two species (22%) each. In contrast families of Agamidae, Elapidae and Gekkonidae were represented by a single species (11%) respectively.

Table 1. Checklist of mammals recorded during surveys at Padang Chong Forest Reserve, Perak.

No.	Family	Common Name	Scientific Name	IUCN	WCA 2010	P1	P2
1	Cercopithecidae	Long-Tailed Macaque	Macaca fascicularis	EN	P		x
		Dusky leaf monkey	Trachypithecus obscurus	EN	P		x
2	Cynocephalidae	Sunda Flying Lemur	Galeopterus variegatus	LC	TP		x
3	Felidae	Leopard Cat	Prionailurus bengalensis	LC	TP		x
4	Hylobatidae	Agile Gibbon	Hylobates agilis	EN	TP		x
		Siamang	Symphalangus syndactylus	EN	TP		x
5	Lorisidae	Greater Slow Loris	Nycticebus coucang	EN	TP		x
6	Mustelidae	Oriental Small Clawed Otter	Aonyx cinereus	VU	TP	X	
7	Suidae	Wild Pig	Sus scrofa	LC	P		x
Total	7						9

IUCN= International Union for Conservation of Nature; LC= Least Concern; VU= Vulnerable; EN= Endangered
WCA 2010= Wildlife Conservation Act 2010; P=Protected; TP; Totally Protected

Table 2. Checklist of avifauna recorded during surveys at Padang Chong Forest Reserve, Perak.

No.	Family	Common Name	Scientific Name	IUCN	WCA 2010	P1	P2
1	Accipitridae	Crested Serpent Eagle	<i>Spilornis cheela</i>	LC	TP		x
2	Alcedinidae	White-throated Kingfisher	<i>Halcyon smyrnensis</i>	LC	TP		x
3	Bucerotidae	Black Hornbill	<i>Anthracoceros malayanus</i>	VU	TP		x
4	Campephagidae	Bushy-crested Hornbill	<i>Anorrhinus galeritus</i>	NT	TP		x
5	Chloropseidae	Fiery Minivet	<i>Pericrocotus igneus</i>	NT	TP		x
		Greater Green Leafbird	<i>Chloropsis sonnerati</i>	EN	TP		x
6	Cisticolidae	Common Tailorbird	<i>Orthotomus sutorius</i>	LC	TP		x
		Dark-necked Tailorbird	<i>Orthotomus atrogularis</i>	LC	TP		x
		Yellow-bellied Prinia	<i>Prinia flaviventris</i>	LC	TP		x
		Spotted Dove	<i>Spilopeliachinensis</i>	LC			x
7	Columbidae	Emerald Dove	<i>Chalcophaps indica</i>	LC	P		x
		Zebra Dove	<i>Geopelia striata</i>	LC			x
8	Cuculidae	Green Imperial Pigeon	<i>Ducula aenea</i>	NT	TP		x
		Chestnut-bellied Malkoha	<i>Phaenicophaeus sumatranus</i>	NT	TP		x
9	Dicaeidae	Crimson-breasted Flowerpecker	<i>Prionochilus percussus</i>	LC	TP		x
		Orangebellied Flowerpecker	<i>Dicaeum trigonostigma</i>	LC	TP		x
10	Dicruridae	Bronzed Drongo	<i>Dicrurus aeneus</i>	LC	TP		x
		Greater Racquet-tailed Drongo	<i>Dicrurus paradiseus</i>	LC	TP		x
11	Estrildidae	Pink-tailed Parrotfinch	<i>Erythrura prasina</i>	LC			x
		Scaly-breasted Munia	<i>Lonchura punctulata</i>	LC	P		x
12	Eurylaimidae	Black-and-yellow Broadbill	<i>Eurylaimus ochromalus</i>	NT	TP		x
13	Irenidae	Asian Fairybluebird	<i>Irena puella</i>	LC	TP		x
14	Laniidae	Tiger Shrike	<i>Lanius tigrinus</i>	LC	TP		x
15	Megalaimidae	Brown Barbet	<i>Caloramphus fuliginosus</i>	LC	TP		x

		Goldthroated Barbet	Psilopogon franklinii	LC	TP	x
		Gold-whiskered Barbet	Psilopogon chrysopogon	LC	TP	x
16	Meropidae	Redbearded Beeeater	Nyctornis amictus	LC	TP	x
		Blue-throated Beeeater	Merops viridis	LC	TP	x
17	Motacillidae	Paddyfield Pipit	Anthus rufulus	LC	TP	x
		Yellow-rumped Flycatcher	Ficedula zanthopygia	LC	TP	x
18	Muscicapidae	Mugimaki Flycatcher	Ficedula mugimaki	LC	TP	x
19	Nectariniidae	Plain Sunbird	Antheptes simplex	LC	TP	x
		Red Junglefowl	Gallus gallus	LC	P	x
20	Phasianidae	Great Argus	Argusianus argus	VU	TP	x
		Crimson-winged Woodpecker	Picus puniceus	LC	TP	x
21	Picidae	Buff-necked Woodpecker	Meiglyptes tukki	NT	TP	x
		Great Slaty Woodpecker	Mulleripicus pulverulentus	VU	TP	x
		Grey-bellied Bulbul	Ixidia cyaniventris	NT	TP	x
		Stripthroated Bulbul	Pycnonotus finlaysoni	LC	TP	x
22	Pycnonotidae	Olive-winged Bulbul	Pycnonotus plumosus	LC	TP	x
		Buff-vented Bulbul	Iole olivacea	NT	TP	x
23	Timaliidae	Fluffy-backed TitBabbler	Macronus pilosus	NT	TP	x
Total						42

IUCN= International Union for Conservation of Nature; LC= Least Concern; NT= Near Threatened; VU= Vulnerable; EN= Endangered
WCA 2010= Wildlife Conservation Act 2010; P=Protected; TP; Totally Protected

Table 3. Checklist of herpetofauna recorded during surveys at Padang Chong Forest Reserve, Perak.

No.	Family	Common Name	Scientific Name	IUCN	WCA 2010	P1	P2
1	Bufo	Dwarf Toad	<i>Ingerophrynus parvus</i>	LC			x
2	Dicroglossidae	Asian Grass Frog	<i>Fejervarya limnocharis</i>	LC			x
3	Megophryidae	Spotted Litter Frog	<i>Leptobrachium hendrickson</i>	LC			x
4	Microhylidae	Dark-sided Chorus Frog	<i>Microhyla heymonsi</i>	LC			x
5	Rhacophoridae	Four-lined Tree Frog	<i>Polypedates leucomystax</i>	LC			x
6	Agamidae	Fringed Flying Dragon	<i>Draco fimbriatus</i>	LC			x
7	Colubridae	Asian Vine Snake	<i>Ahaetulla prasina</i>	LC	P		x
		Yellow-striped ratsnake	<i>Coelognathus flavolineatus</i>	LC			x
8	Elapidae	Blue coral snake	<i>Calliophis bivirgata</i>	LC		x	
9	Gekkonidae	Peter's bowfingered gecko	<i>Cyrtodactylus consobrinus</i>	LC	P	x	
		Asian leaf turtles	<i>Cyclemys dentata</i>	NT	P	x	
10	Geoemydidae	Malayan flatshelled turtle	<i>Notochelys platynota</i>	VU	P	x	
		East Indian brown mabuya	<i>Eutropismultifasciata</i>	LC			x
11	Scincidae	Banded Lipinia	<i>Lipinia vittigera</i>	LC			x
Total							14

IUCN= International Union for Conservation of Nature; NE= Not Evaluated; LC= Least Concern; NT= Near Threatened; VU= Vulnerable
WCA 2010= Wildlife Conservation Act 2010; P=Protected

According to distance category forest interior harbor the highest species richness of vertebrates with 59 species (91% of the total species recorded) are to forest edge that only consist of 7 species (1% of the total species recorded) (Figure 2). Nevertheless, there are vertebrate's species that are only sighted in forest edge but are not observed in forest interior throughout the surveys, such as mammal Oriental Small Clawed Otter (*Amonyx cinerea*), avifauna: Buffnecked Woodpecker (*Meiglyptes tukki*) and herpetofauna Blue coral snake (*Calliophis bivirgata*), Peters's bowfinngered gecko (*Cyrtodactylus consobrinus*), Asian leaf turtles (*Cyclemys dentata*) and Malayan flashelled turtle (*Notochelys platynota*). Furthermore, there are only single species that can be found on forest edge and forest interior) which are Red Junglefowl (*Gallus gallus*). This show that forest edge can be considered to be a distinct habitat which support a distinct community as it is inhabited by a characteristic set of species that differ from the forest interior [4]. In some cases, species richness and abundance increase in forest edge due to the increased food availability and the fact that forest edge is suitable for some species such as generalist species but unsuitable for others such as specialist species [14, 15]. Edge formation cause specialist species that have special habitat requirements to be pushed further into the interior habitat where the characteristics of forest remain unchanged and create the 'vacancies' on the forest edge [6]. Thus, this 'vacancies' or habitat availability may be filled or invaded by species that have a wider tolerance range and the edge may also introduce species that would not formally and normally be found in the interior habitat [4]. However, this can't be applied to all forest edge because forest edge with continued disturbances may not have such increasing in species richness and abundance [17]. In fact, will experience a decrease in richness and abundance of species.

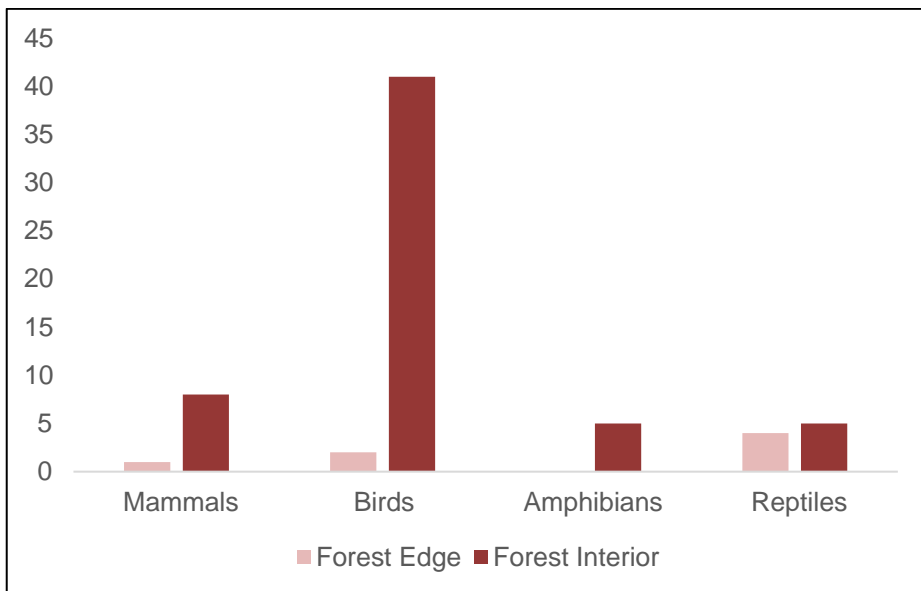


Figure 2. Number of vertebrate species in forest edge and forest interior

Low in vertebrate species richness in the forest edge compared to the forest interior from this study may be related to the continued disturbances toward the forest edge as it is next to the Gerik Pengkalan Hulu main road. This related to forest edge near the road often reduces sign, movements, and abundance of species due to the increased traffic movement, vehicular noise, vibrations and light pollution [18]. In fact, noise pollution was postulated as the

primary disturbance factors that possibly cause stress, hearing loss, and altered behavior, particularly during the breeding season when communication may be masked [10]. In addition, primates with large bodies and/or highly frugivorous show decrease in species richness toward the forest edge as compared to the forest interior. This likely due to the absence of the large and mature fruiting trees on which they rely at the forest edge. This also much are associated with lower tree density, less tree species, smaller tree diameter, less canopy closure and lack of emergent trees at forest edge versus to that of forest interior [15]. This study also shows that there are no amphibians sighted in forest edge during this surveys. This may due to the fact that amphibians require the cool moist conditions of forest floor microhabitats but increasing sunlight penetration on the forest floor in the forest edge may provide drier and warmer forest floor microhabitats that cause amphibians tend to avoid the forest edge [20, 21]. Beside, rich in reptile's species may due to their tolerance for higher temperatures and by behavioural means, most reptiles regulate their body temperature via basking under the sun and move into shades when their body temperature drops or ambient temperature starts increasing where they can tolerate [22]. Study also found that amphibians show stronger impact toward edge effect compare to reptiles edge effect decrease the abundance of amphibian's species higher than reptile's species [23].

4. Conclusion

In conclusion, the study herein is the first insight into the comprehensive checklist of vertebrate's species richness in PCFR. This study records a total of nine species of mammals, 42 species of avifauna and 14 herpetofauna species at PCFR, which 11 of these are classified as threatened species. This suggests that the PCFR is an essential habitat for various vertebrate's species, including the threatened and protected species. In addition, the findings also indicate that the forest interior are different markedly from the forest edge in terms of vertebrate's species richness and taxonomically, where suggested to be treated as distinct habitat which support a distinct set of species. Overall, the forest interior possesses higher species richness compare to the forest edges. PCFR will continue being fragmented, there will be an increase of forest edge related habitats and decrease of forest interior related habitat, which will cause structural and floristic composition changes due to increased edge effects and the forest will face a great threat of total extinctions especially the specialist vertebrate's species. Appropriate regulation and enforcement by relevant stakeholders at the federal and state level are needed to secure and maintain this forest reserve. These efforts are vital for protecting and ensuring the sustainability of the vertebrate population. The study recommends long-term research to include the abundance, diversity, and composition of vertebrate's species in the future. Also, long-term study on micro-environmental factors such as light availability, air and soil temperature, humidity, and nutrients along the edge-to-interior gradient in the forest in order to determine their influence on vertebrate's species richness, composition, and structure.

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