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RESEARCH ARTICLE

Assessment of non-volant small mammals at Lenggor Forest Reserve and Mersing Forest Reserve in Johor, Malaysia.

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ABSTRACT

Surveys of non-volant small mammals were conducted in two fragmented forest reserves within Johor, namely Mersing Forest Reserve (MFR) and Lenggor Forest Reserve (LFR), which are part of the J-PL1 ecological corridor under the Central Forest Spine (CFS) initiative. The surveys were conducted from June to October 2024 to document the diversity of non-volant small mammals at the MFR and LFR. In each forest reserve, six transect lines measuring 100m in length were established at distances of 300m, 500m, and 1000m from the forest edge. Ten collapsible cage traps were set along each transect line and operated for five consecutive nights per session. A total of four sampling sessions were conducted at each site. Apart from this, observation was made to document arboreal species. Overall, 15 species are recorded from both forest reserves. MFR recorded 15 species (six families), while LFR recorded 11 species (four families). Species diversity (Shannon-Wiener Index) is comparable between MFR (H' = 1.658) and LFR (H' = 1.635). Notably, two Vulnerable species, namely *Maxomys whiteheadi* and *Maxomys rajah*, were also documented at both forest reserves. These findings portray the ecological significance of LFR and MFR as vital habitats that support a diverse community of non-volant small mammals. Hence, maintaining and enhancing habitat connectivity within the J-PL1 corridor is crucial for preserving ecological integrity and ensuring the long-term survival of non-volant small mammal populations in this ecological corridor and its adjacent areas.

1.0 INTRODUCTION

Malaysia ranks among the world's top megadiverse countries, encompassing a wide range of habitats and ecosystems that support a rich assemblage of mammalian species (NRES, 2022). Mammals in the region are broadly classified into two groups: volant (flying) and non-volant (non-flying). In Peninsular Malaysia, a total of 223 mammal species has been documented, with small mammals comprising at least 60% of this diversity (Davison & Zubaid, 2007; Shahfiz et al.,2011; PERHILITAN, 2017). Non-volant small mammals are defined as mammals that are incapable of flight, typically with an adult body mass of less than 5 kg (Hayward & Phillipson,1979). This group includes various taxa such as rodents, shrews and treeshrews. Rodentia represents one of the most species-rich orders of non-volant small mammals, accounting for over 40% of mammalian species worldwide (Gorbunova et al., 2008; Delaney et al., 2018). In Malaysia, there are 86 species of rodents from four families (Hystricidae, Muridae, Sciuridae, and Spalacidae) that have been reported (Medway, 1983; Mohd Khan, 1992; Corbet & Hill, 1992; Wilson & Reeder, 2005; Payne & Francis, 2005; Davison & Zubaid, 2007; Francis, 2008; Francis, 2019). Among these, Muridae (rats and mice) were the most abundant group of non-volant small mammals. These rodents occupy a range of forest strata, foraging and resting in burrows on the ground, nesting in tree cavities at mid-levels, and inhabiting the upper canopy (Nadine et al., 2015).

Despite their smaller size, the non-volant small mammals fulfil critical ecological functions, serving as prey and predators, pathogen reservoirs, seed dispersers, biological indicators and pollinators, which contribute significantly to the structure, balance and resilience of forest ecosystems (Himsworth et al., 2013; Vasoo & Ratnamohan, 2015; Munian et al., 2020; Shahfiz et al., 2021).

Mersing Forest Reserve (MFR) and Lenggor Forest Reserve (LFR) are in the state of Johor, the southernmost state in Peninsular Malaysia. These forest reserves are predominantly composed of lowland dipterocarp forest. They are recognized as one of the biodiversity hotspots in Johor that support a wide range of flora and fauna, including endemic and threatened species, such as Asian elephant (*Elephas maximus*), Malayan Tiger (*Panthera tigris*), Malayan Tapir (*Tapirus indicus*) and Bearded Pig (*Sus barbatus*) (PLANMalaysia, 2022). Despite their ecological significance, both forest reserves are pressured by numerous land conversion activities, including agricultural expansion and infrastructure development, which contribute to habitat degradation and forest fragmentation. Such fragmentation disrupts habitat continuity, potentially altering species assemblages and leading to adverse outcomes such as habitat loss and population decline (Damian, 2012).

Henceforth, the Malaysian government introduced the Central Forest Spine (CFS) initiative, which aims to reconnect fragmented forest landscapes in Peninsular Malaysia by establishing ecological corridors. CFS identified 39 ecological corridors across eight states in Peninsular Malaysia, namely Johor, Selangor, Negeri Sembilan, Pahang, Kelantan, Terengganu, Perak, and Kedah. The ecological corridor network consists of 20 Primary Linkages (PLs) and 19 Secondary Linkages (SLs), each serving distinct ecological functions (PLANMalaysia, 2022). PL are continuous linear corridors that facilitate direct movement of wildlife between major habitat areas, functioning as natural highways that support long-distance dispersal and genetic exchange. On the other hand, SL operates as an intermediary connector, linking fragmented forest patches and providing temporary refuge or stopover points for species during their movement. These SLs are particularly critical for species with limited mobility or those sensitive to habitat discontinuity, as they enhance landscape permeability and promote ecological resilience across the broader habitat mosaics.

In Johor, three ecological corridors have been identified, one of which is known as J-PL1. This ecological corridor comprises four forest reserves: Mersing Forest Reserve (MFR), Lenggor Forest Reserve (LFR), Labis Forest Reserve (LBFR), and Sembrong Tambahan Forest Reserve (STFR) (PLANMalaysia, 2022). The corridor covers 14,336 hectares within the broader Endau-Rompin landscape. It plays a critical role in maintaining green connectivity between the Endau-Kota Tinggi Wildlife Reserve and Endau-Rompin National Park (PLANMalaysia, 2022).

MFR and LFR are separated by Federal Route 50, which connects Kluang and Mersing town, respectively. Due to the number of human-wildlife conflicts reported in these areas, a viaduct is proposed to be developed by 2027. Thus, these forest reserves were prioritized over LBFR and STFR.

Previously, the occurrence of small mammals in MFR was documented by Chan & Li (2016) and Mohd Hanif et al. (2008), while surveys in LFR were reported by Yong (2017). However, the available information still underrepresents the diversity of non-volant small mammals in these areas. Hence, this study was undertaken to document and update the diversity of non-volant small mammals inhabiting MFR and LFR before the development phase of the J-PL1 viaduct. The information will also be gathered to monitor the non-volant small mammal community in the areas. It is hoped that the information will contribute in supporting the ongoing development of the wildlife crossing at J-PL1 and to emphasize the importance of ecological connectivity for non-volant small mammal communities in this key ecological corridor.

2. MATERIALS AND METHODS

2.1. Study sites

Surveys were conducted at two forest reserves, namely Mersing Forest Reserve (MFR) and Lenggor Forest Reserve (LFR), which are separated by Federal Route 50 (Kluang–Mersing), a major federal road in Johor connecting the towns of Kluang and Mersing. In each forest reserve, 18 transect lines were established at three designated positions along the proposed J-PL1 wildlife viaduct: 0m (starting point), 500m (midpoint), and 1000m (end point). At each position, two transect lines, each measuring 100m in length, were laid out at distances of 300m, 500m, and 1000m from the main road (Figure 1). The transect lines established within the MFR were systematically labelled as (A1–A6), (B1–B6), and (C1–C6), representing three distinct sampling blocks. Similarly, the transect lines in the LFR were termed as (D–D6), (E1–E6) and

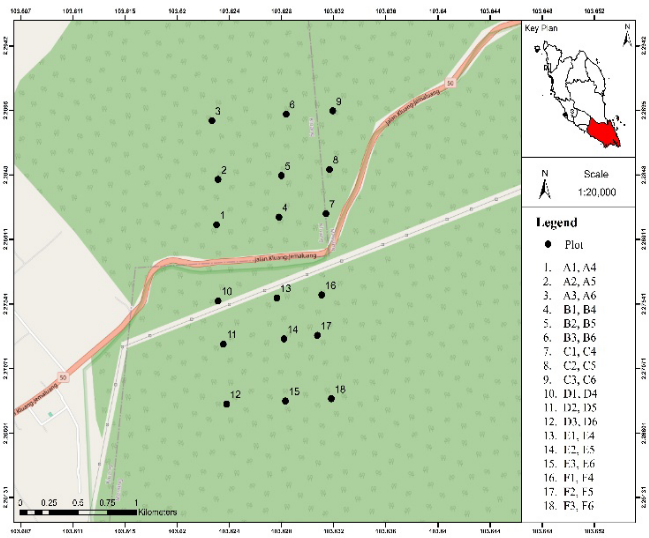

Figure 1: Location of the study sites at MFR and LFR, Johor

(F1–F6). Each set of transects was laid out to ensure comprehensive spatial coverage across the respective forest reserves. These designations facilitated consistent data collection and spatial referencing throughout the study. The location of each transect line is detailed in Table 1. Both study sites are situated at an average elevation of less than 100 meters above sea level and are predominantly characterized by lowland forest vegetation.

Table 1: Location of established transect lines at MFR and LFR, Johor

Transect lines	Coordinates		Elevation
	Latitude	Longitude	(m)
	MFR		
A1	N 02°16'52.2"	E 103°37'21.2"	36
A2	N 02°17'04.1"	E 103°37'21.6"	51
A3	N 02°17'19.5"	E 103°37'19.9"	53
A4	N 02°16'52.3"	E 103°37'20.8"	48
A5	N 02°17'40.3"	E 103°37'20.7"	56
A6	N 02°17'19.6"	E 103°37'19.7"	55
B1	N 02°16'54.2"	E 103°37'38.6"	51
B2	N 02°17'05.1"	E 103°37'39.3"	48
B3	N 02°17'21.2"	E 103°37'40.6"	55
B4	N 02°16'53.8"	E 103°37'38.2"	62
B5	N 02°17'50.3"	E 103°37'39.1"	52
B6	N 02°17'21.2"	E 103°37'40.3"	54
C1	N 02°16'55.1"	E 103°37'51.7"	50
C2	N 02°17'06.7"	E 103°37'52.7"	50
C3	N 02°17'22.1"	E 103°37'53.6"	42
C4	N 02°16'54.8"	E 103°37'51.0"	59
C5	N 02°17'60.4"	E 103°37'52.0"	56
C6	N 02°17'22.2"	E 103°37'53.0"	46
	LFR		
D1	N 02°16'32.2"	E 103°37'21.6"	60
D2	N 02°16'20.9"	E 103°37'23.1"	49
D3	N 02°16'05.2"	E 103°37'24.0"	53
D4	N 02°16'32.0"	E 103°37'21.3"	65
D5	N 02°16'21.2"	E 103°37'23.0"	64
D6	N 02°16'50.0"	E 103°37'23.6"	62
E1	N 02°16'33.0"	E 103°37'38.0"	42
E2	N 02°16'22.3"	E 103°37'40.0"	63
E3	N 02°16'06.0"	E 103°37'40.4"	67
E4	N 02°16'33.0"	E 103°37'38.0"	47
E5	N 02°16'22.4"	E 103°37'39.6"	63
E6	N 02°16'50.9"	E 103°37'40.0"	64
F1	N 02°16'33.8"	E 103°37'50.5"	32
F2	N 02°16'23.2"	E 103°37'49.3"	54
F3	N 02°16'06.6"	E 103°37'53.2"	77
F4	N 02°16'33.7"	E 103°37'50.5"	42
F5	N 02°16'23.0"	E 103°37'49.0"	60
F6	N 02°16'60.5"	E 103°37'53.0"	69

2.2. Non-volant small mammals trapping

Four survey sessions were conducted in June, July, August, and October 2024. For MFR, surveys took place on (i) 23–28 June, (ii) 14–19 July 2024, (iii) 14–19 August 2024, and (iv) 14–19 October 2024. In the meantime, surveys at LFR took place on (i) 22–27 June 2024, (ii)15–19 July 2024, (iii) 13–18 August 2024, and (iv) 13–18 October 2024. The sampling of non-volant small mammals at both sites was conducted using a standardized protocol, employing identical trap types and quantities. Consistency was maintained in bait selection and the duration of sampling across all sites.

The non-volant small mammals were captured using collapsible cage traps with dimensions of 42 cm × 16 cm × 16 cm. A total of ten (10) collapsible cage traps were placed along each transect line at 10m intervals. Oil palm (*Elaeis guineensis*) fruit was selected as the bait throughout the sampling period. This fruit was selected due to its high durability under variable weather conditions and its cost-effectiveness compared to alternative baits such as banana, coconut, jackfruit and salted fish. The baits were replaced with fresh palm oil fruits whenever signs of spoilage or insect damage, particularly from ant infestations, were observed. At the end of each sampling session, all bait materials were collected and removed from the field. Any uneaten oil palm fruit was collected and transported back from the survey sites for proper disposal, preventing environmental contamination and minimizing interference with local wildlife.

The traps remained active for five consecutive nights during each session, and inspections were carried out three times daily at approximately 0730 hours, 1130 hours, and 1800 hours. Inspection timing enables differentiation between diurnal and nocturnal species based on the time when they are captured. The cumulative trapping effort amounted to 3,600 trap-nights. Apart from trapping, observation mainly for arboreal species was also performed whenever possible. The observation was aided with Nikon binoculars (10X42) and a Canon Powershot camera.

All captured individuals were carefully secured in cloth bags for examination. Standard morphological measurements, including total length (TL), head-body length (HB), hindfoot length (HF), ear length (E), and body weight (wt), were recorded for species identification. Additionally, the sex and reproductive condition (e.g., pregnant or lactating) of each individual were taken. Most captured individuals were marked using uniquely numbered metal tags and subsequently released at the point of capture following examination. Species identification was based on references such as Francis (2019) and Payne et al. (2005). Representative individuals of each species were photographed, and muscle tissue samples (from a maximum of three individuals per species) were collected and preserved in acetone. Specimens were then transferred to 70% denatured ethanol for storage. Voucher specimens were deposited in the FRIM Zoological Collection at the Forest Research Institute Malaysia (FRIM) for future reference.

2.3. Data analysis

Species diversity metrics, including the Shannon-Wiener Index (H'), Evenness (SI), Dominance (D), Chao-1 and t-test analysis, as well as the Venn Diagram, were computed using Paleontological Statistics (PAST) software (Hammer et al., 2001). To assess the completeness of species inventories for non-volant small mammal communities at the two study locations, species accumulation curves were generated using iNEXT Online (Hsieh et al., 2016).

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3. RESULT AND DISCUSSION

Overall, a total of 342 individuals representing 15 species of non-volant small mammals were recorded from both MFR and LFR, encompassing six families, namely Erinaceidae, Muridae, Ptilocercidae, Sciuridae, Tragulidae, and Tupaiidae. The complete list of non-volant small mammal species recorded at both MFR and LFR is presented in Table 2.

Table 2: List of non-volant small mammals recorded at LFR and MFR during current study

No.	Family	Common Name	Scientific Name	IUCN	LFR	MFR
1	Erinaceidae	Moonrat	*Echinosorex gymnura*	LC		2
2	Muridae	Long-Tailed Giant Rat	*Leopoldamys sabanus*	LC	15	26
3	Muridae	Brown Spiny Rat	*Maxomys rajah*	VU	39	68
4	Muridae	Red Spiny Rat	*Maxomys surifer*	LC		1
5	Muridae	Whitehead's Rat	*Maxomys whiteheadi*	VU	2	2
6	Muridae	Malaysian Field Rat	*Rattus tiomanicus*	LC	2	2
7	Ptilocercidae	Pentail Treeshrew	*Ptilocercus lowii*	LC	1	2
8	Sciuridae	Plantain Squirrel	*Callosciurus notatus*	LC	1	3
9	Sciuridae	Three-Striped Ground Squirrel	*Lariscus insignis*	LC	10	17
10	Sciuridae	Red Giant Flying Squirrel	*Petaurista petaurista*	LC		1*
11	Sciuridae	Horse-Tailed Squirrel	*Sundasciurus hippurus*	NT	1	1
12	Sciuridae	Low's Squirrel	*Sundasciurus lowii*	LC	1	2
13	Sciuridae	Slender Squirrel	*Sundasciurus tenuis*	LC	3	5
14	Tragulidae	Lesser Oriental Chevrotain	*Tragulus kanchil*	LC		1*
15	Tupaiidae	Common Treeshrew	*Tupaia glis*	LC	44	90
			No. of individuals		119	223
			No. of families		4	6
			No. of species		11	15

IUCN: International Union for Conservation of Nature; LC = Least Concern; NT= Near Threatened; VU = Vulnerable; (*) = Observed

The species diversity between MFR and LFR appeared to be comparable, as indicated by the Shannon-Wiener Index, with MFR (H' = 1.658) and LFR (H' = 1.635) (Table 3). This similarity is statistically supported by the t-test analysis, which yielded a p-value of 0.781. The high p-value indicates that both areas may sustain similar levels of community structure, with no significant differences in species diversity.

Throughout the surveys, MFR recorded a slightly higher species richness, with 15 species and a total of 223 individuals across all six families, compared to LFR, which had 11 species, covering 119 individuals from four families. Furthermore, the Chao-1 estimator generates estimated species richness values of 16.00 for LFR and 12.98 for MFR (Table 3). The small gap between the estimated values and the yielded values may indicate that the surveys for both sites have reached a high level of sampling completeness, with a greater proportion of species successfully detected. Additionally, the Venn diagram illustrates the observed species richness at both MFR and LFR. The overlapping region represents the shared species between the two sites (Figure 2). The number of species shared between MFR and LFR is 11 species; however, the species that were only recorded in MFR are four species, namely *Echinosorex gymnura*, *Maxomys surifer*, *Petaurista petaurista*, and *Tragulus kanchil*.

Table 3: Species abundance, richness and diversity values estimated for MFR and LFR

Sites	No. of species	Individuals	Shannon_H	iChao-1
LFR	11	119	1.635	12.98
MFR	15	223	1.658	16.00

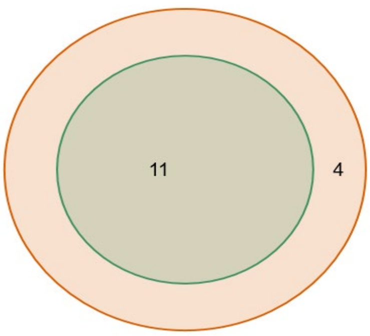

Figure 2: A Venn diagram illustrates the observed species richness at both MFR and LFR. Green circle (LFR) and orange circle (MFR)

Despite similar trapping effort and ecosystem type, MFR exhibited higher observed richness, potentially due to microhabitat variation or species-specific responses to trap placement. During the surveys, the team observed that the areas in which the traps were deployed at MFR have a low canopy openness and higher debris on the forest floor compared to LFR. These conditions likely influenced the number of non-volant small mammal species captured, as they may offer better structural complexity and create favourable microhabitats and microclimatic conditions that support diverse species requirements, including both generalist and specialist species (Hayward & Phillipson, 1979;

Carey & Johnson, 1995). For instance, *Echinosorex gymnura* was recorded in MFR but absent in LFR during the survey period. According to Brozovic et al. (2018), the occurrence of moonrats is positively associated with canopy closure and forest quality. They found that moonrats were sensitive to habitat disturbances such as forest openings resulting from logging activities and required a well-preserved forest environment. In this context, good quality forests are characterized by forests with high canopy closure and are associated with the incidence of forest-dependent mammals (Brozovic et al., 2018; Damian, 2012; Di Bitettii et al., 2008; Faradiana et al., 2021). Moreover, the availability of ground-level microhabitats, such as the hollows of fallen logs and under burrows, may influence its presence, as these conditions are essential for this nocturnal mammal to roost during the day (Francis, 2019). Forests with well-developed canopy structures and dense vegetation also support higher biomass and invertebrate diversity (Ewers et al, 2015). Therefore, the availability of invertebrates as the primary food source for the moonrat also reflects its presence. The good forest conditions also may positively influence the records of *Petaurista petaurista* and *Tragulus kanchil*, another forest-dependent species that was successfully spotted through opportunistic observation at MFR. As for LFR, approximately 200m from the existing road toward LFR, there are strips, estimated to be 30m in width, which create gaps characterized by a low density of forest stands and are densely covered with overgrown shrubs. These conditions may impede the movement of small mammals and reduce the chance of capturing the species that inhabits the area.

Species, *Tupaia glis* is the most abundant at both MFR and LFR, with 90 and 44 individuals, respectively. This was followed by *Maxomys rajah* with 68 individuals recorded at MFR and 39 individuals captured at LFR. *T. glis* is a treeshrew under the Family Tupaiidae. This scansorial species is native and possesses high adaptability, enabling it to thrive in diverse environments, including secondary forests, orchards, plantations, and urban areas (Francis, 2019). The presence of *T. glis* in both MFR and LFR may be attributed to the availability of forested areas with a mixed understory and fruiting tree species. This condition could support their relative abundance by providing a diverse array of food resources, such as fruits and insects, that are suitable for this omnivorous mammal. The lack of diurnal predators may also serve as another potential factor contributing to their high abundance. Furthermore, the bait selected in this study may also be correlated to the number of individuals captured. Roslan et al. (2025) stated that oil palm fruit was the preferred bait among non-volant small mammals, including *T. glis*, when compared to other bait types used, such as banana, sweet potato, and salted fish. The frequent consumption of oil palm fruit by T. glis may suggest a dietary adaptation to this resource, likely to be influenced by its availability in the surrounding environment. Notably, the stretch spanning from Jemaluang to Endau-Rompin, which encompasses both MFR and LFR, possesses an extensive oil palm plantation. Hence, the proximity of both LFR and MFR to the oil palm plantations may have been associated with these results, as Roslan et al. (2025) mentioned that animals typically select food based on accessibility, maintaining consistent dietary patterns unless ecological pressures or physiological changes necessitate adaptation.

Meanwhile, *M. rajah*, a rodent belonging to the family Muridae, is widely distributed throughout the Sunda region of Southeast Asia (Francis, 2019). The higher abundance of the species in MFR is likely attributed to favourable habitat conditions, as it prefers forested environments with a dense understory and abundant leaf litter. These features provide both adequate cover from predators and rich foraging opportunities. As an omnivore, the species typically searches among the leaf litter for fallen fruits, insects, and young shoots, particularly in mature lowland forests (Shadbolt, A. B., & Ragai, R., 2010; Wells et al., 2006; Payne et al., 2005).

In terms of the trapping efforts, a total of 3,600 trap-nights were conducted during this study, yielding an overall success rate of 9.75%, indicating that approximately 10 individuals were captured per 100 trap-nights. This value is higher compared to other studies at other lowland forests, such as at Perlis State Park with 1.78% (Fauzi et al., 2021) and Angsi and Berembun Forest Reserves with 1.6% (Faradiana et al., 2022). One of the potential aspects of our high records is likely due to the higher sampling efforts compared to those of Fauzi et al. (2021) and Faradiana et al. (2022), with 450-trap nights and 3,000-trap nights, respectively.

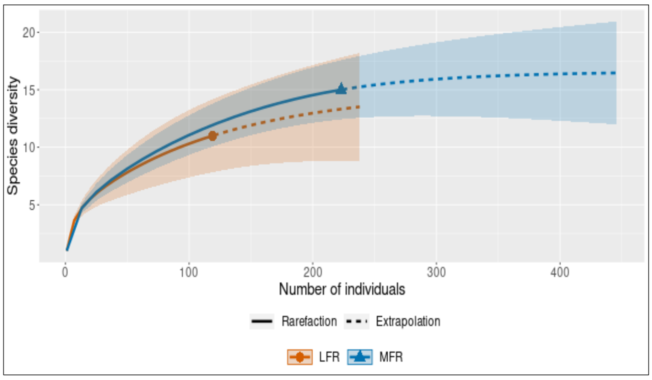

Figure 3: The rarefaction and extrapolation curves of species richness for both MFR and LFR based on the number of individuals captured.

The rarefaction curves for both LFR and MFR approach an asymptote (Figure 3). However, the extrapolated data suggests that additional species may still be discovered. This can be achieved by incorporating multiple sampling methods, such as covering different sites in diverse forest settings (e.g., waterways, various forest strata, including mid-canopy and upper canopy) and applying multiple sampling techniques (e.g., Sherman traps, different baits). Currently, in this study, all collapsible cage traps were deployed at ground level. Consequently, the sampling was primarily effective for ground-dwelling species and may not fully capture the overall species diversity, particularly arboreal species such as flying squirrels.

Furthermore, this study utilized only a single bait type (oil palm fruit). According to Mohd-Taib and Ishak (2021) and Roslan et al. (2025), different small mammal communities exhibit considerably different bait preferences, which are influenced by species-specific dietary habits and habitat characteristics. Therefore, there is a possibility that particular small mammal species may not be attracted or accustomed to the bait used in this study, particularly those species whose primary diet consists of animal-based sources such as wild cats and civets.

Additionally, our study successfully documented a significant number of new distributional records for non-volant small mammals in both forest reserves, thereby adding to the species lists provided in previous studies by Chan & Li (2016), Mohd Hanif et al. (2008), and Yong (2017) (Table 4). MFR contributed 12 additional species records, whereas LFR documented a total of 11 additional species records. Among these, two species, namely M. rajah and M. whiteheadi, which are classified as Vulnerable on the IUCN Red List of Threatened Species, were recorded. This result further emphasizes the importance of these forest reserves as key areas for the in-situ conservation of these non-volant small mammal populations.

Table 4: Compilation of non-volant small mammals recorded at MFR and LFR from current and previous literature.

.No.	Family	Common Name	Scientific Name	IUCN	MFR		LFR		
					1	2	3	4	5
1	Erinaceidae	Moonrat	*Echinosorex gymnura*	LC		/+			
2	Felidae	Leopard Cat	*Prionailurus bengalensis*	LC			/		
3	Lorisidae	Greater Slow Loris	*Nycticebus coucang*	EN			/		
4	Muridae	Long-Tailed Giant Rat	*Leopoldamys sabanus*	LC		/+			/+
5	Muridae	Brown Spiny Rat	*Maxomys rajah*	VU	/	/			/+
6	Muridae	Red Spiny Rat	*Maxomys surifer*	LC		/+			
7	Muridae	Whitehead's Rat	*Maxomys whiteheadi*	VU		/+			/+
8	Muridae	Malaysian Field Rat	*Rattus tiomanicus*	LC		/+			/+
9	Ptilocercidae	Pentail Treeshrew	*Ptilocercus lowii*	LC		/+			/+
10	Sciuridae	Plantain Squirrel	*Callosciurus notatus*	LC		/+			/+
11	Sciuridae	Three-Striped Ground Squirrel	*Lariscus insignis*	LC	/	/			/+
12	Sciuridae	Red Giant Flying Squirrel	*Petaurista petaurista*	LC		/+,*			
13	Sciuridae	Horse-Tailed Squirrel	*Sundasciurus hippurus*	NT		/+			/+
14	Sciuridae	Low's Squirrel	*Sundasciurus lowii*	LC		/+			/+
15	Sciuridae	Slender Squirrel	*Sundasciurus tenuis*	LC		/+			/+
18	Tragulidae	Lesser Oriental Chevrotain	*Tragulus kanchil*	LC		/+,*			
19	Tupaiidae	Common Treeshrew	*Tupaia glis*	LC	/	/			/+
20	Viverridae	Otter-Civet	*Cynogale bennettii*	EN				/	
		No. of families			2	6	2	1	4
		No. of species			3	15	2	1	11

IUCN: International Union for Conservation of Nature; LC=Least Concern; NT=Near Threatened; VU=Vulnerable; (+) = Additional record; (*) = Observed species;1 = Mohd Hanif et al., (2008); 2 = Present study (2025); 3 = Chan & Li (2016); 4 = Yong (2017).; 5 = Present study (2025)

4. CONCLUSION

Despite their fragmented habitats, both MFR and LFR still hold diverse arrays of non-volant small mammal species. This highlights the ecological importance of both forest reserves as essential habitats to sustain their populations. However, further research is still needed to comprehensively document the diversity of these mammals within the forest reserves. Hence, we recommend implementing continuous monitoring throughout all phases of viaduct development—before, during, and following construction. Such longitudinal data collection will address a significant gap in ecological understanding for these areas. Moreover, the application of multiple sampling methods (e.g., covering different forest settings, various bait types, and different trap types) was also suggested to gain a better representation of non-volant small mammal species in these areas. The findings could provide valuable justification for the construction of the viaduct and may offer critical insights into its design and structural specifications to ensure ecological functionality. Integrating infrastructure development with species-specific biological requirements could position the viaduct as an effective tool in conserving the diversity of non-volant small mammals along this vital ecological corridor.

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