Journal of Sustainability Science and Management Special Issue Number 1:
The International Seminar on the Straits of Malacca and the South China Sea 2016: 19-25
ISSN: 1823-8556

BRIEF SURVEY OF NON-VOLANT SMALL MAMMALS ON PULAU PERHENTIAN BESAR, TERENGGANU, MALAYSIA

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Abstract: A brief survey of non-volant small mammals was conducted in Pulau Perhentian Besar, Terengganu, Malaysia from 13th to 19th of September 2015. Pulau Perhentian Besar is well-known as ecotourism island, located on the northeast coast off Kuala Besut, Terengganu and nowadays is known as the Pulau Perhentian Marine Park after been gazette as Fisheries Protected Areas. Non-volant small mammals were captured using cage traps baited with banana and pit fall traps at Teluk Keke area along a 1 km trail. Direct observations were conducted through Visual Encounter Survey (VES) along existing trails as transects. This study had documented 11 species of non-volant small mammals from four orders. *Tupaia glis* (42.4% of total individuals) were recorded as the most captured species followed by *Rattus rattus* (25.4% of total individuals). During VES, *Callosciurus notatus*, *Galeopterus variegatus* were among the most frequently observed species during the daytime and nighttime respectively. Since the last report published, *Trachypithecus obscurus* was only species of big mammal frequently recorded during the survey. This survey also had updated our knowledge of species diversity by an additional of five species, namely, *Crocidura malayana*, *Rattus rattus*, *Sundamys muelleri*, *R. tiomanicus* and *Maxomys whiteheadi*. More field studies are needed to account for trap-shy species, as there is still a lot of forest cover left untouched on the island.

Keywords: Brief survey, species diversity, non-volant small mammals, Pulau Perhentian Besar, South China Sea.

Introduction

Pulau Perhentian contained two islands called Perhentian Kecil and Perhentian Besar. The islands are located about 21 km off the Kuala Besut jetty. It is among one of the islands in Terengganu that is being frequented by tourist as vacation spot for leisure, sight-seeing, diving, snorkeling and jungle trekking. Pulau Perhentian Kecil is inhabited by more than 2,000 local people in a small township and a small village called Kampung Pasir Hantu. Both Pulau Perhentian Kecil and Besar are separated by a very narrow channel with strong water current (Anon, 2015). Pulau Perhentian Besar was enacted as the Marine Protected Area system and had been gazetted as Fisheries Protected Areas under Fisheries Act of 1985.

In Malaysia, few reports were published for small mammals on island and there is no recent study to update on the species diversity. Lim *et al.* (1999) reported on 41 confirmed species observed on terrestrial mammals of Pulau Tioman based on the catalogue of museum specimens and both published and unpublished information gather from different survey in the island. Meanwhile, in Pulau Langkawi Medway (1986) recorded 16 species and were updated with an additional of three Muridae species by Shukor *et al.* (2007). At Lubuk Sembilang of Pulau Langkawi, Lit *et al.* (2012) observed six species of terrestrial small mammals. Pulau Redang also has poor documented species of non-volant small mammals since Saifullah *et al*. (2001) just stated 29 species of marine mammals.

Pulau Perhentian has fairly good published reports on the survey of flora and fauna. Turner *et al.* (2003) stated five species of mammals and later Tamblyn *et al.* (2005) updated the species list to a total of seven species of non-volant small mammals.

Apparently, there is still lack of information on non-volant small mammals species occurrences at Pulau Perhentian Besar as the large parts of the island is unexplored. This survey was aimed to determine the species diversity of non-volant small mammals on Pulau Perhentian Besar, covering the area within Teluk Keke. Besides that, the data collected are important in comparing and updating the mammalian species list.

Study Area

The survey was conducted at Teluk Keke (N 05°53.291' E 102°44.474') along the 1 km trail from 13th to 19th of September 2015. The study area consisted of old secondary forest dominated by Dipterocarpaceae family. The forest type in Pulau Perhentian Besar included old secondary forest that covered from coastal until the sandy rocky area. The vegetation was dominated by Dipterocarpaceae family and followed by Myrtaceae family. Trees species such as *Vatica cinerea* was the most abundant at the trail which was at slightly slope and rocky area, while *Cratoxylum formosum*, *Chaetocarpus castanocarpus* and *Syzygium* species were among the most observed species at the base of the front hills which was 100 metres from the coastal area. Some climbers, palms, small trees and shrubs were also present on the forest floor. During this survey, the phenology of the forest observed were undergoing flowering while some trees were fruiting. These trees are essential to others vertebrate and invertebrate as their food sources. The topography of the forested area contained many ridges with the highest peak reaching 321 metres above sea level (Turner *et al*., 2003).

Figure 1: Sampling site of Teluk Keke, Pulau Perhentian Besar, Terengganu (Source: Google maps)

Field Method

In this survey, both trapping and Visual Encounter Survey (VES) methods were used. A total of 100 standard cage traps and 30 pitfall traps were employed. Cage traps were set up along the trail and positioned from the forest floor up to 15 metres of height from the ground along the trails with approximately five meters interval from each traps. Cage traps were baited with banana slices and dipped with vanilla essence. Pitfall traps with drift fence were set up near selected trail entrance. Both traps were left for six consecutive nights and all the traps were checked twice daily, at 0800 h and 1700 h. VES were also conducted for both diurnal and nocturnal non-volant small mammals that were present along the 1 km trail for six sampling days and nights.

The samples caught were identified following Francis (2001), Payne *et al.* (2005), Francis (2008), Mohd Khan (2012) and Phillipps and Phillipps (2016). Museum samples of each one representatives species were collected and euthanized using chloroform and preserved in 70% ethanol (Tingga *et al.,* 2012) while the released ones were marked with nail polish to avoid recapture. The voucher specimens were labeled with field number, name of species, sex and locality and stored in the Centre for Kenyir Ecosystems Research museum.

Results and Discussion

A total of 59 individuals comprising of 11 species from five families were recorded, namely, Tupaiidae, Cynocephalidae, Sciuridae, Muridae and Soricidae (Table 1). The most abundant species were recorded from the Family Tupaiidae, *Tupaia glis* (Common treeshrew) while three singleton species were represented by the Family Muridae including *Maxomys Surifer* (Red Spiny Maxomys), *M. whiteheadi* (Whitehead's maxomys) and *Sundamys muelleri* (Muller's rat). Interestingly, the only species of big mammals that has been observed in Pulau Perhentian Besar is *Trachypithecus obscurus* (Dusky leaf monkey).

T. glis can easily be observed frequently, foraging on the ground near by the beach and coastal areas as well as *Callosciurus notatus* (Plantain squirrel) during the daytime. They can also be seen moving closely to human (eco-tourist) without fear and was not disturbed by the presence of tourists walking around the beaches and trails. Both species are listed as Least Concern in the IUCN Red List as they can tolerate to disturbed habitats and exhibit high adaptability to its surrounding.

Meanwhile, *Galeopterus variegatus* (Sunda colugo) was among the captivating small mammals spotted at dusk and during night walk where it could easily be observed gliding from one tree to another, usually in a pairs at jungle trail nearer Teluk Keke. It is nocturnal arboreal mammal and is active between 1830 h until 2130 h along the trail. The colugos appeared not to be disturbed by the beam of torchlight as they were ignoring the light and continue to gliding and foraging. The sight and sound of Muridae and Soricidae family can also be observed and heard foraging and walking on the forest floor throughout the jungle trekking area. They started to be active around 1830 h even though the sky was still bright.

The only wild shrew found on the island is *Crocidura malayana* (malayan shrew) and is categorised as Least Concern because it is comparatively wide in distribution, consider to have large population and because it is unlikely to be downgrade fast enough to qualify for listing in a more threatened category (Lunde, 2008). Corbet and Hill (1992) also stated that this species is endermic in Peninsular Malaysia and Southern Thailand. During night walk, the sound of shrew can be heard especially near the pit fall trap's area.

Among all the species captured, there were two species listed as Vulnerable which were *M. rajah* and *M. whiteheadi*. These two species were captured at the forest floor that was covered with leaf litter and on a dead tree log respectively. Both species are in declining population, resulted mostly from degradation and habitat loss of its lowland forest (Aplin

et al., 2008a; Aplin *et al*., 2008b). Appendix 1 shows some of the trapping that were employed and species captured and observed.

In the previous survey, Turner *et al*. (2003) discovered only five species while Tamblyn *et al*. (2005) reported total of seven species, which gives an additional two species. Subsequently, in this survey provides five more additional species, which makes up the total of 12 species of non-volant small mammals present for all studies conducted on Pulau Perhentian Besar. Table 2 shows the species checklist of non-volant small mammals and comparison between previous and current studies, as well as comparison with species present on another island because Pulau Tioman is larger in size and it provides more niches for higher species richness compared to Pulau Perhentian Besar.

Conclusion

This survey provides an updated checklist on species occurrence in Pulau Perhentian Besar since last reported field work with an additional of five species, namely *C. malayana, R. rattus, R. tiomarisu, S. muellori and M. whiteheadi.* Continuation of this survey should be conducted with longer time and sampling effort to identify more of the non-volant species diversity in Pulau Perhentian Besar. Field survey in Pulau Perhentian Kecil should also be carried out in the future in order to assess the full diversity of non-volant small mammals inhabiting these two islands.

Table 1: Taxonomic composition, habitat, and IUCN status of non-volant small mammals (Figures 2 to 7) captured and spotted through six consecutive nights in Pulau Perhentian Besar, Terengganu.

No	Order	Family	Species	English name	Microhabitat	Methods	n	IUCN Status
1	Eulipotyphla	Socricidae	*Crocidura malayana*	Malayan shrew	Forest floor covered with leaf litter	Pit fall trap	4	LC
2	Scandentia	Tupaiidae	*Tupaia glis*	Common treeshrew	Forest floor ranging from coastal to rocky hill area	Cage trap	25	LC
3	Dermoptera	Cynocephalidae	*Galeopterus variegatus*	Sunda colugo	On trees up to canopy range from 10-20 metres	VES		LC
4	Rodentia	Sciuridae	*Callosciurus notatus*	Plaintain squirrel	Forest floor ranging from coastal to rocky hill area and up to canopy of 15 metres	Cage trap	3	LC
5		Muridae	*Rattus rattus*	House rat	Forest floor covered with leaf litter	Cage trap	15	LC
6			*Rattus tiomanicus*	Malaysian wood rat	Forest floor covered with leaf litter	Cage trap	3	LC
7			*Rattus argentiventer*	Ricefield Rat	Forest floor covered with leaf litter	Cage trap	4	LC
8			*Maxomys rajah*	Rajah spiny rat	Forest floor covered with leaf litter	Cage trap	2	VU
9			*Maxomys whiteheadi*	Whitehead's spiny rat	On a tree log	Cage trap	1	VU
10			*Maxomys surifer*	Red Spiny Maxomys	Large boulder with leaf litter coverage	Cage trap	1	LC
11			*Sundamys muelleri*	Müller's rat	Large boulder with leaf litter coverage	Cage trap	1	LC
						Total individuals	**59**	

IUCN classification: Least concern (LC)
Vulnerable (VU)

Table 2: Mammals species between Pulau Perhentian and Pulau Tioman

No	Order	Family	Species	Pulau Perhentian			Pulau Tioman
				Turner *et al*. (2003)	Tamblyn *et al*. (2005)	This study (2015)	Lim *et al*. (1999)
1	Eulipotyphla	Erinaceidae	*Hylomys suillus*	X	X	X	√
2		Socricidae	*Crocidura fuliginosa*	X	Needs conformation	X	X
3			*Crocidura malayana*	X	X	√	X
4			*Crocidura negligens*	X	X	X	√
5	Scandentia	Tupaiidae	*Tupaia glis*	√	√	√	√
6	Dermoptera	Cynocephalidae	*Galeopterus variegatus*	√	√	√	√
7	Primates	Lorisidae	*Nycticebus coucang*	X	X	X	√
8	Carnivora	Viverridae	*Paradoxurus hermaphrodites*	X	Needs conformation	X	√
9	Artiodactyla	Tragulidae	*Tragulus napu*	X	X	X	√
10	Rodentia	Sciuridae	*Ratufa bicolor*	X	X	X	√
11			*Callosciurus notatus*	√	√	√	√
12			*Callosciurus nigrovittatus*	X	X	X	√
13			*Sundasciurus tenuis*	X	X	X	√
14			*Lariscus insignis*	X	X	X	√
15			*Rhinosciurus laticaudatus*	X	X	X	√
16			*Petaurista petaurista*	X	X	X	√
17			*Iomys horsfieldii*	X	X	X	√
18		Muridae	*Rattus rattus*	X	X	√	X
19			*Rattus tanezumi*	√	√	**X**	X
20			*Rattus tiomanicus*	X	X	√	√
21			*Rattus argentiventer*	X	√	√	X
22			*Rattus exulans*	X	X	X	√
23			*Sundamys muelleri*	X	X	√	X
24			*Niviventer cremoriventer*	X	X	X	√
25			*Leopoldamys sabanus*	X	X	X	√
26			*Maxomys rajah*	X	√	√	X
27			*Maxomys surifer*	√	√	**X**	√
28			*Maxomys whiteheadi*	X	X	√	X
29		Hystricidae	*Atherurus macrourus*	X	X	X	√
			Number of species	5	7	11	21
			Total number of species		12		21

√ = present
X = absent

Acknowledgements

We would like to thank Universiti Malaysia Terengganu, Kenyir Research Institute and local authorities for granted the permission to conduct the survey in Pulau Perhentian Besar, Terengganu. Research permit were granted by the Department of Wildlife and National Parks (DWNP). The funding supports are by Geopark Grant (GEOPARK/2015/53167), TRGS (Trans Disciplinary Research Grant Scheme) (TRGS/2014/59373) and GGP (*Geran Galakan Penyelidikan*) (GGP/68007/2014/127).

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APPENDIX 1

Figure 2: Cage trap setup at forest floor

Figure 3: Pit fall trap setup at forest floor

Figure 4: *Rattus rattus*

Figure 5: *Crocidura malayana*

Figure 6: *Maxomys surifer*

Figure 7: *Galeopterus variegatus*