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A PRELIMINARY OBSERVATION OF MAMMALS AND OTHER SPECIES VISITING ARTIFICIAL SALT LICKS IN PENINSULAR MALAYSIA

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ABSTRACT

One of the main activities under the Habitat Enrichment Programme carried out by the Department of Wildlife and National Parks is the development of artificial salt licks in protected areas. Salt lick plays an important role in the health of wildlife by supplying the essential minerals required especially for herbivores. In 2011, a total of nine artificial salt licks were developed in Taman Negara Pahang Sungai Relau, Sungkai Wildlife Reserve and Krau Wildlife Reserve. In 2012, another 21 artificial salt licks were developed in Krau Wildlife Reserve (3), Sungkai Wildlife Reserve (3), Taman Negara Kelantan Kuala Koh (3), Taman Negara Pahang Kuala Tahan (3), Sungai Dusun Wildlife Reserve (3), Tasek Bera (3) and Sungai Ketiar (3). Preliminary wildlife observation data revealed that 25 wildlife species were recorded visiting these artificial salt licks. Four species of mammals recorded the highest visitation frequency at these salt licks; wild boar (30.6% of the total records), Sambar deer (15.4%), followed by the barking deer (13.4%) and the Malayan tapir (8.3%). Overall, 80% of the wildlife recorded at these salt licks were mammals, 16% were avian and 4% were reptiles.

Keywords: habitat, habitat enrichment, artificial salt licks, natural salt licks, minerals

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INTRODUCTION

The definition of 'salt licks' refers to any mineral spring or ground containing salt or any other mineral of which the consumption is condusive to the health or well being of wildlife (Wildlife Conservation Act, 2010). Such salt licks can be natural or artificial and there are two types of natural salt licks found in Peninsular Malaysia; the spring salt licks and dry land salt licks (Chong *et al*., 2005) with the local names varying according to location. In agriculture, farmers used artificial salt licks in form of blocks for health improvement and development of their livestock (Lameed & Jenyo-Oni, 2012). In general, the main component to develop an artificial salt lick is the mineral block which is commercially available in various forms. Salt lick plays an important role in ensuring the health of the wildlife by providing the required essential minerals especially for herbivores mammals. Local communities and poachers have traditionally used this technique for developing artificial salt licks to attract wildlife. On the other hand, wildlife biologists have developed artificial salt licks in the management of wildlife populations for the purpose of improving their health, treatment and managing the populations (Lameed & Jenyo-Oni, 2012).

Salt licks are still found in large, undisturbed forest such as Taman Negara National Park, Krau Wildlife Reserve, and other protected area such as Royal Belum State Park (Chong *et al*., 2005). Salt licks also can be found in forest reserves that are sustainably managed giving sufficient protection to these salt licks. Essential nutrients especially for herbivors such as the calcium, magnesium, sodium, and zinc can be found on the natural salt licks (Lameed & Jenyo-Oni, 2012). In Peninsular Malaysia, study on the utilisation of salt licks by wildlife and the mineral contents are lacking (Chong *et al*., 2005). One of the earliest inventory on salt licks was conducted in Perak and Pahang in the early 1930's and subsequently these salt licks were gazetted under the state wildlife legislation (Hubback, 1932). Chong *et al*. (2005) conducted a study of some salt licks in Ulu Muda, and recommended for the conservation and preservation of willdlife salt licks in the area. In another study, Nor Hani and Mohd Taufik (2008) conducted a wildlife observation study on animals visiting artificial salt licks in Sungai Dusun Wildlife Reserve using camera traps. In this area, two artificial salt licks were developed and recorded eight species of mammals visiting the artificial salt licks. Traeholt and Sanusi (2009) carried out a study on population estimates of Malayan Tapir in Krau Wildlife Reserve

where they deployed camera traps at 13 different sites with natural salt licks. Their study recorded 14 species of mammals and one species of bird using the salt licks. Recently, a comprehensive study of natural salt licks in Sabah was carried out by Matsubayashi *et al*. (2007) focusing on the importance of natural licks for the mammals in Bornean inland tropical rain forest.

This study was planned to gather information on the use of artificial salt licks by wildlife and to understand the importance of salt licks and its management in Peninsular Malaysia. The salt licks are not only important for wildlife as minerals sources but also have high potential for wildlife tourism. The results of this study can be used as a reference and recommendation for the management of wildlife habitats especially in Peninsular Malaysia. Thus, the aims of this paper are to identify the animals that visited the artificial salt licks, the frequency of visitation, and to identify the most effective type and location of artificial salt licks.

METHODOLOGY

Development of Artificial Salt Licks

One of the main activities under the Habitat Enrichment Programme carried out by the Department of Wildlife and National Parks (DWNP) is the development of artificial salt licks in the protected areas under its jurisdiction from 2011–2012 (Table 1). The development of artificial salt licks were embarked on since early 2011 and were confined to protected area that were managed by the DWNP. A total of 30 active artificial salt licks were developed. To maintain the artificial salt licks effectiveness, commercially available coarse salt and mineral blocks were added into the existing salt licks periodically.

Observations and Description of Study Sites

In this study, periodic observations were carried out at artificial salt licks developed in Taman Negara National Parks (TNNP), Krau Wildlife Reserve (Krau WR), Sungkai Wildlife Reserve (Sungkai WR), Sungai Dusun Wildlife Reserve (Sungai Dusun WR), Sungai Ketiar Elephant Sanctuary (Sungai Ketiar ES) and Tasek Bera Ramsar Site (TBRS) (Figure 1).

Table 1 List of protected areas where the artificial salt licks were developed from 2011 and 2012.

No.	Protected Areas	No. of artificial salt licks	Remarks
1	Taman Negara Pahang (Sungai Relau and Kuala Tahan)	6	3 artificial salt licks developed each in 2011 and 2012
2	Taman Negara Kelantan	3	Developed in 2012
3	Sungkai Wildlife Reserve	6	3 artificial salt licks developed each in 2011 and 2012
4	Sungai Dusun Wildlife Reserve	3	Developed in 2012
5	Krau Wildlife Reserve	6	3 artificial salt licks developed each in 2011 and 2012
6	Tasek Bera Ramsar site	3	Developed in 2012
7	Elephant Sanctuary Sungai Ketiar, Hulu Terengganu	3	Developed in 2012
		Total: 30	

TNNP was designated as a national park in 1938/1939 as a result of the recommendation made by the Wildlife Commission of Malaya Report in 1932 (DWNP, 1987). TNNP encompasses of three states, namely Pahang, Kelantan, and Terengganu, each with its own legislation. The Taman Negara Enactment No. 2 (1939), the Taman Negara Enactment No. 14 (1938), and the Taman Negara Enactment No. 6 (1939) were enforced in the state of Pahang, Kelantan, and Terengganu, respectively. Although the enactments were different legally, all three contained similar contents such that the three national parks can be managed as one entity. TNNP was chosen for this study based on its rich biodiversity and the fact that it is the oldest established national park in Malaysia. TNNP covers a total area of 431,400 hectares (ha) divided into the following states; Pahang 248,121 ha (57%), Kelantan 80,250 ha (19%), and Terengganu 103,082 (24%) ha. In this study, two sites in Taman Negara Pahang (Sungai Relau and Kuala Tahan) and one in Taman Negara Kelantan (Kuala Koh) were selected for the development of the artificial salt licks with each site consisting of three salt licks (Table 2).

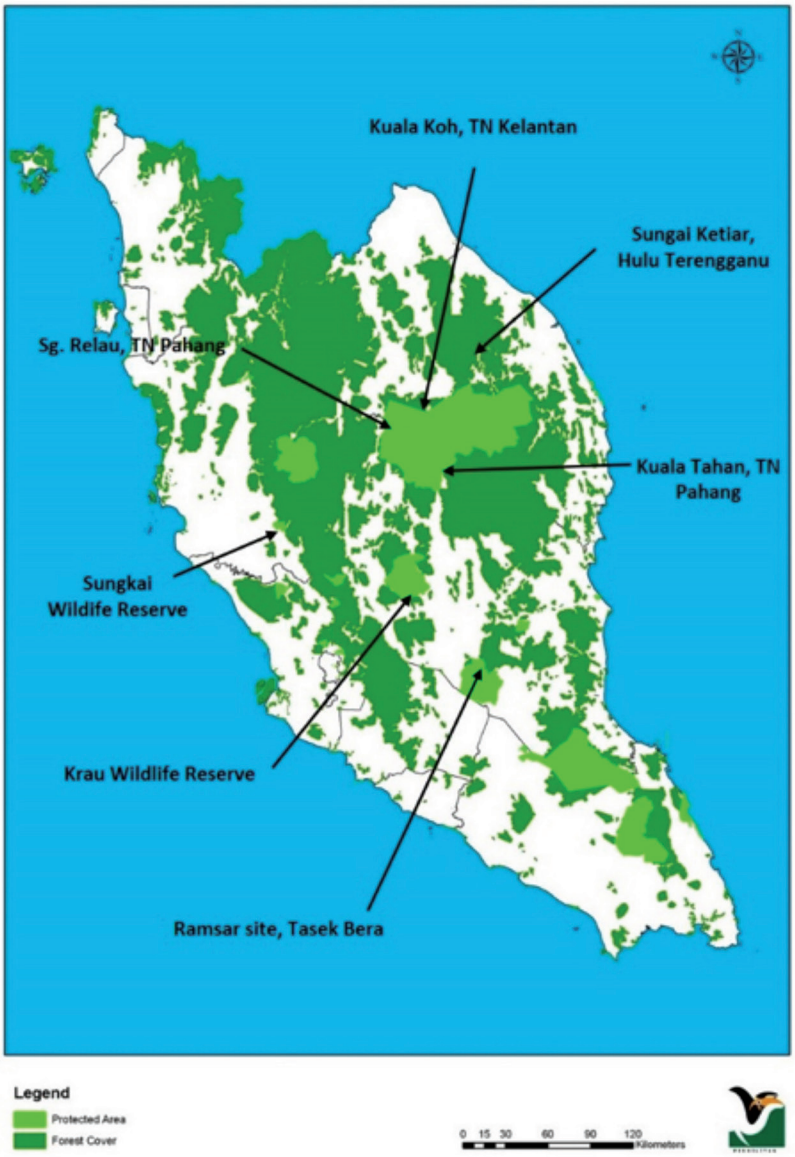

Figure 1 Locations of artificial salt licks in Peninsular Malaysia developed from 2011–2012 under the Habitat Enrichment Programme. *Taman Negara National Parks (TNNP).*

Krau WR

Krau WR was designated as a reserve in 1923 (PERHILITAN, 2013) which covers 62,395 ha of undisturbed lowland dipterocarp forest with Gunung Benom (2,107 m) forming the northern-western border and Bukit Tapah (870 m) demarcating the southern end of the reserve. Krau WR are comprised of completely unlogged forest where lowland forest predominates the central and eastern areas while the northwestern area is covered by higher altitude vegetation (Ebil, 2000). In this study, a total of six salt licks were developed for Krau WR (Table 2).

Sungkai WR

Sungkai WR is located about 60 km south of Ipoh, Perak. The reserve was designated as a protected area in 1928 with an area of 1,805 ha (PERHILITAN, 2013). In 1971, the Sungkai Wildlife Conservation Centre was initially established for Gaur captive breeding programme and currently several other wildlife breeding programmes are conducted including Sambar deer and pheasants. The site is primarily covered by lowland dipterocarp forest and upper dipterocarp forest. A total of six salt licks were developed for Sungkai WR in this study (Table 2).

Sungai Dusun WR

Sungai Dusun WR was designated as a protected area in 1964 by the Selangor State Government with Gazette No. 359 (PERHILITAN, 2013). The size of this area is 4,330 ha, located about 120 km to the north of Kuala Lumpur. This reserve consists of lowland dipterocarp forest and peat swamp forest with the highest point of about 253 metres above sea level. The Sungai Dusun Township is located to the north of the reserve while Sungai Tengi village demarcate the southern border. In the west, the Ben Canal connects Sungai Tengi and Sungai Bernam. This centre can also be accessed via Sungai Besar, Selangor and Tanjong Malim, Perak. Three salt licks were developed in 2012 (Table 2) for the purpose of this study.

Sungai Ketiar ES

Sungai Ketiar ES is located within the Tembat Forest Reserve, Hulu Terengganu, along the Gua Musang-Kuala Berang road. The Federal Government initiated this elephant sanctuary project in 2007 to compliment the task undertaken by the National Elephant Conservation Centre in Kuala Gandah, Pahang (NRE,

2010). This sanctuary is about 134 km from Kuala Terengganu and about 95 km from Kuala Berang and covers an area of about 15,000 ha, encompassing the Sungai Ketiar Ecological Corridor, as recommended under the Central Forest Spine (CFS) Master Plan and is managed by DWNP. Generally, the sanctuary is covered by pristine lowland tropical forests with some parts of regenerating secondary forests. Within the sanctuary, three ecological bridges or viaducts were constructed along the highway which provides safe crossing for wildlife between the forest reserve in the north and Taman Negara Terengganu in the south which has been fragmented by the highway. This sanctuary is an important location for translocated elephants caught from human-elephant conflict areas. In 2008, a grazing field of two hectares in size was developed as an artificial salt lick and planted with napier grass to provide alternative food source for the wildlife. In this study, a total of three salt licks were developed in 2011 (Table 2).

Tasek Bera Ramsar Site (TBRS)

In November 1994, under the Ramsar Convention, Tasek Bera was recognised as the first Ramsar site in Malaysia (Mokbolhassan, 2014). TBRS is the biggest freshwater lake in Malaysia and is located in the middle of a lowland area of the Peninsular Malaysia in the south-east of Pahang state. It is a system of moist land comprising of open-spaced water, swamps, and lowland forest habitats. With an area of 34.6 km long and 25.3 km wide, the lake flows northwards to Bera River and empties into the Pahang River. Tasek Bera covers an area of 31,120 ha with its wetlands consisting of 6,800 ha and 77,380 ha of buffer zone. The nearest towns are Bera, Bahau, Triang, and Kerayong. For the purpose of this study, three salt licks were developed in 2012 (Table 2).

Data Collection and Assumptions

The data collections of wildlife visiting the artificial salt licks were carried out by the staffs at the respective areas monthly from January 2012 to June 2013. The data sources are from the camera traps images, direct observation, and indirect observation of animal such as tracks, droppings, and etc. Each data was recorded on a standardised data sheet. Identification of the tracks were done using guidelines provided by PERHILITAN (2010). The parameters collected from the animal monitoring of salt licks activity were date, time, name of observer, observation method, name of the salt licks, and name of trails to the salt licks. In this study, we employ two assumptions; (1) based on the previous evaluation on habitat enrichments conducted by DWNP, an active artificial salt licks would

Table 2 Name of artificial salt licks, locations, year developed, and number of species visiting the salt licks.

No	Name of salt licks	Location	Year Developed	No. of Species
1	Jenut Padang Ragut	Sungai Relau, Pahang	2011	9
2	Jenut Kundang	Sungai Relau, Pahang	2011	9
3	Jenut Milo	Sungkai WR	2011	8
4	Jenut Kemuai	Sungai Relau, Pahang	2011	8
5	Jenut Pdg Dusun	Krau WR	2012	6
6	Jenut Suau	Sungkai WR	2012	6
7	Jenut Ped	Sungkai WR	2012	6
8	Jenut Rusa	Sungkai WR	2011	5
9	Jenut Paya Ruat	Krau WR	2011	5
10	Jenut Tualang	Kuala Koh, Kelantan	2012	5
11	Jenut 3 (J. Muda)	Kuala Tahan, Pahang	2012	5
12	Jenut Bukit	Sungkai WR	2012	5
13	Jenut Bukit Rengit	Krau WR	2012	4
14	Jenut Hani (K. Senderoh)	Krau WR	2011	4
15	Jenut Semelai	TBRS	2012	4
16	Jenut 1 (J. Rimba)	Kuala Tahan, Pahang	2012	4
17	Jenut 2 (J. Paya)	Kuala Tahan, Pahang	2012	4
18	Jenut Ranting (via. 2)	Sungai Ketiar ES	2011	4
19	Jenut Bertam	Sungkai WR	2011	3
20	Jenut Ulu Senderoh	Krau WR	2011	3
21	Jenut Gajah (via. 1)	Sungai Ketiar ES	2011	3
22	Jenut 2 (Sungai dusun)	Sungai Dusun WR	2012	2
23	Jenut Perlok	Krau WR	2012	2
24	Jenut Ribut	TBRS	2012	2
25	Jenut Belinang	TBRS	2012	2
26	Jenut Ara	Kuala Koh, Kelantan	2012	2
27	Jenut Kempas	Kuala Koh, Kelantan	2012	2
28	Jenut 1 (Sungaidusun)	Sungai Dusun WR	2012	1
29	Jenut 3 (Sungaidusun)	Sungai Dusun WR	2012	1
30	Jenut Sungai (via. 3)	Sungai Ketiar ES	2011	0

be considered as successful if it was visited by three or more species of wildlife and (2) a general assumption that no wildlife activities had taken place in these sites prior to the creation of the artificial salt licks.

RESULTS

A total of 30 artificial salt licks were developed from 2011 to 2012 (Table 1). Table 2 shows the details of each salt licks and the number of species recorded visiting them. Observations revealed that 29 (96.7%) of the artificial salt licks were visited by at least one species of wildlife during the study period. Two of the artificial salt licks namely Padang Ragut and Kundang, located in Taman Negara Pahang, Sungai Relau, recorded high usage with nine wildlife species. Other salt licks that recorded high usage by wildlife were Jenut Milo (8 species) in Sungkai WR, Jenut Kemuai (8 species) and Jenut Padang Dusun (6 species) in Krau WR, Jenut Suau (6 species) and Jenut Ped (6 species) in Sungkai WR.

The overall percentages of the salt licks based on the number of wildlife species observed is presented in Figure 2. Seven salt licks were visited by six or more species of wildlife during the study period representing 23.3% of the total salt licks. A total of 14 salt licks (47.7%) showed average usage with three to five wildlife species observed. Unfortunately, some of the developed salt licks failed to attract wildlife species wherein nine (30%) of the salt licks were only visited by two or less wildlife species. Overall, Figure 3 summarises the effectiveness of each protected areas based on the number of species observed. The most visited artificial salt licks were at Taman Negara Pahang (28.6%), Sungkai WR (28.6%), and Krau WR (23.8%) as compared to the other four locations.

In this study, a total of 337 observations of wildlife were recorded representing 11 orders, 17 families, and 25 species. Table 3 list all the wildlife species recorded and the percentage of observation according to species recorded at all the artificial salt licks. Four species of mammals that have the most frequent visitation to the salt licks were the wild boar (30.6%), Sambar deer (15.4%), followed by the barking deer (13.4%) and the Malayan tapir (8.3%). Throughout the monitoring period, eight species only visited the salt licks once which included the Malayan sun bear, Gaur, crested serpent-eagle, Malayan pangolin, dusky leaf monkey, smooth otter, serow, and red junglefowl. Altogether, 80% of the recorded species represents mammals, 16% of avian and 4% of reptiles.

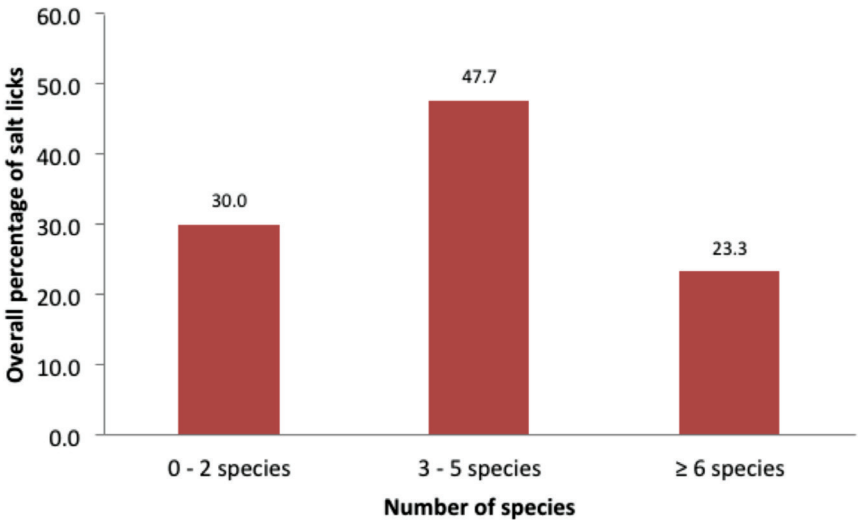

Figure 2 Extent of artificial salt lick used by wildlife.

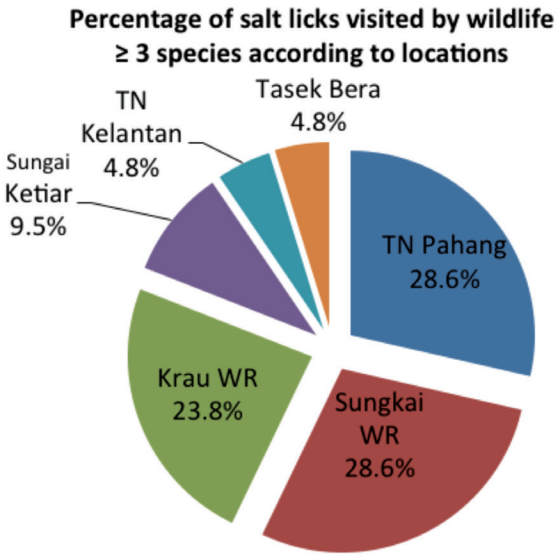

Figure 3 Pie chart showing the effectiveness of salt licks developed in protected areas according to the percentage of number of species visiting each salt lick.

Table 3 List of species according to the frequency of observations.

No.	Common Name	Scientific Name	Diet	No. of observations	%
1	Wild boar	*Sus scrofa*	Omnivore	103	30.6
2	Sambar deer	*Rusa unicolor*	Herbivore	52	15.4
3	Barking deer	*Muntiacus muntjac*	Herbivore	45	13.4
4	Malayan tapir	*Tapirus indicus*	Herbivore	28	8.3
5	Malayan porcupine	*Hystrix brachyura*	Omnivore	26	7.7
6	Asian elephant	*Elephas maximus*	Herbivore	22	6.5
7	Lesser mouse-deer	*Tragulus kanchil*	Herbivore	14	4.2
8	Pig-tailed macaque	*Macaca nemestrina*	Omnivore	10	3.0
9	Malay civet	*Viverra tangalunga*	Omnivore	5	1.5
10	Greater mouse-deer	*Tragulus napu*	Herbivore	4	1.2
11	Asian golden cat	*Catopuma temminckii*	Carnivore	4	1.2
12	Long-tailed macaque	*Macaca fascicularis*	Omnivore	4	1.2
13	Dhole	*Cuon alpinus*	Carnivore	4	1.2
14	Water monitor	*Varanus salvator*	-excluded-	2	0.6
15	Great argus	*Argusianus argus*	-excluded-	2	0.6
16	Malayan tiger	*Panthera tigris*	Mammals	2	0.6
17	Emerald dove	*Chalcophaps indica*	-excluded-	2	0.6
18	Malayan sun bear	*Helarctos malayanus*	Omnivore	1	0.3
19	Gaur	*Bos gaurus*	Herbivore	1	0.3
20	Crested serpent eagle	*Spilornis cheela*	-excluded-	1	0.3
21	Malayan pangolin	*Manis javanica*	Herbivore	1	0.3
22	Serow	*Capricornis sumatraensis*	Herbivore	1	0.3
23	Dusky leaf monkey	*Presbytis siamensis*	Herbivore	1	0.3
24	Smooth otter	Top of Form	Carnivore	1	0.3
		Lutrogale perspicillata Bottom of Form			
25	Red junglefowl	*Gallus gallus*	-excluded-	1	0.3

DISCUSSION

In 2011, DWNP embarked on the Habitat Enrichment Programme through artificial development of salt licks with a total of 30 sites developed throughout 2011-2012. Subsequently, the evaluation on the effectiveness of these salt licks were carried out through continuous monitoring. Based on the assumptions that no activities had taken place at these sites prior to the creation of the artificial salt licks, our findings showed that these artificial salt licks are successful in attracting wildlife species and thus met the objectives set for this project.

The most visited artificial salt licks in this study were in Taman Negara Pahang (28.6%) and Sungkai WR (28.6%) in which two of the artificial salt licks in Taman Negara Pahang, Sungai Relau (Jenut Padang Ragut and Jenut Kundang) recorded the highest visitation by wildlife. The huge size of the area coupled by the habitats suitability supports the existence of many species of wildlife in the area. About 23.8% of the salt licks in Krau WR were visited by at least three species of wildlife while Sungai Ketiar ES, Taman Negara Kelantan and TBRS had less than ten per cent of visitation of three or more species (Figure 3). However, it is important to note that the development of the salt licks in these three areas were started in 2012, while the prior three sites (Taman Negara Pahang, Sungkai WR, and Krau WS) were built in 2011. Perhaps due to this, less number of species was observed and thus more time is needed to monitor and to provide the overall observation of wildlife in these sites.

Salt licks are important source of mineral for many species of mammals and birds in lowland forests of Malaysia. Matsubayashi *et al*. (2007) demonstrated that 37 species of medium to large-sized mammals were recorded in the Dermakot Forest Reserve which accounted for 78.7% of the total local species in Sabah. These species include diurnal and nocturnal, terrestrial and arboreal, with different food habit. In comparison to a study of natural salt licks in the lowland forest of Eastern Ecuador, Blake *et al*. (2011) found that 15 species of birds, 23 non-volant mammals species and at least five species of bats are actively utilising the salt licks. In this study, our preliminary findings showed that artificial salt licks can provide additional source for wildlife to get essential minerals to meet their dietary needs especially the ungulates. In a review by Ebil (1981), the Gaur (*Bos gaurus hubbacki*) regularly utilise salt licks for about two months and then move to the other part of their home range. Other mammals such as the Malayan tapir established their home range with at least one salt lick in its home range (Traeholt & Sanusi, 2009). Similarly, this study observed several Malayan tapir individuals constantly visiting the artificial salt licks with variation in the frequency of visitation and was recorded as the fourth highest number of

visitation. Congruently, Nor Hani and Mohd Taufik (2008) observed that tapir was the most captured animal on camera traps during a study in Sungai Dusun WR.

Overall, the most common species attracted by the salt licks were wild boar, Sambar deer, barking deer and the Malayan tapir. These top four species represented 67.7% in terms of frequency of their appearance in all methods of observation throughout the monitoring period. These species are important prey species for carnivores, including tigers. The herbivores-frugivores were shown to be 80% of the top five species and a species of omnivores (20%) (Table 3). This finding is consistent with the work by Matsubayashi *et al*. (2007) which reported that 60% of the top five species in their study were herbivores-frugivores. However, in this study, only the herbivores-frugivores and omnivores occupied the top five, while Matsubayashi *et al*. (2007) had a carnivore in the top five species. In terms of overall main food habit, 50% of the mammalian species were herbivores-frugivores, while omnivores and carnivores were 20% and 30%, respectively (Figure 4).

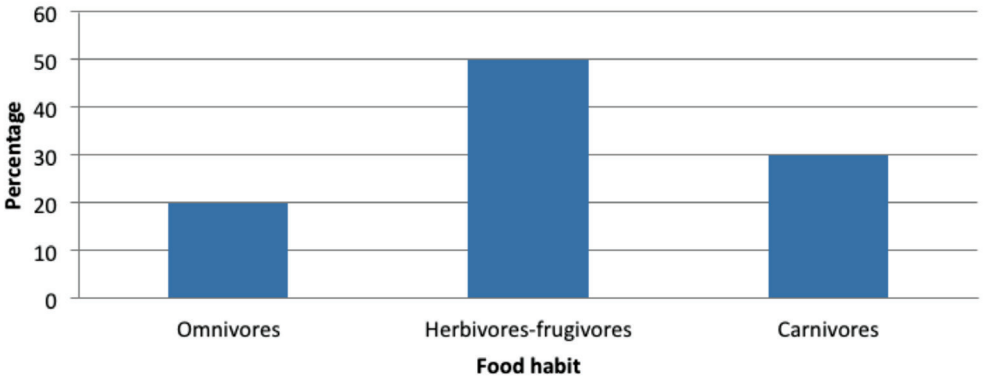

Figure 4 The percentage of mammalian according to their food habits.

In this study, wild boar had the highest number of observation (30.6%) which is about two-fold higher than the second highest observation of Sambar deer (15.4%). Previous studies on salt licks similarly observed the high frequency of wild boar observation (Chong *et al*., 2005; Matsubayashi *et al*., 2007; Nor Hani & Mohd Taufik, 2008; Traeholt & Sanusi, 2009). Sambar deer in this study was mostly observed in Sungkai WR, Krau WR, and Taman Negara but was not observed in TBRS, Sungai Ketiar ES and Sungai Dusun WR, possibly due to the very low density of this animal in those locations. Chong *et al*. (2005) recorded the observation of Sambar deer in one of the natural salt licks in Ulu

Muda, Kedah and it was also reported that Sambar deer was frequently seen at most of the salt licks in Taman Negara (PERHILITAN, 2012). Another common species that is highly observed at natural and artificial salt licks is the barking deer as documented in previous studies (Traeholt & Sanusi, 2009; Nor Hani & Mohd Taufik, 2008; Matsubayashi *et al*., 2007; Chong *et al*., 2005). Finding in this study shows that barking deer contributed to 13.4% of the total observations.

Apart from the ungulates, some species of avian were also recorded to have visited salt licks during the monitoring period of this study. A total of four species of avian namely the red junglefowl, great argus, crested serpent eagle, and emerald dove were captured on camera traps. The emerald dove and the great argus were recorded to have visited the salt licks twice, while the crested serpent eagle and the red junglefowl were recorded to have visited once for the whole monitoring period. Chong *et al*. (2005) in their study recorded a pigeon visiting a natural salt lick in Ulu Muda, Kedah. Additionally, primates such as long-tailed macaque, pig-tailed macaque, and dusky leaf monkey were also recorded visiting the artificial salt licks in this study. Matsubayashi *et al*. (2007) recorded the visitation of pig-tailed macaque, silvered langur and orang utan in their study in Dermakot Forest Reserve, Sabah while in Sungai Dusun WR, it is common to observe the pig-tailed macaque in salt licks (Nor Hani & Mohd Taufik, 2008).

Several important findings were encountered during this study. Firstly, the occurrence of dhole visiting two of the artificial salt licks in Sungkai WR was the first documentation of dhole observation in the area (Magintan *et al*., 2014). Secondly, the visitation of water monitor lizard to one of the salt licks was unexpected. Previous assessment of artificial salt licks in Sungai Dusun WR shows no occurrence of reptiles visiting the salt licks (Nor Hani & Mohd Taufik, 2008) as well as in Dermakot Forest Reserve, Sabah (Matsubayashi *et al*., 2007).

CONCLUSION

A total of 29 or 96.7% out of 30 artificial salt licks developed in 2011 and 2012 were visited by wildlife at least a species. In terms of visitation, 70% of the artificial salt licks were utilised by three or more species, hence, we categorised these licks as effective salt licks. A total of 25 species of wildlife were recorded known to have visited one of the artificial salt licks. Among the highly frequent species recorded visiting artificial salt licks were the wild boar, Sambar deer, barking deer and the Malayan tapir. Further studies can be done in terms of

mineral contents of natural salt licks, animal diversity visiting salt licks,detail frequency of animals visitiation to salt licks and etc.

The habitat enrichment programmes by the DWNP through development of artificial salt licks in protected area were initiated to upsurge the quality of habitats of wildlife. Thus, the department should continue to maintain the activeness of all artificial salt licks. Study of salt licks is still lacking in this region, hence, consistency in assessing and monitoring of wildlife visiting salt licks is required. The authority should organise a continuous patrolling in the salt licks area to avoid poachers. The most common wildlife species attracted by the salt licks were wild boar, Sambar Deer and Barking Deer, which are important prey for carnivores, including tigers. Therefore, constant development and management of salt licks is essential for Malaysia to increase the prey base and subsequently increase the tiger population as envisaged by the National Tiger Conservation Action Plan (DWNP, 2008).

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REFERENCES

Blake, J.G., Mosquera, D., Guerra, J., Loiselle, B.A., Romo, D. & Swing, K. (2011). Mineral licks as diversity hotspots in lowland forest of eastern Ecuador. *Diversity*, **3(2)**: 217–234.

Chong, M.H.N., Tang, S.H. & Suksuwan, S. (2005). Management recommendations for wildlife salt licks with particular reference to Sira Air Hangat at Ulu Muda Forest Reserve, Kedah. Petaling Jaya: World Wide Fund for Nature Malaysia.

DWNP. (1987). Taman Negara Master Plan. Kuala Lumpur: Department of Wildlife and National Parks.

DWNP. (2008). National Tiger Action Plan for Malaysia. Kuala Lumpur: Department of Wildlife and National Parks.

Ebil, Y. & Sorenson, K.W. (2000). Introduction: Krau Wildlife Reserve: protected area management experiences. *Journal of Wildlife and Parks,* **18**: 3–13.

Ebil, Y. (1981). A review of the Malayan Seladang (*Bos gaurus hubbacki*). Kuala Lumpur: Department of Wildlife and National Parks.

Hubback, T.R. (1932). The Wildlife Commission of Malaya Report. Singapore: Wildlife Commission of Malaya.

Lameed, G.A. & Adetola, J.O. (2012). Species-diversity utilization of salt lick sites at Borgu Sector of Kainji Lake National Park, Nigeria. In *Biodiversity enrichment in a diverse world* (Lameed, G.A., ed.), pp. 35–62. Rijeka, Croatia: InTech.

Magintan, D., Mohd. Aminurddin, A., Adnan, I. & Idlan, R. (2014). Observation of Dhole (*Cuon alpinus*) at Sungkai Wildlife Reserve, Perak, Malaysia. *Journal of Wildlife and Parks,* **29**: 69–72.

Matsubayashi, H., Lagan, P., Majalap, N., Tangah, J., Sukor, J.R.A. & Kitayama, K. (2007). Importance of natural licks for the mammals in Bornean inland tropical rain forests. *Ecological Research*, **22(5)**:742–748.

Mokbolhassan, H.K. (2014). Managing Tasek Bera: Department of Wildlife and National Parks and local community participation. *Journal of Wildlife and National Parks*, **27**: 121–127.

Nor Hani, A. Samat & Mohd Taufik, I. (2008). *Cerapan Hidupan Liar Melalui Perangkap Kamera Di Jenut Tiruan Rizab Hidupan Liar Sungai Dusun*. Paper presented at the National Biodiversity Seminar 2008, Port Dickson, Negeri Sembilan.

NRE. (2010). Soal Jawab Parlimen NRE. Kementerian Sumber Asli dan Alam Sekitar. Available from www.nre.gov.my/parlimen/pages/2010-DN1.aspx.

PERHILITAN. (2010). Panduan pengecaman tapak hidupan liar di lapangan. Kuala Lumpur: Jabatan Perlindungan Hidupan Liar dan Taman Negara.

PERHILITAN. (2012). Laporan Pengayaan Habitat 2012. Kuala Lumpur. Jabatan Perlindungan Hidupan Liar dan Taman Negara (unpublished report).

PERHILITAN. (2013). Kompendium PERHILITAN 2013. Kuala Lumpur: Jabatan Perlindungan Hidupan Liar dan Taman Negara.

Traeholt, C. & Mohd Sanusi, M. (2009). Population estimates of Malay Tapir, *Tapirus indicus,* by camera-trapping in Krau Wildlife Reserve, Malaysia. *Tapir Conservation*, **18/1(25)**: 12–20.

Wildlife Conservation Act. (2010). Laws of Malaysia Act 716. Kuala Lumpur: Percetakan Nasional Malaysia Berhad.