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Short communication

The Notes on Mammal Carcasses Collected in Pangandaran Nature Reserve, West Java, Indonesia

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ABSTRACT

A field survey was conducted in Pangandaran Nature Reserve (PNR), West Java, Indonesia between 2011 and 2015, during which fresh carcasses of wild mammals were collected. Body sizes of these carcasses were performed. This paper reports relevant data for future applications.

Introduction

Pangandaran Nature Reserve (PNR) is located on the southern coast of West Java, Indonesia (latitude 7°43′S; longitude 108°40′E), with an average elevation of approximately 100 m above sea level. The PNR was designated as game reserve for ungulates in 1934 and as a nature reserve in 1961 (Rosleine and Suzuki 2012). The reserve is divided into two sections, a 38-ha forest park [called Taman Wisata Aram (TWA)] and a 370-ha nature reserve [called Cagar Alam (CA)] (Tsuji *et al.* 2015) as shown in Figure 1. The average annual rainfall recorded between 2005 and 2013 was 3272 mm (AccuWeather.com 2015, http://www.accuweather.com), and the average annual air temperature (25 °C–30 °C) and humidity (85–95%) in the region were relatively stable.

Although the area is small and isolated, the reserve has a diverse fauna. Forest rangers listed 23 species of mammals and 62 species of birds. They enumerated also important and interesting animals occurring in the reserve, such as primates (*Trachypithecus auratus* and *Macaca fascicularis*), squirrels (*Callosciurus nigrovitatus* and *Ratufa bicolor*), hornbills (*Anthracoceros convexus*), flying foxes (*Pteropus vampirus*), flying lemurs (*Galeopterus variegatus*), mouse deer (*Tragulus javanicus*), palm civet (*Viverricula malaccensis*), porcupines (*Hystrix javanica*), and jungle cat (*Felis bengalensis*) (Sumardja and Kartawinata 1977).

In 2011 we embarked on an ecological study of wild Javan lutungs (*T. auratus*, Cercopithecidae) and Malayan flying lemurs (*G. variegatus*, Cynocephalidae) that inhabit TWA (Tsuji *et al.* 2013, 2015, in press). During the fieldwork we found carcasses of mammals in the forest or on the forest path. For establishing and management of the nature reserve and for educational use, accumulation of fundamental information on fauna and making them public is very important, which is often neglected in Indonesia. On the other hand, data on body size of animals are useful for studying regional variation in body sizes. We therefore report the body size of mammal carcasses we collected so far in PNR.

Materials and Methods

The carcasses found during the observation were transported to the ranger station, where their sex was identified and age-class was

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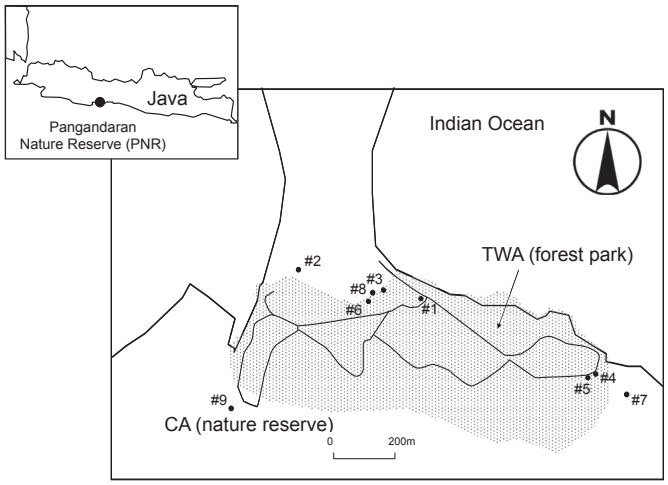

Figure 1. Location of Pangandaran Nature Reserve (top) and study area (bottom). Shaded area represents forest park [Taman Wisata Alam (TWA)], located to the north of nature reserve [Cagar Aram (CA)]. The sites at which carcasses were found are also shown. Location of specimen #9 (lesser mouse deer) is out of the range of this map.

estimated. Furthermore, measurements of several body parts were taken with 0.5-cm accuracy, including the head and body length, tail length, and ear length (Figure 2). Body weights were weighed with 0.1-kg accuracy. It is noteworthy that part of the carcass (#5 and #7) was eaten and lost, and their body weight would be underestimated.

Results

During the field survey, carcasses of Javan lutungs ($n = 3$), Malayan flying lemurs ($n = 5$), and lesser (Javan) mouse deer (*Tragulus javanicus*, Tragulidae) ($n = 1$) were detected. Table shows body sizes of the carcasses (Table). The locations from where the specimens were collected are shown in Figure 1.

Javan lutungs (specimen #1–#3)

All specimens were obtained from animals belonging to the *K* group (Figure 3A) whose home range was located at northern part of the TWA (Tsuji *et al.* 2013). Two of three specimens were found at the northern most part of the home range, at an area adjacent to human settlement. Two of them fell to their death, whereas one was electrocuted.

Malayan flying lemurs (specimen #4–#8)

We detected five carcasses between August and October 2015, on the forest path (Figure 3B). We have never observed such large number of deaths since the beginning of our project. No external injuries were observed, and we could not ascertain the reasons underlying their death. Three carcasses (#4, #5, and #7) were found at the eastern part of the TWA that was dominated by secondary/artificial forests composed of *Tectona grandis* (Verbenaceae), *Pterospermum javanicum* (Sterculiaceae), *Swietenia macrophylla* (Meliaceae, n = 504), and *Vitex pubescens* (Verbenaceae) (Tsuji *et al.* 2015), whereas two (#6 and #8) were found at the northern part of the TWA that was dominated by grassland and high trees were scarce because of recent resort development. Two of five carcasses (#5 and #7) were partly eaten by carnivorous animals (we found their feces near the carcasses); therefore, the body weights of these specimens were possibly underestimated. In addition to taking the measurements, samples of fresh tissue and stomach contents were collected for genetic or dietary analyses in future.

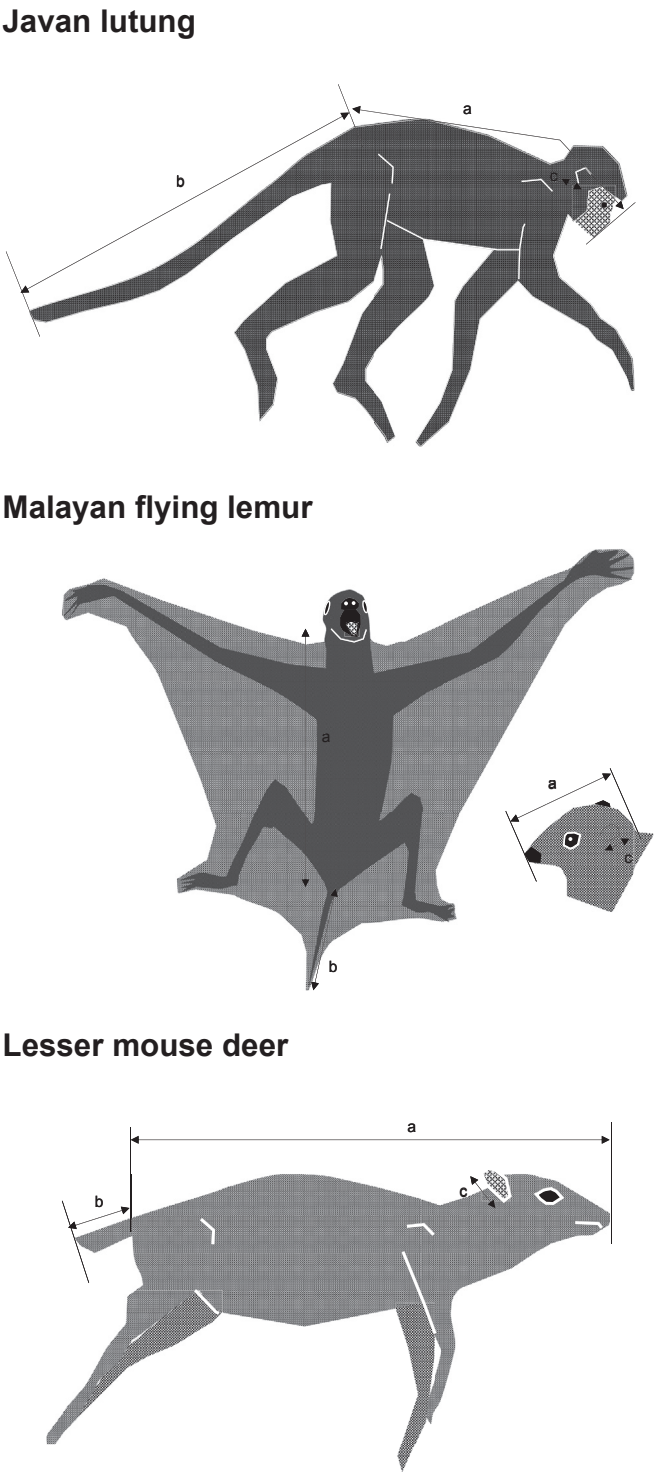

Figure 2. Body parts of the carcasses collected. We measured (A) head and body length, (B) tail length, and (C) ear length. As to the flying lemur, body part and head part are drawn separately.

Lesser (Javan) mouse deer (specimen #9)

A carcass was found near the forest path at south of the TWA. There was no injury, but we could not determine the reason of death of the animal.

Table. External measurements in mammal carcass found in Pangandaran Nature Reserve, West Java, Indonesia

Specimen No.	Location	Date of collection	Condition	Sex	Body weight (kg)	Size of body part (cm)			Age-class	Notes
						Head & body length	Tail length	Ear length		
Javan lutung (*Trachypithecus auratus*, *Cercopithecidae*)										
#1	Pangandaran	Dec. 4. 2013	Fresh	M	0.52	22.0	32.0	3.0	I	<1 month after born
#2	Pangandaran	Aug. 11. 2015	Fresh	F	5–7[*]	98.0	77.0	2.0	A	>5-year-old
#3	Pangandaran	Aug. 14. 2015	Fresh	F	ca 3[†]	51.0	63.0	3.0	J	2–3 year-old
	Captive	–	–	–	7.1	46.0–75.0	61.0–82.0	–	–	Data from Rowe (1996)
Malayan flying lemur (*Galeopterus variegatus*, *Cynocephalidae*)										
#4	Pangandaran	Aug. 22. 2015	Fresh	M	1.00	35.5	24.5	*n.a.*	A	
#5	Pangandaran	Aug. 22. 2015	Rotten	–	0.45	*n.a.*	*n.a.*	*n.a.*	J	Half of the body was eaten
#6	Pangandaran	Sep. 2. 2015	Fresh	F	*n.a.*	39.0	25.0	2.0	–	
#7	Pangandaran	Sep. 9. 2015	Fresh	F	0.56	36.0	25.0	*n.a.*	–	Part of body was eaten
#8	Pangandaran	Oct. 3. 2015	Fresh	F	1.10	28.0	19.0	*n.a.*	A	Lactating
	Pandegeran	–	–	M	1.5 ± 0.1 (n = 11)	39.4 ± 2.6 (n = 11)	–	–	–	Data from Baba (2011)
	Pandegeran	–	–	F	1.8 ± 0.2 (n = 7)	41.8 ± 4.0 (n = 5)	–	–	–	Data from Baba (2011)
	Singapore	–	–	–	1.1 (0.75–1.4)	31–44	–	–	–	Data from Byrnes *et al.* (2008) Data from Byrnes *et al.* (2008)
	Bukit Drive, Singapore	–	1–2 days after death	–	–	20.0	–	–	J	Road killed, data from Lim (2014)
	Bako NP, Sarawak	Jul. 23. 2010	–	M	0.85	27.8	23.4	2.3	–	Data from Dzulhelm and Suriyanto (2012)
	Kota Samarhan, Sarawak	–	Live	M	–	14.5	5.0	–	J	Data from Ketol *et al.* (2006)
	Kota Samarhan, Sarawak	–	Live	F	1.2	31.0	25.0	–	A	Data from Ketol *et al.* (2006)
	Kota Samarhan, Sarawak	–	Live	F	–	19.0	12.0	–	SA	Data from Ketol *et al.* (2006)
	Kota Samarhan, Sarawak	–	Live	F	0.14	15.5	–	–	J	Data from Ketol *et al.* (2006)
	Malaysia	–	–	–	0.51–1.10	24.5–36.0	17.0–25.5	1.9–2.3	–	Data from Khan (2012)
	Borneo	–	–	–	1.06	35.6	–	–	–	Data from Banks (1949)
	Borneo	–	–	–	0.93–1.20 (n = 2)	34.4–37.5 (n = 2)	24.1–24.5 (n = 2)	6.5–7.3 (n = 2)	–	Data from Payne *et al.* (1985)
	Singapore/ Malaysia	–	–	–	1	38.0	28.0	–	–	Data from Harrison (1974)
Lesser (Javan) mouse deer (*Tragulus javanicus*, *Tragulidae*)										
#9	Pangandaran	Oct. 30. 2015	Fresh	F	ca 2	41.0	9.0	3.0	–	
	Sabah, Borneo	–	–	M	1.9 ± 0.2 (n = 8)	–	–	–	–	Data from Matsubayashi *et al.* (2003) Data from Matsubayashi *et al.* (2003)
	Sabah, Borneo	–	–	F	2.1 ± 0.3 (n = 5)[‡]	–	–	–	–	Data from Matsubayashi *et al.* (2003) Data from Matsubayashi *et al.* (2003)
	Malaysia	–	–	–	0.74–2.10	39.6–48.0	–	6.5–8.0	–	Data from Khan (2012)
	Singapore/ Malaysia	–	–	–	2	30.0–45.0	–	7.0–9.0	–	Data from Harrison (1974)
	Borneo	–	–	–	2.72–4.53	48.3–71.1	–	6.4–10.2	–	Data from Banks (1949)

For reference, we show data collected from other study sites.
F = female; M = male, N = sample size; n.a. = we could not measure because given part was eaten; Fresh = <1 day after death; Rotten = 2–3 days after death.
[*] Estimated from Nijboar *et al.* (2006).
[†] Information from forest rangers.
[‡] Two individuals were pregnant.

Discussion

The body sizes and body weights of the Javan lutungs, Malayan flying lemurs, and lesser (Javan) mouse deer were similar to those in other locations under study (Table, Baba 2011; Banks 1949; Byrnes *et al.* 2008; Harrison 1974; Khan 2012; Matsubayashi *et al.* 2003; Rowe 1996). However, to determine the average body size of the mammals in PNR, we need to collect more specimens.

Majority of the specimens were collected in 2015. Our observation time in this year (<1 month) was much shorter than previous years (several months for each year), and duration of the observation is not the determinant of the frequency of the finding carcasses. We are not sure about their cause of the large number of deaths in 2015. As to Malayan flying lemurs, several researchers have found carcasses (Dzulhelmi and Suriyanti 2012; Lim 2014), and they also could not determine the cause of the death.

A likely reason of the animal death is recent environmental changes caused by humans. Since the development of a resort area around TWA started at the end of 2014, many tall trees, whose leaves and fruits form diets of the animals, at the northern part of the TWA were cut down. In the same period, Javan lutungs of the *K* group started invading human settlements in search of food (Tsuji's personal observation). Thus, at least several death cases of lutungs and the flying lemurs could be related to this. To confirm this, we need to monitor the effects of these environmental changes on wildlife behavior and population in PNR and/or to analyze the relationship with vegetation. Abnormal weather condition in 2015 might be another reason of the death. Temperature, rainfall, or

Figure 3. Examples of carcass. We found (A) Javan lutung (*Trachypithecus auratus*) infant with yellow hear, (B) Malayan flying lemur (*Galeopterus variagatus*), and (C) lesser mouse deer (*Tragulus javanicus*).

wind chill in 2015 might be much higher, which might cause unusual activity of animals. Now we are collecting environmental information to test this speculation. For the two specimens of the flying lemurs (#6 and #8), it is possible that the animal had attempted to glide from southern part to north, but landed short of the intended destination (i.e., landed on the ground), and was then attacked by predators or starved to death (see Lim 2014). While the species can glide across distances >100 m (Lim 2007), the tree density in areas we found two carcasses was lower than those inside forest (Tsuji *et al.* 2015).

By collaborating with forest rangers, we have accumulated fundamental information on mammals, which would be important for management and for educational use of the PNR, which in turn contribute to enhance scientific knowledge in Indonesia. By standardizing sampling/measuring methods, we can collect more number of specimens and their body sizes, which enable us to conduct regional comparison. Thus, close cooperation with forest rangers/researchers of other university would be important.

Conflict of interest

There is no conflict of interest.

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References

Baba M. 2011. Comparative ecology of flying giant squirrel and flying lemurs. *Kyushu J. Exp. Anim.* 27:33–6.
Banks E. 1949. Bornean Mammals. The Kuching Press.
Byrnes G, Lim NTL, Spence AJ. 2008. Take-off and landing kinetics of a free-ranging gliding mammal, the Malayan colugo (*Galeopterus variegatus*). *Proc. R Soc. B* 275:1007–13.
Dzulhelmi MN, Suriyanti SNP. 2012. Field notes on the Malayan colugo *Galeopterus variagatus* in Pulau Langkawi, Kedah and Bako National Park, Sarawak, Malaysia. *Sarawak Mus. J.* 91:255–8.
Harrison J. 1974. An Introduction to Mammals of Singapore and Malaya. Singapore National Printers.
Ketol B, Tedong S, Abdullah MT. 2006. *Sarawak Mus. J.* 83:237–40.
Khan MM. 2012. Khazanah Mamalia Semenanjung Malaysia: Panduan Bergambar. Tinta Publishing.
Lim NTL. 2007. Colugo: The Flying Lemur of South-East Asia. Singapore: Draco Publishing.
Lim TL. 2014. Sunda colugo carcass at Bukit Drive. *Singapore Biodiv. Rec.* 2014:286–7.
Matsubayashi H, Bosi E, Kohshima S. 2003. Activity and habitat use of lesser mouse-deer (*Tragulus javanicus*). *J. Mamm.* 84:234–42.
Nijboer J, Clauss M, Olsthoorn M, Noordermeer W, Huisman TR, Verheyen C, van der Kuilen J, Streich WJ, Beynen AC. 2006. Effect of diet on the feces quality in Javan langur (*Trachypithecus auratus auratus*). *J. Zoo. Wildl. Med.* 37:366–72.
Payne J, Francis CM, Phillipps K. 1985. A Field Guide to the Mammals of Borneo. Kota Kinabalu: Sabah Society.
Rosleine D, Suzuki E. 2012. Secondary succession at abandoned grazing sites, Pangandaran Nature Reserve, West Java, Indonesia. *Tropics* 21:91–103.
Rowe N. 1996. The Pictorial Guide to the Living Primates. Rhode Island: Pogonias Pr.
Sumardja EA, Kartawinata K. 1977. Vegetation analysis of the habitat of banteng (*Bos javanicus*) at the Pananjung Pangandaran Nature Reserve, West Java. *Biotrop. Bull.* 13:3–49.
Tsuji Y, Widayati KA, Hadi I, Suryobroto B, Watanabe K. 2013. Identification of individual adult female Javan lutungs (*Trachypithecus auratus sondaicus*) by using patterns of dark pigmentation in the pubic area. *Primates* 54:27–31.
Tsuji Y, Prayitno B, Nila S, Widayati KA, Suryobroto B. 2015. Diurnal resting site selection and daytime feeding behaviour of wild Malayan flying lemur *Galeopterus variegatus* in Western Java, Indonesia. *Mamm. Study* 40:35–45.
Tsuji Y, Widayati KA, Nila S, Hadi I, Suryobroto B, Watanabe K. 2016. "Deer" friends: feeding associations between colobine monkeys and deer. *J. Mamm.* (in press).

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