
10 years on - The diversity and activity of small carnivores of the Sebangau peat-swamp forest, Indonesian Borneo

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ABSTRACT

The distribution and population status of Bornean small carnivores in Indonesian Borneo is very poorly understood. Since 2008, Borneo Nature Foundation has collected 7,145 images of mammalian wildlife in the Sebangau peat-swamp forest, Central Kalimantan. This represents 29,418 trap nights until end March 2018. We have data on 11 species of small carnivores including the endemic collared mongoose (*Herpestes semitorquatus*) and the first information on the Critically Endangered Sunda pangolin (*Manis javanica*) in peat-swamp forests. Data are presented on species diversity and activity patterns including overlap with felids at all locations where small carnivores were photographed. Distribution and activity data on this guild of small carnivores in Indonesian Borneo is very poor and we advocate for more camera trapping studies to work to provide data on small carnivores.

ABSTRAK

Status distribusi dan populasi satwa karnivora kecil di Kalimantan sangat kurang dipahami. Sejak 2008, Borneo Nature Foundation telah mengumpulkan 7.145 gambar satwa liar mamalia di hutan rawa gambut Sebangau, Kalimantan Tengah. Ini mewakili 29.418 perangkap malam hingga akhir Maret 2018. Kami memiliki data tentang 11 spesies karnivora kecil termasuk luwak berkerah endemik (*Herpestes semitorquatus*) dan informasi pertama tentang binatang yang Terancam Punah paling tinggi yaitu Sunda pangolin (*Manis javanica*) di hutan rawa gambut. Data disajikan pada keanekaragaman spesies dan pola kegiatan termasuk tumpang tindih dengan kucing liar di semua lokasi di mana karnivora kecil difoto. Data mendistribusi dan aktivitas binatang karnivora kecil di Kalimantan ini sangat kurang dikenal dan kami menganjurkan agar lebih banyak studi perangkap kamera berfungsi untuk menyediakan data tentang karnivora kecil.

Keywords: Carnivores, Peat-swamp forest, Borneo, diversity

INTRODUCTION

An often overlooked feature of Asian tropical forest communities is the high diversity of sympatric carnivores. The Asian Region supports a total of 80 species in the order Carnivora, and the intact lowland forests support 15-25 species especially in sites with extensive closed-canopy forest (Corlett, 2007). Different forest types support up to six sympatric cats, six civets (plus *Prionodon*), three mongooses, eight mustelids (including otters), two

canids and two bears (Austin et al., 2007; Grassman Jr et al., 2005; Grassman et al., 2005; Veron et al., 2006). In many sites this diversity exceeds that of the Neotropics which support carnivore communities ranging from 15 recorded in western Amazonia and <15 in Central America. African forests are reported to have even smaller numbers: some areas have no dogs or bears and only two cats (Corlett, 2007).

Despite this diversity, the paucity of data on the various small carnivores, and the guilds they function is widespread. Camera traps and the presence of more long-term research projects are addressing this

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issue and lending more insight into the lives of the smaller carnivores (Mathai et al., 2016).

An earlier paper on these species from Sebangau (Cheyne et al., 2010) focused on some of the small carnivores found in this area and highlighted that the activity patterns of the small carnivores in Sebangau demonstrate activity patterns similar to those reported at other sites. However, the common palm civet (*Paradoxurus hermaphrodites*) demonstrates behavioural flexibility to a diurnal activity pattern. Following the Borneo Carnivore Symposium held in Sabah, Malaysia in 2011 (<http://www.fwrc.msstate.edu/borneocarnivoresymposium/>) data for several of the small carnivores were modelled to predict distribution. Table 1 indicates whether these species were predicted to occur in the peat-swamp forests of Sebangau. We note the caveats implicit in modelling as discussed during this modelling process (Kramer-Schadt et al., 2013)

and that otters and the pangolin were not included in these models.

Borneo Nature Foundation and the Wildlife Conservation Research Unit (WildCRU), University of Oxford initiated the Sebangau Felid Project in May 2008 (Adul et al., 2015; Cheyne et al., 2010; Cheyne and MacDonald, 2011).

METHODS

Study Site

This study was conducted in the Natural Laboratory for the Study of Peat Swamp Forest, Sebangau catchment, Central Kalimantan, Indonesia 2°19' S; 113 ° 54' E (Fig. 1). The area is peat-swamp forest (Mixed-Swamp Forest sub-type) and was logged under a concession system from 1991-1997, followed by illegal logging from 1997-2004. The site is at an altitude ca. 10m a.s.l. The area

Table 1. Status of small carnivores in Sebangau based on camera trap data and predicted distribution. Bold indicates species confirmed in Sebangau.

Species	Latin name	Y/N	Predicted probability	Reference
Sunda Pangolin	<i>Manis javanica</i>	Y	Not assessed	NA
Borneo Ferret Badger	<i>Melogale everetti</i>	N	Not expected	Wilting et al., 2016
Hairy-nosed Otter	<i>Lutra sumatrana</i>	N	Not assessed	NA
Sunda Otter Civet	<i>Cynogale bennettii</i>	Y	High	Cheyne et al., 2010; Cheyne et al., 2016
Asian Small-clawed Otter	<i>Aonyx cinerea</i>	Y	Not assessed	NA
Binturong	<i>Arctictis binturong</i>	Y	Medium	Semiadi et al., 2016
Hose's Civet	<i>Diplogale hosei</i>	N	Low	Mathai et al., 2016
Collared Mongoose	<i>Herpestes semitorquatus</i>	Y	Low	Honet al., 2016
Banded Civet	<i>Hemigalus derbyanus</i>	N	Low	Ross et al., 2016
Banded Linsang	<i>Prionodon linsang</i>	Y	Medium	Duckworth et al., 2016
Common Palm Civet	<i>Paradoxurus hermaphroditus</i>	Y	Medium	Duckworth et al., 2016
Malay Civet	<i>Viverra zangara</i>	Y	Medium	Ross et al., 2016
Malay Weasel	<i>Mustela nudipes</i>	N	Low	Meijaard et al., 2016
Masked Palm Civet	<i>Paguma larvata</i>	N	Low	Semiadi et al., 2016
Short-tailed Mongoose	<i>Herpestes brachyurus</i>	Y	Medium	Duckworth et al., 2016
Small-toothed Palm Civet	<i>Arctogalidia trivirgata</i>	Y	Medium	Duckworth et al., 2016
Sunda Stink Badger	<i>Mydaus javanensis</i>	N	Low	Samejima et al., 2016
Yellow-throated Marten	<i>Martes flavigula</i>	Y	Low	Hon et al., 2016

was significantly affected by the forest fires which impacted Indonesia in 2015 (Wich et al., 2016).

Since 2008 a total of 160 cameras have been set in fixed forest areas. A combination of camera models were used including Cuddeback Expert®, Cuddeback Capture IR® (Cuddeback Digital, Non-Typical Inc, WI, USA) Maginon, Crenova and Bushnell. Camera traps were placed along human-made trails (>4 years old) and, where possible, watering areas, located to maximise the success rate of photographic ‘captures’. Activity times were collated as 06h00-12h00, 12h00-18h00, 18h00-00h00 and 00h00-06h00 to account for average dawn and dusk times in Sebangau, which is situated almost on the equator (see (Adul et al., 2015; Cheyne et al., 2013; Cheyne et al., 2016) for more information on the study site).

RESULTS

Small carnivores comprised 313 photographs (4.38% of total wildlife photos ($n = 7145$)) and

represent 11 species (Fig. 2). The most commonly represented species were short-tailed mongoose (37.06% $n = 116$), Malay civet (25.88%, $n = 81$) and common palm civet (15.02, $n = 47$). The least common species were binturong, (0.32%, $n = 1$), small-clawed otter (0.96%, $n = 3$), collared mongoose (1.6% $n = 5$) and Sunda pangolin (1.6%, $n = 5$).

Sunda Pangolin

Pangolins are highly under-represented in the camera trap data, with only 5 independent images in 10 years. Four images were captured in 2010 and a further single image in 2014 (Fig. 3).

Activity

The active time for the small carnivores shows a clear split between species’ active times (Fig. 4 and 5). Short-tailed mongoose, small-clawed otter and yellow-throated marten predominantly active from dawn to dusk. Banded linsang, Malay civet, Sunda otter civet, small-toothed palm civet, common palm civet active predominantly from dusk to dawn and

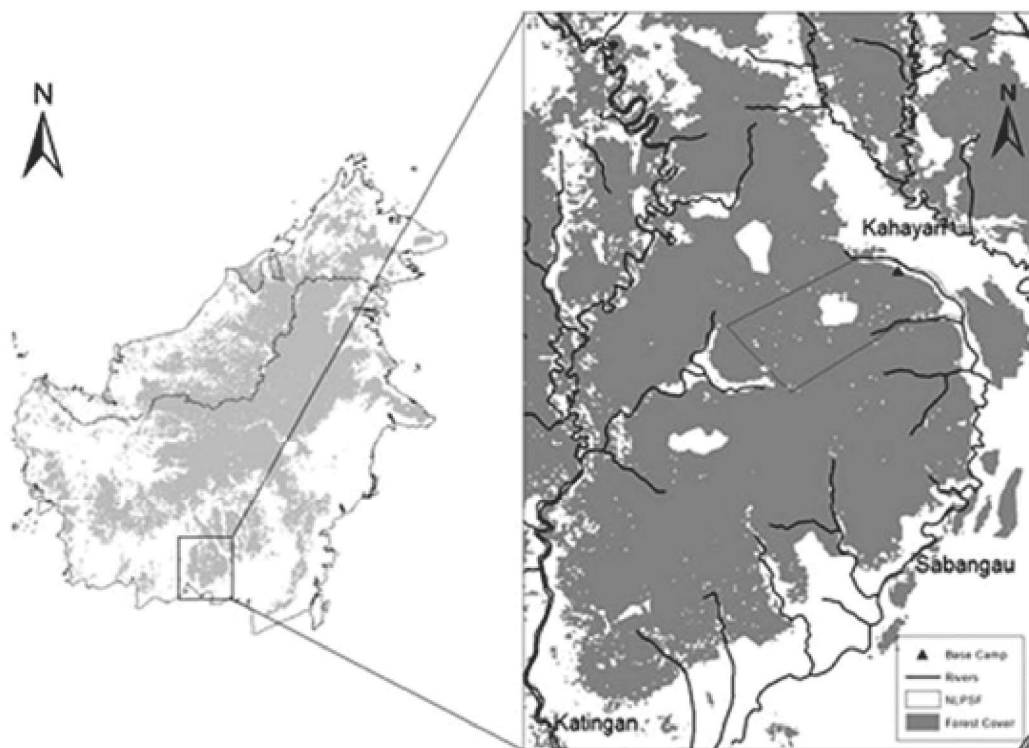


Figure 1. Study site in north-east Sebangau catchment in Central Kalimantan, Indonesia.

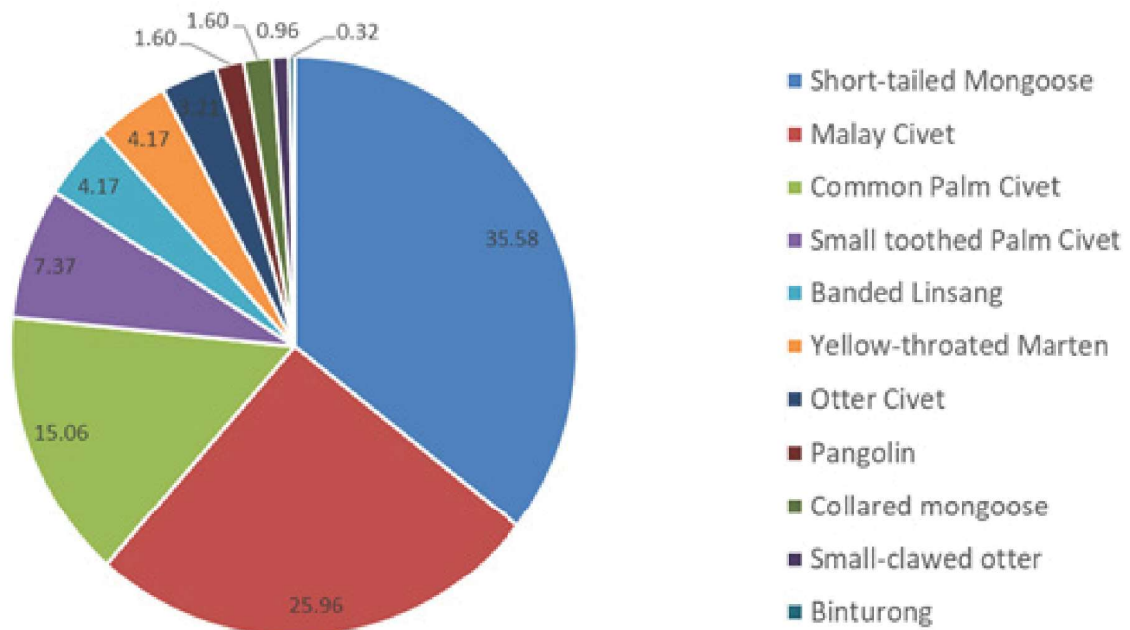


Figure 2. Representation of small carnivore species found in Sebangau as % of total carnivore images.

the Sunda pangolin only active at night. Binturong are not included as the number of photographs is too small to draw reasonable conclusions.

Species sighted but not photographed

Hairy-nosed otter (*Lutra sumatrana*) and the Malay weasel (*Mustela nudipes*) have reportedly been seen in the same area as the cameras by local people (Husson et al., 2009; Page et al., 1997) dating from 1993-2008. Masked palm civet, Sunda stink

badger and Hose's civet have a low probability of occurring in this habitat (Tab. 1).

DISCUSSION

The long period of time required to obtain photographs of small carnivores highlights the importance of long-term data and monitoring to avoid false-negative presence data.

Banded linsang are frequently thought to not appear on ground-based camera traps due to their arboreal and nocturnal activity (Azlan, 2003). These data highlight that long-term camera trapping studies are often required to obtain photo captures of elusive animals and to avoid reporting the false absence of these animals. Hairy-nosed otter are perhaps more likely to be present than not, but their ecology makes it difficult to get sightings/photos. Interestingly, the IUCN Red List does not have Sebangau as a location where hairy-nosed otters occur (IUCN 2015).

Data from Malaysian Borneo support the findings of the Malay civet as a nocturnal animal with activity times in Danum Valley ranging



Figure 3. Sunda pangolin, *Manis javanica*, on camera trap.

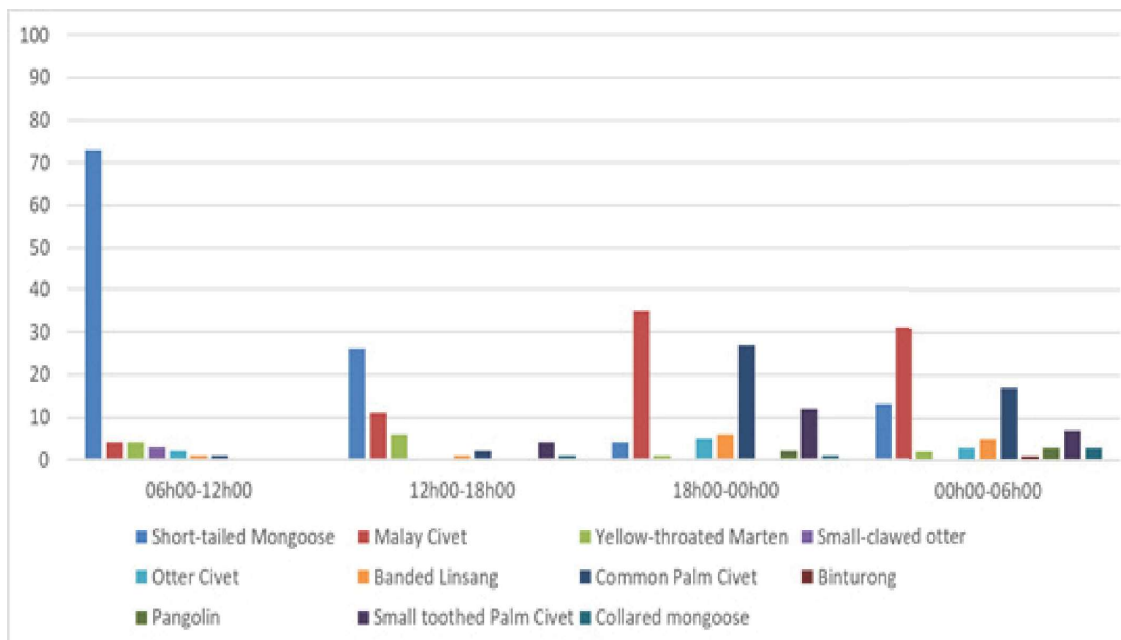


Figure 4. Activity times of small carnivores split into 6h blocks.

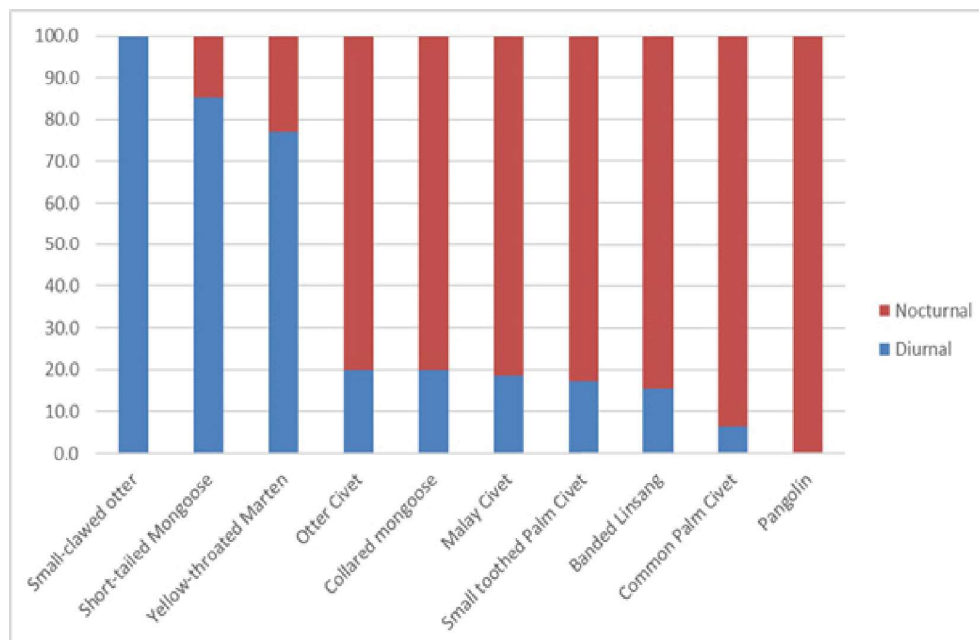


Figure 5. Active split of small carnivores (only species with >3 photos are included).

from 18h00 to 07h00 (Colon, 2002). Van Schaik and Griffiths (1996) concluded that viverrids in Borneo are generally nocturnal as is the carnivore ancestral condition (Martin, 1990). Studies of other forest civet species reveal consistently nocturnal patterns (Dhungel and Edge, 1985; Joshi et al., 1995; Macdonald and Wise, 1979; Rabinowitz, 1991). The common palm civet is confirmed as

predominantly nocturnal in Sebangau, not diurnal as presented in (Cheyne et al., 2010). The yellow-throated marten is primarily diurnal (Duckworth, 1997; Grassman Jr et al., 2005), a behaviour pattern which is supported by data from Sebangau. Mongooses are also reported as diurnal with 85% of Sebangau sightings being between 06h00 and 18h00 (Belden et al., 2007).

Of the species for which there are too few photos to draw concrete conclusions, the Asian small-clawed otters are reported as nocturnal and crepuscular (Foster-Turly, 1992), though all 3 photos from Sebangau were taken after dawn. Eight of ten photos of the otter civet were nocturnal, concurring with data from Sarawak (Sebastian, 2005), though the same author also suggests that it is also occasionally active during the day (Sebastian, 2005). Of 13 photos of the banded linsang, 11 were between dusk and dawn, agreeing with other data that this animal is nocturnal (Azlan, 2003).

For all these species, bar the Malay civet, the data from Borneo are poor and from Indonesian Borneo are almost non-existent (IUCN, 2016). The data presented here highlight the value of camera traps and offer new information on the activity and distribution of the Bornean small carnivore guild.

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