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Fosa *Cryptoprocta ferox* (Photo:Eileen Wyza)

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The views expressed in this publication are those of the authors and do not necessarily reflect those of IUCN, nor the IUCN SSC Small Carnivore Specialist Group. The aim of this publication is to offer the members of the IUCN SSC Small Carnivore Specialist Group, and those who are concerned with small carnivores in families of Ailuridae, Eupleridae, Herpestidae, Mephitidae, Mustelidae, Nandiniidae, Prionodontidae, Procyonidae and Viverridae, original papers, news items, abstracts, and titles of recent literature. Prospective authors (who need not be members of the specialist group) should submit material to the Editors-in-chief.

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Editorial:

Changes to the conservation status and the distribution of the world´s small carnivores

The IUCN Red List of Threatened Species is the most reliable and authoritative source of information regarding the conservation status of biodiversity globally (Schipper *et al*. 2008a, Schipper *et al*. 2008b). This list gets periodical updates, including new assessments for new species or those that were not previously assessed, and accounting for changes to the conservation status of all previously-assessed species, including both genuine and nongenuine changes (i.e., real change on conservation status; Hoffmann *et al*. 2010). These assessments are, in most cases, coordinated by the IUCN SSC Specialist Groups, in the hands of the appointed Red List Authorities, which helps maintain Red Lists updated for each group. For mammals, such systematic assessments started in 1996 (IUCN 1996) and the most updated global assessment was finalized in 2008 (Schipper *et al*. 2008a). In 2015 a new assessment for all small carnivores was released following the accumulation of a significant increase in knowledge (Ramírez-Chaves *et al*. 2016, González-Maya & Ramírez-Chaves 2017). The latest assessment included updates to species assessments and even some changes to previous conservation status assessments. Here I present the current global conservation status and distribution of all small carnivores.

In 2008, 165 small carnivore species were assessed, including one species assessed as Critically Endangered (CR), ten Endangered (EN) and 22 Vulnerable (VU; Schipper *et al*. 2008a, Schipper *et al*. 2008b; Appendix 1). In 2015, a total of 172 species were assessed, with considerable changes on these numbers (Figure 1, Appendix 1). Many changes occurred given significant changes on taxonomic status of many species, but also due to the increase on global small carnivore research and knowledge in general.

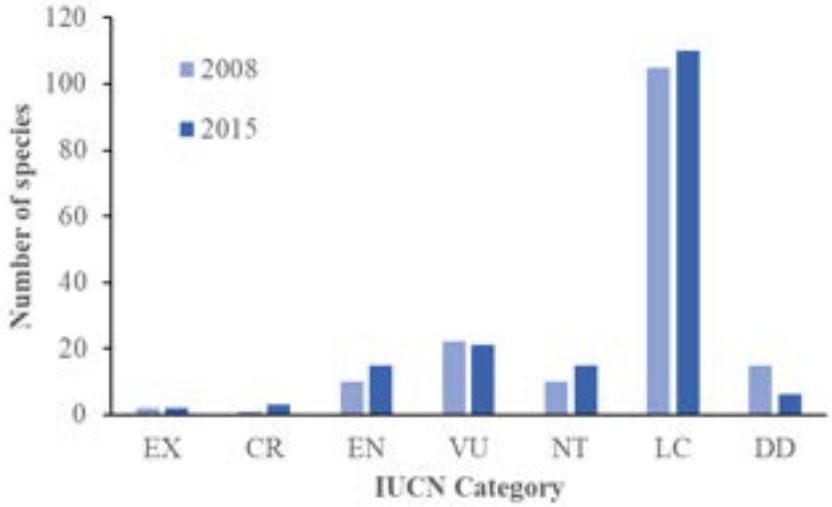

Figure 1. Number of species on each IUCN Red List of Threatened Species category in 2008 and 2015.

For instance, the most significant change occurred on the Data Deficient category, changing from 15 species in 2008 to 6 species in 2015; other changes included the Endangered category from 10 species in 2008 to 15 species in 2015 and from one Critically Endangered species in 2008 to three species in 2015 (Figure 1; Appendix 1). The increase on the number of species assessed is mostly related to newly described species or taxonomic changes (13 spp., e.g., *Bassaricyon* spp. or *Nasuella* spp.; Helgen *et al*. 2009, 2013), however, there are also a number of genuine changes to the threat level of certain species (e.g., *Ailurus fulgens*, *Euplere goudotii*). Remarkably, 19 species were up listed to a higher category level (e.g., *Ailurus fulgens* [VU to EN], *Fossa fossana* [NT to VU], *Mustela lutreola* [EN to CR]) and only six species were down listed to a lower category (e.g., *Herpestes fuscus* [VU to LC], *Gulo gulo* and *Viverra zibetha* [NT to LC]); nine species were also recategorized from Data Deficient to a different category (i.e., NT or LC), showing an increase on species knowledge (i.e., *Crossarchus ansorgei* [DD to LC], *Herpestes semitorquatus* [DD to NT], *Lyncodon patagonicus* [DD to LC]). Interestingly, only one species (*Genetta abyssinica*) moved from LC to DD.

As was previously found for all mammals (Schipper *et al.* 2008a) and for small carnivores (Schipper *et al.* 2008b), updates to the distribution of small carnivores still shows a significant concentration towards the tropical areas (Figure 2A); small carnivores are largely concentrated towards the Afrotropical and Indomalaya realms as was previously found for the group (Schipper *et al*. 2008b; Figure 2A). In terms of threat categories, Critically Endangered species are located in Europe (*Mustela lutreola*), India (*Viverra civettina*) and Mexico (*Procyon pygmaeus*; Figure2B). Endangered species are largely concentrated towards Asia with a high number of species in the southern cone of South America (Figure 2C) while Vulnerable species are mostly concentrated in Asia and Madagascar (Figure 2D).

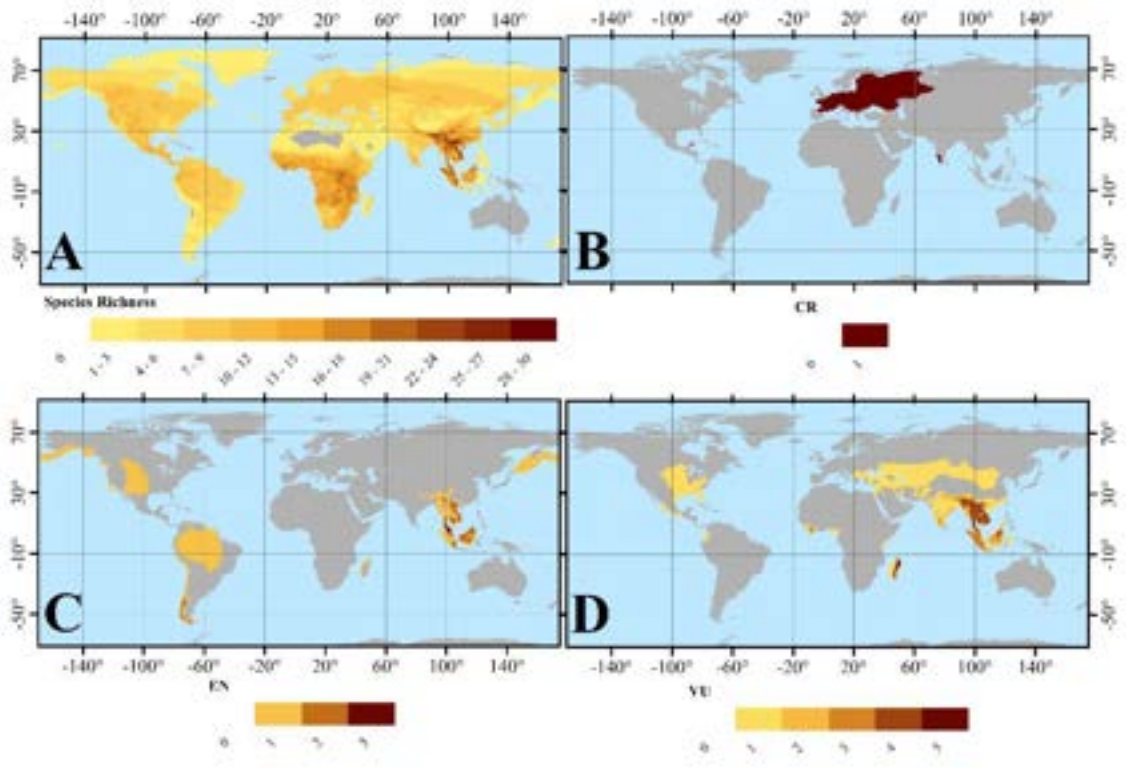

Figure 2. Distribution of small carnivore (A) species richness and those categorized as (B) Critically Endangered - CR, (C) Endangered – EN and (D) Vulnerable - VU.

Current assessment of small carnivores shows two clear patterns: first, knowledge and research has been increasing considerably in recent years, which reflects in our ability to properly assess many species; second, some species have genuinely been uplisted given the advance on many of the threats and the potential decrease in overall populations. Despite previous patterns are still very similar after recent assessments, it is noteworthy the increase in the number of new species in a relative short period of time, and most importantly, the overall worsening on the conservation status of a large proportion of species within the group.

Previous assessments have provided clues on the most critical areas for prioritizing conservation actions for small carnivores. However, it is evident from the most recent assessment that threats to the conservation of small carnivores change over time along with our understanding of their needs. We therefore emphasize the importance of regularly updating species accounts to properly define where protective actions should be focused. This editorial does not aim for an exhaustive account on the changes, but only as an informative approach to help direct priorities as part of the IUCN SSC Small Carnivore Specialist Group actions and in general for small carnivore conservation across the globe.

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Appendix 1. IUCN Red List for small carnivores comparing the 2008 assessment (Schipper et al. 2008) and current status (EX: Extinct, CR: Critically Endangered, EN: Endangered, VU: Vulnerable, DD: Data Deficient, NT: Near Threatened, LC: Least Concern).

Family	Species	2008 Assessment	Current Assessment	Year assessed	Criteria
AILURIDAE	*Ailurus fulgens*	VU	EN	2015	A2cde+3cde+4cde
EUPLERIDAE	*Cryptoprocta ferox*	VU	VU	2016	A2cde+3cde+4cde
	Cryptoprocta spelea	EX	EX	2008	
	Eupleres goudotii	NT	VU	2016	A2cde+3cde+4cde
	Eupleres major	-	EN	2016	A2cde+3cde+4cde
	Fossa fossana	NT	VU	2008	A3cde+4cde
	Galidia elegans	LC	LC	2008	
	Galidictis fasciata	NT	VU	2016	A3cde+4cde
	Galidictis grandidieri	EN	EN	2008	B1ab(i,ii,iii,v)
	Mungotictis decemlineata	VU	EN	2008	A3cde+4cde
	Salanoia concolor	VU	VU	2016	A3cde+4cde
HERPESTIDAE	*Atilax paludinosus*	LC	LC	2008	
	Bdeogale crassicauda	LC	LC	2016	
	Bdeogale jacksoni	NT	NT	2008	
	Bdeogale nigripes	LC	LC	2008	
	Bdeogale omnivora	VU	VU	2016	C1
	Crossarchus alexandri	LC	LC	2008	
	Crossarchus ansorgei	DD	LC	2015	
	Crossarchus obscurus	LC	LC	2008	
	Crossarchus platycephalus	LC	LC	2016	
	Cynictis penicillata	LC	LC	2008	
	Dologale dybowskii	DD	DD	2011	
	Helogale hirtula	LC	LC	2015	
	Helogale parvula	LC	LC	2008	
	Herpestes auropunctatus	-	LC	2016	
	Herpestes brachyurus	LC	NT	2016	
	Herpestes edwardsii	LC	LC	2016	
	Herpestes flavescens	LC	LC	2008	
	Herpestes fuscus	VU	LC	2015	
	Herpestes ichneumon	LC	LC	2016	
	Herpestes javanicus	LC	LC	2016	
	Herpestes naso	LC	LC	2008	
	Herpestes ochraceus	LC	LC	2008	
	Herpestes pulverulentus	LC	LC	2008	
	Herpestes sanguineus	LC	LC	2016	
	Herpestes semitorquatus	DD	NT	2015	
	Herpestes smithii	LC	LC	2016	
	Herpestes urva	LC	LC	2015	
	Herpestes vitticollis	LC	LC	2016	
	Ichneumia albicauda	LC	LC	2008	
	Liberiictis kuhni	VU	VU	2016	C1
	Mungos gambianus	LC	LC	2016	
	Mungos mungo	LC	LC	2016	
	Paracynictis selousi	LC	LC	2016	
	Rhynchogale melleri	LC	LC	2015	
	Suricata suricatta	LC	LC	2008	
MEPHITIDAE	*Conepatus chinga*	LC	LC	2016	
	Conepatus humboldtii	LC	LC	2016	
	Conepatus leuconotus	LC	LC	2016	
	Conepatus semistriatus	LC	LC	2016	
	Mephitis macroura	LC	LC	2008	
	Mephitis mephitis	LC	LC	2016	
	Mydaus javanensis	LC	LC	2015	
	Mydaus marchei	LC	LC	2008	
	Spilogale angustifrons	LC	LC	2016	
	Spilogale gracilis	LC	LC	2016	
	Spilogale putorius	LC	VU	2016	A2abc+3bc+4abc
	Spilogale pygmaea	VU	VU	2016	A2ce
MUSTELIDAE	*Aonyx capensis*	LC	NT	2015	
	Aonyx cinereus	VU	VU	2008	A2acde
	Aonyx congicus	LC	NT	2015	
	Arctonyx albogularis	-	LC	2016	
	Arctonyx collaris	NT	VU	2016	A2cd+3cd+4cd
	Arctonyx hoevenii	-	LC	2016	
	Eira barbara	LC	LC	2016	
	Enhydra lutris	EN	EN	2008	A2abe
	Galictis cuja	LC	LC	2015	
	Galictis vittata	LC	LC	2016	
	Gulo gulo	NT	LC	2016	
	Lutra maculicollis	LC	NT	2015	
	Ictonyx libycus	LC	LC	2015	
	Ictonyx striatus	LC	LC	2008	
	Lontra canadensis	LC	LC	2015	
	Lontra felina	EN	EN	2015	A3cde
	Lontra longicaudis	DD	NT	2015	
	Lontra provocax	EN	EN	2015	A3cde
	Lutra lutra	NT	NT	2015	
	Lutra sumatrana	EN	EN	2015	A2cde
	Lutrogale perspicillata	VU	VU	2015	A2cde
	Lyncodon patagonicus	DD	LC	2016	
	Martes americana	LC	LC	2016	
	Martes flavigula	LC	LC	2016	
	Martes foina	LC	LC	2016	
	Martes gwatkinsii	VU	VU	2015	D1
	Martes martes	LC	LC	2016	
	Martes melampus	LC	LC	2008	

Family	Species	2008 Assessment	Current Assessment	Year assessed	Criteria
	Martes pennanti	LC	LC	2016	
	Martes zibellina	LC	LC	2016	
	Meles anakuma	LC	LC	2016	
	Meles leucurus	LC	LC	2016	
	Meles meles	LC	LC	2016	
	Mellivora capensis	LC	LC	2016	
	Melogale cucphuongensis	-	DD	2016	
	Melogale everetti	DD	EN	2015	B1ab(ii,iii,v)
	Melogale moschata	LC	LC	2016	
	Melogale orientalis	DD	LC	2016	
	Melogale personata	DD	LC	2016	
	Mustela africana	LC	LC	2016	
	Mustela altaica	NT	NT	2016	
	Mustela erminea	LC	LC	2016	
	Mustela eversmanii	LC	LC	2008	
	Mustela felipei	VU	VU	2016	C2a(i)
	Mustela frenata	LC	LC	2016	
	Mustela itatsi	LC	NT	2016	
	Mustela kathiah	LC	LC	2016	
	Mustela lutreola	EN	CR	2016	A3ce
	Mustela lutreolina	DD	LC	2016	
	Mustela nigripes	EN	EN	2008	C1+2a(i); D
	Mustela nivalis	LC	LC	2016	
	Mustela nudipes	LC	LC	2008	
	Mustela putorius	LC	LC	2014	
	Mustela russelliana	-	DD	2016	
	Mustela sibirica	LC	LC	2016	
	Mustela strigidorsa	LC	LC	2016	
	Mustela subpalmata	LC	LC	2016	
	Mustela tonkinensis	-	DD	2016	
	Neovison macrodon	EX	EX	2008	
	Neovison vison	LC	LC	2016	
	Poecilogale albinucha	LC	LC	2008	
	Pteronura brasiliensis	EN	EN	2015	A3ce
	Taxidea taxus	LC	LC	2008	
	Vormela peregusna	VU	VU	2016	A2c
NANDINIIDAE	*Nandinia binotata*	LC	LC	2008	
PRIONODONTIDAE	*Prionodon linsang*	LC	LC	2016	
	Prionodon pardicolor	LC	LC	2016	
PROCYONIDAE	*Bassaricyon alleni*	LC	LC	2016	
	Bassaricyon beddardi	LC	-	2008	
	Bassaricyon gabbii	LC	LC	2016	
	Bassaricyon lasius	DD	-	2008	
	Bassaricyon medius	-	LC	2016	
	Bassaricyon neblina	-	NT	2016	
	Bassaricyon pauli	DD	-	2008	
	Bassariscus astutus	LC	LC	2008	
	Bassariscus sumichrasti	LC	LC	2008	
	Nasua narica	LC	LC	2016	
	Nasua nasua	LC	LC	2008	
	Nasuella meridensis	-	EN	2016	B1ab(iii,v)
	Nasuella olivacea	DD	NT	2016	
	Potos flavus	LC	LC	2016	
	Procyon cancrivorus	LC	LC	2008	
	Procyon lotor	LC	LC	2008	
	Procyon pygmaeus	EN	CR	2008	C2a(ii)
VIVERRIDAE	*Arctictis binturong*	VU	VU	2016	A2cd+3cd+4cd
	Arctogalidia trivirgata	LC	LC	2016	
	Chrotogale owstoni	VU	EN	2016	A2bcd+3bcd+4cd
	Civettictis civetta	LC	LC	2011	
	Cynogale bennettii	EN	EN	2015	C1
	Diplogale hosei	VU	VU	2015	C1
	Genetta abyssinica	LC	DD	2016	
	Genetta angolensis	LC	LC	2016	
	Genetta bourloni	NT	VU	2008	C1
	Genetta cristata	VU	VU	2008	C1
	Genetta genetta	LC	LC	2008	
	Genetta johnstoni	VU	NT	2016	
	Genetta maculata	LC	LC	2016	
	Genetta pardina	LC	LC	2016	
	Genetta piscivora	DD	NT	2008	
	Genetta poensis	DD	DD	2008	
	Genetta servalina	LC	LC	2016	
	Genetta thierryi	LC	LC	2008	
	Genetta tigrina	LC	LC	2008	
	Genetta victoriae	LC	LC	2016	
	Hemigalus derbyanus	VU	NT	2015	
	Macrogalidia musschenbroekii	VU	VU	2008	A2cd+3cd+4cd; C1
	Paguma larvata	LC	LC	2016	
	Paradoxurus hermaphroditus	LC	LC	2016	
	Paradoxurus jerdoni	LC	LC	2016	
	Paradoxurus zeylonensis	VU	LC	2016	
	Poiana leightoni	DD	VU	2015	C1
	Poiana richardsonii	LC	LC	2008	
	Viverra civettina	CR	CR	2016	C2a(i)
	Viverra megaspila	VU	EN	2016	A2cd+3cd+4cd
	Viverra tangalunga	LC	LC	2016	
	Viverra zibetha	NT	LC	2016	
	Viverricula indica	LC	LC	2015	

IUCN/SSC Small Carnivore Specialist Group

SHORT COMMUNICATION

Mountain Weasel *Mustela altaica* records in Ladakh, Jammu and Kashmir state, India

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Abstract.

Distribution maps for Mountain Weasel *Mustela altaica* do not include Ladakh in the north Indian state of Jammu and Kashmir. However, it is common knowledge that this species occurs there and that it is observed on a weekly basis by nature guides and eco-tourists. This is an account of my sightings with exact coordinates and altitudes where this species has been observed, along with referenced reports of colleagues who have seen the species in the area. Based on this information, the distribution maps for this species should be corrected to include the locations specified; this information was used to update the 2016 account of this species in The IUCN Red List of Threatened Species.

Keywords: Hemis National Park, *Mustela altaica*, Ladakh, Northern India, Altai Weasel, Mountain Weasel

Mountain Weasel *Mustela altaica*, also known as the Altai Weasel, is found throughout central Asia and in the Himalayan mountain range. According to the previous distribution map (Abramov 2016) this weasel is very localized in India (Figure 1) and was thought to be restricted to a small area near the tri-point junction with Tibet (China) and Nepal. It was not recognized to occur within 420 km of Hemis National Park or the city of Leh. Lariviere & Jennings (2009) did not include Ladakh in their distribution map for this species.

Figure 1. The IUCN Red List distribution map of Mountain Weasel *Mustela altaica* in Northern India from 2014 (its previous assessment). Areas highlighted in yellow represent the species distribution.

However, common knowledge backed up by photographic evidence confirms that this species does occur in Leh, Hemis National Park and the vicinity. All geographic coordinates and altitudes in the following paragraphs are taken from Google Earth (Google Earth, 2014)

Mountain Weasel is often recorded from the Indus river valley, around the city of Leh, at elevations of around 3,500 m asl. The species has been seen near the Thikse Monastery (3,600 m), around tributaries of the Indus River, and in other areas surrounding Leh. Along with the enigmatic Snow Leopard *Panthera uncia*, this species is one of several animals that people come to this area to observe and photograph.

Figure 1. (A) Mountain Weasel *M. altaica* at Rumbak Village camp, Hemis National Park, Jammu and Kashmir state, India, October 9, 2014 and (B) back and tail coloration of a Mountain Weasel *M. altaica* at Rumbak Village Camp, Hemis National Park, India, 9 October 2014.

In October 2014, I joined an expedition led by Phunchok Tsering at Exotic Travel in Ladakh (www.exoticladakh.com) into the Himalayas of Ladakh, and specifically, Hemis National Park. The expedition was focused on finding Snow Leopards, but there was some emphasis on Mountain Weasel and other species.

While on the excursion, we encountered Mountain Weasels three times in the park and another time whilst driving back to Leh. Our first encounter with the species was at our camp – Rumbak Village Camp (34°03'25"N, 77°25'29"E at an altitude of about 3,900 m). The guides found the weasel in the rocks near the dining tent (see Figure 2). The animal was identified as Mountain Weasel based on the following: longer tail and larger size than Least Weasel *M. nivalis*; lack of black tip and relatively low contrast between upperparts and underparts, unlike the Stoat *M. erminae*; lighter underparts and lack of black mask, as opposed to Siberian Weasel *M. sibirica*; white feet and lighter overall coloration than in Yellow-bellied Weasel *M. kathiah* (Dinets & Rotshild 2005, Lariviere & Jennings 2009).

When we first saw the weasel, it rested on the rocks, but as more people came to view and photograph it, it darted in and out of natural piles of rocks and old stone walls. It ran and hopped from one rocky area to another with great speed and agility. The encounter lasted about 10-15 minutes after which it ran up the dry riverbed and into some bushes. Throughout the rest of our nine-night excursion to Hemis National Park, we encountered two more individuals, at the following localities: once near the 'lower' Kandala Camp (34°02'48"N, 77°23'28"E at an altitude of about 4,400 m), and only an hour later near the 'higher' Kandala Camp (34°02'44"N, 77°22'41"E which is at about 4,500 m). During my stay in Hemis, another observation was made by a separate tour group in the nearby Rumbak Village (34°03'16"N, 77°25'5"E, at 4,505 m). A final observation was made by our driver on the way back to Leh; although it was unconfirmed, the guides are very familiar with this species and are expert identifiers.

Altogether, there were a total of five observations of *M. altaica* in 10 days; three of these were direct observations. This suggests that this animal is not only present in the area but also relatively common. Based on this information and other reports, the distribution range for *M. altaica* should be expanded to include Ladakh. Several other reports with photographic evidence of this species in Ladakh are found on the India page of the mammal watching website, www.mammalwatching.com. This information was used to update the 2016 assessment of this species in The IUCN Red List of Threatened Species; other distribution maps also need to be corrected.

The information presented here is an excellent example of how records and information gathered by naturalists and mammal watchers can be used to improve understanding of a species' distribution and therefore its conservation status.

Acknowledgements

I would like to thank Phunchok Tsering from Exotic Travel in Ladakh for organizing this excursion and using a team of skilled professionals to find us the Mountain Weasel along with Snow Leopards, Wolves, and many other interesting species. I would also like to thank biologist Vladimir Dinets for referring me to the Small Carnivore Conservation journal so that I can share this information in a relevant forum. Finally, I would like to thank the other participants in my group who took part in finding, observing and documenting this species and other species we encountered on the excursion: Jon Hall, Charles Foley, Jason Woolgar, James Woolgar, Morten Joergensen and Kate Goldberg. Peter Zahler and Alexei Abramov provided comments that greatly improved this manuscript.

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SHORT COMMUNICATION

Camera-trap records of groups of ten and eleven Honey Badgers *Mellivora capensis* in northern Botswana

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Abstract.
Camera traps in Wildlife Management Area NG33 to the east of the Okavango Delta in northern Botswana captured videos of groups of ten and 11 Honey Badgers *Mellivora capensis* travelling close together. These group sizes are close to the maximum ever recorded, and double the previous maximum reported from southern Africa. How and why these large groups formed is unknown.

Keywords: Honey Badger, Ratel, *Mellivora capensis*, mustelid, social behaviour, Okavango, Botswana.

Détection par pièges photographiques de groupes de dix et onze ratels *Mellivora capensis* dans le nord du Botswana

Résumé.
Des pièges photographiques dans la Zone de Gestion de la Faune NG33 à l'est du delta de l'Okavango, dans le nord du Botswana, ont capturé des vidéos de groupes de dix et onze ratels *Mellivora capensis* voyageant près l'un de l'autre. Ces tailles de groupe sont proches du maximum jamais enregistré, et le double du maximum précédent rapporté pour l'Afrique australe. Comment et pourquoi ces grands groupes se sont formés est inconnu.

Mots-clés: Blaireau à miel, Ratel, *Mellivora capensis*, mustélidé, comportement social, Okavango, Botswana

Honey Badgers *Mellivora capensis* are large mustelids with a distribution stretching from the southern tip of Africa, through the middle East to Nepal and India (Do Linh San *et al.* 2016). Although they are widespread, their density appears to be low, and local populations are vulnerable to human–wildlife conflict. They are opportunistic predators and in the only area where they have been studied intensively – the southern Kalahari – they live in large, overlapping home ranges. There adults are solitary, but young stay with their mothers until they are nearly full grown at 12–16 months of age (Kingdon 1977, Begg 2001, Begg *et al*. 2003, 2005, 2013).

In northern Botswana, the Botswana Predator Conservation Trust used camera traps to monitor the reactions of Leopards *Panthera pardus* to the scent of a component of their urine. The camera traps were in sets of four, each with two cameras 30 m apart on opposite sides of a vehicle track, facing each other along the track, mounted 78 cm off the ground, and two cameras 10 m apart on opposite sides of the track, aimed diagonally across the track, mounted 58 cm off the ground. All the cameras were 1 m from the edge of the track. The cameras were Reconyx Ultrafire XR6s (Reconyx, Holmen, WI, USA), set for high sensitivity, 1 s trigger delay (the minimum), taking 30 s of video on each trigger. Videos taken at night were illuminated by long-wave (940 nm) infrared floodlights in the cameras.

In the early morning of 17 May 2017 three of a four-cameras array at 19°32’7” S, 23°38’36” E in the NG 33 Wildlife Management Area east of the Okavango Delta captured two consecutive 30 s videos of a group of Honey Badgers trotting past, heading south. On the videos from the last camera in the array, the leading badger that triggered the camera was followed by another one that passed the camera 6 s later, and then by four in a tight bunch after a further 4 s, and a single one 16 s behind the leader. No others appeared until the camera triggered again when a single badger ran past 40 s after the start of the first video, followed by another after 7 s and another after a further 8 s. Ten Honey Badgers passed the camera in 55 s, all going in the same direction (Videos available at: Link1, Link2). Two of the other three cameras captured the same number of animals in two consecutive videos. The fourth camera had been pushed out of position by an elephant and captured only two.

On 17 June 2017 a camera array at 19°30’3” S, 23°38’47” E about 4.8 km northeast of the previous site, captured a group of 11 Honey Badgers moving south along the road. A leading bunch of six was followed after 4 s by another badger, and after 14 s by two more. The next video shows a single badger 34 s behind the bunch of six, followed by another one 8 s later. The one at the rear was limping on its left hind leg (Video available at: Link3). The two other working cameras at the site confirmed the group size.

Figure 1. Partial view of a video extract with part of the 10-individuals group of Honey Badgers recorded in the NG 33 Wildlife Management Area east of the Okavango Delta, Botswana.

The videos are not clear enough to see what sex any of the badgers were. There were no overt interactions between any of them.

These are clearly exceptional group sizes for Honey Badgers; they are usually seen singly, sometimes in twos and rarely in threes. In southern Africa the largest recorded

group had five members (Begg 2001), and Kingdon (1977) reports observers having seen four, six, eight and 12 together in east Africa. The twelve were foraging in a cattle *kraal* but the behaviour of the other large groups, and whether the twelve were, as is likely, simply an aggregation at a rich food source, is unrecorded. What prompted ten and 11 Honey Badgers to travel together is unknown; and no explanation based on known Honey Badger behaviour is plausible. No individual badgers can be recognised from the videos, and the possibilities that the group persisted for a month, that it dispersed and reformed, or that there were two groups with different or overlapping membership all seem unlikely. Both groups were travelling; they were certainly not aggregated at a rich food source, and although groups of up to three males are known to pursue females for mating (Begg 2001), and females may be accompanied by one or two grown cubs, an assembly of ten or eleven would require multiples of such groupings. The behaviour of all the animals matched the "determined straight line trotting" of male associations (Begg 2001) but the two groups were double the size of the largest male association seen by previous authors.

No matter why or how the groups formed, their occurrence shows that there is much still to learn about these charismatic animals.

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SHORT COMMUNICATION

First photographic record of Binturong *Arctictis binturong* in Buxa Tiger Reserve, West Bengal, India

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Abstract.

Binturong *Arctictis binturong* was first reported from two locations in Buxa Tiger Reserve. It was first camera-trapped in the East Himalayan Subtropical Wet Hill forest of Phaskhawa block (Bhutiabasti Beat, Jainti Range) in 2015. An adult male binturong, which strayed out of the eastern sub-montane semi-evergreen forest of Bhutanghat block (Mainabari Beat, North Rydak Range) into a village (West Khalisamari) near Narathali forests under South Rydak Range, was also rescued by cage-trapping and released in its natural habitat at Bhutanghat- 2 compartment near a water source.

Keywords: Hill forests, camera-trap, straying, rescue, rehabilitation.

Within the Indian limits, Binturong *Arctictis binturong*, a Vulnerable (Willcox *et al.* 2016), sparsely distributed and rarely sighted species, is known from all the states of North-east, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, West Bengal (northern parts), Sikkim and Tripura (Choudhury 2013). Earlier, Choudhury (1999) observed that its records from Sikkim and Bhutan suggest that small numbers do occur in the adjacent areas of Neora Valley National Park and also, perhaps, Buxa Tiger Reserve (BTR) in northern Bengal. However, to date, there are no sighting records of this species in northern Bengal prior to the present study (2015) in BTR.

A Binturong was sighted in the moderately dense lower hill forests (Sachaphu forests of Buxa Hills in Sinchula Range) up to an altitude of 650 m under East Division, BTR. First, 100 pairs of automatic trap cameras were set up in the remote sensitive locations of the East Division of BTR (Figure 1). The camera-traps captured the animal at two places in the East Himalayan Subtropical Wet Hill forest (8B/CI) of Phaskhawa block, but the nocturnal images were quite hazy.

Thereafter, on 23 December 2015, a rescue team cage-trapped an adult male binturong that strayed into a fringe village (West Khalisamari) of South Rydak Range (Figure 2) and released it next day morning in its natural habitat of the Eastern Sub-

montane semi-evergreen forest (2B/CIb) in Bhutanghat block under Mainabari Beat of North Rydak Range, BTR (Figure 3).

More scientific investigations including monitoring the habitats of Binturong in the entire Buxa hills are necessary to ensure conservation and survival of this very rare species.

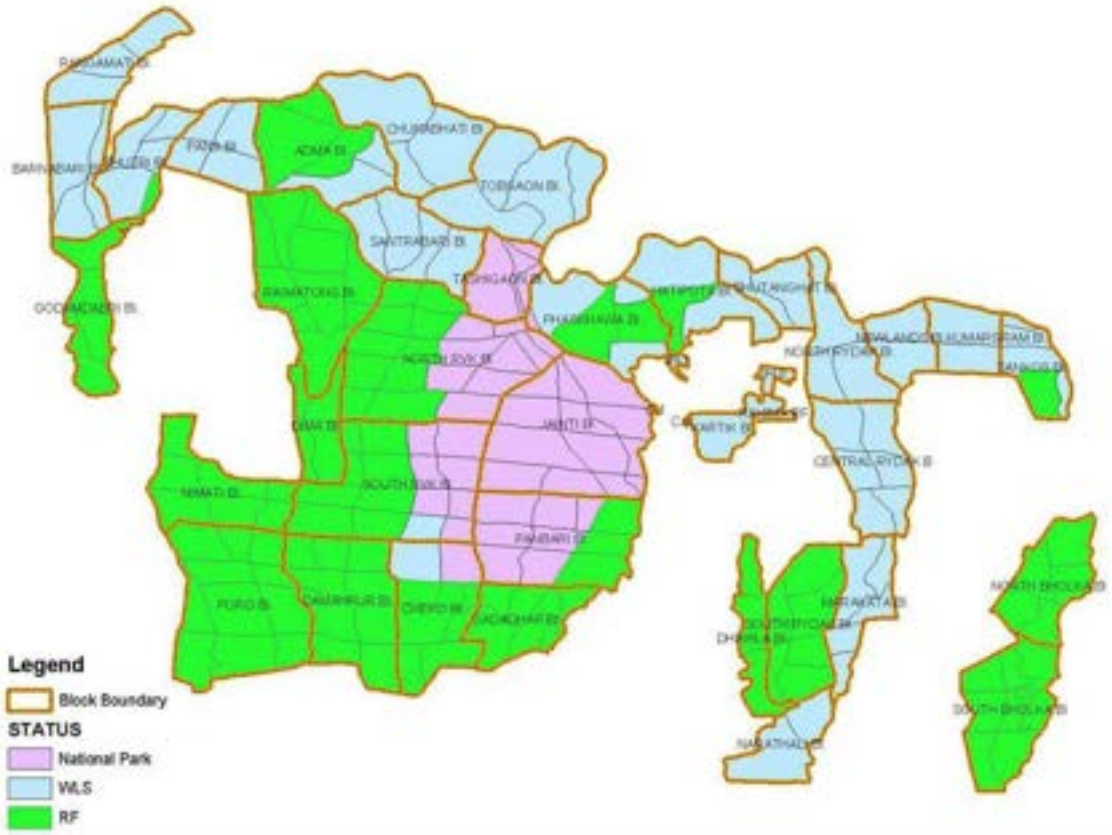

Figure 1. Map of Protected Areas in Buxa Tiger Reserve, Northern Bengal.

Figure 2. Binturong *Arctictis binturong* trapped at Paschim Khalisamari village, Northern Bengal.

Figure 3. Binturong *Arctictis binturong* released in Bhutanghat block under Mainabari Beat of North Rydak Range, BTR.

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SHORT COMMUNICATION

Sighting of a Malay Weasel *Mustela nudipes* at Khlong Saeng Wildlife Sanctuary, Southern Thailand

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Abstract.

A Malay Weasel *Mustela nudipes* was photographed at Khlong Saeng Wildlife Sanctuary, southern Thailand on 10 February 2017. This represents a new locality but is within the known Sundaic range.

Keywords: Malay Weasel, *Mustela nudipes*, Khlong Saeng Wildlife Sanctuary, Thailand, Sundaic region.

Malay Weasel *Mustela nudipes* has been recorded from various habitats, from disturbed to primary forests and across a wide range of elevations (Duckworth *et al.* 2006, Meijaard *et al.* 2016). Its distribution is limited to the Sundaic sub-region in South-east Asia (between approximately 10°N and 5°40 ' S, see Figure 1 in Duckworth *et al.* 2006). Duckworth *et al.* (2006) compiled records of Malay Weasel throughout its world range and traced few records from Thailand, as did Chutipong *et al.* (2014), in a national review of small carnivore status.

Khlong Saeng Wildlife Sanctuary (Khlong Saeng WS) is located in southern Thailand, between 9°01' and 9°22' N and 98°30' and 98°50' E. The 1,155 km^2 sanctuary ranges in altitude from 100 to 1,272 m asl (above sea level). The wildlife sanctuary's main habitat type is evergreen forest. An area of 165 km^2 of lowland evergreen forest was flooded by the Ratchaprapha reservoir in the south of the sanctuary (Nakhasathien 1989). The wet season occurs during April to November and the dry season occurs during December to March (DNP 2006).

On 10 February 2017, we walked a line transect survey for Galliformes around the Pha Pueng area (close to Tham Jear sub-station) in Khlong Saeng WS. The survey ran from 06h30 to 08h30. At 08h16, a Malay Weasel (Figure 1) was observed. The animal was scraping the ground, presumably searching for food. There was a noticeable smell, presumably released by the animal, when it fled. The sighting was at 9°09'03" N,

98°42’01” E, at an elevation of 320 m asl recorded on a GPS (Garmin GPSmap 62s). It was in little-disturbed evergreen forest with sparse ground cover, about 2 km from the reservoir.

This is the first record of a Malay Weasel from Khlong Saeng WS, although the location is inside the known range of the species (see Duckworth *et al.* 2006). Individual records with proper documentation such as this will improve understanding of weasel distribution and conservation status in mainland South-east Asia (e.g. Cheah 2016).

The smell, that was apparently released by the weasel, might be some sort of defence mechanism. Similar behaviour has been recorded in a captured Stripe-backed Weasel *Mustela strigidorsa* (Streicher *et al.* 2010). Once alerted to our presence, the weasel looked at the observers and then quickly fled, with its body almost flat to the ground. This behaviour might reduce detectability by conventional methods such as camera-trapping and may explain why so few records were traced by Chutipong *et al.* (2014). Indeed, several camera-trap surveys in Khlong Saeng WS did not record the species (Gibson *et al.* 2013, Chutipong *et al.* 2014, D. Ngoprasert verbally 2017).

Figure 1. Malay Weasel *Mustela nudipes* staring at observers after being encountered and photographed at Khlong Saeng Wildlife Sanctuary, southern Thailand, 10 February 2017.

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SHORT COMMUNICATION

First record of Stripe-backed Weasel *Mustela strigidorsa* in Cambodia

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Abstract.

A Stripe-backed Weasel *Mustela strigidorsa* camera-trapped in the far north-east of Cambodia in Virachey National Park is the first verifiable record from the country. Identification of the species was enabled by the narrow, white-silver dorsal streak going down the spine which appears clearly in the two camera trap images.

Keywords: Stripe-backed Weasel, Virachey National Park, Cambodia, camera-trapping.

Virachey National Park (Virachey NP) is located in the extreme north-east of Cambodia and borders forested regions of Lao PDR and Vietnam. It encompasses 3,325 km^2 of evergreen forest, upland savannah, secondary forest, and bamboo forest. Part of Virachey NP's boundary is the international border with Lao PDR, a mostly undemarcated area of mountains reaching up to 1,500 meters asl (above sea level). Numerous small streams flow south out of the Virachey NP-Lao PDR border mountains and eventually reach the Sesan River which flows west to meet the Mekong River. Along one of these streams, the O (O=river) Gan-Yu, a camera-trap photographed two images of a Stripe-backed Weasel *Mustela strigidorsa*. Identification of the species was based on the whitish dorsal stripe clearly visible in the photograph that begins near the back of the head and continues in a straight line along the animal's spine terminating at the base of the tail (Figures 1 and 2). Confirmation of the species identification was made with the help of small carnivore specialists. This record represents the first verifiable record of Stripe-backed Weasel in Cambodia.

The images (one event) came during a three-year camera-trapping survey in Virachey NP carried about by Habitat ID and Virachey NP staff that was targeted at larger mammals such as Tiger *Panthera tigris*, Asian Elephant *Elephas maximus* and Gaur *Bos gaurus*. The camera-trap station was at 910 meters asl and at 14°20'42.11" N, 106°58'56.24" E (measured using Garmin eTrex GPS), near the base of Phnom (phnom = mountain) Haling close to the border of Lao PDR in the rocky streambed of the O Gan Yu in relatively undisturbed evergreen forest on 14 February 2015 at 08h36. This stream

usually contains several small pools of water even in the dry season, and many animals come to this location to drink and presumably forage among the steep banks and large boulders. Our guides frequently collected small river crabs for consumption in this stretch of the O Gan Yu. This camera station has also recorded other small carnivores such as Common Palm Civet *Paradoxurus hermaphroditus*, Large Indian Civet *Viverra zibetha*, Binturong *Arctictis binturong*, Asian Small-clawed Otter *Aonyx cinereus* and Yellow-throated Marten *Martes flavigula* (McCann & Pawlowski 2017).

Figure 1. The Stripe-backed Weasel *Mustela strigidorsa* near the bottom left of the camera-trap photograph. The white dorsal stripe is visible in this image. Virachey National Park, 14 February 2015.

Furthermore, a weasel unidentifiable at the species-level but belonging to either Yellow-bellied Weasel *Mustela kathiah* or Striped-backed Weasel was camera trapped on the top of nearby Phnom Haling at (1,420 m asl) on 15 January 2016 at 18h54 (McCann & Pawlowski 2017). The distance between the camera station atop Phnom Haling and the camera station on the O Gan Yu where Stipe-backed Weasel was camera-trapped is 510 meters in elevation and approximately one kilometre in distance. Yellow-bellied Weasel was camera trapped for the first time in Cambodia in the southwestern region of the country known as the Cardamom Mountains and that record found the animal far outside its known range (Phan *et al.* 2014).

Figure 2. Enlarged insert of the camera-trapped Stripe-backed Weasel *Mustela strigidorsa*. The white dorsal stripe is clearly visible. Virachey National Park, 14 February 2015.

Stripe-backed Weasel is only rather rarely encountered in the wild directly or photographed in camera-traps (Abramov *et al*. 2008). It is likely that the species is overlooked and not genuinely rare (e.g. Abramov *et al.* 2008 Chutipong *et al.* 2014). Virachey NP is some distance from other known records of Stripe-backed Weasel. The nearest record comes from Vietnam in 1976 in Binh Tri Thien Province (17°05’,106°43’); the next closest record comes from Lao PDR at the border of Khammouan-Savannkhet province (17˚03'32" N, 106˚07'42" E) at an altitude of approximately 260 m at 13h25 on 20 November 2008, where a lone Stripe-back Weasel was seen near the bottom of a cliff (Streicher *et al.* 2010). Both locations are in the Annamite Mountains, and Virachey NP is also located in the Annamite Mountains over two hundred kilometres to the south. However, as Streicher *et al.* (2010) noted “the true southerly limits remain unclear” for Stripe-backed Weasel. The Virachey NP record in this paper marks a new southerly extension in Indochina (Cambodia, Lao PDR, and Vietnam) for Stripe-backed Weasel, yet a more southerly record was found in the Tenasserim Mountains on the Thai-Myanmar border near Kuiburi NP (Chutipong *et al.* 2014).

This record of Stripe-backed Weasel was initially overlooked when reviewing the images. Numerous squirrels (Sciuridae), mice (Muridae) and birds were recorded hopping

around the boulders in the camera-trap's frame, resulting in an excess of 2000 similar photographs. This explains why the record of Stripe-backed Weasel did not appear in McCann & Pawlowski (2017). The later detection of the Stripe-backed Weasel resulted from a more careful examination of this camera station's photographs focusing on possible mongoose *Herpestes* records, which were not recorded in McCann & Pawlowski (2017). While searching for a mongoose records, the Stripe-backed Weasel images were discovered.

This camera-trap station recorded other species such as Asian Elephant and Asian Small-clawed Otter which are apparently not often encountered in Virachey NP anymore or indeed anywhere else in Ratanakiri or Stung Treng provinces (Pawlowski & McCann 2017, McCann & Pawlowski 2017). In spite of the rich biodiversity of the region and Virachey NP, a 'border belt road' currently under construction threatens the site from where these records come from (McCann 2017).

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ORIGINAL ARTICLE

Observations of a Jungle Striped Squirrel *Funambulus tristriatus* nest predated by a Nilgiri Marten *Martes gwatkinsii* in Kadamane Estate, Sakleshpura, India

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Abstract.

We saw a Nilgiri Marten *Martes gwatkinsii* raiding the nest of Jungle Striped Squirrels *Funambulus tristriatus* in Kadamane Estate in the Western Ghats, India. These are the first observations of this feeding behaviour for this poorly understood species. Our detailed observations are documented in this note.

Keywords: *Martes gwatkinsii*, *Funambulus tristriatus*, rainforest, Western Ghats, endemic

Nilgiri Marten *Martes gwatkinsii* is a rare and poorly known mustelid, endemic to the evergreen and moist deciduous forests of the Western Ghats in South India (Wirth & Van Rompaey 1991). Its range extends from the southern tip of the Western Ghats in Kerala to South-Central Karnataka (up to 13°N; Wirth & Van Rompaey 1991, Mudappa 2002, Krishna & Karnad 2010, Jathanna 2014). Little is known about its behaviour and diet, and our current understanding of the species is from a few scattered (and often very brief) opportunistic sightings across its range (Krishna & Karnad 2010, Jathanna 2014). Nilgiri Martens are known to feed on both plant and animals (Balakrishnan 2005) but are largely carnivorous (Jathanna 2014). They have been seen chasing (and feeding on) Indian Chevrotain *Moschiola meminna*, Indian Giant Squirrel *Ratufa indica*, and Indian Monitor Lizard *Varanus bengalensis* (Hutton 1949, Christopher & Jayson 1996, Kurup & Joseph 2001, Mudappa 2002). They have also been observed probing fallen trees and rotting wood (Kurup & Joseph 2001) and feeding on honey and perhaps bee larvae (Christopher & Jayson 1996, Jathanna 2014). In this paper, we document the process of a Nilgiri Marten raiding a Jungle Striped Squirrel *Funambulus tristriatus* nest.

AV was observing birds at 7h30 in the Northern part of Kadamane Tea Estate (approximately 960 m, 12°51’40” - 12°56’30” N to 75°38’0” - 75°41’0” E) in Karnataka,

India, on 24 April 2016. Something that sounded like a woodpecker drumming in the distance was heard at 7h40. At the place the sound was heard, a stream cuts across the road, feeding marshy areas on either side. A 10–15 m tall *Ficus beddomei* with a dead central trunk but a complete canopy stands in one of the marshy parts. Its trunk is surrounded by *Calamus* sp. that almost reaches the canopy and is also surrounded by *Pandanus* sp. at the base. One 6–8 m tall *Hopea canarensis* grows right next to the trunk of the *F. beddomei*. The dead trunk had at least four visible hollows, approximately 5 cm in diameter, 7–8 m from the ground. Although the pecking seemed distant, AV scanned the dead central trunk for the bird; instead a Nilgiri Marten was observed on the fork of a branch, adjacent to the hollows. It was licking its paws and possibly cleaning its face. It appeared unperturbed by AV's presence less than 15 m away. In a few minutes, the marten went up to the highest of the four visible holes on the dead trunk. It started digging and widening the hole with its paws. Small pieces of wood were flying down and around. It tried to reach inside with its snout every once in a while, but seemed to come out with some discomfort like it had been stung by bees, wasps or ants. However, no bees or wasps were seen flying near the cavity. It dug at the hole from several angles with its whole body sprawled on the trunk which was much wider than itself. It glanced in AV direction a few times but did not react.

After digging for 10–15 minutes, the marten took a break for a minute or so before resuming. At approximately 8h15, after two more short breaks, it suddenly pulled something out of the hole with its snout. The animal pulled out made a squeaky sound and AV only saw that it had a furry greyish tail that was perhaps 10–20 cm long. The marten then lost its grip on the animal which fell through the *Calamus* sp. and *Pandanus* sp. to the ground. The marten did not go after it. Instead, it continued digging at the hole and shortly pulled out another animal with a similar greyish tail. This time both the marten and its prey fell down the tree and AV lost sight of both temporarily. The marten then emerged and went up the tree one more time to look inside the hole. Possibly satisfied that there were no more animals inside, it descended and disappeared in the undergrowth. The process, while AV was watching, took around 35 minutes and it was then unclear what the prey was and whether the marten successfully made off with either or both animals. AV assumed then that the animals were young Indian Giant Flying Squirrels *Petaurista phillipensis* or Travancore Flying Squirrels *Petinomys fuscocappilus*, given flying squirrels live and nest in tree cavities. The entire process had possibly taken longer than the observed period as the lowest cavity had also been slightly enlarged. Although three people (who work locally) conspicuously walked by twice (they were asked to stay quiet in time), the marten remained unperturbed.

The next morning, after assuming that 24 hours was sufficient time for the marten to return and take away any remaining squirrels, we went to the tree to look at the cavities. GH climbed up the tree to look inside and photograph the cavities (Fig. 1A and Fig. 1B). Meanwhile, two dogs which had followed us immediately picked up a smell in the vicinity.

They searched for a short while and came back with a Jungle Striped Squirrel that had died very recently. It had clear bite marks and we assumed that this must be the first squirrel that the marten had caught (Fig. 1C). The dogs did not find any more squirrels possibly indicating that the marten had successfully carried away the second squirrel. The dead squirrel weighed 51.76 g (adult weight: ~140 g). Its head and body length was between 12 and 13 cm (adult HBL: ~15 cm) and its tail measured between 10 and 11 cm (adult TL: ~14 cm). We concluded that the animal may be a juvenile, and that the cavity housed a Jungle Striped Squirrel nest. The adults had perhaps fled as soon as the marten arrived.

Figure 1. (A) The Ficus tree with the nest, (B) the nest opening that was enlarged and (C) The dead Jungle Striped Squirrel *Funambulus tristriatus.*

Nest predation is a new, but not unexpected, addition to the feeding behaviour of a Nilgiri Marten. Other species of martens are known to raid nests of birds and mammals (Sonerud 1985, Parr & Duckworth 2007). If the young of cavity nesting animals does constitute a large part of its diet (there is however no reason to believe so with our current understanding), healthy densities of cavity nesting animals may be important to ensure healthy populations of Nilgiri Martens.

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ORIGINAL ARTICLE

New locality records of the Crab-eating Mongoose *Urva urva* in Satchari National Park, Sylhet, Bangladesh

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Abstract.

We report the first records of the Crab-eating Mongoose *Urva urva* in the forest of the Satchari National Park, Sylhet, Bangladesh. An individual was observed and photographed on 23 December 2015 at the forest edge adjacent to a tea garden and another one was observed on 14 August 2015 along a stream.

Keywords: Crab-eating Mongoose, *Urva urva*, locality record, Satchari National Park, Bangladesh

The Crab-eating Mongoose *Urva urva* is locally known as *Kakrabhuk Beji*. The crab-eating mongoose is grey with a well-marked narrow white stripe on the side of the neck. Its tail is bushy with lighter distal tip (Thapa 2013). Feet are black and hairless. Females possess 6 mammae. This species is generally diurnal and preferably solitary or living in small groups (Khan 2008, Gilchrist *et al.* 2009). The Crab-eating Mongoose is considered as Least Concern (IUCN 2015) but locally recognized as Endangered (IUCN Bangladesh 2003). There are three mongoose species in Bangladesh.

Satchari National Park is a mixed evergreen forest of Bangladesh. The park covers about 243 hectares and is comprised of the Raghunandan Hills Reserve Forests within the Satchari Range. The park is situated nearly 130 km northeast of Dhaka (Mukul et al. 2006). The southern part of the park is bordered by India. Adjoining areas are covered by tea gardens, oil palm trees, lemon gardens, rubber plantation and agricultural fields. The forest holds numerous threatened fauna, such as Hoolock Gibbon *Hoolock hoolock*, Capped Langur *Trachypithecus pileatus*, Asiatic Black Bear *Ursus thibetanus*, Barking Deer *Muntiacus muntjak* and Kalij Pheasant *Lophura leucomelanos*. The climate is tropical, and the annual average rainfall is about 4,162 mm and the relative humidity fluctuates between 74% and 90%.

On 23 December 2015 at 10h57, a Crab-eating Mongoose was observed at the edge of the tea garden at Satchari National Park (24°7’25.65” N, 91°27’5.43” E). The tea garden is adjacent to the forest. The observed crab-eating mongoose was apparently foraging on the ground. Photographs of that individual are shown on Figure 1 to 3. Furthermore, on 14

August 2015 at about 08h10, while we were walking in the stream of the forest, we observed an individual of crab-eating mongoose foraging near the stream. When the mongoose perceived our presence, it ran away. No photograph was taken.

Figure 1. Crab-eating Mongoose *Urva urva* foraging on the patch between the forest and the tea garden at 10h57, 23 December 2015 (Photo: Md. Ashraf Ul Hasan).

The Crab-eating Mongoose is a regularly seen mongoose in much of mainland Southeast Asia (Duckworth 1997, Than Zaw *et al.* 2008). They are found in stream banks, swamps, paddy fields, lowland wet evergreen forest, mixed evergreen forest and even secondary forest (Pham-Chong-Ahn 1980, Menon 2003, Chutipong *et al.* 2014). They are often reported from deciduous forest in Thailand, Cambodia and southern Vietnam (Duckworth 1997, Van Rompaey 2001, Than Zaw *et al.* 2008, IUCN 2015). Khan (2008) and Feeroz *et al.* (2012) also indicated that this species can be found in the Northeast and Southeast of Bangladesh, including the small mangrove patch in Teknaf, and deciduous forests in Gazipur and Sherpur. However, there was no record in the Satchari National Park. Choudhury (2004) surveyed the biodiversity of the Satchari Reserve Forest and reported 13 carnivore species, but did not record Crab-eating Mongoose was found. Our observation provides the first sighting record of Crab-eating Mongoose at Satchari National Park. In both observations, the mongooses were alone and foraging on the ground.

Figure 2. Crab-eating Mongoose *Urva urva* at the Satchari National Park, Bangladesh, 23 December 2015 (Photo: Md. Ashraf Ul Hasan).

Figure 3. Crab-eating Mongoose *Urva urva* disappearing into the forest at Satchari National Park, at 10h58, 23 December 2015 (Photo: Md. Ashraf Ul Hasan).

Satchari National Park is a crucial forest for the conservation of many threatened species. Although some research has been conducted in this forest, there is a lack of knowledge and further information are needed to evaluate and improve the conservation of the fauna and flora of the Satchari National Park. Further research on population estimation and ecology of the Crab-eating Mongoose should be conducted and would help setting up conservation priorities for this species.

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ORIGINAL ARTICLE

Poaching record of a Common Palm Civet *Paradoxurus hemaphroditus* from Assam, India

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Abstract.

We report a chance encounter of poaching of a Common Palm Civet *Paradoxurus hemaphroditus* in Nadangiri Reserve Forest of Assam, Northeast India. We suggest long term monitoring studies in the study area to inform conservation of the species.

Keywords: Wildlife trade, Nadangiri Reserve Forest, Chakrasila Wildlife Sanctuary, Northeast India

The Common Palm Civet *Paradoxurus hemaphroditus* is a nocturnal omnivore that is distributed throughout most of non-Himalayan India except the arid west. It inhabits a wide range of habitats which includes deciduous, evergreen and scrub forests, well-wooded countryside and plantations (Menon, 2014). It is listed as Least Concern on the IUCN Red List (Duckworth et al. 2015) and is included in Schedule II of the Indian Wild Life (Protection) Act, 1972. Globally its distribution includes Afghanistan, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, India, Indonesia, Lao PDR, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, and Vietnam (references). Although distributed in most parts of India, the species is poorly studied for its distribution, ecology or trade, particularly in Assam.

Here we document a new record of the Common Palm Civet from Nadangiri Reserved Forest, one of the least surveyed forests in Assam (Figure 1). The hilly terrain, ranging from 30 – 455 m above sea level is covered with dense semi-evergreen and moist deciduous forest, with patches of grassland and scattered bushes. The Nadangiri RF is noted particularly for the healthy population of Endangered Golden Langur *Tracyipithecus geei*. Other mammals found in Nadangiri and nearby Chakrasila Wildlife Sanctuary include

Rhesus Macaque *Macaca mulatta*, Slow Loris *Nycticebus bengalensis*, Tiger *Panthera tigris*, Leopard *Panthera pardus*, Clouded Leopard *Neofelis nebulosa*, Wild Pig *Sus scrofa*, Barking Deer *Muntiacus muntjak*, Sambar *Cervus unicolor*, and Chinese Pangolin *Manis pentadactyla* (Chetry et al. 2010). Temperatures range from 7^{O}C to 34^{O} C and it receives annual rainfall between 2,000–3,000 mm.

Figure 1. Representation of the study area: Nadangiri RF (Source: Google Earth).

On 27 February 2016 at 07h42, SNJ and two foresters encountered two poachers carrying a dead Common Palm Civet. The encounter took place near a rubber garden at the location 26°24’20.8” N, 90°21’58.1” E. One of the poachers carried the civet on a stick along with a net which they claimed was used to catch and handle the civet (Figure 2). Upon asking, they informed us that they smoked the Civet out of its hole where it was lodged. Additionally, we found one possible burrow used by civet species with fresh faecal matter near it (Figure 3). This can be used by other species as well. We also encountered faecal matter near a fruiting tree of *Ficus glomerata* (Figure 4), which has been identified as the preferred food of the Common Palm Civet (Mohinder Basumatary, personal communication). We found tracks of civets in Nadangiri RF and adjoining Chakrasila Wildlife Sanctuary.

Figure 2. The poached Common Palm Civet at Nadangiri RF, (A-C) pictures taken from different angles.

Figure 3. (A) Potential burrow of Civet with (B) fresh scat (Photo: SNJ).

Figure 4. Fruiting tree of *Ficus glomerata* where faecal matter was found nearby (Photo: SNJ).

Small carnivores in India are threatened by habitat loss, degradation and fragmentation, pollution from insecticides and pesticides, and a general lack of concern toward their long-term conservation (Menon, 2014). Additionally, poaching is pervasive in the study area which is of concern. The poachers claimed that the meat was intended for self-consumption and not for selling at the market. In some parts of its range this species is hunted for bush meat, civet coffee (in Indonesia) and pet trade (Nijman et al. 2014). In South China it is extensively hunted and trapped for wild meat (Duckworth et al. 2008). Earlier records of hunting for bush meat in India were reported by Gupta (2004) where carcasses were found with local tribes during visits to Coimbatore, Tamil Nadu and Agra, Uttar Pradesh between 1998 and 2003. Hunting pressure may affect local populations of NFR, where the landscape is highly fragmented and anthropogenically modified. The local

trade of the civets is yet to be studied and understood; insights into existing international trade links, if any, would further help in conservation efforts. We suggest long term monitoring studies in the study area to inform conservation of the species.

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ORIGINAL ARTICLE

Camera-trap records of small carnivores from Gedu Territorial Forest Division, Bhutan

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Abstract.

During Bhutan's nationwide Tiger *Panthera tigris* survey in 2014, a camera-trapping survey in Gedu Territorial Forest Division in western Bhutan recorded five species of small carnivore: Red Panda *Ailurus fulgens*, Yellow-throated Marten *Martes flavigula*, Siberian Weasel *Mustela sibirica*, Masked Palm Civet *Paguma larvata* and Spotted Linsang *Prionodon pardicolor*. It is likely that a few additional small carnivore species could be occurring in the division; further targeted surveys are warranted, as well as a thorough review of other camera-trap data from the Tiger focused surveys in 2014.

Keywords: Red Panda, Yellow-throated Marten, Spotted Linsang, Masked Palm Civet, Siberian Weasel.

Introduction

Bhutan is located in the Eastern Himalayas at the junction of two biogeographic realms, the Indomalayan and the Palaearctic. Bhutan features in numerous conservation priority exercises (Tempa *et al.* 2013) including as a biodiversity 'hotspot' (Myers *et al.* 2000) and as part of the Kachenjunga Conservation Landscape (Shakya & Joshi 2008). Currently, 71% of the country is forested (DoFPS 2017) and these forests are home to approximately 200 species of mammals (NEC 2011). Approximately 50% of Bhutan is covered by protected areas (WCD 2016); the remaining areas fall under the jurisdiction of territorial forest divisions.

Despite having a relatively large area of contiguous forest cover, the territorial forest divisions in Bhutan have received less attention and funding regarding biodiversity surveys and conservation compared to protected areas. There have been few surveys carried out in the territorial forests and there are hardly any published studies on these areas' flora and fauna. However, a nationwide Tiger *Panthera tigris* survey in 2014 revealed that the territorial forest divisions are very important areas for Tigers and other carnivores.

Small carnivore conservation is underfunded, and therefore they have remained one of the least studied groups of mammals in Bhutan. Red Panda has received relatively better attention in recent years due to its charismatic nature and its Endangered status on The

IUCN Red List of Threatened Species (*e.g.,* Dorji *et al.* 2011a, 2011b). Extensive camera-trapping activities studying larger charismatic mammals can produce considerable information on small carnivores and other ground-dwelling mammals as by-catch images (*e.g.,* Zaw *et al.* 2008, Sangay *et al.* 2014, Scotson *et al.* 2017, Dhendup & Dorji, 2018). However, such information in Bhutan has not yet been compiled and published in any form and should be a priority for small carnivore conservation in the country.

This manuscript documents information on small carnivores in Gedu Territorial Forest Division from a nationwide Tiger survey conducted in 2014. This contribution will serve as a baseline data of small carnivores for the division and as a reference for future research on these species.

Materials and methods

Study area

Gedu Territorial Forest Division (Figure 1) covers the entire district of Chukha in western Bhutan and is a part of the Kanchenjunga transboundary landscape. With a total area of 1,991 km^2, the elevation ranges from 150 to 4,450 m asl. Cool, moist sub-tropical forest and temperate forest dominate the entire landscape with few alpine scrubs in the high hills. The division is drained by Wangchhu River which flows down south into India. The first road and the first hydroelectric power plant in Bhutan were constructed in this division.

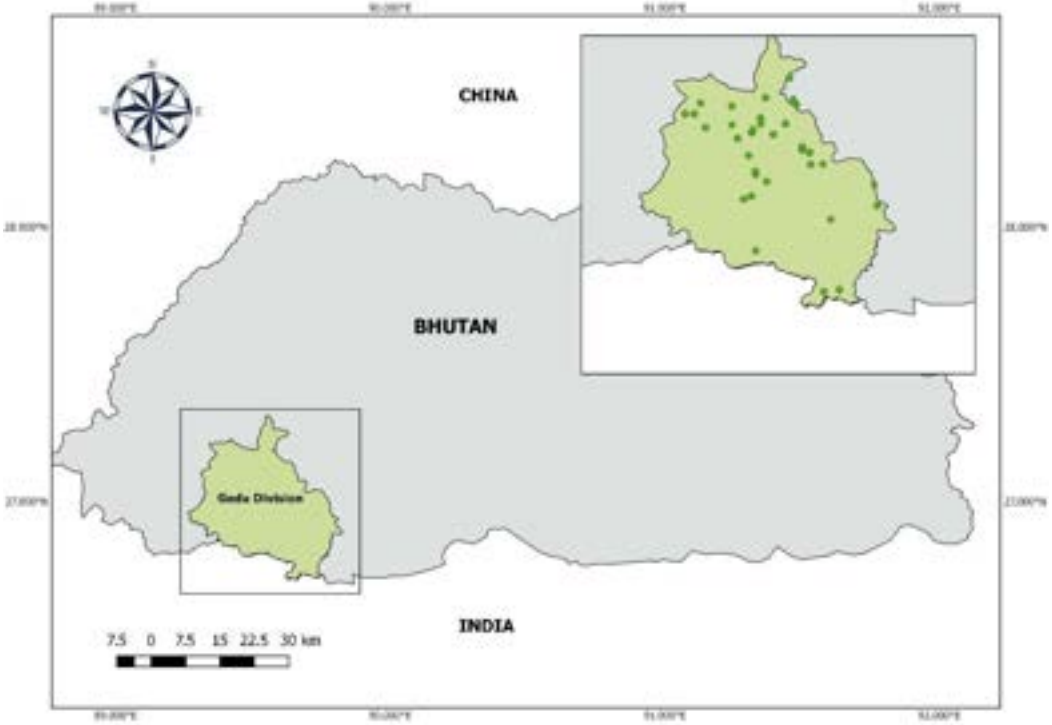

Figure 1. Map of Gedu Territorial Forest Division showing camera-trap locations.

Camera-trapping

For the nationwide Tiger survey (DoFPS 2015), the entire country was divided into 5 × 5 km grid cells, and on each of the cells, potential sites to maximize the capture probabilities of Tiger were located through sign surveys and public consultations. Sites with Tiger and/or prey evidence and the presence of animal or human trails were considered for camera-trapping. At each station, two camera-traps were set up, except in areas which were much less likely to hold Tigers, where one camera-trap was deployed; this allowed a larger area to be covered with the available number of camera-traps. The cameras were set at a height of 45–50 cm above the ground and positioned in such a way that no two cameras were in the same line of view. This was done to avoid the flashes from one camera triggering or spoiling the image quality of the other. Cameras were set to record both day and night and no baits or lures were used. Additional information about the camera-trapping sites was recorded in a data sheet and geographic locations were spatially referenced using a GPS unit. Camera-traps were monitored once every two weeks or if in remote locations, once per month. The cameras were kept in the field for approximately seven months in 2014. Out of the total 45 camera-trap stations which were set, data from 35 stations were used. The remaining ten stations fell out of the division's jurisdiction.

Data Analysis

Overall data organization, storage, and analysis followed Sanderson & Harris (2013). Camera-trap images were downloaded and archived in folders specific to each camera-trap station. The images were then automatically renamed with the date of capture using ReNamer and were archived in a “Site / Location / Species / # [number] of individuals” folder. The species were first identified by the two authors and then later validated by experts. For a series of photographs of the same species at the same station, if the visit to a station occurred after more than 60 minutes, it was considered a notionally independent event (Sanderson & Harris 2013).

Results and Discussion

The data were analysed from a total of 35 camera-trap stations from a trapping period of 206 days. In 17 camera-trap stations, five species of small carnivore belonging to four families were recorded. These comprised Red Panda *Ailurus fulgens*, Masked Palm Civet *Paguma larvata*, Spotted Linsang *Prionodon pardicolor* (Figure 2), Siberian Weasel *Mustela sibirica* and Yellow-throated Marten *Martes flavigula*. Of these five, four are listed as Least Concern, and one is listed as Endangered (Red Panda) on The IUCN Red List of Threatened Species. Except for Yellow-throated Marten for which the highest number of capture locations and notionally independent events were observed, the other four carnivores were photographed relatively rarely (Table 1).

Table 1. Capture records of small carnivores from Gedu Territorial Forest Division, Bhutan.

Species	Notionally Independent Event	No of Camera Stations recorded	Elevation (m)
Yellow-throated Marten *Martes flavigula*	34	16	2149–3595
Masked Palm Civet *Paguma larvata*	12	4	1079–3204
Red Panda *Ailurus fulgens*	2	2	2984–3309
Spotted Linsang *Prionodon pardicolor*	3	2	2150–2718
Siberian Weasel *Mustela sibirica*	1	1	2718

Figure 2. Camera-trap picture of a Spotted Linsang *Prionodon pardicolor* from Gedu Territorial Forest Division, Bhutan in 2014.

The Red Panda is one of the better studied small carnivores in Bhutan (Dorji *et al.* 2011a; 2011b, Dendup *et al.* 2016). The present survey recorded the species at only two camera-trap stations, each once only, at 07h31 and at 10h42. The habitat comprised oak (*Quercus* sp.) and mixed coniferous forests (*Abies* sp. and *Pinus* sp.) with bamboo (*Yushania* sp.) understorey. Yellow-throated Marten is one of the most versatile mustelids in South Asia (Appel *et al*. 2013) and is a habitat generalist; it can be found across a wide range of habitats and elevations. It was by far the most frequently and widely camera-trapped small carnivore in this survey. It was primarily diurnal in activity with no records between 22h00 and 03h00.

Masked Palm Civet was the second most widely and frequently camera-trapped small carnivore. All records came between 20h00 and 05h00 and no image showed more than one animal. The Spotted Linsang was recorded at only two stations, both in cool broad-leaved forests with sparse stands of rhododendron (*Rhododendron arboreum*) in between. The records were at 00h27, 01h10 and 04h14. The single Siberian Weasel was recorded at 09h49 in the morning.

This documentation of small carnivores is the first of its kind in a territorial forest division in Bhutan. Camera-trapping in Gedu Territorial Forest Division recorded only five species of small carnivores. However, it is likely that a few more species may occur there; the survey was targeted towards Tiger, and therefore other small carnivore species may have gone undetected. This could be due to the height of camera-trap placement (30cm or below is ideal for small carnivores, not the 40–50cm used in the Tiger survey) and also because the small carnivores may have been avoiding these areas because of the presence of Tigers.

Small carnivores are known to be threatened by hunting and retaliatory killing (Schipper *et al.* 2008). Recently, a Large Indian Civet (*Viverra zibetha*) was killed in a hamlet in eastern Bhutan for attacking chickens (The Bhutanese 2017). Some parts of Gedu Territorial Forest Division are marred with highways, logging roads, farm feeder roads, power transmission lines and industrial areas; this will lead to habitat disturbance and fragmentation. However, an assessment of the impacts this will have on the area's small carnivores is still lacking. Occasionally, small carnivores are also road-killed, and such incidences need to be reported and recorded. Assessment of the impacts of human-wildlife conflict, habitat fragmentation, and industrial development is needed for the area's small carnivores. There is also an urgent need to review the massive quantities of camera-trap records that exist for Bhutan from the 2014 national Tiger survey, 2015–2016 Snow Leopard survey and other camera-trapping surveys conducted at the local scale. This would dramatically increase knowledge of small carnivore status in Bhutan.

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ORIGINAL ARTICLE

Colour variation of Tayra *Eira barbara* (Carnivora, Mustelidae) in the Caatinga Biome, north-eastern Brazil

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Abstract.

Tayras are medium-sized carnivores which typical body and limbs colour varies from brown to black, with lighter coloured neck and head. However, the coat shade can vary according to geographical location, so this study aimed to report the occurrence of lighter coat of tayra in Caatinga Biome. In the Serra das Almas Private Natural Heritage Reserve, Ceará, northeastern Brazil, ten records of Tayras were obtained, comprising three different morphs: the typical pattern for the species was the most common morph recorded followed by a brown-yellowish individual and an evenly grey individual. Considering the duration of the study and the number of records, it is suggested that the brown-yellowish morph is rare in the study area.

Keywords: coat pattern, mammal, carnivore, mustelids.

Studies on natural history have emphasized the importance of colour patterns in mammals for aspects such as camouflage, communication and physiology (Stoner *et al.* 2003). Cott (1940) postulated four mechanisms that contribute to the concealment of an animal: 1. the overall similarity of colour that refers to the similarity of the colour of an animal and its environment; 2. the similarity of variable colour: which occurs when the colour of the animal varies in response to changes in the environment; 3. obliterative shading: which refers to the coat colour of the animal with a lighter ventral surface compared to its back; and, 4. disruptive coloration: that occurs when distinct stripes or spots act to break up the outlines of an animal, disguising its shape. Regarding communication, the coloration of fur may act through anti-predatory displays, competition for territory, courtship display, and help the recognition of species and even individuals (Ortolani 1999). It has been suggested that coat coloration is related to animal physiology. Because dark coats tend to be found in hot and humid environments, although the factors responsible for this association are not clearly established (Stoner *et al*. 2003). Among mammals, carnivores have high variation of colour patterns. Considering 200 species of carnivores it is estimated 58 different colour patterns present in different parts of the body (Ortolani *et al.* 1999).

The Tayra *Eira barbara* (Linnaeus 1758) is a medium-sized carnivore (body length: 56–68 cm, tail length: 37.5–47 cm, weigh up to 11 kg; Cheida *et al.* 2011). The Tayra have a wide distribution in the Neotropics, occurring from Mexico to northern Argentina. In

Brazil, it is distributed through all biomes, including the northeast region of Brazil where the species has been not mapped (Presley 2000, Cuarón *et al.* 2016). However, there are several records from northeast region of Brazil (Guedes *et al.* 2000, Sousa *et al.* 2004, Pereira & Geise 2009, Paula *et al.* 2011, Dias *et al.* 2014, Feijó *et al.* 2016), and this study. Typically, forest-dwellers, Tayras have strong arboreal habits, using tree hollows and trunks as shelters. They feed mainly on fruit, insects, honey and small vertebrates (Presley 2000, Cheida *et al.* 2011, Rodrigues *et al.* 2013), while also being able to prey on larger mammals such as primates (Camargo & Ferrari 2007, Bezerra *et al.* 2009). Sexual dimorphism in Tayras is little evident, with males slightly larger than females and tend to have more muscled neck and shoulders (Presley 2000). The coat colour varies along its distribution, but in general the dark brown or black colour prevails in the body and limbs, contrasting with the head and neck which tend to be lighter, representing the most common pattern for the species (Presley 2000, Cheida *et al.* 2011, Feijó & Langguth 2013). The variation in colour patters of Tayras along their geographical distribution has induced the description of up to seven subspecies (Presley 2000), and nine according to Wozencraft (2005). This study presents a new lighter coat colour record of Tayra in Caatinga biome.

The Seasonally Dry Tropical Forest, nationally known as Caatinga Biome, is characterized as a semiarid environment, with xerophytic, deciduous, woody and thorny physiognomy (Costa *et al.* 2007). Along with Cerrado and Chaco, Caatinga is part of a complex of seasonal forests creating a diagonal belt in South America between two large areas of tropical rainforests, the Amazon and the Atlantic Forest (Mayle 2004, Caetano & Naciri 2011). Exclusively in Brazilian territory, Caatinga occupies an area larger than 730.000 km^2 in the northeast of the country (Leal *et al.* 2005), with a strong seasonal and unpredictable weather, usually with long periods of drought and high temperatures (Oliveira *et al.* 2012). This study took place in the Serra das Almas Private Natural Heritage Reserve (RNSA), a Private Natural Heritage Reserve, categorized as an advanced post of Caatinga Biosphere Reserve, awarded by United Nations Educational, Scientific and Cultural Organization - UNESCO. The RNSA is placed between Crateús, a municipality in the State of Ceará, and Buriti dos Montes, other municipality in the State of Piauí (Figure 1). Three main vegetation types are found within the limits of Serra das Almas: dense seasonal scrub (carrasco), seasonal thorn forest (arboreal caatinga), and seasonal montane deciduous forest (dry forest), and within the dry forest, there is a remnant of a mango orchard (*Mangifera indica* L.), which follows a stretch of the Melancia Stream, a perennial water course that flows inside the reserve. The data were gathered during a long-term mammal monitoring program carried out in Serra das Almas. A total of 40 sampling stations were monitored for 26 months from 2013 to 2015. Camera traps were set up along trails and close to water sources. The traps covered an area of 25 km^2, and simultaneously active stations were 0.5–1.0 km apart from each other. Camera traps (Bushnell® and Super Scouter®), were adjusted to record the time and date of each event

and were set to operate for 24 hours. Photographs obtained at intervals ≥ 30 min at the same station on the same day were considered independent records (Davis *et al.* 2011).

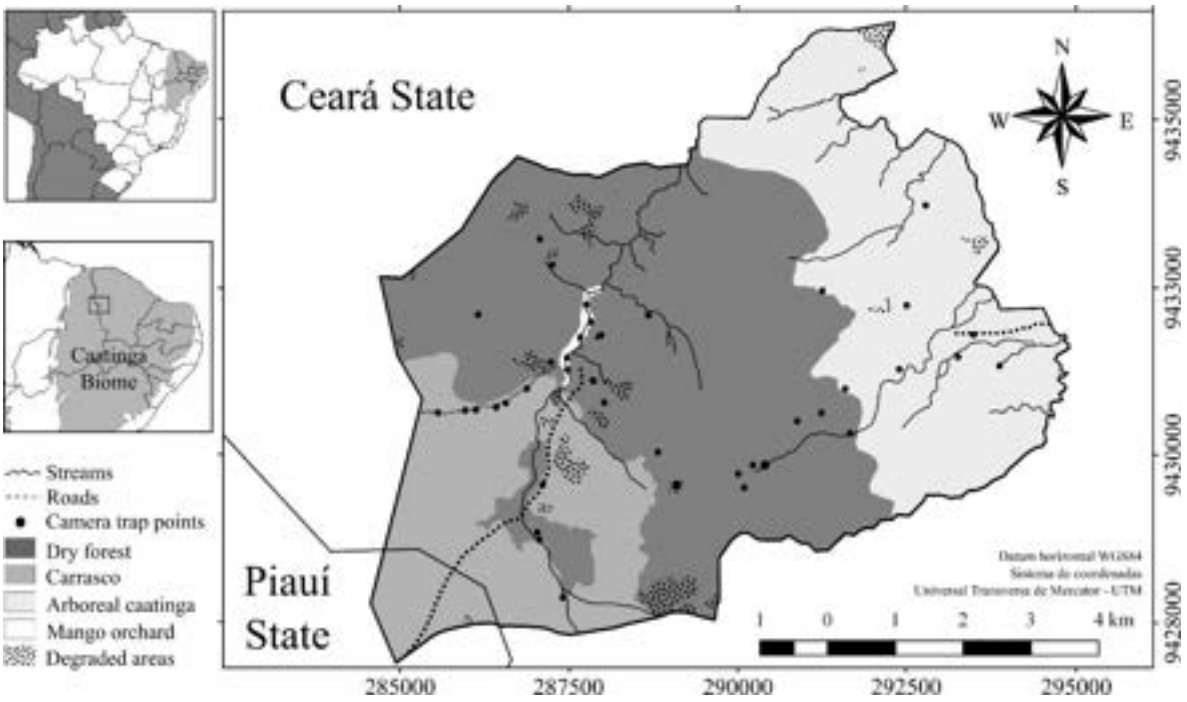

Figure 1. Study area, the Serra das Almas Private Nature Heritage Reserve, CE, Brazil. Stars indicate the points where Tayras were recorded: gray star (gray individual) and white star (brown-yellowish).

Ten records of Tayra were obtained, nine being of the typical morph, as described by Presley (2000) and Feijó & Langguth (2013), one record of an evenly grey individual and five of a brown-yellowish Tayra, the last one always in the company of one individual with the typical colour for the species (Figure 2), with a sampling effort of 4.338 traps/day.

The yellowish coat colour was already recorded in other regions of the Neotropics, including the Rio Negro basin in Amazonia (Trolle 2003) and in the National Park of Madidi, Bolívia (Tarifa *et al.* 2001). In southern Brazil, a creamy-white Tayra was recorded in the Biological Reserve of Sassafrás (Tortato & Althoff 2007). Despite the fact that albinism and amelanism are more common in Tayras than in other mustelids (Presley 2000), the almost white morph recorded by Tortato & Althoff (2007) it is not an example of albinism, once all recorded individuals had pigmented edges and eyes. Even though 50% of the records obtained in RNSA are from Tayras of light coat, the pictures belong to a single individual, suggesting that this morph is rare in the study area. This result differs from that observed in southern Brazil, where light Tayras and with typical colour had a ratio of 1:1 (Tortato & Althoff 2007).

However, Tortato & Althoff (2007) highlighted that the variation of coat colour with presence or absence of spots under the neck are not so reliable characteristics for taxonomic surveys. That idea is sound because, based only in the coat pattern, in RNSA

would occur at least three subspecies, considering the morphs recorded in this study. Following the concealment models (Cott 1940), the brown-yellowish coat of Tayra recorded in RNSA fits well in the overall similarity of colour pattern, at least during the most part of the year, once Caatinga vegetation loses its leaves during the dry season, which gives a pale aspect to the environment. From this condition arose the name "Caatinga" from indigenous Tupi-Guarani origin, meaning "white forest" (Prado 2003). The coat patterns of carnivores usually match with the environment in which they exist, but this association may also be an adaptation related to thermoregulation (Caro 2005). Thus, light coats are favoured in hot and open environments, once they reflect better solar radiation; grey or reddish coat is more predominant in rocky habitats, and dark colours tend to be predominant in dense forest environments (Caro 2005). In this sense, studies indicate that camouflage and communication are two key factors that influence the coloration in mammals. In addition, body coloration tends to evolve to match the background environment and that the extremities act as visible signs for conspecifics and perhaps against predators (Stoner *et al.* 2013).

Figure 2. Record of Tayra (*Eira barbara*) showing one individual with typical colour, black body and lighter-coloured neck and head, and one brown-yellowish individual, both records in the Serra das Almas Private Natural Heritage Reserve, CE, Brazil.

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ORIGINAL ARTICLE

First verifiable record of Spotted Linsang *Prionodon pardicolor* from Nepal since the nineteenth century

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Abstract.

Spotted Linsang *Prionodon pardicolor* has been rarely recorded in Nepal except for Hodgson's collection in the 19th century and several sighting records in Chitwan National Park during the late 1970s and 1980s. A camera-trap record in Annapurna Conservation Area during a Mainland Clouded Leopard *Neofelis nebulosa* survey in January 2017, constitutes the first verifiable evidence of the species in the country since the nineteenth century. This authenticates the westernmost known limit of its current global distribution.

Keywords: Hodgson, montane forest, camera-trap, small carnivore, first recent record, range clarification.

Spotted Linsang *Prionodon pardicolor* is found in the forests of South and South-east Asia and southern China in a wide variety of forest habitats and, sometimes, dense grasslands (Prater 1971, Sunquist 1982, Jennings & Veron 2015). Previously the species was proposed to be rare (Schreiber *et al*. 1989) but with the advent of modern survey equipment like camera traps, it is in at least some of its range recorded more regularly (e.g. Zhang *et al*. 1997, Than Zaw *et al*. 2008, Lau *et al*. 2010). Hence it is categorized as Least Concern by *The IUCN Red List of Threatened Species* (Duckworth *et al.* 2016); the species is however classified as nationally endangered in Nepal (Jnawali *et al.* 2011).

Nepal is believed to be the westernmost range of Spotted Linsang's global distribution with very few authentic records in the country to date. The species was described to science from the country by Brian H. Hodgson (Hodgson 1841) who collected a total of eight specimens, with no specific localities (Hodgson 1841, 1847). Hodgson used 'Nepal' for a much larger area than is encompassed by today's national limits. Hinton & Fry (1923) accepted the Linsang to occur in today's Nepal based on Hodgson's records, but it is not clear how many of the eight originated within the country. Besides this, apparently the only other

claims of specific records of this species from Nepal come from Chitwan National Park (CNP) (Table 1).

Table 1. Reports of Spotted Linsang *Prionodon pardicolor* from Chitwan National Park, Nepal.

Location	Type of record	Habitat	Date(s)	Time of day	Observer, reference	Number of animals
27°34'14" N 84°29'23" E 130 m	Field sighting	Riverine forest (*Dalbergia*, *Bombax*, *Mallotus* and *Trewia*)	January 1978	Dusk	Kirti Tamang per Pralad Yonzon *in litt*. 2008	1
27°30' N 84°20' E 150 m	Found drowned in a well	lowland forest–grassland	Late Feb 1975	n/a	Sunquist 1982 *in litt*. 2008	2
27°30' N 84°20' E 150 m	Field sighting	lowland forest–grassland	17 Jan 1975	late after-noon	Sunquist 1982 *in litt*. 2008	1
27°30' N 84°20' E 150 m	Field sighting	Dense riverine forest	4 Feb 1975	18h30	Sunquist 1982 *in litt*. 2008	1
27°30' N 84°20' E 150 m	Field sighting	Sal forest interspersed with tall grass	Mid Mar 1979	17h00	Sunquist 1982 *in litt*. 2008	1
"western edge of CNP" 150 m	Field sighting	Riverine forest tall grassland	1980s	not known	C. McDougal *in litt*. 2008	1

All *in litt*. records per J. W. Duckworth.

The species has also been reported, without detail, from Kanchenjunga Conservation Area (KCA), easternmost Nepal (Jnawali *et al.* 2011). The most recent report of the species has been from Yamphudin area of Kanchenjunga Conservation Area where a forest guardian from the Red Panda Network claimed to have taken a photograph in 2014 which was apparently deleted later (Sonam Tashi Lama *in litt*. 2017). There have been no verifiable records since Hodgson's, raising concerns on its status in Nepal.

Annapurna Conservation Area

Annapurna Conservation Area spans from 1,300 m to 3,000 m above sea level in Kaski and Lamjung districts. Sikles, Tangting, Pasgaun and Bhujung are the closest permanent human settlements.

The camera-trap survey was targeting Mainland Clouded Leopard *Neofelis nebulosa* and was carried out in the Sikles-Bhujung landscape in Annapurna Conservation Area (Fig. 1) during January–March 2017. A potential camera trapping area was selected using a land use map of the area. Camera-trapping points were selected in the whole of the study area at a

minimum of 1 km separation. Points too close to human settlements (within 1 km) were eliminated from the final camera trap locations. In total, 53 camera-trap stations were used, with each camera-trap unit running for between 70 and 90 days, for a total sampling effort of 4,345 camera-trap nights.

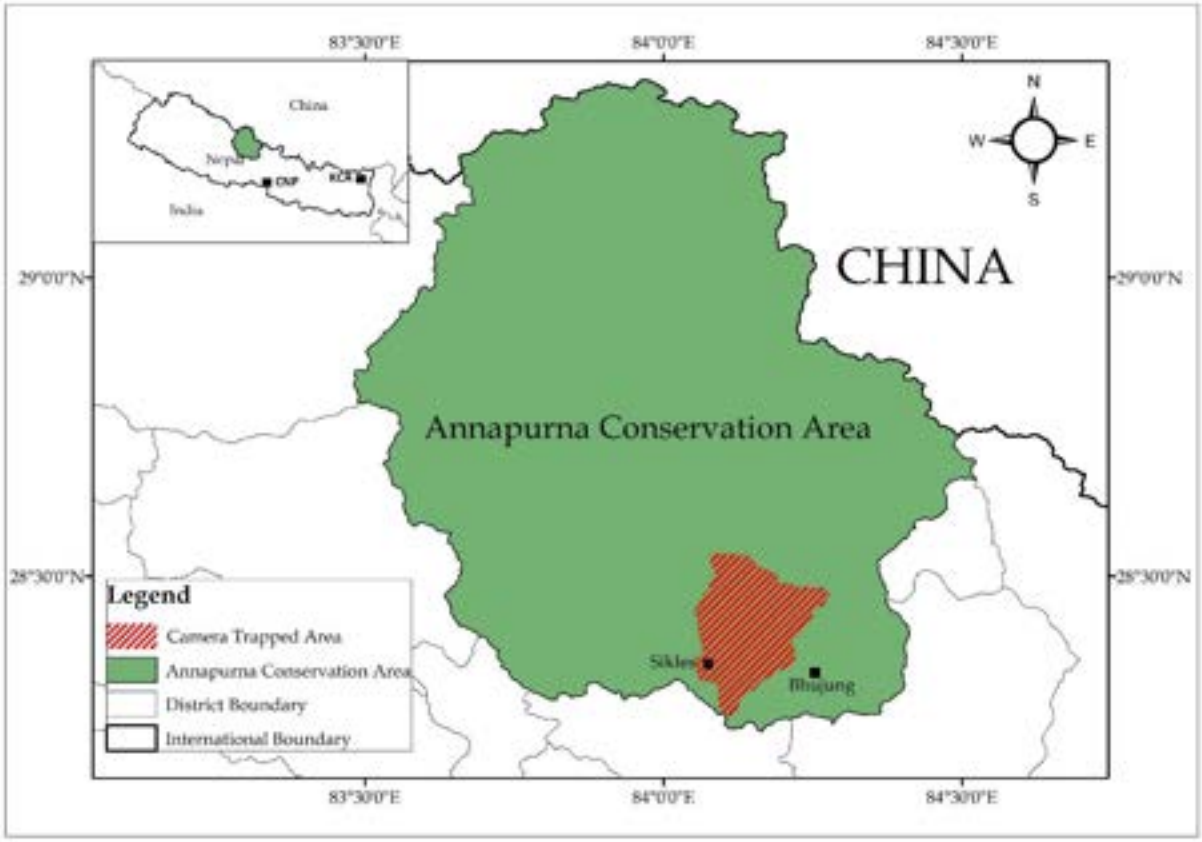

Figure 1. Study area with nearest human settlements. Map of Nepal also shows locations that accounted for other Spotted Linsang *Prionodon pardicolor* records from the country

Spotted Linsang camera-trap records

A survey from December 2016 to March 2017 in the Sikles – Bhujung landscape camera photographed Spotted Linsang at two stations. There was only one record at each station.

The altitudes of the two camera-trap stations were 2,392 m and 2,745 m, estimated from the GPS location. Both stations were in the montane forests with the habitat at the first dominated by oaks *Quercus* and champ *Michelia kisopa* and at the second station by rhododendrons *Rhododendron*, champ, Common Yew *Taxus baccata* and Paper Plant *Daphne papyracea.* Undergrowth common to both camera-trap stations included ground ferns.

Figure 2. Spotted Linsang *Prionodon pardicolor* near Pyanwa dada, Nepal.

Spotted Linsang had never been photographed in Nepal prior to the present survey and there were no verifiable records from the country since those of Hodgson in the 1840s. The present records are approximately 5 km west of the westernmost limit of the species' mapped global distribution range from *The IUCN Red List of Threatened Species* (Duckworth *et al.* 2016). Further exploration could provide information on its status in the areas West of the Sikles-Bhujung landscape, because this part of Nepal remains inadequately surveyed for small carnivores. Although, given the species high tolerance and persistence in areas with few other small carnivores left (e.g., Protected Areas in Vietnam), it is likely the species is not a conservation priority.

Human disturbance is not uncommon in the Sikles-Bhujung landscape. There was a base camp for timber logging 200 m below and a *goth* (a seasonal livestock shed) 150 m above the first camera-trap station. The second station was between two *goths*. During the herding season (i.e., May to August), local people come to the *goths* with their livestock. The herders kill wild birds and mammals using snares and guns which might be one of the primary

threats to the species. However, the species' persistence in heavily hunted areas of northern South-east Asia (e.g., Duckworth 1997, Than Zaw *et al*. 2008, Gray *et al*. 2014, Chua & Lim 2017) suggests the possibility that it would face no threats from human activity in this part of Nepal.

Figure 3. Spotted Linsang *Prionodon pardicolor* captured at Chyarsikharka, Nepal.

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ORIGINAL CONTRIBUTION

Camera-trap records of Sunda Stink-badger *Mydaus javanensis* and other small carnivores in South Kalimantan, Indonesia

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Abstract.
In a modelling exercise in 2016, South Kalimantan was predicted to be mostly unsuitable for Sunda Stink-badger *Mydaus javanensis*. A camera-trap survey from August to November 2014 in Bajuin, Tanah Laut District and Karang Intan, Banjar District, South Kalimantan, Indonesia generated seven Sunda Stink-badger, one Yellow-throated Marten *Martes flavigula*, one Common palm Civet *Paradoxurus hermaphroditus*, two Masked palm civet *Paguma larvata* and six Collared Mongoose *Herpestes semitorquatus* records. These records confirm the occurrence of Sunda Stink-badger in South Kalimantan.

Keywords: Borneo, Malay badger, Mephitidae, Camera-trap records, Teledu.

Sunda Stink-badger *Mydaus javanensis* is a small carnivore found on Java, Sumatra, Kalimantan (Borneo) and the North Natuna Islands (Hwang & Larivière 2003, Wilting *et al.* 2015). This species is one of the most commonly encountered carnivores in Malaysian Borneo (especially Sabah; Wilting *et al.* 2010, Samejima & Robert 2012) and Java (Ario 2007); its status on The IUCN Red List of Threatened Species is Least Concern (Wilting *et al.* 2015). Despite its presumed commonness, little is known about the ecology of Sunda Stink-badger and recent confirmed records are scarce in Central, East, West and South Kalimantan (Samejima *et al*. 2016). The scarcity of records in these areas may reflect lower survey effort than that in Malaysian Borneo, however, it is reported that this species was not recorded in 6,025 camera-trap-nights in Sabangau, Central Kalimantan (Cheyne *et al*. 2010) and in 17,974 camera-trap-nights in the Schwaner Mountains, Central Kalimantan (Samejima & Semiadi 2012). According to the information compiled by Samejima *et al*. (2016), Sunda Stink-badger was reportedly a common species in South Kalimantan about a century ago (e.g. Bock 1882, Lyon 1911). There is no recent evidence indicating the presence of this species in South Kalimantan other than the description in Yasuma (1995):

Sunda Stink-badger was described as common around Banjarmasin and Tanjung, and villagers from those areas apparently knew this species very well.

Digital camera-traps (Trophy Cam HD, Bushnell) were set up during August to November 2014 at 12 stations in two sites (Table 1, Figure 1). Nine cameras were installed in secondary forest adjoining W-BRIDGE (Waseda-Bridgestone Initiative for Development of Global Environment), Bajuin, Tanah Laut District, South Kalimantan, with altitudes between 54 m and 172 m above sea level (asl). Three cameras were installed in the reserved natural forest of Tahura site (Forest Park called Taman Hutan Raya Sultan Adam in Indonesian), Karang Intan, Banjar District, with an altitude of approximately 100 m asl. In both sites, *Imperata cylindrica* and other grass species dominate the habitat, with secondary forests remaining along the valleys. The W-BRIDGE project is focused on the rehabilitation of degraded land using Pará Rubber Tree *Hevea brasiliensis*. To date, 51 tree species have been recorded in the forest near the W-BRIDGE site: *Peronema canescens* was dominant and many beans of *Pithecellobium jiringa* were on the forest floor. In addition, some regenerated small trees with 3–5cm DBH (Diameter at Breast Height) were removed by local people, to be used as stakes in agricultural land. There were 24 tree species recorded and *Cryptocarya* was dominant in Tahura site. The cameras were set on trees about 50–100 cm above the ground with a slant of 10–20 degrees facing the ground and the survey was targeting ground-dwelling mammals. The camera-trap stations were visited at approximately one-month intervals; the memory cards and batteries were then changed. The number of notionally independent photographs were counted for each small carnivore species; photographs of the same species at the same camera-trap station were counted as a notionally independent record if separated by at least 30 minutes.

Table 1. Camera-trap stations in South Kalimantan, Indonesia.

Trap No.	Study site	Coordinates	Elevation (m)
W01	W-BRIDGE	3°41’31.6” S 114°49’50.6” E	54
W02	W-BRIDGE	3°41’31.5” S 114°49’48.7” E	70
W03	W-BRIDGE	3°41’31.7” S 114°49’49.7” E	70
W04	W-BRIDGE	3°41’27.5” S 114°49’44.5” E	125
W05	W-BRIDGE	3°41’27.9” S 114°49’45.3” E	120
W06	W-BRIDGE	3°41’28.8” S 114°49’46.7” E	83
W07	W-BRIDGE	3°41’35.4” S 114°49’33.5” E	145
W08	W-BRIDGE	3°41’34.1” S 114°49’31.5” E	161
W09	W-BRIDGE	3°41’32.1” S 114°49’31.7” E	173
T01	Tahura	3°30’30.3” S 114°56’59.3” E	111
T02	Tahura	3°30’31.2” S 114°56’59.1” E	109
T03	Tahura	3°30’31.0” S 114°56’58.6” E	104

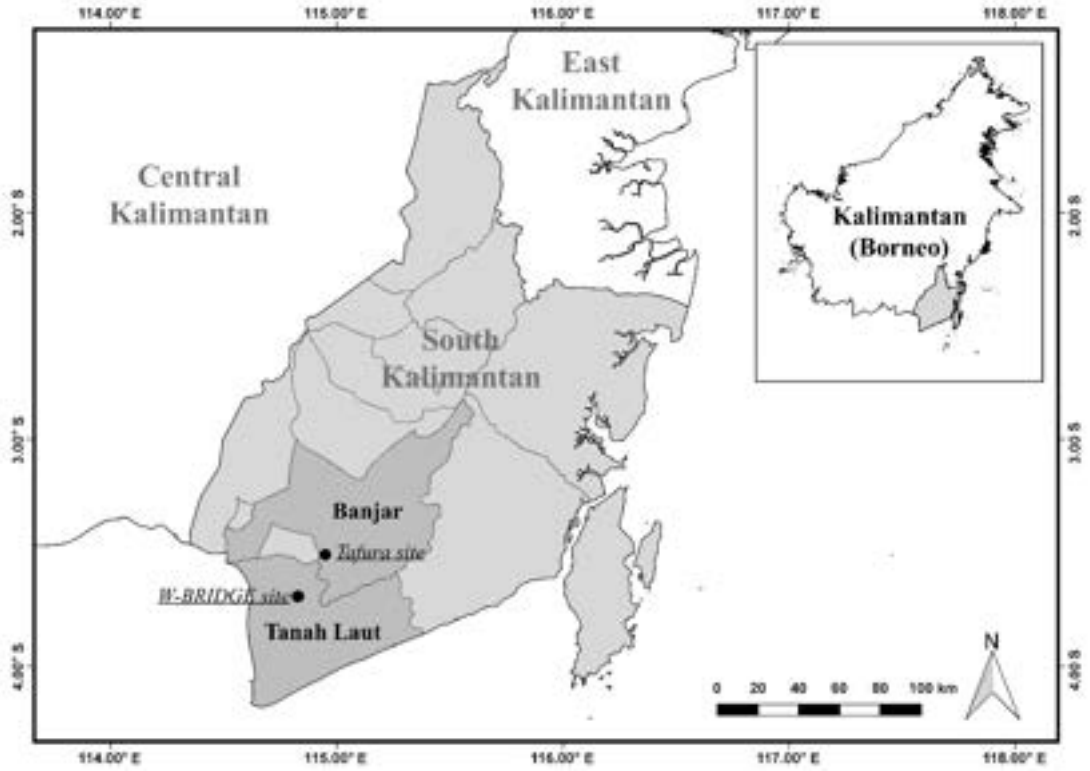

Figure 1. Locations of the two survey sites in South Kalimantan, Indonesia.

A total of 1,149 camera-trap-nights generated seven Sunda Stink-badger records at four camera-trap stations (Table 2, Figure 2). The camera-trapping also generated one Yellow-throated Marten *Martes flavigula*, one Common Palm Civet *Paradoxurus hermaphroditus*, two Masked Palm Civet *Paguma larvata*, and six Collared Mongoose *Herpestes semitorquatus* records (Table 2, Figure 3).

Table 1. Camera-trap records of Sunda Stink-badger *Mydaus javanensis* and other small carnivores from South Kalimantan, Indonesia.

Species	Date	Time	Trap No.
Sunda Stink-badger	2 September 2014	04h15	W06
	2 September 2014	04h24	W04
	7 September 2014	04h44	W05
	8 October 2014	20h21	T03
	9 October 2014	23h37	T03
	12 October 2014	21h31	T03
	25 October 2014	20h59	T03
Yellow-throated Marten	16 September 2014	08h12	W06
Common Palm Civet	31 October 2014	03h44	W08
Masked Palm Civet	23 October 2014	20h33	T02
	24 October 2014	01h50	W08
Collared Mongoose	4 September 2014	08h56	W07
	7 September 2014	11h43-11h59	W01
	22 September 2014	08h27	W07
	29 September 2014	15h22	W07
	3 October 2014	09h02-09h27	W01
	13 October 2014	17h46	W01

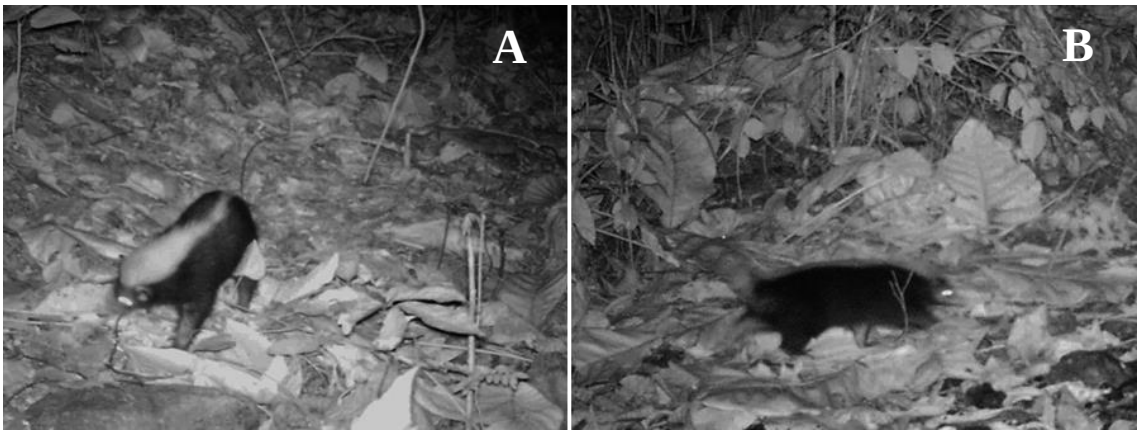

Figure 2. (A) Camera-trapped Sunda Stink-badger *Mydaus javanensis* from W-BRIDGE site, Bajuin, Tanah Laut, South Kalimantan, Indonesia on 7 September 2014 and (B) Tahura site, Karang Intan, Banjar, South Kal imantan, Indonesia on 9 October 2014 (right).

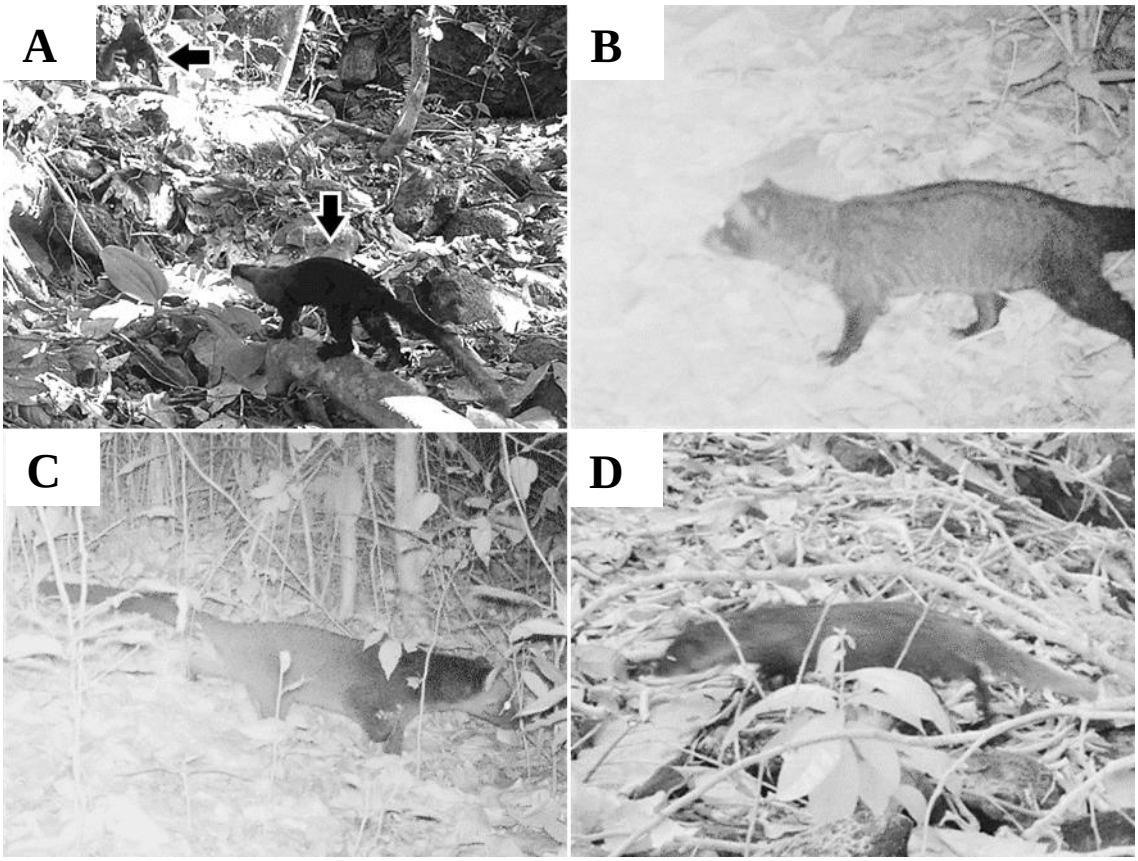

Figure 2. A) Camera-trapped Yellow-throated Martens *Martes flavigula* from W-BRIDGE site, Bajuin, Tanah Laut, South Kalimantan, Indonesia on 16 September 2014, B) Common Palm Civet *Paradoxurus hermaphroditus* from W-BRIDGE site on 31 October 2014, C) Masked Palm Civet *Paguma larvata* from Tahura site, Karang Intan, Banjar, South Kalimantan, Indonesia on 23 October 2014 and D) Collared Mongoose *Herpestes semitorquatus* from W-BRIDGE site on 13 October 2014.

South Kalimantan was predicted to be mostly unsuitable for Sunda Stink-badger (Samejima *et al*. 2016), Yellow-throated Marten (Hon et al. 2016a), Common Palm Civet

(Nakabayashi *et al*. 2016), Masked Palm Civet (Semiadi *et al*. 2016) and Collared Mongoose (Hon *et al*. 2016b) by MaxEnt modelling. The records from this survey suggest that the fragmented forests in South Kalimantan are able to support populations of these species.

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ORIGINAL CONTRIBUTION

Novel photographic and morphometric records of the Western Falanouc *Eupleres major* in Ankarafantsika National Park, Madagascar

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Abstract.
Long-term research on Fosa *Cryptoprocta ferox* has been conducted in Ankarafantsika National Park since 1999, with rare sightings of the forest's second elusive carnivore, the Western Falanouc *Eupleres major*. During annual carnivore live-trapping from 1999-Present, a single Falanouc was captured on the 30th of March 2002. Since this capture, two photographs have been taken of the Falanouc. In June 2011, a project volunteer photographed a Falanouc during the day whilst conducting trap-checks. Recently, a second photograph was recorded during the largest systematic camera-trapping study of Madagascar's western carnivores. From April – July 2014 eighty paired camera-traps operated on average for 79 days, recording a sole image of the Western Falanouc at 01h18 on the 19 April 2014. Herein we discuss the morphometrics and photographic records of the Western Falanouc from Ankarafantsika National Park.

Keywords: Ankarafantsika, camera-trapping, Eupleres, Eupleridae, Falanouc.

Fitantarana ara-tsary sy refy samihafa voaangona mikasika ny Fanaloka Andrefana Eupleres major ao amin'ny Valanjavaboahary Ankarafantsika, Madagasikara

Notanterahana nanomboka ny taona 1999 tao amin'ny Valanjavaboahary Ankarafantsika ny fikarohana lavitrezaka mikasika ny Fosa Cryptoprocta ferox. Tamin'izany no nahitana tsindraindray karazambiby mpihinankena iray hafa izay tsy mbola fahita, dia ny Fanaloka Andrefana Eupleres major. Nandritra ny fisamborana velona ireo karazam-biby mpihinankena izay fanao isan-taona nanomboka ny taona 1999 ka hatramin'izao dia indray mandeha ihany no nahazoana Fanaloka Andrefana, ny 30 Marsa 2002. Nanomboka teo dia sarina Fanaloka Andrefana roa no azo. Tamin'ny Jona 2011 dia nisy mpikaroka mpilatsaka antsitrapo iray nahazo sarina Fanaloka Andrefana anankiray nandritra ny andro mazava tamin'ny fisafoana ireo fandrika napetrany. Vao tsy ela akory, nisy sary faharoa azo tamin'ny fakantsary fandrika nandritra ilay fikaroahana lehibe indrindra mikasika ny biby mpihinankena miaina amin'ny ilany andrefan'i Madagasikara. Ny volana Aprily ka hatramin'ny Jolay 2014 dia fakantsary fandrika miisa 80 no napetraka tao anaty ala nandritra ny 79 andro ka sary tokan'ny Fanaloka Andrefana no azo ny 19 April 2014 tamin'ny 01 ora sy 18mn maraina. Eto isika dia hiady hevitra mikasika ny refy samihafa sy ny sarin'ny Fanaloka Andrefana araka ny tahirinkevitra vao nangonina tao amin'ny Valanjavaboaharin'Ankarafantsika.

A paucity of information currently exists on the two proposed sub-species of the Genus *Eupleres*: *Eupleres goudotii* and *Eupleres major* (Albignac 1972). Each sub-species is typically confined to the geographically distinct landscapes of the eastern rainforests and western deciduous forests respectively (Hawkins 2008), despite proposed distributional overlap in the northerly rainforest of Montagne d'Ambre (Goodman & Helgen 2010). Much of our knowledge of the Falanouc has been derived from museum specimens or personal communications, anecdotal reports from rural villagers, and several published studies (Goodman & Helgen 2010). Across its geographic range, sightings and trappings of the Falanouc have been rare, which may be due to its specialized diet of earthworms and nocturnal habits (Hawkins 2008). Recent technological advances in remote camera sensing now afford greater opportunities to document this enigmatic species.

The first camera-trap image of a Falanouc was recorded in Ranomafana National Park (RNP) in 1997 (Dollar 1999). Over a decade later in the same forest Gerber *et al.* (2012a) conducted the first systematic survey of Madagascar's carnivores using camera-traps, again documenting the eastern *E. goudotii*. This study was followed by Farris *et al.*

(2014)'s documentation of the Eastern Falanouc during their extensive carnivore camera-trapping studies in the Masoala-Makira protected complex in north-eastern Madagascar. Conversely, Madagascar's western dry deciduous forests have received considerably less attention with only one recent camera-trapping study of the Mariarano forest, located approximately 80 km northwest of Ankarafantsika National Park (Evans *et al.* 2013). During this survey, the first camera-trap image of *E. major* was recorded from Madagascar's west coast.

Ankarafantsika National Park (ANP; 16°12' S, 47°09' E) has been the focus of long-term Fossa capture surveys since 1999. The rarity in sightings of Ankarafantsika's second elusive carnivore, the Falanouc, has been described by one of the authors (L. Collar), whose team have rarely encountered Falanouc with only a few confirmed sightings, one physical capture and one volunteer photograph that are reported in this article. From May to July 2014 we undertook the largest systematic camera-trap study in West Madagascar to document the effects of anthropogenic habitat disturbance upon Fossa occupancy. This study forms part of a wider investigation documenting the major anthropogenic threats to the conservation of the Fossa (Merson 2017).

ANP is located approximately 105km from the port hub of Mahajanga. At 1350 km^2 ANP is the largest remaining tract of dry deciduous forest. The region is characterized by an average temperature of 26°C, with a dry season from May to November, and a wet season from December to April. The Route Nationale 4 (RN4) bisects the south-western portion of the forest and is flanked by six rural villages. These villages have a major influence upon the surrounding forest, with large tracts of primary forest converted to savannah through slash and burn agriculture, rice fields and raffia plantations. Ampijroroa, the former name of the Special Reserve adjacent (and now incorporated within) Ankarafantsika, is also the home to the local Madagascar National Park's headquarters, which operates tourism throughout the surrounding area.

Volunteer photograph

Since 1999, typically during the dry season, trapping surveys for Fossa within a transect grid surrounding the Ampijiroa research station are conducted on an annual basis as part of a long-term monitoring program. With the aid of volunteers, traps are baited and checked during the early morning and late afternoon. In June 2011, the first known photograph of a Western Falanouc was taken by an Earthwatch volunteer in ANP (Figure 1). Despite the Falanouc's proposed highly nocturnal-crepuscular activity pattern (Gerber *et al.* 2012b, Goodman & Helgen 2010) this individual was photographed during the day; such diurnal sightings are particularly rare.

Figure 1. Photograph of the Western Falanouc *Eupleres major*, taken by an Earthwatch volunteer in June 2011, Ankarafantsika National Park, Madagascar.

Camera-trap record

From May to July, eighty pairs of camera-traps (Cuddeback Ambush IR 1187) were placed along trails encompassing an area of approximately 40 km^2. Trail systems were chosen intentionally mindful of the target species (Fossa *Cryptoprocta ferox*), frequent use of trails whilst traversing forest, as demonstrated by previous capture studies (Dollar 2006) and the frequent presence of faeces along trails. Camera trap stations were spaced approximately 750 m apart, allowing an equal trapping effort across the sampling area. Site placement along trails was chosen to maintain equal distance from the nearest station but also to maximize chances of detecting passing animals and humans. At each camera-trap station, a pair of Cuddeback Ambush IR 1187 were placed flanking the trail, approximately 20-30 cm above the ground. This method allowed captured individuals to be photographed on both sides, improving species identification (Gerber *et al.* 2012a), whilst additionally accounting for individual camera failure.

At 01h18 on 19 April 2014 a singular photograph captured an individual Western Falanouc (Figure 2). The camera-trap station (16°15’ S, 46°49’ E) was located in riverine degraded forest, nearby to a dry seasonal riverbed, and approximately 2.25 km from the nearest village, Ampombalava. The camera-trap station was in operation for 82 nights

(night being defined as one 24-hour period in which one of the two cameras was in operation) from the 14 April – 4 July 2014, collecting a total of 1.594 images. Within these images, 188 humans, 5 Dogs *Canis lupus familiaris*, 33 Zebu *Bos taurus*, and 9 Fossa were most notably observed.

Figure 2. Camera-trap image of the Western Falanouc *Eupleres major* taken at 01h18 on the 19 April 2014, at Ankarafantsika National Park, Madagascar. Note: the photograph is inverted.

Physical Capture

Trapping was conducted during the wet season from February to April 2002. A total of 38 cage traps (Tomahawk Live Trap, Tomahawk, USA) were placed evenly along trails at two sites surrounding Ampijiroa, bisected by the Route National 4. These sites were chosen as to encompass the two major local microhabitats, a riparian forest and a drier deciduous forest. Traps were baited with earthworms, sardines, corned beef, dry fish and chicken. When an individual Falanouc was captured, it was blow darted (Pneu-Dart Inc., Williamsport, USA) containing the anesthetising agent Telazol (Fort Dodge Animal Health, Fort Dodge, USA) and moved to the campsite for the recording of morphometric measurements.

During approximately three months of trapping, a single adult male Falanouc was captured on the 30 March 2002. Weighing approximately 2.4 kg, the male was on the lower

scale of their proposed weight range from 2–4 kg (Albignac 1974). As documented in museum specimens (Goodman & Helgen 2010), the male's pelage was brownish, whilst the under fur was dense and covered by long guard hairs. Local villagers reported that females of this subspecies are greyish in colour.

The hindlimbs were more developed than the forelimbs, whilst the forefoot consisted of two carpal pads that were notably separated, with the hindfoot featuring a bare metatarsal zone with short hair in the centre. The cranium was 70 mm long (Table 1). There were two canines on the upper jaw and one on the lower jaw. The teeth were extremely specialized and very small/fragile; the carnassials were not very well developed which is likely explained by their diet of earthworms, insects and small invertebrates.

Table 1. Morphometric and cranium and dental measurements of the captured male adult Western Falanouc from Ankarafantsika National Park, Madagascar.

Morphometric measure	Value (mm)	Cranial and dental measures	Value (mm)
Total length	790	Cranium length	70
Head and body length	550	Cranium width	41.33
Neck circumference	155	Snout length	55
Chest circumference	330	Snout width	36.5
Tail length	245	Inter orbital distance	21.06
Tail circumference (base)	175	Mandible length	70
Tail circumference (mid)	100	Mandible height	15.12
Tail circumference (tip)	30	Upper canine n°1 length	3.13
Ear length	39.17	Upper canine n°1 width	1.3
Forelimb length	165	Upper inter canine distance (n°1)	3.53
Hind limb length	212.5	Upper inter canine distance (n°2)	5.29
Biceps circumference	97.5	Lower canine length	3.23
Thigh circumference	150	Lower canine width	1.67
Forefoot length	40	Lower inter canine distance	5.4
Forefoot width	32		
Hind foot length	57		
Hind foot width	37		
Right testicle length	14.38		
Right testicle width	14.43		
Left testicle length	22.14		
Left testicle width	13		
Prepuce length	12.46		

This is the first photographic and morphometric documentation of the Western Falanouc in Ankarafantsika. The rarity of physical sightings has also been confirmed for the eastern sub-species. An observational recording of opportunistic Malagasy carnivore sightings in Analamazaotra forest in Andasibe from 1992–2010, documented only one Eastern Falanouc (Dolsch 2011). In addition to these anecdotal recordings, Goodman and Helgen (2010) provided an exhaustive literature review to describe the species' geographic distribution through published records, unpublished records, and museum specimens. This review served to highlight the lack of data currently available on this little-known species.

To our knowledge our study provides the first (and more detailed) morphometric record of a live wild captured falanouc. This allows comparison against the rare museum measured records of Albignac (1973) and Goodman and Helgean (2010). Our

measurements of head and body length (550mm) and tail length (245mm) are all comparable to those of the museum specimens, whilst some other records such as the cranium length (70mm) differed significantly than previously reported in adult specimens (92.9 and 97mm). These discrepancies could be due to differences in measurement technique and/or the condition of museum versus wild animal specimens. Our records provide important data for future studies to examine morphological differences between the two potential *Eupleres* species (*E. major* and *E. goudotii*), something that has yet to be proven genetically (Goodman & Helgen 2010).

Given the obvious inefficacies of traditional methods for observing and/or physically capturing Falanouc, camera-trapping provides a more suitable non-invasive alternative. Gerber *et al.* (2012a) established a camera-trapping grid of approximately 27 paired cameras for a minimum of 5,565 nights across four sites of increasing habitat degradation. Within the primary and selectively-logged sites, a total of 2 and 16 *E. goudotii* were photographed, respectively. In the other major camera-trapping study of East Madagascar's carnivores Farris *et al.* (2015) amassed a total of 202 images of *E. goudotii* in Masoala-Makira. This large number of photographs was in part due to an increased sampling effort of 15,253 nights across seven sites from August 2008–2013. Within the western forests of Madagascar, the sole camera-trapping study of Malagasy carnivores captured six *E. major* across 24 sites during 227 nights in June–August 2012 (Evans *et al.* 2013). In contrast, our total camera-trapping grid was in collective operation for a total of 6,269 nights, capturing a single image of *E. major* from April–July. Insofar as this low success rate is indicative of very low population density, this raises at least the possibility that anthropogenic pressures in Ankarafantsika could be responsible.

E. major and *E. goudotii* are currently listed as Vulnerable by the IUCN (Hawkins 2016). Much of Madagascar's large fauna currently face significant pressures, predominately deforestation and hunting (Ganzhorn *et al.* 2001, Harper *et al.* 2008, Golden 2009, Schwitzer *et al.* 2014, Farris *et al.* 2015b, Merson 2017), two threats that are under current investigation in our study in Ankarafantsika. Within our study site, much of the landscape has been altered to savannah, agricultural fields, or experiences severe human and invasive species encroachment (Merson 2017). Our camera-trap grid encompassed a balanced mixture of these different habitats and it could be expected that these factors collectively act as a strong Falanouc deterrent. This baseline information should be helpful in ongoing estimations of their population, distribution and ultimately in informing their conservation.

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ORIGINAL ARTICLE

A New Record of an American Marten (*Martes americana*) Population in Southern Vermont

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Abstract.

American Marten *Martes americana* were once widely distributed in Vermont (USA) prior to European settlement, but overtrapping and habitat loss resulted in their extirpation from the state by the early 1900s. Marten were given state level protection in 1972 and despite a three-year reintroduction effort (1989-1991) to restore them, they currently remain endangered in Vermont. Marten sightings, tracks, and recovered carcasses from several parts of Vermont in the last 15 years suggest Marten are once again present in the region but it is unclear how widely distributed they are and whether a breeding population exists. Between 2015 and 2017, we conducted camera surveys in 45 sampling units (5km^2) located primarily within the Green Mountain National Forest of southern Vermont to verify the presence of an American Marten population. Marten were detected in 17 of our 45 sampled units, with several accounts of multiple individuals simultaneously occurring at the same camera station. Data from our camera surveys support the presence of a breeding population of Marten in southern Vermont restricted to a narrow portion of the Green Mountain National Forest. Marten in southern Vermont represent the southernmost population in the eastern United States and conserving them presents a number of challenges due to their potentially low abundance and geographical isolation.

Keywords: camera-trapping, conservation, Marten, United States.

Introduction

American Marten *Martes americana* is a small carnivore native to North America with a broad range that extends from the tree line in Alaska and Canada south through the Sierras and the Rocky Mountains (Figure 1). The range of Marten also extends into the north-eastern United States where, historically, they were widely distributed and reportedly common as far south as western Massachusetts prior to European settlement (Godin 1977). Like other native furbearers (Fisher; *Pekania pennanti*, Mink; *Neovison vison*), their numbers and distribution declined significantly in the Northeast as a result of overtrapping and habitat loss (Silver 1957, Brander and Books 1973) and by the early 1900's, they were extirpated from most areas of the Northeast except for the Adirondacks of New York and northern portions of Maine (Krohn 2012).

Marten were state-listed as endangered in 1972 and their active recovery began with a three-year reintroduction program (October 1989 - December 1991) initiated by the Vermont Fish and Wildlife Department (VFWD) and the United States Forest Service (Moruzzi *et al.* 2003). During this time, Marten from Maine (n=104) and New York (n=11) were reintroduced at two sites with suitable habitat in southern Vermont (DiStefano *et al.* 1990; Royar 1992). Despite these reintroduction efforts, track count surveys in 1990 suggested the presence of no more than four Martens (Royar 1992), and photos taken

during winter 1994 to 1995 confirmed the presence of no more than two (Brooks 1996). A final camera survey, conducted between 1997 and 1998 resulted in no Marten detections and consequently, Vermont Fish and Wildlife deemed the reintroduction effort in southern Vermont unsuccessful (Moruzzi *et al.* 2003). One plausible explanation for the failure of the reintroduction was competition and predation by fishers, another native carnivore of the Mustelidae family that has steadily recovered in last fifty years following a period of overexploitation that peaked in the early 1900's (Brander & Books 1973).

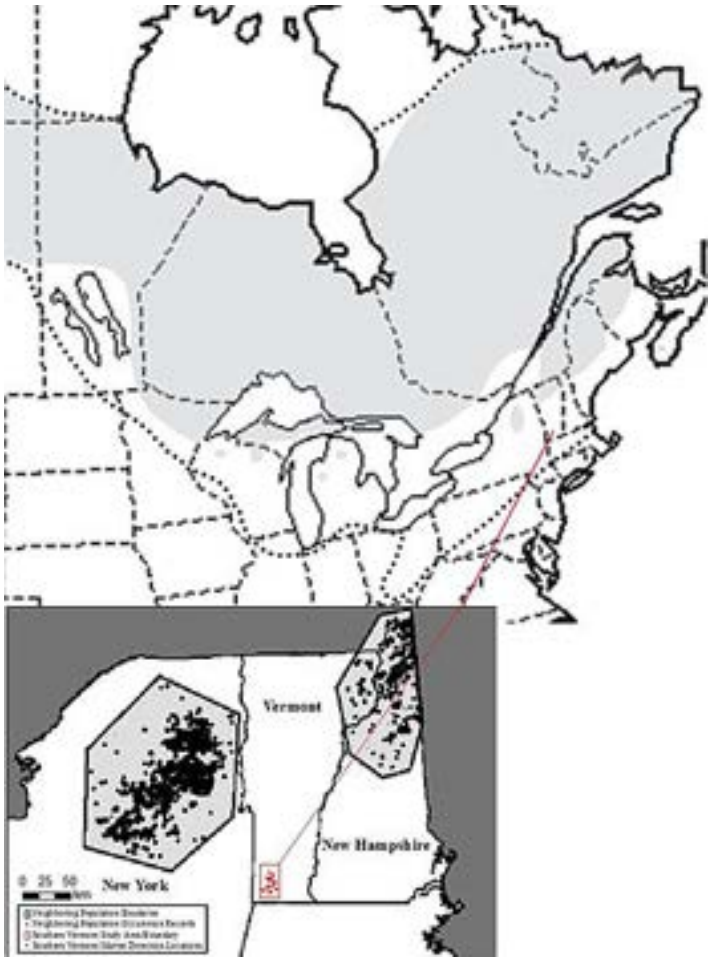

Figure 1. Historical map of the distribution of American Marten in eastern North America modified from Romanski & Belant (2008). Gray shading in top map represents current distribution and dotted line represents distribution prior to European settlement. Bottom map shows neighbouring Marten (*Martes americana*) populations in the North-eastern United States (modified from Jensen 2012) including the current study area (boundary outlined in red) and individual detection locations of Marten from 2015-2016 camera surveys (red dots) in southern Vermont.

Beginning in 1997, sightings and tracks provided evidence that Marten were present in north-eastern Vermont and may represent an expanding population from northern New Hampshire (Kelly 2005). Between 2010 and 2014, an accumulation of evidence including incidental captures during the fisher trapping season, tracks, and two verified photos from

triggered cameras (Chris Bernier, Vermont Fish and Wildlife, personal communication) indicated Marten were also present in southern Vermont. The sporadic reports do not indicate how widely distributed Marten are in southern Vermont and whether a viable self-sustaining population exists. The Marten is currently a state-listed endangered species (10 V.S.A. Chap. 123 2012) in Vermont and as such, requires a thorough understanding of its current distribution, habitat requirements, and limiting factors to effectively manage it. The objectives of our study were to; 1) Provide verifiable evidence of a Marten population in southern Vermont from standardized camera surveys and 2) Provide a preliminary estimate of their geographic distribution across our study area.

Materials and methods

Survey area

Our study area was primarily located within the southern extent of the Green Mountain National Forest (GMNF) in southern Vermont (Figure 2) and included three federally designated wilderness areas (Lye Brook Wilderness Area, George D. Aiken Wilderness Area, and Glastenbury Wilderness Area). We also sampled two units further south in state forests located in north-western Massachusetts. The area we sampled in the GMNF is mountainous with a maximum elevation of 1,220 m and is composed primarily of mixed northern hardwood-conifer stands comprised of American beech (*Fagus grandifolia*), yellow birch (*Betula alleghaniensis*), red maple (*Acer rubrum*), and sugar maple (*Acer saccharum*). Coniferous stands are predominantly spruce (*Picea* spp.) and occur near wetland areas.

Methods

We completed camera surveys between January 2015 and April 2017 in 45 units (5km²) that were scaled to represent an area equivalent to the average home range size of male American Marten (Jensen 2012). During this time, we conducted surveys in 45 sampling units, logging 4,075 total operating trap days, and 97,800 total trap hours. Sample units within our study area were selected based on a stratified random sampling. We created strata using the relative probabilities of a Marten being present within a 5km² unit from a recently developed an Environmental Niche Model (MaxEnt) model of Marten occurrence in the Adirondacks of New York (Jensen 2012). Based on the model, units in our study area were grouped into four strata ranging from high relative probabilities of Marten presence (≥ 0.39) to low probabilities (< 0.15) of Marten presence.

Within each of the 45 sample units, we used an array of 6 randomly placed triggered cameras (Moultrie 990is, Moultrie P150s, and Bushnell Trophy Cam Aggressors) to survey for American Marten. Cameras were mounted on trees 1.5 to 2 m above ground surface and aimed slightly downward toward the base of a bait tree to maximize the field of view. On

the bait tree, we wired one can of sardines approximately 1 m above the ground (Figure 3) and emptied another can at its base. Bait trees were also scented with a skunk essence-petroleum jelly mixture (<15 ml) and a curiosity scent containing peppermint-anise oil extracts (<1.5 ml).

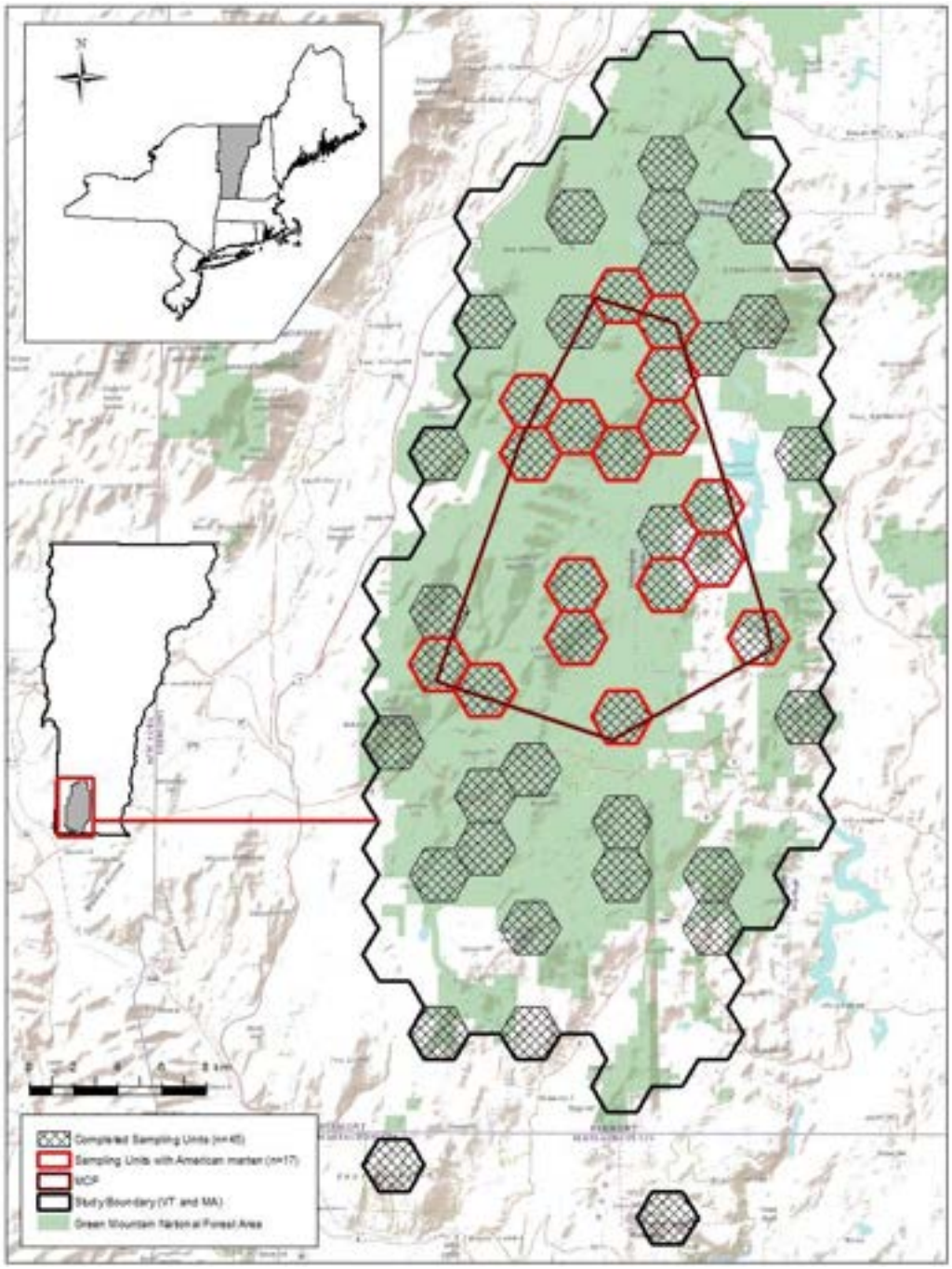

Figure 2. Map of completed survey units (n = 45) in southern Vermont and north-western Massachusetts study area indicating units with American Marten detections (Red). Most units were located within regions of the GMNF (Highlighted in light green). Outline (Brown) represents estimate of the Marten distribution in our study area.

Figure 3. American Marten image captured while visiting camera-station bait in southern Vermont.

Surveys lasted 15 days and were broken up into three five-day periods, during which camera stations were re-scented, re-baited, and data cards exchanged following each survey period. Cameras were set to operate for 24 hours per day and recorded date, time, and temperature of all detections. Images were reviewed by a minimum of two individuals; noting the date, time, and frequency of detections. In cases where species identification was uncertain, three people reviewed the photographic evidence and a positive identification was made only if a consensus could be reached.

Results

Between 2015 and 2017, we detected Marten in 17 of the 45 units (Figure 2). Using ArcGIS data management tools, we calculated a minimum convex polygon to estimate the approximate size of the distribution of this population. The size of distribution covers an area of 184.83 km² based on 48 Marten detection records at individual camera-trap stations within the study area (Figure 2). Marten were found as far north as the southern portion of Lye Brook Wilderness and as far south as Route 9 near Searsburg, Vermont (Figure 2). Detections occurred in all four strata and nearly all occurred during the winter months. Multiple individuals were seen in the same photos (Figure 4) and photos were recorded at different camera of marten that had very different body sizes being consistent with adult and juvenile age classes.

Figure 4. Photographic evidence of multiple American Martens from camera-trap surveys conducted during the winter of 2016 in southern Vermont.

Discussion

Our data from standardized camera surveys provides the first, verifiable records of a contemporary American Marten population in southern Vermont. This Marten population represents the southernmost extent of their known range in the eastern United States and is one of only two breeding populations in Vermont. Marten were historically found throughout New England as far south as Massachusetts (Figure 1) but were virtually eliminated from the Northeast by the early 1900's due to overtrapping and habitat loss. Marten were listed as endangered in the state of Vermont in 1972 and have only been reported in the state within the last 15 years. The earliest reports from north-eastern Vermont suggest that Marten may be moving into the area from neighbouring Canada or New Hampshire. Marten were considered absent from southern Vermont as recently as 2010 until snow tracks and incidental captures suggested otherwise. The reintroduction of Marten to southern Vermont between 1989 and 1991 (Moruzzi *et al.* 2003) was considered unsuccessful but the presence of Marten near the reintroductions suggests that it was either successful or that the area has recently been recolonized via long distance dispersal. A genetic analysis of marten samples (n = 27) supported several possible explanations for their presence in southern Vermont including long distance dispersal from northern Vermont and northern New Hampshire (O'Shea 2014). A more recent examination of mtDNA and microsatellite data from ongoing research suggests that marten in southern Vermont did not likely originate from dispersal events involving other populations following the reintroduction (Aylward et al. 2016 unpublished data) and leaves open the possibility for alternative explanations.

Conservation Implications

The Marten population in southern Vermont is of considerable conservation concern. The limited evidence and the recent timeframe of their presence in southern Vermont indicates they are not likely abundant. Marten also appear to occupy only a narrow distribution in the Green Mountain National Forest and may be regionally isolated from the two closest Marten populations in New Hampshire (150 km) and New York (97 km; Figure 1). Connectivity with other populations of Marten in the region may be possible

based on their maximum recorded dispersal distance however, Johnson et al. (2009) found that 80% of dispersing juvenile Martens established a home range within 20 km from where they were born. If the southern Vermont population of marten is small and isolated, it is more susceptible to demographic stochasticity and the genetic effects of inbreeding and low genetic diversity associated with drift.

Fishers are considered a potential limiting factor of Marten and they were detected in 44 out of our 45 sample units. Previous studies have provided data that Fishers may be important intraguild predators of Marten (Raine 1981, Hodgman *et al.* 1997). The presence of an abundant Fisher population near the area of the Marten reintroduction could explain why it presumably failed. Marten typically inhabit higher elevations and areas with deeper snow compared to Fishers and are better equipped to travel in deep snow conditions due to their lower body mass to total foot area ratio (10.1 to 12.2 g/cm²) compared to Fishers (21.1 to 32.0g/cm²). Thus, deep snow conditions provide a competitive advantage for Marten (Krohn 2012). Changes in annual snowfall due to global climate change could potentially alter competitive dynamics between Marten and Fisher at the southern extent of their range and ultimately jeopardize the persistence of the southern Vermont Marten population.

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ORIGINAL ARTICLE

First evidence of male spatial associations and roadkill mortality in the Fosa *Cryptoprocta ferox* in Ankarafantsika National Park, Madagascar

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Abstract.

Historically, the Fosa *Cryptoprocta ferox* has been considered solitary outside of the mating season. Recent work in Kirindy Forest suggested that males in this species may interact more than previously recognized, yet it was unclear whether that association reflected unique conditions of the population and/or habitat at Kirindy or more generalized behavioural plasticity in the species. Here we document the first evidence of spatial association patterns in Fosa males in the northern deciduous forest of Ankarafantsika National Park, Madagascar, collected using GPS-collars to precisely record positional data at fine temporal scales. These data reveal intriguing patterns, including a male dyad that travelled together on multiple occasions over a two-week period. Results suggest that male associations in the keystone carnivore of Madagascar may be more common than previously recognized, especially in areas of high competition or (invasive or endemic) carnivore density. Notably this paper also documents the first published account of road kill mortality for this keystone predator species, raising awareness regarding a need for better roadkill mitigation strategies within the park.

Keywords: Fosa, conservation, GIS, roadkill, association behavior.

Introduction

Among Carnivora, social organization varies broadly from solitary individuals up to complex multi-male multi-female family units (Macdonald 1983). Many species, including leopards, jaguars, and Eurasian lynx *Lynx lynx*, are well-known to remain solitary outside the mating season (Gittleman 1989, Jackson 1996, Schmidt et al. 1997). Variance in cooperation has been documented in other carnivores such as the Red fox *Vulpes vulpes* (MacDonald 1979, von Schantz 1981). Others still, such as wolves, hyaenas, giant otters, and lions, form cooperative groups containing related individuals as well as newcomers (Kruuk 1972, Duplaix 1980, Macdonald 1983, Mech et al. 1998). Overall, however, at least 85% of carnivore species are considered solitary (Bekoff et al. 1984, Gittleman 1984). The social behaviour in smaller-bodied and rarer carnivores, however, remains largely understudied. In

particular, relatively few studies document sociality in the seven genera and ten extant species of endemic euplerid carnivores occupying Madagascar today (Yoder & Flynn 2004, Farris et al. 2015).

The Fosa *Cryptoprocta ferox* (Figure 1) is Madagascar's largest endemic predator. This small to medium sized species (5-9 kg) occurs throughout the country's forested areas, including high elevations of the Adringitra Mountains (2,000 m) and on the small Isle Saint-Marie (Köhncke & Leonhardt 1986, Hawkins 2003). Despite the species' large natural range (Hawkins 1998), estimated population densities are comparatively low for tropical carnivores at about 1.24 animals per km^2 in some areas (Peters 1983, Hawkins & Racey 2005). In Kirindy Forest, a dry deciduous habitat, the estimated population density is still lower, at one animal per 4 km^2 (Hawkins 1998).

Figure 1. Study individual M1 of *Cryptoprocta ferox* in Ankarafantsika National Park, Madagascar. Credit: Eileen Wyza.

Fosa spatial ecology appears broadly similar to that of other hypercarnivorous (where diet is comprised of over 70% meat) and polygynous species in that males typically occupy larger home ranges and often overlap with other males, whereas females occupy smaller home ranges and rarely overlap with other females (Hawkins 2003). Despite home range overlaps, Fosas were, until recently, assumed to be solitary outside of the mating season (Hawkins 1998, Dollar 1999, Hawkins 2003, Hawkins & Racey 2009, Lührs & Dammhahn

2010, Lührs & Kappeler 2013). Because IUCN currently lists Fosa as vulnerable due to a 30% or greater population drop over the past three generations (Hawkins 2016), low population densities and presumed solitary behaviour are a great cause of concern when considering the species' ability to adapt to continued habitat degradation, persecution hunting, and conflicts with introduced species (Farris et al. 2015).

Anecdotal sightings of Fosas traveling together outside of the mating season, however, have raised questions regarding the generality of solitary behaviour in this species (Hawkins 2003, Lührs & Dammhahn 2010, Lührs & Kappeler 2013), and recent work in Kirindy Forest found evidence of cooperative hunting and strong associations in radio-tracked Fosa males (Lührs & Dammhahn 2010, Lührs et al. 2012, Lührs & Kappeler 2013). Association between male carnivores for territorial defence and access to females has been documented in other species, including cheetahs and Kinkajous *Potos flavus* (Caro & Collins 1987, Gehrt & Fritzell 1998, Boydston et al. 2001, Kays & Gittleman 2001). It is also possible that associations form for heightened efficiency in hunting (Clark & Mangel 1986, Creel & Creel 1995, Lührs & Dammhahn 2010, Lührs et al. 2012).

Global Positioning System (GPS) evidence of Fosa spatial associations have never been reported outside Kirindy Forest. Hence, it remained possible that Fosa ranging and association patterns observed at Kirindy reflect unique conditions of that particular population and/or habitat. Alternatively, *C. ferox* as a species may be capable of greater behavioural plasticity in spatial associations than has previously been appreciated. We explored these alternative possibilities using high-resolution spatial data gathered using GPS collars in a different forested habitat, Ankarafantsika National Park, Madagascar. Documentation of male associations in this paper supports the latter interpretation, indicating Fosas may exhibit some degree of behavioural and associative flexibility in the face of anthropogenic environmental changes, making them a plausible candidate for successful conservation interventions.

Materials and methods

Study area

Ankarafantsika National Park is a dry deciduous forest in north-western Madagascar with distinct wet and dry seasons (Figure 2). The dry season occurs from May to October, and the wet season occurs from November to April (Alonso et al. 2002). Ankarafantsika National Park has experienced an alarming rate of deforestation in recent years, with 20% of its forest disappearing in the decade between 1990 and 2000 (Dollar 2006). Additionally, a major roadway (RN4) bisects the park into eastern and western areas, potentially hindering wildlife movements and significantly increasing threats of wildlife loss due to roadkill.

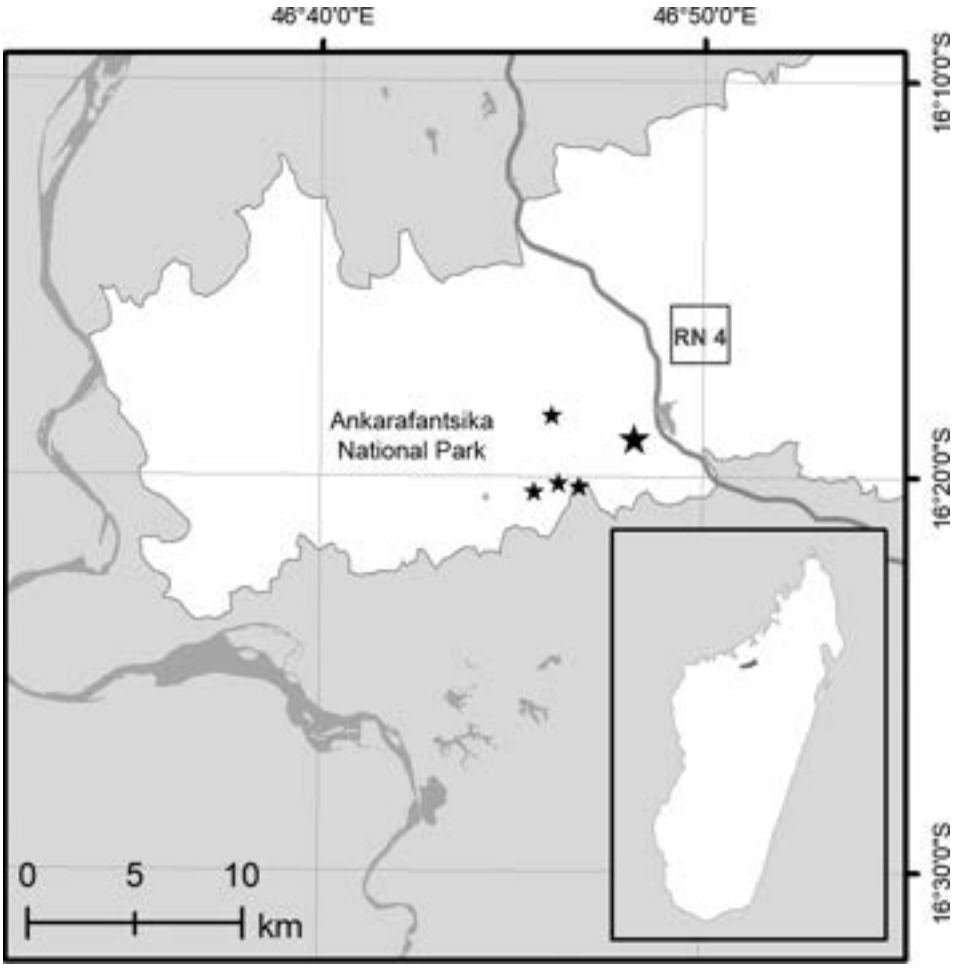

Figure 2. Location of Ankarafantsika National Park in Madagascar and location of RN4 that bisects the park. Locational fixes where the male dyad travelled closer than the critical distance (250 m) are starred. The largest star shows the location where the initial sighting of the association was captured via camera trap, depicted in Fig. 3.

Methods

Fosas were captured and fitted with GPS collars in Ankarafantsika National Park in June, 2016. All data were collected following procedures approved by the Institutional Animal Care and Use Committee (IACUC). Individuals were trapped using Tomahawk bobcat traps (107 x 38 x 51 cm). Forty traps were placed along two trap lines that extended across 20 km. Once captured, Fosas were sedated with Telazol following methods published by Dollar (2006), then fitted with Telonics TGW-4277-4 GPS Iridium collars (220 g, 5.7 x 3.5 x 2.7 cm). Collars were placed only on adult animals large enough that the collars comprised ≤5% body mass. Animals were placed in a recovery cage until the anaesthetic wore off, then released at the capture site.

GPS collars were programmed to take QFP (Quick Fix Pseudoranging) spatial data every 20 minutes. Activity counts were simultaneously measured using the collar's accelerometer. Mortality was identified by an Activity Count registered at 0 for a 24-hour

period. GPS data were supplemented with ten camera trap images using 12 Reconyx HC500/HC600 cameras placed along the trap lines and in close proximity to trap locations.

Doncaster's method of dynamic interaction (Doncaster 1990) was used to explore for association patterns among individuals using the wildlifeDI package in R 3.3.2 (Long 2015). For this study, association was defined by two individuals coming within a critical distance of 250 m from each other within a one-hour period. The default critical distance of 50 m used in prior studies examining association behaviours in foxes (Doncaster 1990) was increased to 250 m due to a comparatively larger body size (e.g., Dollar 2006), and acute sense of olfaction in the Fosa (Köhncke & Leonhardt 1986, Wright 1998).

Results

Two males were captured over the duration of the trapping portion of the study. The male Fosas were initially documented together using camera traps posted along the trap lines and in close proximity to traps. They were first observed traveling together on June 2nd at 17h56, following when one of the males (M1) entered a trap. The second male (M2) remained for nearly 3 hours just outside the apparatus with the trapped male until M1 was removed from the trap at 20h49 (Figure 3), and in fact approached to within 10 m of the capture team when quietly stopped in the vicinity of the capture trap.

Figure 3. Camera trap capture of two male fosa traveling together, with M1 (circled) captured in one of the traps and M2 (foreground) remaining nearby.

This second male (M2) was captured the following morning less than 1 km away from the first capture location. Both males were fitted with GPS collars and released and were then intensively radio-tracked simultaneously for two weeks. Unfortunately, M2 was fatally

injured on the roadway (RN4) by a vehicle only two weeks into the study, severely limiting data collection and calling attention to the direct impacts humans have on Fosa populations as well as the need for continued research and conservation efforts that address roadways.

Over the period of data overlap, however, M1 and M2 travelled together at least two additional times. On June 10th, they travelled for one hour and 20 minutes in the same direction with a measured distance from one another varying between 75-120 m throughout that interval. Four hours from the initial association, M2 ceased activity and M1 continued to travel. The male dyad came together again on June 13th and were measured less than 50 m from each other. They travelled together for two hours until M1 ceased activity and M2 continued traveling.

Doncaster's (1990) method of dynamic interaction was used to determine whether the movements between the dyad statistically showed mutual attraction. The test revealed that the individuals interacted nonrandomly ($p < 0.001$). During the GPS collar study, the two males came within critical distance (250 m) three times simultaneously, and twelve times within one hour of each other. When considering spatial positions during the study period, the probability that the individuals were within 2 km of each other were greater than predicted by chance alone.

Discussion

GPS data document a significant degree of spatial association between the M1-M2 male Fosa dyad at Ankarafantsika. Within a two-week period during the dry season, the two individuals travelled together at least three times. The coordinated movements between the M1-M2 dyad at Ankarafantsika occurred at a higher critical distance than the previous study (Lührs & Kappeler 2013), perhaps due to the larger size of Ankarafantsika National Park relative to the other study locale. Notably, the 50 m critical distance utilized in the Lührs & Kappeler (2013) study is perhaps conservative, as it was based upon the sensory abilities of foxes in urban environments rather than Fosa (Doncaster 1990). Additional studies regarding the sensory abilities of Fosa in forested environments are necessary to determine the ideal critical distance measurement to use for this species in future statistical analyses. Unfortunately, simultaneous data collection of the Ankarafantiska male dyad was truncated due to the death of M2, reducing the opportunity to observe spatial associations over a longer time and across seasons.

Because temporal intervals used in GPS data collection were optimized to extend the overall study duration by recording positions only at 20-minute intervals, it is possible that the individuals also travelled together more frequently for bouts lasting less than 20 minutes. Fosas are able to cross their entire home range in a short period of time (Hawkins 2003), so individuals can certainly travel more than 250 m in 20 minutes. Understanding the speed of travel for Fosa across varying landscapes in order to determine what movement patterns may

have occurred between GPS fixes requires further study to confirm the possibility of greater association.

Documentation of travel associations in male Fosas is rare and has only been recorded to date in dry deciduous forests (Lührs & Kappeler 2013). It is possible that spatial association provide advantages in environments with higher seasonality relative to habitats in more even climates, like tropical rainforests, but this will need to be confirmed through additional data. Previous studies have demonstrated that carnivores exhibit increased social flexibility during times of resource abundance (Silva et al. 1993, Eide et al. 2004). In contrast, the dyad in this study have to date exhibited spatial associations only during the dry season, when overall resource availability is somewhat lower. Therefore, Fosa associations may support the hunting efficiency hypothesis (Creel & Creel 1995, MacNulty et al. 2011), as also suggested by Luhrs & Kappeler (2013).

Alternatively, spatial associations may reflect behavioural plasticity in the face of known threats, such as competition with rising populations of introduced carnivore species such as feral cats and dogs (Farris et al. 2015). Interestingly, associations have been suggested as a means of reducing predation risk in Madagascar's Narrow-striped Mongoose *Mungotictis decemlineata* (Schneider 2015). Although dogs and cats may not prey directly on the Fosa, it is possible that Fosa spatial associations may assist with coordinated defence of kills and other resources in light of the larger overall carnivore populations in the forest. This hypothesis would be supported should sociality increase hunting success or decrease conflict/competition with larger bodied carnivores, particularly considering increased numbers of dogs encountered in and around this (Barcala 2009, Dollar, unpubl. data) and other study areas (Farris et al. 2015) in recent years. Additional studies of larger numbers of Fosa across different seasons and in different parks will help to test among these possibilities, but it is interesting to speculate on the impact of the roadkill on the surviving Fosa male.

Conclusions

Understanding the ranging and behaviour patterns in species of critical conservation priority is paramount to effective habitat and population management. This article affirms recent observations that male Fosa may exhibit flexible cooperative or association patterns, forming temporary coalitions for territorial or hunting purposes (Lührs & Kappeler 2013), contrary to previous interpretations of Fosa as exclusively solitary predators (Hawkins 1998, Dollar 1999, Hawkins 2003). It is also possible that association behaviours could arise from pressures such as introduction of invasive species, as has been documented in the Narrow-striped Mongoose, another Malagasy carnivore (Schneider 2015). As anthropogenic and invasive species pressures increase throughout Madagascar, our results underscore critical topics for intensified study to better integrate research with conservation and management strategies, and ultimately policy governing natural resource protection.

Moreover, this paper provides the first published report of Fosa succumbing to roadbed mortality, with M2 in this study tracked via GPS collar to the point where it was hit by a car and its death by roadkill subsequently investigated and confirmed by villagers living nearby. Roadkill is a well-documented threat to wildlife elsewhere in the world. With roadbed mortality being a significant cause of non-natural death for some carnivores including Florida panthers *Puma concolor* (Taylor et al. 2002, Pimm et al. 2006), Iberian lynx *Lynx pardinus* (Ferreras et al. 1992), wolves (Paquet 1993), and European badgers *Meles meles* (Clarke et al. 1998), recognition of this threat in Madagascar naturally leads to awareness of the need to mitigate roadkill threats in protected areas.

Results of this study encourage deeper investigation of the type and degree of sociality exhibited by male Fosa and suggest a need for focused attention to mitigate the impacts of roadkill on Fosa throughout Madagascar in order to promote the best, most informed conservation efforts and strategies possible.

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ORIGINAL ARTICLE

First records and range extension of Striped Hog-nosed Skunk *Conepatus amazonicus* in Mato Grosso, Brazil

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Abstract.

The distribution of the Striped Hog-nosed Skunk in Brazil encompasses the Caatinga and Cerrado biomes, but the limits of its occurrence in the country remains unclear, especially in the westernmost portion of the Brazilian central plateau. Here we report the first records from the Mato Grosso state, within the Cerrado biome, and suggest the distribution of the species in this state based on reliable occurrence data. In general, the conservation status the Striped Hog-nosed Skunk is categorized as Least Concern, due to its wide distribution range, tolerance to human disturbances, and occurrence in several habitat types. However, we consider the Striped Hog-nosed Skunk a priority species for regional conservation, due to be locally rare and vulnerable to road mortality and other emergent threats within the southeast of Mato Grosso.

Keywords: Cerrado, *Conepatus semistriatus*, Mephitidae, occurrence.

Introduction

The Hog-nosed Skunks *Conepatus* (Gray, 1837) are the only representatives of the Mephitidae in South America, represented by three living species (Redford & Eisenberg, 1992). Two species are recognized in Brazil, the Striped Hog-nosed Skunk *Conepatus semistriatus* (Boddaert 1785) and the Molina's hog-nosed skunk *C. chinga* (Molina 1782) (Eisenberg & Redford 1999, Dragoo 2009).

The Brazilian population of *C. semistriatus* is recognized as *C. s. amazonicus*, which is apparently isolated from the others (Dragoo 2009). However, zoogeographic and genetic evidence show that the name *C. semistriatus* does not apply to the species of *Conepatus* in eastern Brazil and suggesting *C. amazonicus* as available name for the species in the region (Feijó & Langguth 2013). We adopt here *C. amazonicus* as the valid name.

As other species of *Conepatus*, the Striped Hog-nosed Skunk has a long, naked, broad and projected nose (Nowak & Paradiso 1983). Its black body also has two white dorsal stripes (Dragoo & Honeycutt 1999a, 1999b). The tail is less than half the total body length, which in turn tends to get smaller from the north to the south of Brazil (Dragoo 2009). The species uses grasslands containing scattered palms, sparse deciduous forests, shrub woodlands, and grasslands containing sedges and herbaceous plants during the dry season. Clearings and pastures near evergreen forests are frequently occupied by this species (Dragoo 2009).

The Striped Hog-nosed Skunk is categorized as Least Concern - LC (Cavalcanti *et al.* 2013; Cuarón *et al.* 2016) due to its wide distribution range, occurrence in several habitat types and tolerance to human disturbances. However, mortality due to collisions with vehicles is a great threat to *Conepatus* spp. across its distribution area (Kasper *et al.* 2009).

The Striped Hog-nosed Skunk has a disjunct distribution in Mesoamerica, the northern Andes and eastern Brazil. Its range begins in southern Mexico and continues south into northern Peru along the western Andes and east across northern Venezuela and northern Colombia, with an isolated population in northeastern Brazil (Nowak & Paradiso 1983, Eisenberg 1989, Reid 1997, Eisenberg & Redford 1999). Emmons (1997) suggested a southernmost distribution in Brazil across Caatinga and Cerrado biomes. Kasper *et al*. (2009) reported occurrence in the states of Maranhão, Goiás, Minas Gerais, São Paulo, Piauí, Bahia and Distrito Federal, in the Cerrado and/or Caatinga biomes. However, the distribution limits of Striped Hog-nosed Skunk in Brazil remains unclear (Kasper *et al.* 2009).

Lack of data about occurrence of Striped Hog-nosed Skunk and knowledge gaps lead to the dissemination of uncertain information, such as some distribution maps available (Cavalcanti *et al.* 2013, Cuarón *et al.* 2016). Nevertheless, geographic distribution data is of great interest for the design of adequate conservation strategies for this species in Brazil (Kasper *et al.* 2009).

The Mato Grosso state extends over a large geographic area (903,358 km²) in Central Brazil. Originally, the Cerrado biome (comprising a mosaic of natural covers, from open fields to savannas and forests) covered about 352,309 km², about 40% of the territory. The Amazon Forest biome covers 487,813.27 km² (54%), and the Pantanal biome 63,235.05 km² (7% of the territory), according to IBGE-MMA (2017). Until 2011, about 47.30% of the original vegetation of the Cerrado biome had already been cleared (Mato Grosso 2017).

Despite of the occurrence of the Striped Hog-nosed Skunk being indicated for the central region of Brazil (Eisenberg & Redford 1999) and its distribution associated with the Cerrado biome (Cavalcanti *et al.* 2013), the species had not been recorded in the Mato Grosso state until now. In fact, the species is absent in the checklist of large and medium-sized mammalian species from the Cerrado, Pantanal wetland and Amazon Forest biomes in Mato Grosso state (Schneider 2000, FEMA-MT 2002, Santos-Filho & Silva 2002, Marques &

Santos Júnior 2003, Marques *et al.* 2005, Santos Júnior 2005, Rocha *et al*. 2006, Rocha & Dalponte 2006, Schaller 1983, De Lázari 2011, Rossi *et al*. 2001, Rocha *et al*. 2012).

The lack of records in Mato Grosso probably represents non-occurrence of *C. amazonicus* throughout most of the territory. In part, this does not seem to be the result of insufficient surveys, considering the conspicuousness of their features and behaviour, very easy to notice and differentiate from other local small carnivores. Moreover, footprints and trail patterns of Striped Hog-nosed Skunk are typical and easily found and identified.

In this work, we report eight records of Striped Hog-nosed Skunk in the Mato Grosso state, from 2009 to 2013 (Figure 1). The records were made on different occasions during fauna surveys and sporadic records of road-killed individuals.

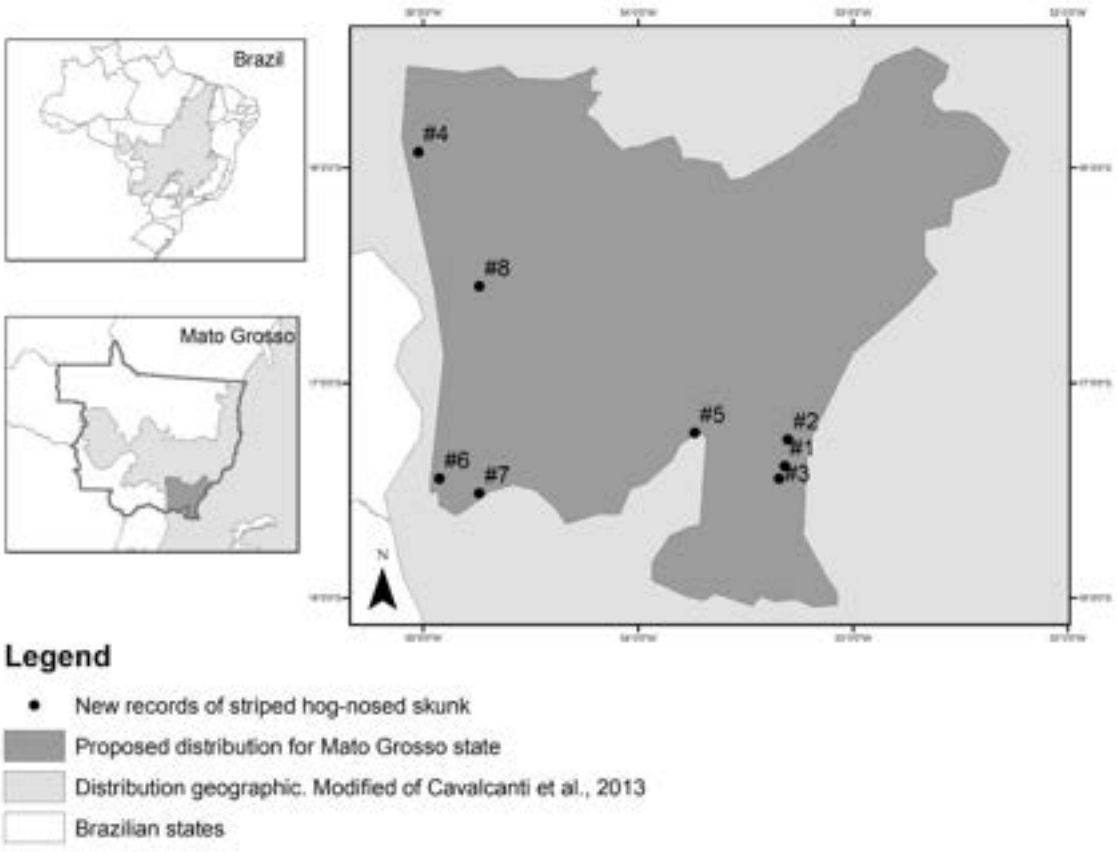

Figure 1. New occurrences of the Striped Hog-nosed Skunk and proposed distribution in Mato Grosso state, Brazil.

The first record consisted on a sighting of an adult individual (Figure 2a) on December 3, 2009 at 08h30, on a woodland savanna (cerrado *sensu stricto*) habitat, 10 km southwest from the city of Alto Araguaia municipality (17°23’10.30” S, 53°19’09.12” W, altitude: 788 m, point # 1, Figure 1).

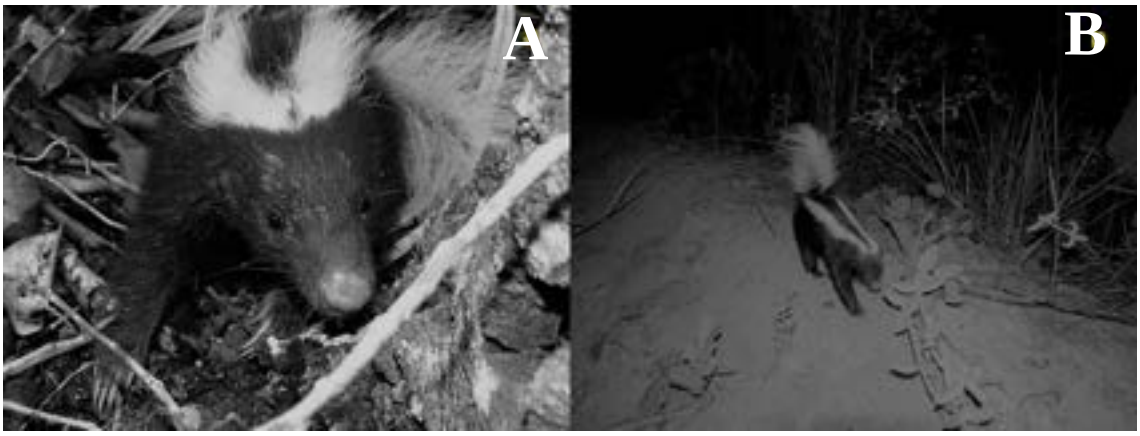

Figure 2. First records of the Striped Hog-nosed Skunk *Conepatus amazonicus* in the southeast of Mato Grosso state, Brazil. (A) Adult photographed in Alto Araguaia municipality (point#1), December 2009. C. Medolago; (B) Adult male in the Itiquira municipality (point #5), February 2013. L Camilo.

A second record correspond to an individual found dead on the December 3, 2009 at 11h30 along the road BR-364 within a fragment of woodland savanna, 10 km northwest of Alto Araguaia municipality (17°15'44.82" S, 53°18'14.40" W, altitude 740 m, point # 2; Figure 1). The third record was made through the direct observation of an adult individual on the December 9, 2009 at 21h00 in a woodland savanna, 12.5 km west of the left bank of the Araguaia river (17°26'32.90" S, 53°20'38.35" W, altitude 748 m, point # 3; Figure 1). Another specimen was found on the October 10, 2012 on road BR-364, 4.5 km northwest of Jaciara municipality (15°55'36.45" S, 55°01'23.01" W, altitude 482 m, point # 4; Figure 1), where the road crosses a matrix of cattle pastures, woodland savanna and semi-deciduous forest.

On the February 11, 2013 at 05h34 a male Striped Hog-nosed Skunk was sighted in the Itiquira municipality (17°13'51.71" S, 53°44 '16,90" W, altitude 696 m, point # 5; Figure 1), near the right bank of Correntes river. A second sighting at the same site was obtained on the February 11, 2013 at 20h38. On both occasions, the animals were foraging in woodland savanna.

Another sighting of an active individual was recorded on the December 30, 2014 in a woodland savanna in the vicinity of the state road MT-299, 20.3 km north of the right bank of the Correntes river (17°26'15,06" S, 54°55'31.26" W, altitude 366 m, point # 6; Figure 1). Two other records correspond to two road-killed individuals. One of them was found on the highway BR-163, in January 2, 2015 at 08h00 in a fragment of woodland savanna 450 m north of the right bank of the Correntes river near Mato Grosso do Sul state border (17°30'40.17" S, 54°44'22.98" W, altitude 421 m, point # 7; Figure 1).

A last record was obtained on the January 15, 2015 through direct observation at 21h30 in an area of woodland savanna near to Parque Ecológico João Basso, a private natural heritage reserve, 17 km southwest of the city of Rondonópolis (16°32'59.57" S,

54°49’04,92” W, altitude 471 m, point # 8; Figure 1). This record represents the only confirmed occurrence of the Striped Hog-nosed Skunk for a protected area in Mato Grosso state.

The data presented here shows that the distribution of the Striped Hog-nosed Skunk within the Cerrado biome extends to approximately 200 km W from the current records of the most extreme western boundary of the species distribution in Central Brazil (Emas National Park in the Goiás state; 18°15’50” S, 52°53’33” E, Rodrigues *et al.* 2002).

Considering the data presented and the lack of records in other regions and biomes of the state, we point out that Striped Hog-nosed Skunk occurrence in the Mato Grosso is locally restricted to the northernmost portion of the Paraná Sedimentary Basin plateau, at southeast portion of the state. Its distribution seems to be limited to the southwest by the eastern border of the northern Pantanal wetlands, to the west and northwest by the scarps of the São Jerônimo and Coroados mountain ranges, correspondingly, to the north by the south ridges of the Guimarães Plateau, and to the northeast by the south foothills of Serra dos Gerais and the Araguaia River (downstream from the city of Barra do Garças; Figure 1). The Araguaia River, at least downstream of the city of Barra do Garças, represents a limit for the distribution of Striped Hog-nosed Skunk in most of Mato Grosso territory, as a wide and easternmost barrier of about 700 km.

To improve Striped Hog-nosed Skunk conservation, further research should address other emerging threats in the region such as the effects of invasive species (Kasper *et al.* 2009) and pesticides (Pignati *et al.* 2014). Moreover, studies indicate that mortality due to collisions with vehicles is the greatest threat to *Conepatus* spp. across its entire distribution (Kasper *et al.* 2009). Of the eight records of Striped Hog-nosed Skunk obtained in the present study, three (37.5 %) were road-killed, indicating that vehicles can be a significant contributor to population decline of Striped Hog-nosed Skunk in Mato Grosso state.

Although conservation status of mammals has not categorized in Mato Grosso state, we suggest that Striped Hog-nosed Skunk be considered as threatened in the state, primarily due to its locally restricted occurrence. Only 13% of the area previously suggested for Striped Hog-nosed Skunk in Mato Grosso is actually occupied by the species. Therefore, considering the absence of Striped Hog-nosed Skunk in most of the Cerrado biome in Mato Grosso, differently from what is presented in the available distribution maps (Cavalcanti *et al.* 2013, Cuarón *et al.* 2016), the conservation status of the species in Brazil and globally should be reviewed.

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