Small Carnivore Conservation

The Journal of the IUCN SSC
Small Carnivore Specialist Group

Volume 50 July 2014

A white-coated Brown Palm Civet *Paradoxurus jerdoni*
in the Western Ghats, India (Photo: Kedar Bhat)

Records of small carnivores and of medium-sized nocturnal mammals on Java, Indonesia

E. J. RODE-MARGONO[1]*, A. VOSKAMP[2], D. SPAAN[1], J. K. LEHTINEN[1], P. D. ROBERTS[1], V. NIJMAN[1] and K. A. I. NEKARIS[1]

Abstract

Most small carnivores and nocturnal mammals in general on the Indonesian island of Java lack frequent and comprehensive distribution surveys. Nocturnal surveys by direct observations from walked transects (survey effort 127 km, about 254 hours) and fixed-point surveys at a total of 14 areas throughout Java during 2012–2014, supplemented by camera-trapping (705 camera-trap-nights) and direct sightings from Cipaganti, western Java, from two years' research presence, yielded records of Leopard Cat *Prionailurus bengalensis* (121 encounters/2 sites), Javan Mongoose *Herpestes javanicus* (4/2), Yellow-throated Marten *Martes flavigula* (1/1), Javan Ferret Badger *Melogale orientalis* (37/1), Banded Linsang *Prionodon linsang* (2/2), Binturong *Arctictis binturong* (3/2), Common Palm Civet *Paradoxurus hermaphroditus* (145/10), Small Indian Civet *Viverricula indica* (8/1), Javan Chevrotain *Tragulus javanicus* (3/2), Javan Colugo *Galeopterus variegatus* (24/5), Spotted Giant Flying Squirrel *Petaurista elegans* (2/1) and Red Giant Flying Squirrel *P. petaurista* (13/3), as well as of the research's focus, Javan Slow Loris *Nycticebus javanicus*. Nine species also plausibly detectable and identifiable through such surveys were not encountered. Although chance and the selection of survey sites, habitat and methods might explain the absence of most of these nine, the lack of records of Small-toothed Palm Civet *Arctogalidia trivirgata*, Sunda Stink-badger *Mydaus javanensis* and Sunda Porcupine *Hystrix javanica* raises concern about their conservation status on Java. Javan Colugo, thought to be confined to western Java, was recorded three times in two sites 600 km away in the easternmost part of the island, thereby significantly extending its known range. Some species showed remarkable flexibility in their choice of habitat and were relatively common in human-modified and unprotected sites. We report descriptive data on behaviour, ecology and sighting distances from human settlements. Regional population declines and possible local extinctions might go undetected, unless surveys are more frequent and geographically broader. Some of the survey sites presented here would allow for more intensive studies of several species.

Keywords: *Arctogalidia trivirgata*, biogeography, camera-trapping, ecological flexibility, *Galeopterus variegatus*, *Hystrix javanica*, Javan Colugo, nocturnal mammals, Small-toothed Palm Civet, spotlighting, Sunda Porcupine

Pengamatan hewan karnivora kecil dan mamalia nokturnal berukuran sedang di Jawa, Indonesia

Abstrak

Sebagian besar dari Ordo karnivora kecil dan mamalia nokturnal di Pulau Jawa, Indonesia kurang memiliki survey distribusi yang komprehensif. Survey nokturnal melalui observasi langsung di jalur transek (sepanjang 127 km, 254 jam), camera-trapping (705 hari jebak kamera), survey titik-tetap nokturnal di 14 area seluruh Jawa 2012-2014, dan catatan tambahan dari Cipaganti, bagian barat Jawa, dari riset selama dua tahun, menghasilkan catatan penampakan Kucing Kuwuk *Prionailurus bengalensis* (121 perjumpaan, 2 lokasi), Garangan Jawa *Herpestes javanicus* (4/2), Amunin Panan *Martes flavigula* (1/1), Biul Slentek *Melogale orientalis* (37/1), Linsang *Prionodon linsang* (2/2), Binturong Muntu *Arctictis binturong* (3/2), Musang Luwak *Paradoxurus hermaphroditus* (145/10), Musang Rase *Viverricula indica* (8/1), Pelanduk Kancil *Tragulus javanicus* (3/2), Tando *Galeopterus variegatus* (24/5), Tando Totol *Petaurista elegans* (2/1) dan Tando Merah *P. petaurista* (13/3), serta spesies yang menjadi fokus penelitian, Kukang Jawa *Nycticebus javanicus*. Sembilan spesies yang seharusnya terdeteksi melalui survey tersebut tidak diketemukan. Meskipun cara pemilihan lokasi survey, habitat dan metode yang digunakan mungkin menjelaskan absennya sebagian besar dari Sembilan spesies ini, tidak ditemukannya Musang Akar *Arctogalidia trivirgata*, Teledu Sigung *Mydaus javanensis* dan Landak Jawa *Hystrix javanica* menimbulkan kekhawatiran akan status konservasi mereka di Jawa. Tando, yang diduga hanya menempati bagian barat Jawa, ditemukan sebanyak tiga kali di dua lokasi sejauh 600 km sebelah ujung timur pulau Jawa, ini menandakan perluasan yang signifikan dari daerah jelajahnya. Beberapa spesies menunjukkan fleksibilitas yang tinggi akan pilihan habitat dan relatif umum ditemui di lokasi yang tidak dilindungi dan telah dimodifikasi manusia. Kami melaporkan data deskriptif akan perilaku, ekologi, dan jarak perjumpaan dari pemukiman manusia. Penurunan populasi regional dan kemungkinan kepunahan lokal tidak dapat terdeteksi, kecuali survey dibuat lebih sering dan meliputi area geografis yang lebih luas. Beberapa lokasi survey yang dijelaskan disini dapat emnjadi area studi yang lebih intensif bagi beberapa spesies.

Introduction

Sundaland, which encompasses the Sunda shelf, is considered a top biodiversity hotspot based on the large number of endemic species and on the high habitat loss (Myers *et al*. 2000, Brooks *et al*. 2002). Most of its southeastern part, the island of Java, is amongst the most densely populated regions in the world. Java holds only 7% of the land area of Indonesia, but 58% of the human population (BPS 2010), putting an enormous pressure on biodiversity (Sodhi *et al*. 2004, Miettinen *et al*. 2011). More than 90% of Java's natural vegetation has been lost, with much of the remaining natural primary or secondary forest coinciding with areas that are difficult of access

such as mountains (Smiet 1992, Lavigne & Gunnell 2006). Many larger mammals are extinct on the island or have a highly fragmented distribution (Santiapillai & Ramono 1992, Whitten *et al*. 1996, Nijman 2013). Threats include forest decline, but also trade in wild animals for pets, traditional medicine or other economic uses. As trade is mostly unrestrained, the high volumes of wildlife being sold may lead to rapid population declines. Sometimes new trends in demand cause a sudden increase in numbers of wild animals for sale in markets. Examples include the soaring trade in slow lorises *Nycticebus* and owls (Strigiformes) as a result of social or international media presence (Shepherd 2012a, Nekaris *et al*. 2013) as well as the rise in popularity of civet coffee (*kopi luwak*) afflicting Common Palm Civet *Paradoxurus hermaphroditus* (Shepherd 2012b).

Small to medium-sized forest-dwelling mammals are often nocturnal and solitary, therefore, difficult to study (e.g. Lim & Ng 2010). With respect to the island of Java, few distribution surveys have covered small carnivores (many of which are nocturnal) or in general, the nocturnal mammals less popular amongst the general public. Many of these species' recent distribution data stem from chance sightings (Duckworth *et al*. 2008, Robson 2008, Eaton *et al*. 2010, Moore 2011), with formal surveys such as camera-trapping extremely rarely written up in accessible venues (e.g. Marliana & Rühe 2012). Because many populations of nocturnal forest-dwelling animals in Southeast Asia are declining (Ceballos & Ehrlich 2002, Sodhi *et al*. 2004), more frequent studies are required.

In the case of Indonesia, many small carnivores and nocturnal mammals, including some that are endemic, are not included in a threat category on *The IUCN Red List of Threatened Species* (IUCN 2014). Javan Ferret Badger *Melogale orientalis* (Data Deficient - DD), Javan Chevrotain *Tragulus javanicus* sensu stricto (DD) and Javan Colugo *Galeopterus variegatus* (Not Recognised - NR) are endemic to Java or to Java and Bali, but there are few data on their occurrence, levels of tolerance to human disturbance and overall conservation status. To aid in updating *IUCN Red List* status and as a baseline for designing conservation schemes, field data for nocturnal mammals on Java are urgently required.

We present data on various small carnivores and similarly-sized nocturnal mammals of Java collected over a 2½-year period, at most sites by nocturnal spotlight transects, supplemented by camera-tapping and collection of incidental observations at one site and replaced by nocturnal spotlight static watches at another. We detail the location and encounter rate of records of the survey species in different parts of Java and report on various observations on behaviour, ecology and threats. The species considered comprise all carnivores except big cats *Panthera* and Dhole *Cuon alpinus*, all giant flying squirrels *Petaurista*, Sunda Porcupine *Hystrix javanica*, Javan Chevrotain, Javan Colugo, Sunda Pangolin *Manis javanica* and Javan Warty Pig *Sus verrucosus*. Eurasian Wild Pig *Sus scrofa*, also present on Java, was not included, because it is non-native. Javan Slow Loris *Nycticebus javanicus* is reported elsewhere (Voskamp *et al*. 2014).

Survey area

Java has a high level of endemism. Many species occurring on Java are better known from its western part (Whitten *et al*. 1996). Precipitation varies from over 6,000 mm per year in parts of west and central Java to less than 1,500 mm in parts of east Java and along the north coast. The annual average temperature varies from 26 °C to 29 °C at sea level (Whitten *et al*. 1996). Java is largely of volcanic origin with altitudes from 0 to 3,676 m asl. The survey sites lay between sea level and 1,850 m asl. While protected sites consisted mainly of secondary forest in different stages of growth as well as forest plantations of mostly non-native trees, unprotected sites were mosaic-like landscapes (*talun*) with forest and bamboo fragments, agricultural fields and non-native forest plantations. Survey sites, with their protection status, are listed in Appendix I. The long-term study site Cipaganti includes several small streams coming from the mountain, typically narrower than 2 m and usually dry from May to July. While observing lorises in Cipaganti, we often spotted small rodents (especially mice) in trees that are potential prey for most carnivore species discussed in this paper. The vegetation in Cipaganti was very open with no or single tree row canopy connection between most of the natural vegetation.

Data collection

All data were collected as part of a long-term research project on Javan Slow Loris. Survey sites were selected because of (i) the known presence of this species; (ii) species distribution models (Thorn *et al*. 2009); (iii) suitable habitat; and (iv) information where it might occur. Likewise, survey methods and equipment were optimised for detecting lorises. Even the camera-traps were set specifically to examine presence of ground-dwelling potential loris predators. This bias has to be taken into account when interpreting other species' records.

We used data from three expeditions: one (April–June 2012) focussing on 11 sites distributed across Java (Voskamp *et al*. 2014), one (May–July 2013) in East Java, and one (February–May 2014) in West Java. On the expeditions, the main survey method was direct sighting of animals from walked nocturnal transects, replaced at one site by nocturnal static observations. Incidental sightings are included from the period April 2012–May 2014 in an ongoing study of Javan Slow Loris in and around the village of Cipaganti, on the eastern slopes of Gunung Papandayan in West Java (Fig. 1).

The ongoing study in Cipaganti is detailed in Rode-Margono *et al*. (in press). Data from Cipaganti result from observations incidental to routine study of Javan Slow Loris and from camera-traps (Cuddeback Attack IR; Bushnell Trophy cam night vision; 1–6 units set on 283 nights, totalling 705 individual camera-trap-nights). The cameras were set 0.5 m above the ground in small openings or wildlife trails in otherwise relatively dense vegetation (small trees, undergrowth, bamboo), but not in very open space because of the risk of theft. Camera-traps were not baited and were set to operate round the 24-hour cycle. Photographs of the same individual or social group (if identifiable) at the same camera-trap station that were less than 2 hours apart are treated as comprising one record. If identification to species was uncertain, records were excluded. No other location was camera-trapped.

At other survey sites, transects along existing paths and roads, or fixed-point surveys (one site) used teams of at least two people walking at an average speed of approximately 500

Fig. 1. Survey sites for nocturnal mammals in Java, Indonesia, in 2012–2014. Nine out of 14 sites are in protected areas. 1 = Ujung Kulon; 2 = Carita; 3 = Gunung Gede Pangrango and Cimungkat*; 4 = Cipaganti* and Pangalengan*; 5 = Sumedang*; 6 = Tasikmalaya* and Limbangan; 7 = Dieng Plateau; 8 = Gunung Bromo; 9 = Meru Betiri; 10 = Ijen Plateau; 11 = Alas Purwo. * = unprotected area.

m/hour, scanning all levels of vegetation using headlamps with a combination of either red (see Nekaris *et al*. 2008) or white filters. Transects were walked during ~18h00–02h00. Fixed-point surveys were conducted between 18h00 and 04h00. At each point, three spots 10 m from each other were selected. At each spot the observer stood silently and systematically scanned all levels of the vegetation for 5 minutes, adding up to individual points surveyed for 15 minutes. Surveys were repeated after a minimum of four hours. The individual points were placed randomly along a 1,700-m transect. During fixed-point surveys, red light was used whenever possible, aided with white light if terrain was difficult. Survey effort for each area is reported in Appendix 1; Cipaganti is included twice, with the first two visits included as a transect survey comparable to the others, and the later period included as the long-term study.

Table 1 lists the small carnivores and similarly-sized mammals considered by the surveys. For each animal sighting we recorded the location using Garmin GPS 60 and 62st, date, time and weather conditions (see Sutherland 2006). We recorded animal species, number of individuals and, if observed in a tree, the height of animal and height of tree (Nekaris *et al*. 2008). We recorded *ad libitum* observations about the sex, age class, behaviour, and reaction towards and distance from the observers. Camera-trap photographs were excluded when reporting the height of the animals in trees, because of the bias of camera placement. For a representative sample of sightings we measured the distance to the nearest human settlement of five or more houses using Google Earth V (7.1.1.1888).

Table 1. Small carnivores and similarly-sized species considered in this survey of various sites in Java, Indonesia, 2012–2014.

Family	Species	*IUCN Red List*[1]	National law[2]
Order Carnivora			
FELIDAE	Fishing Cat *Prionailurus viverrinus*	EN A2cd+4cd	P
FELIDAE	Leopard Cat *Prionailurus bengalensis*	LC	P
HERPESTIDAE	Javan Mongoose *Herpestes javanicus*	LC	NP
MEPHITIDAE	Sunda Stink-badger *Mydaus javanensis*	LC	P
MUSTELIDAE	Indonesian Mountain Weasel *Mustela lutreolina*	DD	NP
MUSTELIDAE	Javan Ferret Badger *Melogale orientalis*	DD	NP
MUSTELIDAE	Asian Small-clawed Otter *Aonyx cinereus*	VU A2acd	NP
MUSTELIDAE	Smooth-coated Otter *Lutrogale perspicillata*	VU A2acd	NP
MUSTELIDAE	Yellow-throated Marten *Martes flavigula*	LC	NP
PRIONODONTIDAE	Banded Linsang *Prionodon linsang*	LC	NP
VIVERRIDAE	Binturong *Arctictis binturong*	VU A2cd	P
VIVERRIDAE	Common Palm Civet *Paradoxurus hermaphroditus*	LC	NP
VIVERRIDAE	Small Indian Civet *Viverricula indica*	LC	NP
VIVERRIDAE	Small-toothed Palm Civet *Arctogalidia trivirgata*	LC	NP
Order Cetartiodactyla			
SUIDAE	Javan Warty Pig *Sus verrucosus*	EN A2cd	NP
TRAGULIDAE	Javan Chevrotain *Tragulus javanicus*	DD	P
Order Dermoptera			
CYNOCEPHALIDAE	Javan Colugo *Galeopterus variegatus*	NR	P
Order Pholidota			
MANIDAE	Sunda Pangolin *Manis javanica*	EN A2d+3d+4d	P
Order Rodentia			
HYSTRICIDAE	Sunda Porcupine *Hystrix javanica*	LC	P
SCIURIDAE	Red Giant Flying Squirrel *Petaurista petaurista*	LC	NP
SCIURIDAE	Spotted Giant Flying Squirrel *Petaurista elegans*	LC	P

[1]Global status on *The IUCN Red List of Threatened Species* (IUCN 2014): DD = Data Deficient, EN = Endangered, LC = Least Concern, NR = Not Recognised, VU = Vulnerable.
[2]Protection status in Indonesia, according to Lampiran Peraturan Pemerintah Nomor 7 Tahun 1999 & Undang-Undang No. 5 Tahun 1990. P = protected, NP = not protected.

Results

Combined transect survey efforts were 82.1 km for protected areas and 44.8 km for unprotected areas. All methods combined recorded 12 of the target species: Leopard Cat *Prionailurus bengalensis* (121 encounters / 2 sites), Javan Mongoose *Herpestes javanicus* (4/2), Yellow-throated Marten (1/1), Javan Ferret Badger (37/1), Banded Linsang *Prionodon linsang* (2/2), Binturong *Arctictis binturong* (3/2), Common Palm Civet (145/10), Small Indian Civet *Viverricula indica* (8/1), Javan Chevrotain (3/2), Javan Colugo (24/5), Spotted Giant Flying Squirrel *Petaurista elegans* (2/1) and Red Giant Flying Squirrel *P. petaurista* (13/3) (Table 2), but not Fishing Cat *Prionailurus viverrinus*, Sunda Stink-badger *Mydaus javanensis*, Asian Small-clawed Otter *Aonyx cinereus*, Smooth-coated Otter *Lutrogale perspicillata*, Small-toothed Palm Civet *Arctogalidia trivirgata*, Indonesian Mountain Weasel *Mustela lutreolina*, Javan Warty Pig, Sunda Pangolin or Sunda Porcupine. The only other wild mammal larger than rats (Muridae) and treeshrews *Tupaia* camera-trapped was Eurasian Wild Pig, with 17 camera-trap records in groups up to seven animals between August 2012 and March 2013. Pigs were often encountered directly in Cipaganti, especially during the dry season (farmers report that they descend from the higher forest area to search for food), but mostly in undergrowth so that species identification was not possible.

Several species were frequently recorded close to human settlements (Fig. 2). Leopard Cat and Common Palm Civet came to the perimeter of villages and Javan Colugo was seen within villages, twice at sport fields surrounded by trees. Cipaganti yielded numerous lengthy sightings of small carnivores at distances of 5–20 m. Leopard Cat and Common Palm Civet in Cipaganti seemed relaxed and uninterested in the observers, several times staying in view for 10–30 minutes, generally resting. One Leopard Cat was observed grooming for 20 minutes (Fig. 3); another crossed a stream, where it caught and consumed a large whitish rodent on the bank. Common Palm Civet frequently walked along or sat on rubber-coated water hoses (used for irrigation) suspended aerially between trees. The camera-traps recorded both Leopard Cat and Common Palm Civet faecal and scent marking a single large stone. In one case a Leopard Cat scent-marked the stone, then two days later a Common Palm Civet faecal-marked the same stone after sniffing at the exact spot of the Leopard Cat mark. Whether this was responsive marking is unknown. Only one Javan Colugo was seen gliding. The others were stationary on trees or poles. If disturbed, they remained where they were or 'hopped' up the tree.

In terms of habitat use, Leopard Cat and Javan Chevrotain were found exclusively on the ground, whereas Banded Linsang and Binturong were observed on the ground and in trees. In Cipaganti, where canopy cover is very open, a Binturong on the path turned immediately on illumination and disappeared. In the second sighting there, the Binturong rested in 12 m-high bamboo, apparently comfortable despite its size, 4 m up. The

Table 2. Number of encounters and distribution of nocturnal mammals and small carnivores at various sites on Java, Indonesia, 2012–2014.

Location	LC	JM	JFB	YtM	BL	B	CPC	SIC	JCh	JCo	SGFS	RGFS	Total
Ujung Kulon*							5		1	2			8
Carita*										12			12
Gunung Gede*					1	1	4						6
Dieng Plateau*							4						4
Gunung Bromo*							1						1
Ijen Plateau*										1		1	2
Meru Betiri*		2					9		2	2		5	20
Alas Purwo*							5						5
Cipaganti	1						3						4
Sumedang							3						3
Tasikmalaya	1						2			7			10
Pangalengan (fixed-point survey)							1				2	7	10
Cipaganti: direct observation	106		3		1	2	71	7					190
Cipaganti: camera-trap	13	2	34	1			37	1					88
Grand Total	121	4	37	1	2	3	145	8	3	24	2	13	363
Encounter rate per km protected area	0	0.02	n.a.	n.a.	0.01	0.01	0.34	n.a.	0.04	0.20	n.a.	0.06	0.55
Encounter rate per km unprotected area	0.02	0	n.a.	n.a.	0	0	0.18	n.a.	0	0.18	n.a.	0.02	0.29
Total encounter rate per km	0.01	0.01			0.01	0.01	0.28		0.02	0.19		0.05	0.46

* = Protected locations. Sightings in Cipaganti (direct observations) are not used in encounter rates.

Species: LC = Leopard Cat, SIC = Small Indian Civet, JFB = Javan Ferret Badger, YtM = Yellow-throated Marten, JM = Javan Mongoose, BL = Banded Linsang, B = Binturong, CPC = Common Palm Civet, JCh = Javan Chevrotain, JCo = Javan Colugo, RGFS = Red Giant Flying Squirrel, SGFS = Spotted Giant Flying Squirrel (Table 1 gives scientific names). 'n.a.' signifies that the species was found only by methods other than nocturnal walked transects. Two survey sites, Limbangan and Cimungkat (Appendix 1), are omitted because no animals were seen.

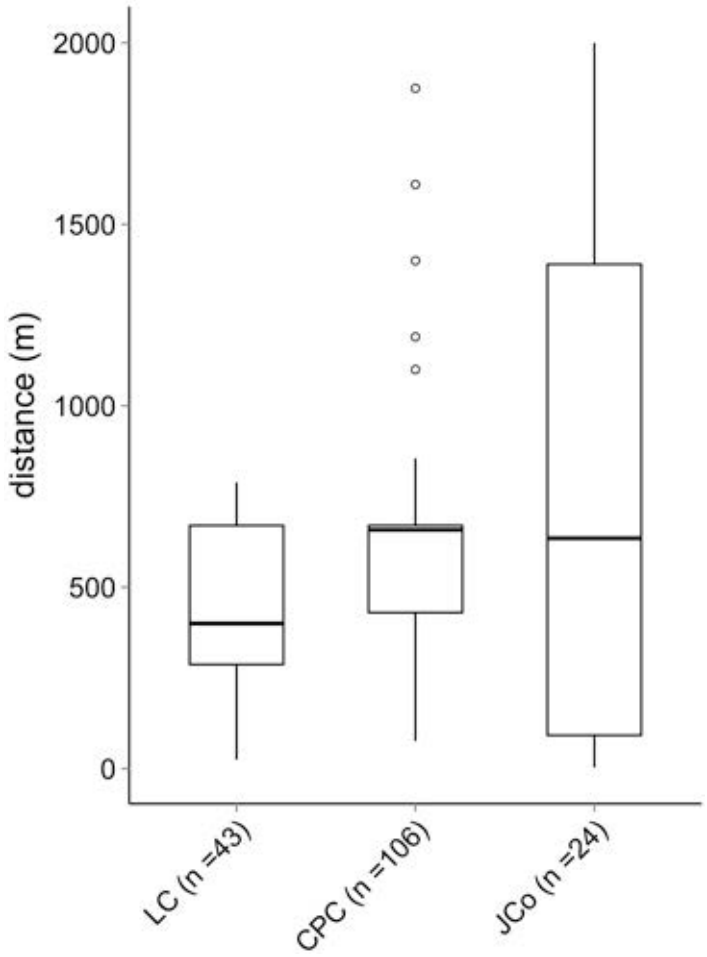

Fig. 2. Median distances (in meters) from individual sightings of three species of nocturnal mammal to human settlements (of at least five houses). The box indicates the 75th and 25th percentiles, the whiskers show the maximum values of the data, circles indicate outliers. All surveys and the long-term study in Cipaganti were included. LC = Leopard Cat *Prionailurus bengalensis*, CPC = Common Palm Civet *Paradoxurus hermaphroditus*, JCo = Javan Colugo *Galeopterus variegatus*.

Fig. 3. Leopard Cat *Prionailurus bengalensis* at Cipaganti, western Java, Indonesia on 4 March 20h13 at 20h30 (Photo: E. J. Rode-Margono). This animal was approached to 6 m and observed for 20 minutes.

Binturong in Gunung Gede Pangrango (closed canopy) was spotted on the path and moved under an observer platform. The Linsang in Cipaganti crossed an asphalt road in an agricultural area with farms, fields and interspersed trees, then disappeared in tall grass and undergrowth. A stream about 3 m wide was less than 500 m away, the nearest larger continuous forest about 1,500 m. The Linsang in Gunung Gede Pangrango was sighted about 6 m up in an 8 m-high tree in closed-canopy habitat. We typically sighted Common Palm Civet in trees, at a median height of 5 m (range 0–33 m; 54 records), and Colugo at 8.5 m (range 2–18 m; 24 records). Height of the trees used by Common Palm Civet was 11 m median (range 6–35 m; 38 records) and by Colugo, 14 m (2–30 m; 23 records).

Common Palm Civet was seen feeding once each on Jackfruit *Arctocarpus heterophyllus* and a fig *Ficus*. In Cipaganti, civet faeces contained coffee beans *Coffea arabica*, birds, small mammals and invertebrates. Camera-traps recorded ferret badgers digging, sniffing and extracting items from the ground, once in a duo.

Concerning sociality, in Cipaganti, six direct observations of immature solitary Leopard Cats, supplemented two (December 2012, April 2014) where a small individual accompanied a large one. Camera-trap video revealed an adult and a juvenile Leopard Cat playing (April 2014). Four times we saw Common Palm Civet kittens: in Tamanjaya an adult with four kittens (roughly 1–2 months old) in a tree trunk fork 14 m up a 20 m tree (March 2012), and in Cipaganti one adult with three kittens on the ground (January 2012, kittens about a third of the mother's body length), one mother–infant duo (June 2012), and one single young (July 2012). Also in Cipaganti, a civet nest (not identified to species) in the base of a banana trunk lined with dead banana leaves, checked on three consecutive days contained at least two kittens (April 2012). The sole Yellow-throated Marten record was a camera-trapped duo of the same size (September 2013; Fig. 4). In two cases, Colugos carried their relatively small but active baby in the patagium while suspending from horizontal branches (March 2012, Ujung Kulon; April 2012, Tasikmalaya). A single juvenile Colugo (about 50% the linear size of an adult) was parked in relatively dense terminal branches (March 2012, Ujung Kulon). Red Giant Flying Squirrel was observed in groups of 2–4 individuals at Pangalengan (April 2014), the Ijen plateau and Meru Betiri (both June 2013); the Spotted Giant Flying Squirrels in

Fig. 4. Yellow-throated Marten *Martes flavigula* at Cipaganti, western Java, Indonesia on 12 September 2013 at 05h40 (Photo: Little Fireface Project).

Fig. 5. First civet trap sighted in Cipaganti, in November 2013 (Photo: W. Tarniwan).

Pangalengan were a duo (April 2014). A duo of Javan Chevrotain comprised animals of similar size (June 2013).

Despite reports of hunting from neighbouring communities, in Cipaganti we have only one report of hunting of nocturnal mammals. In November 2013 we found a civet trap set possibly to catch animals for civet coffee farms (Fig. 5). We dismantled the trap for four nights; on the fifth it was gone. Local people reported that the trap was set by outsiders; the land owner said he had chased the poacher off. The trapping was illegal because it was on private land. In Carita, we encountered two hunters with rifles in the protected forest hunting for Colugo. They reported that local people use it for food and medicine.

Discussion

Faunal community and biogeography

Many nocturnal mammal species remain poorly studied, leading to gaps in knowledge not only of their behavioural ecology and taxonomy but also of their current distribution, abundance and conservation status. Three of 21 species in the survey's remit are listed as Data Deficient on the *IUCN Red List*, yet by no means are the other species well known on Java, or even globally. To our knowledge Java has hosted no long-term study of any of these species. Two of the Data Deficient species were found, Javan Chevrotain and Javan Ferret Badger. Both are endemic to Java and Bali (where occurrence of the chevrotain is not confirmed) (IUCN 2014). Nine of the 21 species were not encountered: Fishing Cat, Sunda Stink-badger, two otter species, Small-toothed Palm Civet, Indonesian Mountain Weasel, Javan Warty Pig, Sunda Pangolin and Sunda Porcupine. This might reflect rarity of these species on Java or coverage of sites and/or use of methods unlikely to find them.

Fishing Cat seems to be associated with coastal areas on Java (Melisch *et al*. 1996), so its absence from the survey sites, all inland, is unsurprising. Indonesian Mountain Weasel is so poorly known that its activity patterns have not been demonstrated. Other tropical Asian weasels seem to be diurnal (e.g. Abramov *et al*. 2008, Ross *et al*. 2013) and if this one is similar, than the lack of records from spotlighting is uninformative about its status. Moreover, the lowest-altitude record traced by Meiri *et al*. (2007) was from 1,400 m. Few sites were surveyed above this altitude (Appendix 1). Otters depend on water and are rarely camera-trapped without specific positioning. The stream at Cipaganti was dry during dry weather periods. At the few sites with seemingly suitable habitat (e.g. Bodogol, Gunung Gede Pangrango), survey effort was probably too low to warrant sightings. Javan Warty Pig was still present in several locations in West Java in 2003 (Semiadi & Meijaard 2006). Although difficult to confirm on spotlight surveys, looking similar to Wild Pig, it should be relatively easy to camera-trap when present. None of the many camera-trapped pigs in Cipaganti were Warty Pig. Although possible to camera-trap, Sunda Pangolin is difficult to spotlight, as it is elusive, tends to freeze when disturbed and has non-reflective eyes. It perhaps inhabits some survey sites, although seems unlikely to occur at the camera-trapped site of Cipaganti.

The absence of records of three species raises concern. We surveyed in many of Java's protected and most natural areas (such as unprotected forest plantations). Although survey effort at some sites was low, the total spotlighting effort should have revealed at least some sightings of Small-toothed Palm Civet, Sunda Porcupine and Sunda Stink-badger, probably frequently, if at all common and widespread in the surveyed areas. However, inspection of the patterns of records of those nocturnal species that were recorded shows that it is possible that the lack of these species' records is a chance effect rather than an indication of genuine rarity in Java. Discounting Javan Mongoose and Yellow-throated Marten, which are mostly diurnal and so stood little chance of detection on the spotlight transects or static counts, all other species in Table 2 are largely or entirely nocturnal. Five of these ten species were found only 0–2 times in all spotlight transects and static counts combined. This suggests the further species not dissimilar to them in status may have been overlooked in the spotlight survey sites simply by chance. This possibility is effectively proven by the difference in species recorded at Cipaganti between spotlight transects (two species) and the incidental sightings and camera-trapping (eight species). Thus, it is quite plausible that the other surveyed areas have faunas as rich as, or even richer than, Cipaganti's.

The difference in species found between the methods used at Cipaganti has a major implication in interpreting the findings for the other survey sites. Any species that does not occur at Cipaganti, and stood a similar chance of being spotlighted at any of the other sites as did half the nocturnal species in Table 2, could have been overlooked entirely. Without the long-term loris study (with its camera-trapping and volumes of incidental direct observations) at Cipaganti, Yellow-throated Marten, Small Indian Civet and Javan Ferret Badger would have had no records either. It is thus possible that the three 'surprising absences' from all survey sites, Sunda Porcupine, Small-toothed Palm Civet and Sunda Stink-badger, simply do not occur at Cipaganti (which is, after all, a non-protected area of highly disturbed habitat) and were overlooked in other areas. Their island-wide status in Java is thus not necessarily that dissimilar to that of Small Indian Civet, Javan Ferret Badger and Yellow-throated Marten. However, this cannot be determined without further information.

Sunda Stink-badger is readily camera-trapped and seen during spotlighting surveys with some regularity although apparently rarely commonly (e.g. Wilting *et al*. 2010, Rustam & Giordano 2014). It remains numerous in at least northern Borneo (Samejima *et al*. in prep.) and the Javan populations have not been suggested to be taxonomically highly distinct. Java constitutes a large proportion of its world range (otherwise, Sumatra, Borneo and the North Natunas). The other two 'surprising absences' raise higher global concerns because they are endemic at some taxonomic level to Java (Small-toothed Palm Civet) or to Java and a few smaller islands to the east (Sunda Porcupine). Allied (sub)species of the civet and the porcupine are readily spotlit (e.g. Duckworth 1992, Willcox *et al*. 2012). Whilst ground-level camera-trapping is unlikely to detect the civet (Willcox *et al*. 2012), Sunda Porcupine should be easily camera-trapped (e.g. Datta *et al*. 2008). Although the porcupine is protected by Indonesian law, we have traced nothing on the species's field status within the last 30 years or more. The distinctive Javan form of Small-toothed Palm Civet is treated by the *IUCN Red List* within a single species covering the genus's entire range. The genus lacks a taxonomic revision since van Bemmel (1952), when taxonomic thinking differed greatly from today's. The failure to find it in over 250 hours walked spotlighting suggests that the possibility, considered by Eaton *et al*. (2010), that the paucity of recent records might relate to limited appropriate survey effort rather than true rarity, is unlikely. Targeted searches for this civet should not be delayed until – whenever it might happen – the genus receives a modern taxonomic review.

Javan Colugo was believed to occur only in western Java east to Pangandaran, close to the border with Central Java (IUCN 2014). Records at the Ijen plateau and Meru Betiri National Park in the island's far east (Fig. 6) represent an extension of known range of some 600 km. All observations were made below 900 m asl. We surveyed no lowlands between Tasikmalaya and Meru Beteri, so targeted search might find the species in Central Java as well.

Unresolved taxonomic issues may lead to (regional) extinctions

Regional extinctions are especially likely to equate to global extinctions of cryptic species where the taxonomy has not been reviewed recently, as is the case for of many species in Java. Some recent taxonomic studies that included Javan taxa found them distinct, including Javan Slow Loris (Wirdateti *et al*. 2006, Nekaris & Jaffe 2007), Javan Colugo (Janečka *et al*. 2008) and Javan Chevrotain (Meijaard & Groves 2004), adding to animals long considered species endemic to Java (and in some cases Bali) such as Javan Ferret Badger and Javan Warty Pig. Javan Chevrotain and Javan Ferret Badger may each even comprise two clearly defined subspecies distributed allopatrically in the west and the east of the island (Long 1992, Meijaard & Groves 2004). Yellow-throated Marten and Small-toothed Palm Civet on Java are both particularly distinct from the respective species's populations elsewhere (Schreiber *et al*. 1989). It is possible that among groups with no comprehensive recent taxonomic review that there are species, currently unrecognised, endemic to Java or nearly so. Where these are also in decline, extinction may be facilitated by a lack of conservation interest in what is currently perceived as only an indistinct taxon at best.

Fig. 6. Javan Colugo *Galeopterus variegatus* at Meru Betiri National Park, East Java on 1 June 2013 (Photo: Guillaume Douay). This represents an eastward extension of known range of some 600 km.

Surprising habitat flexibility in some species

The all-species spotlighting encounter rate was higher in protected areas (total 0.55 sightings/km) than in unprotected areas (total 0.29 sightings/km) (Table 2), but many species were found in human-modified landscapes. At Cipaganti, local farmers start in the fields before dawn so animals are perhaps habituated to human presence. Average, minimum and maximum distances of sightings from human settlements are influenced by the choice of survey sites, but individual records of animals close to human settlement confirm the adaptability of the respective species.

Common Palm Civet was often recorded in agricultural (*talun*) fields and plantations, where it did not fear human presence. In forests elsewhere, Common Palm Civet uses the highest and tallest trees especially for resting, but the canopy is also its foraging habitat (Joshi *et al*. 1995, Su Su & Sale 2007). Our sightings overall were somewhat lower (median 5 m), probably because most were in agricultural areas, where trees are short and animals often use the ground to forage or pass between vegetation fragments.

All but one of the 121 Leopard Cat records were at Cipaganti. Leopard Cat is the most common cat species in Southeast Asia (Nowell & Jackson 1996, Sunquist & Sunquist 2002): our observations are consistent with previous studies showing

its occurrence in both natural habitats and human-modified areas such as agricultural landscapes; its diet, mainly small rodents, might contribute to its tolerance of human-modified habitat (e.g. Rajaratnam *et al*. 2007, Mohamed *et al*. 2009).

All 37 Ferret Badger records were in the *talun* fields of Cipaganti. Javan Ferret Badger lives in both primary forest (e.g. Gunung Gede, Gunung Halimun and Meru Betiri) and near human settlements and tourist trails (Seidensticker & Syuono 1980, Yossa *et al*. 1991, Brickle 2007, Duckworth *et al*. 2008). Nearly all records (34 of 37) were from camera-traps. There was much opportunity for direct observation in the camera-trap survey area, so the resultant small number of Ferret Badger sightings suggests a general elusiveness of this species. Hence, the spotlight surveys might well have overlooked it at other sites.

Seven of 24 Javan Colugo sightings were in agroforest, or even in villages, although Sunda Colugo *G. volans* sensu lato (i.e. including Javan Colugo) has been said to depend on forests with relatively high trees (Lim 2007). This apparent dependence may be biased by the choice of study sites with tall trees (Rode-Margono *et al*. in press). Colugo is strictly arboreal and cannot walk on the ground (Lim 2007). We detected all individuals at heights between 2 m and 18 m. None glided when disturbed: they either froze or moved up the tree. Rather than escape, Colugo seems to rely on camouflage: cryptic coloration and rare vocalisation (Lim 2007, Lim & Ng 2010). All sites with Javan Colugo records also held Javan Slow Loris. The two species might occupy different feeding niches, with colugos feeding mainly on leaves and possibly tree sap (Lim 2007), and lorises on gum, nectar and insects (Wiens *et al*. 2006).

Binturong is usually arboreal (e.g. Nettelbeck 1997). Two of our three sightings were of animals on the ground. Just as with slow loris in areas of discontinuous canopy (Rode-Margono *et al*. in press), Binturong may be forced to use the ground to cross between natural habitat patches. That they do so perhaps indicates adaptability to this kind of habitat.

Following the immense forest loss on Java, many disturbance-sensitive species or species that depend on lowland forest occur in only small, isolated populations with few recorded sightings (Schreiber *et al*. 1989, Melisch *et al*. 1994). We encountered Javan Chevrotain only a few times overall (that said, it was the fourth-most frequently spotlit species in Table 2 and the most frequently spotlit ground-dwelling species), always inside protected areas. This potentially indicates sensitivity to human disturbance. It is presumed to occur mostly in forest and it might need dense understory vegetation (Hoogerwerf 1970, IUCN 2014). By contrast, the low encounter rate of Banded Linsang might reflect survey methods unsuitable for this species (see Cheyne *et al*. 2010). It is reputedly tolerant of disturbed forests and edge habitat (Lim 1973, Van Rompaey 1993).

Threats to study species

Although only one of the 12 species found is categorised by the *IUCN Red List* as globally threatened, all face potential threats, such as habitat loss, disturbance and hunting for wildlife trade (Ceballos & Ehrlich 2002, Shepherd *et al*. 2004, Sodhi *et al*. 2004, Corlett 2007). Species differ in the extent to which these actually pose severe threats. Trade is one of the biggest threats to many Southeast Asian medium-sized mammals and to some bird species such as raptors. Off-takes from wild populations are high (Shepherd *et al*. 2004, Nijman 2010, Shepherd 2012a, 2012b). In Indonesia, numbers of wild civets and Leopard Cat in trade are increasing drastically. Leopard Cat is commonly offered for sale in markets either as pets (often young animals with removed teeth) or skins, even though legally protected (Shepherd *et al*. 2004, Shepherd 2012b). Some civets, especially Common Palm Civet, are in demand for civet coffee (*kopi luwak*) and as a new trend in pets (Shepherd 2012b). Pangolins are heavily traded for traditional medicine (Lim & Ng 2007). Colugos are hunted for consumption in western Java and populations are declining in Southeast Asia (IUCN 2014). Species such as Javan Porcupine, Sunda Colugo, Javan Chevrotain, Sunda Pangolin and Binturong are hardly ever seen at main wildlife markets (Shepherd 2012b), but this does not prove that they are not traded. Sunda Pangolin is numerous in illegal international trade (e.g. Pantel & Chin 2009, Nijman 2010). Porcupines are much traded in Sumatra, Kalimantan and mainland Southeast Asia; thus trade is highly likely also in Java (C. R. Shepherd *in litt.* 2014). Javan Ferret Badger has recently started to appear in wildlife markets (Shepherd 2012b, EJR-M unpubl. data). A sudden rocketing of wildlife trade for particular animals can arise through new trends like civet coffee and the pet trade in lorises or owls following their media appearance in Web 2.0 platforms and movies (Shepherd 2012a, 2012b, Nekaris *et al*. 2013). It is not possible to predict which other species may be similarly affected in the future.

The causal relations between numbers of animals in trade, consumer demand, population trends in the wild and law enforcement or protection of the species are not clear. Whether a drop in animals in trade is caused by a decreasing wild population or by other reasons, and whether an increase in numbers in trade may be followed by a decrease of wild populations can be assessed only if wild populations are reasonably monitored, but this is not the case in Java. Sudden declines of common species by human exploitation can drive Least Concern species to Critically Endangered status or even (local) extinction quickly (see Casey & Myers 1998, Gaston & Fuller 2007).

Ongoing deforestation and modification of natural habitat (see Lavigne & Gunnell 2006) affect species that are less flexible and more dependent on dense forest, particularly those needing lowland habitat with minimal human disturbance. Most species detected in this study were encountered in unprotected areas, except for Javan Chevrotain, which was seen so few times in total that the lack of records from unprotected areas might simply have been a chance effect. Most species' encounter rates were higher in protected areas, although this could be a spurious result from relatively low survey effort in non-protected areas. The clear difference in all-species encounter rates between protected and non-protected areas was mainly, perhaps entirely, driven by Common Palm Civet. The lack of otherwise clear differences raises concerns about the effectiveness of protected areas on Java. Many Indonesian protected areas are not well managed, with ongoing heavy resource exploitation and forest clearing (e.g. Curran *et al*. 2004, Sulistyawati *et al*. 2006, 2008, Bickford *et al*. 2007, Zuhri & Sulistyawati 2007). This may severely inhibit their species conservation role: well managed protected areas should hold wildlife communities radically different from those in heavily anthropogenic areas.

Conclusions and recommendations

These surveys considered 21 species of small carnivores and similarly-sized mammals, including three categorised by the *IUCN Red List* as Data Deficient and six as globally threatened. With only 12 of these 21 species found, the 'absence' of the other nine requires consideration. Most can plausibly be explained by a chance effects and/or the selection of survey sites, habitat and methods inappropriate to the species. However, it is less likely that Small-toothed Palm Civet, Sunda Stink-badger and Sunda Porcupine were common in the surveyed areas. The porcupine is unmistakeable and the stink-badger highly distinctive; both are rather noisy, non-elusive ground-dwellers. Given that surveyors had to scrutinise giant flying squirrels to distinguish the two Javan species, it is unlikely that they could have overlooked Small-toothed Palm Civet at all frequently. Given the wide spread of surveys, the lack of these species' records thus raises concerns about their island-wide conservation status. We highly recommend a reassessment of the conservation status of Sunda Porcupine (including its current *IUCN Red List* status of Least Concern, with abundant population and stable population trend) and intensive taxon-specific surveys for all three species on Java.

Even for presently common species, sudden new threats such as trade of Common Palm Civets for civet coffee might lead to rapid declines. We highly recommend (i) regular surveys of wild populations and (ii) alertness when volumes and/or prices of any species offered on markets change strongly and suddenly.

Four species (Javan Ferret Badger, Javan Colugo, Javan Chevrotain and Javan Warty Pig) are confirmed or suggested to be species endemic to Java (and for some species, also Bali and/or small islands). Others probably remain to be defined. This exacerbates the gravity of the conservation situation caused by habitat destruction, habitat fragmentation and the exploitation for trade or local use. Taxonomic review of those species not yet covered is warranted.

Finally, many species considered here have not been subject to long-term studies anywhere, with a near absence of those studies on Java. Long-term studies of Javan populations, especially the lesser known and Data Deficient species, are needed. We have identified several easily accessible study sites, namely Garut regency and Tasikmalaya regency in West Java, where many species occur, and where long-term studies including radio-tracking, humane trapping and genetic investigations would be possible.

Acknowledgements

We would like to thank Riset and Teknologi (Ristek), (Balai) Konservasi Sumber Daya Alam (BKSDA, KSDA), and the Indonesian Institute of Sciences (LIPI), especially Wirdateti and Gono Semiadi, for their support in this project. This work was supported by the Leverhulme Trust (RPG-084), Mohamed bin Zayed Species Conservation Fund (12254023), People's Trust for Endangered Species, Conservation International Primate Action Fund, Cleveland Zoological Society and Cleveland Metroparks Zoo, Chicago Zoological Society / Chicago Board of Trade Endangered Species Fund, Primate Society of Great Britain, Columbus Zoo, Amersfoort Zoo, Primate Conservation Inc., International Primate Protection League, ZGAP and Finnair. LAHU-KA helped with the administration of research permits and visa. We thank all our field assistants and local people who supported our work, Wulan Pusparini for the translation into Indonesian and Gono Semiadi for advice on species names.

References

Abramov, A. V., Duckworth, J. W., Wang, Y. X. & Roberton, S. I. 2008. The Stripe-backed Weasel *Mustela strigidorsa*: taxonomy, ecology, distribution and status. *Mammal Review* 38: 247–266.

Bickford, D., Supriatna, J., Nanda, Y., Iskandar, D., Evans, B., Brown, R., Townsend, T., Umilaela, Azhari, D. & McGuire, J. A. 2007. Indonesia's protected areas need more protection–suggestions from island examples. Pp. 53–77 in Sodhi, N. S., Acciaioli, G., Erb, M. & Tan, A. K. J. (eds) *Biodiversity and human livelihoods in protected areas: case studies from the Malay Archipelago*. Cambridge University Press, Cambridge, U.K.

[BPS] Badan Pusat Statistik 2010. *Hasil sensus penduduk 2010 – data agregat per provinsi*. Badan Pusat Statistik, Jakarta, Indonesia.

Brickle, N. 2007. Sightings of Javan Ferret Badger *Melogale orientalis*. *Small Carnivore Conservation* 36: 50.

Brooks, T. M., Mittermeier, R. A., Mittermeier, C. G., da Fonseca, G. A., Rylands, A. B. & Konstant, W. R. 2002. Habitat loss and extinction in the hotspots of biodiversity. *Conservation Biology* 16: 909–923.

Casey, J. M. & Myers, R. A. 1998. Near extinction of a large, widely distributed fish. *Science* 281: 690–692.

Ceballos, G. & Ehrlich, P. R. 2002. Mammal population losses and the extinction crisis. *Science* 296: 904–907.

Cheyne, S. M., Husson, S. J., Chadwick, R. J. & Macdonald, D. W. 2010. Diversity and activity of small carnivores of the Sabangau Peat-swamp Forest, Indonesian Borneo. *Small Carnivore Conservation* 43: 1–7.

Corlett, R. T. 2007. The impact of hunting on the mammalian fauna of tropical Asian forests. *Biotropica* 39: 292–303.

Curran, L. M., Trigg, S. N., McDonald, A. K., Astiani, D., Hardiono, Y. M., Siregar, P., Caniago, I. & Kasischke, E. 2004. Lowland forest loss in protected areas of Indonesian Borneo. *Science* 303: 1000–1003.

Datta, A., Naniwadekar, R. & Anand, M. O. 2008. Occurrence and conservation status of small carnivores in two protected areas in Arunachal Pradesh, North-east India. *Small Carnivore Conservation* 39: 1–10.

Duckworth, J. W. 1992. Sighting frequencies of nocturnal mammals in an Ethiopian Rift Valley national park. *African Journal of Ecology* 30: 90–97.

Duckworth, J. W., Roberton, S. I. & Brickle, N. 2008. Further notes on Javan Ferret Badger *Melogale orientalis* at Gunung Gede Pangrango National Park, Java. *Small Carnivore Conservation* 39: 39–40.

Eaton, J. A., Wüst, R., Wirth, R., Shepherd, C. R., Semiadi, G., Hall, J. & Duckworth, J. W. 2010. Recent records of the Javan Small-toothed Palm Civet *Arctogalidia (trivirgata) trilineata*. *Small Carnivore Conservation* 43: 16–22.

Gaston, K. J. & Fuller, R. A. 2007. Biodiversity and extinction: losing the common and the widespread. *Progress in Physical Geography* 31: 213–215.

Hoogerwerf, A. 1970. *Udjung Kulon: the land of the last Javan Rhinoceros*. Brill, Leiden, Netherlands.

IUCN 2014. *2014 IUCN Red List of Threatened species*. <www.iucnredlist.org>. Downloaded on 2 June 2014.

Janečka, J. E., Helgen, K. M., Lim, N. T.-L., Baba, M., Izawa, M. & Murphy, W. J. 2008. Evidence for multiple species of Sunda colugo. *Current Biology* 18(21): R1001–R1002.

Joshi, A. R., Smith, J. L. D. & Cuthbert, F. J. 1995. Influence of food distribution and predation pressure on spacing behavior in palm civets. *Journal of Mammalogy* 76: 1205–1212.

Lavigne, F. & Gunnell, Y. 2006. Land cover change and abrupt environmental impacts on Javan volcanoes, Indonesia: a long-term perspective on recent events. *Regional Environmental Change* 6(1–2): 86–100.

Lim, B. L. 1973. The Banded Linsang and the Banded Musang of West Malaysia. *Malayan Nature Journal* 26: 105–111.

Lim, N. 2007. *Colugo: the flying lemur of South-east Asia*. Draco Publishing and Raffles Museum of Biodiversity Research, Singapore.

Lim, N. T. L. & Ng, P. K. L. 2007. Home range, activity cycle and natal den usage of a female Sunda Pangolin *Manis javanica* (Mammalia: Pholidota) in Singapore. *Endangered Species Research* 3: 1–8.

Lim, N. T.-L. & Ng, P. K. L. 2010. Population assessment methods for the Sunda Colugo *Galeopterus variegatus* (Mammalia: Dermoptera) in tropical forests and their viability in Singapore. *Raffles Bulletin of Zoology* 58: 157–164.

Long, C. A. 1992. Is the Javan Ferret-Badger a subspecies or a species? *Small Carnivore Conservation* 6: 17.

Marliana, S. N. & Rühe, F. 2012. Biodiversity of the Dieng Mountains ecosystem, Java, Indonesia: floristic composition of the vegetation and species richness of the mammalian and avifauna communities. Pp. 31–37 in Feit, U. & Korn, H. (eds) *Treffpunkt Biologische Vielfalt XI*. Bundesamt für Naturschutz (Skripten 309), Bonn, Germany.

Meijaard, E. & Groves, C. 2004. A taxonomic revision of the *Tragulus* mouse-deer (Artiodactyla). *Zoological Journal of the Linnean Society* 140: 63–102.

Meiri, S., Duckworth, J. W. & Meijaard, E. 2007. Biogeography of Indonesian Mountain Weasel *Mustela lutreolina* and a newly discovered specimen. *Small Carnivore Conservation* 37: 1–5.

Melisch, R., Asmoro, P. B. & Kusumawardhami, L. 1994. Major steps taken towards otter conservation in Indonesia. *IUCN Otter Specialist Group Bulletin* 10: 21–24.

Melisch, R., Asmoro, P. B., Lubis, I. R. & Kusumawardhani, L. 1996. Distribution and status of the Fishing Cat (*Prionailurus viverrinus rhizophoreus* Sody, 1936) in West Java, Indonesia (Mammalia: Carnivora: Felidae). *Faunistische Abhandlungen Staatliches Museum für Tierkunde Dresden* 20: 311–319.

Miettinen, J., Shi, C. & Liew, S. C. 2011. Deforestation rates in insular Southeast Asia between 2000 and 2010. *Global Change Biology* 17: 2261–2270.

Mohamed, A., Samejima, H. & Wilting, A. 2009. Records of five Bornean cat species from Deramakot Forest Reserve in Sabah, Malaysia. *Cat News* 51: 12–15.

Moore, R. 2011. Sightings of Javan Small-toothed Palm Civets *Arctogalidia trivirgata trilineata* on Gunung Salak, West Java, Indonesia. *Small Carnivore Conservation* 44: 38–39.

Myers, N., Mittermeier, R. A., Mittermeier, C. G., da Fonseca, G. A. B. & Kent, J. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403: 853–858.

Nekaris, K. & Jaffe, S. 2007. Unexpected diversity of slow lorises (*Nycticebus* spp.) within the Javan pet trade: implications for slow loris taxonomy. *Contributions to Zoology* 76: 187–196.

Nekaris, K. A. I., Blackham, G. V. & Nijman, V. 2008. Conservation implications of low encounter rates of five nocturnal primate species (*Nycticebus* spp.) in Asia. *Biodiversity and Conservation* 17: 733–747.

Nekaris, K. A.-I., Campbell, N., Coggins, T. G., Rode, E. J. & Nijman, V. 2013. Tickled to death: analysing public perceptions of 'cute' videos of threatened species (slow lorises – *Nycticebus* spp.) on Web 2.0 Sites. *PloS One* 8(7): (e69215) 1–10.

Nettelbeck, A. R. 1997. Sightings of Binturongs *Artictis binturong* in the Khao Yai National Park, Thailand. *Small Carnivore Conservation* 16: 22–24.

Nijman, V. 2010. An overview of international wildlife trade from Southeast Asia. *Biodiversity and Conservation* 19: 1101–1114.

Nijman, V. 2013. One hundred years of solitude: effects of long-term forest fragmentation on the primate community of Java, Indonesia. Pp. 33–45 in Marsh, L. K. & Chapman, C. A. (eds) *Primates in fragments: complexity and resilience*. Springer, New York, U.S.A.

Nowell, K. & Jackson, P. 1996. *Wild cats. Status survey and conservation action plan*. IUCN/SSC, Gland, Switzerland, and Cambridge, U.K.

Pantel, S. & Chin, S. Y. 2009. *Proceedings of the workshop on trade and conservation of pangolins native to South and Southeast Asia*. TRAFFIC Southeast Asia, Petaling Jaya, Selangor, Malaysia.

Rajaratnam, R., Sunquist, M., Rajaratnam, L. & Ambu, L. 2007. Diet and habitat selection of the Leopard Cat (*Prionailurus bengalensis borneoensis*) in an agricultural landscape in Sabah, Malaysian Borneo. *Journal of Tropical Ecology* 23: 209–217.

Robson, C. 2008. *Java & Bali*. http://www.birdquest-tours.com/Indonesia-Java-Bali-birding-tour-report/2008. Downloaded 12 December 2013.

Rode-Margono, E. J., Nijman, V., Wirdateti & Nekaris, K. A. I. in press. Ethology of the Critically Endangered Javan Slow Loris *Nycticebus javanicus* (Geoffroy) in West Java. *Asian Primates*.

Ross, J., Hearn, A. J. & Macdonald, D. W. 2013. Recent camera-trap records of Malay Weasel *Mustela nudipes* in Sabah, Malaysian Borneo. *Small Carnivore Conservation* 49: 20–24.

Rustam & Giordano, A. J. 2014. Records of Sunda Stink-badger *Mydaus javanensis* from Rajuk Forest, Malinau, North Kalimantan, Indonesia. *Small Carnivore Conservation* 50: 74–76.

Samejima, H. *et al*. in prep. *Mydaus javanensis*: distribution and status in Borneo.

Santiapillai, C. & Ramono, W. S. 1992. Status of the Leopard (*Panthera pardus*) in Java, Indonesia. *Tigerpaper* 19(2): 1–5.

Schreiber, A., Wirth, R., Riffel, M. & Van Rompaey, H. 1989. *Weasels, civets, mongooses, and their relatives: an action plan for the conservation of mustelids and viverrids*. IUCN, Gland, Switzerland.

Seidensticker, J. & Syuono, I. 1980. *The Javan Tiger and the Meru-Betiri Reserve: a plan for management*. IUCN, Gland, Switzerland.

Semiadi, G. & Meijaard, E. 2006. Declining populations of the Javan Warty Pig *Sus verrucosus*. *Oryx* 40: 50–56.

Shepherd, C. R. 2012a. The owl trade in Jakarta, Indonesia: a spot check on the largest bird markets. *Birding Asia* 18: 58–59.

Shepherd, C. R. 2012b. Observations of small carnivores in Jakarta wildlife markets, Indonesia, with notes on trade in Javan Ferret Badger *Melogale orientalis* and on the increasing demand for Common Palm Civet *Paradoxurus hermaphroditus* for civet coffee production. *Small Carnivore Conservation* 47: 38–41.

Shepherd, C. R., Sukumaran, J. & Wich, S. A. 2004. *Open season: an analysis of the pet trade in Medan, Sumatra, 1997–2001*. TRAFFIC Southeast Asia, Petaling Jaya, Selangor, Malaysia.

Smiet, A. C. 1992. Forest ecology on Java: human impact and vegetation of montane forest. *Journal of Tropical Ecology* 8: 129–152.

Sodhi, N. S., Koh, L. P., Brook, B. W. & Ng, P. K. L. 2004. Southeast Asian biodiversity: an impending disaster. *Trends in Ecology & Evolution* 19: 654–660.

Su Su & Sale, J. 2007. Niche differentiation between Common Palm Civet *Paradoxurus hermaphroditus* and Small Indian Civet *Viver-*

ricula indica in regenerating degraded forest, Myanmar. *Small Carnivore Conservation* 36: 30–34.

Sulistyawati, E., Sungkar, R. M., Maryani, E., Aribowo, M. & Rosleine, D. 2006. The biodiversity of Mount Papandayan and the threats. Presentation at the International Interdisciplinary Conference in Volcano, Yogyakarta, Indonesia, 4–10 September 2006. <http://www.sith.itb.ac.id/profile/databuendah/Publications/8.%20Sulistyawati_VIG.pdf>. Downloaded on 2 June 2014.

Sulistyawati, E., Ulumuddin, Y. I. & Zuhri, M. 2008. Landuse change in Mount Papandayan: its associated impacts on biodiversity and carbon stock. Presentation at the International Conference of Environmental Research and Technology (ICERT), Penang, Malaysia. <http://cache.bi.itb.ac.id/profile/databuendah/Publications/2.%20ICERT_ES.pdf>. Downloaded on 2 June 2014.

Sunquist, M. & Sunquist, F. 2002. *Wild cats of the world*. University of Chicago Press, Chicago, U.S.A.

Sutherland, W. J. 2006. *Ecological census techniques: a handbook*. Cambridge University Press, Cambridge, U.K.

Thorn, J. S., Nijman, V., Smith, D. & Nekaris, K. A. I. 2009. Ecological niche modelling as a technique for assessing threats and setting conservation priorities for Asian slow lorises (Primates: *Nycticebus*). *Diversity and Distributions* 15: 289–298.

Van Bemmel, A. C. V. 1952. Contribution to the knowledge of the genera *Muntiacus* and *Arctogalidia* in the Indo-Chinese archipelago (Mammalia, Cervidae & Viverridae). *Beaufortia* 2 (16): 1–50.

Van Rompaey, H. 1993. The Banded Linsang, *Prionodon linsang*. *Small Carnivore Conservation* 9: 11–15.

Voskamp, A., Rode, E. J., Coudrat, C. N. Z., Wirdateti, Abinawanto, Wilson, R. J. & Nekaris, K. A. I. 2014. Modelling the habitat use and distribution of the threatened Javan Slow Loris *Nycticebus javanicus*. *Endangered Species Research* 23: 277–286.

Whitten, T., Soeriaatmadja, R. E. & Afiff, S. A. 1996. *The ecology of Java and Bali*. Periplus, Singapore.

Wiens, F., Zitzmann, A. & Hussein, N. A. 2006. Fast food for slow lorises: is low metabolism related to secondary compounds in high-energy plant diet? *Journal of Mammalogy* 87: 790–798.

Willcox, D. H. A., Tran Q. P., Vu L., Tran V. B. & Hoang M. D. 2012. Small-toothed Palm Civet *Arctogalidia trivirgata* records from human-influenced habitats in Vietnam. *Small Carnivore Conservation* 47: 46–53.

Wilting, A., Samejima, H. & Mohamed, A. 2010. Diversity of Bornean viverrids and other small carnivores in Deramakot Forest Reserve, Sabah, Malaysia. *Small Carnivore Conservation* 42: 10–13.

Wirdateti, Okayama, T. & Kurniati, H. 2006. Genetic diversity of Slow Loris (*Nycticebus coucang*) based on mitochondrial DNA. *Tropics* 15: 377–381.

Yossa, I., Navy, P., Dolly, P., Yudha, N., Aswar & Yosias, M. 1991. Survey of the carnivores of Gunung Halimun nature reserve, Java. *Small Carnivore Conservation* 5: 3.

Zuhri, M. & Sulistyawati, E. 2007. Pengelolaan perlindungan Cagar Alam Gunung Papandayan. Presentation at Seminar Nasional Penelitian Lingkungan di Perguruan Tinggi. University of Indonesia, Jakarta, Indonesia.

[1]Oxford Brookes University, Nocturnal Primate Research Group, Gipsy Lane, Headington, Oxford OX3 0BP, U.K.
[2]Durham University, Durham DH1 3LE, U.K.
***Email: johanna.margono@gmail.com**

Appendix 1. Survey sites for nocturnal mammals across Java, Indonesia, 2012–2014: location, habitat(s), altitudinal range and spotlight transect effort.

Survey site	Location	Regency, province	Habitat(s)	Altitude (m)	Effort/km
Ujung Kulon National Park*	Tamanjaya	Pandeglang, Banten	Secondary forest	0–110	1.8
Carita Nature Recreation Park*	Carita	Pandeglang , Banten	Forest plantation	20–220	3.1
Gunung Gede Pangrango National Park*	Bodogol, Cibodas	Sukabumi / Bogor / Cianjur, West Java	Secondary forest	800–860, 1,150–1,170, 1,370–1,580	18.7
Limbangan*	Gunung Masgit Kareumbi Game Reserve	Tasikmalaya, West Java	Secondary forest	810–850	2.8
Dieng Plateau, Telaga Sumurup Strict Nature Reserve*	Sokokembang	Wonosobo, Central Java	Secondary forest	600–670	5.1
Bromo-Tengger Semeru National Park*	Pronojiwo; Gunung Bromo	Malang, East Java	Secondary forest	760–910	6.0
Alas Purwo National Park*	Rowobendo, Sadengan, Sumurtrong	Banyuwangi, East Java	Forest plantation (teak), secondary forest	10–110	15.4
Meru Betiri National Park*	Bandealit, Sumber Salak, Rajegwesi, Sukamade	Banyuwangi, East Java	Late stage secondary forest	10–170	29.2
Ijen Plateau Strict Nature Reserve* / unprotected	Kawah Ijen, Ceding, Kalisat, Sidomulyo	Bondowoso / Jember, East Java	Agricultural area/ forest plantation	650–1,740	10.0
Cimungkat	Southeast boarder of Gunung Gede Pangrango NP	Cianjur, West Java	Late stage secondary forest	1,150–1,170	3.1
Cipaganti**	Gunung Papandayan	Garut, West Java	Agricultural area	1,350–1,560	8.9*
Pangalengan	Gunung Papandayan	Garut, West Java	Agricultural area	1,690–1,850	Fixed point surveys
Sumedang	Sumedang	Sumedang, West Java	Forest plantation	560–690	7.6
Tasikmalaya	Bantarkalong, Ciamis, Raksajaya	Ciamis / Tasikmalaya, West Java	Agricultural area/ forest plantation	420–850	15.2

Total study effort was 126.9 km. * indicates protected areas. ** Effort (in km) for the initial survey in Cipaganti before the field study on Javan Slow Loris. The altitude range is that surveyed, not necessarily the total of the protected area or other land unit.

A record of a white-coated Brown Palm Civet *Paradoxurus jerdoni*

H. CHUNEKAR

Abstract

Brown Palm Civet *Paradoxurus jerdoni* is endemic to the Western Ghats of India. An entirely white-coated individual sighted at Amboli hill station, Maharashtra, is evidently the first record of this pelage aberration. Based on the dark nose and slight dark pigmentation in the fur behind the ears, this animal is probably an example of dilution. Although at first sight all white, it is certainly not an albino.

Keywords: albinism, Amboli, dilution, endemic, leucism, pelage aberration

On 13 September 2013, at around 23h30, I sighted an unusual-looking civet while we were walking on a road in Amboli hill station at 15°57′30.72″N, 73°59′50.72″E (datum WGS84; recorded elevation 749 m). It was resting on a tree about 5 m above the ground, in an area of semi-evergreen and moist deciduous forest. The sighting lasted 20 minutes and the animal was photographed with a digital SLR camera (Nikon D800). The individual (Figs 1–2) had almost completely white fur all over, a prominently black nose, and dark pink ear skin. It appeared to be fully grown.

Among the mammals known from this part of India, the animal's general size and structure allow its confident identification as a *Paradoxurus* palm civet. Two species of this genus occur in this part of India. Brown Palm Civet *P. jerdoni* is endemic to the Western Ghats, where it occurs in wet evergreen forests and adjacent coffee estates at altitudes of 500–2,000 m asl (Rajamani *et al*. 2002). Bhosale *et al*. (2013) recorded Brown Palm Civet in Amboli and in Chandoli National Park, extending its known range north by about 200 km. Common Palm Civet *P. hermaphroditus* occurs widely in India (and elsewhere in tropical Asia) but is usually, in this part of its range, in more deciduous and/or open habitats than wet evergreen forest (e.g. Mudappa *et al*. 2007).

Typical-coloured individuals of the two species are readily identified (Figs 3–4). Brown Palm Civet has a fairly uniformly brown coat, darker towards the extremities (head, neck, tail and legs), with dorsal pelage that may be grizzled at times (Pocock 1933, Hutton 1949, Bhosale *et al*. 2013; Fig. 3). In terms of characters potentially visible on a white-pelted animal, Brown Palm Civet has uniformly shortish fur throughout its body, vibrissae that may appear black or dark brown, rounded ears and an abruptly pointed snout (Blanford 1855, 1888–1891, D. Mudappa *in litt*. 2014). The uniformly rather short fur, the shape of ears, head and snout, and the colour of vibrissae of this white civet resemble Brown Palm Civet rather than Common Palm Civet.

The nomenclature of animals missing part or all their normal pigmentation is confused and inconsistent. van Grouw (2013) reviewed this topic with specific reference to birds, but pointed out that the pigmentation process in mammals is comparable to that in birds. Most aberrantly white animals are casually referred to as 'albino' or 'partial albino', but the former is often incorrect for the animal in question and the latter do not by definition exist, and there are several other forms of white, whitish or partly white animal (van Grouw 2013). This animal's black nose (Figs 1–2) shows that it is not an albino or an ino: albino animals lack melanin pigments entirely (hence, the impossibility of a 'partial albino'; van Grouw 2013), so the nose (and eyes, the colour of which were not visible in this animal) then shows pink; while ino individuals produce normal amounts of melanin, the pigment is incompletely oxidised and so the bare parts are also strongly pinkish (van Grouw 2013).

Fig. 1. White-coated Brown Palm Civet *Paradoxurus jerdoni* resting on a tree in Amboli, Maharashtra, India, on 13 September 2013 (Photo: Kedar Bhat).

Fig. 2. White-coated Brown Palm Civet *Paradoxurus jerdoni* resting on a tree in Amboli, Maharashtra, India, on 13 September 2013. This angle of viewing shows the slightly pigmented fur behind the ears, strongly suggesting that the animal is an example of dilution rather than of any of the other potential causes of pale pelage (Photo: Kedar Bhat).

Fig. 3. Brown Palm Civet *Paradoxurus jerdoni*, Valparai, Tamil Nadu, India, on 31 October 2007, showing pelage typical of the species (Photo: Kalyan Varma).

Fig. 4. Common Palm Civet *Paradoxurus hermaphroditus*, Mulshi, Pune, Maharashtra, India, on 15 September 2009 (Photo: Amod Zambre).

Moreover, the area behind the ears, among the darkest parts in typical Brown Palm Civets, seems to have some pigment (Fig. 2). Thus, this aberrant animal seems likely to be a form of dilution, whereby the animals are brown to whitish through reduction of the amount of melanin (van Grouw 2013). The animal is unlikely to be an example of leucism or of progressive greying, because in both those sorts of animals the aberrant hairs are pure white whilst the pigmented hairs are of normal colour (van Grouw 2013): the hairs behind this animal's ears fit neither category. A 'brown' mutation would be unlikely to appear so nearly uniformly clean white, particularly because 'brown' mutations approaching white in colour result from bleaching by sunlight (van Grouw 2013), a process unlikely in the almost wholly nocturnal palm civets.

Aberrantly pale individuals have been recorded in various other species of the family Viverridae (e.g. Delibes *et al*. 2013, Gaubert & Dufour 2013). Hitherto no records of white Brown Palm Civets have been noted, in contrast to Common Palm Civet (e.g. Sharma 2004, Eaton *et al*. 2010). White-pelted individuals are presumably susceptible to predation because of their conspicuous colour, although this may be less of a problem for these nocturnal animals.

Acknowledgements

I thank Kedar Bhat for photographing and sharing the photographs of the white-coated Brown Palm Civet. I am thankful to Girish A. Punjabi and Divya Mudappa for help with identification of this individual as a Brown Palm Civet and for improving the manuscript. I thank Shruti Alekar and Mihir Mahajan for reviewing a version of the manuscript and contribution in the field. I thank Kalyan Varma for the permission to use photograph of the typically coloured Brown Palm Civet. I am also thankful to Amod Zambre for the photograph of Common Palm Civet. I thank the reviewers, especially Hein van Grouw, for comments useful in improving the manuscript.

References

Bhosale, H. S., Punjabi, G. A. & Bardapurkar, R. 2013. Photographic documentation of Brown Palm Civet *Paradoxurus jerdoni* in Maharashtra, India, north of its known range. *Small Carnivore Conservation* 49: 37–39.

Blanford, W. T. 1885. [Exhibition and description of a skull of an apparently new species of *Paradoxurus*]. *Proceedings of the Zoological Society of London* '1885': 612–613.

Blanford, W. T. 1888–1891. *The fauna of British India. Mammalia*. Taylor and Francis, London, U.K.

Delibes, M., Mézan-Muxart, V. & Calzada, J. 2013. Albino and melanistic Genets (*Genetta genetta*) in Europe. *Acta Theriologica* 58: 95–99.

Eaton, J. A., Wüst, R., Wirth, R., Shepherd, C. R., Semiadi, G., Hall, J. & Duckworth, J. W. 2010. Recent records of the Javan Small-toothed Palm Civet *Arctogalidia (trivirgata) trilineata*. *Small Carnivore Conservation* 43: 16–22.

Gaubert, P. & Dufour, S. 2013. First report of a chinchilla phenotype in Viverridae (Carnivora). *Small Carnivore Conservation* 48: 92–95.

Hutton, A. F. 1949. Notes on the snakes and mammals of the High Wavy Mountains, Madura district, south India. *Journal of Bombay Natural History Society* 48: 681–694.

Mudappa, D., Noon, B. R., Kumar, A. & Chellam, R. 2007. Responses of small carnivores to rainforest fragmentation in the southern Western Ghats, India. *Small Carnivore Conservation* 36: 18–26.

Pocock, R. I. 1933. The palm civets or 'toddy cats' of the genera *Paradoxurus* and *Paguma* inhabiting British India. *Journal of the Bombay Natural History Society* 36: 855–877.

Rajamani, N., Mudappa, D. & Van Rompaey, H. 2002. Distribution and status of the Brown Palm Civet in the Western Ghats, South India. *Small Carnivore Conservation* 27: 6–11.

Sharma, S. K. 2004. Occurrence of albino Common Palm Civet and Northern Palm Squirrel in Southern Rajasthan. *Zoos' Print Journal* 19(5): 1483.

van Grouw, H. 2013. What colour is that bird? The causes and recognition of common colour aberrations in birds. *British Birds* 106: 17–29.

11+12, Sangeeta society, Vanaz corner, Kothrud, Pune-411038, Maharashtra, India.
Email: hrishi_chunekar@yahoo.com

Yellow-throated Martens *Martes flavigula* in the Kanchenjunga Conservation Area, Nepal

Angelika APPEL[1] and Ambika Prasad KHATIWADA[2]

Abstract

The Yellow-throated Marten *Martes flavigula* occurs in a broad variety of habitats including temperate and alpine bioclimatic zones in the Himalayas. In the Kanchenjunga Conservation Area in Nepal's Eastern Himalayas, it was among the most frequently camera-trapped carnivores, with photographs from an elevation range of 3,252–4,510 m. This latter constitutes the globally highest altitudinal record of the species.

Keywords: altitudinal range, anthropogenic pressure, camera-trapping, Eastern Himalayas, habitat use, highest elevation record

Introduction

The Kanchenjunga trans-boundary landscape encompasses 14 protected areas and six conservation corridors covering 7,754 km^2 of the Eastern Himalayas in eastern Nepal, Sikkim and Darjeeling (India) and western Bhutan (Shakya & Joshi 2008). The Eastern Himalayas are amongst the 'Global 200' ecoregions harbouring a highly distinctive and irreplaceable biodiversity (Olson & Dinerstein 1998). They are recognised as a global biodiversity hotspot (Myers *et al*. 2000). Centuries-old pilgrim and trade routes pass through the Nepali part of the Kanchenjunga landscape in the country's north-east, connecting markets for agricultural produce between the Himalayan foothills and the Tibetan plateau (Das 1902, Müller-Böker & Kollmair 2000). Agriculture, the traditional occupation and main livelihood of local people, includes shifting cultivation for food grains and potatoes (Aryal *et al*. 2010) and livestock husbandry for milk production and transport of goods (Müller-Böker & Kollmair 2000). The area surrounding the Kanchenjunga massif was included into Nepal's protected area system in 1997. An amendment to the National Parks and Wildlife Conservation Act of 1973 allowed for the designation of 'conservation areas' as a distinct protected area category (Heinen & Shrestha 2006). The Kanchenjunga Conservation Area (Kanchenjunga CA) is conceptualised as people-oriented, reconciling rural development and conservation of cultural traditions and wildlife (Gurung 2006). It encompasses four administrative areas, so-called Village Development Committees (VDCs), consisting of 79 widely scattered settlements; 4,931 people living in 977 households were estimated to reside permanently inside the Kanchenjunga CA as of 2001 (Mountain Spirit 2007).

In the 1990s, wildlife research in the Kanchenjunga CA focused on its flora and vegetation (Carpenter *et al*. 1994, Yonzon 1996). During the past decade, activities shifted to conservation projects related to Snow Leopard *Panthera uncia* (Ikeda 2004), Red Panda *Ailurus fulgens* (Mahato & Karki 2005) and, more recently, Dhole *Cuon alpinus* (Khatiwada 2011).

In the Himalayas, the Yellow-throated Marten *Martes flavigula* inhabits tropical rainforests, subtropical foothills and temperate to alpine habitats (Sathyakumar 1999, Datta *et al*. 2008, Sathyakumar *et al*. 2011, Appel *et al*. 2013). In and around the Indian part of the Kanchenjunga landscape, the Marten has been camera-trapped in several protected areas of Arunachal Pradesh, Sikkim and Darjeeling recently (Datta *et al*. 2008, Sathyakumar *et al*. 2011, Mallick 2013). Carpenter *et al.* (1994), Yonzon (1996) and Katuwal *et al*. (2013) reported sightings in the Kanchenjunga CA, but information about its ecology in this rugged landscape is sketchy.

This article reports Yellow-throated Marten camera-trap records in the south-eastern part of the Kanchenjunga CA, and speculates on its habitat use, activity pattern, avoidance behaviour and tolerance for human-induced disturbance.

Study area

The Kanchenjunga CA extends over 2,035 km^2 and encompasses an impressive mountain landscape ranging in elevation from 1,200 to 8,586 m. The protected area adjoins the Qomolongma National Nature Reserve in Tibet to the north and is contiguous with the Khangchendzonga Biosphere Reserve (Khangchendzonga BR) in Sikkim, India, to the east (Bhuju *et al*. 2007). The Kanchenjunga CA comprises temperate, alpine and nival climatic zones with more than 60% consisting of rocks, glaciers and rivers (Bhuju *et al*. 2007). The seasonal climate is dominated by the June–September monsoon. Annual rainfall was 2,055 mm in 2007, with a maximum monthly precipitation of about 500 mm in July decreasing to about 340 mm in September (Devkota *et al*. 2012).

The study area was located in the southern part of the Kanchenjunga CA, south-west of Mount Kanchenjunga, the main peak of the Kanchenjunga massif that rises within an aerial distance of about 30 km. In the northern and north-western periphery of the study area flows the Simbuwa Khola, a glacial outflow of Mount Kanchenjunga. The core area encompassed by camera-traps comprised about 45 km^2 stretching from 27°28′22″N, 87°51′22″E to 27°29′09″N, 87°57′53″E in the south, and from 27°32′33″N, 87°55′20″E to 27°34′25″N, 87°58′49″E in the north. This area is about 10 hours' walk from the nearest settlements, Hellok of Tapethok VDC in the west and Sherpagaon of Yamphudin VDC in the south-east (Fig. 1). Walking uphill and down dale from Sherpagaon covers an elevation range of 1,800–4,600 m.

Dobremez (1972) combined climatic and phytogeographic regions to describe bioclimatic zones in the Nepal Himalayas. Relevant to our survey, the elevation range of 2,501–3,000 m constitutes the upper temperate; 3,001–3,500 m the lower subalpine; 3,501–4,000 m the upper subalpine; 4,001–4,500

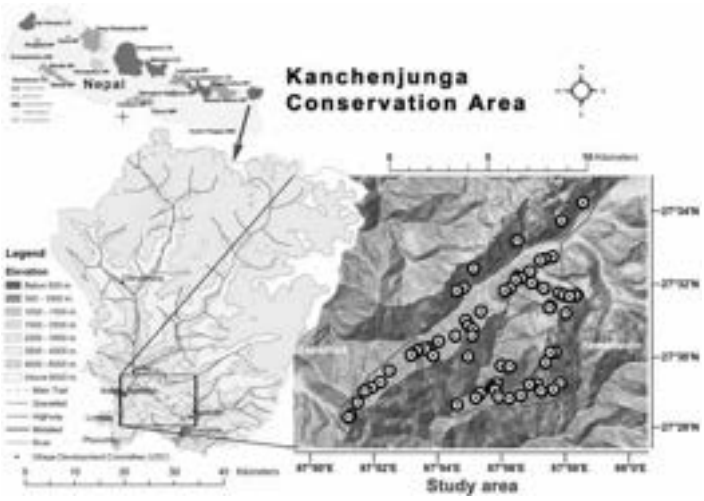

Fig. 1. The Kanchenjunga Conservation Area, Nepal, showing the study area and locations of camera-trap stations (black and white dots).

m the lower alpine; and 4,501–5,000 m the upper alpine bioclimatic zone. Yonzon (1996) described the intermittently occurring forests in the upper temperate bioclimatic zone of the Kanchenjunga CA as comprising stands of fir *Abies spectabilis*, birch *Betula utilis*, hemlock *Tsuga dumosa*, juniper *Juniperus wallichiana*, maple *Acer* and larch *Larix griffithii;* conifer stands prevail in the subalpine zone and are interspersed with shrublands dominated by rhododendron *Rhododendron* and *Juniperus*; *Calamagrostis*, *Carex*, *Festuca* and *Trisetum* are predominant species growing in the subalpine and alpine grazing areas. Shrubs and meadows are found up to 5,000 m elevation.

Materials and methods

Ours was the second camera-trapping survey in this area. It was designed to find Dhole, using 19 Moultrie units equipped with GS D40 cameras. We deployed all units between 24 June and 14 July 2012 and moved them to a second adjacent survey block between 25 July and 16 August 2012. From 15 August onwards we shifted camera-traps to a third adjacent block, where 17 units were active until 5 September 2012. Between 7 and 27 September 2012, 15 units were active in a fourth block. Camera-traps were deployed singly, positioned up to 60 cm above ground, set to 24-hour operation, and used no baits. The terrain is too rugged and steep for a homogeneous distribution of camera-traps, so we placed them foremost along narrow trails that connect settlements with higher-elevation subalpine and alpine pastures used during the monsoon season. AK interviewed herders in August 2010 and concluded that Dholes also use these trails (Khatiwada 2011).

We used a Garmin GPS eTrex 10 unit to determine coordinates (datum WGS84) and elevation of each camera-trap station, and noted habitat characteristics and crown coverage. All elevations are given as delivered by the GPS unit; the level of accuracy is not known. Camera-trap images recorded the time of photograph. Sunset and sunrise times were obtained using the database of the Astronomical Applications Department of the United States Naval Observatory (2012).

'Camera-trap-days' comprise the number of 24-hour periods from deployment of a camera-trap until it was retrieved or stopped working through technical reasons or weather conditions. Photographs showing either single individuals or social units of several individuals each comprise one detection for the species. Based on O'Brien *et al*. (2003), notionally independent photographs were 1) non-consecutive images of the same species, 2) consecutive images of the same species taken at an interval of more than 30 minutes, and 3) successive images of different individuals or, for social species, social units. The average 'photo-capture interval' (PCI) is the number of camera-trap-days per notionally independent photograph (IP) of the species.

Results

Camera-traps in 70 stations gave a total sampling effort of 1,114 camera-trap-days. In 59 stations, trapping sessions lasted an average of 15.6 days ranging from 12 to 20 days. In 11 stations, camera-traps operated for only 1–10 days each. In total 6,513 photographs of vertebrate species comprised 1,015 IPs, out of which 111 IPs (9.95% of all) were of wild mammals: ungulates (27 IPs, 2.66%), canids (25 IPs, 2.46%), unidentifiable mammals (15 IPs, 1.48%), cats (14 IPs, 1.38%), Yellow-throated Marten (11 IPs, 1.08%), rodents (11 IPs, 1.08%), bears (5 IPs, 0.49%), Red Panda (2 IPs, 0.2%) and a bat (1 IP, 0.1%). The remaining IPs were triggered by birds (101 IPs, 9.95%), local people (376 IPs, 37.04%) and domestic animals (427 IPs, 42.07%) including livestock and Domestic Dogs *Canis familiaris*. Table 1 details the sampling effort in each bioclimatic zone, and the IPs and PCIs of Yellow-throated Marten photographed therein; Table 2 details the records individually.

All photographs of Yellow-throated Martens were taken during the day. The earliest was two hours 14 minutes after sunrise, the latest one hour before sunset. Seven IPs show single individuals, four show duos. Martens were camera-trapped at eight stations between the southernmost at 27°28′22″N, 87°51′22″E and the northernmost at 27°32′53″N, 87°57′50″E (Fig. 2), ranging in recorded elevation from 3,252 to 4,510 m. The latter elevation provided three IPs: on 28 July, 6 and 10 August 2012.

Of 33 camera-trap stations in forested habitat, two recorded Martens in the lower subalpine (3 IPs, PCI 68), as did one in the lower alpine bioclimatic zone (1 IP, PCI 18). Of 17 stations in shrubland, one recorded Martens in the lower subalpine (1 IP, PCI 88), as did one in the lower alpine bioclimatic zone (1 IP, PCI 32). Both shrubland sites are about 600 m aerial distance from the nearest forest patch, in both cases located downhill. Of 20 stations in meadows, two recorded Martens in the lower alpine (2 IPs, PCI 14), as did one (3 IPs, PCI 16) in the upper alpine bioclimatic zone (Fig. 3). These stations were about 1,400–1,700 m from the nearest forest patch, in all cases downhill.

In 56 of 70 stations (80% of all stations), photographs were triggered by local people and/or domestic animals. These stations are termed 'disturbed sites' henceforward, whereas the term 'undisturbed sites' refers to the remaining 14 stations where only wildlife was photographed. Human-induced disturbance apparently varied between the bioclimatic zones (Fig. 4). Domestic Dogs were part of social units comprising livestock and people that triggered photographs. Additionally, they triggered 91 IPs (8.97% of all IPs) in altogether 25 stations (35.71% of all stations). In 17 of these stations

Table 1. Survey effort and records of Yellow-throated Marten *Martes flavigula* in the southern part of the Kanchenjunga Conservation Area, Nepal, June–September 2012.

Elevation range of camera-trap stations	Bioclimatic zone and habitat type	Number of camera-trap stations	Number of camera-trap-days	Martens recorded		
				n° stations	IPs	PCI
2,535–2,991 m	Upper temperate forest and shrub	7	114	0	0	0
3,015–3,494 m	Lower subalpine forest, shrub and meadow	21	345	3	4	86
3,514–3,948 m	Upper subalpine forest, shrub and meadow	28	446	0	0	0
4,173–4,446 m	Lower alpine forest, shrub and meadow	11	162	4	4	41
4,510–4,540 m	Upper alpine meadow	3	47	1	3	16
	Total	70	1,114		11	101

IPs: the number of notionally independent photographs; PCI: photo-capture interval, the number of camera-trap-days per notionally independent photograph (see text for definitions).

Table 2. Records of Yellow-throated Marten *Martes flavigula* in the southern part of the Kanchenjunga Conservation Area, Nepal, with dates, time, elevation, habitat and coordinates from north to south.

Date in 2012	Time	Elevation	Habitat	Coordinates
11 August	07h42	4,173 m	forest	27°32′53″N, 87°57′50″E
28 July	07h31	4,206 m	shrubland	27°32′48″N, 87°57′28″E
28 July	07h28	4,280 m	rocky grassland	27°32′00″N, 87°57′34″E
28 July	11h32	4,510 m	rocky grassland	27°31′49″N, 87°58′12″E
6 August	15h24	4,510 m	rocky grassland	27°31′49″N, 87°58′12″E
10 August	17h34	4,510 m	rocky grassland	27°31′49″N, 87°58′12″E
2 August	10h27	4,340 m	rocky grassland	27°31′30″N, 87°57′46″E
28 June	10h03	3,252 m	forest	27°29′49″N, 87°56′14″E
28 June	10h28	3,266 m	forest	27°29′19″N, 87°56′04″E
3 July	12h40	3,266 m	forest	27°29′19″N, 87°56′04″E
14 September	11h35	3,459 m	shrubland	27°28′22″N, 87°51′22″E

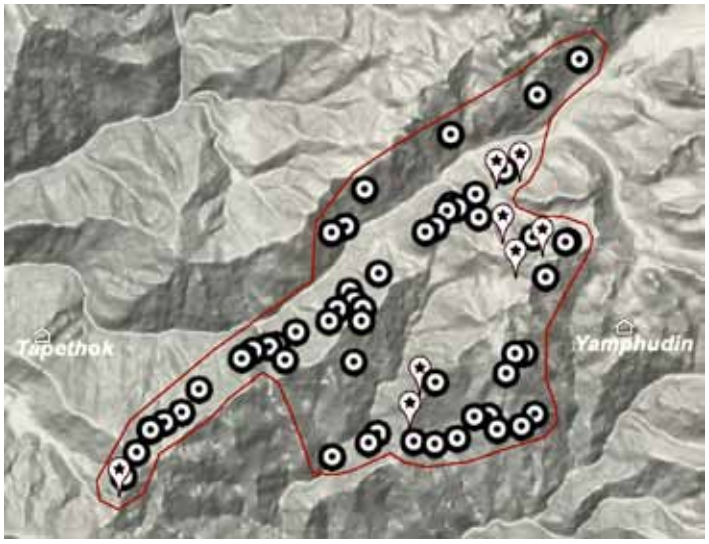

Fig. 2. Location of camera-traps in the southern part of the Kanchenjunga Conservation Area, Nepal; white stars indicate those with records of Yellow-throated Marten *Martes flavigula*.

Fig. 3. Two Yellow-throated Martens *Martes flavigula* in the southern part of the Kanchenjunga Conservation Area, Nepal, on rocks at an elevation of 4,510 m, 28 July 2012 (Photo: Ambika Khatiwada).

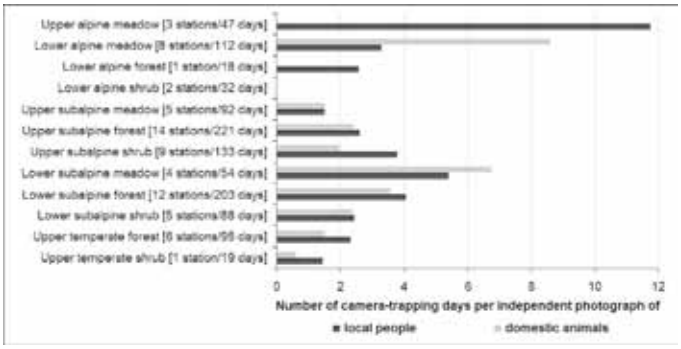

Fig. 4. Photo-capture interval (PCI) of local people and domestic animals in the various bioclimatic zones and habitats surveyed in the southern part of the Kanchenjunga CA, Nepal.

(24.29% of all stations), they preceded or followed groups of livestock and people within one hour in 37 IPs (40.66% of all Domestic Dog IPs). Solitary Dogs triggered the remaining 54 IPs (59.34% of all Domestic Dogs IPs) in 22 stations (31.43% of all stations). Whether the latter were feral or herding Dogs is unclear.

In undisturbed sites, Martens were recorded at a PCI of 46, at one station each in lower subalpine forest and in lower alpine shrubland. In disturbed sites, they were recorded at a PCI of 122, at six stations in the lower subalpine and both alpine bioclimatic zones. In these six disturbed sites, local people triggered 21 IPs (5.58% of all local people IPs at all stations). In only one instance, people were accompanied by a Domestic Dog. Martens were recorded 17 hours to five days later than the most recent preceding people, and one hour to 12 days earlier than the next group of people, including the one with the Dog. Livestock triggered 10 IPs (2.97% of all domestic animal IPs at all stations) in two of these six disturbed sites. They were photographed at least four days later than the Martens, but not preceding them.

Discussion

Four IPs at elevations of 4,340–4,510 m indicate that Yellow-throated Martens use higher elevations during the monsoon season than previously known in the Kanchenjunga landscape. Martens have been recorded in hill forests of Darjeeling up to 3,323 m (Mallick 2013) and in alpine habitat of the Khangchendzonga BR up to 4,010 m (Sathyakumar *et al*. 2011). The Marten duo at 4,510 m constitutes the globally highest-elevation record of the species to date. Above this elevation, survey effort was low (31 camera-trap-days in two stations) and Martens might occur but have been overlooked. Although effort below the lowest record (3,252 m) was more (257 camera-trapping days at 16 stations), it is still plausible that Martens occurred there, but went unrecorded.

The highly agile Marten was observed in groups of up to four in the Himalayas (Carpenter *et al*. 1994, Sathyakumar 1999, Appel *et al*. 2013) and in Southeast Asia (Duckworth 1997, Grassman *et al*. 2005, Parr & Duckworth 2007, Than Zaw *et al*. 2008). Its diurnal activity in the Kanchenjunga CA is consistent with activity patterns reported elsewhere (Grassman *et al*. 2005, Parr & Duckworth 2007, Than Zaw *et al*. 2008, Appel *et al*. 2013). Nandini & Karthik (2007) and Parr & Duckworth (2007) accounted of groups of Martens that tolerated close human proximity while foraging. The Martens in our study area perhaps have a low tolerance for human-induced disturbance: they were not photographed in bioclimatic zones with a high human and livestock frequency.

The Yellow-throated Marten inhabits a broad variety of bioclimatic zones and habitats ranging from mixed evergreen (Duckworth 1997, Grassman *et al.* 2005), deciduous and degraded forest (Datta *et al.* 2008) to upper temperate (Appel *et al*. 2013) and subalpine forest (Mallick 2013). It is often recorded along rivers (Duckworth 1997, Datta *et al.* 2008, Than Zaw *et al*. 2008, Sathyakumar *et al*. 2011, Appel *et al*. 2013, Mallick 2013). But none of these authors refer to Martens in grassland landscapes. In our study area, Martens were recorded foraging in rocky alpine meadows whereas stations in subalpine meadows yielded no such photographs, although each was surveyed to similar intensity. The frequency of people and domestic animals along trails through subalpine meadows was higher than in alpine meadows. The habitat surrounding these trails does not offer quick escape routes or hiding places for Martens when people and livestock approach. Therefore, variation in Marten photo-capture frequency between meadow types could reflect the effects of human and livestock activity. However, it might simply result from differing intrinsic suitability of these habitats, or perhaps a spurious pattern from the low numbers of records.

Previous Marten records in shrubland may be limited to one sighting by Duckworth (1997) in a lowland semi-evergreen habitat in Lao PDR; this was in scrub over recently abandoned cultivation, within 150 m of a forest patch and 500 m of extensive forest (J. W. Duckworth *in litt*. 2014). In the Kanchenjunga CA, Martens use very different forms of shrubland. Some of these shrublands may be on land deforested several decades to centuries ago, whereas others may not be significantly anthropogenic at all. Their origin has not yet been studied in the Kanchenjunga CA. Shrublands in the Sagarmatha National Park farther north-west in the Himalayas have been estimated at 30 to more than 5,000 years of age (Byers 2005).

Camera-traps along trails in upper temperate forests showed a high frequency of people and domestic animals. The lack of Marten records at these forest stations (with a total survey effort of 95 camera-trapping days) coincides with a 46.8% lower sampling effort than at subalpine forest stations. In contrast, Appel *et al*. (2013) recorded Martens in undisturbed upper temperate forest in Nepal's Annapurna CA at a PCI of 24.5 days, despite a much lower sampling effort. Camera-trapping in the temperate zone of our study area might have been too limited to record Martens in disturbed sites.

The lack of photographs in upper temperate and upper subalpine forests does not necessarily indicate the Marten's absence there. It might reflect a low probability of photographing it on the forest floor in disturbed sites. Martens preceded livestock by an average of four days at the few stations recording both, but were not recorded subsequently. Nor were they photographed at stations previously frequented by Dogs. The latter were recorded in more than a third of all stations. Although perhaps just a coincidence, given the few records of Martens, this may indicate that Martens avoid the ground level in sites used by Dogs.

Herding Dogs sniff out and cause the death of ground-dwelling mammals that might otherwise not be found by

people (Young *et al*. 2011, Appel *et al*. 2013). Hence, their presence in the Kanchenjunga CA may also affect space use of other small carnivores. In the adjacent Khangchendzonga BR, Sathyakumar *et al*. (2011) recorded Masked Palm Civet *Paguma larvata*, Large Indian Civet *Viverra zibetha* and Binturong *Arctictis binturong* in temperate bioclimatic zones; and Stone Marten *Martes foina*, Yellow-bellied Weasel *Mustela kathiah*, Siberian Weasel *Mustela sibirica* and Mountain Weasel *Mustela altaica* in subalpine bioclimatic zones. Therefore, these species might be present in the Kanchenjunga CA of Nepal as well.

Acknowledgements

We are grateful to Rufford Small Grants Foundation and People's Trust for Endangered Species, UK, for providing the financial assistance to carry out this survey. We thank the Department of National Parks and Wildlife Conservation for issuing research permits, and in cooperation with the National Trust for Nature Conservation for providing camera-trapping equipment. We highly appreciated the dedicated and hard work of Bibek Acharya, Nirmal Gurung, Basanta Rai, Tashi Lama and Lakpa Sherpa during the field work and all those rainy days in particular. We are much obliged to Khagendra Phembo, Abir Man Rai, personnel of the Kangchenjunga Conservation Area Management Council and Alumni Association for Conservation and Development for their support in coordinating field activities. We sincerely thank Kyran Kunkel, Kate Jenks, Shant Raj Jnawali, Maheshwar Dhakal, Keshav Datt Awasthi, Krishna Pd. Devkota, Hem Sagar Baral, Naresh Subedi, Bishal Ghimire and Lon Grassman for their invaluable advice. For constructive comments on the manuscript we sincerely thank Igor Khorozyan, S. Sathyakumar and an anonymous referee.

References

Appel, A., Werhahn, G., Acharya, R., Ghimirey, Y. & Adhikary, B. 2013. Small carnivores in the Annapurna Conservation Area, Nepal. *Vertebrate Zoology* 63: 111–121.

Aryal, K. P., Kerkhoff, E. E., Maskey, N. & Sherchan, R. 2010. *Shifting cultivation in the sacred Himalayan landscape. A case study in the Kangchenjunga Conservation Area*. WWF Nepal, Kathmandu, Nepal.

Bhuju, U. R., Shakya, P. R., Basnet, T. B. & Shrestha, S. 2007. *Nepal biodiversity resource book. Protected areas, Ramsar Sites, and World Heritage Sites*. International Centre for Integrated Mountain Development, Ministry of Environment, Science and Technology, in cooperation with United Nations Environment Programme, Regional Office for Asia and the Pacific, Kathmandu, Nepal.

Byers, A. 2005. Contemporary human impacts on alpine ecosystems in the Sagarmatha (Mt. Everest) National Park, Khumbu, Nepal. *Annals of the Association of American Geographers* 95: 112–140.

Carpenter, C., Ghimire, S. & Brown, T. 1994. *Report on the flora and fauna of the Kanchenjunga region: wildlands studies, autumn 1994*. WWF, Kathmandu, Nepal (Report 13).

Das, S. C. 1902. *A journey to Lhasa and central Tibet*. E. P. Dutton & Co., New York, U.S.A. and John Murray, London, U.K.

Datta, A., Naniwadekar, R. & Anand, M. O. 2008. Occurrence and conservation status of small carnivores in two protected areas in Arunachal Pradesh, North-east India. *Small Carnivore Conservation* 39: 1–10.

Devkota, B., Paudel, P. P., Bhuju, D. R. & Kubota, T. 2012. Climatic variability and impacts on biodiversity at local level: a case study from Kanchanjanga Conservation Area, Nepal. *Journal of the Faculty of Agriculture, Kyushu University* 57: 453–459.

Dobremez, J. F. 1972. Les grandes divisions phytogéographiques du Népal et de l'Himalaya. *Bulletin de la Société Botanique de France* 119: 111–120.

Duckworth, J. W. 1997. Small carnivores in Laos: a status review with notes on ecology, behaviour and conservation. *Small Carnivore Conservation* 16: 1–21.

Grassman, L. I., Jr., Tewes, M. E. & Silvy, N. J. 2005. Ranging, habitat use and activity patterns of Binturong *Arctictis binturong* and Yellow-throated Marten *Martes flavigula* in north-central Thailand. *Wildlife Biology* 11: 49–57.

Gurung, G. S. 2006. Reconciling conservation and livelihood needs in protected areas of Nepal: a case study of Kangchenjunga Conservation Area. Chapter 3 in McNeely, J. A., McCarthy, T. M., Smith, A., Olsvig-Whittaker, L. & Wikramanayake, E. D. (eds) *Conservation biology in Asia.* Society for Conservation Biology Asia Section and Resources Himalaya, Kathmandu, Nepal.

Heinen, J. T. & Shrestha, S. K. 2006. Evolving policies for conservation: an historical profile of the protected area system of Nepal. *Journal of Environmental Planning and Management* 49: 41–58.

Ikeda, N. 2004. Economic impacts of livestock depredation by Snow Leopard *Uncia uncia* in the Kanchenjunga Conservation Area, Nepal Himalaya. *Environmental Conservation* 31: 322–330.

Katuwal, H. B., Khanal, B., Basnet, K., Rai, B., Devkota, S., Rai, S. K., Nobis, M. & Scheidegger, C. 2013. The mammalian fauna from the Central Himalaya, Nepal. *Asian Journal of Conservation Biology* 2(1): 21–29.

Khatiwada, A. P. 2011. *Status and habitat preference of Dhole (*Cuon alpinus*) in Kangchenjunga Conservation Area*. Tribhuvan University, Institute of Forestry, Pokhara, Nepal (MSc. dissertation).

Mahato, N. K. & Karki, J. B. 2005. Distribution and habitat assessment of Red Panda (*Ailurus fulgens*) in Kanchenjunga Conservation Area with reference to Riya Samba and Lama–Khanak forests. *Nepal Journal of Forestry* 12(3): 32–40.

Mallick, J. K. 2013. Himalayan Yellow-throated Marten (*Martes flavigula*) in West Bengal, India. *Taprobanica* 5(1): 89–93.

Mountain Spirit 2007. *Socio-economic baseline survey. Kanchenjunga Conservation Area Project (1998–2007)*. Report prepared for WWF, Kathmandu, Nepal.

Müller-Böker, U. & Kollmair, M. 2000. Livelihood strategies and local perceptions of a new nature conservation project in Nepal. The Kanchenjunga Conservation Area Project. *Mountain Research and Development* 20: 324–331.

Myers, N., Mittermeier, R. A., Mittermeier, C. G., da Fonseca, G. A. B. & Kent, J. 2000. Biodiversity hotspots for conservation priorities. *Nature* 40: 853–858.

Nandini, R. & Karthik, T. 2007. Field observations of Yellow-throated Martens *Martes flavigula* feeding on flowers in Meghalaya, North-east India. *Small Carnivore Conservation* 37: 26–27.

O'Brien, T. G., Kinnard, M. F. & Wibisono, H. T. 2003. Crouching Tigers, hidden prey: Sumatran Tiger and prey populations in a tropical forest landscape. *Animal Conservation* 6: 131–139.

Olson, D. & Dinerstein, E. 1998. The Global 200. A representation approach to conserving the Earth's most biologically valuable ecoregions. *Conservation Biology* 12: 502–515.

Parr, J. W. K. & Duckworth, J. W. 2007. Notes on diet, habituation and sociality of Yellow-throated Marten *Martes flavigula*. *Small Carnivore Conservation* 36: 27–29.

Sathyakumar, S. 1999. Mustelids and viverrids of the northwestern and western Himalayas. *ENVIS Bulletin (Wildlife and Protected Areas)* 2(2): 39–42.

Sathyakumar, S., Bashir, T., Bhattacharya, T. & Poudyal, K. 2011. Assessing mammal distribution and abundance in intricate Eastern Himalayan habitats of Khangchendzonga, Sikkim, India. *Mammalia* 75: 257–268.

Shakya, B. & Joshi, R. M. 2008. Protected areas and biodiversity conservation in the Hindu Kush–Himalayan Region with special reference to the Kangchenjunga landscape. Pp. 13–20 in Chettri, N., Shakya, B. & Sharma, E. (eds) *Biodiversity conservation in the Kangchenjunga landscape.* International Centre for Integrated Mountain Development, Kathmandu, Nepal.

Than Zaw, Saw Htun, Saw Htoo Tha Po, Myint Maung, Lynam, A. J., Kyaw Thinn Latt & Duckworth, J. W. 2008. Status and distribution of small carnivores in Myanmar. *Small Carnivore Conservation* 38: 2–28.

United States Naval Observatory 2012. *The astronomical almanac online!* http://aa.usno.navy.mil/data/docs/RS_OneDay.php. Downloaded on 5 September 2013.

Yonzon, P. B. 1996. *Status of wildlife in the Kanchenjungha region. A reconnaissance survey*. WWF, Kathmandu, Nepal.

Young, J. K., Olson, K. A., Reading, R. P., Amgalanbaatar, S. & Berger, J. 2011. Is wildlife going to the dogs? Impacts of feral and free-roaming dogs on wildlife populations. *BioScience* 61: 125–132.

[1]Auf dem Dörnchen 14, 56470 Bad Marienberg, Germany. Email: angie@wild-cat.org
[2]c/o National Trust for Nature Conservation, Post Box 3712, Lalitpur, Nepal.

Camera-trap records of small carnivores from eastern Cambodia, 1999–2013

T. N. E. GRAY[1], PIN C.[2], PHAN C.[2], R. CROUTHERS[2], J. F. KAMLER[3] and PRUM S.[2,4]

Abstract

Camera-trapping targeted at large mammals was conducted across nine lowland areas (predominantly under 300 m asl) in eastern Cambodia between 1999 and 2013. At least 10 small carnivore species were recorded including, based on *The IUCN Red List of Threatened Species*, two categorised as Vulnerable (Large-spotted Civet *Viverra megaspila* and Binturong *Arctictis binturong*) and two as Near Threatened (Large Indian Civet *V. zibetha* and Hog Badger *Arctonyx collaris*). Over 75% of small carnivore camera-trap encounters were of Large Indian Civet or Common Palm Civet *Paradoxurus hermaphroditus*, indicating that these species remain widespread and common in eastern Cambodia's lowland forests. Possible declines of Hog Badger, Large-spotted Civet and Small Indian Civet *Viverricula indica* are noted but further research is merited. This is particularly important for Large-spotted Civet, given the likely high significance of this region to its global conservation status.

Keywords: *Arctonyx collaris*, Hog Badger, lowland forest, Large Indian Civet, Large-spotted Civet, Mondulkiri, Phnom Prich, *Viverra megaspila*, *Viverra zibetha*

ការម៉ាស្វ័យប្រវត្តិកត់ត្រានូវប្រភេទមំសាសត្វថ្នាក់ទាបនៅក្នុងតំបន់

ភាគខាងកើតប្រទេសកម្ពុជា ពីឆ្នាំ១៩៩៩ ដល់ ឆ្នាំ២០១៣

ការដាក់កាម៉េរ៉ាថតរូបស្វ័យប្រវត្តិដែលសំដៅទៅលើពពួកថនិកសត្វដែលមានមាឌធំដែលបានធ្វើឡើងក្នុងរវាងឆ្នាំ ១៩៩៩-២០១៣ នៅទូទាំង ៩តំបន់ទំនាបកណ្តាល (ភាគច្រើនមានរយៈកំពស់ក្រោម ៣០០ម ខ្ពស់ជាង នីវ៉ូទឹកសមុទ្រ) ស្ថិតនៅភាគខាងកើតប្រទេសកម្ពុជា។ យ៉ាងហោចណាស់មានប្រភេទមំសាសត្វថ្នាក់ទាបចំនួន ១០ប្រភេទត្រូវបានកត់ត្រាជាប្រភេទដែលទទួលរងគ្រោះថ្នាក់នៅក្នុងបញ្ជីក្រហមរបស់អង្គការសហភាពអភិរក្ស ពិភពលោក The IUCN Red List ដែលមានដូចជា ប្រភេទងាយទទួលរងគ្រោះថ្នាក់ពីរប្រភេទគឺសត្វសំពោចធំ *Viverra megaspila* និងសត្វឈ្មុសប្រែងឬសំពោចភ្នំ *Arctictis binturong,* ប្រភេទសត្វជិតទទួលរងគ្រោះថ្នាក់ពីរប្រភេទគឺ សត្វខ្ទីន *Viverra zibetha* និងសត្វជ្រូកពោន *Arctonyx collars* ។ ភាគច្រើននៃប្រភេទមំសាសត្វថ្នាក់ទាបដែលកាម៉េរ៉ាស្វ័យប្រវត្តិចតបាន (ច្រើនជាង ៧៥%)គឺប្រភេទសត្វខ្ទីន និងសត្វសំពោចក្រអូប *Paradoxurus hermaphroditus* ដែលបង្ហាញថាសត្វប្រភេទនេះនៅមានពាសពេញ និងជាសមញ្ញានៅក្នុងតំបន់ទំនាបព្រៃភាគខាងកើតប្រទេសកម្ពុជា។ ការថយចុះដែលអាចកើតមានចំពោះសត្វ ៣ប្រភេទ (សត្វជ្រូកពោន, សំពោចធំ និងសត្វសំពោចវល្លិ៍រឺសំពោចតូច *Viverricula indica* គឺត្រូវបានកត់សំគាល់ ប៉ុន្តែទាមទារអោយមានការសិក្សាស្រាវជ្រាវបន្ថែមទៀត។ វាគឺមានសារៈសំខាន់ជាពិសេសសម្រាប់សត្វសំពោចធំដែលបានបង្ហាញពីសារៈសំខាន់ខ្ពស់នៅតំបន់នេះដើម្បីការអភិរក្សសត្វប្រភេទនេះជាសកល។

Introduction

The forests of eastern Cambodia are globally significant for biodiversity conservation in particular for their large extent of lowlands not yet widely converted to agriculture and other anthropogenic habitats, together with populations of globally threatened large mammals and waterbirds (Tordoff *et al*. 2005, Phan *et al*. 2010, Gray *et al*. 2012a, O'Kelly *et al*. 2012, Wright *et al*. 2012). Since 1999 WWF Cambodia has partnered with the Royal Government of Cambodia to undertake biodiversity surveys and monitoring, including extensive camera-trapping, in various areas, within and outside the protected area network, across the eastern Cambodian provinces of Kratie, Mondulkiri, Rattanakiri and Stung Treng (Phan *et al*. 2010, Gray *et al*. 2012b). Since 2008 this has focused on the cores of two protected area (Phnom Prich Wildlife Sanctuary [Phnom Prich WS] and Mondulkiri Protected Forest [Mondulkiri PF]) in the Eastern Plains Landscape, Mondulkiri province (Phan *et al.* 2010, Gray & Prum 2012). These two survey areas, mostly below 300 m asl, hold mostly deciduous diptertocarp forest (Pin *et al*. 2013). A little mixed deciduous and highly deciduous semi-evergreen forest (*sensu* Rundel 1999) occurs in Mondulkiri PF. Phnom Prich WS has much naturally patchy semi-evergreen forest. Cambodia was historically poorly collected and surveyed for small carnivores, as for many other mammals of this size-class (Walston 2001), with various species and even genera being found for the first time only recently (e.g. Schank *et al*. 2009). This paper documents the small carnivores (i.e. Herpestidae, Mustelidae [excepting otters (Lutrinae)], Prionodontidae and Viverridae) camera-trapped in order to assist with understanding their global conservation status.

Methods

The camera-trapping here described covered two phases:

June 1999 to November 2007
Nine broadly distributed survey areas in eastern Cambodia, both east (seven areas) and west (two areas) of the Mekong river, were camera-trapped (Fig. 1; reproduced from Gray *et al.* [2012b]). Objectives were largely to document the presence (or non-recording) of globally threatened large mammals (particularly Asian Elephant *Elephas maximus*, Eld's Deer *Cervus eldii*, Hog Deer *Axis porcinus*, wild cattle *Bos* and large carnivores) with cameras placed at locations expected to maximise encounters with these species, and also to minimise the risk of camera theft. CamTrakker (CamTrak South, Inc., Watkinsville, GA 30677 USA) passive infra-red sensor camera-traps were used. Gray *et al*. (2012b) gave more details of methodology, including of data-extraction from this disparate, poorly managed dataset. Unfortunately, effort (e.g. the number of camera-trap nights in each survey area) is no longer available for these surveys.

December 2008 to February 2013
Parts of central and western Mondulkiri PF and eastern Phnom Prich WS were extensively camera-trapped using commercially available infra-red, digital camera units with passive infrared motion detection (Reconyx RapidFire Professional PC90, Holmen, WI, USA; Cuddeback Ambush IR, Green Bay, WI, USA) in which all photographs are digitally stamped with date and time. Fig. 2 (reproduced from Gray *et al.* 2014) shows the approximate locations of these camera-trap stations. Camera-traps were placed in locations (e.g. alongside roads and footpaths, dry stream beds and at seasonal waterholes) chosen to maximise chances of encountering large ground-living mammals, primarily large carnivores (Mainland Clouded Leopard *Neofelis nebulosa,* Leopard *Panthera pardus* and Tiger *P. tigris*) and wild cattle (Banteng *Bos javanicus* and Gaur *B. gaurus*). No camera-traps were baited. All were continuously operational, placed on trees at 20–150 cm (mean 50 cm) above the ground. All notionally independent encounters with small carnivores, defined when successive photographs of the same species at the same station were separated by at least 30 minutes, were extracted from the camera-trap data and recorded. All species identifications from the photographs were made by Pin Chanratana, with support from TNEG.

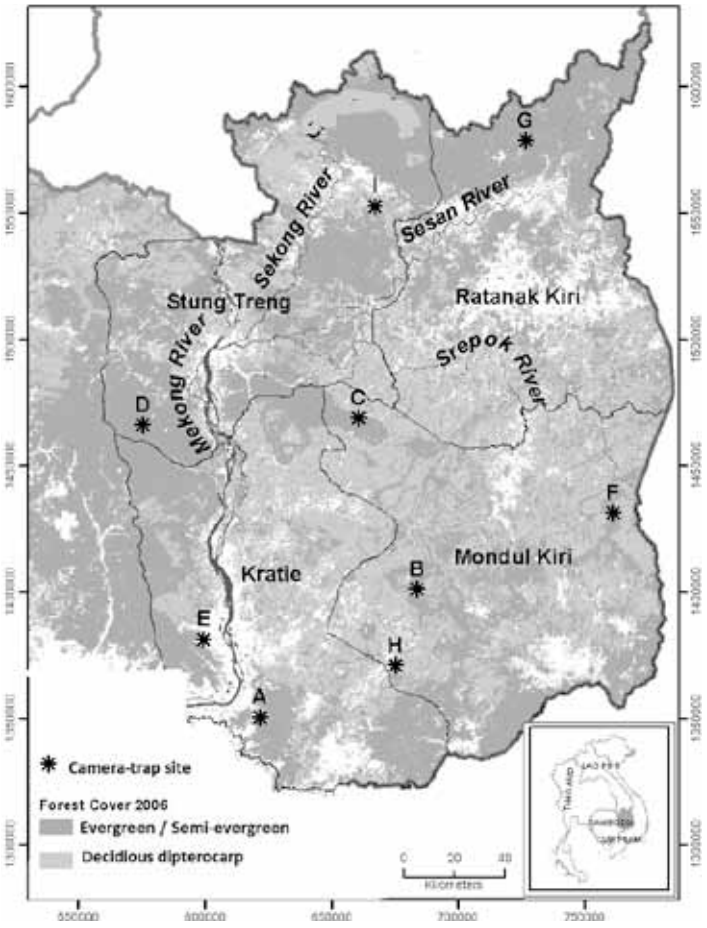

Fig. 1. Approximate locations of survey areas camera-trapped by WWF in eastern Cambodia, 1999–2007. A, Chhlong; B, Phnom Prich Wildlife Sanctuary; C, Prey Khieu; D, Prey Long; E, Prek Prasab; F, Mondulkiri Protected Forest; G, Virachey National Park; H, west Seima/Snoul; I, Western Siem Pang. Reproduced from Gray *et al*. (2012b).

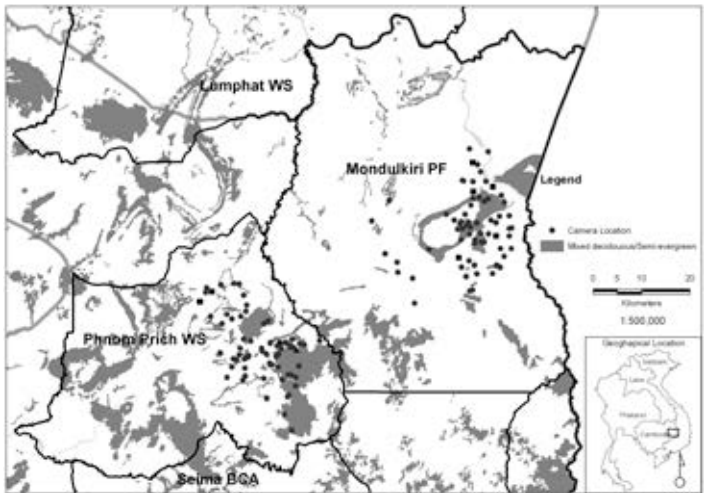

Fig. 2. Approximate location of camera-trap stations in Phnom Prich Wildlife Sanctuary and Mondulkiri Protected Forest between 2008 and 2013. Extent of mixed deciduous/semi-evergreen forest indicated; all white areas within protected areas represent deciduous dipterocarp forest. Reproduced from Gray *et al*. (2014).

Results and discussion

In both study phases (1999–2007 and 2008–2013) at least 10 small carnivore species were camera-trapped (Tables 1 & 2) including two species listed as globally Vulnerable on *The IUCN Red List of Threatened Species* (IUCN 2014), Binturong *Arctictis binturong* and Large-spotted Civet *Viverra megaspila*, and two listed as globally Near-Threatened, Hog Badger *Arctonyx collaris* and Large Indian Civet *V. zibetha* (Table 3). Ferret badgers *Melogale* were recorded but could not be reliably identified to species, following the cautions of Schank *et al*. (2009). The only documented specimens from Cambodia, including one from Mondulkiri, are of Large-toothed Ferret Badger *M. personata* (Schank *et al.* 2009), which is categorised on the *IUCN Red List* as Data Deficient.

Gray *et al.* (2010), based largely on part of the dataset analysed here, concluded that the Eastern Plains Landscape

Table 1. Number of camera-trap encounters for all small carnivores from eastern Cambodia between 1999 and 2007.

Species	A	B	C	D	E	F	G	H	I	Total
Yellow-throated Marten		3(3)	2(2)	1(1)		1(1)				7
Hog Badger		4(3)	1(1)	6(4)		1(1)	4(3)			16
Ferret badger		3(2)		1(1)						4
Large Indian Civet	5(3)	40(19)	6(4)	12(6)			10(9)			73
Large-spotted Civet		16(8)	8(4)	4(3)		6(5)	1(1)		3(1)	35
Small Indian Civet		20(12)	3(2)	3(2)	10(3)	1(1)	4(3)	5(3)	1(1)	47
Common Palm Civet	24(9)	33(21)	10(3)	13(6)	3(2)	2(2)	40(21)	1(1)		126
Binturong	1(1)	1(1)		1(1)						3
Small Asian Mongoose	2(1)			1(1)					1(1)	4
Crab-eating Mongoose				1(1)						1

Columns 'A' – 'I' indicate the number of notionally independent (see text) encounters (and number of camera-trap stations with records) from nine survey areas: A, Chhlong; B, Phnom Prich Wildlife Sanctuary; C, Prey Khieu; D, Prey Long; E, Prek Prasab; F, Mondulkiri Protected Forest; G, Virachey National Park; H, west Seima/Snoul; I, Western Siem Pang. More details of each area are given in Gray *et al*. (2012b).
Scientific names are given in Table 3.

Table 2. Number of notionally independent (see text) camera-trap encounters of small carnivores from Phnom Prich Wildlife Sanctuary (PPWS) and Mondulkiri Protected Forest (MPF) (and number of camera-trap stations with records) between 2008 and 2013.

	2013	2012	2011	2009/2010
Protected areas	PPWS	PPWS	PPWS	PPWS & MPF
Number of camera-trap stations	83	65	19	~ 170
Number of camera-trap-nights	5,283	5,301	1,926	~ 12,570
Dates of survey	Dec 2012 – Feb 2013	Dec 2011 – Jun 2012	Aug 2010 – Sep 2011	Dec 2008 – Feb 2010
Targets for camera-trapping	Clouded Leopard	Leopard	Wild cattle & Elephant	Leopard & Tiger
Broad habitat type	SEF	SEF/DDF	SEF/DDF	DDF
Yellow-throated Marten	15 (13)	7 (7)	3 (3)	6 (4)
Hog Badger	0	1 (1)	1 (1)	9 (5)
Ferret badger	7 (3)	0	2 (2)	0
Large Indian Civet	46 (25)	41 (22)	24 (7)	103 (35)
Large-spotted Civet	0	4 (3)	0	25 (13)
Small Indian Civet	1 (1)	20 (12)	1 (1)	2 (2)
Common Palm Civet	184 (53)	102 (36)	86 (11)	72 (37)
Binturong	2 (2)	0	0	0
Small Asian Mongoose	0	0	1 (1)	6 (5)
Crab-eating Mongoose	8 (5)	5 (2)	5 (3)	3 (2)

SEF = Semi-evergreen Forest, DDF = Deciduous Dipterocarp Forest.
Scientific names are given in Table 3.

is of high global significance for Large-spotted Civet, but camera-trapping has generated just four records of the species since 2010. This is quite likely to reflect the recent proportionally more camera-trapping in mixed deciduous and semi-evergreen forest in Phnom Prich WS, than in deciduous dipterocarp forest in Mondulkiri PF (Table 2), based on the conclusion of Gray *et al.* (2010) that the species is a deciduous dipterocarp specialist in eastern Cambodia. (Records come from other habitats elsewhere in Indochina, including semi-evergreen forest far from any deciduous dipterocarp forest; e.g. Austin [1999].)

A combination of methods (e.g. camera-trapping combined with nocturnal spotlighting) may assist comprehensive documentation of small carnivore communities in Indochina (see, e.g., Wilcox *et al*. 2012). However it is likely that, particularly in the more intensively camera-trapped Mondulkiri PF and Phnom Prich WS, most of the widespread and readily camera-trapped small carnivores have now been found. The globally Vulnerable Owston's Civet *Chrotogale owstoni*, together with Masked Palm Civet *Paguma larvata,* Yellow-bellied Weasel *Mustela kathiah* and Spotted Linsang *Prionodon pardicolor*, might be found to occur in the more hilly and evergreen dominated areas of eastern Cambodia given their presence in adjacent areas of Vietnam (Dang & Le 2010) or the Cardamom mountains of southwest Cambodia and parts of Thailand (Holden & Neang 2009, Redford *et al*. 2011, Phan *et al*. 2014). Small-toothed Palm Civet *Arctogalidia trivirgata* is highly likely to occur in the landscape's evergreen forests but is rarely camera-trapped (Willcox *et al*. 2012); there are recent records from spotlighting in Mondulkiri (Walston & Duckworth 2003) and riverine forest bordering deciduous dipterocarp forest in Western Siem Pang district, Stung Treng province (D. H. A. Wilcox *in litt*. 2014).

All 2008–2013 camera-trap stations lay below 300 m asl. The precise altitudinal distribution of camera-trap stations during the 1999–2007 surveys is unknown, but most, possibly excepting some in Virachey National Park, would also have been in forest below 300 m asl. Two small carnivore species

Table 3. Percentage of all small carnivore camera-trap encounters in each camera-trapping phase (1999–2007 and 2008–2013) in Phnom Prich Wildlife Sanctuary and Mondulkiri Protected Forest represented by each species.

Species	IUCN	% of encounters, 1999–2007	% of encounters, 2008–2013
Yellow-throated Marten *Martes flavigula*	LC	3	4
Hog Badger *Arctonyx collaris*	NT	4	1
Ferret badger *Melogale*	LC/DD	2	1
Large Indian Civet *Viverra zibetha*	NT	31	27
Large-spotted Civet *Viverra megaspila*	VU	17	4
Small Indian Civet *Viverricula indica*	LC	16	3
Common Palm Civet *Paradoxurus hermaphroditus*	LC	27	56
Binturong *Arctictis binturong*	VU	1	<1
Small Asian Mongoose *Herpestes javanicus*	LC	0	1
Crab-eating Mongoose *Herpestes urva*	LC	0	2

'IUCN' column gives global category on *The IUCN Red List of Threatened Species* (IUCN 2014): DD = Data Deficient, LC = Least Concern, NT = Neat Threatened, VU = Vulnerable.

recorded, Hog Badger and Crab-eating Mongoose *Herpestes urva*, were speculated, based on a fair number of records, to be largely or entirely restricted to hill forest in Lao PDR (Duckworth *et al.* 1999). Helgen *et al*. (2008: 369) characterised Hog Badger by "typical absence from lower-elevation habitats and preferred occurrence in little-disturbed hill and lower montane forests above about 500–600 m". Our records of at least 23 Hog Badgers from below 300 m (i.e. all records excluding those from Virachey National Park) suggest that the high proportion of Hog Badger records from hill forest elsewhere in Indochina might be an artificial pattern, perhaps induced by easier hunting in lowland areas. Similarly the 22 records of Crab-eating Mongoose indicate that, at least in eastern Cambodia, the species is unlikely to be strongly associated with hills.

By far the most frequently encountered small carnivores (representing 78% of all small carnivore encounters) were Common Palm Civet *Paradoxurus hermaphroditus* and Large Indian Civet. This suggests that both remain common and widespread throughout the lowland forests of eastern Cambodia. Large Indian Civet is categorised as globally Near Threatened as a result of "circumstantial evidence of trapping-driven declines in heavily hunted and fragmented areas" (IUCN 2014) exacerbated, presumably, by the lack of substantial populations (in contrast to a number of other mammals highly threatened in Indochina such as Sambar *Rusa unicolor*, Jungle Cat *Felis chaus* and Gaur *Bos gaurus*) in the Indian subcontinent away from the north-east. However, recent Large Indian Civet records from further west in the Terai Arc (Bista *et al*. 2012, Ghimirey & Acharya 2014), together with the species's continued abundance in Cambodia and Myanmar (Than Zaw *et al*. 2008), suggest that this listing should be reconsidered.

Encounter rates of small carnivores varied considerably between species. This is likely to result from variation in camera-trap placement, microhabitat use and locomotion preferences, as well as species' actual abundance. As such it is difficult, potentially misleading, to extrapolate additional conclusions from this dataset. The lack of data on sampling effort during 1999–2007 precludes comparing encounter rates between those periods. Nevertheless, comparing the percentage representation of each species within the total series of small carnivore records, between the two camera-trapping phases in Phnom Prich WS and Mondulkiri PF (the only two areas surveyed during both phases) exposes some interesting potential trends (Table 3). The proportional representation of Hog Badger, Large-spotted Civet and Small Indian Civet *Viverricula indica* declined between 1999–2007 and 2008–2013. Most parsimoniously, these trends might represent stochasticity. A decline in proportional representation of some species could also reflect population increases in other species rather than any change in the former species' status. However, Hog Badger is a known target for use in traditional medicine in eastern Cambodia (TNEG pers. obs., based on discussions with local villagers on observing the species in the field) and some recent camera-trapping elsewhere in Cambodia (Edwards 2012) has also reported low/zero encounters with Small Indian Civet. The proportionate decline in Large-spotted Civet records between the camera-trap phases offers a particular potential conservation concern. However it is unclear whether this reflects a genuine decline in animals or simply a proportional shift of camera-trapping effort away from deciduous dipterocarp dominated areas to semi-evergreen forests.

Jungle Cat and Large-spotted Civet, both largely deciduous dipterocarp specialists in at least parts of Indochina, declined and disappeared from most of their South-east Asian ranges without anybody documenting the main contraction phase (Duckworth *et al*. 2005, Gray *et al.* 2010). Therefore, more regular collation of camera-trap and other records for these, and other, small carnivores is merited. This is particularly important given the intensive and ongoing threats to the conservation integrity of the landscape from both large-scale habitat conversion and hunting. Levels of snaring in both Phnom Prich WS and Mondulkiri PF appear to be increasing in parallel with other illegal activities, particularly targeted logging for luxury timber along the Cambodia–Vietnam border which seems, invariably, associated with significant additional resource extraction.

Acknowledgements

We thank the Forestry Administration and the Ministry of the Environment of the Royal Cambodian Government for support and permission to work in Mondulkiri PF and Phnom Prich WS, and the various donors who have supported WWF Cambodia's work in eastern Cambodia, particularly WWF-US, Human Scale and WWF-Sweden. Camera-trapping in 2013 was supported through WildCRU. Daniel Wilcox

and an anonymous reviewer provided comments that improved the quality of the manuscript.

References

Austin, S. C. 1999. Camera-trapping evidence of Large-spotted Civet *Viverra megaspila* in Xe Piane National Biodiversity Conservation Area (NBCA), southern Lao PDR. *Natural History Bulletin of the Siam Society* 47: 255–257.

Bista, A., Chanchani, P., Warrier, R., Mann, R., Gupya, M. & Vattakavan, J. 2012. Detection of Large Indian Civet *Viverra zibetha* in camera-trap surveys in and around Dudhwa National Park in the Terai Region of North India *Small Carnivore Conservation* 47: 54–57.

Dang N. C. & Le T. T. 2010. Southward extension of known range of Owston's Civet *Chrotogale owstoni* in Vietnam. *Small Carnivore Conservation* 43: 44–46.

Duckworth, J. W., Poole, C. M., Tizard, R. J., Walston, J. L. & Timmins, R. J. 2005. The Jungle Cat *Felis chaus* in Indochina: a threatened population of a widespread and adaptable species. *Biodiversity and Conservation* 14: 1263–1280.

Duckworth, J. W., Salter, R. E. & Khounboline, K. 1999. *Wildlife in Lao PDR: 1999 status report*. IUCN, Vientiane, Lao PDR.

Edwards, S. 2012. Small carnivore records from the Oddar Meanchay sector of Kulen–Promtep Wildlife Sanctuary, northern Cambodia. *Small Carnivore Conservation* 46: 22–25.

Ghimirey, Y. & Acharya, R. 2014. Notes on the distribution of Large Indian Civet *Viverra zibetha* in Nepal. *Small Carnivore Conservation* 50: 25–29.

Gray, T. N. E., Pin C. & Pin C. 2010. Status and ecology of Large-spotted Civet *Viverra megaspila* in eastern Cambodia. *Small Carnivore Conservation* 43: 12–15.

Gray, T. N. E. & Prum, S. 2012. Leopard density in post-conflict Cambodia: evidence from spatially explicit capture–recapture. *Journal of Wildlife Management* 76: 163–169.

Gray, T. N. E., Prum, S., Pin, C. & Phan, C. 2012a. Distance sampling reveals Cambodia's Eastern Plains Landscape supports largest global population of the endangered Banteng *Bos javanicus*. *Oryx* 46: 563–566.

Gray, T. N. E, Ou R., Huy K., Pin C. & Maxwell, A. L. 2012b. The status of large mammals in eastern Cambodia: a review of camera-trapping data 1999–2007. *Cambodian Journal of Natural History* '2012': 42–55.

Gray, T. N. E., Phan C., Pin C. & Prum S. 2014. The status of Jungle Cat and sympatric small cats in Cambodia's Eastern Plains Landscape. *Cat News* Special Issue 8: 19–23.

Helgen, K. M., Lim, N. T.-L. & Helgen, L. E. 2008. The hog-badger is not an edentate: systematics and evolution of the genus *Arctonyx* (Mammalia: Mustelidae). *Zoological Journal of the Linnean Society* 154: 353–385.

Holden, J. & Neang T. 2009. Small carnivore records from the Cardamom Mountains, southwestern Cambodia. *Small Carnivore Conservation* 40: 16–21.

IUCN 2014. *IUCN Red List of Threatened Species*. Version 2014.1. <www.iucnredlist.org>. Downloaded on 15 June 2014.

O'Kelly, H. J., Evans, T. D., Stokes, E. J., Clements, T. J., An D., Gately, M., Nut M., Pollard, E. H. B., Men S. & Walston, J. 2012. Identifying conservation successes, failures and future opportunities; assessing recovery potential of wild ungulates and Tigers in eastern Cambodia. *PLoS One* 7(10): (e40482) 1–10.

Phan C, Prum S. & Gray, T. N. E. 2010. Recent camera-trap records of globally threatened species from the Eastern Plains Landscape, Cambodia. *Cambodian Journal of Natural History* '2010': 89–93.

Phan C, Kamler, J. F. & Macdonald, D. W. 2014. The first records of Yellow-bellied Weasel *Mustela kathiah* from Cambodia. *Small Carnivore Conservation* 50: 39–41.

Pin C., Phan C., Prum S. & Gray, T. N. E. 2013. Structure and composition of deciduous dipterocarp forest in the Eastern Plains Landscape, Cambodia. *Cambodian Journal of Natural History* '2013': 27–34.

Redford, T., Banpot, S., Padungpong, C. & Bidatabha, T. 2011. Records of Spotted Linsang *Prionodon pardicolor* from Thap Lan and Pang Sida National Parks, Thailand**.** *Small Carnivore Conservation* 44: 22–24.

Rundel. P. W. 1999. *Forest habitats and flora in Lao PDR, Cambodia, and Vietna*m. WWF, Hanoi, Vietnam.

Schank, C., Pollard, E. H. B., Sechrest, W., Timmins, R., Holden, J. & Walston, J. 2009. First confirmed records of Large-toothed Ferret Badger *Melogale personata* in Cambodia, with notes on country records of *Melogale*. *Small Carnivore Conservation* 40: 11–15.

Than Zaw, Saw Htun, Saw Htoo Tha Po, Myint Maung, Lynam, A. J., Kyaw Thinn Latt & Duckworth, J. W. 2008. Status and distribution of small carnivores in Myanmar. *Small Carnivore Conservation* 38: 2–28.

Tordoff, A. W., Timmins, R. J., Maxwell, A., Huy K., Lic V. & Khou E. H. 2005. *Biological assessment of the Lower Mekong Dry Forests Ecoregion. Final report*. WWF, Phnom Penh, Cambodia.

Walston, J. L. 2001. Mammals of Cambodia. Pp. 135–152 in Smith, J. D. (ed.) *Biodiversity, the life of Cambodia – Cambodian biodiversity status report 2001*. Cambodia Biodiversity Enabling Activity, Food and Agriculture Organisation, Phnom Penh, Cambodia.

Walston, J. L. & Duckworth, J. W. 2003. The first record of Small-toothed Palm Civet *Arctogalidia trivirgata* from Cambodia, with notes on surveying the species. *Small Carnivore Conservation* 28: 12–13.

Willcox, D. H. A., Tran Q. P., Vu L., Tran V. B. & Hoang M. D. 2012. Small-toothed Palm Civet *Arctogalidia trivirgata* records from human-influenced habitats in Vietnam. *Small Carnivore Conservation* 47: 46–54.

Wright, H. L., Collar, N. J., Lake, I. R., Net N., Rours V., Sok K., Sum P. & Dolman, P. M. 2012. First census of White-shouldered Ibis *Pseudibis davisoni* reveals roost-site mismatch with Cambodia's protected areas. *Oryx* 46: 236–239.

[1]WWF Greater Mekong, #21, Street 322, Sangkat Boeun Keng Kang 1, Phnom Penh, Cambodia.
Email: tomnegray@hotmail.com
[2]WWF Cambodia Country Program, #21, Street 322, Sangkat Boeun Keng Kang 1, Phnom Penh, Cambodia.
[3]Wildlife Conservation Research Unit, Department of Zoology, University of Oxford, U.K.
[4]Forestry Administration, Ministry of Agriculture Forestry and Fisheries, 40 Preah Norodom Blvd Phsar Kandal 2, Khann Daun Penh, Phnom Penh, Cambodia.

Notes on the distribution of Large Indian Civet *Viverra zibetha* in Nepal

Yadav GHIMIREY* and Raju ACHARYA

Abstract

The distribution range of Large Indian Civet *Viverra zibetha* in Nepal is treated inconsistently in various sources. Verified point locality records presented here, and records from neighbouring India, suggest that it occurs widely across Nepal. Some published localities require verification.

Keywords: citizen science, documentation, Kathmandu valley, locality, photograph

नेपालमा ठुलो निरबिरालोको भौगोलिक विस्तारबारे टिप्पणी

सारांश

ठुलो निरबिरालो कहाँदेखि कहाँसम्म पाइन्छ भन्ने कुरा भिन्न श्रोतहरुका अनुसार भिन्न हुने गरेको पाइन्छ | नेपाल तथा भारतमा भेटिएका प्रमाणित तथ्यहरुका आधारमा यो प्रजाति नेपालभरी नै पाइने देखिन्छ | यस लेखमा हामीले १९९० पछि नेपालमा पाइएका रेकर्डहरु प्रस्तुत गरेका छौं | यसको अवस्था अझै पनि सामान्य रहेको तर मानिससँग हुने द्वन्दका कारण मानिसले यसलाई मार्ने गरेको पाइन्छ |

Introduction

Large Indian Civet *Viverra zibetha* is native to South and Southeast Asia (Corbet & Hill 1992). There is considerable inconsistency in the definition of the western extent of its global distribution range. For example, *The IUCN Red List of Threatened Species* maps it west only to central Nepal (84°30′E) (Duckworth *et al.* 2008) and Corbet & Hill (1992) included only easternmost Nepal (east of about 87°E), whereas unverified reports summarised by Jnawali *et al*. (2011) suggest occurrence across most of the country. A wide generalised distribution in Nepal is mapped by Baral & Shah (2008). Incompatible with all of these, Lekagul & McNeely (1977) mapped it as almost absent from Nepal (but as occurring through much of east and central and south India, in most of which it does not occur). This paper presents some locality records of the species in Nepal, in the context of this uncertainty.

Methods

Large Indian Civet records were collected via four methods: the authors' survey records from Hugu-Kori forests in Annapurna Conservation Area (see Appel *et al*. 2013); chance observations collected from the Friends of Nature 'Facebook' page where conservationists and general people from various walks of life posted pictures of animals for assistance with species identification; literature review (both published and

Table 1. Records of Large Indian Civet *Viverra zibetha* in Hugu-Kori, Annapurna Conservation Area, Nepal, 2012.

Site	Location	Elev.	Time, date	Vegetation
Idi	28°23′14″N, 84°07′06″E	1,577	04h52, 23 Jan	*Alnus nepalensis, Ceedrela tooni, Myrisine, Macaranga indica, Eliagnus parvofolius, Maesa chisia, Urtica*, fern
Tasha	28°23′20″N, 84°08′09″E	2,420	03h14, 7 Feb	*Quercus glauca, Myrisine, Fraxinus, Daphne papyracea*, fern
Dhoda	28°22′26″N, 84°07′32″E	2,049	20h31, 11 Feb	*Rhododendron, Lyonia ovalifolia*, Shyauladho (Gurung language)
Danda	28°22′52″N, 84°07′22″E	2,174	21h59, 11 Feb; 03h45, 13 Feb	*Q. glauca, Himalayacalamus brevinodus, Rhododendron*, fern
Raura	28°22′41″N, 84°07′33″E	2,250	22h26, 12 Feb	Dishidhu (Gurung), *Q. glauca, H. brevinodus*, fern
Raura	28°22′38″N, 84°08′03″E	2,126	19h26, 13 Feb; 02h54, 17 Feb	*Q. glauca, H. brevinodus, Berberis aristata*, fern
Raura	28°22′39″N, 84°07′49″E	2,128	23h53, 14 Feb; 03h30, 17 Feb; 05h18, 17 Feb	*B. aristata* – Shrubland

Locations are given under the datum WGS84. 'Elev.' = elevation asl, in meters.
Sunset and sunrise at Hugu-Kori during the study time was about 07h00 and 18h00 respectively.

Fig. 1. Large Indian Civet *Viverra zibetha*, Hugu-Kori, Kaski, Nepal, 2008 (photo: Friends of Nature).

grey); and some direct consultation with people who might have credible records of Large Indian Civet in Nepal.

Hugu-Kori forests in Annapurna Conservation Area

Camera-trap records of Large Indian Civet (Fig. 1) in Hugu-Kori are given in Table 1. The area had at least two Large Indian Civets (Appel *et al*. 2013) which were recorded in subtropical and temperate forest according to the bioclimatic zones of Shrestha (2008). Ring-cupped Oak *Quercus glauca* was present in four of seven (57%) locations where the species was camera-trapped, while three (43%) sites had the bamboo *Himalayacalamus brevinodus.* Furthermore, Large Indian Civet was also camera-trapped at three sites within the *Quercus–Himalayacalamus* association suggesting the species's frequent occurrence in it. Fern was the undergrowth in five (71%) of the sites; three sites (43%) had the *Quercus–Himalayacalamus*–fern association.

Table 2. Recent locality records of Large Indian Civet *Viverra zibetha* in Nepal.

Location	Date	Co-ordinates	Elev.	Source	Remarks
Shuklaphanta WR	March 1991	NA	200	Hem Sagar Baral verbally 2012	
Chitwan NP	1995	NA	NA	Joshi *et al*. 1995	Radio-collared
Bharatpur, Chitwan	1998	27°41′00″N, 84°26′00″E	250	Rajendra Suwal *in litt*. 2014	Direct sighting
Bhulbhule, Lamjung*	2008	28°17′28″N, 84°22′10″E	830	Ganga Ram Regmi *in litt*. 2014	Dead animal, partly eaten; wound suggests killed by Leopard *Panthera pardus*
Sikles, Kaski	Feb 2012	28°21′28″N, 84°06′19″E	2,000	Pramod Gurung verbally 2012	Bitten to death by a dog
Parsa WR	2012	27°19′36″N, 84°46′13″E	250	Babu Ram Lamichhane & Naresh Subedi *in litt*. 2014	Camera-trapped during annual Tiger camera-trapping
Hugu-Kori*	2012	–	–	See Table 1	–
Langtang NP, Rasuwa*	16 Mar 2013	28°06′25″N, 85°17′16″E	1,920	FON 2013	Camera-trapped. Fig. 6
Chitwan NP	2014	27°33′16″N, 84°20′23″E	150	Babu Ram Lamichhane & Naresh Subedi *in litt*. 2014	Camera-trapped during annual Tiger *Panthera tigris* camera-trapping
Bardiya NP	2014	28°30′18″N, 81°21′57″E	280	Babu Ram Lamichhane & Naresh Subedi *in litt*. 2014	Camera-trapped during annual Tiger camera-trapping
Kathmandu valley					
Jawlakhel, Lalitpur	1996	27°40′28″N, 85°18′44″E	1,330	Rajendra Suwal *in litt*. 2014	Caught near settlement; brought to Kathmandu Central Zoo
Shivapuri–Nagarjuna NP*	2010	NA	NA	Pandey 2010	Camera-trapped
Bhaktapur	14 May 2012	NA	NA	Sarita Jnawali *in litt*. 2012	Rescued by Kathmandu zoo; male about 5 yrs of age
Sunakothi, Lalitpur	16 May 2012	27°37′52″N, 85°18′56″E	1,400	Sarita Jnawali *in litt*. 2012	Rescued by Kathmandu zoo; female about 3 yrs of age
Gundu, Bhaktapur*	July 2012	27°38′30″N, 85°24′51″E	1,430	Kamal Raj Gosai *in litt*. 2013	Dead female, possibly poisoned. Fig. 5
Pharping*	24 Mar 2013	27°36′46″N, 85°15′52″E	1,580	Hari Basnet *in litt*. 2013	Dead animal. Fig. 7
Kirtipur*	25 May 2013	27°40′00″N, 85°17′00″E	1,400	Dibas Panta *in litt*. 2013	Dead animal, no deep wounds; possibly poisoned

* Identification verified from photograph.
Locations are given under the datum WGS84. 'Elev.' = approximate elevation asl, in meters, derived by various methods.

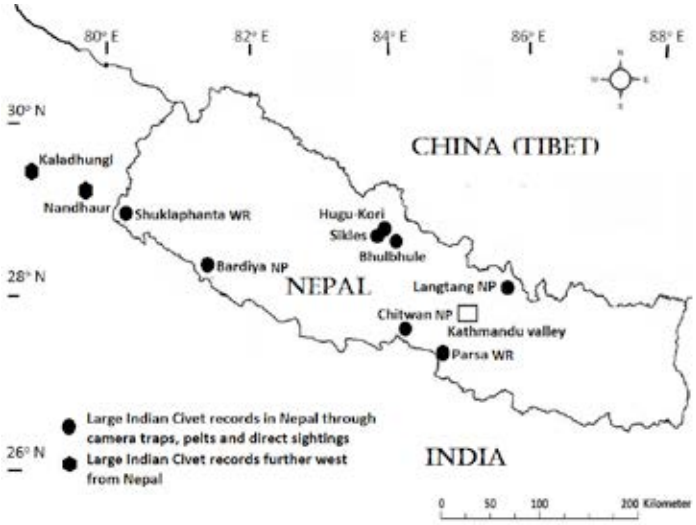

Fig. 2. Recent Large Indian Civet *Viverra zibetha* records in Nepal. Two localities further west in India are shown by a different symbol. Nandhaur is the westernmost documented record globally (Bista *et al*. 2012), while there is a sight record from Kaladhungi (Hem Sagar Baral *in litt*. 2014). The small square, the Kathmandu valley, is expanded in Fig. 3).

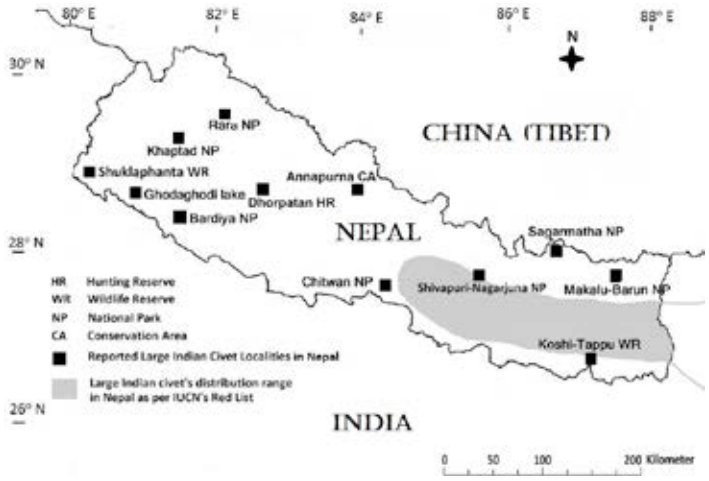

Fig. 4. Localities in Nepal reported by Jnawali *et al*. (2011) to hold Large Indian Civet *Viverra zibetha*. Some localities have been omitted (see text).

Distribution elsewhere in Nepal

Large Indian Civet has been recorded in recent decades from various localities across Nepal (Table 2, Fig. 2), including several in the Kathmandu valley (Table 2, Fig. 3). Based on reports from protected area personnel, Jnawali *et al*. (2011) reported Large Indian Civet widely in Nepal, including areas in the far west (Fig. 4). Areas they reported (but not necessarily verified) to hold the species comprise Annapurna Conservation Area, Bardiya National Park (= NP), Chitwan NP, Dhorpatan Hunting Reserve, Ghodaghodi lake (unprotected), Khaptad NP, Koshi-Tappu Wildlife Reserve (= WR), Makalu-Barun NP, Rara NP, Shivapuri–Nagarjuna NP, Sagarmatha NP and Suklaphanta WR. A high camera-trapping effort in Koshi-Tappu WR for Fishing Cat *Prionailurus viverrinus* since 2011 has recorded, among civets, only Small Indian Civet *Viverricula indica* as yet (Hem Sagar Baral *in litt*. 2014). Large Indian Civet was also mapped as occurring in some high Himalayan districts such as Humla and Mugu by Jnawali *et al*. (2011). These very high altitude reports should be considered cautiously unless direct evidence of its presence is provided. Hence, they are not included on Fig. 4.

Distribution in neighbouring countries

Bista *et al*. (2012) recorded Large Indian Civet in India in the Nandhaur area of Uttarakhand state. This lies west of all records and reports in Nepal. Thus, it is quite possible that the species occurs throughout suitable habitat in Nepal. One Large Indian Civet was sighted at the village of Kaladhungi (Nainital district, Uttarakhand state, India) in 1991 (Hem Sagar Baral *in litt*. 2014), which lies about 50 km further west of Nandhaur. A claim from even further west in India, from Himachal Pradesh (Archana *et al.* 2000) was discredited by Bista *et al*. (2012). The species's occurrence in the northwest of its range,

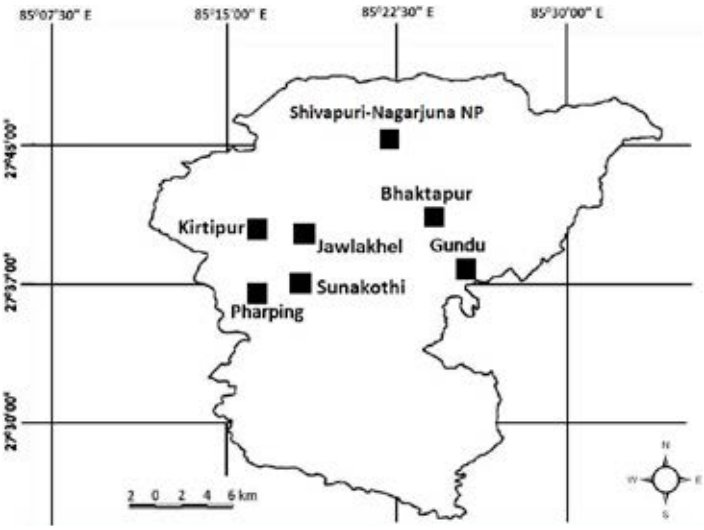

Fig. 3. Recent Large Indian Civet *Viverra zibetha* records in the Kathmandu valley, Nepal.

Fig. 5. Large Indian Civet *Viverra zibetha*, Gundu, Bhaktapur, Kathmandu, Nepal, July 2012 (Photo: Kamal Raj Gosai).

Fig. 6. Large Indian Civet *Viverra zibetha*, Langtang National Park, Rasuwa, Nepal, 16 March 2013 (Photo: Friends of Nature).

Fig. 7. Large Indian Civet *Viverra zibetha*, Pharping, Kathmandu, Nepal, 24 March 2013 (photo: Hari Basnet). Note the intestine lying on the floor above the animal's rear back.

in China, is also treated inconsistently. Wang (2003: 91) accepted records in China west only to "Xizang (south-eastern part)". Even though this is imprecise and Xizang is a very large province, under any definition its south-east lies well east of Nepal. By contrast, Smith & Xie (2008) mapped, as well as a cluster of purported localities in south-east Xizang, a single outlying location some 1,500–2,000 km to the west, along the Nepal border at about 85°E. This source is riddled with errors in its treatment of species distributions (Duckworth 2008), so this location should be discounted unless an original record can be traced.

Discussion

This confirmation of a broader distribution in Nepal than previously documented, together with the extension of the known altitudinal range (up to 2,420 m) by records in Hugu-Kori (Appel *et al*. 2013) (and to 3,080 m in India; Khatiwara & Srivastava 2014) suggest this civet may be more numerous in Nepal than has often been assumed. There is little hard evidence of the types and levels of threat facing Large Indian Civet in Nepal. Its occurrence close to human settlements, perhaps because of availability of easy prey, e.g. poultry as mentioned by Prater (1971), could increase the risk of retaliatory killings of the species. The incidents of encountering dead civets (three in 10 months in the Kathmandu valley alone) suggest that the conflict with people could be quite high.

Acknowledgements

We gratefully thank all those who supported our work: Point Defiance Zoo and Aquarium, USA and the Wuppertal Zoo Society for providing financial support; Department of National Park and Wildlife Conservation and Annapurna Conservation Area Project/Sikles Unit Conservation Office for the permits and logistical help; Naresh Subedi and Babu Ram Lamichhane from National Trust for Nature Conservation for kindly providing the coordinates of the species's photo-capture from three locations; Hem Sagar Baral, Sarita Jnawali, Rajendra Suwal, Ganga Ram Regmi, Pramod Gurung, Kamal Raj Gosai, Hari Basnet and Dibas Panta for valuable information on Large Indian Civet records and photos; Bidhan Adhikary, Geraldine Werhahn and Angelika Appel for their contribution during field work. We could not thank enough Kashmira Kakati and the anonymous reviewers for providing valuable suggestions during manuscript preparation. And lastly, we thank Meja Gurung, Lal Gurung, Mohan Gurung and Pramod Gurung for sharing their knowledge of wildlife wealth of Hugu-Kori.

References

Appel, A., Werhahn, G., Acharya, R., Ghimirey, Y. & Adhikary, B. 2013. Small carnivores in the Annapurna Conservation Area, Nepal. *Vertebrate Zoology* 63: 111–121.

Archana, Sharma, D. N. & Sharma, R. 2000. External morphology of a male Large Indian Civet (*Viverra zibetha* Linnaeus, 1758), *Zoos' Print Journal* 16(7): 532–534.

Baral, H. S. & Shah, K. B. 2008. *Wild mammals of Nepal*. Himalayan Nature, Kathmandu, Nepal.

Bista, A., Chanchani, P., Warrier, R., Mann, R., Gupta, M. & Vattakavan, J. 2012. Detection of Large Indian Civet *Viverra zibetha* in camera-trap surveys in and around Dudhwa National Park in the Terai Region of North India. *Small Carnivore Conservation* 47: 54–57.

Corbet, G. B. & Hill, J. E. 1992. *The mammals of the Indomalayan region: a systematic review*. Oxford University Press, Oxford, U.K.

Duckworth, J. W. 2008. [Review] A guide to the mammals of China… *Birding Asia* 10: 12–14.

Duckworth, J. W., Wozencraft, C., Wang Yin-xiang, Kanchanasaka, B. & Long, B. 2008. *Viverra zibetha*. In: IUCN 2014. *IUCN Red List of Threatened Species*. Version 2014.1. <www.iucnredlist.org>. Downloaded on 16 June 2014.

[FON] Friends of Nature 2013. *Status assessment of wild boar in Langtang National Park, Nepal*. Report to the Department of National Park and Wildlife Research, Langtang National Park, Rasuwa, Nepal.

Jnawali, S. R., Baral, H. S., Lee, S., Acharya, K. P., Upadhyay, G. P., Pandey, M., Shrestha, R., Joshi, D., Laminchhane, B. R., Griffiths, J., Khatiwada, A. P., Subedi, N. & Amin, R. (comps) 2011. *The status of Nepal mammals: the national red list series*. Department of National Parks and Wildlife Conservation, Kathmandu, Nepal.

Joshi, A. R., Smith, J. L. D. & Cuthbert, F. J. 1995. Influence of food distribution and predation pressure on spacing behavior in palm civets. *Journal of Mammalogy* 76: 1205–1212.

Khatiwara, S. & Srivastava, T. 2014. Red Panda *Ailurus fulgens* and other small carnivores in Kyongnosla Alpine Sanctuary, East Sikkim, India. *Small Carnivore Conservation* 50: 35–38.

Lekagul, B. & McNeely, J. A. 1977. *Mammals of Thailand*. Association for the Conservation of Wildlife, Bangkok, Thailand.

Pandey, B. P. 2010. *A report on presence/absence of Clouded Leopard* Neofelis nebulosa *in Shivapuri–Nagarjuna National Park, Nepal*. Department of National Park and Wildlife Conservation, Kathmandu, Nepal.

Prater, S. H. 1971. *The book of Indian animals*, 3rd edn. Oxford University Press and Bombay Natural History Society, Mumbai, India (as updated 1998).

Smith, A. T. & Xie Y. (eds) 2008. *A guide to the mammals of China*. Princeton University Press, Princeton, U.S.A. and Oxford, U.K.

Shrestha, T. B. 2008. Classification of Nepalese forests and their distribution in protected areas. *The Initiation* 1: 1–9.

Wang Y. X. 2003. *A complete checklist of mammal species and subspecies in China: a taxonomic and geographic reference*. China Forestry Publishing House, Beijing, China.

Friends of Nature (FON Nepal), P.O. Box 23491, Sundhara, Kathmandu, Nepal.
***Email: yghimirey@hotmail.com**

Monitored release of captive-born Binturongs *Arctictis binturong* in the southern Cardamom Mountains, Cambodia

Nick MARX and ROTH Bunthouen

Abstract

Two unrelated Binturongs *Arctictis binturong*, born at Phnom Tamao Wildlife Rescue Centre near Cambodia's capital city Phnom Penh, were taken to a release enclosure near the village of Chi Phat in the southern Cardamom Mountains, southwest Cambodia, in March 2010. They were kept in the enclosure, within forest, for one year to allow time to acclimate. In June 2010 a single cub was born; six months later a further two were born. The adults were fitted with radio collars so that post-release movements could be monitored. The release door was opened, giving all the Binturongs access to the forest, at the season of peak fruiting; the second litter was then three weeks old. The adult male and the older cub left the enclosure that night, but remained close by the following morning. The female was inside or near the release cage for the next two weeks, after which she disappeared with her young cubs. Waypoint transmission from the female's radio collar, which dropped off prematurely, was erratic. The male's collar functioned better but also dropped off before programmed to do so. The male stayed within about 1½ km of the release site. The female stayed closer. Camera-traps around the enclosure, where supplementary food remained available, showed that all five Binturongs survived more than two years after release and by late in this period were coming only erratically for food.

Keywords: camera-trapping, captive breeding, rehabilitation, soft release

ការដោះលែងសត្វឈ្លួសប្រែង ***Arctictis binturong*** ដែលកើតពេលចិញ្ចឹមដោយមានការតាមដានត្រួតពិនិត្យនៅតំបន់ជួរភ្នំក្រវាញភាគខាងត្បូងនៃប្រទេសកម្ពុជា

សង្ខេប៖

កាលពីខែមិនាឆ្នាំ២០១០កន្លងទៅ ឈ្លួសប្រែង *Arctictis binturong* ចំនួនពីរក្បាលដែលបានចាប់កំណើតនៅមណ្ឌលសង្គ្រោះសត្វព្រៃភ្នំតាម៉ៅស្ថិតនៅជិតរាជធានីភ្នំពេញនៃប្រទេសកម្ពុជានោះ
ត្រូវបានយកទៅដោះលែងនៅ
តំបន់ហ៊ុមព័ទ្ធក្បែរភូមិដីជាតស្ថិតនៅក្នុងតំបន់ជួរភ្នំក្រវាញភាគខាងត្បូងផ្នែកនិរតីនៃប្រទេសកម្ពុជា។
ឈ្លួសប្រែងទាំងពីរត្រូវបានរក្សាទុកនៅតំបន់ហ៊ុមព័ទ្ធក្នុងព្រៃនោះអស់រយៈពេល
មួយឆ្នាំដើម្បីទុកពេលឲ្យពួកគេអាចបន្សាំទៅនឹងអាកាសធាតុនៅទីនោះ។ នៅខែមិថុនាឆ្នាំ២០១០
ពួកគេបានបង្កើតកូនចំនួនមួយក្បាល ហើយ៦ខែក្រោយពួកគេក៏បានបង្កើតកូនចំនួនពីរក្បាលថែមទៀត។
ឈ្លួសប្រែងទាំងពីរក្បាលត្រូវបានបំពាក់វិទ្យុតាមដាននៅនឹងករបស់ពួកគេ ដូច្នេះសកម្ម
ភាពក្រោយការដោះលែងរបស់ពួកគេត្រូវបានត្រួតត្រង។ ទ្វារសម្រាប់ដោះលែងត្រូវបានបើកចំហ
ដើម្បីផ្តល់ឱកាសឲ្យសត្វឈ្លួសប្រែងទាំងអស់ចូលទៅរស់នៅក្នុងព្រៃនារដូវសម្បូរផ្លែឈើ ស្របពេលដែល
កូនលើកទីពីររបស់ពួកគេអាយុបានពីរសប្តាហ៍ទៅហើយ។ ឈ្លួសប្រែងឈ្មោល និងកូនដំបូងរបស់
គេបានចាកចេញពីតំបន់ហ៊ុមព័ទ្ធនៅពេលយប់ ប៉ុន្តែនៅតែមានវត្តមាននៅជិតតំបន់នោះនាព្រឹក បន្ទាប់។
ចំណែកឯមេរបស់ពួកគេវិញ គឺស្ថិតក្នុងឬក្បែរទ្រុងដោះលែងអស់រយៈពេលពីរសប្តាហ៍ បន្ទាប់ពីពេលនោះមក
នាងបានទៅចាត់ជាមួយនឹងកូនដែលទើបនឹងកើត។ ការបញ្ជូនចំណុច
និយាមកាពីឧបករណ៍តាមដានពាក់ជាប់នឹងកឈ្លួសប្រែងញី
ដែលបានជ្រុះចាត់មុនកាលកំណត់នោះគឺមានភាពមិនប្រក្រតី។
រីឯឧបករណ៍តាមដានពាក់ជាប់នឹងកឈ្លួសប្រែងឈ្មោលដំណើរការ ល្អប្រសើរជាង ប៉ុន្តែក៏បានជ្រុះចាត់មុន
ពេលដោះយកមកពិនិត្យ។ ឈ្លួសប្រែងឈ្មោលស្ថិតនៅ ចម្ងាយប្រមាណជា ១,៥ គីឡូម៉ែត ពីតំបន់ដែលត្រូវ
បានដោះលែង។ ចំណែកឈ្លួសប្រែងញីស្ថិត នៅជិតជាងអាឈ្មោល។ កាមេរ៉ាស្វ័យប្រវត្តិនៅជុំវិញតំបន់ហ៊ុមព័ទ្ធ
ជិតកន្លែងអាហារបន្ថែមសម្រាប់ ពួកគេបានបង្ហាញថា
ឈ្លួសប្រែងទាំងប្រាំក្បាលបានរស់នៅក្នុងព្រៃនេះលើសពីពីរឆ្នាំ បន្ទាប់ពីពួក គេត្រូវបានដោះលែង។

Background

Binturong *Arctictis binturong* is the largest member of the civet family (Viverridae), weighing up to 20 kg. It feeds chiefly on fruit, although it will take birds' eggs and a variety of animals. Its mostly nocturnal and arboreal habits hinder its study; little is known about its wild abundance or behaviour (IUCN 2013). In South-east Asia, many wild mammals have a commercial value, as food, medicine or pets, and are heavily hunted. Despite increasing enforcement efforts, few Binturongs have been confiscated from hunters or wildlife traders within Cambodia over recent years (authors' own data), suggesting that the species may now be rare in the country (it is implausible that there is insufficient demand for them to enter the trade). Binturong has declined sharply in much of its range and is now classed as Vulnerable on *The IUCN Red List of Threatened Species* (IUCN 2013).

Location

A mosaic of grassland and forest about 8 km from the village of Chi Phat in the province of Koh Kong, on the edge of the southern Cardamom Mountains, southwest Cambodia, was se-

lected for The Wildlife Alliance Wildlife Rehabilitation Station. A stream flows throughout the year within the forest 200 m to the north of camp. The site, at about 11°22′N, 103°29′E and about 23 m asl, was selected after surveys in several Cambodian forests assessed their suitability as release areas for wild animals. The need for remoteness had to be balanced with accessibility. Suitability of habitat and availability of permanent water were also considered.

Before Wildlife Alliance's involvement in Chi Phat, illegal hunting and logging were major village activities. This previous heavy hunting means that the area's wildlife populations are currently low, as evinced by villagers' reports and the authors' personal experience. This area is within many hundred km^2 of evergreen lowland forest. Wildlife Alliance has six police patrol stations, manned by Cambodian military police and Forestry Administration officials. One patrol station, Stung Proat, lies around 7 km from the rehabilitation station. Teams of community rangers from Chi Phat also patrol the forest for wildlife crime. This protection, coupled with the hunting-induced low density of wild populations of most species of larger mammals, renders the area suitable for rehabilitation and release of rescued wildlife. Few if any large predators remain.

The rehabilitation station is too new to have reached its full potential. So far the only mammals besides Binturongs (see below) to have been released there are Long-tailed Macaques *Macaca fascicularis*, Bengal Slow Lorises *Nycticebus bengalensis* and East Asian Porcupines *Hystrix brachyura*. Birds released here include hand-raised parakeets *Psittacula* and Hill Mynas *Gracula religiosa*. Three keepers maintain the camp and care for the animals. Their constant presence ensures the safety of the area. Hunting-reduced wildlife populations seem to be rebounding. Sambar *Cervus unicolor*, Red Muntjac *Muntiacus muntjak*, chevrotain *Tragulus*, wild pig *Sus*, Common Palm Civet *Paradoxurus hermaphroditus*, Small Indian Civet *Viverricula indica*, Large-spotted Civet *Viverra megaspila*, ferret badger *Melogale*, Leopard Cat *Prionailurus bengalensis*, East Asian Porcupine, Long-tailed Macaque and Pileated Gibbon *Hylobates pileatus* are seen regularly, whilst bird populations are apparently increasing. Local villagers say that Binturongs are presently rare in the area, presumably because of the former heavy hunting. A high density of fruiting trees suggests the area is good habitat for Binturongs and other animals relying largely on fruit, such as other civets, gibbons and macaques.

Narrative

As of late 2013, five pairs of Binturongs are held at the Phnom Tamao Wildlife Rescue Centre, set in 23 km^2 of regenerating forest 40 km south of Phnom Penh. The founders of this population were confiscated from the illegal wildlife trade. Most of the original pairs have now produced young, some of which have also been paired. A pair of unrelated Binturongs born to confiscated animals was selected for release. They were isolated, checked for condition, and moved to a rehabilitation enclosure closed to visitors. Most wild animal diseases can currently not be checked at veterinary laboratories in Cambodia, although TB was tested for. Blood readings came back within normal parameters for Binturongs. Moreover, the pair remained healthy for over a year isolated in their rehabilitation enclosure. Animals were treated for internal and external parasites, using Ivermectin and Frontline, before release. During this time they were fed once per day, in the late afternoon, with market-purchased fruit, including banana and papaya, two duck eggs and a small amount of meat or fish. The 30 × 30 m enclosure, built using steel uprights and chain link fencing, was open-topped so that the Binturongs could climb in the tall trees growing inside. Metal sheeting around the top of the fencing prevented escape. The substrate is soil with grasses and other wild plants. Once in this enclosure, the Binturongs quickly reverted to apparently natural behaviour, generally shunning the nest boxes provided and sleeping in the tree tops, even during heavy rain storms.

A 10 × 8 × 4 m release enclosure was erected in forest at the Wildlife Rehabilitation Station for the Binturongs, around 100 meters from camp. The enclosure was well branched out and contained a small pool for drinking and, if wanted, bathing. Two blue plastic barrels, or potential nest boxes, were tied to the higher branches. On 2 February 2010 the Binturongs were transported from Phnom Penh to Chi Phat and then by ox cart to the rehabilitation station, which is not accessible by truck. The pair settled into their new environment well, evidently adapting quickly to the change of climate and surroundings. Phnom Tamao Wildlife Rescue Centre has a long extremely hot dry season, whereas temperatures are lower in the southern Cardamoms, where it rains for nine months of the year. In this forest enclosure the Binturongs became more wary although they remained unafraid of their keepers, who brought their food (bananas, papaya, other fruit and duck eggs) each evening. Wild fruit from the forest was provided when readily available.

The release for the Binturongs was scheduled to allow a long acclimation to the new area and climate, and for forest fruiting to peak (March–April, around Chi Phat; pers. obs.). On 3 June 2010, four months after their move, a faint mewing heard from one of the blue plastic barrels that served as nesting boxes indicated that a cub had been born. Keepers then minimised all involvement, with entry into the enclosure restricted to feeding purposes, for around six weeks – best practice for most captive births of wild animals (personal experience). Once the cub was seen outside its barrel, it was considered to be past the danger stage (many wild animals will either reject or kill their offspring if they feel the young are in danger or are interfered with), so cage cleaning resumed.

In preparation for a March release, the adults were sedated using Xylazine and Ketamine and fitted with Tellus 1C radio collars purchased from Followit, Lindesberg, Sweden, on 6 February 2011. Each collar weighed 240 grams. VHF frequencies for the collars were 150.000 and 150.020 MHz. Although the collars looked uncomfortable for the Binturongs, the animals made no obvious attempt to rid themselves of the collars. The collars had a VHF option that allowed manual tracking; GPS waypoints were also transmitted via satellite and downloaded by email, which enabled the animals to be located if the VHF signal was lost. Both collars had been programmed to remain on the animals for six months, although both dropped off somewhat prematurely.

Just when the release was being considered, two more cubs were born to the pair, on 14 February 2011. Were release to be delayed until these cubs were moving around independently, the prime fruiting period would be missed. Experience

with Leopard Cats *Prionailurus bengalensis* (Marx 2008) indicated that a recent birth need not a complicate the release of wild animals: it may even stabilise the adults and make it easier to monitor the released animals. A female may be unwilling to move far from dependant young until they are older and mobile. This approach entails minimisation of all disturbance, and provision of food for the released animals while they learn a new area. Thus, the release was not delayed.

On the evening of 7 March a slide door was permanently opened to allow the Binturongs to leave the enclosure and to return at will. Supplementary food was provided each evening following release at two points, both around six feet from the ground: one at the entrance to the enclosure, the other a feeding platform inside the cage. After trade-confiscated Long-tailed Macaques also released at the rehabilitation station began taking the Binturong food, the latter was put out after dark. Common Palm Civets and ferret badgers have been photographed coming to feed when Binturongs are absent. The food is also eaten the following day by the macaques and by Variable Squirrels *Callosciurus finlaysonii* and chevrotains.

Radio-collar monitoring was supplemented by two other sources of records: direct sightings of the adults and older cub waiting at dusk in the trees for the supplementary food (Fig. 1); and photographs from single camera-traps placed inside the enclosure and at the two supplementary feeding sites. This camera-trapping is ongoing, supplemented by information from other camera-traps placed elsewhere around the rehabilitation station (for other wild animals).

Observations

On 8 March 2011, the morning following release, the male and the oldest cub were outside but close to the enclosure. The female was inside the nest barrel with the new cubs. The following days the male Binturong moved further afield, identified from waypoints and manual tracking conducted each day at this stage. The adults came to the supplementary feeding sites periodically, although not daily: they must have started taking significant quantities of natural food soon after release. The Binturongs were camera-trapped regularly at the feeding sites, but as of late 2013 had never been photographed by the camera-traps placed elsewhere. Both adults wore collars and looked very similar, hindering differentiation on camera-trap photographs. The older cub was recorded only when it came to the supplementary food: its size and the absence of a radio collar allowed easy distinction from the adults.

The female remained in or near the enclosure for around three weeks post-release, tending to her second litter. These were too young to eat solid food and could not have survived without their mother and good shelter from the wet season's daily torrential downpours. On 23 March 2011, the female left the vicinity of the enclosure and the two cubs were no longer in the nest barrel. The adults' collars were delivering GPS waypoints indicating their movements (Fig. 2). The female's collar was less reliable than the male's and often late in giving her position: it stopped delivering GPS waypoints on 1 April, although manual tracking could still be conducted. It dropped off (before programmed to do so) around 25 May 2011 and was never found. Following this, the only method of monitoring her was if she came to the supplementary food: and the loss of collar ensured easy distinction from the male on camera-trap photos. She had moved largely to the north and east, always within the forest, but remained close to the release enclosure, probably to care for her cubs. However, readings were few because of the collar's unreliability.

The male's collar functioned better. In March he moved west and the south of the release enclosure, but returned to feed regularly. In April he changed direction and explored also to the north. Over time he moved somewhat over 1 km in every direction from the release enclosure; the forest seems uniform throughout this area. The collar gave its last waypoint on 8 May 2011 and was recovered on 12 June, having dropped off. He had visited and crossed a small stream to the north of camp. Both Binturongs were always located in forest habitat when tracked using VHF, but might have crossed grassland to enter some areas of forest.

For seven weeks following release it was uncertain whether any cubs survived, but the two adults were camera-trapped

Fig. 1. Released captive-bred adult Binturong *Arctictis binturong* waiting in trees near release-cage, waiting for food to be provisioned (predictable time and place), Chi Phat Wildlife Rehabilitation Station, southwest Cambodia.

Fig. 2. Waypoints from GPS collars attached to two captive-bred adult Binturongs *Arctictis binturong* (one male, one female) released in the southern Cardamom Mountains, Cambodia. The darker areas are tall forest, the plainer, paler, areas a mosaic of grass, scrub and non-woody cultivation.

regularly at the two feeding sites, both now positioned outside the release enclosure, one 2 m away, the other 20 m away. The camera-traps had been moved so that each focused on a feeding platform.

On 10 May 2011, nearly seven weeks after the new litter had disappeared from the nest box, the female and two younger cubs were camera-trapped at a feeding site (Fig. 3). They were then photographed regularly. The oldest cub, forced to survive independent of the mother since the arrival of the second litter, was first positively identified on camera-trap in late June 2011. Following this, if close to the feeding site when food was being put down in the evenings, it would sometimes take food from the keepers' hands (Fig. 4).

The Binturongs' visits to the feeding sites decreased gradually over time. The most significant change took place on the morning of 14 February 2012. The adult female was found once again in the nest barrel inside the release enclosure. A faint mewing indicated that she was not alone. The female and new-born cub disappeared about a week later. The new cub was first camera-trapped just over five weeks later, on 23 March 2012. Following this, both mother and new cub appeared at the feeding sites regularly (Fig. 5).

By September 2013, animals came to the supplementary food on only around half the nights. By then, the original five animals were harder to distinguish, but all seemed still to be alive and were camera-trapped. The Binturongs have also on occasions entered camp by night and killed and eaten chickens that roosted outside their small coop.

There were obvious differences in reaction of the different individual Binturongs to people. The adults, captive born but raised by their natural mothers, were unafraid of people and took food from their keepers' hands on occasions. The older cub also did the same. The anti-poaching patrols in the area meant that a lack of fear of humans posed no overt threat to the Binturongs, which anyway showed great caution in the unusual event of a stranger's presence. However the second litter of cubs, with very little experience of people, was frightened if people approached. Even though the adults fed at the supplementary feeding sites while being watched, these two cubs always raced away at if approached while feeding.

Fig. 3. Released captive-bred adult Binturong *Arctictis binturong* and captive-born cub visiting provisioning station at release site, Chi Phat Wildlife Rehabilitation Station, southwest Cambodia.

Fig. 4. Released captive-bred young Binturong *Arctictis binturong* taking food from keeper's hand at release cage, Chi Phat Wildlife Rehabilitation Station, southwest Cambodia.

Fig. 5. Released captive-bred adult Binturong *Arctictis binturong* and wild-born cub visiting provisioning station at release site, Chi Phat Wildlife Rehabilitation Station, southwest Cambodia.

Discussion

We know of no other Binturongs, captive-bred or otherwise, that have been released, anywhere in their range. All five animals released have survived for more than two years. A female, inexperienced in the wild, cared for two very small, dependant

cubs during a period of difficult weather immediately following her release. These cubs she removed from their nest-box at an evidently appropriate time. The older cub, deprived of maternal attention at any early age, also survived. Survival of the five animals was presumably assisted by the full year inside an enclosure to acclimatise to the new environment; supplementary feeding; the high level of protection of the area; a constant benign human presence maintaining the safety of the release site; the appropriate habitat; release at the optimal season for wild fruit; and the scarcity of predators and wild Binturongs.

The released Binturongs still take supplementary food over two years after their release, but these visits have decreased markedly over time. This food will be supplied each evening for an indefinite period, because it now allows the only means of monitoring survival. Over time, records of visits to the feed stations could be investigated to check for seasonal patterns that might reflect cyclical availability of fruit in the forest.

To maintain a population of Binturongs in this area, other individuals are probably needed to forestall inbreeding. There are probably still wild Binturongs around, but this has not been proven. It would be possible to release another unrelated pair using animals born at Phnom Tamao Wildlife Rescue Centre. The protocols for this are being considered, including attention to territoriality and the merit of another enclosure at a different location, or whether cessation of supplementary food would stimulate the Binturongs already released to move far enough away to permit the release of another pair in the same area.

Acknowledgements

We thank the Cambodian Forestry Administration for government support and permits, the Barbara Delano Foundation for funding the project, and H. Rainey (WCS) who lent us the camera-traps.

References

IUCN 2013. *IUCN Red List of Threatened Species*. Version 2013.1. <www.iucnredlist.org>. Downloaded on 13 September 2013.

Marx, N. 2008. Monitored release of Leopard Cats in the Phnom Tamao Protected Forest, Cambodia. *Cat News* 49: 19–21.

House #86, Street 123, Toul Tompong I, Chamcarmon district, Phnom Penh, Cambodia.
Emails: nmarx@online.com.kh, rothbunthoeun@online.com.kh

Red Panda *Ailurus fulgens* and other small carnivores in Kyongnosla Alpine Sanctuary, East Sikkim, India

Sunita KHATIWARA and Tanushree SRIVASTAVA

Abstract

Camera-trapping in Kyongnosla Alpine Sanctuary, East Sikkim, India, between November 2011 and October 2012 confirmed the persistence of Red Panda *Ailurus fulgens* there, and provided: the first record of Red Panda cub-carrying in the wild; the highest elevational record of Large Indian Civet *Viverra zibetha* and the second-highest record of Leopard Cat *Prionailurus bengalensis* globally; and records of Red Fox *Vulpes vulpes*, Yellow-throated Marten *Martes flavigula* and Stone Marten *M. foina*. Pale Weasel *Mustela altaica* was sighted directly.

Keywords: camera-trapping, cub-carrying, high-altitude records, Large Indian Civet, Leopard Cat, *Prionailurus bengalensis*, *Viverra zibetha*

Introduction

Red Panda *Ailurus fulgens* is one of the most striking creatures inhabiting the Himalaya. Within the order Carnivora, it comprises the monotypic family Ailuridae (Glatston 2011). Categorised as Vulnerable by *The IUCN Red List of Threatened Species* (IUCN 2013), it is distributed widely in the Himalaya including parts of Nepal, India and Bhutan, and further extends to Myanmar and China (Choudhury 2001, Glatston 2011). In India, its distribution is restricted to small pockets of the Eastern Himalaya, in the states of Sikkim, West Bengal (Darjeeling district) and Arunachal Pradesh (Ghose & Dutta 2011), with records of animals of uncertain origin in Meghalaya and Assam (Choudhury 2013).

Red Panda is known to inhabit mostly areas with oak forests, mixed coniferous forests with bamboo understorey and subalpine habitat (Chakraborty 1999). In the Eastern Himalaya, it occupies an elevational range of 1,500–4,800 m (Choudhury 2001), excepting the anomalous records in Meghalaya and Assam, at much lower altitude (Choudhury 2013). The species's unobtrusive nature and the remote, almost inaccessible terrains it occupies hinder its study.

Sikkim, a small mountainous state in the Eastern Himalayan biodiversity hotspot, has a rich fauna and flora including elements of Afrotropical, Indomalayan and Palaearctic origin (Mani 1974). Its wide elevation gradient (300–8,000 m), albeit within a small geographical area, results in diverse vegetation types (tropical forests to cold deserts) and a wide variety of mammals including Red Panda (the state animal) and Snow Leopard *Panthera uncia*.

Sikkim holds the second-largest extent of Red Panda habitat in India after the state of Arunachal Pradesh (Ghose *et al*. 2011). Despite this, little information on the species is available from the state. It was earlier reported from six of Sikkim's eight protected areas: Khangchendzonga National Park in the North and West districts; Singba Rhododendron Sanctuary in the North; Pangolakha Wildlife Sanctuary and Kyongnosla Alpine Sanctuary in the East; Maenam Wildlife Sanctuary in the South; and Barsey Rhododendron Sanctuary in the West (Ghose & Dutta 2011). Recent surveys by Ghose *et al.* (2011) failed to record the species in Fambanglo Wildlife Sanctuary, where Choudhury (2001) had reported it to occur.

Study area

The study area (Fig. 1) spans 2,700–4,200 m asl, with the highest reaches within Kyongnosla Alpine Sanctuary (31 km^2) and the lowest outside. Major vegetation comprises Oak *Quercus* forest mixed with *Arundinaria* bamboo thickets between 2,700 and 3,000 m (I) (mostly in areas outside the sanctuary); Juniper *Juniperus* – rhododendron *Rhododendron* scrub forest with bamboo understorey (3,000–3,300 m) (II); *Rhododendron* forest with scattered fir *Abies* (3,300 – 3,600 m) (III); *Abies*-dominated coniferous forest (contiguous with bamboo thickets at few places) (3,600 – 3,900 m (IV); and Alpine scrub forest (3,900 – 4,200 m) (V). The area is surrounded by reserved forests holding quite a few small villages. People inhabiting these villages are not involved in hunting to the best of our knowledge. There is some evidence of fuel-wood extraction from the surrounding forests.

Methods

An intensive ecological study of small carnivores aimed to generate baseline information on species abundance and distribution patterns. Camera-trapping and faecal surveys between November 2011 and October 2012 covered the area's entire elevation gradient. After marking permanent trails, a reconnaissance survey confirmed trail-use (through indirect evidence) by small carnivores. The 16 trails comprised two, three, eight and three in habitat types II, III, IV and V, respectively, in accordance with their area of coverage in the study area. These trails served as basic sampling units for camera-trapping and to search for other evidence (faeces, footprints and direct sightings) of small carnivores.

The trails were walked once a month. Red Panda faeces were photographed and compared with the available photographic records (e.g. Srivastava & Dutta 2010) to assist the identification of the species. At each trail, one camera-trap unit was deployed 15–30 cm above the ground, attached to a rock or tree trunk, without baits or lures, and was operational for 24-hour monitoring. A one-minute delay was set between successive activations of the camera-traps. Occasions where the same species was photographed more than once within one

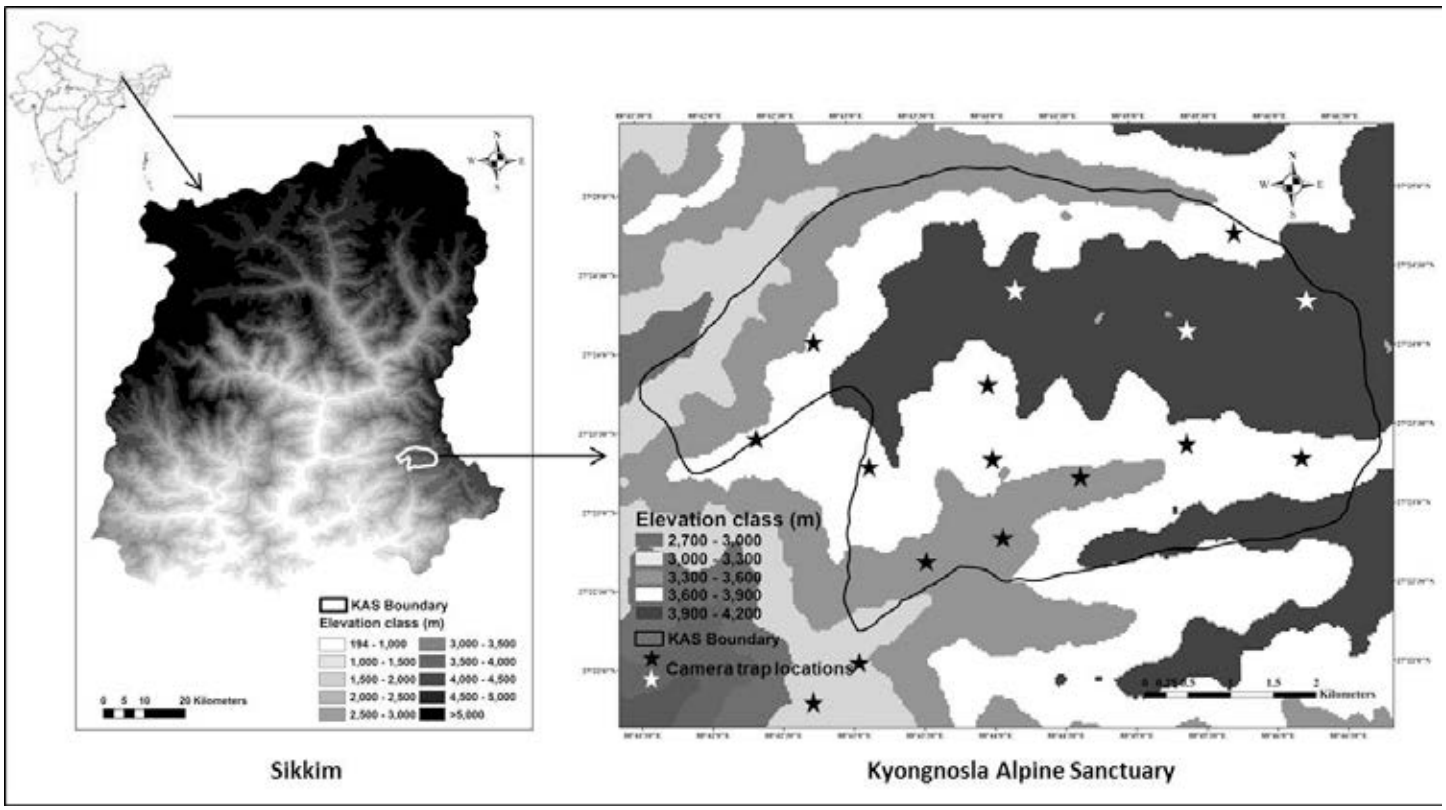

Fig. 1. Kyongnosla Alpine Sanctuary, Sikkim, India, showing camera-trap locations in different elevation classes.

hour by the same camera-trap were considered to constitute a single record. For each record, elevation and geographic co-ordinates were recorded using a handheld GPS (Garmin, GPS-map 60Cx; datum, WGS84) along with information on habitat type, date and time.

Results and discussion

A total of 2,398 camera-trap-nights comprised 334, 570, 1,124 and 370 in habitat types II, III, IV and V, respectively ('Study area' defines the habitat types). Red Panda was photo-captured at three of the 16 camera-trap stations, yielding a total of 13 photographic records. Most (10) photo-captures were recorded from one camera-trap station at an elevation of 3,630 m amid mostly *Abies*-dominated coniferous forest contiguous with bamboo thickets at adjacent lower elevations. *Abies* provides suitable daytime resting sites for the species, whilst bamboo serves as food. A photo-capture on 5 July 2012 at this location showed an adult carrying a cub, the latter estimated to be 1–2 months old (S. Pradhan *in litt.* 2014, A. R. Glatston *in litt.* 2014) (Fig. 2a). This seems to be the first such record from the wild, although cub-carrying is well documented in captivity (Gebauer 2011). The highest (3,780 m) and lowest (2,700 m) elevation records of Red Panda were direct sightings from locations 5–6 km outside the Sanctuary. In all, four direct sightings and four faeces encounters (Fig. 2b) were made (Table 1). Two of the faecal piles were found in the adjacent reserved forests comprising *Juniperus–Rhododendron* scrub forest with bamboo understorey. Although the areas outside the PA lie adjacent to small human settlements, they represent relatively undisturbed habitats with little human interference.

Camera-trapping recorded, among small carnivores, in decreasing order of photo-capture rate, Red Fox *Vulpes vulpes*, Leopard Cat *Prionailurus bengalensis*, Yellow-throated Marten *Martes flavigula*, Red Panda, Stone Marten *M. foina* and Large Indian Civet *Viverra zibetha*; and a Pale Weasel *Mustela altaica* was seen (Table 2). The two Large Indian Civet photo-captures, on 30 December 2011 and 27 February 2012 (Fig. 3) were at 3,080 m. This is nearly 400 m higher than the highest record we could trace from anywhere in the species's range: 2,700 m (Khangchendzonga National Park, Sikkim; Sathyakumar *et al*. 2011). Most photo-captures of Leopard Cat were above 3,300 m, with the highest at a recorded elevation of 3,765 m. This is

Table 1. Red Panda *Ailurus fulgens* records in Kyongnosla Alpine Sanctuary, Sikkim, India, November 2011 – October 2012.

Evidence[1]	Habitat type[2]	Number of records	Measured elevation (m)	Coordinates
PC	IV	10	3,630	27°23.29′N, 88°42.22′E
PC	III	2	3,398	27°22.59′N, 88°43.17′E
PC	III	1	3,560	27°23.02′N, 88°43.94′E
DS	IV	1	3,780	27°22.27′N, 88°47.23′E
DS	I	1	2,700	27°22.19′N, 88°40.83′E
DS	III	1	3,593	27°22.54′N, 88°42.90′E
DS	III	1	3,398	27°22.59′N, 88°43.17′E
F	IV	2	3,789	27°23.42′N, 88°45.09′E
F	II	2	3,109	27°22.37′N, 88°42.91′E

[1]PC, photo-capture; DS, direct sighting; F, faeces.
[2]I, Oak forest mixed with *Arundinaria* bamboo thickets; II, *Juniperus–Rhododendron* scrub forest with bamboo understorey; III, *Rhododendron* forest with scattered *Abies*; IV, *Abies*–dominated coniferous forest contiguous with bamboo thickets; V, Alpine scrub forest.

Table 2. Small carnivore records in Kyongnosla Alpine Sanctuary, Sikkim, India, November 2011 – October 2012.

Species[1]	Evidence[2]	Number of photo-captures in each habitat[3]				Number of camera-trap stations	Elevation range (m)
		II	III	IV	V		
Red Panda	PC, DS, F	0	3	10	0	3	3,000–3,800
Red Fox	PC	11	74	98	0	12	3,000–3,800
Leopard Cat	PC	1	12	25	0	8	3,150–3,800
Yellow-throated Marten	PC	4	0	10	0	5	3,000–3,800
Stone Marten	PC	4	0	2	0	3	3,000–3,600
Large Indian Civet	PC	2	0	0	0	1	3,080
Pale Weasel	DS	0	0	0	0	0	3,910

[1]Scientific names are given in the text.

[2]PC, photo-capture; DS, direct sighting; F, faeces.

[3]I, Oak forest mixed with *Arundinaria* bamboo thickets; II, *Juniperus–Rhododendron* scrub forest with bamboo understorey; III, *Rhododendron* forest with scattered *Abies*; IV, *Abies*–dominated coniferous forest contiguous with bamboo thickets; V, Alpine scrub forest.

well below the exceptionally high elevation of 4,474 m recorded in the Khambachen valley, Kangchenjunga Conservation Area, Nepal (Thapa *et al*. 2013), but above the previous highest record of 3,254 m (also Nepal; Ghimirey & Ghimire 2010). This is probably the highest record from India. Larger mammals camera-trapped included Snow Leopard, Asian Golden Cat *Catopuma temminckii*, Asian Black Bear *Ursus thibetanus*, Himalayan Musk-deer *Moschus chrysogaster*, Himalayan Serow *Capricornis thar*, Himalayan Goral *Naemorhedus goral* and Eurasian Wild Pig *Sus scrofa.*

All the small carnivore species were found in areas between 3,000 and 3,800 m, except for Pale Weasel which was sighted in alpine scrub forest at 3,910 m. The area, although small, seems to support an appreciable fauna including some cryptic small carnivores. Also, with comparatively low human interference, the protected area and surrounds serve as a conspicuous refuge to the species inhabiting the area. More exhaustive and systematic surveys would therefore, be useful to better understand various ecological aspects of the small carnivore community in the area.

Fig. 2. Red Panda *Ailurus fulgens* evidence in Kyongnosla Alpine Sanctuary, East Sikkim, India. (left) Camera-trapped adult Red Panda carrying a cub in *Abies*-dominated coniferous forest, 5 July 2012; (right) faeces recorded in *Juniperus–Rhododendron* scrub forest with bamboo understorey on 3 May 2012.

Fig. 3. Camera-trapped Large Indian Civet *Viverra zibetha* at 3,080 m asl in *Juniperus–Rhododendron* scrub forest with bamboo understorey, 27 February 2012 in Kyongnosla Alpine Sanctuary, East Sikkim, India.

Acknowledgements

We thank the Department of Biotechnology, New Delhi, for funding the study. We are also grateful to National Centre for Biological Sciences for providing us all the necessary help and administrative support. We convey our sincere thanks to Department of Forests, Environment and Wildlife Management, Government of Sikkim, for providing permits, logistical support and cooperation in the field. We would also like to thank Angela Glatston, Sunita Pradhan and Divya Mudappa for their extremely valuable suggestions about the manuscript.

References

Chakraborty, T. 1999. Himalayan heritage: the endangered Red Panda. *Himalayan Paryavaran* 6: 129–132.

Choudhury, A. 2001. An overview of the status and conservation of the Red Panda *Ailurus fulgens* in India, with reference to its global status. *Oryx* 35: 250–259.

Choudhury, A. 2013. *The mammals of North east India*. Gibbon Books and the Rhino Foundation for Nature in NE India, Guwahati, Assam, India.

Gebauer, A. 2011. The early days: maternal behaviour and infant development. Pp. 157–191 in Glatston, A. R. (ed.) *Red Panda: biology and conservation of the first panda*. Academic Press, London, U.K.

Ghimirey, Y. & Ghimire, B. 2010. Leopard Cat at high altitude in Makalu–Barun National Park, Nepal. *Cat News* 52: 16–17.

Ghose, D. & Dutta, P. K. 2011. Status and distribution of Red Panda *Ailurus fulgens fulgens* in India. Pp. 357–373 in Glatston, A. R. (ed.) *Red Panda: biology and conservation of the first panda*. Academic Press, London, U.K.

Ghose, P. S., Sharma, B., Chakraborty, R. & Legshey, K. 2011. Status of Red Panda in Sikkim: a case study in east Sikkim. Pp. 363–378 in Arrawatia, M. L. & Tambe, S. (eds) *Biodiversity of Sikkim – exploring and conserving a global hotspot*. Information and Public Relations Department, Government of Sikkim, Gangtok, India.

Glatston, A. R. (ed.) 2011. *Red Panda: biology and conservation of the first panda*. Academic Press, London, U.K.

IUCN 2013. *IUCN Red List of Threatened Species*. Version 2013.2. <www.iucnredlist.org>. Downloaded on 30 April 2014.

Mani, M. S. 1974. Biogeography of the Himalaya. Pp. 664–681 in Mani, M. S. (ed.) *Ecology and biogeography in India*. Dr. W. Junk b.v., The Hague, Netherlands.

Sathyakumar, S., Bashir, T., Bhattacharya, T. & Poudyal, K. 2011. Assessing mammal distribution and abundance in intricate eastern Himalayan habitats of Khangchendzonga, Sikkim, India. *Mammalia* 75: 257–268.

Srivastava, T. & Dutta, P. K. 2010. Western Arunachal Pradesh offering prime home to the endangered Red Panda. *Current Science* 99: 155–156.

Thapa, K., Pradhan, N. M. B., Barker, J., Dhakal, M., Bhandari, A. R., Gurung, G. S., Rai, D. P., Thapa, G. J., Shrestha, S. & Singh, G. R. 2013. High elevation record of a Leopard Cat in the Kangchenjunga Conservation Area, Nepal. *Cat News* 58: 26–27.

National Centre for Biological Sciences, GKVK Campus, Bellary Road, Bangalore – 560065, India *and* Centre for Wildlife Studies, 1669, 31st Cross, 16th Main, Banashankari 2nd Stage, Bangalore – 560070, India.
Emails: sunitak@ncbs.res.in, tanushrees@ncbs.res.in

The first records of Yellow-bellied Weasel *Mustela kathiah* from Cambodia

PHAN Channa[1], Jan F. KAMLER[2] and David W. MACDONALD[2]

Abstract

The first records of Yellow-bellied Weasel *Mustela kathiah* from Cambodia comprise three photographs from three well-separated camera-trap stations in the Central Cardamom Protected Forest in the south-west of the country in December 2013 – March 2014. The records, consistent with those in neighbouring countries, were from evergreen hill-forest.

Keywords: camera-trapping, Central Cardamom Protected Forest, distribution record, evergreen forest, extension of known range

កំណត់ត្រាលើកដំបូងនៃ *Mustela kathiah* នៅប្រទេសកម្ពុជា

សង្ខេប

កំណត់ត្រាលើកដំបូងនៃ *Mustela kathiah* នៅប្រទេសកម្ពុជាដែលមានរូបភាពចំនួនបី ពីម៉ាស៊ីនថតស្វ័យប្រវត្តិចំនួនបីទីតាំងផ្សេងៗគ្នា នៅក្នុងព្រៃការពារជួរភ្នំក្រវាញភាគកណ្តាលស្ថិតនៅភាគនិរតីនៃប្រទេសកម្ពុជា រវាងខែធ្នូ ឆ្នាំ២០១៣ ដល់ខែមិនាឆ្នាំ២០១៤។ កំណត់ត្រាទាំងអស់ រួមទាំងកំណត់ត្រានៅក្នុងប្រទេសជិតខាងគឺមាននៅក្នុងព្រៃស្រោងតំបន់ភ្នំ។

Introduction

Yellow-bellied Weasel *Mustela kathiah* is a small carnivore found in northern India through the Himalayas into much of southern China and northern South-east Asia (Corbet & Hill 1992). It has never been recorded for Cambodia, but there are historical and/or recent records from the nearby countries of Lao PDR, Myanmar, Thailand and Vietnam (Duckworth & Robichaud 2005, Long & Minh 2006, Than Zaw *et al*. 2008, Supparatvikorn *et al*. 2012). It shows some tolerance to degraded habitats, and is usually found over 1,000 m asl in a range of habitats including montane evergreen forest, scrub and grassland (e.g. Duckworth & Robichaud 2005, Supparatvikorn *et al*. 2012). The first records of Yellow-bellied Weasel from Cambodia were generated by a camera-trap survey to record Mainland Clouded Leopard *Neofelis nebulosa*, the abundance of its prey, and other members of its guild in the southern part of the Central Cardamom Mountains Protected Forest.

Study Site

Central Cardamom Protected Forest (Central Cardamom PF) is located in southwest Cambodia and spans three provinces: northeast Koh Kong, southern Pursat and northwest Kompong Speu. It is the largest protected forest in Cambodia, covering an area of 4,013.13 km^2. The Central Cardamom PF is contiguous with Phnom Samkos Wildlife Sanctuary to the northwest and Phnom Aural Wildlife Sanctuary to the east, forming a combined total area of 9,845.65 km^2. The climate is highly seasonal with a wet season from May to October and a dry season from November to April, during which time precipitation is rare. The annual rainfall is 3,000–4,000 mm (Daltry & Momberg 2000). The average temperature remains high throughout the year, generally between 25 °C and 30 °C, except at higher elevation where it is approximately 20 °C. The coldest months are December and January, when temperatures at the plateau can drop below 10 °C at night. The Central Cardamom PF consists of evergreen forest (89.5%), semi-evergreen forest (3.5%) and deciduous dipterocarp forest (2.5%). Across the Central Cardamom PF, elevation varies from 200 m to over 1,400 m. It supports globally threatened species including Asian Elephant *Elephas maximus*, Dhole *Cuon alpinus*, Siamese Crocodile *Crocodylus siamensis* and White-winged Duck *Cairina scutulata*, plus the near-endemic Chestnut-headed Partridge *Arborophila cambodiana* (Daltry & Momberg 2000). The Central Cardamom PF was already known to support a wide range of small carnivores (Holden & Neang 2009).

Methods

Between 5 December 2013 and 26 March 2014, commercially available trigger infrared, remote-trip digital camera-traps (Cuddeback digital Ambush IR Model: 1187) were used to survey within the southern part of Central Cardamom PF. Altogether 162 camera-traps were deployed, set in pairs at 81 stations covering an area of approximately 110 km^2. The camera-trap stations were selected to maximise the chances of encountering Clouded Leopard. A total of 8,152 camera-trap-nights were achieved.

Fifty camera-trap stations were along animal tracks and ridges, two on old logging roads, 13 along trails infrequently used by people, 10 along the trails close to rivers, five close to paths and one on a dried river bed. Seventy were in evergreen forest and 11 in other forest-types. Each camera-trap was approximately 30 cm above ground, allowing the photo-capture of animals ranging in size from rats (Muridae) to Sambar *Cervus*

Table 1. Records of Yellow-bellied Weasel *Mustela kathiah* by camera-traps from the Central Cardamom Protected Forest, Cambodia. All records of Yellow-bellied Weasel were from evergreen forest.

Date, time	Coordinates (WGS 1984)	Altitude	Habitat and other notes
13 Dec 2013, 14h29	11°52′09.5″N, 103°31′51.1″E	1,160 m	858 m from a river
26 Jan 2014, 13h38	11°51′39.6″N, 103°30′15.9″E	1,140 m	Along an animal trail, 1,737 m from a river
21 Mar 2014, 12h17	11°53′57.9″N, 103°31′15.4″E	860 m	Along an animal trail, 191 m from a river

Fig. 1. Camera-trapped Yellow-bellied Weasel *Mustela kathiah,* Central Cardamom Protected Forest, Cambodia, 13 December 2013.

Fig. 2. Camera-trapped Yellow-bellied Weasel *Mustela kathiah,* Central Cardamom Protected Forest, Cambodia, 26 January 2014.

unicolor. Camera-traps were set to be operational for 24 hours and all photographs were digitally stamped with the date and time. Successive photographs of the same species at the same camera-trap were defined as notionally independent when separated by more than 30 minutes. Camera-trap stations were at least 500 m apart. GPS receivers (Garmin eTrex10 and Garmin 60csx) were used to record the location of each camera-trap station. Altitudes based on 90 m digital elevation data from Shuttle Radar Topography Mission (USGS 2004) were calculated for each camera-trap station using Quantum GIS (v.2.2.0) and GRASS GIS (v6.4.3) software.

Fig. 3. Camera-trapped Yellow-bellied Weasel *Mustela kathiah,* Central Cardamom Protected Forest, Cambodia, 21 March 2014.

Results

In total, 3,955 photographs resulting from 2,113 notionally independent encounters of 39 species of wildlife were recorded, comprising 29 species of mammal and 10 of bird. These included 12 (one Endangered, seven Vulnerable and four Near Threatened) categorised as globally threatened or Near Threatened on *The IUCN Red List of Threatened Species* (IUCN 2014). Yellow-bellied Weasel was recorded from three different locations (Table 1). The minimum distance between each of these three camera-traps was 3 km, suggesting that three different individuals are likely to have been involved. These photographs (Figs 1–3) are the first records of this species in Cambodia. All were from evergreen forest that had been selectively logged during the 1990s.

Discussion

These Yellow-bellied Weasel records are the first of any weasel *Mustela* from Cambodia. They are not unexpected, for two reasons. First, mammals were poorly collected in Cambodia during the main phase of international biological exploration (Walston 2001). Thus, several other species of small carnivore have been recorded as new for the country since a resurgence of surveys in the late 1990s, including Spotted Linsang *Prionodon pardicolor* (Kong & Tan 2002), Small-toothed Palm Civet *Arctogalidia trivirgata* (Walston & Duckworth 2003) and Large-toothed Ferret Badger *Melogale personata* (Schank *et al*. 2009). Secondly, several recent records in neighbouring countries show how well Yellow-bellied Weasel can escape detection, notably in Thailand (Supparatvikorn *et al*. 2012). It seems that, in common with other South-east Asian weasels,

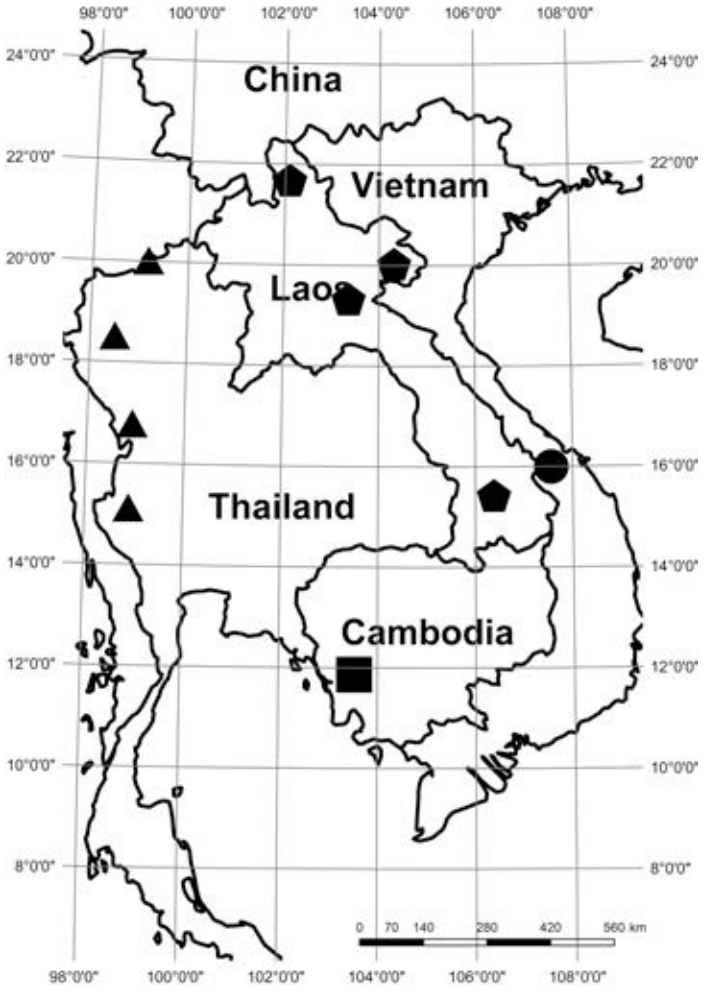

Fig. 4. Records of Yellow-bellied Weasel *Mustela kathiah* in Cambodia (square), all known records from the neighbouring countries of Lao PDR, pentagon (after Duckworth & Robichaud 2005) and Thailand, triangle (after Supparatvikorn *et al*. 2012), and the southernmost known record from Vietnam, circle (Long & Minh 2006). Symbols indicate general areas when there are several records in proximity.

the species is not readily camera-trapped (Supparatvikorn *et al*. 2012). Thus, its range may remain underestimated. At present, these records are the southernmost in the world (Fig. 4): the previous southernmost were from about 15°N in both Thailand (Thung Yai Naresuan Wildlife Sanctuary) and Lao PDR (Bolaven plateau) (Duckworth & Robichaud 2005, Supparatvikorn *et al*. 2012). In common with most other South-east Asian records, they come from in or near evergreen forest in hill areas (above 1,000 m). Most camera-trapping in Cambodia has occurred in the lowlands (below 700 m), particularly in deciduous-dominated landscapes (e.g. Gray *et al*. 2014). This may have contributed to the late discovery of Yellow-bellied Weasel in the country.

Acknowledgements

We express our thanks to the Cambodian Forestry Administration and Conversation International for making our study possible and specifically to Wild Life Research Unit and Fauna & Flora International for their technical survey support and funding. We thank Lat Sovat, In Visattha, Meas Saveoun, Has Vassa, Has Khmour, Yem Sophorn and Lek Mon for assistance with camera-trapping, and Jeremy Holden for comments.

References

Corbet, G. B. & Hill, J. E. 1992. *The mammals of the Indomalayan region*. Natural History Museum Publications and Oxford University Press, Oxford, U.K.

Daltry, J. C. & Momberg, F. 2000. *Cardamom Mountains biodiversity survey 2000*. Fauna & Flora International, Cambridge, U.K.

Duckworth, J. W. & Robichaud, W. G. 2005. Yellow-bellied Weasel *Mustela kathiah* sightings in Phongsaly province, Laos, with notes on the species' range in South-east Asia, and recent records of other small carnivores in the province. *Small Carnivore Conservation* 33: 17–20.

Gray, T. N. E., Pin C., Phan C., Crouthers, R., Kamler, J. F. & Prum S. 2014. Camera-trap records of small carnivores from eastern Cambodia, 1999–2013. *Small Carnivore Conservation* 50: 20–24.

Holden, J. & Neang T. 2009. Small carnivore records from the Cardamom Mountains, southwestern Cambodia. *Small Carnivore Conservation* 40: 16–21.

IUCN 2014. *IUCN Red List of Threatened Species*. Version 2014.1. <www.iucnredlist.org>. Downloaded on 27 June 2014.

Kong K. S. & Tan S. 2002. *A wildlife survey of Kirirom National Park, Cambodia*. Wildlife Conservation Society Cambodia Program, Phnom Penh, Cambodia.

Long, B. & Minh H. 2006. Recent records of and notes on the conservation of small carnivores in Quang Nam province, central Vietnam. *Small Carnivore Conservation* 34&35: 39–46.

Schank, C., Pollard, E. H. B., Sechrest, W., Timmins, R., Holden, J. & Walston, J. 2009. First confirmed records of Large-toothed Ferret Badger *Melogale personata* in Cambodia, with notes on country records of *Melogale*. *Small Carnivore Conservation* 40: 11–15.

Supparatvikorn, S., Sutasha, K., Sirisumpun, T., Kunthawong, N., Chutipong, W. & Duckworth, J. W. 2012. Discovery of the Yellow-bellied Weasel *Mustela kathiah* in Thailand. *Natural History Bulletin of the Siam Society* 58: 19–30.

Than Zaw, Saw Htun, Saw Htoo Tha Po, Myint Maung, Lynam, A. J., Kyaw Thinn Latt & Duckworth, J. W. 2008. Status and distribution of small carnivores in Myanmar. *Small Carnivore Conservation* 38: 2–28.

[USGS] United States Geological Survey 2004. Shuttle Radar Topography Mission, 1 Arc Second scene SRTM_u03_n008e004, Unfilled Unfinished 2.0, Global Land Cover Facility, University of Maryland, College Park, Maryland, U.S.A.

Walston, J. L. 2001. Mammals of Cambodia. Pp. 135–152 in Smith, J. D. (ed.) *Biodiversity, the life of Cambodia – Cambodian biodiversity status report 2001*. Cambodia Biodiversity Enabling Activity, Food and Agriculture Organisation, Phnom Penh, Cambodia.

Walston, J. L. & Duckworth, J. W. 2003. The first record of Small-toothed Palm Civet *Arctogalidia trivirgata* from Cambodia, with notes on surveying the species. *Small Carnivore Conservation* 28: 12–13.

[1]Fauna & Flora International (FFI)
Cambodia Programme, PO Box 1380, #19, St. 360,
Boeng Keng Kang I, Phnom Penh, Cambodia.
Email: phanchannal@yahoo.com
[2]Wildlife Conservation Research Unit (WildCRU),
Department of Zoology, University of Oxford, The
Recanati-Kaplan Centre, Tubney House,
Abingdon Road, Tubney, Abingdon, OX13 5QL, U.K.

Photographic records of the Ratel *Mellivora capensis* from the southern Indian state of Karnataka

S. GUBBI[1,2], V. REDDY[3], H. NAGASHETTIHALLI[1], R. BHAT[1] and M. D. MADHUSUDAN[1]

Abstract

Understanding about the occurrence and distribution of the Ratel *Mellivora capensis* from the Indian subcontinent is hindered by the animal's elusive nature. The first photographic evidence of Ratel for the southern Indian state of Karnataka comprises 41 camera-trap records from Cauvery Wildlife Sanctuary. During January–March 2014, Ratels were detected in the sanctuary's different forest types broadly in proportion to camera-trapping effort therein. A wider occupancy survey, using a range of methods including camera-trapping, would help obtain a better understanding of the distribution of this cryptic species in Karnataka and neighbouring regions.

Keywords: camera-trapping, Cauvery Wildlife Sanctuary, Eastern Ghats, habitat use, Honey Badger

ಸಾರಾಂಶ

ಭರತಖಂಡದಲ್ಲಿ ತರಕರಡಿಯ (*Mellivora capensis*) ಇರುವಿಕೆ ಮತ್ತು ವಿಸ್ತರಣೆಯನ್ನು ತಿಳಿಯುವುದು ಈ ಪ್ರಾಣಿಯ ಗೂಢ ಸ್ವಭಾವದಿಂದಾಗಿ ಕಷ್ಟಸಾಧ್ಯವಾಗಿದೆ. ದಕ್ಷಿಣ ಭಾರತದ ಕರ್ನಾಟಕ ರಾಜ್ಯದಲ್ಲಿ ತರಕರಡಿಯ ಛಾಯಾಗ್ರಹಿತ ಚಿತ್ರ ಸಾಕ್ಷಿಯು, ಮೊತ್ತ ಮೊದಲಿಗೆ, ಕಾವೇರಿ ವನ್ಯಜೀವಿಧಾಮದಲ್ಲಿ 41 ಕ್ಯಾಮೆರಾ ಟ್ರಾಪ್ ಚಿತ್ರಗಳೊಂದಿಗೆ ದಾಖಲಿಸಲ್ಪಟ್ಟಿದೆ. ತರಕರಡಿಗಳು 2014ರ ಜನವರಿ–ಮಾರ್ಚ್ ತಿಂಗಳಿನಲ್ಲಿ, ವನ್ಯಜೀವಿಧಾಮದ ವಿವಿಧ ರೀತಿಯ ಕಾಡುಗಳಲ್ಲಿ ಅಳವಡಿಸಿರುವ ಕ್ಯಾಮೆರಾ ಟ್ರಾಪ್‌ಗಳಲ್ಲಿ ಸ್ಥೂಲ ಪ್ರಮಾಣದಲ್ಲಿ ಪತ್ತೆಯಾಗಿವೆ. ಕ್ಯಾಮೆರಾ ಟ್ರಾಪಿಂಗ್‌ನೊಂದಿಗೆ ಇತರ ಕ್ರಮಗಳನ್ನೊಳಗೊಂಡು ವಿಸ್ತಾರವಾದ ಹಿಡುವಳಿಕೆ ಸಮೀಕ್ಷೆಯು, ಕರ್ನಾಟಕ ಮತ್ತು ನೆರೆಯ ಪ್ರದೇಶಗಳಲ್ಲಿ ಈ ಗೂಢ ಪ್ರಭೇದದ ಪ್ರಾಣಿಯ ವಿಸ್ತರಣೆ ಹಾಗೂ ಇತರ ವಿಷಯಗಳ ತಿಳಿವಳಿಕೆಗೆ ಸಹಾಯವಾಗಬಹುದು.

Introduction

The Ratel or Honey Badger *Mellivora capensis* (Mustelidae) is widespread across parts of Africa, the Arabian Peninsula, western Asia and the Indian peninsula (Begg *et al.* 2008). Owing to its elusive nature, there is very little reliable, current information on its status and distribution from the Indian subcontinent. In particular, there are rather few recent records from the southern half of India. Although it is globally listed as Least Concern under *The IUCN Red List of Threatened Species* (Begg *et al.* 2008), its perceived relative rarity in India means it receives the highest level of protection there and is listed under the Schedule I of the Wildlife (Protection) Act, 1972.

This note presents the first-ever photographic evidence of occurrence of Ratel, to the best of our knowledge, from the southern Indian state of Karnataka. Two earlier suggestions about its occurrence in the state come from southern Karnataka. Karanth (1986) reported a Ratel in Mysore Zoo in 1974, caught in the Srinivasapura area of Kolar district. The second, Kumara & Singh (2007), mentioned pre-1960s reports from Kolar district (no details given) and the rescue of a Ratel from a well near Sathanur in Bangalore Rural district in 2003. Their own extensive interview surveys yielded "no positive response for the occurrence of this species from any part of the State" (p. 160).

Study area

Cauvery Wildlife Sanctuary (1,027 km^2; Cauvery WS) lies within 11°56'55"–12°24'36"N, 77°09'41"E–77°46'40"E (WGS 84, Fig 1). It is in the Ramanagara, Mandya and Chamarajanagara districts of Karnataka along an eastern spur of the Western Ghats, and is considered to be a connection to the Eastern Ghats (WGEEP 2011). The vegetation in Cauvery WS is dominated by tropical dry thorn, dry deciduous and woodland savannah forests, but includes moist deciduous forests, riverine forests along the River Cauvery, and small patches of '*shola*' (montane evergreen) forests (KFD 2004). The River Cauvery runs east to west through Cauvery WS, dividing it into two parts. The altitude of Cauvery WS ranges from 254 to 1,515 m asl, It receives a mean annual rainfall of 750–800 mm. The temperatures vary from 15 °C to 42 °C. There are 31 villages

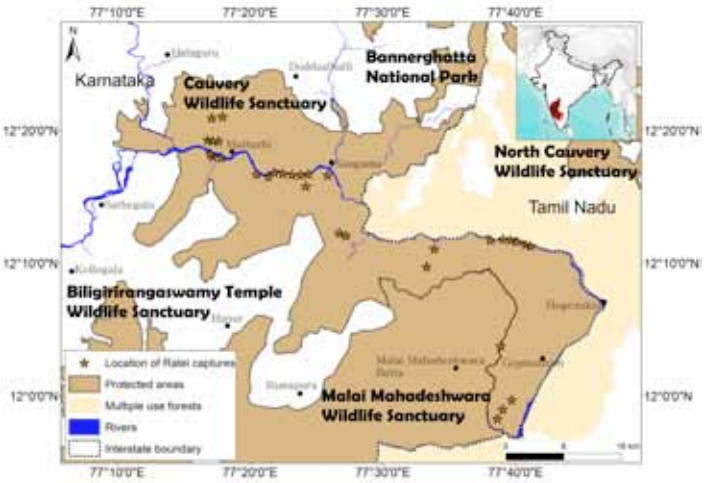

Fig. 1. Cauvery Wildlife Sanctuary, Karnataka, India, showing the location of records of Ratel *Mellivora capensis* and the adjoining land designations.

and hamlets within Cauvery WS covering an area of about 66 km^2 (TORGCCI 2001, RDPR 2011).

Methods

A survey within Cauvery WS between January and March 2014, part of a study to estimate Leopard *Panthera pardus* densities, deployed 65–72 pairs of Panthera V4 passive infrared camera-traps over approximately 961 km^2. These were active throughout the day and night on 11 sampling occasions (spanning 12–13 days) within each of the five forest ranges of Cauvery WS, logging a total camera-trapping effort of 3,652 trap-days across 332 camera-trap stations. Camera-trap stations were selected to maximise the likelihood of photographing Leopard. Thus, all camera-traps were placed along forest roads, which large cats use frequently for movement. The distance between camera-traps varied from 1.1 to 3.2 km. No baits or lures were used to attract animals to the camera-traps. Camera-traps were placed in all habitats within each forest range during the 12–13 day sampling period. We used a Pearson's Chi-squared test (Crawley 2007: 305) of independence on a contingency table (Table 1, columns 2 & 3) to test if Ratel encounter frequencies in different habitats were independent of the camera-trapping effort in them.

Results

Of the five forest ranges that comprise Cauvery WS, a Ratel was first camera-trapped in Halagur Range in January 2014. The species was subsequently recorded from Hanur, Kaudalli and Malai Mahadeshwara Hills Ranges, but has not yet been recorded from Sangama Range. Altitude of camera-trapped Ratels varied from 275 to 1,087 m asl. In all, Ratels were photo-captured, always by night (Figs 2–3), 41 times at 31 camera-trap stations. They were photographed twice at eight camera-trap stations and thrice at one, with successive records at any given station separated by at least 30 minutes. Of the 41 photo-captures, seven showed Ratels in duos. The other images each showed a single animal, although it cannot be concluded these animals were solitary: other individuals may have been present but not in positions to be recorded on the image. It was possible to identify sex of the animal in 19 photographs: males on 14 occasions and females on five.

Fig. 2. A duo of Ratels *Mellivora capensis* camera-trapped in Cauvery Wildlife Sanctuary, southern India, 3 March 2014 (Photo: Sanjay Gubbi/ NCF/Panthera).

Fig. 3. In a rare picture, a Ratel *Mellivora capensis* encounters a Leopard *Panthera pardus* at a waterhole in Cauvery Wildlife Sanctuary, southern India, on 1 January 2014 (Photo: Karnataka Forest Department).

Ratels were detected in all different forest types of the study area (scrub, dry deciduous and riverine) in proportion to the camera-trapping effort within them (Table 1, $X^2 = 3.13$, df = 3, $p = 0.37$) suggesting no evidence of habitat selectivity at the scale of sampling. However, further investigation would be required to determine if there truly is no selection: for one thing, camera-traps do not reliably indicate activity, so high encounter rates are possible in habitats of little value to a species but through which it must travel to reach its selected habitats.

Of the 17 small carnivore species expected to occur in Karnataka state (Kumara & Singh 2007), we camera-trapped and/or directly sighted eight in Cauvery WS: Jungle Cat *Felis chaus*, Rusty-spotted Cat *Prionailurus rubiginosus*, Common Palm Civet *Paradoxurus hermaphroditus*, Small Indian Civet *Viverricula indica*, Ruddy Mongoose *Herpestes smithii*, Indian Grey Mongoose *Herpestes edwardsii* and Smooth-coated Otter *Lutrogale perspicillata*. Pictures of the ratel, other mammals and Cauvery WS can be viewed at https://www.youtube.com/watch?v=WRNibpOxeSs.

Discussion

One Ratel image was obtained right on the southern boundary of Cauvery WS with Malai Mahadeshwara Hills Wildlife Sanctuary (MM Hills WS). Their similar ecological characteristics and habitat continuity mean that there is a strong likelihood of Ratel occurring in MM Hills WS, and a possibility that it might also occur in the eastern parts of Biligirirangaswamy Temple Tiger Reserve that adjoins MM Hills WS. Beyond Karnataka state, it is plausible, again based on habitat similarities, that Ratel also occurs in the adjoining state of Tamil Nadu within the neighbouring Sathyamangalam Tiger Reserve, North Cauvery Wildlife Sanctuary, and the reserved forests of Kestur, Bilikal, Mallahalli, Natrapalaiyam, Biligundlu, Voddappatti, Bevanurmalai and Badanavadi.

It was suggested that Ratel occurred at very low densities in Karnataka (Kumara & Singh 2007). However, this relatively

Table 1. Encounter rates of Ratel *Mellivora capensis* in different habitat types in Cauvery Wildlife Sanctuary, southern India, January–March 2014.

1	2	3	4
Habitat type	**Camera-trap effort (trap-days)**	**N° Ratel encounters**	**Ratel encounters/ 100 camera-trap-days**
Scrub forest	1,969	25	1.26
Dry deciduous forest	1,474	12	0.81
Riverine forest	198	4	2.02
Hardwickia binata plantation	11	0	0
OVERALL	3,652	41	1.12

frequent camera-trapping, with 41 photo-captures, suggests that it might not be all that uncommon locally. A wider occupancy survey, using a range of methods including camera-trapping, would help obtain a better understanding of the distribution of this cryptic species in Karnataka and neighbouring regions.

Acknowledgements

We are grateful to Karnataka Forest Department for permissions and all the field support. We also acknowledge the help of Deepak Bhat, Madhusudan and Kunjan in field data collection, H. C. Poornesha for GIS support and Ram Alluri for the video. The study was carried out with support from Whitley Fund for Nature and Kaplan Graduate Awards. We would like to thank two anonymous reviewers for useful suggestions on this manuscript.

References

Begg, K., Begg, C. & Abramov, A. 2008. *Mellivora capensis*. In: IUCN 2013. *IUCN Red List of Threatened Species*. Version 2013.2. <http://www.iucnredlist.org/details/41629/0> Downloaded on 8 June 2014.

Crawley, M. J. 2007. *The R book*. John Wiley & Sons, Sussex, U.K.

Karanth, K. U. 1986. Status of wildlife and habitat conservation in Karnataka. *Journal of the Bombay Natural History Society* 83(Supplement): 166–179.

[KFD] Karnataka Forest Department 2004. *Management plan of Cauvery Wildlife Sanctuary*. Government of Karnataka, Bangalore, India.

Kumara, H. N. & Singh, M. 2007. Small carnivores of Karnataka: distribution and sight records. *Journal of the Bombay Natural History Society* 104: 155–162.

[RDPR] Rural Development and Panchayat Raj, Government of Karnataka 2011. *Karnataka village level information system*. Government of Karnataka, Bangalore, India.

[TORGCCI] The Office of Registrar General & Census Commissioner of India 2001. *District census handbooks*. Ministry of Home Affairs, Government of India, New Delhi, India.

[WGEEP] Western Ghats Ecology Expert Panel 2011. *Report of the Western Ghats Ecology Expert Panel*. Ministry of Environment and Forests, Government of India. <http://moef.nic.in/downloads/public-information/wg-23052012.pdf>. Downloaded 3 July 2014.

[1]Nature Conservation Foundation, 3076/5, 4th Cross, Gokulam Park, Mysore – 570 002, India.
[2]Panthera, 8 West 40th Street, 18th Floor, New York, NY 10018, U.S.A.
Email: sanjaygubbi@gmail.com
[3]Deputy Conservator of Forests, Cauvery Wildlife Sanctuary, Karnataka Forest Department, Kollegala – 571 440, India.
Email: kvvasanthreddy@gmail.com

Further observations of Small-toothed Palm Civet *Arctogalidia trivirgata* in Namdapha National Park, Arunachal Pradesh, India

Krishna C. MURALI[1], Awadhesh KUMAR[1], Sunita KHATIWARA[2] and Chewang BONPO[3]

Abstract

There are few records of Small-toothed Palm Civet *Arctogalidia trivirgata* from India. Two recent records from Namdapha National Park, Changlang district, Arunachal Pradesh, are only the third and fifth recent records from India: a group filmed on 12 November 2012, and a single photographed on 10 March 2014.

Keywords: *Canarium strictum*, *Neolamarckia cadamba*, rarity, sighting, Three-striped Palm Civet

Small-toothed Palm Civet *Arctogalidia trivirgata* is a nocturnal, arboreal small carnivore distributed in India's North-eastern states, Yunnan (China), mainland SE Asia, Sumatra, Borneo and western Java (Corbet & Hill 1992). In India, there are very few records. A specimen was collected at Mokokchung in the Naga Hills (Nagaland) at 5,000 ft on 5 September 1919 (Wroughton 1921, Mills 1923). The origin of an 1856 specimen from Darjeeling, West Bengal (Sclater 1891, who located it in Sikkim) was queried by Choudhury (2013) because the site lies far from the known range. Sterndale (1884) indicated occurrence in 'Assam', an area then much larger than the present-day state, but gave no localities. A record from Sylhet (no precise locality; Blanford 1888–1891, Mills 1923, Pocock 1939) might also be from India, although most of this area is in present-day Bangladesh. The species has been said to occur, apparently based on second-hand reports, in hills and foothills to the south of the river Brahmaputra in Assam (Choudhury 1997a) supported by one village captive in Dibrugarh district in 1994 (A. U. Choudhury verbally to Kakati & Srikant 2014); in eastern Arunachal Pradesh, especially in the districts of Tirap, Changlang, Lohit and perhaps Dibang Valley (Choudhury 1997b); and in Manipur (Choudhury 2000), Mizoram and Tripura (Choudhury 2013). Apparently the only other published records from India are from Namdapha National Park, Changlang district, Arunachal Pradesh, in December 2009 (Naniwadekar *et al*. 2013), from Balpakram National Park, Meghalaya, in April 2013 (Choudhury 2013, Kakati & Srikant 2014), and from Dampa Tiger Reserve, Mizoram, in March 2014 (Raman & Zakhuma 2014).

On 12 November 2012, a group of four Small-toothed Palm Civets was recorded near the 'Hornbill Camp' at 27°32′14″N, 96°26′53″E (datum WGS84; recorded altitude 647 m) in Namdapha Tiger Reserve at 21h50 during research on flying squirrels. The civets were in a *Neolamarckia cadamba* tree at a height of 16.3 m (measured using a Bosch Laser distance measurer). During 10 minutes' observation (over some of which they were filmed; the resulting images are not of sufficient quality for printing here), the animals seemed undisturbed by the strong (6 V) yellow lights. They moved over tree branches, then slowly three individuals disappeared into dense canopy. One individual stared, motionless, at the spotlight for nearly five minutes, then also moved into the canopy. The forest guard and a villager who shared the observation said that they did not previously know of the presence of such a species. When the video was shown to three forest officials and four forest guards, they too expressed their ignorance towards the presence of this species in the park. This might reflect the nocturnal and arboreal nature of the species (see Duckworth & Nettelbeck 2008), and that most patrolling by the forest guards happens by day. Our point of sighting was about 1 km away (aerial distance) from the sighting of Naniwadekar *et al*. (2013). The animals observed, initially taken to be giant flying squirrels *Petaurista*, fitted the description in Naniwadekar *et al*. (2013) with no obvious differences.

On 10 March 2014 CB watched and photographed a solitary Small-toothed Palm Civet at 27°33′N, 96°29′E (within 700–800 m asl), approximately 1 km from the Rani Jheel area of Namdapha National Park, at 21h47 (Fig. 1). This point of

Fig. 1. Small-toothed Palm Civet *Arctogalidia trivirgata* in a *Canarium strictum* tree, near Rani Jheel, Namdapha National Park, India, on 10 March 2014 (Photo: Chewang Bonpo).

observation lies about 4.15 km straight-line distance from the November 2012 observation, and 5.15 km from the sighting of Naniwadekar *et al*. (2013). This Small-toothed Palm Civet was moving in a *Canarium strictum* tree at a height of 7 m from the ground.

Namdapha National Park is profiled in Ghosh (1987), Proctor *et al*. (1998), Datta *et al.* (2003) and Nath *et al.* (2005). During regular observations there since August 2011, KCM and AK observed Small-toothed Palm Civet only this once, despite about 160 hours of spotlighting research on flying squirrels. This covered 26 km of trails within a 110 km^2 part of the park's total 1,985 km^2. This suggests that Small-toothed Palm Civet could be rare in the surveyed part of the park. Naniwadekar *et al*. (2013) wondered if the rarity of the species's records in the park merely reflected the limited spotlighting to date. Because only a very small proportion of the park has yet been surveyed by spotlighting, nothing can be concluded about its abundance in the park as of now.

Acknowledgements

KCM and AK thank the Natural Resource Data Management System (NRDMS) division of Department of Science & Technology (DST) and Council of Scientific and Industrial Research (CSIR), Government of India, New Delhi and IDEA WILD for financial and equipment support respectively; the Principal Chief Conservator of Forest (Wildlife & Biodiversity), Arunachal Pradesh, and the Field Director of Namdapha National Park for permissions to survey and for logistical support; Anwaruddin Choudhury and Rohit Naniwadekar for their valuable inputs that helped us in improving the manuscript (they and Will Duckworth viewed the videos and agreed with the species identification); and Erebo Chakma, Bironjay Basumatary, Tinku Chakma and Japang Pansa for their assistance in the field. Also, special thanks to Jainy & Nosang Limbo for helping in sighting the species at Rani Jheel.

References

Blanford, W. T. 1888–1891. *The fauna of British India. Mammalia*. Taylor and Francis, London, U.K.

Choudhury, A. 1997a. The distribution and status of small carnivores (mustelids, viverrids and herpestids) in Assam, India. *Small Carnivore Conservation* 16: 25–26.

Choudhury, A. 1997b. Small carnivores (mustelids, viverrids, herpestids and one ailurid) in Arunachal Pradesh, India. *Small Carnivore Conservation* 17: 7–9.

Choudhury, A. 2000. Some small carnivore records from Nagaland, India. *Small Carnivore Conservation* 23: 7–9.

Choudhury, A. 2013. *The mammals of North east India*. Gibbon Books and the Rhino Foundation for Nature in NE India, Guwahati, Assam, India.

Corbet, G. B. & Hill, J. E. 1992. *The mammals of the Indomalayan region*. Natural History Museum Publications and Oxford University Press, Oxford, U.K.

Datta, A., Japang, P., Madhusudan, M. D. & Mishra, C. 2003. Discovery of the Leaf Deer *Muntiacus putaoensis* in Arunachal Pradesh: an addition to the large mammals of India. *Current Science* 84: 454–458.

Duckworth, J. W. & Nettelbeck, A. R. 2008. Observations of Small-toothed Palm Civets *Arctogalidia trivirgata* in Khao Yai National Park, Thailand, with notes on feeding technique. *Natural History Bulletin of the Siam Society* 55: 187–192.

Ghosh, A. K. 1987. *Quantitative analysis of faunal resources of proposed Namdapha Biosphere Reserve*. Report submitted to Zoological Survey of India, Calcutta, India.

Kakati, K. & Srikant, S. 2014. First camera-trap record of Small-toothed Palm Civet *Arctogalida trivirgata* from India. *Small Carnivore Conservation* 50: 50–53.

Mills, J. P. 1923. Bombay Natural History Society's mammal survey of India, Burma and Ceylon. Report No. 36. Naga Hills. *Journal of the Bombay Natural History Society* 29: 221–229.

Naniwadekar, R., Shukla, U., Viswanathan, A. & Datta, A. 2013. Records of small carnivores from in and around Namdapha Tiger Reserve, Arunachal Pradesh, India. *Small Carnivore Conservation* 49: 1–8.

Nath, P. C., Arunachalam, A., Khan, M. L., Arunachalam, K. & Barbhuiya, A. R. 2005. Vegetation analysis and tree population structure of tropical wet evergreen forests in and around Namdapha National Park, Northeast India. *Biodiversity and Conservation* 14: 2109–2135.

Pocock, R. I. 1939. *The fauna of British India, Including Ceylon and Burma. Mammalia*, 2nd edn, I. Taylor & Francis, London, U.K.

Proctor, J., Haridasan, K. & Smith, G. W. 1998. How far north does lowland evergreen tropical rain forest go? *Global Ecology and Biogeography Letters* 7: 141–146.

Raman, T. R. S. & Zakhuma 2014. Occurrence of Small-toothed Palm Civet *Arctogalidia trivirgata* in Dampa Tiger Reserve, Mizoram, India. *Small Carnivore Conservation* 50: 47–49.

Sclater, P. L. 1891. *Catalogue of Mammalia in the Indian Museum, Calcutta*, 2. Trustees of the Indian Museum, Calcutta, India.

Sterndale, R. A. 1884. *Natural history of the Mammalia of India and Ceylon*. Thacker, Spink & Co., Calcutta, India.

Wroughton, R. C. 1921. Scientific result from the mammal survey. No. XXVI (B): a new palm-civet from Assam. *Journal of the Bombay Natural History Society* 27: 600–601.

[1]Wildlife Resource & Conservation Laboratory, Department of Forestry, North Eastern Regional Institute of Science & Technology (NERIST), Deemed University, Nirjuli-791109 (Itanagar), Arunachal Pradesh, India.
[2]National Centre for Biological Sciences, GKVK Campus, Bangalore-560065 India.
[3]Bonfarmhouse, Kewzing, South Sikkim, India.
Emails: [1]muralikrishna.c@hotmail.com, tpileatus@gmail.com; [2]sunitak@ncbs.res.in; [3]chewangrinchen@gmail.com

Occurrence of Small-toothed Palm Civet *Arctogalidia trivirgata* in Dampa Tiger Reserve, Mizoram, North-east India

T. R. Shankar RAMAN[1] and ZAKHUMA[2]

Abstract

Single Small-toothed Palm Civets *Arctogalidia trivirgata* were seen and photographed on two consecutive nights in March 2014 in Dampa Tiger Reserve, Mizoram, India. They visited a fruiting tree used also by Masked Palm Civet *Paguma larvata* and Common Palm Civet *Paradoxurus hermaphroditus*. The present note describes the observation, adding to the few recent records of *A. trivirgata* from North-east India. The sighting was close to the location of a 1995 sighting of Stripe-backed Weasel *Mustela strigidorsa*, another species rarely recorded in the region. We suggest further targeted spotlighting and camera-trap surveys for better documentation of the occurrence and distribution of small carnivores in Dampa.

Keywords: Lushai hills, *Mustela strigidorsa*, northeast India, small carnivores, Stripe-backed Weasel, survey

Dampa Tiger Reserve (Dampa TR) is the largest protected area in the state of Mizoram in the Lushai hills of North-eastern India, having a core area of around 500 km^2 and buffer zone of 488 km^2. The Reserve is notable for its carnivore richness, with at least 11 small carnivore species reported (Zathang 2012, 2014). This paper provides photographic confirmation of Small-toothed Palm Civet *Arctogalidia trivirgata* in the tropical wet evergreen rainforests of the Reserve, which adds to the few recent confirmed records of the species in India (Choudhury 2013, Mudappa 2013, Naniwadekar *et al*. 2013, Kakati & Srikant 2014, Murali *et al*. 2014) and is an additional small carnivore species record for Dampa TR. While this civet species has been listed as occurring in Mizoram state (Choudhury 2013, Sawmliana 2013), no specifics of earlier records could be traced from Mizoram. The range of Small-toothed Palm Civet includes parts of Southeast Asia and South Asia (see Murali *et al*. 2014, for distribution and reports from India).

Between 22 and 28 March 2014, as part of a bird survey in Dampa TR, we were camped at Tuichar Puk, a cave (puk = cave in Mizo language). The cave is located at 23°40′19.6″N, 92°25′10.7″E (WGS 84 datum, elevation 350 m measured on a Garmin eTrex GPS, verified with altimeter) along Tuichar Lui, a perennial stream running through primary tropical wet evergreen forests. The forest canopy height is around 30–35 m with evergreen and some deciduous trees, and lianas, interspersed with tall (about 40 m) emergent trees such as *Dipterocarpus turbinatus*, *Tetrameles nudiflora* and *Artocarpus chaplasha*. Besides this forest type, Dampa TR has tropical semi-evergreen and moist deciduous forests and extensive bamboo and secondary forests, across the elevation range of about 100–1,100 m within the Reserve.

During our stay at Tuichar Puk, three species of civets were seen visiting and foraging on a particular fruiting tree that was less than 20 m away from the cave: Masked Palm Civet *Paguma larvata*, Small-toothed Palm Civet and Common Palm Civet *Paradoxurus hermaphroditus.* Single Masked Palm Civets were seen on the first two nights (Fig. 1). On 22 March, at 19h20, we heard branches rustle on the tree and when we scanned with torchlights, we saw the eye-shine of a Masked Palm Civet. The civet had prominent dark facial mask, greyish brown pelage, white whiskers, dark ears, and long tail (tail coloration not clear in dense vegetation). The civet, observed until 19h45 from a distance of about 25–30 m, did not appear disturbed and moved along the branches, remaining partly hidden in the dense canopy much of the time, foraging on the terminal branches that held clusters of fruit. When a field assistant moved to get a better look from below the tree, the civet unhurriedly walked along a branch to where it intersected a tall bamboo culm, then walked head first down the culm and disappeared into the forest.

Fig. 1. Masked Palm Civet *Paguma larvata* on fruiting tree, looking towards Small-toothed Palm Civet *Arctogalidia trivirgata* on liana on neighbouring tree. Dampa Tiger Reserve, Mizoram, India, 23 March 2014.

Fig. 2. (left) Faecal piles on the fruiting tree and (right) herbarium specimen with fruit and seeds (seeds from faeces placed on separate leaf on right include three seeds from fresh faeces on right). Dampa Tiger Reserve, Mizoram, India, 25 March 2014.

When examining the fruiting tree on 23 March, blackish conical piles (13 cm tall, 15–20 cm diameter) of seed-containing faeces, each clearly the result of multiple defecations and none very fresh, were observed on the sloping main trunk and branches (Fig. 2a). The tree, tentatively identified as a species of the family Oleaceae (Fig. 2b), was 117 cm in diameter at breast height and grew sloping towards the river, with its canopy at least 15 m above the ground.

On the night of 23 March, at 19h55, two civets were seen near Tuichar Puk: a Masked Palm Civet on the fruiting tree, and another civet which we first thought may be the same species, on a liana draped over a tall tree a few meters from the fruiting tree. This second civet kept looking towards the Masked Palm Civet but did not join it on the fruiting tree. When the animal moved to a better position on the liana we took a closer look through a pair of 8.5 x 42 Swarovski binoculars from a distance of less than 20 m, and observed that it was a Small-toothed Palm Civet. This individual had a dark face with dark (blackish) whiskers and pale (whitish) ears (Fig. 3). The animal's pelage was distinctly more brown than the greyish *Paguma*, unmarked dorsally but for three distinct dark stripes running along the top of the body to the rump, with a long brown tail darker in the distal half, appearing black for the last 12–15 cm towards the tip (Fig. 4). The Small-toothed Palm Civet, apparently ignoring us, moved down closer on the lianas to the same level as the fruiting tree's canopy, but did not move onto the fruiting tree. The Masked Palm Civet was also seen looking repeatedly in the direction of the other civet that was approximately 15–20 m away. No direct interaction between the two species was noticed, besides the apparent avoidance by the Small-toothed Palm Civet of the fruiting tree where the Masked Palm Civet was foraging. At 21h00, when we decided to leave the animals, the Masked Palm Civet was still foraging on the fruiting tree, and the Small-toothed Palm Civet moved higher up on the liana onto the taller tree's branches and was lost to sight.

On 24 March, soon after 20h00, two civets were again observed on the same fruiting tree. One was a Common Palm Civet, foraging in the dense branches, and only its head with more distinct white facial markings and dark throat were visible most of the time (Fig. 5). The second was a Small-toothed Palm Civet, also foraging on the branches with fruits. Although

Fig. 4. Small-toothed Palm Civet *Arctogalidia trivirgata* on liana. Left: view of tail and part of rear dorsal pelage showing dark stripes. Right: side view showing unmarked pelage except for dorsal stripes. Dampa Tiger Reserve, Mizoram, India, 23 March 2014.

Fig. 3. Small-toothed Palm Civet *Arctogalidia trivirgata* on a liana in Dampa Tiger Reserve, Mizoram, India, 23 March 2014.

Fig. 5. Common Palm Civet *Paradoxurus hermaphroditus* on fruiting tree in Dampa Tiger Reserve, Mizoram, India, 24 March 2014.

the two civets did not appear to have any close confrontation, 3–4 spitting snarls were heard at one point. It could not be confirmed which civet had made the sounds. The civets were observed foraging and moving for around 45 minutes, mostly hidden behind leaves and less than 10 m apart from each other. Both were still on the tree when we stopped observation to minimise disturbance.

On 25 March 2014, one of the conical faecal piles had fresh deposition on top, perhaps from one of the palm civets. Examining a small part of fresh and old faeces revealed seeds of this fruiting tree species in the old faeces, while the fresh faeces had one intact and one slightly damaged seed of the tree, and a third green seed of an unidentified plant species. During the day, White-throated Bulbuls *Alophoixus flaveolus* fed in the same tree, pecking at ripe fruit and swallowing bits of pulp. Civets were not seen again on the tree for the remainder of the stay at the cave, possibly because few ripe fruits remained.

Extensive camera-trapping and opportunistic surveys by Forest Department staff in Dampa TR since 2006 has recorded various small carnivores: camera-trap photographs of Yellow-throated Marten *Martes flavigula*, Hog Badger *Arctonyx collaris*, ferret badger *Melogale*, Large Indian Civet *Viverra zibetha*, Small Indian Civet *Viverricula indica*, Common Palm Civet, Masked Palm Civet, Binturong *Arctictis binturong* and Crab-eating Mongoose *Herpestes urva*; and field photographs of Asian Small-clawed Otter *Aonyx cinereus* (Zathang 2012, 2014, V. Lal Fala verbally 2014). The absence of camera-trap records of Small-toothed Palm Civet from Dampa TR may reflect the species's arboreal nature (see Willcox *et al*. 2012). Another possibility is that the species might have been overlooked in the camera-trap data, which could be investigated by further scrutiny of earlier camera-trap photographs. No systematic spotlighting surveys have been carried out for small carnivores in Dampa TR and this could be another reason why the species had not been sighted earlier.

Dampa TR might also have other small carnivore species remaining to be confirmed. Less than 50 m away from this Small-toothed Palm Civet sighting location, on 18 January 1995, TRSR had a fleeting glimpse of a Stripe-backed Weasel *Mustela strigidorsa*, then reputed to be one of the rarest and least-known mustelids in the world (Abramov *et al*. 2008). The animal, seen from a few meters away in poor light during early dawn, ran quickly across the rocks of Tuichar Lui and disappeared into a crevice. The dorsal stripe and throat appeared yellow against a rufous pelage; the animal had a bushy tail concolorous with the rest of the pelage. No other details could be noted. On the present survey, the location noted for the Tuichar cave (23°40′19.6″N, 92°25′10.7″E, about 30 m from the sighting location) is more accurate than the location (23°35′N, 92°22′E) reported to Abramov *et al*. (2008) for the sighting. One other small carnivore, the Spotted Linsang *Prionodon pardicolor*, is mentioned as occurring in Dampa TR (Zathang 2012), but no specific sight record or photograph is known (L. Zathang verbally 2014). It would be worthwhile to corroborate the presence of Stripe-backed Weasel and to confirm the possible occurrence of Spotted Linsang through baited camera-trap photographs in the future.

Additional surveys may determine if Small-toothed Palm Civet occurs elsewhere in the Reserve and surrounding landscapes, particularly if appropriate methodology such as spotlighting is used to survey for the species. Because the western edge of Dampa TR runs along the international boundary with Bangladesh, where the status of Small-toothed Palm Civet was reported as uncertain although suitable habitat remains in the adjoining hill tracts (Duckworth *et al*. 2008), the present report suggests the possibility of its occurrence in the wider region.

Acknowledgements

We thank the Mizoram Forest Department, especially the Field Director of Dampa Tiger Reserve, Lalthanhlua 'Tlana' Zathang for inviting us to do the survey, besides providing permits, and financial and logistics support. Thanmawia and Muankima provided excellent field assistance during fieldwork and camping, for which we are grateful. We also thank Divya Mudappa, William Duckworth and two referees for helpful suggestions. TRSR is also grateful to Kimthanga, who first took him to Tuichar Puk, and introduced him to these wonderful forests.

References

Abramov, A. V., Duckworth, J. W., Wang, Y. X. & Roberton, S. I. 2008. The Stripe-backed Weasel *Mustela strigidorsa*: taxonomy, ecology, distribution and status. *Mammal Review* 38: 247–266.

Choudhury, A. 2013. *The mammals of North east India.* Gibbon Books and the Rhino Foundation for Nature in NE India, Guwahati, Assam, India.

Duckworth, J. W., Timmins, R. J., Roberton, S., Long, B. & Azlan, A. 2008. *Arctogalidia trivirgata*. In: IUCN 2014. *IUCN Red List of Threatened Species*. Version 2014.1. <www.iucnredlist.org>. Downloaded on 25 June 2014.

Kakati, K. & Srikant, S. 2014. First camera-trap record of the Small-toothed Palm Civet *Arctogalida trivirgata* from India. *Small Carnivore Conservation* 50: 50–53.

Mudappa, D. 2013. Herpestids, viverrids and mustelids. Pp. 471–498 in Johnsingh, A. J. T. & Manjrekar, N. (eds) *Mammals of South Asia*, 1. Universities Press, Hyderabad, India.

Murali, K. C., Kumar, A., Khatiwara, S. & Bonpo, C. 2014. Further observations of Small-toothed Palm Civet *Arctogalidia trivirgata* in Namdapha National Park, Arunachal Pradesh, India. *Small Carnivore Conservation* 50: 45–46.

Naniwadekar, R., Shukla, U., Viswanathan, A. & Datta, A. 2013. Records of small carnivores from in and around Namdapha Tiger Reserve, Arunachal Pradesh, India. *Small Carnivore Conservation* 49: 1–8.

Sawmliana, M. 2013. *The book of Mizoram plants (includes wild animals, birds, etc.)*, 2nd edn. P. Zahkuma, Chanmari West, Aizawl, Mizoram, India.

Willcox, D. H. A., Tran Q. P., Vu L., Tran V. B. & Hoang M. D. 2012. Small-toothed Palm Civet *Arctogalidia trivirgata* records from human-influenced habitats in Vietnam. *Small Carnivore Conservation* 47: 46–53.

Zathang, T. 2012. Dampa: out of woods? *Cheetal* 50(2): 14–36.

Zathang, L. 2014. *Tiger conservation plan Dampa Tiger Reserve 2013-14 to 2022-23*. Mizoram Forest Department, West Phaileng and Aizawl, Mizoram, India.

[1]Nature Conservation Foundation, 3076/5, 4th Cross, Gokulam Park, Mysore 570002, India.
[2]Dampa Tiger Reserve, P. O. West Phaileng 796431, Mizoram, India.
Emails: [1]trsr@ncf-india.org; [2]zakhumadon@gmail.com

First camera-trap record of Small-toothed Palm Civet *Arctogalida trivirgata* from India

Kashmira KAKATI* and Shikha SRIKANT

Abstract

An April 2013 camera-trap record of Small-toothed Palm Civet *Arctogalida trivirgata* in Balpakram National Park, Meghalaya, constitutes the first camera-trap record of the species from India, and one of few records by any method from the country.

Keywords: Balpakram National Park, Meghalaya, shifting cultivation

Indian records of Small-toothed Palm Civet

Among the many proposed subspecies of Small-toothed Palm Civet *Arctogalidia trivirgata*, three groups are typically recognised: *A. t. leucotis* and allied forms, from mainland areas north of the Thai–Malay peninsula; *A. t. trivirgata* and allied forms from the Thai–Malay peninsula, Sumatra and Borneo; and *A. t. trilineata* from Java (Van Bemmel 1952, Corbet & Hill 1992).

There are few records of Small-toothed Palm Civet from the Indian sub-continent. The species has been considered to be very rare in the region (e.g. Choudhury 1999), although surveys among hunters suggest that it might be recorded only rarely because it is nocturnal and arboreal (Choudhury 2013). There may be only one historical record from India, from Nagaland in 1919 (Wroughton 1921). There are also statements of occurrence in Darjeeling (see below) and Sylhet, which lies mostly in present-day Bangladesh and the precise locality of the civet is not recorded (Blanford 1888–1891, Sclater 1891). There seem to have been no Indian records between 1919 and 1994. Since then, there have been five first-hand records from three sites, all in North-east India: (i) a captured juvenile seen at the village of Kothalguri, Dibrugarh district, in the state of Assam in 1994 and later released into the Upper Dehing (West Block) Reserve Forest (RF) near the village by A. U. Choudhury (verbally 2014). The animal is believed to have been caught somewhere in the belt of wet evergreen forest on the Assam (Tinsukia district) – Arunachal Pradesh (Tirap district) border (Choudhury 2013); (ii) three sightings at Namdapha National Park, Arunachal Pradesh, in 2009, 2012 and 2014 (Naniwadekar *et al*. 2013, Murali *et al*. 2014); and (iii) a sighting at Dampa Tiger Reserve, Mizoram state in 2014 (Raman & Zakhuma 2014).

We hereby add Balpakram National Park, Meghalaya state, also in North-east India, as another locality record in India for the Small-toothed Palm Civet. This record is the first in India by the camera-trap method.

Study area

The Balpakram–Baghmara Landscape is approximately 600 km^2 and is located in the South Garo Hills district of the state of Meghalaya, North-east India. Government-owned forests cover 68% of the landscape and comprise two protected areas, Balpakram National Park (notified area 220 km^2 + 132 km^2 acquired but yet to be notified) and Siju Wildlife Sanctuary (5.18 km^2), and two Reserve Forests (RF): Baghmara RF (43.9 km^2) and Rewak RF (6.47 km^2) (Fig. 1). The remaining is community land of the Garo tribe, where land use includes shifting cultivation, areca nut, cashew and rubber plantations, community forests and village settlements. Altitude ranges from 50 to 1,023 m asl at Chutmang peak. Both primary and secondary stands of Tropical Moist Evergreen Forest, Tropical Semi-evergreen Forest and Tropical Moist Deciduous Forest, as defined by Champion & Seth (1968), occur here, as do grasslands, shola and riparian forests and degraded land (Kumar & Rao 1985). The terrain is hilly with deep gorges and limestone formations (Wanniang & Thiek 2007).

Methods

Systematic camera-trapping under a three-year project 'Assessing Mammal Presence in the Balpakram–Baghmara Landscape, Meghalaya, India' is underway. The study design uses 2 km × 2 km grid cells where eight camera-traps per cell are deployed for 10 consecutive days. Two to three cells are sampled per camera-trap session, with each cell sampled once. During January to May 2013 and November 2013 to April 2014, 24 cells were sampled. At one station, the camera-trap was stolen. Therefore, results were obtained from camera-traps deployed at 191 different stations for a total of 1,910 camera-trap-nights. Camera-trap stations are selected after sign surveys in each cell.

A sign survey in the Chutmang West grid cell on 24 March 2014 revealed tracks probably of Leopard Cat *Prionailurus bengalensis*, another larger but indistinct carnivore track and remains of a freshly killed crab on the Agisep stream bed, as well as Sambar *Rusa unicolor* droppings further along the trail.

New record

A Small-toothed Palm Civet was camera-trapped at 20h33 on 2 April 2013 in Balpakram National Park (Fig. 2). The camera-trap station (Fig. 3), in an area of Tropical Moist Evergreen forest on a low, south facing slope of the Chutmang hills, was in the Chutmang West grid cell in the rocky Agisep stream at 25°18′14″N, 90°44′05″E (datum WGS84) at a nominal altitude of 693 m (recorded with a Garmin Etrex GPS). The camera-trap was facing, and six feet from, where a narrow foot-trail crossed the stream-bed. The Chutmang peak was about 880 m northeast of this location. At the time of survey, the stream had very little flowing water. It broke the canopy by about 15 m.

Tree species such as *Walsura robusta* and *Mesua ferrea* formed a closed canopy on either side of the stream, with cane

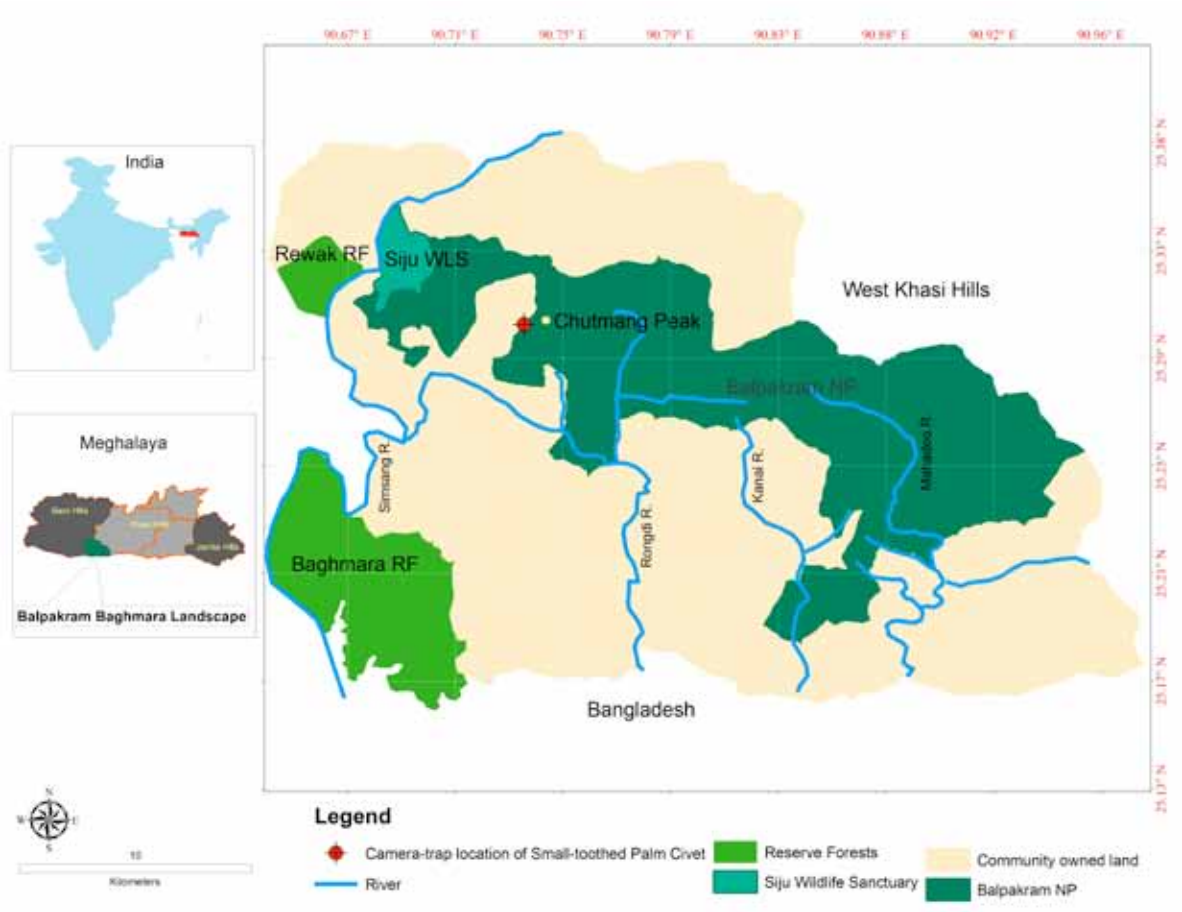

Fig. 1. The Balpakram–Baghmara Landscape, Meghalaya, India, showing location of camera-trapped Small-toothed Palm Civet *Arctogalida trivirgata*.

Fig. 2. Camera-trap photograph of Small-toothed Palm Civet *Arctogalida trivirgata*, Balpakram National Park, Meghalaya, India, on 2 April 2013.

Fig. 3. Camera-trap station where a Small-toothed Palm Civet *Arctogalida trivirgata* was photographed in Balpakram National Park, Meghalaya, India, on 2 April 2013.

and ferns on the bank slopes. Canopy height, estimated visually, was over 25 m. The camera-trap was fixed to a fallen log, 1 foot above ground level. The camera-trap station was 100–130 m inside the Balpakram National Park boundary, just outside which lay shifting cultivation or *jhum* areas of the village of Meduawe. This included open grassy fields and 2-year *jhum* fallows dominated by *Macaranga denticulata*.

Other species photographed at this camera-trap station were Crab-eating Mongoose *Herpestes urva*, an unidentified weasel *Mustela*, Asiatic Brush-tailed Porcupine *Atherurus macrourus* and Sambar. Chutmang peak and the Balpakram plateau in the National Park are sites of cultural and scenic interest for the Garos, especially for those who retain traditional belief. People from the local area as well as other parts of the Garo Hills often visit these two sites on day-trips. People were photographed at the camera-trap station on three of the

10 camera-trap-days. On the day of camera-trap deployment itself (25 March 2013), 23 young people were photographed walking up or down the trail between 11h00 and 15h00. A few of the youth piled stones and sticks, considered a token ritual offering to spirits, on the two rocks between which the Small-toothed Palm Civet is seen in the photograph.

Discussion

This is the first published camera-trap record of the Small-toothed Palm Civet from India, and the first confirmed record of the species for the state of Meghalaya. Meghalaya may represent the western distribution limit of Small-toothed Palm Civet, if its Indian range is limited to forests south of the Brahmaputra river as proposed by Choudhury (2013). A record from over 150 years ago from Darjeeling district (Sclater 1891) is located in present day West Bengal, and is from west of Meghalaya. Citing the lack of any nearby record since, however, Choudhury (2013) doubted its validity, while conceding it to be possible. We were unable to locate references to camera-trap records of the northern (Indo-chinese) subspecies-group except for one photograph of a dead animal being carried by a hunter in Veunsay, Cambodia (B. Rawson per J. W. Duckworth *in litt*. 2014). One animal, however, was captured in a chicken-baited cage-trap kept at ground level in Phu Khieo Wildlife Sanctuary in north-eastern Thailand during a carnivore study in 1998–2002 (Lon Grassman *in litt*. 2014). On the other hand, the Sundaic forms are camera-trapped occasionally, at least in Borneo (e.g. Fig. 11b in Eaton *et al*. 2010).

It has been suggested that even where common, the species is not often detected on camera-traps because of its mainly arboreal nature; and therefore a lack of camera-trap records does not imply it is rare (Walston & Duckworth 2003, Duckworth & Nettelbeck 2008, Willcox *et al*. 2012). No photographs were obtained during 2,240 camera-trap-nights at Namdapha (Datta *et al* 2008), a site known to hold the species (Murali *et al*. 2014), nor in over 3,000 camera-trap-nights across the Jeypore–Dehing Landscape (Kakati 2010), which includes the Upper Dehing (West Block) Reserve Forest, near where A. U. Choudhury (verbally 2014) has the only first-hand record for Assam. Both Namdapha and the Jeypore–Dehing Landscape have tall, wet evergreen forest (Assam Valley Tropical Wet Evergreen forest, category 1B/C1; Champion & Seth 1968); most or all records from South-east Asia of the northern forms of Small-toothed Palm Civet come from evergreen forest (e.g. Duckworth 1997, Walston & Duckworth 2003, Duckworth & Nettelbeck 2008, Willcox *et al*. 2012).

Even though the Jeypore–Dehing Landscape in Assam has a previous record of Small-toothed Palm Civet, this civet was not detected during several spotlight surveys there in 2007–2010 by KK. In over 32 hours of spotlighting on 20 days (mostly from a jeep, some on foot) KK had about 50 animal sightings. This included Red Giant Flying Squirrel *Petaurista petaurista candidula* (20 sightings), Common Palm Civet *Paradoxurus hermaphroditus* (eight sightings involving 10 animals), Large Indian Civet *Viverra zibetha* (two sightings), Small Indian Civet *Viverricula indica* (two sightings), Masked Palm Civet *Paguma larvata* (one sighting of two animals) and Particoloured Flying Squirrel *Hylopetes alboniger* (one sighting), among other species. In limited spotlighting (8 hours) from a vehicle in the Baghmara Reserve Forest of the Balpakram–Baghmara Landscape in 2014, we had 12 animal sightings including Common Palm Civet (two sightings), Bengal Slow Loris *Nycticebus bengalensis* (two sightings) and Asian Elephant *Elephas maximus* (four sightings of groups). It is therefore possible, given the number of other arboreal animals seen, that Small-toothed Palm Civet is indeed rare in the Indian part of its range.

Acknowledgements

The project is funded by a research grant from the Science and Engineering Research Board (SERB), Department of Science and Technology, Ministry of Science and Technology, Government of India to KK through Samrakshan Charitable Trust, New Delhi. At the Department of Environment and Forests, Government of Meghalaya, for permissions and the support provided, we thank Principal Chief Conservator of Forests T. Marak, Wildlife Warden C. Budnah, Divisional Forest Officer (DFO) S. N. Sangma and DFO Balpakram National Park P. R. Marak; Assistant Conservators of Forests M. M. Sangma and C. G. Momim; and Forest Guards Tusar Sangma, Witness Marak, Sontos Sangma, P. D. Sangma and Bitra Sangma. We are grateful to the Nokmas and villagers of Balpakram and to our field guides Jonesh, Winilson, Jahanal, Susilas, Joyhind, Lambu, Newel, Aton, Gerong and Senson and camp assistants Babul and Kenet. We acknowledge Kamal Medhi for providing GIS support and the field team of Samrakshan Charitable Trust for logistic support in 2013.

References

Blanford, W. T. 1888–1891. *The fauna of British India. Mammalia*. Taylor and Francis, London, U.K.

Champion, H. G. & Seth, S. K. 1968. *A revised survey of the forest types of India*. Government of India Press, New Delhi, India.

Choudhury, A. U. 1999. Mustelids, viverrids and herpestids of North-eastern India. *ENVIS Bulletin (Wildlife and Protected Areas)* 2(2): 43–47.

Choudhury, A. 2013. *The mammals of North east India*. Gibbon Books and the Rhino Foundation for Nature in NE India, Guwahati, Assam, India.

Corbet, G. B. & Hill, J. E. 1992. *The mammals of the Indomalayan region*. Natural History Museum Publications and Oxford University Press, Oxford, U.K.

Datta, A., Naniwadekar, R. & Anand, M. O. 2008. Occurrence and conservation status of small carnivores in two protected areas in Arunachal Pradesh, North-east India. *Small Carnivore Conservation* 39: 1–10.

Duckworth, J. W. 1997. Small carnivores in Laos: a status review with notes on ecology, behaviour and conservation. *Small Carnivore Conservation* 16: 1–21.

Duckworth, J. W. & Nettelbeck, A. R. 2008. Observations of Small-toothed Palm Civets *Arctogalidia trivirgata* in Khao Yai National Park, Thailand, with notes on feeding technique. *Natural History Bulletin of the Siam Society* 55: 187–192.

Eaton, J. A., Wüst, R., Wirth, R., Shepherd, C. R., Semiadi, G., Hall, J. & Duckworth, J. W. 2010. Recent records of the Javan Small-toothed Palm Civet *Arctogalidia* (*trivirgata*) *trilineata*. *Small Carnivore Conservation* 43: 16–22.

Kakati, K. 2010. *Camera-trapping survey of carnivores in the Jeypore–Dehing Landscape, Assam, India*. Final Report to the Critical Ecosystem Partnership Fund – Eastern Himalaya. Guwahati, India.

Kumar, Y. & Rao, R. R. 1985. Studies on Balpakram Wildlife Sanctuary in Meghalaya. 3. General account, forest types and fauna. *Indian Journal of Forestry* 8(4): 300–309.

Murali, K. C., Kumar, A., Khatiwara, S. & Bonpo, C. 2014. Further observations of Small-toothed Palm Civet *Arctogalidia trivirgata* in Namdapha National Park, Arunachal Pradesh, India. *Small Carnivore Conservation* 50: 45–46.

Naniwadekar, R., Shukla, U., Viswanathan, A. & Datta, A. 2013. Records of small carnivores from in and around Namdapha Tiger Reserve, Arunachal Pradesh, India. *Small Carnivore Conservation* 49: 1–8.

Raman, T. R. S. & Zakhuma 2014. Occurrence of Small-toothed Palm Civet *Arctogalidia trivirgata* in Dampa Tiger Reserve, Mizoram, India. *Small Carnivore Conservation* 50: 47–49.

Sclater, P. L. 1891. *Catalogue of Mammalia in the Indian Museum, Calcutta*. Part 2. Trusties of the Indian Museum, Calcutta, India.

Van Bemmel, A. C. V. 1952. Contribution to the knowledge of the genera *Muntiacus* and *Arctogalidia* in the Indo-Chinese archipelago (Mammalia, Cervidae & Viverridae). *Beaufortia* 2 (16): 1–50.

Walston, J. L. & Duckworth, J. W. 2003. The first record of Small-toothed Palm Civet *Arctogalidia trivirgata* from Cambodia, with notes on surveying this species. *Small Carnivore Conservation* 28: 12–13.

Wanniang, T. & Thiek, R. L. 2007. *Draft management plan of Balphakram National Park, South Garo Hills, Meghalaya for the year 2007 to 2012*. Balpakram National Park Division, Meghalaya, India.

Willcox, D. H. A., Tran Q. P., Vu L., Tran V. B. & Hoang M. D. 2012. Small-toothed Palm Civet *Arctogalidia trivirgata* records in human-influenced habitats in Vietnam. *Small Carnivore Conservation* 47: 46–53.

Wroughton, R. C. 1921. Scientific result from the mammal survey. No. XXVI (B): a new palm-civet from Assam. *Journal of the Bombay Natural History Society* 27: 600–601.

Madhuban Hill, Government Press Road, P.O. Bamunimaidam, Guwahati-781021, Assam, India.
***Email: kashmirak@hotmail.com**

Suggested English names for Madagascar's species of Carnivora

J. W. DUCKWORTH[1], A. F. A. HAWKINS[2], Harison RANDRIANASOLO[3], Aristide ANDRIANARIMISA[4] and S. M. GOODMAN[5]

Abstract

Madagascar is the only faunal region to which all native species of Carnivora are endemic. These species comprise the family Eupleridae, itself endemic to Madagascar. Until recently, these animals were generally taken to be island representatives of mongooses (Herpestidae) and civets (Viverridae), but genetic investigation proves that they are all descended from one colonisation by a species neither a civet nor a mongoose. Many of the widely used English names for most of the species, such as 'Malagasy Civet' for *Fossa fossana* and 'Malagasy Narrow-striped Mongoose' for *Mungotictis decemlineata*, thus suggest misleading evolutionary relationships. Furthermore, most of the species have multiple English names in use in the main sources used by those who prefer English names to scientific names: over three dozen names for the 11 species here recognised. This inconsistency risks increasing confusion when referring to species. English names that do not suggest incorrect relationships are already available (derived from Malagasy names for these animals) and to some extent in use. Here we recommend one name for each species as unambiguous, short, and not taxonomically misleading. Several other members of the Order Carnivora elsewhere in the world where genetic investigations have dramatically revised previously accepted relationships remain known by taxonomically misleading English names.

Keywords: common name, Eupleridae, misleading name, nomenclature, vernacular name

Tolotra anarana amin'ny teny anglisy ho fiantsoana ireo biby mpihinana hena manta Malagasy

Fehiny

Toeram-ponenan'ny biby tena miavaka loatra i Madagasikara satria ireo karazam-biby mpihinana hena manta mivelona araboajanahary rehetra ao aminy dia tokana aman-tany. Voasokajy ao amin'ny fianakaviana Eupleridae, izay tsy hita raha tsy ao Madagasikara ihany koa, ireo karazana ireo. Hoan'ireo karazana samihafa era-tany ao anatin'ny fokon'ireo biby mpihinana hena manta, na dia nisy aza ny fandalinana ara-tarazo maty paika dia mbola misy ihany ny fametrahana anarana mampifangaro ny fiaviana. Noheverina foana fa mitovy fiaviana amin'ireo Mangosta sy ny havany akaiky (Herpestidae) ary ny Sivety (Viverridae) any amin'ny firenena hafa ireo biby voalaza ireo teo aloha. Ny fikarohana ny tarazo anefa dia manamarina fa tena hafa tokoa izy ireo satria sady tsy Sivety no tsy Mangosta. Izany indrindra no ilazana etoana fa maro amin'ireo anarana teny anglisy iantsoana ireo karazana biby Malagasy ireo no mila fanitsiana, tahaka ny filazana fa ny 'Malagasy Civet' dia *Fossa fossana* ary ny 'Malagasy Narrow-striped Mongoose' dia *Mungotictis decemlineata.* Mitarika fikorontanana tanteraka eo amin'ny fiantsoana azy ireo izany tranga izany. Manampy trotraka izany koa ny fisian'ireo anarana teny anglisy maromaro izay be mpampiasa tokoa, entina hiantsoana karazana iray (Misy ireo tia mampiasa kokoa ny teny anglisy noho ireo anarana siantifika). Maherin'ny 36 ireo anarana entina hilazana ny karazana 11 misy. Ireo anarana amin'ny teny anglisy izay tsy mametraka mivantana ny fifandraisana arapivoarana biolojika dia misy ary efa ampiasaina (nitsiry avy tamin'ny anarana teny Malagasy an'ireo biby). Izany tsy fifanarahana rehetra izany dia tena mitarika savorovoro. Anarana tokana, fohy sady mazava, ary tsy atahorana hifangaro amin'ny hafa isaky ny karazana àry no atolotray etoana.

Background

Madagascar supports the most taxonomically distinct assemblage of the order Carnivora (hereafter 'carnivore') found anywhere in the world. None of the major faunal regions with native Carnivora—Palaearctic, Oriental (Indomalayan), Ethiopian (Afrotropical), Nearctic and Neotropical—has its entire native species complement composed of forms unique to the region in question. By contrast, in Madagascar all native carnivores belong to the family Eupleridae, and this family is confined to Madagascar (Goodman 2009). Reflecting obsolete taxonomic thinking, many commonly used English names for these animals obscure their evolutionary distinctiveness. For example, *The IUCN Red List of Threatened Species* (IUCN 2013) gives such primary (i.e. recommended from among those listed) English names as 'Malagasy Civet' for *Fossa fossana* and 'Malagasy Narrow-striped Mongoose' for *Mungotictis decemlineata*. These animals do indeed look and behave somewhat like civets (Viverridae) and mongooses (Herpestidae), respectively (Fig. 1). But these names suggest that these animals are simply Madagascar's representatives of the widespread civets and mongooses, so mask the animals' phylogenetic distinctiveness and their remarkable exemplification of convergent evolution.

The proposal of new English names for species that already have them should be avoided wherever possible, because the use of multiple names for one species leads to confusion among the people who rely on them: those with a disinclination to use scientific names (many of the general public). However, other English names not implying misleading relationships are already used by some sources for these animals. Although less widely used outside Madagascar at present, we

Fig. 1. Some of Madagascar's carnivores (left) and the superficially similar animals found elsewhere (right). Top left, Ring-tailed Vontsira *Galidia elegans*, and top right, Common Slender Mongoose *Herpestes sanguineus*; centre left, Spotted Fanaloka *Fossa fossana*, and centre right, Malay Civet *Viverra tangalunga*; lower left, Fosa *Cryptoprocta ferox*. There is no lower right image, because no animal in Africa or Asia particularly closely resembles a Fosa. This is no doubt why it has, uniquely among Madagascar's carnivores, been known in English since scientific discovery by its Malagasy name, rather than by a phylogenetically misleading one (Photos: Nick Garbutt (www.nickgarbutt.com) except top right, by Emmanuel Do Linh San).

propose that these should therefore be employed globally and that the 'mongoose' and 'civet' names should be expunged from use for Madagascar's carnivores.

English names of species (e.g. White-tailed Mongoose *Ichneumia albicauda*) are often comprised of a 'group name', which occurs in the name of multiple species (here, 'mongoose') and a 'modifier' that indicates the species within the group (here, 'White-tailed'). Where a group is monospecific (e.g. Aardwolf *Proteles cristata*) or an idiosyncratic name is given to a species within a multi-species group (e.g. Tiger *Panthera tigris*, on conventional classification), no modifier is needed.

The range of existing English names

Table 1 shows the great inconsistency in English names for Madagascar's carnivore species as given in various widely-used sources, including *Mammal species of the world* (Wozencraft 2005), *Handbook of the mammals of the world* (Goodman 2009), the most-used field guide to Madagascar's mammals as a whole (Garbutt 2007), and *The IUCN Red List of Threatened Species* (IUCN 2013). This abundance of names in itself impedes communication because people accustomed to using one name may not realise that the same species is being referred to under another. This problem alone argues for the selection and promotion of the most appropriate name for each species. Much thought has gone into the English names for birds, including attempts to supply a 'global standard': one unique, unambiguous and non-misleading name for each species (e.g. Cheesman & Oehser 1937, King *et al*. 1975, Sibley & Monroe 1990, Gill & Wright 2006). English names of mammals have received much less attention (Wilson & Cole 2000, Duckworth & Pine 2003, Grubb 2006).

Existing English names for Madagascar's carnivores fall into two categories: (i) those with no vernacular heritage for the Madagascar species, but invented by zoologists using existing English names of other animals for basic group names ('civet' and 'mongoose'); and (ii) Malagasy words used with or without English language modifiers such as 'Broad-striped' and 'Madagascar'. All names in the former category are now problematic through their implication of close relationship to animals outside the Eupleridae. Before genetic investigations, some Madagascar carnivores were believed to be mongooses and others civets (e.g. Schreiber *et al*. 1989). Thus, names using 'civet' and 'mongoose' were not, according to the beliefs of the day, taxonomically misleading. However, there is now no doubt that the native Madagascar carnivores arose from a single ancestor that was neither a civet nor a mongoose (Veron & Catzeflis 1993, Yoder *et al*. 2003). Thus, English names that do not suggest misleading relationships must come either from the Malagasy language, or, as a last resort, be newly coined.

Many Malagasy vernacular names have been documented for the island's carnivores (Goodman 2012). Only one, 'fosa', has so far been the basis for an English name in pre-eminent use outside Madagascar. Confusingly, in English ('Fossa' or 'Fosa') this means *Cryptoprocta ferox*, yet a different Madagascar carnivore has the scientific name *Fossa fossana*. The original, correct, use of this name is for *Cryptoprocta* (e.g. Goodman 2012). Unfortunately, by the International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature 1999), *Fossa* must remain permanently in use as a scientific name for a different animal. This animal, *F. fossana*, is widely called 'fanaloka' in Madagascar.

'Fanaloka' is applied by the Malagasy also to *Eupleres* and even *Salanoia* (Goodman 2012). This is assumed to be the same word which when applied to *Eupleres* in English is typically transcribed as 'falanouc' or, much less often, 'fanalouc' (e.g. Schreiber *et al*. 1989) or 'fanaluk' (e.g. Haltenorth & Diller 1980). These spellings appear to be transcription errors. 'Falanouc' is not itself a Malagasy word (HR pers. obs.); even to western ears, 'fanaloka' is certainly a better rendition of the spoken word. Goodman (2012) did not record 'falanouc' for any species; and in numerous discussions with rural Malagasy at localities scattered across the island from 1988 to 2007, AFAH has never heard villagers distinguishing 'fanaloka' and 'falanouc' as two animals or words.

Another problematic name in use in Madagascar is '*jaboady*'. This is generally applied to the introduced Small Indian Civet *Viverricula indica* (Goodman 2012). The word itself is evidently also an introduction, being used for this same species in its Indian native range (Wroughton 1912 ['jabadio'], Rao *et al*. 2007 ['jawadi']). It is doubtless related to the Arabic word 'al zabad' for civet (see Dannenfeldt 1985). The name is applied sometimes to other species (e.g. Hawkins 1994), although whether this results from identification error (people think the animal in question is Small Indian Civet), non-specificity or a genuine, species-specific use by at least the interlocutor in question has not been documented.

Selecting the optimal English name for each species

Table 1 presents, for each species, our chosen English name and the alternative names as used in publications available to the general public. Long experience with bird names has shown that the English names most likely to be optimal are familiar (even better if in established usage), non-ambiguous, short and informative (summarised in Duckworth & Pine 2003).

Cryptoprocta
Because of the conflict over which animal is referred to by 'fossa' in English and scientific nomenclature, the spelling 'fosa', the direct Malagasy spelling (Goodman 2012), is superior. Although it is far less widely used than is 'fossa', it is starting to appear (e.g. Garbutt 2007). A second species of the genus, Giant Fosa *C. spelea*, survived to about 1,500 years before present (Goodman *et al*. 2004, Crowley 2010). Because this second species is now extinct, it seems unnecessary to require *C. ferox* to have a modifier to prevent 'fosa' being both a species name and a group name for two species.
Recommendation: *Cryptoprocta ferox*: Fosa

Eupleres
Although several Malagasy names have been documented for this genus (Goodman 2012), of them only 'falanouc' (and variant spellings) seems ever to have been used in English and thus this, despite its etymological bastardy (see above), is the only non-destabilising group name for the genus. This would constitute also the full species name if the genus is consid-

Table 1. English names in use for Madagascar's species of Carnivora.

Scientific name	Optimal English name	Alternative English names
Cryptoprocta ferox	Fosa[3,7,9]	Fossa[1,2,4,5,6,(7),8]
Eupleres goudotii sensu lato	n/a (Falanouc[2,3,5,7,9])	Malagasy Mongoose[(1)], Slender Falanouc[(1)], Small-toothed Mongoose[(1),8], Fanalouc[6]
Eupleres goudotii sensu stricto	Eastern Falanouc[7]	Falanouc[1]
Eupleres major	Western Falanouc	Major's Falanouc[1], Giant Falanouc[7]
Fossa fossana	Spotted Fanaloka[1,3,(7)]	Malagasy Civet[(1),2,5,6,(7)], Striped Civet[(1),8], Malagasy Striped Civet[4,(7)], Fanaloka[7,9]
Galidia elegans	Ring-tailed Vontsira[1,3,7]	Malagasy Ring-tailed Mongoose[(1),5,6], Ring-tailed Mongoose[(1),2,4,(7),8,9]
Galidictis fasciata	Broad-striped Vontsira[1,3,7]	Malagasy Broad-striped Mongoose[(1),6], Broad-striped Mongoose[(1),5,8,9], Broad-striped Malagasy Mongoose[2,(7)]
Galidictis grandidieri	Grandidier's Vontsira[1,3,7]	Grandidier's Mongoose[(1),2], Giant-striped Mongoose[(1),5,(7)], Giant Striped Mongoose[6,9]
Mungotictis decemlineata sensu lato	n/a (Bokiboky)	Malagasy Narrow-striped Mongoose[(1),5,6], Narrow-striped Mongoose[(1),2,4,(7),8,9], Narrow-striped Boky[1,3,7]
Mungotictis decemlineata sensu stricto	Northern Bokiboky	
Mungotictis lineata	Southern Bokiboky	
Salanoia concolor	Brown-tailed Vontsira[1,3,7]	Malagasy Brown-tailed Mongoose[(1),6], Brown-tailed Mongoose[(1),2,5,(7),9], Salano[(1),(7)], Plain Mongoose[8]
Salanoia durrelli	Durrell's Vontsira	Durrell's Salanoia[1]

A reference in parentheses indicates that the source gives this name as an alternative (specifically, called a 'former name' in Goodman 2012); note that not all sources contain all species. Guidance on pronunciation is given in the Appendix.
1, Goodman (2012); 2, Wozencraft (2005); 3, Goodman (2009); 4, Goodman & Benstead (2003); 5, *The IUCN Red List of Threatened Species* (IUCN 2013); 6, Schreiber *et al*. (1989); 7, Hunter & Barrett (2011); 8, Haltenorth & Diller (1980); 9, Garbutt (2007).

ered monospecific. If two species in the genus are accepted (as by Goodman & Helgen 2010), the segregate needs an English name and the name for the residual requires a modifier. 'Major's Falanouc' is unsuitable for *E. major*: although the original description of the taxon (Lavauden 1929) lacked an explicit etymology of '*major*', this word can mean 'larger' in Latin: because the name is introduced directly after the author's statement that the animal is much bigger than is *E. goudotii*, it was plausibly used by him in this sense. Some Madagascar animals are named after C. I. Forsyth Major, but it seems implausible this was Lavauden's intent: Major collected no *Eupleres* (Jenkins & Carleton 2005) and it is exceptional for a species name commemorating a person to be a noun in apposition, not in the genitive form (which would usually be *majori*, as in the synonym [of *Fossa fossana*] *Fossa majori* Dollman, 1909). Hunter & Barrett (2011) used 'Giant Falanouc' and 'Eastern Falanouc' for *E. major* and *E. goudotii*, respectively. With 'Giant Falanouc' not yet in wide use, for an animal that is hardly gigantic (camera-trap images can be difficult to tell to species: Evans *et al*. 2013) the names 'Eastern Falanouc' and 'Western Falanouc' (as used by Evans *et al*. 2013) are more informative.
Recommendation: *Eupleres goudotii*: Eastern Falanouc; *Eupleres major*: Western Falanouc

Fossa
With only one species in the genus, there is no requirement for the group name 'Fanaloka' in English to have a modifier, because *F. fossana* needs to be distinguished from no other 'fanaloka'. However, because 'fanaloka' in Malagasy can mean several genera of carnivores, use of 'Spotted' as a modifier will help reduce confusion in situations where both Malagasy and English are in use.
Recommendation: *Fossa fossana*: Spotted Fanaloka

Galidia and *Galidictis*
Two of these animals, the widely sympatric *Galidia elegans* and *Galidictis fasciata*, are each known as 'vontsira' across their geographical ranges (Goodman 2012, 2013). The only Malagasy name documented by Goodman (2012) for the third, *Galidictis grandidieri*, is 'votsotsoke'. This species's lack of a name using 'vontsira' reflects its range, widely disjunct from the other two species, where a different dialect of Malagasy is spoken. In English, calling them all vontsiras reduces the number of group names to be learnt. A shared group-name by the two *Galidictis* species is also appropriate given their morphological similarity: *G. grandidieri* was not named until 1986 (Wozencraft 1986), even though its holotype (skin and skull) had been collected in 1929, identified at the time as *G. fasciata* (Rand 1935), and held in an international zoological collection. The modifiers could be English or Malagasy: for *G. fasciata*, for example, 'Broad-striped Vontsira' or the directly documented full Malagasy name 'Vontsira Fotsy'. For global ease of communication, it seems advisable to use English-language modifiers for these species. *Galidictis grandidieri* has already, despite its late discovery, three alternative English-language modifiers in use: 'Grandidier's', 'Giant-striped' (i.e. the stripes are giant) and 'Giant Striped' (i.e. the striped animal is giant). Use of 'giant' in either context seems fanciful.
Recommendation: *Galidictis grandidieri*: Grandidier's Vontsira; *Galidictis fasciata*: Broad-striped Vontsira; *Galidia elegans*: Ring-tailed Vontsira

Mungotictis
In modern times, *Mungotictis decemlineata* (sensu lato), of the western dry forests, is allopatric from the species known in Malagasy as 'vontsira' (of the eastern humid and northern dry deciduous forests). Given its similarity in body form, it is

likely that if one were presented to residents of the eastern forest, they would call it a 'vontsira'. This could be an acceptable English group name for the animal. However, there appears to be no tradition of this usage. 'Boky-boky' and 'Boky' have been used in English (e.g. Goodman 2012, Jansen van Vuuren *et al*. 2012); 'Boky' has the advantage of being shorter, but the doubled form is in much wider use in Madagascar. Its usual rendition in European languages, 'Boky-boky', does not accord with the Malagasy correct form, which is 'Bokiboky'. This spelling has been used only rarely in English (within, e.g., Woolaver *et al*. 2004), as has 'Bokyboky' (e.g. Burney & Ramilisonina 1999). Conventionally, the genus has been considered monospecific, so a modifier ('Narrow-striped') unnecessarily lengthens the name. If the genus contains two species (*Mungotictis decemlineata* and *M. lineata*; see Hawkins *et al*. 2000, Goodman *et al*. 2005, Goodman 2013), as will shortly be proposed formally by B. Jansen van Vuuren, then modifiers for each would be required, appropriately 'Northern' and 'Southern', given their relative ranges.

Recommendation: *Mungotictis decemlineata*: Northern Bokiboky; *M. lineata* Southern Bokiboky

Salanoia

Both *Salanoia* species are called 'vontsira' by the Malagasy living where they occur (Goodman 2012) and using this as the English group name is thus preferable to introducing another, also locally used group name, 'salano' or 'salanoia'. The two species, which are extremely similar (Durbin *et al*. 2010), should have the same group name.

Recommendation: *Salanoia concolor*: Brown-tailed Vontsira; *Salanoia durrelli*: Durrell's Vontsira

Discussion

These recommendations for English names of Madagascar's carnivores propose for most species a name already in use in at least one influential source (Table 1). Of the four minor exceptions, three relate to recent species-level taxonomic change: (i) the recognition that two species of *Mungotictis* exist, so a necessarily new modifier for each; (ii) the replacement of both existing modifiers for a newly elevated species by a more meaningful one; and (iii) the correction of an apparently unintended group-name for a newly discovered species. The fourth involves minor correction of presentation of a Malagasy word. These 11 species possess between them over three dozen other names used in major bibliographic sources, a situation generating unnecessary and considerable confusion. Together with the recent clear demonstration that all members of the family Eupleridae are a unique evolutionary group, it is high time to support one clear English name for each species. Currently, the phylogenetically misleading names still seem to be those predominantly in use, at least for some species: on 15 April 2014, a Google search for "Ring-tailed Mongoose" found about 141,400 results versus that for "Ring-tailed Vontsira" finding about 7,420. This means that there may be some resistance to adoption of the names proposed here. In a parallel case, the British Ornithologists' Union (BOU) intended all BOU publications to follow the internationally proposed English names for bird species of the International Ornithological Congress (IOC) (Gill & Wright 2006). After some years of trial where the IOC draft names were listed before names in common use in Britain (e.g. Dudley *et al*. 2006), opposition from the bird-watching community in Britain reversed this policy such that in the most recent *Checklist of birds of Britain* (Harrop *et al*. 2013) the parochial name is placed first and emboldened, at variance with the Union's general policy to use English names that are internationally meaningful and unambiguous (BOURC 2007). There are far fewer people who have got into the habit of using any particular English names for Malagasy carnivores than there are British birdwatchers, so we hope for rapid general adoption of the names recommended here. This will be expedited if these names are used by the sources (both printed and internet) most used by the general public. An example of a successful shift in names, for exactly the same reason, is Strahan's (1983, 1985) prominent adoption of the Australian aboriginal names for mammals known for some time by Europeans under names such as 'native cats' and 'marsupial rats'. Thirty years later, taking 'Wikipedia' as an arbiter of popular usage, the only English names for species in the list of Australian monotremes and masupials that are such misleading hangovers are for the two 'marsupial-moles' *Notoryctes* (http://en.wikipedia.org/wiki/List_of_monotremes_and_marsupials_of_Australia).

With genetic investigation showing that traditional morphology-based classifications of mammals sometimes do not reflect the real history of evolution, Madagascar's carnivores are not the only ones where English names need fresh attention. The discovery that the African animals known as 'linsangs' *Poiana* are not closely related to the Asian linsangs *Prionodon*, but constitute another remarkable case of convergent evolution (Gaubert & Veron 2003), has stimulated a propensity to refer to *Poiana* as 'oyans', not 'linsangs' (e.g. Gaubert *et al*. 2008, Jennings & Veron 2009, Hunter & Barrett 2011). This remains far from universal, with 'linsang' still used for this genus, unfortunately, in the recently published landmark handbook *Mammals of Africa* (Kingdon & Hoffmann 2013). There seems to have been no progress with English name review for the other small carnivores subject to recent major change in phylogenetic placement. Most notably, *Nandinia binotata*, usually called 'African Palm Civet' or 'Two-spotted Palm Civet' is not a civet (Viverridae) any more than is *Fossa fossana* (Flynn & Nedbal 1998). It is merely somewhat similar in habits to the Asian palm civets (Viverridae: Paradoxurinae). With apparently no existing English name not including the word 'civet', this would be a prime case for a new English name, perhaps one based on a name in a local language in its native range. Similarly, the two stink-badgers *Mydaus* of the Sunda Shelf (Southeast Asia) are not close relatives of badgers (Mustelidae) but are the only Old-world skunks (Mephitidae) (Dragoo & Honeycutt 1997). Finally, Giant Panda *Ailuropoda melanoleuca* is an aberrant bear and is not closely related to the original provider of the name 'panda', Red Panda *Ailurus fulgens* (Yu *et al*. 2004), despite the implications of the shared group name.

Acknowledgements

We thank Kalyan Varma for advice on how to perform the appropriate Google searches; Don Wilson, Ron Pine and Nick Garbutt for constructive comments on the submitted MS and all – strongly – supporting the value of the exercise; Anselme Toto Volahy and Lance Woolaver for their input on local names for *Mungotictis*; and Nick Garbutt and Emmanuel Do Linh San for the use of their fine photographs.

References

[BOURC] British Ornithologists' Union Records Committee 2007. British Ornithologists' Union Records Committee: 35th Report (April 2007). *Ibis* 149: 652–654.

Burney, D. A. & Ramilisonina 1999. The *Kilopilopitsofy*, *Kidoky*, and *Bokyboky*: accounts of strange animals from Belo-sur-mer, Madagascar, and the megafaunal "extinction window". *American Anthropologist* 100: 957–966.

Cheesman, W. H. & Oehser, P. H. 1937. The spelling of common names of birds. *Auk* 54: 333–340.

Crowley, B. E. 2010. A refined chronology of prehistoric Madagascar and the demise of the megafauna. *Quaternary Science Reviews* 29: 2591–2603.

Dannenfeldt, K. 1985. Europe discovers civet cats and civet. *Journal of the History of Biology* 18: 403–431.

Dollman, G. 1909. XXXV – A new species of *Fossa* from central Madagascar. *Annals and Magazine of Natural History* (8)4: 306–307.

Dragoo, J. W. & Honeycutt, R. L. 1997. Systematics of mustelid-like carnivores. *Journal of Mammalogy* 78: 426–443.

Duckworth, J. W. & Pine, R. H. 2003. Selecting English-language names for a world list of mammals, illustrated by species of Indochina. *Mammal Review* 33: 151–173.

Dudley, S. P., Gee, M., Kehoe, C., Melling, T. & the British Ornithologists' Union Records Committee (BOURC) 2006. The British List: a checklist of birds of Britain (7th edition). *Ibis* 148: 526–563.

Durbin, J., Funk, S. M., Hawkins, F., Hills, D. M., Jenkins, P. D., Moncrieff, C. B. & Ralainasolo, F. B. 2010. Investigations into the status of a new taxon of *Salanoia* (Mammalia: Carnivora: Eupleridae) from the marshes of Lac Alaotra, Madagascar. *Systematics and Biodiversity* 8: 341–355.

Evans, B., Rakotondraparany, F., Cole, L., Graham, S., Long, P. & Gandola, R. 2013. The carnivores of Mariarano forest, Madagascar: first insights. *Small Carnivore Conservation* 49: 15–19.

Flynn, J. J. & Nedbal, M. A. 1998. Phylogeny of the Carnivora (Mammalia): congruence vs incompatibility among multiple datasets. *Molecular Phylogenetics and Evolution* 9: 414–426.

Garbutt, N. 2007. *Mammals of Madagascar*, 2nd edn. Pica Press, East Sussex, U.K.

Gaubert, P. & Veron, G. 2003. Exhaustive sample set among Viverridae reveals the sister-group of felids: the linsangs as a case of extreme morphological convergence within Feliformia. *Proceedings of the Royal Society of London B* 270: 2523–2530.

Gaubert, P., Chalubert, A. & Dubus, G. 2008. An interactive identification key for genets and oyans (Carnivora, Viverridae, Genettinae, *Genetta* spp. and *Poiana* spp.) using Xper^2. *Zootaxa* 1717: 39–50.

Gill, F. B. & Wright, M. T. 2006. *Birds of the world: recommended English names*. Princeton University Press, Princeton, New Jersey, U.S.A.

Goodman, S. M. 2009. Family Eupleridae (Madagascar carnivores). Pp. 330–351 in Wilson, D. E. & Mittermeier, R. A. (eds) *Handbook of mammals of the world, 1. Carnivores*. Lynx Edicions, Barcelona, Spain.

Goodman, S. M. 2012. *Les Carnivora de Madagascar*. Association Vahatra, Antananarivo, Madagascar.

Goodman, S. M. 2013. Carnivorans or the Order Carnivora. Pp. 271–285 in Goodman, S. M. & Raherilalao, M. J. (eds) *Atlas of selected land vertebrates of Madagascar.* Association Vahatra, Antananarivo, Madagascar.

Goodman, S. M. & Benstead, J. P. 2003. (eds) *The natural history of Madagascar*. University of Chicago Press, Chicago, Illinois, U.S.A.

Goodman, S. M. & Helgen, K. M. 2010. Species limits and distribution of the Malagasy carnivoran genus *Eupleres* (family Eupleridae). *Mammalia* 74: 177–185.

Goodman S. M., Rasoloarison, R. M. & Ganzhorn, J. U. 2004. On the specific identification of subfossil *Cryptoprocta* (Mammalia, Carnivora) from Madagascar. *Zoosystema* 26: 129–143.

Goodman S. M., Thomas, H. & Kidney, D. 2005. The rediscovery of *Mungotictis decemlineata lineata* Pocock, 1915 (Carnivora: Eupleridae) in southwestern Madagascar: insights into its taxonomic status and distribution. *Small Carnivore Conservation* 33: 1–5.

Grubb, P. 2006. English common names for subspecies and species of African primates. *Primate Conservation* 20: 65–73.

Haltenorth, T. & Diller, H. 1980. *A field guide to the mammals of Africa including Madagascar*. Collins, London, U.K.

Harrop, A. H. J., Collinson, J. M., Dudley, S. P., Kehoe, C. & the British Ornithologists' Union Records Committee (BOURC) 2013. The British List: a checklist of birds of Britain (8th edition). *Ibis* 155: 635–676.

Hawkins, F. 1994. *Eupleres goudotii* in west Malagasy deciduous forest. *Small Carnivore Conservation* 11: 20.

Hawkins, A. F. A., Hawkins, C. E. & Jenkins, P. D. 2000. *Mungotictis decemlineata lineata* (Carnivora: Herpestidae), a mysterious Malagasy mongoose. *Journal of Natural History* 34: 305–310.

Hunter, L. & Barrett, P. 2011. *A field guide to the carnivores of the world.* New Holland, London, U.K.

International Commission on Zoological Nomenclature 1999. *International code of zoological nomenclature*, 4th edn. The International Trust for Zoological Nomenclature, c/o the Natural History Museum, London, U.K.

IUCN 2013. *IUCN Red List of Threatened Species*. Version 2013.2. <www.iucnredlist.org>. Downloaded on 5 March 2014.

Jansen van Vuuren, B., Woolaver, L. & Goodman S. M. 2012. Genetic population structure in the Boky-boky (Carnivora: Eupleridae), a conservation flagship species in the dry deciduous forests of central western Madagascar. *Animal Conservation* 15: 164–173.

Jenkins, P. D. & Carleton, M. D. 2005. Charles Immanuel Forsyth Major's expedition to Madagascar, 1894 to 1896: beginnings of modern systematic study of the island's mammalian fauna. *Journal of Natural History* 39: 1779–1818.

Jennings, A. P. & Veron, G. 2009. Family Viverridae (civets, genets and oyans). Pp. 174–232 in Wilson, D. E. & Mittermeier, R. A. (eds) *Handbook of the mammals of the world, 1. Carnivores*. Lynx Edicions, Barcelona, Spain.

King, B. F., Woodcock, M. & Dickinson, E. C. 1975. *A field guide to the birds of South-east Asia*. Collins, London, U.K.

Kingdon, J. & Hoffmann, M. (eds) 2013. *Mammals of Africa, V. Carnivores, pangolins, equids and rhinoceroses*. Bloomsbury, London, U.K.

Lavauden, L. 1929. Sur un nouveau carnivore malgache du genre *Eupleres*. *Comptes Rendus de l'Académie des Sciences* 189: 197–199.

Rand, A. L. 1935. On the habits of some Madagascar mammals. *Journal of Mammalogy* 16: 89–104.

Rao, S., Ashraf, N. V. K. & Nixon, A. M. A. 2007. Search for the Malabar Civet *Viverra civettina* in Karnataka and Kerala, India, 2006–2007. *Small Carnivore Conservation* 37: 6–10.

Schreiber, A., Wirth, R., Riffel, M. & Van Rompaey, H. 1989. *Weasels, civets, mongooses, and their relatives: an action plan for the conservation of mustelids and viverrids*. IUCN, Gland, Switzerland.

Sibley, C. G. & Monroe, B. L. 1990. *Distribution and taxonomy of birds of the world*. Yale University Press, New Haven, U.S.A.

Strahan, R. (ed.) 1983. *The Australian Museum complete book of Australian mammals*. Angus and Robertson, London, U.K., and Sydney and Melbourne, Australia.

Strahan, R. (ed.) 1995. *Mammals of Australia*. Smithsonian Institution Press, Washington D.C., U.S.A.

Veron, G. & Catzeflis, F. 1993. Phylogenetic relationships of the endemic Malagasy carnivore *Cryptoprocta ferox* (Aeluroidea): DNA/DNA hybridization experiments. *Journal of Mammalian Evolution* 1: 169–185.

Wilson, D. E. & Cole, F. R. 2000. *Common names of mammals of the world*. Smithsonian Institution Press, Washington D.C., U.S.A. and London, U.K.

Woolaver, L., Nichols, R., Rakotombololona, W. F., Volahy, A. T. & Durbin, J. 2004. Status of the Narrow-striped Mongoose *Mungotictis decemlineata* of Madagascar. *Small Carnivore Conservation* 30: 7–9.

Wozencraft, W. C. 1986. A new species of striped mongoose from Madagascar. *Journal of Mammalogy* 67: 561–571.

Wozencraft, W. C. 2005. Order Carnivora. Pp. 532–628 in Wilson, D. E. & Reeder, D. M. (eds) *Mammal species of the world. A taxonomic and geographic reference*, 3rd edn. Johns Hopkins University Press, Baltimore, Maryland, U.S.A.

Wroughton, R. C. 1912. Bombay Natural History Society's Mammal Survey of India: Report 2. *Journal of the Bombay Natural History Society* 21: 820–825.

Appendix. Notes on pronunciation of the Malagasy names.

Fosa = Fòòs(a)

Falanouc = Fàhlahnook

Fanaloka = Fahnàhlook(a)

Vontsira = Voontsìr(a)

Bokiboky = Bookibook(y)

The grave accent shows the syllable of emphasis. Bracketed letters are slightly de-emphasised, or swallowed. A long 'a' is followed by an 'h', otherwise each 'a' is short.

Yoder, A. D., Burns, M. M., Zehr, S., Delefosse, T., Veron, G., Goodman, S. M. & Flynn, J. J. 2003. Single origin of Malagasy Carnivora from an African ancestor. *Nature* 421: 734–737.

Yu, L. Li, Q., Ryder, O. A. & Zhang, Y. 2004. Phylogeny of the bears (Ursidae) based on nuclear and mitochondrial genes. *Molecular Phylogenetics and Evolution* 32: 480–494.

[1]6 Stratton Road, Saltford, Bristol BS31 3BS, UK.
Email: will.duckworth@iucn.org
[2]IUCN, 1630 Connecticut Avenue, NW, Suite 300, Washington DC 20009, U.S.A.
[3]Conservation International, BP 5178, Antananarivo 101, Madagascar.
[4]Wildlife Conservation Society Madagascar Program, BP 8500, Soavimbahoaka, Anatananarivo 101, Madagascar *and* Animal Biology Department, Faculty of Science, University of Antananarivo, BP 906, Ankatso, Antananarivo, Madagascar.
[5]Field Museum of Natural History, 1400 South Lake Shore Drive, Chicago, Illinois 60605, U.S.A. *and* Association Vahatra, BP 3972, Antananarivo 101 Madagascar.

Observations of Mentawai Palm Civet *Paradoxurus* (*hermaphroditus*) *lignicolor* from Siberut island, Indonesia

J. A. EATON

Abstract

Four Mentawai Palm Civets *Paradoxurus* (*hermaphroditus*) *lignicolor* were spotlit and photographed at Bebe, in the north-east corner of Siberut, on the night of 28 February 2014, an area of several square kilometers of plantations mixed with remnant forest patches. This is one of few recent published observations of the taxon, which remains too little known to assess its conservation priority. Six presumed Siberut Flying Squirrel *Petinomys lugens*, another very poorly known taxon, were also seen.

Keywords: endemic, habitat, locality record, *Petinomys lugens*, Siberut Flying Squirrel, spotlighting

Pengamatan musang luwak Mentawai *Paradoxurus* (*hermaphroditus*) *lignicolor* dari pulau Siberut, Indonesia

Abstrak

Empat musang luwak Mentawai *Paradoxurus (hermaphroditus) lignicolor* terdeteksi dan difoto di Timur-laut Siberut, area perkebunan bercampur dengan sisa hutan seluas beberapa kilometer persegi, pada malam hari 28 Februari 2014. Ini merupakan catatan terbaru dari taksa tersebut yang hingga kini masih terlalu sedikit informasi untuk mengetahui prioritas konservasinya. Tercatat juga enam penampakan dari satwa yang diduga sebagai kepul sipora *Petinomys lugens*, juga merupakan satwa dengan sangat sedikit informasi.

Lying 85–135 km west of the Sumatran mainland in Indonesia is the Mentawai archipelago (0°55′–3°20′S, 98°31′–100°40′E), a chain of four main islands (Siberut, Sipora, North and South Pagai) and several small islets. The islands have been separated from Sumatra since the mid-Pleistocene period, over 500,000 years ago, allowing an unusually high level of biological richness and endemism to evolve (Chasen & Kloss 1927, Wilting *et al*. 2012). Although the six endemic primates are relatively well documented, the carnivores have never received much attention. Two species of the latter are known, Banded Civet *Hemigalus derbyanus* and a palm civet *Paradoxurus* variously considered a species endemic to the archipelago, Mentawai Palm Civet *P. lignicolor*, or conspecific with the widespread Common Palm Civet *P. hermaphroditus*. In addition, Asian Small-clawed Otter *Aonyx cinereus* is also recorded for Siberut in some sources (e.g. Wilting *et al*. 2012), but there seem to be no specimens or otherwise explicit primary records. The first mention appears to be in Whitten & Whitten (1980), where the species is listed on the basis of a sight record. T. Whitten (*in litt*. 2014) cautions that the basis for this listing is no longer available and suggests that the species's occurrence on the island be considered subject to confirmation. There appears to be neither specimen nor confirmed records since – but nor does there seem to have been any concerted effort to find the animal.

This palm civet is quite distinct morphologically from the typical Common Palm Civets through South-east Asia, lacking the latter's strongly contrasting facial markings and having a plain, warm brown pelage ('lignicolor' meaning the colour of wood) in contrast to the grizzled, typically cold brown or grey of Common Palm Civet (Corbet & Hill 1992). Surprisingly, a recent genetic investigation involving both nuclear and mitochondrial DNA, while confirming the morphological distinctiveness of the taxon, considered the appropriate rank to be that of subspecies (Patou *et al*. 2010). However, given the isolation of the islands for such a long period from the Sumatran mainland, the distinct pelage colour of the palm civet on them (there seem to be no known intermediates with typical Common Palm Civets) suggests that it should probably be best considered a separate species. It may itself have two subspecies, one on Siberut and one on Sipora and the Pagai islands (Chasen & Kloss 1927, Pocock 1934). Banded Civet is represented on the Mentawai islands by *H. d. minor* (the taxonomic validity of which has never been questioned) on South Pagai and by *H. d. sipora* (sometimes united with the nominate race, from Sumatra) on Sipora; it also occurs on Siberut and perhaps North Pagai (Schreiber *et al*. 1989, Jennings *et al*. 2013). Both Mentawai Palm Civet and the Mentawai races of Banded Civet were regarded as high global priority taxa in the conservation of small carnivores by Schreiber *et al*. (1989). Remarkably few recent observations of these civets have been published, perhaps only that of the palm civet by Abegg (2003). The Siberut Conservation Programme (SCP), until recently active in the north of Siberut, occasionally encountered Mentawai Palm Civet while conducting their primatological research; there was even one living close to their main field station about 10 km west of Bebe (for this locality, see below). Their research area was 'rented' from the local people/clans on the basis of formal agreements that also deemed the area a no-hunting zone (M. Quinten *in litt*. 2014).

Between 27 February and 1 March 2014, JAE made a brief visit to the largest island, Siberut, in search of the endemic bird taxa and mammals. Co-ordinates were recorded with a Garmin eTrex20 (datum WGS84). The areas immediately surrounding the main port of Muarasiberut appeared heavily exploited, with much evidence of logging, slash-and-burn and heavy hunting pressures by the ethnic Mentawai

tribes resulting in relatively few sightings of mammals. One night was spent in a forest camp (1°35′36″S, 99°08′07″E) with hunters. During 1½ days in the field, JAE had a single encounter with two Kloss's Gibbons *Hylobates klossii* and two encounters (one vocal, one sight) with Simakobu *Simias concolor*, which the hunters immediately spotted having already taken JAE straight to the spot that the gibbon appears every morning. When questioned why they had not hunted the gibbons, the hunters replied that it is illegal and a heavy fine would be imposed, so they now only hunt the other primates (although by law, all primates are fully protected). The Simakobus disappeared the moment we spotted them. During that single night survey in the forest, no mammals were seen. A shaking of branches directly above JAE pointed to the possible presence of a civet: the sounds were similar to those of many other arboreal civets JAE has heard, and dissimilar from the shakes made, for example, by flushed roosting birds or by branches or heavy fruit falling through the strata.

A single night and morning (28 February – 1 March 2014) was then spent in an area known by the locals as 'Bebe' (0°58′45″S, 98°56′25″E), in the north-east corner of Siberut, located between the villages of Labuan Bajau (north) and Bose (south). This lowland area of gentle terrain (0–30 m asl) comprised several square kilometers of coconut, banana and cocoa plantations mixed with remnant forest patches. This habitat dominates part of the island's east coast, with the natural forest further inland of this, with large patches of swamp and mangrove forest remaining in parts along the coastline, judging from Google Earth. Much of the eastern forest continues to be exploited. The area houses just a few families, predominantly Javanese farmers. The contrast from Muarasiberut could not have been more stark. In three hours of spotlighting around the coconut plantation, at least four Mentawai Palm Civets were found (Fig. 1). They were feeding in the palms, around the base of the palm fronds or along the fronds themselves. The civets were not shy at all, allowing JAE to stand right underneath them as they stared down just 5 m above. The civets appeared quite bulky, more so than Common Palm Civet with which JAE is very familiar, and with a proportionally shorter tail. The body colour was a pale, quite bright brown with a slight grey cast but a brighter, paler nape and slightly paler underparts. One individual (Fig. 2) was noticeably smaller, especially in the face and a more uniform, darker brown: it was presumed to be an immature. This is at variance with Thomas's (1894: 666) description of a young (retaining all milk teeth) as having "a curious golden grey colour, entirely without marking", and being "pale". More study on the aging of this taxon is desirable.

Six presumed Siberut Flying Squirrels *Petinomys lugens* (Fig. 3) were behaving in similar manner in the palms. They tended to stop feeding and freeze in the spotlight, so it was not clear on what they were feeding. This is the only species of small flying squirrel confirmed to occur on Siberut (two other endemics occur on other Mentawai islands) and the characters observed fit those given for the species in Corbet & Hill (1992). Although Corbet & Hill (1992) omitted Siberut from this form's range (confining it to Sipora and North Pagai), this seems to have been a slip, because specimens (as *P. hageni lugens*) from Siberut were documented by Jenkins & Hill (1982). *The IUCN Red List of Threatened Species* (IUCN 2013), while calling the

Fig. 1. Mentawai Palm Civet *P.* (*hermaphroditus*) *lignicolor*, Bebe, north-eastern Siberut, 28 February 2014.

Fig. 2. Mentawai Palm Civet *P.* (*hermaphroditus*) *lignicolor*, Bebe, north-eastern Siberut, 28 February 2014. A smaller, darker, individual, presumably immature.

Fig. 3. Presumed Siberut Flying Squirrel *Petinomys lugens*, Bebe, north-eastern Siberut, 28 February 2014.

species 'Siberut Flying Squirrel', similarly stated that it occurred only on Sipora and North Pagai. It also said that the species 'prefers forest' and categorised the species, partly on the basis of forest loss rates, as Endangered, noting that it might even warrant the category of Critically Endangered. Clarification of the extent to which it depends on forest is essential for a more informed categorisation.

In addition to these night-time observations, in the single morning at Bebe, JAE saw three species of primate with relative ease, allowing prolonged views (further views of Kloss's Gibbon and Simakobu, and a single troop of 4–5 Siberut Langurs *Presbytis siberu*), along with Mentawai Treeshrew *Tupaia chrysogaster* and several Mentawai Squirrels *Callosciurus melanogaster*. Mentawai Ground Squirrel *Lariscus obscurus* was observed only once, in damp understorey in southern Siberut.

Occurrence in such open, altered habitats by Mentawai Palm Civet suggests that it might be found to be widespread on Siberut, perhaps even locally numerous. But if so, this is likely to be the case only away from the hunting pressures of the indigenous hunters and gatherers of Siberut. Indeed, the four hunters around Maurasiberut all said they really enjoyed a good civet! Moreover, the island is under threat from logging, both commercially (big boats were seen carrying some big logs out) and for clearance for crop-growing. If Mentawai Palm Civet is as adaptable to habitat encroachment as is Common Palm Civet, this conversion may not affect it too negatively: but more surveys are essential to determine the level of conservation priority, if any, of this animal.

Acknowledgements

I would like to thank Erik Meijaard and Marcel Quinten for commenting on the draft, Tony Whitten for commenting on the status of Asian Small-clawed Otter on Siberut, Wulan Pusparini for the Indonesian text, and Gono Semiadi for clarifying the Indonesian names of the endemic taxa. Special thanks to Will Duckworth for helping with the draft, diligent background checks on the otter and flying squirrels of the islands, and providing references, along with the encouragement to write this paper.

References

Abegg, C. 2003. Encounter with a Siberut Palm Civet, Mentawai Islands, West Sumatra, Indonesia. *Small Carnivore Conservation* 29: 20–21.

Chasen, F. N. & Kloss, C. B. 1927. Spolia Mentawiensia. Mammals. *Proceedings of the Zoological Society of London* '1927': 797–840.

Corbet, G. B. & Hill, J. E. 1992. *The mammals of the Indomalayan region*. Natural History Museum Publications and Oxford University Press, Oxford, U.K.

IUCN 2013. *IUCN Red List of Threatened Species*. Version 2013.2. <www.iucnredlist.org>. Downloaded on 6 June 2014.

Jenkins, P. D. & Hill, J. E. 1982. Mammals from Siberut, Mentawei Islands. *Mammalia* 46: 219–224.

Jennings, A. P., Mathai, J., Brodie, J., Giordano, A. J. & Veron, G. 2013. Predicted distributions and conservation status of two threatened Southeast Asian small carnivores: the Banded Civet and Hose's Civet. *Mammalia* 77: 261–271.

Patou, M. L., Wilting, A., Gaubert, P., Esselstyn, J. A., Cruaud, C., Jennings, A. P., Fickel, J. & Veron, G. 2010. Evolutionary history of the *Paradoxurus* palm civets – a new model for Asian biogeography. *Journal of Biogeography* 37: 2077–2097.

Pocock, R. I. 1934. The geographical races of *Paradoxurus* and *Paguma* found to the east of the Bay of Bengal. *Proceedings of the Zoological Society of London* '1934': 613–683.

Schreiber, A., Wirth, R., Riffel, M. & Van Rompaey, H. 1989. *Weasels, civets, mongooses, and their relatives: an action plan for the conservation of mustelids and viverrids*. IUCN, Gland, Switzerland.

Thomas, O. 1894. On some mammals collected by Dr. E. Modigliani in Sipora, Mentawei islands. *Annali del Museo Civico di Storia Naturale Giacomo Doria* 14: 660–672.

Whitten, A. J. & Whitten, J. E. A. 1980. *Saving Siberut: a conservation master plan*. WWF, Bogor, Indonesia.

Wilting, A. Sollmann, R., Meijaard, E., Helgen, K. M. & Fickel, J. 2012. Mentawai's endemic, relictual fauna: is it evidence for Pleistocene extinctions on Sumatra? *Journal of Biogeography* 39: 1608–1620.

A-3A-5, Casa Indah I, Kota Damansara, Selangor, Malaysia.
Email: jameseaton@birdtourasia.com

Observations of Mountain Weasel *Mustela altaica* and Siberian Weasel *M. sibirica* in Nepal

Yadav GHIMIREY[1]*, Raju ACHARYA[1], Anand CHAUDHARY[2] and Anil PRAJAPATI[3]

Abstract

Mountain Weasel *Mustela altaica* and Siberian Weasel *M. sibirica* were observed at localities new for the species, Annapurna Conservation Area (ACA) and Mugu district, respectively. These add to the few specific locality records for each species in Nepal.

Keywords: altitude, central Himalaya, distribution, Data Deficient, Near Threatened, threats

पहाडी र साइबेरियाली मलसांप्रोको नेपालबाट नयाँ रेकर्ड

सारांश

एउटा पहाडी मल्सांप्रो *Mustela altaica* र एउटा साइबेरियालि मल्सांप्रो *M. sibirica* क्रमशः अन्नपुर्ण संरक्षण क्षेत्रको माथिल्लो मुस्तांग र मुगु जिल्लाको रारा तल नजिक देखिएका थिए। यस्ता सूचनाहरुले नेपालमा थोरै मात्र जानकारी भएका मल्सांप्रोको प्रजातिहरुको भौगोलिक विस्तारको बारेमा महत्वपूर्ण जानकारी मिल्दछ। प्रस्तुत लेखमा यी दुवै मल्सांप्रोको नयाँ ठाउँ बिशेषबाट गरिएको रेकर्डबारे विवेचना गरिएको छ।

Five species of weasels *Mustela*, Stoat *M. erminea*, Siberian Weasel *M. sibirica*, Yellow-bellied Weasel *M. kathiah*, Mountain Weasel *M. altaica* and Stripe-backed Weasel *M. strigidorsa*, are reported to occur in Nepal (Baral & Shah 2008, Jnawali *et al.* 2011). However, the occurrence of Stripe-backed Weasel in Nepal was questioned by Abramov *et al*. (2008), whilst none of Mitchell (1975), IUCN (2012) or Thapa (in prep.) included Stoat as a member of the Nepal fauna. Even the other three species are known from relatively few authenticated localities in the country, and information about weasels from the entire Himalayan region is typically scarce. This note presents additional localities of Mountain and Siberian Weasels from the Nepal Himalaya.

A full-grown Mountain Weasel (Fig. 1) was observed on 17 August 2008 in mid-afternoon between Samar and Syangbochen in Mustang district (28°58′N, 83°48′E; altitude 3,800 m). The location lies within Annapurna Conservation Area, the largest protected area in central Nepal. The terrain was gently rolling, with much short shrubby vegetation amid rocky outcrops. The animal kept looking at the observers from behind the rocks, repeatedly darting in and out from the crevices and coming as close as 5 m. The day was sunny with a light breeze.

An adult Siberian Weasel (Fig. 2) was observed on 21 December 2012 at 12h00 near Pina Village Development Committee in Mugu district, north-west Nepal (about 29°32′N, 82°06′E; altitude somewhere within 2,700–3,000 m). The day

Fig. 1. Mountain Weasel *Mustela altaica*, Annapurna Conservation Area, Nepal, 17 August 2008 (Photo: Anand Chaudhary).

Fig. 2. Siberian Weasel *Mustela sibirica*, Mugu district, Nepal, 21 December 2012 (Photo: Anil Prajapati).

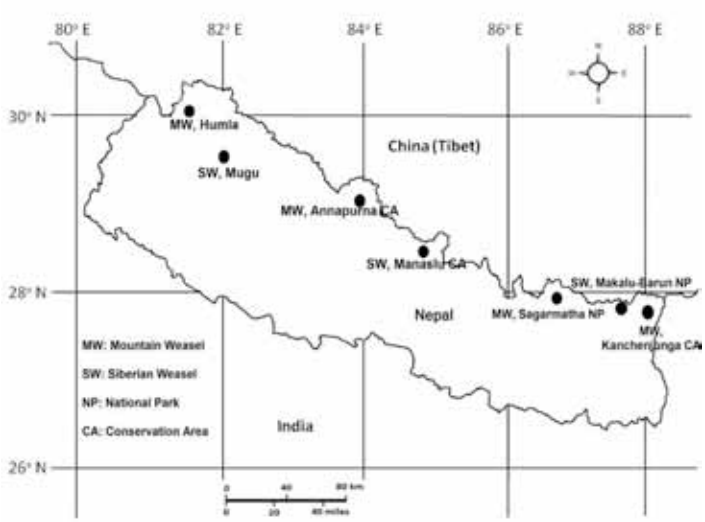

Fig. 3. Records of Mountain Weasel *Mustela altaica* and of Siberian Weasel *M. sibirica* in Nepal.

was sunny and the weasel came within 15 m of the observers, curiously peeping out from a fuel-wood pile outside a house about 100 m away from more natural habitat.

These two weasel species are recorded from only a few specific localities, including the present records, in Nepal. Therefore their national status is uncertain at present. Available records of both the species are shown on Fig. 3. Mountain Weasel has recently been recorded from Sagarmatha National Park and Kanchenjunga Conservation Area further east of Annapurna Conservation Area (Katuwal *et al*. 2013) and from Thadodhunga, Humla district (Ghimirey & Acharya in prep.) lying west from Annapurna Conservation Area. It was portrayed as occurring across the mountain region of Nepal by Jnawali *et al*. (2011), but no details were given of the sources for this, notably of the methods of detection and of verification, if any. This range should therefore be seen as hypothetical. It is categorised globally as Near Threatened on *The IUCN Red List of Threatened Species* (IUCN 2012) while it is assessed as Data Deficient nationally (Jnawali *et al*. 2011). Potential threats in Nepal include depletion of prey base, habitat degradation and general disturbance through livestock and other anthropogenic activities (Jnawali *et al*. 2011).

Siberian Weasel has recently been recorded in Makalu–Barun National Park (Ghimirey & Acharya 2012) and Manaslu Conservation Area (Katuwal *et al*. 2013). It is considered a Least Concern species both nationally and globally (Jnawali *et al*. 2011, IUCN 2012). However information is not available on its population size and potential threats in the country (Jnawali *et al*. 2011). Therefore, its national status category might warrant further revision: Data Deficient might be appropriate.

Acknowledgements

We would like to thank Bird Conservation Nepal and Royal Society for Protection of Birds for supporting the fieldwork.

References

Abramov, A. V., Duckworth, J. W., Wang Y. X. & Roberton, S. I. 2008. The Stripe-backed Weasel *Mustela strigidorsa*: taxonomy, ecology, distribution and status. *Mammal Review* 38: 247–266.

Baral, H. S. & Shah, K. B. 2008. *Wild mammals of Nepal*. Himalayan Nature, Kathmandu, Nepal.

Ghimirey, Y. & Acharya, R. 2012. Records of Siberian Weasel *Mustela sibirica* and Yellow-bellied Weasel *Mustela kathiah* from Makalu-Barun National Park, Nepal. *Small Carnivore Conservation* 47: 68–69.

Ghimirey, Y & Acharya, R. in prep. Mountain Weasel in Humla: its status and ethnobiology.

IUCN 2012. *IUCN Red List of Threatened Species*. Version 2012.2. <www.iucnredlist.org>. Downloaded on 10 May 2013.

Jnawali, S. R., Baral, H. S., Lee, S., Acharya, K. P., Upadhyay, G. P., Pandey, M., Shrestha, R., Joshi, D., Lamichhane, B. R., Griffiths, J., Khatiwada, A. & Amin, R. (comps) 2011. *The status of Nepal mammals: the national red list series*. Department of National Parks and Wildlife Conservation, Kathmandu, Nepal.

Katuwal, H. B., Khanal, B., Basnet, K., Rai, B., Devkota, S., Rai, S. K., Nobis, M. & Scheiddeger, C. 2013. The mammalian fauna from the Central Himalaya, Nepal. *Asian Journal of Conservation Biology* 2: 21–29.

Mitchell, R. M. 1975. A checklist of Nepalese mammals (excluding bats). *Säugetierkundliche Mitteilungen* 23: 152–157.

Thapa, S. in prep. Checklist of mammals of Nepal.

[1]Friends of Nature (FON Nepal), PO Box 23491, Sundhara, Kathmandu, Nepal.
[2]SUNY College of Environmental Science and Forestry, Syracuse, New York, U.S.A.
[3]Asia Network for Sustainable Agriculture and Bio-resources (ANSAB), Nepal.
***Email: yghimirey@hotmail.com**

Tree climbing and denning by Common Dwarf Mongoose *Helogale parvula*

M. HOFFMANN[1], R. L. ROBERTS[1] and J. KERN[2]

Abstract

Common Dwarf Mongoose *Helogale parvula* is usually portrayed in the published literature as a wholly ground-dwelling mongoose, poorly adapted to climbing trees. Records from three sites show that, in some habitats, Mongooses do make good use of trees, including for denning purposes, although it remains unclear why trees are used for denning when other preferred den sites such as termitaries are available.

Keywords: arboreal, density, Herpestidae, terrestrial

Common Dwarf Mongoose *Helogale parvula* is a small, social mongoose (Herpestidae) widely distributed from the Horn of Africa to the north-eastern parts of South Africa's KwaZulu–Natal province (Kingdon 1977, Creel 2013). Creel (2013) described it as most common in open woodlands, thickets and wooded savannas, particularly where there are termitaria, rock outcroppings or crevices, or hollow logs for use as dens. Waser *et al*. (1995) suggested that the most important determinant of Common Dwarf Mongoose habitat preference is the density of suitable dens, with active or quiescent termite mounds (especially those of *Macrotermes*) being particularly favoured. While it is often observed clambering on termitaria, rocks or logs or branches of fallen trees, it is not commonly considered a climber and tree denning is rarely recorded. Indeed, Rautenbach (1982: 140) noted that "*Helogale parvula* is terrestrial, with no tree climbing whatsoever recorded", a sentiment echoed by Skinner & Chimimba (2005). In his years studying Common Dwarf Mongoose in the Serengeti National Park in Tanzania, Scott Creel (Dept of Ecology, Montana State University, *in litt.* 2014) never saw it denning in trees, although Rood (1983: 458), who studied the same population for a longer period of time, made reference to den sites in "hollow trees". A year-long study of den use in the extreme south of their range found more than three-quarters of dens were in subterranean termitaria with no use of trees recorded (Hiscocks & Perrin 1991). Kingdon (1977: 195) noted "although they often climb short distances up trees, particularly sloping trunks, they are not skilled at it". Taylor (1974) assigned Common Dwarf Mongoose to his 'terrestrial walking and scrambling' category noting that *Helogale* and *Mungos* are notable for having long distal phalanges, features characteristic of fossorial species.

At about 07h45 on 29 September 2013, less than 5 km along the S3 road between Phabeni Gate and Pretoriuskop rest-camp in the southern sector of South Africa's Kruger National Park (Mpumalanga province; about 25°01′S, 31°17′E), two of the authors (MH and RLR) observed a group of around 10–15 Common Dwarf Mongooses leaving what appeared to be a hollow about 1.5 m above the ground in a tall (>5 m) unidentified tree. The Mongooses descended the trunk of the tree head first, and scampered off one after the other once reaching the ground. Park restrictions prohibited alighting from the vehicle and therefore closer examination of the tree or the hollow. Although it is possible that the Mongooses might have entered the tree for a purpose other than denning, the early hour of the observation for this unequivocally diurnal species (Creel 2013) suggested that they were using the tree for overnight shelter. Here, we present data from longer-term studies showing that, contrary to available information in the published literature, tree denning is not necessarily unusual.

Roughly 100 km north-west of the September 2013 observation site, at Sorabi Rock Lodge Reserve (24°11′S, 30°46′E) in South Africa's Limpopo Province, where JK has a long-running research project on Common Dwarf Mongoose, individuals not only made use of trees as sentinel posts but also for denning. Of 191 known overnight refuges, the majority were termite mounds (108), but rocky crevices (43) and trees (40) were well used. Of nine groups whose home ranges and refuge use were well known, six used hollow trees; in one group, trees accounted for as many as 44% of known refuges (the remainder comprising 16% termite mounds and 40% rocks). Preferred trees included Knobthorn *Acacia nigrescens* and Leadwood *Combretum imberbe*. Mongooses were seen climbing up several meters (as high as 2.5 m; Fig. 1), even when trunks were vertical. When denning in termitaria, Mongoose groups usually marked latrines communally on the mound surface; however, when using trees, latrines were established a few meters from the base of the tree. In a second study site only 10 km from Sorabi Rock Lodge, at Phuza Moya Private Game Reserve (24°15′S, 30°45′E), Common Dwarf Mongooses have also been recorded using tree hollows for denning, albeit more rarely. During an eight-year study, out of 155 overnight refuges used repeatedly by groups, only three were located in trees (two in Knobthorn and one in Marula *Sclerocarya birrea*) (L. Sharpe, Dept of Botany and Zoology, Stellenbosch University, *in litt.* 2014). Here Mongooses also occasionally climbed trees to forage, either chasing prey up trees or climbing up to excavate arthropods and small vertebrates from bark crevices and tree hollows.

Although Common Dwarf Mongoose is evidently not well adapted to tree climbing, the records reported here suggest that in some habitats it uses trees both for sentinel posts and denning. Although the use of trees for refuge might be more common in habitats where termite mounds are scarce, Mongooses at the two South Africa study sites do not appear to be using tree hollows because of a scarcity of suitable termite mounds (for example, at Phuza Moya all three tree-hollow refuges were located within 30 m of well-used termite

Fig. 1. Common Dwarf Mongoose *Helogale parvula* climbing a Knobthorn *Acacia nigrescens* tree, Sorabi Rock Lodge Reserve, Limpopo Province, South Africa, 17 May 2013 (Photo: J. Kern).

mound refuges; L. Sharpe *in litt.* 2014). In the highest density areas of the Serengeti grasslands, Rood (1983) reported densities reaching 31 individuals per km^2 at the start of the breeding season and home ranges averaging 0.35 km^2. In the bushveld of Sorabi, average home-range size is smaller (0.25 km^2), but at the start of the breeding season population density reached 42 individuals per km^2 (based on 73 Mongooses in eight groups). It is possible that tree denning may increase when Mongoose density is high and alternative refuges (such as trees) are more readily available to supplement more preferred refuge sites (termite mounds). Clearly, the determinants of tree denning in Common Dwarf Mongoose remain poorly understood.

Acknowledgements

Benny Rouwhorst is thanked for allowing JK to work on Sorabi Rock Lodge Reserve. We are particularly grateful to Scott Creel for sharing information on his work in the Serengeti, and to Lynda Sharpe and Peter Waser for their constructive comments on the manuscript, as well as for kindly contributing some of their own observations and data from long-term studies.

References

Creel, S. 2013. Dwarf Mongoose *Helogale parvula*. Pp. 368–373 in Kingdon, J. & Hoffmann, M. (eds) *Mammals of Africa, V. Carnivores, pangolins, equids and rhinoceroses*. Bloomsbury, London, U.K.

Hiscocks, K. & Perrin, M. R. 1991. Den selection and use by Dwarf Mongooses and Banded Mongooses in South Africa. *South African Journal of Wildlife Research* 21: 119–122.

Kingdon, J. 1977. *East African mammals: an atlas of evolution in Africa*, *IIIA. Carnivores*. Academic Press, London, U.K.

Rautenbach, I. L. 1982. *The mammals of the Transvaal*. Ecoplan Monograph, Pretoria, South Africa.

Rood, J. P. 1983. The social system of the Dwarf Mongoose. Pp. 454–488 in Eisenberg, J. F. & Kleiman, D. G. (eds) *Advances in the study of mammalian behaviour*. American Society of Mammalogists (Special Publication 7) and Allen Press, Lawrence, KS, U.S.A.

Skinner, J. D. & Chimimba, C. T. (eds) 2005. *The mammals of the Southern African subregion*, 3rd edn. Cambridge University Press, Cambridge, U.K.

Taylor, M. E. 1974. The functional anatomy of the forelimb of some African Viverridae (Carnivora). *Journal of Morphology* 143: 307–336.

Waser, P. M., Elliott, L. F., Creel, N. M. & Creel, S. R. 1995. Habitat variation and mongoose demography. Pp. 421–447 in Sinclair, A. R. E. & Arcese, P. (eds) *Serengeti II: dynamics, management, and conservation of an ecosystem*. University of Chicago Press, Chicago, U.S.A.

[1]IUCN Species Survival Commission, c/o United Nations Environment Programme - World Conservation Monitoring Centre, 219c Huntingdon Rd, Cambridge, CB3 0DL, U.K.
Email: mike.hoffmann@iucn.org
[2]School of Biological Sciences, University of Bristol, Bristol, U.K.

Observations of Javan Small-toothed Palm Civets *Arctogalidia trivirgata trilineata* apparently feeding on the nectar of *Calliandra calothyrsus* flowers on Gunung Salak, West Java

Richard S. MOORE[1] and WIHERMANTO[2]

Abstract

Observations on Gunung Salak, West Java, Indonesia, of Javan Small-toothed Palm Civet *Arctogalidia trivirgata trilineata* apparently feeding on the floral nectar of the introduced tree *Calliandra calothyrsus* suggest that nectar may provide an important fall-back food to this species in disturbed habitats. Further studies could confirm the nectarivorous feeding habits of this palm civet and whether they contribute to the pollination of *C. callothyrsus*.

Keywords: diet, introduced food-plant, kaliandra, nectarivory, pollination, Viverridae

Pengamatan perilaku Musang Akar Jawa *Arctogalidia trivirgata trilineata* tampaknya makan nektar Bunga Kaliandra Calliandra calothyrsus di Gunung Salak, Jawa Barat

Abstrak

Pengamatan di Gunung Salak, Jawa Barat terhadap Musang Jawa-gigi kecil *Arctogalidia trivirgata trilineata* yang sedang makan nektar bunga Kaliandra *Calliandra calothyrsus* memberi kesan bahwa nektar bisa jadi menyediakan pakan pengganti yang baik terhadap spesies ini di habitat terganggu. Penelitian lebih lanjut diperlukan untuk memastikan perilaku memakan nektar dari spesies ini dan apakah mereka berkontribusi terhadap penyerbukan *C. callothyrsus*.

A Javan Small-toothed Palm Civet *Arctogalidia trivirgata trilineata* was observed on 7 March and a second on 14 April 2014 in flowering kaliandra trees *Calliandra calothyrsus* in secondary forest on the north face of Gunung (= Mount) Salak, West Java (6°40′S, 106°44′E) at an altitude of 1,110 m asl. Both civets were beige in colour (Eaton *et al*. [2010] discussed variation in pelage colour in this taxon). One sighting, a male, was observed at 21h53 and the other, presumed to be a female, at 23h12. The two sightings were less than 50 m apart. Both civets averaged heights of 5 m above ground and were observed for approximately 10 minutes, until moving off quickly through the trees and out of sight. Both civets remained inactive for a short time, probably owing to initial disturbance by the observers, but then suddenly became active again and proceeded to move with speed and agility amongst the terminal branches of the kaliandra tree feeding, apparently, on the floral nectar (Fig. 1). The trees were approximately 7 and 9 m tall respectively. Other kaliandra trees of varying sizes were in the vicinity, some with adjoining canopies. Each civet visited approximately 20–30 flowers during the observation periods. Depending on the position of the flower, the civets licked around the base of the flower directly, or pulled the flower towards the mouth with either one or both forepaws whilst the hind legs were supporting the body on another, sturdier, substrate. After feeding for a few seconds from each flower, the civet released the flowers, which did not appear to be damaged. It is possible that, rather than or as well as taking nectar, the civets were licking small invertebrates from the flowers. However, having witnessed Javan Slow Lorises *Nycticebus javanicus* feeding on *C. calothyrsus* nectar in the same manner at very close range, the authors are fairly certain this was not the case.

Fig. 1. Javan Small-toothed Palm Civet *Arctogalidia trivirgata trilineata* feeding at *Calliandra calothrysus* flowers, Gunung Salak, West Java, Indonesia, 14 February 2014.

The diet of Small-toothed Palm Civet is predominantly fruit complemented with small animals (Duckworth & Nettlebeck 2008, Shepherd & Shepherd 2012). Whilst the Javan subspecies *A. t. trilineata* is one of the most poorly documented larger mammals in Java, two recent observations of it feeding on the fruits of *Ficus* and *Cinammomum sintoc* also suggest strong frugivory (Eaton *et al*. 2010, Moore 2011). Nectar feeding had not previously been recorded in this taxon. Northern Small-toothed Palm Civet *Arctogalidia trivirgata* of subspecies-group *leucotis* has been observed feeding at flowers (misleadingly described in Duckworth [1997: 9] as "feeding on flowers"): on 3 November 1992, one was watched for 20 minutes in the crown of a small 15 m tree (below the semi-evergreen forest canopy),

licking the 'bottlebrush-like' flowers (i.e. with stamens projecting beyond the corolla, giving external anthers). This was presumably taking nectar but it was not possible to exclude that small invertebrates were being licked up (J. W. Duckworth *in litt*. 2014). Alleged nectarivory in other carnivores has been witnessed only in Yellow-throated Marten *Martes flavigula* feeding on *Cynometra polyandra* in North-east India (Nandini & Karthik 2007), Common Palm Civet *Paradoxurus hermaphroditus* feeding on nectar of Silk-cotton tree *Bombax ceiba* in Nepal (Joshi *et al*. 1995) and Masked Palm Civet *Paguma larvata* feeding on *Mucuna birdwoodiana* in Hong Kong (Lau 2012).

The genus *Calliandra*, in the family Leguminosae, originates from Mexico, Central and South America, and *C. calothyrsus* was first introduced to Indonesia from Guatemala in 1936 by Dutch botanists (MacQueen 1992, Chamberlain & Hubert 2001). *Calliandra calothyrsus* is used principally as a source of cattle fodder and fuel wood, but also for manure, erosion control and honey production (Chamberlain & Hubert 2001, Syamsuwida *et al*. 2014). If sufficient moisture is available, *C. calothyrsus* can flower throughout the year, although flowering usually peaks between November and January (Chamberlain & Hubert 2001).

Calliandra calothyrsus trees were abundant at the location of the sightings on Gunung Salak (Mirmanto *et al*. 2008) and are found up to elevations of 1,400 m asl. This fast-growing invasive species was introduced as a potential shade tree for coffee, but now thrives in lower-level disturbed forests, where it is harvested by locals for livestock feed and fuel wood (NRC 1983). The extremely wet climate in West Java, and particularly in the Gunung Salak region (annual rainfall 4,000–5,000 mm) enables *C. calothyrsus* to flower all year round. *Calliandra calothyrsus* becomes florally receptive during late afternoon and nectar is produced during the night, suggesting an evolved dependence on nocturnal visitors for pollination (Chamberlain & Hubert 2001). Owing to the morphology of *C. calothyrsus* flowers (Fig 2), small insects such as bees and wasps can reach the nectar without coming into contact with the reproductive parts (Chamberlain & Hubert 2001). Larger insects or mammals that rub against the stamens whilst feeding are therefore the more likely pollinating agents.

The floral nectar of *C. calothyrsus* comprised the primary diet of six rehabilitated and released *Nycticebus javanicus* on Gunung Salak (Moore 2012). Preliminary studies of two wild *N. javanicus* also suggest a high reliance on this species in this habitat (Yayasan IAR Indonesia, unpublished data). Various species of nectar-feeding bat (Pteropodidae) inhabit Gunung Salak (Prawiladilaga *et al*. 2008), but whilst bats are known pollinators of this species elsewhere (MacQueen 1992), feeding on *C. calothyrsus* flowers on Gunung Salak was only observed occasionally by the monitoring team during the over three years of nightly monitoring of released Slow Lorises.

The diet of *A. t. trilineata* is still relatively unknown owing to its nocturnal nature, typically high canopy feeding and general lack of study. The extent to which *A. t. trilineata* uses the nectar of *C. calothyrsus* as a food source in this disturbed habitat is uncertain. As with *N. javanicus* on Gunung Salak, introduced *C. calothyrsus* may provide an alternative or fallback food source for *A. t. trilineata* when preferred/original food trees have been logged. Java's huge human population and accompanying demand for raw materials has contributed to extensive clearance and disturbance of indigenous forests (Smiet 1992). If *A. t. trilineata* can adapt to the increasingly prevalent anthropogenic and disturbed habitats in Java by feeding on introduced species, this could prove an important factor to its continued survival. Whether *A. t. trilineata* contributes to the pollination of *C. calothyrsus* remains to be seen. With only these couple of short sightings available at a single location, further studies into the extent of nectarivory of this subspecies would be most informative.

Fig. 2. Flower of kaliandra *Calliandra calothyrsus*, Gunung Salak, West Java, Indonesia, 3 February 2013.

Acknowledgements

We thank Indah Winarti for the Indonesian translation.

References

Chamberlain, J. R. & Hubert, J. D. 2001. Reproductive biology and seed production. Pp. 12–28 in Chamberlain, J. R. (ed.) Calliandra calothyrsus*: an agroforestry tree for the humid tropics*. Oxford University Press, Oxford, U.K.

Duckworth, J. W. 1997. Small carnivores in Laos: a status review with notes on ecology, behaviour and conservation. *Small Carnivore Conservation* 16: 1–21.

Duckworth, J. W. & Nettelbeck, A. R. 2008. Observations of Small-toothed Palm Civets *Arctogalidia trivirgata* in Khao Yai National Park, Thailand, with notes on feeding technique. *Natural History Bulletin of the Siam Society* 55: 187–192.

Eaton, J. A., Wüst, R., Wirth, R., Shepherd, C. R., Semiadi, G., Hall, J. & Duckworth, J. W. 2010. Recent records of the Javan Small-toothed

Palm Civet *Arctogalidia* (*trivirgata*) *trilineata*. *Small Carnivore Conservation* 43: 16–22.

Joshi, A. R., Smith, J. L. D. & Cuthbert, F. J. 1995. Influence of food distribution and predation pressure on spacing behavior in palm civets. *Journal of Mammalogy* 76: 1205–1212.

Lau, M. W. N. 2012. Masked Palm Civet *Paguma larvata* apparently feeding on nectar of *Mucuna birdwoodiana*. *Small Carnivore Conservation* 47: 79–81.

MacQueen, D. J. 1992. *Calliandra calothyrsus*: implications of plant taxonomy, ecology and biology for seed collection. *Commonwealth Forestry Review* 71: 20–34.

Mirmanto, E., Wiriadinata, H., Royyani, M. F., Ichikawa, S. & Ismirza 2008. *Merajut pesona flora hutan pegunungan tropis di Gunung Salak*. Pusat Penelitian Biologi LIPI, Jakarta, Indonesia.

Moore, R. S. 2011. Sightings of Javan Small-toothed Palm Civets *Arctogalidia trivirgata trilineata* on Gunung Salak, West Java, Indonesia. *Small Carnivore Conservation* 44: 38–39.

Moore, R. S. 2012. *Ethics, ecology, and evolution of Indonesian slow lorises (*Nycticebus *spp.) rescued from the pet trade*. Oxford Brookes University, Oxford, U.K. (Ph.D. thesis).

Nandini, R. & Karthik, T. 2007. Field observations of Yellow-throated Martens *Martes flavigula* feeding on flowers in Meghalaya, North-east India. *Small Carnivore Conservation* 37: 26–27.

[NRC] National Research Council 1983. Calliandra*: a versatile small tree for the humid tropics.* National Academy Press, Washington, D.C., U.S.A.

Prawiladilaga, D. M., Maharadatunkamsi, I., Mumpuni, I., Fitriana, Y., Prasetyo, A., Marakarmah, A., Wijamukti, S., Dewi, I., Supriatna, N., Giyanto, Laksana, W., Hendra, P., Mulya, A., Suryana, T., Mulyadi, E. & Irawan, Y. 2008. *Fauna survey at Resort Kawah Ratu – Gunung Salak, Gunung Halimun–Salak NP.* Division of Zoology, LIPI, Bogor, Indonesia.

Shepherd, C. R. & Shepherd, L. A. 2012. *A naturalist's guide to the mammals of South-east Asia*. John Beaufoy, Oxford, U.K.

Smiet, A. C. 1992. Forest ecology on Java: human impact and vegetation of montane forest. *Journal of Tropical Ecology* 8: 129–152.

Syamsuwida, D., Kurniaty, R., Putri, K. P. & Suita, E. 2014. Kaliandra (*Calliandra callothyrsus* [sic]) as a timber for energy: in a point of view of seeds and seedlings procurement. *Energy Procedia* 47: 62–70.

[1]Yayasan IAR Indonesia, Curug Nangka, Kp. Sinarwangi, Ciapus, Bogor, Indonesia.
Email: rich_s_moore@hotmail.com
[2]Bogor Botanical Gardens, Jalan Juanda 13, Bogor, Indonesia 16003.
E-mail: wihermanto@yahoo.com

Recent camera-trap records of Yellow-throated Marten *Martes flavigula* in the southern Sikhote-Alin mountains, the Russian Far East

Linda KERLEY[1,2] and Mikhail E. BORISENKO[2]

Abstract

Yellow-throated Marten *Martes flavigula* has a wide Asian range. Its current distribution map on *The IUCN Red List of Threatened Species* shows a small range in the Russian Far East mostly comprised of western Primorski Krai and south-western Khabarovski Krai. It excludes south-eastern Primorski Krai, even though the species had been stated to occur there as recently as 1984. During 2010–2013 Yellow-throated Marten was camera-trapped 24 times at 15 camera-trap stations in south-eastern Primorski Krai. The spread of records geographically across the survey area and through the survey period suggests a resident, well established, population in this area. We recommend that the range as given in Yudin (1984) be used by the *IUCN Red List*.

Keywords: Asian Badger, groups, *Meles leucurus*, range, scent-mark, year-round activity

Недавние съёмки харзы *Martes flavigula* с помощью фотоловушек в южном Сихоте-Алине Дальнего Востока

Краткий обзор

Харза *Martes flavigula* имеет широкий ареал обитания в Азии. Согласно списку Красной книги МСОП о видах, находящихся под угрозой, текущая её карта распространённости представляет небольшой ареал на Дальнем Востоке России, в основном включающий в себя запад Приморского края и юго-запад Хабаровского края, но не включает территории юго-востока Приморского края, хотя данный вид был отмечен там в относительно недавнем 1984 году. В течении 2010–2013 года харза была отснята 24 раза в 15 пунктах установки фотоловушек на юго-востоке Приморского края. Распределение снимков географически вдоль области исследования и в течении периода исследования предполагает наличие резидентной, довольно устойчивой, популяции в данной области. Мы рекомендуем, чтобы ареал, предлагаемый Юдиным в 1984 году, использовался в Красной книге.

Ключевые слова: Азиатский барсук, группы, *Meles leucurus*, ареал, ольфакторные метки, активность в течении года

Yellow-throated Marten *Martes flavigula* has a wide Asian range, from northern India east and south across South-east Asia to the Greater Sundas, and north to Korea and the Russian Far East (Corbet 1978, Corbet & Hill 1992). The current species map on *The IUCN Red List of Threatened Species* (Abramov *et al*. 2008) shows a small range in the Russian Far East mostly comprised of western Primorski Krai and south-western Khabarovski Krai. On this map, the south-eastern Russian Far East is noticeably specifically excluded (Fig. 1) even though the species has been recorded there (e.g. Heptner *et al*. 1967, Yudin 1984). This note documents the species's recent occurrence in this area, in south-eastern Primorski Krai.

Lazovsky Zapovednik (a zapovednik is a strict nature reserve; 1,240 km^2 in size) and Zov Tigra National Park (870 km^2) are located in south-eastern Primorski Krai, in the temperate Ussuri broadleaf and mixed forest ecoregion (Khokhryakov & Shokrin 2002). The region experiences warm summers (averaging 17.4°C near the coast of the Sea of Japan and 23.5°C further inland), and cold winters (averaging -10.4°C near the coast of the Sea of Japan to -30°C further inland) (Khokhryakov & Shokrin 2002), but local climate varies significantly even within Lazovsky Zapovednik, reflecting distance to the sea. Areas near the sea are generally cooler in summer and warmer in winter, with typically less deep winter snow.

A research study on Tigers *Panthera tigris* in the Russian Far East (Kerley & Borisenko 2010, 2013) established a network of

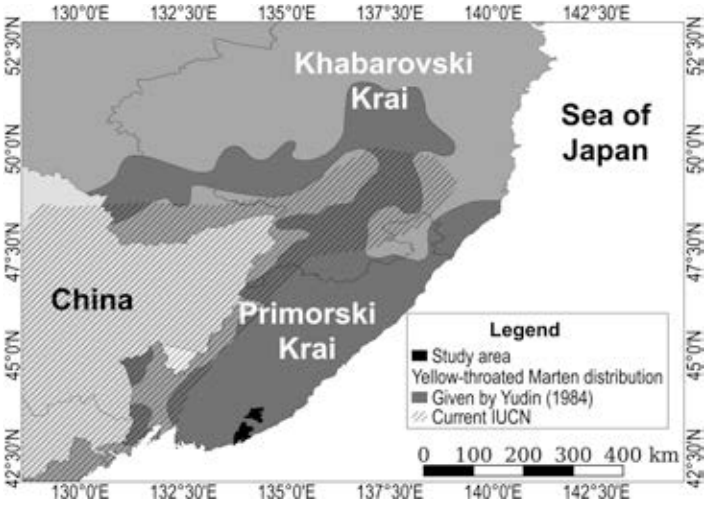

Fig. 1. Yellow-throated Marten *Martes flavigula* north-east Asian range, according to *The IUCN Red List of Threatened Species* (Abramov *et al*. 2008), the Russian range according to Yudin (1984: Fig. 160), and locations of Lazovsky Zapovednik and Zov Tigra National Park.

77 unbaited camera-trap stations (Bushnell Trophy Cam digital camera-traps, Bushnell Co, Overland Park, KS, USA) throughout Lazovsky Zapovednik and Zov Tigra National Park giving an effective survey area of approximately 1,500 km^2. Camera-trap stations were spaced no more than 10 km apart on forest roads

and trails in places frequented by Tigers. Each camera-trap was attached to a tree approximately 45–60 cm from the ground, set to 24 hours operation. The same stations were used throughout the study period of January 2010 to August 2013. Notionally independent records were defined as those photographs taken at least 24 hours apart from others at the same camera-trap station.

Over 37,906 camera-trap-days, Yellow-throated Martens were recorded 24 times at 15 camera-trap locations (Fig. 2, Table 1). Records came from an elevation range of 20–560 m; there was no significant camera-trap effort above 560 m. Records came from all months except August, September and December, indicating year-round activity, even during the coldest, snowiest, period (January to mid February). Animals were often photographed in groups, consistent with other reports (Yudin 1984, Parr & Duckworth 2007). Minimum group sizes were of two (six times), three (once; Fig. 3) and four (once) individuals. Heptner *et al*. (1967) described colour variation between age classes: based on this, the groups appeared to be families with one more brightly coloured individual (presumably the adult female). Animals sometimes came to sniff at Tiger scent-marks (four times; Fig. 4) and this latter behaviour was also shown in the area by Asian Badger *Meles leucurus* (Fig. 5). Twenty-one of the photographs were taken in daylight hours, with the other two close to daylight. This is consistent with the generally diurnal nature of Yellow-throated Marten elsewhere in its range (e.g. Than Zaw *et al*. 2008).

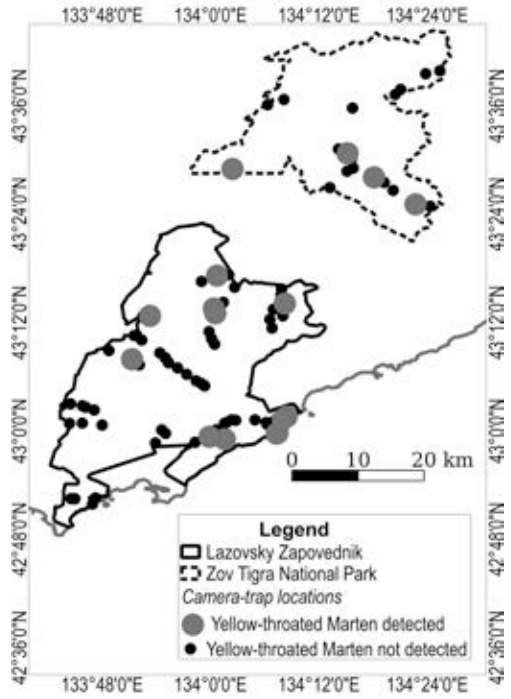

Fig. 2. Locations of camera-traps in Lazovsky Zapovednik and Zov Tigra National Park, south-eastern Primorski Krai, Russia, during 2010–2013. Yellow-throated Martens *Martes flavigula* were recorded at the large grey circles but not at the small black dots.

Table 1. Records of Yellow-throated Marten *Martes flavigula* in Lazovsky Zapovednik and Zov Tigra National Park, Russia.

River drainage	Date	Time	Latitude N	Longitude E	Elev.	Habitat type
Lazovsky Zapovednik						
Perekatnaya	12 May 2013	17h15	43°13′26″	134°00′50″	289	Broadleaf/pine *Pinus* mix riparian
Perekatnaya	17 Feb 2013	15h58	43°13′01″	134°00′33″	401	Broadleaf/pine *Quercus* mix riparian
Egerevka	6 May 2013	08h19	43°12′42″	133°52′32″	236	Oak/birch *Betula* riparian
Koreiskaya Pad	19 Nov 2010	13h14	43°02′37″	133°46′11″	218	Broadleaf/pine mix riparian
Sharokia	15 Feb 2013	16h09	43°17′11″	134°00′44″	370	Broadleaf/pine mix riparian
Sokolovka	7 Jan 2013	12h37	42°59′07″	134°01′17″	198	Broadleaf/pine mix riparian
Sokolovka	25 Feb 2013	09h24	42°59′04″	134°01′36″	152	Broadleaf/pine mix riparian
Proselochnaya	3 Jun 2012	17h34	43°00′48″	134°06′25″	20	Broadleaf riparian
Proselochnaya	23 Jun 2013	11h24	43°01′34″	134°08′23″	67	Oak forest/ridge above sea
Tumannaya Mountain	19 Apr 2012	13h37	42°59′45″	134°07′25″	161	Oak forest/cliff top above sea
Tumannaya Mountain	6 Jan 2012	12h10	42°59′45″	134°07′25″	161	Oak forest/cliff top above sea
Tumannaya Mountain	19 Jul 2012	15h12	42°59′45″	134°07′25″	161	Oak forest/cliff top above sea
Tumannaya Mountain	12 Jun 2012	10h13	42°59′45″	134°07′25″	161	Oak forest/cliff top above sea
Tumannaya Mountain	16 May 2012	08h53	42°59′45″	134°07′25″	161	Oak forest/cliff top above sea
Tumannaya Mountain	9 June 2013	18h23	42°59′45″	134°07′25″	161	Oak forest/cliff top above sea
Valunovka	21 May 2013	12h18	43°07′39″	133°51′32″	208	Broadleaf/pine mix riparian
Zov Tigra NP						
Milogradovka	15 Apr 2012	14h26	43°25′05″	134°22′43″	201	Pine/broadleaf mix
Milogradovka	22 Mar 2012	16h03	43°25′05″	134°22′43″	201	Pine/broadleaf mix
Milogradovka	27 Mar 2012	16h06	43°30′32″	134°15′19″	365	Pine/broadleaf mix
Milogradovka	5 May 2012	07h33	43°30′32″	134°15′19″	365	Pine/broadleaf mix
Milogradovka	4 Nov 2011	12h51	43°26′38″	134°20′14″	247	Pine/broadleaf mix
Milogradovka	4 Nov 2011	19h03	43°30′32″	134°15′19″	365	Pine/broadleaf mix
Milogradovka	23 Oct 2012	16h00	43°26′38″	134°20′14″	247	Pine/broadleaf mix
Pasechnaya	12 Apr 2013	04h26	43°28′50″	134°03′14″	560	Pine/broadleaf mix

Coordinates were taken with Garmin GPSmap 62 and use the WGS84 datum.
'Elev.' = Recorded elevation, in meters, taken from the GPS.

Fig. 3. Three Yellow-throated Martens *Martes flavigula*, Tumannaya Mountain, Lazovsky Zapovednik, Primorski Krai, Russia, 9 June 2013.

Fig. 4. Yellow-throated Marten *Martes flavigula* sniffing at Tiger *Panthera tigris* scent-mark, Sharokia drainage, Lazovsky Zapovednik, Primorski Krai, Russia,15 February 2013.

Fig. 5. Asian Badger *Meles leucurus* sniffing at Tiger *Panthera tigris* scent-mark, Proselochnaya drainage, Lazovsky Zapovednik, Primorski Krai, Russia, 9 May 2013.

The spread of records geographically across the survey area and through the survey period suggests a resident population well established in this area. This is consistent with the distribution as given in Heptner *et al*. (1967) and Yudin (1984). The *IUCN Red List* gives no reason for the excision of south-east Primorski Krai from the range. We therefore recommend that the range as given in Yudin (1984) be used by the *IUCN Red List*. This requires the addition to the current *IUCN Red List* map of eastern Primorski Krai north to the River Khor (see Fig. 1).

Acknowledgements

We thank A. A. Laptev and A. I. Myslenkov of Lazovsky Zapovednik, and Y. I. Berseniev of Zov Tigra National Park, for logistical support. We also thank the Dorothy Howard Charitable Trust, Amur Leopard and Tiger Alliance, Mohamed bin Zayed Species Conservation Fund, Bio-Resources Inc., Dave McCullough and The Indianapolis Zoo for financial support. Two anonymous reviewers helped improve the text.

References

Abramov, A., Timmins, R. J., Roberton, S., Long, B., Than Zaw & Duckworth, J. W. 2008. *Martes flavigula*. In: IUCN 2013. *IUCN Red List of Threatened Species*. Version 2013.2. <www.iucnredlist.org>. Downloaded on 11 April 2014.

Corbet, G. B. 1978. *The mammals of the Palaearctic region: a taxonomic review*. British Museum (Natural History) and Cornell University Press, London, U.K., and Ithaca, U.S.A.

Corbet, G. B. & Hill, J. E. 1992. *The mammals of the Indomalayan region: a systematic review*. Natural History Museum Publications and Oxford University Press, Oxford, U.K.

Heptner, V. G., Naumov, N. P., Yurgenson, P. B., Sludskii, A. A., Chirkova, A. F. & Bannikov, A. G. 1967. *Mammals of the Soviet Union, II, part 1b. Carnivora (weasels; additional species)*. Vysshaya Shkola, Moscow, U.S.S.R. (In Russian.)

Kerley, L. L. & Borisenko, M. E. 2010. Amur Tiger investigations by camera-traps in Lazovsky Reserve and adjacent areas. Pp. 110–119 in Myslenkov, A., Voloshina, I. & Kerley, L. (eds) *Proceedings of the scientific conference, devoted to the 75 anniversary of Lazovsky reserve. Lazo, September 28–29, 2010*. Russkij Ostrov, Vladivostok, Russia. (In Russian with English abstract.)

Kerley, L. L. & Borisenko, M. M. 2013. New locations for the Leopard Cat in the Russian Far East. *Cat News* 59: 20–21.

Khokhryakov, S. A. & Shokhrin, V. P. 2002. *Amphibians, reptiles, birds, and mammals of Lazovsky Zapovednik (Russian Far East). An annotated species list*. Russkij Ostrov, Vladivostok, Russia.

Parr, J. W. K. & Duckworth, J. W. 2007. Notes on diet, habituation and sociality of Yellow-throated Marten *Martes flavigula*. *Small Carnivore Conservation* 36: 27–29.

Than Zaw, Saw Htun, Saw Htoo Tha Po, Myint Maung, Lynam, A. J., Kyaw Thinn Latt & Duckworth, J. W. 2008. Status and distribution of small carnivores in Myanmar. *Small Carnivore Conservation* 38: 2–28.

Yudin, V. G. 1984. Order Carnivora. Pp. 216–316 in Krivosheev V. G. (ed.) *A guide to terrestrial mammals of the far east USSR*. Nauka, Moscow, U.S.S.R. (In Russian.)

[1]Zoological Society of London, Lygovaya 7, Lazo, Primorsky Region, 692890, Russian Federation. Email: linda.kerley@zsl.org
[2]Lazovsky Zapovednik, Lazo, Primorsky Region, 692890, Russian Federation.

Records of Sunda Stink-badger *Mydaus javanensis* from Rajuk Forest, Malinau, North Kalimantan, Indonesia

RUSTAM[1] and A. J. GIORDANO[2]

Abstract

Several records of the little known Sunda Stink-badger *Mydaus javanensis* from North Kalimantan, Indonesia, on the island of Borneo were gathered during a pilot survey of local mammals. Recent records from Indonesian Borneo are few. Field observations and records of hunted individuals suggest a locally abundant population.

Keywords: Borneo, camera-trap, hunting, Mephitidae, sight records, Teledu

Catatan Kehadiran Teledu Sigung *Mydaus javanensis* dari Hutan Rajuk, Malinau, Kalimantan Utara, Indonesia

Abstrak

Beberapa catatan kehadiran jenis yang masih sangat jarang diketahui, Teledu Sigung *Mydaus javanensis* dari Kalimantan Utara, Indonesia, di Pulau Kalimantan berhasil dikumpulkan selama survey pendahuluan mamalia secara lokal. Catatan terkini tentang jenis ini dari Pulau Kalimantan wilayah Indonesia sangat sedikit. Observasi lapangan dan catatan temuan dari para pemburu menunjukkan bahwa populasi jenis ini melimpah secara lokal.

Sunda Stink-badger *Mydaus javanensis* is a small ground-dwelling Old World relative of skunks (Mephitidae) that appears to be patchily distributed across the islands of Borneo, Java, Sumatra and the Natuna archipelago (Corbet & Hill 1992, Hwang & Larivière 2003, Meijaard 2003, Long *et al*. 2008). Although listed as Least Concern by *The IUCN Red List of Threatened Species* (Long *et al*. 2008), too little is known about its range and ecological requirements to be sure of its conservation status. Samejima *et al*. (in prep.) mapped most of the approximately 170 records that they traced from Borneo as part of a species distribution model; those excluded were either too old or spatially imprecise to be useful for the model. Of those included, most hail from the island's northernmost part, the Malaysian state of Sabah. Among those from Indonesian Borneo are a few recent records from Bukit Soeharto (Yasuma 1994) and Sungai Wain Protection Forests in East Kalimantan (G. Fredriksson *in litt*. 2011). Previous records from elsewhere in Kalimantan include one each from the Sintang district of West Kalimantan (location unknown; G. Semiadi *in litt.* 2011), PT. Sari Bumi Kusuma timber concession area of Seruyan & Katingan Districts in Central Kalimantan, and the Meratus Forest of South Kalimantan (G. Semiadi *in litt.* 2011). The validity of much older published localities in Kalimantan for the species (collated by Payne *et al*. 2005) is not reviewed here.

Long Ketrok Protection Forest (Long Ketrok PF) lies south of the Mentarang River in North Kalimantan province, Indonesian Borneo. It is largely contiguous with other forest in the Malinau district (see Blom 2010), including an area of forest very roughly 200 km to the south where Samejima *et al*. (in prep.) mention two recent Stink-badger records. A December 2012 – February 2013 exploratory mammal survey of Long Ketrok PF focused on a part of this 600 km^2 area known locally as Rajuk Forest (Fig. 1), near a small village of the same name. The vegetation of Rajuk seems typical of lowland mixed dipterocarp rainforest in Borneo in that it is dominated by a native climax tree community of Dipterocarpaceae and Lauraceae (GIZ 2013). This 'protected forest' has been designated for limited use by six villages (Rajuk, Paking, Punan Setarap, Sentaban, Setarap and Setulang) comprising four dominant Dayak ethnic communities (Punan, Kenyah, Lundaye and Abai). Villages are prohibited from cutting and extracting trees, particularly in the forest core, but non-timber forest products are harvested frequently, including many wildlife species.

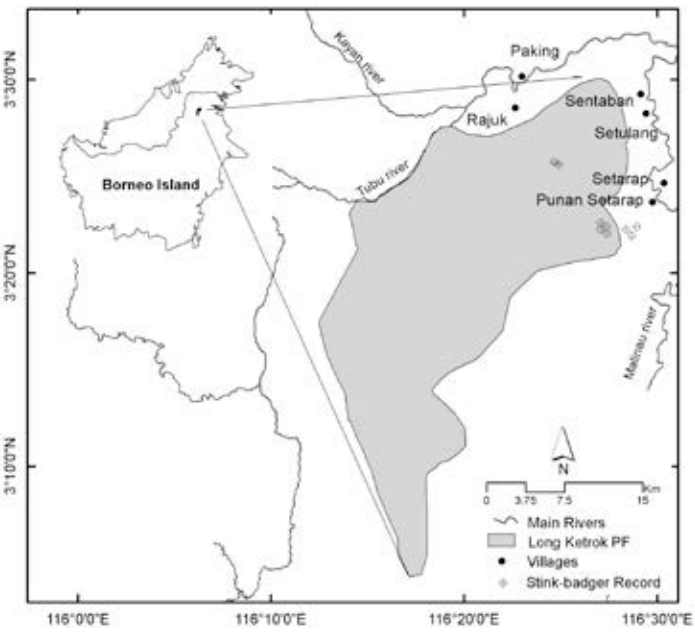

Fig. 1. Long Ketrok Protection Forest, Malinau, North Kalimantan, Indonesia, showing approximate location of Sunda Stink-badger *Mydaus javanensis* records in the Rajuk Forest.

Nine Stink-badger point locations from Rajuk forest (Table 1; direct field sightings, recently killed animals, detections

Table 1. Sunda Stink-badger *Mydaus javanensis* records from Rajuk forest, Malinau, North Kalimantan, Indonesia.

Geographic coordinates (recorded altitude)[1]	Date (time)	Type of record	Habitat characteristics
3°25′28″N, 116°24′34″E (112 m)	16 Dec 2012 (21h00)	Field sighting	Secondary forest near river
3°25′46″N, 116°24′22″E (106 m)	17 Dec 2012 (21h21)	Field sighting	Primary forest near river
3°22′39″N, 116°29′13″E (37 m)	2 Feb 2013 (11h19)	Two individuals, killed by hunter*	Secondary forest near river
3°22′54″N, 116°28′29″E (56 m)	2 Feb 2013 (17h22)	Field sighting	Primary forest near river
3°23′00″N, 116°27′48″E (165 m)	5 Feb 2013 (16h30)	Odour[2]	Secondary forest near logging road
3°22′30″N, 116°26′59″E (113 m)	6 Feb 2013 (18h29)	Field sighting	Primary forest near river
3°22′46″N, 116°26′31″E (58 m)	9 Feb 2013 (11h00)	Odour[2]	Secondary forest near river
3°22′42″N, 116°27′12″E (145 m)	9 Feb 2013 (08h18)	Killed by hunter* (hunting dog[3])	Secondary forest near paddy field
3°22′41″N, 116°29′13E (40 m)	10 Feb 2013 (09h00)	Killed by hunter*	Secondary forest near paddy field

[1]Recorded via personal GPS unit under the WGS84 datum. [2]As for skunks, the distinctive odour of Sunda Stink-badger is pronounced and once recognised, is unlikely to be confused with anything else (authors' pers. obs.). [3]Dogs indicate Stink-badgers in low tree cavities, which then are killed by the hunter. *Carcases of hunter-killed specimens observed first-hand.

by odour) were recorded from forest below 200 m asl (the entire area lies below 300 m). Although none was greater than 200 m from riverine or streamside habitats, this may not be a biologically relevant pattern but rather a result of chance alone. These particular characteristics, largely consistent with records from Sabah (Payne *et al*. 2005), differ somewhat from records of the species from Sarawak (at similar latitude to North Kalimantan province). Many of the latter originate from montane habitats (Giman & Jukie 2012), which were not present in Long Ketrok. Preliminary niche distribution models (Samejima *et al*. in prep.) suggested that habitat was of moderate to moderately high suitability for Stink-badgers in the vicinity of Long Ketrok PF.

Fig. 2. Hunter-killed Sunda Stink-badger *Mydaus javanensis* from Rajuk Forest, Malinau, North Kalimantan, Indonesia.

Four Stink-badger carcases, reportedly killed by local people in nearby forest, were observed (see Fig. 2). Most ethnic Dayak appeared to be effective hunters, especially the Punan. One might expect the animal's odour to affect the taste of its meat, although the rank quality of Hog Badger *Arctonyx collaris* meat is esteemed by some rural hill minorities in Lao PDR (J. Chamberlin per J. W. Duckworth *in litt*. 2013). The Punan demonstrated how the animal's strong odour is mitigated. The animal is initially roasted thoroughly in an effort to remove hair and expel internal fluids, reportedly to allow easier separation of the stomach from the abdominal cavity. Once the stomach bulges over the fire, presumably from internal gases, it and glands are removed, and the rest of the meat is then edible.

Sunda Stink-badger appears to be taken not infrequently by hunters in this area. In Rajuk Forest, local people claim that its odour is frequently encountered. The animal's use of riverine habitats close to human paths may make it easy to locate. The impacts, if any, of hunting on the local Stink-badger population are unclear, as is how the population density of Long Ketrok compares with other parts of North Kalimantan. Records, including evidence of scarcity or absence, from other habitats in Kalimantan such as disturbed forests, higher elevations, non-forest habitats and further from watercourses, would help to clarify this species's ecological range. Finally, a more accurate assessment of Sunda Stink-badger's conservation status requires ascertaining impacts of hunting on local populations.

Acknowledgements

We would like to thank Tunggul Butar Butar, Andreas Mensch, Suprianto, Karlina and staff of Deutsche Gesellchaft für Internationale Zusammenarbeit (GIZ) Samarinda, as well as the Clouded Leopard Project (at Point Defiance Zoo) and S.P.E.C.I.E.S. for financial and logistical support.

References

Blom, B. 2010. Reduced emission from deforestation and forest degradation (REDD) in East Kalimantan, Indonesia: barrier and advantages to project equitability. *Tropical Resources Bulletin* 29: 59–65.

Corbet, G. B. & Hill, J. E. 1992. *Mammals of the Indomalayan Region: a systematic review*. Natural History Museum and Oxford University Press, London and Oxford, U.K.

Giman, B. & Jukie, A. 2012. Distribution of Sunda Stink-badger *Mydaus javanensis* in Sarawak, Malaysia. *Small Carnivore Conservation* 46: 12–16.

[GIZ] Deutsche Gesellschaft für Internationale Zusammenarbeit 2013. *Survey report: ground-based forest carbon inventory in Malinau district, East Kalimantan.* GIZ, Forest and Climate Change Programme (FORCLIME), and Ministry of Forestry, Republic of Indonesia, Jakarta, Indonesia.

Hwang, Y. T. & Larivière, S. 2003. *Mydaus javanensis*. *Mammalian Species* 723: 1–3.

Long, B., Hon, J., Azlan M. J. & Duckworth, J. W. 2008. *Mydaus javanensis*. In: IUCN 2012. *IUCN Red List of Threatened Species*. Version 2012.2. <www.iucnredlist.org>. Downloaded on 26 December 2012.

Meijaard, E. 2003. Mammals of South-east Asian islands and their late Pleistocene environments. *Journal of Biogeography* 30: 1245–1257.

Payne, J., Francis, C. M. & Phillipps, K. 2005. *A field guide to the mammals of Borneo*, 4th reprint. Sabah Society and WWF Malaysia, Kota Kinabalu, Sabah, Malaysia.

Samejima, H. *et al*. in prep. *Mydaus javanensis* distribution in Borneo.

Yasuma, S. 1994. *An invitation to the mammals of East Kalimantan*. PUSREHUT (Special Publication 3), Samarinda, Indonesia.

[1]Faculty of Forestry, Mulawarman University, Samarinda, East Kalimantan 75119, Indonesia.
Email: bahandang@gmail.com
[2]Department of Natural Resources Management, Texas Tech University, Lubbock TX 79409, U.S.A.; and S.P.E.C.I.E.S., LifeScape International, Lindenhurst, NY 11757, U.S.A.
Email: species1@hotmail.com

A case of colour aberration in Stripe-necked Mongoose *Herpestes vitticollis* in the Western Ghats, India

Divya MUDAPPA and R. GANESH

Abstract

A colour-aberrant Stripe-necked Mongoose *Herpestes vitticollis* has been observed over three years near the town of Valparai in the Anamalai hills, Tamil Nadu, India. This individual lacks the black and grey colours on its face, legs and tail-tip and the dark stripe on the neck is pale brown. Thereby, the animal looks uniformly pale orange in colour.

Keywords: Anamalai hills, mutation Brown, pelage coloration, Valparai

The Stripe-necked Mongoose *Herpestes vitticollis*, the largest of the mongooses in Asia, is found along the Western Ghats in south India and in Sri Lanka. The species occurs in a wide range of habitats ranging from wet evergreen forests to dry deciduous forests, and some non-forest habitats (Mudappa 2013).

The typical pelage colour of the Stripe-necked Mongoose is rufous, sometimes grizzled. The head is small, pointed and greyish in colour. The chest and legs are dark to nearly black in colour. The tail, reddish with a black tip, is usually carried horizontal with the tip turned upwards. The species gets its name from the distinct black stripe, bordered by white, marked on either side of the neck, behind the ears (Fig. 1). Along the Western Ghats, the colour varies: individuals in the southern Western Ghats are redder than those in the northern parts (Van Rompaey & Jayakumar 2003). However, Van Rompaey & Jayakumar (2003) in their review of the species have not reported the occurrence of any colour aberration in Stripe-necked Mongoose.

Here, we report a colour aberration in Stripe-necked Mongoose seen in the town of Valparai, Anamalai hills, Tamil

Fig. 1. A Stripe-necked Mongoose *Herpestes vitticollis* of typical colour in Valparai, Anamalai hills, India (July 2010). Note the colours – rufous and grizzled body and tail; dark chest and legs, grey face, black tail-tip (Photo: Kalyan Varma).

Corbet, G. B. & Hill, J. E. 1992. *Mammals of the Indomalayan Region: a systematic review*. Natural History Museum and Oxford University Press, London and Oxford, U.K.

Giman, B. & Jukie, A. 2012. Distribution of Sunda Stink-badger *Mydaus javanensis* in Sarawak, Malaysia. *Small Carnivore Conservation* 46: 12–16.

[GIZ] Deutsche Gesellschaft für Internationale Zusammenarbeit 2013. *Survey report: ground-based forest carbon inventory in Malinau district, East Kalimantan.* GIZ, Forest and Climate Change Programme (FORCLIME), and Ministry of Forestry, Republic of Indonesia, Jakarta, Indonesia.

Hwang, Y. T. & Larivière, S. 2003. *Mydaus javanensis*. *Mammalian Species* 723: 1–3.

Long, B., Hon, J., Azlan M. J. & Duckworth, J. W. 2008. *Mydaus javanensis*. In: IUCN 2012. *IUCN Red List of Threatened Species*. Version 2012.2. <www.iucnredlist.org>. Downloaded on 26 December 2012.

Meijaard, E. 2003. Mammals of South-east Asian islands and their late Pleistocene environments. *Journal of Biogeography* 30: 1245–1257.

Payne, J., Francis, C. M. & Phillipps, K. 2005. *A field guide to the mammals of Borneo*, 4th reprint. Sabah Society and WWF Malaysia, Kota Kinabalu, Sabah, Malaysia.

Samejima, H. *et al*. in prep. *Mydaus javanensis* distribution in Borneo.

Yasuma, S. 1994. *An invitation to the mammals of East Kalimantan*. PUSREHUT (Special Publication 3), Samarinda, Indonesia.

[1]Faculty of Forestry, Mulawarman University, Samarinda, East Kalimantan 75119, Indonesia.
Email: bahandang@gmail.com
[2]Department of Natural Resources Management, Texas Tech University, Lubbock TX 79409, U.S.A.; and S.P.E.C.I.E.S., LifeScape International, Lindenhurst, NY 11757, U.S.A.
Email: species1@hotmail.com

A case of colour aberration in Stripe-necked Mongoose *Herpestes vitticollis* in the Western Ghats, India

Divya MUDAPPA and R. GANESH

Abstract

A colour-aberrant Stripe-necked Mongoose *Herpestes vitticollis* has been observed over three years near the town of Valparai in the Anamalai hills, Tamil Nadu, India. This individual lacks the black and grey colours on its face, legs and tail-tip and the dark stripe on the neck is pale brown. Thereby, the animal looks uniformly pale orange in colour.

Keywords: Anamalai hills, mutation Brown, pelage coloration, Valparai

The Stripe-necked Mongoose *Herpestes vitticollis*, the largest of the mongooses in Asia, is found along the Western Ghats in south India and in Sri Lanka. The species occurs in a wide range of habitats ranging from wet evergreen forests to dry deciduous forests, and some non-forest habitats (Mudappa 2013).

The typical pelage colour of the Stripe-necked Mongoose is rufous, sometimes grizzled. The head is small, pointed and greyish in colour. The chest and legs are dark to nearly black in colour. The tail, reddish with a black tip, is usually carried horizontal with the tip turned upwards. The species gets its name from the distinct black stripe, bordered by white, marked on either side of the neck, behind the ears (Fig. 1). Along the Western Ghats, the colour varies: individuals in the southern Western Ghats are redder than those in the northern parts (Van Rompaey & Jayakumar 2003). However, Van Rompaey & Jayakumar (2003) in their review of the species have not reported the occurrence of any colour aberration in Stripe-necked Mongoose.

Here, we report a colour aberration in Stripe-necked Mongoose seen in the town of Valparai, Anamalai hills, Tamil

Fig. 1. A Stripe-necked Mongoose *Herpestes vitticollis* of typical colour in Valparai, Anamalai hills, India (July 2010). Note the colours – rufous and grizzled body and tail; dark chest and legs, grey face, black tail-tip (Photo: Kalyan Varma).

Fig. 2. Pale orange-coloured Stripe-necked Mongoose *Herpestes vitticollis* lacking the darker pelage including the tail-tip and legs, with the dark neck-strip of a pale brown colour. Valparai, Anamalai hills, India, 15 April 2014 (Photo: R. Ganesh).

Nadu (10°19′49″N, 76°57′36″E; datum WGS84; altitude 1,134 m) from 2011 to date. It seemed to be a sub-adult (judging by the size) when it was first seen. Now it is a full-grown adult. Stripe-necked Mongooses are seen quite frequently in this region and the individuals usually have the typical reddish pelage. This particular individual has a noticeably different coloration. It lacks the dark pigmentation of the pelage all over and does not have the black tail tip or legs. It is uniformly pale orange (Fig 2a) with the head much lighter than the rest of the body. The normally black neck-stripe (Fig. 2b) is pale brown. This animal is seen almost every day, using the same trail, at the edge of Valparai town. The regularity of the animal's appearance, its consistent habits and the observations of its growth indicates that only one individual is involved.

The main pigment that causes the reddish-brown appearance in the Stripe-necked Mongoose is phaeomelanin. Although the colour aberration reported here is paler than the typical form seen in the area, the individual is not an albino because its eye colour is dark as in typical individuals, and because albinos lack all melanins: this animal retains the typical phaeomelanin colours in the pelage. This aberration appears to result from the mutation Brown (Tyrp1b, Tyrosinase-related protein 1), where the eumelanin is not fully oxidised and therefore blacks and greys (dependent on the density of eumelanin granules) of the pelage appear as brown to pale brown (van Grouw 2013).

Colour variations in small carnivores are slowly coming to the attention of field researchers (e.g. Ross *et al*. 2012, Chunekar 2014), with increases in the number of photographers and use of camera-traps. A greater understanding of the kind and cause of colour aberrations in mammals would be useful. It is important to note this as identification of small carnivores can be very tricky because of fleeting glimpses and thus misidentifications are possible. However, in this region, where Stripe-necked Mongooses are quite frequently seen, this is the only individual of this coloration seen thus far.

Acknowledgements

We would like to thank Sreedhar V. for keeping an eye out for this individual and helping set camera-traps and take pictures. We thank T. R. Shankar Raman, and the reviewers of the paper, H. van Grouw and J. Ross, who all provided valuable comments.

References

Chunekar, H. 2014. A record of a white-coated Brown Palm Civet *Paradoxurus jerdoni*. *Small Carnivore Conservation* 50: 12–13.

Mudappa, D. 2013. Herpestids, viverrids and mustelids. Pp. 471–498 in Johnsingh, A. J. T. & Manjrekar, N. (eds) *Mammals of South Asia*, 1. Universities Press, Hyderabad, India.

Ross, J., Gemita, E., Hearn, A. J. & Macdonald, D. W. 2012. The occurrence of reddish-orange mongooses *Herpestes* in the Greater Sundas and the potential for their field confusion with Malay Weasel *Mutela nudipes*. *Small Carnivore Conservation* 46: 8–11.

van Grouw, H. 2013. What colour is that bird? The causes and recognition of common colour aberrations in birds. *British Birds* 106: 17–29.

Van Rompaey, H. & Jayakumar, M. N. 2003. The Stripe-necked Mongoose, *Herpestes vitticollis*. *Small Carnivore Conservation* 28: 14–17.

Nature Conservation Foundation, 3076/5, 4th Cross, Gokulam Park, Mysore – 570002, India.
Email: divya@ncf-india.org

Notes on mating behaviour of two small carnivores in Bangladesh

Hassan AL-RAZI, Shayer Mahmood Ibney ALAM*, Mohammad Abdul BAKI and Nadim PARVES

Abstract

Small Asian Mongoose *Herpestes javanicus* is a common yet poorly documented species in Bangladesh. A pair was observed mating near a small bush on an island in the Buriganga River at 11h10 on 14 January 2014. Nine successive copulations were separated by about 20 to 50 seconds. Masked Palm Civet *Paguma larvata* is believed to be rare in Bangladesh and its behaviour is very poorly known. A pair up a tree in Satchari National Park at 07h43 on 25 April 2014 was observed copulating (two bouts) and its post-mating behaviour documented.

Keywords: breeding behaviour, copulation, *Herpestes auropunctatus*, *Herpestes javanicus*, Masked Palm Civet, *Paguma larvata*, Small Asian Mongoose

Introduction

Direct observations of wild tropical Asian carnivores mating are rarely reported. This paper describes from Bangladesh single observations of mating in Small Asian Mongoose *Herpestes javanicus* and Masked Palm Civet *Paguma larvata*. Coordinates and approximate altitudes are derived from Google Earth.

Small Asian Mongoose *Herpestes javanicus*

Small Asian Mongoose *Herpestes javanicus* sensu lato has a wide native distribution from Iran and Iraq through Pakistan and northern India to southern China and the Malay Peninsula, as well as Hainan and Java (Corbet & Hill 1992). In Bangladesh it is widely distributed, except in the interior of the Sundarbans mangrove forest, and is very common (Khan 2008). It uses various habitats, including village bushes and cultivation (Khan 2008). It is polygamous (Ewer 1973, Rood 1986). Although social structure is not known to vary between regions (Rood 1986), the species is extremely poorly studied in some areas, including in Bangladesh.

Along the Buriganga River on 14 January 2014 at 11h10, we observed about 12 Small Asian Mongooses on a small (around 3 ha) island (23°43′09.21″N, 90°21′27.86″E, elevation 13 feet) in the river. All 12 individuals seemed in a playful mood. They evidently belonged to one group because they were coming in and out of 5–6 holes in the soil under a bush. These holes presumably led to their den. The area, dominated by scrub, was about 60 m from the mainland. The weather was relatively cold (around 15 °C) and slightly foggy. Two of the mongooses came out from the bushes, one running behind the other. We observed the pair, from our boat, at a distance of about 15–20 m. They seemed to ignore our presence, even though we were 18 people talking with each other at the beginning of the event. When, after a minute, they started copulating we observed them silently. The pair copulated nine times, with bouts lasting (in succession) 21, 23, 17, 14, 26, 58, 20, 24 and 107 seconds. During copulations (Fig. 1), the female lay on her abdomen, facing her head forward and looking sidewise. The male did not obviously look around, but sometimes put its head on the female's dorsum. While copulating, the male tried to pull the female's abdomen upwards with its forelimbs. After each copulation, the male tried to maintain a distance of about 1 m from its mate, pushing the female away for about 20–50 seconds each time. Then the male approached the female to mount again. Both animals shook their bodies during this interval on four occasions. No aggressive behaviour, such as biting, was observed during the mating. We saw the pair run out of the bushes, mate in the open, then return to the bushes, but we do not know whether they also mated in the bushes before or after the observation. The observed sexual encounter lasted about 10–12 minutes, some 2–2½ m from the den.

During this time, a juvenile Mongoose was walking around, about ½ m, from the pair (Fig. 2). The juvenile sometimes tried to approach the female. The male chased the juvenile away if it got close to the pair while mating. It did approach the female closely during copulation intervals and the female, in return, entertained it affectionately. Perhaps the juvenile was an offspring of the female; it seemed to pose no threat to the mating pair.

These mongooses are sexually dimorphic in size, with males typically weighing almost 150% of females (Baldwin *et al*. 1952). In our observation the male was larger than the female. In the Northern Hemisphere, breeding females are found from the end of February until early September (Pearson & Baldwin 1953, Nellis & Everard 1983) and in the Southern Hemisphere from August to February (Gorman 1976). Khan

Fig. 1. Mating pair of Small Asian Mongooses *Herpestes javanicus*, Buriganga River, Bangladesh, 14 January 2014 (Photo: Omar Shahadat).

Fig. 2. Mating pair of Small Asian Mongooses *Herpestes javanicus* and juvenile, Buriganga River, Bangladesh, 14 January 2014. The juvenile approaching the pair (top) and affectionately received by the female during a copulation interval (bottom; Photos: Omar Shahadat).

(2008) mentioned that Small Asian Mongooses breed mainly from March to July in Bangladesh, but it is not clear whether 'breeding' includes the entire period of mating until departure of offspring or some portion thereof. This observation was, in January, slightly earlier than the stated periods. We could not trace any other information on mating of this species. However, recently Murali *et al*. (2012) observed a pair of Indian Grey Mongooses *H. edwardsii* mating: similar to the present observation, the pair mated in an open spot then disappeared into nearby bushes. That pair copulated fewer times but with longer intervals and bouts of copulation.

Masked Palm Civet *Paguma larvata*

Masked Palm Civet *Paguma larvata* ranges widely from northern Pakistan to the Greater Sundas, including much of eastern and southern China (Corbet & Hill 1992). It inhabits various forest types and is partly arboreal and solitary (e.g. Rabinowitz 1991, Duckworth 1997, Grassman 1998, Than Zaw *et al*. 2008). Its reproduction, while well-studied in captivity (e.g. Jia *et al*. 2000, 2001, 2002a, 2002b) is poorly known in the wild, with such studies as there are apparently not discussing mating (e.g. Torii & Miyake 1986).

Satchari National Park is a semi-evergreen forest. On 11 April 2014 at 07h43, about 50 m from the Dhaka–Sylhet highway (at 24°07′36.80″N, 91°26′50.95″E; about 80 m asl), in deep forest with some tall trees, we were watching some birds on a tall tree. Suddenly, all birds flew from the tree at one time, and we heard a sound (*oow-oow-oow*) from there. The sound came from a mating pair of Masked Palm Civets on a branch approximately 15 m above ground. Hidden in a small bush about 30 m away from the civets, we observed the pair.

Copulation started on thin branches and the first bout lasted 103 seconds. The female then tried to escape and then the male pushed it away. The female moved down 1 m to a thicker branch followed by the male. After 41 seconds they started mating again, this bout lasting 3 minutes, 49 seconds. During copulation, the female seemed to concentrate on balance, trying to keep in the middle of the branch, while the male seemingly intent all the time on mating. The male kept its body over the female's dorsum, holding tightly by its forelimbs, and bit the skin of the female's neck (Fig. 3). The male continued thrusting the female with its body, with about 2-second intervals licking or biting the female's back and neck. The biting became aggressive late in copulation. At first the female seemed relaxed about the mating but by the end of the second copulation it seemed to try to repel the male by biting. After

Fig. 3. Mating pair of Masked Palm Civets *Paguma larvata*, Satchari National Park, Bangladesh, 11 April 2014. The pair mating (top) and the male biting the female during mating (bottom) (Photos: Nadim Parves).

Fig. 4. Male Masked Palm Civet *Paguma larvata* resting after copulation, Satchari National Park, Bangladesh, 11 April 2014 (Photo: Nadim Parves).

copulation, the male released the female and lay on the branch (Fig. 4). The male looked very tired and was licking its copulatory organ with its tongue. The female also seemed tired. After mating, it went to the branch where the mating began, and lay down there. Both male and female seemed very tired; within five minutes they fell asleep. During mating, the female evidently noticed us, but ignored us.

Masked Palm Civet is overwhelmingly nocturnal with occasional day-time activity (Rabinowitz 1991, Duckworth 1997, Grassman 1998, Than Zaw *et al*. 2008). However, this pair mated in the morning, about two hours after sunrise. The temperature was 32 °C and humidity was 74%. The related Common Palm Civet *Paradoxurus hermaphroditus* is also largely nocturnal, yet two observations of mating pairs also took place by day (Borah & Deka 2011; at 16h45 and 11h30–13h00), as did an apparent pre-copulatory chase (Timmins & Duckworth 2013; at 11h45). Incidental observations such as these are far more likely to be made by day than by night. This may be the reason why these records of mating in the predominantly nocturnal palm civets were all made by daylight: captive Masked Palm Civets mate commonly by night (Jia *et al*. 2002a).

Acknowledgements

The authors are highly thankful to Professor Dr Gulshan Ara Latifa, Department of Zoology, University of Dhaka, for supporting the field trip to the River Buriganga. Authors are also thankful to Munir Ahmed, Range Officer, Satchari Range, Bangladesh Forest Department, for his help during data collection in forests and to Omar Shahadat and Ashraf ul Hasan.

References

Baldwin, P. H., Schwartz, C. W. & Schwartz, E. R. 1952. Life history and economic status of the mongoose in Hawaii. *Journal of Mammalogy* 33: 335–356.

Borah, J. & Deka, K. 2011. An observation of Common Palm Civet *Paradoxurus hermaphroditus* mating. *Small Carnivore Conservation* 44: 32–33.

Corbet, G. B. & Hill, J. E. 1992. *The mammals of the Indomalayan region*. Oxford University Press, Oxford, U.K.

Duckworth, J. W. 1997. Small carnivores in Laos: a status review with notes on ecology, behaviour and conservation. *Small Carnivore Conservation* 16: 1–21.

Ewer, R. F. 1973. *The carnivores*. Cornell University Press, Ithaca, New York, U.S.A.

Gorman, M. 1976. Seasonal changes in the reproductive pattern of feral *Herpestes auropunctatus* in the Fijian Islands. *Journal of Zoology, London* 178: 237–246.

Grassman Jr., L. I. 1998. Movements and fruit selection of two Paradoxurinae species in a dry evergreen forest in Southern Thailand. *Small Carnivore Conservation* 19: 25–29.

Jia, Z. Y., Jiang, Z. G. & Wang, Z. W. 2000. The behavioral patterns of Masked Palm Civet in reproductive season. *Acta Theriologica Sinica* 20: 108–115.

Jia, Z. Y., Jiang, Z. G. & Wang, Z. W. 2001. Copulatory behavior in captive Masked Palm Civets, *Paguma larvata*. *Folia Zoologica* 50: 271–279.

Jia, Z. Y., Duan, E. K., Jiang, Z. G. & Wang, Z. W. 2002a. Copulatory plugs in Masked Palm Civets: prevention of semen leakage, sperm storage, or chastity enhancement? *Journal of Mammalogy* 83: 1035–1038.

Jia, Z. Y, Duan, E. K., Jiang, Z. G. & Wang, Z. W. 2002b. Effects of number of homosexual partners on copulating date in female captive Masked Palm Civets (*Paguma larvata*), and fluctuation of urine estrogen during breeding season. *Acta Zoologica Sinica* 48: 610–616.

Khan, M. M. H. 2008. *Protected areas of Bangladesh– a guide of wildlife*. Nishorgo Support Program, Bangladesh Forest Department, Dhaka, Bangladesh.

Murali, K. C., Ramachandran, S. & Mutthulingam, P. 2012. An observation of Indian Grey Mongoose *Herpestes edwardsii* mating. *Small Carnivore Conservation* 47: 75–76.

Nellis, D. & Everard, C. 1983. The biology of the mongoose in the Caribbean. *Studies of the fauna of Curacao and other Caribbean islands* 195: 1–162.

Pearson, O. & Baldwin, P. 1953. Reproduction and age structure of a mongoose population in Hawaii. *Journal of Mammalogy* 34: 436–447.

Rabinowitz, A. 1991. Behaviour and movements of sympatric civet species in Huai Kha Khaeng Wildlife Sanctuary, Thailand. *Journal of Zoology, London* 223: 281–298.

Rood, J. P. 1986. Ecology and social evolution in the mongooses. Pp. 131–152 in Rubenstein, D. I. & Wrangham, R. W. (eds) *Ecological aspects of social evolution.* Princeton University Press, Princeton, New Jersey, U.S.A.

Than Zaw, Saw Htun, Saw Htoo Tha Po, Myint Maung, Lynam, A. J., Kyaw Thinn Latt & Duckworth, J. W. 2008. Status and distribution of small carnivores in Myanmar. *Small Carnivore Conservation* 38: 2–28.

Timmins, R. J. & Duckworth, J. W. 2013. *A survey of gibbons and other wildlife in the Bokeo section of Nam Kan National Protected Area, Lao PDR*. Fauna & Flora International, Cambridge, U.K.

Torii, H. & Miyake, T. 1986. Litter size and sex ratio of the Masked Palm Civet, *Paguma larvata*, in Japan. *Journal of the Mammalogical Society of Japan* 11(2): 35–38.

Department of Zoology, Jangannath University,
Dhaka 1100, Bangladesh.
***Email: shayermia@hotmail.com**

Contents

An aberrant colour form of Stripe-necked Mongoose *Herpestes vitticollis*, Valparai, Tamil Nadu, India (Photo: Ganesh Raghunathan)

ISSN 1019-5041