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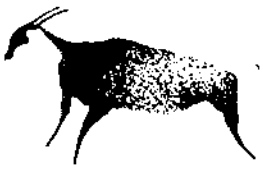

Malay Weasel Mustela nudipes *catching rat*
Photo: Neil Franklin / LIPI (Indonesian Institute of Sciences) / PHKA (Directorate of the Department of Forrestry)

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Small carnivores of the Udzungwa Mountains: presence, distributions and threats

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Summary

The mammalian carnivores of the Udzungwa Mountains National Park (UMNP) area were intensively investigated over a period of one year from November 2001 to November 2002. This was the first study in this area targeting this important group of animals. A combination of field methods was employed: ecological inventories (rapid assessment surveys; scat, spoor and sign surveys; camera trapping) and socio-economic investigations (structured village interviews). Some 678 km of transect were walked; 10,608 camera-trap hours were carried out, and 128 village interviews undertaken, across representative areas throughout the park and its buffer zones.

A total of 17 species of small carnivore (Mustelidae, Viverridae and Herpestidae) were confirmed for the UMNP and an additional species is 'probable'. This corresponds to at least 85% (or as many as 90%) of the Tanzanian total. These data show that UMNP is one of the richest protected areas (if not the richest) for small carnivores in Eastern Africa, as well as one of the most important. The presence of Jackson's Mongoose *Bdeogale jacksoni* was particularly significant. This little known and 'vulnerable' species was formerly recorded only from two areas; in and around Mt Kenya and south of Mt Elgon. This represents an important new record for Tanzania. Other high-risk species recorded included Lowe's Servaline Genet *Genetta servalina lowei* known only from the Udzungwas. Meller's Mongoose *Rhynchogale melleri* and the Bushy-tailed Mongoose *Bdeogale crassicauda* meanwhile, are significant and very rarely recorded. The former may be a new record for this animal in terms of altitude and habitat type. The Udzungwa carnivore community is rich and of considerable importance. Its status and complexity will depend much on the continued conservation of all Udzungwa habitats.

Introduction

As in most of Africa, small carnivores in Tanzania are little known, and the only recent information is often the documentation of Kingdon (1977; 1990; 1997) and the predictions of continental-scale databanks (Boitani *et al.*, 1999). Many species are deemed to be under threat because of habitat degradation, and persecution due to hunting and poisoning (Schreiber *et al.*, 1989). However, there are insufficient data to assess their distribution, population or degree of threat and thus to plan appropriate conservation intervention. In this paper we present data on the small carnivores from a wider investigation into all mammalian carnivores carried out in the Udzungwa Mountains in Southern Tanzania (De Luca & Mpunga, 2002, 2005).

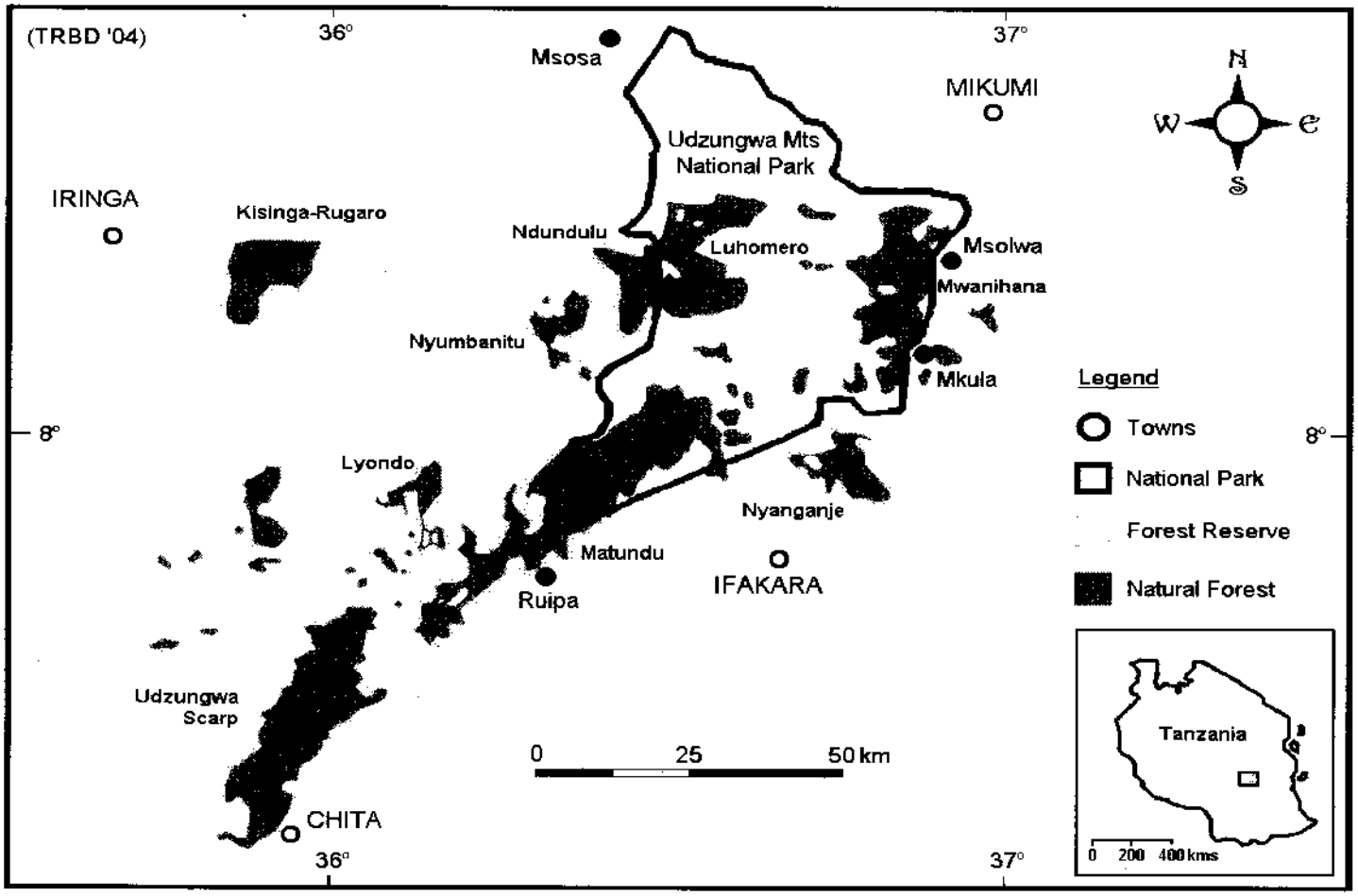


Fig. 1. Map of the Udzungwa Mountains area showing boundaries and the location of 'interview' villages.

Table 1. Locations and details of camera trap placements. Geographical positions of camera traps are given in WGS84 degrees-decimal minutes coordinates.

CT No.	Sensor Type	Location name	Habitat type	Loc. S	Loc. E	Altitude
TM6	P	Mbatwa	Open/closed woodland	S 07 34 772	E 036 35 903	1127
TM3	A	Mbatwa	Open/closed woodland	S 07 34 903	E 036 36 489	1127
TM5	P	Mbatwa	Open/closed woodland	S 07 35 051	E 036 36 797	1127
TM7	P	Mbatwa	Open/closed woodland	S 07 35 298	E 036 37 658	1132
TM8	P	Mbatwa	Open/closed woodland	S 07 35 512	E 036 37 369	1164
TM4	A	Mbatwa	Open/closed woodland	S 07 36 216	E 036 37 369	1373
TM1	A	Mbatwa	Open/closed woodland	S 07 36 344	E 036 37 218	1393
CT2	P	Mkula river/Sonjo	Lowland forest	S 07 47 591	E 036 52 615	719
CT4	P	Mkula river/Sonjo	Lowland forest	S 07 47 684	E 036 52 798	495
CT1	P	Mkula river/Sonjo	Lowland forest	S 07 47 693	E 036 52 712	526
CT3	P	Mkula river/Sonjo	Lowland forest	S 07 47 838	E 036 52 918	484
TM2	A	Mkula	Lowland forest	S 07 47 925	E 036 53 129	430
CT4	P	Mkula	Lowland forest	S 07 48 014	E 036 53 164	450
CT1	P	Mkula	Lowland forest	S 07 48 028	E 036 53 204	450
CT3	P	Mkula (ex-NP)	Lowland forest	S 07 48 117	E 036 55 799	285
CT2	P	Mwanihana	Open woodland	S 07 45 626	E 036 50 097	950
CT3	P	Mwanihana	Open woodland	S 07 47 596	E 036 49 865	980
CT4	P	Mwanihana	Open woodland	S 07 45 807	E 036 50 265	?
CT1	P	Mwanihana	Montane forest	S 07 49 0??	E 036 49 5??	1800
CT3	P	Mwanihana	Open woodland	S 07 48 081	E 036 51 675	650
CT2	P	Mwanihana	Montane forest	S 07 49 002	E 036 49 533	1830
CT3	P	Mwanihana	Wooded grassland	S 07 48 554	E 036 49 454	1470
CT4	P	Mwanihana	Open woodland	S 07 47 479	E 036 49 809	950
CT1	P	Mwanihana	Open woodland	S 07 47 713	E 036 50 265	915
CT2	P	Ruipa	Lowland forest	S 08 02 858	E 036 20 513	317
CT1	P	Ruipa	Lowland forest	S 08 03 303	E 036 20 668	415
TM2	A	Ruipa	Lowland forest	S 08 04 876	E 036 19 258	330
CT1	P	Ruipa	Lowland forest	S 08 02 986	E 036 20 761	415
CT3	P	Ruipa	Lowland forest	S 08 03 472	E 036 21 080	394
CT3	P	Ruipa	Lowland forest	S 08 03 474	E 036 21 078	343
CT3	P	Ruipa	Lowland forest	S 08 03 601	E 036 20 550	368
CT4	P	Ruipa	Lowland forest	S 08 03 643	E 036 20 148	327
CT2	P	Ruipa	Lowland forest	S 08 03 324	E 036 20 164	280

The Udzungwa Mountain National Park (UMNP) includes two of the richest forests of the region in terms of the number of species of primates, duikers and birds (Dinesen *et al.*, 2001); Mwanihana in the East and Luhomero in the West Kilombero Scarp. Consequently, they are cited as first conservation priority areas amongst all Udzungwa forests. However, despite their importance for global biodiversity, these forests are among the most threatened ecosystems in the world (Bakarr, 2000). Whilst the biodiversity of the Udzungwas has been well documented (see Rodgers & Homewood, 1982; Lovett & Wasser, 1993, Various authors, 1998; Ehardt *et al.*, 1999; Dinesen *et al.*, 2001; Frontier Tanzania, 2001a & b), there have previously been no surveys focusing on carnivores.

As part of a broader examination of carnivore status across southern Tanzania, we investigated the UMNP and buffer zones from November 2001 to November 2002. Combining ecological and socio-economic investigations we sought to record carnivore presence and relative abundance, habitat preference and the factors limiting their abundance. The work stems from a component of the Wildlife Conservation Society's *Southern Highlands Conservation Programme* and seeks to examine carnivore distributions, abundance and threats from unexplored sites, and provide conservation remedies and advice.

UMNP covers almost one fifth (1,999km^2) of the Udzungwa Mountains range and lies between 7°30'- 8°15'S and 36°20'-36°55'E (Fig. 1). It embraces a variety of habitats including natural forest (lowland, submontane and montane) ranging from 280 m to 2,600 m a.s.l. In addition, a corridor of wooded grassland and open and closed woodland lies between the two main forest blocks in the East and in the West. There is a longer variable dry season in the West (about 7 months) and shorter dry season in the East (about 5 months). The wet season between March and May has a short peak in December. Rainfall amounts to approximately 2,000 mm per year in the east decreasing to 800-1,000 mm in the west (Hall, 1986). The specific aims of the study were to produce a comprehensive and up-to-date carnivore list for the UMNP area and to investigate causes of threat for each species in order to provide information necessary for the implementation of conservation initiatives.

Methods

Fieldwork was carried out between November 2001 and November 2002. In order to determine small carnivore presence we used a combination of field methods: ecological inventories (sign surveys and camera trapping), and socio-economic investigations (village interviews). Initially however, we performed rapid

assessment surveys across different areas in order to select appropriate sampling sites representative of the park's diverse habitats, altitude, rainfall conditions and human influence. During such surveys all carnivore signs were also noted. Subsequently, four ecologically different areas were selected for camera trap placement (Table 1).

All carnivore signs and tracks were recorded at all times during fieldwork. Grid references, altitudes and habitat types were routinely noted. The distances and co-ordinates of transects walked were recorded by handheld Garmin GPS III+ and uploaded to a geographical information system using ArcView 3.2. Spoor was measured, identified and photographed, and data on footprints, signs and scats were noted on standard data sheets. A total of 678 km of transect was walked during the survey (adjusted to 822 km to include a factor of terrain roughness, De Luca & Mpunga, 2005).

Camera trapping was carried out in each area for a minimum of 210 trap-nights. A total of 10,608 camera-trap hours (884 trap-nights) were achieved in all areas. Between 5 and 13 camera traps were employed at any one time. Initially passive infrared units (Camtrakker™) were used (www.camtrakker.com). Subsequently, the number of camera traps employed was increased by using active infrared monitors (Trailmaster™1500) (www.trailmaster.com). Placement locations were chosen to maximize capture rate. Carnivores prefer to follow animal trails therefore most of the camera traps were placed in the vicinity of such trails. All traps were set to work from dusk to dawn between 7 pm and 7 am, and mounted on a pole at about 25-30 cm from the ground. They were baited and checked at regular intervals (De Luca & Mpunga, 2005).

To supplement information from the field 128 people were interviewed in four villages located within the buffer zones around the National Park: Mkula and Msolwa to the east of Mwanihana, Ruipa village just outside Matundu forest in the extreme south, and Msosa near Mbatwa in the north (Fig. 1). Mkula and Msolwa lie on the eastern boundary at 5 and 10 km respectively from park headquarters at Mang'ula. Interviews employed structured questionnaires, and interviewees were selected on their knowledge of the area. The interviews permitted the collection of data on carnivore sightings, location, date, frequency of sightings, and the vernacular names of the species in question. Human-carnivore conflict and hunting was also ascertained and data were taken on the frequency of problem animal occurrences and the ways employed to prevent or reduce them. Information on carnivore exploitation and consumptive uses was gathered in order to assess the degree of threat. Results about human carnivore conflict and carnivore exploitation are presented elsewhere (De Luca & Mpunga, 2005).

Table 2. Checklist of small carnivore species recorded in the UMNP area during this study.

	English name	Species	Kiswahili	Ph	Ob	Ac	Pr	% Mkula n=35	% Msolwa n=33	% Ruipa n=34	% Msosa n=30
		Mustelidae									
1	African Clawless Otter	*Aonyx capensis*	Fisi Maji Kubwa		**O**			82.0	84.9	60.6	23.3
2	Zorilla	*Ictonyx striatus*	Kicheche			**A**		36.4	57.6	63.6	33.3
3	Striped Weasel	*Poecilogale albinucha*	Chororo		**O**			18.2	63.6	63.6	46.0
4	Honey Badger (Ratel)	*Mellivora capensis*	Nyegere	**Ph**				39.4	63.6	63.6	90.0
		Viverridae									
5	Common Genet	*Genetta genetta*	Kanu	**Ph**				15.2	42.4	78.8	46.7
6	Servaline Genet	*Genetta servalina*	Kanu	**Ph**				12.1	33.3	21.2	40.0
7	Large-spotted Genet	*Genetta maculata*	Kanu	**Ph**				9.1	30.3	24.2	0.0
8	African Civet	*Civettictis civetta*	Fungo	**Ph**				88.0	87.9	67.7	72.7
9	African Palm Civet	*Nandinia binotata*	Fungo	**Ph**				12.0	27.3	15.2	10.0
		Herpestidae									
10	Egyptian Mongoose	*Herpestes ichneumon*	Nguchiro				**P**	21.2	27.3	18.2	30.0
11	Slender Mongoose	*Herpestes sanguineus*	Nguchiro		**O**			51.5	57.6	60.6	46.7
12	Dwarf Mongoose	*Helogale parvula*	Kitafe			**A**		48.5	42.4	54.6	80.0
13	Banded Mongoose	*Mungos mungo*	Nkuchiro		**O**			39.0	72.7	48.5	70.0
14	Marsh Mongoose	*Atilax paludinosus*	Nguchiro wa Maji	**Ph**				48.5	81.8	45.5	3.3
15	White-tailed Mongoose	*Ichneumia albicauda*	Karambago	**Ph**				0.0	6.1	0.0	80.0
16	Meller's Mongoose	*Rhynchogale melleri*	Nguchiro	**Ph**				0.0	0.0	0.0	6.7
17	Bushy-tailed Mongoose	*Bdeogale crassicauda*	Nguchiro	**Ph**				0.0	0.0	3.0	13.3
18	Jackson's Mongoose	*Bdeogale jacksoni*	Nguchiro	**Ph**				0.0	0.0	0.0	0.0
			TOTALS	**11**	**4**	**2**	**1**				

Key: Ph – Photo trapped; Ob – Observed (O)/ Spoor (S); Ac – Claimed by at least 60% of interviewees from at least one village area, and record accepted. Pr – Probable; claimed by 25 – 50% of interviewees from at least one village area. The Ph-Ob-Ac-Pr colums are additive. The columns with % indicate the percentage of people per village who claimed to have seen the animal in the Udzungwas area.

Results and discussion

A total of 17 small carnivore species was confirmed (and an additional species recorded as probable) in the UMNP area. An annotated checklist of these 18 species with their means of record is thus given in Table 2. Of the total, 11 were caught on film and a further four from direct observations and spoor. Two more species were claimed by at least 60% of interviewees from at least one village area, and the records accepted. The species cited as probable was claimed by 25-50% of interviewees from at least one village area. The list includes four mustelids, five viverrids and nine herpestids. One of the herpestids (see below) represents a new record for Tanzania and the national total of small carnivore species now stands at 20 species. As a consequence, UMNP contains at least 90% of the country's total and 42% of all small carnivore species in Africa (Boitani *et al.*, 1999; Mills *et al.*, 2001).

Furthermore, UMNP contains one more species than Serengeti National Park, an area more than six times the size, and known for having one of the largest predator and prey biomass(es) in the world (Caro & Durant, 1995; Sinclair, 1995). It is probable that UMNP is the richest protected area for carnivore diversity in Eastern Africa, if not beyond. The diversity can be explained by the biogeography, the range of habitat types and altitudes. The gazettement as a national park and consequent management over the last decade has also contributed to the conservation of both carnivores and prey.

In Matundu forest a mongoose that we have identified as Jackson's Mongoose *Bdeogale jacksoni* was caught on film. The shape of the ears, the intense yellow on the side of the neck and throat, and the white bushy tail are distinctive (back cover). This represents a new species record for Tanzania. The animal is little known, highly localised and formerly known only from montane and bamboo forest on Mt. Kenya and lowland forest near Mt. Elgon (Kingdon, 1997). Its status is classified as 'vulnerable' (VU B1 + 2c) by IUCN (2004) with a population that seems to be severely fragmented and with the subpopulations probably not containing more than 1,000 mature individuals. The animal has since also been photo trapped in the same area by F. Rovero (*pers. comm.*).

Table 3. Photo-trapping rates per species (number of independent photos / the number of trap-nights in areas where species was expected), ranked according to trap success.

Species	No. of independent pictures	No. of trap-nights	Photo trapping rate
Bushy-tailed Mongoose	79	674	8.53
Marsh Mongoose	32	674	21.1
Large-spotted Genet	15	637	42.5
White-tailed Mongoose	4	210	52.5
African Civet	15	884	58.9
Meller's Mongoose	8	688	86
Common Genet	3	460	153
Jackson's Mongoose	3	674	225
Honey Badger	3	884	295
African Palm Civet	2	674	337
Servaline Genet	2	674	337

Furthermore, during interviews a villager from Mkula mentioned having seen a mongoose corresponding to this description at the edge of the bamboo forest (1,700m) in the Kihulula area, Mwahihana. This area is higher than Matundu and if its presence is confirmed there, it would be habitat more similar to the central Kenya records of the Aberdare range and Mt. Kenya.

Jackson's Mongoose is similar to the White-tailed Mongoose *Ichneumia albicauda* but the latter has leaner legs, no yellow tints on the neck and throat and has five toes (Kingdon, 1997). The White-tailed Mongoose was caught on film only in Mbatwa in the drier north of UMNP. Meller's Mongoose *Rhynchogale melleri* was photographed in the Mwanihana montane bamboo forest at 1,850 m. The colour of the pelage, the dark legs and tail and the distinctive upturned shape of the muzzle are indicative of the species. Meller's Mongoose is normally associated with woodland up to approximately 1,500 m (Kingdon, 1997), and it is possible that this is the first record for this species in such a habitat and altitude. Its conservation status is regarded as being 'low risk' and 'least concern' (Lr+Lc). However, in the Tanzanian

Table 4. Camera trap locations with altitude ranges (Alt.), number of trapping hours (7pm-7am) and trap nights, number of cameras per location (CTs), frequency (F: number of times animals were photographed including unidentified mongooses), number of species per site (Spp), number of species per unit effort (Spp / Effort), species photographed at each site.

Location	Alt.(m)	Trap hours (1900-0700) Trap nights	CTs	F	Spp	Spp / Effort	Species photographed
Mwanihana	950-1850	2,964 247	9	87	5	0.0024	African Civet, Marsh Mongoose, Bushy-tailed Mongoose, Lowe's Servaline Genet, Meller's Mongoose
Mkula	300-750	2,772 231	8	78	4	0.0014	African Civet, Marsh mongoose, Large-spotted Genet, Bushy-tailed Mongoose
Ruipa / Matundu	300-450	2,352 196	9	96	8	0.0034	Jackson's Mongoose, Honey Badger, African Palm Civet, Marsh Mongoose, African Civet, Common Genet, Large-spotted Genet, Bushy-tailed Mongoose
Mbatwa	1150-1400	2,520 210	8	12	4	0.0015	African Civet, White-tailed Mongoose, Large-spotted Genet, Honey Badger

and Zambian part of the range, human populations have expanded considerably and dogs in particular could be an increasing local threat (Stuart & Stuart, *in prep.*).

The Bushy-tailed Mongoose *Bdeogale crassicauda* was the most photographed species in UMNP (back cover) with the highest photo-trapping rate (Table 3). The subspecies occurring in this region is *B. c. puisa* (Schreiber *et al.* 1989). Despite records that associate this species with wooded grassland rather than forest (Kingdon, 1977), our data show that it can be found (sometimes in pairs) in montane forest up to 1,850 m, and lowland forest between 300 and 750 m (Table 4). The only location where the species was not photographed was Mbatwa, a dry thicket woodland. It is nowhere considered common (Kingdon, 1997).

The Marsh Mongoose *Atilax paludinosus* was the second most photographed species (Table 3). The subspecies occurring in East Africa is *A. p. robustus* (Kingdon, 1997). With the exception of the dry woodland of Mbatwa, it was photographed in all habitats sampled from 300 m up to 1,850 m in the montane bamboo area of Mwanihana (where a pair was caught a few times). Its presence seemed to be linked to the vicinity of watercourses as it was not recorded more than 2 km away from rivers and streams.

Other more common mongooses recorded in the UMNP area were the Slender Mongoose *Herpestes sanguineus*, seen near park headquarters, Sonjo and Mbatwa, the Banded Mongoose *Mungos mungo* observed in the Mwanihana area near Mkula, and the Dwarf Mongoose *Helogale parvula*, a common species whose presence was claimed by 60% of all interviewees and 80% of those in Msosa. Finally the presence of the Egyptian Mongoose *Herpestes ichneumon*, a common and widespread carnivore, is considered very probable based on the interview data.

Lowe's Servaline Genet *Genetta servalina lowei* is an uncommon and little-known arboreal forest species, described from a skin found in the Dabaga area in 1932 by Willoughby Lowe (Kingdon, 1977; Brink *et al.*, 2002; De Luca & Mpunga, 2002). This species was photographed in the Mwanihana area (980 m) in habitat described by Rodgers & Homewood (1982) as intermediate rain forest, as well as in montane forest bordering bamboo at 1,830 m (Table 4). These data suggest that in Tanzania the species itself is a forest animal as in West Africa (Ray, 2001; Van Rompaey & Colyn, 1998).

Surprisingly, the Common Genet *Genetta genetta* was photographed only in lowland forest at Matundu, but not in the drier habitat of Mbatwa where it was more expected. The subspecies occurring in this region is G. g. *dongolana* (Kingdon, 1997). In Matundu however, the Common Genet (back cover) was sympatric with the Large-spotted Genet *Genetta maculata*, where ecological separation is probably achieved by different use of the forest habitat (Ray, 2001). The Large-spotted Genet (back cover) and the African Civet *Civettictis civetta* were present in various habitats (lowland forest, open and closed woodland) and across a broad altitudinal range (280-1,470 m). However, the Large-spotted Genet was not photographed in the montane forest or the woodland of Mwanihana (Table 4). It is possible that the Large-spotted Genet is in competition with the Servaline Genet, and/or that its distribution does not extend to higher elevations (Kingdon, 1997).

Together with the Servaline Genet, the African Palm Civet *Nandinia binotata* showed the lowest photo-trapping rate (Table 3; back cover). African Palm Civets are mainly arboreal but do come to ground to forage (Rosevear, 1974) or to seek water (Sanderson, 1940). With our camera traps set on the ground, this could explain the relatively low number of pictures. However, our current work in the Southern Highlands (in prep.) has shown that this species is also easily photo trapped on the forest floor. The individual photographed in Matundu does not show the narrower stripes on the neck typical of *N. b. gerrardi* (back cover), but has narrow poorly defined rings on the tail like *N. b. arborea* (Van Rompaey & Ray, *in prep*).

In East Africa palm civets are chiefly associated with fragmented forest up to 2,000 m (Kingdon, 1997). However, they are also found in lowland forest (such as Matundu), deciduous, gallery and riverine forests and savanna woodlands, as well as in cultivated mosaic forest and fields bordering forest edges (Charles-Dominique, 1978; Happold, 1987; Skinner & Smithers, 1990).

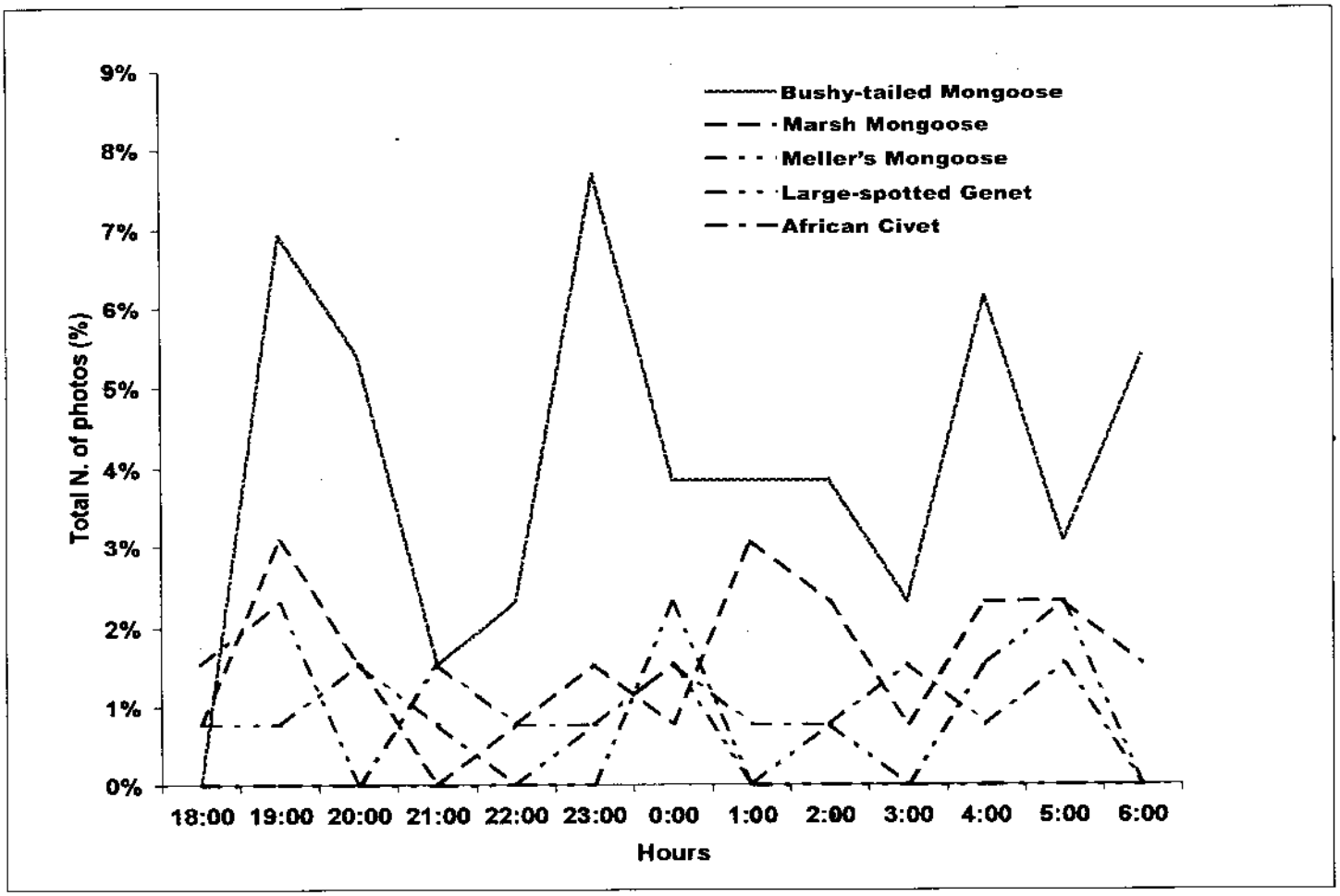
The Honey Badger *Mellivora capensis* was photographed in both Mbatwa and Matundu/Ruipa confirming its versatility in adapting to both wetter and drier conditions (Table 4). Spoor of the Striped Weasel *Poecilogale albinucha* was observed only in Mbatwa although the interview data suggests that it is widespread. The Zorilla *Ictonyx striatus* meanwhile, also a widespread animal, was acknowledged by 63% of interviewees in Ruipa.

Camera trapping is an effective tool for investigating the ecology of individuals and populations of animals. It is particularly valuable in remote areas, difficult terrain or dense forests that prevent direct observation. However, success rates for carnivores can be slow (see Carbone *et al.*, 2001). Indeed, with the exception of the two most commonly photo-trapped species, the Bushy-tailed and Marsh Mongooses, success rates in UMNP were relatively slow in terms of the photo-trapping rate or number of trap-nights per picture (Table 3). Table 4 illustrates camera trap success in the four locations studied, and indicates that the lowland forest of Matundu was the most diverse area for small carnivores. Matundu is already considered to be one of the richest areas in terms of birds and duikers (Dinesen *et al.*, 2001).

The frequency of independent photos for species with more than five pictures taken (and for which time data were recorded), was plotted in order to show their nocturnal activity patterns (Fig. 2). All pictures taken more than 5 minutes apart were considered 'independent'. The Bushy-tailed and Marsh Mongooses (occupying the same habitat) showed similar activity patterns during the night, with peaks at 19:00, 23:00 and 04:00 hrs, while Meller's Mongoose was most active at 01:00 hrs; a time of decreased activity for the other two species. The activity pattern of other species showed that whilst the African Civet was active throughout the night, the Large-spotted Genet avoided the times when Spotted Hyaenas *Crocuta crocuta* were particularly active (at around 23:00 hrs). It was active at 19:00, 00:00 and 05:00 hrs. The 19:00 hrs peak was the only one that corresponded to those of Bushy-tailed and Marsh Mongooses. Given that their diets are similar, it is possible that the Large-spotted Genet may be avoiding competition with the mongooses by descending less from the trees at this time. Interestingly also, the Bushy-tailed Mongoose activity peaked at around 23:00hrs. At this time we photographed a Spotted Hyaena with a Bushy-tailed Mongoose in its mouth.

According to Bakarr (2000), the major threats for wildlife within the UMNP area are illegal logging, excessive firewood collection, uncontrolled fire, medicinal plant collection, hunting and trapping of prey species. These are the result of increased

Figure 2. Activity pattern of small carnivore species (trapped > 4 times) in the UMNP area. The y-axis is the percentage of the picture taken per species over the total number of pictures of the species shown below.



population pressure within the last few decades. The demands for arable land and development have created barriers to wildlife dispersal by interrupting habitat patches (for example the road along the eastern side of the park separating it from Selous Game Reserve). Inadequate land use planning has exacerbated the problem.

During interviews, we investigated the terms of co-existence with people and identified the source of exploitation such as hunting and consumptive use (De Luca & Mpunga, 2005). Whilst we revealed hunting of carnivores, especially for retribution, medicinal and traditional purposes (De Luca & Mpunga, 2005), the impact on small carnivores was probably limited compared to the negative effects of habitat degradation. To quantify the impact of these threats on carnivore species however, long-term research and monitoring examining habitat use, edge effects, the size of habitat openings, responses to disturbance, hunting, and dispersal across heterogeneous landscapes is required (Sunquist & Sunquist, 2001). This study was an initial step towards this, by documenting the species composition and distribution of carnivore communities in UMNP.

The persistence of the carnivore community will depend on how the specialist and generalist species respond to landscape changes, such as habitat size and the persistence of connections between habitat patches (Terborgh *et al.*, 1997). In UMNP, forest conservation initiatives are likely to help the survival of forest dependent species. However, if habitats degrade changes in species composition would occur with an increase in generalist species that are more successful at adapting to human modified habitats.

Conclusion

This study recorded at least 17 species from 3 families of mammalian carnivores from the UMNP area. On the basis of these data, UMNP must be considered as amongst the richest protected areas for carnivore diversity in Eastern Africa and certainly one of the most important.

The presence of Jackson's Mongoose *Bdeogale jacksoni* is particularly significant being a new record for Tanzania. Amongst the species recorded, many are little known and information about their ecology is lacking, although many are believed to be under threat. The Udzungwa carnivore community is rich and important both in terms of its global significance and its ecological value. Its status and complexity will depend much on the preservation of lower levels of the ecological pyramid, and the tackling of the causes of threat.

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Recent records of Large-spotted Civet *Viverra megaspila* from Thailand and Myanmar

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The Large-spotted Civet *Viverra megaspila* is known by relatively few recent records from anywhere in its range. There are published historical and/or recent records from Myanmar, Thailand, Laos and Vietnam (Wilson & Reeder, 1993; Duckworth, 1994). It was also mapped for Cambodia in the generalised distribution maps of Lekagul & McNeely (1977) and Corbet & Hill (1992), although the first specific records appear to be in Walston (2001). Singapore is frequently stated to hold the animal (e.g. Chasen, 1925), although a recent re-examination of a specimen from there at the Muséum National d'Histoire Naturelle found that it was in fact a Malay Civet *Viverra tangalunga* (G. Veron *in litt.* 2004). The identity of the Singapore specimen(s) referred to in Chasen (1925), possibly not seen by him, remains unclear, and some authors are explicit the species does not occur there (e.g. Harrison, 1966).

There are many literature statements of occurrence in peninsular (= West) Malaysia (e.g. Robinson & Kloss, 1920; Chasen, 1940; Harrison, 1966; Medway, 1969), and at least one historical specimen (BMNH 1879.11.21.624, from Penang; G. Veron *in litt.* 2004). However, the only recent claim from the country seems to be of a road-kill from Sungai Petani in July 1985 (Asakawa *et al.* 1986). There are also several recent assertions of occurrence in southern China (southern Yunnan and western Guangxi; Wang Ying-xiang, 1987, 2003; Zhang Yong-zu, 1997; Wang Sung, 1998; Sheng Helin *et al.* 1999). Occasional reference to occurrence in India is based solely on the alternative viewpoint that the Malabar Civet *V. civettina* of the western Ghats is conspecific; *V. megaspila* itself has apparently never been suspected in the country.

Lekagul & McNeely (1977), in a comprehensive review of the mammals of Thailand, described the species as "found all over the country and ... rather common". Little over a decade later, a global review of all species of Viverridae (Schreiber *et al.* 1989) considered it very little known, traced no records from any protected areas, and urged the need for surveys to assess its current status.

In the 15 years since this alert for status information of Large-spotted Civet, few records have come to light. During extensive surveys of the Lao national protected area system in the 1990s, it was found at only two sites, Xe Pian and Phou Xang He National Protected Areas, with one animal found in a zoo in this general area. This contrasted with the widespread and often frequent occurrence of Large Indian Civet *V. zibetha* in the areas surveyed (Duckworth, 1994, 1997; Duckworth *et al.* 1999). Large-spotted Civet was recorded again in Xe Pian by Austin (1999). The only other subsequent record from Laos appears to be of remains seen in a hunter's possession on the Nakai Plateau, central Laos, in 2002 (K. Khounboline verbally, 2003). There appear to be few recent records from Vietnam (R. J. Timmins *in litt.* 2004). The species has been found at several sites in Cambodia (J. L. Walston *in litt.* 2004). However, we have traced no recent specific information on status in Thailand or Myanmar. Here we report recent records through camera-trapping on extensive surveys of both countries, and the lack of records from a similar survey programme in West Malaysia. These records were incidental to the primary survey aim, to document the status of Tiger *Panthera tigris*.

Large-spotted Civet Viverra megaspila *from Myanmar. Photo: WCS Myanmar Programme.*

Materials and methods

Surveys using heat-and-motion-sensitive CamTrakker™ (Camtrak South Inc., Georgia, USA) camera-traps were mounted at numerous sites across Thailand, Myanmar and West Malaysia during 1997-2002. Camera-traps are good at amassing the very many hours of observational effort which may be needed to detect low-density, shy and/or nocturnal mammals, provided they are ground-dwelling (e.g. Griffiths & van Schaik, 1993; Cutler & Swann, 1999). Moreover, the photographs provide objective and verifiable evidence of species' presence, a consideration particularly pertinent to Large-spotted Civet given its general morphological similarity to the Large Indian Civet with which it is widely sympatric, and to Malay Civet which overlaps in distribution in the Sundaic subregion. Field protocol was shaped by the primary aim of the surveys, to document Tiger presence and abundance. Cameras were thus deployed in grids and along traplines across areas predicted on various grounds (e.g. habitat type, condition and extent, human use patterns) potentially to hold Tigers (see Myanmar Forest Department 2003 for further details). Points of relevance to the recording of Large-spotted Civet are that:

- a wide geographical range was covered in each country;
- a wide range of altitudes and habitats were covered in each country;

- most trapping was in relatively remote areas;
- camera-traps were set at a height suitable for being triggered by passing small carnivores, as shown by the overall numbers of viverrid photographs;
- in total, surveys covered all seasons of the year although individual sites were not trapped throughout the year;
- the need for semi-quantitative information on Tiger status meant that massive survey effort was undertaken at all sites, typically several hundred to several thousand trap nights at each;
- in total, there were eight survey areas in Thailand and 17 in Myanmar; and nine in Malaysia surveyed in a comparable manner by a collaborative programme of the Department of Wildlife and National Parks and the Wildlife Conservation Society.

Records

Few photographs of Large-spotted Civet were obtained: one each from two survey areas in Myanmar, and two from one survey area in Thailand. The details are as follows:

- **Htaung Pru Reserve Forest, Southern Taninthayi Division, Myanmar**
  Location, extent and description of survey area: the survey area, of 120 sq. miles (310 km²), lies in the Htaung Pru Reserve Forest over 11°38'-11°38'N, 99°03'-99°07'E, in Taninthayi and Bokpyin Townships, Myeik District. The eastern portion is drained by the Naukpyan, La Mu, Tabalat, and Ngawun streams, which flow into the Little Taninthayi River. To the west the Monoron Stream flows into the Lenyar River to the south. The area is partially low-lying with swamps and grassland that are annually flooded, interspersed with mixed evergreen - bamboo forest groves on higher ridges. The area lies on both sides of the new Taninthayi-Bokpyin highway, and is partially under cultivation for rice and areca palm, with some shifting cultivation. The area has two monsoons with a prolonged wet season from June – November, and annual rainfall of around 160" (4,100 mm). Base camp was situated 3 miles (5 km) south of Htaung Pru Village containing 15 households, with a further 38 households in adjacent Manoron Village.
  - Number of trap-nights in survey area: 837
  - Location of camera-trap: 11°37.27'N, 99°04.49'E
  - Date and time: 7 February 2002, 01h49
  - Elevation: 110'-2,264' (33-690 m); exact altitude of camera trap 80' (25 m)

- **Hukaung Valley Wildlife Sanctuary, Kachin State, northern Myanmar**
  Location, extent and description of survey area: 525 sq. mi. (1,360 km²) at 26°36' - 26°42'N, 96°34' - 96°53'E in the newly declared Hukaung Valley Wildlife Sanctuary (size 2,493 sq. miles; 6,459 km²), which has even more recently been expanded to the Hukaung Valley Tiger Reserve at 21,890 sq. km. To the north an upland area rising to 6,758' (2,060m) divides the Tarung Tawan watershed and Gedu River catchment, with the Kumon Mountains to the east, the Nambyu and Nampyek River catchments in the south and the Tarung River and old Ledo Road to the west. Vegetation is predominantly dense lowland evergreen forest interspersed with meadows. Rainfall is about 2,340 mm annually. Apart from a 5 acre shifting cultivation area near Tawang River, there were no permanent human settlements in the survey area.
  - Number of trap-nights in survey area: 1,563
  - Location of camera-trap: 26°38.75'N, 96°51.10'E
  - Date and time: 2 December 2002, 18h19
  - Elevation: 193 - 1,307' (59 - 398 m); exact altitude of camera trap 900' (277 m)

- **Taphyra National Park, eastern Thailand**
  Location, extent and description of survey area: roughly 100 km² within 20 km from the Thai-Cambodia border, one of three plots used to assess large mammal occurrence in this part of the Dong Phayayen-Khao Yai Forest Complex. Much of the area was dominated by scrubby, low stature secondary evergreen forest, and scrub roughly 10-20 m high with a few scattered larger trees remaining, but with no continuous canopy anywhere. There were very few rattans in the understory and no bamboo. Some *Licuala* palms were present along the banks of streams. Annual rainfall is approximately 1,200 - 2,000 mm. A well-used trail passed through the area and was littered with instant noodle packets, articles of clothing and other items, suggesting use by people other than forest product collectors and hunters. These were thought to be possibly immigrant workers from Cambodia. There were many large stumps of *Afzelia* which were now coppicing. These post-dated the era of legal logging concessions and were indicative of more recent poaching. Newer (1-2 year old) signs of logging were also found. During part of the survey, wheelbarrow tracks appeared overnight on one trail, indicating the possible extraction of illegal timber or possibly a hunted large mammal.
  - Number of trap-nights in survey area: 1,384.
  - Locations of camera-traps: (a) 14°07.02'N, 102°37.00'E; and (b) 14°10.52'N, 102°44.63'E
  - Dates and times: (a) 17 November 1998, 05h35; and (b) 11 October 1998, 01h03
  - Elevation: c. 300m; exact altitude of camera traps (a) 120m and (b) 270m

Discussion

These records come from, in total, a wide geographical range and (together with recent Lao, Vietnamese and Cambodian records) effectively confirm that Large-spotted Civet persists across its non-Sundaic, non-Chinese, historical range. All three records are from evergreen forest: this is the predominant habitat of other recent records, although some have been from deciduous dipterocarp forest (Duckworth, 1994; Austin, 1999). There is no evidence of the species in areas remote from forest, but the Thailand records, from an extensive logged-over area, strengthen the suggestion by Duckworth (1994) that the species is not particularly sensitive to forest degradation.

Almost all field records with known altitudes have been from the extreme lowlands (below 300 m). There are two, as yet unpublished, apparently from higher altitudes: from the Nakai Plateau, Laos, at c. 520 m, and from Konkhakhin, Vietnam, assumed to be about 700-900 m (Le Trong Trai verbally, 2000, photograph examined by JWD). However, both are of hunted animals for which the precise capture site is not known. These two areas are plateaux possessing habitat more typical of lower areas, and, especially in the case of the Nakai Plateau, a suite of lowland indicator bird species (Evans & Timmins, 1998). These records from Myanmar and Thailand, from such widely disparate sites, yet all from below 300 m, consolidate the impression that Large-spotted Civet is a lowland species. This contrasts with Large

Indian Civet, which ranges widely in South-east Asia up to well over 1,000 m (e.g. Duckworth, 1997), and was recorded in these surveys over ranges of 50-1,280 m in Thailand and of 15-1,628 m in Myanmar. Notably, in the highest altitude site for Large-spotted Civet with nocturnal survey data, the Nakai Plateau at about 520 m, Large Indian Civet is considerably more numerous (Duckworth, 1997), whereas in the extreme lowlands of Xe Pian, the balance is reversed, with Large-spotted Civet being much the commoner (Austin, 1999). Indeed, we are not aware of any site in non-Sundaic South-East Asia lying predominantly under 300 m, supporting 500+ sq. km of (semi-) evergreen forest, and having received heavy camera trapping or spotlighting effort, that has not recorded the species.

A restriction to lowland forest probably explains the apparent contradiction in status assessment between Lekagul & McNeely (1977) and observers in and after the 1990s. During the interim, massive areas of lowland forest were logged across the species' range and, particularly in Thailand and Vietnam, converted to non-forest land-uses. There was doubtless a major decline in the species' population during this period, accompanied by a change in distribution pattern from being widespread to restriction to isolated sites. In its distributional range, only Cambodia and parts of Myanmar retain truly extensive, albeit mostly degraded, level lowland forests. All records come from large forest blocks (500 km^2 or bigger), with no evidence for persistence in fragmented forests. It is difficult to tell if this is a meaningful result, because much fieldwork for mammals, especially Tigers, necessarily focuses on the largest remaining forests. In increasingly smaller fragments, persistence by forest species becomes ever more unlikely, reflecting increased risks of chance extinction, possible loss of seasonal movement areas and, especially in Indochina, heightened vulnerability to the effects of hunting. Information on the lower size class of fragments able to support viable populations of Large-spotted Civet is lacking. The conservation needs of a host of lowland species with large area needs argue for the retention of very large lowland forest blocks at representative sites across South-east Asia (e.g. Seidensticker *et al.* 1999; Lambert & Collar, 2002) and this would certainly be beneficial for this civet.

These trapping rates (one per 837 trap nights, one per 1,563 trap-nights and one per 692 trap-nights at the respective sites) are well below those of Austin (1999) who found in two habitat-types of Xe Pian, one per 69 and one per 49 trap-nights respectively. However, this disparity in encounter rate probably reflects, at least partly, methodological differences. Austin (1999) baited some camera sites and all Large-spotted Civet photographs were at baited sites, whereas no baits or lures were used for these surveys in Thailand, Myanmar and Malaysia. Moreover, it is highly likely that all Austin's (1999) trap sites were below 300 m altitude, whereas the present Thai and Myanmar surveys set cameras across a wide altitudinal range. Hence, it should not be concluded that these sites are holding much lower density populations than Xe Pian.

Mammal hunting is very heavy across most of the Large-spotted Civet's range. Ground-dwelling civets can be caught by various methods, notably snares and other traps, direct shooting, cornering with dogs, and digging out of dens. Recent advances in the reduction of guns in civilian usage across much of the range (especially Cambodia, Laos, and Vietnam) may, ironically, have heightened pressure on species such as Large-spotted Civet, whereby former shooters increase snaring levels to compensate. Reduction of snaring levels is likely to be a lot more challenging than reduction of gun usage, for several reasons. Gun campaigns have been primarily driven by civil order needs rather than wildlife conservation, whereas snaring does not have this priority. Snaring needs less complex materials than shooting, so there is no possibility of controlling the equivalent of 'ammunition'. And, snaring is now a major means of trapping the vast number of mammals to supply the rocketing Chinese and, increasingly, Vietnamese markets for wildlife meat. Active hunting is still rife in the Hukaung Valley, Myanmar, with people using both black powder guns and bows-and-arrows to hunt. There is only limited information on hunting pressures in the Htaung Pru Reserve Forest. In Taphyra National Park, Thailand, snares, pipebombs and black powder guns are all used to kill large mammals.

The conservation needs for Large-spotted Civet can now be revised from those in Schreiber *et al.* (1989). There remains a need for further status information, notably camera-trap or spot-lighting surveys in areas within the species' range with no recent confirmation of its presence. This is particularly so for peninsular Thailand and Malaysia, which are ecologically very different from the non-Sundaic (more northern) areas whence come all the recent records. The lack of any Large-spotted Civet photographs from the nine survey areas in Malaysia is particularly of concern. The sites ranged from the Thai border in Perak State to Johore State in the far south, and were surveyed between December 1997 and December 1999, and involved 174 camera-trap set-ups and 6,259 trap-nights of sampling. Other small carnivores were detected: Yellow-throated Marten *Martes flavigula*, Large Indian Civet, Malay Civet, Banded Linsang *Prionodon linsang*, Common Palm Civet *Paradoxurus hermaphroditus*, Masked Palm Civet *Paguma larvata*, Binturong *Arctictis binturong* and Banded Civet *Hemigalus derbyanus*. This indicates that Large-spotted Civets were probably not simply overlooked through inappropriate methodology. Recent records not so far written up, notably from Cambodia, need to be presented. But now that several protected areas are known to hold the species, more important is on-ground effort to ensure that forest extent at key sites is not decreased or fragmented. Coupled with this is the need to reduce, and preferably eradicate, snaring from declared protected areas; usually this will be in accord with the area regulations, at least in total protection (core) zones. Key sites are likely to include several areas in Cambodia (J. L. Walston *in litt.* 2004), Xe Pian National Protected Area in Laos, and all the three Thai and Myanmar sites discussed here: these all include hundreds of sq. km of forest at below 300 m.

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1st International Symposium on Wolverine Research and Management

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Viverrid and herpestid observations by camera and small mammal cage trapping in the lowland rainforests on Borneo including a record of the Hose's Civet, *Diplogale hosei*

Konstans WELLS[1], Alim BIUN[2], and Marius GABIN[2]

Introduction

Tropical rainforest frontiers are, for good reasons, a central issue in recent ecological and conservation debates, and pointing out the high biodiversity simultaneously with the rapid ongoing loss of the habitat is the content of a considerable proportion of research articles. South-East Asian rainforests, in particular, are a major sacrifice to the international timber markets (see e.g., Sodhi *et al.*, 2004). Little time is left to study the dynamics of diverse species assemblages in their primeval condition or, more fundamentally, the natural geographic range of species that are mostly as yet barely investigated. Needless to say, despite some efforts, studies on mammals in this region are particularly in their infancy. They are often limited to a few focal species, and rarely describing comprehensive patterns on a geographic scale.

Borneo, the second largest tropical island in the world after New Guinea, is of much interest due to its high biodiversity and biogeographic composition of endemic and widespread Sunda species. Groves (1985) listed 32 % of Borneo's terrestrial mammal species as endemic, with the lack of endemic genera possibly reflecting the time span of Borneo's isolation. The dipterocarp rainforest with probably around 3,000 different tree species (MacKinnon *et al.*, 1996) harbours around 130 non-volant mammal species (Payne *et al.* 1985) including nine civets and three mongooses. Although some civet species can be frequently encountered on night surveys and some life history information is available (e.g., Macdonald & Wise, 1979; Dhungel & Edge, 1985; Rabinowitz, 1991; Colon, 2002), knowledge on their distribution patterns and ecological impacts remains poor with few structured studies undertaken.

Apart from their wide array of small vertebrate and invertebrate prey, civets feed also on a variety of fruits, and the regular encounter of intact seeds in faeces indicates their role as seed dispersers (Lambert, 1990; Rabinowitz, 1991; Engel, 1999; Shanahan & Compton, 2001; *pers. obs.*). Civets' resource exploitation covers a wide spatio-temporal array, with dichotomous strategies such as diurnal *vs.* nocturnal, terrestrial *vs.* arboreal, carnivorous *vs.* frugivorous, and further gradients such as montane *vs.* lowland or primary *vs.* secondary forests. To understand in more details how species are able to cope with environmental variability both within an individual's home range or on a population scale would therefore not only unravel questions on tropical rainforest dynamics but is also essential for conservation issues of this little known small carnivore community. As long as there are no more concrete scientific efforts, progress will be a slow-fusion puzzle of records that might add to our knowledge of species distribution and abundance.

Here we report a record of the rare Hose's Civet *Diplogale hosei* from the lowland rainforest at Mount Kinabalu NP in Sabah, Borneo, and provide further data on small carnivore records resulting from camera and small mammal live trapping.

Malayan Civet Viverra tangalunga. *Photo: Kontans Wells*

Materials and Methods

The main study area was in the primary lowland rainforest of Mount Kinabalu NP, Sabah, Malaysia near the village Poring Hot Spring (N 06° 02.248'N, 116° 42.482'E) at an elevation of ca. 600 m.

Five Camera traps (Konica) were set up on the ground between December 2003 and March 2004 by A. B., comprising a total effort of approximately 100 camera nights. Cameras where checked only weekly, and as some film rolls were finished beforehand, we were not able to cover the entire time period. The 35 mm cameras were triggered by a passive infra-red sensor with a minimum time delay of 20 seconds between consecutive inputs.

Small mammal cage traps (14 x 14 x 28 cm in size, and some bigger ones) were set up by K. W. in the same forest area as well as in two additional primary (Danum Valley, Tawau Hills NP) and three secondary forest sites (Kg. Monggis, Kg. Tumbalang, Luasong Field Centre) in distances of 17 - 236 km at altitudes between 400-900 m. Trapping activity was conducted alternating between the different forest areas, comprising a total trap effort of more than 42,000 terrestrial and 1,800 arboreal trap nights during 18 monthly trapping sessions. As this trapping effort was not focusing on small carnivores, capture success was rather biased by small trap size only approachable for immature individuals and the use of banana bait, but trap effort and attractiveness of traps were supposed to be similar in all sampled areas.

Results

The camera trapping activity resulted in a total of 335 pictures from wildlife species: 299 (89 %) from mammals, 34 (10 %) from birds and two from the Rough-scaled Brown Skink *Mabuya rudis*. Only eight (2 %) of all pictures were from viverrids and an

herpestid, including four species: Hose's Civet *Diplogale hosei*, Banded Civet *Hemigalus derbyanus*, Banded Linsang *Prionodon linsang*, and Collared Mongoose *Herpestes semitorquatus* (Table 1). The Malay Civet *Viverra tangalunga* was recorded by camera trapping after the study in September 2004 in the same area.

Small mammal cage trapping resulted in a total trap success of 12 individuals (27 captures) of civets out of 1,256 mammals (3,912 captures) (Table 2). All captures were of the species Small-toothed Palm Civet *Arctogalidia trivirgata*, Common Palm Civet *Paradoxurus hermaphroditus*, and *Viverra tangalunga* and all came from the two primary forests of Tawau Hills NP and Danum Valley: no viverrid was captured in Kinabalu Park or any secondary forest. A single individual of *A. trivirgata* was trapped in a tree at a height of 18 meters in Tawau Hills NP, whereas all other captures were on the ground. Nearly all captures were in the same period of the year, between September and October (fruiting season of dipterocarps and other common tree species) although trapping effort was similar throughout different seasons.

Discussion

Our record of the Hose's Civet, *D. hosei*, in Mount Kinabalu NP adds another proof of this species in a lowland rainforest habitat. This rarely known species has been mostly recorded form montane forest sites in Sabah and Sarawak (Payne *et al.*, 1985; Dinets, 2003; Van Rompaey & Azlan, 2004; Yasuma, 2004), though Francis (2002) reported it from an altitude of only 450 m in Brunei and Payne *et al.* (1985) listed an altitude of 600 m at Batu Song in Sarawak. Given the fact that this species is rarely recorded, the few available lowland records comprise a relatively high proportion of observations of this species from all habitats combined. This poses the question whether the range of this montane species is larger than expected, at least including lowland forest areas near its montane habitats. Such a consideration might be important, particularly as little is known about the population structures of species restricted to mountain areas and how dispersal and migration ensure exchange between the apparently subdivided populations in the hilly landscape of Borneo. The interest in this elusive species increased only recently (see references above), and lowland forest records as well as the recent nature of most sightings increase the possibility that *D. hosei* is more common and widespread than previously thought (P. Cavallini, *pers. comm.*).

Our additional survey data support the idea that viverrid species might be easily overlooked by any sampling method, with scattered and biased records providing only a fraction of local assemblages. Camera and live trapping data revealed different spectra of species, although the reasons for this cannot be established. It is probably not simply that one or other of the two techniques is in general better for each of the species because, for example, Common Palm Civets are regularly camera-trapped elsewhere. Whatever the reasons, at studies with low total encounters (such as here), such incompleteness is almost certain to be part of a species inventory list. All species of Bornean civets (except the rare *D. hosei*) have been recorded in disturbed forest areas, although abundance was found to decline in this habitat (Heydon & Bulloh, 1996; Colon, 2002; *pers. obs.*) and we captured no civet there. Clearly, the traps used in our study were not ideal for small carnivores, although all captured civet species are well known to enter traps baited with banana (further, a Short-tailed Mongoose *Herpestes brachyurus* entered such a trap in Mount Kinabalu NP before, Wells *et al.*, 2004). In the context of understanding tropical forest ecology, the heterogeneity in the rainforest environment needs to be considered both within and between patches from a local to regional scale, and also on the vertical axis. Studies on small carnivores in the Bornean rainforest need to consider such aspects both for recording methods and study designs, providing not only a challenge but also a promising model to get a more complete insight in an elusive and complex species assemblage.

Acknowledgments

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Table 1. Species of viverrids recorded during the camera trapping survey in Kinabalu Park. Given are the number of images taken per species and the respective times of records.

Species name		Number of images	Time of photo record
Hose's Civet	*Diplogale hosei*	1	22:20
Banded Palm Civet	*Hemigalus derbyanus*	1	03:54
Banded Linsang	*Prionodon linsang*	3	04:40, 04:47, 05:10
Collared Mongoose	*Herpestes semitorquatus*	3	09:05, 10:51, 13:10

Table 2. Species of viverrids recorded with small mammal cage traps. The months in which captures took place are presented. Dan: Danum Valley. Taw: Tawau Hills NP

Species name		Recording site	No. of individuals trapped			
			Mar	Aug	Sept	Oct
Three-striped Palm Civet	*Arctogalidia trivirgata*	Dan, Taw	1	1		1
Common Palm Civet	*Paradoxurus hermaphroditus*	Dan, Taw			5	1
Malayan civet	*Viverra tangalunga*	Dan				3

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International Conservation Breeding Program established for Owston's Civet

Scott ROBERTON and Stewart MUIR

The Owston's Civet Conservation Program (OCP) of Cuc Phuong National Park exported 3 breeding pairs of Owston's Civet to England in December, marking the beginning of an international conservation breeding program to ensure the survival of the species into the future. Owston's Civet (*Chrotogale owstoni*) is a species of carnivore in the Viverridae family. It lives in forest in Northern and Central Vietnam, Lao PDR and Southern China. The IUCN/SSC Small Carnivore Specialist Group lists Owston's Civet as Globally Threatened and one of the highest priority species for conservation action. It is under serious threat from widespread hunting and trapping in forests within its range feeding a demand for its meat from restaurants, body parts from traditional medicine makers and its beautiful skin for taxidermists in Vietnam and China.

The OCP has been working on the conservation of this and other species of small carnivore in Vietnam for the last ten years. During the course of the program a number of Owston's Civet have been rescued from the illegal wildlife trade by Forest Protection rangers and transferred to the centre in Cuc Phuong, establishing a breeding population in Vietnam. This international conservation breeding program for the species has been established to minimise the risks associated with holding all the animals in one location and aims to maintain a captive population of the species until such a time that Vietnam's protected areas are under considerably less threat than now and more information is known on the species' exact ecological needs.

Newquay Zoo, Thrigby Hall Wildlife Gardens and Paradise Wildlife Park in England are the first zoos to join the program yet next year more breeding pairs will be sent to America and maybe even Australasia. All the institutions involved in the Program are committed to conservation and this is reflected in the exhibit design, research program and awareness strategy for the species in captivity.

The Program is to a majority co-ordinated from Vietnam, the core range state of the species, and the focus for technical and financial assistance sourced through the institutions involved in the Program. This Program is aimed at assisting zoos in fulfilling their conservation potential by providing a link between the *ex situ* work of the zoo on Owston's Civet with conservation work being carried out in the species natural range. The specific goals of the program are as follows:

- Establish a well-managed genetically-healthy captive population of Owston's Civet
- Increase global awareness of Owston's Civet and Vietnam's small carnivores in general.
- Undertake appropriate captive research and improve veterinary knowledge of Owston's Civet and other small carnivores.
- Encourage improvements in the husbandry and breeding of Owston's Civet, so that this may be available to support *ex situ* maintenance of other threatened or rare small carnivores.

This is the first time a program like this has been established in Vietnam with such a focus on linking the conservation of a species in the wild to an international breeding program and it is a testament to the steps forward Vietnamese conservationists and forest protection rangers are making in the battle to conserve Vietnam's unique natural heritage.

For more information on this program please contact:

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Stop press: Liza just gave birth to the first ever Owston's Civet born outside of Vietnam!

Observation of a Malay Weasel in Sumatra

Neil FRANKLIN and Philip WELLS

It has taken several years of perspective to appreciate the fortuitousness of this particular observation. The photograph of the Malay Weasel (*Mustela nudipes*) shown on cover dates from April 1994, taken in the hill forests of Kerinci Seblat National Park (1.4 million hectares), Sumatra, Indonesia.

At the time we were in a four person group surveying for Sumatran rhinoceros, in the course of a two year population status assessment project, carried out in collaboration with the Indonesian Institute of Sciences (LIPI). For this particular survey, in the South Sumatra province section of the park, we had travelled overland from the town of Lubuk Linggau to the district of Musi Rawas, then travelling another day by powered boat up the Batang Empu river through the outpost villages of Suka Menang and Tandjung Agung. Finally, reaching the borders of the park on foot, the survey commenced.

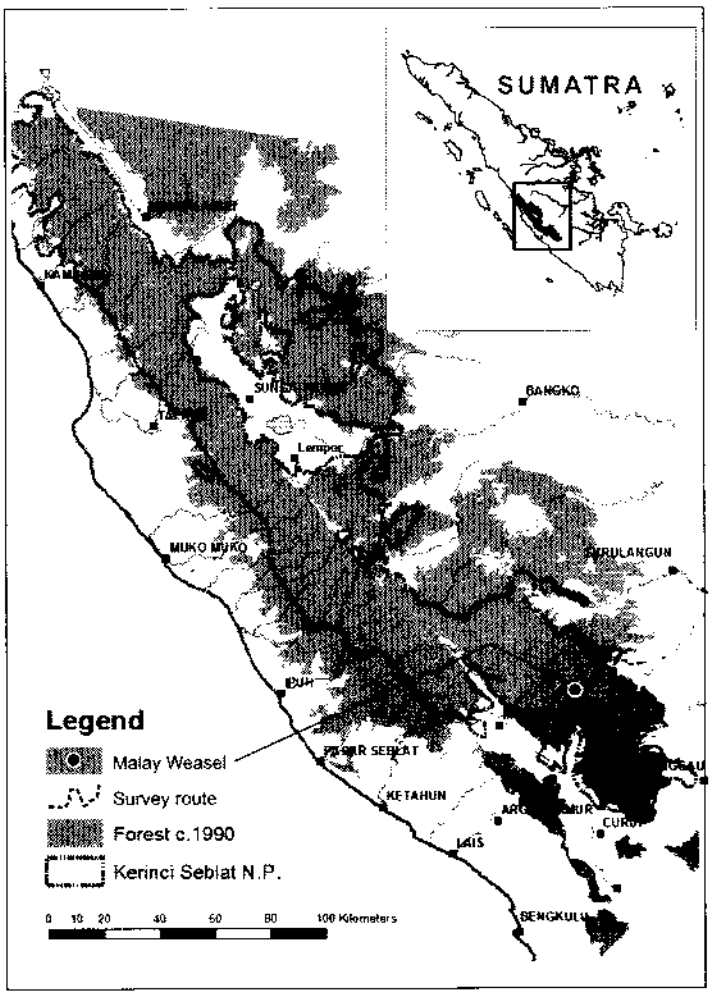
On the 25th April when the photograph was taken we were 5 days trekking into the field. The location itself was about as remote as one can get in the KSNP, far removed from human settlements, at an altitude of about 800 metres, surrounded by beautiful primary hill rainforest, and on the banks of a small, but fast-flowing, rocky river.

At 17:50 hrs, while wading upstream to make camp for the night, we noticed the darting bright yellow movements of an animal on the sandy banks of the river. Being accustomed to most rainforest wildlife running in the opposite direction, it was a great surprise to be able to approach the animal as it continued its frantic scrabble. As we came out of the river and on to the bank we could see the animal (clearly a weasel though we could not identify its species at the time) was locked in fierce combat with a common rat. The weasel was so intent on its prey that we could clumsily approach within 2 meters, set down our rucksacks, casually preparing a camera (a basic fixed-focus 35 mm model) while the weasel continued its tug-of-war with the rat. Both animals were clearly dishevelled and waterlogged and had probably been going at it for some time, both on the bank of the river and in the water. Fortunately for the rat, the only hold the weasel had was a solid lock on the last inch of the rat's tail.

After several minutes, when our tired group had sat down and made itself comfortable on the river bank, the weasel inadvertently let go – at which point the rat bolted, launching itself into the fast currents of the river. Within a second the weasel spotted us, literally within touching distance throughout this time, and shot off with lightening-fast "zig-zag" movements into the bush.

In the aftermath, the local guides with us reported that this weasel is an irregular but welcome visitor to the farmlands on the forest edge, being an obvious deterrent to vermin, and in particular to rats. Locally it is known as the *Musang Pisang* (Banana Weasel), where the Indonesian word *musang* covers both civets and weasels.

Despite covering more than 2,700 km of trails throughout the park in the subsequent two years we only ever saw the Malay Weasel on one other occasion, that time in mixed rainforest/ rubber at an altitude of about 400 metres. It was a flashing glimpse, but the bright yellow body, snow-white tail and head, pink eyes and ears, and its characteristic darting movements, were all unmistakable.



Location of Malay Weasel photograph in the Kerinci Seblat National Park of Sumatra, Indonesia.

Putting these observations firmly in context, further field work between 1996 and the present (under the Sumatran Tiger Conservation Program in collaboration with the Indonesian Department of Forestry) has provided more than 25,000 trap days from remote cameras operating in remote lowland, hill and peat-swamp forests across Sumatra. Despite obtaining photographs of such rarities as the Flat-Headed Cat (*Prionailurus planiceps*) and Otter Civet (*Cynogale bennetti*), among many other species, to date we have not yet recorded the Malay Weasel. As a means to furthering our understanding of the species' distribution and habitat preferences, it would be of great interest to hear about other groups' findings working throughout the Malay Weasel's supposed range.

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Workshop on the European mink
19-22 October 2004, Moliets et Maâ (Landes, France)

*According to all estimations the European Mink (*Mustela lutreola*) is one of the most endangered European mammals. It is still present in some areas of southwestern France and northern Spain. A four-day workshop gathered managers of areas where the species is (or may be) present to propose and discuss some of the best possible management for its conservation. The location of the meeting gave the opportunity to the participants, including several Spanish conservationists, to visit the "mink country".*

At the beginning of the XXth century the European Mink, a small semi-aquatic mustelid, was distributed over all the most western part of France. A hundred years later, when it was officially given a full protection status, the species has lost more than half of its known distribution area. In 1999 the French Ministry in charge of the Environment initiated, with a financial support, a national conservation plan. The management of the plan has been deputed to the "Aquitaine" regional direction of the Environment (DIREN*), its animation to the French mammal society (SFEPM**), whereas works in the field were implemented by many partners (hunting agency and associations, pest control groups, nature protection associations, staff of protected areas and regional organizations, etc. and a very active office (GREGE***).

Quite logically, all these people attended the workshop, which functioned both as a conclusion to the first five-year conservation plan that ended in 2003, and as a prelude to a new effective action plan that is intended to start in 2005.

Each of the four days was devoted to a specific main topic: management of wetlands and rivers (first and second days), dangers linked to pest control (third day) and consequences of road and railway construction (habitat destruction) and traffic with possible technical solutions to prevent casualties (fourth day).

The first lecture by Pascal Fournier presented the state of the art. What do we really know about such a secretive species, not always recognised where it is still present? The main questions of the workshop were asked at this occasion. Apparently, the European mink is occupying a narrow ecological niche, tightly related to wetlands, which can be seen both as a foraging place and as a refuge against the competition of larger carnivores. As *M. lutreola* does not seem to be a very efficient hunter, individuals occupy quite large home ranges compared to their own size. The few radio-tracked animals (intra-abdominal transmitter) showed that they were able to move over more than 10 kilometres overnight, which is quite a large distance for an animal of about 1 kg, but which is also a little risky (many roads to cross and many possibilities to meet a predator). The monitoring of animals also stressed some of the threatening factors. The drainage of so many wetlands is one of the major threats. France lost 67% of its wetlands during the last century and the process is still not over. In their roost minks are so confident that they will not move or try to escape if a machine is passing by to hollow out a river and they may thus be destroyed or buried. Minks are often caught in traps for Coypu (*Myocastor coypu*) and American Mink (*M. vison*) and dogs and cars also kill some animals. The presence of the American Mink, a possible competitor and an unquestionable pathogen reservoir, which is classified as a pest in the country is one example of a new threat facing its European counterpart. However, even before the American Mink escaped and/or was released from fur farms, the native species had already declined.

To try to bring a positive answer to this situation, Christian Maizeret, one of the first workers on the ecology of the species in France, proposed a global scheme for the conservation of the European Mink over the 68 river valleys still visited by the species in France. If 53 of these hydrographical networks are included in the European Natura 2000 network, the 15 others should not to be ignored. The proposal is quite pragmatic. The idea is to start by a situation diagnosis and then to define the most adapted conservation measures following the specific diagnosis of the location. Four pilot zones are currently tested before extending the work to the whole distribution area of the species.

Beside these two communications, cases studies were presented, on all of the workshop items, starting with the role of habitats linked to the typical landscapes of Southwest France, mainly in the Aquitaine region. For instance, the « barthes » of the river Adour or the « saligues » of the « gave » (river) Pau, in fact the parts of the valleys that are seasonally flooded, were presented as typical and classical European Mink habitats. Recently, agriculture deeply modified the original ecosystems. The French national plan for wetlands (1995) was then presented with its 2003 situation: destruction of marshes, ponds, wet fields and pastures is still going on.

Concerning Coypu live-trapping, a small square opening on one side of the cage is enough to allow minks to escape, contrary to the much larger rodent. In areas where the European Mink is, or could be present, the use of killing traps to catch European Polecat (*M. putorius*), which still can be classified as a pest without any scientific reasons as it is also declining, should be forbidden. The use of poison to control rodents should also be forbidden in all the mink range.

The question of road construction is also sensitive as new projects, from small roads to highways and high-speed railways, are very often passing through wetlands, even through some protected areas, rather than through farmlands, industrial or urban areas. So destruction of European Mink habitats is likely to continue even if enterprises are officially urged to consider habitat protection and species conservation in their projects. In order to reduce road casualties, some devices are now adopted in new sites, but many old roads remain dangerous.

To conclude, these four days brought many useful data, easy to use for land managers, trappers, road builders and conservationists. A booklet on habitat management of the European Mink, printed and distributed in 2004, and the next proceedings of the workshop, will put together the experiences of the speakers. We do hope that these four days, ending the first five-year plan will quickly lead the emergence of a new action plan. European Mink, here and over all its range still need support, expertise, skills and help.

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Distributional notes on the African Palm Civet *Nandinia binotata* in Tanzania

Andrew PERKIN

Introduction

The African Palm Civet *Nandinia binotata* occurs widely in the forests of west, central and eastern Africa. This paper presents results of surveys that focused on a sample of forest types in Tanzania and Kenya that have different biogeographical affinities: i) the volcanic forests of Kilimanjaro and Mt. Meru (Tanzania), ii) the western Guineo-Congolean forests (Tanzania), iii) the forests of the southern highlands (Tanzania) and iv) the Eastern Arc and coastal forests of Tanzania and Kenya (Lovett & Wasser, 1993). The Southern Highland, Eastern Arc and coastal forests contain high levels of species endemism and have been classified as one of the world's top biodiversity hotspots but there has been limited information on small carnivores (ICBP, 1992; Mittermeier *et al.*, 1998; Myers *et al.*, 2000; Burgess *et al.*, 2004). Most of the least degraded remnants of these forest types are confined to gazetted forest reserves, national parks and nature reserves.

Small carnivores are often one of the least recorded groups of mammals in an area, since many species are cryptic, and they are often nocturnal, arboreal and/or elusive. In East Africa, they have been surveyed with varying intensity over the last century. *N. binotata* is very arboreal and so it is presumably captured by ground based camera traps only relatively rarely. It is, however, readily detected by its eye-shine and vocalisations. *N. binotata* in Tanzania and Kenya is known to occur in most types of forest in non-arid areas (Kingdon, 1997; Wilson & Reeder, 1993) but site-specific records of the presence of this species are relatively few (Table 1). Based on these few records in East Africa, the considered range of the subspecies *N. b. arborea* (Heller, 1913) has been extrapolated to Tanzania, Uganda and Kenya to Malawi, Mozambique and Zimbabwe where there are ecologically suitable forest habitats (Kingdon, 1997; Wilson & Reeder, 1993).

Figure 1. An African Palm Civet Nandinia binotata *camera trapped in the Udzungwa Mountains on the ground.* N. binotata *spends most of its time in trees and other forest vegetation. (Photo kindly supplied by F. Rovero)*

Methods

Surveys for nocturnal mammals (principally galagos) were conducted in 21 forests in Tanzania and Kenya intermittently between 1995 and 2002. A variety of methods were used: 1) spotlighting with a Petzel headtorch and a 4 D-cell Maglite; 2) tape recordings with a Sony WM-C6C tape recorder and Sennheiser K6-ME66 directional microphone; 3) chardonneret traps (Charles-Dominique, 1977) baited with ripe bananas, mangos and locally fermented palm wine, to capture galagos and other mammals alive; and 4) interviews with local people. During these surveys small carnivores sightings were noted especially as they often induced bouts of alarm calling by galagos on which small carnivores are known to predate (Charles-Dominique, 1977).

Table 1. Published records of Nandinia *in Tanzanian mainland forests and Kenyan coastal and Eastern Arc (i.e. the Taita Hills) forests.*

FOREST	LOCALITY	REFERENCE
Coastal forests		
Shimba Hills	04°13'S, 39°25'E	Engel (2000)
Genda Genda Forest Reserve	05°33'S, 38°38'E	Burgess & Clarke (2000)
Pugu/Kazimzumbwi Forest Reserve	06°42'S, 39°05'E	Burgess & Clarke (2000)
Tong'ongha Forest Reserve	08°25'S, 39°01'E	Burgess & Clarke (2000)
Unguja Island in Zanzibar	06°15'S, 39°24'E	Perkin, (2004)
Rondo Forest Reserve	10°10'S, 39°10'E	Honess (1996)
Eastern Arc Forests		
East Usambara Mountains	05°01'S, 38°40'E	Burgess & Clarke (2000)
West Usambara Mountains	04°40'S, 38°30'E	Swynnerton & Hayman (1951)
Uluguru Mountains	06°55'S, 37°43'E	Allen & Loveridge (1927);Swynnerton & Hayman (1951)
Northern Volcanic forests		
Mts. Kilimanjaro and Meru	03°04'S, 37°22'E & 03°14'S, 36°45'E	Swynnerton & Hayman (1951)
SW Highlands of Tanzania		
Ukinga Mountains	09°07'S, 33°37'E	Allen & Loveridge (1933),Swynnerton & Hayman (1951)

Table 2. Records of Nandinia binotata *in Tanzania made during these surveys. Sites where* Nandinia binotata *were not recorded are presented too.*

Site	Position/ location	Nocturnal survey effort (Hrs)	Presence recorded yes (Y)/no (N)	Data source: O – observation T- trapping H - heard
COASTAL FORESTS				
Tana River	01°43'S, 40°03'E	34	N	-
Primate Reserve Arabuko Sokoke	03°20'S, 39°5'5E	27	N	-
Diani private forest and surrounding kaya forests	04°19'S, 39°33'E	42	N	O
Pande	06°42'S, 39°05'E	84	N	-
Pugu/Kazimzumbwi	06°54'S, 39°05'E 07°00'S, 39°03'E	106	Y	O
Zareninge	06°08'S, 38°38'E	47.5	Y	OH
Kichi Hills	08°20'S, 38°50'E	36.5	N	OH
Namakutwa	08°17'S, 39°03'E	6	N	OH
Kiwengoma	08°22'S, 38°56'E	12	Y	O
Jozani, Unguja Isl. Zanzibar	06°16'S, 39°24'E	42.5	Y	OHT
Mkungwe FR	06°52'S, 37°54'E	27	Y	O
Mangala FR, lowland Uluguru Mts.	07°10'S, 37°40'E	12	Y	H
Mtanza Msoma	08°19'S, 38°45'E	16	N	-
Pemba Island	04°55'S, 39°42'E	39	N?	OH
EASTERN ARC				
Taita Hills (Kenya)	03°20'S, 38°15'E	92.5	Y	OH
S Pare Mts.	02°70'S 37°94'E	12	Y*	OTH
West Usambara Mts.	09°30'S 38°46'E,	25	Y	H
East Usambara Mts.	09°90'S 38°69'E,	370	Y	OH
Nguru	05°27'S 37°36'E,	16	Y**	OH
Rubeho Mts.	06°48'S 36°58'E,	55	Y	H
Uluguru Mts.	06°51'S 37°45'E,	63	Y	OH
Udzungwa Mts.	07°50'S 36°20'E,	88	Y	OH
WESTERN FORESTS				
Mt. Rungwe	09°00'S 32°05'E,	120	Y	O

*W. T. Stanley (Pers. comm.), specimens held at the Field Museum of Natural History, Chicago, USA. Specimen numbers: FMNH 151366, 151367, 151544.
** W. T. Stanley (Pers. comm.)

Results

JOZANI FOREST, UNGUJA ISLAND

Sightings of *N. binotata* in the ground-water forest of Jozani Forest Reserve, Unguja Island, were recorded. This record represented an extension of known range, and therefore a brief description is included below; for further details, see Perkin (2004). One individual was seen in the same tree on three consecutive nights. Distant screaming calls similar to those made by *N. binotata* on the African mainland were also heard on one occasion. One individual was trapped twice on consecutive days (the animal was distinguished by a small tear on the left ear). The trapped individual was caught in an area on the edge of the ground-water forest bordering the coral rag thicket forest at 06°15.99'S, 39°24.88'E. No biometric measurements were taken due to the lack of anaesthetic materials to handle the animal safely. The animal was estimated to be 1.5-2 kg in weight, head and body 40-50 cm long and the tail 50-60 cm long. The characteristic twin whitish spots on the shoulders were not obviously visible and the colour of iris was golden yellow. On the dorsum the fur was grizzled brown with clearly defined dark

The tail was the same colour as the dorsum, bushy with ill-defined dark tail rings. This individual closely resembled the [illegible] in Kingdon (1997) apart from the eye colour.

TANZANIAN COASTAL FORESTS

The surveys found *Nandinia binotata* in several coastal forests but not in others where its occurrence might be expected (Table 2).

Discussion

TANZANIAN AND KENYAN MAINLAND FORESTS

The recent finding of *N. binotata* in Unguja Island, Zanzibar indicates that its distribution still requires evaluation, especially on the nearby Pemba and Mafia islands off the Tanzanian coast. The other data from the Tanzanian mainland presented here broadly support the range for *N. binotata* in the forests of Tanzania as suggested by various authors (e.g. Wilson & Reader, 1993; Kingdon, 1997). However, documented occurrence was patchy indicating either low densities, poor detection levels or perhaps the local absence of this species. This picture will no doubt change as field workers report their findings. Honess (1996) reports that it is common on the Rondo plateau forests in SE Tanzania. When encountered, they did not appear to be worried by humans: conversely, they mostly just sat and stared from the trees before eventually they, or the observers, moved on. Their eye-shine is bright enough for them to be detected even over a distance exceeding 100 m, if vegetation is not too thick. *N. binotata* seems to be confined to forest (including patches), and not to occur in coastal thicket or mixed woodland. However, it will tolerate forest edge cultivation mosaics with fruiting trees.

The Eastern Arc and coastal forests demonstrate interesting patterns of small carnivore diversity. Of the Servaline Genets subspecies *Genetta servalina archeri* was recently described from Unguja Island, Zanzibar (Van Rompaey & Colyn, 1998), and *G. s. lowei* was only recently rediscovered in the Udzungwa Mts. (De Luca & Mpunga, 2002). The Bushy-tailed Mongooses *Bdeogale* spp. Peters, 1850 demonstrate similar diversity. *Bdeogale crassicauda puisa* Peters, 1852 occurs on the Tanzanian mainland in the Eastern Arc, coastal forests and the SW Highlands whereas, *B. c. omnivora* Heller, 1913 is known only from a few specimens from Sokoke forest on the Kenyan coast and possibly occurs in the lowland E. Usambara Mts. (Kingdon, 1997; Kingdon & Howell, 1993). *Bdeogale omnivora tenuis* Thomas & Wroughton, 1908 is the Zanzibar subspecies. Further research especially genetic analysis, on the East African populations of *N. b. arborea* might therefore reveal hitherto unknown levels of taxonomic diversity.

Conservation

The greatest threat for the coastal forests is habitat fragmentation caused by charcoal production, logging and land clearance for agriculture (Burgess & Clarke, 2000; Burgess *et al.* 2003). For example Pugu forest on the edge of Dar es Salaam is now almost completely cleared (Ahrends, 2005). On Unguja Island, Jozani Forest Reserve is now part of a new national park and represents the largest remaining forest patch, but it is still threatened with habitat degradation particularly through charcoal production. The Eastern Arc, Southern highland, and Kilimanjaro forests are all designated as central government catchment forests reserves and as such have greater protection status than the coastal forests. Nonetheless, they are still threatened with ongoing logging and land clearance. As these recent carnivore discoveries show (Van Rompaey & Colyn, 1998; Brink *et al.* 2003; Perkin, 2004) these East African forests are becoming increasingly understood to be important for carnivore diversity at a time when the threats against them are intensifying. Further surveys are required and techniques such as genetic analysis, photo trapping, large cage traps set in trees, and tape recording of vocalizations need to be employed to help reveal cryptic carnivores. In the case of *N. binotata* photo trapping needs to be more arboreal to mirror its habits, otherwise it can easily be missed (Goldman & Winther-Hansen, 2003). Hunting of *N. binotata* is reported in some localities and is thought to be at a low level (*pers. obs.*), but Allen & Loveridge (1927, 1933) mention hunting of this species for food and probably this still occurs today at varying levels. Currently *N. binotata* is considered 'Low Risk/Least Concern' by IUCN (2004) but any future identification of specifically distinct forms would require a re-evaluation of this assessment. In general, however, conservation of forest habitats will ensure conservation of this species in Tanzania and Kenya.

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Small carnivore species photo trapped in the UMNP area:
Bushy-tailed Mongoose Bdeogale crassicauda *(left top), Jackson's Mongoose* Bdeogale jacksoni *(right top), Large-spotted Genet* Genetta maculata *(left bottom) and African Palm Civet* Nandinia binotata *(right bottom).*
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