

SMALL CARNIVORE CONSERVATION

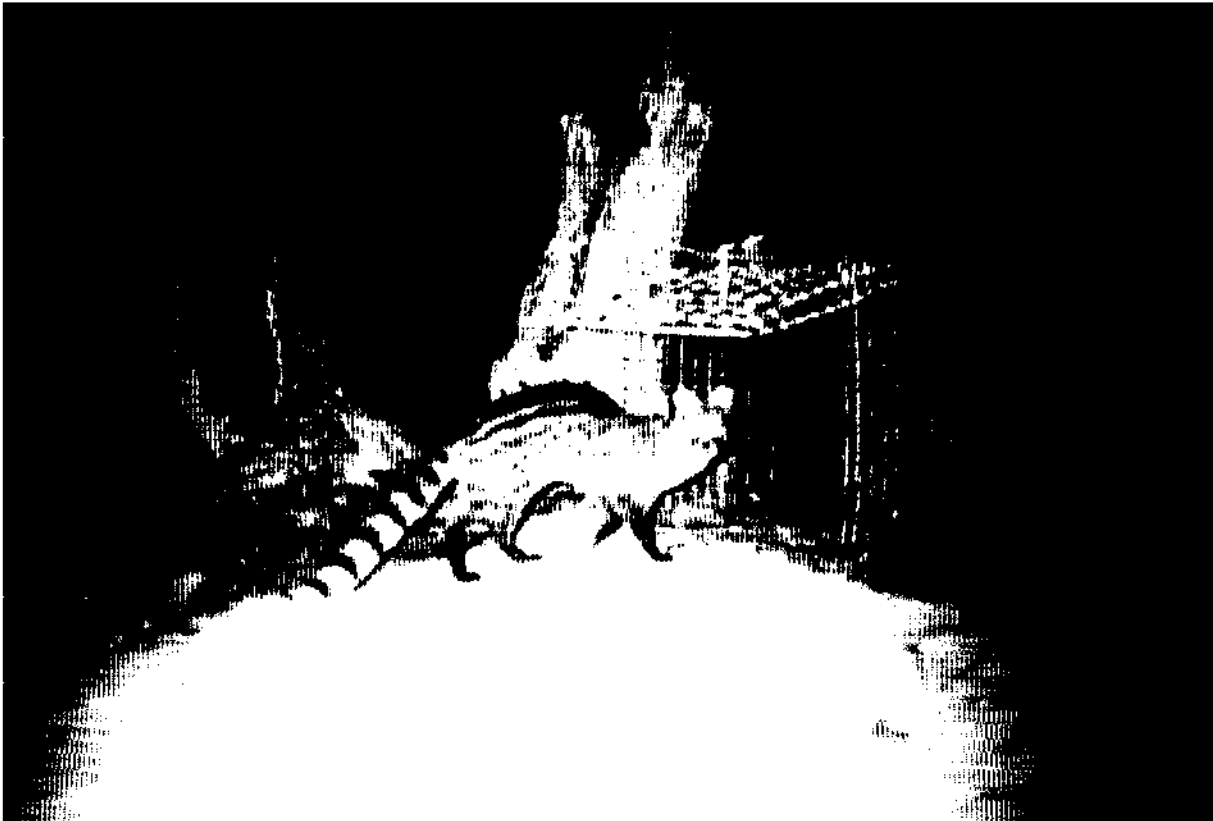
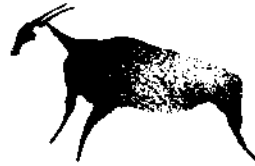


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Small Indian Civet Viverricula indica caught by a camera trap entering a live trap – Photo: Su Su

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The rediscovery of *Mungotictis decemlineata lineata* Pocock, 1915 (Carnivora: Eupleridae) in southwestern Madagascar: Insights into its taxonomic status and distribution

Steven M. GOODMAN¹, Hannah THOMAS² and Darren KIDNEY²

Summary

The endemic genus and species *Mungotictis decemlineata*, occurring only in a limited region of western Madagascar, is poorly known and questions remain about its distribution and patterns of geographic variation. Two subspecies are generally recognized, *M. d. decemlineata*, occurring in the northern range of this species, and *M. d. lineata*, previously only known from the holotype and presumed to occur in the southern limit of the range. A recently collected specimen from a region in which this species had not previously been documented helps to resolve several aspects concerning the validity of *M. d. lineata* and the distribution of this species.

Introduction

One of the more geographically limited species of Malagasy Carnivora is the diurnal or crepuscular Narrow-striped Mongoose, *Mungotictis decemlineata* (A. Grandidier, 1867), known from a limited area in the western lowland portion of the island. The common name "mongoose" is a misnomer, as recent genetic evidence shows that this genus is not associated with the family Herpestidae, but rather it and all other native Malagasy Carnivora form a monophyletic group (Yoder *et al.*, 2003) that are now placed in the endemic family Eupleridae (Wozencraft, in press). Until a few years ago little information was available on *M. decemlineata* (Albignac, 1976), but recent field studies have provided considerable insight into the natural history and distribution of this animal (e.g., Rabeantoandro, 1997; Razafimanantsoa, 2003; Woolaver *et al.* 2004).

The nominate form, *M. d. decemlineata*, is generally cited as occurring in the Menabe region, a lowland area falling between from the Tsiribihina River south to the Mangoky River (Fig. 1), but until recently few details were available about the presence of this animal in the southern portion of this proposed range. A second subspecies, *M. d. lineata* Pocock, 1915 has a complicated taxonomic history that is discussed in detail and resolved by Hawkins *et al.* (2000). This latter form was previously known only from the holotype in The Natural History Museum, London. Several authors have suggested that *M. d. lineata* might occur in the southwestern portion of the island south of Toliara, near Lac Tsimanampetsotsa; closer to the Toliara region, from where the holotype apparently originates; or perhaps further north in the region of the PN de Kirindy Mitea (Nicoll & Langrand, 1989; Schreiber *et al.*, 1989; Hawkins *et al.*, 2000). Further, given that *M. d. lineata* was known from a single specimen and that museum material of *M. d. decemlineata* is extremely limited, it has been previously unclear if the characters used to separate these two subspecies are discrete or fall within the range of a single taxon. Until a recent field inventory of the forested area along the Manombo River, to the north of Toliara, no further information was available about the distribution of *Mungotictis* in southwestern Madagascar. The purposes of this paper are to report on a recently trapped individual

and use the associated specimen to assess patterns of geographical variation and the taxonomic status of members of this genus.

Methods

We consulted specimens of *Mungotictis* housed in several natural history museums. The acronyms of these institutions are: BMNH – The Natural History Museum, London [formerly the British Museum (Natural History)]; FMNH – Field Museum of Natural History, Chicago; and MNHN – Muséum National d'Histoire Naturelle, Paris.

Five external measurements were recorded in millimeters from a few captured individuals. These included: total length (TL), head-body length (HB), tail length (Tail), hind foot length (not including claw) (HF), and ear length (Ear). Further, body mass in grams was measured using a balance. SMG measured seven cranial and five dental characters using digital calipers, accurate to the nearest 0.1 mm. The measurements, their definitions, and acronyms are: greatest skull length (GSKL): from posterior-most part of

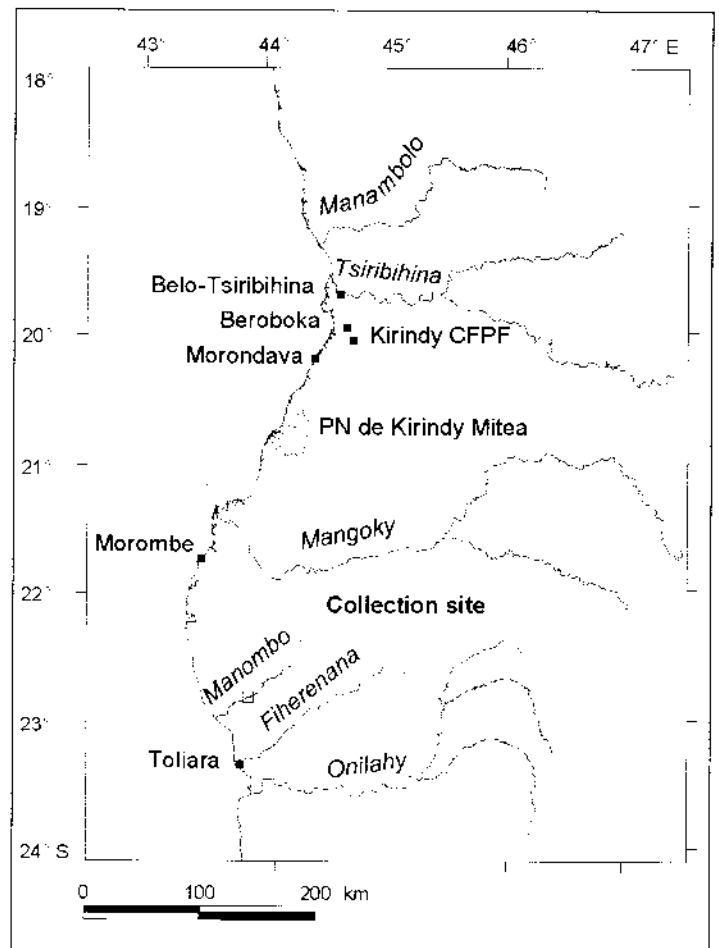


Fig. 1. A map of the western portion of Madagascar and sites mentioned in the text.

occipital bone to anterior-buccal alveolar border of incisors; condylobasal length (CBL): from posterior-most part of occipital condyle to anterior-buccal alveolar border of incisors; zygomatic breadth (ZB): greatest width across zygomatic arches; postorbital width (POW): dorsal width at most constricted part of skull; mastoid breadth (MB): greatest breadth across skull at mastoid processes; palatal length (PL): from distal edge of premaxillae to anterior most edge of palate; post-palatal length (PPL): from occipital condyle to the distal most edge of palate; upper toothrow (UTR): length across the occlusal surface of incisors to distal most edge of the distal molar; molar row length (MRL): length across the occlusal surface of the maxillary molar series; C-M¹: crown length from the anterior-buccal alveolar border of the canine to the posterior buccal margin of the third molar; width M² (WM²): width of upper second molar at across cusp; and width M³ (WM³): width of upper third molar at across cusp.

Results and discussion

Description of the study site and certain aspects of the specimen:

On 9 November 2004, during a biological inventory of the forest along the Manombo River valley, a medium-sized carnivore, referable to *Mungotictis decemlineata* was captured. The trap site was at: Toliara Province, Manombo River valley, near Andoharano, 22°48.352'S, 043°44.912'E, at approximately 400 m above sea level (Fig. 1). The specimen bears the field number Frontier-Madagascar (MGF) 044-084 and has been cataloged in the Field Museum of Natural History (FMNH 184087).

From its source to Andoharano, close to the site the *Mungotictis* specimen was captured, the Manombo River cuts a passage through the limestone rock of the Mikoboka Plateau, creating a steep-sided valley. On both sides of the river, thin alluvial soils support a narrow band of gallery forest (between 25-50 m) immediately adjacent to the flood plain. Beyond this, the gallery forest gives way to dry deciduous forest, with a taller canopy layer. The specimen reported here was found on the southern bank of the Manombo River, in dry deciduous forest on a gentle, north-facing slope. It was captured in a National trap placed on the ground and baited with dried meat. The habitat at the trap site is characterized by having continuous, high canopy cover (roughly between 15-25 m in height), but sparse shrub or ground layer vegetation covering the thin, rocky soil. This habitat also shows various signs of disturbance. Local villagers use the area as the most accessible route along the river and have cleared a path wide enough for the passage of a cattle-cart. There is also considerable evidence of tree cutting and tuber-extraction.

Pelage coloration

A number of pelage characters have been proposed to separate the two forms of *Mungotictis* (Hawkins *et al.*, 2000). The dorsum of *M. d. decemlineata* is a grizzled pale gray with a series of pale brown stripes that commence diffusely in the shoulder region and terminate along the hindquarters. The venter and legs are pale orange-brown. In contrast, the holotype of *M. d. lineata* (BMNH skin 1847.10.19.3 and skull 1848.5.12.2), which is a slightly overstuffed sub-adult with partially unossified cranial sutures and not fully erupted adult dentition, has darker dorsum coloration than specimens of *M. d. decemlineata* in the BMNH. Further, the dorsal stripes are darker and more distinct than in the nominate form and commence as well defined stripes notably higher on the nape and just distal to the ears and terminate at the base of the tail. The venter of the holotype is distinctly darker than in specimens of the nominate form and approaches a russet color.

The six BMNH specimens of *M. d. decemlineata* collected by C. S. Webb in the region of Beroboka include two sub-adults (1948.213 and 1948.210), based on tooth eruption patterns and skull ossification, and provide the means to assess age variation in pelage coloration at a single locality. The other four specimens are adult. All of these six specimens, regardless of their age, are consistent in their dorsal fur coloration, including the diffused dorsal striping. In contrast, their ventral coloration shows considerable variation from a cream-beige to a dark beige-brown. These differences are not related to age as the two sub-adults represent the extremes in coloration. This series is considerably different in coloration and the extent of the dorsal stripes from the holotype of *M. d. lineata*, and by extrapolation these differences cannot simply be attributed to age. Two specimens comprising an adult (FMNH 176128) and a sub-adult (FMNH 176129) from the southern portion of the Menabe region, taken in the Kirindy Mitea Forest, are similar in dorsal pelage coloration to the Beroboka series, while that from the Manombo River closely matches the holotype of *M. d. lineata*. The Manombo specimen has a beige venter with a distinctly dark russet wash, very similar to the *M. d. lineata* holotype, and notably darker than individuals from the Menabe region.

Table 1. External measurements of *Mungotictis decemlineata*. External measurements of the holotype of *M. d. lineata* are not available. Measurements proceeded by asterisks where made from liquid preserved specimens, otherwise data taken from original specimen labels. Data presented as mean \pm standard deviation (minimum-maximum, n=sample size) for three or more specimens.

	TL	HB	Tail	HF	Ear	Weight
Beroboka						
Adults	—	276 \pm 15.9 (264-294, n=3)	202 \pm 10.1 (191-209, n=3)	61 \pm 1.0 (60-62, n=3)	24.3 \pm 0.6 (24-25, n=3)	—
Subadults	—	217-218, n=2	173-186, n=2	55-56, n=2	23-24, n=2	—
Kirindy Mikea						
Adult male	525	295	229	66	25	605
Subadult male	565	315	202	65	27	507
Manombo River						
Adult female	*550	335	*215	65	25	—

Table 2. Cranial measurements of *Mungotictis decemlineata*. Data presented as mean \pm standard deviation (minimum-maximum, n=sample size) for three or more specimens.

	GSKL	CBL	ZB	POW	MB	PL	PPL
<i>M. d. decemlineata</i>							
Beroboka							
Adults	58.4-59.5, n=2	56.2-57.1, n=2	34.4 \pm 1.3, 32.9-35.3, n=3	12.4 \pm 0.6 11.7-12.9, n=3	25.4-25.5, n=2	26.3-29.9 28.1 \pm 1.8	24.7-25.3, n=2 n=3
Sub-adults	55.8, n=1	53.3, n=1	26.2-29.2, n=2	12.2-13.5, n=2	23.6, n=1	22.6-25.2, n=2	23.5, n=1
Kirindy Mikea							
Adult male	64.5	62.5	34.1	12.5	25.8	27.3	28.5
Sub-adult male	63.6	60.9	33.2	15.0	26.1	29.5	26.7
<i>M. d. lineata</i>							
Holotype <i>M. d. lineata</i>							
Sub-adult	—	54.4	—	13.8	23.4	29.5	26.7
Manombo River							
Adult female	59.2	57.6	34.0	12.0	24.5	25.3	27.6

Measurements

Given that different collectors made the external measurements, presumably not with exactly the same technique, it is inappropriate to highlight relatively subtle differences between the specimens (Table 1). Having said that, the specimens from Kirindy Mikea measured by SMG tend to be larger than those collected by Webb at Beroboka. Further, this trend continues with the Manombo River specimen, which is larger for certain measurements than individuals taken further north in the Menabe region. However, sample sizes are insufficient to draw any definitive conclusions about patterns of latitudinal size variation.

In certain cranial characters (e.g., GSKL, CBL, ZB, and PPL) the individuals from Kirindy Mikea tend to be larger than the Beroboka series, while in the balance of cranial and dental measurements there is considerable overlap in specimens from these two localities (Tables 2 & 3). Thus, the possible trend of increasing body size with increasing latitude is not as apparent within these variables as with the external measurements. Further, the cranial measurements of the Manombo River specimen largely fall within the range of variation of animals from the Menabe region.

Conclusions

On the basis of dorsal pelage coloration and striping there are two distinct patterns found in *Mungotictis* populations in lowland western and southwestern Madagascar. Specimens collected in the region of the central Menabe, from the Beroboka area south to Kirindy Mikea, have more lightly colored gray backs and diffused dorsal striping that commences

at the nape and extends to the hindquarters. These animals are referable to *M. d. decemlineata*. In contrast, the individual obtained along the Manombo River and the holotype of *M. d. lineata* are notably darker in coloration and with more precisely defined dorsal stripes that originate on the nape and extend to the base of the tail.

Using these comparisons there are consistent and discrete patterns in pelage coloration between specimens attributed to *M. d. decemlineata* and *M. d. lineata*. External, cranial, and dental measurements show considerable variation across their geographic range of this species and these do not clearly distinguish between the northern and southern populations. It is important to reiterate that sample sizes are small. The Mangoky River has its origins deep in the interior of the island and in lowland western Madagascar forms a wide river that might pose a dispersal barrier for this carnivoran. Given that *M. d. decemlineata* occurs to the north of this river and *M. d. lineata* to the south, these two forms are presumably genetically separate. Ongoing molecular studies being

Table 3. Dental measurements of *Mungotictis decemlineata*. Data presented as mean \pm standard deviation (minimum-maximum, n=sample size) for three or more specimens.

	UTR	MRL	C-M3	WM2	WM3
<i>M. d. decemlineata</i>					
Beroboka					
Adults	25.0 \pm 0.86 24.1-25.8 n=3	18.0 \pm 0.90 17.1-18.9 n=3	21.5 \pm 1.20 20.3-22.7 n=3	5.7 \pm 0.27 5.5-6.0 n=3	3.8 \pm 0.0 3.8-3.8 n=3
Sub-adult	—	—	—	5.5, n=1	—
Kirindy Mikea					
Adult male	26.1	18.0	21.6	5.9	3.0
Sub-adult male	26.9	18.6	23.1	5.9	3.8
<i>M. d. lineata</i>					
Holotype <i>M. d. lineata</i>					
Sub-adult	24.4	18.0	20.9	6.0	4.0
Manombo River					
Adult female	25.0	17.2	20.8	6.2	3.0

conducted in the laboratory of Dr. Anne Yoder should help to measure levels of differentiation between these two taxa.

On the basis of current information the southern limit of *M. decemlineata* is the region to the south of the Manombo River. This river is very close to the southern limit of dry deciduous forest in southern Madagascar, and the more austral forest formation is spiny bush dominated by the family Didieraceae. In fact, in the lowlands south of the Mangoky River, dry deciduous forest is largely confined to river valleys such as the Manombo and is effectively isolated by the surrounding xerophytic vegetation. The next major east-west draining river system to the south is the Onilahy River, which, like the Mangoky, commences notably to the interior. Recent inventories undertaken along the Fiherenana and Onilahy Rivers failed to record this animal (Frontier Madagascar, 2002, in press). Further, several areas to the south of the Onilahy River have been inventoried over the past few years, including the Tsimanampetsotsa region in the heart of the spiny bush, and no evidence of this carnivore has been found (Goodman *et al.*, 2002; cf. Schreiber *et al.*, 1989). In the region south of the Onilahy River another unknown endemic carnivore, *Galidictis grandidieri*, is broadly distributed (Mahazotahy *et al.*, submitted).

Conservation implications

It is widely known that the island of Madagascar holds a very unique biota, with levels of endemism unparalleled by any other region on Earth. To a large extent, the humid forests of the eastern portion of the island have received the majority of attention from the international conservation community. However, it is the dry forests of the west that show higher levels of faunal heterogeneity and with more notable levels of micro-endemism. Further, the dry deciduous forests of western Madagascar are under the most severe human pressures of any natural forest formation on the island (Smith, 1997; Tidd *et al.*, 2001). These threats to the native forest and the biota they hold include conversion of forest to agricultural areas, charcoal production to supply fuel for regional population centers, cattle pasture, considerable hunting pressure, and locally large-scale wood extraction and mining.

The Manombo specimen of *Mungotictis* was obtained in a region known as the Mikea Forest, spanning the zone from the Fiherenana River north to the Mangoky River, bordered to the west by the coastal area and to the east by a limestone plateau. In this region there are several species of locally restricted endemic animals, such as the Long-tailed Ground-Roller *Uratelornis chimaera* and the Subdesert Mesite *Monias benschi*, as well as other unique faunal elements (Seddon *et al.*, 2000). Recent biological inventories of this region have revealed that it has considerable floristic and faunistic heterogeneity (Raselimanana & Goodman, 2004) and a number of animals appear to be unique to this region. These include, for example, two species of small mammals recently named new to science, a rodent *Macrotarsomys petteri* Goodman & Soarimalala, 2005 and a shrew tenrec *Microgale jenkinsae* Goodman & Soarimalala, 2004. The discovery of a local population of *Mungotictis decemlineata lineata* in the Mikea Forest magnifies and underscores the need to protect it. Initial steps have been taken to place a portion of the southern Mikea Forest, the zone between the Manombo and Fiherenana Rivers, into a conservation area, including the site where the *Mungotictis* specimen was found (see http://www.panda.org/about_wwf/what_we_do/projects/project_details.cfm?sPrjId=MG0887).

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Small carnivores and their threats in Hlawga Wildlife Park, Myanmar

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Abstract

The dynamics of a small carnivore community and threats to it were investigated between June 2000 and May 2003 in Hlawga Wildlife Park, Myanmar. Methods included observation of individuals and signs (tracks, scats) and camera trapping. Seven species of small carnivore were confirmed in Hlawga: Common Palm Civet *Paradoxurus hermaphroditus*; Small Indian Civet *Viverricula indica*; Small-toothed Palm Civet *Arctogalidia trivirgata* (probably a released animal); Crab-eating Mongoose *Herpestes urva*; Small Asian Mongoose *Herpestes javanicus*; Jungle Cat *Felis chaus* and Leopard Cat *Prionailurus bengalensis*. The Common Palm Civet and the Small Indian Civet were the predominant species. Crab-eating Mongoose, Jungle Cat and Leopard Cat were sighted once by spotlighting. Common Palm Civet and Small Indian Civet occasionally attack domestic poultry. A lot of hunting, snaring, and other persecution of small carnivores was done by the people residing near the reserve. Habitat loss by removal of larger trees has continued in the buffer zone and trees are even cut in the core area. Burning is also destroying the habitats, started by people in buffer zone in dry season. Greater protection is essential for small carnivores in a small reserve near to the capital city.

Introduction

Myanmar comprises an area of 676,577 km² ranging from 09° 58' to 28° 29' N and has a great diversity of ecological systems, fauna and flora. Biodiversity conservation is a part of present government policy, as shown by Myanmar's early signature of the 1992 Convention on Biological Diversity and its accession to CITES in 1997. In 1994, new legislation significantly widened the scope of animals accorded protection. The new act recognises three protection categories, totally protected, protected (can be taken with permission) and seasonally protected. Under the main wildlife act of 1994, which defines 45 mammal species as endangered, 39 species are accorded "total protection", 12 species are "protected" and two "seasonally protected". Among the small carnivores, the Viverridae and Herpestidae (and the Felidae) are accorded "protected" status and the Small Indian Civet *Viverricula indica* and Yellow throated Marten *Martes flavigula* are listed as "totally protected". These legal listings reflect the fact that many small carnivore species in Myanmar are considered to be endangered or that their populations are perceived to be subject to threats such as habitat loss or extermination as pests. If this important group of mammals is to be accorded appropriate protection in Myanmar it is imperative that methods of assessing their status in various habitat types and examining threats to their survival are rapidly developed. Some information on their ecology is available from neighbouring Thailand and Laos (Rabinowitz, 1990, 1991; Rabinowitz & Walker, 1991, Duckworth, 1997; Grassman, 1998; Grassman *et al.* 2005) but in Myanmar there is a total lack of this kind of information on small carnivores and of the role they play in the country's overall forest ecology. Therefore, this study was designed to assess the status of small carnivores in Hlawga Wildlife Park and the threats to their population.

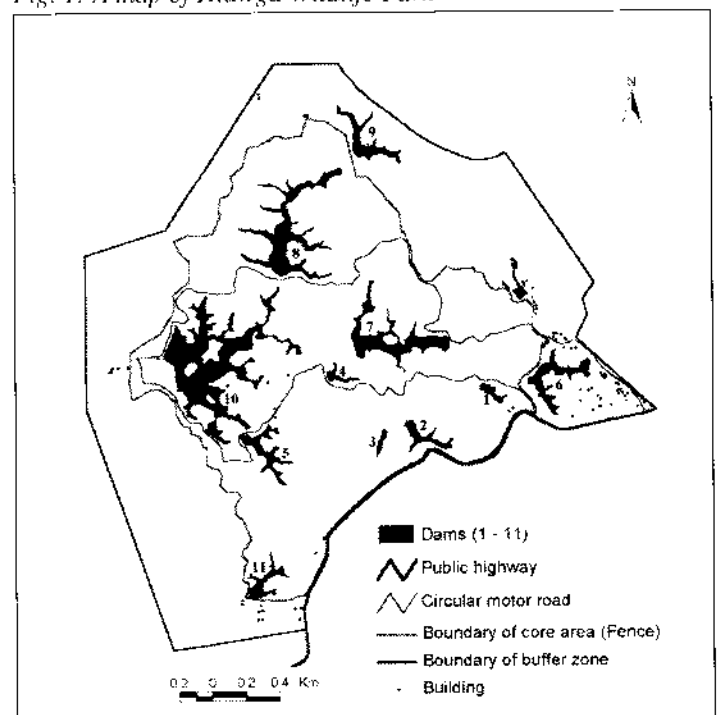
Study area

Established in 1982, Hlawga Wildlife Park is one of the Myanmar's smallest protected areas (Fig. 1) and is located approximately 35 km north of Yangon (17°02'35"N, 96°06'49"E). It comprises 624 ha of undulating terrain at 12-60 m, including a core area of 327 ha in the centre of the park. The core area is enclosed by a 297 ha buffer zone except the southern part of the core area which has a public highway and no protected buffer. The core area is enclosed by a 2-metre-high chain-link fence, restricting the movement of the larger mammals but allowing smaller and arboreal species, including the small carnivores under study, to move in and out.

Selective logging and exploitation for timber and fuel has left much of the park and particularly the buffer zone heavily degraded. The majority of park is covered by a secondary growth of mixed deciduous forest vegetation. In the north-eastern third of the park are isolated patches of rattan and related cane species. In the centre and eastern portion, a number of flat valley bottoms have mainly a shrub covering with few large trees. Additionally, there are a few patches of grassland on the edge of several of the lakes and some flooded areas in the rainy season. There are eleven water bodies of various sizes in the park, resulting from the damming of streams.

Seventeen villages are located in close proximity to the eastern, northern and western boundaries of the wildlife park. In addition, there are several large military camps near the park and a village housing park staff is situated in the eastern part of the buffer zone.

Fig. 1: A map of Hlawga Wildlife Park



The park is open to the public on a fee-paying basis and has over 100,000 visitors annually, who are confined to vehicles using a 8 km circular road except where they are permitted to walk around at designated picnic spots. A number of refreshment and other facilities catering for visitors are clustered in the western part of the park.

The climate of the park is split into three well-defined seasons, namely the rainy season from mid-May to October, the cold season from November to February and the hot season from March to mid-May.

The core area contains a number of large mammals, including Sambar *Cervus unicolor*, Eld's Deer *C. eldii*, Hog Deer *Axis porcinus*, Red Muntjac *Muntiacus muntjak* and Eurasian Wild Pig *Sus scrofa*. Many of these were translocated into the park, some from the inundation area of a nearby reservoir. A single Mythun *Bos frontalis* has been brought to the park. There is a large population of Rhesus Macaques *Macaca mulatta*, especially in the core area. Hlawga has a diverse avifauna, comprising some 34 species of waterfowl, including some migrants, and 147 species constituting the bird community of the forest (Khin Swe Win, 2003). Reptiles are represented by the monitor lizard *Varanus* sp(p), a number of other lizards and various snake species which are frequently seen. A variety of anuran amphibians are also present in large numbers, especially around water bodies. The streams and lakes contain many fresh-water fish which attract piscivorous birds and some (illegal) fishermen. Arthropods abound, including termites, ants, Orthoptera, Coleoptera, millipedes and scorpions.

Methods

In order to become familiar with the appearance and the signs (footprints and scats) of small carnivores in the field, initial studies were carried out in Yangon Zoological Garden and Tharkay-ta Crocodile Farm over a few days (June 2000, November 2000, January 2001). Plaster-of-Paris positive casts of available civet, cat and mongoose species were made from natural initial negative ones. Some clear prints were obtained by holding and pushing the animals' feet into tray of damp mud. These were kept for reference in the field. Scats of each species were available in the zoo (although these were based on a zoo diet and may not have shown fully natural characters), and a few were collected from nature. Identifying features (size, shape, type of ending) were noted and recorded.

Data on the presence and relative abundance of small carnivores in Hlawga were obtained from several sources, including signs (footprints and scats), direct observation, camera-trapping, live-trapping and hunter interviews and trapped specimens between September 2000 and May 2003. The main circular road of the park and the branch roads were used as survey lines in addition to twice-weekly surveys into each sub-area following wildlife trails of the park on a rotational basis.

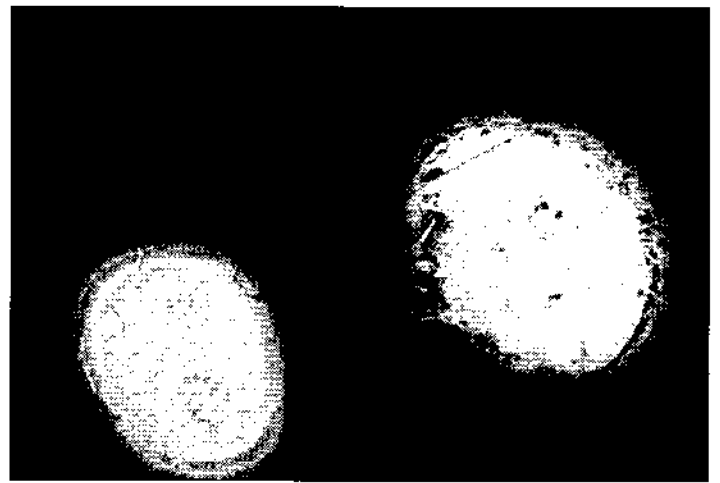
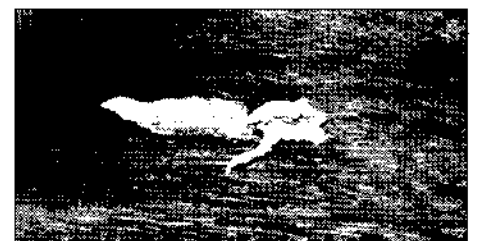


Fig 2: Photographs of *P. hermaphroditus* and *V. indica* foot prints

For the correct identification of a species, characteristics of tracks must be noted very carefully. Most tracks found in the wild show incomplete details. Footprints showed up particularly well on a sandy or muddy substrate. Fresh footprints could be more readily detected after clean sweeping with a broom to provide an "impression pad" on some sandy patches. Whenever possible, footprints were measured (width and length) with measuring tape. In order to do a drawing, a clear transparent plastic sheet was put over a 23 x 15.5 cm glass plate, with 2 cm high "feet", which was placed over the footprint without contacting it. The outlines of the footprint were sketched out onto the plastic sheet with a permanent marking pen. The footprints were also photographed and colour prints prepared. The footprints of Common Palm Civet and Small Indian Civet were distinctly different according to the preliminary studies. There are five rounded toes around the palm pad in Common Palm Civet. Small Indian Civet has four toes, slightly more slender, and a more slender palm pad (Fig. 2). However, the footprints of cat species (Jungle Cat and Leopard Cat) were similar to that of Small Indian Civet with claws, and hence were difficult to identify definitely. Footprints were counted by summing all complete footprints which could certainly be identified to species and hence, as these are not statistically independent datapoints, no statistical tests have been applied in analysis.

Scats were collected with a note of date, location and suspected species (where the form of the scat was distinctive). Some were photographed and each sample was superficially identified with reference to include fragments. Moist scats were preserved in formalin: acetic acid: ethyl alcohol (ratio of 2:1:1) solution and dried out for future lab analysis. Common Palm Civet scats mostly contained indigestible seeds or plants remains and were very obvious. Sometimes they included animal remains. Sometimes scats were very long and were coated with plant mucus. Common Palm Civets often defecated close to path trails or on roads. Small Indian Civet scats had a few, or no, remains of plants and were brownish in colour. Their size varied with that of the animal

Fig. 3: Photographs of scat samples, left-right: *V. indica*, *P. hermaphroditus*, *Felidae* sp.



remains they contained. The castings were long, sometimes sausage-shaped, smelt musty when fresh and had either rounded ends or tapering ends like cat scats. These were also often deposited close to path trails and on roads. Cats scats were similar to those of Small Indian Civet scats but were smaller, contained no plants remains, had more digested contents than Small Indian Civet, had harder and more twisted, tapering ends, smelt musty when fresh, and in colour some were whitish (Fig. 3). The mongoose scats were small, black and pointed with digested contents.

Direct observation of individuals was made at night with the aid of a powerful halogen spotlight operated from a vehicle driven slowly along the main circular road, and sometimes in the southern public highway. These spotlighting sessions, of up to 1.5 hours in duration, were made around three times a month from September 2000 to May 2003.

Three types of live-trap were used. One with a live bait compartment (size: 88 x 33 x 41.5 cm); another without such a compartment (size: 62.5 x 19.5 x 19.5 cm), both wire mesh traps; and a wooden type trap without a compartment. All were made locally. A variety of baits, live and dead, were tested including live chicken, beef, fish and bananas. From September 2000 to August 2001, traps were pre-baited, testing a variety of types of bait. In order to allow the target species to become familiar with the traps, live traps were placed along paths where small carnivores were known to travel with the door tied open to allow free entry and exit of animals were sampled in all sectors of the core area. Further pre-baiting was carried out during October 2001 to January 2002; and during June 2002. During the pre-baiting periods, bananas proved to be the preferred bait. The identity of animals visiting the traps was established from footprints left near the trap entrance and in some cases from camera traps set up in the vicinity of the pre-baited traps.

Camera-trapping in this study was carried out from September 2000 to October 2002 using a small number (2-4) of camera traps (CamTrakker, CamTrak South Inc. Georgia, USA) deployed over three-weekly periods in the core area. Camera traps were set up mostly at the junction of paths or trails where small carnivores were known to travel. The mechanism was set to record the passage of animals between dusk and dawn (there were too many people about to make day-time photography practicable), with time and date imprinted on the film. During the pre-baiting period of live-trapping, each camera-trap was placed facing a pre-baited live trap, in order to record which species were being attracted to the baits.

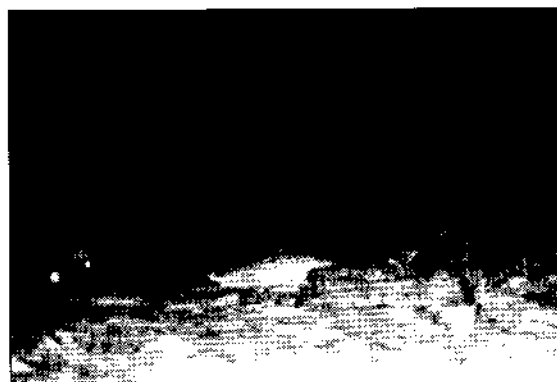


Fig. 4: Common Palm Civets captured by a photo trap.

In addition to these methodologies, certain useful information was obtained from verbal reports, made by reliable persons, including staff of the Forest Department working in the park, on the sighting, capture and killing of the target species in the Hlawga area.

Results

Seven species of small carnivore were confirmed to occur in Hlawga Wildlife Park in this survey (Table 1): Common Palm Civet *Paradoxurus hermaphroditus*; Small Indian Civet *Viverricula indica*; Small-toothed Palm Civet *Arctogalidia trivirgata* (as a probably released animal); Crab-eating Mongoose *Herpestes urva*; Small Asian Mongoose *Herpestes javanicus*; Jungle Cat *Felis chaus* and Leopard Cat *Prionailurus bengalensis*.

Paradoxurus hermaphroditus footprints were more numerous in the hot season but neither footprints of *V. indica* nor scats of *P. hermaphroditus* or *V. indica* showed any suggestive differences with season.

Common Palm Civet *Paradoxurus hermaphroditus*

The Common Palm Civet was by far the most abundantly recorded small carnivore species (Fig. 4) in Hlawga Wildlife Park, with a total of over 5,389 footprints and 2,519 scats being attributed to this species during the 32 months of observation. Additionally, the species was recorded in 160 camera-trap photos from the 783 trap nights and directly observed 128 times spotlighting. It was recorded in mixed deciduous forest from 32 m to 62 m, the altitude range over which camera-traps were set.

Table 1: Evidence of small carnivores, September 2000 to May 2003

Evidence	<i>P. hermaphroditus</i>	<i>V. indica</i>	<i>A. trivirgata</i>	<i>H. javanicus</i>	<i>H. urva</i>	<i>F. chaus</i>	<i>P. bengalensis</i>	Total
Footprints (observed all sectors of park)	2499	146	0	14		0		2659
Footprints (around live traps)	2711	19	0	0		0		2730
Scats	2373	124	0	17		5		2519
Resting sites *	289	69	1	0		0		359
Camera-trapping	160	29	0	0		0		189
Spotlighting	128	16	0		1	1	1	147
Accidental capture	0	0	1	6		0		7

* Most of these have been located by radio-tracking as part of another study

Small Indian Civet *Viverricula indica*

The Small Indian Civet was the next most recorded small carnivore (see cover) in Hlawga Wildlife Park. However, data for this species need to be interpreted against the fact that interviews suggest it spends much more time in the buffer zone of the park yet the majority of surveys were focused in the core area, so *V. indica* may be under-represented. A total of 146 footprints and 124 scats were determined to be from *V. indica* in addition to 29 camera-trap photos

recorded around the park. Only 16 individuals of Small Indian Civet were found by spotlighting. *V. indica* was recorded over 44-59 m asl in both mixed deciduous forest and bamboo forest.

Other small carnivores

Evidence for the remaining five small carnivore species was sparse and suggests a lower order of abundance compared with *P. hermaphroditus* and *V. indica*. The complete absence of any

Table 2: Camera-trapping data (September 2000 to October 2002)

County Source	Altitude (m)	GPS co-ordinates		Habitat type	Total camera trap nights	Total n° photos	Total n° civet photos	
		Latitude	Longitude				<i>P. hermaphroditus</i>	<i>V. indica</i>
1	49	17°02.576'	96°06.624'	MD	21	22	2	0
2	43	17° 02.727'	96° 06.795'	MD	28	34	0	0
3	45	17° 02.737'	96° 06.438'	MD / cane	28	28	20	0
4	34	17° 02.759'	96° 06.233'	MD	21	32	0	0
5	46	17° 02.579'	96° 06.137'	MD / shrub	28	52	3	0
6	38	17° 02.668'	96° 06.055'	MD	7	6	0	0
7	38	17° 02.545'	96° 05.996'	MD	21	14	1	0
8	37	17° 02.546'	96° 05.622'	MD	28	18	1	0
9	40	17° 02.453'	96° 05.321'	MD	21	15	1	0
10	44	17° 02.317'	96° 05.953'	MD	21	53	1	0
11	38	17° 02.435'	96° 05.811'	MD	21	15	0	0
12	32	17° 02.449'	96° 05.845'	MD	28	14	0	0
13	36	17° 02.522'	96° 05.751'	MD	7	0	0	0
14	41	17° 02.612'	96° 05.692'	MD	7	0	0	0
15	44	17° 03.009'	96° 05.704'	MD	7	2	1	0
16	47	17° 03.129'	96° 05.851'	MD	28	28	3	16
17	47	17° 02.997'	96° 05.909'	MD	28	32	29	1
18	44	17° 02.864'	96° 06.168'	MD	21	53	19	1
19	52	17° 03.038'	96° 06.213'	MD / cane	28	15	5	2
20	55	17° 03.167'	96° 06.181'	MD / cane	28	26	4	0
21	51	17° 03.177'	96° 06.070'	MD / cane	28	21	1	0
22	50	17° 03.205'	96° 06.049'	MD / cane	28	12	0	0
23	51	17° 03.277'	96° 06.112'	MD / cane	28	11	0	0
24	60	17° 03.149'	96° 06.383'	MD	7	6	0	0
25	59	17° 03.148'	96° 06.382'	MD	7	6	0	0
26	59	17° 03.202'	96° 06.352'	MD	28	15	1	3
27	56	17° 03.276'	96° 06.252'	MD / cane	28	27	14	1
28	57	17° 03.031'	96° 06.373'	MD / cane	28	9	1	0
29	54	17° 02.963'	96° 06.376'	MD / cane	28	14	1	3
30	55	17° 02.938'	96° 06.451'	MD	28	12	4	1
31	55	17° 02.851'	96° 06.493'	MD	28	41	30	0
32	61	17° 02.922'	96° 06.642'	MD	28	34	0	0
33	57	17° 02.833'	96° 06.595'	MD	7	7	1	1
34	62	17° 02.857'	96° 06.712'	MD / shrub	28	35	16	0
35	61	17° 02.797'	96° 06.708'	MD / cane	27	5	1	0
TOTAL					783	764	160	29

MD = Mixed Deciduous



Fig. 5. Accidentally captured Small-toothed Palm Civet

camera-trap records, during 783 trap nights, for any of these five species provides the strongest indication of their very low densities, at least in the core area where all camera-trapping was carried out.

The presence of *Arctogalidia trivirgata*, previously unrecorded in Hlawga Wildlife Park, is based on an accidental capture of a single individual (Fig. 5) discovered living under the roof of a staff house in the buffer zone, near the eastern boundary of the core area. This is a highly unusual way to find this species, and my field assistant, who previously hunted in the park, told me that he had never seen this species before. Moreover, as unwanted captive animals of various species are released from time to time in Hlawga, this seems to be likely origin of this individual. Small numbers of footprints (14) and scats (17) of mongooses (species not determined) were obtained; one Crab-eating Mongoose was seen while spotlighting and a total of six Small Asian Mongooses were captured in traps set for pests by park staff (who view mongooses as pests) in both core area and buffer. Five cat scats were found but were not distinguishable between *Felis chaus*, *Prionailurus bengalensis* and domestic cats. There was a single spotlighting observation of each wild species, but park staff reported that they had previously been more common.

Relative abundance

The ratio of the frequency of occurrence of the two most common species, *P. hermaphroditus* and *V. indica*, indicated from the four most reliable sources in Table 2. Figures for footprints and scats are much higher than those for camera-trap shots or spotlighting observations but all are measures of abundance; none can be related to the number of individual animals present. Camera-trapping and spotlighting have a fairly equal chance of "observing" the presence of either species during their nocturnal activity period, although the semi-arboreality of Common Palm Civet may reduce camera-trap detections by a small amount. The mean ratio of $12.4 \pm 6.6 : 1$ probably gives a fair indication of the order of magnitude of the relative abundance of these two most numerous species in Hlawga overall, because although camera-trapping was

Table 2. Ratios of Common Palm Civet to Small Indian Civet frequencies indicated by data from various sources

Record type	PC	:SIC
Footprints (observation all sectors of park)	17.1	: 1
Scats	19.1	: 1
Camera-trapping	5.5	: 1
Spotlighting	8.0	: 1
MEAN	12.4	: 1
95% confidence interval	± 6.6	

only undertaken in the core area, the other three methods also covered the buffer zone.

Threats to small carnivores

A disturbing variety of threats to the survival of small carnivores in the Hlawga area were observed during this study.

The absence of Common Palm Civet and Small Indian Civet from the southern block of the core area (both camera-trapping and live-trapping were carried out in this area) may reflect the intense human pressure in this part of the park. Even timber removal from the core area was recorded on one occasion by a camera trap (Fig. 6) and it is well known to be a major cause of habitat degradation in both the core area and buffer zone of Hlawga. Almost all larger trees have disappeared from the buffer zone.

Despite the small size and protected status of Hlawga Wildlife Park the small carnivore community is still threatened by habitat destruction. Accidental forest fires, started by local people in the buffer zone in dry season, destroy forest and also result in the death of small carnivores and their vertebrate and invertebrate prey. The buffer zone is frequently burned in the hot season and this happened on four separate occasions in 2003. About one third of the buffer zone was burned in total and after one fire, one of the radio-collared Common Palm Civets was found to have disappeared. While no estimate of the numbers of the various species destroyed in this way is available, burnt corpses of small mammals, including a Common Palm Civet (Fig. 7) and birds have been found in severely burned areas.

Reports from reliable sources and local communities indicate that all small carnivore species are subject to persecution in the general area of Hlawga Wildlife Park. All seven species are stated to occasionally attack domestic poultry. In the case of Common Palm Civet, such attacks are relatively rare (Bartels, 1964 discredits its possibility altogether) and may occur, if at all, only at times when other food sources, such as fruits, are less plentiful. But Small Indian Civet attack domestic poultry more often than Common Palm Civet and forestry staff living in the staff quarters killed one of the radio-collared Small Indian Civets in May 2003. In the case of Crab-eating Mongoose, Small Asian Mongoose and Jungle Cat, however, attacks on poultry are quite frequently reported and result in a concerted effort by the villagers concerned to trap and kill the animals in retaliation, sometimes without bothering to accurately identify the real culprit.

Snaring and trapping is widespread in the core area of the park and particularly in the buffer zone. Sometimes some snares for small carnivores were found near the staff quarters and near the forest security guard's place in the buffer zone. During the dry season when the vegetation has become sparse, villagers who live around the park set many snares in and near the buffer zone. Common Palm Civets and Small Indian Civets that move around a lot the buffer zone are sometimes captured by these snares. One radio-collared Small Indian Civet female and one Common Palm Civet male were lost during the tracking period and were suspected to have been captured by snares (and their transmitters destroyed). The remains of a collared Common Palm Civet were found in the core area in May 2002 (the transmitter was still working) with a snare attached to one leg. While this small snare may have been set to catch ground birds, such snares are clearly a danger to many small vertebrates. I also learned from informants that villagers who frequently come into the buffer zone to cut wood capture animals as well.



Fig 6. Camera trap photo of timber poacher in action

Together with other wildlife species, all small carnivores are eaten as meat by local people living in the buffer zone of the park as well as being sold for cash income whenever there is an opportunity to do so. One hunter claimed to have caught approximately 60 *P. hermaphroditus* in an area adjacent to the southern boundary of the park and sold them for human consumption or traditional medicine in villages bordering the park.

In addition to this list of anthropogenic threats to small carnivore survival, some evidence of natural causes of their mortality was gathered. For example, Common Palm Civet remains (hair) were sometimes found in the scats of Small Indian Civet. While these cases could result from Small Indian Civets scavenging on the dead remains of a Common Palm Civet, there is little evidence of such habits in this species which is, however, known to be an aggressive predator. It seems possible that such predation by Small Indian Civet occasionally extends to the Common Palm Civet which is an abundant small carnivore in Hlawga. Similarly, it could be possible that the small cats also prey on Common Palm Civets, although no specific evidence for this was found during this study.

The corpse of collared Common Palm Civet n° 2 was located, by its transmitter, in circumstances suggesting it may have been killed by another male Common Palm Civet (n° 4) occupying an adjacent home range. The latter had been located very near to n° 2 (in its home range) a few nights prior to its death and took over part of the dead male's former range shortly thereafter. The remains of another radio-collared animal (n° 3) were located on 8 June 2002, via its transmitter, in the faeces of a wild pig. However, it cannot be assumed that the Common Palm Civet was attacked by the pig while still alive (although this is a possibility): it may have died of other causes before the pig consumed it.

Discussion and conclusions

Small carnivores are mostly difficult to observe due to their secretive behaviour. Useful descriptive accounts on distribution and status of various small carnivores were recorded by observing tracks and signs. Camera-traps are particularly suitable for detecting cryptic, rare and/or nocturnal species and detailed information on their presence and relative abundance was obtained with them, some together with pre-baiting. Spotlighting by night is also suitable for observing nocturnal species. Human activities conflict with small carnivores and an understanding of these is needed to safeguard the future stability of the small carnivore community.

Discounting the single Small-toothed Palm Civet as a probable release, Hlawga has two viverrids, two herpestids and two felids. The small size of Hlawga (6.24 km²) demonstrates that diversity and extent of habitat are both important to maintaining

a fuller small carnivore community. The Royal Chitwan National Park in Nepal, which is 932 km² in area, is home to 22-24 carnivore species, ranging in size from the Small Indian Mongoose *Herpestes auro-puntatus* (0.6 kg) to the Tiger *Panthera tigris* (170 kg), and includes five viverrids and herpestids (Joshi *et al.* 1995). The much larger Huai Kha Khaeng Wildlife Sanctuary in Thailand (2,575 km²) has 21 carnivores, including four species of small to medium-sized felids and six civet and mongoose species (Rabinowitz, 1990, 1991). At four large sites in Laos, of 1,140-3,445 km² in size, five viverrids and one herpestid were found in Nakai Nam Theun National Protected Area (NPA); six viverrids and one herpestid on the Nakai Plateau; five viverrids and one herpestid in Phou Xang He NPA; five viverrids and one herpestid in Xe Pian NPA, Laos (Duckworth, 1997; Austin, 1999; Khounboline, 2005).

Meaningful estimates of densities of small carnivores, most of which are solitary and nocturnal, are very difficult to obtain and are noticeably absent from most publications on these species. The presence of a species in a particular area is often based on very limited chance sightings, such as Rabinowitz's (1990) single observations of Jungle Cat and Asian Golden Cat *Catopuma temminckii* in Huai Kha Khaeng Wildlife Sanctuary. Both factors applied in the present study, but from a variety of evidence it was possible to show clearly that Common Palm Civet is abundant and widely distributed in Hlawga and that Small Indian Civet, with perhaps a twelfth of the numbers of Common Palm Civet, is the second most abundant small carnivore. Similarly, Kumar *et al.* (2002) found that in an area of India where Common Palm Civet and Small Indian Civet are sympatric, numbers seen per km were Common Palm Civet 67 and Small Indian Civet 10, a ratio of 6.7:1. Firm evidence for the presence of Small-toothed Palm Civet and Small Asian Mongoose was provided by their accidental capture (the latter on several occasions, the former probably as a released captive), while the previously recorded presence of Crab-eating Mongoose and the two cats (Jungle Cat and Leopard Cat) was confirmed by single sightings and a few scats and footprints, that could not be attributed to a particular species. The absence of any camera-trap records of either of the cats is perhaps due to a shyness of strange objects in their environment and also, in this case, to the fact that they may do most of their hunting in the thick ground cover of the buffer zone, rather than the more open forest floor of the core area where all camera-trapping was carried out. The possibility that numbers of the more aggressive species, such as Small Indian Civet and the two mongooses, are limited by their persecution as raiders of domestic poultry has to be taken account of in assessing overall relative abundance of Hlawga's small carnivores. Such factors are also likely to apply in evaluating small carnivore populations in other forest areas of Myanmar that are in close proximity to high-density human settlement.

Some problems were encountered in camera-trapping. Sometimes one animal came and stayed for a long time in front of a camera-trap and used the film all up. Large wildlife such as deer (for species, see above) and wild pigs did not disturb the camera-traps but sometimes they were interfered with by visitors in the daytime and also by mushroom collectors in the forest. When a camera-trap was set up near to the park security house, some forest staff family came and disturbed it and it took their photographs providing evidence of their identity. Military people sometimes had duties in the forest and, alerted by the automatic flash, they approached the camera-traps and their photographs were taken. Some parts of the park are unsafe and poachers and hunters often tried to cut the locked cable wire to take off the camera-traps. When this happened the camera-traps were shifted and set up in alternative



Fig 7: Charred corpse of *P. hermaphroditus* killed by fire

places. Camera-trap malfunctioning mostly occurred in the rainy season due to high humidity and there was a need to check the set camera-traps carefully every day. When there was too much rain, the cameras got moisture inside them and the film became wet (in spite of the manufacturer's claim that the camera-traps are moisture proof). Sometimes ants intruded into the camera-traps and damaged components such as the sensor in the rainy season. As a result of these problems camera-traps were not set up during periods of very heavy rain.

A number of factors relating to the conservation of small carnivores in Hlawga, most of which are probably relevant to other areas of Myanmar with small carnivore populations, emerged during the study. While some past modifications of the environment have resulted in an increased diversity of habitats in Hlawga, the present high rate of tree cutting in the core area, particularly saplings and immature specimens of tall tree species, is seriously reducing the habitat of semi-arboreal vertebrates such as the Common Palm Civet, the squirrels *Callosciurus pygerythrus* and *C. finlaysoni*, the treeshrew *Tupaia* and a variety of high canopy birds. In addition to the obvious threat to the Common Palm Civet population, this may also indirectly threaten Small Indian Civets which depend on smaller mammals and birds as major items of diet.

Extensive burning of the buffer zone vegetation toward the end of the dry season (which facilitates illegal hunting) is a further form of habitat destruction, which also results in the death of small carnivores and their vertebrate and invertebrate prey. Such effects of fire on small carnivore populations have been documented by Rabinowitz (1990) who considered forest burning to be a major threat to the survival of some small carnivore species. This probably applies particularly to fragmented landscapes.

The widespread snaring and trapping in the core area and particularly in the buffer zone, even if not specifically aimed at small carnivores, is having a considerable negative effect on the viverrids, numbers of which are destroyed by these (illegal) activities, especially during the dry season. These destructive devices are unselective in the animals they catch and catch a variety of their prey species in addition to the small carnivores themselves.

Capture and killing of small carnivores, mainly Small Indian Civet and the two mongooses, as reprisal for damage inflicted on domestic stock, mainly poultry, is a further threat to the numbers of these species in Hlawga area and is probably affecting the mongoose populations, which are already low, more than the Small Indian Civet. This pattern of small carnivore destruction is known to be common in areas of the country where their populations are in close contact with human settlements.

The unusually small size of Hlawga Wildlife Park, as a protected area, undoubtedly contributes to the fact that these species reside and range outside the core area (in which wild prey are harder to catch than the confined domestic species in the buffer and beyond). The small carnivores that do exist appear to live and search for food outside the core area. From faecal analysis, rodents were commonly eaten by Common Palm Civet and Small Indian Civet, and there are commensal rodents around settlements. Staff chickens also might be an easily available food supply.

As already indicated, the marked tendency of these small carnivores to feed opportunistically on domestic poultry, also frequently reported from other areas (Gurung & Singh, 1996; Nowell & Jackson, 1996; Kanchanasakha *et al.* 1998; Francis, 2001), brings them into conflict with park staff and villagers living in or near the buffer zone. The possibility that numbers of the more aggressive viverrids such as Small Indian Civet, and the two mongoose species are limited by their persecution as raiders of domestic poultry has to be taken account of in assessing overall relative abundance of Hlawga's small carnivores. It is alarming to note that another small carnivore, with similar predatory habits to these three species, which was once relatively common in Hlawga, the Large-toothed Ferret Badger *Melogale personata*, was totally exterminated from the area a few years ago. My field assistant, a former hunter, and Forestry staff all reported that ferret badgers were very abundant in the park and were previously seen frequently.

Although these results came from one small reserve, it is likely that they apply to many other areas of Myanmar where small carnivores are living.

Conservation recommendations

In the interests of improving the conservation of small carnivores in Hlawga and also in Myanmar generally, the following recommendations are directed to the attention of wildlife managers and conservation practitioners.

1. The tightening up of law enforcement regarding small carnivores, notably enforcement of the existing "totally protected" status of the Small Indian Civet and "protected" status of the family Viverridae.
2. The conduct of carefully designed surveys in a number of locations throughout the country to examine the status of mustelids, viverrids, herpestids and small felids, and determine whether any species are in need of greater protection than that accorded them by existing legislation.
3. A well-planned conservation education module, possibly in form of a video, on the role of small carnivores in overall forest ecology (seed dispersal, eating of pests such as rats and mice, etc.), the importance of protecting small carnivores and their habitats, and appropriate ways of dealing with the poultry-killing tendencies of certain small carnivore species. Copies to be made available to conservation education personnel in all appropriate localities, for educating Forest Department staff and local residents.
4. Greater control over the current excessive removal of timber from Hlawga and other practices causing damage to the habitat such as burning of the buffer zone and widespread littering by visitors to the park.

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Continued on page 16

Recent sightings and habitat characteristics of the endemic Nilgiri Marten *Martes gwatkinsii* in Western Ghats, India

P. BALAKRISHNAN

Introduction

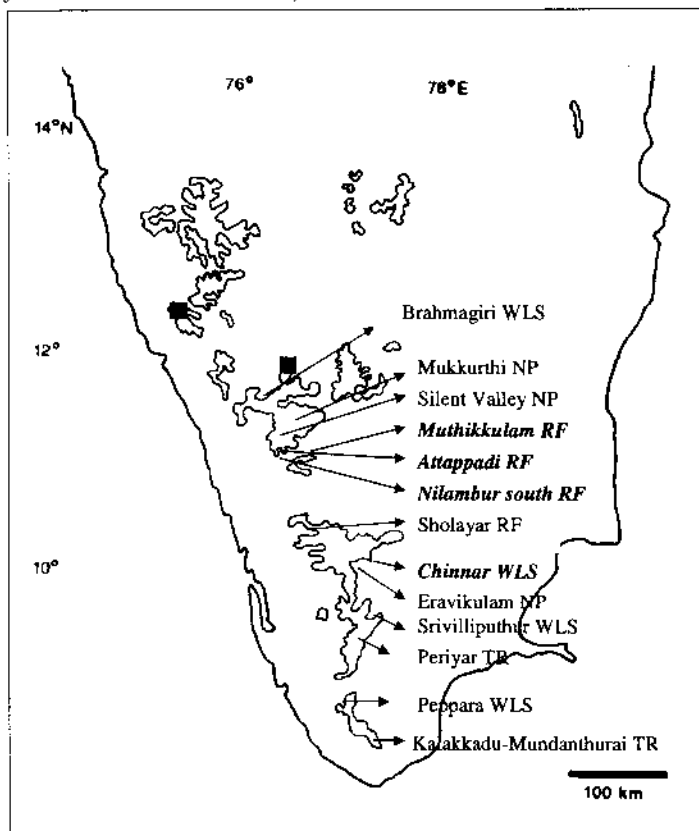
Scientific information on the distribution, abundance and ecology of many carnivore species in Western Ghats such as Rusty-spotted Cat *Prionailurus rubiginosus*, Nilgiri Marten *Martes gwatkinsii* and Malabar Civet *Viverra civettina* is very limited (Johnsigh, 1986; Nowell & Jackson, 1996; Mudappa, 1998) and this is a major handicap in their conservation (Kumar & Yoganand, 1999). The Nilgiri Marten is one of the largest and rarest Indian mustelids and is endemic to the Western Ghats. It is the southern counterpart of the Yellow-throated Marten *Martes flavigula* of the Siwaliks and Himalayas. It was considered as rare by Pocock (1941). The Action Plan of the then IUCN/SSC Viverrid and Mustelid Specialist Group (Schreiber *et al.* 1989) recommended field surveys to locate remaining populations of the species and to determine whether the existing reserves give adequate protection to Nilgiri Marten.

In this article I present the recent sight records and information on the habitat of the Nilgiri Marten.

Study species

Within its natural range, the Nilgiri Marten is unmistakable for its mostly black body with a stout tail, typical weasel-like legs

Fig. 1. Distribution of Nilgiri marten Martes gwatkinsii in Western Ghats, India. Localities of new records in bold italics and black boxes represent localities of museum specimens. (Map modified from Schreiber et al. 1989).



and a flat, pointed head (Mudappa, 1999). The yellowish-orange neck is a particular identification mark of the species. It could easily be mistaken for the Malabar Giant Squirrel *Ratufa indica* that occurs in the rainforests because of its colour and size. However, the Nilgiri Marten has a short black tail that is not as bushy as that of the Malabar Giant Squirrel (Mudappa, 2001). Martens are partly frugivorous and insectivorous. They kill and eat any small bird or mammal which they can overcome (Roberts, 1977). There are reports of them hunting Indian Chevrotain *Tragulus meminna* and Monitor Lizards *Varanus bengalensis* (see Mudappa, 1999) and, even, feeding on nectar (Hutton, 1944).

Quantitative data on the microhabitat use by Nilgiri marten are scarce. Consequently, there is some uncertainty in the preferred habitats and altitudinal distribution of this species. Balakrishnan (1986) states that the Nilgiri Marten occurs in deciduous forest and grasslands. However, this appears doubtful, because it was never recorded from the grasslands of Karnataka in spite of the extensive fieldwork (see Schreiber *et al.* 1989). Mudappa (1999) reported that moist and tropical rainforests falling within an altitudinal range of 300 – 1200 m are the preferred habitats of Nilgiri Marten. Recent reports indicate that it survives in forest patches on mountain summits and is occasionally encountered in coffee and cardamom plantations (Schreiber *et al.* 1989). In a survey of lesser carnivores in Nilgiri Biosphere Reserve, Yoganand & Kumar (1999) recorded the scats of Nilgiri Marten only from montane-evergreen forests and wattle plantations of Mukkurthi.

Nilgiri Marten has been reported from Rajamala in Eravikulam National Park (Madhusudan, 1995), Mukkurthi National Park (Yoganand & Kumar, 1995, 1999), Peppara Wildlife Sanctuary and Silent Valley National Park (Christopher & Jayson, 1996), Sholayar (Vijayan, 1979), Upper Bhavani (Gokula & Ramachandran, 1996), Brahmagiri (Schreiber *et al.* 1989), Kalakkadu-Mundanthurai Tiger Reserve (Mudappa, 1998), Srivilliputhur Wildlife Sanctuary (see Mudappa, 2001) and Periyar Tiger Reserve (Kurup & Joseph, 2001).

Materials and Methods

This study was carried out as a part of the on-going ecological studies of Grey-headed Bulbul *Pycnonotus priocephalus*, a restricted-range bird species of the Western Ghats. The survey covered all the possible habitat types (dry thorn forest and scrub, moist deciduous, wet and semi evergreen, montane evergreen (shola – grasslands) and plantations (Champion & Seth 1968), ranging from an elevation of 60 m to 2,300 m. For each detection of the Nilgiri Marten the habitat parameters such as habitat type, elevation, location of the animal in the canopy, height, girth at breast height (gbh) and species of the tree used, canopy height, % canopy cover, % sub-canopy cover, % shrub cover (by visual estimation), distance to nearest water source and distance to the trek path were recorded.

Results and Discussion

A survey across four south Indian states of the Western Ghats covering 730 km resulted in a single sighting of Nilgiri Marten in the upper reaches of the Chinnar Wildlife Sanctuary (10°15'-21' N, 77°15'-17' E). There was no sighting from the extensively surveyed Kudremukh National Park of Karnataka, Palni Hills, Kalakkadu-Mundanthurai Tiger Reserve of Tamil Nadu and Goa part of Western Ghats (despite the previous records of the species from some of these areas). There was no sighting from the montane grasslands and moist deciduous forests.

Apart from this single sighting, a total of six sightings of eight individuals of Nilgiri Marten were recorded from various parts of Nilgiri Biosphere Reserve during September 2002 to April 2004. Twice they were seen in pairs and the rest of the sightings were of solitary individuals. All the sightings were from the Kerala part of Western Ghats (Fig. 1). There were three sightings from Silent Valley National Park (11°04'-13'N, 76°24'-29'E) and one each from Attappadi Reserve Forests (10°55'-11°14'N, 76°25'-43'E), Muthikkulam Reserve Forests (10°56'-59'N, 76°41'-45'E) and Nilambur South Reserve Forests (11°20'-31'N, 76°06'-16'E). There were two more sightings of the Nilgiri Marten during this period from Silent Valley National Park (Anoop Das, Sibi and Anilkumar, pers. comm.) Both sightings were of paired individuals.

All the sightings except the one at Chinnar Wildlife Sanctuary (WLS) were from the medium-elevation rainforests. The lowest sighting was at 600 m and highest was at 1,400 m with an average of 990 m. In Chinnar WLS the marten was recorded in a shola forest contiguous to the Eravikulam National Park, at an elevation of 1,350 m. Although it is not possible to speculate on the favoured altitudinal distribution of this species, because neither previous nor recent records have been scaled against effort. Most records come from mid- and higher elevation evergreen forest, shoal forests and plantations at higher altitudes; but this is where most forest remains and most effort has been concentrated, so, on its own is uninformative.

Most sightings of the Nilgiri marten came from areas with less canopy and sub canopy cover (Table 1). The vegetation parameters at the detection sites varied considerably; but most of the sightings of martens were in the top layer of the canopy. They preferred taller trees with an average of 16 m height and 190 cm

girth. It is interesting that five of the seven sightings of Nilgiri Marten were on *Elaeocarpus* spp., two in the hollows of the tree and rest in the canopy. The sighting of this marten by Sibi & Anilkumar was also in a hollow of an *Elaeocarpus* tree (back cover). The external morphology of the *Elaeocarpus* trees with many hollows may possibly be suitable as shelter to martens. However, it is difficult to draw a conclusion from few sightings about the relationship between Nilgiri Marten and *Elaeocarpus* spp. (*Bhadrasham* in local language). The detection sites were away from the trek paths (mean distance = 99 m), but were at medium distance from water (mean = 65 m).

The marten is legally protected (Schedule II part II of the Indian Wildlife Protection Act, 1972); is listed on Appendix III of the Convention on International trade in Endangered Species (CITES), and listed as VUB1+2c (IUCN, 2003). However, habitat destruction, fragmentation and hunting are the major hindrance in the effective conservation of Nilgiri Marten. A local hunter described his kill as a *Maranai* (local name for marten) weighing about two kg from Nilambur Reserve Forests and his description of the animal was similar to the external morphology of the marten.

Most of the past records of the species are from protected areas. However, the result of this study indicates their occurrence in unprotected areas. Of the seven sightings three were from unprotected areas. Although poaching incidents are not so frequent in the protected areas, measures to regulate hunting in the unprotected areas especially in the low elevation forests are not effective. Hence, there is a need for more survey work, and probably more protected areas in the lower altitudes of the species' range. Legal protection of the reserve forests contiguous to the Silent Valley National Park is most essential for the effective conservation of the Nilgiri Marten.

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Table 1. Habitat characteristics at the detection locations of Nilgiri Marten *Martes gwatkinsii* in Western Ghats, India (N = 7)

Variable	Range	Mean	SE
Altitude (m)	600-1400	992.86	327.15
Location of the animal in the canopy (m)	7-18	11.86	3.72
Height of the tree on which the animal was sighted (m)	9-22	16.86	4.71
Mean Gbh of the tree (cm)	90-310	190.71	79.08
Mean canopy height (m)	10-20	15.86	4.34
Canopy cover (%)	30-50	39.29	8.38
Sub canopy cover (%)	20-40	27.86	6.99
Shrub cover (%)	40-70	57.14	11.13
Distance to nearest water source (m)	5-350	65.29	126.47
Distance to trek path (m)	15-300	99.29	100.18

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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

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The Yellow-bellied Weasel *Mustela kathiah* has a relatively wide Asian range, occurring from northern India east through the Himalaya, much of southern China and northern South-East Asia (Corbet & Hill, 1992). It has long been known to occur in the northern highlands of Indochina, including Laos (e.g. Osgood 1932), but extensive surveys of mammals there in the 1990s (see Duckworth *et al.* 1999) resulted in only one record. This hampered assessment of its national conservation status. This note reports two recent field sightings from Phongsaly province, Laos, and clarifies the species' South-East Asia range, which is generally underestimated. Although the species was not assessed as a priority species by the IUCN/SSC *Action plan for the conservation of mustelids and viverrids* (Schreiber *et al.* 1989), it flagged baseline survey for small carnivores across Laos as urgent, in the light of the country's remaining extensive habitat and hence conservation potential. The surveys during the 1990s revealed that many species of mammals live at extremely low density across the country, even within remaining little-altered habitat. This is apparently a result of high levels of hunting, in part driven by trade (Duckworth *et al.* 1999, Noreen & Claridge, 2001). Hence, clarification of status of all mammal species remains at least a national-level conservation priority.

Survey area and methods

The sightings were made during field observations to investigate bird and large mammal communities of Phongsaly province, Laos (e.g. Fuchs *et al.* in prep.). Phongsaly is Laos' most northern province and is largely mountainous, even the lower-altitude areas being on rugged terrain. During wide-ranging wildlife surveys in Laos from 1992-1999, it hosted only brief reconnaissance visits, whereas most other provinces had at least one multi-observer intensive field survey lasting several weeks (Duckworth *et al.* 1999). By contrast, in the past it was one of the better-collected Lao provinces for mammals, primarily through the work of the Kelley-Roosevelts' expedition (Osgood, 1932). On this recent survey, effort totalled about nine observer-weeks of dedicated field searching (six in November-December 2004 and three in March 2005); additional wildlife field-work activities with a lower chance of field sightings (e.g. trapping small mammals and village interviews to assess large mammal status) are not included in this effort estimation. Observations covered a representative selection of the province's habitats, although little time was spent in remote tall forest. Most observations were along and adjacent to the forested, lower-hill Nam Ou river, and in a matrix of cultivation, scrub, ruderals and grass and remnant forest around Phongsaly town.

Field sightings

Single Yellow-bellied Weasels were observed on Phou Fa (=Fa mountain) on 28 November 2004 at 07h30, and close to Ban Bakong (=Bakong village) on 24 March 2005 at 09h30. Phou Fa (21°41'N, 102°06'E) has a relict and degraded 200 ha patch of montane evergreen forest across 1,480-1,625 m altitude: the weasel was at c.1,550 m. The forest patch is linked through extensive scrub

and grassland to various other small and degraded forest patches around Phongsaly town. Ban Bakong (21°37'N 102°05'E) is amid the same landscape and the weasel was in a scrubby coombe about 1.6 km west of the town, and at least 1 km from any forest, at c.1,200 m.

In both cases the weasel was seen clearly, at c.20 m and 8 m range respectively, leaving no doubt as to the identification. The first animal, seen by both of us, showed dark mahogany-brown upperparts with no pale dorsal stripe, and rich deep yellow underparts including the throat. The tail was c.60% of the head-and-body length and was visually much more prominent than on, e.g., Least Weasel *M. nivalis* or Stoat *M. erminea*. The animal was about Stoat-sized. It was carrying a rat (possibly *Niviventer* sp.) and was observed in total for c.1-2 minutes as it crossed and recrossed a dirt road, seemingly unsure how to negotiate the steep slope back into the forest. The animal near Ban Bakong, seen by J. W. D. alone, showed a rich yellow throat, chest and fore-belly (the lower belly was not visible) and rich dark brown upperparts, again with no pale dorsal stripe. It was in view for only a few seconds before disappearing in the abundant thick grass. Although neither of us had previously seen the species in life before, J. W. D. had examined the extensive collection of weasels at the Natural History Museum, South Kensington, London, in connexion with other field sightings of weasels in Laos (Duckworth, 1997), and hence was able to concentrate during the observations on the field characters necessary to rule out Siberian Weasel *M. sibirica*, Back-striped Weasel *M. strigidorsa* and Least Weasel from identification. Particular attention was given to assessing the relative tail length on the first animal.

Habitat and human use patterns of occupied sites

There are only four previous records from Laos, and thus this species's national conservation status was assessed as "Little known in Laos" by Duckworth *et al.* (1999):

- One was collected around Phongsaly town (i.e., close to the recent sightings), Phongsaly province, in April or May 1929 (Osgood, 1932; Delacour, 1940).
- One was collected around Xiangkhouang town ("Xien Quangkoo"; c.19°20'N 103°22'E), the former provincial capital of Xiangkhouang province, on 3 January 1926 (Thomas, 1927; Osgood, 1932; Delacour, 1940; Natural History Museum specimen n° BMNH 1926.10.4.26).
- One was seen by day in Nam Xam National Protected Area (NPA) (within 20°02'-14'N, 104°18'-53'E), Houaphanh province, 26 January 1998, in *Fokienia*-dominated mixed evergreen forest at about 1,500 m (Showler *et al.* 1998; D. A. Showler *in litt.* 1998).
- One was collected on the Bolaven Plateau (within 14°42'-15°30'N, 106°15'-50'E), presumably at about 1,200-1,400 m, by T. D. Carter on the Legendre expedition (see Legendre, 1932; Dickinson, 1970) on 5 February 1932 (Tizard, 2002; American Museum of Natural History specimen n° AMNH 87393).

Hence, the three Lao records with known altitudes come from at least 1,200 m. Moreover, the Xiangkhouang and Bolaven areas lie mostly at 1,100–1,400 m. Little land near any of these sites is significantly lower. That all records certainly or presumably come from 1,100–1,550 m is unsurprising, because for elsewhere Corbet & Hill (1992) gave a lower altitudinal limit of 1,000 m. It is not an artificial effect of survey coverage, because during the 1990s baseline surveys, effort below 1,200 m considerably exceeded that in higher areas (e.g. Duckworth, 1997).

Both recent sightings were within 10 km of Phongsaly town. In this region, hunting was intense and few other mammals were seen. Gunshots were commonly heard. Small bands of children, and even young men, with catapults (probably after mostly squirrels and birds) were a daily sight. Discounting murids and bats, the only other wild mammals seen in this degraded landscape were Northern Treeshrew *Tupaia belangeri*, Inornate Squirrel *Callosciurus inornatus*, Eastern Striped Squirrel *Tamias maritimus* and a species of *Dremomys*, probably Red-cheeked Squirrel *D. rufigenis* (all widespread and regularly seen); Pallas's Squirrel *Callosciurus erythraeus* (on Phou Fa only); and, surprisingly (given the hunting pressure), a few Red Muntjacs *Muntiacus muntjak*. These latter were widespread, even being audible (on Phou Fa) from the town centre, a situation unique to Lao provincial capitals in our experience. Signs (which were not searched for systematically) showed that at least one species of civet (Viverridae) was also present. In these areas, mammals were encountered much less frequently in March 2005 than in November–December 2004. The combined totals for *Tupaia*, *Callosciurus* and *Dremomys* (*Tamias* squirrels were not counted individually) were c.38 animals seen on 12 observation days in November–December, whereas only three were seen on eight observation days in March. Muntjacs were seen or heard only in December, with five contacts of six animals. Rather than implying province-wide mortality on a huge scale, it seems more plausible that many of the mammals found in the first period were post-breeding dispersants in suboptimal habitat, which succumbed to the heavy hunting in the intervening few months. Other factors potentially return to more forested areas might also produce this pattern.

Apparently no *Mustela* species has ever been studied in South-East Asia, and Yellow-bellied Weasel's habitat use remains little known in the region. It may be relatively non-specific, because the 1998 sighting was in extensive forest, whereas the 2004–2005 sightings came from a largely degraded landscape remote from extensive forest. No specific information accompanies the historical specimens but all three areas, Phongsaly, Xiangkhouang and the Bolaven plateau, had by then already undergone partial conversion to scrub and ruderal, non-forest, landscapes (Engelbach, 1932; Legendre, 1932; Coolidge & Roosevelt, 1933; David-Beaulieu, 1944). Although further information is needed, it seems likely that this species is probably tolerant of even quite severe habitat degradation. Landscapes similar to the areas of the Phongsaly records are extensive across Laos's northern highlands. As such, Yellow-bellied Weasel may yet be found to be widespread in Laos, especially if, as suggested by the Phongsaly records, it persists in the face of heavy hunting. Overall, it is possible that the paucity of Lao records to date may merely reflect generally low encounter rates of tropical weasels. However, set against this, it was not recorded in either of the field surveys in Laos most likely to detect this species: a camera-trap survey in the Nam Et–Phou Louey NPA (Johnson *et al.* 2004) and a direct observation survey in the Nakai–Nam Theun NPA (Duckworth, 1998), respectively. These found 19 and 15 species

of carnivore, respectively, making them by far the most comprehensive assessments of carnivore communities ever conducted in Laos; and both had most of their fieldwork over 1,000 m, the former in the northern highlands and the latter in the mid-high Annamites. There is clearly more information needed on Yellow-bellied Weasel in Laos before making a final assessment of conservation status.

Notes on the South-East Asian range of *M. kathiah*

Indochina

Historically, most of the South-East Asian Yellow-bellied Weasel records came from the northern highlands of Vietnam, e.g. seven specimens are listed from three sites by Osgood (1932), and it was also recorded in this region by Dao Van Tien (1978). Corbet & Hill (1992) mapped the Indochinese range of Yellow-bellied Weasel as only the northern highlands south to c. 18°N. There are two recent field records from well to the south, in the Annamite mountains of central Vietnam. One was camera-trapped in primary evergreen forest at 1,000 m altitude in A Vuong proposed Nature Reserve, Tay Giang district, Quang Nam Province (c.16°00'N, 107°30'E) on 30 January 2003 (Long *et al.* 2004). Even further to the south, one was seen in the Ngoc Linh highlands at about 15°N in the late 1990s (J. C. Eames *in litt.* 1999). The Bolaven specimen from Laos remains the most southerly record, but the species might yet be found even to extend into far southern Indochina, as do most of the Indochinese montane forest birds (e.g. Robson, 2000).

Thailand

Although there are no historical records for Thailand (Lekagul & McNeely, 1977), the species evidently occurs in the northern highlands. Vikorn (2001) documented a road-kill *Mustela* specimen from Doi Pha Luang station (1,850 m) in Doi Pha Hom Pok National Park (c.o. 20°07'N 99°12'E), Fang, Chiang Mai province on 31 Dec 2000. It was in the adjacent pine plantations (Kaset Sutasha per J. Murray *in litt.* 2005). Vikorn (2001) identified it as Least Weasel *M. nivalis*, without discussing the possibility of *M. kathiah*. The article's photographs show a small mustelid with entirely rich yellow underparts, except for a white throat. J. W. D. examined this specimen at Thailand's National Science Museum in May 2002 and considers that it is in fact a Yellow-bellied Weasel. The rich deep yellow venter and relatively long tail do not accord with Least Weasel. Although Vikorn's (2001) measurements of head-and-body (185 mm and tail 95 mm) are smaller than given for *M. kathiah* by Corbet & Hill (1992), the ratio, 51%, is within the range of that species (50–70%: Corbet & Hill, 1992). By contrast, it is far too long a tail for Least Weasel, according to figures (maximum 42%) in Abramov & Baryshnikov (2000). The geographically closest race of Least Weasel, named as the species *Mustela tonkinensis* Björckgren, 1942, is known only from the holotype, from Chapa (= Sa Pa), far-northern Vietnam. It is sufficiently morphologically divergent that it might better be considered a separate species, although one of the few recent examinations of the specimen (by Abramov & Baryshnikov, 2000: 397) maintained it as "just a subspecies of *M. nivalis*"; its tail length is 38% of its head-and-body length (*contra* figures of 45% given elsewhere: A. Abramov *in litt.* 2005). The Doi Pha Hom Pok specimen seems most unlikely to be this taxon, not only on relative tail length, but also because the holotype, with the throat and chest sharply white, has the rest of the underparts white with a yellowish tinge (Björckgren, 1942), distinguishing it clearly from Yellow-bellied Weasel.

Myanmar (Burma)

There is ambiguity in current literature over the species' status in Myanmar. Neither edition of the standard national reference to the country's mammals, Tun Yin (1967, 1993) included any species of the genus *Mustela*. They were presumably considered too small to be included in the first edition, which covers only large mammals. Omission from the second edition, which treated small mammals as well, is assumed to be an editorial oversight. The 1993 revision was started by the original author, who died on the job, picked up by a colleague and friend, who also expired, and eventually brought out by a third party (Saw Han in Tun Yin 1993): hence, such an omission is less surprising that it might at first seem. To add to the confusion, the species was not mapped for Myanmar by Corbet & Hill (1992), although they referred in the text to occurrence in the north of the country. Perhaps understandably, it has been omitted from a newly published comprehensive, though popular, guide to the larger mammals of Myanmar (Parr, 2005). Hence, it is worth documenting that the Natural History Museum, London, holds six skins from Myanmar, all collected in the Nam Tamai valley by R. Kaulbach and associates in 1938. Recorded coordinates are 27°42'N, 97°54'E and 27°30'N, 97°30'E. Three specimens come from 3,000' (c.900 m), and one from 4,500' (c. 1,350 m) altitude (H. Van Rompaey *in litt.* 2005; see also Pocock, 1941:359).

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Appendix: other records of small carnivores from the 2004-2005 Phongsaly survey

There are few recent records of mustelids, herpestids and viverrids from Phongsaly province, or indeed from the neighbouring provinces of Udomxai and Louangphabang. Baseline field surveys of birds and large mammals, with significant spot-lighting, took place across many areas in south and central Laos during 1992-1996 (Duckworth, 1997), but the subsequent somewhat similar surveys in the country's northern highlands did not include significant amounts of spot-lighting or any other technique capable of assessing the small carnivore community (Tizard *et al.* 1997; Davidson, 1998, 1999; Showler *et al.* 1998). Although the present survey did not include significant spotlighting, records of other species are detailed here, because the only other published records from the province are those in Osgood (1932). In addition to those detailed above and below, these comprise Back-striped Weasel *Mustela strigidorsa*, Hog Badger *Arctonyx collaris* and Small-toothed Ferret Badger *Melogale moschata* from around Phongsaly town, and Large Indian Civet *Viverra zibetha* from Ban Muangyo (21°30'N, 101°50'E). Many other species can reasonably be predicted to occur in the province, which remains under-surveyed for these families by comparison with south and central Laos, and some may have been recorded by other biologists working through the same EU project in 2004-2005. A reconnaissance visit to the province by WGR in 1996 (see Fuchs *et al.* in prep.) recorded no small carnivores, but techniques used were not very suitable for detecting such animals.

Yellow-throated Marten *Martes flavigula*

Phou Dendin National Protected Area (NPA): [two probably this species in riverside evergreen forest along the Nam Ou (= Ou river) upstream of the mouth of the Nam Khang (some way downstream of 22°04'N, 102°03'E; 580 m) on the mid-morning of 5 December 2004; Khamthai Khamavongsa, verbally]. One 100-200 m away from the Nam La (a little way upstream of 22°04'N, 102°16'E; altitude unknown) at c.07h30 on 10 December 2004; the animal appeared along a fence line between dense scrub/secondary growth and a dry rice paddy. One on 13 December 2004, along the vegetated west bank of the Nam Ou below Ban Hathin (22°03'N, 102°16'E; 520 m), still within the NPA, about 09h30.

A widespread and, at least in some areas of Lao PDR, frequently seen species (Duckworth, 1997).

Otters (Lutrinae)

Phou Dendin NPA: spraints were found commonly along the surveyed stretch of the Nam Va (several km upstream of 21°54'N, 102°20'E) in March 2005. However, this was a short stretch and it is conceivable that all spraints came from one, roving, animal. A healthy population cannot therefore be inferred.

No unequivocal otter signs (clear tracks or spraints) were seen in the course of the December survey, a very noteworthy

negative return, given the amount of time spent looking on soft sediments along the Nam Ou that took prints well. Otters have been subject to heavy trade from at least some parts of Indochina into China (Poole, 2003) and it seems likely, given Phongsaly's proximity to China that otters are now very rare in the province. This may be of particular conservation concern because Eurasian Otter *Lutra lutra* has only been reliably reported in Lao PDR from Phongsaly (Osgood, 1932; Duckworth *et al.* 1999). The statement by Conroy *et al.* (1998: 25) that "[*Lutra lutra* is] believed to be extinct in Laos" was bold, given the almost total absence of suitable surveys in much of the country, but it seems unlikely that if it does not survive on the remotest parts of the Nam Ou (as seems possible) there would be significant populations elsewhere in the province. Clarification of otter status in Phongsaly province and elsewhere in the northern highlands is a high priority.

Small Indian Civet *Viverricula indica*

Phou Dendin NPA: one snared and eaten by Ban Tan (22°07'N, 102°20'E; 964 m) villagers on 10 or 11 December 2004 (skin seen and photographed).

This civet is known by rather few field records in Lao PDR, but it is unclear how much this reflects genuine scarcity and how much lack of effort in its favoured habitats (Duckworth *et al.* 1999). It was already recorded from Phongsaly by Osgood (1932).

Common Palm Civet *Paradoxurus hermaphroditus*

Phou Dendin NPA: singles along the lower Houay Hinnoy (22°04'N, 102°03'E; 580 m) on 1 December 2004 and on the Nam Ou bank 1 km downstream of the point 22°05'N, 102°09'E (510 m) on 4 December 2004, both during brief spotlight surveys.

A common species throughout south and central Lao PDR (Duckworth, 1997) and presumably the North, although there is little specific information from the northern highlands.

Crab-eating Mongoose *Herpestes urva*

Phou Dendin NPA: one along the Nam Ou about 2 km downstream of point 22°05'N, 102°09'E (510 m) on 4 December 2004 (16h05). Two singles foraging on opposite banks of the lower Nam Khang (a little upstream of 22°06'N, 102°15'E; 530 m) on 7 December 2004 (09h05 and 09h10). A party of three, all of a size, foraging along the west bank of the Nam Khang, upstream of Ban Tatoung (22°09'N, 102°13'E; c. 520 m) on 8 December 2004 (c.15h30).

Crab-eating Mongoose remains common in the hilly areas of south and central Lao PDR, particularly near large rivers (Duckworth, 1997), but there is little specific information from the northern highlands. Occurrence is not surprising given the locality records from neighbouring areas given by Van Rompaey (2001).

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Small carnivores on small islands. New data based on old skulls

Shai MEIRI

Introduction

Insular animals have a research and conservation importance that far exceeds their relative numbers.

First and foremost the insular settings often promote allopatric speciation and diversification, sometimes in the form of adaptive radiation, and thus much of the global biodiversity resides in such evolutionary hotspots. The isolation and depauperate faunas of many islands mean many insular populations and species are genetically distinct from their mainland relatives and thus are often of great conservation priority. Indeed most anthropogenic extinctions of animals occurred on islands (e.g. Steadman, 1995; MacPhee & Flemming, 2000).

In addition, the restricted area and isolation of islands often make them interesting "natural experiments" of ecological and evolutionary phenomena (MacArthur & Wilson, 1967; Mayr, 1967; Roth, 1992), and consequently a focus of much ecological, evolutionary and biogeographic research. Indeed Darwin and Wallace developed their theory of evolution by natural selection after inspirational first-hand impressions of insular animals (Darwin, 1845, 1859; Wallace, 1868, 1880).

Records of occurrence of insular organisms are often important in studies relating to the assemblage and evolution of ecological communities (MacArthur & Wilson, 1967; Lawlor, 1986; Burness *et al.* 2001; Meiri *et al.* 2005a).

Small carnivores are no exception to these generalizations: There are eight endemic Madagascar species of small carnivores, up to five species of endemic insular raccoons (although some are probably introduced *Procyon lotor* [Helgen & Wilson, 2003; Zeweloff, 2003]), one species of insular coati (*Nasua nelsoni*), and ten species endemic to islands in south and southeast Asia (*Diplogale hosei*, *Paradoxurus zeylonensis*, *P. lignicolor*, *Macrogalidia musschenbroekii*, *Herpestes semitorquatus*, *Melogale everetti*, *M. orientalis*, *Mustela lutreolina*, *Mydaus javanensis* and *M. marchei*). In addition, there are two endemic canid species (the extinct *Dusicyon australis* and extant *Urocyon littoralis*) and one endemic insular cat species (*Felis badia*).

Small carnivores inhabit many islands worldwide, and some of these insular populations are of great conservation priority, including many of the abovementioned species and many insular populations of more widespread species (e.g. *Martes flavigula robinsoni* in Java, *M. melampus tsuensis* in Tsushima, *Genetta genetta isabelae* in Ibiza [IUCN 2002], *Spilogale gracilis amphiala* on the California Channel Islands [Verts *et al.* 2001]).

Moreover, many insular populations of small carnivores are probably threatened, but data regarding them are deficient. For example 60 out of 106 populations of "possibly threatened mustelids and viverrids" listed in Schreiber *et al.* (1989) are insular (see also Cook *et al.* 2001). The problem of data deficiency is actually more acute than these figures suggest, for the simple reason that many insular populations of small carnivores are virtually unknown to science and their unique features and conservation status cannot therefore be explored.

Here I list insular carnivores, compiled from museum specimens, that went unnoticed in recent publications.

Material and Methods

As part of my PhD studies (Meiri, 2004; Meiri *et al.* 2004a, 2005a) I contacted, starting in late 1999, curators and collection managers in natural history collections worldwide and requested data regarding specimens of insular carnivores. In the last five years I visited 31 of these collections and recorded locality data for insular carnivores. I also received many data from Tamar Dayan and Daniel Simberloff, who measured carnivores as part of their ongoing research of carnivore microevolution (e.g. Dayan *et al.* 1989, 1991, 2002; Dayan & Simberloff, 1994; Simberloff *et al.* 2000; Meiri *et al.* 2004a, 2004b, 2005a, 2005b).

I reviewed the literature to find data on insular carnivore occurrences. Particularly important publications included: Schreiber *et al.* (1989), Wozencraft (1993) and Nowak (1999) for the entire world, Sasaki (1991), Abe (1994), Dobson (1994) and Millien-Parra & Jaeger (1999) (for Japan); McCabe & Cowan (1945), Banfield (1974), Hall (1981), Crowell (1986), Macdonald & Cook (1996) and Conroy *et al.* (1999) (for North America); Heaney (1986), Corbet & Hill (1992), Heaney *et al.* (1998) and Meijaard (2003) (for SE Asia); Corbet & Harris (1991), Masseti (1995) and Mitchel-Jones *et al.* (1999) (for Europe); Kostenko (2002) (for Kuril Islands), but many more were scanned.

Here I list occurrence of mustelids (to the exclusion of otters), procyonids (Florida Keys populations omitted), herpestids and viverrids on islands, that went unnoticed in the literature, based on museum specimens. Introduced populations are not included. Data for other carnivore taxa are available upon request. For each island I list its latitude and longitude.

Results

Sixty-seven small carnivores occurrences derived from museum specimens that were not found in a survey of the literature are listed in Table 1. I deliberately omitted some locality data that seem highly dubious. The Smithsonian Institute, for example, holds a supposedly Singaporean specimen of the Indian Gray Mongoose (*Herpestes edwardsii*, USNM 004000/A38520, see Table 1 for museum acronyms). However Craig Ludwig (USNM, pers. com.) suspects this listing may have been in error, or that this is an introduced specimen. Furthermore, Singapore is and has been (the specimen was catalogued in 1860) a major trade center, and thus records of supposedly Singaporean specimens should be taken with a grain of salt (Chris Smeenk, pers. com.). The natural distribution of *H. edwardsii* does not reach the Malay Peninsula, although this species was introduced there (Wells, 1989). Mistakes in both taxonomy and locality are not uncommon in museum collections (pers. obs.: invariably some collections are better than others in this regard). I have therefore tried to present only data for which the accuracy of seems highly likely (usually meaning that the species is recorded from the adjacent mainland or nearby islands). Some islands I was simply unable to locate (e.g. *Arctogalidia trivirgata*, BMNH 9.4.1.122, from "Bliah Kunder Island", *Mustela sibirica* BMNH 6.11.2.31 and BMNH 8.2.26.107 from "Joshi" and "Jukue" islands, respectively).

Table 1. New island records of insular carnivores.

SPECIES	ISLAND	SOVEREIGNTY	MUSEUM	#	SPECIMEN #	SEEN BY	LAT	LONG
<i>Arctogalidia trivirgata</i>	Kadan Kyun (Mayanpin=King)	Myanmar	BMNH	1	1937.9.10.18	M	12°30'N	98°22'E
<i>Cynogale bennettii</i>	Singapore	Singapore	BMNH	1	5.9.25.1	M	01°22'N	103°48'E
<i>Herpestes javanicus</i>	Madura	Indonesia	BMNH	1	10.4.7.15	M	07°00'S	113°20'E
<i>Herpestes javanicus</i>	Sumatra	Indonesia	RMNH, ZMB	5	RMNH 9843, ZMB 34040	M	00°05'S	102°00'W
<i>Martes americana</i>	Gilford	Canada	RBCM	5	13504	M	50°45'N	126°20'W
<i>Martes flavigula</i>	Singapore	Singapore	USNM	1	3999	M	01°22'N	103°48'E
<i>Martes foina</i>	Cres	Croatia	CNHM			ns	44°54'N	14°27'E
<i>Martes foina</i>	Dugi Otok	Croatia	CNHM			ns	44°09'N	15°03'E
<i>Martes foina</i>	Falster	Denmark	ZMUC	1	2377	S	54°30'N	12°00'E
<i>Martes foina</i>	Hvar	Croatia	CNHM			ns	43°09'N	16°45'E
<i>Martes foina</i>	Lestovo	Croatia	CNHM			ns	42°46'N	16°55'E
<i>Martes foina</i>	Lolland	Denmark	ZMUC	3	5408	S	54°40'N	11°30'E
<i>Martes foina</i>	Pag	Croatia	CNHM			ns	44°30'N	15°00'W
<i>Mustela erminea</i>	Barter	USA	CMN	1	2593	M	70°07'N	143°40'W
<i>Mustela erminea</i>	Cairn	Canada	CM	2	5392	M	56°17'N	76°35'W
<i>Mustela erminea</i>	Douglas	USA	UAM	1	52304	M	58°16'N	134°00'W
<i>Mustela erminea</i>	Falster	Denmark	ZMUC	3	3322	S	54°30'N	12°00'E
<i>Mustela erminea</i>	Flaherty	Canada	CM	4	15189	M	56°14'N	79°17'W
<i>Mustela erminea</i>	Fyn	Denmark	ZMUC	10	2416	S	55°20'N	10°30'E
<i>Mustela erminea</i>	Hinchinbrook	USA	MVZ	1	912	D	60°20'N	146°25'W
<i>Mustela erminea</i>	Innetalling	Canada	CM	1	15198	M	55°05'N	79°04'W
<i>Mustela erminea</i>	Lolland	Denmark	ZMUC	1	3103	S	54°40'N	11°30'E
<i>Mustela erminea</i>	Puget	USA	USNM	1	274190	M	46°10'N	123°23'W
<i>Mustela erminea</i>	Sitkalidak	USA	USNMZ	1	97461	D	57°08'N	153°11'W
<i>Mustela erminea</i>	Tukarak	Canada	CM	25	15188	M	56°27'N	78°45'W
<i>Mustela erminea</i>	Unalaska	Canada	USNM	3	13025	M	53°30'N	167°00'W
<i>Mustela nivalis</i>	Falster	Denmark	ZMUC	1	1219	S	54°30'N	12°00'E
<i>Mustela nivalis</i>	Lolland	Denmark	ZMUC	2	5809	S	54°40'N	11°30'E
<i>Mustela nivalis</i>	Pag	Croatia	CNHM			ns	44°30'N	15°00'W
<i>Mustela putorius</i>	Aero	Denmark	ZMUC	1	749	S	54°43'N	10°20'E
<i>Mustela putorius</i>	Krk	Croatia	CNHM			ns	45°05'N	14°35'E
<i>Mustela putorius</i>	Rab	Croatia	CNHM			ns	44°46'N	14°46'E
<i>Mustela sibirica</i>	Iki	Japan	BMNH	3	8.2.26.75	M	33°47'N	129°43'E
<i>Mustela sibirica</i>	Rishiri	Japan	NSMT	1	10122	M	45°11'N	141°15'E
<i>Mustela sibirica</i>	Sado Shima	Japan	NSMT	9	14651	M	38°00'N	138°25'E
<i>Mustela vison</i>	Broughton	Canada	RBCM	3	1578	M	50°49'N	126°45'W
<i>Mustela vison</i>	Conanicut	USA	FMNH	1	156115	M	41°32'N	71°21'W
<i>Mustela vison</i>	Esther	USA	UAM	1	24834	M	57°51'N	136°26'W
<i>Mustela vison</i>	Foster's	Canada	MCZ	1	86995	M	44°43'N	67°28'W
<i>Mustela vison</i>	Haystack	Canada	RBCM	1	1564	S	54°43'N	130°37'W
<i>Mustela vison</i>	Judith	USA	AMNH	1	30887	M	35°22'N	76°22'W
<i>Mustela vison</i>	King	Canada	CMN	1	16517	M	52°30'N	127°00'W
<i>Mustela vison</i>	Nunivak	USA	UAM	22	32698	M	60°00'N	166°30'W
<i>Mustela vison</i>	Price	Canada	RBCM	1	4538	M	52°28'N	128°42'W
<i>Mustela vison</i>	Sidney	Canada	RBCM	3	9250	M	48°37'N	123°18'W
<i>Nasua narica</i>	Isla Popa	Panama	USNM	1	360453	ns	09°07'N	81°44'W
<i>Paguma larvata</i>	Koh yao	Thailand	TISTR			ns	09°00'N	98°00'E
<i>Paguma larvata</i>	Rutland	India	BMNH	1	1937.7.22.1	M	11°25'N	92°40'E
<i>Paradoxurus hermaphroditus</i>	Bawean	Indonesia	RMNH	1	34704	M	05°40'S	112°40'E
<i>Paradoxurus hermaphroditus</i>	Con Son	Vietnam	USNM	2	357286	M	08°43'N	106°36'E
<i>Paradoxurus hermaphroditus</i>	Koh Samui	Thailand	TISTR			ns	09°00'N	100°00'E
<i>Paradoxurus hermaphroditus</i>	Koh yao	Thailand	TISTR			ns	09°00'N	98°00'E
<i>Paradoxurus hermaphroditus</i>	Samar	Philippines	ZMB	1	2754	M	12°00'N	125°00'E
<i>Paradoxurus hermaphroditus</i>	Telcbon (Telibon)	Thailand	USNM	1	83268	M	07°15'N	99°23'E
<i>Potos flavus</i>	Isla Parida	Panama	BMNH	1	3.3.1.57	M	08°07'N	82°20'W
<i>Potos flavus</i>	Isla Popa	Panama	USNM	5	579215	M	09°07'N	81°44'W
<i>Potos flavus</i>	Isla San Cristobal	Panama	USNM	3	449532	M	09°15'N	82°16'W
<i>Procyon lotor</i>	Cayo Nancy	Panama	USNM	1	464962	ns	09°19'N	82°11'W
<i>Procyon lotor</i>	Isla Bastimentos	Panama	USNM	3	464411	M	09°15'N	82°08'W
<i>Procyon lotor</i>	Isla Popa	Panama	USNM	6	579204	M	09°07'N	81°44'W
<i>Procyon lotor</i>	Isla San Cristobal	Panama	USNM	5	449533	M	09°15'N	82°16'W
<i>Procyon lotor</i>	Sanibel	USA	FMNH	2	49227	M	26°26'N	82°07'W
<i>Viverra zangalunga</i>	Bawal	Indonesia	USNM	1	153841	M	02°43'S	110°05'E
<i>Viverra zangalunga</i>	Java	Indonesia	RMNH, ZMB	2	RMNH 34825, ZMB 13377	M	08°00'S	110°00'E
<i>Viverra zangalunga</i>	Leyte	Philippines	USNM	1	458892	M	10°50'N	124°50'E
<i>Viverra zangalunga</i>	Pinang	Malaysia	ZRC	1	ZRC 4.1449	M	05°22'N	100°14'E
<i>Viverra zangalunga</i>	Telok Pai	Indonesia	USNM	1	125095	M	01°50'S	109°00'E

Museum acronyms: American Museum of Natural History (AMNH); Natural History Museum, London (BMNH); Carnegie Museum of Natural History (CM); Canadian Museum of Nature (CMN); Croatian Natural History Museum (CNHM); Field Museum of Natural History (FMNH); Museum of Comparative Zoology, Harvard University (MCZ); Museum of Vertebrate Zoology, University of California, Berkeley (MVZ); National Science Museum, Tokyo (NSMU); Royal British Columbia Museum (RBCM); Rijksmuseum van Natuurlijke Historie, 'Naturalis', (RMNH); Thailand Institute for Scientific and Technological Research (TISTR); University of Alaska, Fairbanks, Museum (UAM); University of Michigan Museum of Zoology, Ann Arbor (UMMZ); Smithsonian Institution, Washington, D.C. (USNM); Museum für Naturkunde, Humboldt Universität, Berlin (ZMB); Zoological Museum, University of Copenhagen (ZMUC); Zoological Reference Collection, National University of Singapore (ZRC).

= number of specimens examined. Specimen 0 was drawn at random from available data when an island population was known by more than one specimen.
Seen by: D = David Dayan, M = Shai Meiri, S = Daniel Summerfelt, ns = specimen not seen by author, but locality data reported by the museum (spec. com. to Shai Meiri and Daniel Dayan). Lat = latitude, Lon = longitude.

Discussion

Some of the data in Table 1 contradict published records. Peterson (1967) lists *Mustela erminea* as absent from Unalaska. Regarding *Herpestes javanicus*, Wells (1989) explicitly states that "a claimed presence in Sumatra... is not supported", based on his measurement of the type specimen of *H. rafflesii* at the BMNH. However Chris Smeenk (RMNH) informs me that Sody (1949) claimed to have collected specimens from this island. Regarding the existence on *Viverra zangalunga* on Java, however, I know of no other records that corroborate it, apart from the two specimens I measured in Leiden and Berlin.

Insular carnivores represent great opportunities for research and often immediate target for conservation efforts. The high profile of carnivores makes them obvious candidates for the role of flagship species (Simberloff, 1998). I hope the new locality data listed here will encourage efforts in both these fronts.

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Sighting of a Sunda Otter Civet *Cynogale bennettii* in Sarawak

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On 19th October 2000, a Sunda Otter Civet *Cynogale bennettii* was seen at Samunsam Wildlife Sanctuary, western Sarawak, Malaysia. This is one of only a handful of records for Borneo, and the first for western Sarawak (see Payne *et al.* 1985). This detailed description of the sighting is documented here to address the dearth of information on this species in the wild, and to contribute towards the building of a knowledge-base for this little-known and rarely seen animal. Few naturalists have ever observed the animal in the field, anywhere in its world range (peninsular Thailand and Malaysia, Borneo and Sumatra; Schreiber *et al.* 1989).

The Site

Samunsam (01°57'N, 109°39'E) is Sarawak's first Wildlife Sanctuary, recently extended to 22,801 ha, and encompassing beach, level lowland dipterocarp, tropical heath, mangrove and peat swamp forests. Sub-montane forests also occur in limited extent in the highest part of the Sanctuary (1,369 m asl) on the northern slopes of the Mount Pueh massif, which reaches 1,600 m, and is the highest western outlier of Borneo's central mountain spine. The Sanctuary shares its western boundary with the Malaysian-Indonesian international border.

The Sighting

It was a wet and overcast day, with a brief shower between 14h00 and 15h00. The evening was heavily overcast with threat of further rain, with another 15 min shower at 17h00. At 17h15, I was walking the main trail from the sanctuary headquarters into the forest trail grid system. Along this trail, at 17h40, I heard an animal digging on the forest floor, at a distance of about 20 m. Scanning the dark forest floor with binoculars, I spotted the animal's location from leaves being flung up into the air. The animal was digging amongst the leaf litter at the base of a rattan bush.

I moved to get into a better position to observe the animal. My movement alerted the animal to my presence. It froze for about 5 seconds, then darted about 10 m in a straight line, to a position about 10 m from me. My first sight of the animal as it moved was that it had white on its head and face.

The animal was behind a branch, allowing a view of only the back half of its body. The animal had a dark brown pelage, with a short tail. The hind-quarters was evenly coloured dark greyish brown, with a distinct grizzled appearance. There were longer, lighter-coloured hairs sticking out from its lower back, contrasting with the even-brown colouring of the body. The animal was breathing heavily, causing its entire body to heave.

I observed this animal for about 20 seconds, then it darted off, again in a straight line from my left to right, across the trail and into the forest. The trail was about 3 m wide, and completely clear of vegetation, giving a clear view of the animal as it crossed the trail, about 6-7 m from my position.

The animal was about 1 m long. It had very long greyish (not white) whiskers, held flush along its sides without touching the ground as it moved. The whiskers reached almost midway down its

flanks. The entire back was grizzled, giving the animal a silvery appearance towards the back half of the body. It had short, black legs. The tail was short and thick, tapering slightly to its tip, entirely dark brown without grizzling, and in length was about 25% of the total length (nose to tip of tail) of the animal.

No clear view was obtained of its head, but there was clear white on the face and above the eyes. It was not possible to ascertain the shape of the head. When the animal was seen moving in the open, the white on the face, and on the head was obvious, but the exact markings and patterns could not be determined.

The area where it was seen digging was damp but not waterlogged. The leaf litter was scattered and the soil disturbed, but no claw marks were evident. While the animal was observed shifting the leaves with its feet, the scouring of the soil appeared to have been done with the muzzle rather than the feet, reminiscent of areas dug up by wild pigs *Sus* spp.

The Location and Habitat

The animal was sighted in level dry lowland mixed dipterocarp forest, with an estimated elevation of not more than 5 m above sea level. The animal was first observed close to a small, 2 m wide, forest stream, about 5 m from the water's edge. The trail crosses this stream, with a small wooden bridge over it. The stream had clear water, a stony pebbled bed, with lightly vegetated banks. The area where the animal was first observed had an open understorey, leaf-littered forest floor, with some rattan clumps.

This stretch of the stream is entirely forested, but a short distance downstream it becomes brackish and open, with palms *Oncosperma* and pandans *Pandanus* spreading across the widening watercourse before it enters the sea.

Discussion

The main features that identified this animal as an Otter Civet were the short tail, the long whiskers and white markings on the face. The short tail, thicker towards the base, excludes all the other civets on Borneo. The Malay Badger or Teledu *Mydaus javanensis* does not have an obvious tail, and has clear white markings down its entire back. The long whiskers rule out all other small carnivores in Borneo, including other relatively plain brown species such as otters and mongooses.

No other animal on Borneo, or anywhere else for that matter, has such long whiskers. The suggestions that these whiskers are tactile, and used for detecting prey in water are strengthened by the observation that despite their extraordinary length, they were stiff and the animal could hold them firmly along its sides as it moved.

The white on the face and above the eyes are consistent with descriptions of the Otter Civet. The Malay Civet *Viverra zibetha* has a black face with white on its snout, a black and white patterned throat and neck, a spotted body and a long, banded tail. Hose's Civet *Diplogale hosei* has a white muzzle, neck and underparts.

The gait of the animal was distinct. It moved in a scurrying fashion, totally unlike the gait of a typical civet (e.g. *Viverra*), which has longer legs and a more bounding movement when running. Its body was held level and close to the ground when running, without any obvious vertical or lateral flexing of the spine. This movement is best described as scuttling, and suggests a short-legged animal with a thickset torso, not unlike a badger.

The Otter Civet's apparent rarity is puzzling. Records have been obtained almost exclusively from direct sightings, rather than from camera-trapping or standard mammal survey techniques such as spot-lighting and conventional traps. Its obvious adaptations to an aquatic or semi-aquatic existence have led to suggestions that it may be largely confined to peat swamp forests. This cannot be disproved at the present, given the paucity of survey work in the peat swamps of Malaysia and Indonesia. However, this sighting adds to other records in recent years from lowland dry forest.

This sighting was obtained during wet and dim conditions, on a day that had been dreary from morning. The Otter Civet is assumed to be nocturnal, and this sighting is consistent with this postulation, being seen in the late evening in low light conditions. The significance of these weather conditions can only be speculated upon, but nevertheless, represents an interesting insight into the ecology and behaviour of this enigmatic animal.

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Otter Civet at Kaeng Krachan National Park, Thailand



The note below first appeared in Bird Conservation Society of Thailand Bulletin and seems not to have been formally written up. Attempts to trace the original observer have failed, and with kind permission of the Bird Conservation Society of Thailand, the record is reproduced here, because of its outstanding interest in lying at the margin of the range of this very poorly known species.

The Editors

Reference:

- Anon. (= Round, P. D.). 1998. Otter Civet at Kaeng Krachan National Park. *Bird Conservation Society of Thailand Bulletin* 16(5):16.

Two Otter Civets *Cynogale bennettii* were seen in Kaeng Krachan National Park (12°57'N, 99°23'E°, Phetchaburi by Mrs Shanna Sheridan-Johnson on 12 March 1998, at approx. 9 a.m., along the road in lowland forest between the km 15 and km 18 markers. They descended to a small stream at the side of the road and, a few seconds after reaching the water, noticed the observer's presence and scurried away (but not before all the salient features had been noted). They were brown in colour, had short, broad tails, partially webbed feet, wide mouths/snouts, and very long whiskers. The underfur was said to be buffy, with grey tips at the end of the hairs. Does anyone else know of any confirmed recent records of this species? The request for further information produced no other records.

Otter Civet Cynogale bennettii
Photo: Wassenaar Wildlife Breeding Center

A Large-spotted Civet *Viverra megaspila* record from a mid-altitude plateau, Lao PDR

Khamkhoun KHOUNBOLINE



The Large-spotted Civet *Viverra megaspila* is rather rarely recorded across its range and was identified by Schreiber *et al.* (1989) as a priority for field surveys to locate

surviving populations, and for explanation as to the causes of its apparent rarity. Since then, there have been various field records from several countries. These were reviewed by Lynam *et al.* (2005), who found that overwhelmingly records came from below 300 m altitude; in the context of recent forest conversion across many countries of the species's range, such an altitudinal restriction could alone be responsible for the recent scarcity of records. Lynam *et al.* (2005) referred to two unpublished records from higher areas, and this note documents one of these.

On 28 September 2001, I was on the Nakai plateau, central Lao People's Democratic Republic, and found in Ban Thalang (= Thalang village; former name Ban Namtheun; 17°51'N, 105°03' E) a freshly-killed Large-spotted Civet. It was distinguished from Large Indian Civet *V. zibetha* by the bold and sharply-edged black spotting on the dorsum, with an upper row of spots amalgamating as a horizontal bar towards the tail base, and the tail pattern, of a dark dorsal stripe over bold dark rings. As the species can be difficult to identify (see Duckworth, 1994), I photographed the animal (Fig.) and these features are clearly visible.

Ban Thaleng lies at ca. 520 m and is thus significantly higher than the other recent field records presented in Duckworth (1994, 1997), Austin (1999) and Lynam *et al.* (2005). Although the animal was seen in a village and the precise hunting site is unknown, it can safely be assumed to be at this altitude or perhaps slightly higher. The Nakai plateau covers 1,250 km², is largely flat and supports a mosaic of pine and broad-leaved evergreen forest at 500-600 m. Hillocks dominated by broadleaf forest occur, particularly in its east (Thewlis *et al.* 1998). Hunting has been heavy in this area since at least the early 1990s. All evidence suggests that wildlife meat eaten on the plateau is killed locally and that none is brought in: to the contrary, much wildlife is exported from the plateau to towns in the province and further afield (Nooren & Claridge, 2001:181-182). Moreover, Ban Thaleng is 25 km from the western edge of the plateau and the nearest habitat below 300 m altitude.

This single record should not be taken to indicate that Large-spotted Civet might occur widely up to this altitude. Firstly, it is probably rare on the plateau. None was seen in extensive mammal surveys, including spot-lighting and examination of hunted animals, during 1994-1995 (Duckworth, 1997; Evans *et al.* 2000). This work found Large Indian Civet regularly, and so would presumably also have turned up Large-spotted Civet, if it were at all common in the area. Ecologically, the plateau is somewhat anomalous for its altitude. It supports populations of various birds (which have been much more thoroughly surveyed across Lao PDR than have small carnivores) more typical of lower-lying areas. This presumably reflects its almost level topography, in contrast to the

rugged hills over much of much of Lao PDR (Evans & Timmins, 1998). In this context, it would not be so surprising also to find on the plateau some mammal species above their usual altitudinal range. This is also the most northerly record in Lao PDR, although this may mean little because the species has been camera-trapped far to the north in Kachin State, Myanmar (Lynam *et al.* 2005).

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A short note on the activity patterns of *Viverra tangalunga* and *Paradoxurus hermaphroditus* in a secondary forest in Peninsular Malaysia

Mohd. AZLAN J. bin Abd. GULAM AZAD

This note examines the activity patterns of some viverrids using camera trap photographs. The information on viverrids was gathered during a camera trapping study on Tigers *Panthera tigris* at Jerangau Forest Reserve in Terengganu, Malaysia (Azlan & Sharma, 2003), which was conducted from February 2000 until October 2001. This accords with Kawanishi's (2001) call for the use of auxiliary data on non-target species from camera-trapping studies. The cameras were set at approximately 50cm above the ground targeted on terrestrial animals. Detailed information on camera setting and study site has been described in Azlan & Sharma (2003). A total of 2,226 photo records of identifiable wildlife were recorded, in which 42% of the diversity of mustelids, viverrids, and herpestids that occurs in Peninsular Malaysia was identified (Azlan, 2003).

In order to calculate activity level, the date and time imprinted on the photograph, were used. Using the methodology of Wong *et al.* (2003), the number of photographs taken at various times were related to activity periods. During the study, some of the photos without a time record were discarded from analysis. This has enabled estimates of activity level only for Malay Civet *Viverra tangalunga* and Common Palm Civet *Paradoxurus hermaphroditus*, based on 19 and 14 filtered photographs respectively. Photo records within the range of 1800-0600hrs were grouped as nocturnal activities while within 0600-1800hrs were grouped as diurnal activities.

The percentages of activity level for each species were calculated as:

$$\left(\frac{I_i}{\sum I} \right) \times 100 \dots \dots \dots (1)$$

Where I_i is the number of filtered photos at each hour and $\sum I$ is the total number of filtered photos for 24 hours period along the study conducted.

Viverra tangalunga a ground dwelling civet (Medway, 1978) while *P. hermaphroditus* is largely aboreal (Payne *et al.* 1985). Figs. 1 and 2 show that both species are predominantly crepuscular. Nocturnal activities of *V. tangalunga* showed at least two distinct peaks, immediately before dawn and shortly before dark. This finding is consistent with Colón, (2002), where an experiment using radio telemetry showed *V. tangalunga* was found active between 1800 hrs and 0700 hrs.

This suggests a period of rest between 08:00 hrs to 1800 hrs, and 0700 hrs to 1800 hrs for *V. tangalunga* and *P. hermaphroditus* respectively. Very low terrestrial activities diurnally suggest that these animals may avoid confrontation with larger predators such as Tigers *Panthera tigris* and Leopards *P. pardus*, which occur in this study area. *P. hermaphroditus* also shows a higher nocturnal activity level compared with *V. tangalunga* (Table 1).

1-19

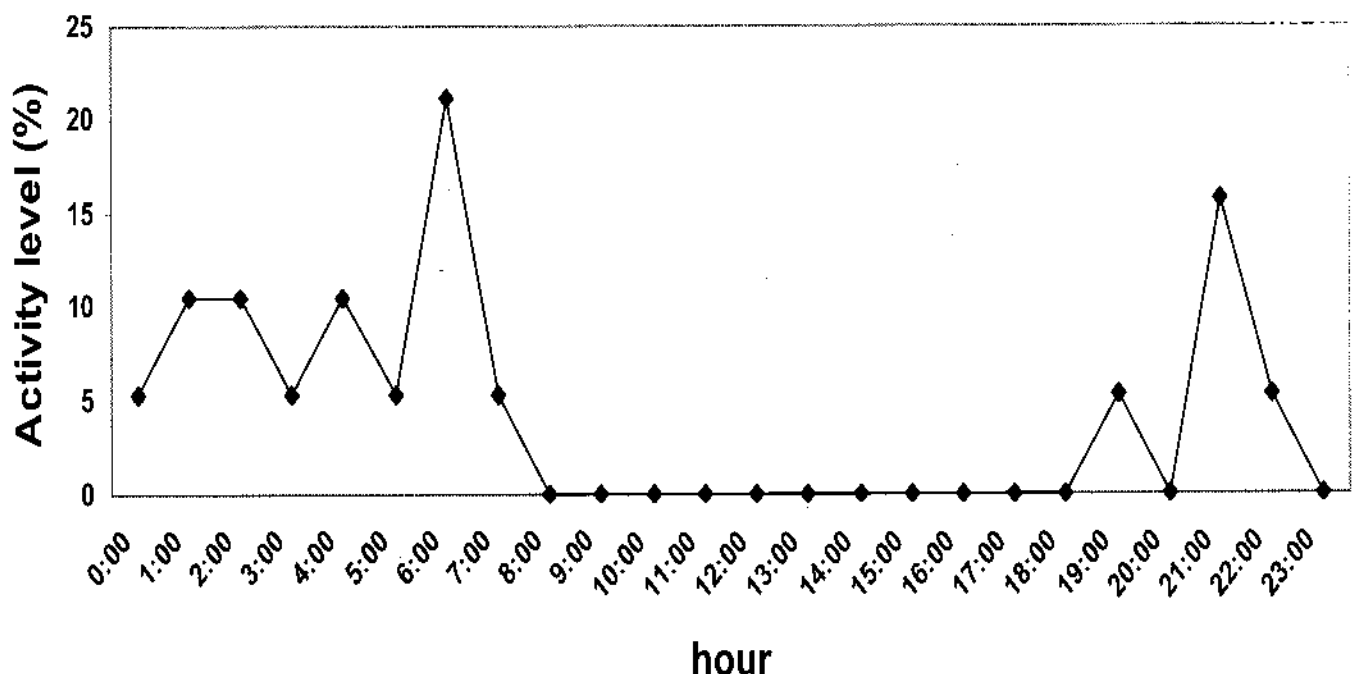


Fig. 1. Activity level of *V. tangalunga* recorded in a secondary forest in Peninsular Malaysia.

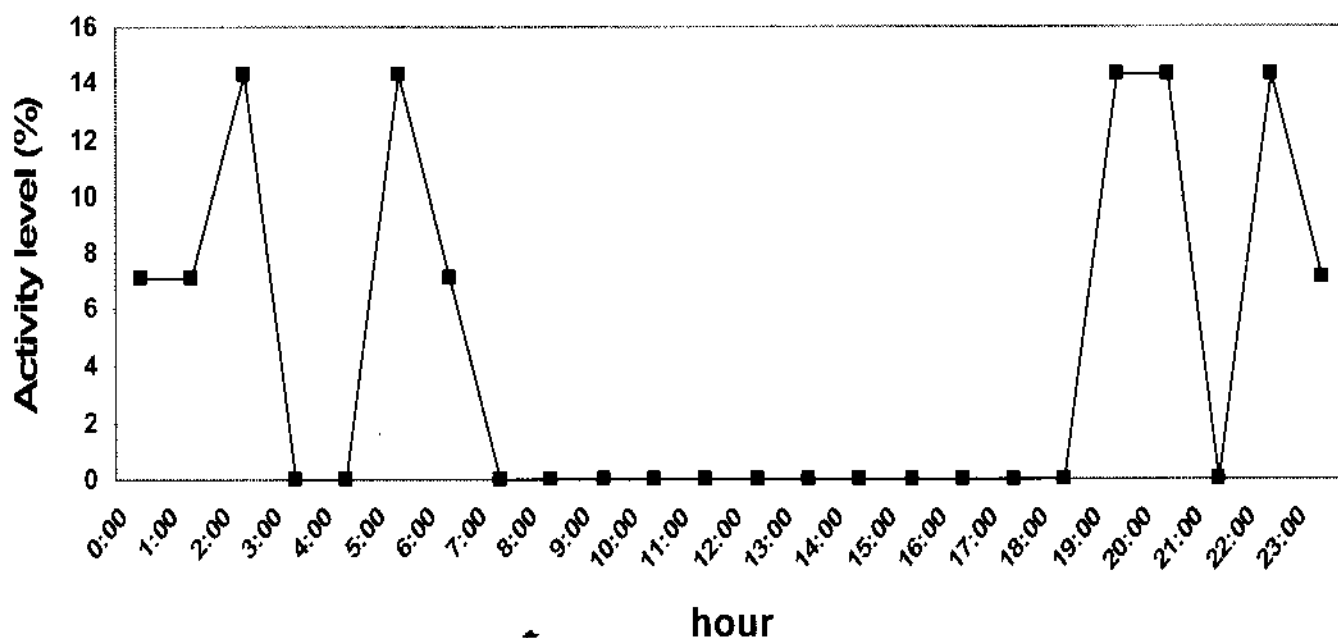


Fig. 2: Activity level of (%) *P. hermaphroditus* recorded in a secondary forest in Peninsular Malaysia

Table 1. The percentage of nocturnal and diurnal activity level for *P. hermaphroditus* and *V. tangalunga* recorded in a secondary forest in Peninsular Malaysia

SPECIES	COMMON NAME	(I)	%NOCTURNAL	%DIURNAL
<i>P. hermaphroditus</i>	Common Palm Civet	14	93	7
<i>V. tangalunga</i>	Malay Civet	19	74	26

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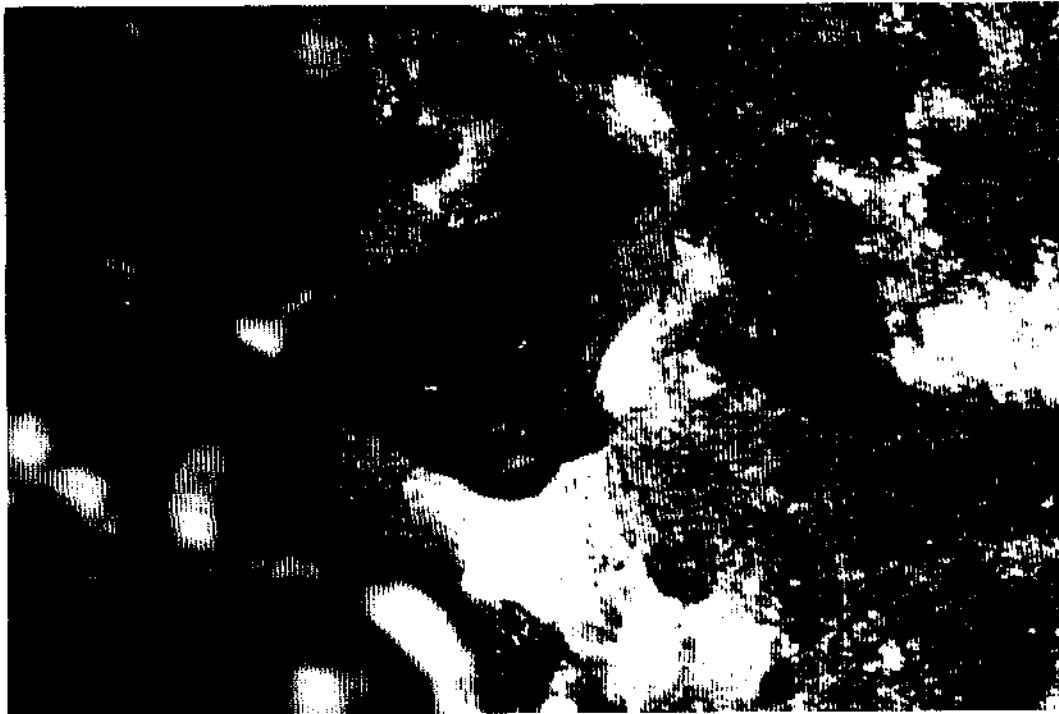
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*The Nigiri Marten *Martes gwatkinsii*, one of the rare endemic mammals of the Western Ghats, photographed from Silent Valley National Park, Kerala – Photo: Sibi. M)*

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