

Small carnivore records from the Cardamom Mountains, southwestern Cambodia

Jeremy HOLDEN and NEANG Thy

Abstract

Few specific data are available on the occurrence of small carnivores in Cambodia either historically or recently. Presented here are the results from camera-trapping (targeted at other species) at several sites in the Cardamom Mountains, including wetlands and hill forest. These are supplemented by records from other methods. Excepting the arboreal Small-toothed Palm Civet *Arctogalidia trivirgata* and uncertainty over how many species of otter are present, all the small carnivores that could reasonably be expected to inhabit this part of Cambodia were recorded by at least one method during the surveys, which spanned 2000 to 2009. This included the second record of Spotted Linsang *Prionodon pardicolor* from Cambodia. Significant numbers of otters (*Lutrinae*) and Large-spotted Civets *Viverra megaspila* remain, although these have declined widely across South-east Asia. Small carnivores in this area are harvested through generalised hunting and as by-catch for quarry species of large carnivores and herbivores, but no evidence was found that any species was itself a highly-sought quarry.

Keywords: *Arctictis binturong*, *Arctonyx collaris*, conservation status, distribution, otters, *Prionodon pardicolor*, *Viverra megaspila*

សេចក្តីផ្តើម

ទិន្នន័យសំខាន់ៗមួយចំនួន ល្អិតវត្តមាននៃមីសាសីសត្វតូចៗនៅក្នុងប្រទេសកម្ពុជា បានធ្វើកំណត់ត្រាតាំងពីអតីតកាល ក៏ដូចជា ក្នុងពេលថ្មីៗនេះ។ នេះ គឺជាការបង្ហាញលទ្ធផលដែលបានមកពីការដាក់ម៉ាស៊ីនថតស្វ័យប្រវត្តិ (ដែលមានគោលដៅលើប្រភេទ ផ្សេងៗ) ពីកន្លែងមួយចំនួននៅក្នុងតំបន់ភ្នំព្រាវាយ រាប់បញ្ចូលទាំងតំបន់ជីសើម និងព្រៃភ្នំពងឈៃ។ លទ្ធផលទាំងនេះ ត្រូវបានបំពេញ បន្ថែមដោយកំណត់ត្រាផ្សេងៗ ដែលបានមកពីមធ្យោបាយផ្សេងៗទៀត។ ក្រៅពីសំបោចអុជខ្នង *Arctogalidia trivirgata* និងភាព មិនមានច្បាស់លាស់នៅឡើយអំពីថា តើមានសត្វហើមប្រភេទ ដែលមានវត្តមាននោះ មីសាសីសត្វតូចៗទាំងអស់ដែលបានឃើញថា តា បានរស់នៅក្នុងតំបន់នៃប្រទេសកម្ពុជា ត្រូវបានធ្វើកំណត់ត្រា យ៉ាងហោចណាស់ក៏តាមវិធីសាស្ត្រមួយ ក្នុងអំឡុងពេលនៃការ ស្រាវជ្រាវចាប់ពីឆ្នាំ ២០០០ ដល់ ២០០៩។ កំណត់ត្រាលើកដំបូងនៃកំពុងចូលមុខ *Prionodon pardicolor* ពីប្រទេសកម្ពុជា ក៏ត្រូវ បានរាប់បញ្ចូលផងដែរ។ ចំនួនហើម *Lutrinae* និងសំបោចធំ *Viverra megaspila* នៅមានវត្តមានច្រើនត្រូវបានរាយការណ៍សំគាល់ នៅឡើយ បើទោះជាចំនួននេះត្រូវបានថយចុះប្រសិនបើទាំងតំបន់អាស៊ីអាគ្នេយ៍ក៏ដោយ។ មីសាសីសត្វតូចៗនៅក្នុងតំបន់ ទាំងនេះ ត្រូវបានធ្វើអាជីវកម្មតាមរយៈនៃការប្រមាញ់ និងការចាប់ដោយចៃដន្យ នៅពេលដែលអ្នកប្រមាញ់បានសំដៅលើវា មីសាសីសត្វ និងគីណាស៊ី។ ក្រៅពីនេះ វាមិនមានភស្តុតាងដែលបញ្ជាក់ថា មីសាសីសត្វតូចៗជាប្រភេទដែលជាគោលដៅសំបាប់ការ ប្រមាញ់នោះទេ។

ពាក្យគន្លឹះ: *Arctictis binturong*, *Arctonyx collaris*, ស្ថានភាពអភិរក្ស រចាយ ហើម *Prionodon pardicolor*, *Viverra megaspila*

Introduction

The Cardamom Mountains region of southwestern Cambodia spans more than 20,000 km², following the northern margin of the Gulf of Thailand (Daltry & Momberg 2000). The range begins in the Khao Soi Dao Mountains of Thailand and extends 225 km southeast to the Elephant Mountains of Bokor National Park, east of Kampot. This wild and remote region is composed of forest-covered peaks and foothills separated by low-lying basins and valleys. Phnom Aural at 1,771 m is both Cambodia's tallest peak and the highest point in Cardamom range. In the west, Phnom Samkos and Phnom Tumpor reach 1,717 m and 1,551 m., respectively; while peaks in the Central Cardamoms reach elevations of 1,400 m. These mountains in Cambodia include five protected areas: the Phnom Samkos Wildlife Sanctuary; the Phnom Aural Wildlife Sanctuary; the Central Cardamoms Protected Forest; and Kirirom and Bokor National Parks. All these protected areas have only recently been established and are progressing at varying speeds towards significant on-ground protection of habitat and wildlife.

Eleven categories of habitat and vegetation type have been recognised from the Cardamoms region: dry deciduous forest (now more generally known as deciduous dipterocarp forest); mixed deciduous forest; dry evergreen forest; lowland evergreen forest; hill evergreen forest; gallery forest; bamboo thicket; pine forest; marshland; grassland; and fernland (Ashwell 1997). Rainfall is relatively heavy, averaging around 3,000 mm annually. The southwest monsoon falls in the region during May–October; while

December–April sees a prolonged dry period with infrequent rain. Temperatures show little seasonal change, averaging 25–30°C (Ashwell 1997).

Until the last decade of the 20th century, the Cardamom Mountains remained very poorly surveyed, especially for cryptic species such as small carnivores. The first recent mammal survey of the Phnom Samkos Wildlife Sanctuary, in 2000, recorded 10 species of small carnivores (excluding cats [Felidae]; Daltry & Momberg 2000). A record for *Lutra lutra* resulting from this survey was based on tracks and, following discussion in Poole (2003), it is disregarded here.

In this report we bring together small carnivore records gathered during our surveys for Fauna & Flora International in the western Cardamoms, spread across nine years. This is by no means an exhaustive review of the records available from this area, not even by FFI, let alone by the various other conservation organisations active in the area.

Survey Sites

Fieldwork was carried out in two protected areas: the Phnom Samkos Wildlife Sanctuary and the Central Cardamoms Protected Forest.

The Phnom Samkos Wildlife Sanctuary, near the northwestern end of the Cardamom Mountains, is centred at approximately 12°16'N, 103°07'E with an area of 332,566 ha (Ministry of Environment 2006). The sanctuary covers parts of three provinces,

Battambang, Pursat and Koh Kong. Between February and July 2006 a six-month camera-trapping programme was conducted on and around the two highest peaks in the sanctuary: Phnom Samkos itself, and the adjacent massif of Phnom Tumpor.

The sandstone massif of Phnom Samkos is the second highest peak in the Cardamom range. Logging operations in the 1990s cut a series of roads through the surrounding foothills and lower slopes, removing most of the commercially valuable trees. At elevations above 500 m the terrain becomes very steep and is relatively undisturbed evergreen forest for the most part. During the 2000 surveys an excursion was made to the summit, but no camera-traps were placed.

During the 2006 surveys, cameras were placed in the secondary logged forest accessed from the village of Chheu Teal Chrum (12°12'15"N, 103°07'08"E), at altitudes below 500 m. These were concentrated around or close to saltlicks used by large mammals such as Asian Elephants *Elephas maximus* and Gaur *Bos frontalis*. A second and more extensive set of cameras were placed on the Phnom Tumpor complex, a series of rhyolitic peaks clustered in a coronet-shaped massif. The approaching slopes of Phnom Tumpor are extremely steep and covered in dense bamboo thicket, while the higher areas comprise hill evergreen forest and open basaltic clearings. The base camp for these surveys was at about 1,100 m beside the permanent Ou Kran stream (12°22'06"N 103°03'26"E), one of the few areas of the peak that has water all year round.

Veal Veng Marsh (12°02'–03"N, 103°15'–18"E) consists of approximately 1,000 ha of riparian marshland with small areas of swamp forest at 560 m (Daltry 2002). It is situated in Pursat province and forms part of the Central Cardamoms Protected Forest.

Methods

The small carnivore records given in this report were collected between 2000 and 2009 during biodiversity surveys for other purposes. Records came in various ways, including sight records, hunters' trophies, and signs. Most, however, came through a series of camera-trapping programmes, operated between 2006 and 2008. Although these camera-trapping programmes targeted larger-bodied species, cameras were placed in a way that ensured smaller mammals, such as small carnivores, were recorded as well. Night surveys were frequently made in search of reptiles and amphibians, and civets were occasionally encountered; but no systematic spotlighting for nocturnal mammals was undertaken.

TrailMaster™ 1550 and 1500 Infrared Trail Monitors were used for all camera-trapping. These were fitted with Canon Sure-shot, Olympus Infinity, and Yashica T4 film cameras. Cameras were fixed to their posts with UniLoc™ tripod heads and protected with metal covers made locally in Phnom Penh. Film stock used was Fuji Superia 200 ASA. Green duct tape was used to protect any exposed cables from rodent or termite attacks. No baits or lures were used. Cameras were set to record both day and night.

Cameras were placed to target many different species, from Asian Elephants to Siamese Crocodiles *Crocodylus siamensis*. Without exception, the infrared beam was positioned to pass within 8–20 cm above the ground, low enough to record most small carnivores.

During a six-month period between January and July 2006 a total of 25 camera placements was made on Phnom Samkos and Phnom Tumpor. This programme produced a total of 2,097 trap-days: 517 trap-days on Samkos and 1,580 trap-days on Tumpor.

Camera-traps targeting crocodiles were set in Veal Veng marsh over the two dry seasons (late December of the previous calendar year to late March) of 2007 and 2008. The 12 cameras set during the 2007 programme, in addition to targeting crocodiles, were also placed in adjacent forested areas to assess general mammal presence. This programme totalled 1,194 trapping days. The five traps set during the 2008 programme operated for approximately 370 trapping days, and were concentrated solely on crocodiles. In spite of this targeting, three species of small carnivore were recorded.

Species Accounts

Table 1 lists all species recorded during the surveys and summarises their distribution as documented. The pictures on the back cover are those of small-carnivores camera-trapped in Cambodia.

Yellow-throated Marten *Martes flavigula*

This mustelid was only camera-trapped during daylight hours, often in pairs, on both Phnom Samkos and Phnom Tumpor. A single animal was also observed at midday in secondary logged forest below Phnom Samkos. The Cambodian animals have a strikingly pale body colour compared with Sundaic specimens, which are overall dark brown with a yellow throat. Martens camera-trapped in the Cardamoms showed a pale buff body colour with dark hind quarters, front legs and tail. The face was also dark with a black bar from behind the ear shading the yellow throat.

Hog Badger *Arctonyx collaris*

On Phnom Tumpor this species regularly appeared on camera-traps set along forested ridge paths at 1,000–1,200 m. A single animal was also camera-trapped at night on the foothills of Phnom Samkos in very disturbed habitat at 300 m. Of the 15 camera-trap records, seven were made at night, with an equal number for daylight hours. A single crepuscular image was made at 06h18. The Tumpor area is difficult of access and suffers minimal human disturbance, so these data probably reflect the natural behaviour patterns of this species. Animals were generally consistent in pelage tone and pattern with each other, and showed a paler, yellower, colour than J.H. is used to from Sumatra (see Holden 2006); this is consistent with pelage differences noted by Helgen *et al.* (2008), who separated the Sumatran population as a separate species Sumatran Hog Badger *A. hoevenii*. As in Indonesia and Vietnam (own data), locals refer to this animal as a species of pig: the commonly used Khmer name is *Chruk Poun*, *chruk* being pig.

Ferret badger *Melogale sp(p)*.

Ferret badgers were recorded twice on different camera-traps set on Phnom Tumpor. Both images were taken at night on cameras placed beside animal wallows, which during the dry season were also used as drinking holes by various other species. Due to the difficulties of distinguishing between Large-toothed Ferret Badger *M. personata* and Small-toothed Ferret Badger *M. moschata* (both of which might occur in Cambodia) these records must remain indeterminate. Evidence from the lowlands south of the Cardamoms and from eastern Cambodia has recently confirmed that at least *M. personata* is present in Cambodia (Schank *et al.* 2009).

Hairy-nosed Otter *Lutra sumatrana*

Hairy-nosed Otter is known in Cambodia from the vicinity of the

Table 1. Small carnivores recorded in the Cardamom mountains.

Species	Scientific name	Location	Altitudes	Habitat Type	CTR	Method
Yellow-throated Marten	<i>Martes flavigula</i>	PT, PS	300–1,200	SEF, PEF	5	O, C
Hog Badger	<i>Arctonyx collaris</i>	PT, PS	300–1,200	PEF	15	C
Ferret badger	<i>Melogale</i> spp.	PT	1,000–1,200	PEF	2	C
Hairy-nosed Otter	<i>Lutra sumatrana</i>	VV?, PS	500–560?	PEF, SF?	5?	C?, H
Smooth-coated Otter	<i>Lutrogale perspicillata</i>	SB	300?	PEF	0?	H
Oriental Small-clawed Otter*	<i>Aonyx cinereus</i>				0	
Large Indian Civet	<i>Viverra zibetha</i>	PT	800–1,300	PEF	18	O, C
Large-spotted Civet	<i>Viverra megaspila</i>	VV	250?; 560	M, DD?	13	C
Small Indian Civet	<i>Viverricula indica</i>	SB, VV	250?; 560	M, DD?	22	C
Spotted Linsang	<i>Prionodon pardicolor</i>	PT	1,200	PEF	1	C
Common Palm Civet	<i>Paradoxurus hermaphroditus</i>	PS, PT, VV	300–1,000	SEF, PEF	24	C
Masked Palm Civet	<i>Paguma larvata</i>	PT	1,000–1,200	PEF	3	C
Binturong	<i>Arctictis binturong</i>	PT	250?	?	0	H
Small Asian Mongoose	<i>Herpestes javanicus</i>	SB	100	V	0	O
Crab-eating Mongoose	<i>Herpestes urva</i>	PT, PS	1,000–1,200	SEF, PEF	28	O, C

Codings refer to records from the authors' surveys; records from other sources are given in the species accounts.

Location: PS, Phnom Samkos; PT, Phnom Tumpor; SB, Samkos Basin; VV, Veal Veng.

Habitat: SEF, Secondary evergreen forest; PEF, Primary evergreen forest; SF, Swamp forest; M, Marshland; DD, Dry Dipterocarp; V, Village.

CTR: Camera-trap record, with the number referring to independent events, not number of images.

Method: O, Observed in the wild; C, Camera-trapped; H, Captive or dead animal (where objective validation of identification was possible and import from another area seemed unlikely).

*This species was not recorded on the present surveys.

flooded forest of Tonle Sap (Poole 2003). Its presence in the Cardamom Mountains was finally confirmed after examination of a skin in Chhe Teal Chrum village, Pursat province, reportedly hunted in 2006 from the Ang Krang River at the foot of Phnom Samkos. The Ang Krang is a small stream flowing through hilly primary and secondary logged forest at about 400 m altitude. Despite having been reportedly stored in a village house for the past three years, the skin was still in good condition, retaining the pads and claws, and clearly showing the hair-covered rhinarium, the chief diagnostic feature of this species (Lekagul & McNeely 1977). The ground colour was chocolate brown, shading into a darker tone on the head and along the dorsum and tail. The whitish coloration of the throat was not extensive, extending no further than the length of the head. It showed a slight yellowish tint that may have been caused by exposure to wood smoke. The white coloration on the upper lip was irregular in thickness, ranging from a few millimeters to almost 1 cm in places. Measurement from snout to tail tip was recorded at 125 cm. After skinning the otter, the hunter had eaten it, reporting that the flesh was not very palatable. None of the skeleton remained. The skin was left in the possession of the hunter.

Between January 2007 and March 2008, on three camera-traps set for crocodiles, a series of six photographs showing a large, dark-coloured, otter, felt most likely to be Hairy-nosed Otter, were made in Veal Veng marsh. The cameras were set close to an area of permanently flooded forest, constituent tree species not determined (12°02'5.3"N, 103°15'51.5"E), at 560 m. All six photographs were taken during daylight hours. When questioned about otter presence, hunters usually described three types: two

large types, one of which they referred to as 'black' and one as 'brown'. The 'black' type they described as usually solitary; while the 'brown' species lives in 'groups' and has a flatter tail, which probably relates to *Lutrogale*. The third type appears to be *Aonyx*, reported as 'grey', much smaller, and known from rivers, where it occurs in 'groups'.

Smooth-coated Otter *Lutrogale perspicillata*

Two fresh skins identified as Smooth-coated Otters were seen in the possession of wildlife traders travelling along the Anglong Reap road during the 2000 survey of Phnom Samkos; they reportedly came from the Tum Yong River (Daltry & Momberg 2000). Local hunters described otters apparently of this species (see Hairy-nosed Otter).

Oriental Short-clawed Otter *Aonyx cinereus*

Short-clawed Otter was reported as 'observed' in lowland evergreen forest of the Central Cardamoms during the 2000 survey (Daltry & Momberg 2000), but no further details are given. Spraints around Phnom Tumpor in 2007 possibly belonged to this species. This suggestion was made because the spraints were found mid-stream along forest rivers on small rocks. Local hunters described otters apparently of this species (see Hairy-nosed Otter), but at present no verifiable records from the Cardamoms seem to be available.

Large Indian Civet *Viverra zibetha*

In Phnom Tumpor this was a very common civet, recorded regularly on the camera-traps. All records were made at night in forest

at altitudes of 800–1,300 m. One bold animal was observed at night foraging around our forest camp at about 800 m.

Large-spotted Civet *Viverra megaspila*

Viverra megaspila and *V. zibetha* did not appear to be syntopic in the Cardamoms. While *V. zibetha* was common in the hill forests of Phnom Tumpor, *V. megaspila* was only recorded in the open marshland and fragment forests of Veal Veng, where it was camera-trapped 13 times. Large-spotted Civet is believed to occur at lower altitudes than does Large Indian (Lynam *et al.* 2005) and this appears to be the case in the Cardamoms. However, the Veal Veng marsh, at 560 m, is higher than areas from which *V. megaspila* records with precise altitudes have typically come (Khounboline 2005). Lower altitudes than this (250–300 m) in the heavily logged evergreen forest around Phnom Samkos did not produce any records of this species, perhaps suggesting it prefers more open habitat. It seems unlikely that this species was absent from Samkos through over-hunting: human presence in the area was low and no traps targeting civets or small mammals were seen. It is possible that viverrid tracks seen in the deciduous forests of the Samkos basin (where no camera-traps were set) belonged to this species, as it occurs in the landscape dominated by deciduous dipterocarp forests of Monduliri province, northeastern Cambodia (T. Gray, WWF Greater Mekong Programme, *in litt.* 2008), although R. J. Timmins (*in litt.* 2009) knows of few, if any, records from such forest itself within Cambodia. In Veal Veng this civet was camera-trapped in the centre of the marsh, some distance from any tree cover, and was frequently recorded moving close to the water's edge. Footprints, presumably from this species, were occasionally seen skirting pools and drainage channels. This civet's habit of foraging close to water, plus its cat-like footprints, seem likely to have led to frequent erroneous reports, from both field biologists and local hunters, of Fishing Cat *Prionailurus viverrinus*. Local people often use the term *kla trey* ('fish cat') for both species, even when shown photographs. Unlike *Viverricula indica*, no individuals were photographed with obviously wet fur, suggesting they are not entering the water at all frequently, if at all.

Although Large-spotted Civet was not recorded in Cambodia until recently (by Walston *et al.* 2001), a variety of surveys (the results remaining, to date, largely unpublished; e.g. J. L. Walston *in litt.* to Lynam *et al.* 2005) suggest that Cambodia is among the countries retaining the largest populations of this generally much-decreased civet (Lynam *et al.* 2005).

Small Indian Civet *Viverricula indica*

Records of this small civet were restricted to Veal Veng and village roads through the deciduous dipterocarp forests of the Samkos basin. In Veal Veng this species appeared on camera-traps every week, both in open marshland, and in the small forest areas that followed the water courses flowing through the marsh. It was often recorded close to water, and on occasion photographs showed individuals with wet fur, as if they had just been in the water. An alternative possibility is that they had been drenched by foraging in dewy grass, but this seems less likely because Large-spotted Civet, also abroad in such habitat, was never photographed with wet fur. The only records from the Samkos basin were from footprints, apparently belonging to this species, along roads and beside drying-out pools near the village of Chheu Teal Chrum at about 250 m.

Spotted Linsang *Prionodon pardicolor*

A single photograph was taken of a Spotted Linsang in May 2006 on a camera-trap set at about 10 cm from the ground, in primary evergreen forest on Phnom Tumpor. The photograph was made at night along a forest trail and represents the first record of a linsang in the wild from Cambodia. Spotted Linsang is known from all countries neighbouring Cambodia, Laos (e.g. Evans *et al.* 1994), Vietnam (e.g. Long & Minh Hoang 2006) and Thailand, where it was reported as 'very rare and localized' (Van Rompaey 1995). Thus, its occurrence in Cambodia is not unexpected. The only previous country record was of a dead animal collected from a hunter, which presumably originated from the nearby Kirirom National Park (Kong Kim Sreng & Tan Setha 2002), an outlying branch of the Cardamom Mountains.

Linsangs are often thought to be mainly arboreal, but various records have been made with camera-traps, showing animals on the ground. This is perhaps because they forage through the lower shrub layer (Kuznetsov & Baranauskas 1993, Van Rompaey 1995). One method successfully employed to camera-trap these small animals is to place cameras focused on fallen trees, logs or low buttresses. Camera placements like this have repeatedly secured photographs of Banded Linsang *P. linsang* in Sumatra (Holden 2006) and of Spotted Linsang twice in Vietnam (Long & Minh Hoang 2006).

Common Palm Civet *Paradoxurus hermaphroditus*

This civet was recorded on camera-traps set around Phnom Samkos at 300 m (three records) and in the forested areas around Veal Veng marsh (20 records). All camera-trap records were made at night. On Phnom Tumpor a single image was made at about 1,000 m in primary forest. As with *Viverricula indica*, individuals around Veal Veng were camera-trapped with wet fur.

Masked Palm Civet *Paguma larvata*

Duckworth (1997) suggested that this is a hill and montane species in adjacent Laos (although this is clearly not so throughout its range: it occurs as low as 100 m in Sumatra; Holden 2006) because all records there were from over 500 m. Findings in the Cardamoms were consonant with this: records were obtained only above 1,000 m, and only on Phnom Tumpor. All three records were made at night.

As with Yellow-throated Marten, this species showed markedly different pelage coloration from animals in Indonesia. Cambodian individuals show a pale, buff, ground colour, with dark feet and terminal portion to the tail (which lacks the white tip seen in Sumatran animals). The face and head are black with a white central stripe running from above the snout, across the top of the head, through to between the shoulders.

Binturong *Arctictis binturong*

The single Binturong record was of a trapped animal confiscated in the village of Tumpor (12°22'40"N, 103°06'18"E) and released by park rangers. As this is a remote village with poor road access, it is safe to conclude that the animal was caught locally.

Small Asian Mongoose *Herpestes javanicus*

Small Asian Mongoose never appeared on camera-traps, either because it was small enough to pass undetected, or more likely, because no camera-traps were set in the kind of disturbed habitat it uses (e.g. Than Zaw *et al.* 2008, and references therein). During

the period of fieldwork, one individual was seen crossing the main Pramouy–Pursat road (at 12°18'31.7"N 103°31'53.3"E) at about 100 m close to a village, at around midday. Daltry (2002) recorded this species around Veal Veng marsh.

Crab-eating Mongoose *Herpestes urva*

Crab-eating Mongoose was regularly photographed on Phnom Tumpor but was found only occasionally on Phnom Samkos. It was also observed once at 12h00 on Phnom Tumpor foraging in forest at about 1,000 m. It was not recorded in the more open habitat of Veal Veng marsh and adjacent forests. Although commonly camera-trapped near water, it also frequented ridge trails through drier areas of forest. Despite reports that it is infrequent at higher elevations (Van Rompaey 2001) in the Cardamoms it was especially common above 1,000 m. As in Laos, Myanmar and elsewhere (Duckworth 1997, Than Zaw *et al.* 2008), it appears to be strictly diurnal in the Cardamom Mountains: all camera-trap records were during full daylight, usually in the morning.

Discussion

These opportunistic records documented nearly all species of small carnivores known from Cambodia, or likely to occur. The most obvious exception is Small-toothed Palm Civet *Arctogalidia trivirgata*, which was recorded in eastern Cambodia by Walston & Duckworth (2003) and, given its known range in Thailand adjacent to the Cardamoms (e.g. Khao Yai National Park; Duckworth & Nettelbeck 2008), it is likely that it occurs in the survey area. It is, however, a difficult species to camera-trap, because of its arboreal habits (Duckworth & Nettelbeck 2008). The status of Eurasian Otter *Lutra lutra* in Cambodia, if it occurs at all, is opaque (Poole 2003). The possibility that weasels *Mustela* might occur in Cambodia remains; these seem not to be well recorded by camera-trapping, at least in South-east Asia (e.g. Abramov *et al.* 2008). Owston's Civet *Chrotogale owstoni* occurs close to Cambodia, but if it enters the latter country at all it is likely to be only in the evergreen forests of the east, of limited extent, which are climatically similar to and contiguous with the species's main range in Vietnam (R. J. Timmins verbally 2006). The recently described Taynguyen Civet *Viverra tainguensis* from Vietnam is taken, following Walston & Veron (2001), to be a synonym of Large Indian Civet. In addition, Wozencraft (2005) listed Cambodia within the range of Malay Civet *Viverra tangalunga*, despite there being no records known to anyone who has surveyed mammals in the country. The 30 images of *Viverra* civets from this project do not show any Malay Civets. It is likely that Wozencraft's (2005) statement was an error, and pending a record with primary detail the species should not be considered to inhabit Cambodia. Similarly, Papeş & Gaubert (2007) seem to imply that Otter Civet *Cynogale bennettii* might be expected to occur quite widely in Cambodia, specifically in the Cardamoms, but (as they themselves indicate) there has never been any record from the country or from adjacent areas of neighbouring countries.

The main focus of the Cardamom Mountain surveys undertaken in the past three years was to determine the status of large and seriously threatened species, such as Tiger *Panthera tigris*, Leopard *P. pardus*, Asian Elephant, bears *Ursus*, and the wild cattle Gaur and Banteng *Bos javanicus*. Elephant and Gaur were regularly recorded and an Asian Black Bear *Ursus thibetanus* was recorded once, while both Tiger and Leopard remained unrecorded,

despite careful placement of camera-traps targeting these species. This seems to suggest that they have been largely exterminated from the more accessible areas of the Cardamom Mountains. This conclusion was supported by local reports of rampant hunting in the early years of the millennium. The small carnivores, at least for the moment, seem not to be the subject of targeted hunting. At present, hunting effort seems to be concentrated on the remoter peaks where snares are set to target Southern Serow *Naemorhedus sumatraensis* and bears. Dogs are used to hunt tortoises and turtles (Chelonia) and pangolins *Manis*. Small carnivores appear to be mostly victims of by-catch and of general hunting: civets and small cats caught in snares, either in those set in remoter areas for Southern Serow, or for pigs *Sus* in forest adjacent to agricultural areas. They also feature as an opportunistic catch where dogs are used, such as the case of the Hairy-nosed Otter from the Ang Krang.

The type of systematic hunting with snares as frequently found in Vietnam, where viverrids are often the main target (Long & Minh Hoang 2006), was observed only once during the survey periods, in forest adjacent to Veal Veng Marsh. These snares were reportedly set for porcupines *Hystrix* but were robust enough to catch small carnivores.

Although civets are at least occasionally eaten in Cambodia (*pers. obs.*), they are not the valued delicacy there that they are in Vietnam (Robertson 2007), but rather seem to be an opportunistic meal for protein-starved rural dwellers. However, an influx of Chinese construction labourers into Veal Veng and the administrative centre of Pramouy, working on a series of dam projects, may well change this situation, especially as civet numbers dwindle in Vietnam.

These same dam projects may well also seriously threaten the area's otters. There remain few data of which otter species use which habitats within the Cardamoms, and even how many species occur, and how well they could adapt to the habitat changes precipitated by dam-building. Otters are also occasionally caught as by-catch in fishing nets used in the marsh, but no evidence was found of specific otter hunting.

Acknowledgements

The authors wish to thank Fauna & Flora International for funding these surveys; the Cambodian Ministries of the Environment and Forestry Administration for granting permission to work in the protected areas and protected forests, and providing rangers to assist with fieldwork; Chhun Sopheap of the Cambodia Crocodile Conservation Project for running the 2008 camera-trapping programme in Veal Veng; and Will Duckworth, Colin Poole, Rob Timmins and two anonymous referees for their many useful comments and suggestions for this report.

References

- Abramov, A. V., Duckworth, J. W., Wang Y. X. & Robertson, S. I. 2008. The Stripe-backed Weasel *Mustela strigidorsa*: taxonomy, ecology, distribution and status. *Mammal Review* 38: 247–266.
- Ashwell, D. 1997. *A national biodiversity prospectus: a contribution towards the implementation of the Convention on Biological Diversity with particular emphasis upon Cambodia's terrestrial ecosystems*. IUCN Cambodia, Phnom Penh, Cambodia.
- Daltry, J. C. (ed.) 2002. *Social and ecological surveys of the Veal Veng wetland, Cardamom Mountains, Cambodia, with special reference to conservation of the Siamese Crocodile*. Fauna & Flora International Cambodia Programme, Phnom Penh, Cambodia.

- Daltry, J. C. & Momberg, F. (eds) 2000. *Cardamom Mountains Biodiversity Survey 2000*. Fauna & Flora International, Cambridge, U.K.
- Duckworth, J. W. 1997. Small carnivores in Laos: a status review with notes on ecology, behaviour and conservation. *Small Carnivore Conservation* 16: 1–21.
- Duckworth, J. W. & Nettelbeck, A. R. 2008. Observations of Small-toothed Palm Civets *Arctogalidia trivirgata* in Khao Yai National Park, Thailand, with notes on feeding technique. *Natural History Bulletin of the Siam Society* 55: 187–192.
- Evans, T., Bleisch, B. & Timmins, R. 1994. Sightings of Spotted Linsang *Prionodon pardicolor* and [Back]-striped Weasel *Mustela strigitorosa* in Lao PDR. *Small Carnivore Conservation*, 11: 22.
- Helgen, K. M., Lim, N. T.-L. & Helgen, L. E. 2008. The hog-badger is not an edentate: systematics and evolution of the genus *Arctonyx* (Mammalia: Mustelidae). *Zoological Journal of the Linnean Society* 154: 353–385.
- Holden, J. 2006. Small carnivores in Central Sumatra. *Small Carnivore Conservation* 34 & 35: 35–38.
- Khounboline, K. 2005. A Large-spotted Civet *Viverra megaspila* record from a mid-altitude plateau, Lao PDR. *Small Carnivore Conservation* 33: 26.
- Kong Kim Sreng & Tan Setha 2002. *A wildlife survey of Kirirom National Park, Cambodia*. Wildlife Conservation Society Cambodia Program, Phnom Penh, Cambodia.
- Kuznetsov, G. & Baranuskas, K. 1993. The behaviour, activity, and feeding of the Spotted Linsang (*Prionodon pardicolor*) in captivity. *Small Carnivore Conservation* 8: 5.
- Lekagul, B. & McNeely, J. A. 1977. *The mammals of Thailand*. Association for the Conservation of Wildlife, Bangkok, Thailand.
- Long, B. & Minh Hoang 2006. Recent records of and notes on the conservation of small carnivores in Quang Nam province, central Vietnam. *Small Carnivore Conservation* 34 & 35: 39–46.
- Lynam, A. J., Myint Maung, Saw Htoo Tha Po & Duckworth, J. W. 2005. Recent records of Large-spotted Civet *Viverra megaspila* from Thailand and Myanmar. *Small Carnivore Conservation* 32: 8–11.
- Ministry of Environment 2006. *Phnom Samkos Wildlife Sanctuary management plan*. Cambodian Ministry of Environment, Phnom Penh, Cambodia.
- Papeş, M. & Gaubert, P. 2007. Modelling ecological niches from low numbers of occurrences: assessment of the conservation status of poorly known viverrids (Mammalia, Carnivora) across two continents. *Diversity and Distributions* 13: 890–902.
- Poole, C. M. 2003. The first records of Hairy-nosed Otter *Lutra sumatrana* from Cambodia with notes on the national status of three other otter species. *Natural History Bulletin of the Siam Society* 51: 273–280.
- Robertson, S. I. 2007. *The status and conservation of small carnivores in Vietnam*. School of Biological Sciences, University of East Anglia, U.K. (PhD thesis).
- Schank, C., Pollard, E. H. B., Sechrest, W., Timmins, R. J., Holden, J. & Walston, J. 2009. First confirmed records of Large-toothed Ferret Badger *Melogale personata* in Cambodia, with notes on country records of *Melogale*. *Small Carnivore Conservation* 40: 11–15.
- Than Zaw, Saw Htun, Saw Htoo Tha Po, Myint Maung, Lynam, A. J., Kyaw Thinn Latt & Duckworth, J. W. 2008. Status and distribution of small carnivores in Myanmar. *Small Carnivore Conservation* 38: 2–28.
- Van Rompaey, H. 1995. The Spotted Linsang, *Prionodon pardicolor*. *Small Carnivore Conservation* 13: 10–13.
- Van Rompaey, H. 2001. The Crab-eating Mongoose, *Herpestes urva*. *Small Carnivore Conservation* 25: 12–17.
- Walston, J. L. & Duckworth, J. W. 2003. The first record of Small-toothed Palm Civet *Arctogalidia trivirgata* from Cambodia, with notes on surveying the species. *Small Carnivore Conservation*. 28: 12–13.
- Walston, J. & Veron, G. 2001. Questionable status of the “Taynguyen Civet”, *Viverra tanguensis* Sokolov, Taznov and Pham Trong Anh, 1997 (Mammalia: Carnivora: Viverridae). *Mammalian Biology* 66: 181–184.
- Walston, J., Davidson, P. and Men Soriyun 2001. *A wildlife survey of southern Mondulkiri province, Cambodia*. Wildlife Conservation Society Cambodia Program, Phnom Penh, Cambodia.
- Wozencraft, W. C. 2005. Order Carnivora. Pp. 532–628 in Wilson, D. E. & Reeder, D. M. (eds) *Mammalian species of the world*, 3rd edition. Johns Hopkins University Press, Baltimore, U.S.A.

P.O. Box 1380, 359 Street 306, Bong Keng Kang, Phnom Penh, Cambodia.
Emails: Jeremy_holden1@yahoo.co.uk;
neangthy@yahoo.com