

## Occurrence of Small Carnivores in Gandhigram Range of Namdapaha National Park, Arunachal Pradesh, India

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### Abstract

A camera-trapping survey was carried out in Namdapha National Park in Arunachal Pradesh between the study from December 2008 to November 2010, as part of a Status and Distribution of Malayan sun bear in North-Eastern, India programme. We captured 5 species belonging to 3 families of small carnivores of about 15 species that are expected to occur in the Namdapaha national park of Arunachal Pradesh. The Captured species included Large Indian Civet, Masked Palm Civet, Common Palm Civet, Crab-eating Mongoose and Yellow-throated Marten. Habitat loss and hunting are the major threats for the small carnivore survival in nature. The Small Indian Civet is exploited for commercial purpose. Hunting technique varies from guns to specially devised traps, and hunting of all the small carnivore species is common in this area.

**Keywords:** Camera-trapping, Eastern Himalaya, herpestid, mustelid, viverrid, carnivore's species.

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### Introduction

Mammals of the families Felidae, Viverridae, Herpestidae, Mustelidae and Procyonidae are generally called small carnivores. This category excludes Family Canidae. About 37 species of small carnivores are reported from India; with more than 50% of these species occur in North-East India, with some species occurring nowhere else in India (Mudappa, *in press*). They belong to the families Felidae (cats), Viverridae (civets, linsangs and binturong), Herpestidae (mongooses), Procyonidae (Red Panda) and Mustelidae (otters, martens, weasels, and badgers). Namdapaha national park may have 15 species of small carnivores, being a highly diverse group of mammals.

The current species extinction crisis is occurring at unprecedented rates and is being driven by human activities (Pimm *et al.*, 1995; Mace *et al.*, 2001; Novacek and Cleland, 2001). The limited resources available to address these issues must be targeted to maximum effect (Groves *et al.*, 2002). For many taxa a lack of knowledge, combined with a lack of popular interest has resulted in them 'slipping through the cracks' of conservation action and policy.

Small carnivore (herpestids, mustelids, viverrids) diversity is centred in two major regions in the Indian sub-continent, in the Eastern Himalaya and

North-East Hills and the Western Ghats (Sterndale, 1884; Pocock, 1939; Nowak, 1999). The high diversity of small carnivores in North-East India is due to the region being located at the confluence of three important bio-geographical realms, with several species being unique to the region within India. These include the spotted linsang, binturong, crab-eating mongoose, hog badger, two species of ferret-badgers, while several of the other civets range into other parts of India and the yellow-throated marten into the western Himalaya. In the Eastern Himalaya in Arunachal Pradesh, the diversity is greater due to the wide altitudinal range of the state resulting in a high diversity of habitat types from lowland forests to alpine areas. The rain forests have a distinct assemblage of small carnivores with nocturnal and solitary civets being the most species-rich. While many are terrestrial, some especially those in the sub-family Paradoxurinae are arboreal. The rainforests of North-East India harbour a diverse assemblage of mustelids, viverrids and herpestids, many of which are threatened by hunting in this region, yet very little information exists on their status, distribution, abundance and ecology throughout their range in North-East India (Choudhury, 1997a; 1997b; 2003; Datta, 1999) and South-East Asia apart from general status reviews of small carnivores/single

species in specific countries based on anecdotal information (Duckworth *et al.*, 1994; Duckworth, 1997; van Rompaey, 1995; Evans *et al.*, 2000; Azlan, 2003; Holden, 2006; Long and Hoang, 2006). Most information is restricted to sighting records (Nettlebeck, 1997). Anecdotal evidence suggests that hunting of most small carnivores is often retaliatory around villages when poultry is killed by some of these species. There is also accidental or opportunistic killing of these species when they are caught in snares or traps set for other animals. Hunting is mainly carried out with guns, cross-bows and a variety of indigenous traps and snares. Most species are rare and several are nocturnal precluding observational studies, therefore camera trapping is a useful method to document species richness and estimate relative abundances. However, very few studies have used this method to specifically survey small carnivores (Mudappa, 1998; Long and Hoang, 2006), most often camera traps surveys designed for other species have obtained incidental information on richness and abundance of small carnivores (Grassman, 2003; O'Brien *et al.*, 2003; Lynam, 2003; Johnson *et al.*, 2006). Much work on small carnivores have used night walks along established trails to estimate encounter rates or densities, however in many areas, these may be time consuming and labour-intensive and preclude wider spatial coverage. Density and abundance estimates vary based on habitat type. In south-east Asian forests, estimates suggest high densities of 31.5/km<sup>2</sup> for 8 civet species in undisturbed primary forest (Heydon and Bulloh, 1996), although encounter rates for most species drop in logged forests. A few studies have used radio-telemetry to study ranging patterns of small carnivores (Rabinowitz, 1991; Joshi *et al.*, 1995; Grassman, 1998; Grassman *et al.*, 2005; Mudappa, 2001), while effects of habitat fragmentation has been studied on small carnivores in the Western Ghats (Mudappa *et al.*, 2007). Namdapha and Pakke are believed to harbour 15 species of terrestrial/arboreal forest-dwelling small carnivores, apart from 2-3 species of the aquatic otters. In addition, Namdapha also harbours the red panda (*Ailurus fulgens*) and possibly high-altitude weasels in the temperate and alpine areas (Ghosh, 1987). In this chapter, we only report on the relative abundance and diversity of species that occur in the evergreen and semi-evergreen forests up to 1200m based on camera-trapping surveys carried out from 2008-2010 and on opportunistic sightings. Relative abundances of small carnivores were estimated and compared to those obtained in several other tropical forests.

### Study Site

The study was conducted within the 1985 sq.km Namdapha national park (27°23'30" - 27°39'40"N and 96°15'2" - 96°58'33"E; Fig 1) in Arunachal Pradesh, North-East India.

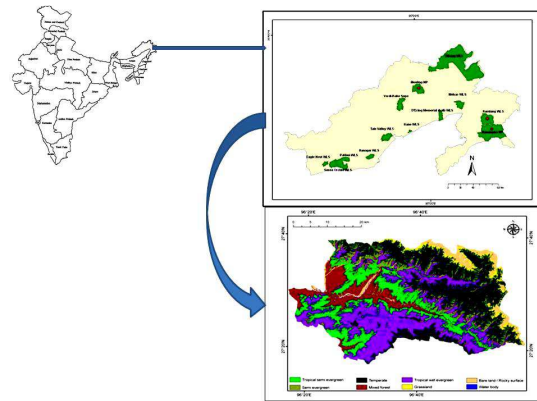


Fig 1: Map of Namdapaha National Park, Arunachal Pradesh.

The site harbours some of the northern most tropical rainforests in the world (Proctor *et al.*, 1998) and extensive dipterocarp forests. The elevation ranges from 200 to 4571 m. With increasing elevation, there is a transition in habitat to subtropical broad-leaved forests, subtropical pine forests, temperate broad-leaved forests, alpine meadows and perennial snow. Though primary forests cover most of the park, there are extensive bamboo and secondary forests. The park lies within the Indo-Myanmar global biodiversity hotspot (Myers *et al.*, 2000) at the junction of the Palearctic and Malayan bio-geographic realms resulting in a highly diverse species assemblage. With about 425 recorded bird species, Namdapha national park is a paradise for bird watchers. Further surveys in the higher altitudes are likely to add to the list. The area has five species of hornbills and several pheasant species. The area is home to several species of rare wren babblers, laughing thrushes, parrot bills, fulvettas, shrike babblers and scimitar babblers. Namdapha is one of just 2 sites known to support the snowy-throated babbler (*Stachyrei oglei*). Other rare, restricted range or globally endangered species include the White-bellied heron, Rufous-necked hornbill, Green cochoa, Purple cochoa, Beautiful nuthatch, Ward's trogon, Ruddy kingfisher, Blue-eared kingfisher, White-tailed fishing eagle, Eurasian hobby, Pied falconet, White-winged wood duck, Himalayan wood owl, Rufous-throated hill partridge, and White-cheeked hill partridge. It is one of the best places to observe and study several species of *Phylloscopus* warblers. Many migratory species range through this area in winter such as the Amur falcon,

long-billed thrush, dark-sided thrush and eye-browed thrush. Ninety mammal species are reported from the park, including nine species of felids, two bear species, 15 viverrid and mustelid species and seven primate species. Four species of mountain ungulates, red goral (*Nemorhaedus baileyi*), serow (*Nemorhaedus sumatraensis*), takin (*Budorcas taxicolor*) and musk deer (*Moschus* sp.) occur at higher elevations, while the hog deer (*Axis porcinus*) is restricted to the grassland habitat in the river valleys. Recent surveys have also resulted in two new records for India, the leaf deer (*Muntiacus putaoensis*) and the black barking deer (*Muntiacus crinifrons*).

## Methods

### Camera trapping

The study focused on an area of 160 km<sup>2</sup>, roughly encompassing the moist evergreen habitat within the Namdapha National Park below 2000 m. A uniform grid (2 x 2 km) was imposed on a map of the area. A grid size of 4 km<sup>2</sup> was selected to match the scale of other camera-trapping surveys in south-east Asia (Grassman, 2003; O'Brien *et al.*, 2003; Kawanishi and Sunquist, 2004; Johnson *et al.*, 2006). Of the 40 grids covering the study area, a random selection of 20 grids was made. All field work was carried out on foot. Given logistic difficulties in the hilly terrain, limitations of time, manpower and equipment, sampling was carried out between August 2008 and September 2010. We surveyed small carnivore species using 10 passive infra-red camera trap units (DEERCAM) and 20 Digital camera traps. In each of 20 sampled grids, two or three camera traps were deployed. Traps were deployed along animal trails, streambeds, and ridgelines, in locations with evidence of animal movement. We recorded the GPS location, altitude and other habitat parameters at each trap site. A group of highly skilled *Lisu* trackers assisted in identifying suitable locations for deploying camera traps. At every location, one passive infra-red camera trap was placed perpendicular to the expected direction of animal movement at a height of 25-35 cm from the ground. We maintained a minimum distance of 1km between trap locations. However, the traps were operational for 24 hours a day, and were removed after a period of 7 days. The number of camera trap days was calculated from the date of deployment till the date of retrieval (if film was not used up) or till the date of the final photo. A potential bias of our survey was that all camera traps were located on the ground; therefore certain species that are more reported to be more arboreal may not be captured as frequently.

All camera-traps were located on the ground; therefore small carnivores that are more arboreal will not be captured as frequently as those that are more ground-living and may even be entirely overlooked.

### Data analysis

Based on photo-capture rates of small carnivore species, an index of relative abundance was calculated as the number of days required obtaining a photo capture of a species. Photo-capture rates from the current study were compared with other studies in South-east Asia.

## Result and Discussion

### Species richness

We had a combined trapping effort of 540 trap-nights in Namdapha (2008–2010) with a total of 25 independent photos of five species. Of the 15 species of small carnivores in the tropical forests of Namdapha, five species were recorded in 350 trap-nights during the systematic survey from December 2008 to November 2010. Of the total 15 species of small carnivores (viverrids, mustelids and herpestids), only five species were recorded on camera traps (Table 1). Three civet species, the Himalayan or Masked Palm civet, the Common palm civet and the Large Indian civet, a Crab-eating mongoose and yellow-throated marten were photo-captured (Appendix 1). The yellow-throated marten is the only small carnivores that is sighted relatively often in the daytime, was also recorded on camera traps, only 7 of the 15 are true rainforest-dwelling species recorded (Datta *et al.*, 2008). These include the Himalayan palm civet, large Indian civet, Yellow-throated Marten, Ferret badger, Crab-eating Mongoose and Binturong (Table 2). We recorded three of six species of civets are believed to occur in Namdapha National Park, an additional species (the Small-toothed palm civet (*Arctogalidia trivirgata*) is believed to occur (Choudhury, 2003), although this remains unconfirmed. The common palm civet and the Small Indian civet are also reported in deciduous forest habitats, while the latter is known to occur even in degraded forests close to human habitation. The Small Indian civet was possibly not recorded as our sampling was restricted to interior primary forests. The Small Indian mongoose was also not recorded as it generally occurs in open degraded forests close to habitation. Otters were not recorded possibly because they are aquatic and only a few of our trapping locations were close to streams. The more arboreal binturong and spotted linsang were also not captured.

Table 1: Small carnivore species richness in Namdapaha National Park (2008-2010)

In India	In Namdapaha	Species Recorder	Other evidences
37	15	5	3

Table 2: IUCN Red list status of small carnivores in Namdapaha national

Family Name	Common name of species	Scientific name of species	IUCN Red list sta	IWPA Status
Viverridae	Large Indian Civet	<i>Viverra zibetha</i>	NT	II
Viverridae	Common Palm Civet	<i>Paradoxurus hermaphrodi</i>	LC	II
Viverridae	Masked Palm Civet	<i>Paguma larvata</i>	LC	II
Herpestidae	Crab-eating Mongoose	<i>Herpestes urva</i>	LC	II
Mustelidae	Yellow-throated Marten	<i>Martes flavigula</i>	LC	II

Note-Near Threatened (NT), Least Concern (LC).

Appendix 1: List of Small carnivores found in different places in NNP

Area	Specie	Latitude	Longitude	Altitude	Distribution
Gandhigram Range(70 mile)	<i>Viverra zibetha</i>	27° 23' 24.6"	96° 48' 12.5"	1010	Tropical wet ever green forest
Musala	<i>Paradoxurus hermaphroditus</i>	27° 23' 37.9"	96° 48' 12.2"	1015	Tropical wet ever green forest
Kherbari	<i>Paguma larvata</i>	27° 24' 00.3"	96° 54' 11.9"	1036	Tropical semi ever green forest
Kherbari	<i>Herpestes urva</i>	27° 24' 08.1'	96° 44' 56.9"	1076	Tropical semi ever green forest
Musala	<i>Martes flavigula</i>	27° 23' 42.2"	96° 48' 46.8"	1053	Tropical wet ever green forest

Capture rates of the Yellow-throated Marten, Common Palm Civet and Large Indian Civet were relatively high in Namdapaha compared with other Species; it, along with the Yellow-throated Marten, appears to be common.

### Species Accounts

Table 3 lists all species recorded during the surveys and summaries their distribution as documented.

#### Yellow-throated Marten (*Martes flavigula*)

This Mustelid was only camera-trapped during daylight hours, often in pairs at altitude 1053. A single animal was also observed at midday in semi ever green forest below 1000 msl. The Indian 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 Gandhigram range 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.

#### Large Indian Civet (*Viverra zibetha*)

This was a very common civet, recorded regularly on the camera-traps. All records were made at night in forest at altitudes of 1010. One bold animal was observed at night foraging around our forest camp at about 900 m.

#### Common Palm Civet (*Paradoxurus hermaphrodites*)

This civet was recorded on camera-traps set around at 1015 m (three records). All camera-trap records were made at night. On a single image was made at about 1,015 m in Tropical wet ever green forest.

#### Masked Palm Civet (*Paguma larvata*)

Table 3: Relative Abundance indices for species recorded in camera traps in Gandhigram range of Namdpaha national park December 2008 to September 2010

Species Name	Total no. of photos	No. of Camera trap days
Large Indian Civet	3	125
Masked Palm Civet	3	100
Common Palm Civet	4	209
Yellow-throated Marten	13	75
Crab-eating Mongoose	2	228

Table 4: Small carnivore’s comparison with other studies in South-East Asia

Location Reference	Namdapha (NP) Present study	Namdapha (NP) Datta, et al. (2008)	Taman-Negara (2004)	et	Phu Khieo Sanctuary, Thailand Grassman 2003	Wildl Hukaung Myanmar: Than Z et al. (2008)	Vall	
Trap nights	350	1537	14054		1224		8836	
Yellow-throated Marten	13	384	2008		1224		492	
Ferret badgers	-	384	NA		-		-	
Hog Badger	-	-	NA		408		4418	
Linsang	-	-	14054		-		2945	
Large Indian Civet	3	140	2008		68		442	
Large-spotted Civet	-	NA	-		-		8836	
Small Indian Civet	-	-	-		-		1767	
Common Palm Civet	4	384	3513		306		353	
Masked Palm Civet	3	307	2342		-		8836	
Binturong	-	4685	-	408	4685	1473	408	1473
Crab-eating Mongoo	2	768	NA		-		233	
Total species recorded	5	6	9*		5		10	

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 900 m. records were obtained only above 1,036 m, all three records were made at night.

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.

**Crab-eating Mongoose (*Herpestes urva*)**

Crab-eating Mongoose was regularly photographed. It was also captured once at 1,076 m. 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, at the elevation of 1076m usually in the morning time.

Athreya and Johnsingh (1995), recorded three civet species (Binturong, Large Indian Civet, and Masked Palm Civet) in Namdapha during a survey for the Clouded Leopard *Pardofelis nebulosa* using baited camera-traps (fowl or dried fish) with an effort of 113 trap-nights. A camera-trapping survey for the Tiger in 1996–1997 recorded only the Large Indian Civet in 451 trap-nights (Karanth and Nichols, 2000); however cameras were set up higher above ground and located along broader trails during this study and therefore may have been unsuitable for capturing small carnivores.

**Species richness and abundance: comparison with other works**

Comparisons with other studies, its need to be high trapping effort is required to capture small carnivore species in Namdapha national park. In our study we captured five species, with the efforts of 350 days trap night (Table 4). While in Namdapha; Datta et al. (2008) reported that the captured of six species with 1,537 trap-nights, while an additional species was

captured after 215 more trap-nights. In Thailand, with 1,224 trap-nights, only five species were captured (Grassman, 2003). In Laos, with 3,588 trap-nights, 11 small carnivore species were camera-trapped (Johnson *et al.*, 2006), and eight were recorded in Vietnam in 6,337 trap-nights (Long and Minh Hoang, 2006), although species-specific capture rates are not provided in the last two studies. In the Hukaung Valley, Myanmar, even after 8,836 trap-nights, only ten species were captured (Than Zaw *et al.*, 2008). In Malaysia (where the small carnivore assemblage differs somewhat from that in north-east India), only nine small carnivore species were recorded in 14,054 trap-nights. In all these studies, only about half or much less

than half (22-62%) of the total small carnivore species assemblage, predicted to be within the camera-trapped area, were captured.

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