

Records of small carnivores from in and around Namdapha Tiger Reserve, Arunachal Pradesh, India

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Abstract

For most of Northeast India's diverse assemblage of small carnivores, direct observations and ecological information are limited. Opportunistic direct observations and camera-trap records from 2008 to 2013 in eastern Arunachal Pradesh recorded 11 small carnivore species of the 20 likely to occur. Observations included the first confirmed Small-toothed Palm Civet *Arctogalidia trivirgata* sighting from India; dietary observations on five species; and hunting of two species.

Keywords: *Arctictis binturong*, *Arctogalidia trivirgata*, Binturong, Eastern Himalaya Biodiversity Hotspot, Northeast India, Small-toothed Palm Civet

Introduction

Northeast India is a distinct area for biodiversity in India: it includes two global biodiversity hotspots (Myers *et al.* 2000) and is at the junction of two biogeographic realms, the Indo-Malayan and Palaeartic. Northeast India encompasses a diversity of habitats from the Brahmaputra floodplains in Assam to alpine meadows in the upper reaches of the Eastern Himalaya. As a consequence of its biogeographic history and this ecological complexity, it harbours a stunning diversity of floral and faunal elements (Champion & Seth 1968, Mani 1974).

Namdapha Tiger Reserve is situated in the eastern portion of the state of Arunachal Pradesh, northeast India. It is at the junction of the Eastern Himalaya and Indo-Burma Biodiversity Hotspots (Myers *et al.* 2000). Sixty percent (20 out of 33) of small carnivore species known to occur in India (Mudappa 2013) are expected to occur in this reserve, comprising 16 forest-dwellers, three otters and Stone Marten *Martes foina*.

Thirteen species were confirmed in Namdapha by Athreya & Johnsingh (1995), Datta (1999) and Datta *et al.* (2008a). Additional surveys that have occurred are not formally published yet (e.g. Sarma 2012). As many small carnivores are nocturnal, direct observations and ecological information in northeast India are limited. This paper reports direct observations of 11 species (six civets, one linsang, two mongooses and two mustelids) between 2008 and 2013, including the first record of Small-toothed Palm Civet *Arctogalidia trivirgata* for the area.

Study area

Namdapha Tiger Reserve (Namdapha TR), eastern Arunachal Pradesh, India, is part of the Eastern Himalaya Biodiversity Hotspot (Myers *et al.* 2000). It covers 1,985 km² over 200–4,500 m asl. Its forests are thought to include the northernmost tropical rainforest in the world (Proctor *et al.* 1998). The reserve is known to contain over 639 plant genera (Chauhan *et al.* 1996), 137 species of mammals and almost 500 species of birds (Srinivasan *et al.* 2010). It is famous for holding three, perhaps four, species of big cats (Tiger *Panthera tigris*, Leopard *P. pardus*, Clouded Leopard *Neofelis nebulosa* and possibly Snow Leopard *P. uncia*) and several other large carnivores (Datta *et al.* 2008a). To the east and southeast of Namdapha TR are large tracts of contiguous forest of Hkakaborazi National Park and Hukaung Valley Tiger Reserve in Myanmar while to the north is the Kamlang Wildlife Sanctuary in India. To the

west and southwest are Reserved Forests that are administered by Namsai Forest Division and Jairampur Forest Division of the Arunachal Pradesh Forest Department. Reserved Forests are state-owned forestlands where activities like logging are permitted under Working Plan prescriptions made by the Forest Department. Several Reserved Forests were visited frequently: sites in Tengapani (444 km²) and Turung (164 km²) Reserved Forests of Namsai Forest Division to the northwest of Namdapha TR, and Rima (68 km²) and Miao (124 km²) Reserved Forests of Jairampur Forest Division to the west and southwest of Namdapha TR. Apart from Namdapha TR, all surveyed sites face pressure from logging. Despite the ban on hunting as per the Indian Wildlife (Protection) Act, 1972, hunting is pervasive across all these sites, albeit at different intensities.

The intensive sampling area in Namdapha TR was the Hornbill Plateau (500–700 m asl), which spreads over 15 km², harbouring some of the last remaining dipterocarp forests in Arunachal Pradesh. The dominant emergents in the area include *Shorea assamica*, *Terminalia myriocarpa*, *Altingia excelsa*, *Schima wallichii* and *Phoebe*. The Hornbill Plateau has never been logged, except for isolated illegal incidents at its periphery. Hornbill Plateau is, however, visited by Chakmas from nearby settlements to extract resin of *Canarium strictum* and to hunt and fish. Chakmas are a community from Bangladesh who were resettled in eastern Arunachal Pradesh in the 1960s by the Indian government. The hunters' main targets are large mammals like Sambar *Rusa unicolor*, Barking Deer (Red Muntjac) *Muntiacus muntjak*, Himalayan Serow *Capricornis thar*, Red Serow *C. rubidus*, Wild Pig *Sus scrofa*, Gaur *Bos gaurus* and primates. Smaller mammals, including small carnivores, are taken opportunistically.

The Reserved Forests experience significant logging. Turung (150–250 m asl) and Tengapani (150–250 m asl) Reserved Forests represent some of the last remaining lowland evergreen forests in Arunachal Pradesh. Unregulated logging has degraded these forests progressively and parts of Turung RF have been converted to settlements and plantations. Tengapani RF is relatively isolated and although extensively logged, only small areas have become settlements and plantations. All sampling sites lie south of the Lohit River, which is the main tributary of the River Brahmaputra. The main branch of River Brahmaputra (locally also known as the Siang) is further northwest of the sampling sites.

Methods

Direct sightings and camera-trapping detections are reported here. The sightings were opportunistic during walks mostly by day but occasionally by night, during a January 2008–March 2013 research project on hornbills (Bucerotidae). Time spent in Namdapha TR and adjoining areas totalled about 572 days: January – March 2008 (~ 20 days); November 2008 – April 2009 (~ 180 days); November 2009 – April 2010 (~ 150 days); November 2010 – March 2011 (~ 120 days); November 2011 – February 2012 (~100 days) and March 2013 (2 days). In Namdapha TR, most sightings were made near Hornbill Camp (27°32.325'N, 96°26.495' E). Variable amounts of time (November 2008 – April 2009; January 2010) were spent in Tengapani (27°43.366'N, 96°02.936' E) and Turung (27°46.264'N, 96°16.813' E) Reserved Forests and (November 2008 – April 2009, November 2009 – April 2010) in Miao (27°28.854'N, 96°13.432' E) and Rima (27°21.335'N, 96°11.661' E) Reserved Forests. Geographical coordinates and elevations were derived from a Garmin Etrex Legend (datum: WGS84).

In March 2009, in the Madhuban area of Tengapani RF, two passive infra-red Deercam-300 camera-traps were deployed from 17h00 to 05h00 along game roads and animal trails showing footprints of Leopards and other animals. Effort totalled 25 camera-trap-nights. On the Hornbill Plateau, two passive Reconyx Rapidfire RM45 camera-traps (43 trap nights, January 2012 – February 2012) were deployed throughout the day and the night. Hence, one camera-trap-night corresponded to one camera-trap deployed 12 hours in Tengapani RF but for 24 hours on the plateau.

Species accounts

Appendix 1 details the records of the 11 small carnivore species detected.

Yellow-throated Marten *Martes flavigula*

Yellow-throated Martens were encountered on at least 17 occasions. Thirteen sightings were of animals foraging, of which nine were in *Ficus cf. tsajhela* to forage on figs and/or lurking to nab frugivorous birds coming to the figs. Three Martens were seen chasing an adult female Red Muntjac on Hornbill Plateau. During the chase, they called incessantly, seemingly for contact between them. On first hearing their single-note whistles, an assistant plucked a fresh leaf and made a high-pitched sound: within a minute, the deer almost ran into us, followed by the Martens, which came from three different directions separated from each other by 5 m. The deer on detecting us changed direction and was followed by the Martens. Whether they caught the deer was not determined. Yellow-throated Martens have been recorded to chase Himalayan Tahr *Hemitragus jemlahicus*, Alpine Musk-deer *Moschus chrysogaster* and Himalayan Goral *Naemorhedus goral* (Sathyakumar 1999). On two other occasions, three individuals were seen in understorey trees; on detecting us, they climbed down and ran away on the forest floor. On both these occasions they called rather frequently. Another individual was seen attacking a wasp nest in a tree cavity about 1–2 m above the ground. Every time the animal was stung, it fell to the ground only to

climb again and continue foraging on the wasp larvae. Another individual was seen digging into a dead tree on a sandy bank along Deban nullah on the reserve's western border. On seeing us, it scampered towards the forest. Closer inspection revealed a bee nest in the cavity under the dead log. In Turung RF, a single Yellow-throated Marten was seen inspecting an old fruit of *Gynocardia odorata* (Flacourtiaceae) on the trunk of the tree, probably for insects. Yellow-throated Martens were seen singly, in duos and in groups of three, always by day. When feeding on figs, they generally moved with great ease and speed on the different branches, often to the alarm of hornbills and small frugivores also feeding on the figs. Two Martens feeding in the same fig tree as a Binturong showed no interspecific interaction. Despite the many observations in *Ficus cf. tsajhela* and watches of other figs, we did not see Martens feeding on any other fig species, although on one occasion RN (during a fruit-tree watch) saw a single individual running (on the forest floor) below a fruiting *F. drupacea*. Local Lisu tribesmen believe that seeing a Yellow-throated Marten is a bad omen, so they are occasionally hunted. Smoked remains were seen in a house in Gandhigram, a village beyond Namdapha TR's western border.

Asian Small-clawed Otter *Aonyx cinereus*

A Small-clawed Otter was observed by RN, AD and others in a small forest stream next to Hornbill Camp (Fig. 1). The animal allowed approach within 1 m. It was calling incessantly (a sharp single-note whistle). It kept going upstream and then ran or swam downstream, during observation for more than 20 minutes. It dived in a small deep pool in the stream and then it called from the edge of the stream or from big rocks in the stream. Subsequently, it was seen five times by day until January 2011, in the same stream, and was filmed and photographed. Its bold and vocal behaviour was odd considering that these animals are heavily hunted in this region (Datta et al. 2008a). We do not know the reasons for its apparent disappearance after January 2011.

Spotted Linsang *Prionodon pardicolor*

RN and assistants saw a single Spotted Linsang barely 1.5 m



Fig. 1. Asian Small-clawed Otter *Aonyx cinereus* in a stream near Hornbill Camp, Namdapha Tiger Reserve, Arunachal Pradesh, India, 27 November 2010 (Photo: Aparajita Datta).

away, crouched in sparse undergrowth. On our approach, it crawled backwards and escaped into denser undergrowth few meters away. Mohammed Firoz Ahmed and his team camera-trapped this species in Namdapha TR in 2012 (Sarma 2012).

Large Indian Civet *Viverra zibetha*

Large Indian Civet was camera-trapped in two localities (Fig. 2). One was seen crossing the Namsai–Wakro road about 4 km from Namsai town. It was seen regularly in Namdapha TR in all winters during 2008–2012, feeding on leftovers (mostly rice) around the Hornbill camp (Fig. 3). Over a period, the animals did not get disturbed by torchlights and camera flashes, continuing to forage despite these intrusions. All sightings were on the forest floor in the night, corroborating earlier studies (Duckworth 1997 and references therein).

Small Indian Civet *Viverricula indica*

Small Indian Civet was seen and photographed on two occasions each (Fig. 4). All records were by night. This species is often said to be more common in the secondary and open forests than in closed evergreen forest (Duckworth 1997, Datta *et al.*



Fig. 2. Camera-trapped Large-Indian Civet *Viverra zibetha*, Tengapani Reserved Forest, Arunachal Pradesh, India, 22 March 2009 (Photo: Eastern Himalaya Program, Nature Conservation Foundation).



Fig. 3. Camp-scavenging Large Indian Civet *Viverra zibetha*, taken at 8–10 m range near Hornbill Camp, Namdapha Tiger Reserve, Arunachal Pradesh, India, 12 March 2010 (Photo: Rohit Naniwadekar).



Fig. 4. Camera-trapped Small Indian Civet *Viverricula indica*, Tengapani Reserved Forest, Arunachal Pradesh, India, 22 March 2009 (Photo: Eastern Himalaya Program, Nature Conservation Foundation).

2008a, Than Zaw *et al.* 2008 and references therein). Notably, therefore, the camera-trap record from the Hornbill Plateau was in a large contiguous patch of primary evergreen forest at least 10 km from the nearest human settlement.

Common Palm Civet *Paradoxurus hermaphroditus*

RN and assistants sighted a single Common Palm Civet scampering down a mid-storey tree in forest far from habitation, probably disturbed by our presence. This species is relatively common in the area, occurring both in primary and secondary forests close to habitation (Datta *et al.* 2008a).

Masked Palm Civet *Paguma larvata*

Masked Palm Civet was seen on seven occasions in three localities, and was camera-trapped under a fruiting *Prunus ceylanica* tree on four occasions within 24 hr. This species was seen feeding on fruits of an unidentified liana and of *P. ceylanica*. All sightings were of singles in the night up trees except on one occasion when two individuals were seen feeding on *P. ceylanica* fruits, indicating that the animals are nocturnal, arboreal and generally solitary and not shy, as reported earlier (e.g. Pocock 1939, Duckworth 1997). The regularity of sightings suggests that these civets may be quite common, easy to see, and potentially to study, in Namdapha TR.

Small-toothed Palm Civet *Arctogalidia trivirgata*

A single Small-toothed Palm Civet was sighted by AD, RN, Japang Pansa and Ngwayotse Yobin, using torch lights and binoculars (8 × 40) during a night walk to look for nocturnal mammals, near Hornbill Camp. Poor light conditions prevented our taking good pictures of the animal. It was spotted on a branch about 8 m above ground and 6 m from the trail, allowing a very clear view, and was watched for more than half an hour. The tail was bushy, thick, very long (longer than the head and body length) and unmarked. The ears were more towards the sides of the head than on Common Palm Civet and rounded, with their inner side white. The venter was lighter than the dorsum, which was uniformly dark brown or buff on the parts visible (the upper dorsum, where the species is striped, was not visible). We were unable to see if this animal had facial markings, given the blaze of the reflecting eyes. It was smaller than a Masked Palm Civet, but its tail was possibly longer. On our approach to take

pictures, it swiftly climbed onto the upper branches and was seen briefly amongst the moving branches until it was lost in the neighbouring canopy.

The observation site lies south of the Brahmaputra, and the entire Indian distribution of Small-toothed Palm Civet is reportedly south of this river, in the eastern parts of Arunachal Pradesh, upper Assam, Nagaland and Manipur (Choudhury 2003). We traced no confirmed sight records from India. It is common in at least some areas of its range (e.g. Duckworth 1997). It has not been camera-trapped in Namdapha TR, nor was it recorded in extensive recent camera-trap surveys in Myanmar, including heavy effort in areas adjacent to Namdapha TR (Than Zaw *et al.* 2008). These camera-traps were at forest-floor level, perhaps explaining non-detection of this highly arboreal species. Similarly, in northeast India relatively little effort is invested in spotlighting, which might be a better technique in detecting this species (Willcox *et al.* 2012). Local hunters/people did not appear to know of this species, suggesting that it might be rare in these forests. The two tribal people who watched the species with us had never seen one before, even though they knew all other civet species of the area. One of them (Japang Pansa) is a very knowledgeable naturalist who has observed/watched small carnivores, while most other assistants from the Lisu tribe were hunters and know all the other civets well. In addition, the Lisu have specific names for individual civet species, but seem not to have one for this species. One possible reason for this is that their main target species during hunting are mostly larger ungulate species, large cats and bears, whereas civets are hunted only when they are encountered in the forest occasionally or are trapped in snares set out in the fields.

Binturong *Arctictis binturong*

Binturong was sighted ten times on the Hornbill Plateau (Fig. 5) and once in Tengapani RF. On all occasions except one (when it was seen on the ground by AV and US) it was on fruiting fig *Ficus* trees, as has been reported previously (e.g. Nettelbeck 1997). In Namdapha TR, they were seen foraging on *Ficus* cf. *tsajhela* (the commonest strangler fig in the area) on five occasions and once each on *F. nervosa*, *F. drupacea* and an un-

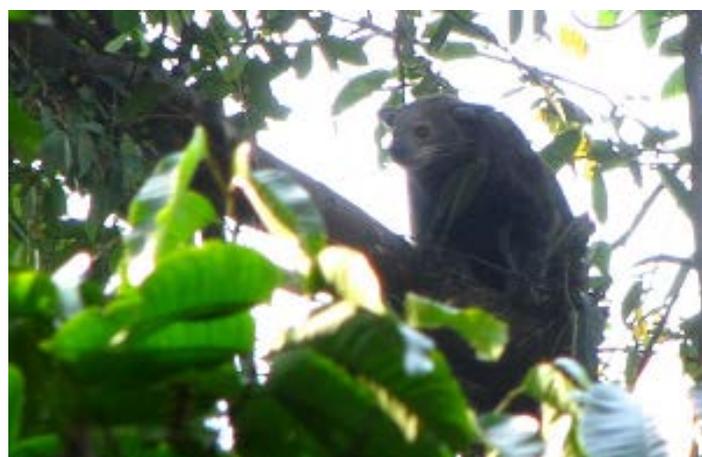


Fig. 5. Binturong *Arctictis binturong* on *Ficus nervosa*, Hornbill Plateau, Namdapha Tiger Reserve, Arunachal Pradesh, India, 21 March 2010 (Photo: Rohit Naniwadekar).

identified fig. AV and US saw two on the ground at 22h30 on a streambed near Hornbill Camp. The first came out of the forest and stopped at a small pool of water and drank and washed itself, quite unperturbed by the observers only a few meters away. It then walked along the stream and disappeared into the forest. The second individual followed a minute or so after the first left, and behaved similarly. Once, four Hoolocks (gibbons) *Hoolock hoolock* were seen foraging for approximately 80 minutes in the same *F. nervosa* tree as a Binturong, which was already present on the tree. Both the species were in the upper canopy but in different portions of the tree. No interaction between gibbons and Binturong was seen, in contrast to the brachiating around the Binturong, displaying and attacking observed by Nettelbeck (1998) with White-handed Gibbons *Hylobates lar*. A duo of Yellow-throated Martens foraging in the same tree as a Binturong also showed no interaction. When feeding on figs, Yellow-throated Martens ran along the branches feeding intermittently, while Binturongs remained stationary on one branch and moved only after completing feeding on that branch. Unlike other carnivores in the area, Binturongs appeared indifferent to our presence in most sightings, in keeping with local beliefs and earlier knowledge (Duckworth 1997). One assistant, a former hunter, mentioned that despite repeatedly shooting at Binturongs and missing them, the animals remained in place until they were shot. This assistant also said that Binturongs have much fat in winter, apparently making their meat tastier then.

Crab-eating Mongoose *Herpestes urva*

Of five Crab-eating Mongoose records, two were in Namdapha TR, one in Turung RF and two of freshly killed animals, in Tengapani RF. Two in Namdapha TR seen by day emerged from undergrowth and, on seeing the observers, paused less than 10 m away and tried to hide in separate bushes where their tails conspicuously stuck out. Of two found killed in Tengapani RF, one was chased and hacked to death with a stick by a local labourer (Fig. 6), while the second was killed by logging truck drivers using a catapult. Both were killed to be eaten. The gut of the first individual held unidentified aquatic insects, rice and a fish. Of the three sightings (four individuals) in the wild, one



Fig. 6. Crab-eating Mongoose *Herpestes urva* killed with a stick in Madhuban area of the Tengapani Reserved Forest, Arundachal Pradesh, India, 24 March 2009 (Photo: Rohit Naniwadekar).

was near a seasonal water course (logging trail), one was near a perennial stream, while the group of two were on the forest floor (at least 500 m away from any stream).

Small Asian Mongoose *Herpestes javanicus*

Small Asian Mongoose was seen crossing roads on several occasions in Miao and Diyun RF and surrounding unclassified forest near human settlements in 2009 and 2010. This species appears to be commensal with people and occurs in degraded forests close to human habitation. It has never been camera-trapped or otherwise detected in primary forests away from human settlements in the survey area.

Discussion

The finding of the hitherto unreported Small-toothed Palm Civet in Namdapha TR underscores the need for using a diverse array of techniques for documenting presence of small carnivores in an area. Six of the 11 species reported here were also detected outside Protected Areas, highlighting the potential value of unprotected areas in conserving small carnivore diversity.

Small carnivores face potential threats from hunting as indicated in cases of Yellow-throated Marten and Crab-eating Mongoose. Wildlife in northeast India faces severe hunting pressures, and Namdapha TR, in particular, has low densities of large carnivores and herbivores (Datta *et al.* 2008b). Small carnivores, however, continue to survive here and elsewhere in northeast India. Otters seem to be the only small carnivores here that are specifically targeted by hunters, but all continue to be hunted opportunistically. All possibly face other threats like logging and other forms of habitat degradation. Predictable foraging behaviour of civets results in their being hunted at fruiting trees in the nights according to one of our assistants, i.e. on figs and *Gynocardia odorata* (Flacourtiaceae) (see Datta & Rawat 2008). There is little information on abundance of these carnivores or on their basic ecology and functional roles in the region's ecosystems. A thorough quantitative understanding of small carnivore distributions and densities is important to identify areas for targeted conservation. Studies on their ecology and behaviour are essential to understand how such a large number of sympatric species co-exist. Until then, incidental records of occurrence and behaviour can help in understanding these elusive animals, albeit to a limited degree.

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References

- Athreya, V. R. & Johnsingh, A. J. T. 1995. *Survey of the Clouded Leopard (Neofelis nebulosa) in North-east India*. Wildlife Institute of India (unpublished report), Dehradun, India.
- Chauhan, A. S., Singh, K. P. & Singh, D. K. 1996. *A contribution to the flora of Namdapha, Arunachal Pradesh*. Botanical Survey of India, Kolkata, India.
- Champion, H. G. & Seth, S. K. 1968. *A revised survey of the forest types of India*. Government of India Press, New Delhi, India.
- Choudhury, A. U. 2003. *The mammals of Arunachal Pradesh*. Regency Publications, New Delhi, India.
- Datta, A. 1999. Small carnivores in two protected areas of Arunachal Pradesh. *Journal of Bombay Natural History Society* 96: 399–404.
- Datta, A. & Rawat, G. S. 2008. Dispersal modes and spatial patterns of tree species in a tropical forest in Arunachal Pradesh, north-east India. *Tropical Conservation Science* 1: 163–185.
- Datta, A., Naniwadekar, R. & Anand, M. O. 2008a. Occurrence and conservation status of small carnivores in two protected areas in Arunachal Pradesh, north-east India. *Small Carnivore Conservation* 39: 1–10.
- Datta, A., Anand, M. O. & Naniwadekar, R. 2008b. Empty forests: large carnivore and prey abundance in Namdapha National Park, north-east India. *Biological Conservation* 141: 1429–1435.
- Duckworth, J. W. 1997. Small carnivores in Laos: a status review with notes on ecology, behaviour and conservation. *Small Carnivore Conservation* 16: 1–21.
- Mani, M. S. 1974. *Ecology and biogeography in India*. Dr. W. Junk, The Hague, Netherlands.
- Mudappa, D. 2013. Herpestids, viverrids and mustelids. Pp. 471–498 in Johnsingh, A. J. T. & Manjrekar, N. (eds) *Mammals of South Asia: ecology, behaviour and conservation*, 1. Universities Press, Hyderabad, India.
- Myers, N., Mittermeier, R. A., Mittermeier, C. G., da Fonseca, G. A. B. & Kent, J. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403: 853–858.
- Nettelbeck, A. R. 1997. Sightings of Binturongs in the Khao Yai National Park. *Small Carnivore Conservation* 16: 22–24.
- Nettelbeck, A. R. 1998. Encounters between Lar Gibbons (*Hylobates lar*) and Binturongs (*Arctictis binturong*). *Folia Primatologica* 69: 392–396.
- Pocock, R. I. 1939. *The fauna of British India, Including Ceylon and Burma. Mammalia*, 2nd edn, I. Taylor & Francis, London, U.K.
- Proctor, J., Haridasan, K. & Smith, G. W. 1998. How far north does lowland evergreen tropical rain forest go? *Global Ecology and Biogeography Letters* 7: 141–146.
- Sarma, B. 2012. Camera traps, Tigers and Namdapha. <<http://blog.aaranyak.org/2012/04/namdapha-tiger-census-2012/>>. Downloaded on 10 October 2013.
- Sathyakumar, S. 1999. Mustelids and viverrids of the northwestern and western Himalayas. Pp. 39–42 in Hussain, S. A. (ed.) *EN-VIS Bulletin: wildlife and protected areas. Mustelids, viverrids and herpestids of India*. Wildlife Institute of India, Dehra Dun, India.
- Srinivasan, U., Dalvi, S., Naniwadekar, R., Anand, M. O. & Datta, A. 2010. The birds of Namdapha National Park and surrounding areas: recent significant records and a checklist of the species. *Forktail* 26: 92–117.
- Than Zaw, Saw Htun, Saw Htoo Tha Po, Myint Maung, Lynam, A. J., Kyaw Thinn Latt & Duckworth, J. W. 2008. Status and distribu-

tion of small carnivores in Myanmar. *Small Carnivore Conservation* 38: 2–28.

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

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Appendix 1. Details of records of small carnivores in and around Namdapha Tiger Reserve, India, 2008–2013.

Site	Location	Habitat (altitude)	Date	Record details	Remarks
Yellow-throated Marten <i>Martes flavigula</i>					
Namdapha TR	Hornbill (precise location not recorded)	Primary sub-tropical evergreen forest (~ 650 m)	9 Mar 08	Direct sighting	Three, chasing Red Muntjac at 11h30
Namdapha TR	Hornbill (27°32.365' N, 96°26.890' E)	Primary sub-tropical evergreen forest (680 m)	9 Nov 09	Direct sighting	One, feeding in <i>Ficus cf. tsajhela</i> (05h47–05h51)
Namdapha TR	Hornbill (27°32.365' N, 96°26.890' E)	Primary sub-tropical evergreen forest (680 m)	15 Nov 09	Direct sighting	One, feeding in <i>Ficus cf. tsajhela</i> (06h05–07h00)
Namdapha TR	Hornbill (27°32.365' N, 96°26.890' E)	Primary sub-tropical evergreen forest (680 m)	19 Nov 09	Direct sighting	Two, feeding in <i>Ficus cf. tsajhela</i> (07h58–08h00)
Namdapha TR	Hornbill (27°32.365' N, 96°26.890' E)	Primary sub-tropical evergreen forest (680 m)	20 Nov 09	Direct sighting	Two, feeding in <i>Ficus cf. tsajhela</i> (06h10–06h26)
Namdapha TR	Hornbill (27°32.365' N, 96°26.890' E)	Primary sub-tropical evergreen forest (680 m)	20 Nov 09	Direct sighting	Two, feeding in <i>Ficus cf. tsajhela</i> (07h02–07h15)
Namdapha TR	Hornbill (27°32.318' N, 96°26.935' E)	Primary sub-tropical evergreen forest (700 m)	5 Dec 09	Direct sighting	One, feeding in <i>Ficus cf. tsajhela</i> (07h45–07h55)
Namdapha TR	Hornbill (precise location not recorded)	Primary sub-tropical evergreen forest (~ 650 m)	28 Feb 11	Direct sighting	Feeding on <i>Ficus cf. tsajhela</i> (06h15)
Namdapha TR	Hornbill (precise location not recorded)	Primary sub-tropical evergreen forest (~ 650 m)	7 Mar 11	Direct sighting	Feeding on <i>Ficus cf. tsajhela</i> (6h25)
Namdapha TR	Hornbill (precise location not recorded)	Primary sub-tropical evergreen forest (~ 650 m)	7 Mar 11	Direct sighting	Feeding on <i>Ficus cf. tsajhela</i> (12h33)
Namdapha TR	Hornbill (27°32.552' N, 96°27.622' E)	Primary sub-tropical evergreen forest (840 m)	Jan 11	Direct sighting	Under a <i>Ficus drupacea</i> tree (in morning)
Namdapha TR	Hornbill (precise location not recorded)	Primary sub-tropical evergreen forest (~ 650 m)	Dec 2011 – Feb 2012	Direct sighting	Three, coming down a tree (seen twice)
Namdapha TR	Hornbill (precise location not recorded)	Primary sub-tropical evergreen forest (~ 650 m)	Nov 09	Direct sighting	Attacking tree-cavity wasp nest; eating larvae (morning)
Namdapha TR	Deban Nullah (27°30.472' N, 96°23.358' E)	Stream (340 m)	1 Dec 09	Direct sighting	Attacking and feeding on honey-bee hive (in afternoon)
Namdapha TR	Hornbill camp (27°32.29' N, 96°26.51' E)	Primary sub-tropical evergreen forest (640 m)	2008–2012	Direct sighting	Seen at least twice near the camp in daytime
Turung RF	Turung RF (precise location not recorded)	Degraded logged lowland forest (~ 270 m)	1 Mar 08	Direct sighting	Searching inside remains of old <i>Gynocardia</i> fruit (08h15)
Turung RF	Turung RF (precise location not recorded)	Degraded logged lowland forest (~ 270 m)	Jan 09	Direct sighting	One, crossing the Namsai–Wakro main road.
Vijaynagar USF	Yakhulo (27°15.286' N, 96°57.067' E)	lower montane forest (1380 m)	7 Apr 09	Direct sighting	07h30
Vijaynagar USF	Gandhigram (27°16.944' N, 96°54.064' E)	Village (~ 1,000 m)	24 Dec 09	Dead Animal	Smoked remains of the animal
Asian Small-clawed Otter <i>Aonyx cinereus</i>					
Namdapha TR	Hornbill camp (27°32.29' N, 96°26.51' E)	Stream (640 m)	27 Nov 10	Direct sighting	10h30; subsequently seen on five occasions (by day)

Site	Location	Habitat (altitude)	Date	Record details	Remarks
Spotted Linsang <i>Prionodon pardicolor</i>					
Namdapha TR	Hornbill camp (27°32.29' N, 96°26.51' E)	Primary sub-tropical evergreen forest (640 m)	1 Dec 10	Direct sighting	Near the camp (19h50)
Large Indian Civet <i>Viverra zibetha</i>					
Namdapha TR	Hornbill camp (27°32.29' N, 96°26.51' E)	Primary sub-tropical evergreen forest (640 m)	Many	Direct sighting	Feeding on camp leftovers by night; 1–2 individuals
Namsai RF	Namsai–Wakro Road (27°40.511' N, 95°53.832' E)	Open forest near human settlement (150 m)	Mar 09	Direct sighting	At night
Namdapha TR	Hornbill (27°32.317' N, 96°26.820' E)	Primary sub-tropical evergreen forest (670 m)	4 Feb 12	Camera-trap	00h44
Tengapani RF	Madhuban (precise location not recorded)	Logged lowland forest (~ 200 m)	22 Mar 09	Camera-trap	At night
Small Indian Civet <i>Viverricula indica</i>					
Namdapha TR	M.V. Road (27°29.795' N, 96°21.510' E)	Sub-tropical evergreen forest (410 m)	7 Mar 13	Direct sighting	At night
Namdapha TR	Hornbill (27°32.317' N, 96°26.820' E)	Primary sub-tropical evergreen forest (670 m)	3 Feb 12	Camera-trap	22h37
Digboi Town	Tinsukia–Miao Road (27°23.541' N, 95°36.839' E)	Near human settlement (150 m)	1 Mar 13	Direct sighting	At night
Tengapani RF	Madhuban (precise location not recorded)	Logged lowland forest (~ 200 m)	22 Mar 09	Camera-trap	At night (photographed)
Common Palm Civet <i>Paradoxurus hermaphroditus</i>					
Namdapha TR	Hornbill Plateau (27°31.811' N, 96°24.674' E)	Primary sub-tropical evergreen forest (580 m)	22 Nov 10	Direct sighting	~10h00
Masked Palm Civet <i>Paguma larvata</i>					
Namdapha TR	Waasi (27°34.054' N, 96°29.043' E)	Primary sub-tropical evergreen forest (1,300 m)	3 Dec 08	Direct sighting	~ 19h30
Namdapha TR	Waasi (27°34.054' N, 96°29.043' E)	Primary sub-tropical evergreen forest (1,300 m)	4 Dec 08	Direct sighting	~ 19h30
Namdapha TR	10 Mile along M.V. Road (27°30.228' N, 96°19.766' E)	Secondary evergreen forest (300 m)	22 Dec 11	Direct sighting	At night
Namdapha TR	near Hornbill camp	Primary sub-tropical evergreen forest (640 m)	16 Feb 12	Direct sighting	21–22h
Namdapha TR	near Hornbill camp	Primary sub-tropical evergreen forest (640 m)	16 Feb 12	Direct sighting	21–22h
Namdapha TR	near Hornbill camp	Primary sub-tropical evergreen forest (640 m)	29 Feb 12	Direct sighting	~ 21h
Namdapha TR	near Hornbill camp	Primary sub-tropical evergreen forest (640 m)	1 Mar 13	Direct sighting	Feeding on <i>Prunus ceylanica</i> at ~ 19h; two individuals
Namdapha TR	Hornbill (precise location not recorded)	Primary sub-tropical evergreen forest (~ 650 m)	15 Feb 12	Camera-trap	18h30–00h30
Small toothed Palm Civet <i>Arctogalidia trivirgata</i>					
Namdapha TR	Hornbill (27°32.318' N, 96°26.104' E)	Primary sub-tropical evergreen forest (640 m)	5 Dec 09	Direct sighting	19h30
Binturong <i>Arctictis binturong</i>					
Namdapha TR	Hornbill (precise location not recorded)	Primary sub-tropical evergreen forest (~ 650 m)	29 Feb 09	Direct sighting	On ground (22hr00); two individuals
Namdapha TR	Hornbill (27°32.365' N, 96°26.890' E)	Primary sub-tropical evergreen forest (680 m)	8 Nov 09	Direct sighting	Feeding on <i>Ficus cf. tsajhela</i> (morning)
Namdapha TR	Hornbill (27°32.365' N, 96°26.890' E)	Primary sub-tropical evergreen forest (680 m)	9 Nov 09	Direct sighting	Feeding on <i>Ficus cf. tsajhela</i> (06h57–07h26)
Namdapha TR	Hornbill (precise location not recorded)	Primary sub-tropical evergreen forest (~ 650 m)	9 Dec 09	Direct sighting	Feeding on <i>Ficus cf. tsajhela</i> (06h40)
Namdapha TR	Hornbill (precise location not recorded)	Primary sub-tropical evergreen forest (~ 650 m)	9 Dec 09	Direct sighting	Feeding on <i>Ficus cf. tsajhela</i> (07h09)
Namdapha TR	Hornbill (27°32.402' N, 96°26.802' E)	Primary sub-tropical evergreen forest (660 m)	10 Dec 09	Direct sighting	Feeding on <i>Ficus cf. tsajhela</i> (13h30–14h56)

Site	Location	Habitat (altitude)	Date	Record details	Remarks
Namdapha TR	Hornbill (27°31.599' N, 96°25.022' E)	Primary sub-tropical evergreen forest (590 m)	Apr 10	Direct sighting	Feeding on <i>Ficus nervosa</i> (06–11h)
Namdapha TR	Hornbill (precise location not recorded)	Primary sub-tropical evergreen forest (~ 650 m)	26 Nov 11	Direct sighting	07h11
Namdapha TR	Hornbill (precise location not recorded)	Primary sub-tropical evergreen forest (~ 650 m)	28 Jan 11	Direct sighting	Feeding on <i>Ficus drupacea</i> (14h07)
Namdapha TR	Hornbill (precise location not recorded)	Primary sub-tropical evergreen forest (~ 650 m)	Mar 11	Direct sighting	Feeding on unidentified <i>Ficus</i> (in morning)
Tengapani RF	Madhuban (27°43.38' N, 96°03.65' E)	Logged lowland forest (210 m)	7 Feb 09	Direct sighting	Feeding on <i>Ficus altissima</i> (06h20)
Crab-eating Mongoose <i>Herpestes urva</i>					
Namdapha TR	Deban Nullah (27°30.472' N, 96°23.358' E)	Stream (340 m)	6 Feb 12	Direct sighting	Running along stream (09h35)
Namdapha TR	Hornbill (precise location not recorded)	Primary sub-tropical evergreen forest (~ 650 m)	24 Feb 12	Direct sighting	Forest floor (daytime); two
Tengapani RF	Madhuban (27°43.450' N, 96°3.048' E)	Logged lowland forest (~ 200 m)	24 Mar 09	Dead animal	Killed with a stick (daytime)
Tengapani RF	Madhuban (27°43.450' N, 96°3.048' E)	Logged lowland forest (~ 200 m)	26 Mar 09	Dead animal	Killed with a catapult (daytime)
Turung RF	Turung RF (27°46.186' N, 96°16.883' E)	Degraded logged lowland forest (270 m)	29 Mar 09	Direct sighting	On a logging trail, 13h20
Small Asian Mongoose <i>Herpestes javanica</i>					
Miao and Diyun RF	Precise location not recorded	Near human settlement (~ 250 m)	2009–2010	Direct sighting	Daytime, at least thrice