

Detection of Large Indian Civet *Viverra zibetha* in camera-trap surveys in and around Dudhwa National Park in the Terai Region of North India

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Abstract

Large Indian Civet *Viverra zibetha* is a widely distributed small carnivore, but its present distribution in India is poorly documented. In camera-trapping surveys in Dudhwa National Park and adjoining areas, it was recorded in 21 of 538 trap-sites operated between December 2010 and June 2012. Camera-traps were deployed in forests from the sub-Himalayan Nandhour River region to Katerniaghat Wildlife Sanctuary in the Terai Arc Landscape of India. Most records came from Dudhwa National Park. The westernmost location where Large Indian Civet was camera-trapped is the Nandhour region. Possible causes for low capture rates and non-detection of the species in some patches are presented. Data of this nature collected over a longer time-span will clarify the distribution, habitat preferences, ecological attributes and population status of small carnivores such as Large Indian Civet.

Keywords: deciduous forest, extension of known range, fragmentation, monitoring, Terai Arc Landscape

उत्तर भारत के तराई क्षेत्र में दुधवा नेशनल पार्क तथा समीपवर्ती क्षेत्रों में कैमरा ट्रैप सवेक्षण के दौरान बड़ा भारतीय मुश्कबिलाव (*विवेरा जिवेथा*) की उपस्थिति दर्ज होना

सारांश

बड़ा भारतीय मुश्कबिलाव (*विवेरा जिवेथा*) विस्तृत भू भाग में पाया जाने वाला छोटा मांसाहारी जीव है, परन्तु भारत में इसकी वर्तमान स्थिति अच्छी तरह लिपिबद्ध नहीं की गयी है। दुधवा राष्ट्रीय उद्यान तथा समीपवर्ती क्षेत्रों में कैमरा ट्रैप कार्य के दौरान, दिसम्बर 2010 से जून 2012 तक यह जीव 538 कैमरा ट्रैप स्थलों में से 21 जगह दर्ज किया गया। ये कैमरा ट्रैप भारत के तराई आर्क भू क्षेत्र में उप हिमालयन नंधौर नदी क्षेत्र से कतर्नियाघाट वन्य जीव विहार तक लगाये गये थे। इस जीव की सर्वाधिक उपस्थित दुधवा राष्ट्रीय उद्यान में दर्ज की गयी। कैमरा ट्रैप के आंकड़े बताते हैं कि तराई आर्क भू क्षेत्र में नंधौर क्षेत्र बड़ा भारतीय मुश्कबिलाव की पश्चिम दिशा में उपस्थित हेतु अंतिम क्षेत्र है। इस प्रजाति के कुछ क्षेत्रों में कम पाये जाने तथा न दर्ज होने के संभावित कारण प्रस्तुत किये जा रहे हैं। लम्बे समय तक इस प्रकार के आंकड़े जमा करने पर छोटे मांसाहारी जीवों जैसे बड़ा भारतीय मुश्कबिलाव की उपस्थित, अनुकूल आवास तथा पारिस्थितिकीय जरूरतों जैसे कारक स्पष्ट हो सकेंगे।

मुख्य शब्द—पर्णपाती वन, जंगल का बटना, अनुश्रवण, तराई आर्क भू क्षेत्र

Introduction

Large Indian Civet *Viverra zibetha* is a small carnivore of the family Viverridae with legislative protection under Schedule II of the Wildlife Protection Act (1972) of India; Schedule II represents species listed for prohibition of hunting under the Act (MoEF 1972). Large Indian Civet is categorised as Near Threatened on *The IUCN Red List of Threatened Species* (Duckworth *et al.* 2008). It is widely distributed in Southeast Asia (e.g. Corbet & Hill 1992, Gray *et al.* 2010, Jennings & Veron 2011) and, apparently more sporadically, in Nepal and India (e.g. Prater 1948). Joshi *et al.* (1995) indicated its occurrence in Chitwan National Park (= NP), Nepal, and it has been camera-trapped recently in Parsa Wildlife Reserve, Bardia NP and Shukhlaphanta Wildlife Reserve there (N. Subedi, National Trust for Nature Conservation, Nepal, *in litt.* 2012). Within India, Prater (1948) stated that the species occurs in Sikkim, upper Bengal and northeast India, and was a common carnivore of Sikkim and Darjeeling. Although Corbet & Hill (1992), Prater (1948) and Lydekker (1907) showed the species to occur in the Nepal Terai, these authors do not indicate its presence in the Indian Terai states of Uttar Pradesh and Uttarakhand which are near, and in some cases connected with, Civet-occupied

areas in Nepal. A report of a Large Indian Civet in Himachal Pradesh (Archana *et al.* 2001), disjunct and well west of the documented Indian range, contains photographs showing it to be based on the erroneous identification of a dead palm civet (Paradoxurinae; K. Kakati *in litt.* 2012). To date, the distribution of Large Indian Civet in India remains poorly documented, and little is known of its ecology from anywhere in its range.

Study sites and methods

Camera-traps were deployed in four forest patches within the area of 29°12'–28°08'N, 79°35'–81°19'E (WGS 1984 datum) along Indian parts of the Terai Arc Landscape, namely: Katerniaghat Wildlife Sanctuary (with camera-trapped area of about 400 km², 28°23'–28°18'N, 81°02'–81°19'E); Dudhwa National Park (about 600 km², 28°37'–28°20'N, 80°32'–80°55'E); connected forest patches of Kishanpur Wildlife Sanctuary (about 200 km², 28°26'–28°13'N, 80°19'–80°29'E) and Pilibhit Forest Division (about 600 km², 28°49'–28°19'N, 79°54'–80°20'E); and Nandhour River region (about 400 km², 29°13'–29°02'N, 79°35'–80°04'E). Nandhour includes parts of Haldwani, Champawat and Terai–East Forest Divisions. Low-lying Terai habitats in the study area (such as sites within Dudhwa Tiger Reserve)

are represented by the following vegetation types (defined following Kumar *et al.* 2003, Midha 2008): Sal *Shorea robusta*-dominated forests (Dense Sal, Moderately Sal, Mixed Sal and Open Sal forests), other forests (Mixed Deciduous, Tropical Semi-evergreen, Tropical Seasonal Swamps, *Terminalia alata*-*Acacia catechu*-*Dalbergia sissoo* forest, *Aegle*-dominated forest) and grasslands (Upland and Lowland Grasslands). In addition to these forest types, in the mountainous regions of the Nandhour and Ladhiya river valleys, stands of montane vegetation including pine *Pinus* and oak *Quercus* are found.

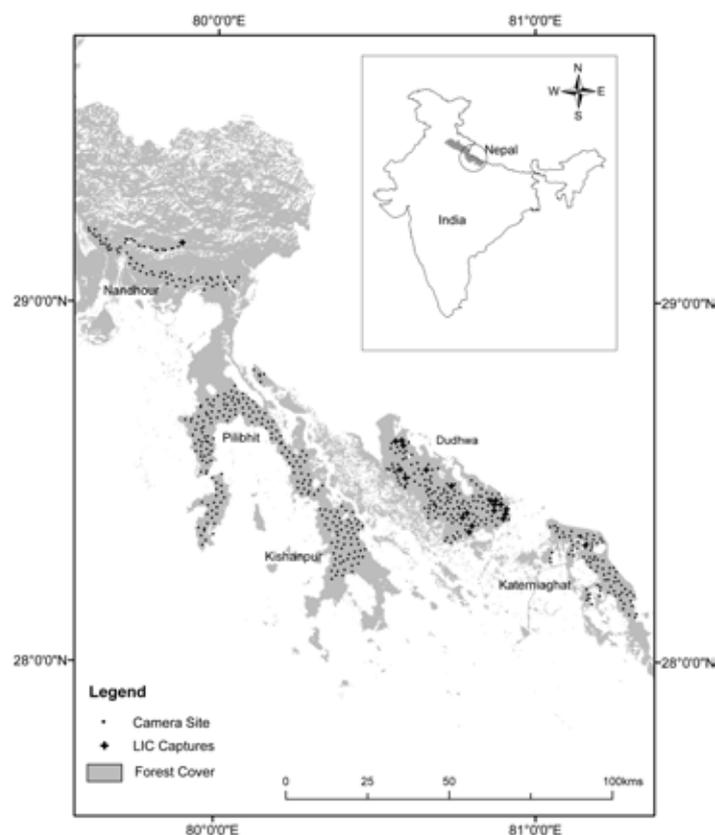


Fig. 1. The survey area in the Terai-Bhabar region, India, 2010–2012, showing camera-trap sites with Large Indian Civet *Viverra zibetha* captures.

Camera-traps surveys, directed primarily towards Tigers *Panthera tigris*, covered over 2,000 km² of forest patches (Fig 1). Each camera station, placed about 2 km apart from any other, comprised a pair of cameras facing each other and secured to trees or poles along forest roads or trails, at 45 cm above the ground. Cameras were functional at each site for 15–40 days during which they were operative throughout the 24-hr cycle. No baits or lures were used. They were monitored by field team at intervals of 2–5 days. These surveys, carried out primarily in the winter and spring seasons, are the most exhaustive of their kind in our study area so far. In the Nandhour region, camera-trap survey effort was higher in the lowlands and prominent river valleys than in the interior mountainous zone; we surveyed about 40% of high-quality Tiger habitat here. Table 1 summarises the total effort at each survey site, and the number of independent captures, capture rate and locations of capture of Large Indian Civet at each. ‘Independent captures’ are photographs that were captured at least 30 minutes from the previous one of the same species (see O’Brien *et al.* 2003). The ‘capture rate’ is the total number of trap-nights required per independent capture of Large Indian Civet.

Results

We obtained 38 independent captures of Large Indian Civet with effort of over 10,000 trap-nights, recorded in 21 of the 538 camera stations located in Terai-Bhabar region of North India over the period December 2010–July 2012 (Table 1, Fig. 1). The spatial frequency of occurrence (number of sites with capture/total number of sites) of the species in our study area is 0.039. All photographs showed single Civets. All were taken at night.

Of the sites surveyed, Dudhwa National Park recorded by far the highest rate of Large Indian Civet captures (providing 95% of all captures; Figs 2–3), whereas only a single capture each was obtained at Nandhour and at Katerniaghat Wildlife Sanctuary. Survey effort in Katerniaghat was similar to Dudhwa. We obtained no pictures of Large Indian Civet from camera-traps in Pilibhit Forest Division and Kishanpur Wildlife Sanctuary, which together account for about 800 km² of the total study area (40% of the overall area, and 40% of total

Table 1. Summary of Large Indian Civet *Viverra zibetha* camera-trap records at different sites in the Terai-Bhabar region, India, 2010–2012.

Site	N° trap stations operated (n° trap-nights)	N° independent captures ¹	Capture rate ²	Capture locations (outermost)
Pilibhit Forest Division	157 (>2,400)	-	-	-
Kishanpur Wildlife Sanctuary	63 (2,648)	-	-	-
Nandhour (Haldwani, Champawat and Terai – East Forest Divisions)	74 (1,473)	1	1,473	29°09'54"N, 79°53'24"E
Dudhwa National Park	159 (2,626)	36	72.9	28°21'48"N, 80°34'04"E (N); 28°21'48"N, 80°47'38"E (S); 28°25'38"N, 80°54'36"E (E); 28°35'20"N, 80°34'36"E (W)
Katerniaghat Wildlife Sanctuary	85 (>2,100)	1	>2,100	28°19'34"N, 81°9'22"E

¹See text

²Trap-nights per capture of Large Indian Civet



Fig. 2. Large Indian Civet *Viverra zibetha*, Dudhwa National Park, India, 29 February 2012.



Fig. 3. Large Indian Civet *Viverra zibetha*, Dudhwa National Park, India, 24 February 2012.

camera-trap stations). We do not conclusively rule out the existence of Large Indian Civet in this forest patch, but these data clearly suggest that this species, if present there, is scarce.

In addition to Large Indian Civet, Common Palm Civet *Paradoxurus hermaphroditus*, Small Indian Civet *Viverricula indica*, Himalayan (= Masked) Palm Civet *Paguma larvata*, Rusty-spotted Cat *Prionailurus rubiginosus*, Jungle Cat *Felis chaus*, Fishing Cat *Prionailurus viverrinus*, Leopard Cat *Prionailurus bengalensis* and unidentified mongooses *Herpestes* were camera-trapped in the study area.

Discussion

This proof of Large Indian Civet in and around Dudhwa National Park, India, represents a small westward extension of known range for the species, from its occurrence in proximate areas in Nepal (Prater 1948, Joshi *et al.* 1995). The species was either unrecorded or undocumented in previous surveys of this part of India (e.g. De 2001, Jhala *et al.* 2011, Mathur *et al.* 2011, Verma 2011). The marked difference in number of captures between Dudhwa and surrounding sites suggests a genuine pattern in Large Indian Civet status. Habi-

tat or patch connectivity, in combination with factors such as, perhaps, forest type, understorey characteristics, and the types and levels of human activities, may influence the persistence of this species in remnant habitat patches in the Indian Terai.

We believe that this species was previously unrecorded in this region because it appears to occur locally and at low densities. Its nocturnal, forest-dwelling characteristics reduce its contact with humans. Reasons underlying the species's sporadic distribution (and apparent variation in abundance) are hard to pin-point, but several factors may be relevant.

Forest type may be an important determinant for the occurrence of Large Indian Civet. Within Dudhwa, Large Indian Civet captures were predominantly in mixed forest patches of various species composition (comprised of trees such as *Terminalia tomentosa*, *Syzygium cumini*, *Careya arborea*, *Lagerstroemia parviflora* and *Ficus*, in association with *Shorea robusta*). The understorey in such forests is dominated by *Flemingia*, regenerating *Mallotus philippensis* and a variety of grasses and sedges. Relatively fewer Large Indian Civet captures were recorded in Sal-dominated forests and extensive tall-grassland tracts. Although Kishanpur, Pilibhit and Katerniaghat, the other sites in this study that are classified as Terai habitat, have similar forests, vegetation maps developed by Midha (2008) indicate that mixed forests, where Large Indian Civet were photographed most frequently, are situated primarily in the eastern areas of Dudhwa NP. The Nandhour region is represented by tracts of Sal, mixed montane forests and riparian vegetation, but lacks the marsh lands and grassland tracts found in the other sites.

Additionally anthropogenic pressure, including forest management (clearing of understorey and burning) might also influence small carnivore presence. In general, Nandhour, Katerniaghat and Pilibhit experience higher such pressures, with humans collecting wood and grass, harvesting timber and grazing by cattle, than do Kishanpur Wildlife Sanctuary and Dudhwa NP. Pilibhit Forest Division is a site with intensive commercial tree-felling operations by the state Forest Department.

Finally, it seems reasonable to speculate that the loss of connectivity between these various Indian sites and from proximate Nepal forests might also affect the distribution of small carnivores, which might not disperse effectively across large patches of agriculture, or cross roads and canals in the matrix between forest patches (Mathur *et al.* 2011). This may work in combination with the other factors discussed here. We recommend that long-term Tiger monitoring programmes also maintain a database for species such as Large Indian Civet, and monitor the occurrence of these species in the landscape over time.

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