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## SHORT COMMUNICATION

### JUNGLE CAT *FELIS CHAUS* SCHREBER, 1777 (MAMMALIA: CARNIVORA: FELIDAE) AT HIGH ELEVATIONS IN ANNAPURNA CONSERVATION AREA, NEPAL

Bikram Shrestha, Naresh Subedi & Ram Chandra Kandel

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### SMALL WILD CATS SPECIAL ISSUE



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## Jungle Cat *Felis chaus* Schreber, 1777 (Mammalia: Carnivora: Felidae) at high elevations in Annapurna Conservation Area, Nepal

Bikram Shrestha<sup>1</sup> , Naresh Subedi<sup>2</sup> & Ram Chandra Kandel<sup>3</sup>

<sup>1</sup>Department of Biodiversity Research, Global Change Research Institute, Czech Academy of Sciences, Bělidla 4a, 60300 Brno, Czech Republic.

<sup>1</sup>Institute of Environmental Studies, Faculty of Science, Charles University, Benátská 2, 12801 Praha 2, Czech Republic.

<sup>1</sup>Forum of Natural Resource Managers (FONAREM), Koteswhor, Surya Koth Marga, Kathmandu 44600, Nepal.

<sup>2</sup>National Trust for Nature Conservation, Godawari Sadak, Lalitpur 44700, Nepal.

<sup>3</sup>Department of National Parks and Wildlife Conservation, Madan Bhandari Path Kathmandu 44600, Nepal.

<sup>1</sup> [bikramone@gmail.com](mailto:bikramone@gmail.com) (corresponding author), <sup>2</sup> [nareshsubedi@gmail.com](mailto:nareshsubedi@gmail.com), <sup>3</sup> [rkandel06@gmail.com](mailto:rkandel06@gmail.com)

**Abstract:** To date, the Jungle Cat *Felis chaus* has been recorded in the lowlands and mid-hills in Nepal. Photographic evidence, however, is scarce, particularly in alpine habitat. Here we present the first photographic records of the Jungle Cat in an alpine habitat in Lower Mustang of the Annapurna Conservation Area, Nepal. It was recorded by camera traps at elevations of 3,000–3,100 m in 2014 and 2016 in 10 detections during 2,755 trap days. In July 2016, one individual was sighted at an elevation of 3,300m. The habitat of these records comprised riverbed, a poultry farm adjacent to agricultural land and shrubland of *Juniper* and *Caragana* species.

**Keywords:** Camera trap, alpine habitat, Himalayas, small wild cat

The Jungle Cat *Felis chaus* is usually associated with wetlands and open habitats across a wide geographic region extending from Egypt, western and central Asia, to southern and southeastern Asia (Nowell & Jackson 1996). In the Himalayan foothills, it has been recorded up to 2,400m (Nowell & Jackson 1996; Gray et al. 2016). In Nepal, it is considered to be widely distributed and

listed as Least Concern in the national Red List (Jnawali et al. 2011). Only a few authors, however, reported photographic records of the Jungle Cat in Nepal (Karki 2011; Pandey 2012; Lamichhane et al. 2014; Basnet et al. 2017). Ghimire et al. (2012) accounted of sightings by local people near settlements in the buffer zone of Makalu-Barun National Park below 2,560m, but provided only a photograph of a skin found in a village. Katuwal et al. (2018) listed it as occurring at elevations of 180–1,800m, but without photographic evidence. It was photographed at indeterminate elevations in the Himalayan foothills of Shivapuri–Nagarjun National Park (Pandey 2012). Basnet et al. (2017) reported Jungle Cats in an urban area in the Kathmandu Valley at around 1,400m. Records in the Terai lowlands range at 125–300 m (Karki 2011; Lamichhane et al. 2014).

Here, we present the first photographic records of the Jungle Cat obtained in an alpine habitat in Lower Mustang,

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Annapurna Conservation Area, Nepal. This evidence was collected incidentally during a monitoring study targeting the Snow Leopard *Panthera uncia* and other predators.

**STUDY AREA**

The Annapurna Conservation Area (ACA) extends over 7,629km<sup>2</sup> in the central Himalaya and ranges in elevation from 790m to the peak of Annapurna I at 8,091m (Bhuju et al. 2007). Our study area inside ACA was located in Lower Mustang (LM) and Upper Manang (UM), stretching from 29.336°N in the north to 28.261°N in the south and from 83.476°E in the west to 84.426°E in the east. The study area of about 250km<sup>2</sup> included the remote valleys of Namu-Vrapsa, Lupra, Muktinath & Jhong in LM, and Proper Manang, Khangsar, Tilicho & Yak Kharka in UM (Figure 1). These are U-shaped valleys with broad ridges running northwest to southeast and covering alpine habitats at elevations of 2,500–4,700 m. Their exposure determines the natural vegetation. The cool, north-facing slopes are densely forested with Himalayan Pine *Pinus wallichiana*, Himalayan Fir *Abies spectabilis*, and

Himalayan Birch *Betula utilis*, while only Juniper *Juniperus* bushes and some grasses thrive on the drier south-facing slopes, which have higher evaporation rates. These alpine valleys fall in the rain-shadow of the Annapurna Mountain Range, with a dry and cold climate. It is a transition zone between the moist, southern Himalayan slopes and the high deserts of Tibet (Ale et al. 2014; Shrestha et al. 2018).

The total annual precipitation is 1,099mm at 2,760m elevation in the northern rain shadow (Putkonen 2004). In the upper part above 3,000m, the rain shadow area of LM and UM receives an average rainfall of less than 260mm. The mean minimum monthly air temperature falls to -2.7°C in winter, while the maximum monthly air temperature reaches 26°C in summer (NTNC 2008; Koirala & Shrestha 2017). The maximum snow water equivalent increases from about 220mm at 3,000m to about 1,078mm at 4,400m (Putkonen 2004).

Snow Leopard, Leopard *Panthera pardus*, Wolf *Canis lupus*, Golden Jackal *Canis aureus*, Red Fox *Vulpes vulpes*, Eurasian Lynx *Lynx lynx*, and Pallas’s Cat *Otocolobus*

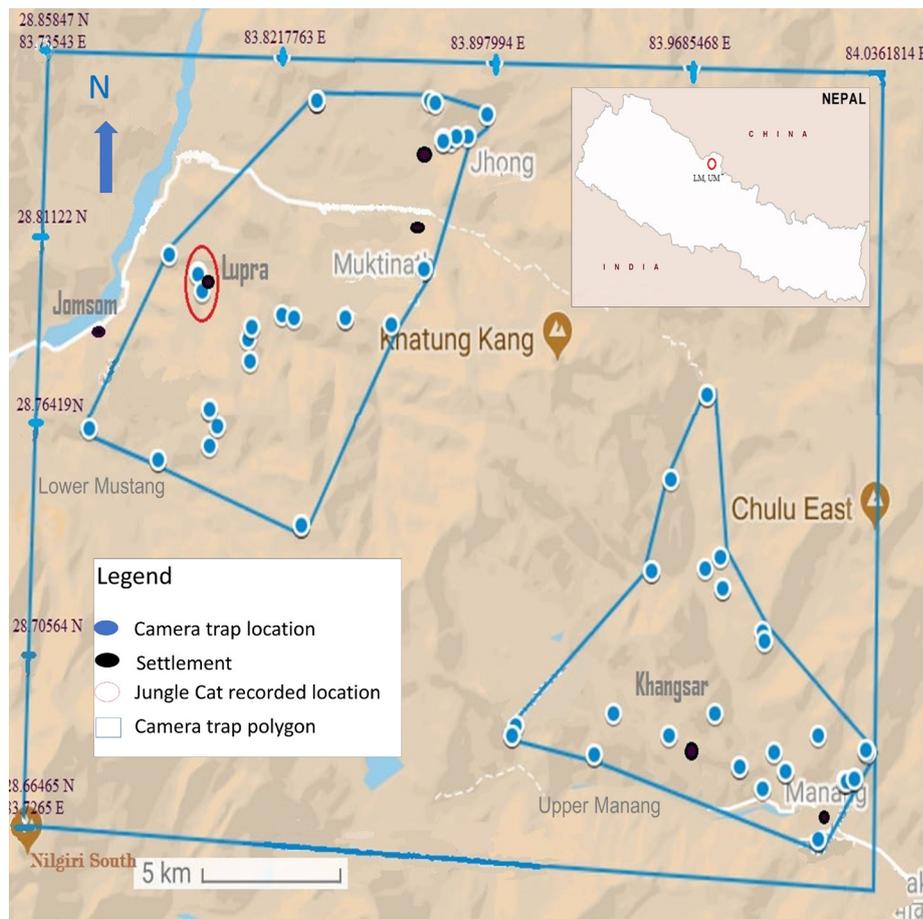


Figure 1. Study area in Lower Mustang and Upper Manang, Annapurna Conservation Area, Nepal.

*manul* were detected by camera trap surveys and scat DNA tests (Shrestha et al. 2018). Blue Sheep *Pseudois nayaur* and Himalayan Muskdeer *Moschus leucogaster* are the only wild ungulates in the study area (Shrestha et al. 2014, 2018); small mammals include Royle's Pika *Ochotona roylei*, Woolly Hare *Lepus oiostolus*, Siberian Weasel *Mustela sibirica*, Stone Marten *Martes foina*, rat species, and Sikkim Vole *Alticola sikkimensis* (Shrestha et al. 2018).

#### MATERIAL AND METHODS

For a survey on Snow Leopard and other predators, we deployed remotely-triggered camera traps (Bushnell, passive infrared detector Trophy Cam HD model no. 119676) along well-defined, narrow ridge-lines, valleys or adjacent to frequently scent-sprayed rocks and scrapes. The study area was divided into a grid of 4x4 km cells representing the probable average home range size of female Snow Leopards (Jackson 1996; Oli 1997). We placed 32–48 camera traps in 17 locations in LM and 17–20 in UM in 2014 and 2016 during two camera trapping sessions in each site, including dry (October–January) and wet seasons (June–August). In each location, we deployed one or two camera traps depending on the accessibility of locations; two camera traps were installed along trails and ridges, and one at places where Snow Leopards regularly spray on rocks. The duration of our field work was affected by heavy snow in October and November 2014.

The camera traps were placed 40–50 cm above ground, 2–3 m away from the anticipated path of the Snow Leopard, thus facilitating recording of both large and small mammals. The camera traps were active for 24 hours, and the interval between consecutive photographs was set to one second. They were checked approximately every seven to 10 days, and batteries were changed if necessary.

The GPS coordinates and elevation of the camera trap locations were recorded using a handheld device Garmin GPSMAP device. We identified photographs of recorded species using Baral & Shah (2008), and categorized the photographs of identifiable species into full images showing the whole body and partial images showing only part of the body. Photographs of the same species at the same locations taken an hour apart were considered as independent detections.

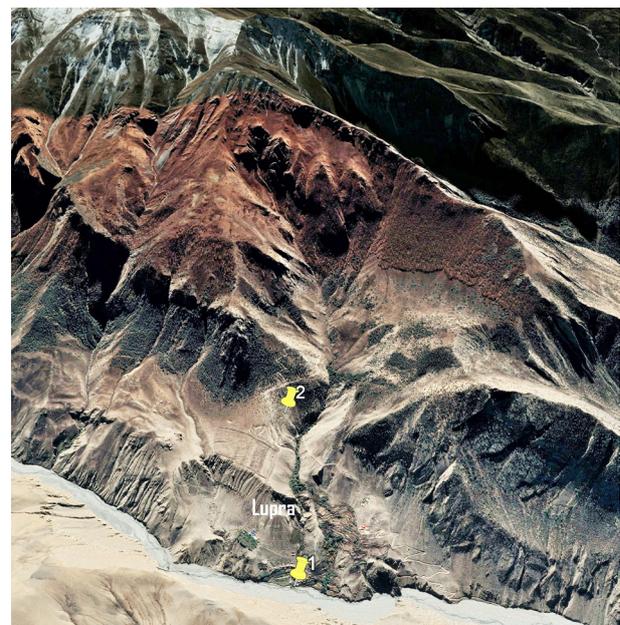
In 2016, one local person claimed that he frequently lost his chicken and pigeons from his poultry house in Lupra Village at 3,000m (Placemark #1 in Figure 2). Therefore, one camera trap was placed there for one month targeting the entrance of a poultry shed.

#### RESULTS

The total survey effort of 2,755 camera trap days comprised 735 days in the dry season of 2014 and 2,020 days in the wet season of 2016. This survey effort yielded 11,036 photographs of 15 wild mammals, one bird species and domestic animals. These photographs include 10 independent detections of a single Jungle Cat (Table 1). In 2014, a Jungle Cat was recorded in six detections with seven full and 18 half images (Image 1). In 2016, it was recorded in four detections with 10 full and 56 half images by the camera trap in Lupra Village (Image 2). A single Jungle Cat was sighted above Lupra Village at an elevation of 3,300m on 4 July 2016 in a shrubland dominated by tall *Juniper* and *Caragana* shrubs (Placemark #2 in Figure 2).

#### DISCUSSION

Our photographic records obtained at 3,000–3,100 m represent the highest elevations recorded for the species in Nepal. In the snow-free season, one individual moved up to an alpine shrubland at an elevation of 3,300m. The association of the Jungle Cat with shrublands and riverine habitats is well established (Gurung 1983; Mukherjee 1989; Nowell & Jackson 1996). The photographs taken at the entrance of a poultry shed in winter corroborate the observation that it seeks for prey close by human settlements (Ogurlu et al. 2010; Sanei et al. 2016), at least during the cold season.



**Figure 2.** Satellite view of the site where the Jungle Cat was recorded in a riverbed (# 1) on 16–18 December 2014 and sighted (# 2) on 04 July 2016.

**Table 1. Details of independent detections of Jungle Cat between December 2014 and July 2016 in Lower and Upper Manang of the Annapurna Conservation Area.**

Date and time	Location	Detections	Elevation	Habitat
16.xii.2014, 20.11h–21.25h; 17.xii.2014, 00.22h–01.00h; 18.xii.2014, 03.41h	28.803°N, 83.791°E	2 3 1	3,000m	Riverbed, about 50m far from Lupra Village
23.vi.2016, 02.15h–03.32h; 25.vi.2016, 07.04h–22.29h	28.819°N, 83.791°E	2 2	3,100m	Poultry farm in Lupra Village
04.vii.2016, 17.55h	28.794°N, 83.794°E	1 (sighted)	3,300m	Shrubland adjacent to agriculture land



**Image 1. Jungle Cat recorded on 16–18 December 2014 in a riverbed at an elevation of 3,000m in Lupra. © Bikram Shrestha and Gyurmi Gurung.**



**Image 2. Jungle Cat recorded on 23 June 2016 at a poultry farm at an elevation of 3,100m in Lupra. © Bikram Shrestha and Gyurmi Gurung.**

Pocock (1939) accounted of Jungle Cat skins collected in the Indian Himalayas up to elevations of around 2,400m. Sathyakumar et al. (2011) reported its presence at between 1,750m and 3,950m in Khangchendzonga Biosphere Reserve, Sikkim. In Nepal, it was recorded at lower elevations by camera traps in Shivapuri–Nagarjun National Park (Pandey 2012), and in Chitwan National Park (Karki 2011; Lamichhane et al. 2014). These two protected areas harbour temperate and subtropical to tropical bio-climatic zones, respectively (Bhujju et al. 2007). In Chitwan National Park, it inhabits grasslands and forest fringes (Gurung 1983).

Most of our photographic records of the Jungle Cat in the vicinity of Lupra Village were obtained after dark and by night. We, therefore, assume that it hides farther away from the village during the day. It has, however, also been observed by day in India and Iran (Kalle et al. 2013; Sanei et al. 2016).

Little is known about the ecology of the Jungle Cat in Nepal due to lack of targeted studies; only ad-hoc

presence records and incidental sightings are available. Basnet et al. (2017) reported five incidents of Jungle Cats being chased by free-ranging dogs, and two Jungle Cats being killed in an urban area at the Pulchowk Engineering Campus in the Kathmandu Valley.

The diet of the Jungle Cat has only been studied in India's Sariska Tiger Reserve in Rajasthan, where small mammals, rodents and birds constituted its main prey (Mukherjee et al. 2004). The authors concluded that one Jungle Cat eats up to 7,300 rodents per year. We, therefore, assume that Royle's Pika, Woolly Hare, rat species and Sikkim Vole are among the potential prey species of the Jungle Cat in our study area. As suggested by Mukherjee et al. (2004), its protection has economic benefits for farmers, as it contributes to controlling rodents in agricultural environments.

At present, it remains unclear whether the Jungle Cat observed in our study area is a rare wanderer to the remote Lupra Valley. Local people in neighbouring valleys did not indicate a sighting of a Jungle Cat.

Further research is needed on the adaptive capability of the Jungle Cat to alpine environments.

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