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Distribution update

First photographic record of Indian wolf in Rajaji Tiger Reserve, Uttarakhand, North India

Anubhuti Krishna[1], Samrat Mondol[1] and Salvador Lyngdoh[1]*

[1] Wildlife Institute of India, Dehradun - 248001, Uttarakhand, India. Email: salvador@wii.gov.in

* Correspondence author

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Abstract

We report the photo capture of wolves from Rajaji National Park and Tiger Reserve in the Northern state of Uttarakhand, India. A total of five photographs were recorded from the protected area providing the first conclusive evidence of wolves here. The wolves were identified as belonging to the peninsular Indian wolf lineage, *Canis lupus pallipes*. With the current record, the state of Uttarakhand now hosts both lineages of wolves, i.e., the Himalayan (*C. l. chanco*) as well as the Indian subspecies. We suggest regular monitoring and intensive study of the species to better understand this new documentation in an area with no previous such records as this may be an instance of distributional extension.

Introduction

Historically, the wolf (*Canis lupus*) was one of the most widely distributed terrestrial mammals, second only to humans (Mech 1970). However, in recent times, it has disappeared from nearly one third of this large range. While the Red List of the International Union for the Conservation of Nature places the wolf under the Least Concern category, several local populations are listed as Endangered (Mech and Boitani 2010). CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora 3.3.1973) lists the wolf in Appendix II (potentially endangered species), except for populations in Bhutan, Pakistan, India and Nepal listed in Appendix I (species in danger of extinction). In India, the Indian wolf (*C. l. pallipes*) subspecies is listed under Schedule I of the Wildlife Protection Act, 1972.

Two allopatric lineages of wolves with geographically isolated populations, both of which are believed to be very ancient, exist in the Indian subcontinent. These are the Himalayan wolf (also known as the Tibetan wolf), occurring in the Himalayas and Trans-Himalayas, and the Indian wolf of peninsular India. Both have been shown to be deeply divergent (200,000 – 700,000 years ago) and distinct from the broadly distributed wolf populations of the Holarctic clade, while also showing distinction between themselves (Hennelly et al. 2021). They have, therefore, been deemed as evolutionary significant units and may warrant recognition as separate species (Werhahn et al. 2020, Hennelly et al. 2021). Such studies clearly demonstrate the uniqueness of the wolf populations found in India and therefore demand an effective conservation strategy as well as encourage scientific curiosity, especially with regards to the Indian wolf since it represents one of the world's most endangered wolf populations.

Previously, the Indian wolf was thought to be completely absent north of the river Ganges, its distribution in the northern parts of the country being well known only from the states of Uttar Pradesh, Rajasthan, and Bihar. The subspecies was not known to be present in the flood plain and Terai areas of Uttarakhand, Nepal, and Bihar. However, recent record of the subspecies has been documented from the eastern Terai region demonstrating its presence in the area for the very first time (Maurya et al. 2021).

Methods

The Rajaji Tiger Reserve (RTR) is situated in and falls entirely within the Indian state of Uttarakhand. It is constituted by 13 ranges, three of which – Shyampur, Laldhang, and Kotdwar – comprise the buffer zone of the reserve. The remainder of the 10 ranges form the Rajaji National Park (RNP), the core zone of RTR. The park was notified and established in the year 1983 as an amalgamation of three previously recognized protected areas, the Rajaji Sanctuary, Motichur Sanctuary, and Chilla Range of Pauri Forest Division, and was subsequently declared a tiger reserve by the National Tiger Conservation Authority in April 2015.

RNP extends between 29°15' and 30°31'N latitudes and 77°52' and 78°22'E longitudes, covering an area of 820.42 km^2 (Joshi and Dixit 2012). It spreads across three districts of Uttarakhand, namely Dehradun, Haridwar, and Pauri. The Ganges flowing through the park in the North-South direction splits it into two regions: Western Rajaji (WR) and Eastern Rajaji (ER). The western part is a constituent of tiger habitat block (THB) I of the Terai Arc Landscape (TAL) whereas the eastern portion falls within THB II of TAL. WR consists of seven ranges: Ramgarh, Kansrao, Motichur, Chillawali, Dholkhand, Beribara, and Haridwar. The former three form the northern part of WR, while the latter four constitute the southern portion. ER on the other hand consists of the three ranges of Chilla, Gohari, and Rawasan. Over the years the park has come to be surrounded on almost all sides by human habitation in the form of settlements ranging from small villages and suburban towns to large cities such as Haridwar and Rishikesh. While ER remains connected to Corbett Tiger Reserve and further eastward reaches of the TAL, WR sits more or less isolated.

A study was carried out during the months of January through May of 2021 to assess the response of leopards (*Panthera pardus*) to tiger (*P. tigris*) pres-

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ence in Rajaji National Park. Data were collected via deployment of camera traps within the study area. To assist with even spacing between camera trapping stations, the study area was divided into grids of size 2 km x 2 km. Single camera traps, capturing only one flank, were deployed at a height of about 30 – 40 cm above the ground along animal trails, raus (dry seasonal drainages), forest roads, and water holes in these grids. Sites for the placement of the camera traps were decided based on presence of leopard and/or tiger signs such as scats, tracks, scrapes, and scratches, as well as information gathered from the Rajaji Forest Department staff. This allowed maximization of photographic captures of the desired species. Camera traps also captured images of potential prey during the sampling duration.

In accordance with the study design, most grids contained a single camera trapping station. However, some regions of the park falling within the study area were inaccessible due to the terrain and hence no camera traps could be deployed in such grids. Under these circumstances, an additional camera trapping station was set up in a nearby grid resulting in a few grids containing two camera traps. However, it was ensured that no two trapping stations were closer than 1.25 – 1.50 km. At each camera trap location, data was collected on the date of deployment and the camera ID. The location of the deployment station was also recorded using a handheld Garmin eTrex 20x GPS. The camera traps employed for the study (Cuddeback X-Change™) use a built-in passive infrared sensor triggered by changes in the infrared radiation within the detection zone to capture images. Additional information collected by the camera trap and displayed on the captured picture included date and time of the capture, the ID of the camera trap, and the phase of the lunar cycle.

All deployed cameras in WR were checked regularly (approximately once every week). However, in ER, cameras deployed in Chilla range (i.e., close to the southeastern side of RTR) were checked only once and the others were only revisited at the time of retrieval due to COVID-19 restrictions in place at the time of field sampling. Photo captures were considered indepedant if separated by >30 minutes.

Results

WR registered a total of 4,999 independent captures over the entire sampling period of 1,326 trapping days. ER, on the other hand, had 5,677 independent records over 1,222 days of camera trapping. A total of 28 mammalian species were recorded from WR while 27 were photo-captured in ER. Mammal species found across both WR and ER included barking deer (*Muntiacus muntjak*), chital (*Axis axis*), sambar (*Rusa unicolor*), wild pig (*Sus scrofa*), elephant (*Elephas maximus*), black-naped hare (*Lepus nigricollis*), red junglefowl (*Gallus gallus*), Kalij pheasant (*Lophura leucomelanos*), peafowl (*Pavo cristatus*), langur (*Semnopithecus hector*), macaque (*Macaca mulatta*), porcupine (*Hystrix indica*), palm civet (*Paradoxurus hemaphroditus*), small Indian civet (*Viverricula indica*), and rusty spotted cat (*Prionailurus rubiginosus*). Nilgai (*Boselaphus tragocamelus*) was exclusively camera trapped in WR while hyena (*Hyaena hyaena*), black bear (*Ursus thibetanus*), and sloth bear (*Melursus ursinus*) were only recorded from ER. Domestic prey included cattle (*Bos taurus*) and buffalo (*Bubalus bubalis*) in both WR and ER with additional captures of feral dog (*C. l. familiaris*, n = 1) in WR and feral cat (*Felis catus*, n = 2) in ER. Among the large predators, a total of 328 independent leopard captures were recorded in WR. ER, on the other hand, registered 233 independent tiger records but only 27 independent leopard captures.

We recorded captures of the Indian wolf from two locations within the Beribada Range of WR (Figure 1). A total of five wolf photo captures were registered (Table 1, Figure 2).

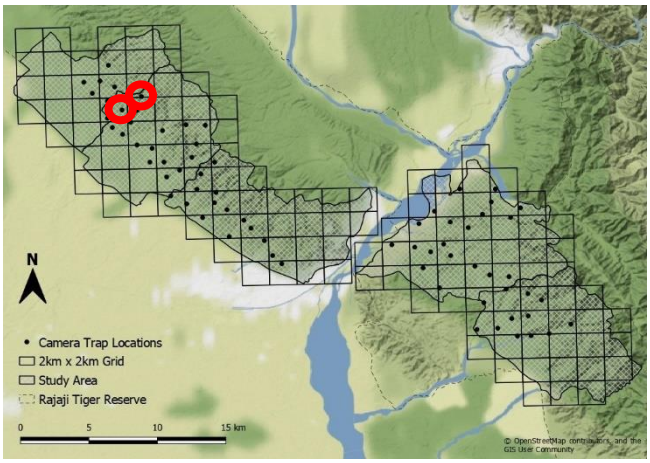

Figure 1. Map showing the study area with 2 km x 2 km grids and camera trap locations. Western Rajaji lies to the left of the river Ganges while Eastern Rajaji lies to the right. The red circles are indicative of wolf photo capture sites.

Discussion

The photographic evidence shows the presence of Indian wolf in RNP during the study period. The species should therefore be included in the fauna of the reserve. Although previous records of wolves from the area have been mentioned by various field staff and researchers, they have been inconclusive. This, however, is the first confirmed photographic record of wolves from the area and may be indicative of the presence of both subspecies of wolves in the state of Uttarakhand, the Tibetan/Himalayan wolf (Bhattacharya and Sathyakumar 2010, Joshi et al. 2020) and the Indian wolf.

It is unclear if the photo captures were those of a single individual or multiple animals, however, the former seems more likely. It is also currently unknown if this is a transient/dispersing individual or a resident. Further monitoring of the protected area will be key in establishing such details. The photo capture of the Indian wolf in RTR may, in addition, represent an extension of its currently thought-of range. Regions of Saharanpur, Roorkee, and Muzaffarnagar, southern to RTR and falling within a 50 km radius, have known distributions of Indian wolves. These animals are known to be cursorial travelers and can negotiate low to medium disturbances, thus enabling dispersion from these regions to the protected area. The current patterns of heavy land use change within this original distributional range of the subspecies may have led some individuals to disperse to areas of refuge and more abundant prey. Though wolves are known to cause heavy livestock mortality within their distributions, the present record has not been linked with any such disturbances to local agro-pastoralists. Old records of wolves from the area, however, have been linked to many incidences of child lifting (Burns 1996, Singh and Kumara 2006, Agarwala et al. 2010). Indian wolves have been reported to have home ranges much smaller than those of North American gray wolves. The average home range reported so far for three packs of Indian wolves is 113.4 ± 24.0 km^2 (range = 65.2 – 138.7 km^2; Jethva 2002) and home ranges for two lone male wolves have been estimated at 181.0 km^2 and 227.6 km^2 (Jethva 2002). In another study carried out in the Indian state of Maharashtra, the average home range of four packs was estimated at 183.58 ± 22.9 km^2, where individual home ranges of alpha males varied from 128.81 – 216 km^2 and alpha females between 163.40 – 213 km^2 (Habib 2007).

Table 1. Photo capture details of wolves from Rajaji Tiger Reserve.

Date	Time	Camera Trap ID	Latitude	Longitude	Elevation (m)	Place	Flank
28- 02 -2021	06:22 AM	C 31	30.06964797	78.001027	420	Bam Block	Left
28- 02 -2021	11:01 AM	C 31	30.06964797	78.001027	420	Bam Block	Right
28- 02 -2021	11:03 AM	C 31	30.06964797	78.001027	420	Bam Block	Left
28- 02 -2021	06:48 AM	C 33	30.07986702	78.015777	471	Bam Block	Right
28- 02 -2021	07:57 AM	C 33	30.07986702	78.015777	471	Bam Block	Left

Figure 2. Camera trap images of Indian wolf (*C. l pallipes*) captured from two locations within the Bam Block of Rajaji Tiger Reserve, Uttarakhand.

While there does exist a region of admixture of the Indian, Holarctic, and Himalayan wolf lineages in Ladakh, the Indian wolf along with the Himalayan wolf represent two of the most ancient wolf lineages around the globe (Hennelly et al. 2021). Continuous monitoring and further research of the Indian wolf is suggested so as to help devise a long-term conservation plan for this evolutionary significant unit which is genetically distinct and highly persecuted.

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Biographical sketch

Anubhuti Krishna holds a Master's degree in Wildlife Science from the Wildlife Institute of India, Dehradun. Her general interests span large carnivore ecology, mesopredator responses, and ecosystem dynamics.

Samrat Mondol, Ph.D, is a faculty and scientist at the Department of Animal Ecology and Conservation Biology, Wildlife Institute of India. He specialises in molecular ecology.

Salvador Lyngdoh, Ph.D, is a faculty and scientist at the Department of Animal Ecology and Conservation Biology, Wildlife Institute of India. He specialises in animal and carnivore ecology, particularly in tropical and mountainous ecosystems.