INTERNATIONAL JOURNAL OF CONSERVATION SCIENCE
ISSN: 2067-533X Volume 12, Issue 1, January-March 2021: 259-266 www.ijcs.ro

PRELIMINARY SURVEY ON ASIATIC BLACK BEAR IN SIKKIM HIMALAYA: AN OUTLINED PLAN FOR CONSERVATION

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Abstract

Demand for forest products has increased in the developing nation and possess a serious threat to wild flora and local fauna. The Asiatic black bear is one of the high conflict species found in the Sikkim and it comes under schedule I in Wildlife Protection (Act) 1972. Due to the road construction and widening, habitat destruction, human interference in their prime habitat, and numerous hydro-power projects immensely affecting the habitat of the black bear in Sikkim. With this background present study was initiated to document the suitable presence of black bears along with the human-bear interaction in and around Khangchendzonga National Park through secondary and primary data collection. We recorded that the presence of the Black bear is more in the transistion, buffer areas as concerning to the Khangchendzonga National Park(core area). Along with possible presence, the huge growth of conflicts like livestock killing, crop depredation, property damage, and even attack on a human is in wide-ranging ways. Various effective strategies and mitigation measures for the conflict are also discussed and have been outlined in the recommendation. Besides, the State government must have to start its own Asiatic Black bear Action Plan for the successful conservation and management plan for better future conservation.

Keywords*: Asiatic black bear; Conservation; Human-bear conflict; Khangchendzonga National Park; Sikkim*

Introduction

The human population increases continuously with an increase of demands on forest products like timber, food, a place for grazing, agricultural expansion, and water supply from the forest for fulfillment there basic need always leads to Human-Wildlife Interaction [1-3]. Actuality the conflict always materializes, whether inside or near to the border of the protected area or villages near to the protected area [4, 5]. In this scenario, large animals have more rates of wildlife intervention like human mortality, livestock depredation, and agricultural damages, and its triggers to unwanted retaliatory of the species [5, 6]. Globally the Asiatic Black bear (*Ursus thibetanus*) is kept in Vulnerable [7], and in India, it is in Schedule I of the Indian Wildlife (Protection) Act 1972 due to a large number of poaching, hunting, land fragmentations, habitat loss and for their conservation the limiting factor became people response the human-bear conflict [8].

Throughout their distributional ranges in India, very few studies on its ecology and threats have been carried out and they are mostly from the western Himalayas [9-13]. Only a few studies were carried out on the Asiatic Black bear in the eastern Himalayas [14-16]. In

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North-East India, the Asiatic black bear is widely distributed in all northeastern states [10]. In Sikkim, the black bear was distributed throughout the state ranging up to an elevation of 4300m [17] and they are disappeared from in some parts of their range due to habitat loss, uncontrolled farming, felling of trees, overgrazing by pack animals, extensive road building and numerous hydro-electric projects [14]. As a fact, the black bear invades in the villages of the Sikkim have drastically increased in the last few years, which leads to livestock loss and crop depredation even human attack. They usually occur at the end of autumn, when the availability of food is less in the forest [15, 16]. This type of intrusion always led to the retribution killing of the species in the conflict area [18].

However, no methodical monitoring and mitigation controlling actions for the black bear are not been formulated yet by the State Goverment. Ecology of black bears, local stakeholders, and community awareness program, renovation, and extensive study of traditional methods and conservation education will play an important role in the main conservation of black bears in Sikkim Himalayas.

Materials and Methods

The study was carried out in the Khangchendzonga National Park (KNP), buffer areas, and the fringes villages from 2015-2016 (Fig. 1). The park is distributed in the West and North district of Sikkim and geographically lies between 27°30’ to 27°50’N latitude and 88°30’ to 88°37’ east longitude making its India highest protected area. KNP and surrounding contain a remarkable range from sub-tropical to alpine to Trans-Himalayan (Cold Desert) within a small geographical area [17, 19].

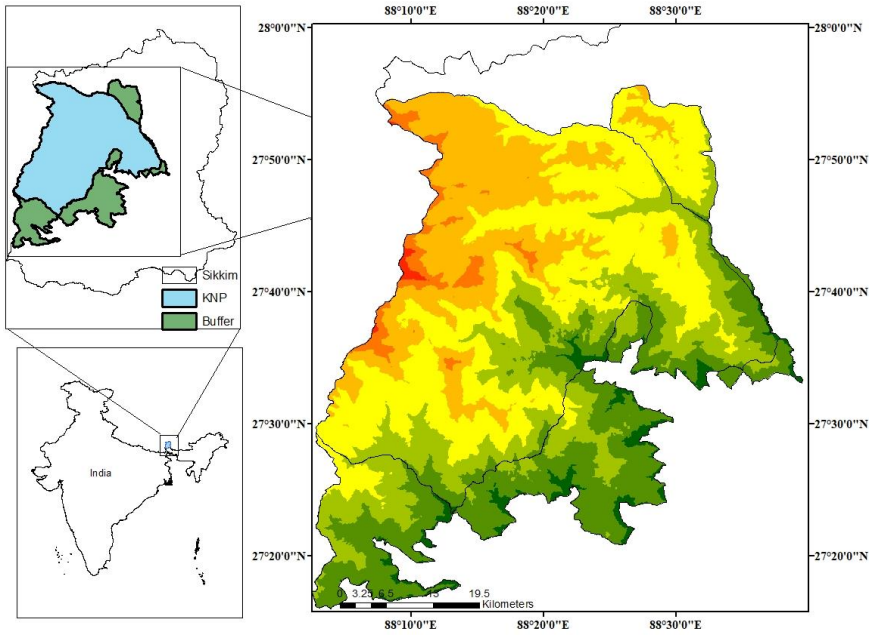

Fig. 1. Map of the study site of KNP and its surrounding

This area is recognized as a global biodiversity hotspot [20] and also one among the important Global 200 Ecoregions [21]. The Lepchas, Bhutias, and Nepalese are the main ethnic group and constitute 90% of the total population of fringe villages of KNP, and 10% of the population are defense personals and business communities. The villages are located in the

altitude zone of 800–3000m asl. They are mostly subsistence-level farmers, and mostly dependent on forest products for their basic needs. At the beginning of the research work, a first-hand survey and data collection for the presence of the black bear and Human-Bear conflict was carried in the three different ranges i.e. Yuksom range, Chungthang range, and Dzongu range of KNP and buffer area.

The study site was divided into the 4×4km grid to evaluate the presence of the Asiatic black bear in the KNP using the ArcMap 10.3.1 and ProGoogle earth. Trail sampling, scanning, and sign surveys in the KNP, buffer areas, and surrounding were used in search of direct (i.e., observations, leftover after the bear attack, roaring sound) and indirect signs of bear presence (i.e., claw marks, feeding signs, scats, tracks, dens, etc.). At the same time, a pre-designated questionnaire survey was carried out in the randomly selected 12 fringe villages ot of 26 villages which come under the distance of 1.5km from the boundary of the protected area. The questionnaire was organized into 6 different section sections: i) Demographic, socio-economic condition and dependency on forest products, ii) List of the major conflicting animal and the nature of conflict (Season, time, frequency, intensity, etc.), iii) Adoption of any scientific or traditional controlling method against human-bear conflict, iv) Loss of property and compensation allowance provided by the government, v) Perception of local people's attitude towards wildlife especially Asiatic black bear and human-wildlife conflict.

Results

Asiatic black bear is distributed throughout the three ranges (Yuksom, Dzongu, and Chungthang) but as higher in elevation the presence of the bear gets low. The higest percentage of data collection was feeding observation followed by the pugmarks and crop raid (Fig. 2). Total 242 bear case was recorded in 52 grids from KNP and buffer areas in which 24 claw marks, 36 pugmarks, 57 feeding observations, 32 scats, 14 trail or track used, 4 dens, 1 skull, 4 direct sightings, 3 times bear roaring sound, 28 numbers of a dead animal killed, 34 crop depredation and 5 property damage by a black bear (Figs. 3 and 4).

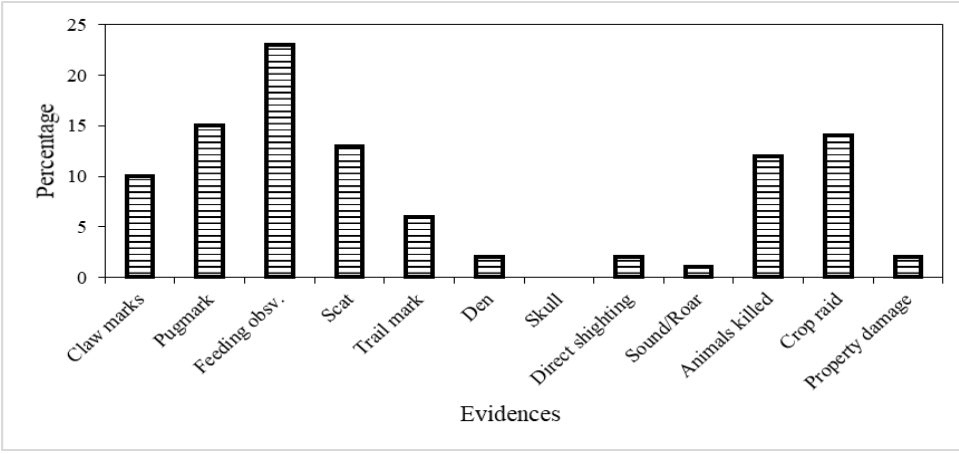

Fig. 2. Direct and Indirect data collected from KNP and its surrounding

The data collected from the KNP were restricted to up to 3500m asl. The presence and human-bear interactions were recorded high in the Yuksom range followed by the Dzongu range and the Chungthang range. The data collection sesons were divided into three sesons i.e. April-June (Summer), July-September (Moonson) and October-March (Winter). During the time of data collection, the data related to the black bear was collected more from a transistion

zone as compared to the buffer zone and core zone of KNP. Feeding observation, crop damages and animal killed were recorded highest where the human settelments are near to the forest lines. The highest amount of human-bear interaction was recorded in the summer and rainy seasons (June-October) from the buffer and fringes villages (Fig. 3).

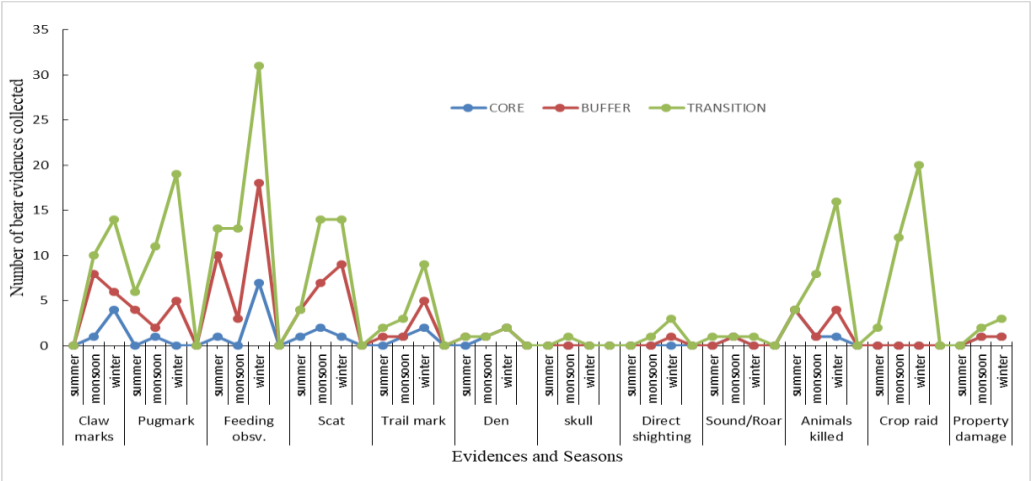

Fig. 3. Seasonal collections of evidence from the KNP and its surrounding area

The data gathered from the questionnaire survey and field observations that 10 major species were recorded from the surrounding of KNP. The species like goat (21%) and maize (30%) were recorded highest in the KNP surrounding villages. Other agricultural crops and livestock were recorded less damage as compared to maize and goat. September- November month(winter seasons) was recorded as the highest black bear attack months in the fringe villages (Table 1).

Table 1. Calendar of major crops and livestock damage by black bear from KNP surrounding

Major species damage	Months of Depredation					Percentage (%)
Goat	February	September	October	November	December	21
Sheep	March	August	October	November		11
Yak calf/adult	May	June	July	August		5
Foal/horse adult	April	May	July	August		2
Poultry	February	March	September	November	December	9
Maize	July	August	September	October	November	30
Finger millet	September	October	November			7
Buckwheat	September	October	November			10
Gauva	October					3
Squash	July	August				2

A total of 26 KNP fringe villages were included in the questionnaire survey, which was nearer to the protected area, for which only 12 village villages were selected for interviews. Most of the interview people were from the age group of (26-72yrs). During the survey, 94% of the respondent are mainly a farmer and they depend upon the agricultural, horticultural practices and other remaining 6% respondent depended on business. Almost in all 26 villages, they cultivated the same crops and cultivation pattern includes maize, wheat, finger millet, barley, buckwheat, pulses, potato, and cardamom respectively. The cardamom cultivation in Sikkim is gaining its production for the last five years and due to the high value of these spices, it is surpassing the other crops. Also, all the respondents have livestock, and they sell their

products in the nearest market like milk, milk product, wool, meat, and the tours and trekking. In some areas, the fatal attack and serious injury done by the black bears were also recorded.

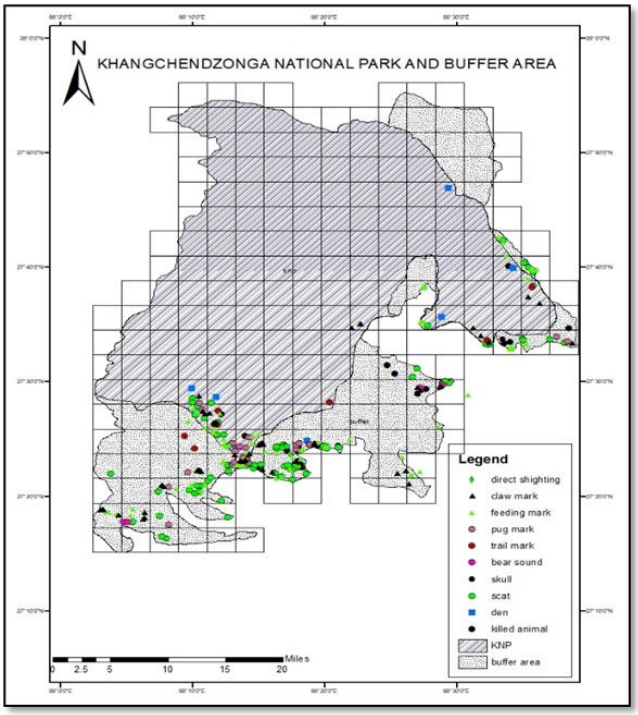

Fig. 4. Different types of data collection from the KNP and the buffer areas in 2015-2016

During the survey, the highest number of livestock killed was the goat and sheep followed by the horse and yak. More than 80% of large animals like cattle and pack animals have reported only serious attacks not killed. The livestock attack was mostly reported from October-November and June-July. A large number of cornfields were raided by black bears from August- late October. According to data gathered from 82% of respondents mentioned that the bear mainly attacks during fruiting time and mostly at night. There is more than 71% of the respondent was affected by the cornfield depredation by the Black bear. After maize, the fruits of *Machilus edulis*, buckwheat, guava and finger millet were a raid by the black bear. The high attack rate on the livestock and crop occurred in the villages and agricultural fields which are very close to the boundary of the protected area which is ≤1km. A total of 53 cases of livestock and crop depredation was recorded during the studies the attack occurred significantly more often at very closed to the boundary of protected area ≤1km (Kruskal – Wallis, $X2 = 16.045$, $df = 2$ $p = 0.0003$, $\alpha = 0.5$).

The respondent shows a high positive attitude towards bear conservation besides the menacing attack. The age between 26yrs-56yrs respondent was looking for new mitigation measures while above this age group they are looking for good compensation on bear attacks from the Government and other various NGO sides. Based on the present study from sign survey, transect walk and interviews with the local people on the Human-bear interaction a possible presence of Asiatic black bear has been mapped using ArcGIS 10.3 (Fig.5.).

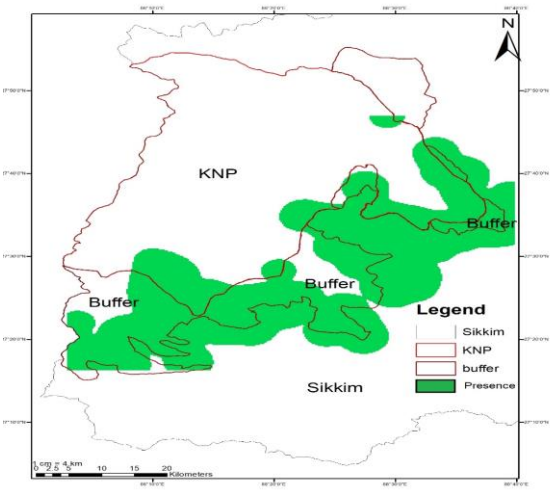

Fig. 5. The possible presence of an Asiatic black bear in and around KNP.

Discussions

The Asiatic black bear is one of the flagship species of Sikkim and distributed from tropical to temperate forest which play a major sources of seed dispersal in the region. However the KNP is inscribed in the world heritage site, a little information is available on its ecology and the human-bear conflict from Sikkim, especially from the KNP and fringes villages. The present study was conducted in the KNP, buffer area and the fringe villages to generate information on the possible distribution and the human-bear interaction. In table 2 are presented the major tree species of study area of KNP and surrounding area.

Table 2. Major tree species of study area of KNP and surrounding area

Botanical Name	Family	Altitudinal distribution(M)	IUCN Status
Abies densa	Pinaceae	2800-3700	Least Concern
Alnus nepalensis	Betulaceae	200-2800	Least Concern
Castanopsis hystrix	Fgaceae	450-2300	Least Concern
Machilus edulis	Lauraceae	1200-2500	Least Concern
Machilus odoratissima	Lauraceae	1500-2100	Least Concern
Cryptomeria japonica	Taxodiaceae	900-2500	Near Threatened
Rhododendron arboreum	Ericaceae	1800-3600	Least Concern
Symploccos kuroki	Symplocaceae	1500-3000	Least Concern
Viburnum spp.	Caprifoliaceae	2100-2700	Least Concern
Quercus lamellosa	Fagaceae	1300-2500	Least Concern
Rhododendron griffithianum	Ericaceae	2800-3400	Least Concern
Zanthoxyllum acanthopodium	Rutaceae	1500-2750	Least Concern
Engelhardtia acerifolia	Juglandaceae	1300-1900	Least Concern

The combined result from both the secondary data and primary data collection the species distributed throughout the study area. However, bears are more in the buffer areas as compared to the KNP. It is also noticed that during the study period that cardamom plantation has come up to 2400m asl which is replacing the other cash crops and it will directly increase the bear interaction because the bear doesn't eat cardamom and they will move farther inside the area in search of food. From the present study, the Yuksom range has more bear presence, livestock kill, and agricultural depredation as compare to the two ranges. In North Sikkim, especially in the Dzongu range, the more conflicts were recorded from outside the KNP jurisdiction. We also recorded the types of crop damage and the black bears' killing pattern of livestock. Major crop damage was looping, sweeping, tearing while livestock were dragged

from their place(especially from resting sites). The major part of livestock eaten is the stomach and upper neck side. More than 70% of the attack were recorded during the late night and early morning due to their nocturnal habits. The study also shows that in the month of sept-oct-nov-dec the less fruiting and alternate fruiting mechanism in these trees like *Machilus spp, Symplocos theifolia, Castonopsis hystrix, Machilus edulis* are highly responsible for human-bear conflict which is residing near to the forest area. The negative attitude of local inhabitants was found only where there is a large number of crops, livestock, and pack animal were killed.

Conclusions

Based on the present study, that KNP and buffer areas hold a good number of Asiatic black bear in the low land areas and there are various challenges which can minimize the human-bear interaction. Alongside the black bear, there are other species like wild boar, barking deer, and porcupine is present in the areas which are causing crop depredation. For the better future safeguard of the species and mitigation measures, the following recommendation is put forward.

- The more scientific research work on the ecology, population, distribution, feeding behaviour, seasonal movements, and bear conflict management should be work throughout the Sikkim.
- Plantation practices of Rhododendron, Pine, *Machilus edulis* and the fodder trees initiative taken by Forest Government in the core area, buffer areas as well as near to the fringe villages should be stopped immediately. And the collection of wild fruit *Machilus edulis, Machilus odoratissima,* and *Machilus gammieana* by local villagers should be checked by the forest official and EDC members with continuous patrolling in the forest and villages.
- Compensation schemes should be regulated by the higher authority and the dissemination of compensation should be properly monitored and examine before and after distribution. The rotational agricultural practices in the village should be better measures on the conflict.
- Traditional methods using by the local villagers need to be studied for better outcomes. Various scientific methods especially bio-fence should be introduced as introduced by others in its distributional ranges.
- Awareness and workshop campaign with capacity building programs should be regularly organized in the villages with resources persons.
- State-level black bear conservation and management action plans should be developed instantaneously and implemented throughout the Sikkim.

Abbreviations

KNP - Khangchendzonga National Park.
NGO - Non-Governmental Organization.
WWF - World Wide Fund for Nature.

Acknowledgments

We are thankful to the Forest, Environment, and Wildlife Management Dept. Govt. of Sikkim for supports and granting the research permit. We are grateful to The Rufford Small Grants for Nature Conservation, WWF-India, Wildlife Trust of India for financial supports and Idea Wild equipment support.

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Received: June 02, 2020
Accepted: January 10, 2021