

Population of Asiatic Black Bear (*Ursus thibetanus*) in Kaghan and Siran Valleys, District Mansehra, Pakistan

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ABSTRACT

Population estimation survey of Asiatic black bear (*Ursus thibetanus* G. (Baron) Cuvier, 1823) was conducted in Kaghan and Siran Valleys of Khyber Pakhtunkhwa (KP) province of Pakistan. The different surveys (questionnaire, sighting, and sign survey) were conducted in all sites of the forests from June to November 2018. Thirteen different types of signs were observed during the field survey. Potential site selection was based on sign observation (Encounter Rate; ER). Four black bears were observed from three different spots. Two mature male bears were seen in Kaghan Valley (Kamal Bann and Malakandi Reserve Forest) and a mother with a single cub was observed in Siran Valley during dusk. Population estimation was carried out by transect method, with 18 transects were in Kaghan and 15 transects in Siran Valley. A total of 1858 signs were recorded during the field survey; among these 1213 dig marks, 186 plants uprooting and two setting places. An average of 49.95 signs/km² was recorded; this is a very high encounter rate. According to BBC (British Broadcasting Corporation) Science and Nature, the home range size of Asiatic black bears is 10 to 20 km², so we concluded that more than 24 black bear were present in both valleys.

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Authors' Contribution

ZU conducted field surveys and collected data into a meaningful manuscript under the supervision of SM and ZI. FA and NA reviewed the manuscript for grammatical mistakes. AMK helped in tables formation and scientifically proofread and formatted the manuscript.

Key words

Sign survey, Transect method, Encounter rate, Home range, *Ursus thibetanus*

INTRODUCTION

Out of eight bear species worldwide, six are found in Asia (Hwang, 2000; Khan, 2012; Fujiwara *et al.*, 2013; Escobar *et al.*, 2015) and two Asiatic black bear *Ursus thibetanus* and Himalayan brown bear *Ursus arctos* are found in Pakistan (West, 2005; Nawaz, 2007; CITES, 2014; Ripple *et al.*, 2014; Garshelis and Steinmetz, 2016). The Asiatic black bear was once widely distributed in

Karakoram, Himalayas, and the Hindu Kush ranges, but is now limited to specific spots due to habitat degradation and population contraction (Roberts, 1997; Hwang, 2000; Crooks, 2002; Ripple, 2004). Black bear populations are present in northern parts of Pakistan, including Mansehra, Battagram, North Dir, South Chitral, Swat (KP), Gilgit Baltistan (GB) and Azad Jammu and Kashmir (AJ&K) (Roberts, 1997; Sheikh, 2005; Nawaz, 2007; Fakhar-i-Abbas *et al.*, 2015). Asiatic black bear in Pakistan has received very little attention from conservationists/researchers and sighting records indicate a sharp decline in their population during the last 40 to 50 years (Sheikh, 2005; Nawaz, 2007; Waseem and Ali, 2011; Fakhar-i-Abbas *et al.*, 2015).

Black bear prefers to live in den in bushy areas within the forest, mostly in moist temperate coniferous, dry temperate, alpine, sub-alpine, and broad leaved forests (Woods and Kalpatrick, 1997; Waseem and Ali, 2011; Fakhar-i-Abbas *et al.*, 2015; Garshelis and Steinmetz, 2016) at altitudes ranging between 1500 to 4500 meter

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above the sea level (asl) (Schaller, 1977; Waseem and Ali, 2011; Ali *et al.*, 2015; Fakhar-i-Abbas *et al.*, 2015). Population density varies from one to ten bear per 10 km², with an average of two bear/ 10 km² (Kolenosky *et al.*, 1992; Hwang, 2000; Waseem and Ali, 2011; Garshelis and Steinmetz, 2016). The conservation status of Asiatic black bear is vulnerable under the International Union for Conservation of Nature (IUCN) Red List (Hwang, 2000; Zahler *et al.*, 2004; Garland *et al.*, 2016; Pires and Moreto, 2016).

The population diversity of black bear depends upon their home range in a specific region, and it varies among different species of bears (Garland *et al.*, 2016). Usually, male bears occupy a larger home range (more than 50 km²) as compared to females (12 to 50 km²) (Rogers, 1977; Young and Ruff, 1982; Ali *et al.*, 2015). The breeding process occurs from May to June, while cubs (one to five) are born from early December to late February and cubs stay with their mother for 12 to 20 months (Stevens and Lofts, 1988; Waseem and Ali, 2011; Furusaka *et al.*, 2017; Hamasaki *et al.*, 2020; Deus *et al.*, 2021; Hamasaki and Dan, 2021; McCormack and Cotoras, 2021). The presence of black bear can also be determined from the pattern of feeding including claw marks, broken branches, soil digging for termites, and bark removal from the trees that are used as a food source during the winter season (Servheen, 1990; Crooks *et al.*, 2011; Cardinale *et al.*, 2012). IUCN Bear Specialists Group (BSG) points out that, Asiatic black bears are at high risk in a different part of Southeast Asia (Servheen, 1990; Hwang, 2000; Fujiwara *et al.*, 2013; Pires and Moreto, 2016). The species declined due to habitat destruction, and increase in human activities like cultivation shifting, grazing of livestock, illegal killing for sport, poaching, reactive killings against crops depredation (Servheen, 1990; Garland *et al.*, 2016).

Population estimation of black bear was carried out in Kaghan and Siran Valleys of the District Mansehra (Khyber Pakhtunkhwa, Pakistan). The presence of black bear has been indicated by different researchers (Roberts, 1997; Sheikh, 2005; Nawaz, 2007; Ripple *et al.*, 2014; Fakhar-i-Abbas *et al.*, 2015; Ullah *et al.*, 2020), in the area without reporting the size of the population exploiting the area. Present research reports the size of the population of black bear in the District Mansehra by following multiple sampling techniques.

MATERIALS AND METHODS

Study area

Kaghan (22,000 ha) and Siran (13,744 ha) valleys (North-East of District Mansehra: 34.234°-35.184°N; 72.817°-74.134°E; Khyber Pakhtunkhwa) constitute the

present study area. These valleys have diverse ecosystems, including moist temperate coniferous forest, sub-alpine forest, and subtropical woodlands. The area also has small lakes and streams, river Kunhar along with, mountain peaks covered by snow.

Methods

Structured interviews of 100 volunteers randomly selected from local community and wildlife and forest staff in different villages of the study area (Fig. 1) (original in Urdu, facsimile of English translation), after letting them know the purpose of the study (Ullah *et al.*, 2021a, b; Khan *et al.*, 2021a). After potential site selection, we visited the specific sites between June and November 2018 and searched for bear signs (recorded with high-resolution DSLR Camera: Canon Eos 6d WG DS126401, Japan, with zoom lenses: EF 24-105 mm 1:4 L IS, and 70-200 mm, IS USM, Japan), taking help of binocular (Nikon Aculon A211 12X50 No.6055245, China) and plotted position of the detected signs on the map using GPS (GARMIN: etrex 10 and etrex 30, FCC ID: IPH-01842, Taiwan) and sites having bear signs were selected for detailed survey. Transects sampling methods were followed at all potential sites. We also visited crop fields and tried to observe bears, with the help of local farmers (Khan *et al.*, 2021b; Ullah *et al.*, 2021).

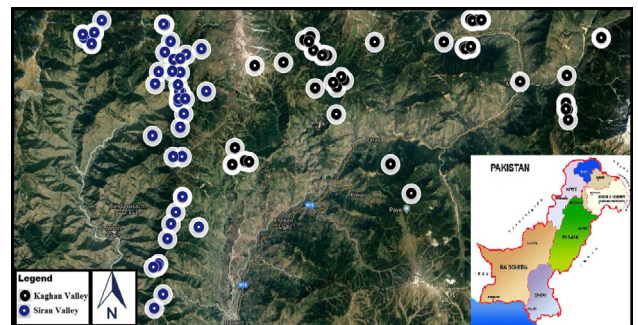


Fig. 1. Map showing the locations of volunteers responding to the questionnaire.

Population estimation was carried out by sign survey technique. Signs of black bear, i.e., pug marks/footprint, claw marks, tree marks/bark off, plants uprooting, stone replacing, dig marks, bite marks, scat samples, hair samples, bee hive damages, trafficking routes, location of livestock killing, crop damages, coarse wood damages and place of temporary setting/sleeping were observed in the forest. Variable-length transects (100-500 m and 10-20 m wide) were drawn in each potential site. Two persons walked through transect areas adopting a zigzag path to search for bear signs, while the third person moved straight

to record the data. We surveyed 33 transects with a total length of 4900 m (18 in Kaghan, 15 in Siran) (Fig. 2). The encounter rate was calculated for each sign by dividing the number of signs observed by the length of the transect.

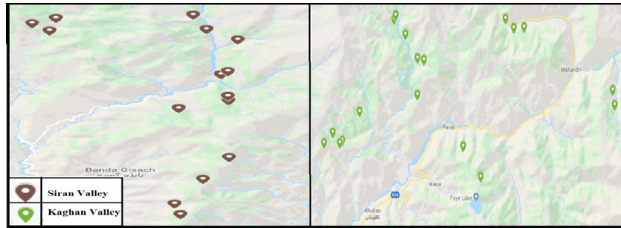


Fig. 2. Map location of different transects.

RESULTS

Potential bear sites

Interviews with respondents suggested 14 potential Asiatic black bear population sites of which 9 are in Kaghan and 5 in Siran valley (Table I).

Bear sighting

Three adults and two cubs of a black bear were sighted at three localities. On July 16 (6:36 pm) an adult Male black bear was recorded from a distance of 300 m in Kamal Bann Reserved Forest (Compartment No. 13) of Kaghan Valley. The second time a female bear, with a single cub, was sighted from a distance of 335 m on September 1 (6:51 pm) at Punjul Reserve Forest (Compartment No. 3₁) of Siran Valley while digging (fresh footprints and dig marks later observed). The third time a Male black bear was observed from a distance of 450 m on September 29 (7:26 pm) at Malakandi Reserve Forest (Compartment No. 4) of Kaghan. All sightings of the bears were associated with dense shrubs within the forest suggesting denser shrubby areas as the preferred habitat of the Asiatic black bear (Fig. 3). The black bear is a very shy animal and usually avoids human encounter, Survey team did not intentionally disturb the black bear for sighting, and only accidental sightings of the black bear were recorded casually during the field survey.

Sign survey

We recorded 13 bear signs; which were further divided into two main types based on appearance rate, i.e. frequent and rare (Supplementary Table I).

Of 1858 bear signs recorded, dig marks (1213; 65.2%) appeared in the highest frequency, followed by plants uprooting (186; 10%), other signs appeared in low frequency. An average number of bear signs (49.95/ km²)

suggests a very high encounter rate. According to BBC Science and Nature, the average size of the Asiatic black bear home range is 10 to 20 km². A of total 33 potential sites (37.19 km²) were selected as the sample area from both valleys (357.44 km²). Bear signs observation among all the sites of the sample area indicated that bear is present in the entire study area because selected spots covered the whole study area by placing distance between them. Based on the average home range (15 km²), we calculated that more than 24 ($24/33,744 = \text{one per } 1406 \text{ m}^2$) black bears are present within the entire study area of both valleys.

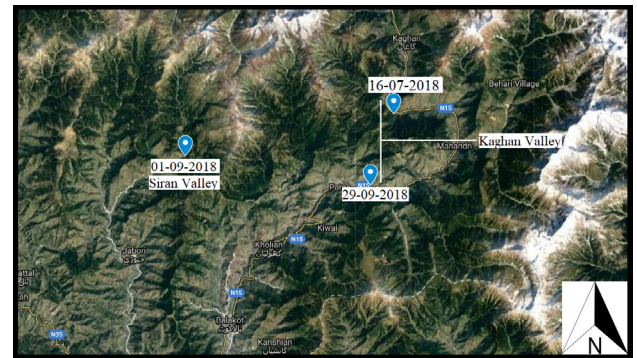


Fig. 3. Google location of the sighted black bear.

Potential sites confirmation based on data analysis

The percentage of each sign in the following table determined highly potential sites from both valleys. This percentage was calculated based on standard encounter rates (SER). There are 28 high potential sites in the study area, among these 16 sites are present in Kaghan Valley while 12 are in Siran Valley. These potential sites were recommended for the conduction of a detailed and genetic-based survey of black bears. Comparison between questionnaire-based survey and data analysis for potential sites are mostly the same. A questionnaire-based survey represents 33 potential sites in both valleys, while after analyzing bear signs only 28 potential sites were confirmed to be present in both valleys.

Percentage of the standard encounter rate for both categories (mostly appeared and rarely appeared signs) is given in Supplementary Table II. The total percentage for each sign was considered as 100, but only those were shown in the table which occurred above the standard encounter rate, below this was ignored for highly potential site selection.

Among 33 potential sites, only 28 sites were selected as highly potential sites because a very high number of signs were recorded above the standard encounter rate (SER). Only five sites (K4, K12, S19, S23, and S28) do not follow the rules of SER. Mostly and rarely appeared

signs were divided based on the appearance rate. Total six different types of (mostly appeared) signs were observed 46 times in 24 potential sites, similarly, seven different types of (rarely appeared) signs were observed 30 times in 18 potential sites from both valleys (Fig. 4).

Public response

The vast majority of respondents (92%) suggested an increase in the sighting of Asiatic black bear during the recent past. The average number of sightings during the last 8 years was 4.5 bears per respondent.

Respondent responses suggested that black bear lives in groups as well as solitary forms, presence in the group depends upon various combinations i.e. single adult male, single adult female, male and female, Male, female with cubs, cubs only and female with cubs. Sighting observations represented the population size of black bears. According to the local respondents, black bears were mostly sighted in a group of female mothers with cubs (29.68%) followed by a single female (17.96%) from different locations (Table II). Based on the average, 2.13 bears were seen by each individual among different groups.

The population fluctuation depends upon the encounter rate and is last seen in the forest. All the latest observations were divided into three categories (2018, 2017, and 2016) on annual basis. Among these, the highest observations (57.4%) were recorded in 2018 followed by (35.4%) in 2017 (Table III).

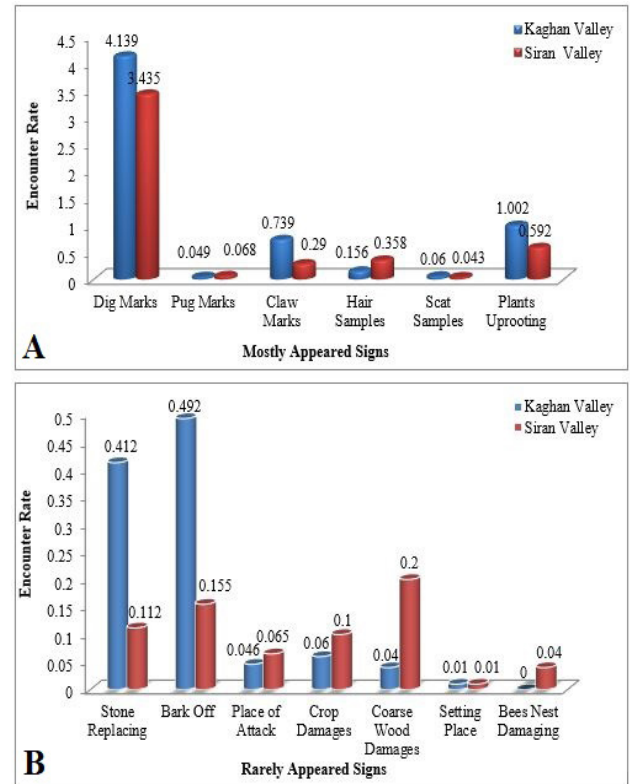


Fig. 4. Encounter rate of mostly (A) and rarely (B) appeared signs from both valleys.

Table I. Potential sites of black bear.

S.#	Forest zone	Number of compartment	Compartment number having Bear signs	Potential bear area (ha)
Kaghan valley				
1	Manshi Reserve Forest	36	4 {C1, C8, C10, C12}	582.50
2	Malakandi Reserve Forest	19	3 {C1, C4, C6}	349.60
3	Kamal Bann Reserve Forest	14	3 {C8, C10, C13}	309.90
4	Nuri Bichla Reserve Forest	32	2 {C26, C27}	270.70
5	Nagan Reserve Forest	18	2 {C8, C14}	253.30
6	Bageer Guzara Forest	6	1 {C14}	233.00
7	Bhonja Guzara Forest	25	1 {C24}	158.00
8	Ganila Guzara Forest	2	1 {C1}	103.60
9	Hungrai Guzara Forest	1	1 {C7}	163.00
Siran valley				
10	Punjul Reserve Forest	12	7 {C3 _I , C3 _{III} , C4 _I , C9 _{II} , C10 _{II} , C11 _{II} , C12 _{II} }	679.80
11	Una Reserve Forest	06	3 {C2 _{III} , C3, C5 _{III} }	292.90
12	Manda Guchha Guzara Forest	18	2 {C7, C15}	97.12
13	Jacha Guzara Forest	23	1 {C14}	89.03
14	Deoli Guzara Forest	49	2 {C17, C20}	85.30
Total		261 33		3667.75

C, Compartment; Roman numbers (I, II, III). Sub-Division in the compartments

Table II. Sighting frequency of the black bear from the local community

	Single male	Single female	Male and female	Male, female, cubs	Cubs only	Female and cubs	Total
Average No of black bears per sighting	1.8	2.3	1.5	1.3	2.1	3.8	2.13
Sighting frequency (%)	14.06	17.96	11.71	10.15	16.40	29.68	100

Table III. Information's about the black bear population collected from the local community.

S. #	Questions from interviewers (n=100)*	Response of the interviewers (in percentage)		
1	Frequency of Asiatic black bear in the study area?	Increased 92%		
		Decreased 1%		
		Do not know 7%		
2	Did you see the black bear in the study area?	Yes 68%		
		No 32%		
		Average: 4.5 bears seen/ respondent		
3	Have you ever seen bears in a group? (two or more)	Yes 47%		
		No 53%		
		Average No. seen per group = 3.8 bears		
4	When the black bear was last sighted? (annual wise)	54% community answer this question		
		2018	2017	2016
		57.4%	35.4%	7.2%

*n, Number of Questionnaires

DISCUSSION

A signed survey was conducted for population estimation of black bears in Kaghan and Siran Valleys using the transect method. A survey of 33 (18 Kaghan and 15 Siran) transects suggested a sign density of 49.95/km² which is reasonably high indicating a wider distribution of bear. Using BBC Science and Nature information on the home range of Asiatic black bears (10-20 km²) we estimate a population of more than 24 black bears in these valleys. A similar study conducted by [Waseem and Ali \(2011\)](#) at two potential sites (Punjul and Malakandi Reserved Forest) of District Mansehra recorded 35 black bear signs with an average sign density of 4.3 /km², which is very low compared with the presently reported sign density. [Waseem and Ali \(2011\)](#) suggested a population of 4 black bears in the two valleys surveyed by them.

A questionnaire-based survey (n= 1873) was conducted in different areas (258 localities) of Pakistan to assess the population of bears. Among all the sites, Asiatic black were exclusively present in 45 localities of District Mansehra and Battagram. The black bear is a very clever animal and usually destroys the maize crops (regularly in two localities irregular in 6 localities) and fruits such as grapes, apricot, walnut, and mulberry. The average

depredation of bears is 54 cattle, 188 sheep and goats, 4 yaks, and 9 horses and donkeys with a total loss of US\$ 28,400 ([Fakhar-i-Abbas et al., 2015](#)). Similarly, this study is based on the questionnaire-based survey, sign survey and human bear conflict in Kaghan and Siran Valleys. It indicated that quite a good population (n=24) of Asiatic black bears is present in both valleys.

CONCLUSION

Population estimation survey of an Asiatic black bear was conducted in Kaghan and Siran Valleys. Thirteen different types of signs were observed during the field survey. Four black bears were observed from three different spots. Two mature bears were seen in Kaghan Valley and a mother with a single cub was observed in Siran Valley during dusk. Total 1858 signs were recorded during the field survey; among these Dig marks (1213) were recorded the highest number of signs followed by Plants uprooting (186), while the lowest number of the observed sign was setting places (2). An average of 49.95 signs/km² was recorded; this is a very high encounter rate. According to BBC Science and Nature, the home range size of Asiatic black bears is 10 to 20 km², so we concluded that there are more than 24 black bears (one per 1406 m²) present in

both valleys.

Availability of data and materials

Data of this article is available for any sort of publicity after publication.

Ethics approval consent to participate

This research work has no such animals or data where we provide ethical approval certificate, therefore there is no need for ethical approval.

Supplementary material

There is supplementary material associated with this article. Access the material online at: <https://dx.doi.org/10.17582/journal.pjz/20211205151252>

Statement of conflict of interest

The authors have declared no conflict of interest.

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