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Movement of Asiatic Black Bear: Sign Survey Evidence from Kaghan and Siran Valleys, Pakistan

Zaib Ullah^{*1}, Sajid Mahmood², Zafar Iqbal³, Naveed Akhtar¹, Gul Bacha Khan¹, Ahmad Ali⁴, Samina Yasmin², Muhammad Saqlain⁵, Mohammad Ayaz Khan⁶ and Muhammad Arif⁷

¹Department of Zoology, Hazara University Sub-Campus Battagram, Khyber Pakhtunkhwa, **Pakistan**

²Department of Zoology, Hazara University Mansehra, Khyber Pakhtunkhwa 21120, **Pakistan**

³Department of Botany, Hazara University Mansehra, Khyber Pakhtunkhwa 21120, **Pakistan**

⁴Department of Biochemistry, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi, **Pakistan**

⁵Department of Zoology, Horizon Degree College Chakwal, **Pakistan**

⁶Sustainable Forest Management Project, Islamabad, **Pakistan**

⁷Sustainable Forest Management Project, Peshawar, Khyber Pakhtunkhwa, **Pakistan**

*Correspondence: zaibullah_zoology@hu.edu.pk Received 28-03-2021, Revised: 17-04-2021, Accepted: 20-04-2021 e-Published: 05-05-2021

Population abundance and movement of Asiatic black bear (*Ursus thibetanus*) was investigated at Kaghan and Siran Valleys, District Mansehra. Population estimation was carried out by taking transect method, data were collected from 33 transects; among these 18 were present in Kaghan and 15 in Siran Valley. Total 1858 signs recorded during the survey; among these Dig marks (1213), Pugmarks (18), Claw marks (134), Hair samples (65), Scat samples (11), Plants uprooting (186), Stone replacing (62), Bark off (98), Place of livestock's killing (14), Crop damages (16), Coarse wood damages (35), Setting place (2) and Bees nest damaging (4). An average of 49.95 signs/Km² was recorded; this is a very high encounter rate comparatively. According to BBC Science and Nature, size of the home range of Asiatic black bear is 10 to 20 km², so we recommend that there is more than 19 black bear present in both valleys, most of their population have been moved from Kaghan to Siran Valley. The age of the claw marks was calculated to find out movements of bear, it is divided into four categories, among these the highest are recent marks (45.08%) followed by fresh marks (32.78). As a result of this research, we point that the population of Asiatic black bear was moved from Kaghan to Siran valley due to server disturbance and habitat degradation in Kaghan valley in the last few years.

Keywords: Population Abundance, Movement, Sign Survey, Transect, *Ursus thibetanus*

INTRODUCTION

Historical perspective and fossil record showed that 16 species of bears were recorded in past time (Garshelis and Steinmetz, 2016) whereas currently eight species have been reported throughout the world; Polar bear (*Ursus maritimus*), Asiatic black bear (*Ursus thibetanus*), Sloth bear (*Melursus ursinus*), American black bear (*Ursus americanus*), Brown bear (*Ursus arctos*), Sun bear (*Helarctos malayanus*) and

Giant Panda (*Ailuropoda melanoleuca*). Among these three species were found in North America, two in Europe, one in South America, and six species in Asia. Two species of bears (black and brown) are distributed in the Northern area of Pakistan and Azad Jammu Kashmir (Khan, 2012). The Asiatic black bear is considered one of the largest carnivore species in the world (Ripple et al. 2014), which was originated in France and Germany but limited to Asia recently (Gutleb and

Ziaie, 1999) and distributed through Pakistan, Afghanistan, Iran, India, Japan, Indo-China, Korea, Laos, Vietnam and Taiwan (Garshelis and Steinmetz, 2016; Escobar et al. 2015).

The average weight of a black bear is 92 to 140kg for females while 115 to 270kg for males with particularly straight and humped shoulder and black (Banfield et al. 1974). The Feet's of the black bear is strong, muscular, and powerful with five claws, which are used for tearing roots, digging, and for climbing (Kolenosky, 1992). Black bears have relatively poor eyesight; smell and hearing power well developed (Kolenosky, 1992). A black bear is a charming animal with tremendous power, and intelligence (Ernest et al. 2000). It's well-known for its cognitive ability, long-term memory, speed, skills, and marvelous strength. Claw marking and bark off are unique behaviors of black bears; it is not common among all bears (Kolenosky, 1992). Black bear is one of the adjustable and adoptable animals (West, 2005). Bear is a nocturnal animal and mostly appears at dawn and twilight; and going to hibernate in the winter season while highly active in the summer season where they search for better foods (Ernest et al. 2000; Ullah et al. 2020).

Variation in diet among black bears occurred based on food abundance and geographic region (Robbins, 2000). Black bear is strongly omnivore species, the major source of food is plants materials including leaves, grasses, shrubs, trees bark, fruits, barriers, and nuts. More than 90 percent of their diet composed of plant materials (Hwang et al. 2002). They also feed on small animals and insects including moose, deer, fishes, chickens, meat, and jungle honey are the best food, about 2% of their diet is composed of mammals (Myers, 2016). Most of the black bears show a diurnal pattern of feeding while little doing nocturnal foraging (Kozakai et al. 2013; Khan et al. 2021). Identification of the food items can also be determined from signs of feedings like shelves (branches broken in the trees show that bears feed on leaves); claw marks on the tree are made when they remove bark off and eat. Ants feeding are also determined from the following signs: digging the soil, stone replacing by bears, coarse wood digging, put the nose close on the ground, and movements of first paws in the soil (Fujiwara et al. 2013). Food items can also be identified by using dietary analysis of scat samples. Bear can digest plants and other food items like small animals. Plants items are easily differentiated by observing their seeds in scat samples (Farrell et al. 2000).

Approximately 1000 individuals of black bears were recorded in Pakistan (Ullah et al. 2020). In Canada, it was estimated that the range of population density varies from one to ten bears per 10 km², average density approximated two bears per 10 km² (Kolenosky, 1992). The conservation status of the Asiatic black bear is vulnerable under the International Union for Conservation of Nature (IUCN), Red List, while American black bear is endangered under US Federal List (Hwang et al. 2002). Generally, females have very clear home ranges between 12 to 50 km² (Amstrup and Beecham, 1976; Rogers, 1977; Young and Ruff, 1982). Sub adults males have very larger home ranges sometimes they may be more than 50 km² depend upon the availability of food sources and den selection (Rogers, 1977). An adult male has a five times larger home range than that of adult females. Females and their descendant's individuals share home ranges (Myers, 2016). Differences in home ranges depend upon variability in habitat, availability of the food like production and distribution of oaks, and suitability of den sites (Hazumi, 1993).

MATERIALS AND METHODS

Study Area

The study was carried out in Kaghan and Siran Valleys located in North-East of District Mansehra, Khyber Pakhtunkhwa, Pakistan (34.234° to 35.184°N and 72.817° to 74.134°E). Geographical locations of both valleys showed border with District Battagram and independent state Azad Jammu and Kashmir. Kaghan Valley has high importance regarding wildlife; it has protected areas including National Parks (Saif-Ul-Malook and Lulusar-Dodipat) and a Wildlife Sanctuary (Manshi). Siran Valley is located at the East of Kaghan Valley; it's also greatly known for tourist hiking especially to elevated Mountain "Mossa Musalla" (13,500 feet). These valleys have diverse ecosystem including moist temperate coniferous forests, sub-alpine forests, and subtropical woodlands and also includes small lakes, streams, mountains peaks covered by snow, and a river "Kunhar". Area of the Siran Valley (13,744 ha) while Kaghan (22,000 ha), total areas of both valleys are 35744 ha, including Reserves and Guzara Forests (Ullah et al. 2020) (figure 1)

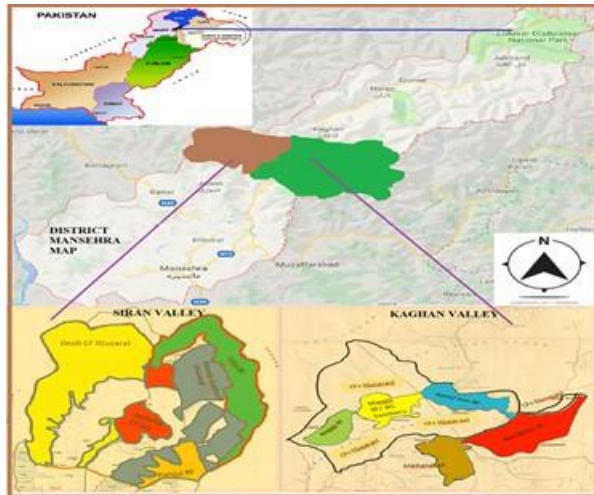


Figure 1: Map of the study area

RESULTS

Potential sites selection

Potential site selection was based on the presence of multiple signs of black bear. Potential site selections were helpful for the conduction of detailed surveys like population abundance, movement, and habitat analysis. A total of 33 potential sites were identified from the study area, among them 18 sites from Kaghan Valley while 15 sites in Siran Valley. Data about signs and vegetation were collected from identified potential sites.

Sign survey of black bear

Total thirteen different categories of bear signs were recorded from both Kaghan and Siran Valleys. These were: Pug Marks, Scat Samples, Claw Marks, Bark off, Dig Marks, Plants Uprooting, Stone Replacing, Hair Samples, Place of Livestock's Killing, Crop Damages Coarse Wood Damages, Place of Temporary Setting and Bees Nest Damaging. Each sign was recorded by taking the GPS reading and made pictures. The encounter rate was calculated for each sign from all transects. Encounter rate (ER) was calculated by following this equation, the number of each sign divided by the length of the transect (No of sign/transect length) (figure 15).

Pugmarks:

Pugmarks of black bears were observed on different media; we encountered pug marks on snow, mud, and sand (figure 3). A total 18 number of pug marks with (0.117) encounter rates were recorded from both valleys, Siran Valley represents the higher encounter rate (0.068) followed by Kaghan Valley (0.049). The highest

encounter rate (0.058) was recorded from Punjul Reserve Forest (PNJRF) of Siran Valley (figure 2). The detail of the encounter rate for each sign is represented in (table 1 and 2). Pugmarks of black bears were differentiated with elongated five claws and pointed nails as compared to other carnivores.

Scat samples:

Black bear scat samples were differentiated on their size and food contents. Total 11 fresh scat samples with a 0.103 encounter rate (ER) were collected from both valleys. Among these, six samples (ER: 0.06) from Kaghan and five samples (ER: 0.046) from Siran Valley were encountered (figure 4).

Claw marks:

A total of 146 claw marks with (1.029) encounter rates were recorded during the field survey. Claw marks were recorded along with GPS coordinates. Both valleys are represented with a high number of claw marks. Among both valleys; the Highest number of claw marks 112 (ER: 0.739) were recorded from Kaghan and 35 (ER: 0.29) from Siran Valley (figure 5). Detail of each claw mark and its encounter rate is given in (Table 1).

Bark off:

Bark off/removal of bark from conifer trees was one of the unique behaviors of the Asiatic black bear. The size of this mark is very clear and may persist for three to six years on the tree. A total of 98 bark signs along with a 0.647 encounter rate were recorded from both valleys. Among these, the highest number of bark removal 88 (ER: 0.4915) were from Kaghan Valley (figure 5).

Dig marks:

Soil digging is a very common behavior among all bears, a very high encounter rate of soil digging was recorded among all signs. A total 1213 dig mark with a very high number encounter rate (7.574) was recorded, among these 676 (ER: 4.139) were recorded from Kaghan and 537 (ER: 3.435) from Siran Valley (figure 6).

Plants uprooting:

Black bears prefer to plants items as a food source. A total of 186 plants uprooting were recorded from the study area and its encounter rate was 1.594 among all transects. Kaghan Valley was represented with 115 plants uprooting

spots with a 1.002 encounter rate, while 71 spots with a 0.592 encounter rate were recoded from Siran Valley. Plant's uprooting of black bear was differentiated during the field survey (figure 7).

Stone replacing:

Black bears misplace stones in the forest for searching ants and worms, Data about stone

replacing were recorded from study sites. Sixty-two stone replacing (ER: 0.524) were recorded along with pictures from both valleys. Fifty stone replacing points (ER: 0.412) were recorded from Kaghan Valley and 12 stone replacing points (ER: 0.112) were present in Siran Valley (figure 8).

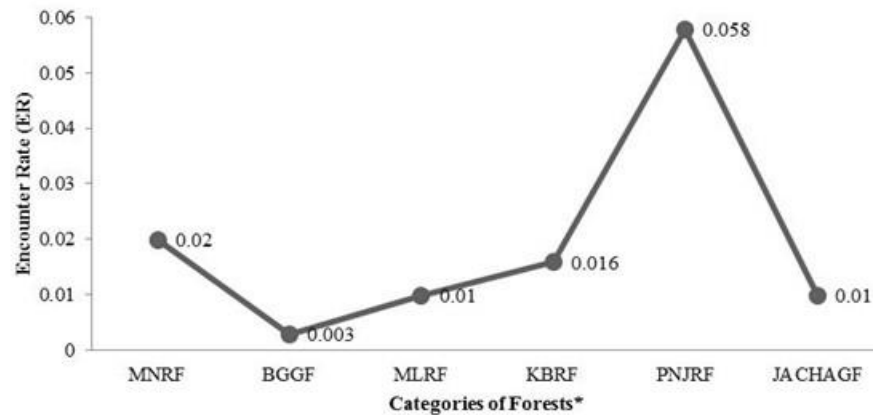


Figure 2. Encounters Rate of pug marks in different zone of forest from both Valleys

*MNRF (Manshi Reserve Forest), BGGF (Bageer Guzara Forest), MLRF (Malakandi Reserve Forest), KBRF (Kamal Bann Reserve Forest), PNJRF (Punjul Reserve Forest), JACHAGF (Jacha Guzara Forest).



Figure 3: Pugmarks of black bear



Figure 4: Scat samples of black bear



Figure 5: Claw marks and bark off from trees



Figure 6: Digging of Soil



Figure 7: Plants uprooting for food searching



Figure 8: Stone replacing for searching the ants and termites



Figure 9. Hair samples of black bear



Figure 10: Remnants of killed livestock's



Figure 11: Maize crops damaged by black bear



Figure 12: Coarse wood damages



Figure 13: Temporary setting place



Figure 14: Beehive damaged by black bear

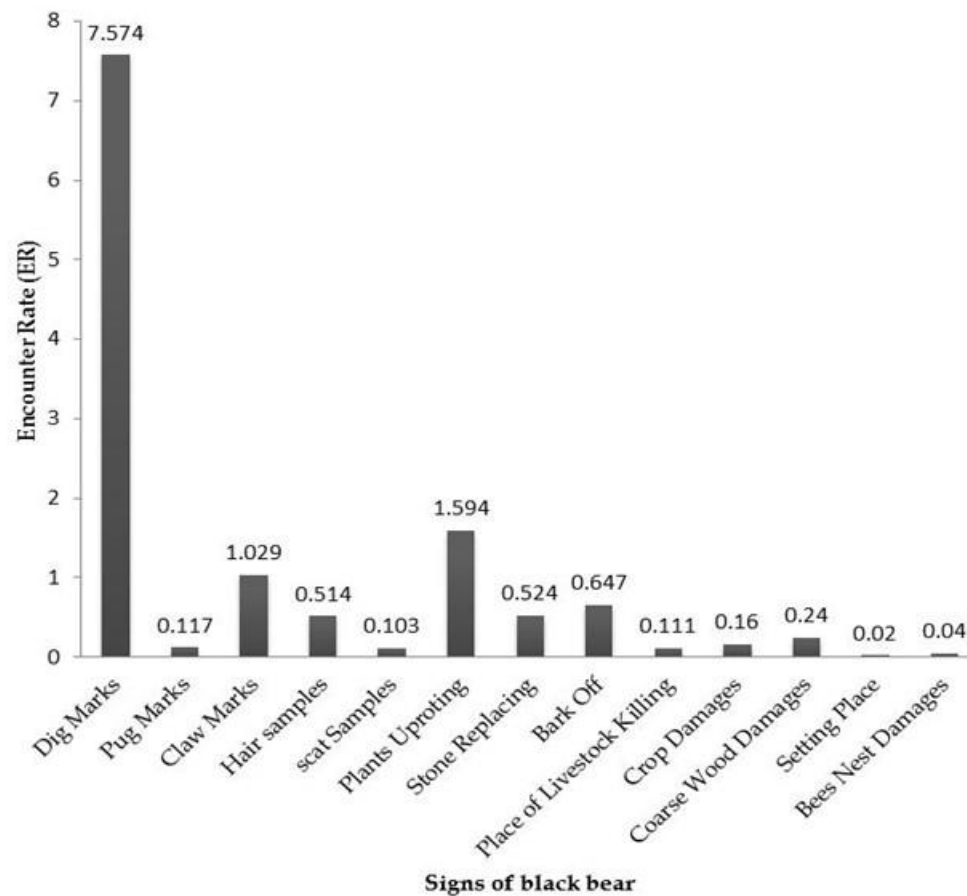


Figure 15: Encounter rate (ER) of black bear signs from both Kaghan and Siran Valleys

Table 1: Encounter Rate (ER) was calculated for each category of signs (A)

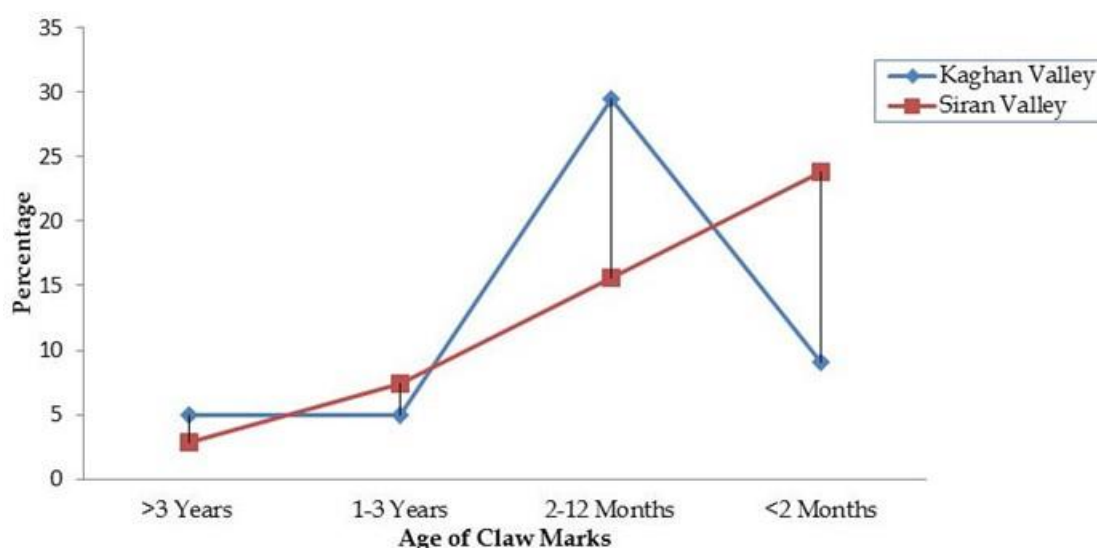
Transect code	Transect Length/ Width	Compartment Area (Km ²)	Forests	Dig Marks (ER)	Pug Marks (ER)	Claw Marks (ER)	Hair Samples (ER)	Scat Samples (ER)	Plants Uprooting (ER)
MNRFC12	100/10	245.2	Kaghan	85(0.85)	2(0.02)	4(0.04)	1(0.01)		2(0.02)
MNRFC10	300/10	115.3	Do	12(0.04)		30(0.1)	2(0.006)		1(0.003)
MNRFC8	100/10	170.4	Do	4(0.04)		2(0.02)		1(0.01)	3(0.03)
BGGFC11	300/10	233.099	Do	20(0.066)	1(0.003)		3(0.03)		2(0.006)
MNRFC1	100/10	105.9	Do	18(0.18)		8(0.08)	8(0.08)		4(0.04)
MLRFC6	100/10	90.2449	Do	6(0.06)		2(0.02)		1(0.01)	
BNJGFC24	100/10	158.00	Do	21(0.21)		2(0.02)		1(0.01)	2(0.02)
MLRFC4	100/10	105.218	Do	9(0.09)		8(0.08)			2(0.02)
MLRFC1	100/10	99.148	Do	30(0.30)	1(0.01)	2(0.02)			2(0.02)
KBRFC8	300/10	77.6996	Do	200+(0.66+)	2(0.006)	8(0.026)			9(0.01)
KBRFC10	300/10	141.64	Do	160(0.533)	3(0.01)	19(0.063)			7(0.023)
KBRFC13	100/10	90.6496	Do	4(0.04)		2(0.02)	1(0.01)		1(0.01)
NBRFC26	100/10	125.453	Do	5(0.05)		4(0.04)			2(0.02)
NBRFC27	100/10	145.282	Do	2(0.02)		1(0.01)			4(0.04)
GNGFC1	100/10	103.6	Do	2(0.02)		8(0.08)			2(0.02)
HNGRIGFC1	100/10	163.088	Do	52(0.52)		4(0.04)		1(0.01)	50(0.50)
NGRFC14	100/10	113.312	Do	30(0.30)		7(0.07)	2(0.02)		15(0.15)
NGRFC8	100/10	140.021	Do	16(0.16)		1(0.01)		2(0.02)	7(0.07)
MNGGFC7	400/15	40.4686	Siran	33(0.0825)		5(0.012)	2(0.005)		3(0.007)
PNJRFC3 _{III}	300/10	75.6762	Do	28(0.093)	1(0.003)	1(0.003)	7(0.023)	1(0.003)	3(0.01)
PNJRFC3 _{II}	100/10	63.5356	Do	40+(0.40)	2(0.02)	1(0.01)	1(0.01)		4(0.04)
MNGGFC15	100/10	56.656	Do	5(0.05)		5(0.05)	4(0.04)		1(0.01)
UNRFC2 _{II}	100/10	74.0575	Do	11(0.11)		1(0.01)	1(0.01)		1(0.01)
UNRFC3	100/10	106.432	Do	9(0.09)		1(0.01)	2(0.02)		
JACHAGFC14	100/10	89.0308	Do	11(0.11)	1(0.01)		10(0.10)		3(0.03)
DEOLIGFC20	100/10	35.6123	Do	3(0.03)		1(0.01)			
DEOLIGFC17	100/10	49.7763	Do	5(0.05)		2(0.02)			3(0.03)
UNRFC5 _{III}	100/10	112.503	Do	2(0.02)		3(0.03)			2(0.02)
PNJRFC4 _I	400/15	94.6964	Do	200+(0.5+)	2(0.005)	2(0.005)	8(0.02)		10(0.025)
PNJRFC9 _{II}	100/10	126.262	Do	80+(0.80+)	1(0.01)	2(0.02)	3(0.03)		20(0.20)
PNJRFC10 _{II}	100/10	125.453	Do	60+(0.60+)		4(0.04)	6(0.06)	1(0.01)	7(0.07)
PNRFC11 _{II}	100/10	70.0106	Do	30(0.30)		2(0.02)	3(0.03)	1(0.01)	6(0.06)
PNRFC12 _{II}	100/10	124.238	Do	20(0.20)	2(0.02)	5(0.05)	1(0.01)	2(0.02)	8(0.08)
Total	4900(m)	3667.663(ha)	Both	1213(7.574)	18(0.117)	147(1.029)	65(0.514)	11(0.103)	186 (1.594)
Keys for transect code: A (signs with high appearance rate) RFC (Reserve Forest Compartment), GFC (Guzara Forest Compartment), Natural numbers 1-27 (Compartment numbers), and Roman numbers I-III (Sub Division of Compartment) are common for all transects. MN (Manshi), BG (Bageer), ML (Malakandi), BNJ (Bhonja), KB (Kamal Bann), NB (Nuri Bichla), GN (Ganila), HNGRI (Hungrai), NG (Nagan), MNG (Manda Gucha), PNJ (Punjul), UN (Una), JACHA (Jachah) and DEOLI (Deoli).									

Table 2: Encounter Rate (ER) was calculated for each category of signs (B)

Transect Code	Transect Length/Width	Compartment Area (Km ²)	Forests	Stone Replacing (ER)	Bark Off (ER)	Place of Livestock's Killing (ER)	Crop Damages (ER)	Coarse Wood Damages (ER)	Setting Place (ER)	Bees nest Damaging (ER)
MNRFC12	100/10	245.2	Kaghan	1(0.01)	1(0.01)					
MNRFC10	300/10	115.3	Do	1(0.003)	28(0.093)					
MNRFC8	100/10	170.4	Do		2(0.02)					
BGGFC11	300/10	233.099	Do	1(0.003)	1(0.003)					
MNRFC1	100/10	105.9	Do	4(0.04)	6(0.06)	1(0.01)				
MLRFC6	100/10	90.2449	Do	4(0.04)	2(0.02)					
BNJGFC24	100/10	158.00	Do	3(0.03)	3(0.03)					
MLRFC4	100/10	105.218	Do	1(0.01)	5(0.05)					
MLRFC1	100/10	99.148	Do		1(0.01)			2(0.02)		
KBRFC8	300/10	77.6996	Do	6(0.02)	4(0.013)	1(0.003)				
KBRFC10	300/10	141.64	Do	5(0.016)	10(0.033)	1(0.003)				
KBRFC13	100/10	90.6496	Do	2(0.02)	1(0.01)	1(0.01)				
NBRFC26	100/10	125.453	Do		4(0.04)		4(0.04)			
NBRFC27	100/10	145.282	Do	6(0.06)	1(0.01)			2(0.02)		
GNGFC1	100/10	103.6	Do	2(0.02)	5(0.05)	2(0.02)	2(0.02)			
HNGRIGFC1	100/10	163.088	Do	5(0.05)	3(0.03)				1(0.01)	
NGRFC14	100/10	113.312	Do	9(0.09)						
NGRFC8	100/10	140.021	Do		1(0.01)					
MNGGFC7	400/15	40.4686	Siran		2(0.005)					
PNJRFC3 _{III}	300/10	75.6762	Do		1(0.003)	1(0.003)		3(0.01)		
PNJRFC3 _{II}	100/10	63.5356	Do					2(0.02)		
MNGGFC15	100/10	56.656	Do			2(0.02)	10(0.10)			
UNRFC2 _{II}	100/10	74.0575	Do		1(0.01)					
UNRFC3	100/10	106.432	Do		2(0.02)	3(0.03)				
JACHAGFC14	100/10	89.0308	Do	1(0.01)	1(0.01)			2(0.02)		
DEOLIGFC20	100/10	35.6123	Do	1(0.01)	1(0.01)			4(0.04)		
DEOLIGFC17	100/10	49.7763	Do	2(0.02)						1(0.01)
UNRFC5 _{III}	100/10	112.503	Do		1(0.01)	1(0.01)				
PNJRFC4 _I	400/15	94.6964	Do	1(0.0025)	3(0.0075)	1(0.0025)		12(0.03)		
PNJRFC9 _{II}	100/10	126.262	Do	3(0.03)	2(0.02)			3(0.03)		2(0.02)
PNJRFC10 _{II}	100/10	125.453	Do		4(0.04)			5(0.05)		
PNRFC11 _{II}	100/10	70.0106	Do		2(0.02)					1(0.01)
PNRFC12 _{II}	100/10	124.238	Do	4(0.04)					1(0.01)	
Total	4900(m)	3667.663(ha)	Both	62(0.524)	98(0.647)	14(0.111)	16(0.16)	35(0.24)	2(0.02)	4(0.04)
Keys for transect code: B (signs with low appearance rate) RFC (Reserve Forest Compartment), GFC (Guzara Forest Compartment), Natural numbers 1-27 (Compartment numbers), and Roman numbers I-III (Sub Division of Compartment) are common for all transects. MN (Manshi), BG (Bageer), ML (Malakandi), BNJ (Bhonja), KB (Kamal Bann), NB (Nuri Bichla), GN (Ganila), HNGRI (Hungrai), NG (Nagan), MNG (Manda Gucha), PNJ (Punjul), UN (Una), JACHA (Jachah) and DEOLI (Deoli).										

Table 3: Total number of bear signs observed from both Valleys

Forest	Dig marks	Pugmarks	Claw marks	Hair samples	Scat samples	Plants uprooting	Stone replacing	Bark off	Place of livestock's killing	Crop damages	Coarse wood damages	Setting place	Bees nest damaging
Kaghan	676	09	112	17	6	115	50	78	6	6	4	1	0
Siran	537	09	34	48	5	71	12	20	8	10	31	1	4
Total	1213	18	134	65	11	186	62	98	14	16	35	2	4

**Figure 16: Movement of black bears on the bases of age-wise claw mark observation between two Valleys****Hair samples:**

Hair samples of black bears were differentiated based on morphology and color. A total of 65 hair samples (ER: 0.514) were noninvasively snagged from black bear; among these, the highest number 48 hair samples (ER: 0.358) were collected from Siran followed by Kaghan Valley which is 17 hair samples with (0.156) encounter rate (figure 9).

Place of livestock's killing:

Fourteen sites were observed in both valleys, where black bears attack livestock. The encounter rate of livestock killing was 0.111 from both valleys. Siran Valley contains eight livestock killing spots with (0.065) encounter rate, while six killing spots (ER: 0.046) were recorded from Siran Valley. The remnants of killed sheep and horse were observed, both pictures of the remnant were

captured and GPS reading was recorded. The dead remnant showed that the bear population is significantly present in the study area and causes economic losses and damages for the local community (figure 10).

Crop damages:

The attacks and damages of the bear to crops and fruits were recorded photographically at the study sites. A total of sixteen different fields were observed where black bears damage the maize crops. Among these, the greatest damages were recorded from Siran Valley with an encounter rate (0.10) while Kaghan Valley showed a 0.06 encounter rate of maize crop damages. Bear especially attack maize crops and cause economic loss for the local farmers. The picture showed that bears damage the maize crop (figure 11).

Coarse wood damages:

A total of 35 coarse wood were recorded, and its encounter rate (ER: 0.24) was calculated. The highest number of damages was recorded from 31 different places of Siran Valley with the 0.20 encounter rate, while four damages were recorded from Kaghan Valley with the 0.04 encounter rate (Figure 12).

Place of temporary setting:

Black bears also stay for a short time within nutritious areas, considered as the temporary setting place in highly bushy areas. Just two such places (each in a valley) were identified during the field survey from both valleys. This type of information is very helpful for the current population and showed that bears are present in the study area (Figure 13).

Bees nest damaging:

A total of four different places were recorded, where black bears damage the beehives in the forest. This type of behavior is only limited to bear family. All the four damages of beehives from Siran Valley and its encounter rate (ER: 0.04) were recorded during data collection. Siran Valley represents the high number of bear signs as compare to Kaghan Valley (Figure 14).

Total thirteen different types of signs were observed during the field survey from both valleys. Each sign was observed from different transects, these signs represent the behavior of black bears. There were total 1858 bear signs were observed during the field survey, among these, the highest number of sign was dig marks (1213) observed. The total number of signs and their types were observed from each valley is shown in (table 3).

Total 244 claw marks and bark off were recorded from both valleys. The age of the marks was divided into four categories, among these 118 marks (48.33%) from Kaghan Valley and 125 marks (51.21%) were recorded from Siran Valley. All the marks were divided into four groups, fresh (32.78%), recent (45.08%), old (12.29%), ancient (9.42%). The highest ratio (23.77%) of fresh marks was observed from Siran Valley, while (29.50%) of recent marks was observed in Kaghan Valley. It means a high percentage of fresh signs is observed from Siran Valley, while old marks were highly observed from Kaghan Valley. It indicated that Asiatic black bears moved from Kaghan to Siran Valley due to an increase in human activates (figure 16).

DISCUSSION

A sign survey was conducted for the movement of black bears in Kaghan and Siran valleys. During the sign survey transect method was selected for all signs observed in the forest, a total of 33 (18 Kaghan and 15 Siran) transects were drawn in both valleys. Thirteen different types of bear's signs were observed during the field survey, the rate of observation was very high in both valleys. A total of 1858 bear signs were observed in the study area. The number of average signs observed in the study area is 49.95/Km². According to the BBC Science and Nature, the average home range of Asiatic black bears is 10 to 20 km². The average of these numbers is 15 km² was selected for population abundance and movement. About 293.04 km² area was selected as a sample, bear signs were conformed in each studied compartments of both valleys. Based on home ranges there are more than 19 Asiatic black bears are present in both Kaghan and Siran valleys and most of their population has been moved from Kaghan to Siran Valley because of the high rate of human activities and disturbance in Kaghan Valley. A similar study was also conducted by Waseem and Ali, (2011) in district Mansehra, according to their research they conducted a sign survey in two potential sites (Punjul and Malakandi Reserve Forest). The transects method was selected, a total of eight transects were drawn in the two sites for the collection of all necessary information about black bears. A total of 35 signs of a black bear were observed during the field survey, these signs are comprised of footprints (14), claw marks (13), soil digging (04), scat samples (03), and one den were encountered. An average of 4.3 signs/Km² observed in both sites, compartments 11 and 6 of Malakandi reserve forest and compartment 10 of Punjul reserve forest were highly used by Asiatic black bear. 40% footprints and 37% claw marks were observed as the highest number of signs from both sites which was defined by the presence of footprints and claw marks. A temporary setting place was encountered in Malakandi reserve forest compartment 10. Based on home ranges it's declared by BBC sciences and nature, there are approximately four Asiatic black bears in both Kaghan and Siran valleys. This study is much similar to our research work; both of the studies were conducted in the same area. The upper cited study was conducted only in two areas (Malakandi and Punjul Reserve Forests) where they observed 4.3 signs /Km², while our study identified all the forests of both Kaghan and Siran valleys with the high number of

Signs 49.95/Km². In the comparison of both valleys, it is observed that most of the bear population is present in Kaghan Valley as compare to Siran valley. Comparison between number of signs 1858 (our research) and 35 (upper mention) also have a big difference among two studies. As a result of population abundance, there are huge variations between 04 and 19 number of Asiatic black bear individuals, these differences may be based on sample size variations or conservation effort increased the populations of black bears in both Valleys. The study was conducted by (Waseem and Ali, 2011) indicated that a high bear population was present in Kaghan Valley as compare to Siran valley but our findings indicated the opposite situation here. Finally, we point that the population of Asiatic black bear was moved from Kaghan to Siran valley due to server disturbance and habitat degradation in Kaghan valley in the last few years.

CONCLUSION

Population abundance and movement of Asiatic black bear (*Ursus thibetanus*) was investigated through sign survey techniques at Kaghan and Siran Valleys, District Mansehra. During the sign survey transect method was selected for all signs observed in the forest, a total of 33 (18 Kaghan and 15 Siran) transects were drawn in both valleys. 13 different types of bear's signs were observed during the field survey, rate of observation was very high in both valleys. A total of 1858 bear signs were observed in the study area. The number of average signs observed in the study area is 49.95/Km². According to the BBC Science and Nature, the average home range of Asiatic black bears is 10 to 20 km². The average of these numbers is 15 km² was selected for population abundance and movement. About 293.04 km² area was selected as a sample, bear signs were conformed in each studied compartments of both valleys. Based on home ranges there are more than 19 Asiatic black bears are present in both Kaghan and Siran valleys, most of their population has been moved from Kaghan to Siran Valley because of the high rate of human activities and disturbance in Kaghan Valley. As a result of this research, we point that the population of Asiatic black bear was moved from Kaghan to Siran valley due to server disturbance and habitat degradation in Kaghan valley in the last few years.

CONFLICT OF INTEREST

The authors declared that the present study

was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

ZU conceived of the presented idea and also wrote the manuscript. ZU designed the research methodology and performed the field survey in a meaningful way. SM and ZI verified the methods. SM and ZI encouraged ZU to investigate the current research gap and supervised the findings of this work. NA, GBK, and AA discussed the results and contributed to the final manuscript. ZU, SM, NA, SY, MS, MAK and MA reviewed the manuscript. All authors read and approved the final version.

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