



Damages Done by Black Bear (*Ursus thibetanus*) in Moji Game Reserve and its Surroundings, Leepa Valley, Azad Jammu and Kashmir (Pakistan)

Babar Zahoor, Basharat Ahmad*, Riaz Aziz Minhas and Muhammad Siddique Awan

Department of Zoology, Faculty of Sciences, University of Azad Jammu and Kashmir, Muzaffarabad

ABSTRACT

The present study was conducted to investigate human-black bear (*Ursus thibetanus*) conflict in and around Moji Game Reserve (MGR) Leepa valley, Azad Jammu and Kashmir, Pakistan. The main cause of human-black bear conflicts was damages in the form of livestock killings, crop raiding and human casualties. Estimated quantity of maize grains and fodder damaged during the years 2013-2015 was 40280 kg and 149300 kg, respectively. The total estimated cost of damages due to crop raiding (grains & fodder) during 2013-2015 was \$22042.31, and the crop raiding intensity during 2015 was significantly higher than 2013 and 2014 ($\chi^2=376.16$; $df=2$; $p\leq 0.001$). Among livestock ($n=304$), goats, sheep and cattle were reported killed between 2013 and 2015. The total estimated cost of livestock killings during 2013-2015 was \$38260 and estimated cost (\$25180) during 2015 was significantly different from 2013 and 2014 ($\chi^2=19463.28$; $df=2$; $p\leq 0.001$). During the study period livestock ($n=8$) and human ($n=3$) injuries, and one case of human killing by black bear were also reported. People of the area had negative perception about black bear and wanted to eradicate it from the area that poses a severe threat to its conservation in the area.

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Authors' Contribution

BA designed the project, analysed the data. BZ collected the data and wrote the manuscript. RAM provided technical support in data collection. MSA reviewed the manuscript.

Key words

Black bear, Conflict, Crop raiding, Livestock killing, Human casualties, Perceptions, Moji Game Reserve, Kashmir.

INTRODUCTION

Asiatic black bear (*Ursus thibetanus*), a red list species and endemic to Asia (Garshelis and Steinmetz, 2008; Sunar *et al.*, 2012) is declining throughout much of its range (Wani, 2013). In Pakistan, it is listed as vulnerable on Pakistan Red List (Sheikh and Molur, 2005).

Human-wildlife conflicts have occurred since the beginning of humanity. All the continents, developed as well as developing countries are facing this problem but the rate of problems varies with particular environment and people's way of life (Lamarque *et al.*, 2009). Due to global urbanization expansion, wildlife is becoming dependent on anthropogenic resources for food. This dependency of wildlife is responsible for lowering human tolerance and increasing human-wildlife conflicts (Treves and Karanth, 2003; Can *et al.*, 2014). Human-wildlife conflicts can be both direct, including injury and death, and indirect, including loss of crops and livestock, and damage to property (Bhattarai, 2009; Lamarque *et al.*, 2009). Human-wildlife conflict is becoming a critical threat to the survival of many globally endangered species (Distefano, 2005).

Human-black bear conflicts arise in residential, rural and agricultural sites (Gore *et al.*, 2006), and is considered most problematic and most dangerous pest animal by the local communities (Chetri, 2013). Towards the end of autumn season, bears become more active and travel long distances in search of excess food for accumulation of body fats before hibernation that results in conflicts between human and black bear (Bargali, 2012; Sunar *et al.*, 2012; Wani, 2013). In spring, as bears have just come out of hibernation, the rate of encounters by black bear is low (Charoo *et al.*, 2009).

People living near black bear habitat, instead of reporting about damages and humans injuries, prefer to kill bears to prevent further damages (Sakurai, 2012; Perveen and Abid, 2013). In Azad Jammu and Kashmir, the black bears, distributed in different mountainous areas including Leepa valley (Ahmed *et al.*, 1999; Qureshi *et al.*, 1999; Saber *et al.*, 1999) are reported to come in conflict with locals. In Moji Game Reserve (MGR), Leepa valley crop raiding and human attacks by black bear are already documented (Ahmed *et al.*, 1999). However, no detailed scientific study on human-black bear conflict has been carried out in the area. Present study has been conducted in MGR to investigate spatio-temporal patterns of human black bear conflicts with reference to crop raiding, livestock killings and attacks on humans.

* Corresponding author: kbamaknool@yahoo.com
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Fig. 1. Map showing the location of study area.

MATERIALS AND METHODS

Study area

The study was conducted in Moji Game Reserve (MGR) and its surrounding areas, Leepa valley, Azad Jammu and Kashmir. The Game reserve is at a distance of 80 km from Muzaffarabad, the capital city of Azad Jammu and Kashmir, located at N 34° 16.377, E 73° 48.108, between 1600 m and 3540 m above sea level (ASL) (Fig. 1). The area was declared as game reserve in 1982, with total area of 3860 hectares of Jhelum Valley Forest Division (Ahmed *et al.*, 1999).

The rugged terrain of Moji Game Reserve with high ridges and steep slopes, has many springs which drain into perennial streams. The area lies within the range of monsoon with pleasant summer and harsh and cold winter. The area comprises mainly of moist temperate forest, alpine and sub-alpine zones. The dominant plant species include a variety of angiosperms, gymnosperms, fungi, ferns, mosses, and medicinal plants (Ahmed *et al.*, 1999).

Methods

Data on human-black bear conflicts (number of bear encounters, human and livestock attacks, crop raiding,

etc.) from ten different villages were gathered directly and through interviews, participatory observations, focus group discussions, reports of sighting by villagers and semi-structured questionnaires (Spencer *et al.*, 2007; Bhattarai, 2009).

During surveys in the area signs *e.g.* scraping, digging, foot prints, scat, killing sites, *etc.* were also recorded. For searching of black bear signs we walked along existing livestock and human trails into the forest (Akhtar and Chauhan, 2010; Bista and Aryal, 2013; Datiko and Bekele, 2013). The data was analyzed by descriptive statistics, and χ^2 -test (Bhattarai, 2009; Datiko and Bekele, 2013) using SPSS 14.0.

RESULTS AND DISCUSSION

The results of present investigation indicate that human-black bear conflicts were highest during two seasons. In summer, when shepherds, along with large livestock herds were present in the study area at high altitude, the rate of conflicts was high due to killing of livestock. While in autumn, when crops, mostly maize are ready to harvest, the rate of conflicts with locals was high due to the intensive crop raiding by black bear.

Respondent's information

Sum total of 137 questionnaires from male (94 percent, n=129) and female (6 percent, n=8) residents, mostly (59%) illiterate, were collected from the study area. Most of the respondents (n=86) were temporary residents, spending time from April to early September along with their livestock. Majority (n=34, 20%) of the respondents belonged to age group 48-57 years followed by age group 28-37 years (n=22, 16%). Some of the respondents experienced crop raiding (n=76), and other experienced livestock losses (n=57) only, while a few (n=4) lost their crops as well as livestock. Black bear mostly killed livestock of temporary residents during summer season, since the herds used to stay at night in open pastures where they were likely to fall victim to predators. On the other hand, crop raiding intensity was much higher for permanent residents who used to cultivate crops for their livelihood, as considerable number of respondents (n=25) had monthly income less than \$50. People of the area, being poor, adapt multiple professions, and depend on natural resources of the protected area to fulfill their basic needs. Present findings are supported by previous studies, reporting human-black bear conflicts in the villages around the protected areas, where, the human inhabitants were dependent on forest resources such as fuel wood, livestock grazing, and collection of non-timber forest produce (Charoo *et al.*, 2009).

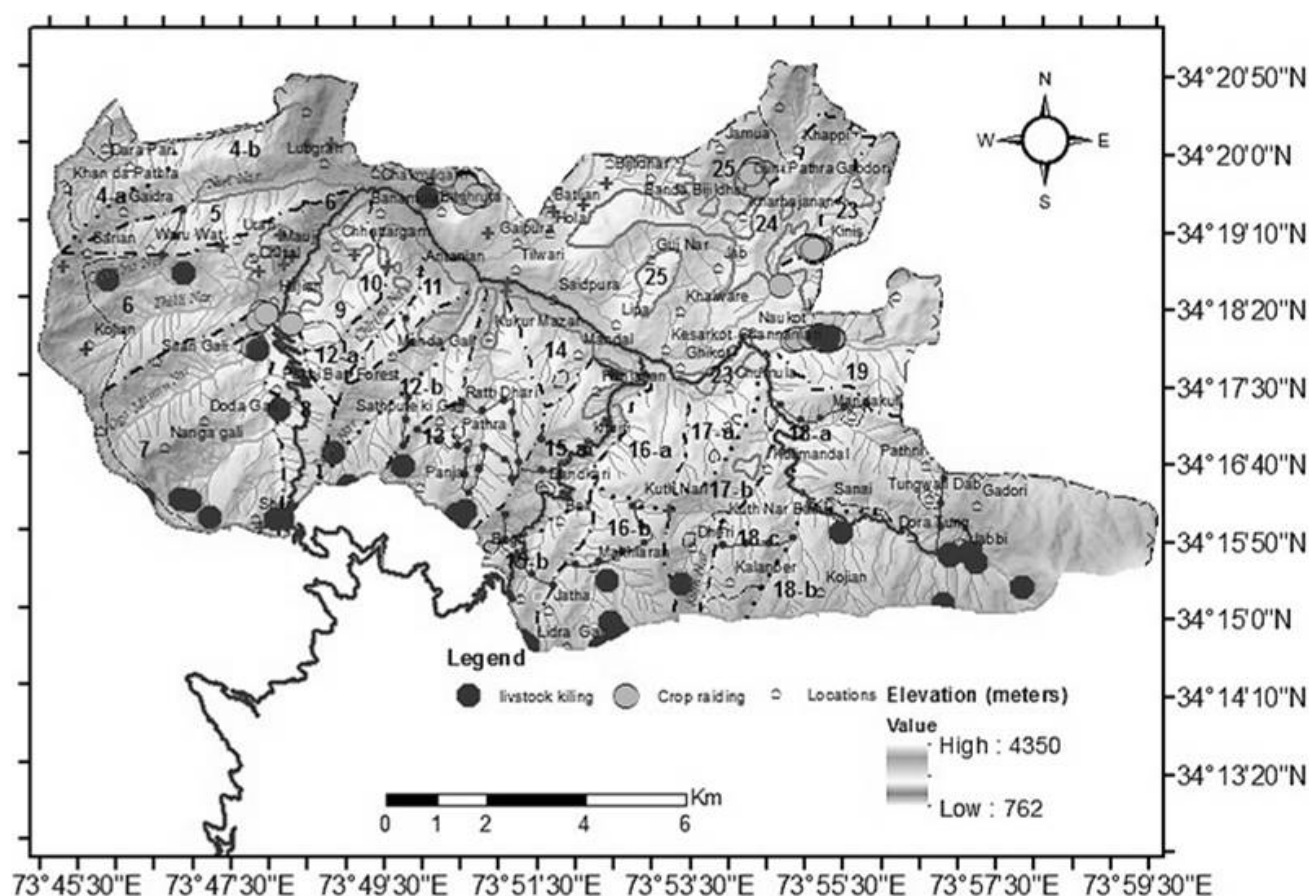


Fig. 2. Crop raiding and livestock killing in different areas at different elevations of study area.

Table I.- Spatial pattern of crop raiding by black bear in MGR and its surroundings during 2015.

Name of villages	GPS coordinats	Amount of damaged crop (kg)	Percentage damage
Lamniyan	N34° 13.733 E73° 48.615	120	42.85
Leepa	N34° 17.981 E73° 54.772	9960	32.388
Western Ghaipura	N34° 19.627 E73° 50.463	3480	22.395
Chaqmuqam	N34° 19.763 E73° 49.985	1160	15.62
Moji	N34° 17.836 E73° 47.729	1020	21.25
Total crop damage		15740	26.900

Majority (93%, n=127) of the respondents possessed different types of livestock (*i.e.* cow, ox, buffalo, goats, sheep, horse, mule, donkey) and poultry, some among

them (66%, n=91) had predator proof shelters while the rests (34%, n=46) keep their livestock in open pastures.

Maximum (n=79, average 12 attacks/ month) crop raiding cases were reported during the year 2015, followed by year 2014 (n=75, average 10 attacks/ month) and year 2013 (n=73, average 9 attacks/ month). However, there were no significant differences in the number of cases recorded during three years ($\chi^2=0.245$; df=2; $p\geq 0.05$).

The highest number (n=25, 31%) of crop raiding cases by black bear were recorded between 2101m and 2300 m (asl) followed by elevation range between 2301 and 2500 m asl (n=20, 25%), 1901 and 2100 m asl (n=18, 23%), 2501 and 2700 m (n=12, 15%) and 1700-1900 m asl (n=5, 6%). There was significant difference in the crop raiding cases of black bear between different elevation ranges ($\chi^2=12.37$; df=4; $p\leq 0.05$) (Fig. 2). During 2015, the highest damage (9960 kg) due to crop raiding was reported at village Leepa lowest damage (120 kg) at village Lamniyan (Table I; Fig. 2).

Maximum cases of crop raiding by black bear were reported at the fringe of forests, while some cases took

place inside villages, away from forest. Minimum distance between crop fields and forest results in maximum crop raiding. High quality food and croplands near forest area are also reported to attract bears (Charoo *et al.*, 2009).

Crop damage by black bear

Detailed data of crop damage was collected for the period of three years between 2013 and 2015. Black bear damaged both maize grain and its fodder, while eating grains it would breakdown stem by rolling up the maize crop, and producing bad irritating smell, rendering fodder unpalatable for livestock. Losses become double due to such nature of black bear attacks on crops. The similar behaviour was reported by many other authors (Akhtar and Chauhan, 2010; Perveen and Abid, 2013; Ali *et al.*, 2015).

Total cultivated area affected by black bear was 30.451 hectares during 2015, 28.066 hectares during 2014 and 27.172 hectares during 2013. However, this difference in crop damaged area by black bear was statistically non-significant ($\chi^2=0.199$; $df=2$; $p\geq 0.05$). The total estimated yield of crop (grains) in the affected area has significantly increased from 2013 (68,960 kg), 2014 (62,020 kg) to 2015 (70,420 kg) ($\chi^2=600.06$; $df=2$; $p\leq 0.001$). Likewise, the damage to maize grain in the year 2013 (11,560 kg, 16.41%) has significantly increased in the subsequent years of 2014 (12,980 kg, 18.43%) and 2015 (15,740 kg, 22.35 %) ($\chi^2=672.93$; $df=2$; $p\leq 0.05$). On the basis of local market rate (\$0.3/ kg), total estimated cost of damaged maize grain during 2013 (\$3468), 2014 (\$3894) and 2015 (\$4722) was significantly different ($\chi^2=201.88$; $df=2$; $p\leq 0.001$).

The total maize fodder production in the affected areas was estimated as 315,000 kg in 2013 that gradually increased to 325,800 kg in 2014 and 354,600 kg in 2015, and this increase was highly significant ($\chi^2=2525.84$; $df=2$; $p\leq 0.001$). The total amount of fodder damaged by black bear in 2013 (42,600 kg) increased in subsequent years of 2014 (48,200 kg) and 2015 (58,500 kg), and this increase was also highly significant ($\chi^2=2613.918$; $df=2$; $p\leq 0.001$). Likewise, on the basis of market rate (\$0.06/ kg), the estimated cost of damaged fodder during 2013 was \$2841.42 that gradually increased in 2014 (\$3214.94) and 2015 (\$3901.95), and this difference was highly significant ($\chi^2=174.34$; $df=2$; $p\leq 0.001$). The total estimated cost of damages (grains and fodder) in 2013(\$6309.42), 2014 (\$7108.94) and 2015 (\$8623.95) was also significantly different during different years ($\chi^2=376.16$; $df=2$; $p\leq 0.001$).

Monthly pattern of crop raiding

Crop raiding of most of the respondents (n=67) took place daily or after every two or three days from September till harvesting of crop in early October. However, some

respondents (n=7) reported crop raiding from late august to early October when crop harvesting started. A few cases of raiding by black bear were reported in September (n=5) and October (n=1). The number of crop raiding incidences were significantly higher from September to early October ($\chi^2=148.2$; $df=3$; $p\leq 0.001$). The reasons behind this may be that maize crop get more nutritious and milky in these months and before hibernation black bear takes more and more food. In Dachigam National Park, Kashmir, crop damage is most common during May to November and is much higher in summer while maize crop is mostly damaged in August and September (Charoo *et al.*, 2009).

Crop raiding and action taken against black bear

Most of the crop damages were reported near the forest (n=45, 56%) or inside the villages (n=35, 44%). For this reason, respondents (n=32, 40%) would stay in the fields at night and also used effigies (n=27, 34%), beating silver tins (n=11, 14%), whistling and shouting (n=5, 6%), and some (n=5, 6%) used lightening, firing, fencing and stoning to keep black bear away from the crop fields.

Table II.- Temporal pattern of livestock killings recorded during 2013-2015.

Year	Month	Goat	Sheep	Cow	Ox	Total
2013	April	1	-	-	-	1
	May	1	-	-	-	1
	June	4	-	-	1	5
	July	16	-	1	-	17
	August	1	-	-	-	1
Subtotal=25						
2014	April	2	-	-	-	2
	May	6	-	-	-	6
	June	13	1	-	-	14
	July	32	3	1	2	38
	August	4	-	1	1	6
Subtotal=66						
2015	April	1	-	1	-	2
	May	5	1	1	-	7
	June	28	9	-	-	37
	July	84	36	1	1	122
	August	32	8	-	-	40
	September	5	-	-	-	5
Subtotal=213						
Total=		235	58	6	5	304

Livestock killings

Besides crop raiding, most of the respondents (n=61) were affected due to livestock killings by black bear from April to September. In the last three years (2013-2015), 304 livestock killings were reported. Most cases of livestock

killings (n=213) were reported in 2015 followed by 2014 (n=66) and 2013 (n=25). There was significant increase in the livestock killings from 2013-2015 ($\chi^2=192.86$, $df=2$, $p \leq 0.001$) (Table II).

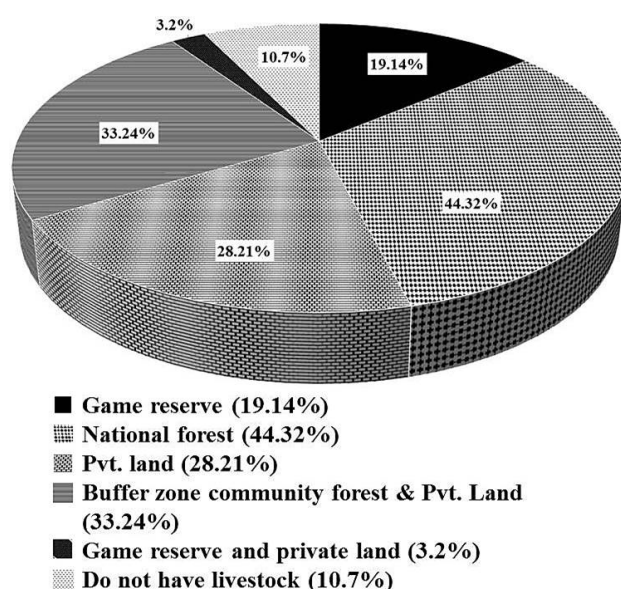


Fig. 3. Livestock grazing in MGR and its surroundings.

Rate of livestock killings by black bear during 2013-2015 was much higher than the rate of crop raiding, the reason might be its preference for proteinaceous food. Majority of the people graze their livestock in national forest and stall feeding is almost absent throughout the study area (Fig. 3). It is easy and cost effective to kill livestock easily available in the habitat like pastures or inside forest rather than raiding crops near human settlements. Livestock is reported to graze frequently in the habitat of black bear (Bista and Aryal, 2013) and its diet contains a good proportion of meat, for which it kills livestock rather than damaging crops (Sunar *et al.*, 2012).

Livestock killings by black bear were reported in six different villages of the study area, most of the cases from Leepa (n=117) (Table III; Fig. 2). Most of the killings were reported in the month of July (Table III), when livestock grazing in the habitat of black bear is at peak and thick shrub cover provides protection and blind for attack. However, other studies conducted in Senchal Wildlife Sanctuary Darjeeling, West Bengal, India and in Kashmir valley, India showed that the rate of human-black bear conflicts increased at the end of autumn and start of winter because of more intake of food for the accumulation of body fats before hibernation (Sunar *et al.*, 2012; Wani, 2013). Of total killings, goats (n=235, 77%) became major victim followed by sheep (n=58). Earlier study conducted

in Machiara National Park, Pakistan, confirmed the vulnerability of goats and sheep from spring to early winter (Dar *et al.*, 2009). Highest number (52%) of killings were reported from pastures as compare to open areas near huts (31%), in the forest (15%) and inside villages (2%).

Table III.- Spatial pattern of livestock killings recorded during.

Village	Coordinates	Elevation (m)	2013	2014	2015	Total
Moji	N34° 15.964 E73° 48.251	2747	14	24	39	77
Antnian	N34° 16.346 E73° 48.993	3152	-	-	2	2
Ghaipura	N34° 16.559 E73° 49.705	2772	-	-	51	51
Leepa	N34° 14.699 E73° 51.277	3266	6	24	87	117
Reshian	N34° 14.611 E73° 50.896	2864	5	18	33	56
Chaqmu-qam	N34° 19.465 E73° 49.984	1878	-	-	1	1
Total			25	66	213	304

Altitudinal variation in livestock killings

Maximum (n=159, 52%) livestock killings were recorded between 2601 and 3000 m asl followed by elevation range between 3001 and 3400 m asl (n=119, 39%), 2201 and 2600 m asl (n=14, 5%) and 1800-2200 m asl (n=12, 4%) (Fig. 2). The number of livestock killings at different elevation ranges was significantly different ($\chi^2=219.42$; $df=3$; $p \leq 0.001$). The area between 2101m and 2300 is most suitable for crop cultivation; hence low livestock damage was recorded there. Maximum livestock killings were reported between 2601 m and 3000 m, the high altitudinal area where water, fuel wood and grass for livestock are easily available. According to Charoo *et al.* (2009) most of the cases of human-black bear conflicts in Dachigam National Park, Kashmir occurred between 1900 m and 2000 m ASL.

Cost of killed livestock

Total estimated cost of livestock, killed by black bear during 2013-2015 was about \$38260. Highest damage (\$25180) was reported during 2015 as compare to 2014 (\$9420) and 2013 (\$3660). This difference during different years was highly significant ($\chi^2=19463.28$; $df=2$; $p \leq 0.001$).

Black bear mostly killed livestock at night between 21:00 h and 24:00 h in 2105 (n=43, 71%), and in all cases single bear was reported to attack at a time (Fig. 4). Most of the respondents (51%) used to watch their livestock at

night and only 5 percent tried to chase and shoot black bear (Fig. 5). About activity period of black bear for livestock killing and crop raiding, most of the respondents (n=115, 84%) expressed that black bear came out of the forest at night. However other respondents, besides mentioning night had also included, morning, mid-day and evening as an activity period of black bear (Fig. 6). More than half (n=73, 53%) of respondents expressed that black bears came out of forest to eat crops (Fig. 7).

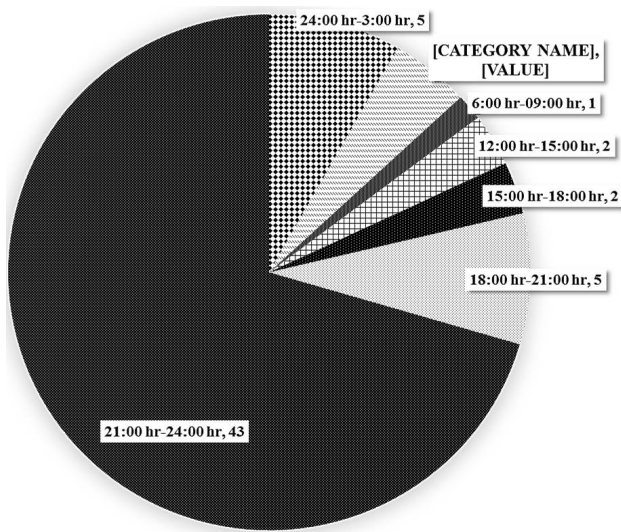


Fig. 4. Temporal pattern of livestock killing by black bear during 2015.

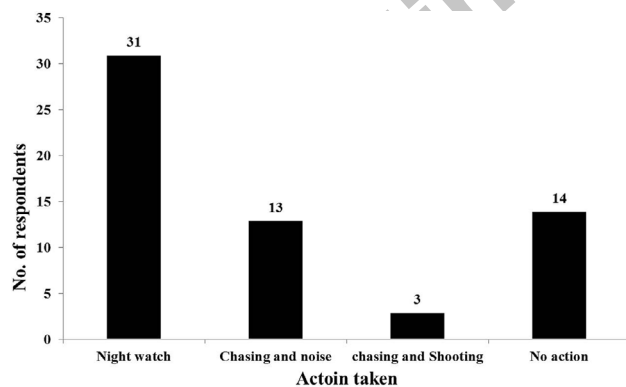


Fig. 5. Mode of action taken against Livestock killings by black bear.

Livestock killing and crop raiding pattern recorded during night coincide with previous study by Wani (2013) in Kashmir valley, India. However, there were some reports that black bear was also active during morning, day time and in evening. According to Chaudhry *et al.* (2010) black bear depredate livestock and raid crop diurnally or

nocturnally. Charoo *et al.* (2009) reported in Dachigam that the bears were more active in croplands during early morning and late evening. Most cases of cattle killing by black bear (61%) were in evening and 37% were at night or early morning in Indian Himalaya (Chauhan, 2003).

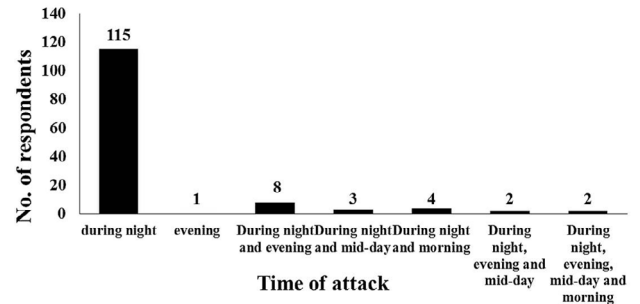


Fig. 6. Knowledge about activity period of black bear of local people.

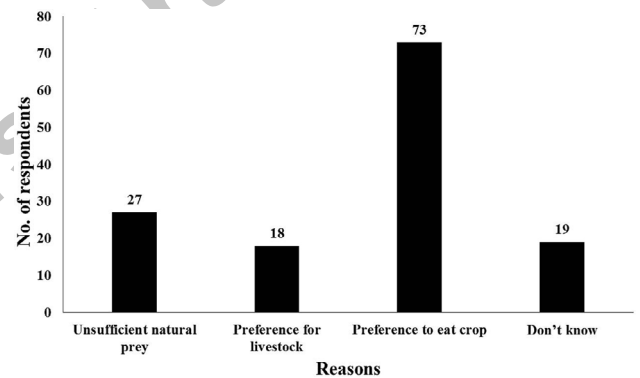


Fig. 7. Perception of local people about the reasons of black bear attack.

People used different techniques to keep black bear away from livestock and crop fields such as guarding their livestock and crop at night, guarding their livestock during grazing in the presence of herder, use the fences, silver tins, whistling and shouting, lightening, firing, and stone pelting *etc.* However, none of the methods is much effective to inhibit black bear from entering the area. According to Chetri (2013), barbed wires followed by electric fences and sound and fire crackers are very effective to control the attacks of black bear in crop fields.

Comparison between damage cost of livestock killing and crop raiding by black bear

The cost of livestock killing and crop damage varied from 2013 to 2015. In 2013 the cost of crop damage was approximately 2 times higher than livestock killing while in 2014 and 2015 the cost of livestock killing was

Table IV.- Human injuries caused by black bear attacks in MGR and its surroundings during the last 20 years.

Sr. #	Name	Locality	GPS	Elevation (m)	Date of attack	Activity during attack	Time of attack (h)	Victim	Result
1	Muhammad Nazeer Khan	Tharra	N34° 13.877 E73°49.789	2493	July-1995	Grazing his livestock	13:00	Old male	Injured
2	Chaudhry Muhammad Nazeer	Chakharh Nakka	N 34° 18.544 E73° 46.997	2485	June-1999	Going back to his home	02:00	Adult male	Injured
3	Nabiullah	Morcharh	N34° 15.996 E73° 47.212	2904	July-2002	Going through forest	12:00	Old male	Killed
4	Chaudhary Sittar Muhammad	Lakhi Jungle	N34°16.073 E73° 50.494	2858	July-2015	Rescuing his goat	21:00	Old male	Injured

approximately 1.3 times and 3 times higher than crop damage, respectively. The gradual increase in the rate of crop raiding and livestock killings might be due to different reasons; the population of black bear in the study area might be increasing, human settlements near core zone of black bear, reduction in bears killing rate due to ban and fine on killings of wild species, migration of bears from Indian occupied Kashmir to Pakistan administered Kashmir or due to possible natural habitat degradation to a great extent and black bear is forced to approach human settlements in search of food.

Livestock injured by black bear

During three years, 11 animals including 7 goats in 2015, 2 goats in 2014 and 1 goat and 1 sheep in 2013 were reported injured by the black bear and there was no significant difference in the number of livestock injured during different years ($\chi^2=4.547$; $df=2$; $p\geq 0.05$)

Black bear attacks on humans

Four attacks on humans (all were shepherds) were reported during the last 20 years, which resulted in three injured and one death (Table IV). According to Charoo *et al.* (2009), around Dachigam National Park, Kashmir, India, 19 attacks on humans were reported during working in crop fields ($n=13$), forests ($n=4$) and in villages (2).

Community perception about bear conservation

Majority of respondents ($n=135$, 96%) have negative perception about bear conservation and wanted to eradicate them, however, a few ($n=5$, 4%, educated) were in favour of its conservation. People disliked this species due to crop damage (56%), livestock killing (39%) and attacks on humans (5%). Most of the people ($n=87\%$) preferred to conserve bears only in zoos, (13%) in Game Reserve.

Some other studies (Charoo *et al.*, 2009; Perveen and Abid, 2013) also documented livestock killing and crop raiding (95%) as main reasons of human-black bear

conflicts. Besides these reasons, the fear of the black bear attacks on human is also reported intensify this existing conflict. A bear was killed in Lub Graan when he entered the house of a person, more likely to seek refuge from harsh winter rather than to attack on livestock or human. According to the respondents (bears are killed to minimize the risks of attack on humans, killing of livestock and prevention of crop damage $n=130$, 95%), and also for the trade of body parts ($n=7$, 5%). Most of the respondent reported black bear attacks inside ($n=53$, 39%) and outside ($n=37$, 27%) of buffer zone, some reported attacks along border of the game reserve and buffer zone ($n=34$, 25%) while a few ($n=13$, 9%) reported its attacks only inside the game reserve. As for black bear management, most of the respondents ($n=83$, 61%) suggested to kill black bears, some ($n=29$, 21%) suggested capture and release into some other areas and others ($n=25$, 18%) suggested capture and keep them in enclosures.

People were not satisfied with black bear management, and demanded (94 percent, $n=129$) compensation to victims or their families, some of the respondents (4 percent, $n=6$) preferred conservational education while a few ($n=2$, 2%) preferred the monitoring to create awareness among villagers. In Indian held Jammu and Kashmir, the Forest department facilitates victims by paying compensations for killing incidences. In Nepal, victims are also somehow compensated with some amount (Bhattarai, 2009; Akhtar and Chauhan, 2010). In AJK, government or any N.G.O did never compensate affectees, and respondents were totally unsatisfied with the present management strategy of black bear.

CONCLUSION AND RECOMMENDATIONS

Present study conducted on human-black bear conflict revealed that most of the people (59%) were illiterate; having poor socioeconomic conditions, depend on livestock (36%) and crops (29%), the major sources of

their livelihood. Black bear caused great damages to the livestock (\$38260) and crops, mostly maize (\$8623.95) of the local people that results in conflicts. Most of the affected people belonged to the shepherd community who used to live temporarily along with their livestock for a shorter period during summer season and lack proper shelters for livestock. Permanent residents own their lands and used to cultivate crops, therefore, most of the cases of crop raiding were related to them. Livestock killing and crop raiding gradually increased from 2013 to 2015, which might be an indication of annual increase in bear population of the area. People used different acts to prevent black bear from attack, like whistling, shouting, stoning, firing and chasing, fencing, beating silver tins, using effigies and staying at night.

In order to overcome ever increasing problem of human-black bear conflicts, it is necessary to take measures including compensation for losses, monitoring, education, and awareness programs about the importance of black bear in ecosystem. Proper guarding and protection measures during the cropping season like fencing of wood, steel and iron rods around fields can also minimize the risk of crop raiding. Construction of proper predator-proof shelters for livestock can be the best way to prevent livestock losses. The removal of livestock huts within the forest area and minimizing interference of local people near the habitat of black bear can reduce the human-black bear conflict.

Statement of conflict of interest

The authors declare no conflict of interest.

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