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Negative interactions between humans and Asiatic black bears (*Ursus thibetanus*) in northern Pakistan

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Abstract

The conservation of the vulnerable Asiatic black bear (*Ursus thibetanus*) in Pakistan is challenged by retaliatory killing, driven by negative interactions between people and bears, such as livestock depredation. We distributed a questionnaire among 369 individuals in rural communities within the Mansehra District, Pakistan, where bear retaliatory killings are often reported. We focused on human–Asiatic black bear negative interactions, such as livestock depredations, crop damage, and human injuries occurring between 2015 and 2019. Although the number of livestock depredation events was small in absolute terms (an average of 11.5 livestock heads reported to be killed annually), it had a large estimated economic impact in terms of local economies ($1367 per year, or a total of $5.469 between 2015 and 2019). Such annual estimated costs account for 93% of the per capita gross domestic product for Pakistan, roughly equivalent to $55,853 for a US citizen. Additionally, 30 incidents between people and bears were registered, where 6% human were fatal. We recommend awareness campaigns on different mitigating interventions, and training on how to use them, as well as behaviors to reduce the risk of negative interactions.

KEYWORDS

Asiatic black bear, human–wildlife conflicts, livestock predation, retaliatory killing

1 | INTRODUCTION

Persecution (e.g., retaliatory killing, legal and illegal wildlife trade) have contributed to large carnivore decline worldwide (Ripple et al., 2016; Wolf & Ripple, 2017). The predatory behavior of large carnivores can result in livestock depredation or mauling of people and their pets, representing one of the main factors challenging human–large carnivore coexistence (e.g., López-Bao et al., 2017; Lute et al., 2018). These negative interactions can lead to opposition towards the presence of large carnivores or even retaliatory killing (Liu et al., 2011; Treves et al., 2006). For example, although human maulings are rare (e.g., Bombieri et al., 2019; Penteriani et al., 2016), they can trigger strong opposition to sharing the landscape with large carnivores. Conflicts over large carnivores and their conservation are driven by different socio-economic, political, psychological, and ecological factors. For example, the impact of livestock depredation on household economic status can be critical in some

marginalized rural and remote mountainous areas (Liu et al., 2011; Mishra, 1997; Suryawanshi et al., 2013), where livestock losses or crop damage is more impactful on livelihoods (Charoo et al., 2011; Morrison, 2009).

Asiatic black bears (*Ursus thibetanus*) are listed as Vulnerable by the IUCN Red List, and are included in the Appendix I of the Convention on the International Trade of Endangered Species (Bista & Aryal, 2013). Conflicts around Asiatic black bears have been reported across many parts of their range, such as in Nepal (Adhikari et al., 2018), Bhutan (Penjor & Dorji, 2020) India (Yadav et al., 2009, 2019), China (Liu et al., 2011), and Japan (Honda & Kozakai, 2020). Such conflicts include livestock predation (Dar et al., 2009; Hwang et al., 2010; Jamtsho & Wangchuk, 2016), crop damage (Bista & Aryal, 2013; Liu et al., 2011; Yamada & Fujioka, 2010), and human incidents (Awais et al., 2016; Khan et al., 2012). Increased anthropogenic activities combined with a reduction in natural food resources have also been suggested to escalate bear–human negative interactions (Bargali et al., 2005; Fredriksson, 2005; Yadav et al., 2009). Associated with poaching, illegal trade also affects black bears (Abbas et al., 2015). In Asia, people still use bear parts for various purposes, including traditional medicinal (e.g., gall bladder, fat) or for decorative uses (e.g., skin, paws) (Nijman et al., 2017; Phelps et al., 2010; Zahler et al., 2004). The illegal market price of the four paws of Asiatic black bear is estimated to range from $400 to $500, from $150 to $200 for the gallbladder, and from $200 to $300 for the skin (Zahler et al., 2004).

In Pakistan, it is estimated that the Asiatic black bear population has decreased by around 49% during the last three decades. Up to nine distinct bear areas can be found in the northern region (Abbas et al., 2015), including Neelum valley (Ahmad et al., 2016), Kohistan valley, Swat, Dir (Perveen & Abid, 2013), Kaghan Valley (Ali et al., 2018), and Gilgit Baltistan (Ali et al., 2015). Among these, the district of Mansehra has been reported as one of the main conflict hotspots (Ali et al., 2018; Awais et al., 2016; Awais & The Wildlife Society, 2008; Perveen & Abid, 2013; Ullah et al., 2020; Waseem & Ali, 2017a, 2017b; Waseem et al., 2020). Bear poaching has been reported in recent years associated with varying motivations, such as in the case of killing adult females to get the cubs for street dancing (a practice which has decreased over time, but can still be observed in some areas of Pakistan), for the illegal trade of bear body parts (Abbas et al., 2015; Ullah et al., 2020; Waseem et al., 2020), or as retaliation after bears have caused damage. At least nine Asiatic black bears were killed in retaliation by local residents during the study period (March–October 2019).

We aim to understand the nature of conflicts around Asiatic black bears in Mansehra District of Khyber Pakhtunkhwa (KPK), Pakistan, and the associated economic impact to local economies. Our study may help to understand the impact of bears on the well-being of local communities, as well as the conservation challenges for the species in north of Pakistan.

2 | MATERIAL AND METHODS

2.1 | Study area

This study was conducted in the Mansehra District of KPK, Pakistan, covering an area of about 4579 km^2 (Figure 1). This landscape is a part of the greater Himalaya ranges, where heavy snowfall occurs in January (Metrological Department Pakistan). Human population density in the area is 340 inhabitants/km^2 (District Mansehra, 2007). Main economic activity in this area relies on livestock and agriculture practices. Increasing demand on natural resources, for instance, on forests, has been observed in recent years. The livestock commonly kept includes several species such as ass, buffalo, cattle, goat, horse, mule, poultry, and sheep (Ahmad et al., 2015). Owing to the rapid increase of human population in this area in recent decades, small land holdings, and lack of alternative sources of income, there is substantial pressure on land and natural resources. Intense illegal logging activities, for example, have resulted in small forest patches only remaining in remote areas (Waseem et al., 2020). Asiatic black bear (*U. thibetanus*) have been blamed as the most problematic predator in the study area (Awais & The Wildlife Society, 2008). The common leopard (*Panthera pardus*) are also distributed in the study area however there are few reported interactions (Ali et al., 2017; Roberts, 1997).

2.2 | Survey design

We developed a questionnaire to obtain information on negative interactions between humans and bears (e.g., livestock depredation, crop damage). As a first step, we used official records of conflicts around bears in this region, available at the Khyber Pakhtunkhwa Wildlife Department regional headquarters from 2015 to 2019, in order to identify conflict areas to administer the survey. These records included the name of the village, the year and/or season, the location of the damage/incident, main landscape, household affected, and any sighting of Asiatic black bears (Ambarlı & Bilgin, 2008). Once the conflict zones were identified, we randomly selected households for face-to-face interviews (Wang & Macdonald, 2006).

We interviewed people who were over 18 years old and who carried out their activities in forests and pasture areas, such as grazing livestock, or collecting herbs or

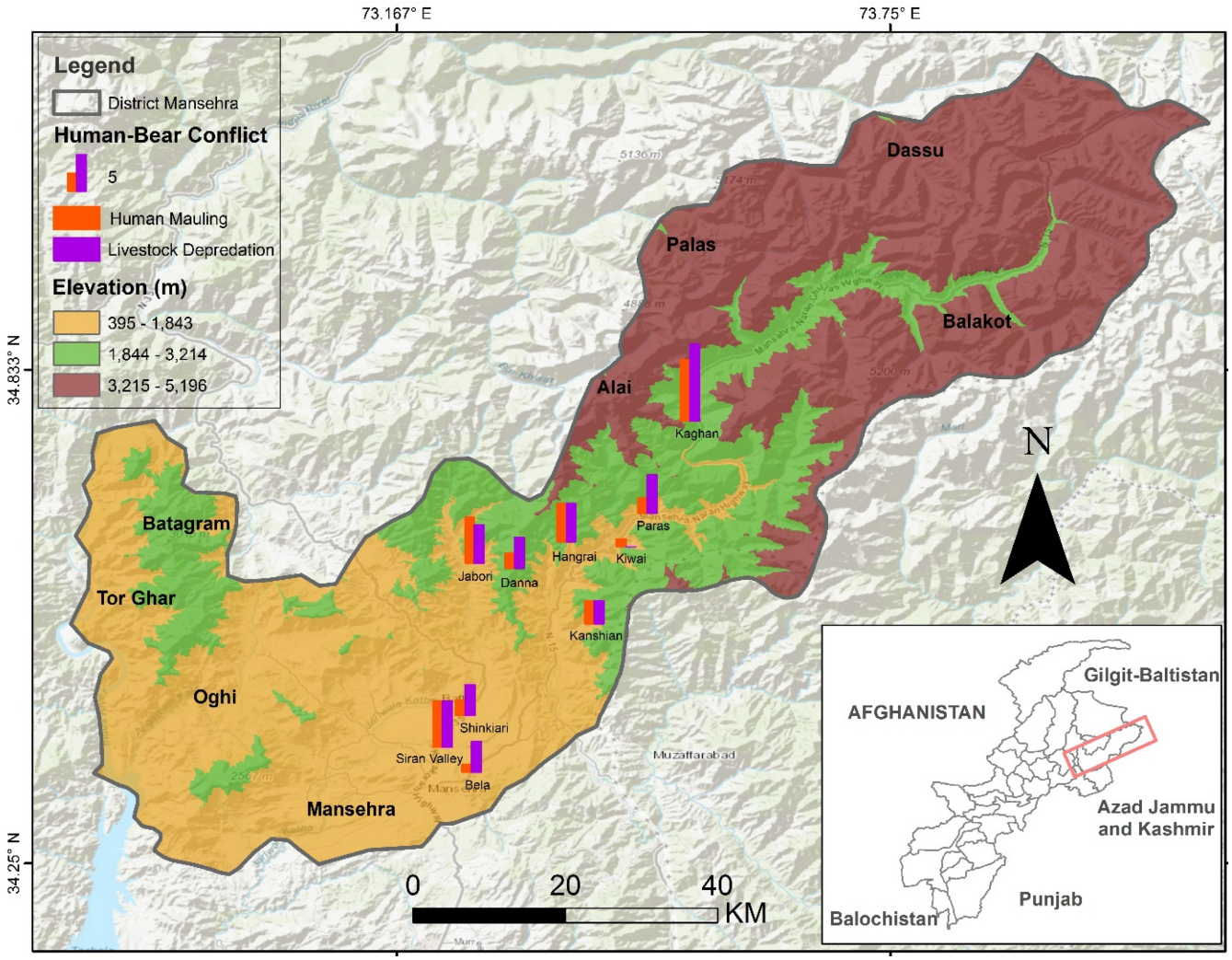

FIGURE 1 Villages (with bar charts) showing the frequencies of human-black bear negative interactions within study area (Mansehra District of Khyber Pakhtunkhwa, Pakistan)

mushrooms (these activities are carried out mainly by men in this area). Thus, the interviewed people were more likely to have the possibility for an interaction with a large carnivore (e.g., either by just observing the animals during their activities outside or by experiencing negative interactions with bears) (Gros, 1998). Interviews were conducted between March and October 2019, and ethical consent was granted from each participant prior to interview, including providing respondents with information about the purpose of this study.

We used a mix of qualitative and quantitative questions (Alexander et al., 2015; Dar et al., 2009). The questionnaire was available in Urdu, a national language, and Hindko, a local language (Perveen & Abid, 2013). We first gathered demographic data, including gender, age, education history, and professional activities. We then asked questions related to their perception towards Asiatic black bears, associated negative interactions between bears and humans (e.g., occurrence of livestock depredations and the type and number of livestock killed, incidences of crop damage or interaction with humans), and the methods used to prevent damages (presence of shepherds, livestock guarding dogs, or both). We also recorded perceptions in relation to the trends of incidents (Ali et al., 2018).

If interviewees reported incidents with humans, we also noted information on the number of bears involved, the context where the incident happened, the reaction of people, and the occupation of the people involved. We additionally noted the location of the incident: forest, agricultural land, or village and the available evidence about the involvement of bears in the incident (e.g., direct observation, indirect signs such as footprints/pugmarks, soil digs, hairs, scats, bite marks, claw marks, or peeling of tree bark). Every negative interaction between bears and people registered was classified according to the season (Spring: March–April, Summer: May–August, Autumn: September–November, Winter: December–February) and time of the day (Morning and

onward: 5 a.m. up to 4 p.m.; Evening: 4 p.m. up to 7 p.m.; Night: remaining hours).

2.3 | Data analysis

We first applied a Chi-square test of independence to determine the relationship between livestock loss, incidents with humans (lethal and nonlethal), and crop raiding with different factors: season (summer, autumn, winter, or spring), sex (male or female), time (day, evening, or night), location (agricultural land, forest, or village), occupation (livestock holder, former, govt. servant, business man), and experience (sighting, claw marks). We used a Fisher's exact test in cases where there were a small number of frequencies (<5 in cross tabulation). Financial loss associated to livestock depredations was calculated based on the average annual market prices in Pakistani rupees, which was then converted to US dollars on May 15, 2020 (National Bank of Pakistan). This calculation was based on the type of livestock killed (e.g., age, sex). However, for crop damage, overall loss was recorded first in Pakistani rupees from each respondent who experienced it and later converted to US dollars on the same day, for example, May 15, 2020. For analysis, we used the Statistical Package for Social Sciences (SPSS v.26) and considered $p < .05$ as statistically significant.

3 | RESULTS

3.1 | Demographic information

We carried out 400 face-to-face interviews, but only 369 were fully completed and considered in subsequent analyses. The majority of responses were from males (89%) and only 1.6% of respondents were <20 years old. Most interviewees were from age groups 20–30 (38.4%) and 30–40 (31%), with older age groups featuring to a lesser degree (age groups 40–50: 16%, 50–60: 10.2%, and 60: 2.4%). The majority of interviewees (58.8%) reported that they did not have access to education, followed by primary education (30.8%). Only 10.2% of respondents reported having a higher education level. The occupations of most respondents were related to farming and forest activities (94.0%).

3.2 | Perceptions about sharing the landscape with Asiatic black bears

Half of the respondents believed they were competing with bears for resources in the area, and that coexistence with bears was not possible (55.7%; Table 1). Forty-three percent of respondents perceived bears as a threat to livestock, and the majority of respondents identified bears as the most problematic predator in the area (Table 1). Sixty-three percent also believed that Asiatic black bear incidents have increased in recent years (Table 1).

Most respondents did not respond to the question about damage prevention measures. Respondents felt that an achievable solution to reduce livestock depredation was to use bonfires (20.5%) or livestock guarding dogs (8.6%).

3.3 | Livestock depredation and economic loss

Respondents noted that Asiatic black bears were responsible for killing 46 livestock heads between 2015 and 2019. Bears mainly killed sheep (23 heads) and goats (22 heads). They only reported one head from cattle. Respondents blamed the Asiatic black bear for an estimated economic loss of $5469 between 2015 and 2019, around $1367 per year.

Contrary to the perception from respondents about the trends in conflicts around bears, most livestock depredation events occurred in 2015 (29.7%), followed by 2016 (27.6%) (Figure 2). The majority of incidents were reported to have occurred in forested areas (67.3%), followed by villages (32.6%). We did not record any incident in agricultural lands. Most depredation events occurred in summer (58.6%) and autumn (21.7%) (followed by spring: 15.2%, and winter: 4.3%; $\chi^2 = 22.0$, $p = .001$) and at evening (52.1%) and night (32.6%) (day: 15.2%; $\chi^2 = 108.2$, $p = .001$; Table 2). Most livestock depredations occurred when livestock was not guarded (70.1%), followed by situations where livestock was guarded only by livestock guarding dogs (20%) and the presence of shepherds (9.9%).

3.4 | Crop raiding

In relation to crops, 59% of respondents reported damage. Among them, the primarily damaged crops were maize (*Zea mays*) (25.4%), potatoes (*Solanum tuberosum*) (11.6%), tomatoes (*Lycopersicon esculentum*) (8%), and fruits (6.2%), such as Persian walnuts (*Juglans regia*) and paradise apple (*Malus pumila*). Around 4.3% of respondents reported damage to apiaries. Of the total crop damage, about half (51.5%) were recorded only in 2016 and did not feature in other years. The highest instances of crop damage were reported to occur during the summer (65%), followed by autumn (29%) ($\chi^2 = 401.9$, $p = .001$; Table 2). Most crop damage (95%) occurred at night, while the remaining (5%) occurred in the evening. The

TABLE 1 Perception of respondents towards Asiatic black bears presence and coexistence

Questions	Yes (%)	No (%)	No opinion (%)
Q1. Do you think people and Asiatic black bear are competing for resources in the area?	237 (64.1)	100 (27.0)	32 (8.6)
Q2. Do you think humans and bears can coexist?	133 (36)	206 (55.7)	30 (8.1)
Q3. Do you consider that Asiatic black bears pose threats to livestock?	159 (43)	77 (20.8)	133 (36)
Q4. Do you think that bears are the most problematic predators in the area?	259 (70)	14 (3.8)	96 (26)
Q5. Do you believe that Asiatic black bear incidents are increasing in this area?	234 (63.2)	48 (13)	87 (23.4)

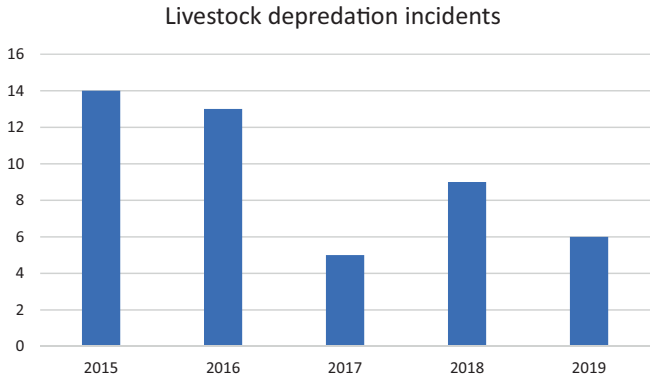

FIGURE 2 Number of annual livestock killed by Asiatic black bears in the study area

total estimated cost associated with crop damage between 2015 and 2019 was $7302.

3.5 | Incidents with humans

Respondents reported a total of 30 incidents between bears and humans between 2015 and 2019; with two of them being fatal (6.6%). Most incidents were reported on males (63.3%), older than 30 years old (83.3%). Most incidents were reported in 2015 (30%) and 2016 (36.6%). Half of these incidents occurred in forest areas, mainly associated with collecting wood or medicinal plants, followed by agricultural lands (36.6%), when people were working among crops. Only 13.3% of incidents were reported in villages ($\chi^2 = 49.7$, $p = .000$; Table 2). Most incidents were reported in autumn (40%) and summer (36.6%) and occurred in the evening (40%) or at night (33.3%) (Table 2). About 16.6% incidents involved a female bear with cubs.

4 | DISCUSSION

Our survey aimed to identify perceptions and interactions between humans and Asiatic black bears in the District Mansehra area of Pakistan. Anthropogenic activities, such as the expansion of infrastructures and forest conversion to agricultural land, are often implicated in conflicts between bears and humans in this area (Ali et al., 2018). The majority of respondents reported negative perceptions and high costs associated with sharing the landscape with Asiatic black bears, primarily due to livestock depredations. The estimated economic loss in the case of livestock depredation was $5469 ($1367 per year). This is remarkable in this socio-economic context, accounting for 93% of the per capita gross domestic product for Pakistan. For comparison, this figure would be equivalent to $55,853 for a US citizen.

Our results revealed sheep and goats as the most vulnerable livestock to Asiatic black bears depredation, which is similar to findings reported in other areas (Kabir et al., 2014; Waseem et al., 2020). Few respondents used livestock damage prevention methods. Therefore, awareness campaigns promoting the use of different interventions to mitigate conflicts, and training on how to use them properly, may contribute to reducing livestock depredation (Eklund et al., 2017; Van Eeden et al., 2018). These campaigns have the potential to also reduce human bear incidents (Conover, 2002; Gore & Knuth, 2006; Sato, 2008) and may increase favor of human bear co-existence in the study area. For example, a study from Quichua community (South America) evaluated community knowledge, attitudes, and behavioral intentions towards Andean bear (*Tremarctos ornatus*) conservation after administering an environmental education program over a 5-year period. They reported that the behavioral intentions that favored bear conservation increased over time (Espinosa & Jacobson, 2012).

We found that livestock predation followed a seasonal pattern, with most incidents occurring during spring–summer (Dar et al., 2009; Sogbohossou et al., 2011). This is the season when residents graze their livestock in dense forest areas, and coincides with when bears are more active. Thus, more efforts should be invested in protecting livestock at this time of the year, when livestock

TABLE 2 Frequency of livestock killed, crops raiding, and human mauling by Asiatic black bears according to different variables in the study area

Variables	Categories	Livestock killed (%)	Chi-square	*p* value
Livestock incidents				
Incident location	Forest areas	31 (67.3)	209.6	**.000***
	Villages	15 (32.6)		
	Agricultural lands	0 (0%)		
Season	Summer	27 (58.69)	22.0	**.001***
	Autumn	10 (21.7)		
	Spring	7 (15.2)		
	Winter	2 (4.34)		
Time of incidents	Evening	24 (52.17)	108.2	**.000***
	Night	15 (32.6)		
	Morning and onward time	7 (15.2)		
Crops raiding incidents				
Gender	Male	202 (60.8)	14.1	.028*
	Female	17 (45.9)		
Season	Winter	3 (1.3)	401.9	.001*
	Summer	142(65)		
	Spring	8 (3.6)		
	Autumn	65 (29.8)		
Time of incident	Morning	0 (0)	388.0	.001*
	Evening	11 (5)		
	Night	208 (95.4)		
Occupation	Livestock holder	33 (8.9)	128.4	.001*
	Farmer	170 (46)		
	Govt. servant	8 (2.1)		
	Business man	8 (2.1)		
Human mauling				
Gender	Male	19 (63.3)	25.7	.000*
	Female	11 (36.6)		
Place of incident	Forests	15(50)	49.7	.000*
	Villages	11(36.6)		
	Agricultural lands	4 (13.3)		
Season	Winter	1 (3.3)	30.5	.000*
	Summer	11 (36.6)		
	Spring	6 (20)		
	Autumn	12 (40)		
Time of incident	Morning	8 (26.6)	72.2	.000*
	Evening	12 (40)		
	Night	10 (33.3)		
Experience of incident	Personal sighting	28 (93.3)	190.9	.000*
	Track/claw marks, etc.	2 (6.6)		
Occupation	Livestock holder	6 (20)	1.9	.596
	Farmer	22 (9.5)		

TABLE 2 (Continued)

Variables	Categories	Livestock killed (%)	Chi-square	*p* value
	Govt. servant	1 (3.7)		
	Business man	1 (4.8)		

is free-ranging. For example, nonstationary electric fences and calving control could be used at this time of the years, together with increasing livestock guarding (Mulej et al., 2013; Sillero-Zubiri & Laurenson, 2001). Livestock guarding dogs, may be an effective strategy that can be easily accepted by locals, since some respondents already reported less conflicts when livestock guarding dogs were present.

Despite the low number of incidents with humans in Asia, they have been reported in many other countries including India, Bhutan, and Japan (Charoo et al., 2009, 2011; Honda & Kozakai, 2020; Huygens et al., 2004; Jamtsho & Wangchuk, 2016; Sathyakumar, 2001). About 30 people were injured in different incidents between 2015 and 2019 of which two cases were fatal. Around seven people on average were injured by Asiatic black bears annually during the study period, compared to only two humans per year according to previous records from 1998 to 2015 (Perveen & Abid, 2013). Most incidents occurred inside the forest when people were collecting timber or medicinal plants, or following their grazing livestock. Around 90% of rural people in this area depend on the surrounding forests for timber (Ali et al., 2022), and more than 95% for medicinal plants (Ahmad et al., 2015). Similar findings were reported in other studies, high human-black bear conflicts in forest areas, where people relied on the forest for resources (Babar Zahoor et al., 2020; Charoo et al., 2009; Chauhan, 2003; Liu et al., 2011). This contrasts with a study in India which found the majority of incidents by Asiatic black bear towards humans occurred in agricultural lands and only 23.5% occurring in the forest (Charoo et al., 2011). This demonstrates the importance of understanding regional differences between human bear interactions in order to identify and mitigate against human-bear conflicts.

Based on our survey results, we recommend the following suggestions to mitigate conflicts associated to Asiatic black bears presence in the western Himalayan. First, since most livestock depredation and incidents with bears were reported at night, more efforts are needed to protect livestock during this time, and to raise awareness of how to reduce the chance of a risky encounter. For example, a report from China suggests that bear-proof fences for households which suffer substantial losses through bear incidents are an effective and cost-saving intervention to diminish human-bear conflict (Papworth et al., 2014). Second, community training programs about various nonlethal interventions could be implemented, as few people reported using nonlethal interventions. Such programs could be an effective way for capacity building in reducing negative interactions between bears and humans, shifting perceptions towards bears, and facilitating landscapes of coexistence (Campbell, 2012). It is of high practical value to study what interventions can play a critical role in conflict mitigation in this area, especially regarding livestock depredation and reducing the likelihood of a human incident. For example, nonstationary electric fences, calving control, and the use of livestock guarding dogs, may be interventions that can be easily implemented (Khorozyan & Waltert, 2020; Landry et al., 2005; Linnell et al., 2012). Third, improvement of bear habitat, such as increasing availability of natural sources of food, may reduce bear visits to village areas (Ali et al., 2017).

Capacity building to effectively mitigate human-wildlife conflicts is recommended for local staff. Wildlife department staff should collaborate closely with experts and locals to implement interventions and reduce the likelihood negative bear interactions. Currently, the wildlife departments have limited resources and there is no NGOs contributing to support these actions. As such, such collaboration remains extremely rare in Pakistan.

AUTHOR CONTRIBUTIONS

Abid Ali: Data collection, writing – original draft preparation, data curation, conceptualization, methodology, formal analysis, visualization, monitoring, writing – review & editing.
Iftikhar-uz-zaman: Data collection and project administration.
Talha Omer: Formal analysis.
Shakeel Ahmad: Writing – original draft preparation.
José Vicente López-Bao: Monitoring, writing – review & editing and investigations.
All authors have read and agreed to the published version of the manuscript.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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