Ukrainian Journal of Ecology, 2023, 13(4), 34-46, doi: 10.15421/2023_442

ORIGINAL ARTICLE

Assessment of human-carnivore conflict in Gahiret-Goleen conservancy area Chitral, Pakistan

N. Ahmad^{*}, S. Shabana, M. Syed

Department of Zoology, Government Degree College Chitral, University of Chitral, Pakistan *Corresponding author E-mail: ahmadnowsheed54@gmail.com **Received:** 01 April, 2023; Manuscript No: UJE-23-102317; **Editor assigned:** 03 April, 2023, PreQC No: P-102317; **Reviewed:** 15 April, 2023, QC No: Q-102317; **Revised:** 22 April, 2023, Manuscript No: R-102317; **Published:** 29 April, 2023

Human-carnivore conflict is a major issue that negatively impacts both carnivores and humans. Livestock predation by carnivores leads to enormous economic losses and retaliatory killings of carnivores. This study aimed to identify the occurrence, nature, and carnivores involved in conflicts, as well as the perception of local communities towards carnivores, preference ranking, causes of livestock predation, and economic costs of the conflict in the Gehrait-Goleen Conservancy Area of Chitral, Pakistan, over a two-year period (2020-2022). Interviews were conducted using a questionnaire method to assess conflicts. Severe conflicts were identified in the study area in the form of livestock predation, with wolves, snow leopards, lynxes, feral dogs, jackals, and foxes identified as predators. Wolves were perceived as the most dangerous predators of livestock in pastures by 77% of respondents, accounting for 42.9% of total livestock depredation. Due to significant damages caused by wolves, 41% of respondents favored completely eliminating their population from the area, while 48% suggested eradicating foxes. Lack of guarding and predator-proof corrals/sheds were identified by 45.33% and 21.33% of respondents, respectively, as major reasons for livestock predation. Carnivores killed a total of 313 livestock, including 107 poultry, during the past two years, resulting in a loss of USD 20758 for respondents. The huge economic loss, combined with inadequate compensation and a lack of awareness, fosters a negative perception of carnivores in the Gehrait-Goleen Conservancy Area.

Keywords: Carnivore, Human carnivore conflict, Predation, Livestock, Compensation.

Introduction

The term "carnivore" evolved from the Latin word carovorare. It is a combination of two words, caro means "flesh" and vorare means to devour. So, carnivores are those animals that feed on the flesh and meat of other animals. Carnivores evolved some 60 million years ago from small insect-eating mammals and until now 286 living species of carnivores have been identified and reported across the globe (Mason, 2001; Lariviere, et al., 2017) describe carnivores as:

Carnivore, any member of the mammalian order Carnivora (literally, "flesh devourers" in Latin), comprising more than 270 species. In a more general sense, a carnivore is any animal or plant that eats other animals, as opposed to an herbivore, which eats plants. Although the species classified in this order are meat eaters, a substantial number of them, especially among bears and members of the raccoon family, also feedextensively on vegetation and are thus actually omnivorous.

Miller and Harley (2016) defined and explained carnivorous animals as members of the order Carnivora and include dogs, cats, raccoons, wolves, jackals, lions, etc. The members of the order are predatory mammals and are described as having a highly developed sense of smell, well-developed canines, a large cranium, and a carnassial apparatus formed by modification of molar and premolar teeth. In-universe carnivores are animals that take mostly meat and flesh of other organisms as food. Carnivores, sometimes called predators are an important component of an ecosystem and a food web. Carnivores are heterotrophs and reside in the third trophic level of the food web. Most of the carnivores eat herbivores, some of them rely on omnivores, and some carnivores prey on other carnivores. Carnivores may be obligate (depend only on meat for survival), hypercarnivores (diet contains greater than

70% of meat), and, mesocarnivores (diet contains at least, 50% of animal meat), and hypocarnivores (diet contains less than 30% of animal meat) (Encyclopedic entry).

From time immemorial humans rely on natural resources to fulfill their needs of life. Some of these important resources include forests, rangelands, and pastures on which humans depend the most. Basically, these areas are natural habitats of wild animals including carnivores. urbanization, climate change, industrialization, agricultural expansion, and rapid human overpopulation lead to human settlements overlying these habitats. As a result of this habitat overlap, an important ecological interaction comes into existence called human-carnivore conflict (HCC). Human-carnivore conflict is a negative interaction between people and carnivorous animals in which both negatively affect each other. In this interaction, carnivores injure and kill human livestock/poultry and sometimes harm or even kill humans. On the other hand, carnivore is harmed by human activities such as hunting carnivores' natural prey and habitat destruction and loss (Treves and Karanth, 2003). Carnivores are predators in nature and their predations on livestock cause severe economic losses to local communities and stimulate an aggressive response in people towards the carnivores. Predator-proof corral pens and proper inspection and care of livestock during grazing can minimize the economic losses due to predation (Bano, et al., 2019).

Humans are the dominant species on the surface of the earth and shaped each and every ecosystem of the world(Attia *et al.*, 2018; Vitousek, et al., 1997). About 40-50% of the land surface has been manipulated by humans for various purposes. Land transformation for urbanization, agriculture, and irrigation constitutes 10-15% while 6-8% have been transformed into pastures (Vitousek, et al., 1997). This transformation of land leads to human settlements overlapping with wild habitats. It ultimately causes human-wildlife conflict (Barua, et al., 2013). It is an interaction in which wild animals and humans negatively affect each other needs and behavior (Mekonen, 2020). Human-wildlife conflict is high and severe in an underdeveloped and developing nation (Khattak, et al., 2021). Humans and carnivores coexist with each other by sharing habitats. However, predation on sheep, goats, cows, and poultry turns this coexistence into conflict in which both carnivores and humans are negatively impacted. So, predation is the main cause of the conflict and poses serious challenges to the conservation of carnivores (Bano, et al., 2019).

Carnivores are an essential part of an ecosystem that regulates the population of herbivorous animals in that habitat thus protecting the crops and vegetation from overgrazing by these animals however as the carnivores and humans coexist and compete with each other for food and habitat this causes human-carnivore conflict. This conflict ranges from damage to crops, and buildings, to death to livestock, and even death to people (Badry, et al., 2020). Conflict with humans along with habitat loss, climate change, and diseases are the main factors leading to the decline in the large carnivore population. The snow leopard is one of the top- ranked voracious carnivores that pray on wild ungulates and livestock. It is an endangered species in the high-altitude ecosystems of central Asia. Reactive killing, poaching, prey declining and habitat loss are the main factors threatening its population (Bano, et al., 2019). In a study on the status of the snow leopard in Pakistan and its conflict with local farmers, Hussain (2003), estimated that there are about 35-50 snow leopards in four potentially important areas for the animal in Baltistan. Normally in the region the snow leopard preys on ibex and markhor however sometimes livestock of the local community are attacked by these endangered carnivores and it is the primary cause of conflict with humans. Predation on livestock causes drastic economic losses to farmers and a lack of loss compensation to farmers by Government or Nongovernment organizations further enhances the negative perception of the farmers aboutsnow leopards.

About 226 species of carnivores have been reported, all of them predators and belonging to the order Carnivora of class Mammalia. The population of prey and herbivores is regulated and maintained by these carnivores and thus has an integral role in maintaining the structure and functioning of an ecosystem. Carnivores' diet selection, habitats, and predations on human livestock are some factors that lead to human-carnivore conflict (Treves and Ullas Karanth, 2003). Humans and carnivores share habitats and compete for resources. Human pets and livestock are attacked by carnivores, posing threats to the carnivore population. Globally 26% of carnivore species have been given either the status of vulnerable, endangered, or critically endangered by the International Union for the Conservation of Nature (IUCN) (Venumière-Lefebvre, et al., 2022). Human-carnivore conflict is a serious and growing concern for conservation biologists as it causes a sharp decline in the population of large carnivores such as brown bears (*Ursus arctos isabellinus*). Naturally, large carnivores are low in population in an ecosystem but play a crucial role in maintaining the ecosystem. Climate change, the surging human population, the decline in food, and, habitat loss along with the hunting of carnivores for the trade of their organs and for excitement are factors further declining their population (Hameed, et al., 2022).

Land transformation and other human activities alter the environment for carnivores. land conversion by man for various purposes can shorten the habitat for carnivores, whereas livestock husbandry has a direct impact on the population of carnivores. Predation of livestock by carnivores can lead to retaliatory killing of carnivores (Arzabe, et al., 2021). Biological resource use is the leading threat to the small carnivore population. It includes poaching, and over and illegal hunting of small carnivores for the trade of their organs to be used in traditional medicines (Marneweck, et al., 2021; Sodhi, et al., 2004). Southeast Asian fauna is under severe threat due to rapid and drastic deforestation and will lose about 42% of its biodiversity in the impending century. Along with deforestation, land transformation and over use of wildlife negatively impact the biodiversity of the region (Sodhi, et al., 2004).

In a study to understand the dynamics of human-wildlife conflict in KPK, Pakistan, Khattak, et al., (2021) found common leopard (*Panthera pardus*), the grey wolf (*Canis lupus*), golden jackal (*Canis aureus*), red fox (*Vulpes vulpes*) as predators on livestock and cause a lot of economic losses (USD 48,490 annually in the study area). Wolf was stated as the most destructive carnivore followed by the golden jackal and common leopard. 90% of the respondents in the study area have a negative perception of the golden jackal. Thus, lack of awareness in the populace about the significance of carnivores, lack of compensation, and predation of livestock are the main causes of human-carnivore conflict in the study area.

In a study on the pattern of predation and human-wildlife conflict in Misgar valley, Pakistan, Bano, et al., (2019) found that about 364 livestock have been killed by carnivores and other non-predatory elements from 2014-19. In the study area, wolves and snow leopards are top-ranked predators of livestock contributing 1.5% and 0.58% damage to livestock respectively. Thus, predation of livestock was found to be the prominent cause of human-carnivore conflict and a big hurdle in conservation.

The presence of the Himalayan lynx (*Lynx lynx isabellinus*) and its depredation of livestock from Chitral, Pakistan have been reported. 80 losses have been documented from Golan and Arkari valley. About 39.9% of the local farmers have the opinion to wipe out their population from the area to lessen the economic impact (Din, et al., 2015). Wolf, jackal and Common red fox are important carnivores in Zewar Gol, Ujnu Gol, and shah Junali in Torkhow valley, district Chitral, Pakistan. Most of the inhabitants do have not proper knowledge about the importance of wild animals thus lack of awareness and predation of livestock are the root causes of human-wildlife conflict in the region (Din and Nawaz, 2011).

Chitral is a mountainous area that provides habitat for many birds, reptiles, fishes, and wild animals, including some destructive carnivores (snow leopard, wolf, lynx, jackal, fox, and feral dogs). Reduction in the natural prey of carnivores, habitat loss, habitat fragmentation; human manipulation and intervention in carnivore's habitat or disturbances created by people are the leading causes of conflict, due to which carnivore animals kill or injure livestock/poultry and threaten or kill people, and thus conflict starts. So, the prime objectives of the study were to estimate poultry and livestock losses due to predation by carnivores in the study area during 2020-2022, to study attitudes and perceptions of the local community towards the carnivores, and to propose recommendations to reduce the level of human-carnivore conflict in the study area. Besides these prime objectives, respondents were asked about the major causes of predation of livestock. In a separate questionnaire, respondents were asked to know about various carnivores and whether their population in the area should either be increased or decreased or whether their current status should be maintained.

Materials and Methods

Description of the study area

Location

Chitral is a northern most district of Pakistan. It is divided into two districts lower and upper by the government of KPK. Together upper and lower Chitral cover an area of 14,850 square kilometers. Hindukush mountain range surrounds it from the northwest, on the northeast by Pamir, and the Hindu Raj Mountain range covers it on the southern side. More than 28% of the area is covered by glaciers, snow-clad mountains, bare rock, and barren ground, 62% is covered by pasture with scattered trees, and 4.7% is covered by dry temperate forests (NWFP and IUCN, 2004). The study area Gehrait-Goleen conservancy area is located in the district of Chitral, Pakistan. Gehrait-Goleen conservancy lies between 35°40′9.22″N and 71°45′59.07″E with an area of 95000 hectares. On December 16, 1998, the area was declared a community game reserve. The area has boundaries in the north with River Chitral, a ridge between Basqargol in the east, a ridge between Shishikoh valley in the south, and again River Chitral in the west (Kakakhel, 2020).

In Chitral village conservation committees (VCCs) play their part in the conservation of the biodiversity of the area generally and particularly Markhoor. There are 13 VCCs in the Gehrait-Goleen conservancy area which include; VCC Keso Geldeh, VCC Kessu VCC Metrarjaowan, VCC Gehrai No.1, VCC Gehrait No. 2, VCC Gang Gehrait, VCC Syed Abad, VCC Broze, VCC Nerdet Danin, VCC Kaari, VCC Koghuzi, VCC Goleen, VCC Jughor whereas Toshi Shasha conservancy contains 12 VCCs. (Kakakhel, 2020) (Fig. 1).



Fig. 1. Location of gehrait-goleen conservancy area.

Climate

District Chitral is surrounded by tall mountain ranges. These mountain ranges prevent the entry of the moon soon rain system in the district and thus it doesn't receive the moon soon rains. Drosh and Chitral towns receive an average rainfall of 650 mm and 500 respectively in spring and winter seasons. Upper areas of the district receive less precipitation, mostly in the form of snow (NWFP and IUCN Pakistan, 2004).

Fauna

In a study to estimate the population trend of Markhoor (*Capra falconeri falconeri*) in Chitral goal national park, Toshi Shasha, and Gehrait-Goleen conservancies, Kakakhel, (2020) estimated 482 animals in 2016, 503 animals in 2017, 633 in 2018, and 634 animals in 2019 in Gehrait-Goleen conservancy area. During four years of study (2016-2017), the population showed an upward growth in Gehrait-Goleen Conservancy. Thus, this investigation confirms the presence of Markhoor in our study area. Younis, et al., (2022) conducted a study to investigate the relative abundance of mammalian fauna in Chitral Gol National Park, Pakistan from June 17 to August 3, 2019. For the study, cameras were installed in various positions to capture photographs of animals in the area. Results of the study show Leopard cat, Himalayan lynx, grey wolf, Golden jackal, cape hare, golden marmot, red fox, Markhoor, feral dogs, and, common leopard are some of the important mammals of Chitral Gol National Park (CGNP).

As our study area (Gehrait-Goleen Conservancy Area) has similar climatic features to that of CGNP. So, we assumed that some of these mammals may be found in our area. Later on, during data collection pictures of the mammals were shown to respondents in order to know whether these animals were found in our study area or not. It showed that some of these mammals were reported by the locals in Gehrait-Goleen Conservancy Area (GGCA).

In a study on the Avifauna in different zones of district Chitral, the following bird species have been reported from different areas of the district including Gehrait-Goleen Conservancy Area; Black-headed Myna (*Sturnus pagodarum*), Jungle Crow (*Corvus macrorhynchos*), Long-tailed Shrike (*Lanius schach*), Golden Oriole (*Oriolus oriolus*), Simla or black Crested Tit (*Parus rufonuchalis*), Mistle Thrush (*Turdus viscivorus*), Blue Rock Thrush (*Monticola solitarius*), Blue-headed Rock Thrush (*Monticola cinclorhyncha*), Pied Wheatear (*Oenanthe pleschanka*), Guldenstadt Red Start (*Phoenicurus erythrogaster*), Black Red Start (*Phoenicurus ochruros*), Stone Chat (*Saxicola torquate*), Brown Accentor (*Prunellafulvescens*) (Manzoor, et al., 2017).

Flora

The area is rocky in terrain and supports the flora of a dry temperate zone with the main species including *Quercus ilex, Cedrus deodara, pinus gerardiana,* and other associated species. However, the dominant vegetation is oak (Kakakhel, 2020). Over all district of Chitral supports diverse flora, besides fruit, the locals utilize plants as fuel and to cure various diseases. 30 species of plants have been recorded and documented from different zones of the area along with their uses in traditional medicines. In the study, *Pistacia integerrima* (Sawer), *Artemisia maritime* (Dron), *Juniperus excelsa* (Saroz), *Elaeagnus angustifolia* (Sinjor), *Ephedra regeliana* (Somani), *Juglans regia* (Birmogh), *Pinus wallichiana* (Patupar), *Pinus gerardiana* (Jalghoza), *Platinus orientalis* (Chinar), and *Punica grenatum* (Dalum) were identified as the main flora of Chitral on which people rely for food, wood, fodder, and are used by the locals for treatment of diseases (Awan, et al., 2001). In another study on the Ethnobotany and medicinal flora of Chitral, Ali and Qaiser, (2009) collected *Descurainia Sophia, Fraxinus hookeri, Pistacia khinjuk*, and *Salix denticulata* from areas lying in the Gehrait-Goleen Conservation area.

Methods of data collection

Research design and data collection techniques

After thorough study and analysis of related articles and papers from the world generally and particularly from district Chitral, closed ended questionnaire was developed containing name, age, and, educational background of respondents. Through this questionnaire data (carnivore seen, perception of respondent about carnivores, livestock details, and predation of livestock) for the period 2020 to 2022 were collected. Beside this questionnaire, representatives of VCCs and wildlife watchers were also contacted to share information about the study topic. The questionnaire was in English language however during interviewing, the questions were properly explained and asked in Chitrali language. This study was conducted in three villages of Gehrait-Goleen conservancy area from December 4, 2022 to January 13, 2023 in order to assess human-carnivore conflict in the study area. Primary data were obtained through the questionnaire and for related concept and literature reviews search engines (Google scholar, Semantic) were utilized.

Target population

Gehrait-Goleen conservancy area contains 13 villages. We opt three villages (Gehrait, Jughoor Gol, and Goleen) to assess humancarnivore conflict for the period of two years (2020-2022). All of the respondents selected from these areas were shepherds and have livestock and depend on natural resources (forests, pastures). The people and their livestock encounter with carnivores and most of the livestock depredation cases have been reported from these villages. 25 households from each of the villages were randomly selected. An adult (age above 18) fromeach household was interviewed to collect data.

Data management and analysis

After collection, data were stored in computer and analyzed by using MS excel 2019 to show results in the form of chart, figures, and tables.

Results and Discussion

Age and literacy level of respondents

In order to determine and identify the carnivores involved in human-carnivore conflict, nature of damages, perception of local community toward carnivores, major causes of depredations, and economic cost of the conflict in Goleen-Gehrait conservancy area, a total of 75 pastoralists were interviewed. 34.6% of the total respondents were belonging to age group 18-27, 21.3% of the total respondents were representing age cohort 27-36, 16% were from age group 36-45, 10.6% were from age category 45-53, 14% of the respondents were belonging to age group 53-62, and 2.6% of them were belonging to age group above 62 years. Percentage of respondents on the basis of literacy shows that majority of the respondents were illiterate (56%). Respondents having primary education were 10.56%, respondents with middle education were 14.6%, and respondents having matric level of education were 10.6%, and respondents with FA/F.sc and above were just 8% of the total respondents (Fig. 2 and Fig. 3).



Fig. 2. Classification of respondents on the basis of age.



Fig. 3. Classification of respondents on the basis of literacy level.

Occurrence of human-carnivore conflict

In response to the first objective of this study different questions such as nature of conflict, animals involve in conflict, damages to livestock and poultry due to depredation by carnivores, perception of the respondents towards carnivores, response of respondents after the predation of livestock by carnivores, economic losses due to predatory and non-predatory factors, and compensation provided by relevant authorities in case of livestock depredation by carnivores were asked to know whether human-carnivore conflict exist in Gehrait-Goleen conservancy or not. As in this study the respondents were herders and have sufficient number of livestock and poultry. They and their livestock encounter with carnivores at different time of the year in pasture and village. More than 98% Of the total respondents had conformed the conflict with carnivores in the study area.

Animals involve in conflict

In Gehrait-Golain conservancy area wolf, jackals, lynx, feral dogs, fox, and snow leopard were reported as wild carnivores and were found involved in human-carnivore conflict in the area. Majority of the herders considered wolf as a most destructive predator of livestockhowever only single case of livestock depredation was linked with snow leopard for the past two years.

Nature of damages caused by carnivores

The study area was a hotspot for livestock rearing and human-carnivore conflict. The inhabitants of the study area and their livestock were totally relying on natural resources such as forests and pastures. Predation of livestock and poultry by carnivores was found to be the main reason for conflict. Thus, killing livestock and poultry by wolves, lynxes, feral dogs, jackals, and snow leopards was identified as damages and losses to the local community. During the study non a single case of human death by carnivores reported. Wolves, jackals, lynxes, feral dogs, and foxes were blamed to be involved in predation of livestock by the respondents. However single case of cattle predation in summer pasture of Jughoor Gol was linked with snow leopard. During 2020-

2022 total of 315 livestock including poultry were killed by the carnivores in the study area. Majority of the cases were done by wolves (42.85%) followed by fox (26.34%), feral dog (13.65%), lynx (7.61%), and jackals (9.20%), and only one incident was linked with snow leopard. Thus, in the area wolf and fox were identified as destructive predators of livestock and poultry respectively (Table 1 and Fig. 4).



Fig. 4. Livestock depredation cases from 2020-2022.

 Table 1. Livestock killed in Gehrait-Goleen Conservancy Area, Chitral, Pakistan.

Carnivores	Goats	Sheep	Cattle	Poultry	Total	% of Total
Wolf	108	12	15	0	135	42.85%
Jackal	14	5	0	10	29	9.20%
Feral Dogs	31	8	0	4	43	13.65%
Lynx	5	9	0	10	24	7.61%
Fox	0	0	0	83	83	26.34%
Snow leopard	0	0	1	0	1	>1%

During data collection, additional information about the livestock composition of the area was documented. Table 2 shows that majority of the respondents hold highest number of goats (69.69%) followed by poultry (15.04%), sheep (9.87%), and cattle (6.06%). This result of livestock composition excluding the percentage attributed by poultry falls in line with that of (Dar et al., 2009) where the percentage contributed by goats is higher than that of sheep andcattle and less than that of poultry.

Table 2. Detail of livestock in GGCA, Chitral, Pakistan.

Livestock Type	Total	% of total
Goats	2083	69.69%
Sheep	298	9.87%
Cattle	183	6.06%
Poultry	454	15.04%

Perceptions of local community

Understanding the perception of a local community towards wild animals in particular carnivores is important for the conservation of wildlife in any area (Attia, et al., 2018). From the results, it was found that respondents from the Gehrait-Goleen conservancy area consider wolves, jackals, feral dogs, lynxes, and foxes dangerous for livestock and poultry. However, foxes were perceived as the most dangerous for poultry in the study area. Among the carnivore, wolves had the highest percentage in terms of ranking as dangerous for livestock. 77.33% of the total respondents blamed it as the most destructive predator of livestock. When it was inquired about the most dangerous predator of poultry then 89% of the respondents point out fox as the most destructive carnivore of poultry in the study area. The majority of the respondents have a positive perception of the leopard and want to enhance its population in the study area. Although only a single case of livestock predation was linked with it during the past two

years still 13.33% of the respondents consider it as dangerous for livestock. 5% and 4% of the total respondents have an opinion that feral dogs and lynxes are dangerous for livestock respectively (Fig. 5).



Fig. 5. Perceptions of respondents about carnivores in Gehrait-Goleen Conservancy area.

Preference ranking of respondents

The preference ranking of respondents about wolves, foxes, jackals, feral dogs, lynxes, and snow leopards was determined through a questionnaire which was developed by following that of (Ahmad, 2020). The results showed that the majority of the inhabitants in the Gehrait- Goleen Conservancy Area have a positive attitude towards the Snow leopard. And about 36% of them have opined that the population of snow leopards should be increased in their area. Another 36% of the respondents wished that its current status should be maintained in the study area. 22% of the respondents respond by saying that the population of snow leopards should be wiped out from their vicinity. While 6.66% wished to reduce its population.

During the study it was also determined whether the population of snow leopard is increasing or decreasing in GGCA. In response to this question 72% of the respondents opined that its population is decreasing and remaining 28% have no idea about the population trend of snow leopard. About 41% of the respondents wished to eliminate wolves from GGCA as they prey on the livestock of the community and cause acute economic losses.13.3% of them consider maintaining its current status, 34.66% want a reduction in its population, and the remaining 10.66% of the respondents had an opinion to increase its population in the area. 44% of the respondents said the population of wolves is decreasing in GGCA. According to 28%, it is increasing and another 28% of them are unaware of the population of wolves whether it is increasing or decreasing.

When the respondents were asked about their ranking of jackals in GGCA then 13.33% of the respondents suggested to maintain their current status, 36% want to reduce, 8% want to increase and 42.66% of the respondents wished to eliminate their population from the area. According to 85% of the respondents the population of jackals is increasing in the area. As jackals usually reside adjacent to the villages and damage the livestock and fruits therefor the respondents in the area have a negative attitude toward jackals.

In GGCA the preference ranking of the majority of the respondents for fox was found to be not encouraging and 48% wished to completely eradicate its population. Predation of poultry by foxes was found to be the main reason for this negative attitude. Similarly, 28% of the respondents had suggested a reduction in its population, 21.33% opined to maintain its current status, and only 2.66% of the respondents wished to increase the fox population in GGCA. 24% of the respondents were found to be unaware of the fox population whether it is increasing or decreasing in GGCA. According to 58.66% of the respondents, its population is increasing while 17.33% of them mentioned that it is decreasing. In the study area predation of poultry was the common reason for the hatred for foxes.

All of the respondents in GGCA are concern about the uncontrolled surging population of feral dogs, they complained that these are not part of the natural ecosystem. According to all of them feral dogs' population is increasing which doesn't only threaten the wild fauna of GGCA but also damages the livestock and properties of the inhabitants. Sometimes they also threaten the humans due to which all of the respondents were of the opinion to completely eliminate feral dogs' population from the area.

In the study area 7.66% of the depredations were attributed by lynx and majority of the depredated domestic animals were found to be poultry. Due to this 36% of the respondents had wished to eliminate its population, 17.33% wished to increase its population,

22.66% were in favor of maintaining its current status, and another 22.66% were found to reduce its population. Overall, in the area the preference ranking for lynx was found to be no appreciable. According to 28% of the respondents the population of lynx is increasing while 30.66% mentioned that its population is decreasing and the remaining 40.33% were found to have no idea about the population trend of lynx in their vicinity (Table 3 and Fig. 6).



Fig. 6. Attitude of 75 respondents from local communities living in the GGCA Chitral, Pakistan.

Carnivores	Population trend of carnivores in GGCA				
	Increasing	Decreasing	No idea		
Snow leopard	0%	72%	28%		
Wolf	28%	44%	28%		
Lynx	28%	30.66%	40.33%		
Jackals	85%	3%	12%		
Fox	58.66%	17.33%	24%		
Feral dogs	100%	0%	0%		

Major causes of the predations

In the study the major causes of livestock predations by carnivores were also determined by developing a close ended questionnaire. Highest number of respondents 34 (45.33%) point out lack of guarding or proper care during grazing is the major cause of livestock predation. 21.33% had opined that improper corral/shed is another reason of livestock predation. According to 18.66% of the respondent lack of natural prey in the area is a key reason of the incidents and 9.33% responded respond by saying that grazing in carnivore hotspot/sensitive habitat is the reason of the predations (Fig. 7).



Fig. 7. Reasons of livestock depredation in GGCA, Chitral, Pakistan.

Economic costs of human-carnivore conflict

Table 1 and 4 shows that during 2020-2022 total of 313 livestock were killed by predators in GGCA. Majority of the livestock depredated during the study period were found to be goats (49.84%) followed by poultry (34.18%), sheep (10.86%) and cattle (5%). Among predators, wolves had the highest contribution (42.49%), followed by fox (26.51%), feral dogs (13.73%), lynx (7.66%), and jackals (6.07%). If the overall damages by predation is translated in term of economic value, then it shows that the conflict causes about 20758\$ losses to the community. This huge economic loss hampers negative perception for carnivores and thus is aserious hindrance in the path of conservation of carnivores in the area.

Table 4. Economic losses due to depredation in GGCA during 2020-2022.

Livestock	Total Carnivores						Price in USD		
	Killed	Wolf	Feral	Lynx	Fox	Jackals	Snow	Price of single Total	
			dogs				leopard	head	
Goats	156	106	31	5	0	14	0	98\$	15290\$
Sheep	34	12	8	8	0	5	0	75\$	2557\$
Cattle	16	15	0	0	0	0	1	158\$	2539\$
Poultry	107	0	4	10	83	10	0	3.47\$	372\$
Total economic lost in terms of USD=20758\$									

Discussion

Globally human-carnivore conflict is a serious issue that affects both humans and carnivorous animals. Studies conducted by various scholars across the globe clearly indicate that habitat overlap and livestock predation are the two major reasons of the conflict. In this study in Gehrait-Golain conservancy area it was found that severe kind of human carnivore conflict exists in the area in the form of livestock predation. Interview questionnaire method was utilized to investigate the occurrence, nature, and animals involve in the conflict and economic losses to the local community. The same method was utilized by (Ahmad, 2020) to assess the nature of human carnivore conflict in Mollen Gol Chitral.

In the study three villages were selected and a total of 75 respondents (25 from each village) of varying age cohort and literacy level were interviewed in order to determine the nature, causes, and economic cost of the conflict. In the study it was found that more than 98% 0f the total respondents had conformed the conflict with carnivores in the study area. The percentage of respondents who experienced conflict with carnivores in Gehrait-Goleen conservancy area deviates from that of the percentage of (Ahmad, 2020) in which 19% of the total respondents had claimed conflict with carnivores. Our result deviates from it because in the latter study majority of the respondents were general villagers and have either few or no livestock. This result is near to that of (Awan, et al., 2020). According to their study 60% of the respondents point out livestock depredation is a cause of human-leopard conflict and about 90% of them considered leopard as a dangerous animal in and around Ayyubia, National Park, Pakistan. Our

result correlates with that of (Din, et al., 2013) in which majority of herders (70.17%) have conflict with wolf as it predates on livestock.

In the study area wolf, jackals, lynx, feral dogs, fox, and snow leopard were reported as wild carnivores by the local community and were found involved in human-carnivore conflict in Gehrait-Goleen Conservancy. The same animals were also reported by (Ahmad, 2020) from Mollen Gol Chitral, Pakistan. The carnivores occurring in Gehrait-Goleen Conservancy Area are also reported by (Din, et al., 2011) in Torkhow valley, Chitral, Pakistan except the lynx which was not reported in the latter area. In another study by (Din, et al., 2013) also reported jackals, fox, and wolves as carnivores in Hindu Kush Mountain Range of Pakistan. The presence of wolf, lynx, and snow leopard were also reported in a study conducted by (Hameed, 2021). However, in this study a rare animal, Himalayan brown bear was also reported which was not reported in Gehrait-Goleen Conservancy Area.

In Gehrait-Golain Conservancy Area predation on livestock and poultry were identified as the two major causes of the conflict. Table 1. indicates that a total of 156 goats, 34 sheep, 13 cattle, and 107 poultry were damaged by various carnivores. Majority of the cases attributed by wolves 42.49% followed by fox (26.51%). The results show close statistical association with that of (Ahmad, 2020) where wolf has the highest percentage of livestock depredation (90%) followed by a fox with 73% of the total poultry depredation in villages. 80 livestock losses, comprising goats (66.25%) and sheep (33.75%) were reported and linked with lynx in a study conducted by (Din, et al., 2015) in the Hindu Kush Mountain range, Chitral, Pakistan. However, in this study predation of livestock by other carnivores was not documented.

The results of livestock predations in Gehrait-Goleen Conservancy Area by wolves also correlates with the results of study conducted by (Din, et al., 2017) in the Pamir Mountain ranges of Pakistan, Afghanistan, and Tajikistan where total of 1419 livestock were reported depredated by wolves (53%) and snow leopards (47%). However, the level of livestock depredations by snow leopard in Gehrait-Goleen Conservancy Area is less than one percent. In contrary, the level of predation by lynx (7.65%) in our study area was higher than that of their study area which was below one percent. Less than one percent of the total cases were attributed by brown bear in the Pamir Mountain ranges however neither the presence of brown bear was reported in Gehrait-Goleen Conservancy Area of livestock predation was linked with it.

Knowledge of local's perception about carnivores in any area is important to develop strategies to conserve carnivore population. Fig. 4 highlights the perception of local community in GGCA for carnivores. 77.33% of the total respondents blamed wolf as the most destructive predator of livestock and 89% of the respondents point out fox as the most destructive carnivore of poultry in the villages in the study area. The results of the perception of respondents in GGCA shows a close resemblance to that of (Ahmad, 2020) where wolves and foxes were determined as the most destructive predators of livestock and poultry in Moleen Gol Chitral, Pakistan respectively. The same trend about lynxes and jackals was found in the latter study.

The perception of respondents towards wolves in the Gehrait-Goleen Conservancy Area is also the same as that of the study conducted by (Din, et al., 2013) where wolves were taken as the most dangerous for livestock predation. In a study (Bano, et al., 2019) found that 63% of the respondent consider snow leopard as lethal to livestock and the remaining 37% of them point out wolf as destructive predator of livestock in in Misgar valley of Hunza, Pakistan.

Fig. 5 and Table 3 mention the preference ranking and population trend of carnivores in GGCA respectively. Fig. 4 showed that majority of the respondents are soft hearted towards snow leopard as compare to other carnivores particularly wolves and feral dogs. Table 3 shows that the population of feral dogs is increasing in the study area and that all of the respondents want to eliminate its population from the area. In GGCA the preference ranking of the majority of the respondents for fox was found to be not encouraging and 48% wished to completely eradicate its population. Similarly, as mentioned in the table that 72% of the respondents have opinion that the population of snow leopard is decreasing and thus 36% of them wished to increase its population in the area. Ahmad, (2020), in a study mentioned that 71% of the respondents wished to increase the population of snow leopard in their area however in GGCA only 36% of the respondents have the same opinion about the animal in their area. This low percentage in the latter area may be due to the nature of the respondents which were all shepherds. They were concern about their livestock and the majority of them were of the opinion that neither the increase nor the reduction or elimination is good for them.

Fig. 6 shows that lack of guarding and lack of predator proof corral/sheds are the major causes of livestock predation followed by lack of natural prey in the habitat and grazing in carnivore sensitive zones. The reasons of livestock predation were also studied by (Bano, et al., 2019) in Misgar Valley of Hunza, Pakistan. Where they found majority of the respondents (53%) opined lack and loss

of natural prey in the area is the main reason due to which carnivore attack on their livestock. While 24% were of the opinion that exposure to predator and another 23% mentioned livestock as preferred prey for carnivore due to which they become victims of the incident.

Table 4 shows that total of 313 livestock and 107 poultry have been killed by carnivores in the study area during two years. Thus, in the study area the conflict has caused about 20758\$ losses to the community. This huge economic loss further aggravates the prevailing negative perception in the community for carnivores.

Conclusion

Ouestionnaire based investigation was conducted in Gehrait-Goleen Conservancy to assess human-carnivore conflict, animals involve in the conflict, and economic cost of the conflict. The results showed a severe kind of human-carnivore conflict exists in the study area. In the area, the respondents point out wolves, jackals, lynxes, foxes, feral dogs, and snow leopards as predators of livestock and poultry. Predation of domestic animals by these carnivores was found to be a prime reason for the conflict. This conflict harms the local community in terms of the predation of their livestock and also poses a serious threat to the population of rare carnivores by enhancing negative attitudes in the community toward the carnivores. In case of severe losses, the aggression of the people turns into the retaliatory killing of the carnivores. In the study area the majority of the respondents either want to increase or maintain the current status of snow leopard. In the area, 77.33% of the total respondents had perceived wolves as the most destructive predator of livestock followed by snow leopards. The majority of the predation had contributed by wolves due to which severe hatred occurs in the community for wolves and due to which 41% of the respondents want to completely eliminate its population from GGCA. The same perception and preference had been found for foxes. Fox was blamed by the respondents to be involved in the destruction of poultry in villages. For the past two years, 83 poultry were killed by foxes due to which 48% of the locals had in favor of completely eradicating fox's population from GGCA. Among carnivores, the most severe kind of hatred is found for feral dogs and all of the respondents wanted to eliminate its population. Collectively, in the study period 313 livestock including poultry were reported to be killed by carnivores. Translation of these losses into money shows that 20758\$ lost were caused by these carnivores.

References

Ali, H., Qaiser, M. (2009). The ethnobotany of Chitral valley, Pakistan with particular reference to medicinal plants. Pakistan Journal of Botany, 41:2009-2041.

Attia, T.S.N., Martin, T.N., Forbuzie, T.P., Angwafo, T.E., Chuo, M.D. (2018). Human wildlife conflict: causes, consequences and management strategies in Mount Cameroon National Park South West region, Cameroon. International Journal of Forest, Animal and Fisheries Research, 2:34-49.

Din, J.U., Hameed, S., Shah, K.A., Khan, M.A., Khan, S., Ali, M., Nawaz, M.A. (2013). Assessment of canid abundance and conflict with humans in the Hindu Kush Mountain Range of Pakistan. Wildlife Biology in Practice, 9:20-29.

Marneweck, C., Butler, A.R., Gigliotti, L.C., Harris, S.N., Jensen, A.J., Muthersbaugh, M., Jachowski, D.S. (2021). Shining the spotlight on small mammalian carnivores: global status and threats. Biological Conservation, 255:109005.

Oli, M.K., Taylor, I.R., Rogers, M.E. (1994). Snow leopard Panthera uncia predation of livestock: an assessment of local perceptions in the Annapurna Conservation Area, Nepal. Biological Conservation, 68:63-68.

Ahmad, O. (2020). Assessment of human-carnivore conflict in Chitral, Pakistan. Ukrainian Journal of Ecology, 10:61-65.

Aryal, A., Brunton, D., Ji, W., Barraclough, R.K., Raubenheimer, D. (2014). Human–carnivore conflict: ecological and economical sustainability of predation on livestock by snow leopard and other carnivores in the Himalaya. Sustainability Science, 9:321-329.

Arzabe, A.A., Retamal, P., Simonetti, J.A. (2021). Is livestock husbandry more stressing than other anthropic activities to wild carnivores?. Applied Animal Behaviour Science, 241:105380.

Awan, M.N., Yaqub, A., Kamran, M. (2020). Survey of human-leopard (Panthera Pardus) conflict in Ayubia National Park, Pakistan. Journal of Bioresource Management, 7:1-5.

Awan, M.R., Shah, M., Akbar, G., Ahmad, S. (2001). Traditional uses of economically important plants of Chitral District, Malakand Division, NWFP, Pakistan. Pakistan Journal of Botany, 33:135-146.

Assessment of human-carnivore conflict in Gahiret-Goleen conservancy area Chitral, Pakistan

van Bommel, J.K., Badry, M., Ford, A.T., Golumbia, T., Burton, A.C. (2020). Predicting human-carnivore conflict at the urbanwildland interface. Global Ecology and Conservation, 24:e01322.

Bano, R., Khan, A., Mehmood, T., Abbas, S., Khan, M.Z., Shedayi, A.A., Nawaz, M.A. (2021). Patterns of livestock depredation and human-wildlife conflict in Misgar valley of Hunza, Pakistan. Scientific Reports, 11:23516.

Citation:

Ahmad, N., Shabana, S., Syed, M. (2023). Assessment of human-carnivore conflict in Gahiret-Goleen conservancy area Chitral, Pakistan. *Ukrainian Journal of Ecology.* 13: 34-46.

(cc) EY This work is licensed under a Creative Commons Attribution 40 License