HIMALAYAN BROWN BEAR *(Ursus arctos isabellinus)* ECOLOGICAL & HUMAN-BEAR CONFLICT INVESTIGATION IN KASHMIR WITH SPECIAL REFERENCE TO HABITUATION TO GARBAGE DUMPS IN THE CENTRAL WILDLIFE DIVISION

(July 2021 - October 2021)

PILOT RESEARCH

Wildlife SOS
Field Conservation Project

HIMALAYAN BROWN BEAR (*Ursus arctos isabellinus*) ECOLOGICAL AND HUMAN – BEAR CONFLICT INVESTIGATION IN KASHMIR WITH SPECIAL REFERENCE TO BEAR HABITUATION TO GARBAGE DUMPS IN THE CENTRAL WILDLIFE DIVISION

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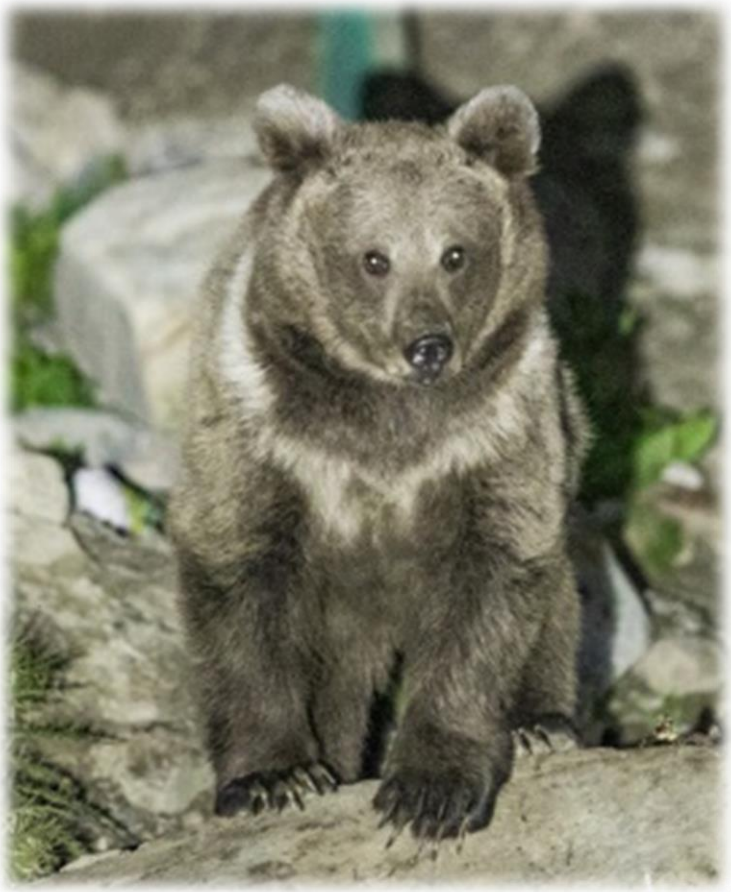

WILDLIFE SOS

DEPARTMENT OF WILDLIFE PROTECTION J&K GOVT.

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DEDICATED
to
(Late) Dr. Lisa Milella

(06.02.1974 – 19.05.2022)

"Dr. Lisa Milella has been a ray of hope for a variety of distraught animals. Her dedication to the field of veterinary dentistry has bought accolades from across the world. Her passing will be mourned by many, and her work will continue on through the many others who worked alongside her. A saviour, a role model, and a hopelessly passionate veterinarian who will be cherished by all".

Research Team
Wildlife SOS

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ABBREVIATIONS

BRO	Border Road Organisation
BSF	Border Security Force
CITES	Convention on International Trade in Endangered Species
CRPF	Central Reserve Police
CWD	Central Wildlife Division
EN	Endangered
etc	Extra
FMD	Foot and Mouth disease
ft	Feet
GPS	Global Positioning System
HBI	Horizontal blanking interval
IUCN	International Union for Conservation of Nature
J & K	Jammu and Kashmir
Km	Kilometre
M	Meter
N	Number
NH	National highway
NTFP	Non timber forest product
PA's	Protected areas
Q-GIS	Quantum geographic information system
RAI	Relative abundance index
REM	Random encounter model
SDA	Sonamarg developmental authority
Sq. Km	Square Kilometre
UT	Union territory
UTM	Universal Transverse Mercator

Rashid Yahya Naqash
REGIONAL WILDLIFE WARDEN
KASHMIR REGION

FOREWARD

The two most pressing man animal conflict situations in Kashmir landscape today involve Black/Brown Bears and leopards. They cause maximum attacks, human injuries and deaths besides damage to standing crop and livestock. Conservation of wildlife thus is facing a severe challenge due to public perception and hostility due to these attacks. Jammu and Kashmir is home to both the Black and Brown Bears and these along with leopards have held the Union Territory in a veritable state of terror for decades now. Although conflict is not a new phenomenon in the world, and in Kashmir too, there is historical evidence to show that it is an old phenomenon, it has certainly escalated greatly in the past few years. This is due to change in forest cover, change in land-use practices, change in livelihood options practiced by the local populace, decrease in wild prey/natural food, illegal hunting and over exploitation of the resources by villagers, change in behaviour of these animals and easy access to food in the fringes. Statistics clearly show a rise in incidences of such conflicts.

Any long-term solution of such conflict is bound to be multi-disciplinary and should deal in equal measure with animal biology and human attitudes as well. It should also provide succour to the victims of such attacks as quickly and efficiently as possible. Finally land use needs to be addressed. If these steps are not taken and attention is focused only on the problem animal then it is likely that the solution is temporary and that the problem will recur in another place at another time.

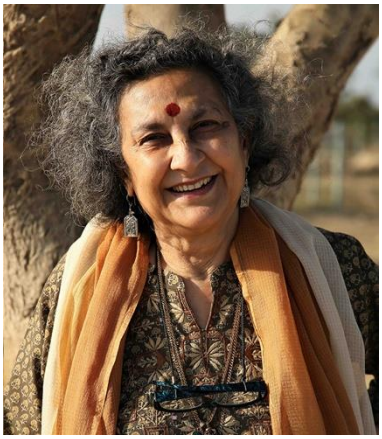
The Wildlife SOS has been working in Kashmir on such conflicts for many years now. Recently in consultation with the Department of Wildlife Protection has initiated a research-based study in Thajwas landscape to look into the causes of the increase in Human – Bear interactions and has tried to work out an insight in order to suggest site specific mitigative measures both on short- and long-term basis.

The team has successfully conducted an extensive survey in the area in a very short span of time, using camera traps as well as adopting to occupancy model by interviewing cross sections of people like herders, hoteliers, civil society, and other stake holding departments and has therefore, been successful in making a spatial assessment of the causes of such increase in Human-Brown Bear interactions. The density of brown bears has been assessed by the team using the camera trapping method with Random Encounter Model (REM) and feeding behaviour and seasonal changes in the diet has also been studied based on scat analysis. The study is helpful in determining people's perceptions believing in conservation through coexistence. Based on these findings a set of results and recommendations have been produced in the form of this report.

I am sure that the report will be extremely useful to foresters, wildlife managers, policy makers, academicians, researchers and local communities in dealing with the complex issue of human- bear conflicts in the UT of Jammu & Kashmir.

(Rashid Yahya Naqash)

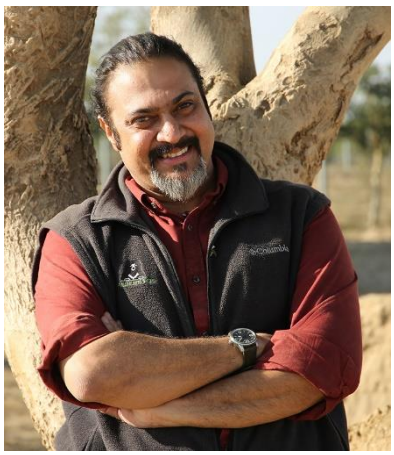
FOREWORD



We at Wildlife SOS, are so pleased to be able to present to you our team's immense hard work in the UT of Jammu & Kashmir with respect to studying brown bears. Our main goal since the start of Wildlife SOS has been to support wildlife conservation in its truest form and to see this project play a role in leading to the conservation of brown bears has been a rewarding experience.

This elusive species has been a challenge to work with, but our team's efforts along with tremendous help from the J&K Wildlife Protection Department have yielded great results. A variety of members have contributed to this endeavor, which has led to assessing the several anthropogenic pressures on this species and forming well-informed management decisions involving key stakeholders.

This project dives into gathering a comprehensive understanding of what is affecting these critically endangered bears in a manner that has not been done before. We hope to make real progress and eventually help with the reduction of human-bear conflict in the area. Congratulations to the entire team of Wildlife SOS and we hope to keep collaborating with the Wildlife Protection Department of Jammu and Kashmir in protecting their unique wildlife.



Best Wishes,

Geeta Seshamani

Geeta Seshamani
Co-founder & Secretary
Wildlife SOS

Kartick Satyanarayan
Co-founder & CEO
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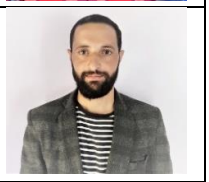
Mr. Umer Nazir Field Assistant umerwagay1@gmail.com	

PREFACE

We are excited to present our Technical Report on "**Himalayan Brown Bear (*Ursus arctos isabellinus*) Ecological and Human - Bear conflict investigation in Kashmir with special reference to bear habituation to garbage dumps in the Central Wildlife Division"** to J&K Wildlife Protection Department, our generous supporters and to the conservation community. This project has been an honour to work towards considering the amount of inspiration, it has had on the lives of people and brown bears.

The project provides valuable baseline data on the brown bears, their habitat and the problems confronting by the brown bears and the Landscape. Such information would be of vital importance for conservation and management initiatives.

Our main motive at Wildlife SOS has always been to take Wildlife Conservation to new heights and this study have helped us get closer to this.

Brown Bear Field Research Team
Wildlife SOS

ACKNOWLEDGEMENTS

Research project at such a scale could not have been possible without the support of the J&K Wildlife Protection Department, who have been motivating and guiding us through this Brown Bear Project at Sonmarg. We hope to collaborate further in future with the goal of Conservation for Jammu and Kashmir's treasured wildlife.

Our sincere thanks are due to Shri. Suresh Kumar Gupta, IFS, Chief Wildlife Warden, J&K, Shri Rashid Y. Naqaash, Regional Wildlife Warden, Kashmir for the necessary permissions and support throughout the conduct of the Project.

This report is a combination of efforts from our team, along with other dedicated researchers to help understand the ecology of Brown Bears in Jammu & Kashmir. The project has pushed the conservation efforts towards this species by gathering scientific evidences to ascertain their dependence on human habitat. Our Co-founders, Mr. Kartick Satyanarayan & Mrs. Geeta Seshamani, have been a massive support to this endeavour.

We express our sincere thanks to Shri Altaf Ahmad Dentoo, Wildlife Warden, Central Division, Srinagar, the Range Officer, Ganderbal, Mr. Feroz Ahmad and all the Field Officers from Central Wildlife Division, Kashmir for their continuous support and guidance.

We express our sincere thanks to Dr. Qayoom, Assistant Professor, SKUAST-K and all other Officers at Sheep & Animal Husbandry Departments for their valuable inputs during the field surveys. We also thanks to Dr. Ashok Kumar, WSOS, for his valuable contributions during the data analysis and report writing.

We thank all the Government Departments, Indian Army, CRPF, BSF, J&K police for their immense support during our field operation. Special thanks are due to Commanding Officers at 254 and 123 Transit camps, Chief Executive Officer at Sonmarg Development Authority and Officers at Shri Amarnath Shrine Board who directly facilitated us in many ways to succeed in this project.

We also thank Mr. Balasubramanian and Mr. Muddasir Manzoor, Field Researchers, Mr.Showkat Ahmad, Driver, Mr. Mustaq Ahamed, Field Assistant and all the Pony Owners and Shepherds for their cooperation and unforgettable hospitality during our field visit.

It gives us immense pleasure to thank all the staffs of J&K WSOS, BBRC, ABRF and WSOS – Delhi, who have dedicated their heart and soul for this project. Without their visible and invisible support, we couldn’t have achieved the project towards the success.

Project Team
Wildlife SOS

EXECUTIVE SUMMARY

The Himalayan Brown Bear (*Ursus arctos isabellinus*) is one of the largest carnivore species with a restricted distribution in the alpine meadows of the Himalayas. Brown bear population, distribution and human-bear conflict were studied in the Central Wildlife Division of Kashmir (June 2021 to October 2021). The density of brown bears was assessed using the camera trapping method with Random Encounter Model (REM). Sampling was carried out in five square kilometer grids, and the cameras were placed randomly within the grids. The brown bear distribution was also studied by indirect evidence and by questionnaire survey methods. The feeding behavior and seasonal changes in the diet were studied based on scat analysis. The human-bear conflict and people's perceptions were assessed by a questionnaire survey along forest fringes and settlement areas.

The estimated density of brown bears was 1.5/km^2. The other species recorded in the camera trap were Red Fox, Yellow-throated marten, Marmot, Jackal, Ibex, Livestock and stray dogs. The bear sign encounter rate was 0.12/km with signs recorded only in the North-Western region (Sarbal) and the Eastern region (Amarnath). Bears occurred mainly in the hilly terrain and sub-alpine meadows. The elevational distributional range of brown bears was 3000 to 5000 m which was similar to the earlier reports from India. Diet composition based on scat analysis revealed 75% of food items were scavenged from garbage. Out of 20,627 camera trap footage, 9,131 footage (62%) had bear foraging sequences. These garbage dumps were prone to attracting and serving as easy food for the wildlife. Bear scavenging in the garbage dumps could be attributed to proximate factors like food availability, palatability, habitat degradation and ultimate factors like nutrient requirements and an increase in body mass. Further, the expansion of tourism activities and holy pilgrimage lead to habitat fragmentation and destruction.

The questionnaire survey in our study area revealed that the Livestock population of goat and sheep was 24950 in 101 different flocks. Livestock depredation and crop depredation were the major forms of conflict. Livestock grazing, migratory graziers (dhars) and developmental activities are threats to the conservation of Himalayan brown bears. The proposed Zojila tunnel route will help in minimising human-bear conflict and road accidents in Srinagar, Kargil and Leh area. The site-specific management recommendations were given to minimize human-bear confrontation, waste disposal, alternate methods for animal husbandry, and tourism.

CHAPTER – 1

1. ABOUT THE PROJECT

1.1 Introduction

Human Wildlife Interaction has become more and more common in and around the protected areas across the world. In India, the increase in human and livestock populations has created pressure on all natural resources. Habitat modification has caused many wildlife species to become ecologically dislocated (Chauhan and Ramveer Singh 1990). Most protected areas are fragmented, degraded, and disturbed from anthropogenic activities. Forests, pastures, and wastelands have been brought under cultivation to sustain increased demand for cereals and other food products (Chauhan and Sawarkar 1989).

The interaction between human and wildlife species always led to a negative attitude towards the conservation of wildlife species (Bagchi and Mishra, 2006; Aryal et al., 2016). It is reported that major causes of interaction between humans and wildlife are crop raiding, livestock killing, house damage, human kill or injury, and also killing or injury of wildlife in retaliation. These interactions happen because of insufficient quality and quantity of food resources in their natural habitats in particular seasons, and habitat loss, degradation, fragmentation, conversion of forest land-use change for different purposes like agricultural, road/rail network, industries, hydropower project, etc. (Graham *et al*., 2005; Athreya and Belsare, 2007; Kabir *et al* , 2014).

1.1.1 Background

Bears have a wide global distribution with presence in 62 countries and are found in every continent except Africa, Australia and Antarctica (Nowak and Paradiso, 1983). Globally, there are eight species of bears viz., Asiatic black bear (*Ursus thibetanus),* Polar bear (*Ursus maritimus),* American black bear (*Ursus americanus),* Brown bear (*Ursus arctos),* Sloth bear (*Melursus ursinus),* Spectacled bear (*Tremarctos ornatus),* Giant panda (*Ailuropoda melanoleuca)* and Sun bear (*Ursus malayanus)* (Waits *et al*., 1999) Europe has Two species, three are in North America, one in South America, and six in Asia. Of the eight species of bears in the world, four bear species viz. sloth bear, Asiatic black bear, Himalayan brown bear and Malayan sun bear have been reported in India (Prater, 1990).

1.2 General distribution of Brown bear

The brown bear (*Ursus arctos*), is widely distributed throughout the Pelearctic (Europe and Asia) and Nearctic (North America) faunal regions. In the Palearctic region, *U. arctos* is commonly referred to as the brown bear, whereas in North America, it is called the grizzly bear. The brown bear occupies a diverse array of habitats, from arctic tundra to boreal of Russia in the north and coastal forests, to the mountain forest and grassland ecotone of the Himalayas in the south (Servheen, 1990).

The Asian range of brown bear extends from Turkey, Iran and Afghanistan to Pakistan and along the Himalayas of India, Nepal and Bhutan, and then north and east through the mountains of central Asia, Tibet, Northern China and Mangolia to Russia (Jackson, 1990). Along the Himalayan-Tibetan region, two subspecies of brown bears have been reported (Prater, 1990 and Schaller, 1998). The brown bear subspecies, *Ursus arctos pruinosus*, which is known as Tibetan brown bear, has been recorded from Damodar Kunda valley, Mustang district, Nepal (Gurung, 2004), and the subspecies, *Ursus arctos isabellinus* often known as red bear is believed to occur in the north western parts of Nepal (Schaller, 1998).

1.3 Status of Himalayan Brown bear

- **Species: *U. arctos***
- **Subspecies: *U. a. isabellinus***
- **Genus: *Ursus***

Range: North-western and central Himalaya, including India, Pakistan, Nepal, the Tibetan Autonomous Region of China and Bhutan.

Habitat: High altitude open valleys, alpine meadows and above timberline.

Status: IUCN Red List- Critically endangered.

CITES - Appendix I

Indian Wildlife (Protection) Act of 1972 - Schedule 1

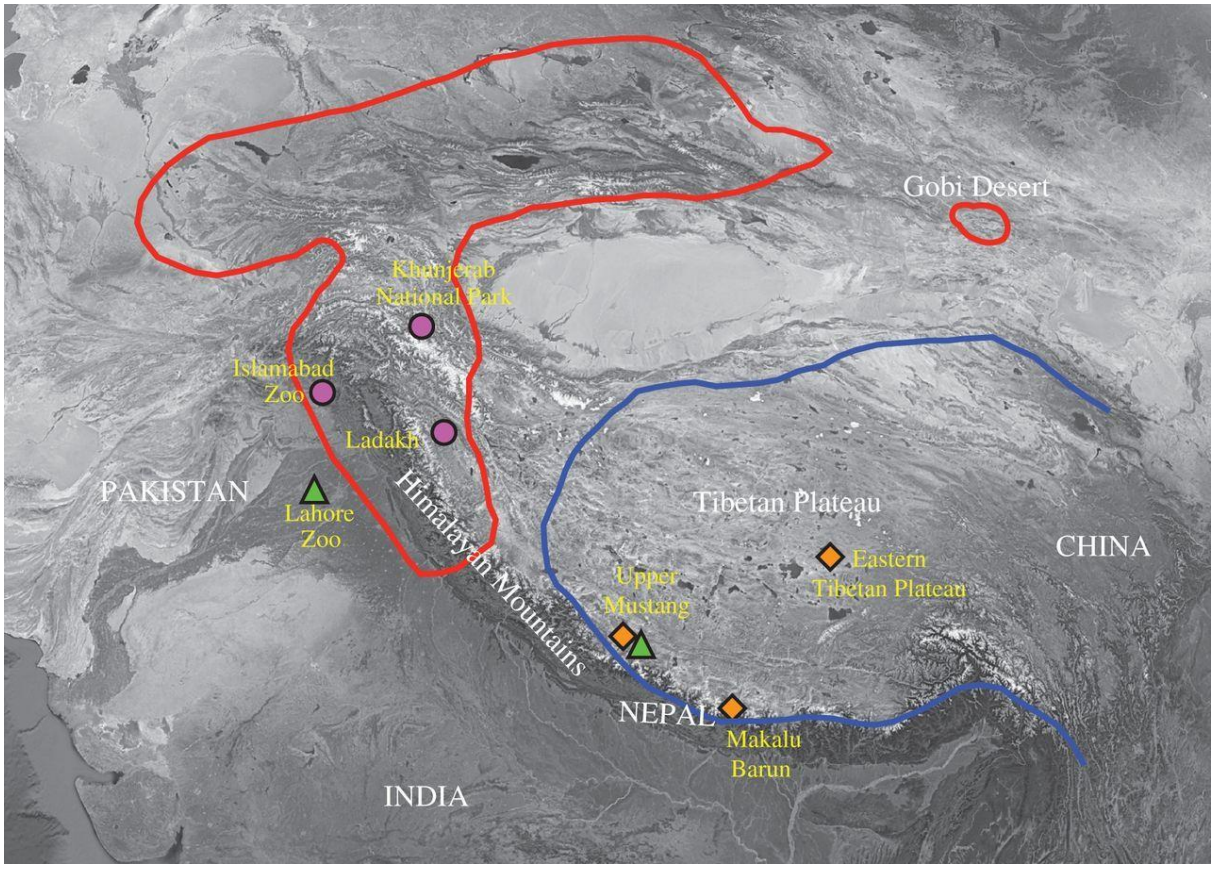
Table 1. Himalayan Brown bear distribution and population size

Population	Countries	Degree of isolation	Population size (mature adults)	Population area of distribution (Km^2)	Population trend	Red list category
Himalayan Mountains	Nepal, India, Pakistan	Connectivity with China, Tibet possible	130 - 220 (72-121)	35000	Unknown	EN

1.3.1 General distribution in India

Brown bear is one of the least widely distributed large mammal in the Indian sub-continent, yet very little is known about its ecology and behaviour in India. The report on the status and conservation of the bears of the world indicated scant information on Himalayan brown bear in India (Servheen, 1990). The Himalayan brown bear occurs in very low densities in the sub-alpine and alpine regions between 3000-5000m in the Greater Himalayas and in some parts of the Trans-Himalayan regions (Sathyakumar, 2001 and 2006a). The Brown bears are largely confined to the north western and western Himalayan ranges in Jammu and Kashmir, Himachal Pradesh and Uttarakhand (Sathyakumar, 2006).

Fig.1 Map showing Brown bear distribution ranges



1.3.2 Distribution of Brown bear population in Jammu and Kashmir

They occur in the rolling uplands and alpine meadows above timberline in the Himalayan regions of Jammu and Kashmir Union Territory (UT) and Ladakh UT (Schaller, 1977). Brown bears are poorly studied due to their elusive nature and distribution in rugged landscape. So far, very little information is available on the species except for few distribution records and short-term studies focused on bear-human conflict. Much of its distribution range

in India is largely unexplored and hence, there is paucity of scientific information which is vital for the conservation of the species and management of its habitats.

Table 2. Himalayan Brown bear distribution in Jammu & Kashmir

State/UT	Brown bear distribution - areas	Reference
Jammu and Kashmir	Lidder	Sathyakumar, 2002
	Sindh	
	Marwa	
	Kistwar	
	Poonch	
	Badharwa	
Ladakh	Zanskar Valleys	Sathyakumar, 2002
	Suru Valleys	

1.3.3. Threats to the Himalayan Brown bear

Threat: Global warming, Developmental activities, Tourism, expansion of shrine developmental activities, Human-animal conflict, rapid habitat loss, retaliatory killings, poaching for fur, claws and organs and, in some rare cases bear baiting.

In Ganderbal district, Central wildlife division of Kashmir, the Himalayan brown bear occurs in rolling uplands, alpine meadows and sub-alpine forests. Due to increasing human population, habitat degradation, expansion of tourism and tourism related infrastructure developmental activities, expansion of roads, tunnelling activities, livestock grazing (sheep's and goats), retaliatory killings, expansion of shrine developmental activities, plantation in natural habitats (afforestation), collection of medicinal plants and other human activities, brown bear population is highly disturbed and threatened. Habitat degradation is mainly due to unsustainable use of alpine regions, increasing biotic pressure and habitat fragmentation. Further due to encroachment on the forest land and continuous habitat degradation in the course of time, the status of the Brown bears continues to be endangered in this area, but at the same time it is leading to more conflicting situation.

CHAPTER - 2

2. STUDY AREA

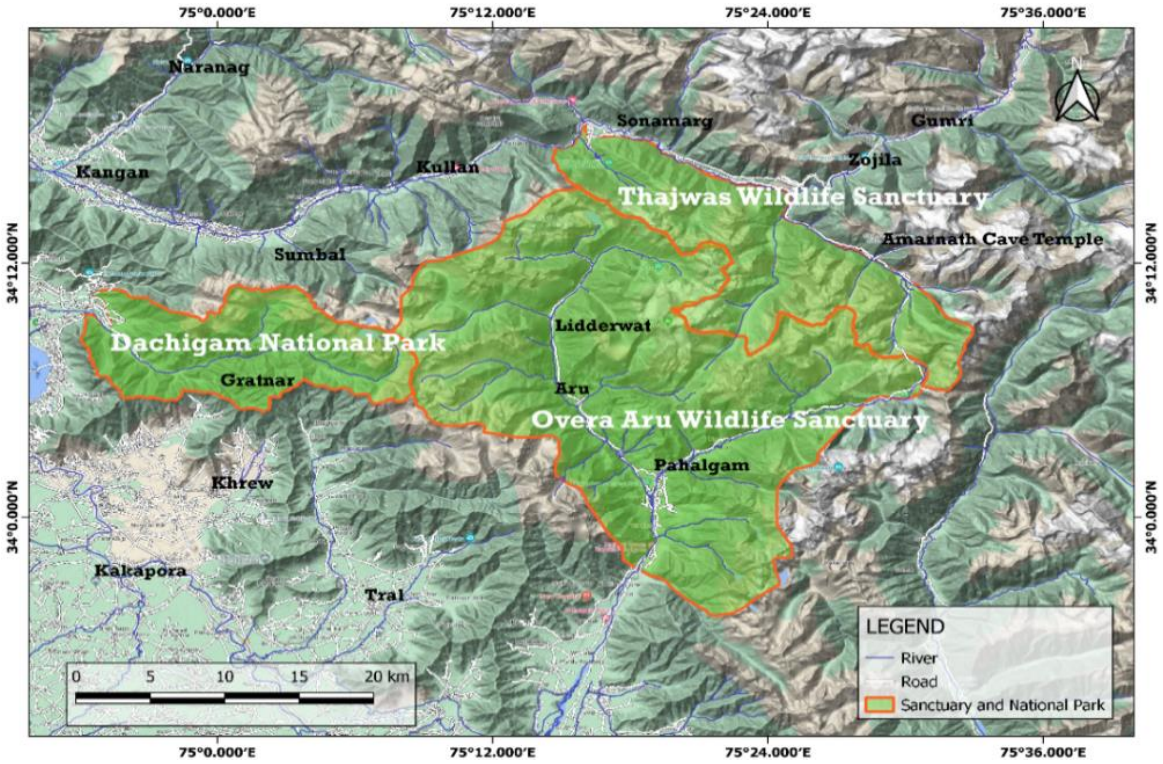
2.1 Location, Topography, Climate, Vegetation and Forestry

The study area was in the Ganderbal district of Central wildlife division (CWD) Kashmir, in Trans-Himalayan region of India. The Himalayan range is one of the most fascinating and spectacular natural wonders on earth. The Himalayan and Trans-Himalayan region of the country are known for its biodiversity, natural beauty and for the uniqueness found in the species composition. The CWD includes two National parks (Dachigam National Park - 141 sq. km. & City Forest National Park – 9.07 sq.km.), one wildlife sanctuary (Thajwas (Baltal) Wildlife Sanctuary – 203 sq.km.) and five conservation reserves (Khrew – 50.25, Khonmoh – 67, Brain Nishatb – 15.75, Khimber / Dara / Sharazbal – 34 and Wangat / Chatergul – 12 sq.km.).

Our study area included the areas of Thajwas (Baltal) Wildlife Sanctuary (203 sq.km), Sonamarg, Laxpathri, Nilgrath and Sarbal villages. In these areas the main source of income is tourism and Amarnath pilgrimage and tourists visit the places from across the country and also from abroad. The villagers stay in their villages for maximum five to six months during the summer season (May to September/October) and during harsh winter season they move to their respective towns. This region mostly lies between 2,600 to 6,400 metres (14,800 to 19,700 ft) and is very cold and arid. Sonamarg, a small town, located at the base of buffer zone of Thajwas (Baltal) Wildlife Sanctuary is the main tourist attraction and remains abuzz with tourists. The main highway (NH1) passing through Sonamarg leads to Drass, Kargil and Leh - Ladakh. The study area located at 34.18° N to 75.17° East, from Srinagar 80km and Kargil 123 km (Fig. 2).

The study area falls in the "**Sindh valley"** of Trans Himalayan region. The forest types of central forest division are sparse alpine steppe and grass land meadows. Extensive areas consist of bare rock and glaciers. These areas fall in the distribution range of Snow Leopard (*Panthera uncia)*, Tibetan Wolf (*Canis lupus langier*), Himalayan Brown bear (*Ursus arctos isabellinus*), Asiatic Ibex (*Capra ibex*), Musk Deer (*Moschus spp.*), and Marmot (*Marmota marmota)* etc. The area experiences four distinct seasons which are spring (March–May), summer (June–August), autumn (September–November) and winter (December–February). Frequent snowfalls during winters lower the temperature of this township to as low as minus 20-24 degrees.

Fig.2 Map of Study area map



The rapidly increasing population and subsequent infrastructure development for catering to the population rise as well as the tourism industry is leading to deforestation, depletion of natural resources and conditions of scantiness. These regions which play vital role not only in India but also in sub-continental economy, is in the grip of environmental degradation. The carrying capacity of the Himalaya is decreasing day by day due to the heavy pressure of both increasing human and livestock population. Historically, local communities were dependent on natural resources for their livelihood. Still, these mountainous areas undergo rapid socio-economic and environmental changes due to hasty increase in population, forest degradation and developmental activity.

2.2 Project Goal and Objectives

The population and distribution of Brown Bears in Central Wildlife Division of Kashmir is fragmented because of habitat degradation in several parts due to anthropogenic activities or progress of various developmental activities and human settlements. Human activity and encroachment both within and outside Protected Area's results in high frequencies of human-brown bear conflict and restricted movement of brown bears and other wild animals among the fragmented forest patches.

The proposed work was envisioned to assess the status and distribution of Brown Bear populations and to study bear-human conflicts in Central Wildlife Division of Kashmir, with a goal of finding solutions that will benefit both people and wildlife.

Objectives:

The followings were the main objectives of the research Project:

- To study the population status and distribution of brown bear in Central wildlife division in Kashmir.
- To assess the human induced pressures or anthropogenic pressures in the brown bear habitat
- To evaluate the nature and frequency of human brown bear conflicts in the study area, their dependence and habituation to garbage dumps
- To find out the solution to minimize conflicts that will benefit both people and wildlife.

CHAPTER - 3

3. PROJECT ACTIVITIES AND METHODS

The project will help to better understand brown bear distribution, feeding behaviour and human bear interface in Central Wildlife Division of Kashmir Region. It was initiated on June 2021 and was completed in October 2021.

3.1 Status and distribution of brown bears

Population density is an important state variable in ecology and monitoring of wildlife populations. All the data was collected non-invasively using both animal signs and camera trapping from Central Wildlife Division Kashmir. The Brown bears were surveyed using standard camera trapping methods. The study area was divided into sample units of 5 km x 5 km grid, locating the centroid of each unit using Q - GIS, and designating these points as potential trap points and logistically accessible grids could be covered and representing the home range of brown bear size (Collins et al., 2005). Actual trap points were located at ecologically optimal sites within 50 m radius of the centre point, typically on a road or active game trail. Once a point was located, we recorded the UTM coordinates using GPS. The camera traps were placed at about 2.5feet height from the ground on animal trails and paths and mostly kept 2 to 3 m apart from the trails. We used Bushnell 119837C 16.0 Megapixel Trophy ® Essential E3 HD Low Glow cameras during the study.

For assessing the current brown bear distribution and movement in the study area the information from locals and indirect evidences like scats, foot prints and feeding signs encountered during field visit were used and all locations were collected with GPS. Regular data flowed in about the location of the brown bear from shepherds, pony owners, minor forest produce collectors, wildlife protection department field staffs, resident villagers, tourist guides, shop keepers and from incidence of human – bear conflict affected people. We observation recorded in the areas where:

(1) bears had been sighted by local people;

(2) bear depredations had occurred; or

(3) bear sign had been observed.

It was more productive to rely on this data rather than doing actual sampling.

3.2 Brown bear density estimation using Random Encounter Model (REM)

The data was analysed with a random encounter model developed by Rowcliffe *et al*. (2008) for estimating animal density using camera traps without the need for individual recognition. This method models the rate of contact between the animals and camera traps. It considers the characteristics of the species, their mobility (average daily distance travelled) and

the average number of individuals in a group. Additional needed parameters are the angle and radius of the detection zone of the camera trap. The radius of the detection zone of the camera trap (*r*) used is 0.0073km and the angle of the detection zone (θ) is 65°=1.134 radians. Photos showing the prolonged stay of an individual in front of the camera trap were considered as one individual registration to avoid overrepresentation of the species. This method uses the following formula:

$$D = \frac{y}{t} \cdot \frac{\pi}{vr(2+\theta)}$$

Where

D - Population density (ind./km^2)

y - total number of independent captures

t-total number of camera trap days

r- radius of the detection zone of the camera trap (km)

θ - angle of the detection zone of the camera trap (radians)

v- mobility of the species (distance moved in a day, km)

3.3 Diet composition

The feeding behaviour and seasonal changes in the dietary intake of bears was studied through scat analysis (Laurie and Seidensticker, 1977; Baskaran, 1990; Manjrekar, 1989; Schaller, 1969, 1989; and Sathyakumar, 2003). Many field naturalists and wildlife biologists relied heavily on fecal analysis to quantify diets for various bear species (Mattson *et al*., 1991; McLellan and Hovey, 1995 and Murie, 1981). The bear scats were visually identified (Xu et al. 2006), as no other species in the study area produce faeces similar to bears. Intact scats encountered while walking transect and in other areas were all collected for scat analysis (Gokula, *et al.,* 1995; Joshi, *et al.,* 1997; Desai, *et al.,* 1997; Bargali, *et al.,* 2004). Scats were collected using zip lock polythene cover. The locations of the scat collected were marked using GPS. For each scat, the ID number, date of collection and vegetation type recorded over the cover using permanent marker pen. The fresh scats were sun dried. The collected scats were washed using sieves to segregate the plant and animal remains. Further, it was segregated species wise and proportion of each species in the scat was estimated by volume and then identified prey species from each scat using microscopic methods similar to those described by Mukherjee et al. (1994) and followed by Aryal and Kreigenhofer (2009). We calculated the percent frequency of occurrence for each species in our sample and for each of the dietary categories.

3.4 Biotic pressure

Since the survival of brown bear depends on availability of suitable habitat, food and water in the sanctuary and the quality of habitat is generally reflected in the status of food, shelter, vegetation cover and its seasonal variation. Therefore, the data on effect of biotic pressure on all these necessities was collected with the help of questionnaires from shepherds, resident villagers, pony owners with focus on past and present land use pattern and assessment of developmental activities.

3.5 Human-Brown Bear conflict

To know the nature and extent of the human-brown bear interaction, a semi-structured questionnaire survey was conducted followed by informal interviews among the affected 193 people located in the Central division. The questioners were selected based on the incident and intensity of human bear interfaces. The interface of victims were interviewed using a questionnaire form to understand about the circumstances of the incident (Rajpurohit and Krausman, 2000; Bargali, *et al.,* 2005; Kulkarni, *et al., 2007*). Data on the conflict location, age, sex of victim, victim's activity, brown bear responsible, group size of victim *etc*. were collected. Interviews were also conducted in the villages along the forest fringes, settlements and shepherds to know the people's perception on brown bear. We recorded information on the number, place of occurrence, date, and time of any human attacks, casualties, and livestock-depredation cases, as well as compensation, relief measures, and other problem species. The interviews were conducted in the local language and were carried out familiarly by following the guidelines as described by Kvale (1996) and Aliet al. (2018). Direct observation was also made to gather information on the crop damages, livestock kill, human casualties, and property damages together within a geographical area of the questionnaire survey. Based on the information gathered from villagers and direct observation, we mapped the intensity status of HBI using Google Earth and Q GIS.

The entire questionnaires were covered into different structures like demographic and socio-economic status of respondents, different type of crops grown, sowing and harvesting time, seasons and damage pattern by brown bears, distance of damage from the protected area, Shepherds and local communities rearing livestock, livestock kills, distance of livestock kill from protected area, shepherds migratory route and any wildlife conflict existence, Non Timber Forest Product (NTFP) collections from the protected area, types of measures used by the local people to avoid/reduce the brown bear conflicts (scientific and traditional), records of bear attacks on human, damage of property and insights and lenience towards bears.

CHAPTER - 4

4. RESULTS & DISCUSSION

Himalayan brown bear density, diet composition, threats and challenges in human-bear co-existence were studied in the Thajwas Wildlife Sanctuary from July 2021 to October 2021. Brown Bear density was estimated using a random encounter model with a density value of 1.5/km^2. The bear sign encounter rate was 0.12/km with signs recorded only in the North-Western Region (Sarbal) and the Eastern part (Amarnath) region. Diet composition based on scat analysis revealed 75% of food items were scavenged from garbage. Livestock depredation, crop depredation were the major forms of conflict. Livestock grazing, migratory graziers (dhars) and developmental activities are threats to the conservation of Himalayan brown bears.

4.1 Brown Bear distribution

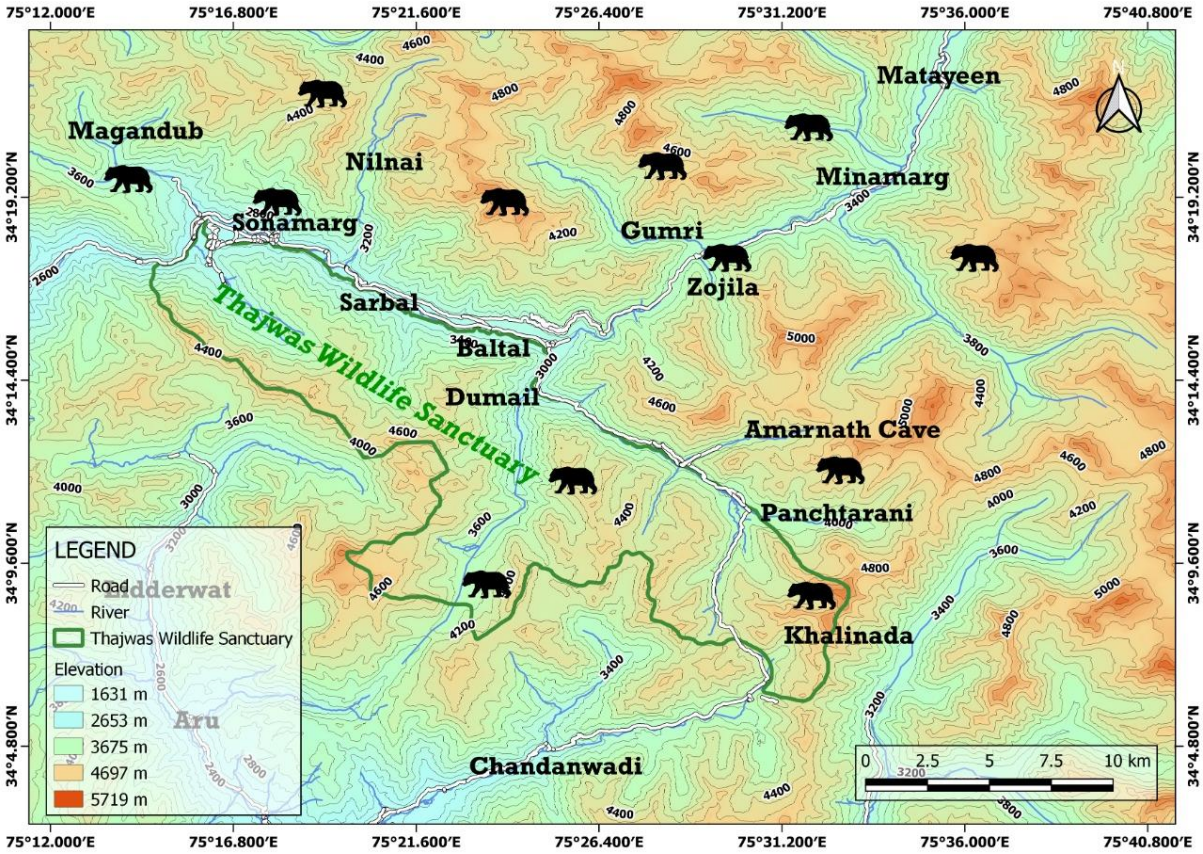
A total of 355.5 kms of trails were selected for sign surveys in the Central Wildlife division. Trails were selected as transects as brown bears tend to use footpaths, forest trails, and forest roads. Transects were walked and all brown bear signs, such as scats, tracks, and any feeding sign (Fig. 3), were recorded within a 5m width along the centreline of the trails. The stage of signs like fresh or old were noted. GPS coordinates were also taken for the signs recorded. Several signs recorded divided by the total length walked in each habitat were used to derive the number of signs per kilometre for different habitats (Baskaran, 1990).

Fig. 3 Brown bear Indirect signs like scats, foot prints & nail marks.

The brown bear feeding signs and indirect sign surveys revealed a specific pattern of habitat use of the bears in the study area. Bears occurred mainly in the hilly terrain and sub-alpine meadows. We used sign surveys to study the presence of a bear in the study area. Sign survey data further confirms the distribution range of bears in the study area. Direct sightings of brown bears revealed congregations of bears in a few areas, especially in the North-Western region (Sarbal) and Eastern part (Amarnath/Baltal) region. The bear sign data was further supplemented with corroborated information obtained from interviews with Wildlife

department staff, local villagers, shepherds, pony owners, and tourist guides. (Fig.4). This survey provided information on the distribution of brown bears. The elevational distributional range of brown bears was 3000 to 5000m which was similar to the earlier reports from India (Sathyakumar, 2006). The congregation of bears to the sites could be attributed to the seasonal food abundance and dumping of food waste at garbage site received from hotels throughout Sonamarg. Similarly, studies on the Grizzly bears in Yellowstone National Park were heavily depends on garbage dumps (Craighead *et al*. 1995). Thus, Brown bears in the study area were distributed in the alpine meadows with a specific elevational range and were heavily dependent on the grazier's livestock and garbage sites.

Fig. 4 Himalayan Brown bear distribution map



The relative abundance of the brown bear was estimated using indirect signs such as tracks, scats and feeding signs along the transect. The length of trails was 2 to 18 km respectively. The number of brown bear scats and signs recorded **0.12 ± 2/km** in Central Wildlife Division. Brown bear scats were recorded only in the North-western region (Sarbal) and eastern part (Amarnath) region.

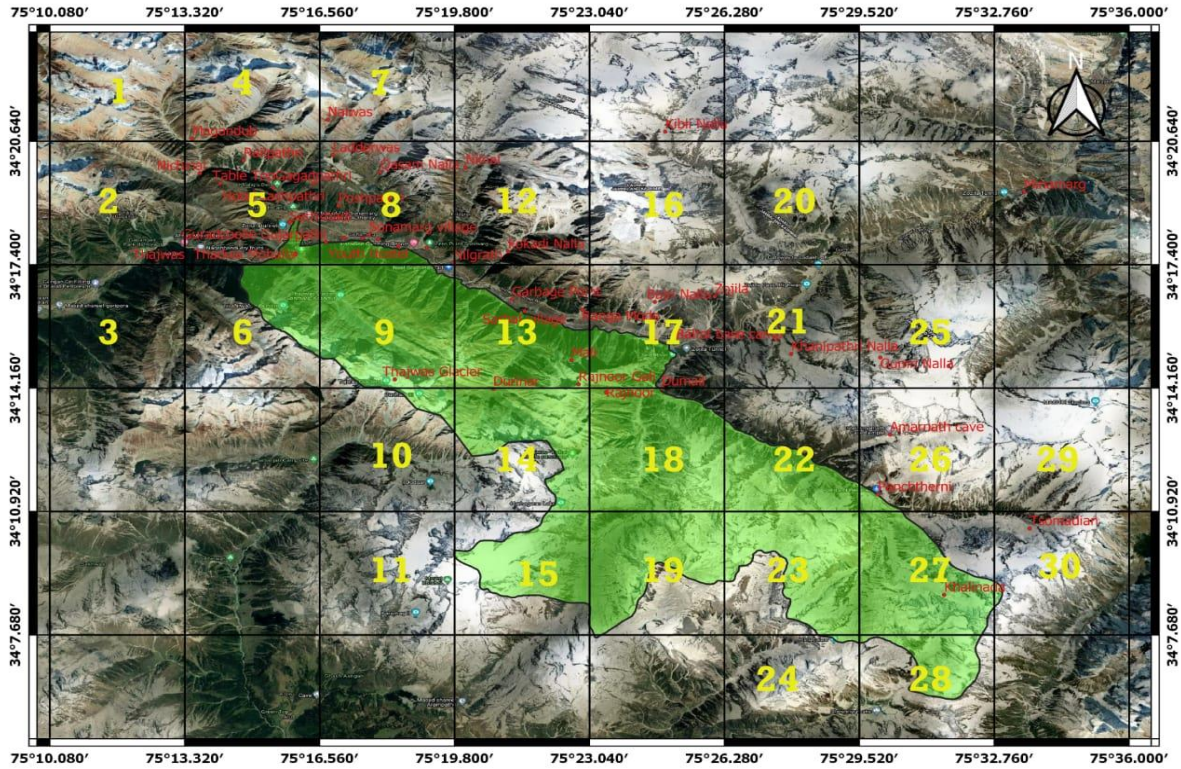
Brown bears have the ability to effectively use different landscapes attributed to their omnivorous generalist lifestyle, which was an indication of adaptability. In Alaska and British Columbia, Brown bears were found to use a variety of habitats including old-growth forests,

coastal sedge meadows and south facing avalanche slopes. During summer, most bears used alpine and subalpine meadows. From midsummer through early fall, they moved to coastal habitats and concentrated along streams to feed on spawning salmons (Lefranc *et al*., 1987 and Schoen *et al*., 1994). On the north slope of Alaska and the barren ground of northern Canada, brown bears were found to occupy a treeless landscape, and in the Central Arctic, esker complexes and riparian tall shrub habitats were preferred by bears throughout the year (McLoughlin, 2000).

4.2 Camera trap results

Camera trapping is widely recognized as a very effective tool in the investigation of presence, morphology, behaviour, and movements of individuals and populations of animals (De Luca and Mpunga, 2005). It is a cost-effective way of detecting the presence of fauna in an area. Also, for some nocturnal or retiring species, it provides an edge in non-intrusive detection. Additionally, camera trap photos are also an effective way to engage local communities and possibly foster stewardship for wildlife conservation on their properties (Kays and Slauson, 2008). The entire study area was divided into 27 grids (5x5km) and the trapping was conducted in 16 grids (Fig.5).

Fig.5 Study area – 5km x 5km grid Map



Camera trap sampling was carried out from 8th July 2021 to 28th Oct 2021 for 112 days with a sampling range of 10 to 59 days at each site (Table. 3). The species recorded were Himalayan brown bear, Red fox, Yellow-throated marten, Marmot, Jackal, Ibex and domestic animals such as horse, cattle and stray dogs. Tourist were photo captured in the Thajwas location alone. Species composition varied with sites, brown bear was recorded in five sites, with maximum capture in the Sarbal, Army camp and Amarnath. Jackal were also found scavenge along with bears in the Sarbal area. A Yellow-throated Marten was recorded in the Nichnai site.

Table 3. Sampling effort and details of animal captured at different locations

Grid No.	Place	Trap effort (days)	No. of Frames	No. of Animal Frames	Brown bear	Red fox	Yellow throated Marten	Marmot	Jackal	Dog	Ibex	Horse	Cattle	Tourist
3	Nichnai– 1	32	273	176	106	3	29			33			5	
5	Lidderwas top	18	2	2								2		
6	Thajwas– 1	18	114	45								12		20
7	Thajwas	23	0	0										
8	Lidderwas– 1	18	54	33								33		
9	Army camp - 123 –1	59	2152	373	313					58		2		
10	Thajwas Top	20	0	0										
14	Nilagrar	10	0	0										
15	Garbage - Sarbal – 1	20	7565	1396	921	14			22			439		
19	Dumail -1	12	0	0										
20	Bholevaley	14	0	0										
23	Zojilaoppsite	18	15	3			1					2		
24	Zojila - Khanpathri nalla – 1	28	78	59	1								58	
25	Datarapur	10	0	0										
28	Gumri nalla – 1	15	94	13								5	8	
29	Amarnath – 1	55	787	209	186			4		5	2	12		

4.3 Brown bear density estimation

The total camera trap sampling effort (*t*) was 640 trap nights. In the current study, we obtained 25 independent brown bear captures (*y*). The random encounter model is not sensitive to repeated captures of the same individuals, so individual recognition is not necessary. Brown bears were recorded in five sites of the 16 camera trap locations. Because the daily movement data was not available for the Himalayan brown bear, we used daily movement data from other brown bear species with a value of 3.5km per day (Mertzanis, *et al*., 2005; Cirovic *et al*., 2015).

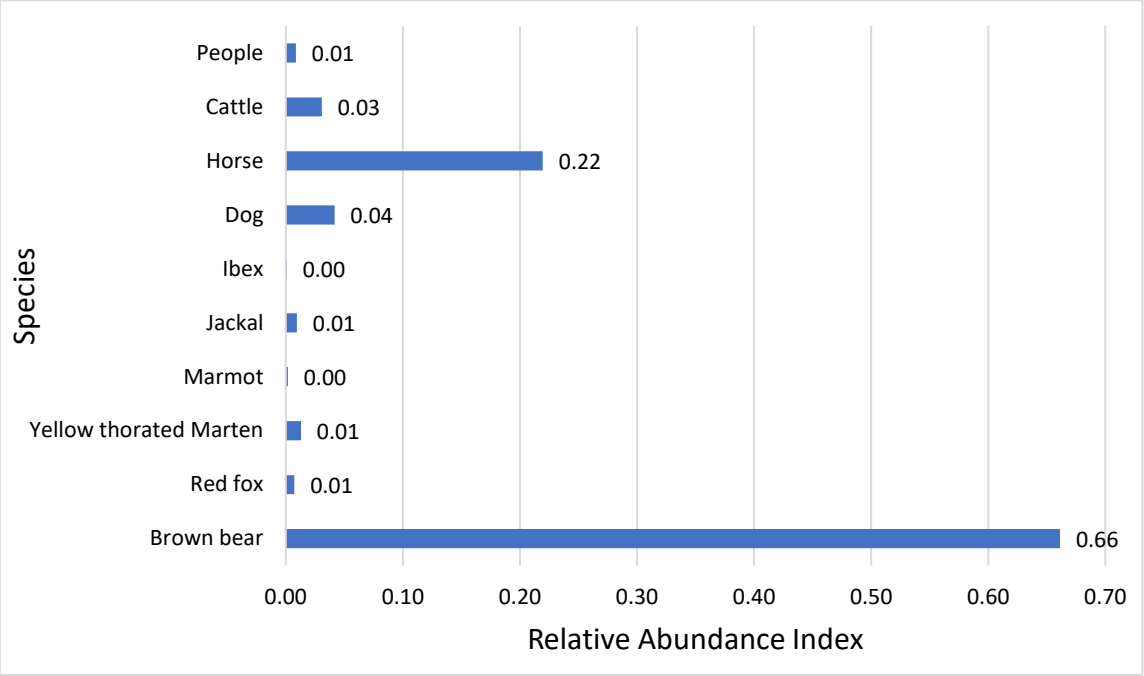
The density estimate based on random encounter method was 1.53/km^2. The estimated density is slightly higher due to the presence of garbage sites that might attract a greater number of bears captured in the camera traps. Multiple captures within the same day were removed from the analysis. The estimated Himalayan brown bear density is similar to the other brown bear species density (1.7/km^2) in the Bulgaira (Popova *et al*., 2018). This method of population estimation can be used where individual identification of species is not possible.

4.4 Relative abundance Index

Camera traps still provide a good means of quantifying data through the analysis of results per unit effort. Not only can this indicate a relative index of abundance, but it can also help highlight more significant areas or provide an approximation of relative index of abundance per site (De Luca and Mpunga 2005). Most commonly used, Photo Capture Rate, a measure of unit effort per site for capturing each species, can be comparable to relative abundance of the focal species in the area, termed Relative Abundance Index (RAI) (Jenks et al. 2011).

The camera trapping exercise captured a Himalayan brown bear at five (31.3%) out of 16 grids where the cameras were set up (Fig. 9). Most of the captures happened around areas where the sign abundance was comparatively higher. During the survey, the brown bear was captured by five different camera traps, with 1527 independent captures. The RAI measured for brown bears at Central Wildlife Division during the study period, when compared with that of other species recorded during the survey, suggested that the brown bear was the most predominantly captured species during the sampling (Fig. 6).

Fig. 6 Showing Relative Abundance Index.



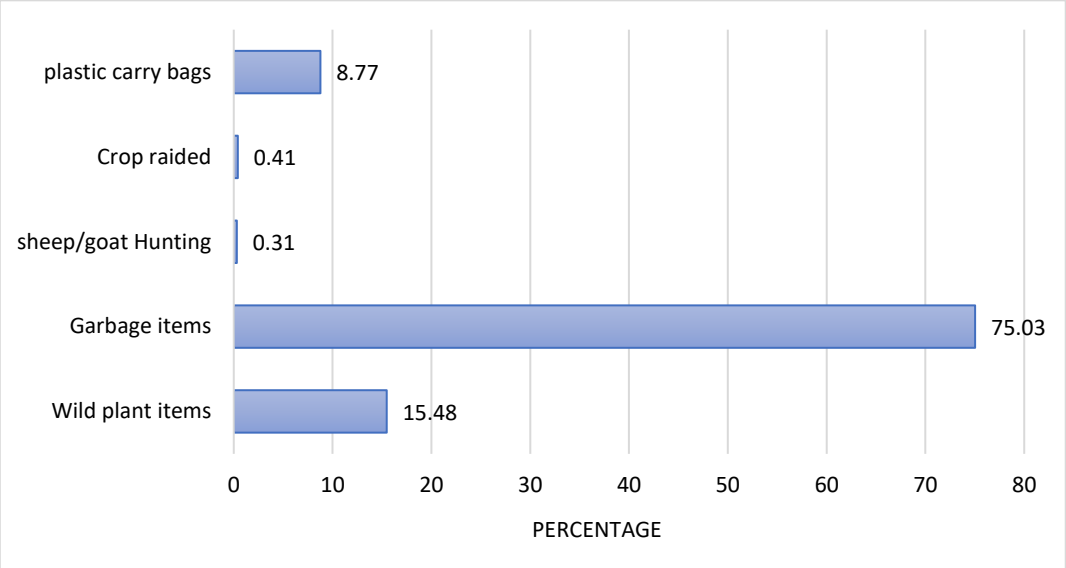
4.5 Diet composition of Brown bear

We used the scat analysis method to study the feeding ecology of brown bears in our study area. This method has provided reliable estimates of food items consumed by the brown bears. The scat analysis revealed that brown bears in the area fed upon vegetative materials, fleshy fruits and minimal animal matters. Brown bears are opportunistic omnivores, their diets comprised of fruits, other plant materials, and animal items such as mammals, fishes and insects. The major food items of brown bear were grouped into variety of ways based on taxonomic group and method of acquisition (Le Franc *et al*., 1987).

The analysis of total 408 scats, showed both plant and animal matter in the diet of brown bear scats. Plant and animal matters were considered to know their contribution to the diet, but it was found that the frequency of occurrence of garbage food items (75%) was higher in the scats of brown bear than the wild plant matter (16%), crop raid (0.41%) and sheep hunting (0.31%) respectively (Fig. 7). Bears are noncecal monogastric and do not digest fiber efficiently (Bunnell and Hamilton, 1983) so highly digestible high calorie food are essential to their diet (Pritchard and Robbins, 1990; Costello et al., 2016).

As it has been reported that Grizzly bear in the Yellowstone National Park were heavily dependent on garbage dumps (Craighead *et al*. 1995). Thus, scavenging in the garbage site could be attributed to the proximate factors such as food availability, palatability, habitat degradation and ultimate factors nutrient requirements and increase in the body mass.

Fig. 7 Diet composition of brown bears based on scat analysis



Open garbage dumps are a source of highly nutritious foods and there are reports of utilization of Anthropogenic foods (i.e., garbage, livestock feed, pet food, bird seed, human foods, garden crop, honey) from these sites by brown bears wherever humans and bears coexisted (Herrero, 1985).

Out of 408 scat analysis, 86 scats were found to have plastic carry bags, milk powder and chocolate cover. The animal matter comprised of goat, sheep hair and bones, chicken claws, feathers, nails and egg shells in the bear diet (Table 4). The wild plant matter eaten by brown bears consisted of fibres, seeds and multiple herbaceous plant matter. Anthropogenic foods which were confirmed through scat analysis from garbage sites included animal matters like chicken feathers, claws and nails, egg cells, sheep hairs, bones & nails, combined with food waste matters like chana dal, pigeon pea beans, ground nut, rice, oats, onion, tomato, carrot, potato, lady's finger, fruit seeds, watermelon, cherry, pumpkin and apple.

Table 4. Shows the brown bear food composition through scat analysis

S. No	Common Name	Scientific name	Frequency	Percent Frequency
Wild Food items				
1	Grass species	Unidentified	133	13.73
2	Seeds	Unidentified	1	0.10
3	Barks & fibers	Unidentified	16	1.65
Animal Items				
4	Chicken remaining	*Gallus gallusdomesticus*	113	11.66
5	Egg Cells	*Gallus gallusdomesticus*	12	1.24
6	Sheep hairs & skins	*Ovis aries*	3	0.31
Vegetable, Fruits, pulses & serials				
7	Chana Dal	*Cicer arietinum*	41	4.23

8	Rice	*Oryza sativa*	85	8.77
9	Pigeon Pea	*Cajanus cajan (L.) Millsp.*	60	6.19
10	Onion	*Allium cepa L.*	80	8.26
11	Tomato	*Solanum lycopersicum L.*	59	6.09
12	Carrot	*Daucus carota*	31	3.20
13	Lady's-Finger	*Abelmoschus esculentus*	12	1.24
14	Beans	*Phaseolus vulgaris L.*	42	4.33
15	Chilli	*Capsicum frutescens*	84	8.67
16	Potato	*Solanum tuberosum*	21	2.17
17	Methi	*Trigonella foenum-graecum*	21	2.17
18	Watermelon	*Citrullus lanatus*	17	1.75
19	Cardamom	*Elettaria cardamomum*	3	0.31
20	Black Pepper	*Piper nigrum L.*	9	0.93
21	Cherry	*Prunus cerasus*	1	0.10
22	Groundnut	*Arachis hypogaea*	24	2.48
23	Pumpkin	*Cucurbita moschata*	3	0.31
24	Apple	*Malus domestica*	9	0.93
Crops				
25	Oats	*Avena sativa*	4	0.41
Synthetic or semi-synthetic materials				
26	Plastics carry bags	Fruit jam covers, milk powder packs, carry bags	85	8.77

Bears have been reported to cause extensive damage to agricultural crops, apiaries, orchard fruits, and livestock (Bargali *et al*., 2005; Garshelis *et al*., 1999; Iswariah, 1984; Chauhan, 2003; and Fredriksson, 2005).

Figure eight showed apparent monthly variation in the occurrence of different food items in the scats of brown bears. Garbage food items occurred in the scats from all the four months with lower percentage in October. The lower percent garbage in October could be attributed to lower number of tourists. The occurrence of plant matter gradually increased from July to October corresponding the phenology of the grasses. Oats (n=6) remaining were found in the months of August and September.

Fig. 8 Monthly variation in the food items of Himalayan brown bear

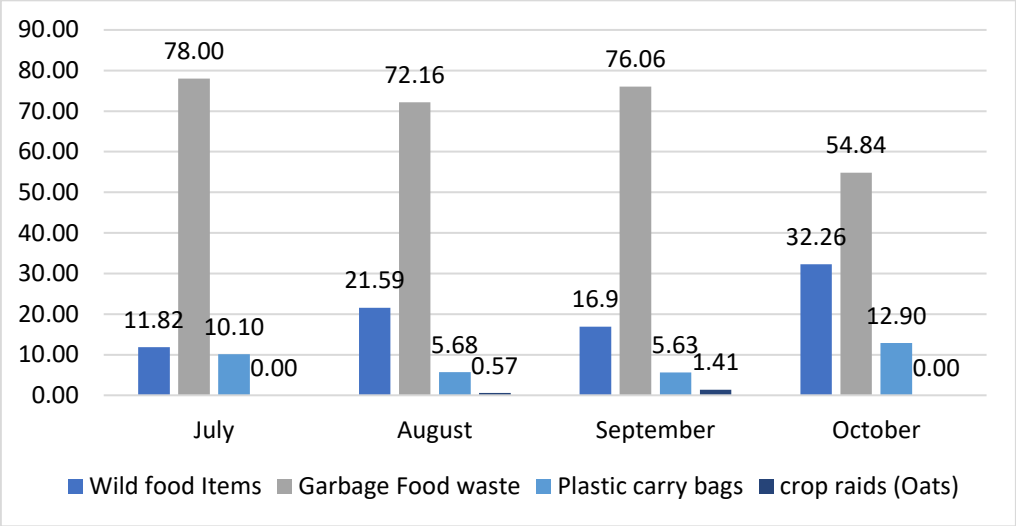


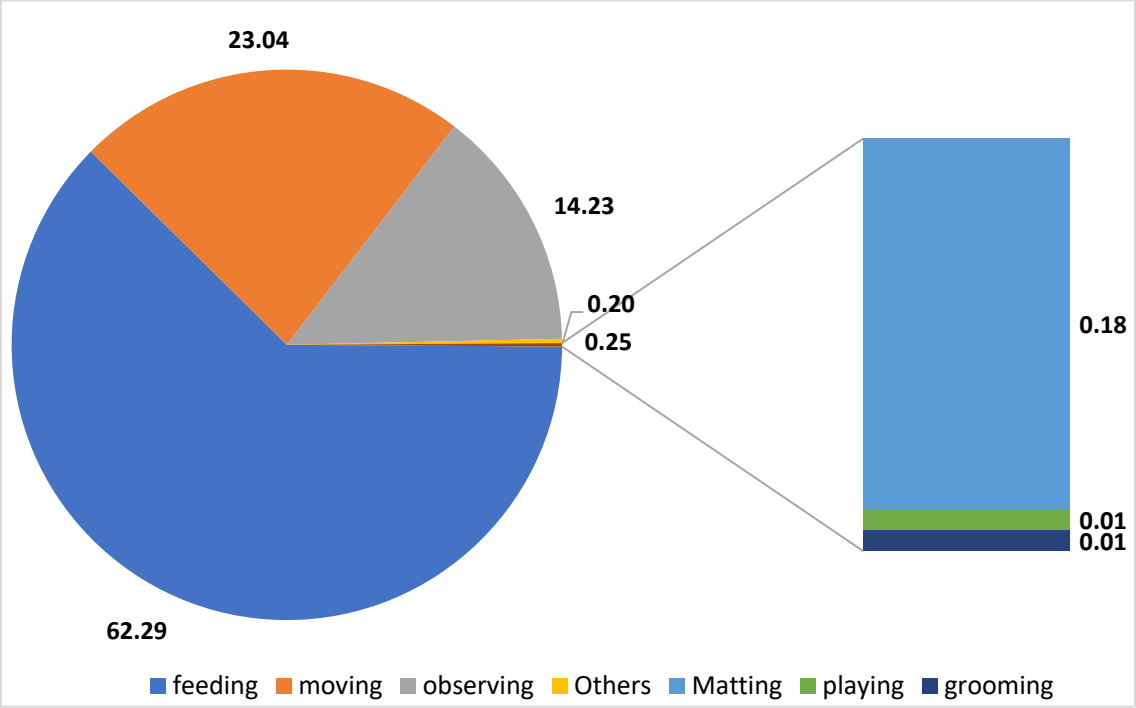
Table. 5 The list of the common edible plant and grass species recorded during our study area.

List of grass Species of Sonamarg		
S. No.	**Local Name**	**Scientific Name**
1	Pahalgasseh	*Achillea millefolium*
2	Guid gasseh	*Stipa sibirica*
3	Wanngasseh	*Brachypodium sylvaticum*
4	Zabbgasseh	*Carex setigera*
5	Bonj	*Phalaris* sp.
6	Handh	*Taraxacum officinales*
7	Kawdash	*Berberis lyceum*
8	Hapatfal	*Sambaucus wightiana*
9	Khayur	*Pinus Wallichiana*
10	Kulhak	*Nasturtium officinales*
11	Kazal Handh	*Cichorium intybus*
12	Pambechalan	*Rheum emodi*

4.6 Brown bear foraging based on camera trap footages

Out of 20,627 camera trap footages, 9,131 footages (62%) had bear foraging sequences. Brown bears foraged on food waste, chicken (head, intestine, legs, skin, feathers, and bones), mutton, leftover bones along with other food materials thrown in the garbage sites (Fig. 9). These garbage dumps were prone to attracting and serving easy food for the wildlife and domestic species. Studies carried out in the Grizzly bear in Yellowstone national park were heavily depended on garbage dumps (Craighead *et al*., 1995).

Fig. 9 Different activities observed through camera trap records



4.7 Biotic pressure

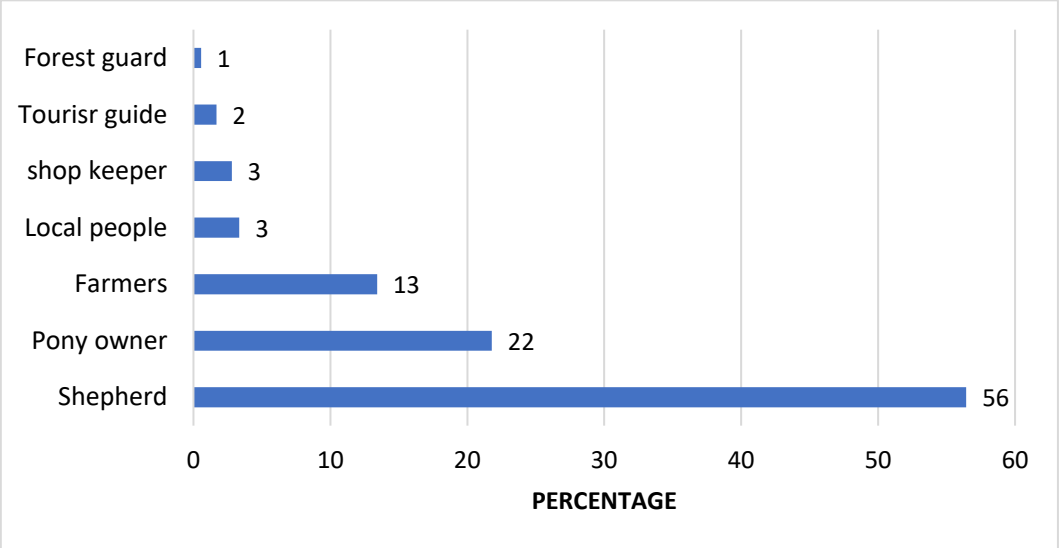
Survival of brown bear depends on availability of suitable habitat, food and water in the sanctuary. The quality of habitat is generally reflected in the status of food, shelter, vegetation cover and its seasonal variation. Increase in human population, expansion of developmental activities, agriculture, livestock grazing pressure and collection of medicinal plants are existent threats to the brown bear population in the area.

The necessity of assessing preference or avoidance of a given habitat or plant species in terms of its availability has long been recognized (Neu *et al.*, 1974). Most of the protected areas are fragmented, degraded, and disturbed from anthropogenic activities. Forests, pastures and wastelands were brought under cultivation to sustain increased demand of cereals and other food products (Chauhan and Sawarkar, 1989). Further livestock depredation causes negative attitude towards bear conservation.

4.7.1 Overgrazing & exploitation in alpine grassland meadows

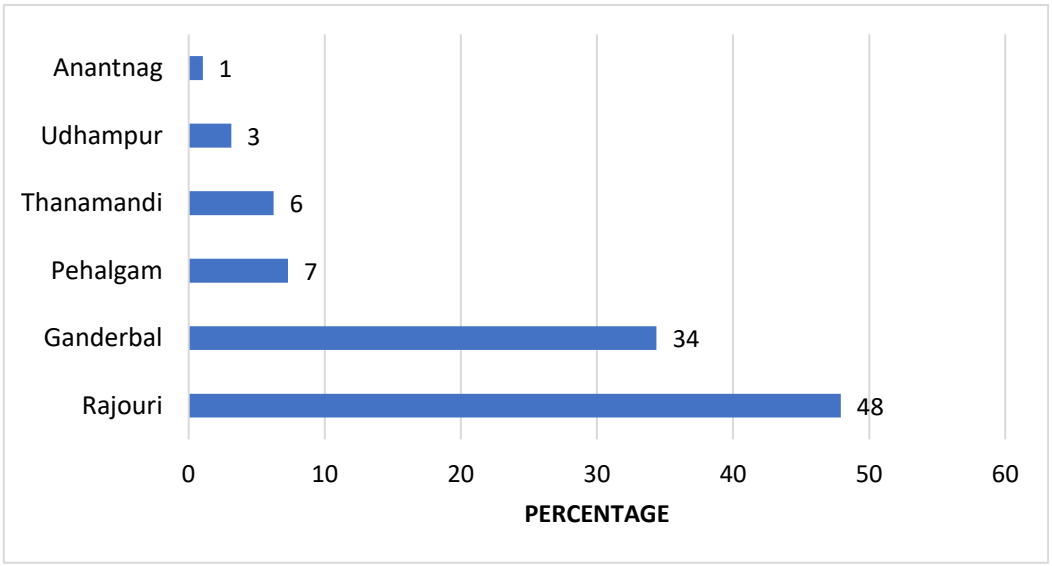
We conducted a total of 179 interviews with different stakeholders in our study area regarding brown bear status, past & present distribution and human-brown bear interface. Out of 179 questionnaires, there were 101 shepherds, 39 pony owners, 29 farmers and remaining being local villagers, tourist guides and the wildlife protection department front line staffs (Fig. 10).

Fig. 10. Interviews with different stakeholders



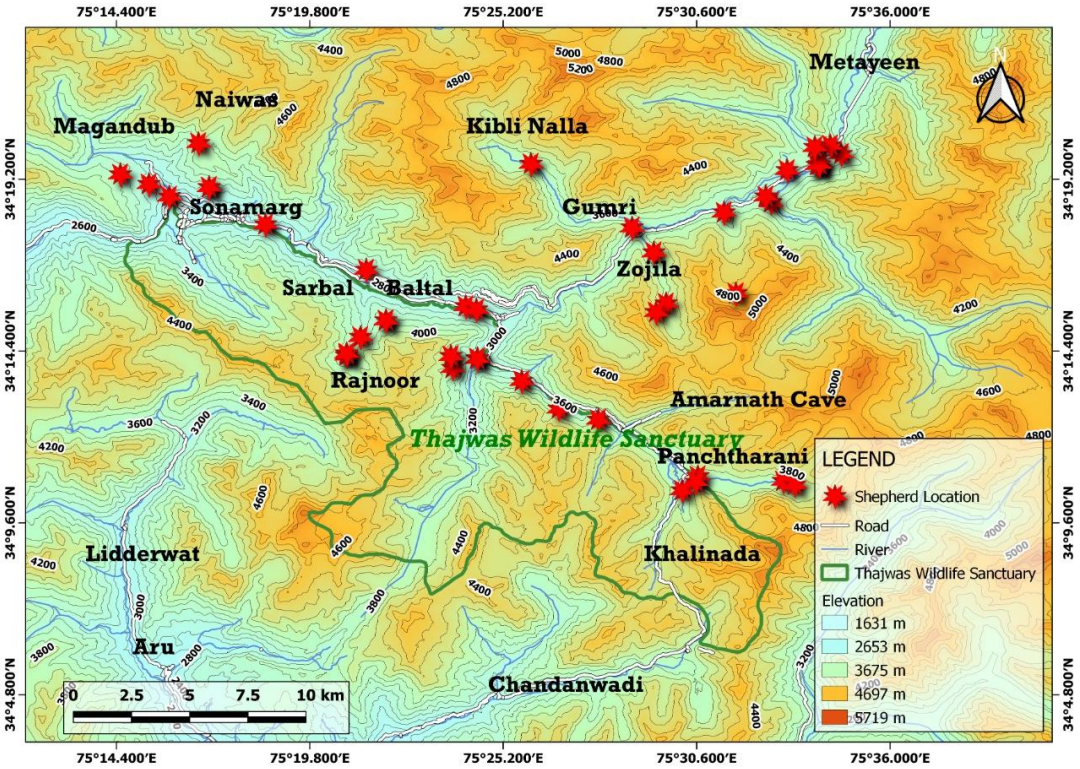
The questionnaires from shepherds (n=101) most of them had migrated from different districts of Jammu & Kashmir (UT),Rajouri (48%), Ganderbal (34%), Pehalgam (7%), Thanamandi (6%), Udhampur (3%) and Anantnag (1%) (Fig. 11).

Fig. 11 Migratory shepherds from different districts in J&K (UT)



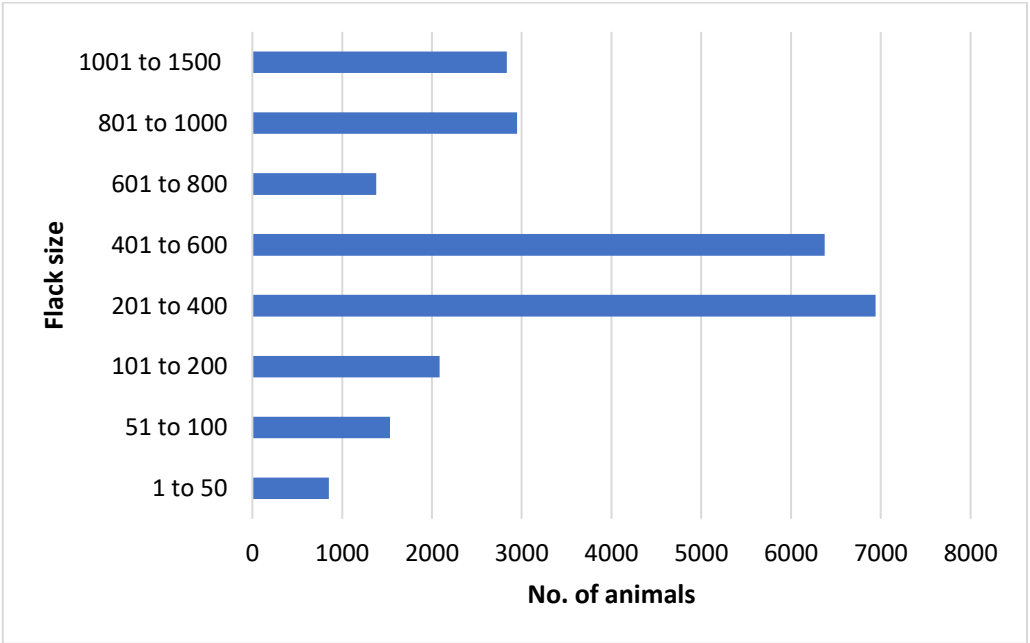
The shepherds from Jammu (Rajouri, Kalakote & Udhampur) start their migration (450-500 km) in the month of April – May towards the grass land meadows in the Central Wildlife Division of Kashmir and finally reach in the month of June. Map showing the shepherds distribution in different altitude in our study area (Fig.12), majorly 83% of graziers were spread above the 3000 mtr. to 4000 mtr. sprawled across prime habitat of brown bear and snow leopard. The shepherds would spend more than three months in the grassland meadows (up to September) and then move back to their home town.

Fig. 12 Map showing the graziers distribution



The questionnaire survey in our study area revealed that the livestock population of goat and sheep numbers were 24950 in 101 different flocks (Fig. 13). The number of animals (50-1500) were varying from different flocks and the shepherds were owned 42 % of livestock, the remaining 58 percentage had other owners (wealthy people).

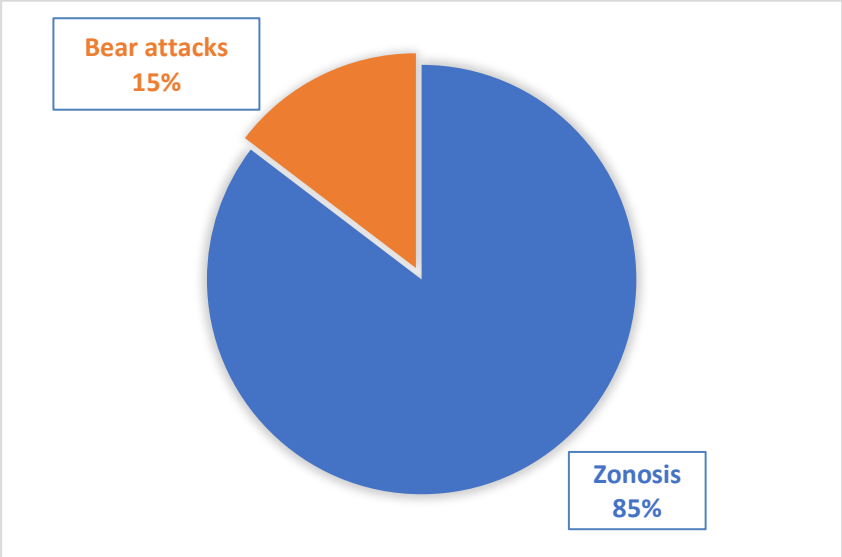
Fig. 13 Livestock population (goat & sheep) in different flocks



4.7.2 Zoonotic diseases threat to Wildlife

Out of the 101 flocks, 77 flock shepherds were reported to have the infectious zoonotic disease (Foot and Mouth Disease) and 56 flock shepherds reported brown bear attacks which killed their livestock in last two years (2020-2021).

Fig. 14 Percentages of outbreaks in livestock flocks



4.7.3 Establishing Infrastructures like roads and tunnel work

The Zojila Pass is a strategic link connecting the Ladakh region to Srinagar and the rest of India. The region, however, does not have all-weather connectivity, especially to Leh, the capital of the Union Territory of Ladakh. Historically, the roads between Srinagar and Kargil gets covered in snow from November to March and are also prone to avalanches in the Sonamarg region, restricting the movement between the two places. At present it is one of the most dangerous stretches in the world to drive a vehicle in National Highway-1 between Srinagar and Leh.

To improve the connectivity between Srinagar, Kargil and Leh, the Jammu & Kashmir government is looking to build two strategic tunnels--Z-Morh Tunnel (6.5 km) and the Zojila Tunnel (14.2 km) that will provide all-year connectivity between Srinagar to Leh and the tunnel will also help improve connectivity between Srinagar and Ladakh, making for a strategic asset for the Indian Army.

These created tunnels aim to minimize human animal interaction particularly with regards to road accidents, vehicular traffic and human disturbance. Presently the roads bifurcate the habitat, the tunnel once put to use, will give native wildlife species access to their entire habitats. This is particularly relevant in the summer and early winter months for brown bears who actively forage and gain energy for hibernation.

4.7.4 Tourism

Tourism starts in the month of May and lasts up to the month of November/December. The need to regulate tourism in Thajwas wildlife sanctuary, buffer zone and adjacent wildlife potential areas is required. A minimum of 2500 to 3000 people arrive to visit the Thajwas glacier in Sonmarg and surrounded areas, in the months of November and December, 10,000 to 15,000 people are expected during early winters. Recently, the government announced the proposal for development of a **township** project (Fig. 15) in between the Sonmarg to Baltal region. It is expected to be developed as a winter destination with modern facilities for winter sports, luxury accommodation and other necessary infrastructure in collaboration with the administration of Ladakh and Jammu and Kashmir (source –Union Road transport and highways, J&K administration & ministry and Border Road Organisation -BRO).

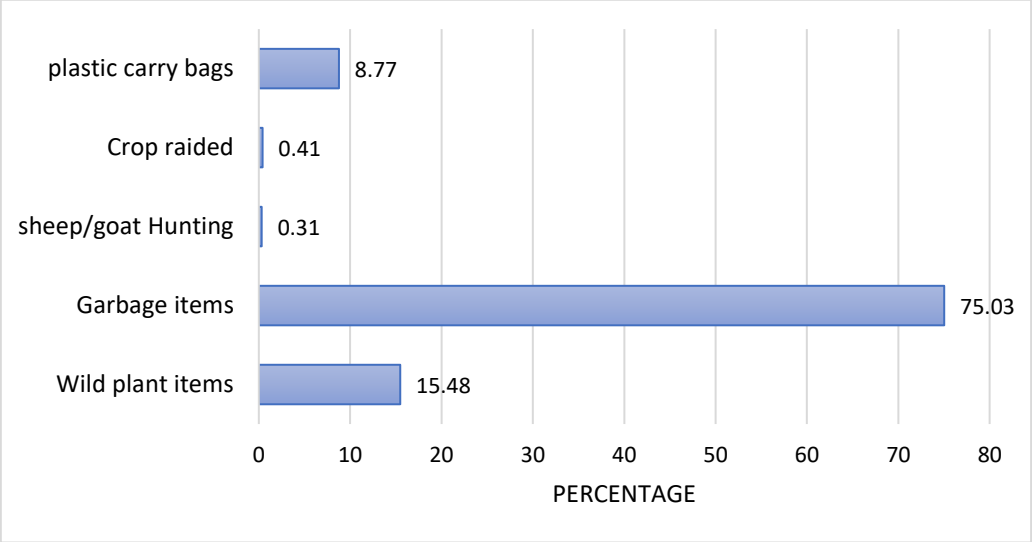
Fig. 15 Map shows the proposed township project proposed by J&K administration and Border Road Organisation -BRO

Such developmental activities will occupy the entire stretch of Sonmarg to Baltal (15 km) valley. This needs a thorough consideration as this patch of habitat acts as a corridor for wildlife connecting areas from Durinar, Sarbal to Zojilla, Nilgrat and Nichnai areas (Fig. 15) It will support long term benefits which can be predicted specifically in case of large ranging species such as brown bear. Tourism & human activities begin from Lashpathri village, Sonmarg and extend up to other side of Army training centre and Nilgrat village. If the entire valley is encroached for human usage area, the chances for human-wildlife interaction increases drastically, and subsequently the loss of habitat and loss of wildlife species will follow.

4.7.5 Garbage sites

Brown bears most frequently visited the SDA garbage site Sarbal, Army Transit camps (254 & 153) garbage sites and Amarnath holy camp garbage sites. In SDA garbage site, we observed a minimum of 3 to a maximum of 11 garbage vehicles disposing 50 to 550 kg of food & other wastes every day. These garbage sites acted as an active foraging ground for nearby domestic and wild animals. We observed brown bears arriving at the garbage sites to feast on food and chicken waste on a daily basis, which then led us to analyze the feeding behavior of brown bear through scat analysis. The collected scats revealed that 75 % of scats contained garbage food items and 8.77 % of scats contained plastic carry bags and milk pocket plastic covers (Fig.16). A total of eleven different brown bears were observed at the Amarnath holy cave camp garbage site, which the bears used for foraging during the day too. In both army transit camp (153 & 254) in Sonmarg, brown bears were observed digging the fence and entering into the camp site every day during nightfall to forage on garbage sites. An average of 1 to 3 different brown bears were observed in both these sites every day.

Fig. 16 Brown bear scat analysis shows different food and garbage items



We also observed an everyday average of 12 to 15 kg of (1-2 lit) water PET bottles, soft drinks PET bottles and broken jam glass bottles thrown in the SDA Sarbal garbage sites in Sonmarg. All the garbage is bought from different place, often not segregated into wet and dry waste (Fig. 17).

Fig.17 Food waste along with plastic covers and pet bottles

Brown bears visited all these garbage sites every day. These garbage sites act as a foraging ground for domestic and wild animals alike. During our study period, we encountered brown bears, red fox and jackals regularly on camera trap records in all the garbage sites along with other domestic animals like dogs, ponies & cattle (Fig.18).

Fig.18 Camera trap picture brown bear along with other animals

There are many reports that inappropriate disposal of trash, agricultural and marine refuse acted as major attractants for brown bears and resulted in human bear conflict (Yamanaka, 1986 and Mano, 1990a, b). In Austria, attacks on cattle, pigs and beehives were found quite common (Gulleb, 1993). In Scandinavia, the brown bear population was reported increasing and dispersing, that resulted in more interactions with humans (Swenson *et al*., 1999).

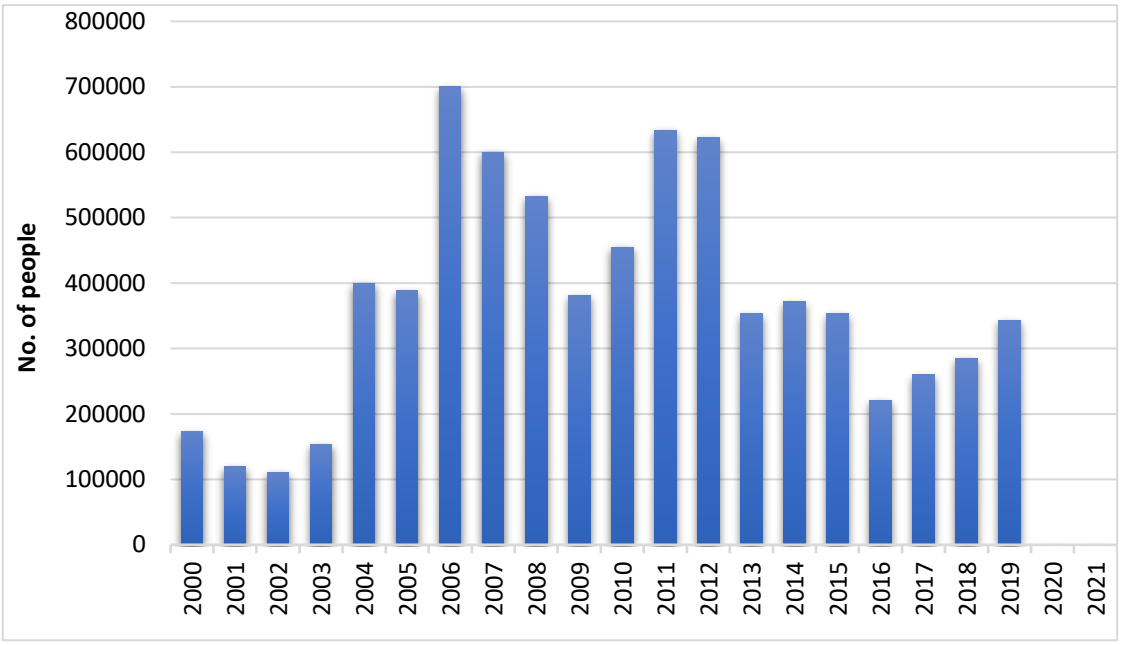
4.7.6 Establishing and developmental activities at holy cave

The pilgrimage, *Amarnath Yatra*, usually occurs during the summer months of July–August every year, and an average of 3, 72,782 pilgrims and a per day average of 6755 pilgrims visit the holy cave (Fig. 19).

Fig. 19 Pilgrims visiting the Amarnath Yatra during the Yatra period (File photo – Google)

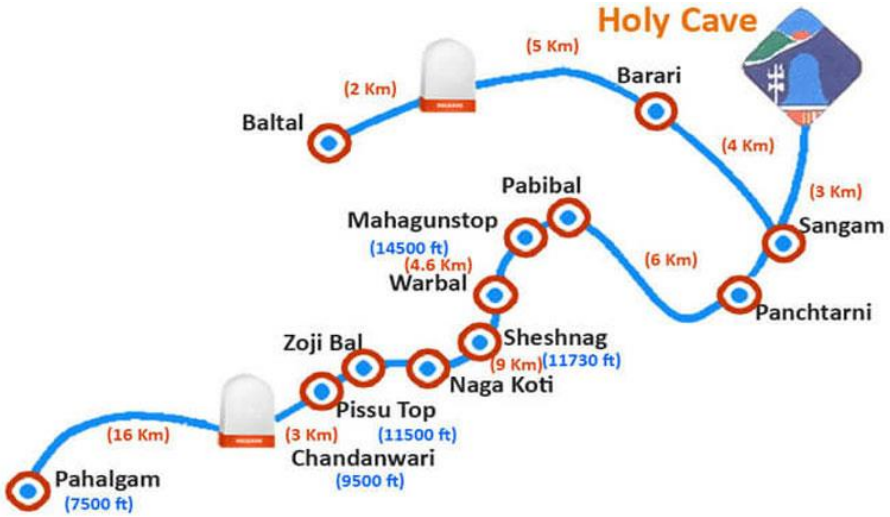
The figure shows the number of people who visited the Amarnath holy cave in the last 21 years (2000-2021). However, people were not allowed in the years 2020 and 2021 because of restriction due to the coronavirus pandemic (Fig. 20).

Fig. 20 Pilgrims visit during the Amarnth Ji holy during 2000-21



For the Year 2022 keeping in view the current carrying capacity of the tracks, availability of infrastructure at the Yatra Camps, and all other relevant considerations, the government has decided to allow 7500 pilgrims to be registered for Shri Amarnath Yatra per day per route. This would mean that Pahalgam – Chandanwari track (36 km) and Sonamarg – Baltal track (14 km) (Fig. 21) will have 7500 Yatris (Pilgrims) each day for the holy Shri Amarnath Yatra.

Fig. 21 Two different routes to Amarnath holy cave



We observed the brown bears were visiting the Amarnath holy cave garbage sites during day hours also (Fig. 22). Most of the bears seems to have forgotten their original feeding behaviour and these kind of garbage sites were very attractive as easy foraging ground and lead

to food habituation. It is a serious concern as such behaviours if passed to next generation could lead to changes in feeding behaviour with young ones considering it as their natural behaviours and lead to conflicting situation in the future. One of the surprising finding in the study was that not only bears but other animals like marmots and the elusive Asiatic Ibex were regular visitors and marmots especially were highly habituated taking food from even pilgrims' hand also (Fig. 22).

Fig. 22 Brown bears & other wildlife visiting during day hours in Amarnath holy cave garbage site.

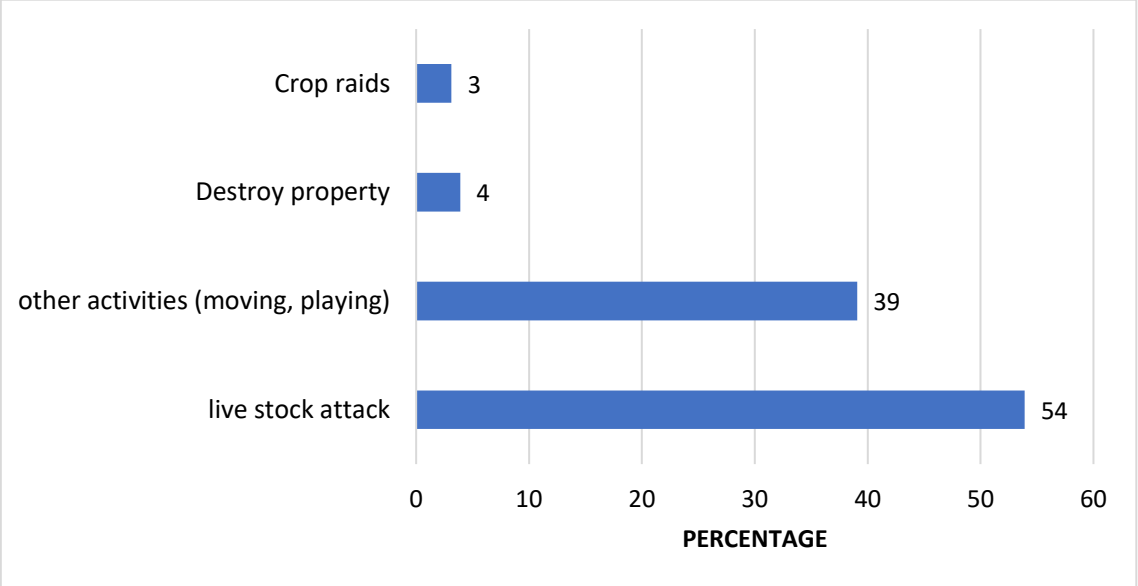
In Denali National Park, Alaska, activity pattern and habitat use of brown bear was studied in alpine areas by Stelmock and Dean (1986), and found that brown bears were generally diurnal in the early spring with a crepuscular pattern of activity and during the fall phase bears were active throughout the daytime and twilight hours and possibly during darkness. Their study also revealed that habitat use and activity of bears were influenced by the phonological development of cowberry (*Empetrum nigrum*), peavine (*Hedysarum alpinum*), horsetail (*Equisetum arvense*), polar grass (*Arctagrostis latifolia*), soapberry (*Shepherdia canadensis*), and availability of animal food items.

4.8 Challenges in human-bear co-existence

Human-bear co-existence challenges were assessed using pre-designed questionnaires survey. Information on the type of crops and livestock damaged, quantum of damage caused to different crops and livestock and the time of the year when maximum damage occurs, was collected.

The questionnaire survey in our study area revealed that out of the 101 flocks, 54% livestock depredation, property damage 4%, crop damage 3% and other activities like moving, running 39% were reported during our study period (Fig. 23). Property damage and crop damage happened in the Sarbal, Nilgrat and Sonmarg villages. During the month of July – August, the crop species such as oats and maize were damaged at the time of harvest in the Sarbal (n=7) and Sonmarg villages. Property damages such as house and shops were reported in the Nilgrat (n=7) and Sonmarg villages (n=3) during night hours respectively.

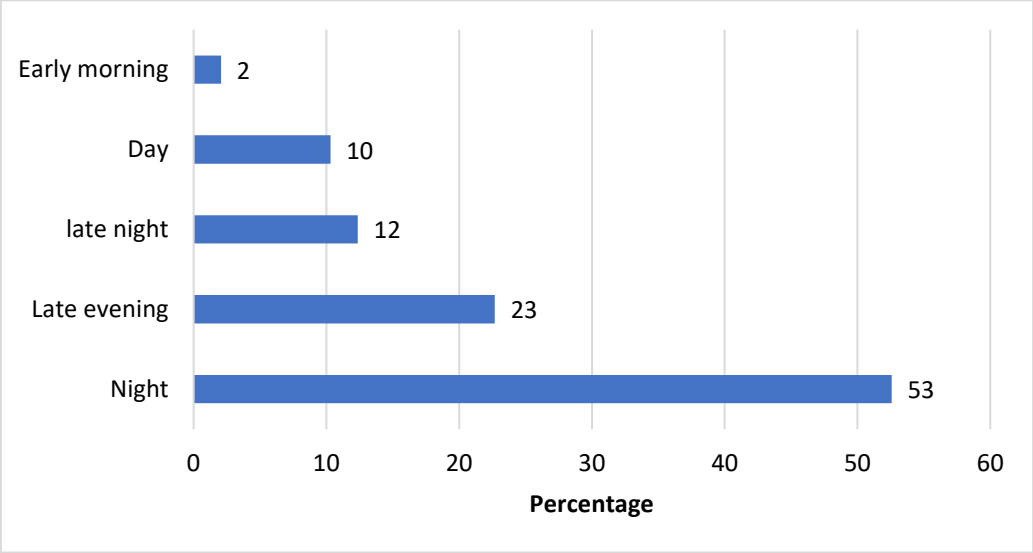
Fig. 23 Brown bear different activities derived from questionnaire survey



In the alpine pastures of India, brown bears were found to cause extensive livestock depredation. Reports of killing of brown bears by the migratory graziers to reduce livestock depredation have also been observed in these regions (Sathyakumar, 2006a).

Most of the livestock depredation happened during nightfall at 53%, late evening at 23%, late night at 12% and early morning hours at 2% (Fig. 24). To protect their livestock, the shepherds often insisted to keep two or more dogs, to alert the guarding shepherd to their flock during night hours. If a brown bear does approach, the dogs would start barking, alerting the shepherds to use torches and eventually chase the brown bears away.

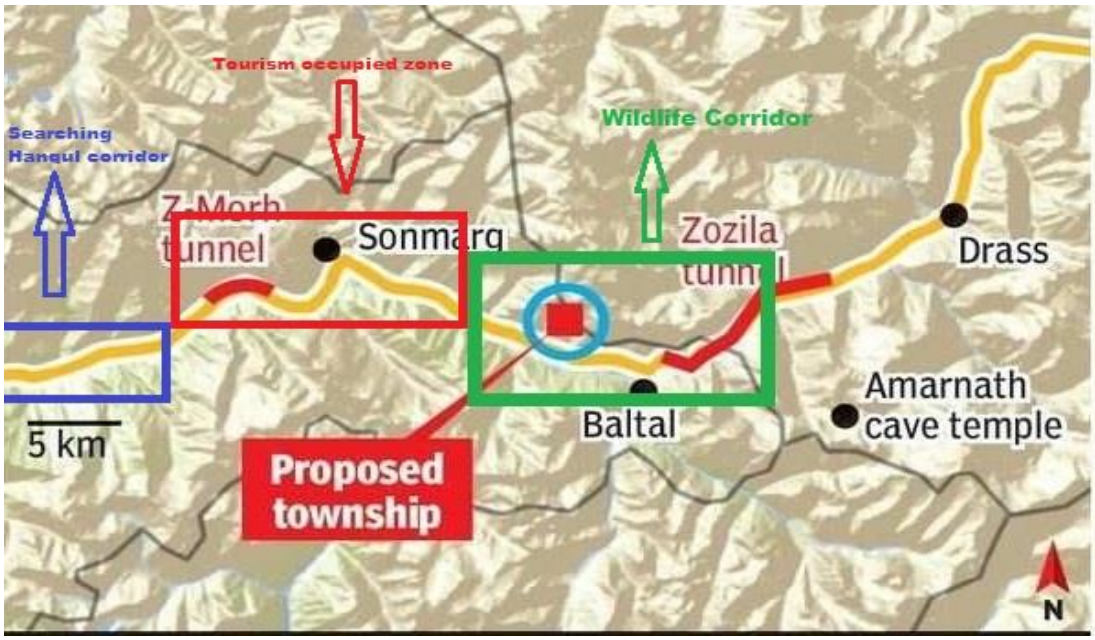
Fig. 24 Livestock depredation by brown bear at different times



The proposed township (near Baltal-specific) could cause devasting effect on the bear habitat and it could potentially increase human-bear conflict.

This piece of land act as a corridor (Fig. 25) for all the wildlife species, especially for short ranging animals moving from Sarbal to Nilgrath and Zojilla directions. During our study period, we recorded 9 to 11 brown bears everyday visiting to the SDA garbage site, Amarnath holy cave garbage site and 2 to 3 bears in all the transit camp garbage sites because of easy access to food in all the garbage sites.

Fig. 25 Map shows the wildlife corridors and human occupied areas.

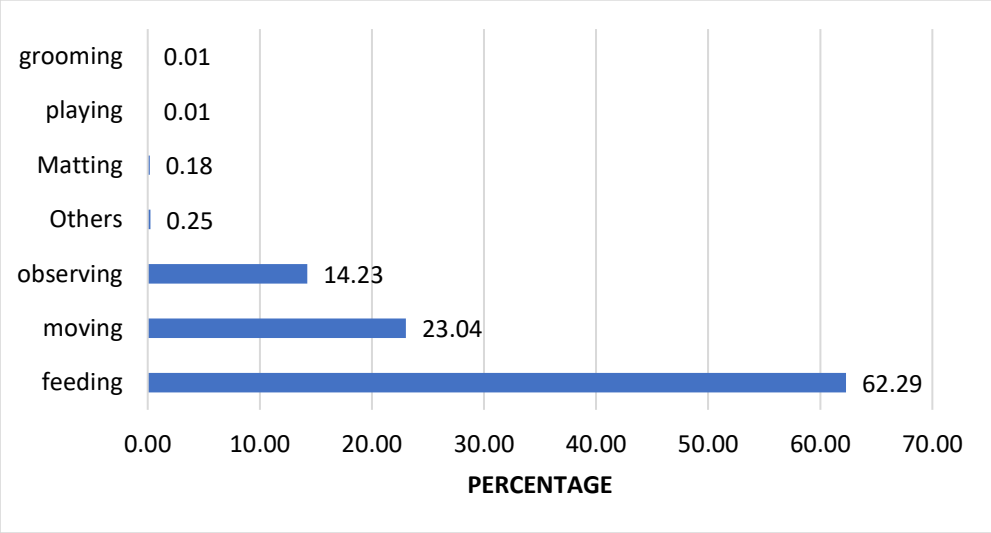


4.9 Brown bear observation and activities

The study also revealed that brown bear ranged broader spectrum of elevations and used the upper elevation range more often. In our study area, the active period for brown bears was found from mid-April through end of December, and elevation between 2600m to 4800m was used during the summer and early winter. The similar activity patter behaviour was observed in Trentino, Italy, the active period for brown bears was found from mid-April through early November, and elevation between 1000m to 1500m was used during the summer and bears denned above 1500m (Osti, 1975).

Brown bear activities were observed through direct observation and camera trap footages. We observed 62 % feeding behaviour at garbage sites, one time feeding on carcass of livestock at Nichnai, followed by 23 % moving, 14% observing, mating - 0.18% and playing & grooming observed 0.01 % respectively (Fig. 26).

Fig. 26 Brown bear activity pattern recorded during the study period.



At Amaranth holy cave garbage site, brown bears are habituated to visit during day hours and the garbage sites are usually visited by the bears during night hours. Our most common observation was the bears entering the garbage sites (9 to 11 bears) during feeding time, and the dominant bear often chasing other bears and domestic live stocks from the area. In the month of July, we observed mating behaviour (0.18%) at garbage site during feeding time and the pair bonds were observed for 4 to 5 days (Fig. 27). Earlier studies point to the same behaviour, which was observed in a different area, mating was found to occur at concentrated food sources (Glenn *et al*., 1974 and Craighead *et al*., 1995) or in poor-quality foraging sites (Herrero and Hamer, 1977; Hamer and Herrero, 1990 and Brady and Hamer,

1992). Pair bonds could last several weeks (Murie, 1944; Herrero and Hamer, 1977and Hamer and Herrero, 1990) or might last only a few hours (Craighead *et al.*, 1969). Females were found to mate with multiple males and might have a litter with offspring sired by different males; males could sire litters with multiple females in a breeding season (Craighead *et al*., 1995, 1998).

Fig. 27. Brown bear mating behaviour observed during the study period

On average, females attained sexual maturity sometimes between 4 and 7 years of age, and found to give birth to one to three cubs about every 3 years (Craighead and Mitchell, 1982). Offspring remained with the female for 2-4 years before weaning. Brown bears have been found promiscuous. Females were found to mate with multiple males and might have a litter with offspring sired by different males; males could sire litters with multiple females in a breeding season (Craighead*et al*., 1995, 1998). Pair bonds could last several weeks (Murie, 1944; Herrero and Hamer, 1977and Hamer and Herrero, 1990) or might last only a few hours (Craighead*et al.*, 1969).

Female brown bears did not reach sexual maturity until 3.5 years old (Hensel *et al.*, 1969; Ballard *et al.*, 1982; Craighead and Mitchell, 1982 and Aune *et al*., 1994), and some females were found to produce first litters at the age 4 years. Age of first litter production in brown bears varied widely geographically (LeFranc *et al*., 1987; Blanchard, 1987; Stringham, 1990 and McLellan, 1994), and was related to age at maturation and body size (Blanchard, 1987 and Stringham, 1990), which in turn was positively related to diet quality (Hilderbrand *et al*., 1999a). During the denning period, bears moved to higher elevations, remained through June and radio-collared females entered the den in mid-October and emerged in mid-May (Collins *et al*., 2005).

On August 8th first time, we were observed the camera trap footage on single cub along with mother visited in the SDA garbage site (Fig. 28).

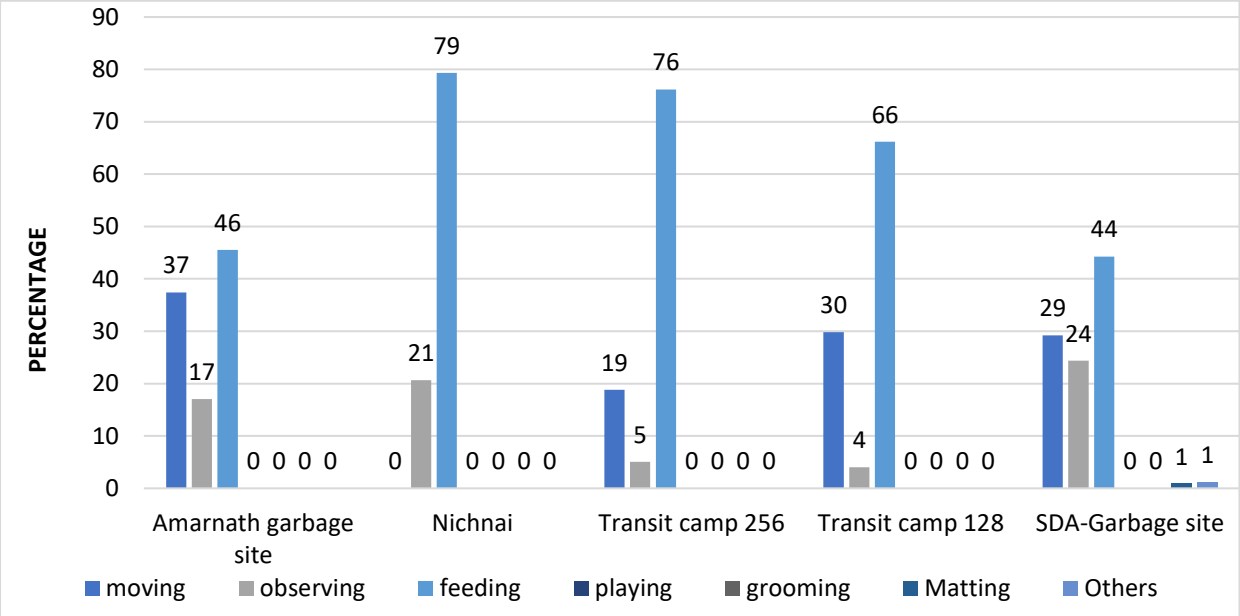
Fig. 28 First visit of mother with cub in SDA – garbage site during the study period

During our study period we got camera trap footages and direct observation of mother with cubs (single cub with mother) at SDA – Sarbal garbage site while at Amarnath garbage site we sited two cubs with mother and these were regular visitor for foraging.

The number of cubs varied among individuals and populations but was found typically 1-3 per litter. Litters of four were rare (Onoyama and Haga, 1982; Bunnell and Tait, 1985; Sellers and Aumiller, 1994 and Case and Buckland, 1998), but litters as large as six were also documented. Mean litter size has been correlated with adult female body mass, intake of dietary meat, primarily salmon and ungulates (Bunnell and Tait, 1981; Stringham, 1990; McLellan, 1994 and Hilderbrand *et al*., 1999a); and garbage (Stringham, 1986).

We observed various behaviour activities like moving, observing/watching, grooming, mating, cubs playing with mother, cubs playing with other bear cubs, chasing the other bears and other species in different garbage sites (Fig. 29).

Fig. 29 Activity pattern observed all the garbage sites during the study period



We observed in Nichnai grid camera trap footages brown bear was feeding in livestock carcasses (Fig. 30).

Fig. 30 Brown bear feeding livestock carcasses.




CHAPTER -5

5. MANAGEMENT RECOMMENDATIONS

The species of brown bear and snow leopards are apex predators in the high-altitude alpine meadows and needs to be studied thoroughly on long term basis for their status, distribution, ranging pattern, behaviour, prey predator relationship and other anthropogenic pressures. Results of the current study shows that brown bears are regular visitors at the garbage sites which shows a high anthropogenic pressure and also signifying the problems in their foraging habitats.

The main factors that bring humans and brown bear into situations of increasing confrontation in and around Thajiwas Sanctuary are:

a. Expansion of developmental activities corresponding to tourism and holy pilgrimage activities into brown bear prime habitat leading to habitat fragmentation and destruction.
b. Loss of corridors and blocking of traditional migratory routes leading to change of movement pattern and confrontation.
c. Food habituation due to presence of sufficient easy food at open food dumping and Garbage sites.
d. Huge presence of migratory livestock and shepherds for 3-4 months during summer and Autumn season in the brown bear habitat is one of the major causes of disturbance and as a result conflict

Key Stake holders in the landscape

1. Wildlife Protection Department
2. Shri Amarnath Ji Shrine Board
3. Sonamarg Developmental Authority (SDA)
4. Highways Department – Roads & Tunnels
5. Security Agencies – Indian Army, Border Security Force (BSF), CRPF and J&K police.
6. Animal and Sheep Husbandry Departments
7. J&K Tourism Development Authority

5.1 Management recommendations to the Amarnath Ji Shrine Board

Keeping in view the safety of local people and Pilgrims, it is important to consider the following recommendations in order to ensure the minimization of current and the future brown bear-Human conflict situations.

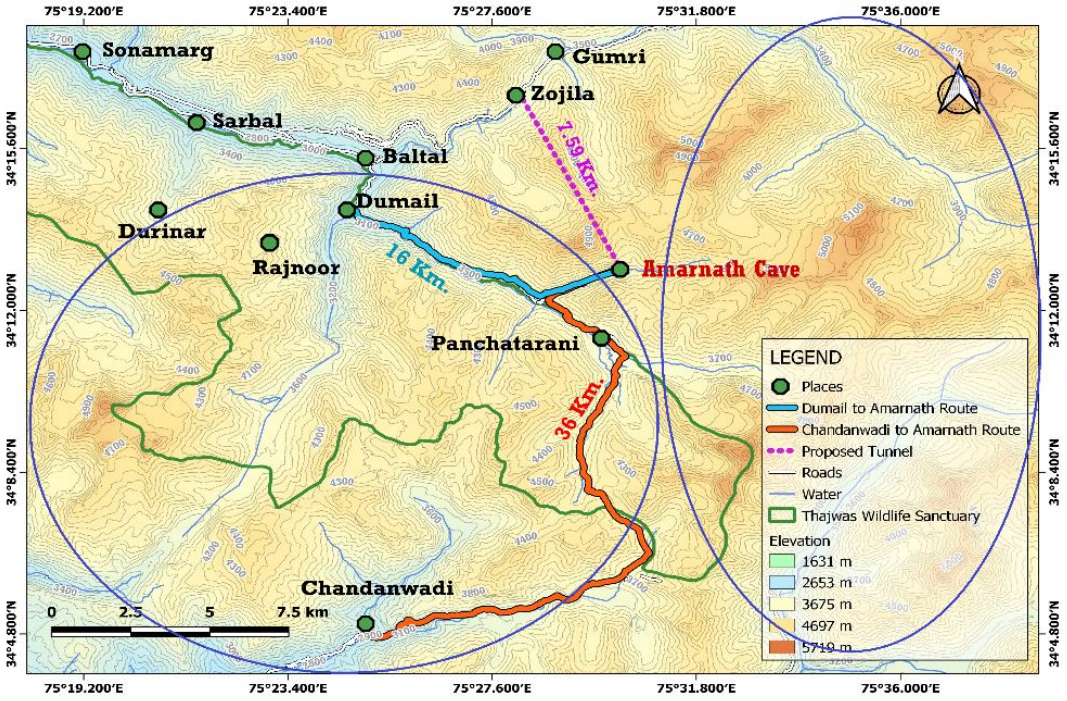
Holy cave pilgrim's regularisation

a. Limitation should be imposed based on the carrying capacity of the land scape to avoid future conflict.

b. Both the Domail to Amarnath (16 km) and Chandanwadi to Amarnath (36 km) holy routes are leading in brown bear and snow leopard habitats.

c. A tunnel route can be proposed from Baltal/Zojilla to Amarnath (7.59km) to avoid human pressure on the wildlife corridors (Fig. 31).

Fig. 31 Map showing proposed tunnel route from Baltal to Amarnath



d. If tunnel route to Amarnath happens the entire landscape remained free from human disturbances.

e. Garbage dumping sites should be very far from the holy cave and human accommodation should be properly fenced.

f. Systematic garbage disposal system should be put in place in and around holy cave area and animal proof bins should be placed around community kitchens at the holy cave with an enclosed wall or chain link mesh perimeter reinforced with solar electric power fence to prevent the wildlife from foraging in waste food dump yards

g. Banning plastic carry bags, pet jars and advocating use of the eco-friendly bags and 5 lit. bottles (alternative plastic things) should be done
h. Baltal base camp and Amarnath holy camp perimeter should be strengthened with solar power fence to avoid human wildlife interface.
i. Both the holy cave routes and Amarnath holy Cave site need to place more animal alert sign boards and awareness programme with visitors be conducted on regular basis.

5.2 Management recommendations to the Administration for Proposed Township project

a. Proposed township project to develop in between the Sonmarg to Baltal region would be detrimental for Wildlife. Such developmental activities will occupy the entire stretch from Sonmarg to Baltal (15 km) valley. This project must be avoid/shift from this place to some other non-wildlife areas.
b. We need to consider the wildlife in this region, this patch of habitat where the township is proposed,acts as a crucial corridor connecting from Durinar, Sarbal side to Zojilla, Nilgrat and Nichnai areas and they support long term benefits which can be predicted specifically in case of large ranging species such as brown bear.
c. If the entire valley is encroached for human usage , the chances for human-wildlife interaction increases drastically and with this there will be the loss of habitat and loss of wildlife species.
d. Proposed new townships and its implementation leads to a major disaster because it completely blocks the movement of brown bears between habitats (Map Fig: 15)
e. Proposed new roads leading to Zojilla tunnel should have lot of under pass to facilitate the wildlife movement and crossing between corridors.
f. Wildlife crossing areas should be identified and necessity to place sign boards and speed breakers to control the speedy vehicles.

5.3 Management recommendations to the Sonmarg Development Authority (SDA)

Garbage sites & disposal

The main focus of SDA should be on the proper solid waste disposal management which is the major attraction for the bears to come into the human settlement. The various measures that can be utilized include

a. Garbage disposal sites must be located very far away from human habitation.

b. The perimeter of the bigger garbage disposal sites (eg. SDA – garbage sites) should be reinforced with chain link mesh with solar electric fence to protect the wildlife to enter into waste food dump yards.

c. In the forest periphery or enclosed villages and tourist zones, hotels & houses should use proper bear proof garbage bins (Fig. 32) or animal proof garbage bins.The disposal of trash should happened in an enclosed wall or chain link mesh perimetered area reinforced with solar electric power fence to protect the wildlife from entering the waste food dump yards. (Fig. 33). (The SDA should persuade the hotels, tourist accommodations and house owners residing in the bear prone villages to go for the Bear Proof Garbage bins in order to prevent the bears to raid the garbage dumping sites. The bear proof bins can be custom made and can be procured on the partnership basis between the SDA and other parties.)

Fig. 32 Proper separations of the waste.

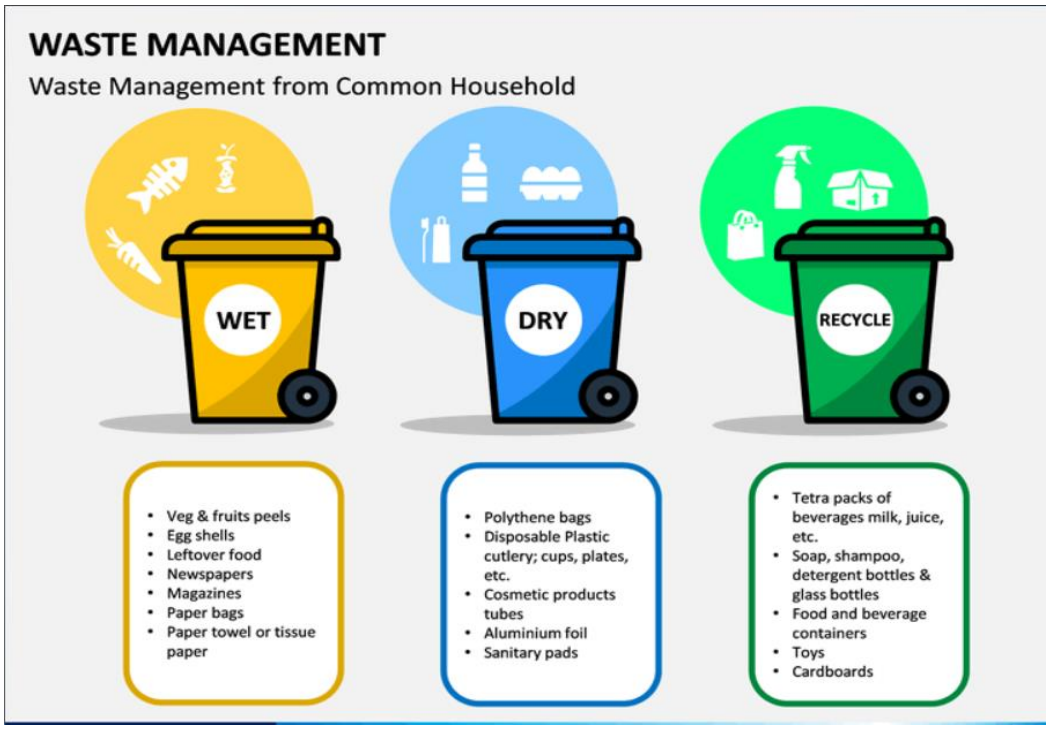


Fig. 33 Shows bear proof garbage bins & perimeter fence

d. Banning pet jars and plastic covers. Even the water bottles should be of minimum 5 litres and eco-friendly bags should be made compulsory in place of plastic covers like in Nilgiris District in Tamil Nādu (https://www.dtnext.in/News/TamilNadu /2019/09/02011154/1174834 / Plastic-bottles-banned-in-Nilgiris-70-water-kiosks-.vpf). Order copy enclosed.

e. Controlling the tourist flow towards the main brown bear habitat.

5.4 Management recommendations to the Wildlife Protection Department

a. It seems the existing Protected Areas Networks were established in isolation; hence it may not yield long term benefits as expected especially in case of large ranging species such as brown bear and snow leopards. Hence, there is a need to identify areas with conservation potential for implementing **landscape level** strategies.

b. **Radio collaring** of the brown bears is strongly recommended to understand their habitat usage, behaviour, annual, seasonal, and daily range patterns, and area of usage

and also to study their activity or hibernation as per the changing anthropogenic pressures. On the basis of movement pattern of the brown bears identified using radio collaring, the area mostly utilized by bears for foraging can be protected.

c. Since the Brow Bears follow a definite trail, therefore the radio collaring will help in identifying the strategic points away from the human settlements which can be used for provision of the feeding supplement and real time location-based data used as an **"Early Warning Alert Data"** for avoiding the confrontation.
d. Plantation should be avoided in the grass land – meadows
e. Regular monitoring of the brown bear population and their habitat and making necessary steps for its restoration.
f. Strengthening the Anti-poaching, Anti-smuggling drives/squads, Law enforcement and wildlife crime control.
g. The foremost life activity happens for the long ranging wildlife species are also falls between (May – December) and its about 8 months and the same hold good for the people and tourist as well.

Buffer zone monitoring - Thajwas Wildlife Sanctuary

a. Buffer zone needs to be strengthened as it has been of minimal importance previously.
b. Safety sign boards needs to be placed at Thajiwas glacier area and regular awareness programmes to be conducted.

5.5 Management recommendation to the J&K Tourism Development Authority regarding Tourism and developmental activities

a. Regularisation of resorts, hotel and restaurants and also to regulate the flow of tourists as per the carrying capacity of the area.
b. Declaring Sonmarg as NO POLYTHENE ZONE and to avoid plastic pet jars (water bottle & soft drink bottles) do alternate installation of soft drink, soda fountain machines for all the tourism places (Fig. 34).
c. During our study period, we observed that three to four times bears damaged the small shops which have been in proximity to the garbage sites and also approached the resort areas adjacent to the river. So, in order to avoid bear conflict - seasonal and temporary resorts/tents and small shops be relocated far from the garbage site and also the resorts adjacent of the river.

d. Awareness programs – like sign boards, camps, pamphlets, short films, documentaries and avoidance behaviour etc be made and circulated among the local populace as well as Visitors

e. River basin protection/conservation

f. Avoid Trash pollution to the Sindh River

Fig. 34 Shows the alternate pet jars and soft drinks soda fountain machine

5.6 Management recommendation to the Animal and Sheep Husbandry Departments

Anthropogenic pressure

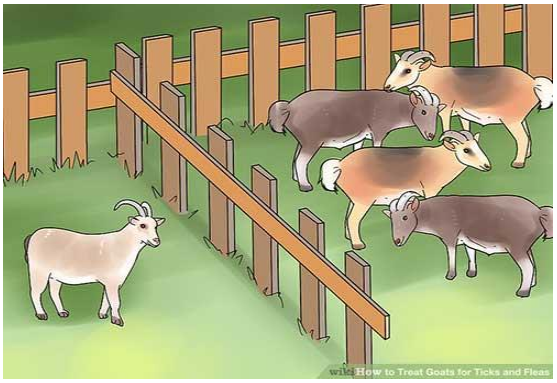
Grazing pressure is a big threat in the brown bear habitat. The nomadic graziers were seen moving in every nook and corner of the alpine grassland meadows in Trans Himalayan region. This has directly and indirectly affected the wild fauna, flora and their habitats. Thus

a. There is a need for grazing regulation in Alpine-grass land meadows and restriction on the number of live stocks.

b. Vaccination of the Livestock against the Zoonotic diseases is crucial.

c. Alternative livestock farming will be very beneficial to the wildlife habitats and wild fauna and flora, for example – goat & sheep farming: https://www.jliedu.com/blog/sheep-goat-farming

Fig. 35 Alternative livestock forming



This kind of approaches benefits towards

Benefits to Nomadic shepherds

- Directly improve their goat & sheep farming scientifically and more economic benefits towards the government agencies and shepherds.
- Evasion from zoonotic diseases.
- Good quality breed farming.
- Nomadic shepherds' life style will change if they are in one permeant and safe place.
- Children's education will improve with the changing lifestyle.
- Need to educate this community and develop their approaches in a more scientific way.
- To direct/indirect benefits to wildlife habitat and wildlife
- Free from human presence
- Directly/indirectly it will reduce the pressure on habitat and less competition to the herbivores.
- These kinds of approaches should be reducing the human wildlife interface.

d. Livestock depredation – very often brown bear approaches the shepherd huts during night hours to hunt for the sheep/goats so proper design of bear proof pens be made available to the Livestock herders to avoid the losses due to Bear attacks.

e. Need to regularly conduct awareness programmes and educate the value of wildlife and its habitats through short films, documentaries and avoidance behaviour etc.

f. Need to educate on Dos and Don'ts while in wildlife habitation.

5.7 Management recommendation to the security agencies (Army, CRPF, BSF and J&K police Departments).

a. Garbage disposal sites must be located very far away from camp sites.
b. Bigger garbage disposal sites should be protected in the perimeter reinforced with chain link mesh with solar electric fence to protect the wildlife from waste food dump yards.
c. Proper waste management and disposal of wet and dry garbage should be done properly. Appropriate disposal should be conducted so as to limit their harm to the environment and wild animals.
d. Habituation to feed wild animals in hand or very close to human habitation should be avoid and this will be inviting the conflict.
e. Need to regularly conduct awareness programs like short films, documentaries and avoidance behaviour etc.
f. Need to place more sign boards and Dos and Don'ts in wildlife regions.

Future Goals

Maintain and restore habitat connectivity in the Central Wildlife Division in Kashmir by reducing various human induced pressures through community participatory approach and enhancing protection mechanism in the brown bear habitat.

a. Give first and most preference/prioritize to the wildlife and its habitats.
b. Need to implement long term monitoring and research on brown bear.
c. Implementing Landscape level protection and strategies
d. Carry out a sizable number of GPS Radio collaring of the wild brown bears (around 15 to 20 animals) to understand their habitat usage and behaviour.
e. Creating awareness programme to different level of stakeholders and sensitizing regarding the habitat and importance of wildlife.
f. Need to place more sign boards in all the tourist places and animal crossing areas.
g. Need to properly dispose the garbage and creating plastic free zone.

CHAPTER -6

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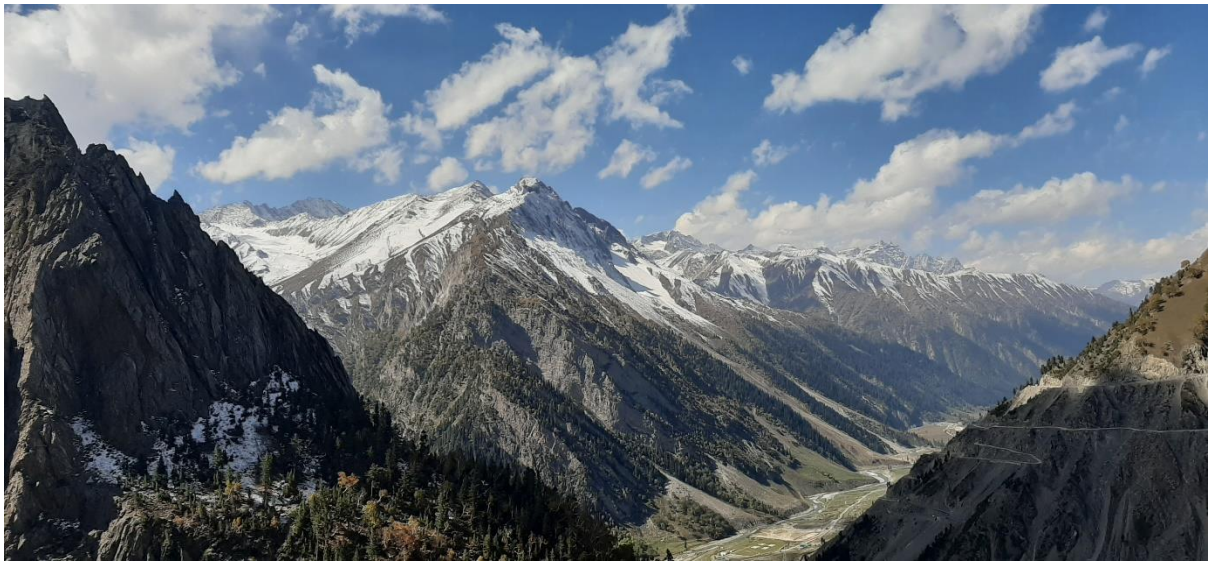
Annexures

Annexure. I Glaciers and alpine grassland meadows



Annexure. II Different kind of anthropogenic pressures in our study area

Annexure. III Meeting with different stack holders in our study period

Annexure. IV Different field activities during our study period

Annexure. V Brown bear direct sighting and Camera trap pictures during our study period








Annexure. VI Brown Bear project permission letter

Government of Jammu & Kashmir
Office of the Chief Wildlife Warden

Boulevard Road Near Lalit Grand Palace Srinagar 190001 Tel/Fax No: 0194-2501069 (May-October).
Manda - Hills (Near Ashoka Hotel) Jammu 180005, Tele/Fax: 0191-2572570 (November-April).
Email. jkwildlife78@gmail.com

PERMISSION

Whereas, Ms. Aaliya Mir, Project Manager, Wildlife SOS Project Jammu & Kashmir, Srinagar India has applied to this department vide letter No- WSOS/MWAC/BB/03-04 dt-19-04-2021 seeking permission in her favour for **"setting up of Face Detection Camera Traps to be installed in Sonamarg Landscape"** The proposal of setting up of camera traps is aimed to know the movement patterns of Brown Bears in Sonamarg Landscape Kashmir for a period of six months.

Whereas, Regional Wildlife Warden Kashmir vide No: RWLW/K/Tech/2021/119-21 dated 19-04-2021 has also recommended for grant of permission in favour of Ms. Aaliya Mir. Project Manager, Wildlife SOS Project Jammu & Kashmir to conduct the aforementioned task.

In view of the above and in exercise of powers vested with the undersigned under the provisions of sub-Section (bb) of the section (12) of the Wildlife (Protection) ACT. 1972, permission is hereby accorded in favour of Ms. Aaliya Mir, Project Manager, Wildlife SOS Project Jammu & Kashmir, Srinagar for **setting up And installation of Face Detection Camera Traps in Sonamarg Landscape** for a period of six month from the date of issue of this permission subject to the fulfillment of the following conditions:-

1. That the camera traps shall be installed under the supervision of Wildlife Warden Central Division.
2. That the agency will provide outcome of the work to the Regional Wildlife Warden, Kashmir and shall update about progress of the work.
3. That the entry of the agency will be recorded in the log book maintained by the concerned Wildlife Warden and will be submitted to office of the Chief Wildlife Warden.
4. That the agency shall abide by the provisions of the Wildlife Protection Act, 1972.
5. That the habitat where the work is to be done shall not be disturbed.
6. That this permission shall pertain to the Wildlife Protection Act, 1972. The other clearance wherever necessary shall be obtained by the applicant separately.
7. That on non-submission of final outcome and on violation of above terms and conditions, the SOS shall not be given any further extensions in permission and in future shall be barred by the Department of Wildlife Protection for any such research activity.

Sd/-
(Suresh Kr. Gupta) IFS
Chief Wildlife Warden
Jammu & Kashmir.

No: - WLP/Res/F-101/21-22/ 128-30 Dated: - 22/4/2021

Copy for information and necessary action to:-

1. Regional Wildlife Warden. Kashmir, Region, Srinagar.
2. Wildlife Warden Central Division.
3. Ms. Aaliya Mir, Project Manager, Wildlife SOS Project Jammu & Kashmir, Srinagar India

Sohail Ahmad Wagay
Assistant Conservator of Forest
(Technical)
22/04/21

Annexure VII Questionnaires Survey Data Sheet

Himalayan brown bear (*Ursus arctos isabellinus*) and Asiatic black bear (*Ursus thibetanus*) Data sheet

Date: **Time:** **Name of Interviewer:**

Name of the Interviewee: Age: Gender:

Education: Phone number:

Occupation: Farmer/Livestock grazer/Tourist guide/Local/Pony wala/Others:

IF FARMER: crops species/any history of crop raiding species and related details: Number of houses and number of residents in the village and human attack from which wildlife:

Crop protection methods:

IF PONY WALA: Number of ponies/ number of huts / any conflict details

Native/Migrated from:

Native village: District:

IF SHEPHERD:

Current flock lactation:

Latitude: Longitude: Elevation (m):

Migrated from: Resident for (Yrs):

No of Livestock possessed: Owner detail:

Started from the month of:

Reached the current location on:

Entry route: _____to_____to_____to_____

Past routes year wise:

Any wildlife interface faced? (Seen/Species/Place/injury/number of animal injured or killed/time). In case of predation. Why is this happening?

Past stories year wise:

Migrated from:

Distance covered: _____ Kms and reason why this long travel: _____

Return to native in the month of:

Exit route:_____to_____to_____to_____

Any wildlife interface faced? (Seen/Species/Place/injury/number of animal injured or killed/time). In case of predation. Why is this happening?

Past stories year wise:

Knowledge on disease outbreaks and number of animals died / reason for death in the present trip and in the past trip:

Livestock flock protection methods:
(fire/crackers/fence/dog/guarding/torch/gun/shouting/others) – Number of dogs

COMMON QUESTIONS FOR ALL:

Wild animals seen? List: _____

Black/brown bear: _____ Description: _____

Number of animals seen: _____

Month	Year	Number of bears and classification in case of cubs	Sighting time	Sighting place	Activity of animal

Public attitude toward the bear:

Any denning location:

Population of bears: Increasing/decreasing _____

Bear feeding (Natural/Livestock/Crops/garbage/Others) _____

Livestock attack detail: (Goat/Sheep/Pony/Cow /Dog)

Domestic Species	No. of Attack	Month	Year	Injured	Killed	Eaten or Not	Parts consumed

Any bear mortality:

Past and present situation of prey species presence: (if it is an elderly/old candidate) and why?

Annexure. VIII Himalayan Brown Bear Indirect sign Survey Data Sheet

Himalayan Brown Bear *(Ursus arctos isabellinus)*

Indirect sign - Data sheet

Date: _____Place: _____ St. Time: _____ Ed. Time____

St Lat: _____Long: _____End Lat.: _____Long.: _____

Grid No: _____ Distance walked: _____km.

GPS reading		Sign type*	Sign status Fresh/Old	Size of Scat	Scat ID No.
Latitude	Longitude				

Annexure. IX Camera trap Data Sheet

CAMERA TRAP DATA SHEET

Place: **Range:** **Division:**

Camera Id: **Date of Fixed:** **Removing Date:**

Latitude: **Longitude:** **Elevation (m):**

Date of frame	Time	Species	No. of animals	No. of frames captured		Behaviour	Remark
				Videos	Photos		

"To survive today, other animals must endure global warming, pollution and fewer habitals. More tragically, they must endure the silence of human hearts."

Anthony Douglas Williams

WILDLIFE SOS