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Frequency and Geospatial Distribution of Human Conflict with *Ursus thibetanus* and *Panthera pardus* in Chenab Valley of Jammu and Kashmir, India

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Abstract: Human wildlife conflict has been reported in different locations of Chenab valley like other parts of world. Forests in valley are mainly dominated by conflict causing Himalayan Black Bear and Leopard. Himalayan black bear (*Ursus thibetanus*) and leopard (*Panthera pardus*) are involved in conflicts with humans for many reasons. The majority of local population is rural and face unavoidable threat of wildlife conflict. The present study was carried out in Chenab Valley of Jammu and Kashmir, India to evaluate the frequency of conflict incidences, ex-gratia disbursed among the victims of wildlife and geospatial distribution of conflict cases. Conflicts are manifested when people are killed or injured by wild animals. The causes of conflict in valley are livestock predation by leopard, wildlife depredation of crops in farms and inadequate or lack of compensation for losses. A dynamics in number of human-black bear and human-leopard conflict cases have been observed and location of incidences was randomly distributed. The aim of present investigation is to analyze the problem of human wildlife conflict and to emphasize on the conservation of wildlife from human killings.

Keywords: Chenab valley, Geospatial distribution, *Ursus*, *Panthera*

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Introduction

India is habitat for large number and wide variety of animals. It is hotspot for biodiversity with its diverse ecosystems and abundance of biodiversity has been attributed by diverse climatic regions. India is the country in the world where lions and tigers coexist (Agarwal *et al*., 2011; Mashalla and Ringo, 2015). Wildlife conservation and management is essential to conserve the rare and endangered wildlife species (Treves *et al*., 2006; White and Ward, 2010; Sethy and Chauhan, 2013). Due to expansion in human encroachment and poaching activities, a considerable decline in the population of wild animals has been occurred (Kaltenborn *et al*., 2006; Karanth *et al*., 2012). The conflicts between humans and wild animals are existing since ancient time and occurred due to competition for natural resources, need and greed of the people

(Miller, 2015; Mukherjee, 2016). The wildlife is highly threatened by habitat fragmentation, habitat loss, and human population explosion (Malaviya and Ramesh, 2015). The increase in human population has propelled agricultural and industrial growth leading to the conversion of the forest lands into urbanisation and agricultural fields (Namgail *et al*, 2007). Due to these catastrophic changes wild animal populations face acute shortage of resources such as water and food, this enforces them to move into the human habitat (Wand and Macdonald, 2006; Panday *et al*., 2017). During such migrations, surveillance and tracking of wild animals herds are difficult due to their nature of movement. Human wildlife conflict is example of the growing competition between people and wildlife for space and resources not only in study site but throughout the world (Heyward *et al*., 2006). In addition to food crops, forests are being logged for the timber or cleared to make space for crop cultivation. The increase in the population density of humans beyond sustainable levels results decrease in food availability to wild animals. The shortage of fodder has also other negative impacts on the survival of wildlife like decrease in rate of reproduction and hence normal birth rate decrease (Austin, *et al*., 2010; Johansson *et al*., 2015). The consequence of the shortage of wild food leads to a corresponding increase in the crop raiding and incidents of human wildlife conflicts (Graham *et al*., 2010; Rohini *et al*., 2016).

With the increase in human population a considerable increase has been reported in forest encroachment, grazing activities, cultivation of wastelands and deforestation (Dickman, 2010; Prashanth *et al*., 2013). Forests in Jammu and Kashmir provide shelter to large number of wildlife. As long as there is sufficient food and water wild animals live in harmony with nature (Bulte and Rondeau, 2005; Mir *et al*., 2015). The large biodiversity of plants existing in the forests supports variety of herbivores which in turn supports carnivorous animals like tiger (Diana *et al*., 2008; Anand and Radhakrishna, 2017). The constriction of wildlife habitats resulted in competition for natural resources between wild animals and the local communities of study area. This often results in wildlife human conflict (Arlet and Molleman, 2010; Baruch-Mordo, 2014). Wild animals enter in human settlement and agricultural fields for food and causes damage to agriculture and horticulture crops. A variety of vertebrates wildlife species are implicated in causing damage to horticultural crops in India (Boitani *et al*., 2010; Boulhosa and Azevedo, 2014). Conflict causing vertebrates are generally mammals that cause damage to agricultural crops and loss of human life (Table 1). Some of the wildlife species are losing their natural habitat and are adapting themselves to the man altered habitat (Chavez and Gese, 2006; Cavalcanti *et al*., 2010). Human population pressure and increasing human animal conflicts have also led to the emergence of wildlife agriculture interactions. The aim of study is to highlight the frequent wildlife and human conflict incidences and emphasize on conservation and management of wildlife.

Materials and Methods

Study Area:

The study area Chenab valley (latitude 33.7782°N and altitude 76.5762°E; GPS 12H meter) is located in Jammu and Kashmir in northern India. Jammu and Kashmir state consists of three distinct regions *viz.* Jammu region, Kashmir region and Ladakh region. The study site is part of Jammu region and is comprised of two major districts i.e. Doda and Kishtwar (Fig. 1).

Sampling and collection of data:

The data was collected through field visits during 2018-19. The collected data was both primary and secondary. The primary data was collected through field visits from the victims of wildlife and the secondary data was collected from wildlife department.

Field visits:

The methodology of data collection was based on field survey and field experience of the study area.

Table 1: Checklist of dominated wildlife in study area (Courtesy: Wildlife Department Chenab Division Kishtwar)

S. No.	Common Name	Scientific Name
1.	Brown Bear	*Ursus isabellinus*
2.	Leopard	*Panthera pardus*
3.	Himalayan musk deer	*Moschus moschiferus*
4.	Hangul	*Cervus elaphus hangula*
5.	Shrew	*Capricornis sumatraenis*
6.	Kashmiri Flying Squirrel	*Hylepated fimbriatus*
7.	Himalayan Black Bear	*Selenaractos thibetanus*
8.	Red Fox	*Vulpus Montana*
9.	Jackal	*Canis aurcus*
10.	Leopard Cat	*Felis bengalensis*
11.	Common Langur	*Presbytis entellus*
12.	Rhesus Macaque	*Macaca mulata*
13.	Porcupine	*Hystrix indica*
14.	Himalayan monal	*Lophophorus impejanus*
15.	Himalayan snowcock	*Tetraogallus himalayensis*
16.	Western tragopan	*Tragopan melanocephalus*
17.	Snow Leopard	*Uncia uncial*
18.	Langur	*Semnopithecus entellus*

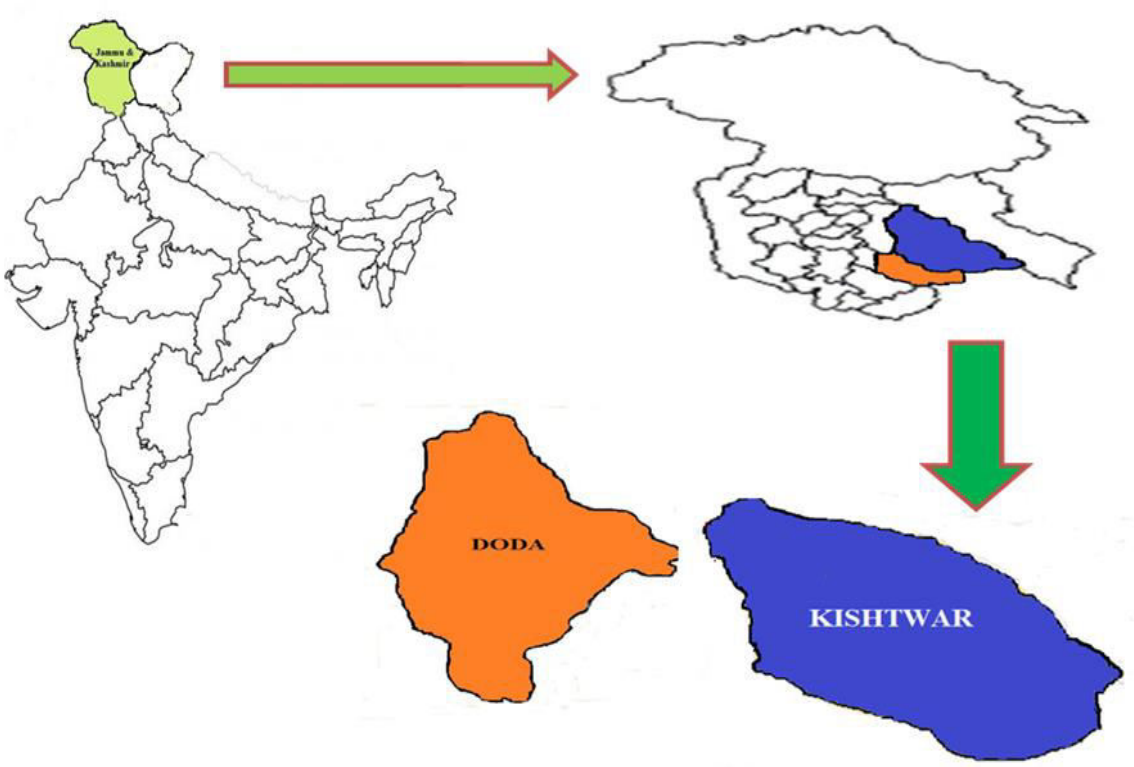

Fig.1: Depiction of study area.

Accordingly field visits was carried out in different locations of Chenab valley to the injured and families of dead victims of wildlife. The secondary data which includes the available dominated wildlife of valley was collected from the Department of Wildlife, Chenab division Kishtwar, Jammu and Kashmir, India.

Questionnaire survey:

Questionnaire survey was conducted in both the districts of study area and recorded human wildlife conflict cases of last decade. Questionnaires were distributed among injured wildlife victims and dead victims of wildlife to

know the causes and to identify the geospatial distribution of cases. The amount of compensation (in Indian rupees) disbursed by the wildlife department among the victims was also recorded.

Statistical analysis:

The data was statistically analyzed by using Spearman's Rho correlation coefficient and One Way ANOVA (Analysis of Variance) by using ms-excel 2016 and IBM SPSS software.

Results and Discussion

Globally human fatalities due to wildlife have created significant impacts in terms of antagonism towards conserving wildlife species. A diversity of wild animals has been reported across the world involved in conflicts with humans (Balme *et al*., 2009; Barua *et al*., 2013; Constant *et al*., 2015). Conflicts between humans and wild animals are common and challenging which results in loss of human lives and sometimes retaliatory killings of wild animals (Gadd, 2005; Karanth *et al*., 2013; Galvin *et al*., 2015). In recent years *Ursus thibetanus* and *Panthera pardus* are involved in conflict with humans in Chenab Valley. During present investigation the total number of reported injured cases were 263 from the year 2010-2019 and maximum number (45) of injured cases due to human wildlife conflicts were reported during 2015-16 and least (18) during 2016-17. *Ursus thibetanus* has caused 169 injured cases alone and 94 by *Panthera pardus* (Fig. 2). Likewise 31 total deaths were reported from 2010-2019 due to human wildlife conflict in the Chenab valley. 18 causalities occurred due to *Ursus* and 13 due to *Panthera*. Maximum (14) human deaths were recorded during the year 2015-16 but no death case was reported during 2014-15 (Fig. 3). The present findings shows that human conflicts with *Ursus thibetanus* were more than *Panthera pardus* which is due to random distribution, entrance into the human settlements and resource sharing of *Ursus* with local population than leopard (Ahsan and Uddin, 2014; Dutta *et al*., 2015; Nghikembua *et al*., 2016). The ex-gratia disbursed by the Wildlife Department to victims from 2010 to 2018 was uneven (Fig. 4). Inadequate compensation to the wildlife victims results in intolerant behaviour of local population towards conflict causing wild animals which perhaps increase the conflict incidences (Nyhus *et al*., 2003; Wani, 2013; Greeshma *et al*., 2016). A non-parametric Spearman's Rho test was used to analyze the correlation coefficient between the total human wildlife conflict cases and the amount of ex-gratia disbursed. The total number of injured cases were significantly ($P<0.05$) related with the amount of ex-gratia disbursed and Spearman's correlation coefficient was $r=0.723$. However, no relationship was observed between the ex-gratia disbursed and total number of dead cases (Table 2). Field survey clearly portrays frequency of geospatial distribution of human wildlife conflict cases were randomly distributed in the forests, in agricultural farms, near human settlements and in any other location throughout the valley. Local population and government can play an important role in mitigation and prevention of human wildlife conflicts as the forest ecosystem is dominated by humans directly or indirectly and forests are influenced by human activities (Honda and Kawauchi, 2011; Clark and Slocombe, 2011; Goswami *et al*., 2014;). The findings of geospatial distribution of conflict cases are evidence of random scattering of conflict causing wild animals. One way analysis of variance (ANOVA) was

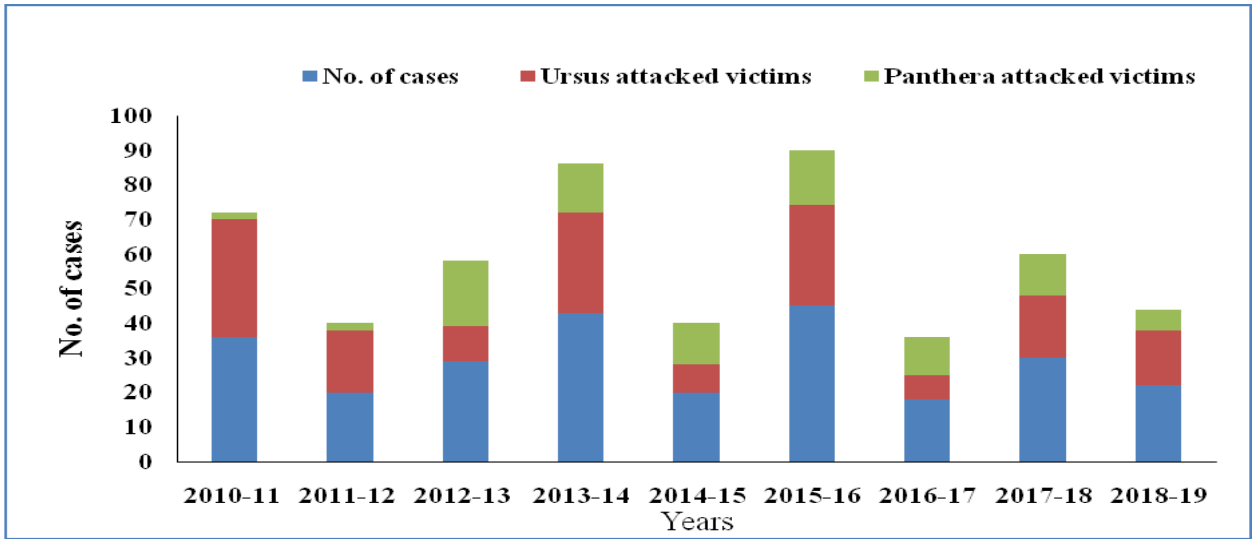

Fig. 2: Injured cases due to wildlife

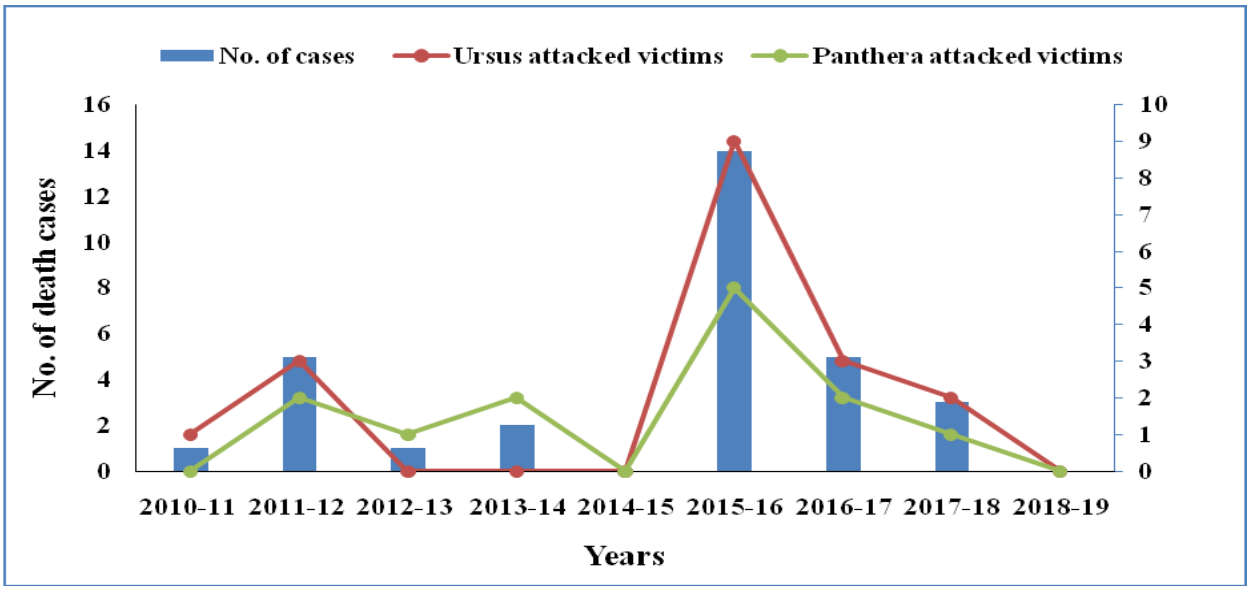

Fig. 3: Cases of dead victims of wildlife of study area

Table 2: Correlation between number of total cases and amount of ex-gratia disbursed

			Amount of Ex-gratia Disbursed	Total Cases	No. of Injured Cases	No. of Dead Cases
Spearman's rho	**Amount of Ex-gratia Disbursed**	**Correlation Coefficient**	1.000	0.433	0.723*	-0.211
		Sig. (2-tailed)	.	0.244	0.028	0.586
		N	9	9	9	9
*. Correlation is significant at the 0.05 level (2-tailed).						
**. Correlation is significant at the 0.01 level (2-tailed).						

Table 3: One way ANOVA for comparing mean values of HWC incidences at different locations

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	87.333	3	29.111	0.889	0.457
Within Groups	1048.222	32	32.757		
Total	1135.556	35			

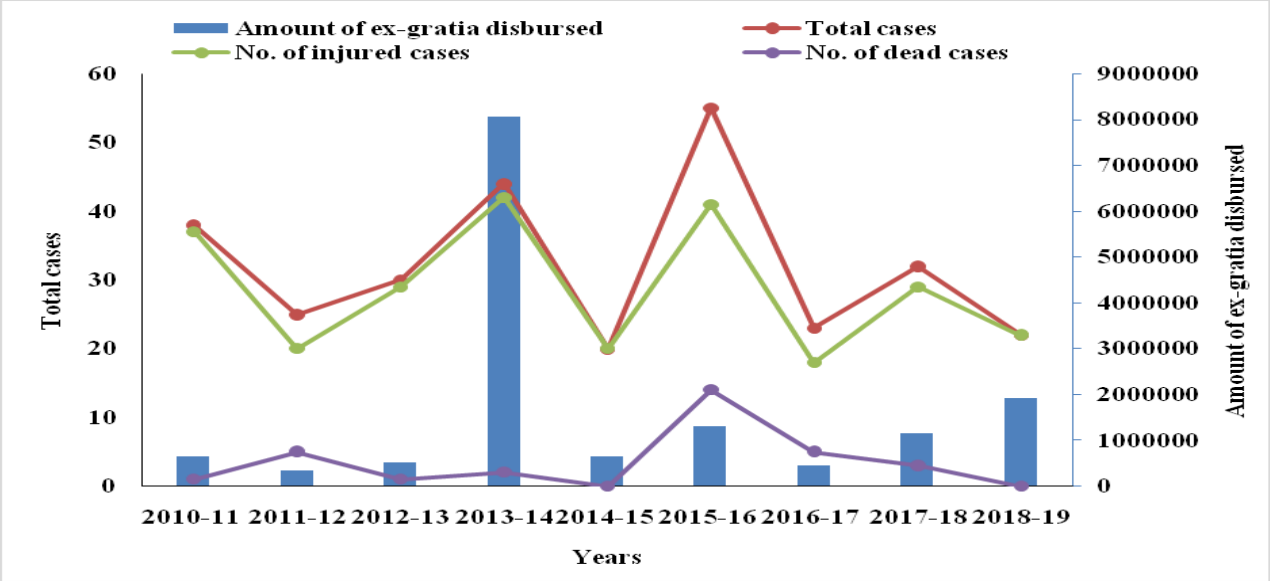

Fig. 4**:** Amount of ex-gratia disbursed among the wildlife victims.

performed for comparing the mean values of human wildlife conflict incidences of different locations. No statistical significant difference was observed in the mean values of conflict locations (Table 3). With the spread of settlement and changing land use, natural habitats of wildlife have become restricted to small and fragmented patches of human dominated landscapes. This enhances the interactions and potential conflicts between human and wildlife (Jackson and Wangchuk, 2004; Ogra, 2008; Jasmine *et al*., 2015). Unspecified location of incidents of wildlife depicts the overlapping of resources with humans and involvement of humans with the wildlife habitat.

Conclusion

The findings of present investigation illustrates that conflicts are associated with wild primates and the casualties to the local residents are caused by *Ursus thibetanus* and *Panthera pardus*. The frequency of human wildlife conflict cases are reported annually. Therefore, there is need to assess the conflict cases to save precious human lives and to check the habitat loss of wild animals. Government should provide the descent compensation to victims in order to avoid intolerant attitude of local population towards wildlife. Wildlife conflicts can be avoided by sustainable development in the interest of humans and wild animals.

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