Abundance of snow leopard (*Panthera uncia*) and its wild prey in Chhekampar VDC, Manaslu Conservation Area, Nepal

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Snow leopard (*Panthera uncia*) is the striking symbol as well as an indicator of intact eco-regions of high mountains it inhabits. Despite the advancement in new methods, scholars argue that signs are still a reliable indicator for the purpose of habitat use study of snow leopards. The relative abundance of snow leopard and its major prey species such as blue sheep (*Pseudois nayar*) and Himalayan tahr (*Hemitragus jemlahicus*) in the Chhekampar Village Development Committee within the Tsum Valley of the Manaslu Conservation Area was determined by sign survey using Snow Leopard Information Management System (SLIMS) and block survey using Vantage Point Method, respectively. We also assessed human snow leopard conflict through household and key informant survey. The encounter rate of snow leopard signs were 3.57/km on an average, indicating low abundance, whereas prey species such as blue sheep and Himalayan tahr had 3.8 and 1.8 animals/ km^2, respectively. The livestock depredation rate was 1.29% with snow leopard accounting to only 0.32% of the total. Due to the low abundance of snow leopard but sufficient number of large-sized wild prey species, livestock predation by snow leopard was minimum, and therefore, the local people had positive perception towards snow leopard conservation. Though the present situation including the local religious tradition and social norms is supportive in conservation of snow leopard, it may not sustain unless incentive programs are encouraged timely..

Key words: Blue sheep, conflict, Himalayan tahr, livestock depredation, predator, prey density

The snow leopard (*Panthera uncia*) is one the least known and most endangered of the world's large cat species, and the striking symbol of World's highest place, predating in the high mountains of central and southern Asia (Schaller, 1977). The distribution of the snow leopard extends between elevations of 3,000 m to 5,500 m in 12 Asian countries, encompassing a total potential habitat area of 1,835,000 km^2 (McCarthy and Chapron, 2003). In Nepal, it is found in the northern chain of Himalayan frontier along the Tibetan border (HMGN, 2005), with the largest populations in Dolpa, Mugu, Manang, and Mustang districts (Bajimaya, 2001). Its distribution has been confirmed in the mountain protected areas (PA) of Nepal *viz.* the Langtang National Park, the Shey-Phoksundo National Park (SPNP), the Annapurna Conservation Area (ACA), the Sagarmatha National Park (SNP), the Kangchenjunga Conservation Area, the Api Nampa Conservation Area, the Dhorpatan Hunting Reserve and the Manaslu Conservation Area (MCA), and also possibly in the Makalu-Barun National Park (HMGN, 2005). It has been fully protected by National Parks and Wildlife Conservation Act 1973 of Nepal (HMGN, 1973). Because of decline in its population due to habitat loss and other factors, it has been listed in the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of endangered species since 1986 (Jackson *et al.*, 2008) and included in Appendix I of the Convention on International Trade in Endangered Species of Fauna and Flora (CITES) since 1975, and hence, all international commercial trade in the species, its parts and derivatives is prohibited (McCarthy and Chapron, 2003), to support snow leopard conservation.

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The presence and survival of the snow leopard is also an indicator of intact eco-regions they inhabit (Jackson and Hunter, 1996). Based on the habitat use analysis aided by empirical studies, the total snow leopard habitat in Nepal is estimated to be about 13,000 km^2 with the estimated population of 301–400 snow leopards (WWF Nepal, 2009; GoN, 2013). Unfortunately snow leopards are declining throughout their range due to various threats including habitat and prey loss and persecution (Nowel and Jackson, 1996). The Himalayan region continues to experience problems of illegal hunting, human-wildlife conflicts, and habitat degradation and fragmentation (Wegge *et al.*, 2012; Devkota *et al.*, 2013). Knowledge of snow leopard prey species is essential to understand the ecology of this predator, and thereby, provide better conservation options of this endangered species.

Status of the species is one of the parameters of greatest intrinsic interest to biologists studying snow leopard population dynamics (Krebs, 1985; Buckland *et al.*, 1993; Turchin, 1998 cited in Maheshwari, 2006). Large carnivores may face important trade-offs between habitat features, and knowing how these factors influence habitat use is critical to the conservation of snow leopard (Wolf and Ale, 2009). Study on snow leopard by sign methods are easy and less expensive (Fox *et al.*, 1991). Despite the criticisms on the accuracy of this method (McCarthy, 2000), scholars have concluded that signs are reliable indicator of the habitat use by snow leopard (Ahlborn and Jackson, 1988; Wolf and Ale, 2009). Population distribution and availability of prey influence the quality of a predator's habitat and the health of a predator population, and thereby, can strongly influence predator density. Therefore, knowledge of important prey species is essential to understanding predator ecology. Knowledge of prey density and predator-prey ratios can help give insight into snow leopard numbers in a particular area. There must be sufficient prey to support the predicted predator population (Jackson and Hunter, 1996). The snow leopard is an opportunistic predator capable of killing prey more than three times its own weight (Schaller, 1977). Throughout the Himalayan range, because of livestock depredation, the snow leopard enters into conflict, and this intensity is inversely proportional to availability of wild prey species (Oli *et al.*, 1994), and is one of the main challenges for snow leopard conservation (Jackson *et al.*, 2010). The snow leopard feed on large range of natural prey, but it prefers the larger ungulates because of the net energy gain per unit effort expended (Wegge *et al.*, 2012). Thus, blue sheep (*Pseudois nayar*) and Himalayan tahr (*Hemitragus jemlahicus*) are considered to be important primary prey species for snow leopards in Nepal and elsewhere in the Himalayan region (Oli, 1994).

Previous studies (Oli, 1994; Ale *et al.*, 2007; Upadhyaya, 2010; Wegge *et al.*, 2012; Devkota *et al.*, 2013) have attempted to address issues on snow leopard conservation in other protected areas of Nepal. However, no studies have been conducted in the Manaslu Conservation Area, especially in the Chhekampar Village Development Committee (VDC) within the Tsum Valley so far to explore status of snow leopard and its prey species updating existing knowledge for its wise conservation. To implement appropriate strategies of snow leopard conservation, the impact of snow leopard predation on its natural prey and livestock is required (Wegge *et al.*, 2012), and this requires the knowledge on availability of natural prey and livestock depredation beforehand. Therefore, this study explores the abundance of snow leopard, its prey species, and people's perceptions on snow leopard in the Chhekampur VDC within the Tsum Valley of the MCA, fulfilling the existing gap in this important but unexplored area.

Materials and methods

Study area

The MCA is located between 28º 21' N to 28º45'N latitudes and 84º29' E to 85º11'E longitudes in Gorkha district in the northern-central Himalaya of Nepal (Fig. 1). The MCA was gazetted in 1998 with an area of 1663 km^2.

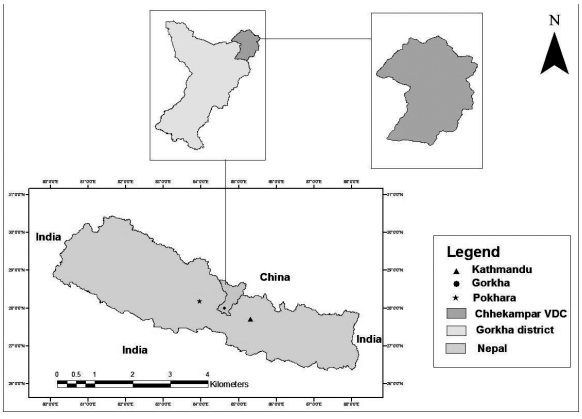

Fig. 1: Map of the study area

Biogeographically, the MCA corresponds to the Tibetan plateau of the Palearctic region, and represents Trans Himalayan ecosystem (NTNC, 2016). Himalayan black bear (*Ursus thibetanus*), blue sheep, musk deer (*Moschus chrysogaster*), Himalayan serow (*Naemorhedus sumatraensis*), Himalayan tahr, goral (*Naemorhedus goral*), Assamese monkey (*Macaca assamensis*) and snow leopards are the main wild animals recorded in the area (NTNC, 2016). Besides these wildlife species, this area is also rich in high-value medicinal plant species such as Yarsagumba (*Cordyceps sinensis*), Pakhanved (*Bergenia ciliate*), Nirmasi (*Delphinium denudatum*), Panchunle (*Dactylorhizia hatagirea*) and Satuwa (*Paris polyphylla*). Bordering the Annapurna Conservation Area to the west, the Tibetan plateau to the north and east, and the mid-part of Gorkha district to the south, the Manaslu region popularly known as 'Tsum Valley' was restricted to tourism until 1991. Since then, the region has been opened up for organized tourism.

This study was carried out in the Chhekampar VDC within the Tsum Valley lying in the northern part of the MCA. The total area of the Chhekampar VDC is 317 km^2 situated at the altitude of 2,959 m above sea level (asl). There are several Buddhist monasteries including renowned Mu Gumba in the Tsum Valley. The Lamas (Boudhist monk) and Amchis (traditional Buddhist healers) are very positive towards wildlife species and their conservation. Most of the local inhabitants are of Buddhist origin. They have strong social norms and values for maintaining non-violence traditional culture and practices over the region. If someone violates the rules, s/he will be punished as per the existing norms.

The total human population in the Chhekampar VDC was 983 people within 263 households, distributed in 11 hamlets (CBS, 2012). The livelihood patterns are based on small agriculture (e.g. potato, wheat, buckwheat and millet), livestock productions (e.g. manure, drought power and sources of food and protein) and seasonal migration for labor work. Lopping of tree branches for fodder together with collecting fire-wood, leaf-litters and other high-value forest resources are basic components of the daily livelihoods of the local communities. Cow, Yak, Jhopa (cross breeds of yak and cow), and horses are the main livestock reared by the villagers. These livestock heard used to graze across the pasture land with temporal coral for most of the time. During the study period, livestock depredation was reported to have been occasionally occurred by the snow leopard.

Study design

We performed sign survey, and carried out key informants interview and household questionnaire survey to collect primary information about snow leopard and prey species. The study was conducted in the Chhekampar VDC of the Tsum Valley between November, 2010 (Pre-winter) and May, 2011 (Post winter). Secondary information were obtained from various sources such as documents of the MCA Office at local level and the related literatures.

Sign survey of snow leopard

The field surveys were conducted twice: during pre-winter (November to December 2010) and post-winter (April to May 2011) periods. After consultation meeting with the key informants (local people, previous researcher, MCA staffs), the study area was divided into three blocks comprising the potential habitat of the snow leopard.

As snow leopards are extremely difficult to sight directly, indirect sign survey was conducted to estimate their density. For this purpose, transects routes were established by randomly selecting feasible landforms where snow leopard signs were likely to be found, e.g. along ridgelines, cliff bases, river bluffs (Jackson and Hunter, 1996; Bajimaya, 2001). These transects were ≥1 km apart with a maximum of 5 km separation (Janecka *et al.*, 2008). Each transect was searched for sign within a 5 m-wide strip on either side. The type of signs (scrapes, feces, pugmarks, spray/ urine, or claw marks), the sign measurements, the estimated age of sign and whether the sign was relic or non-relic were recorded. Within 20 m radius of the signs, slope, aspect, elevation, habitat type, landform ruggedness, dominant topographic feature as mentioned in the SLIMS manual were recorded (Thapa, 2006). To ensure whether the signs were authentically of the snow leopards, we relied upon more than single type of signs such as scrapes and scent sprays or claw rakes.

Geographic coordinates (GPS points) were taken for all snow leopard evidences (observations/

signs) in order to map snow leopard distribution. Following the field surveys for snow leopard signs, the potential area of the snow leopard occurrence was mapped in the whole VDC. Topographic maps at the scale 1:50000 were used to delineate survey blocks and to layout transects within each block; the GPS points taken in the field were overlaid on these maps. Then, on the basis of the information collected from the local people regarding the snow leopard potential area and field verification, a map showing the snow leopard signs and its prey species distribution was prepared.

Density estimation of prey species

The major prey species of the snow leopard were identified on the basis of the discussion with the conservation area staff and the local people as well as the available literature. Block count method was used to estimate the density of prey species. In each block, direct observations were done in the morning (06:00–10:00 Hrs) and the evening (14:00–17:00 Hrs) from the trails and fixed point method (vantage point) so as to identify the prey species such as blue sheep and their number (Schaller, 1977; Oli, 1996). Monitoring from the trails (Jackson and Hunter, 1996) was done as the main sampling method for determining the status of the prey species of the snow leopard. The visible area from the trail was scanned using binoculars (8–30×) and a spotting scope (15–60×) to identify the prey species and their number. In order to make the study easier, the study area was divided into three blocks, and the total counting of the prey species was done.

Assessment of livestock loss and people´s perception towards snow leopard conservation

Livestock depredation was assessed by household surveys (Sharma *et al.*, 2006). From the randomly selected 50 households out of the total 262, we used questionnaire at household level to record livestock damage during the last one year period. We assessed the conflict and collected the information on livestock damages by wild animals. The Household surveys were focused on quantifying information that was measurable overtime in terms of conflict imparted by snow leopards and other predators. The household heads, either male or female, were considered as the respondent. We cross-checked their answers to minimize intentional exaggeration. The local teachers and the MCA Committee Members faciliated in rapport building with the local people and also in translation work when needed. The people´s perception towards snow leopard conservation was measured in Likert Scales (1–5).

Results and discussion

Abundance of snow leopard signs

The snow leopard signs were observed within the 14 transects that were laid both in the high and low potential areas within the entire Chhekampar VDC. The type, total length and the mean length of transects along with the number of signs observed were recorded (Table 1). A total length of 8.12 km distance was observed within the 14 transects; the average length of a transect being 580.07 m within a range of 420 m to 725 m. Shorter transects were laid out so as to save time and also more importantly to represent the whole site (study area). Out of the 14 transects, only 6 (42.85%) had snow leopard signs whereas the remaining 8 transects (57.15%) had no evidence of snow leopard signs. Among the different types of snow leopard sign, only scrapes, pugmarks and feces were recorded in the sites. Of the total 29 signs recorded, 14 (48.28%) were feces followed by scrapes and pugmarks. The average encounter rate was 3.57 signs/km indicating low snow leopard density.

The snow leopard signs were categorized into three classes based on their age which was guessed on the basis of wetness, integration, coloration, odor and their appearance; a sign was categorized as “very fresh”, if it was between one week and one month old and categorized as “old” if it was more than one month old. Most of the signs (78.57%) observed were of old age (Fig. 2). This indicated that the area had relatively little snow leopard activity at the time of the survey. The Human activities and the livestock population were found to be high in the area, and so the snow leopard habitat was highly disturbed. The scrapes and the old feces were found to be more frequent, because they were not damaged by human disturbance as compared to the other signs; scrapes, in particular, tend to be very long lived in the protected areas and the areas where there is no disturbance from livestock.

Table 1: Snow leopard signs

Transect Number	Transect length (m)	Sign types and their numbers			
		Scrapes	Pugmarks	Feces	Total
1	626	0	2	1	3
2	725	0	0	0	0
3	420	0	0	0	0
4	620	3	2	2	7
5	550	0	0	0	0
6	600	0	3	2	5
7	520	0	0	0	0
8	600	0	0	0	0
9	612	0	0	0	0
10	480	0	0	0	0
11	522	0	0	0	0
12	588	2	0	2	4
13	721	2	0	3	5
14	537	1	0	4	5
Total	**8.12 km**	**8**	**7**	**14**	**29**
Encounter rate (sign/km)		0.99	0.86	1.72	3.57

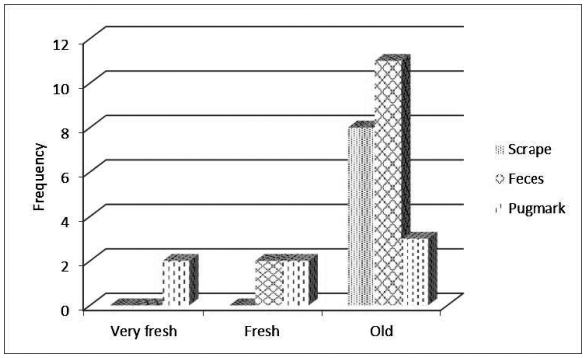

Fig. 2: Age of signs

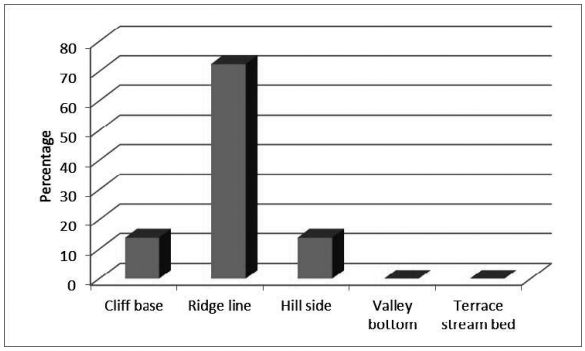

Fig. 3: Sign distribution according to topographic features

Habitat feature of snow leopard

The area with snow leopard signs and its surrounding area are considered to be potential habitat of snow leopard. According to dominant topographic features, about three fourth signs were recorded on the ridgelines (Fig. 3). Snow leopard use ridgelines more frequently to travel across the landscape and is considered to be the potential habitat. Ruggedness landform appears to be a determining factor for the presence of snow leopard, and could indicate suitable habitat. Along the ridgelines, majority of the signs were found in the rolling areas, with slightly broken to moderately broken landform, indicating snow leopard's preferred land form habitat (Fig. 4).

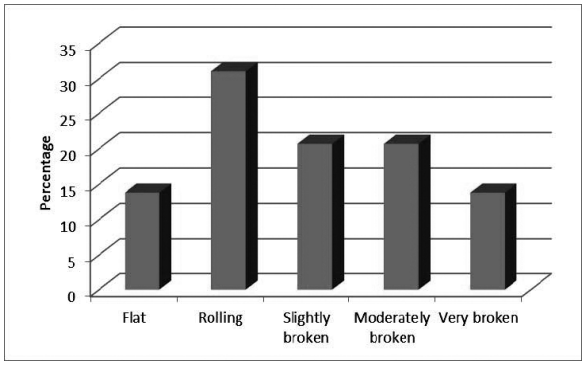

Fig. 4: Distribution of snow leopard sign according to landform ruggedness in Chhekampar VDC, MCA

Primary vegetation type is another important factor that determines the use of the site by snow

leopard. In this regard, grassland forms the major land use type preferred by snow leopard (Fig. 5). Based on the above parameters, the potential habitat of snow leopard seems to be more than 3,000 m asl. Based on the distribution of snow leopard sign overlaid on the vegetation map (Fig. 6) abundance was highest in the Alpine pasture lands.

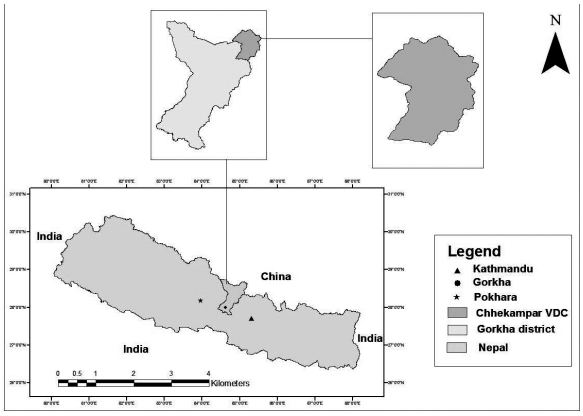

Fig. 5: Snow leopard sign distribution according to vegetation type

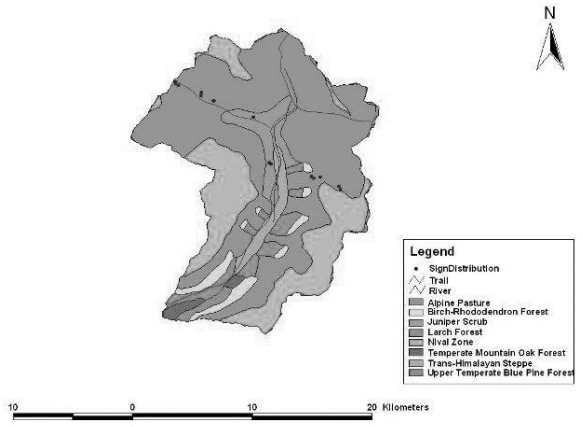

Fig. 6: Distribution of snow leopard signs in different habitat in MCA

Prey species abundance

Blue sheep, Himalayan tahr, musk deer, Himalayan marmot (*Marmota himalayana*), Himalayan serow, hare (*Lepus oiostolus*), Royle's pika (*Ochotona roylei*) and impeyan pheasant (*Lophophorus impejanus*) were found to be the major wild prey species of snow leopard in Chhekampar area. Forty-five herds of blue sheep were sighted in Block II (103.6 km^2) and Block III (89.6 km^2), with an estimated total population of 733 animals; the density of blue sheep being 3.8 animals/km^2. Block II and Block III were located at the north-west and north-east parts of the study area, respectively. Next to blue sheep, Himalayan tahr was the another major prey species found in the area, but the herd of Himalayan tahr was sighted only in Block I (124.2 km^2) which is located at the southern part of the study area with comparatively lower elevation range. Altogether, nine herds of Himalayan tahr with an estimated total population of 223 were observed in Block I; the average herd size being 25 (range 2 to 74 individuals); the density of Himalayan tahr in this area being 1.8 animals/km^2. There was no habitat overlap of these two species. Majority of the Himalayan tahr herd were sighted in the hillside among the different topographic features.

The blue sheep herds were sighted in different topographic features including the cliff-base (15.56%), the hillside (35.56%) and were most abundant on the ridgelines (48.89%) whereas Himalayan tahr were most abundant in the hillside (66.67%) followed by the ridgeline (22.22%) and the cliff-base (11.11%). Four habitat types-barren land, grassland, shrubland and forest have been mostly used by blue sheep, with higher distribution in the shrubland (48.89%) and none in the forest. Similarly, the highest abundance of Himalayan tahr was found in the shrubland (55.56%) but none in the barrenland. Among the rugeddness landform that includes flat, rolling, slightly broken, moderately broken and very broken lands; the rolling land had the highest density of blue sheep herds (57.78%) followed by the slightly broken land (20.00%), the moderately broken land (8.89%), the flat land (6.67%) and the very broken land (6.67%). On the other hand, the slightly broken land (55.56%) was preferred by the Himalayan tahr followed by the rolling land (22.22%), flat land (11.11%), the moderately broken land (11.11%) and none in the very broken land. Himalayan monal (Danphe), Himalayan marmot, Royale's pika and wooly hare were the other prey species recorded in the field.

Livestock loss and people´s perception towards snow leopard conservation

We found 933 livestock heads with the average holding of 18.66 heads/HHs in the Chhekampar VDC. The major livestock were cow/bull, horse/mule and yak/chauri. The yak/chauri was the dominant livestock followed by cow/bull. However, there were no records of goat/sheep and dogs. Twelve livestock were found to be lost because of snow leopard and other factors

(starvation, diseases and sliding) but only three yak/chauri were found to be killed by snow leopard in 2010. This figure accounted for 1.29% of the total livestock. The snow leopard was the only predator believed to damage the livestock in this region. Of the total 12 livestock lost (1.29% of total herd), the snow leopard was responsible for 25% (3 yak/chauri). Of the total livestock, predation by snow leopard was only 0.32%. Although jackals were reported to be found in the Chhekampar VDC, no losses by jackals was recorded. In addition, no wildlife attacks on human or injuries by predators were noticed in the last year.

In the four seasons- snow leopards killed two livestock in winter and one in summer. There was no record of livestock killed in spring and autumn seasons. A loss in winter is attributed to seasonal migration of people towards lower regions along with their livestock to avoid extreme cold weather. During this period livestock are prone to attack by predators, particularly snow leopards, and in the pastures where livestock are mostly left unguarded overnight. It is quite interesting to mention that snow leopards and their main preys- Himalayan tahr and blue sheep together with the other wild animals also conduct the same seasonal movements during winter. The loss in summer (April–June) is attributed to the engagement of the people in collecting yarsagumba and they cannot spend more time guarding their livestock at the pasture land.

The Likert scale attitude survey revealed that 80% of the local people had a positive attitude towards snow leopard conservation. Thirty six percent of the local people strongly liked snow leopards whereas 31% strongly liked blue sheep/ Himalayan tahr and 24% strongly liked wildlife in general. Respondents with strongly positive attitude towards wildlife were basically Lamas and Amchis. The presence of Himalayan tahr and blue sheep were found to be good indicators for snow leopard conservation signifying that there was no immediate threat of its main prey. According to the respondents, the blue sheep and Himalayan tahr used to frequently enter their croplands, and damaged crops. However, none of the respondents disliked or strongly disliked the Himalayan tahr and blue sheep.

The positive attitude of the people towards wildlife including snow leopards in this study area is associated with religious ties and traditional cultural and social norms. The majority of the local people who have faith in Buddhism believe that snow leopards are ambassadors of god and feel that the presence of snow leopards in their area is a matter of dignity. Traditionally, killing and hunting is strictly enforced in the restricted zone. If any one uses violence against snow leopards this goes against their social norms, and they must be punished by Lamas and socially ostracized.

Discussion

Though Fecal DNA Analysis is the most promising method for monitoring snow leopard population, Snow Leopard Information Management System Survey Method can be improved by rigorous training of observers and designing sampling schemes (McCarthy *et al.*, 2008). The result of this study may have some methodological errors, but are useful in reveling the primary information of snow leopards in an unexplored area like the Chhekampar VDC. The result of this study indicated that the sign density of snow leopard (3.57 signs/km^2) was quite less as compared to similar studies in other parts of the snow leopard range. In the Mustang region of Nepal, Upadhyaya (2010) recorded 10.83 signs/km^2, and concluded that the area had good density of snow leopard. Similarly, 8.22 signs/km^2 in the Kanchanjunga Conservation Area, and 12.7 signs/km^2 in the SPNP have been recorded (Thapa, 2006). In Humla and Sagarmatha regions of Nepal, the highest percentages of scrapes (10.64±2.50% and 58.7% respectively) were recorded during the sign surveys (Lama, 2015; Wolf and Ale, 2009). However, the highest number of scats were encountered in the field survey in western Nepal (59.6% in Humla and 61% in Dolpa region) (FoN, 2014; GGN, 2014). In this study too, the highest percentage of scats were encountered in the signs (Table 1; Figure 2). In our study, the presence of old scats indicated that the area had not been used by the snow leopard recently, and this might be because of the heavy disturbance of human activities in the area. The ridgelines were found to have been excessively used by the snow leopards not only to detect prey species, but also might have been used for easy escaping when needed. There seems to be not much preferences in the use of landform ruggedness by the snow leopard, though the flat and very broken land form are less used. The grassland and shrub land are

almost equally used by the snow leopard because of the availability of prey species in these habitat types. Because of the habitat destruction and other anthropogenic activities, snow leopards are at high risk (Wegge *et al.*, 2012; Devkota *et al.*, 2013), so knowing how these factors influence habitat use is critical to the conservation of snow leopard (Wolf and Ale, 2009). The density of blue sheep (3.8 animals/km^2) in the study area as compared to other regions of Nepal, is higher than in the SPNP (2.27 animal/km^2; Devkota *et al.*, 2013) and upper region of Mustang district (0.86 animal/km^2; Aryal *et al.*, 2014). However, the density of the blue sheep in this study area is quite less than that of 8.4 animals/km^2 in the Phu Valley of Manang district (Wegge *et al.*, 2012). Similarly, Shrestha (2006) had observed the mean herd size of 18.7 animals of Himalayan tahr in the SNP, which is less than the mean herd size of 25 animals found in the present study.

Our results shows that the livestock depredation rate (1.29%) is lower than the similar studies conducted in other parts of Nepal. The livestock loss was 2.6% in the Annapurna Conservation Area (Oli *et al.*, 1994) and 11.1% in the SPNP (Devkota *et al.*, 2013). This could be because of the low abundance of snow leopards and high abundance of wild prey species like blue sheep and Himalayan tahr. The percentage of livestock loss is found to be less than 7.1% due to snow leopard and wolf in Ladakh (Namgail, 2004) while the loss is 18% because of wolf and snow leopard in Kibber Wildlife Sanctuary in India (Mishra, 1997). A study by Kunwar (2003) in the ACA also recognized the snow leopard as the principal predator where it was responsible for 58% of the total livestock loss. However, he reported seven wild predators in the ACA and Devkota *et al.* (2013) also reported snow leopard as the principal predator where it was responsible for 45.6% of the total livestock depredation in the SPNP, which is quite higher than in our study. The loss to snow leopards in winter is comparable to the results revealed in the ACA by Oli *et al.* (1994), where 39% of the feces of snow leopards collected in winter contained the remains of livestock. However, another study in the same area by Jackson *et al.* (1996) reported predation losses throughout the year, but with a peak in spring and early summer (AprilJune). This result of the assessment of the people's perception towards snow leopard conservation is contradictory to the result explored by other researchers; Kunwar (2003) in the Upper-Mustang, Oli *et al.* (1994) in the Annapurna Conservation Area; where majority of the respondents strongly dislike snow leopards. Similar perception was reported for blue sheep (Kunwar, 2003). Because of the negligible human snow leopard conflict in the study area, people have positive perception towards snow leopard and its prey species in this region. The religious belief of Buddhism has very positive impact upon the wildlife conservation in the Tsum Valley.

Our study has explored the abundance of snow leopard signs and its prey species in new sites, opening opportunities for further studies. The religious belief of the local people is the major factor in accepting snow leopard conservation. However, since the people of the locality are poor and much depend on the natural resources, and if alternatives to their livelihoods are not available, the present condition may not go a long way. Incentives programs such as relief and insurance programs for livestock depredation coupled with other incentive programs for crop damages should be encouraged timey to keep on gaining local peoples' support in snow leopard conservation in the landscapes of the Tsum Valley of the MCA.

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