Survey of Snow Leopard *(Uncia uncia)* and Blue Sheep (*Pseudois nayaur*) populations in the Kangchenjunga Conservation Area (KCA), Nepal.

Final report

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By

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Executive summary

This study was carried out in the Kangchenjunga Conservation Area (KCA), Eastern Nepal from Feb - Nov 2007. We used the Snow Leopard Information Management System, SLIMS (second order survey technique) to determine the relative abundance of snow leopard in the upper part of KCA. Altogether, 36 transects (total length of 15.21 km) were laid down in the major three blocks of KCA. 104 Signs (77 scrapes, 20 feces, 2 Scent mark, 3 Pugmarks and 2 hairs) were recorded. Fixed-point count method was applied for blue sheep from appropriate vantage points. We counted total individual in each herd using 8×42 binocular and 15-60× spotting scope. A total of 43 herds and 1102 individuals were observed in the area. The standard SLIMS questionnaire was conducted to find out relevant information on livestock depredation patterns. Out of 35 households surveyed in KCA, 48% of herders lost livestock due to snow leopards. A total of 21 animals were reportedly lost due to snow leopards from August to September 2007.

INTRODUCTION

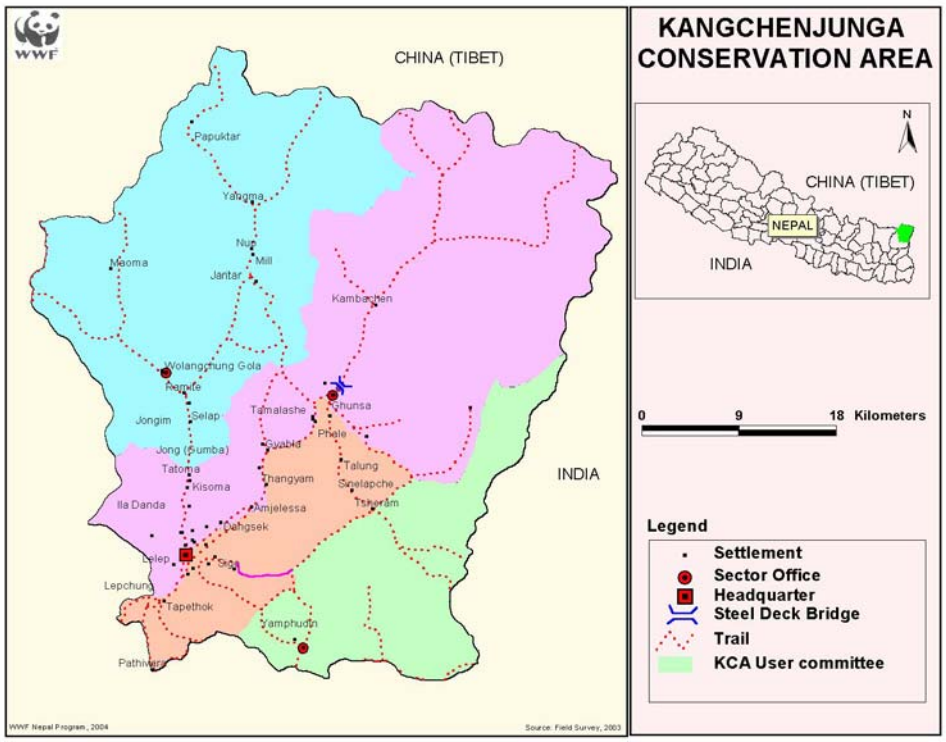
The Snow Leopard (*Uncia uncia*) is an endangered species lives in the mountains of the Central Asia and the Himalayas, often in very high altitudes with extremely low winter temperatures and far away from sheltering forests (Nowel and Jackson, 1996). In Nepal it inhabits the main Himalayan chain along the Tibetan border (HMG Nepal, 2005). It is widely but thinly distributed throughout its range in the mountains of Central Asia (Hussain 2003). They are one of the least known of the large cats, due in large part to the remote and rugged habitat of the central Asian mountains where they occur (McCarthy 2005). The purpose of this study was to evaluate the current conservation status of snow leopard and blue sheep in the Kangchenjunga Conservation Area where three objectives were addressed: Our first objective was to evaluate the population status of the snow leopard and the blue sheep in the upper part of KCA. The Second objective was to record livestock depredation rate by snow leopards and conservation education and outreach programs for locals was our third objective.

METHODS

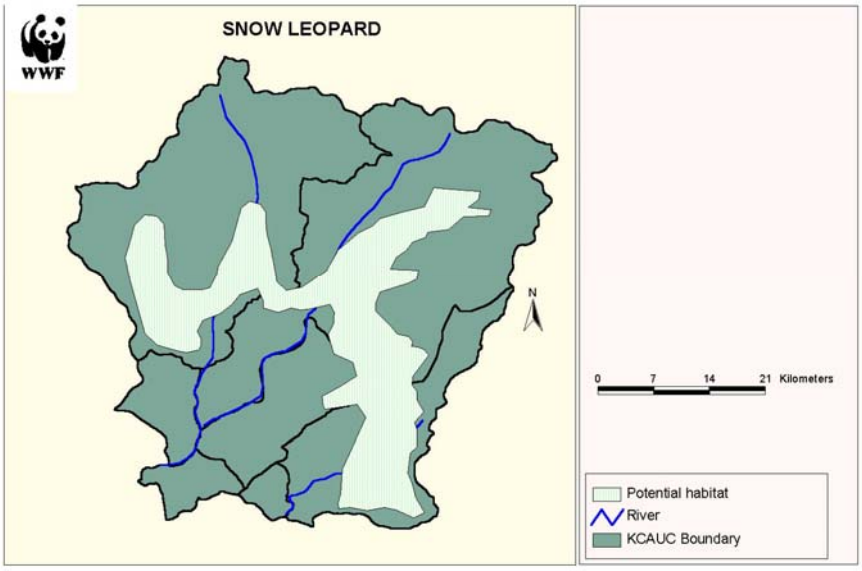
Study Area

Kangchenjunga Conservation Area lies in northeast region of Nepal (27.15'-27.56' North to 87.32' to 88.65' East) bordering to Sikkim of India. It is an extraordinary landscape with unique floral and faunal diversity, breath-taking scenery, and rich cultural heritage (Map 1 & 2). Biogeographically, it lies in eastern Himalayas (Olson and Dinerstein 1998).It was designated in 1997 and is the newest of Nepal's protected areas. The Conservation Area supports many species of flora and fauna that are characteristic of the eastern Himalaya. The Qomolongma National Nature Reserve of China lies to the north and the Kanchenjunga National Park in Sikkim in India to the east. Mount Kanchenjunga, the third highest mountain in the world (8586m), lies within the Area. There are four main river valleys: the Simbua Khola and the Ghunsa, Kabeli and Tamur. The vegetation ranges from subtropical to alpine. Subtropical vegetation comprises moist broadleaved forests of mixed *Schima wallichii*, *Engelhardtia spicata* etc, *Schima wallichii/Castanopsis tribuloides* and *C. tribuloides/C. hystrix*. In the temperate zone there are moist broadleaved forests of oak/laurel dominated by *Quercus glauca, Q. lamellosa* and *C. tribuloides* etc, *Q. lamellosa* forests, *Q. semecarpifolia* forests and mixed broadleaved/coniferous forests of *Q. semecarpifolia/Tsuga dumosa/Abies spectabilis/Betula utilis/Rhododendron arboreum* etc. The subalpine zone has a wide range of forest types: *Tsuga dumosa/Abies spectabilis* forest, *Abies spectabilis* forest, *Larix griffithiana* forest, *Juniperus indica* forest, *Rhododendron* forests and *Betula* forest. Vegetation in the alpine zone consists of scrub and meadows (Rastogi *et al*. 1997).As many as 279 bird species have been recorded in the Conservation Area, but many more are likely to occur (Thapa and Karki 2006).Globally threatened mammals include the Assamese Macaque *Macaca assamensis*, Asiatic Black Bear *Ursus thibetanus*, Snow Leopard *Uncia uncia*, Himalayan Musk Deer *Moschus chrysogaster*, Serow *Capricornis sumatraensis* and Red Panda *Ailurus fulgens*.

Map 1: Kangchenjunga Conservation Area



Map 2: Potential habitat of snow leopard in the KCA



Procedure:

The study was conducted over a 9-month period from Feb-Nov 2007. Using the SLIMS protocol, snow leopard sign surveys were conducted in three major valleys Olangchungola,Ghunsa and Yangma of KCA. Transect routes were plotted on available 1:50,000 topographical maps, and placed along land forms where snow leopard sign is most likely to be found, such as on ridge lines, cliff base and river bluffs (Bajimaya 2001, Mc Carthy 2000, Jackson and Hunter 1996). Transects route were short and run along landform edges. All transects were be walked by a pair of observers and all signs were recorded using the SLIMS survey methodology. Furthermore, Four Infrared sensor camera trap units were used along known or suspected snow leopard trails identified by the past studies as described by Jackson (2005) in order to get the photographs of snow leopard.

Fixed point counts from ridgeline vantage points were conducted using the methods detailed by Jackson and Hunter (1996) for the survey of blue sheep. Survey blocks were outlined on maps. Each block was scanned and all sheep counted and assigned to sex and age classes when possible.

SLIMS questionnaire surveys were conducted in local villages in the survey area in order to evaluate the level of human-snow leopard conflict, record damage estimates from livestock depredation and record land use practices such as grazing and overall usage of pasturelands.

RESULTS AND DISCUSSION

1) Abundance of snow leopard in the KCA

A total of 36 transects with a total length of 15.21 km (with mean length of 7.07 km ranging from 198 to 790m) were laid in the Kangchenjunga Conservation Area. Among them, 13 transect with total length of 4.149 km were in Olangchungola block, 12 transect with 5.566km length in Yangma, 12 transect with 5.495km length in Ghunsa (Table 1). It was found that Yangma block had the highest sign encounter rate (9.522 sign/km) of the snow leopard comparing to Ghunsa (5.381 sign/km) and Olangchungola (3.667 sign/km) block. The Yangma is relatively less disturbed and less poaching intensity compared to Olangchungola and Ghunsa block. The tourist pressure in Ghunsa area is higher than Olangchungola and Yangma. Hussain (2003) also reported that abundance of snow leopard is related with human disturbances. The snow leopard signs were recorded only from 20 transects. It was identified 65 Sign sites (both relic and non relic) and 104 all sign item. Individual sign included 77(74%) scrapes, 20(19%) feces, 3(3%) pugmark, 3(3%) scent mark 2(2%) and 2(2%) hair (Fig. 1) were recorded within the total searched transects where as McCarthy and Mukhtsag (1995) recorded 933 Scrapes, 623 fecal piles and 62 scent spray in Mangolia. Similarly, Ale (2006) also reported that 59.93% scrapes, 32.14% feces, 1.79% hair, 3.57% pugmark and 3.57% of scent mark in sagarmatha National Park.

Out of 65 sign sites 45% relic and 55% non-relic sign types were found (Fig. 2). Ages of signs were found 55% old, 43% fresh and 2% very fresh. The signs were observed in altitude between 4200m and 4950 m asl. Both abundance of sign sites and sign type were higher in the Yangma block (Table 1). The good sign abundance in Yangma blocks indicates good snow leopard abundance.

On 24th October, 2007 at 7:30 am, an adult snow leopard stalking a blue sheep herd was observed in Lonak, Ghunsa block. The cat and its activities were followed visually for 6 hours.

Table 1: Sign sites and sign encounter rate of snow leopards in KCA

Block	Number of Transect	Length (km)	Sign Site	Mean Site/km	Sign (all)	Mean sign/km
Yangma	12	5.566	32	5.749	53	9.522
Ghunsa	11	5.495	22	4.003	35	5.381
Olangchungola	13	4.149	11	2.651	16	3.667
Total	36	15.21	65	12.403	104	18.57
Mean Total	12	5.07	21.66	4.134	34.666	6.19

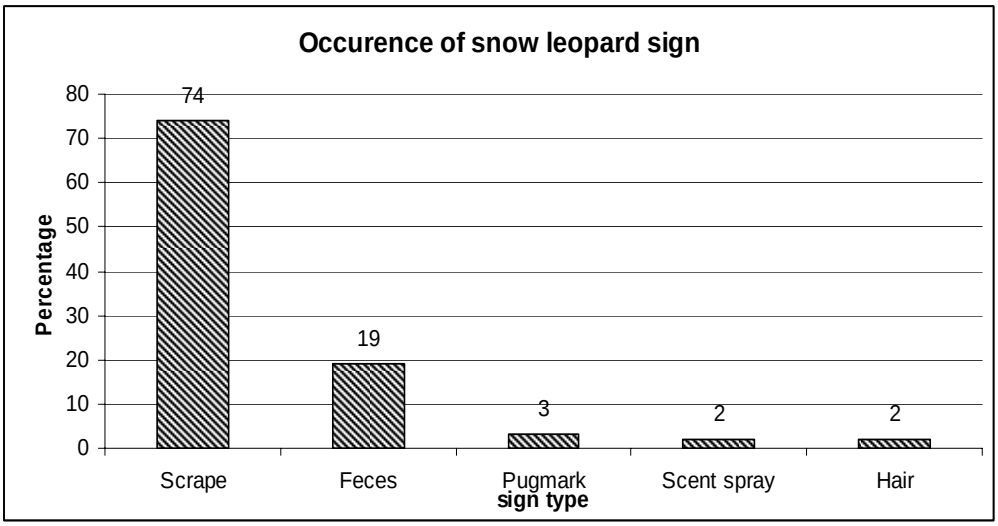


Fig 1: Occurrence of Snow leopard sign in KCA

2) Population survey of Blue sheep in KCA

The blue sheep is major prey species of snow leopard in Nepal Himalaya (Jackon 1995). A total of 1102 Blue sheep were recorded from the three major survey blocks (Table 3). Out of the total 1102 blue sheep from 43 herds; only 902 blue sheep were classified according to age and sex category. This comprised 29% adult female, 17% lamb, 11% yearling, 8% young male, 6% sub-adult male, 11% adult male and 18% were unidentified blue sheep. The group size was varied in the different block. The average group size was

31.66 in the Yangma 24.64 Ghunsa and 14.12 in the Olangchungola block. The sex ratio (female to male) observed during the entire survey block was 0.90 (90 males per 100 females). Oli *et al*. 1993) reported similar higher sex ratio (0.93) in Manang and 0.72 in Shey-phoksundo National Park (Thapa 2006). Recruitment rate (female to lamb) was found to be average 0.56 (56 lamb per 100 female). This rate indicates the stable population of blue sheep in the area, as stable reproductive rate in stable population of ungulates oscillates around 0.5-0.6 and reproductive rate in growing population may exceed 0.7 (Ale *et al.* 2006).

Majority of blue sheep were recorded in the Grassland (65%) followed by scrub (24%) and barren land/cliff (11%). Most of the herds were observed between the altitude of 4400m- 4700m (n =35). Similarly herds were found on average 32^0 Slope (n=.31) and 145^0 aspect (n=32). The estimated average mean distance to cliff for the blue sheep herds were 150m (n=35). Wilson (1981) indicates a general preference by blue sheep for gentle, grass covered (60-70% grass/sedges) slopes with southerly and /or eastern exposures, at altitudes ranging from 3960m to 4570m. The landform ruggedness utilized by the average blue sheep herds were 47% on rolling terrain, 5% were on cliff, 33% were on broken terrain, 10% very broken and 5% were found on the flat land respectively. Among the total herd observed, 60% blue sheep were observed in hill slope followed by 20% in cliff, 13% valley floor and 7% in the ridgeline.

Table 2: Population structure of blue sheep in KCA

Place/Block	Adult Female	Lamb	Yearling	Young Male	Sub-adult male	Adult male	Unidentified	Total
Yangma	181	105	68	51	54	73	38	**570**
Olangchungola	38	16	15	8	6	8	22	**113**
Ghunsa	100	59	32	31	17	40	140	**419**
Total	**319**	**180**	**115**	**90**	**77**	**121**	**200**	**1102**

3) Human- snow leopard interaction in the KCA

The animal husbandry is the major source of economy of the local people living in the KCA (Khatiwada and Chalise 2006). The major livestock owned by the local people (farmers) of the Olangchungola, Yangma and Ghunsa is Yak, Cow and goat. The survey results revealed that the snow leopard signs were more above the 4200 m which showed the availability of the snow leopard in the higher areas where the prey species live (4400-4700m). The area like Sinjema,Mauma, Nurak, Sangjung in Olangchungola, Pangmbo, Nuphoo, Phusyang, Nangama, Chherchen pokhari and Chherchen and khambachen, Ramdang, Lonak, Jimbu bari, Doodh pokhari are the major grazing area of the livestock. These above mentioned areas also favored the habitat of Blue sheep. High diet overlaps between livestock and blue sheep, together with density-dependent forage limitation, results in resource competition and a decline in blue sheep density (Mishra *et al.* 2004). In turn such reduction of wild prey often leads snow leopard to prey on domestic livestock. Livestock, due to their reduced escape capabilities compared to wild herbivores, become especially vulnerable for the predation (Nowell and Jackson 1996).

Interview with the local people indicated that mortality of the livestock was caused by different sources that are predator, lack of forage, winter snow/cold, disease and accident. Among the total lost, the highest mortality was caused by the predator (60%). Losses to snow leopard in the year 2006 to August 2007 were only 21 head of stock or it's about 0.60 head per household. Khatiwada (2004) reported the actual loss of livestock by predator (62%) in Langtang National Park, Nepal. A similar pattern was noted by Jackson *et al*. (1990) from Annapurna conservation Area; estimate the depredation rate 19.6%.and Oil (1991) estimated the depredation rate 2.6% from Manang Area, Nepal. However there was no any response of other predators. 48.6% household claimed loss of livestock and no loss of any livestock were claimed by 51.4% household. Interview to herders in Ghunsa, Yangma and Olangchungola block (35 households belonging livestock) indicated that the mean herd size for all domestic stock was 32.9 animals per household. 71.4% herders were found negative towards snow leopard conservation whenever 28.6% herders were responded positive toward snow leopards. It is estimated that by the

livestock depredation made, total US $ 4,911 (NRS 3, 09,435) lost per year in the Ghunsa, Yangma and Olangchungola valley which is US $ 140.33 (NRS 8,841) per household per year. Gurung and Thapa (2004) estimated the annual depredation of snow leopard about Rs378, 500.00 (US$5185) or Rs12, 617.00 per household per year which is relatively higher than present study.

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