Status and distribution of

Tibetan antelope (Chiru) and associated mammals

in

Changchenmo Valley and Daulet Beg Oldi
Ladakh, India

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Jammu and Kashmir Government

Department of Wildlife Protection

Wildlife Division Leh-Ladakh

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(Pantholops hodgsoni)

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foreword

The high altitude expanse of Tibetan plateau extending into north- eastern ladakh of Indian territory is the western most range of the highly endangered species of Tibetan antelope, also known as chiru, and Wild yak.

Ladakh-trans-Himalayan ecosystem is the most fragile and hardy ecosystem which represents unique, diverse, and rare assemblage of high altitude wildlife. This biodiversity is in danger of extinction and needs to be protected and preserved for posterity.

The population of Tibetan antelope (chiru) has drastically depleted globally on account of it's large scale persecution for getting shahtoosh, the fine under wool, used for making shahtoosh shawls.

Outside the People's Republic of China the Tibetan antelope is reported from Daulet Beg Oldi (DBO) in Karakoram (Nubra) wildlife sanctuary and Changchenmo Valley of Changthang cold desert wildlife sanctuary in ladakh. Within the Indian limits these are the only sites supporting a relic population of chiru.

Wild yak and Tibetan antelope population globally diminished because of hunting, loss of habitat and other anthropogenic pressures during the last some decades. Recognizing the urgent need for the conservation of these species the Jammu and Kashmir Government made an amendment in the J&K wildlife protection Act in the year 2002, banning hunting of wild animals and trade in chiru products like shahtoosh (under wool) and initiated surveys in these areas to formulate management strategies for the conservation of these depleting species and their habitat.

Scientific research, surveys and comprehensive studies are indispensable for long term conservation of species facing the threat of extinction. The Present survey conducted by the Wildlife Protection Department in DBO and Changchenmo valley in north-eastern Ladakh is of significant importance for the future planning process and implementation of the species recovery plan.

The present report is based on a recent survey conducted by a team of officers and the field staff of the Wildlife Division Leh in Changchenmo valley and DBO in high altitudes

of north-eastern Ladakh. I appreciate the efforts of Sh.Jigmet Takpa, Conservator of Forests (Wildlife) Ladakh, Leh ,Sh. Tahir Shawl Wildlife Warden, Wildlife Division, Leh and the staff of the Wildlife Division Leh who spent time in harsh climatic conditions at such desolate, remote, inaccessible and difficult topography for conducting this exercise.

Although the chiru is considered as the key stone species of Changthang ecosystem special efforts and measures are required to ensure the survival of many other rare and endangered species including wild yak, Tibetan gazelle, ladakh urial and snow leopard in Ladakh trans-Himalayan cold desert ecosystem.

It is indeed expected that the results of the survey shall go a long way in the conservation of the highly endangered species of the high altitude biodiversity.

(A K Srivastava) IFS
Chief Wildlife Warden
Government of Jammu & Kashmir

acknowledgment

The survey conducted in Changchenmo and Daulet Beg Oldi involves the support and help of many people including security forces. We express our heartfelt gratitude to Sh. A. K. Srivastava the Chief wildlife Warden, Jammu and Kashmir Government, for encouraging and supporting us to take up this exercise.

Our special thanks are due to Sh.Hilaluddin Khan, a staunch field biologist and member IUCN for helping us in analysis of the data.

We also place on record our special thanks to Sh.J.V.S Singh, the then Deputy Inspector General Indo-Tibetian Border Police (ITBP) Leh, for facilitating our survey by helping and providing us with logistic help in Changchenmo valley. The ITBP officers and officials at Phobrang, Tsokshalu and Hot spring camps received us with warmth and guided us in the area for which they deserve our appreciation and thanks.

Sh. Abdul Rauf Wildlife Range Officer Leh, Sh.Tsering Angchok Wldlife Range Officer Changthang, Sh. Tsering Angchok-II, Wildlife Range Officer Durbok Block, assisted in making necessary logistic preparations and finalization of the survey progamme. We extend our thanks to them.

Sh. Tsering Angchok-II, Sh. Tsering Phuntsog, Sh.Tashi Tsering, Sh. Sonam Norbu, Sh. Smanala Tsering, Sh.Tsewang Rabgais, Sh.Tsering Phuntsog-II, Sh.Mohd.Omar, Sh. Tsering Angchok (Nubra) and Sh.Sonam Gyalsan of Wildlife Division Leh worked with dedication and sincerity in harsh and tough condition as survey teams in the field. Their hard work and dedication is acknowledged with special thanks.

Last but not the least we are thankful to Sh. Ashwini Upadhyaya, Researcher wildlife Institute of India for his association and involvement in this survey in the field at Changchenmo Valley.

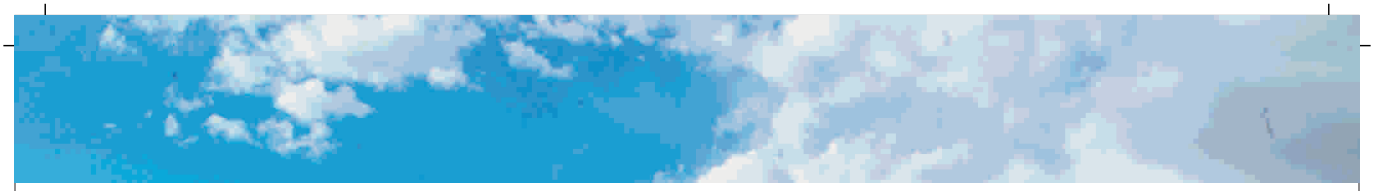
Executive Summery

The state of Jammu and Kashmir is represented by the biogeographic zone 1A. Ladakh, the northern most part of India represents the Trans Himalayan region of Jammu and Kashmir. It covers more than 92000 Sq. kms of the geographical area of Jammu & Kashmir. Being high altitude cold desert region it experiences harsh climatic conditions which include extreme low temperature and very low rainfall leading to low environmental productivity. This cold desert region appears barren with low number of wild animals per surface area. Nevertheless, more than 700 species of plants, predominantly herbs and shrubs, have been reported from this region. The vegetation growth starts in the month of April with the melting of snow, it is on its full bloom in the month of July August and starts disappearing by the end of September.

Thirty three species of mammals are known to have been reported from Ladakh. Two species of mammal viz., Himalayan weasel and musk deer have not been reported after 1960 (Otto Pfister, 2004).However, as per the reports of locals musk deer is still sighted in Kargil district of Ladakh region. The avifauna, most of which is migratory and vary seasonally, is quite rich representing about 276 species. Within the India limits this region is the only area that provides breeding ground to the black-necked crane, the state bird of Jammu and Kashmir and bar-headed geese.

The fauna of eastern Ladakh has affinity with the Tibetan Plateau species. The central and western parts of this region are influenced by the Himalayan and central Asian species. Ladakh region supports the richest wild sheep and goat community represented by eight species and subspecies all of them being listed under schedule 1 of the Jammu & Kashmir Wildlife Protection Act (Amended 2002).

The major part of Indian cold desert region belongs to Ladakh in Jammu & Kashmir followed by Lahaul-Spiti in Himachal Pradesh. Ladakh being the highest inhabited plateau of the world is known for its inaccessible remoteness and cold climatic conditions. Due to increasing settlement more and more areas are coming under human pressure. Ungulate species are widely distributed but their densities are decreasing mainly by heavy grazing pressure from local herders.

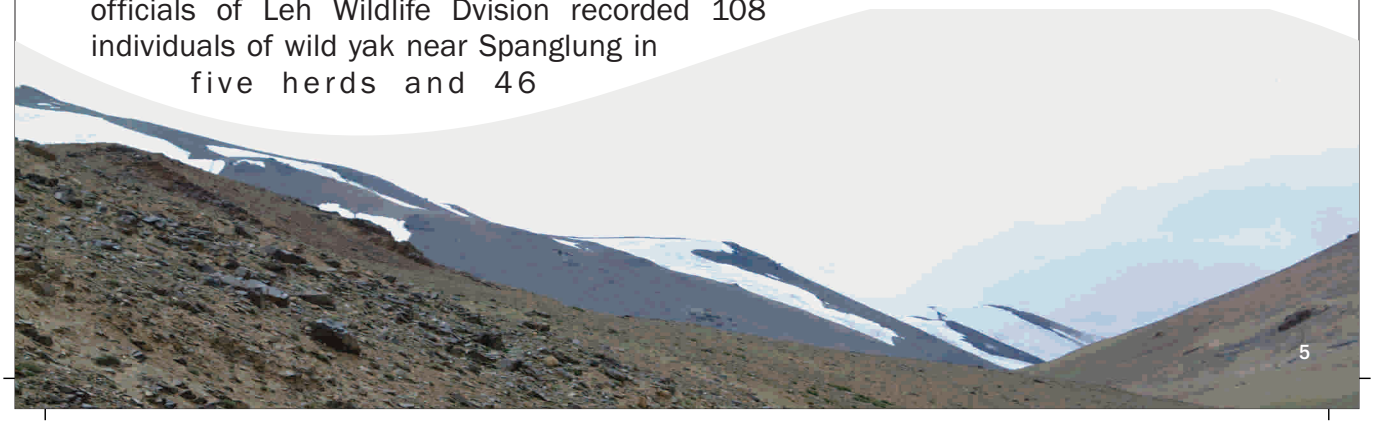


Changchenmo valley in Changthang wildlife sanctuary and Daulet Beg Oldi (DBO) in Karakorum (Nubra) wildlife sanctuary in North -Eastern Ladakh are the western most range of highly endangered species of Tibetan antelope (*Panthelops hodgsonii*) or chiru and Wild yak (*Bos mutus*).Outside the Tibetan plateau in China chiru is found only at these two sites within Indian limits. Being one of the hardiest animals of the world it occupies alleviations ranging between 3200 meters and 5,500 meters. It can withstand temperature as low as minus 40C.

In the beginning of the century the global population of the chiru was estimated at around one million individuals which dwindled drastically due to large scale killing mainly for its under wool known as shahtoosh used for making shawls which command attractive price in international market. It is reported that about 4 to 5 chiru are killed for making one shahtoosh shawl. It is believed that the present population of chiru in the world today is between 75000 to 100000 individuals (personal communication with Mr. Schaller at Leh, 2008).

The Department of Wildlife Protection , Jammu and Kashmir Government, realizing the need for long term conservation of chiru and wild yak in North Eastern Ladakh initiated surveys for determining status and distribution of these endangered species. This report is based on the survey and census conducted by the Leh Wildlife Division during the months of August and September 2007 in Changchenmo valley and Daulet Beg Oldi respectively. Although the main objective of the survey was to record the presence of the species mainly ungulates at these two sites the chiru was the focus of this exercise. A total of 320 individuals of chiru were recorded at both these site of which 270 were recorded from DBO and 48 from Changchenmo valley. The Changchenmo population comprised of all males while in DBO male, female and fawn were sighted. The detail of the species encountered at both the sites has been discussed in the following pages.

Only two wild yaks were recorded in Changchenmo valley during this survey. However during a subsequent visit to Changchenmo valley in August 2008 (with Dr.Ranjit Sinh and Dr Asad Rehmani for road survey) the wildlife officials of Leh Wildlife Dvision recorded 108 individuals of wild yak near Spanglung in five herds and 46



individuals of argali near Sirlung Burma(Takpa jigmet and Tsering Angchok, personal communication). Again around 200 individuals of wild yak were sighted by wildlife Daily Wager in December 2008 in Kukrang nallah in Changchenmo valley (Tsering Angchok Range officer, personal communication).

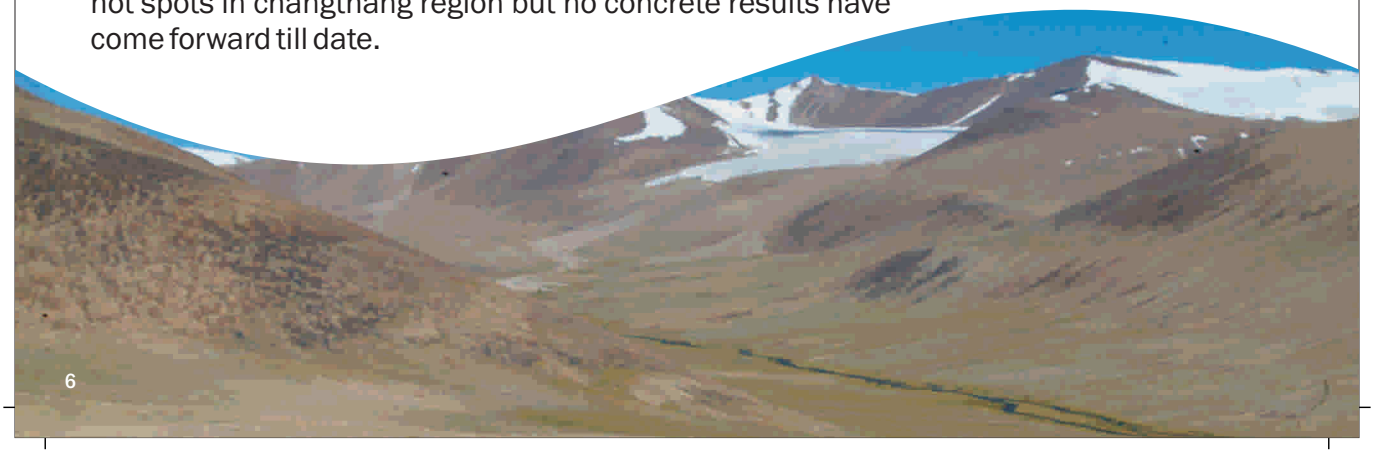
Further recent reports by the local herders suggest the extension of wild yak range in Changchenmo valley towards Marsmikla as 10 individuals of wild yak were sighted by the herders near Marsmikla during December 2008. As per their reports these 10 individuals stayed near Marsmikla area for about a week.

It is pertinent to mention here that during this survey Tibetan argali (Ovis ammon) were sighted for the first time and photographed in Changchenmo valley. Only indirect evidences of the presence of argali were recorded earlier from this area.

Intensive studies are required further to ascertain firmly whether the population of chiru at these two sites is migratory or resident as there are some unconfirmed reports about the presence of chiru at these two sites during winter also.

A collaborative study involving Chinese conservationists across the border would pave the way for long term conservation of chiru and wild yak and result into formulation of comprehensive management planning.

The presence of dogs at these two sites near security camps is a matter of serious concern and needs to be tackled on priority basis. These dogs thrive on the left over food thrown by security personals near their camps. They chase many ungulate species including chiru and also cause damage to them with serious injuries some time leading to death. They have also been seen to dig out marmots and pikas from their burrows and kill them. The matter was discussed with the security personnel including the higher authorities of ITBP at Leh to get rid of the menace of dogs at such important conservation hot spots in changthang region but no concrete results have come forward till date.



Introduction

Ladakh region receives very little precipitation and experiences extreme cold and arid climatic conditions. This accounts for low productivity, sparse vegetation cover and typical alpine characteristics. Wild animals occur in low densities and need larger areas to maintain their viable populations. Both animals and plants have adapted themselves in order to overcome extreme environmental hardships. Although the region is not as rich as many other bio-geographic regions of the country but behavioural, morphological and ecological adaptations among species makes unique assemblage. Understanding of such unique assemblages will help the local management authorities to manage such a fragile and low productive ecosystem.

Floristically, the region is treeless expanse and available plants are generally found growing along the river margins, or in moist rock crevices due to scarcity of the precipitation (Awasthi 1997). There are three main elements in the flora of Ladakh viz. alpine, desertic and oasitic (Stewart 1916). The alpine herbs grow in the belt along the edges of melting glaciers and never spread to the exposed slopes. The main flora of Ladakh is desertic type that covers the upper slopes and valleys, and has close affinities with the floras of Tibet and Siberia (Awasthi 1997). The characteristic feature of the vegetation is the cushion like habits of plants which is an adaptation for cold dry winds and blizzards (Kashyap 1925). Although cushion species specifically, *Acantholimon lycopodioides, Caragana pygmaea* and *Thylacospermum rufifragus* grows in abundance in the region but do not make up a large component of the species diversity. The oasitic mesophytic includes a few tree forms like *Acer, Juniperus, Elaeagnus, Populus* sp., *Prunus* sp., etc. along the river margins. The other common plants are *Anaphalis nepalensis, Anemone tetrasepala*, *Polygonum affine, Primula rosea, Taraxacum officinale, Trollis acaudatus*, etc. The Nubra valley, north of Leh, has stunted shrubs of *Berberis ulicina* and *Rosa webbiana* and trees of *Prunus armenica, Populus* sp., *Salix* sp. and *Ulmus* sp. (Naqshi *et al.* 1989).

Despite the low productivity and sparse vegetation cover, fauna of Ladakh is diverse and rich in wild ungulates and species of smaller mammals. Animal occur in extremely low densities in Ladakh, yet the region has local concentrations of palaerctic fauna comparable with any region in the world (Hilaluddin 1997). They have wide distribution in the

Tibetan plateau and extends in the Trans Himalayas inside Indian Territory and thus occupy larger ranges to maintain viable populations. Consequently, their habitat requirements may be hundreds rather than tens of square kilometers to encompass summer and winter dispersal areas (Rodgers & Panwar, 1988). So far 20 mammal species (Hilaluddin 1997) and over 225 bird species (Chundawat & Rawat 1994) have been reported from Ladakh region.

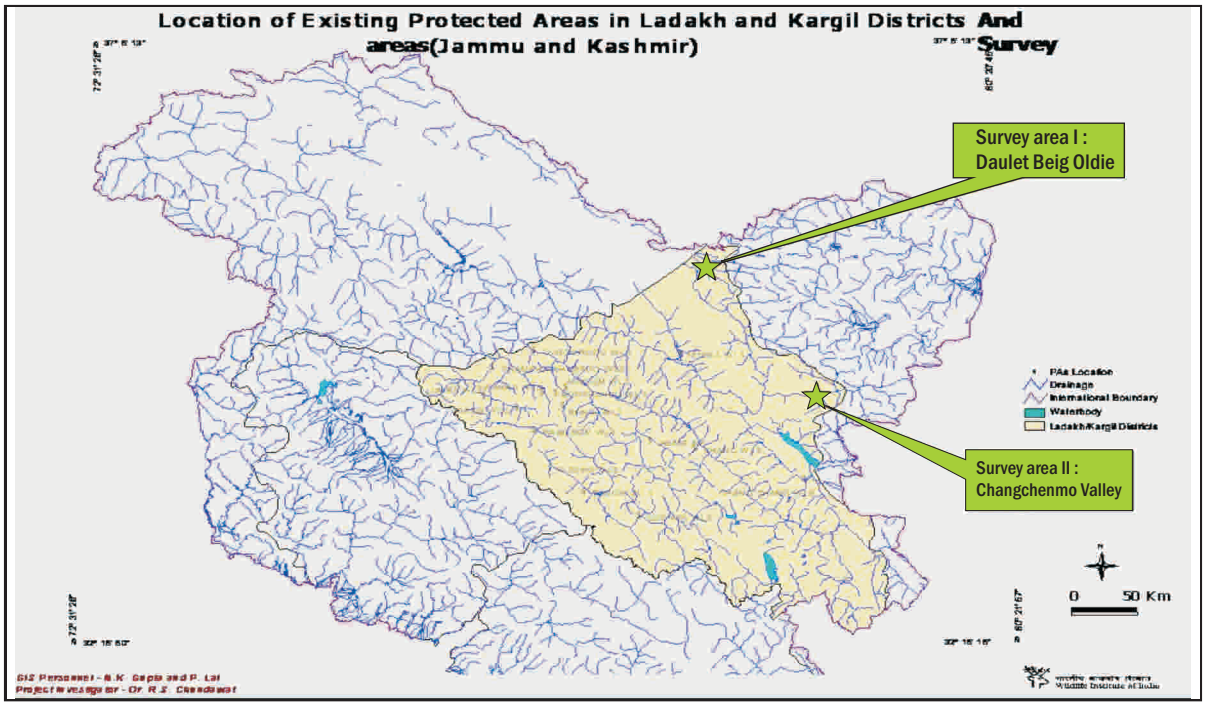
The prevalent harsh environmental and ecological conditions in the region have induced several morphological and physiographical adaptations among the animals, specifically small body size, darker coloration, thick fur, thick and bushy tail, large nostrils and hibernation. Snow leopard (*Uncia uncia*) and Tibetan Wolf (*Canis lupus chanco*) represent species that have undergone such adaptations. These adaptations not only facilitate evolution as is evident in some families of mammals but also bring about speciation of genera into number of species and subspecies. Ladakh together with the mountains of Tibet and Pakistan supports the most diverse wild sheep and goat communities in the world with eight distinct species and subspecies. Although life in this zone is well adapted to local harsh environment conditions but developmental activities and presence of nomadic pastorals and local graziers with their large number of livestock have adversely affected the native wildlife. The survival of many species is threatened because of their low densities, small and isolated populations, and further degradation of their already fragile habitats.

Most of the information on the fauna of the region is available in the form of anecdotes or simply natural history observation (please see Hilaluddin 1997 for review). However, in the recent past few status surveys and ecological

studies were conducted (please see Chundawat & Rawat 1994 for review) which provided crucial information on the distribution and status of few animal species found in the region and such information on other equally important animal species either remained fragmented in the region or is lacking. Therefore, present survey was undertaken to fill the existing gap.

Study Area

The survey was carried out in Changthang (Changchenmo Valley) and parts of



Karakoram Wildlife Sanctuary. Both the surveyed areas are free of human habitations mainly due to security reasons and are accessible only during the months of July to October on foot.

The survey team specifically, walked through the valleys and hills around Changchenmo valley, Hotspring, Kugrang area, Marsmik la, Bahu Nallah, Silung Yogma, Silung Barma & Hotspring area, Tsoktsalu area,

Marsmik la area and Line of Control (LoC) nullah within Changthang (Changchenmo valley) area . The Changchenmo valley is bounded by river Changchenmo and hills in the north, Silung Burma in the east, Silung Yogma in the west and hill ranges in the south between Silung Burma & Silung Yogma nullahs.

Within Karakoram Wildlife Sanctuary, the survey team covered three major sites viz. Daulat Beig Oldi (DBO), Gapstian and Depsang plains. The survey team specifically, traveled across Chongtash area, Dipsang plains, Pollu, Upper Chip Chang, behind Chip Chang, Gapstain, Trek junction, Trek junction Lake area and upper Trek area. The DBO is situated south of Karakoram Range at the Indo-China border and therefore is under direct administration of Indian military forces. The Karakoram nullah drains the catchment southwards and meets the DBO nullah and Chip Chap river flowing westwards to fall into the Shyok river, which originates from the Rimo glacier. The Depsang plains lie east and south of Gapstain - an area contiguous of DBO. The Depsang plains fall eastwards towards and across the Line of Actual Control (LAC) into the Aksai Chin area.

Methods

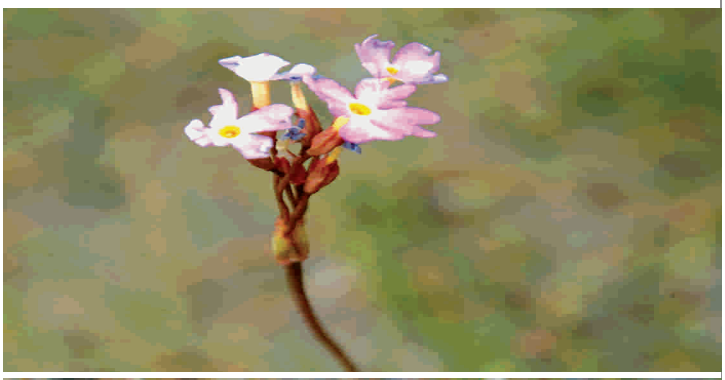
Animal survey

The animals were counted by two teams each in two survey locations with the assistance of binoculars and spotting scope. Both survey teams worked independently but used similar data collection method and formats. The survey teams walked along transects through reported

animal habitat to scan for animals (appendix1). Sometimes, ridges were used as vantage points to scan the area. Once an animal was sighted, the time of animal sighting, location of animal, its geographic coordinates and number, age and sex composition of herd, degree of slope, elevation, aspect and habitat attributes were recorded. Starting time and end time of each monitoring trip was also recorded. The distances covered during transect monitoring were recorded using Global Positioning System (GPS). In addition indirect evidences such as pellets and hoofmarks were also recorded in order to document occurrence of animals (appendix 2a). The defense personnel posted in the study area were also interviewed to obtain information about the animal species, specifically for period beyond survey duration. A total of five transects were monitored for animal abundance in Changthang area, whereas 11 transects were monitored in DBO area of Nubra Valley.

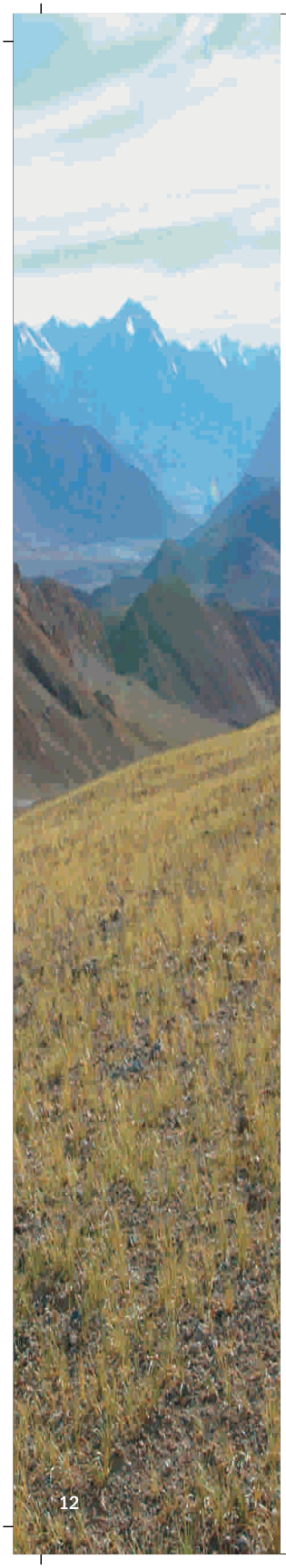
Vegetation survey

The composition of shrubs and herbs within each transect was also assessed. For this purpose, 5 sample points along each transect were selected at 500 meters regular distances on 15 meters either side of the transect in order to avoid relatively disturbed vegetation in the form of trampling by cattle and humans. Circular plots were established for shrubs (3 m radius), respectively; whereas, 1 m X 1 m square plots were established for quantifying populations of



Data analysis

Animal encounter rates per km transect walk at a given day were calculated as the total number of individual of a species seen on a particular transect on that particular day divided by the total distance walked by the observer on that transect. The mean encounter rates of each species with standard error of the estimates are produced. The vegetation densities per unit area were calculated as the total number of individuals of each species for the area sampled.



Results

Status and distribution of animals

A total of 10 species were recorded during the survey. Animal species sighted and encounter rates of animals are given in table 1. Within Changchenmo valley, 0.28 mean Blue sheep (*Pseudois nayaur*) ± 0.19 SE per km transect walk were sighted, whereas they were encountered at 0.29 mean Blue sheep ± 0.19 SE per km transect walk in DBO area. Chiru (Pantholops hodgsoni) were more commonly sighted in DBO area (2.54 mean chiru ± 0.63 SE per km transect walk) as compared to Changchenmo Valley (0.33 mean chiru ± 0.13 SE per km transect walk).

A total of 320 Chiru (272 from DBO and rest from Changchenmo valley) were observed as part of the present survey. The largest seen herd of chiru from DBO is 59 individuals at Gapstain followed by 56 in upper Chip Chap area and 46 heads at Trek junction area, whereas the largest herd size in Changchenmo Valley area is 16 individuals. The overall number of chiru sightings averaged 7.8 ± 1.01 SE (Changthang: 5.33 mean ± 1.65 SE; DBO: 8.5 mean ± 1.2 SE). The chiru were always recorded between 4,443 m and 5,137 m elevation from MSL during the survey.

A total of 45 (30 in Changchenmo valley and rest in DBO area) Blue sheep were recorded by the survey team. Within Changchenmo valley, the largest herd comprised of 17 individuals and was seen at Tsoktsalu. The remaining herds were seen at LoC area. In DBO area, the largest herd comprised of 15 individuals was recorded from Bursey and smallest herd comprising of 10 individuals was seen at Chong Tash.

During the present survey, 73 kiang (*Equus kiang*) on nine occasions were recorded from Changchenmo valley. The largest seen herd of kiang was 27 individuals. The survey team neither sighted kiang from DBO area nor recorded its presence through indirect evidences. Similarly, a total of 42 Tibetan argali (Ovis ammon) were seen in Changchenmo Valley area. The largest herd comprising of 14

individuals of Tibetan argali was recorded from LoC area. About 69% sighting of this species were from LoC area alone. The other animal sighting area of Tibetan argali are Marsmik la Pass and Silung Yogma.

The survey team recorded two male wild yaks one each from Silung Yogma and Silung Barma area within Changchenmo valley. However, survey party recorded hoofmarks and dung piles and other indirect evidences of its existence around Kugrang river and Changchenmo river beds. The survey team could neither sight any wild yak in DBO area nor could record any evidences of its existence therein. Very recently, a herd comprising of 200 wild yaks has been seen from Changchenmo valley during August 2008 (See executive summary).

From the present data, it is not possible to estimate age and sex composition of kiang because the observers either could record only male herds on few occasions or could not distinguished sex and age of individuals during most of the sightings as animal escaped in no time. Similarly, the herd composition (age and sex ratio) of wild yak could not be determined because of limited sightings of wild yak during the present survey. Also, detailed information are lacking on age and sex composition of wild yak in literature.

Age and sex ratio of animals

The overall group composition of chiru in the study area is 1.67 adult males: 1.71 adult females: 1 yearling (Changchenmo: 23 adult males: 0 adult females: 1 yearling ; DBO: 0.86 adult males: 1.67 adult females: 1 young) with an average sightings of 1.66 mean adult males ± 0.65 SE: 1.71 average adult females ± 0.76 SE: 1 mean young ± 0.33 SE (Changchenmo valley = 23.23 mean adult males ± 1.64 SE : average 0 adult females : 1 mean young ± 0.21 SE; DBO = 1.15 mean adult males ± 0.69 SE: average 1.67 adult females ± 0.93 SE: 1 mean young ± 0.39 SE). The analysis of the present data buttressed by field observations revealed a male biased sex ratio of chiru with 1 adult mean male ± 0.65 SE : mean adult 1.03 female ± 0.76 SE (Changchenmo valley = 5.11 mean adult male ± 1.67 SE : 0 mean adult female ; DBO = 1 mean adult male ± 0.69 SE : 1.45 mean adult female ± 0.93 SE).

The herd composition of Tibetan argali within Changchenmo valley was 4.51 mean males : 5.02 adult females : 1 young with an average sightings of 2.57 adult males ± 0.92 SE : 2.86 adult females ± 1.07 SE : 0.57 young ± 0.43 SE. The analysis of the sex data revealed a female biased sex ratio of 1 adult male : 1.11 adult females.

The overall group composition of Blue sheep in the study area is 1.42 adult males : 3.42 adult females : 1 young (Changchenmo valley: 1 adult male : 1.62 adult females : 1.12 young; DBO: 3 adult males : 9.33 adult females : 1 young) with an average sightings of 4.25 adult males ± 1.46 SE : 10.25 adult females ± 2.63 SE : 3 young ± 0.47 SE (Changchenmo valley = 4 adult males ± 1 SE : 6.5 adult females ± 1.5 SE : 4.5 young ± 0.51 SE; DBO = 4.5 adult males ± 2.5 SE : 14 adult females ± 1 SE : 1.5 young ± 0.47 SE).The present data suggest female biased sex ratio of 1 adult male : 2.41 adult females (4.25 mean adult ± 0.99 SE : 10.25 adult females ± 2.03 SE) of Blue sheep in the study area. Within Changchenmo valley, 1 adult male : 1.65 adult females (4 mean adult males ± 1 SE : 6.5 mean adult females ± 3.5 SE) was observed. The analysis suggest a female biased sex ratio of 1 adult male : 3.11 adult females (4.5 mean adult males ± 0.99 SE : 14 mean adult females ± 1 SE) within DBO area.

Vegetation structure and composition

A total of 11 plant species were recorded during the present survey (table 2). *Cheno podium* occupied the dominant status in the niche, showing maximum density in the region. *Scorzonera virgata* followed by *Arrebia gullata* occupied co-dominant status in the vegetation spectrum. Other species occurred in low densities and their contribution to the niche is negligible, although they do add to floristic diversity of the region.

Discussion

The present survey recorded five ungulate species from the region and all of them are listed under Schedule I of the Indian Wildlife Protection Act 1972, Jammu & Kashmir Wildlife Protection Act (Amended upto 2002) and in appendix I of CITES. This gives an indication of the precarious status of wild animal species found in the region and the conservation significance of the region. There are several species of wild animals that are at the verge of local extinction process due to excessive hunting by other then natives of the region in the past, and lately because of severe competition with livestock and loss of habitat due to increasing human and livestock populations (Ranjitsinh 1981; Osborne et al. 1983).

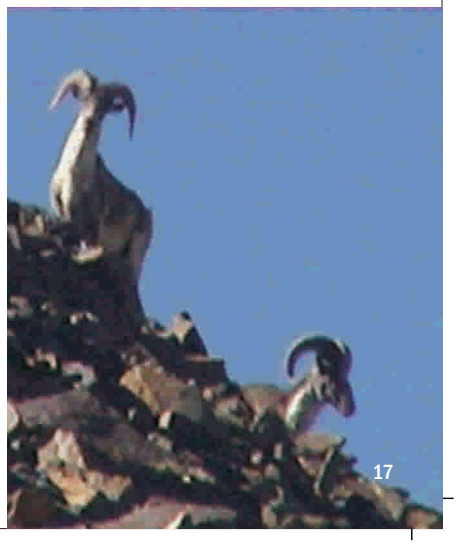
The **Tibetan antelopes** alias chiru still follow their traditional routes to Aksai-Chin area in small numbers in the eastern Ladakh (Fox et al. 1991; Hilaluddin 1997) but are vulnerable to hunting specifically by the para military forces present in the region (Chundawat & Rawat 1994). The chiru is listed threatened with extinction in the IUCN Red Data List (IUCN, 2004). The species inhabits an area of approximately 1,600 km across the Tibetan Plateau with its eastern limit near Ngoring Hu (China) and the western limit in Ladakh, India (Prater 1980) in between 3250m in Xinjiang Tula valley and above 4,000 in the Depsang Plains in northern Ladakh upto 5,500 m elevation (Roosevelt & Roosevelt 1926). The Tibetan Plateau includes most of the Chinese Province of Qinghai, part of the northwestern Sichuan Province, the southwestern part of Gansu Province, and the southern bordering areas of Xinjiang Uygur Autonomous Region, and entire Xizang area in Tibet Autonomous Region (Schaller 1993). The age and sex ratio of chiru varies with the climatic conditions, specifically snowfall (Schaller 1998) mainly due to mortality among calves (Schaller 1993). Group composition (38% males, 39% females, 23% young) of chiru recorded as part of the present study is contrary to Schaller (1998), who reported group composition of 29% males: 53% females: 18% young from central and east Changthang in China.

Among the other ungulates kiang is locally abundant in the Tibetan Plateau region with over 1500 numbers in entire Ladakh (Fox et al. 1991). The kiang so commonly

occurs in the valley of Tibetan Plateau that it is reported to be adversely affecting the pastures used by Chang-pa, for their flock of sheep, goats and domestic yak (Hilaluddin 1997), who have been utilizing these pastures for centuries. The unusual congregation of kiang in these pastures has brought the species in direct conflict with nomadic herders of the region (Chundawat & Rawat 1994). There are two sub-species of kiang found in the Indian Trans Himalaya. The western kiang (Equus k. kiang) is in the Changthang region and parts of Spiti and the southern kiang (Equus k. ploydon) in Sikkim. They inhabit wide open valleys with gentle rolling slopes at an average elevation of 15000 feet. With ever increasing developmental activities in the region, kiang populations are pushed to few remote valleys, where they congregate in large numbers.

Yak (Bos mutus), listed as Vulnerable in the Red Data List of IUCN 2004 due to its indiscriminate hunting for meat and wool (IUCN 2004), have also been hunted in the region from Chang Chenmo valley in the past (Dhar & Gaur 1983). Recently, a small population of around 200 wild yaks has been reported from Chang Chengmo valley by the staff of Wildlife department in Dec. 2008. Historically, the species also inhabited north-east Siberia and reached south to the headwaters of the Hwang Ho and Yalang rivers in the Province of Tsinghat. However, wild yaks are is presently restricted to the highlands of the Tibetan plateau, Qinghai province, Tibetan & Xinjiang autonomous regions and the Quilian mountains in the Gansu province; extending from Karakorum in the west, eastward along the south slope of the Altai Tang over the Kunlun mountains to the Nanshan mountain (Dyblor 1957; Belyyar 1980; Flerow 1980; Olsen 1991; Lu Zhonglin & Li Kongliang 1994). Some populations of wild yak have also been reported in the high ranges in some parts of Kumaon and Himachal Pradesh (Bedi, 1984; Gupta & Kumar 1994; Alfred et al 2006) and Nepal (Schaller 1998). Thus, more systematic surveys are required to estimate its actual status in the wild in India.

Tibetan argali or nayan (Ovis ammon hodgsoni) is the largest of all the wild sheep and is the only subspecies of argali mentioned in Appendix I of CITES. Partial to very open, smooth and rolling slopes, it has a very limited distribution within Indian Territory, only close to the Tibetan Plateau. The species occurs at very low densities in the region, seldom reaching 0.5 animals per km^2. Its largest known population (75-90 individuals) of this species is found in a small valley near Gaya and Meru in the region (Chundawat & Rawat 1994).



Fox et al. (1991) estimated that not more than 200 individual survive in Changthang area of Ladakh. The species is also known to occur in parts of Spiti (Himachal Pradesh), Uttranchal and Sikkim (Prater 1980) but nothing is known about its status therein. Therefore, systematic surveys are required to estimate its actual status in the region.

Blue sheep is one of the common ungulate found in the region. The name Blue sheep is more a misnomer, as it is neither blue in colour nor a true sheep. This species belong to genus Pseudois represented by two species worldwide. Only Pseudois nayaur inhabits Indian Territory. Blue sheep has a contiguous distribution in the Indian Himalaya ranging from Ladakh (Jammu & Kashmir) in the west, Spiti in Himachal Pradesh and parts of Uttranchal, to northern Sikkim in the east in areas with rolling slopes and wide valleys in extremely low densities (Prater 1980) within 65,000 km^2 geographical area (Chundawat & Rawat 1994). This species has also crossed the Himalayan range where its distribution is very patchy. Schaller (1977), Fox et al. (1991) and Chundawat (1992) has estimated its densities ranging between 1.5 to 2.5 individuals per km^2 in the Trans Himalaya. According to Chundawat & Rawat (1994), the total population size of Blue sheep may be between 20-25 thousand in entire

Table 1.
Wild animal abundance in Changchenmo Valley of Changthang cold desert wildlife sanctuary and Daulet Beg Oldie of Karakoram (Nubra) Wildlife Sanctuary recorded during the survey.

Species		Encounter rates (# of animals seen/km walk)			
		Chang Chenmo Valley		DBO	
Common name	Scientific name	Mean	SE	Mean	SE
Blue sheep	*Pseudois nayaur*	0.28	0.19	0.29	0.19
Chiru	*Pantholops hodgsoni*	0.33	0.13	2.54	0.63
Long-tailed marmot	*Marmota caudate*	0.11	0.06	0	
Plateau pika	*Ochotoma curzoniae*	0.11	0.11	0	
Tibetan argali	*Ovis ammon*	0.32	0.22	0	
Wild ass	*Equus kiang*	0.48	0.26	0	
Wild yak	*Bos mutus*	0.02	0.01	0	
Tibetan wolf	*Canis lupus chanco*				
Wooly hare	*Lepus capensis tibetanus*				

Table 2.
Vegetation abundance in Chang Chenmo Valley recorded during the survey.

Species	# of plants per hectare	
	Mean	SE
Arnebia gullata	108.88	47.14
Artemissia biennis	54.44	36.85
Cassiope fastigiata	81.66	43.04
Chenopodium peidica	244.97	61.87
Christolea crusiifolia	190.53	50.92
Cyprus sp.	81.66	43.04
Danuncullus brotherusii	27.22	27.22
Delphinum cathmerianim	81.66	43.04
Ephedra gavardiana	54.44	36.85
Myricaisia rosea	81.66	43.04
Nepeta podastachys	54.44	36.85
Pottentilla anserine	81.66	43.04
Rhodiolo himalensis	27.22	27.22
Scorzonera virgata	136.10	49.69
Stipa sp.	81.66	43.04
Tanacetum tibetum	81.66	43.04

Appendix 1.

Details of transects walked in the study area

Transect #	Location	Transect feature		
		Start point	End point	Locality
1	Chang Chenmo Valley	Phobrang	Marsamik la	Marsamik la
2	-do-	Marsamik la	Bahu Nullah	-do-
3	-do-	Hotspring	Konka la	Hotspring area
4	-do-	Hotspring	LoC Nullah	LoC area
5	-do-	Hotspring	Silung Yogma	Silung Yogma
6	-do-	Silung	Kugrang	Kugrang area
7	-do-	Yogma Hotspring	Silung Burma	Hotspring area
8	-do-	Marsamik la	Tsotsalu	-do-
9	DBO area	Chong Tash	Bursey	Chong Tash area
10	-do-	DBO	Dipsang Plains	Dipsang area
11	-do-	DBO	Baltipollu	Baltipollu
12	-do-	DBO	Upper Chip Chap river	Chip Chap area
13	-do-	DBO	Behind Chip Chap river	-do-
14	-do-	DBO	Gapstian	Gapstian area
15	-do-	DBO	Trek Junction	Trek Junction
16	-do-	TTrekjunction	Lake area	-do-
17	-do-	Lake	Upper Trek	-do-

Appendix 2a. Changchenmo survey Team members

S. No.	Name	Designation
1	Tahir Shawl	Wildlife warden, Leh
2	Tsering Angchok-II	Wildlife Range officer
3	Tashi Tsering	I/C Forester
4	Sonam Nurboo	Wildlife Guard
5	Smanala Tsering	----do-----
6	Tsewang Rabgais	----do-----
7	Sonam Gyalsan	Driver

Appendix 2b. Daulet Beg Oldi survey Team members

1	Tsering Phuntsog-II	Wildlife Forester
2	Tsering Phuntsog-I	Wildlife Guard
3	Mohd. Omar	----do-----
4	Tsering Angchok	----do-----

Appendix 3. List of Mammals encountered during the survey period in Changchenmo valley and DBO area

SL no.	Species	Distribution	
		Karakorum (DBO)	Changchenmo valley
1	Tibetan antelope (Chiru)	246	48
2	Argali or Nayan	-	42
3	Blue Sheep	40	30
4	Wild Ass (kiang)	-	67
5	Wild Yak	-	2
7	Tibetan Wolf	1	-

Note: Other mammals encountered include Tibetan Wholly Hare, Tibetan Marmot&Pika

Appendix 4: List of plants recorded from Karakoram (DBO) and Chang Chenmo Area

Species Name	Karakorum(DBO)	Changchenmo
Alyssum canescens		√
Androsace robusta		√
Arenaria bryophylla		√
Arnebia euchroma		√
Arnebia guttata		√
Artemisia brevifolia		√
Artemisia salsoloides		√
Artemisia sp.4	√	√
Astragalus nivalis		√
Astragalus sp.		√
Astragalus sp. 2		√
Brassicaceae		√
Calamogrostis holciformis		√
Carex moorcroftiana		√
Carex sp.		√
Chenopodium sp.	√	√
Christolea crassifolia		√
Christolea sp.1		
Chrysanthemum pyrethroides		√
Corydalis hendersonii		√
Corydalis moorcroftiana		√
Cremanthodium nanum		√
Crepis flexuosa		√
Delphinium brunonianum		√
Draba sp.		√
Draba sp.		√
Dracocephalum heterophyllum		√
Elsholtzia eriostachya		√
Elymus jacquemontii		√
Elymus schrenkianus		√
Ephedra gerardiana		√
Erodium tibeticum		√
Festuca sp.		√
Gentiana sp.		√
Gentiana prostrata		√
Heracleum pinnatum		√
Hippophae tibetana		√
Kraschenninikovia pungens	√	√
Kobresia schoenoides	√	
Leontopodium pusillum		√
Leontopodium sp.		√
Leontopodium sp.		√
Leymus secalinus		√
Lonicera semenovii		√

Marrubium lanatum		√
Myricaria prostrata		√
Nepeta longibracteata		√
Oxytropis humifusa		√
Oxytropis microphylla		√
Oxytropis sp.		√
Oxytropis tatarica	√	√
Pedicularis cheilanthifolia		√
Pedicularis rhinanthoides		√
Pleurospermum hookerii		√
Polygonum cognatum		√
Polygonum molliaeforme		√
Potentilla biflora		√
Potentilla multifida		√
Potentilla sp.		√
Potentilla sp.-3		√
Primula nutans		√
Pucciniella himalaica		√
Ranunuculus involucratus		√
Rheum sp.		√
Rhodiola sp.		√
Rhodiola tibetica		√
Salsola jacquemontii		√
Saussurea bracteata	√	
Saussurea glacialis		√
Saussurea glanduligera		√
Saussurea gnaphaloides		√
Scrophularia dentata		√
Sibbaldia tetrandra		√
Silene sp.		√
Stipa sp.		√
Tanacetum sp.		√
Tanacetum tibeticum		√
Taraxacum sp.		√
Thermopsis inflata		√
Thylacospermum caespitosum		√
Triglochin maritima		√
Waldhemia glabra		√
Waldhemia tomentosa		√

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