The yak population in Mongolia and its relation with snow leopards as a prey species

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Summary

There are currently about 1000 snow leopards in Mongolia with an overall density of 1.10 cats per 100 km^2 of occupied habitat. These cats occupy an area range of probably less than 90 thousand km^2. The snow leopards commonly use terrain that is extremely rugged, in the same habitat where yak graze and often unguarded. Consequently, they, along with horses, are often killed by snow leopard, more so than other large livestock. During our study, 168 faecal samples of the snow leopard were collected and analysed. Results show that ibex made up 38.7% of the total diet, small mammals 4.6%, red deer 2.4%, marmot 7.1%, and domestic livestock 31% (including sheep 17.3%, horse 5.4%, cow 4.8%, and goat 3.6%). In addition to prey, vegetation (14.9%) and soil (2.3%) were also found in the faecal samples.

Keywords: Mongolia, prey species, snow leopard, yak population

Introduction

The status of snow leopards in Mongolia has only been superficially dealt with prior to 1989 (Bannikov 1954; Bold and Dorjzunduy 1976; Mallon 1984; Zhirnov and Ilyinsky 1986; O'Gara 1988). The cat's approximate distribution in Mongolia is known but little information on snow leopard numbers is available. Dash et al. (1977) suggested that snow leopards generally occur in areas where ibex (*Capra ibex sibirica*) are present, and that the goat is a principal component of the cats' diet. Mallon (1984) concluded that snow leopards are widely distributed in the mountains of western Mongolia but are not common and have likely declined in numbers during this century. They were thought to occur in the Altai Mountains, the Khangai Mountains, the Hanhoohy Uul and Harkhyra ranges, and in isolated mountainous sections of the Trans-Altai Gobi (Mallon 1984; Schaller et al. 1994) with an area probably totalling less than 90 thousand km^2 (McCarthy et al. 2000).

Population estimates for snow leopards in Mongolia have ranged from a few hundred to more than 4000. It is believed that about 1000 currently exist with an overall density of 1.10 cats per 100 km^2 of occupied habitat. The habitat characteristics of the snow leopard population have also been assessed (Schaller et al. 1994). Yak graze in the same habitat as a snow leopard and are often left unguarded. Consequently, they, along with horses, are often killed by snow leopard, more so than other large livestock.

The yak population in Mongolia

Approximately 4.6% of the grazing land of Mongolia is located in the high mountain regions and is suitable for yak to graze. The average altitude is above 3700 metres above sea level (masl). Though the livestock population of Mongolia was relatively constant for 60 years, their numbers increased rapidly over the last 10 years (by

about a million/year, reaching 33.4 million in 1999) as Mongolia underwent a transition period from socialisation to the market economy and as livestock became privatised. The number of yak also increased in this period, by 42.5% between 1994 and 1999, so that there are now 813,300 yak registered in Mongolia. The main population of yak are located in the high Altai Mountain range, the Khangai Mountain range and the Kharkhiraa and Khovsgul mountains. In the Gobi Altai Mountains and Gurvansaikhan, there also is a limited number of yak in the higher pastures.

Snow leopard diet analysis—methodology

Field surveys to determine snow leopard diets have been undertaken in Mongolia for the last decade, especially in western and southern Mongolia where snow leopards predominate. During these trips, 168 snow leopard faecal samples were collected and analysed.

Collected faeces were dried out in the air directly after collection in the field, and stored into bags. To ensure that samples were authentically from snow leopards, they were collected adjacent to snow leopard signs such as scrapes and scent sprays or claw rakes. At the laboratory the remains of prey species were separated and dried. To identify hair remains, hair samples were collected from domestic livestock, live wildlife and stuffed specimens in museum collections, and used to prepare original slides for identification following the methods outlined by Teerink (1991) and Oli (1993). The remains that could be identified were tabulated by species name. The remains of small mammals (in the form of bones, hair etc.) that could not be determined by species were simply classified under the general heading 'small mammals'.

Results and discussion

Snow leopards *(Uncia uncia)* in Mongolia mainly feed on ibex *(Capra ibex sibirica)*, argali sheep *(Ovis ammon),* pika *(Ochotona sp)*, hare *(Lepus tolai),* marmot *(marmota sibirica),* snowcock *(Tetraogallus altaicus)*, chukar *(Alectoris chukar)* and livestock (including yak). They sometimes also feed on Mongolian goitered gazelles *(Gazella subgutturosa),* red deer *(Cervus elaphus)*, roe deer *(Capreolus pygargus)*, young bears *(Ursus arctos)* and other wildlife. Bold and Dorjzunduy (1976) collected and analysed 50 faecal samples of snow leopards from the region of South Gobi, Tost Mountain. A total of 82% of the samples contained wildlife remains, mostly ibex hair[1].

1. Twelve samples contained the remains of grasshopper, ibex and vegetation; 12 samples contained chukar (*Alectoris chukar*) and blue hill pigeon *(Columbia rupestris)* remains; 3 samples contained hare remains; 8 samples contained mostly ibex hair; 9 samples contained vegetation remains; and 6 samples contained the brown colour remains of blood and meat of unknown animals.

Schaller et al. (1994) collected 29 faecal samples of snow leopard during a month-long-field survey. The main food items found were ibex (62.8%) and marmot (17.6%), in addition to yak (2.6%) and vegetation remains (17%). The results of Amarsanaa's (1985) study to determine the winter diet of snow leopards at Burkhan Buudai Mountain in the Altai Mountain ranges are tabulated (Table 1). The study was based on the analysis of 32 faecal samples.

Table 1. *Winter diet of snow leopards at Burkhan Buudai Mountain.*

Prey species	Cases	Percentage
Ibex	15	46.9

Chukar	4	12.5
Yak	4	12.5
Horses	3	9.3
Argali sheep	2	6.3
Hare	2	6.3
Pika	1	3.1
Snowcock	1	3.1
Vegetation	1	3.1

Source: Amarsanaa (1985).

In our study, a total of 266 remains of various food items such as bones, hair etc. were found in the 168 analysed samples of snow leopard faeces. Five samples (3%) of the total 168 contained the remains of three prey species, 53 samples (31.5%) contained the remains of two prey species, and 109 (64.8%) contained the remains of one prey species. We were not able to determine the content of one sample. The results of the analyses for both sites (see Table 2) show that ibex made up 38.7% of the total diet, small mammals 4.6%, red deer 2.4%, marmot 7.1%, and domestic livestock 31% (including sheep 17.3%, horse 5.4%, cow 4.8% and goat 3.6%). In addition to prey, vegetation (14.9%) and soil (2.3%) were also found in the faecal samples.

In this initial survey, snow leopard appear to feed mainly on ibex and small mammals. This result could partially be attributed to the fact that we collected snow leopard faeces in July, August and October (Table 2). However, we tried to determine roughly the age of 59 of the snow leopard faecal samples by season. Of this sub-sample, 12 were dated from the autumn, 6 from the winter, 6 from the spring, and 35 from the summer. Analysing this small amount of data by season proved to be difficult, but we present our preliminary results in Table 3. The seasonally disaggregated data suggest that snow leopards are feeding mainly on ibex and sheep during the winter, on sheep and horse during the spring, and on small mammals and ibex during the summer and autumn months.

Table 2. *Snow leopard diet in Uvs and South Gobi Provinces.*

	Uvs		South Gobi		Total	
Prey species	Cases	Percentage	Cases	Percentage	Cases	Percentage
Small mammals	35	46.7	43	46.2	78	46.4
Ibex	24	32	41	44	65	38.7
Sheep	19	25.3	10	11	29	17.3
Vegetation	15	20	10	11	25	14.9
Soil	3	4	9	9.7	12	7.1
Horse	2	2.7	7	7.5	9	5.4
Cow	3	4	5	5.4	8	4.8
Pika	–	–	10	11	10	4.4
Goitered gazelle	–	–	6	6.5	6	3.6
Goat	2	2.7	4	4.3	6	3.6
Marmot	2	2.7	–	–	2	2.7
Red deer	4	5.3	–	–	4	2.4
Birds	3	4	1	1	4	2.4
Insects	4	5.3	–	–	4	2.4
Hare	2	2.7	–	–	2	1.2
Roe deer	1	1.3	–	–	1	0.6

Ground squirrel	1	1.3	–	–	1	0.6
Unknown	–	–	1	1	1	0.6

Table 3. *Snow leopard diet by seasons.*

	Winter		Spring		Summer		Autumn	
Prey species	No.	Percentage	No.	Percentage	No.	Percentage	No.	Percentage
Ibex	4	67.7	–	–	13	37.1	7	58.3
Small mammals	1	16.7	1	25	16	45.7	7	58.3
Sheep	3	50	4	100	5	14.3	1	8.3
Red deer	–	–	–	–	2	5.7	1	8.3
Cow	1	16.7	–	–	1	2.85	1	8.3
Goat	–	–	1	25	2	5.7	–	–
Horse	–	–	2	50	1	2.85	–	–
Marmot	–	–	–	–	2	5.7	–	–
Birds	–	–	–	–	1	2.85	–	–

We attempted to calculate biomass used by snow leopards using the following formula:

$D = B \times C$ ($B = Y = 1.98 + 0.035 \times A$)

where A = average weight in kg; B = biomass per faeces sample in kg; C = number of samples containing a certain species; D = biomass of prey used.

In this case study we found that the main diet items of the snow leopard were ibex, small mammals, sheep and horse (Table 4).

Table 4. *Biomass used by snow leopards.*

Prey species	Average live weight (kg)	Biomass per faeces (kg)	No. of faeces containing species	Biomass used (kg)
Ibex	80	4.81	65	312
Small mammals	0.2	2	78	156
Sheep	30	3	29	87
Horse	140	6.9	9	62
Marmot	4.5	2.1	12	25.2
Goat	25	2.9	6	17.4
Birds	1.5	2	4	8
Hare	3.5	2.1	2	4.2

In this study, we found ibex to be one of the main prey species of the snow leopard. The study areas at Uvs and South Gobi, which have been protected since 1970, have very good populations of ibex in pasture areas not used for grazing. When the results of this study, conducted in areas where wildlife are adequately protected, are compared to studies conducted in areas with more livestock occupied areas, the snow leopard diet analyses show that wild prey species make up more of the snow leopard's diet than domestic livestock in protected areas. Possible explanations for this may be either that livestock have replaced wild prey in some pasturelands or that livestock are simply easier to kill than their wild counterparts, or perhaps both.

The percentage of goat in the snow leopard diet in Uvs, and even into the Gobi

Gurvansaikhan National Park, is small compared to the results of previous research in other areas due to small herd sizes. In a study conducted by Bold and Dorjzunduy (1976), domestic goats accounted for 82.4% of total livestock predated by cats. Amgalanbaatar et al. (1999) did a similar study in the Tost and Nemegt mountains. In the past 20 years, predation on domestic goats by snow leopards has increased up to 87.8% because of a rapid increase in the goat population in response to demand for cashmere. However, in our study area, wildlife are well protected and goat populations are relatively small, thus the percentage of domestic goat in the snow leopard diet is reduced. This study suggests if wild prey populations are viable, herders may not need to worry so much about their animals. Another important food item found in this study was small mammals, most likely because we collected the faeces mostly in the summer and autumn seasons.

The snow leopard diet differs by region depending on the potential prey species and fauna in the regions. In the Yamaat valley of Turgen, which is strictly protected and contains an important red deer population, snow leopards usually locate along the forest borders and feed on the red deer. In the South Gobi, such as in Gobi Gurvansaikhan National Park, if the summer is hot and dry and goitered gazelles migrate up to the mountains looking for water resources and good grazing, they can be attacked by cats.

Snow leopards often kill horse and yak, which herders do not guard. As they are also farther ranging than other livestock, their pasture may also overlap with snow leopard habitat. In this study, yak remains were not found in the faecal samples and horse remains were significantly less than what we expected. The reason for this could be that the study areas are strictly protected and the number of domestic animals pastured there are few. Another reason could be that in these areas the populations of wild prey species, such as ibex, small mammals and hare, are sufficient and thus easier prey for the snow leopard than either horse or yak.

Vegetation remains were found in many of the samples, especially in those collected in areas of more grassy terrain such as in the Turgen Mountains, as opposed to those collected in the barren terrain in the South Gobi. Conversely, more soil was found in the South Gobi samples than those from Uvs. Most likely the animals are ingesting vegetation and soil while eating prey.

Habitat assessment

The snow leopards commonly use terrain that is extremely rugged. Habitat quality for snow leopards is related to both physical and biological attributes. Leopards may use elevations between 900 and 5500 masl. However, in northern habitats such as western Mongolia they select ranges between 900 and 2500 masl. A strong affinity for steep and highly broken terrain has been well documented throughout their range (McCarthy et al. 2000). The presence and density of large mountain ungulates is also a strong measure of habitat quality. Finally, human use, both direct and indirect in the form of livestock grazing, is an influencing factor in habitat quality.

Yak in Mongolia reside in very similar habitat to snow leopards. Yak usually graze in high alpine pastures (mainly at altitudes above 2500 masl) and are left to roam freely in the mountains in winter without protection. Yak graze on 49 species of vegetation, the dominant types being *Cetraria, Betula, Kobresia* and *Cladonia* (Magash and Jaina, in preparation). They generally move 3–5 km/day while grazing and rest under cliffs where it is easier for snow leopards to catch them. Though yak and snow leopards ranges overlap in summer, snow leopards mainly preys on yak in winter when small mammals and marmots are not available. The snow leopard seems to prey on yak because 1) their respective ranges overlap, and 2) because yak are left unguarded while they graze. More work is needed to determine the

actual extent of yak' depredation, including the extent of economic loss to herders, and means of controlling predation, if local communities deem it a major problem.

Acknowledgement

Thanks to Dr Thomas M. McCarthy, International Snow Leopard Trust, for co-operation and information on Mongolian snow leopard populations and habitat assessment.

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