

Observations on snow leopards in Mongolia

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In 1989 and 1990 we made four field trips in Mongolia, each lasting one to two months. Two of these trips were devoted mainly to research on brown bears (*Ursus arctos*) and wild Bactrian camels (*Camelus bactrianus ferus*) in the Great Gobi National Park where snow leopards (*Uncia uncia*) also occur, but the other two trips concentrated on snow leopards.

During the winter of 1989-90 we made an extensive snow leopard survey through the Transaltay Gobi of southern Mongolia and the Altay Mountains of western Mongolia. A year later, we studied one snow leopard population in the Altay Mountains from 9 November to 28 December 1990 (see Figure 1). Since little information has been published about snow leopards in Mongolia (Bannikov 1954, Bold and Dorzhzunduy 1976, Mallon 1984, Zhirnov and Ilyinsky 1986), we present here our preliminary findings.

METHODS

During the survey we checked on the status and distribution of snow leopards by interviewing herders, officials and other persons along our travel route. In addition, we spent one to three days at several localities to search for scrapes, droppings and other snow leopard spoor.

Our study was conducted in the Uert drainage and adjoining Shar Hadny and Bajnsair drainages of the Burhan Budai, a subrange of the Altay (96°50' E, 45°40' N). This area encompasses about 200 km² of rugged, arid terrain with elevations that range from about 2,100 m in the valleys to 3,100 m and higher on the ridges. On 12 November 1990 we encountered a male snow leopard on an ibex (*Capra ibex*) he had just killed, and we caught him the following night in an Aldrich foot snare that we had placed by the carcass. We tranquilized him with Telazol at 3.7 mg/kg and fitted him with a radio collar (Telonics). Between 13 November and 27 December we radio located the male on 36 days and also observed him on 10 days for a total of 22.5 hrs. Motion sensors in the radio transmitter indicated whether the animal was active or inactive. We monitored the male's activity for three whole days, taking a reading every

FIGURE 1. Approximate distribution of snow leopards in Mongolia.

15 minutes. Since the male continued to visit his ibex kill after being radio collared, we added goat meat to the site and this he also consumed. Food was weighed before and after he ate.

Prey items in snow leopard droppings were identified by the color, length and texture of hair and by such remains as claws and teeth. Most droppings contained only one kind of food; if more than one was present, the percent of each was estimated.

DISTRIBUTION AND STATUS

The general distribution of snow leopards in Mongolia has been outlined by Bannikov (1954) and Mallon (1984). The species occurs along the whole sweep of the Altay Mountains from the Russian border in the west to the eastern limit at about 106°20' E. In the Transaltay Gobi, south of the Altay, are isolated, rugged ranges many of which have or until recently had snow leopards. North of the Altay snow leopards occur in the Hangai Mountains, and, farther west, in the Hanhöhiy Uul and Harkhyra Uul ranges. The cats once occupied the mountains west of Hövsgöl Lake, but they are probably extinct there now (Amarsanaa, pers. obs.).

The actual range occupied by snow leopards is considerably smaller than that shown in Figure 1. The animals prefer steep slopes broken by boulders, gullies and cliffs (Jackson and Ahlborn 1984, Fox et al. 1988). Large parts of the western Altay consist of high rolling hills and broad valleys. The Hangai Mountains are partly forested and most ridges are smooth and often barely above timberline. The snow leopard's range is therefore highly fragmented even in continuous mountain tracts.

Estimates of the total number of snow leopards in Mongolia range from 500 to 900 (Bold and Dorzhzunduy 1976, cited in Zhirnov and Ilyinsky 1986) to 2,000 to 4,000 (Marechal 1986, cited in Green

1988). The cats are considered extremely rare in the Hangai Mountains (Bennikov 1954, Mallon 1984) and scarce in the Hanhöhiy Uul and Harkhyra Uul (Amarsanaa, pers. obs.).

Most snow leopards in the country are found in the Transaltay Gobi and Altay. The desert ranges of the Transaltay Gobi are low, with the plains at about 900 m and peaks seldom above 2,000 m, but often rugged. Water is usually confined to isolated seepages. In this area, snow leopards have "adapted to foothills and even oases within true deserts" (Zhirnov and Ilyinsky 1986). A number of these desert massifs lie in the South Gobi Province where Bold and Dorzhzunduy (1976, cited in Shirnov and Ilyinsky 1986) estimated a population of 190 to 250 snow leopards in 6,000 km². There, in the Tost Uul range which is about 1,000 km² in size, they calculated a density of 4.4 animals/100 km², whereas an official gave us an estimate of half that number. In two days there, we found the tracks of three animals together, probably those of a female with two large cubs, and of a single animal which we tracked in snow for 5.8 km. During a one-day visit in the nearby Zoolon Uul, we saw the fresh tracks of one animal at a spring. This region still supports a moderate snow leopard population, judging by the accounts of our informants and the amount of livestock killed by the cats (see below).

Farther west in the Transaltay Gobi is the Great Gobi National Park. The park is divided into two sectors, one of 44,190 km² and the other of 8,810 km². Zhirnov and Ilyinsky (1986) recorded the presence of snow leopard on all high ranges in the park. R. Tulgat (pers.comm.), who worked in the park as biologist during the 1980s, estimated a total of 30 snow leopards in the large sector and 25 in the small sector. We spent a month in the Shar Ula, a massif in the large sector, and found cat spoor in only two places, near the Tsagan Tohoin Bulak and Hoshoot oases.

In the Altay we searched for snow leopard spoor in three localities during our winter survey. In the 723-km² Khokh Serkheen Nuruu Reserve, southwest of the city of Hovd, we found no evidence of snow leopard in two days of searching even though the species is known to occur there. In the Jargaian massif, east of Har Us Lake, we saw tracks of two animals within a day. In the central Altay, within our study area in the Burhan Budai range, snow leopard spoor was abundant and we estimated that at least 10 snow leopards (including large cubs) frequented the 275 km² area. Amarsanaa, based on extensive personal experience, considered that this area has one of the highest snow leopard densities in the country.

In the Tian Shan region of Kirgizia, Koshkarev (1989) sampled snow leopard densities in 20 areas totalling 4,545 kms and found that densities varied from 0.8 to 4.7 animals/100 km². For the whole region of 65,800 km² he calculated an average density of 0.98 animals/100 km². A similar survey must be conducted in Mongolia before the size of the snow leopard population can be estimated with any degree of confidence. The actual area frequented by snow leopards in Mongolia probably does not exceed 90,000 km², including tracts in which the cats are rare. Our impression is that about 1000 snow leopards survive in the country.

BEHAVIOR OF SNOW LEOPARDS IN THE STUDY AREA

Food habits

Snow leopards have few prey species available in the study area. Argali sheep (*Ovis ammon ammon*) were once common, but they vanished during the early 1980s as a result of hunting and perhaps emigration. In December 1989 we attempted to count all ibex in the study area. A total of 337 ibex were tallied, but tracks indicated that we had overlooked several herds, and there may have been as many as 450 animals. Ibex decreased during the 1970s and 1980s, according to our local informants, mainly because of commercial hunting by the government. Marmots (*Marmota bobac*), killed for their pelts, are not abundant judging by the number of burrows. These rodents hibernate from late September or early October until the end of March or beginning of April, making them unavailable as prey during this period. There were also 3,175 resident head of livestock in December 1990.

Twenty-nine snow leopard droppings were collected, all of them deposited during the months prior to our study. Their contents, expressed as percent of total contents in the sample, consisted of 62.8% ibex, 17.6% marmot and 2.6% domestic yak; grass and stems of a forb comprised 17.0%.

On 12 November at 1145 hrs we flushed an adult male snow leopard from a freshly killed adult female ibex at the base of a steep slope. The cat had attacked the ibex on the hillside and mauled her throat before losing his grip. The ibex had then tumbled at least 150 m into the valley. When we found the snow leopard, he had eaten about 1 kg of meat from the inside of one thigh. Between that day and December 22

we contacted the cat almost daily (except on 25 November and 10, 16, 17 and 18 December) and this gave us an opportunity to measure his rate of food intake.

The male returned to his kill on 17 November, four days after we collared him, and he ate a total of 21 kg during four consecutive nights. After eating apparently nothing for 8 days, he returned to his kill and consumed 1 kg of ibex and some domestic goat meat. He ate a final 7 kg of ibex on 11 December, one month after making the kill. The ibex had weighed 46 kg and he had eaten 65% of it. The male ate on 13 days between 12 November and 22 December, consuming up to 9 kg in one night, for a total of 66 kg, or an average of 1.7 kg per day. Emmons (1987) calculated that large cats require about 40 to 45 g of food per kilogram of cat per day. The male snow leopard weighed 37.5 kg, and he would therefore need 1.5 to 1.7 kg of food per day, figures similar to his actual consumption.

Movements

The radio-collared male remained on the same slopes on the west side of the Uert valley from 12 November to 20 December except for five brief excursions into the adjoining Shar Hadny drainage. On 21 December the male was for the first time radio-located on the east side of the Uert valley, and on the following night he moved into the Bajnsair drainage. The snow leopard had remained within an area of about 12 km² during most of the 41 days we tracked him (Figure 2). One could argue that he used such a small area because food was available to him at one site. However, he once failed to eat for 7 consecutive days and once for 8 days, periods during which he could have traveled widely. Up to 65 ibex in one or more herds frequented the same slopes as he did on the west side of the valley, predator and prey at times only 100 to 200 m apart.

The ranges of snow leopards in one Nepal population overlapped extensively (Jackson and Ahlborn 1989), and they also overlapped in our study area. Evidence for four other snow leopards was found within the 7 km² used by the radio-collared male. On 19 November, 4 December and 11 December two snow leopards walked together up the Uert valley, apparently the same female with a large cub, judging by track size. On 18 December a second male was observed in the valley, and that night between 1925 and 2100 hrs he miaowed loudly and repeatedly.

On 15 December a three-year old domestic female yak descended into the Uert valley. A snow leopard had bitten her rump and one upper foreleg. The yak died that night in a stone corral where its body was overlooked by a medium-sized snow leopard that walked by about 75 m away. Mongolians do not eat livestock that has been killed by predators, and the yak carcass was left in the valley. During the night of 22-23 December a snow leopard (presumably the same one whose spoor we saw on 16 December) ate much of one foreleg, the side of the neck and part of the rib cage of the frozen yak. In addition to these four snow leopards, a female with two large cubs killed a yearling horse in the Uert drainage just north of the range occupied by the radio-collared male. According to resident herdsmen, this female usually resided in the Shar Hadny drainage. Thus five adult and three subadult snow leopards were at some time in the Uert drainage during our study.

Activity

Jackson and Ahlborn (1988) found that snow leopards are most active from dawn to about 1000 hrs and from late afternoon on into the night, and that on average, females were active for 45.6% and males for 55.9% of the day. Our radio-collared male showed a similar activity pattern. Radio signals (99 readings) between 1100 hrs and 1645 hrs indicated that the male was usually at rest, his active level

FIGURE 2. Home range of a male snow leopard in the Uert study area during November-December 1990.

averaging less than 50%. At that time of day he seldom traveled more than a few meters from one rest site to another. For example, on 21 November he reclined by a large boulder in a ravine at 1145 hrs. From that

time, until we ceased to observe him at 1815 hrs he only changed his resting position. Two days later we found him at the same site at 1100 hrs. He defecated at 1110 and moved to another rest site 30 m away where he remained until 1130. He then walked 60 m uphill, rested and at 1245 once again moved a short distance. There he lay down but remained alert until 1315 hrs. After that he seemed to sleep until 1620 when he travelled uphill and out of sight. The male used the same rock cleft as a rest site on the six days of 3, 11, 12, 13, 14 and 19 December. The rock cleft, formed by one boulder leaning onto another, hid the cat from sight except when he rested at the entrance. On two of the six days, the male reclined at the entrance when we first saw him at 1330 hrs, on three days he ventured into the open to rest at 1410, 1415 and 1650 hrs, and on one day was still inside in late afternoon.

We monitored the male's activity for three whole days. Temperatures during those days remained below freezing and dropped as low as -26°C . On two days (3-4 and 13-14 December) the male had eaten during the night prior to being monitored. He remained in the same locality during these two days and was seldom active, except at 1400 and 2100 to 2300 hrs when his average active level rose above 50%. An average of 32.3% of the radio signals indicated an active animal during the two days. On the third monitoring day, 21-22 December, the male had probably not eaten for six days. He was active from just after dusk at 1900 to midnight, then rested off and on until 0500, and finally traveled steadily for over 3 hrs until dawn. Of his signals that day, 53.3% were active (Figure 3).

CONSERVATION

The headline of an article in the Mongolian newspaper *Hudulmur*, dated 13 December 1990, read: "The money which was eaten by snow leopard". This is an accurate reflection of the public attitude concerning predation by snow leopards on livestock. Such predation is widespread and in some localities may have a considerable impact on the livelihood of herdsman. For instance, in 1990 the eight resident families in our study area had a total of 2,990 sheep and goats, 94 horses, 59 yak, and 32 camels. Of these, snow leopards killed 13 sheep and goats (0.4%), 16 horses (17.0%) and 7 yaks (11.9%). In a letter dated 25 November 1989, the district government of Dalandzadgad complained to the central government that 29 families had reported a total loss of 224 state-owned livestock so far that year.

However, only a small fraction of the total livestock in a region is killed each year by snow leopards. In the South Gobi province, two districts reported losses of 0.34 to 0.38% of the total livestock population. Annual predation rates in the Altay ranged from insignificant, as in the Tugrik district, to 0.13-0.14% in two other districts (Table 1). In the Beger district, the site of our study area, the government records were not wholly precise but the predation rate was about 0.18%.

Snow leopards do not prey on the different kinds of domestic animals in proportion to their abundance. Of the 817 kills and 485,766 head of livestock listed in Table 1, snow leopards preyed on 0.03% of the camels, 0.15% of the sheep and goats, 0.34% of the yaks and cattle, and 0.77% of the horses. The cats have a particularly heavy impact on horses. For example, in December 1989 we visited a herdsman in the Tost Uul range. He had about 300 horses of which snow leopards had killed 21 (2 yearlings and 19 foals) since April. He showed us three mauled foals, two with wounds on the shoulders and one with bites on the throat. That same month we met four families who had tried to settle in the Bajnsair valley of our study area earlier that year, but they had moved out after losing 19 of their 60 horses to predation. Herdsmen guard sheep and goats in daytime and keep them near their homes at night, whereas camels, yaks, and horses are permitted to roam untended in the mountains. The animals are usually not stabled because not enough fodder can be gathered for them in these arid mountains. Lack of veterinary care may result in death from infection even for those animals that have escaped an attack with only minor injuries.

Most livestock was state-owned until December 1989, and herders were paid a **TABLE 1. Amount of livestock killed by snow leopards in several Mongolian districts.**

Area	District	Size (km ²) of district	Total Year	Total livestock	Total killed	Percent killed
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Gobi	Sirya	7520	1987	55,900	213		0.38	
	Gurvantis		ca. 20,000		1989	66,573	227*	0.34
Altay Mountains	Tugrik	7430	1989	90,143	8		trace	
	Deluun	5490	1989	163,650	224		0.14	
	Manhan	4390	1989	109,500	145		0.13	

* Only State-owned livestock recorded January - November

FIGURE 3. Activity of a male snow leopard during three sample days of radio monitoring.

salary to care for the animals. Every family was also permitted to keep private livestock, usually no more than 75 head. If a herder lost a state-owned animal to predation, he was fined, the size of the penalty depending on the age, sex and kind of animal. Snow leopards are legally protected in Mongolia, but if predation in an area is heavy, a herder naturally prefers the risk of a penalty for killing a snow leopard to an even larger penalty for losing livestock. Consequently, we found steel traps set to catch snow leopards on several occasions. Tolerance for snow leopard predation is unlikely to increase now that most livestock has been transferred to private ownership.

Unrestricted hunting greatly depleted wildlife populations until new laws in 1953 gave a measure of protection to many species, including ibex and argali. Wildlife generally increased in the mountains during the next quarter century (Mallon 1984). By the 1980s many herders had acquired guns, enforcement of regulations had relaxed, and wild ungulates were killed commercially by the government. Ibex and argali numbers declined in most areas, according to our informants. In addition, the Transaltay Gobi had a drought during which many water sources disappeared. Herders concentrated around the remaining springs thereby denying wildlife access to water. And those animals that attempted to drink were often killed. With ibex and argali becoming increasingly scarce, snow leopard may have to depend more on livestock. This trend may be particularly marked in the Transaltay Gobi where an absence of marmots deprives snow leopards of an important prey buffer.

In 1986 Mongolia established an annual quota of five snow leopards for foreign trophy hunting, the only country that permits legal killing of this endangered species. Few snow leopards have actually been shot under this program, apparently none in 1989 and only one in 1990, which was described in a July 1990 news release from *Mongolpress*: "Well-known Austrian hunter Keindel was in Mongolia for the first time in autumn last year... This time he again arrived here to get a Gobi snow leopard. And he achieved his aim. A marvelous skin and the excitement of chasing became an excellent compensation for all the efforts and expenses. The hunting license alone costs 16 thousand dollars". Mongolia is not a member of the Convention on International Trade in Endangered Species, but most foreign hunters come from signatory countries and may not import their snow leopard trophy legally. The status of wildlife in Mongolia is precarious and that of snow leopards still little known. Given this situation, we consider it imprudent for scientists to encourage trophy hunting of this endangered species (O'Gara 1988) and for the government to permit it.

Three reserves contain snow leopards, the Great Gobi National Park, the Khökh Serkheen Nuruu Reserve, and the Khasagt Khairkhan Uul Reserve, but only in the uninhabited Gobi Park is there no conflict between snow leopards and herders with their livestock. Some means must be found that permit herders and snow leopards to coexist with a minimum of conflict. As an initial step we have proposed to the government that special areas be created in which herders and their domestic animals will be permitted to live in a traditional manner but agree not to harm wildlife in exchange for economic benefits such as a reduction in taxes or compensation for livestock killed by snow leopards.

ACKNOWLEDGEMENTS

This work is based on a collaborative effort between the Mongolian Association for Conservation of Nature and Environment and Wildlife Conservation International. We are greatly indebted to J. and L.

Bennett, who were filming Mongolian wildlife for Survival Anglia; to E. Schaller for valuable help in collecting data on the radio-collared leopard; to O. Byambaa, who was our interpreter and assisted in various other ways; and to many herders and officials, who provided information and hospitality.

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