Snow leopard conservation project, Mongolia: WWF Project Summary of Field Work

Full Text:

1. Introduction

The snow leopard (*Uncia uncia*) is the largest predator of central Asia's high mountain regions. It is known for its rarity and as an indicator of the ecological health of high altitude ecosystems. In Mongolia, the available habitat totals 130,000 km^2 and is though to maintain a population of 1000 to 1500 animals. The main populations occur in the Altai and Trans-Altai Gobi mountain ranges, with more isolated populations in the Khangai, Khan Khokhii and Kharkhiraa mountains. All these areas are part of WWF`s Global 200 Key Eco-Region, Altai-Sayan. Major threats to snow leopards in Mongolia are caused by the disappearance of prey species or conflicts with the local people due to livestock predation. Conservation measures are impeded by lack of information of type and severity of threats, population densities, and prey abundance. Mongolia continues to expand its protected area network, yet basic information is lacking for protected sites. Research on large mammals in most cases is limited to rudimentary population surveys.

2. Objectives

The project's overall objective is to promote and help ensure the long-term conservation of the snow leopard in Mongolia. The project will provide a model for snow-leopard conservation in a protected area of the Mongolian Altai range, experience which will be transferred to other protected areas in which snow leopards occurs. The main components of study plan include:

Component 1: Status survey of snow leopard in a two primary study sites and other selected areas of the Altai range in the Uvs and Bayan-Olgi Aimaqs

Component 2: Status survey of prey species, such as Argali and Ibex in the area located under Component 1.

Component 3: Validate the Snow Leopard Information Management System survey techniques and attempt to equate sign density with known leopard density.

Component 4: Collect genetic samples to estimate genetic exchange between neighboring regions.

Component 5: Establish a community enterprise program in a selected SPA buffer zone communities to provide alternative income sources for local herders, thereby reducing pressures on resources.

Component 6: Work with local schools in and adjacent to SPA buffer zones to improve conservation education.

Component 7: Examine snow leopard food utilization in areas of varying habitat quality, wild and domestic prey density, and human use.

Component 8: Initiate a multi-media program aimed at reducing trade in snow leopard parts.

3. Progress

Training

An extensive training program covering snow leopard ecology, conservation and monitoring was facilitated by this project and hosted by the Uvs SPA office in October 1999. The week-long training session was planned to be an international event with Russian biologists from the bordering Altai-Sayan region attending. Unfortunately, economic conditions in Russia immediately prior to the meeting prevented this. The training was attended by biologists form Khovd, Bayan Olgi and Uvs aimaqs, and from the WWF office in Ulaanbaatar. The program included 3 days of classroom seminars and workshops covering topics in snow leopard ecology and conservation issues. This was followed by 3 days of field practicals in survey techniques using the Snow Leopard Information Management System (SLIMS) protocols. The session was led by project consultant Tom McCarthy and was also attended by snow leopard expert Dr. Joe Fox of Norway who spoke on ungulate conservation matters.

Additional training in SLIMS field methodologies was provided to the Bayan Olgi SPA staff during a visit to Altai Tavaan Bogd Park in western Bayan Olgi aimag in September 1998.

Field experience and training was also provided to 2 ecology students from universities in Ulaanbaatar. We have accepted students onto the project during both years of operation and feel that this provides valuable experience that is otherwise difficult for Mongolian students to gain. The students are supported by the project in terms of field costs, transport, food and a small stipend. The return for our investment has been excellent in terms of work accomplished by the students, however, we believe the primary benefit is providing future Mongolian conservationists with field experience on an active research and conservation project.

Field ResearchSign Surveys

Several additional sites have been visited this year to extend the snow leopard status survey coverage. Survey activity was continued on a monthly basis throughout the year. Sites were visited in both of the SPAs that are the focus of this project; Turgen Mountain and Tsagaan Shuvuut. Additionally, we conducted several surveys in areas adjacent to these reserves and in areas of eastern Uvs aimag that are currently under consideration for protected status, namely the Hanhoohy mountains. We also initiated preliminary surveys in the recently established Altai Tavaan Bogd National Park in Bayan Olgi aimag Additional surveys of herders and snow leopard habitat were conducted in September and October throughout central Bayan Olgi aimag.

A total of seven areas were visited this year and 31 new transects walked for a total of 16.27 km. Individual transects range from 250 to 1200 m. The total number of transects surveyed during the two years of the project is 89 with just over 70 km in cumulative length. Each piece of sign encountered on a transect is recorded as to type (scrape, feces, scent spray, pug mark, or claw rake), and relative age. Feces are collected for food habits analyses and for genetic assessments. Habitat parameters are assessed at each site where sign is found. Variables of interest include elevation, slope, aspect, habitat type, range use by livestock, ruggedness of terrain, and distance to cliff.

On each transect approximately 10 random "non-sign" sites per km of transect are also categorized for the same habitat information as snow leopard sign sites. Random site characterizations will eventually provide a body of data for the northern Altai that allows a rigorous examination of snow leopard habitat use versus availability.

Data from our sign surveys suggest that snow leopards are using habitats preferentially and not in proportion to their occurrence. Throughout their range it has been reported that snow leopards commonly use terrain that is extremely rugged. Leopards in Uvs exhibit a similar pattern (Fig. 1.) and marks have been found predominantly in moderately to very broken terrain, which cumulatively make up 70.6% of all observations. Similar preference for heavily broken terrain has been seen in other survey sites in Mongolia. However, more use of rolling terrain was observed in Uvs than elsewhere in the country and cliff habitat was slightly under-represented in Uvs. This may be explained in part by the subjective way in which this variable is estimated and could be observer-biased. However, an 8-fold increase in rolling terrain use in Uvs is likely significant and will be further assessed.

In Ladakh, India snow leopards travel routes, as indicated by sign deposition, averaged less than 35 m from steep cliffs. In western Nepal snow leopard sign was often within 25 m of habitat edges, such as cliffs. In Uvs we found a similar affinity for steep habitat with nearly 60% of all snow leopard sign being found less than 30 m from cliffs (Fig. 2.). Use declined sharply at 50 m and very few sign are found in areas more than 100 m from cliffs.

Of the total 1274 pieces of snow leopard sign observed the majority, 932 (73.2%), were scrapes. Feces accounted for 233 (18.3%) of sign and scent sprays (2.7%), pug marks (3.3%) and claw rakes on trees (2.6%) totaled only 109 sign. This is a significant factor when we consider the input of local herders regarding snow leopard density. We have found that many local people are unaware of what scrapes are and base their feelings of snow leopard numbers only on paw prints. Given that prints account for such a limited (3.3%) of the total snow leopard sign in an area, it can be very misleading if only herder interviews are used to estimate local snow leopard abundance. Further, leopards scrape most frequently in areas are

only occasionally visited by humans, such as knife edged ridge lines where livestock grazing is not common. The predominant type of sign and area of deposition together make it essential that herder interviews be supported by standardized surveys conducted by skilled observers.

Standardization of survey techniques is critical to being able to compare data from various parts of snow leopard range. SLIMS was designed with this in mind and is now being employed in several Asian countries where snow leopards occur. It has also been extensively applied throughout Mongolia, allowing a comparison of regional sign density in Figure 3. If we accept the assumption that sign density is an indication of snow leopard density, the most abundant populations in Mongolia occur in the eastern Trans-Altai Gobi region in and around the Gurvhan Saikhan National Park. This is followed by the central Trans-Altai Gobi, Uvs, and the Great Gobi SPA. We start to see a falling off in sign density in the central Altai (Khovd aimag) and low densities in Olgi, the Khangai Mountains and the southwest portion of the country or western Trans-Altai Gobi. Surveys have also been conducted in the Khovsgol lake region, but no sign was found.

The data presented in Figure 3 should be interpreted with some caution. Sign density is reported as the mean density over all transects in each region and the data has a high degree of variability. Hence, even at a 90% level, confidence intervals for 6 of the 8 regions all overlap. Only the eastern Trans-Altai Gobi and the western Trans-Altai Gobi, the two extremes in density, appear to be significantly different from any other region. A regional comparison may not then be appropriate to the data and individual locations may be more informative.

Such a comparison of the data for Uvs aimag is provided in Figure 4. One area had a very high density in relation to other sites. Yamaat Valley is within Turgen Mountain SPA but has been depicted separately to emphasize the extreme densities of sign we consistently find there. The Turgen SPA is also heavily used by leopards, as are the immediate environs of Uliasty and Habstal. Together these areas make up 4 of the top 5 sites in sign density. The only site that falls outside the Turgen vicinity and exceeded 15 pieces of sign per km of transect was Hanhoohy mountain range, an isolated massif in the east portion of the aimag.

As with Mongolia-wide data, the mean number of sign per km of transect within Uvs is somewhat variable and must be viewed carefully. The Turgen data may be the best example, where removal of a single transect that had more than 170 pieces of sign per km would reduce the Turgen sign density as a whole to 13/km, a 48% decrease. Khovd Som, is another example, but one in which transect results are likely under-representing actual leopard use. Only a few transects were completed there and despite minimal sign on those tracts, we have supplementary data on livestock depredation and snow leopard poaching that suggest much higher densities. Further research is needed there.

In Tsagaan Shuvuut SPA, on the other-hand, numerous transects have been completed and indicate snow leopards densities are moderate in a few portions of the reserve, but low in the SPA overall. Given the intensity of sampling in this SPA, we believe this is an accurate representation of snow leopard status there.

We surveyed several sites this year that were considered possible corridors for cat dispersal or movement between mountain ranges. Physically, corridor sites are usually isolated peaks in steppe or desert that would provide cover for cats crossing such terrain between mountain ranges. These corridor sites are usually too small to harbor a resident population of cats and rarely maintain any ungulate prey. While not containing permanent residents, they would serve an important function in facilitating movement and genetic interchange between populations. In other parts of Mongolia such corridors have been characterized by sign densities far exceeding averages even for good habitat, often upwards of 100 per km. Feces are also the dominant sign type in corridors as opposed to scrapes. In last year's report we noted that Zesteen Mountain, on the northern edge of Turgen SPA, had sign of density and type to suggest possible corridor status. It is also an isolated massif on the edge of the range, characteristic of a corridor site. Further visitation this year seems to uphold this idea and we now believe that it is a highly used travel route between Turgen SPA and mountains to the north. Only a portion of the massif lies within the protected area and we contend it should all be protected. We will advise SPA managers that as a minimum it be given buffer zone status and managed in a way that limits disturbance to transiting leopards.

Other potential corridor sites were looked at to the west of Turgen and laying between that SPA and Tsagaan Shuvuut. While these areas exhibited the physical attributes of corridors, little or no use was indicated by sign. We will continue to examine potential corridor sites in our surveys.

Preliminary sign surveys were conducted this year in Bayan Olgi aimag. An investigative trip covering the length of the aimag from south to north was completed by McCarthy and Allen in September and October. Numerous herder interviews were conducted while signs surveys were conducted in only 4 areas and totaled 7 transects. Despite placement in areas that appeared to be good snow leopard habitat, little sign was found. This agreed with local herder's perception that snow leopards were not common in the areas visited. The aimag totaled only 5.8 pieces of sign per km of transect which is quite low compared to other regions (Fig. 3). However, as stated previously, regional averages can mask areas of moderate to high density leopard use, or areas that deserve protection.

Within Bayan Olgi sign density ranged from 20 pieces per km of transect in Bulgan to none in several sites. The new Altai Tavaan Bogd National Park was briefly visited and despite the presence of adequate habitat and high density ungulate populations, no sign was found on the few short transects we conducted. Snow leopards do inhabit the area as evidenced by a recent attack on a horse whose wounds we observed and confirmed to be consistent with a snow leopard attack. The area warrants extensive research as it is likely a key site in any potential interchange of snow leopards between Mongolia, Russia, China and Khazakstan.

Habitat Assessment

Habitat quality for snow leopards is related to both physical and biological attributes. Elevations between 900 m and 5,500 m may be used by leopards, however, in northern habitats such as western Mongolia they select ranges between 900 m and 2,500 m. A strong affinity for steep and highly broken terrain has been well documented throughout their range and is confirmed in the results of this study (see above and Figures 1 and 2). 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.

Given the above list of attributes thought to influence habitat quality for snow leopards, this project has addressed habitat assessment using several methods. Prey densities have been estimated through standardized surveys and are slated to be continued to monitor trends in populations. Extensive interviews of herders have been conducted to document distribution of grazing activities in and adjacent to protected areas, numbers and type of livestock, attitudes of herders to predators, past history of killing snow leopard and wolves, and level of livestock losses to predators. The later can also be monitored as an indicator of changes in snow leopard or wild prey densities. Finally, habitat physical structure is being analyzed through GIS mapping of known or suspected snow leopard habitat in Uvs. We are comparing sign survey results with slope, aspect, and elevation to model habitat quality. The GIS analyses are being conducted at the US Fish and Wildlife Service GIS laboratory in Ft. Collins, Colorado, USA in cooperation with ongoing snow leopard studies funded through the Wildlife Conservation Society of New York, USA. Analyses are expected to be completed by late August 1999. Additional GIS coverages have recently been requested of the Mongolian government and, if the provided, will allow human density, small and large livestock density, climate (snow cover and mean extreme temperatures), and bio-region and geo-botanical designation to be considered in the model.

In this report we summarize the habitat assessment data in terms of prey surveys and herder interviews. We also discuss the influence of prey density on snow leopard numbers. A follow-up report on the GIS model will be available in autumn 1999.

Prey Surveys -- Major prey species available to snow leopards in Uvs include ibex, argali, red deer, wild boar, and musk deer. Leopards are also known to take marmots, snow cock, and small mammals. Only a limited number of prey surveys were conducted this year. Baseline counts were established in key areas in FY1998 and will be used for trend monitoring over time. Table 1 depicts prey counts over the two years of work to date.

Ibex may be the most common wild food source in snow leopard diets in Mongolia and were also the most abundant large mammal in the survey area. Large populations occur in both Tsagaan Shuvuut SPA and Turgen Mountain SPA. Ibex numbers in the Yamaat area of Turgen seem particularly high. In Altai Tavaan Bogd Park we observed 65 head of ibex on a single snow leopard transect. Argali and red deer appeared in moderate numbers in both Turgen and Tsagaan Shuvuut, while wild boar was scarce and only observed in Turgen. Snow cock are numerous and widespread in all mountain areas.

Herder Interviews -- To ascertain the level of herding pressure in leopard habitat, and to examine the impact of predators on livestock, we conducted herder interviews at every opportunity. During this project year 72 families in 15 soms across 3 aimags were interviewed. At each household we discussed livestock numbers and type, methods of herd protection, losses to predators, attitudes regarding protected status of snow leopards and hunting regulations for wolves, and their past history of hunting either species..

It is a delicate and often difficult task to interview herders about their livestock, especially losses, due to their reluctance to discuss death. Results must be viewed with this in mind, although presence of a Mongolian biologist during most interviews was helpful in gaining accurate information

Overall losses to predators were modest (Table 2) at about 1.0%. of all stock. Snow leopard depredation accounted for 76 kills from a herd base of 19,626, or a stock loss of 0.4%. Snow leopards took 0.3 % of the small stock and 0.9 % of the large stock. A single herder claims to have lost 100 of his small stock to snow leopards when a cat entered a corral. Such excess killing is known to occur in leopards when they are in confined places with large numbers of stock. However, this incident could not be substantiated. If we omit that data we see that, as is normally the case, snow leopards in free ranging settings prey more frequently on large stock, likely due to the lack of herder presence. Small stock is usually well cared for with a guard during the day and in corrals at night. Large animals on the other hand are turned loose in the mountains and are more easily taken by predators.

Looking at losses to predators and resultant attitudes toward the responsible species, we see an clear dichotomy. Table 3 depicts stock loss percentages by aimag and the feelings on protection or hunting of the predators involved. While losses to wolves are similar or only slightly higher than that to snow leopards, wolves are more vilified. Between 27 and 59 % of heads-of-households believed that snow leopards should be protected, 25 to 55 % felt that no more than a limited hunt should be allowed. Many of those in favor of limited hunting thought that only cats known to depredate on livestock should be removed. Unlimited hunting of the cats was espoused by less than 20% of respondents. Wolves on the other-hand found no supporters for protection and 81-93% were in favor of unlimited hunting of all wolves.

Historically few people have taken part in snow leopard hunting. No herders in Uvs or Khovd aimag admitted to having hunted them. Only in Bayan Olgi did 8% of the herders state they had hunted the cats in the past. Wolf hunting or trapping was more commonly engaged in with a range of 36% in Khovd to 53% in Bayan Olgi. The positive attitudes of herders toward snow leopards and the lack of participation in past hunting indicates that respect for the cat, despite some losses of livestock, is widespread. This is a good base from which conservation programs can be built, and in that respect Mongolia is much more fortunate than many other countries where snow leopard depredation has lead to little support for the cats among pastoralists.

Herding remains a concern in all the protected areas of interest to this study, including the prime snow leopard habitat of Yamaat Valley. The density of snow leopards in Yamaat might indicate that current herding intensity is not an impediment to the cats. However, changes in herding practices or livestock numbers may take time to be reflected in cat populations. Wild ungulate numbers in Yamaat may be negatively effected by current levels of domestic stock grazing. Overgrazing of pasture lands can take several years to appear. Reduced recruitment of young into the herds can result from conflicts with humans in critical birthing and rearing habitat and go unnoticed in total counts for some time. This study has provided baseline data that will allow these trends to be detected.

Locations of herding activity and stock densities are being incorporated into the GIS habitat models and will be provided to SPA staff to assist in management planing. Plans for Yamaat and other critical snow

leopard and ibex habitat must stipulate no increase in stock numbers or families be allowed, and further, that a gradual reduction be a goal. This will be a difficult task and alternative income sources could provide an essential element in attaining that goal. Irbis Enterprises, the project's community-based conservation program (see details below), provides such a source of income and ties it to other conservation measures.

Estimates of Snow Leopard Density

The surveys we are conducting are not designed to provide an estimate of total snow leopard numbers. Rather, they provide a benchmark against which future trends can be measured. It also allows for comparison of relative densities between areas at present, as was described above and depicted in Figures 1 and 2. This is important for allowing immediate conservation actions to be focused on areas harboring the most leopards or providing critical travel corridors. However, there is interest in determining actual population size in various areas, such as the protected areas that are the focus of this project.

We have attempted to addressed this through enumeration of individuals using a photo-trap camera system in Yamaat Valley. The system we selected used a 35 mm automatic camera housed in a lexan case and attached to a pressure-sensitive foot pad. The cameras were placed along trails known to be used by snow leopards. Often they were adjacent to snow leopard sign sites. The pressure triggers were concealed on the trail and in many cases a scent lure of lynx urine was placed on a nearby stone or bush. Seven cameras were put out in July and remained until August. Two cameras were then left in the field until December when we added 8 additional cameras. Ten cameras were then deployed until April. Total camera days was approximately 1300.

Field staff experienced substantial difficulty with the cameras in the winter when batteries tended to freeze and leave the units inoperable. Summer and autumn use did not meet with similar technical problems, but results were still not encouraging. Over the entire course of the experiment, more than 100 frames were exposed, but only 7 contained pictures of snow leopards, and one captured an image of a red deer. Of the 7 snow leopard images, 5 were from one cat visit and 2 from another. The two visitations occurred at night and were in different locations. Both a summer visit and a autumn visit were included. Spot patterns indicate they were two different cats. In both cases the cats were caught in the act of sniffing scent marks on rock overhangs. One cat is seen re-spraying the rock with urine. The cameras will be placed in the field again during more suitable weather conditions in the next year.

Another method to estimate cat numbers is to use known prey densities. In areas where snow leopards occur, researchers have been able to compute a standard ratio of prey biomass to snow leopard biomass. Using these published ratios we can attempt to arrive at a population estimate for the Yamaat Valley system and a density estimate for Tsagaan Shuvuut SPA.

In prime habitat in Nepal a biomass ratio of 1:100-150 was determined for snow leopard to large ungulate prey. In Yamaat Valley, where ibex are the primary large prey, our surveys yield 584 ibex/100 km^2. Given the mix of sex and age groups we used an average body weight of 40 kg/animal, yielding a total of 29,250kg/100 km^2. If we then use the conservative ratio of 150 kg of prey/kg of cat, Yamaat Valley should support 195 kg of snow leopards. An average adult snow leopard weight in Mongolia is about 40 kg, which equals 3.9 or 4 snow leopards per 100 km of habitat.

The second method of equating snow leopard numbers to prey numbers uses kill rates per cat per year. Again using published formulas we find that a large felid needs about 40-45g of food/kg of cat/day. Using the conservative 45g requirement and a snow leopard body weight of 40kg, 1.9-2 kg of food per day is required per cat. In a year a cat would then need about 730 kg of food. Ibex are about 65-70 useful meat and the rest waste. An average ibex of 40 kg would thus yield 28 kg of food to a cat. From numerous studies, including one in Mongolia, it is evident that large ungulates make up at most 60% of a snow leopard's diet. Thus, of the 730 kg required food, not more than 438 kg would be ibex. At 28 kg/ibex, about 15.6 ibex a year would need to be taken by each cat. Assuming that a cropping rate of about 10% is possible for ungulate herds without leading to decline, 156 ibex/snow leopard would be required. Recalling that Yamaat has a minimum of 584 ibex per 100 km^2, we calculate that it would maintain 3.7 snow leopards, a figure almost exactly the same as that arrived at by the biomass calculation.

Using these values and extrapolating to the Yamaat Valley system of approximately 250 km^2, we arrive at a population of 9 to 10 leopards.

In Tsagaan Shuvuut SPA this study determined a minimum of 415 ibex per 100 km^2 a prey base that would support 2.6 - 2.8 snow leopards per 100 km^2 by the two above methods of calculation. We are not prepared to extrapolate that to a population estimate for the SPA as a whole, because the prey base varies substantially over the area and further surveys are needed.

How do these density estimates compare to areas where leopard numbers have been estimated? In Uerte Valley of Gobi-Altai aimag an earlier study determined that about 10 cats frequented the 270 km^2 study area, or about 3.7 snow leopards/100 km^2, the same density we calculated for Yamaat Ibex densities are thought to be slightly lower in Uerte than in Yamaat, but livestock numbers are higher. If snow leopard numbers are similar in the 2 areas we might expect a higher incidence of livestock depredation in Uerte Valley. This is supported by data from a one year period in Uerte when 19 horses and several young yak were taken by leopards.

Further south in the Trans-Altai Gobi, a long-term snow leopard research project has determined that 4 cats use an area of about 400 km^2, or 1 cats/100 km^2. Ibex numbers in the area have been calculated at about 125-150/100 km^2. Again, the ratio of cats to prey remains consistent with published ratios on both a biomass and a ibex/cat basis.

A 1967 study at Tost Uul in Omnogobi aimag determined a snow leopard density of 4.4/100 km^2 over a 500 km^2 area. The ibex density was estimated at 400/100 km^2, or only about 60% of what would be required under the suggested predator/prey ratios. Although there was a high incidence of livestock losses reported in the area, 38 animals/year during the study, most of the losses were goats and sheep which would not provide the required biomass to balance the equation. We believe that either the stock losses were under reported or the snow leopard population over estimated. Given that livestock was then cooperatively owned and herders were fined for losses to predators, under reporting of losses or falsely claiming loss to disease may have been likely.

If the snow leopard/prey ratio methods provide reasonable estimates of cat numbers, and if sign density is an accurate measure of relative snow leopard density, we should see favorable comparisons between the two indicators. In the case of Yamaat Valley and Tsagaan Shuvuut that is unclear. Prey density in Yamaat would predict a snow leopard density 1.4 times that of Tsagaan Shuvuut. However, sign density in Yamaat is about 2.0 times that of the Tsagaan Shuvuut site where ibex numbers were calculated. In the Trans-Altai Gobi research site where prey density accurately predicts 1 cat per 100 km^2, sign density is about 75% of that for Yamaat, far from the 25% we would expect if the two indicators were providing comparable estimates.

Why is this the case? Two potential error factors are immediately obvious - conditions other than prey density determine snow leopard numbers, and sign density on transects can be a function of more than cat density. Both of these confounding factors are being examined in this study. As previously stated we are using GIS to examine numerous abiotic and biotic habitat parameters to build a predictive model of snow leopard habitat use and density. In a companion study funded in part through this project, a Mongolian graduate student is looking at influences on sign longevity, such as livestock presence, season, and climatic conditions. This will allow calibration of SLIMS survey results to local site conditions, yielding more accurate comparisons across areas.

The discrepancy between sign density and prey density in predicting leopard numbers may be explained by yet another factor. While predator-prey ratio predictions are generally linear, sign deposition rates may not be. This has been confirmed in part by our data from corridor sites. Sex and age ratios may also effect sign deposition rates in a non-linear fashion. This study will not provide enough known leopard densities to examine that relationship.

Other Field Research

Snow leopard food habits were assessed by D. Amarbat, a student in the Biology faculty of Mongolian State University in Ulaanbaatar. Amarbat was one of two who were provided field experience with the project in the summer of 1998. She analyzed feces collected on survey trips in Uvs and in South Gobi after receiving training in fecal analyses by the staff of the Hustaiin Nuruu Reserve. She recently complete the study as part of her thesis requirements through the University. A full report of her findings has yet to be submitted to the project, but a summary follows.

A total of 75 snow leopard feces from Yamaat, Turgen and Tsagaan Shuvuut SPAs, and 93 from South Gobi were analyzed. Feces were most commonly composed of a single prey item (64.8 %), with 31.5 % containing 2 items and only 3.0 % contained 3 items or more. The main food item for in the diets were rodents, including marmot and mice (46.4 %), and ibex (38.7 %). Some 31% of feces contained domestic livestock including sheep (17.3 %), horse (5.4 %), cow (4.8 %), and goat (3.6 %). Snow leopard diets differed in Uvs and South Gobi. Seasonal differences were also apparent. In winter, ibex and sheep were common in the feces, spring tended toward sheep and horse; and in summer and autumn rodents and ibex comprised the bulk of the diet. A detailed diet analysis is forthcoming.

Samples of hair and snow leopard feces for genetic analyses were collected from study areas visited throughout Uvs and Bayan Olgi. Hair samples were taken from rub sites when possible. These will be provided to ISLT for analyses. Dispersal or genetic interchange with neighboring populations of snow leopards in Russia, China, and Khazakstan may then be estimated. This project aspect is being conducted on a cooperative basis with ISLT and results will be made available to this project for future reports.

Conservation Activities

Community-Based Conservation Program

The program we initiated in two soms this year entitled Irbis Enterprises has been completely reported on by Priscilla Allen and is included as an appendix to this report. This is considered one of the most important conservation activities of the project to date. Other conservation agencies in Mongolia, both national and international, and local NGOs have expressed much interest in the project and the potential for expansion to other snow leopard areas in the country. Media coverage within Mongolia has been positive as well. Even in its first year, Irbis Enterprises has made an immediate difference in the well-being of people living adjacent to SPAs in Uvs and with its strong conservation linkages is promoting local appreciation for nature in general, and snow leopards in particular.

Conservation Awareness

The goal of implementing a multi-media program aimed at reducing trade in snow leopard parts was addressed this year. The media efforts so far have included television and printed materials. Several television advertisements were written and prepared for production. The ads addressed 3 issues: 1) poaching of wildlife and how it constitutes a theft from ALL the people of Mongolia, 2) loss of wildlife as a loss to Mongolia's cultural heritage, and 3) degradation of Mongolia's protected areas. The first two had distinct snow leopard themes. The final versions of the television advertisements have not been approved by the WWF Mongolia and revisions are being made.

Printed media took the form of brochures that are aimed at both tourists and Mongolians. The message on the bilingual leaflets relates to illegal killing, sale, and export of snow leopards and other rare animals. The criminal penalties within Mongolia and in CITES member countries is explained. The brochures were printed in both English-Mongolian and a German-Mongolian versions and will be made available through airports, train stations and tourist hotels.

Conservation Law Assessment

To further address the poaching and sale of snow leopards, we hosted a workshop of government officials and interested NGOs to discuss the possibilities of strengthening laws on poaching and selling of wildlife, snow leopards in particular. It was made apparent during the meetings that current law is ambiguous on ownership of snow leopard parts. It is clear that sale is illegal, but purchase is not specifically addressed. These issues will be thoroughly addressed in the Snow Leopard Management Plan that is a primary goal of the project in FY 2000.

The need for tighter laws and a better understanding of them by government officials and citizens was made clear this spring when project consultant P. Allen found a hat made of snow leopard fur for sale in the state owned department store in Ulaanbaatar. Initial contact with Ministry of Nature officials regarding the sale of such items met with little interest. The hat was purchased by the consultant and is now in WWF possession pending follow up of the incident.

Conservation Education
To date we have worked only on preparing materials for distribution to schools. Materials were adapted from a conservation education program used in a similar pastoral community in Pakistan (designed by Peter Zahler, WCS) and incorporate ideas and activities from a project previously initiated in Mongolia (UNDP Biodiversity Project). Mongolian teachers have assisted in translation and review, and graphics were done by local artists. All materials and activities reflect the local conditions and conservation concerns. The lessons are designed to be simple to deliver, although they cover important conservation concepts. The main method of delivery will be through illustrations, reinforced by activities to stimulate discussion. A series of activities demonstrates key issues concerning conservation and the role of the snow leopard in particular. Major themes in the materials are: general ecology of mountain ecosystems, and humans and nature and ways to protect it. No funds were allocated to workshops for training local teachers in use of these materials during this project year. However, the materials are now ready to pilot in schools near the snow leopard areas.

3.1 Outputs this Fiscal Year
* Final Project Plan for FY99 (7/98)
* Report on surveys for 1997-98 (7/98)
* Training materials for Snow Leopard workshop held in Uvs in Autumn 1998 (10/98)
* Revised leopard data forms and electronic databases for Uvs, Olgi, and Khovd offices (10/98)
* MOU for cooperation with ISLT,GTZ, and Univ. of Norway-Tromso (11/98)
* Television advertisements written (11/98)
* Anti-poaching leaflets (12/98)
* Consultants Activity report (12/98)
* Field Activity and Progress Report (B. Buyantsog) Monthly
* Technical Progress Report and Summary (T. McCarthy) 4/99
* Irbis Enterprises Implementation and Progress Report (P. Allen, 6/99)

3.2 Targets Obtained and important developments this reporting period
* establishment of a model community-based conservation project
* monthly surveys of snow leopard sign
* establishment of an electronic database for the study at the Uvs SPA office
* establishment of SLIMS validation study in Yamaat Valley
* hosting conference on snow leopards for regional biologists
* collection of genetic materials for ISLT cooperative study
* trap camera placement and review of results
* initial GIS analyses and preparation for modeling habitat use and quality
* preparation of educational materials and anti-poaching media materials

3.3 Targets not attained
1. Distribution of training materials and training in their use was not accomplished due to time and monetary constraints.

2. Fecal analyses were not completed due to financial constraints, but this activity has bee taken on by a graduate student and results are expected by year-end.

3.5 Prospects for the accomplishment of the projects objectives
Both the research and conservation goals of the project have a high likelihood of being met in the next fiscal year of the project. The primary objective of completing a management plan for the country will be

undertaken in autumn. The habitat assessment and predictive snow leopard use model will be completed by December 1999 thanks to assistance from the US Fish and Wildlife Service and funding from the Wildlife Conservation Society. Anti poaching and CITES educational materials will be distributed and added media measures implemented.

Acronyms
ISLT - International Snow Leopard Trust
SLIMS - Snow Leopard Information Management System
SPA - Strict Protected Area
GIS - Geographic Information System
WCS - Wildlife Conservation Society, New York

Table 1. Snow leopard prey surveys, Uvs Aimag, Mongolia, 1997 - 98.

Date	Area	km²	Species: Ibex	Argali	Red Deer	Wild Boar		Musk Deer		Snow Cock Tracks
10/97	Tsagaan Shuvuut			50	118 (16%)	9(0%)	0	0	0	0

11/97	Turgen Mtn.		12	29(21%)	0	65(unk)	0	0	10 boar	
12/97	Yamaat Valley		80	176(12%)		0	27(0%)	1(unk)	0	0	1wolf
1/98	Otor Mtn.		80	23(13%)	0	0	0	0	47	6wolverine	
2/98	Harihraa	20	0	0	0	0	0	0	---		
3/98	Tsagaan Shuvuut			50	202(23%)		0	0	0	0	7

4/98	Yamaat Valley		124	724(unk)		24(unk)	0	5(unk)	0	0	---
4/98	Tsagaan Shuvuut		124	515(unk)		0	0	0	1	20	---
4/98	Tsagaan Gol		184	0	85(0%)	0	0	0	0	---	
5/98	Uliasty Shil		50	209(unk)		0	0	0	0	32	---
5/98	Zesteen Shil		20	9(unk)	0	0	0	0	2	---	
9/98	Altai Tavan Bogd		20	65(unk)	0	0	0	0	0	---	

Percent young in parentheses.
unk = unknown.

Table 2. Livestock numbers and percent losses to predators, by som, from information gathered during herder interviews in Uvs, Khovd, and Bayan Olgi aimags, Mongolia, 1998-99.

					Losses over past 3 years to: Snow Leopards		Wolves			
Aimag	Som	# house-holds	# Small	Stock[a]	# Large	Stock[b]	Total Stock		% of Small	
	% of Large	% of Small	% of Large							
Uvs	Bokhmoron	2	111	28	1138	0 %	2.4 %	0 %	7.1 %	
	Khovd	11	4634	1208	5842	0.1 %	0.4 %	0.2 %	1.3 %	
	Sagil	3	100	0	100	0 %	0 %	0.3 %	0 %	
	Turgen	9	1254	429	1683	0 %	1.9 %	0.5 %	1.9 %	
Khovd	Buyant	1	400	254	654	0 %	0.4 %	0 %	0 %	
	Khovd	4	954	219	1173	0 %	2.9 %	1.1 %	3.0 %	
	Most	2	360	60	420	0 %	0.6 %	0 %	0.6 %	
	Tsetseg	1	400	52	452	0 %	0 %	0 %	0 %	
	Oinch	3	300	36	336	0.2 %	0 %	0.6 %	0 %	
Bayan Olgi	Bulgan		9	2060	244	2304	0 %	1.4 %	0.1 %	0.1 %
	Deluun	15	3270	605	3875	1.0 %	0.8 %	0.7 %	0.7 %	

Oichort	1	200	100	300	0 %	1.3 %	0 %	0 %	
Tolb	2	210	48	258	0 %	1.4 %	0 %	2.8 %	
Tsingel	4	724	153	877	0.4 %	1.3 %	1.0 %	2.0 %	
Ulan Khos	5	968	247	1215	0 %	0.1 %	0.4 %	3.6 %	

[a] Small stock includes sheep and goats

[b] Large stock includes horses, yaks, cows, and camels

Table 3. Average annual livestock losses to predators (1995-98), and herder attitudes toward protection of snow leopards and wolves, as established by herder interviews in Uvs, Khovd, and Bayan Olgi Aimags, Mongolia, 1998-99.

				Attitude to protection [a], sample size, and hunting history [b]					
Aimag	% loss to Leopards			P	L	H	U	(n)	Have Hunted
Uvs	0.2 %	46 %	25 %	17 %	12 %	(24)	0 %		
Khovd	0.3 %	27 %	55 %	0 %	18 %	(11)	0 %		
Bayan Olgi		0.6 %	59 %	23 %	9 %	9 %	(34)	8 %	
	% loss to Wolves								
Uvs	0.6 %	0 %	17 %	83 %	0 %	(24)	44 %		
Khovd	0.6 %	0 %	9 %	91 %	0 %	(11)	36 %		
Bayan Olgi		0.6 %	0 %	8 %	89 %	3 %	(36)	53 %	

[a] Percent of heads-of-household who: P = believe full protected status is appropriate
L = believe limited hunting is appropriate
H = believe an open unlimited hunt is appropriate
U = had no opinion or was uncertain

[b] Percent of households from which a member has hunted this species in the past.

Figure 1. Comparison of the percent of snow leopard sign sites found in habitats of various ruggedness in Uvs Aimag and in all of Mongolia, 1993-1999.

Figure 2. Distance from cliff of snow leopard sign on transects in Uvs Aimag, Mongolia, 1998-99.

Figure 3. Density of snow leopard sign in pieces per kilometer of transect by region in Mongolia, 1993-99.
Figure 4. Density of snow leopard sign in pieces per kilometer of transect in various sites within Uvs Aimag, Mongolia, 1998-99.