Snow Leopards in the Qomolangma Nature Preserve of Tibet Autonomous Region

Full text:

The 33,910 km^2 Qomolangma Nature Preserve (QNP) was established in 1989 by the government of the Tibet Autonomous Region. The preserve protects the highly unique and diverse biota and ecosystem found along the border of China and Nepal, centered around the world's highest peak, Mt. Qomolangma (also known as Mt. Everest). QNP is located between 27 48'-29 19'N and 84 30'-88 00'E, within a five county area of Shigatse Prefecture in south-central Tibet. It is an innovative project aimed at integrating development with conservation and ensuring that Tibet's unique natural and cultural resources are managed in environmentally and culturally sound ways. Implementation of the preserve is being undertaken by the Working Commission of the Tibetan Autonomous Region Government, in association with the Woodlands Mountain Institute through a 12 year agreement.

The seven core areas protect a wide range of ecosystems, from upper subtropical forests to the world's highest juniper forest in the Karma Valley, as well as alpine and desert communities (Li 1991). A management plan is being drafted for the QNP, with specific objectives to protect rare fauna and flora, maintain the region's high endemism and biodiversity, rehabilitate damaged ecosystems, preserve its spectacular natural landscapes, and to promote harmonious economic and social development for people living within its boundaries. QNP will be managed by a special office under the Working Commission of the Nature Protected Area for the Tibet Autonomous Region.

The preserve is zoned according to three major categories: core, buffer and periphery zones (Working Commission 1992). There are seven Core Zones (30% of the preserve), or areas where wildlife and natural values receive precedence. These are surrounded by a buffer zone, where traditional agricultural and animal husbandry systems will be closely integrated with nature and landscape conservation. The remaining areas of QNP, supporting the majority of its human population are designated "Periphery Zones", or areas where economic development and agriculture receive greater priority but where human activities are as environmentally sustainable as possible.

Although recent surveys have been undertaken in Xinjiang (Schaller et al. 1987 and 1988a), Qinghai and Gansu (Schaller 1988b), little is known about snow leopard status and distribution in Tibet (Feng et al. 1986), the core of the species vast range in Central Asia. Liao and Tan (1988) described the geographical distribution of snow leopards in China, noting that snow leopards possibly occurred along the border with Nepal in the Qomolangma region. This paper summarizes information gathered during three preliminary field surveys conducted in October 1990, September-October 1991 and March-April 1992, by a team of scientists from the Milu Ecological Research Centre, the QNP Management Bureau's Dingri Branch Office, and Woodlands Mountain Institute.

METHODS

The objective of the first two field trips was to establish the status and distribution of rare mammals and to locate potential study sites for an in-depth study of snow leopards, their prey and interactions with humans. The survey team visited representative parts of the preserve and gathered information by: 1) interviewing officials, herders and other persons known to be knowledgeable about local wildlife; 2) conducting searches for snow leopard sign (scrapes, droppings and pugmarks) in suitable habitats using sign transects, random searches and other techniques (ISLT, 1992); and 3) reviewing the literature. We also attempted to obtain population counts of blue sheep (*Pseudois nayaur*) in three watersheds (Qomolangma Base Camp, Gundan and Cha valleys), totalling about 750 km^2 (Lu et al., this symposium).

For each animal sighting, detailed information was gathered on the habitat, vegetation, topography, land-use and human activity of the site. Herders were questioned about loss of livestock to wild predators in order to assess potential people-wildlife conflicts and to identify depredation "hotspots". Representative habitats were sampled with respect to habitat type, dominant vegetation present, canopy cover, land-use, landform ruggedness, distance to selected features such as escape cover and water, and wildlife sign present.

During 1992 field work, we set 10 leg-snare traps and one box trap in an unsuccessful attempt to trap snow leopards inhabiting an area (Cha Valley) subject to significant livestock and human disturbance. Detailed counts of the area's blue sheep population were made from a series of fixed observation points located in 10 blocks totalling about 45 km^2 (see Lu et al., this symposium). Capture techniques followed

those described by Jackson et al. (1991). Sign transects were conducted using the same methodology employed in a four year study of radio-tagged snow leopards in Nepal (Jackson and Ahlborn 1986, Ahlborn and Jackson 1988). A snow leopard habitat suitability map for the preserve was derived from a 1:500,000 air navigation chart, using a simplified version of the Habitat Suitability Index (HSI) model described by Jackson and Ahlborn (1991).

STATUS AND DISTRIBUTION

Judging by herder's reports of livestock predation, snow leopards are widely but sparsely distributed throughout the preserve. While they seem to occur in most mountainous regions of QNP, the best populations are found in the southern portion of the preserve along the northern slopes of the Great Himalaya Range, which demarcates the border with Nepal (Figure 1). These mountains tend to be more sparsely populated by humans and support landscape that is generally well broken by cliffs, irregular rocky slopes and deep gorges or gullies, which is considered to constitute ideal habitat for the species (Jackson and Ahlborn 1984). The largest portion of contiguous snow leopard habitat is found in Jilong (Kyirong) County, along the western edge of QNP. Few, if any animals occur in wide lake basins such as that surrounding Peikucuo, or along the larger river valleys which are densely populated by man (such as the middle Pengqu or Pungchu river or near the administrative center of Shegar or Dingri). Snow leopards may occasionally travel across the gently rolling hills surrounding lake basins or along ranges lacking rocky cover. Presumably these are mostly subadults that are dispersing from core areas rather than representing resident animals.

Snow leopard sign abundance ranged from 0 to 45/km along transects conducted near Mt. Qomolangma (N = 2) and in the Cha or Zha Valley (N = 6). The number of scrapes per kilometer in these areas was 14 and 4, respectively. By comparison, the average density of sign found along similar transects in the Langu Valley of Nepal was about 28 per kilometer (Ahlborn and Jackson 1988). The Langu leopard population was estimated at about 12 cats per 100 km^2. Sign of various ages near the Rongbuk Monastery suggests that the area supports at least one resident snow leopard, while there are a minimum of two resident snow leopards in the Cha area.

Based on topography, snow leopard habitat is best developed in the western part of QNP between Mt. Shishapangma and the mountains south of the Yarlung Tsangpo, in the Lapche and the Rongxia valleys, and in mountains bordering the Pengqu or Arun River, as it is known in Nepal. These areas coincide with sites reported by local residents to support most snow leopards, or are areas where snow leopards are frequently blamed for killing livestock. The amount of "good" habitat totals approximately 8,000 km^2 or about 25 % of QNP's overall area (Figure 1). In a few areas there are probably more than 5 snow leopards per 100 km^2, but the overall population size cannot be established until more data are available. However, there may possibly be in excess of 100 snow leopards within the preserve.

The presence of snow leopard appears to be closely correlated with that of blue sheep, also known in China as rock sheep. Blue sheep are widely distributed in QNP, being most common in core snow leopard habitat. They are rare along road corridors or in more settled areas, unless there is an abundance of cliffs and other rocky terrain to serve as escape cover. Locals report that some populations are still being hunted, although the numbers of blue sheep appear to be increasing throughout the preserve.

FIGURE 1. Distribution of snow leopard habitat in the Qomolangma Nature Preserve, Tibet.

THREATS TO SNOW LEOPARD

Snow leopards are hunted for their valuable pelts and bones, or in retribution for killing livestock. The other major threat to the species involves the depletion of its prey base, also due largely to hunting by both local residents and outsiders. Although snow leopards are listed as "First Class Protected" animals under the law, they are killed by persons seeking quick profits. Snow leopard bones are highly prized as an

ingredient in various traditional Chinese medicines, especially now that tiger bones are hard to procure. The beautiful pelt makes fur coats much sought after by some westerners. A snow leopard's bones may bring a poor villager as much as 190 US dollars (1800 ¥ or 150 - 300 ¥ per kg), while the pelt is said to be worth from nine to 18 dollars (50 or 100 ¥) to its hunter. Demands for both bones and pelts remains strong in urban centers, both within and outside of China. Enforcement of Tibet's newly declared hunting regulations and CITES (Convention on International Trade in Endangered Species) rules are urgently needed if pressures on wild populations are to be alleviated and the species' future better ensured.

In order to maintain snow leopards and other wildlife in QNP, protective measures need to balance the needs of people living in the preserve with those of wildlife. Each snow leopard requires a relatively large, prey-rich home range in order to minimize dependence upon domestic livestock and consequent people-wildlife conflict. Jackson and Ahlborn (1984) estimated that an adult snow leopard, subsisting largely upon large prey items, consumes 20 - 30 adult blue sheep annually, thus necessitating a blue sheep population of around 200 animals.

The fact that livestock depredation due to snow leopard is widespread within the preserve may be partly due to the scarcity of alternative prey. Schaller et al. (1988) reported that marmots (*Marmota himalayana*) represented over 45% of a Qinghai snow leopard's diet during the six month period the rodent was available. However, populations of this species are very low in QNP due to its low rainfall and poor soils, so that these snow leopards lack an alternative to livestock in areas where there are few blue sheep. Thus, full protection of native ungulates is essential in this protected area.

Leaders of more than a dozen communities were interviewed in an attempt to assess livestock damage due to wild predators in the QNP (Table 1). While this information must be interpreted with due caution (since some herders may attribute animals dying of disease or succumbing to accidents to those blamed on predators), it suggests that livestock losses vary between 1 and 3 percent on average, a figure that is comparable to some rangelands in the western U.S. It is apparent that snow leopard is one of the major predators of livestock, along with wolf (*Canis lupus*), lynx (*Felis lynx*) and golden eagle (*Aquila chrysaetos*). Not surprisingly, sheep and goat losses exceed that of larger-bodied domestic stock such as yak, cattle and their cross-breeds. As much as a half of the sheep and goat losses may result from golden eagle predation upon lambs during their first few weeks of life, suggesting that lambing in better guarded confinement would reduce overall depredation losses significantly.

Damage is most severe in sparsely populated areas, some of which include the proposed preserve core zones. The highest rate recorded was 9.5 percent for a village (Gielung) in Jilong County bordering particularly broken country that offered ideal habitat for snow leopards. No losses were reported during the past year in two villages, one being Jarshi, a settlement of 22 families located 15 km south of Dingri (Tingri) on the edge of a wide plain. Whereas Cha, located near our intensive snow leopard study site, has not suffered from loss during the past year, two nearby villages (Loucham and Khanchi) lost 8 and 20 animals, respectively. Such variation in depredation rates for villages, which likely encompass a snow leopard's home range, presumably occur because some villagers guard herds with greater vigilance than others and because different pastures are in use during winter and early spring when most losses are reported. Other important factors may include herd size and the number of shepherds available -- animals are more likely to stray from large herds that become spread-out than from those which forage in tightly-knit groups. Similarly, animals are more likely to become separated and lost when foraging in broken, rocky terrain, which constitutes preferred hunting habitat for the snow leopard. Persistent depredation "hotspots" may also be associated with the presence of a particularly wily snow leopard that has learned to successfully subsist upon livestock and to evade efforts to kill it. Females with young cubs may find it especially difficult to subsist without taking domestic stock, especially in those areas where blue sheep have been depleted.

TABLE 1. Livestock depredation losses reported from different parts of the Qomolangma Nature Preserve, Tibet.

		Loss Rate[1]		Loss per	Total Losses		
		Sheep/	Yaks/	family			Major predator
Location	Unit goats	crosses	¥	¥	US$	species	

Jia Tsuo La Dingri Co	7 villages	2.3	2.8	NA	*89,600	*19,000	wolf, snow leopard	
Jian (Pang la)	12 villages 575 families	0.9	0.1	20	11,700	2,484	snow leopard, Dingri Co lynx	
Gielung Kyirong Co	1 village 9 families	9.5	0.0	100	900	191	golden eagle, snow leopard	
Munza	1 village	1.0	0.1	314	14,450	3,068	wolf, golden eagle	Kyirong Co 46 families
Simi	1 village	1.3	0.0	64	2,062	438	snow leopard, lynx	Dingri Co 32 families
Zhangmu Nielamu Co	1 family	0.0	3.8	1,000	1,000	212	common leopard	
Suta Nielamu Co	1 village	0.06	0.1	NA	2,500	531	wolf, snow leopard, lynx	
Jarshi	1 village	No losses		0	NA	NA	snow leopard, lynx, wolf	Dingri Co 22 families
Cha	1 village	No losses		0	NA	NA	snow leopard, golden eagle	Dingri Co 40 families
Khanchi	1 village	2.5	8.0	530	5,300	963	snow leopard, lynx, gold.eagle	Dingri Co 10 families
Loucham Dingri Co	1 village 9 families	2.1	0.0	58	520	94	snow leopard, lynx, gold. eagle	

[1] Expressed as the percent of total livestock population.
* Questionable figure.

The value of livestock lost to predators averages about 55 yuan or US $ 10 per family per annum for the dozen communities interviewed, assuming that lost animals are valued at the indicated market worth (65 ¥ sheep and goats and 1,000 ¥ for yak or cattle), with a foreign exchange rate of 5.5 ¥ per US dollar. As much as 30-50% of the animals lost in some sheep-raising areas are lambs, but they are half as valuable as an adult sheep. However, loss is rarely, if ever, evenly distributed among a village's residents. In general, most families suffer only slight loss, often with several years elapsing between events. A few families reported catastrophic losses, which usually occur when a snow leopard enters a poorly-made livestock pen during the night, becomes confused and kills dozens of animals. We were told of such an incident where 107 sheep were killed in a single night in October of 1988 at a village situated northeast of Rongbuk. Such loss could have been easily avoided had the night-time enclosure been properly constructed. While these events are extremely rare, they may so anger people that a concerted predator control program is launched, to the detriment of those snow leopards not living off livestock.

MANAGEMENT AND CONSERVATION

Conservation and development need to be mutually beneficial, as recognized by the QNP Management Bureau. The extent to which QNP's unique natural and cultural resources can be preserved

will ultimately depend upon the benefit local communities receive from the preserve. The following management actions are necessary in order to realize the preserve's potential natural and economic benefits:

* Development and implementation of species / habitat protection and management plans and unifying conservation strategies
* Implementation of ecologically sustainable development policies and guidelines
* Training of Management Bureau staff in protected area planning and management techniques
* Educating the general populace on the need for conservation
* Strengthening management by promoting co-operation between government departments and non-governmental agencies

In terms of snow leopard conservation, the key management needs can be summarized as follows:

Protection and Enhancement of the Prey Base

Authorities are to be commended for addressing the sensitive issue of hunting of wildlife, and reversing the decimation of the region's large mammal population. Ungulates in many parts of the QNP are making a strong come-back, although hunting with modern rifles continues to adversely affect some blue sheep populations. In addition, musk deer (*Moschus chrysogaster*) are subject to heavy poaching by hunters crossing the border from Nepal. Wildlife populations could probably sustain limited subsistence hunting without adverse impact, especially if traditional weapons were used and such activity were under the control of local communities. Populations are quickly decimated when hunting is undertaken commercially.

Predators tend to feed upon what is most readily available. Livestock comprises the majority of biomass available at present, so that protection of blue sheep populations represents a wise strategy in this regard. Similarly, rodent control programs should only be authorized under exceptional circumstances.

In some areas, habitat rehabilitation may be warranted. The provision of alternatives for fuelwood and the use of improved animal husbandry techniques would reduce habitat degradation and resource depletion, thereby benefitting people and wildlife alike.

Trade in Protected Species

Firm steps are needed to prevent the sale and transport of rare species like the snow leopard. Proposals to ban the sale of animal parts, especially in public market places like Lhasa's Barkhor, should be implemented with both vigor and urgency. Unless alternatives are found to the use of snow leopard or tiger bones in Chinese medicine, these species face a very bleak future.

Alleviating People-Wildlife Conflict

The main source of people-wildlife conflict in QNP is that associated with livestock predation, since animal husbandry is the dominant agricultural activity in the area. Losses depend upon a variety of factors, including how well domestic animals are guarded during the day or night, the amount of hiding cover present for predators, the availability of natural prey, the status of predator populations or their refuging habitat, and the size of the particular livestock herd. For example, sheep or goats are most vulnerable when being grazed in steep or rugged broken terrain. In such situations one or two sheep may easily become separated from the herd and fail to return to the night-time enclosure. They may then be killed during the night if a predator happens upon their scent, before the owner has had an opportunity to search for missing animals.

A variety of remedial measures are available, from compensation and predator control to improving herd management practices. None are wholly effective and all have detrimental aspects to them. For example, monetary compensation is costly and fails to address root causes of depredation; not only is predator control rarely effective, but it may be contrary to the very goal of a nature preserve. Allowing a predator to consume its kill, whether the prey item is domestic or wild, greatly reduces the likelihood that it will immediately kill again. The feasibility of breeding dogs skilled in guarding and herding sheep could be investigated. Prey species conservation needs to be strongly promoted, while compensation could be offered in cases of hardship or to those families residing in or near designated depredation "hotspots" that

provide core snow leopard habitat. Ultimately, however, the best solution may rest with improving the standard of living by ensuring that benefits from tourism reach local communities (Dixon and Sherman 1990) and by educating herdsmen on improved techniques of protecting their animals from wild predators.

Identification and Protection of Core Areas and Corridors

Another important action involves the identification and designation of key refuging habitat for snow leopard and their prey. Core areas, linked by corridors, should be designated according to the principles of conservation biology (Shafer 1990, Villarrubia and Jackson, this symposium). This includes establishing corridors linking habitat within and outside the preserve, and designating large rather than small core zones wherever possible. The mountains around Gundan and Goren in the western part of the preserve are a good example of habitat meeting many of these criteria: the total amount of habitat is large (in excess of 5,000 km^2) and it is located immediately north-east of Nepal's Nar-Phu region, which contains some of that country's best snow leopard habitat, managed under the auspices of the Annapurna Conservation Area. There is no natural barrier preventing animals from moving between the two areas. Blue sheep population density amounts to 10 or more animals per square kilometer in more remote areas, and the region is sparsely inhabited by some 750 people in 15 or 20 settlements.

Research and Training

Studies aimed at inventorying rare plants and animals, mapping important habitats and communities, and at gathering in-depth life-history information for key species should be promoted at every opportunity. Research institutions working in the Preserve have already prepared extremely useful base-line resource maps on vegetation, crops, livestock ownership, population density and other topics (Lab of Quantitative Vegetation Ecology). Prior review of research proposals by a committee composed of nationally and internationally renown scientists and planners would greatly assist in attracting research that leads to practical solutions for important land management issues. Preserve staff need to be trained in the latest techniques for sustainable land-use planning and resource management. This may involve scientific exchanges and training workshops in other Asian countries or elsewhere overseas.

CONCLUSIONS

The Tibet Autonomous Region's commitment to conservation hinges upon its ability to protect reserves like Qomolangma, to control hunting and trade in animal parts, and to promote sustainable development for people who live in the same area. The QNP is making promising plans in this regard. Research in other ecosystems has clearly established the importance of corridor areas between separated protected areas as a means for minimizing detrimental in-breeding within small populations. This is all the more crucial in species like the snow leopard that require large home ranges and are sparsely distributed. Such corridors need to be identified and protected to the extent possible by promoting land-use practices and policies which sustain both pastoralism and wildlife (Miller et al. 1992, Miller and Jackson, this symposium).

The QNP is significant as a protected area that links otherwise isolated snow leopard populations in Nepal. Thus the preserve connects otherwise isolated snow leopard habitat in Langtang and Sagarmatha (Mt. Everest) National Parks, which are about 100 km apart. The newly declared Makalu-Barun National Park and Conservation area (also supported by Woodlands) is another example of protected areas linked via the QNP. Such biological linkage strengthens the case for formal or informal transboundary parks, for much of the world's snow leopard habitat is located along international borders. It is another reason for the snow leopard serving as an internationally significant keystone species.

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