Caprinae

Newsletter of the IUCN/SSC Caprinae Specialist Group

October 2005

In this issue

A 10-Year View of Wild Sheep Management in Sonora, Mexico

Introduction

Helicopter surveys are widely used to estimate wild sheep population trends. To determine population density and distribution of wild sheep in Sonora, Mexico, standardized helicopter surveys were flown beginning in 1992. Surveys are standardized by flying at the same time of year, same time of day, same speed, same elevation, and with the same observers. The results from these surveys were used to initiate a sport harvest program to take advantage of the available wildlife resource and to produce revenue to fund a wild sheep conservation program, including habitat studies, disease research, and transplants.

To determine current population trends and to ensure that the sport harvest program was having no adverse impacts on the wild sheep population in Sonora, standardized helicopter surveys were again conducted in 2003. In this report, the results of these current surveys are compared to those surveys conducted in 1992/1993 to provide a 10-year view of the population trends of wild sheep in Sonora, Mexico. The determination of these trends is particularly important as the number of harvest permits for wild sheep has increased significantly during this period; and a large number of animals have been taken from the wild and placed within enclosures. This data is essential for the Wildlife Department of Mexico to properly manage their wild sheep populations.

Methods

The methodology of helicopter surveys has been described in Lee and Lopez-Saavedra (1993 and 1994). The surveys conducted in 2003 were flown in the same fashion, and with many of the same observers, as those in 1992/93. The 1992, 1993, and 2003 surveys were conducted during November. During the surveys, the helicopter is flown at approximately 50 mph (80 km/h) and the observers view approx. 1/8 mile (ca. 200 m) per side for a total coverage of around 12.5 square miles/ hour. Considering the time spent manoeuvring to classify animals, the actual area covered is approximately 10 square miles (about 25 km^2)/ survey hour.

The Wildlife Department of Mexico divided the various mountain ranges in Sonora into 11 regions. These divisions were based upon proximity of suitable habitat, similarity of habitat, and containing no barriers to wild sheep movement within the region.

Results and Discussion

Tables 1 and 2 (see page 7) show the results of the surveys. The wild sheep population in Sonora appears to be quite stable. The wild sheep population in Sonora appears to be stable. While there have been significant declines in some areas, these have been offset by significant increases in others. In particular, Sierra Viejo and El Alamo saw precipitous population declines. Feral goats were seen in both of these ranges. During the 2003 survey, areas which had previously produced either no or few observations in 1993 showed increases - like Noche Buena, El Tullido, Loma Bonita, Coloraditos, La Vibora, and La Pinta. The wild sheep in Sierra San Francisco and Sierra Seri have both also shown increases in number.

Average group size has a significant effect upon sightability rates. The average group size remained similar between the surveys at 3.4 for 1992/93 and 3.2 for 2003.

An important consideration during this period is the possible over harvest of rams through the sport harvest program. The evidence of over harvest would appear first in a reduction in the percentage of Class 3 and 4 rams (those favoured by hunters) and second in a reduction in the ram to ewe ratios. The percentage of Class 3 and 4 rams to total rams was 50% in 1992/93 and 52% in 2003. The ram to ewe ratio in 1992/93 was 40.9 versus 37.2 in 2003. The ratio of Class 3 and 4 rams to ewes was 20.3 in 1992/93 versus 19.4 in 2003. The consistency of these data shows the accuracy of the standardized surveys, as well as the stability of the populations. It is also indicative of the appropriateness of the harvest level through this period.

Tiburon Island

Another portion of Sonora of importance to wild sheep is Tiburon Island. Following the 1975 transplant of 20 wild sheep from the adjacent mainland to the island, the wild sheep population flourished. The first significant helicopter survey was conducted in 1993.

In 1993, in 4.7 hours of survey time, a total of 293 animals were classified as 10-22-40-16-151-43-7-4. In 2003, in 5.1 hours of survey time, a total of 306 animals were classified as 10-18-24-11-

162-55-11-15. Age and sex ratios were 58:100:28 versus 39:100:34. Production of young animals on the island is good. However, while Class 3 and 4 males made up 64% of the rams in 1993, this had declined to 56% in 2003.

Since 1998, over 300 animals have been removed from the island, about ¾ of these being females. With the effect of these removals, and considering the very restricted legal harvest (4 males per year) – male animals must be being removed from the population by other means. It may be necessary to better police illegal activities that appear to be occurring.

Recommendations

Due to the costs of helicopter surveys, safety concerns, and potential disturbance of the wild sheep, unless there has been some significant change in climate or harvest, standardized surveys should be conducted no more than every 3 years.

The number of permits issued is not as important as the number of animals that are actually harvested. The standardized collection of harvest data is strongly encouraged; as is the use of horn plugs to facilitate the enforcement of harvest quotas.

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Acknowledgements

Thanks to all of the observers who participated in the survey: Armando Aparico, Crispin Ballesteros, Israel Barba, Enrique Grajeda, Rebeca Kobelkowsky, Eugenio Larios, Martin Franco, Franciso Navarro, Roberto Noriega, Juan Manuel Segundo, Ignacio Rivera, Felipe Rodriguez, Francisco Villa, and Ismael Wadarrama.

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The Arabian Tahr: A Review of its Biology and Conservation

The Arabian tahr is one of three species in the genus *Hemitragus*, which are disjunctly distributed in mountain environments of southwestern India (*H. hylocrius*), the southern slopes of the Himalayas (*H. jemlahicus*) and southeastern Arabia (*H. jayakari*). Hassanin *et al* (1999) suggested that tahr were probably of Eurasian origin and most closely related to ibex, goats and bharal (*Pseudois)*. However, more recent molecular genetic research (Ropiquet and Hassanin, 2005) surprisingly concludes that the genus *Hemitragus* is polyphyletic, and that the Arabian tahr is genetically most similar to the North African aoudad (*Ammotragus lervia*) and more distantly related to the other tahr species. Here I refer to tahr as species in the genus *Hemitragus.*

The Arabian tahr, *al wa'al* in Arabic, was described in 1894 by Thomas from skulls collected in Oman by Atmaram S.G. Jayakar. It is an endangered species (IUCN 2004) endemic to Oman and the United Arab Emirates.

The first systematic field studies of the species were carried out by Paul Munton from 1976-1978, and his papers (Munton 1985, 1988) describe many interesting aspects of the species' biology. *H. jayakari* has proven difficult to observe. Munton made 27 sightings of a total of 37 animals, of which 21 were solitary, and rangers only observe tahr on about 30% of their patrols. Insall (1999) provides additional information on their ecology and conservation, much of it derived from his conversations with local people knowledgeable about tahr biology. Recently, Robinson *et al* (2004) analyzed the size and composition of tahr groups based on 1,631 records of ranger observations in the Wadi as Sarin protected area.

H. jayakari is the smallest of the 3 species; males and females have ca. half the mass of their congeners (Table 1). They prefer the upper elevations (900-1800 m) of northern-facing steep slopes and cliffs, where tree and shrub vegetation is more diverse, and domestic and feral goats are less common. These optimal ecological conditions comprise a rather small portion (24%) of the approx. 19,000 km^2 of available habitat (Insall 1999).

Arabian tahr are primarily browsers, consuming leaves, fruits and seeds from a variety of trees, shrubs and grasses (Munton 1985, Al Majaini 1999). Al Majaini (1999) identified 37 plant species in the faeces, of which 33 are dicotyledons and 30 are also eaten by goats. Tahr must drink regularly, every 2-3 days during the hot summers, and when water sources dry they will move to new areas outside their normal ranges. In Wadi Al Qiyd, Munton's main study area, tahr apparently occupy small ranges of approximately 0.3 km^2. Munton (1985) believed that unlike other Caprinae, Arabian tahr are territorial, living in small groups of 2-3 animals consisting of a male and female with or without young. They appear to mark small areas by scraping their horns in the soil, and the depressions may contain hair, faeces and urine. Rice (1988) describes the scraping behaviour of the Nilgri tahr as a form of object aggression directed at a patch of dirt left by a previous animal. In captivity *H. jayakari* males and females maintain strong social hierarchies (Wood 1992). These and other aspects of the social system deserve additional research.

From 1983 to 2000, the mean Typical Group Size (Jarman 1974) in Wadi as Sarin varied monthly from 3.1 to 4.5 animals, but these means are not statistically different. Although most groups consisted of a male and female, or a pair and one young, larger groups (4-11 individuals) are also seen, but not more frequently at certain times of the year. Groups of females and young were uncommon, single males were seen regularly, but male groups were extremely rare, the largest with 3 individuals. Sex ratios are balanced in groups of all sizes. This suggests that Arabian tahr do not form female-dominated breeding groups or bachelor herds typical of the Himalayan and Nilgri tahrs and other polygynous caprids (Robinson *et al*, 2004).

Captive Arabian tahr breen mainly from from November to December, and gestation lasts about 140 days. Births peak in April but kids are dropped throughout the rest of the year. Year-round birthing is also indicated by the field observations. When conditions are good, females can

produce two young (Wood 1992; Insall 1999), which might help the species' ability to recover from periods of population decline. Apparently Arabian tahr do not form large seasonal rutting herds; rather reproduction may occur opportunistically in small, dispersed family units. Differences in breeding and social systems among the tahr species are likely to be related to the contrasting spatial and temporal patterns of plant productivity in their respective ecosystems (Table 1; see page 8).

The number of wild Arabian tahr is not known with reasonable accuracy. Munton (1985) indirectly estimated a tahr density of 9.6 individuals per km^2 in ungrazed (by livestock) areas of optimal habitat, and 2.0/km^2 in grazed secondary environments. He derived these figures on the assumption that recently used scrapes, or clusters of scrapes (= a focus), represent the activity of a male or a male-female pair. Thus, the density of single scrapes and foci equal the density of adult pairs. He calculated the observed number of young/female to be 0.46 and assumed each pair rears 0.6 young, adjusting for kids that go unnoticed. Using these estimates, he concluded that 1293 tahr were living on 7 sites in northern Oman and the world population might consist of <2000 animals.

Eleven years later, Munton revisited his study area and found new scrapes in addition to many old ones still in use. Records indicated that from August 1982 to March 1987, rangers saw 2 to 3 animals per patrol that sighted tahr. Based on this perceived increase in animals and the fact that hunting had been declared illegal in 1976, Munton (1988) estimated that the population was increasing by 6% per annum and would therefore double every 10-12 years. He predicted the Wadi as Sarin population would have 1600 animals by the year 2000. More recently a report from the February 2000 Workshop of Population and Habitat Viability Assessment (PHVA) for the Arabian Leopard and Tahr predicted that the Arabian tahr population should now exceed 6000 individuals (www.breedingcentresharjah.com)! The basis for this surprising estimate is not given.

From this brief history one can conclude that there is still uncertainty about the number of Arabian tahr surviving in Oman and the United Arab Emirates. However, it is clear that more reliable estimates are urgently needed. Achieving this will test the ingenuity of field biologists.

Efforts to conserve the Arabian tahr were initiated in 1973 by David Insall, and in 1975 active protection was granted over a wide area of the eastern Hajar mountains of Oman. However, this region is yet to be given official status by a Royal Decree. Men from villages near tahr habitat were employed as rangers under the Office of the Advisor for Conservation of the Environment, Diwan of the Royal Court, and they have monitored portions of the protected area since 1975, especially in Wadi as Sarin. In 1977 rangers began recording their tahr observations (adult or young, sex, number, locality) on Arabic proformas. This practice continues and today there are nearly 5000 patrol records.

In 1980, a small captive herd was established at the Omani Mammal Breeding Centre with the intention of re-introducing tahr into the wild. Breeding has been successful at the Centre, and the herd has provided biologists with valuable information (see Wood 1992). Concerns over inbreeding are being addressed by incorporating new stock into the herd as they become available.

Since its inception, the management philosophy of the protected areas has been to use local people and their knowledge. The value of the traditional *hamiyah* in range conservation is but one example. *Hamiyaat* are areas governed by tribal laws that forbid grazing by domestic animals but do allow hand-cutting of fodder. Tahr are attracted to these small reserves by their richer plant life, a fact that hunters used to ambush them. Munton (1985) and Insall (1999) have recommended that the remaining *hamiyaat* be protected under modern legal code. The *hamiyaat* comprise approximately 185 km^2, about 1% of the nominal tahr habitat and 4% of the optimal area.

Human migrations to urban areas have increased in Oman during the past two decades, leaving goats that were once tended to become feral and traditional grazing practices without practioneers. Consequently feral animals now forage in areas that were once the domain of the tahr. The recent appearance of roads and domestic buildings within the protected areas signals potentially new sources of disturbance and habitat fragmentation, and plans for mineral extraction in the southern part of the range may result in significant habitat loss.

Conservation initiatives in the next decade may prove critical to the survival of *al wa'al al arabi*. A Royal Decree granting the protected areas official status is urgently needed, as is an increase in ranger staff, training and patrol activity. These actions will discourage grazing, poaching and development activities, allowing field biologists time to gather population data and to devise a sound plan to protect the region's only endemic large mammal.

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Conservation News

Captive Rearing of *Capra falconeri heptneri*

Our captive breeding program for Tadjik markhor (*Capra falconeri heptneri*) in semi-open conditions of forest biotope in the Lesser Carpathians, Slovakia, aims to produce a stable breeding herd of genetically non-inbred young.. The Association for Rescue of Endangered Species of Animals – ARESA, in co-operation with research facilities in Slovakia and with various international conservation organisations, would like to contribute to global protection of markhor, eventually re-introducing it to its countries of origin

The ARES markhor breeding program includes the following stages:

1. Creation of a breeding herds to minimize inbreeding
2. Formation of a gene reserve by rearing sires from genetically distant families
3. Introduce our captive bred markhor to controlled biotopes (reservation with rigid protection mechanism, zoos), or other protection facilities, to increase numbers of the subspecies and create a sufficient gene reserve for the subspecies.

By selective reproduction determined through DNA analyses, we plan to ensure the possible introduction of outbred young in their countries of origin or to conditions agreed within the scope of co-operation.

Rearing technology

All animals are reared in a natural forest ecosystem of the Lesser Carpathians range (Malé Karpaty) in south-western Slovakia. Currently, we have 12 animals (5 adult males, 4 breeding females and 3 young), with 6 kids born in our facility during the last 2 years. Animals are housed in a large enclosure, a secondary enclosure (to house males or for another herd) and quarantine facilities.

Legislation – legal rearing

Protection of exotic animals and plants is regulated in national legal regulations that implement EU regulationsas well as the CITES, Bern and Bonn Conventions. ARESA closely co-operates with state authorities for nature and country protection, scientific authorities such as CITES, and NGOs for animal protection. I was a member of the Advisory board of the Ministry of the Environment of the Slovak republic for CITES and took part in the development of technology of rearing of markhor*Capra falconeri heptneri*. All animals are immutably marked by a microchip, by determining DNA profile and by an ear tag.

Rearing conditions

The total area of the Markhor facility is 11.3 ha divided into 2 different sized sections. There are also 2-4 ha available as a quarantine facility. The area enclosed is predominantly forested with oak and black pine, along with European hornbeam and European beech.

Animal nutrition

In co-operation with several experts on the nutrition of wild animals, we created optimum feeding diets, which, however, are only supplemental because animals predominantly rely on eating the bushes, tree shoots and grass in the enclosures.

We also collect and analyze information on the nutritional quality of particular plant species. Quality of alimentary factors and total nutrition of animals is measured at least once a year by blood analysis along with performance of metabolism tests, to monitor health status of animals.

Genetics

The Slovak Agriculture University and the Research Institute of Animal Production, both at Nitra, have been involved in the molecular-genetic analyses of all markhor that are, or will be, allocated to the reproductive herd. We have also performed genetic comparison tests to assess kinship and monitor genetics of animals to be added to herds. The aim is the elimination of inbreeding, confirmation of parentage, genetic identity, etc.

Veterinary care

We perform regular veterinary controls to control or eliminate microorganisms, endoparasites and ectoparasites. The disinfection programme is based on preventive disinfection of the feeding stalls, animal shelters, resting places, trails and other parts of the breeding herd.

Effectiveness of disinfection is based on the principle of periodic alternation of effective agents, which have mainly bactericidal, sporocidal, virusinactivating and fungicidal effects. Dung, which can be a potential seedbed of contamination, is removed regularly. This veterinary program keeps endoparasites as well as other undesired pathogens to the minimum.

Conclusions

Preservation of Markhor requires international co-operation, which will help to reintroduce coherent herds into open nature and, primarily to sufficient gene reserve in case of extinction of free living populations. Our role is to lend a helping hand to preserve such marvellous animals as the Tadjik markhor.

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Abstracts

Population structure and habitat components of a non-hunted argali population in the East Gobi, Mongolia.

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Abstract: Argali sheep ground surveys and plant community studies were conducted on a 163.8 sq. km. portion of a 607.4 sq. km. study area in the eastern Gobi during 1993 and 1998. The steppe plant community consisted of 27.1, 25.1, and 13.7 percent grasses/sedges, shrubs, and forbs, respectively, including 20 species of forbs, 7 of grasses, and 4 of shrubs. A total of 162 argali (15 ewes, 8 lambs, 99 rams, and 40 unclassified ewes and lambs) were observed in 1993, and 171 (70 ewes, 28 lambs, 33 rams, and 40 unclassified ewes and lambs) in 1998. Argali estimates were 0.99 per sq. km. in 1993 and 1.04 per sq. km. in 1998, indicating a stable trend. The high ram numbers in larger size classes (>50%) and average age at natural death of 9 years (range 6-13) indicate that the rams survive to old age. A ratio of 40 lambs:100 ewes in 1998 indicate an increasing population. This argali population is probably viable due to favorable forage conditions, curtailed illegal hunting, unfragmented habitats, and stable numbers.

J. Bombay Nat. Hist. Soc. (2005) 101(3):353-359.

Isolation and characterization of 15 microsatellite loci in the Korean goral (*Nemorhaedus caudatus*).

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Abstract: The genus *Nemorhaedus* of Rupicaprini under the subfamily Caprinae includes three species, *N. caudatus* (long-tailed goral), *N. goral* (Himalayan goral), and *N. baileyi* (red goral). *Nemorhaedus* species is distributed throughout northern Pakistan across Northeastern Asia including Korea (Mead, 1989). The South Korean government has categorized the goral as an endangered species and has also designated the species as a Natural Monument (No. 273). Recently, the wild populations have severely declined due to poaching and habitat fragmentation to an estimated census of less than 780 individuals. To assist conservation efforts by identifying genetic trends in declining and fragmented populations, microsatellite markers have been extensively used to investigate genetic diversity and population structure. Species-specific microsatellites are considered as more powerful genetic markers to generate an accurate genetic composition of a species itself. In this study, we isolated 15 polymorphic microsatellite loci from a Korean goral genomic library and genotyped 20 captive and free-ranging Korean goral.

The data presented describes the development and characterization of species-specific microsatellite markers to study genetic variability among Korean goral populations. Of the 24 loci identified, 15 proved to be polymorphic in the Korean gorals sampled for this study. . The mean number of alleles per locus was 4.6. The average observed heterozygosity was 0.44 and the average expected heterozygosity was 0.61. Six loci out of fifteens showed significant deviation from Hardy-Weinberg Equilibrium (HWE). One explanation for the significant deviation from HWE is the sampling of individuals from different populations indicating population substructure. These novel microsatellites should benefit future studies of the endangered species of other Asian gorals and their relatives for the study of genetic diversity and potential conservation management.

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Molecular Ecology Notes (2005) 5, 421-423.

Habitat Selection by East Caucasian Tur (*Capra cylindricornis*)

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Abstract: Habitat selection by East Caucasian tur (*Capra cylindricornis*), a species of global conservation concern, was examined in relation to terrain, climate and degree of human disturbance using a Geographical Information System and logistic regression. The study area was in the part of the Greater Caucasus of Georgia, where the species protection was not enforced. Two models of tur habitat requirements were obtained: one model at a scale of 20 x 20 m plots, and the other one at a scale of different habitat fragments made up of 20 x 20 m plots identified by the first model at its optimal cut-off value. The second model refined the first one.

The first model suggested that the probability of a 20 x 20 m plot being part of tur habitat was positively correlated with slope, distances to roads and livestock summer camps, and negatively correlated with human population density and annual rainfall. The probability had a bell-shaped correlation with elevation, reaching its maximum at 3008.4 m. The second model suggested that a fragment of a land made up of 20 x 20 plots with optimal characteristics for tur occurrence was more likely to contain tur if the area of the fragment was larger and its distance to the nearest area where tur occurred was shorter.

The results show that the occurrence of East Caucasian tur is affected by climate, terrain, human disturbance and habitat fragmentation, and can be predicted regardless of seasonality in the species movements. These models can be applied to the management of the species and its habitat in the areas of the Caucasus that lie at > 1000 m asl and have an annual rainfall > 600 mm, and where the species protection is not enforced.

Biological Conservation 120 (2004) 391-398

Obituary

Alexander Kirillovich Fedosenko

March 12, 1930 – February 8, 2004

The news of Alexander Fedosenko's death early February was sudden, dismaying and deeply saddening. Up to his last day, he was working on his papers and a final book, when his heart stopped this life-long work.

Alexander Fedosenko was born in the Novosibirsk region in Western Siberia on March 12, 1930. After finishing of the Moscow Institute of Hunting in 1954, he began his career in the hunting business in Siberia (Taymyr Peninsula) and later as zoologist in different organizations of Kazakhstan. In 1960 Alexander Fedosenko began research work at the Kazakh Academy Sciences' Institute of Zoology, where he investigated the ecology of small rodents of Tian Shan. As a result of this work he submitted his thesis and received his PhD in zoology in 1965.

An unexpected shift in his research occurred after earning his doctorate, when he was assigned the task to investigate red deer. This new theme of investigation was so different from his former research subjects, the mouse, that Alexander investigated the ecology of red deer without special enthusiasm. In the early stages, he only did a minimum of work just to satisfy his reports requirements, while at the same time he continued to research his more interesting mouse "under the table". Gradually, however, he began to see more and more interesting phenomena in the lives of red deer. At this same time the ethology was flourishing, and Alexander read many papers and books on the behavior of large ungulates and carnivores. Eventually he forgot about rodents at all, and devoted his research to the lives of wild ungulates. He observed many large animals, all of which were interesting to him: red deer, argalis, wild boars, urials, ibexes, roe deer, snow leopards, wolves, lynxes, and bears. Alexander wrote many interesting papers about these species as well as several outstanding books, "Maral" (Siberian deer) and "Mammals of Kazakhstan". In 1982, Alexander Fedosenko moved from Kazakhstan to Russia (Moscow), where he began to work in the Central Scientific Laboratory of the Nature Reserves Authority of Russia. There he continued to observe large mountain animals everywhere across the vast areas of the former USSR, such as the Taymyr Peninsula, Sayany, Altai (Russia), Pamir (Tadjikistan) and Tian Shan (Kazakhstan, Kirgizia). Alexander Fedosenko enjoyed observing many different species, but the most important and the most loved for him was the argali, which he looked for constantly during all his fieldwork. Alexander wrote many papers on these wild sheep, and eventually the book "Argali in Russia and Adjacent Countries" (2000), in which he published the results of his argali investigations during more than 30 years of work and where it is possible to find all known data on argali living in the world. Over the next three years he published "Urials"(2002) and prepared the book "Siberian ibex" (2004), which was finished two weeks before his death. In addition, he was also an active member and expert of IUCN/SSC Caprinae Specialists Group and took part in the writing of Action Plan for Caprinae "Wild Sheep and Goats and their Relatives" (1997).

We lost a very eminent and inspiring researcher and friend who enjoyed to discovering the secrets of wild nature. Alexander Fedosenko will be missed by us all, and we shall remember him through the enthusiasm he instilled in us and the many significant papers and books he's left behind.

His colleagues and friends.

David Blank

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Acknowledgements

Dr. Rich Harris

Editorial Note

Views expressed in the articles in this newsletter, do not necessarily reflect those of the Caprinae Specialist Group

Tables for "**A 10-Year View of Wild Sheep Management in Sonora, Mexico**" by R. Lee

Table 1. The total numbers of bighorn observed (# obs) and the number observed per survey hour (obs/h) for each mountain range within the 7 regions

		1992/93	2003
Region	**Range**	**# observed (obs/hour)**	**# observed (obs/hour)**
1	Pinacate	25 (16.7)	22 (27.5)
	Blanca	6 (6/7)	2 (2.9)
2	Pinta	6 (3.5)	11 (15.7)
	San Francisco*	23 (12.8)	42 (46.7)
3	Cubabi	8 (6.2)	1 (1.0)
	Silla	14 (17.5)	7 (23.3)
	San Antonio	4 (6.7)	10 (12.5)
	Coloraditos	0 (0)	1 (5.0)
4	Alamo*	19 (14.6)	0 (0)
	Viejo	126 (43.4)	17 (8.9)
	Verruga	15 (21.4)	11 (27.5)
	Picu	8 (8.0)	9 (9.0)
	Aguirre	29 (41.4)	16 (17.8)
	Santa Maria	10 (50.0)	24 (48.0)
	Julio	15 (37.5)	0 (0)
5	Vibora	0 (0)	10 (14.3)
	Rajon	1 (3.3)	0 (0)
6	Los Mochos*	24 (36.9	18 (30.0)
7	Tinajas	7 (23.3)	30 (60.0)
	Tepopa	19 (47.5)	3 (7.5)
	Seri	66 (44.0)	83 (69.2)
	Cirios	77 (48.1)	18 (16.4)
	Tordilla	30 (75.0)	15 (18.8)
	TOTALS	**532 (24.9)**	**350 (22.4)**

*Surveyed both in 1992 and 1993 – data presented are the averages of the 2 surveys

Table 2. Age and sex classifications, and number of hours flown in each of the regions in Sonora, Mexico.

	1992/93	1992/93	2003	2003
Region	**Classifications***	**Hours**	**Classifications**	**Hours**
2	2- 5- 4- 1- 12- 4- 2- 0	2.4	0- 0- 2-2- 14- 5-1- 0	1.5
3	2- 3- 4- 0- 13- 5- 1- 1	3.5	1- 2- 3-0- 32-11-0- 4	1.6
4	1- 1- 2- 1- 17- 3- 0- 1	2.9	1- 2- 4-0- 9- 2-0- 1	2.1
7	5-20-21- 3-110-17-25-22	7.2	5- 5- 7-1- 42-13-2- 2	5.8
8	0- 0- 0- 0- 1- 0- 0- 0	0.6	1- 1- 0-0- 5- 3-0- 0	1.1
10	0- 1- 3- 1- 12- 5- 1- 1	0.6	1- 2- 2-0- 11- 2-0- 0	0.6
11	8- 7-10- 6-111-16-23-18	4.2	5- 9-13-4- 83-23-5- 7	4.0
Totals	18-37-44-12-276-50-52-43	21.4	14-21-31-7-196-59-8-14	15.6

* Classifications are listed as Class I rams, Class II rams, Class III rams, Class IV rams, adult ewes, lambs, male yearlings, female yearlings

Table for "**The Arabian Tahr: A Review of its Biology and Conservation**" by M. Robinson

Table 1. Selected characteristics of the three extant species of *Hemitragus* (references in Robinson *et al* 2004). Data for the Hymalayan Tahr are from wild native populations and from Pare' *et al* 1996.

	Arabian tahr (*H. jayakeri*)	**Nilgiri tahr** *(H. hylocrius)*	**Himalayan tahr** (*H. jemlahicus*)
Habitat	steep arid slopes, cliffs (900-1800 m asl)	wet seasonal montane grassland & stunted evergreen forest (1200-1600 m asl)	Meadows and cool temperate forest (>2500 m asl)
Weight (kg)			
Males	38-45	80-100	90
Females	17-20	50	36
Diet	Diverse; selective browser	grazer	Grass & leaves
Birth Season	Year-round, peak March-April	Year-round, peak January-February	April-July, peak April
Mating Season	September-November	June-August	October-January
Gestation (days)	140	178	180
Typical Group Size	3.1- 4.5	11-71	?
Grouping Behaviour	Mixed groups only	All-male, female & young, mixed groups	All-male, female & young, mixed groups
Solitary males	yes	yes	yes
Mating System	unknown	polygynous	polygynous