

Impact of musk trade on the decline in Himalayan musk deer *Moschus chrysogaster* population in Neelum Valley, Pakistan

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The Himalayan musk deer, *Moschus chrysogaster* inhabits the forests of Neelum Valley, Jammu and Kashmir, including Machiara National Park. A study was made to ascertain the extent of trade in Himalayan musk and to assess the hunting pressure and present conservation status of the population of Himalayan musk deer. Musk deer are killed to excise the musk pod found in mature males between the genital organs and the umbilicus. According to information gathered from nine major professional musk traders, 26 (65%), 31 (73.8%) and 44 (97.77%) musk pods were collected illegally during 2000–02 respectively. However, cumulative total number of musk deer killed during 2000–02 was at least 40, 42 and 45 respectively, as revealed by data obtained from 209 hunters. Data show that though male musk deer are killed for musk pod collection, females are also killed in illegal harvesting. There is limited use of musk as traditional medicine for pulmonary diseases in the area. However, poaching activity fetches US \$275–310 per musk pod; hence musk trade poses a major threat to the survival of the species.

Population of Himalayan musk deer is on a rapid decline because of hunting pressure and destruction of natural habitat due to nomadic and local grazing, along with unsustainable commercial logging and extraction of medicinal plants by the government as well as by the locals. Measures to conserve the species are outlined within the framework of sustainable use of living resources for development.

Keywords: Himalayan musk deer, musk pod, musk trade, Neelum Valley.

MUSK deer are endemic to Asia. They live in natural forests; artificial forests are not suitable habitats for them until the forests mature and understorey shrub, grass and herb layers are developed. Asian musk deer species include *Moschus berezovskii* found in southern China and northern Vietnam, *Moschus chrysogaster* found in Afghanistan, Bhutan, India, Myanmar, Nepal and Pakistan, and *Moschus moschiferus* found in China, Mongolia, the Himalayas and Korea. *M. chrysogaster* populations¹ in Afghanistan,

Bhutan, India, Myanmar, Nepal and Pakistan are listed under Appendix I of CITES, while other populations are included in Appendix II.

The Himalayan musk deer is classified as a lower risk species, near threatened². *M. chrysogaster* belongs to the family Moschidae of the ungulates. It weighs about 10 kg and measures approximately 100 cm in length and 60 cm in height³. The hind legs are about 5 cm longer than the forelegs, indicating a tendency to move by leaping. The Himalayan musk deer is the smallest of Himalayan ungulates living in the cold environment⁴. Hooves, including lateral toes are long and slender. Most of the hair is coarse. Neither sex possesses antlers. The male musk deer has long, saber-like upper canine teeth that project downward up to 5.41 cm below the lips³. In females and juveniles, the canines are small and not visible. The most notable and unique feature is the musk bag or pod which develops when the male has reached sexual maturity. The musk deer is a territorial animal. Its habitat is characterized by small valleys between steep inaccessible ridges at the upper limits of the tree line⁵. In Neelum Valley, Pakistan musk deer are found between 2270 and 3860 m asl⁶. Its favourite habitat in the area is mixed coniferous forest⁶. Traditionally, musk deer are killed in order to excise the musk gland or 'pod', as it is known in the trade⁷. The high value of musk has been an incentive for the illegal hunting of musk deer.

The musk, a jelly-like oily substance with strong odour and reddish-brown colour becomes a powdery mass when dried and gradually turns black. Natural musk is priced for the intensity and endurance of its aroma and has historically been used as an ingredient in some of the world's best perfumes. Musk is highly valued on account of its fixative and scent properties. Muscon⁸, the odourous component of musk constitutes about 0.5–2.0%. Musk is used both as a sedative and a stimulant to cure a variety of ailments^{9–11}. Musk is a more effective antidote for snake venom than hydrocortisone¹². Musk is effective as a general stimulant of the heart and the central nervous system (CNS)¹³. Musk is contained in about 300 pharmaceutical preparations in traditional East Asian medicine (TEAM), as a sedative and stimulant to treat a variety of ailments related to the heart, CNS, breathing and sexuality. It is one of the most expensive natural products with a retail value higher than gold.

Male musk deer produce on an average about 25 g musk per year¹⁴. Hunting methods do not discriminate age and sex of animals. Both females without musk gland, and juveniles, which secrete little musk in the case of males, are killed along with adult males⁷.

At present 52 countries participate in musk trade, with Russia being the major world supplier of raw musk, while European countries such as France, Germany and Switzerland are significant importers¹⁴. A total of 35 countries were involved in the legal trade of musk products during the period 1978–96. According to official data of CITES,

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East Asia and South East Asia are major traders and consumers of musk products primarily for medicinal purposes¹⁴. Japanese import of musk originating from the Himalayas (i.e. Pakistan, India and Nepal) averages about 170 kg/year⁷.

The aim of this study was to ascertain the extent of trade in Himalayan musk in order to assess the hunting pressure and present conservation status of the musk deer population. Strategies for conservation of the species are developed in accordance with the objectives to provide information on musk trade, to ensure sustainable utilization of species and maintain ecological processes.

During the survey (summers of 2000–02) nine middlemen along with 209 hunters of different age groups were interviewed. Number of livestock heads posing grazing pressure along with data on local human population were also collected from nine major localities.

In addition, a questionnaire form was also filled by relevant musk collectors (middlemen) guides and hunter. Any information considered unreliable while evaluating the musk trade and its potential impacts on the population of Himalayan musk deer, was ignored.

Azad Jammu and Kashmir (AJK; 73–75°N, 32–35°E) is a part of the great Himalayas that branches-off from Nanga Parbat¹⁵. Crescent-shaped mountains and hillocks encircle the area from Qummary heights to Iftakharabad. The lower part of Muzaffarabad district lies within the lower Himalayan ranges, and upper Neelum Valley (part of Muzaffarabad district) exists in inner Himalayas¹⁶. The area is situated between 34°28′–34°48′N and 37–74°58′E and covers an area of 345,026 ha. Neelum Valley is 260 km long, running along the Neelum river bordering the line of control with Indian Kashmir. There are lateral valleys adjoining the main valley, forming a spur-like surface. The interlocking pattern of mountains presents a variety of aspects¹⁷. Chilas, Astor and Gilgit in the north and northeast; Kaghan valley in the northwest, Muzaffarabad in the southwest and Indian Kashmir in the southwest surround the area. Neelum Valley is a mountainous area divided into two parts by the Neelum river that enters into the AJK from Tao Butt and flows down to Muzaffarabad to join river Jhelum.

The data revealed that the total number of hunters ($n = 209$, $SD = 18.65$) in the area poses significant ($P < 0.01$, $P < 0.05$) impact on the musk deer killed during 2000 ($n = 40$, $SD = 2.79$), 2001 ($n = 42$, $SD = 2.55$) and 2002 ($n = 45$, $SD = 3.20$; Table 1). Increase in human population has resulted in significant rise in number of livestock heads ($r = 0.947$), which is enhancing pressure on musk deer habitat exploitation and competition for food resources (Table 2). Along with grazing animals, locals and nomads access the core habitat of musk deer.

The demographic data revealed that Hanthi village is posing major threat to the conservation of habitat and species survival in its natural haunts. These local dwellers ($n = 810$) live in close vicinity of the musk deer habitat at 2140 m asl; hence maximum hunting pressure of 25, 21.43 and 22.22% was observed during 2000–02, respectively, from this village alone. Correspondingly, more than 33% of the total poachers also lives in Hanthi (Table 2 and Figure 1), resulting in steep decline of the deer species. Results also revealed that population of musk deer in Neelum Valley is on rapid decline due to increased hunting pressure for the collection of musk pod and destruction of natural habitat. If this pressure continues unabatedly, the musk deer may soon become extinct in the area.

Musk deer are mostly killed for the musk gland found in mature males between the genital organs and the umbilicus. Many professional hunters are involved in musk-pod extraction and trade by killing the musk deer. During the course of the study, a total of nine hunters agreed to uncover information about musk trade. They were interviewed to evaluate the effect of musk trade on the existing and future deer population in the area. According to data obtained from major professional traders, in 2000 a total of 26 (65%) musk pods were collected, while in 2001 it was to 31 (73.8%) and subsequently in 2002 alone, there was a sharp increase to 44 (97.77%) musk pods from the same area (Figure 1). It is also evident that there is no discrimination of sex in this illegal practice. This shows that the trend of killing musk deer for musk trade is increasing by an alarming rate.

To meet their day-to-day demands, the locals depend largely on natural resources resulting in over-exploitation

Table 1. Data showing rank correlation among different variables from the study area

Variable	Forest area	Human population	No. of livestock	Sub villages	No. of hunters	Musk deer killed in 2000	Musk deer killed in 2001
Human population	-0.032						
No. of livestock	0.089	0.947					
Sub villages	0.059	0.916***	0.969				
No. of hunters	-0.109	-0.030	0.099	0.082			
Musk deer killed in 2000	-0.152	-0.380	-0.185	-0.133	0.753**		
2001	0.095	-0.097	0.073	0.164	0.662*	0.797	
2002	-0.157	0.301	0.495	0.498	0.783*	0.686*	0.750*

*** $P < 0.001$; ** $P < 0.01$; * $P < 0.05$.

Table 2. Demographic information linked to unsustainable exploitation of Himalayan musk deer population and habitat in the study area

Villages surveyed	No. of sub villages	Total livestock	Human population	No. of hunters involved	No. of musk deer killed (year)		
					2000	2001	2002
Borr	2	4864 (8.62%)	1500	20	5	3	6
Ghamot National Park	5	2581 (4.56%)	1500	12	5	8	5
Gail	4	5950 (10.54%)	7200	14	2	3	3
Hanathi	2	1400 (2.48%)	810	70	10	9	10
Lari	4	6590 (11.68%)	5000	15	2	2	1
Machiara National Park	28	24030 (42.54%)	24030	32	4	6	10
Palri	4	1752 (3.10%)	2869	15	7	5	4
Salkhla	4	5250 (9.30%)	9500	11	1	2	2
Sarian	8	4077 (7.23%)	4000	20	4	4	4
Total	61	56494	56409	209	40	42	45

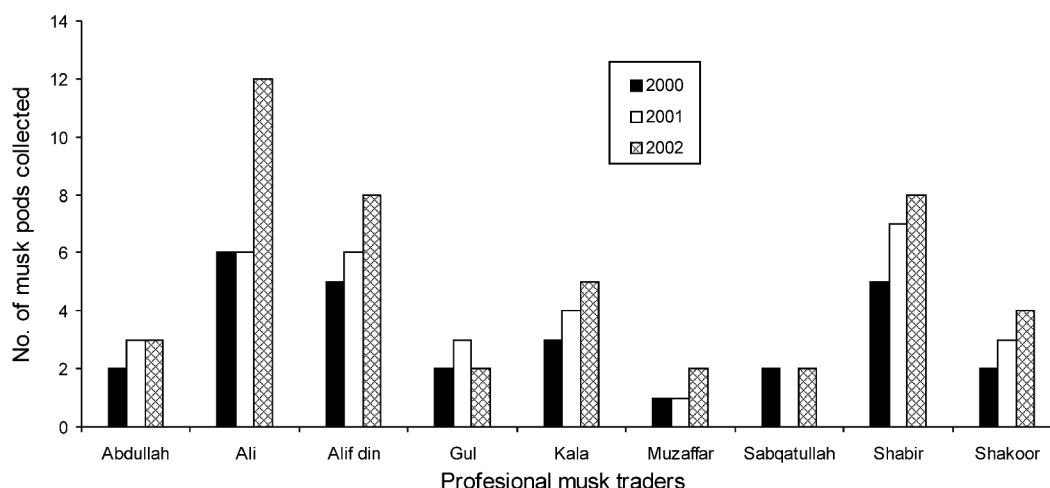


Figure 1. Proportion of annual musk pod collection by musk traders from poachers during 2000–02 in Neelum Valley, AJK, Pakistan.

of such resources. Local hunters can earn about US \$275–310 per musk pod of 25 g average weight, while selling them to middleman. The market price is higher than gold, and hence poses pressure on the survival of the species. The small size of the musk gland means that it is easy to hide and transport. Musk is used for the treatment of ailments caused due to cold climate such as pneumonia, cough and chest congestion. However, use of musk as traditional medicine is limited in the area and clearly reflects that international commercial trade is the main reason for poaching. Along with the hunting pressure the semi-nomadic habit of local livestock holders is a cause of habitat degradation, resulting in pushing the population of musk deer to isolated pockets, which is not a preferred habitat. According to the official data of Neelum Valley Development Board, in addition to local livestock, a total of around 150,000 livestock heads enter every year in Neelum Valley from lowlands for seasonal grazing. These nomads (Bakarwals) invade alpine and sub-alpine pastures of core habitat of musk

deer in June and remain up to September. External nomads along with local graziers damage natural resources and habitat relentlessly.

Population of Himalayan musk deer is on a rapid decline in the area. Hunting wild musk deer to obtain the musk pod and habitat degradation are major threats to the very survival of the species. Local inhabitants do not have sufficient awareness about the importance of biological resources and their role in naturally balanced ecosystem. Hence they over-exploit the biological resources for short-term gains. Weak law enforcement has made it easy for poachers and musk-pod traders to continue their illegal activities. The existing pressure may result in the extinction of the musk deer from Neelum Valley and elsewhere in the western Himalayas. There is an urgent need to make a vigilant check on this activity to conserve the dwindling population of musk deer in its natural haunts.

In order to overcome the socio-economic and poverty-related issues, the animals should be propagated in Machiara

National Park for sustainable extraction of musk without killing the deer, as is being practised in China. The money obtained should be used for sustainable development projects in the area, so that community may get better access to basic health and education facilities.

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