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CONSERVATION AND STATUS OF MARKHOR (*Capra falconeri)* IN THE NORTHEN PARTS OF NORTH WEST FRONTIER PROVINCE, PAKISTAN

By

Sajjad Ali
M.Sc (Forestry), Pakistan Forest Institute, Peshawar, Pakistan, 1995

Professional Paper

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Approved by:

Dr. David A. Strobel, Dean
Graduate School

Dr. Daniel H. Pletscher
Director Wildlife Biology Program

Dr. Kerry Foresman
Division of Biological Sciences

Dr. Mark Hebblewhite
Wildlife Biology Program

Ali, Sajjad M.S May 2008 Wildlife Biology

Conservation and Status of Markhor (*Capra falconeri)* in the Northern Parts of North West Frontier Province, Pakistan

Director: Dr. Daniel H. Pletscher

Pakistan is blessed with a great variety of wild flora and fauna, including a rich diversity of wild Caprinae (sheep and goats) represented by 7 species divided into 12 subspecies. These animals are found in Balochistan and Sindh in the south and the North West Frontier Province (NWFP) and Northern Areas in the north. Markhor is a wild goat which belongs to the family Bovidae and sub family Caprinae. In 1992, it was transferred from Appendix II to Appendix I of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES). The inclusion of markhor in Appendix I brought an end to the trophy hunting program for markhor which was initiated by the North West Frontier Province Wildlife Department (NWFP WD) in 1983. In 1993, the NWFP WD involved local communities in conservation of wildlife through notifying Community Game Reserve Rules under the Wildlife Act of 1975. In 1997, with special approval of CITES, the NWFP WD launched the community-based markhor trophy hunting program in the Province. Eighty percent of the permit fee is deposited in a Village Conservation Fund (VCF) as an incentive to encourage involvement of local communities in conservation of markhor and other associated wildlife species. This has resulted in a positive change in the attitudes of local people towards wildlife which led to an increase in the population of markhor in community managed conservation areas (CMCA). The markhor conservation program in CMCAs was as effective as in government managed protected areas. Credit for this achievement goes to the NWFP WD for involvement of the local community in conservation of natural resources. In NWFP, markhor face a number of threats that include habitat fragmentation, dependence of local communities on natural resources, unawareness, poaching, and lack of conservation funds making conservation of markhor a challenging task both for the government and local communities. The community-based markhor conservation program in NWFP succeeds due to the economic incentive. Uncertainty prevails about the sustainability of this program because a complete ban on markhor trophy hunting by government and/or non-government conservation organizations could occur. For the long term sustainability of the markhor conservation program, it is essential to explore alternative means of income and to build the capacity of local communities in the field of conservation.

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List of Acronyms and Abbreviations

CBC	Community-based Conservation
CWM	Community-based Wildlife Management
CGNP	Chitral Gol National Park
CITES	Convention on International Trade in Endangered Species
CMCA	Community Managed Conservation Area
CTHP	Community-based Trophy Hunting Program
DFID	Department for International Development
DFO WL	Divisional Forest Officer Wildlife
GEF	Global Environmental Facility
GoNWFP	Government of North West Frontier Province
GoP	Government of Pakistan
HJP	Himalayan Jungle Project
IUCN	International Union for Conservation of Natural Resources
IUCN-P	International Union for Conservation of Natural Resources Pakistan
MACP	Mountain Areas Conservancy Project
NCCW	National Council for Conservation of Wildlife
NGO	Non-Governmental Organization
NWFP	North West Frontier Province
NWFP WD	North West Frontier Province Wildlife Department
PAMP	Protected Area Management Project
PCDP	Palas Conservation and Development Project
PRIF	Pre-Investment Facility

SCC	Supra Conservation Committee
SPSS	Statistical Packages for Social Sciences
TSC	Tooshi Shasha Conservancy
UNDP	United Nations Development Program
VCC	Village Conservation Committee
VCF	Village Conservation Fund
VWW	Village Wildlife Watcher
WWF	World Wide Fund for Nature
WWF-P	World Wide Fund for Nature-Pakistan

1. Introduction

Large herbivores were found in abundance in the vast plains of Africa, steppes of Asia, and the prairies of America during prehistoric times. Overexploitation, habitat destruction, and diseases led many species to the verge of extinction; therefore, strict conservation measures were needed to save them from extirpation (Gordon et al. 2004, IUCN 2004). Management of large herbivores is necessary for several reasons. First, most of the large herbivores serve as an important source of revenue through hunting and ecotourism (Dekker and van der Wall 2000). Second, populations of some of them have declined to a critical level due to loss of habitat and over-exploitation (Gordon 2004). Finally, these herbivores play a major role in the structuring and functioning of their respective wild habitats (Martin 1993).

In developing countries, wildlife conservation activities are often limited by financial constraints. Additionally, the means to prioritize the needs of local people during development and implementation of conservation policies and programs are lacking (Lewis et al. 1990). Together, this results in a rapid loss of wildlife and their habitats in many developing countries. The majority of the world's biological species and largest surviving supplies of natural resources are found in developing countries (Bowers 1997), where many plant and animal species have been lost due to wanton poaching and habitat destruction (Haule et al. 2002). Similar causes have contributed to extinction of at least 178 wildlife species since the 16th century (Butle & Horan 2003). Malik (1994) feared that many plant species and microorganisms in Pakistan might have become extinct

before being discovered. Currently, 23% of all known mammalian species worldwide are threatened with extinction (IUCN 2004).

1.1. Biological Diversity of Pakistan

Pakistan has a rich variety of flora and fauna due to its diversified landscape ranging from sea level to 8,611 m (28,251 ft). The country consists of three faunal regions, i.e. the Palearctic region west of the Indus, the Oriental region east of the Indus, and the Ethiopian region throughout the southern coastal belt (WWF-P 2001a, WWF-P 2003). Approximately 5,910 species of plants, 182 species of mammals, 662 species of birds, 174 species of reptiles, and more than 5,000 species of invertebrates have been recorded in Pakistan (GoP et al. 2000, IUCN-P 2003). Pakistan supports 10 out of 18 known mammalian orders including the world's smallest mammal, the Mediterranean pigmy shrew (*Suncus etruscus*) as well as the largest mammal, the blue whale (*Balaenoplera musculus*) along the coast (Roberts 1977). Eleven major ecological zones have been identified: i) permanent snow fields fringed by alpine meadows and sub-alpine scrub; ii) steppe forest and alpine dry steppe; iii) cold wetlands; iv) temperate coniferous forest; v) Himalayan moist temperate forest; vi) sub-tropical pine forest; vii) dry sclerophylous and tropical deciduous forest; viii) arid sub-tropical forest; ix) tropical thorn forest; x) warm wetlands; and xi) mangrove and littoral swamps (Champion et al. 1965, Beg 1975, Roberts 1977). Malik (1995) and WWF-P (2003) identified several causes of biodiversity loss in the country, the major being habitat destruction due to conversion of wild lands

into agricultural lands, timber extraction, fuelwood collection, over-grazing, and over-exploitation of plants and animals. In Pakistan, eight species of mammals and one species of bird have become extinct within the past 400 years (Khan and Husain 1985, Roberts 1997) while 22 species of mammals, 26 species of birds and 9 species of reptiles are threatened with extinction (GoP et al. 2000, IUCN 2007).

1.2. Biological Diversity of NWFP

NWFP has a great variety of wildlife resources compared to the other provinces of the country. The Province is home to over 50 species of mammals, more than 500 species of birds, 42 species of reptiles, and several species of amphibians. Some of the most beautiful and endangered species of mammals and birds, such as snow leopard (*Uncia uncia*) and western tragopan pheasant (*Tragopan melanocephalus*), are found in the unique geographical zones of the Province. Chitral Gol National Park (CGNP) in Chitral and Palas valley in Kohistan support the largest surviving populations of Kashmir markhor (*Capra falconeri cashmiriensis*) and endangered tragopan, respectively. Temperate coniferous forests and adjoining alpine meadows provide habitat for two species of primates, two species of leopards, two species of bears, four species of wild ungulates, five species of pheasants, and hundreds of other animal and bird species. The foot hills and plains provide habitat for five species of wild ungulates, 4 species of partridges, and numerous species of other birds and

reptiles. The rivers and other wetlands in the province provide habitat for indigenous and migrating waterfowl and cranes (Malik 1993).

1.3. Community-based Conservation (CBC)

In 1980, governments and influential donor organizations around the world began to realize that biodiversity cannot be conserved in developing countries without the involvement of local communities in its management (Brandon and Wells 1992, Baker 1997a). Moreover, Rao and Geisler (1993) also emphasized the importance of empowering local people in natural resource management and considered it as the most effective and efficient approach for the conservation of biodiversity in developing countries.

Conflicts are always possible when resources are shared; additionally communities living within or near protected areas frequently bear the cost of conservation (Bajracharya et al. 2006). Therefore, sound approaches to the development of adjacent local communities who are dependent on resources are necessary during the planning of management activities for protected areas. The most successful approaches to the integration of conservation and developmental projects involve the sharing of the benefits of wildlife joint management (Thompson 1997), and development of the local people to compensate for the cost of conservation incurred to them due to living near the protected areas (Lamarque 1995).

Participation of local communities means to empower and build capacity of the people for active involvement in management of resources,

making decisions, and controlling adverse activities (Cernea 1985). Turner (2006) referred to CBC as the involvement of people who are dependent on the natural resources or affected by conservation and management activities. Stakeholder participation in urban-suburban wildlife management varies from agency-based, expert-controlled decision making to broad power sharing among stakeholders (Chase et al. 2000). Stakeholders include local governments, interest groups, citizens experiencing impacts from wildlife, and others. Inclusion of all stakeholders promotes community-based co-management through collaborative efforts (Schusler 1999, Chase et al. 2000). CBC programs, which encompass provision of incentives and value-added economic aspects of the resources for sustainable use, result in a sense of stewardship among local communities to safeguard natural resources as their common social responsibilities (Baker 1997b).

Two general outcomes are expected from Community-based Wildlife Management (CWM): 1) maintenance of wildlife habitats and conservation of species; and 2) improved social and economic well-being of the human communities. The success of CWM programs often depends on revenues from wildlife offsetting costs associated with the program. Additionally, the target communities must be interested and willing to participate (Songorwa 1999).

The CBC approach is designed to provide compensation or other benefits to reduce dependence of the local communities on the natural resources of a protected area (Bajracharya et al. 2006). This approach achieves its goal by providing opportunities to the people living within and in the vicinity of protected

areas to participate in land use policy and management decisions, creating a sense of ownership among the people over wildlife resources, and providing local people with economic benefits from wildlife conservation (Hackel 1998). Ahmad and Sattar (2001) believed that conservation programs are successful and sustainable only when they fulfill the objectives of improving the socio-economic condition of the local people and ensuring optimal ecological benefits from conservation activities. Therefore, to create interest among local people in management and conservation programs, economic incentives as compensation to local people for the cost of conservation should be considered during development and implementation of conservation programs (Liu 1995).

In many developing countries, government policies now consider the right of local people to use wildlife outside protected areas (Harris and Shilai 1997). Economic incentives greatly increase the probability of both sustainable use of wildlife and support of local communities who are considered partners in the conservation of biodiversity (Mehta and Kellert 1998, Wunder 2000, IUCN 2003). Incentives encourage local communities to view wildlife as an asset for development rather than a cost (Butle et al. 2003). The World Conservation Strategy (1980) emphasized conservation of natural resources for human survival rather than solely for the total preservation of biological resources (IUCN 1990).

1.4. Importance of Local Knowledge in Conservation

Local knowledge is the popular or folk knowledge that remains in the informal sector, usually unwritten and preserved in oral traditions rather than texts (Brush and Stabinsky 1996). The importance of local knowledge is usually overlooked by many environmentalists and/or scientists, despite the fact that rural people acquire knowledge through direct contact with the environment and through experiences in the use of natural resources (Berkes 1993). Local people are familiar with the vegetation of the habitat as well as the associated wild animals (Johannes 1993). Therefore, McNeely et al. (1990) considered local knowledge and local leadership very important in CWM. They described local people as the decision makers about the use of local resources and hence very important. Their decisions are affected by several factors, including their own self interest. Therefore, it is essential to know the interests of local people before planning for conservation.

1.5. Trophy Hunting as a Tool for Conservation

Sustainable use of natural resources through community involvement is acceptable if the overall management process is economically and socially attractive to local people as a long-term livelihood strategy (Ahmad and Sattar 2001). Due to its economic value, sustainable management of wildlife can be used as a development tool for rural communities (Lamarque 1995). Baldus (2001) also viewed wildlife conservation and rural development as not conflicting

targets. Wildlife use includes game viewing, tourism, sale of live animals, and hunting for trophy and /or meat. The latter activity is the backbone of a major tourist industry known as safari hunting (Mayaka et al. 2005).

In recent years, provision of economic benefits to indigenous people in some of the developing countries involved hunting as a conservation tool (Johnson 1997). Hunting programs are categorized into wildlife conservation-based programs and business-based enterprises. In the former case, revenue from hunting is used to meet the running cost of wildlife conservation while the latter category is adopted to create opportunities for jobs and generate revenue (Harris and Pletscher 2002). Trophy hunting can be an incentive and a source of high income generation from a small amount of wildlife use (Eltringham 1994, Loveridge et al. 2006). With this income, local communities and governments can maintain wildlife areas and their associated species (Decker 1995). Baker (1997b) argued that trophy hunting is an outcome of CBC, which recognizes that wildlife conservation is for both the animals and people.

Trophy hunting as a lucrative form of use is just one way by which CBC can obtain revenue from wildlife (Loveridge et al. 2006). It is a moral obligation of conservationists to involve local people in conservation practices especially in poor countries where people whose livelihood is affected and bear the cost of conservation programs due to living alongside wildlife (Adams and Hulme 2001). Barrow et al. (1995) considered compensation for the cost of conservation as a condition for the success of CBC and the revenue so generated must be

distributed among the community members in an open, transparent, and well-conceived manner.

Trophy hunting is often advantageous both ecologically and economically, because it requires little infrastructure, draws small crowds, produces less litter than ecotourism, and only a small fraction of the population, i.e. old males having aesthetic value, are harvested. This activity often generates more revenue than ecotourism from a small number of trophy hunters (Mayaka et al. 2005, Loveridge et al. 2006). Baker (1997b) found that hunters willingly pay relatively more money and travel long distances for the privilege of hunting an unusual trophy animal. Importantly, the revenue so generated can be used for conservation of biodiversity through involvement of local communities (Loveridge et al. 2006). Trophy hunting has great potential and serves as an important source of incentives for local people especially in areas where the tourism industry can not be developed due to political instability (Leader-Williams and Hutton 2005).

Trophy hunting is a significant wildlife management strategy in many countries of Asia, Africa, and Europe (Lechuga 2001) that has resulted in a positive change in attitudes of local people towards wildlife, the active involvement of communities in natural resource projects, and the achievement of conservation goals (Lewis and Alpert 1997, Baker 1997a). Due to economic benefits from trophy hunting in these countries, the local people are ready to tolerate some level of crop damage rather than killing a highly valued animal like the elephant (*Loxodonta africana*) (Haule et al. 2002). For example, in 1982,

Shangaan people in the Mahenye area, adjacent to Gonarezhou National Park, Zimbabwe, were financially benefited from the sale of two elephants. This greatly changed their attitudes towards wildlife and the local community voluntarily deputed 100 people from Ngwachumene Island, an important wildlife habitat on the border of the National Park, for the protection of wildlife (Loveridge et al. 2006).

Trophy hunting has been integrated into many conservation programs and projects as a conservation tool for sustainability of wildlife resources and improved socio-economic conditions of the communities (Hofer et al. 2002, Logan and Moseley 2002). This approach can be adopted for the conservation of wildlife outside of national parks and areas which lack alternative wildlife-based land uses such as photographic ecotourism (Lindsey et al. 2007).

Trophy hunting has the potential to play an important role in rehabilitation of wild lands and generates revenue from wildlife with minimal effects on populations of trophy species (Lindsey et al. 2007). For example, trophy hunting operators are playing an important role in facilitating the recovery of wildlife populations in the Coutada hunting area in Mozambique following the civil war (Lindsey et al. 2006). Revenue from trophy hunting has resulted in creation of Wildlife Management Areas and development of Wildlife Conservancies on community-owned land in many countries of Southern Africa (Weaver and Skyer 2003, Baldus and Cauldwell 2004) and subsequently, can provide important incentives for careful management, protection, and reintroduction of species into depleted habitats (Lindsey et al. 2007). On private

land in South Africa, for example, trophy hunting facilitated the recovery of bontebok (*Damaliscus dorcas*), black wildbeest (*Connochaetes gnu*), and cape mountain zebra (*Equus zebra*) by providing financial incentives for reintroduction (Flack 2003). Similarly, incentives from trophy hunting accelerated the recovery of the southern white rhinoceros populations and their reintroduction onto game ranches (Williams et al. 2005).

According to Shackleton (2001) trophy hunting has a significant role in conservation as compared to other uses of wildlife. Likewise, trophy hunting can be used as a tool for the conservation of endangered species even when excessive exploitation might be the original cause of the conservation problem (Lindsey et al. 2007). Trophy hunting can also be used as a tool for removal of problem animals (crop raiders or livestock killers), that otherwise are killed in retaliation by those who suffer; additionally, revenue can be earned through their hunting. Over 50% of clients are willing to pay more or the same as typical trophy fees for such problem animals (Lindsey et al. 2006).

In spite of the potential important role in conservation of wildlife species, trophy hunting should not be considered a sustainable use of wildlife resources until and unless it is based on scientifically-determined wildlife population estimates, comprehensive quotas, transparent and accountable revenue collection and distribution among the stakeholders at the local level, competent management, oversight of the industry, and last but not the least, reputable and honest outfitters (Baker 1997b).

Trophy hunting generates revenue but is not always beneficial to the population of the animal harvested. Trophy hunting can lead to female-biased adult sex ratios. In the case of polygynous species, the fecundity rate does not seem to be affected due to female-biased sex ratio (Ginsberg and Milner-Gulland 1994). However, selective harvesting in monogamous species and species in which males provide parental care cause a negative impact on the population growth rate (Greene et al. 1998). Removal of older males can result in a high proportion of young males in a population. Females may avoid mating with young males, resulting in reduced recruitment of new individuals (Holand et al. 2006). The young males are sometimes unable to inseminate females during their first estrus. The delay in parturition can lead to reduced body weight the following winter, which can affect survival, body size, and reproductive capacity (Kruuk et al. 1999). The population with a high proportion of juveniles and yearlings leads to greater population variability due to sever winter mortality (Cameron and Benton 2004, Gorden et al. 2004). Solberg et al. (2002) found reduced fecundity in primiparous moose in a population with a female-biased sex ratio (0.25-0.70) due to selective hunting. Similarly, Hard et al. (2006) expected a decline in the reproductive success of male red deer (*Cervus elaphus*) in the case of higher male harvest rate (> 30%). In phenotype-based selective harvest, including trophy hunting, hunters usually hunt for antler or horn size, typically a heritable trait. This affects sustainable wildlife management. For example, trophy hunting of bighorn rams (*Ovis canadensis*) caused a significant decline over time in their body weight and horn size (Coltman et al. 2003).

The benefits of properly managed and monitored trophy hunting outweigh any of its disadvantages (Loveridge et al. 2006). To minimize the implications of trophy hunting, 1% of the estimated population was recommended for hunting in mountain goat (*Oreamnos americanus*) population (Voyer et al. 2003); this is greater than the harvest of markhor in Pakistan.

1.6. Introduction to Markhor (*Capra falconeri*)

Pakistan has a rich diversity of wild Caprinae (sheep and goats). Seven Caprinae species inhabit Pakistan, and these are divided into as many as 12 subspecies (Roberts1977, Hess et al. 1997). Markhor belong to the family Bovidae and sub family Caprinae (Schaller 1977, Roberts 1977), and were first described by Wagner in 1839 (Huffman 2004). The name “Markhor” apparently was derived from Persian language meaning snake eater. However, it is mostly considered to be derived from Pashto language word “Mar Akhkar” in which “Mar” means snake and “Akhkar” means horn. The markhor has horns twisting like a snake; therefore it got its name as “Mar Akhkar”. With the passage of time, it changed to markhor (Roberts 1977).

On the basis of horn shape and body characteristics, Schaller and Khan (1975) recognized two subspecies of markhor in Pakistan: 1) flare-horned markhor having horns with a diverging spiral which includes the Kashmir markhor (*Capra falconeri cashmiriensis*) and Astor markhor (*Capra falconeri falconeri*); and 2) Straight-horned markhor with cock screw horns which includes the Kabul markhor (*Capra falconeri megaceros*) and Suleiman markhor (*Capra falconeri*

jerdoni). The straight-horned markhor is smaller in size than flare-horned markhor and have comparatively smaller horns (Robert 1969). Females in both sub species have much smaller horns than males (Roberts 1977). Ellerman and Morrison-Scott (1951) identified five sub species of markhor in Pakistan: Astor markhor, Kashmir or Pir Panjal markhor, Kabul markhor, Suleiman markhor, and Chiltan markhor (*Capra falconeri chialtanensis*), where as Roberts (1969, 1977) described the former four forms as subspecies of markhor and considered the Chiltan markhor as a hybrid between true markhor and wild goat. Shackleton (2001) considered the taxonomic position of Chiltan markhor uncertain between wild goats and true markhor. The IUCN Caprinae Specialist Group and IUCN Red List consider the two subspecies of markhor described by Schaller and Khan (Shackleton 2001).

1.6.1. Description of markhor

Markhor are sturdy animals having strong and comparatively short legs with broad hooves (Robert 1977). Malik (1987) described its coat color as varying from brown to blackish brown and gray. An average adult male of flare-horned markhor stands 99-104 cm at the shoulder and has a total body length of 132-185 cm (Malik 1981). Females are about half of the size of mature males (Malik 1987). The weight of male flare-horned markhor ranges from 100-110 kg (220-242 lbs) and that of female from 32-50 kg (70.5-110 lbs) (Ranjitsinh et al. 2005).

Fig. 1: ***Capra falconeri cashmiriensis***

Fig. 2: ***Cara falconeri megaceros***

Fig. 3: ***Capra falconeri jerdoni***

1.6.2. Biology of markhor

Markhor are gregarious animals. Females live in small herds with their kids and young males; however, mature males are solitary and join females only during the rutting season (Roberts 1977). Markhor are diurnal feeders with the greatest activity in the early morning and late evening, but in winter they feed intermittently throughout the day (Roberts 1977). They browse as well as graze. They occasionally climb into Oak trees (*Quercus* spp.) to consume the foliage (Schaller 1977). Food preferences change with the season and availability. Markhor eat oak leaves when the ground is covered with snow, while in summer they feed primarily on forbs and grasses (Aleem 1976, Schaller 1977).

Female straight-horned markhor become mature at 30-36 months (Roberts 1977) while the age of first reproduction in flare-horned markhor is 24 months (Aleem and Malik 1977). The rutting season starts in late October to early December and lasts for about one month. Gestation is approximately160 to 170 days (Roberts 1977). One kid is most common in females' ≤ 5 years while twins are common in older females (Aleem and Malik 1977). According to Roberts (1977), markhor may live up to 10-12 years.

1.6.3. Habitat of markhor

The markhor is a goat of low elevations as compared to other Capra. Markhor occur from about 700 m to 1000 m along the lower slopes of the Suleiman Range upward to around 2700 m in winter and to 4000 m during the summer in Chitral valley (Schaller 1977). Markhor are mostly confined to arid and

steppe forest (Roberts 1969, Huffman 2004), merging to *Artemesia* steppe which is characterized by extreme diurnal as well as seasonal variation in temperature. This habitat consists of thin and sparse *Juniperus* on the northern aspect with little or no forest cover on the southern aspect. Markhor prefer areas with precipitous slopes and cliffs receiving little precipitation (Roberts 1969).

Common plant species found in its habitat include Oak (*Quercus ilex*), Sagebrush (*Artemisia* sp.), *Indigofera* sp.*, and Ephedra* sp. as dominant species below 2600 m with a few scattered wild Almond (*Amygdalus* sp.), Pistachio (*Pistacio* sp.), Spruce (*Picea smithiana*), and Fir (*Abies pindrow*) at higher elevations. The grasses *Cymbopogon*, *Stipa*, and *Chrysopogon* provide ground cover (Schaller 1977, Malik 1981).

1.6.4. Distribution of markhor

Markhor are found in the South Asian countries of Pakistan, India, and Afghanistan, and in the Central Asian countries of Turkmanistan, Tajikistan, and Uzbekistan (Schaller 1977). In Pakistan, these animals inhabit the desert hills in southern Balochistan, southwestern Sindh, and high mountain ranges in the northern parts of the country, mostly in small fragmented populations (Shackleton 2001). Astor markhor is confined to the slopes of the Nanga Parbat Massif in the Gilgit region. The Pir Panjal or Kashmir markhor occurs about 65 km north of Chitral town, southwards into Dir and westwards on the slopes of Ludakh Sar and Mankial in Swat Kohistan and Indus Kohistan. A few of this sub species also occur in Azad Kashmir. The Kabul markhor has been reported in the southern

border region of Chitral as well as in Murghazar Hills of Swat valley. They also occur in the Khanori hills of the Malakand Agency and the Sakra range to the north east of Mardan and Safed Koh range in the upper Kurram valley. The Suleiman markhor is widely distributed but also restricted in numbers. It occurs on all the major adjacent mountain ranges in the north and east of Quetta. Chiltan markhor are confined to Chiltan hills south west of Quetta (Schaller and Khan 1975, Roberts 1977) (Fig.1).

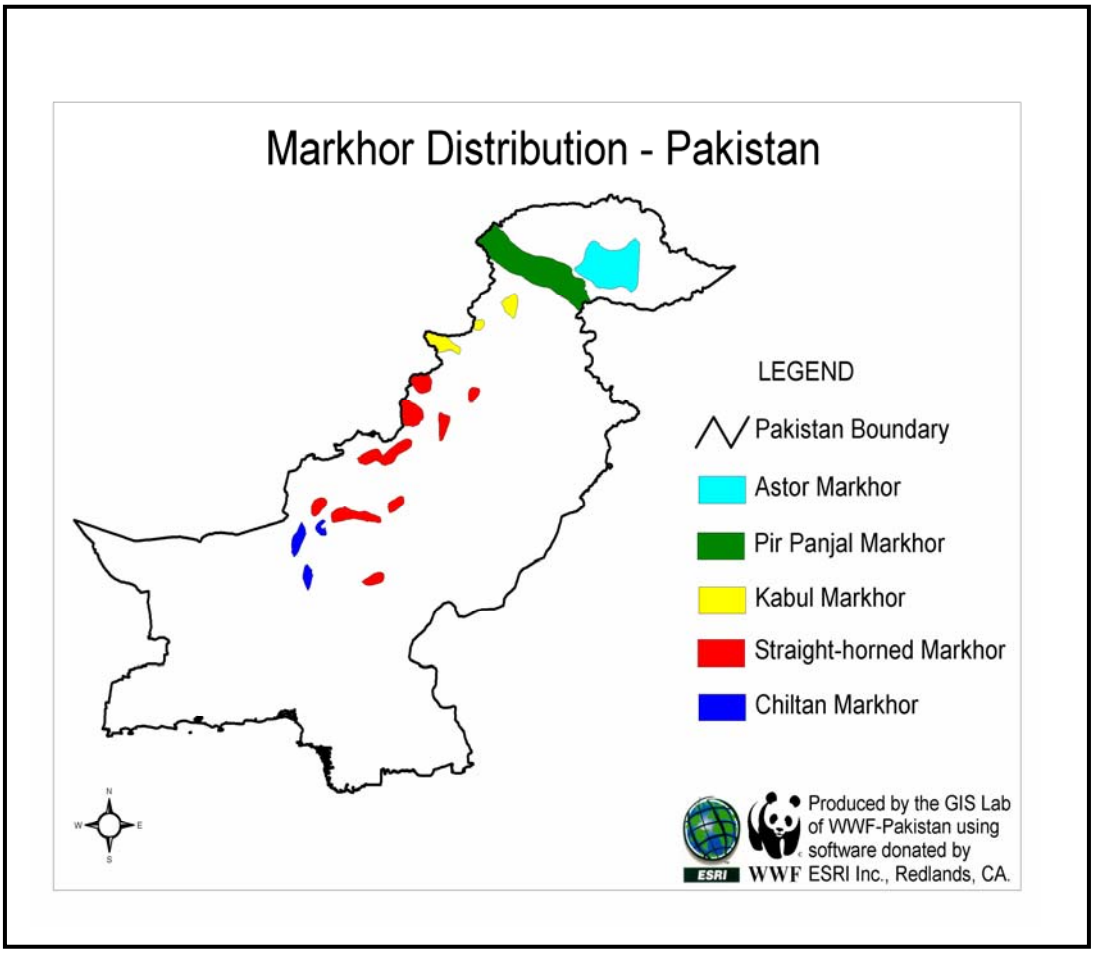

Fig.4: Markhor distribution in Pakistan

1.6.5. Status of markhor

Markhor have a wider distribution in Pakistan than in any other country (Hess et al. 1997). According to Roberts (1969), the estimated population of flare-horned markhor was well below 1000 in Chitral, Dir, Swat, and Indus Kohistan. Schaller and Khan (1975) estimated 125-150 animals in Chitral Gol, 125 in Tooshi, and a total of about 500-600 markhor in Chitral Division. They provided a rough estimate of 1500 flare-horned markhor in the western portion of Swat. Malik (2002a) estimated 800-1000 markhor in Chitral Division. Survey reports indicate 1400 markhor in Chitral, Dir Kohistan, and Swat Divisions (NWFP WD 2005a). This number is based on actual sightings of the animal. Therefore, the markhor population in the region is much higher than this number. Unfortunately, surveys were conducted in different areas at different times, making comparisons difficult.

Shackleton (1997) pointed out that most Caprinae species face threats of extinction due to genetic isolation, specialized habitat requirements, and low reproductive rates, in addition to human causes. The CITES places a ban on all forms of export of a species which is endangered. However, when threats such as excessive poaching and/or habitat loss contribute to a decline in the population of the species within a country, the CITES ban on export is less effective in the conservation of the species (Caughley et al. 1990). In 1975, the straight-horned markhor was placed in Appendix I and flare-horned was included in Appendix II of CITES (Rosser et al. 2004). In 1992, on a proposal from the United Kingdom, flare-horned markhor was transferred to Appendix I of CITES.

Appendix I of CITES consists of species which are internationally endangered. These are species whose international trade is strictly prohibited in all its forms while Appendix II includes all those species threatened with extinction, may or may not be affected by trade, and whose international trade is allowed but restricted (CITES 1992). All subspecies of markhor were declared as endangered by IUCN in 1996 (IUCN 1996).

1.6.6. Demographic effect of trophy hunting in markhor

Trophy hunting of animals having large horns, antlers, and tusks has occurred since ancient times. Wild ungulates which are considered trophy animals bear marked sexual dimorphism and are polygynous in nature (Frisina et al. 2000, Shackelton 2001, Roberts 2001). Moreover, the individuals selected for trophy hunting are usually older males, some of which have little future role in breeding activity. Hunting of markhor in Pakistan is less than the 1 or 2% of the total male population size recommended annually for trophy hunting (Harris 1993, Morrill 1993, Baker 1997b). Therefore, removal of these males is unlikely to affect the reproductive capacity of the population, should have a minimal effect on markhor genetics, and have a negligible impact on overall population size (Morrill 1993, Baker 1997b, Shackleton 2001, Roberts 2001).

1.6.7. Predation of markhor

Humans are the primary predators on markhor. Because markhor inhabit very steep and inaccessible mountainous habitat, several strongholds of

markhor populations have been rarely approached by man. Golden eagles (*Aquila chrysaetos*) have been reported preying upon young markhor. Among the wild carnivores, Himalayan lynx (*Felis lynx*), leopard cats (*Felis bengalensis*), snow leopards (*Uncia uncia*), wolves (*Canis lupus*), and black bears (*Ursus thibetanus*) are the main predators of markhor (Roberts 1969, Schaller 1977, Malik 1981).

1.7. Trophy Hunting in Pakistan

1.7.1. Background of trophy hunting in Pakistan

Trophy hunting is a wildlife conservation tool widely recognized and accepted for the conservation and protection of wild resources by local communities through incentives in the form of hunting fees. This approach has recently been adopted in Pakistan where most species of wild ungulates are threatened with extinction. Therefore, government and non-government conservation organizations are trying to conserve wild ungulates through trophy hunting programs in CBC areas by providing the communities a share in the trophy hunting fee as an incentive.

Pakistan has led the world in introducing the concept of community-based trophy hunting programs (CTHP) to the conservation of biodiversity in high alpine ecosystems (WWF-P 2001b). Limited trophy hunting has been practiced in Pakistan since the 1980s in Balochistan, NWFP, and Northern Areas as a management tool for the conservation of Suleiman markhor, Afghan urial (*Ovis vignei blandfordi*), Punjab urial (*Ovis vignei punjabiensis*), Sindh ibex (*Capra*

hircus blythi), flare-horned markhor, and Himalayan ibex (*Capra ibex sibirica*). Benefits (fees) from the hunts were used for the conservation and protection of the species (Shackleton 2001). The GoP has initiated several biodiversity conservation programs such as CTHP which need support for their sustainability to benefit both the wildlife and communities in the long run. The main goal of Pakistan's CTHP is to contribute to the conservation and protection of the country's rich and precious biodiversity. The goal of CTHPs should be the conservation of wildlife and their habitats and may be achieved both through community and government agencies (Shackleton 2001).

1.7.2. Community-based markhor trophy hunting program (CTHP) in NWFP

Markhor are highly prized by international hunters for their majestic horns. In 1983, the NWFP WD started the Chitral Conservation Hunting Program, a trophy hunting program for markhor. This was not a CBC program because all proceeds went to the government. The NWFP WD issued two annual permits for trophy hunting in CGNP under an agreement with Shikar Safari Club of the United States of America. The permit, which started at US $5,000 in 1983, reached US $15,000 in 1991. During this period, 16 markhor were hunted in and around CGNP (Johnson 1997, Malik 2002a, Mir 2006).

The GoP imposed a complete ban on hunting and export of all wild mammals including markhor for a period of three years subjected to the special permission of the Prime Minister (GoP 1991). Markhor had been in Appendix II

since1975, but in 1992, it was transferred to Appendix I of CITES (CITES 1992). The inclusion of markhor in Appendix I resulted in the temporary end to trophy hunting program in the country (Malik 2002a).

In 1993, the NWFP WD embarked upon a program of community participation in wildlife conservation. Rules for Private Game Reserves were notified in 1993 (GoNWFP 1993) and NWFP became the first province of Pakistan to involve and empower the local communities in the conservation of wildlife. Special attention was paid to the conservation of markhor in the province. Communities were organized and two areas (Gehrait and Tooshi Shasha) were declared as CMCAs called conservancies in Chitral with the consent of the local communities (GoNWFP 1998a, 1998b). Markhor conservation plans for these conservancies were prepared with the involvement of local communities under the Global Environment Facility (GEF) funded project, “Maintaining biodiversity in Pakistan with Rural Community Development”. A trophy hunting policy was approved which stated that 75% of the trophy hunting fee would go to communities (GoNWFP 1997, 1998a, 1998b, Malik 2002a).

Subsequently, the GoP submitted a proposal to CITES for allocation of an annual trophy hunting quota for markhor to act as an incentive for the communities to conserve markhor. It was proposed that 75-80% of the trophy hunting fee would be deposited in VCF of the communities and would be spent on conservation and related developmental programs by Village Conservation Committee (Malik 2002a).

CITES (1997) approved an annual markhor trophy hunting quota of six animals for Pakistan subject to the condition that trophy hunting would be allowed only in CMCAs. The National Council for Conservation of Wildlife (NCCW), which is a scientific and management authority for CITES in Pakistan and distributes trophy hunting quota for CITES-listed species in the country, allocated three markhor to NWFP for trophy hunting. The quota issued by NCCW was based on information provided in the markhor conservation plans submitted by the provincial governments (Shackleton 2001, Malik 2002a).

Due to the success of the CTHP, CITES (2002) increased the trophy hunting quota for Pakistan from 6 to 12 for CMCAs to further encourage communities' involvement in the conservation of markhor; NCCW allocated an annual quota of 4 hunts out of these 12 markhor to NWFP. The hunting season for markhor in NWFP is from the first week of December to end of March; these are the most suitable months for trophy hunting of markhor in the mountains of NWFP (NWFP WD 2006, Malik 2006). Trophy hunting in NWFP is offered as a package consisting of one markhor along with one Himalayan ibex (Malik 1999). The hunter must pay a permit fee for both species in the package (see Table 1 for US $ amounts, and section 1.7.4). In addition to the Trophy Hunting Permit Fee, US $100 is charged as a big game shooting license fee under the provisions of the NWFP Wildlife Act, 1975 (NWFP WD 2006, Malik 2006). The records of NWFP WD show that 28 hunting permits for markhor have been issued in CMCAs from 1998 to 2007 and 75-80% of the permit fee has been deposited in VCF as the communities' share (Table1). Trophy hunting of markhor

is offered in four CMCAs in the northern parts of NWFP (Malik 2006). These Conservancies are

i. Tooshi Shasha Conservancy (TSC) in District Chitral;

ii. Gehrait Goleen Conservancy in District Chitral;

iii. Mankial Valley Conservancy in District Swat; and

iv. Kaigah Nullah Conservancy in District Kohistan.

Table 1: Revenue from trophy hunting of markhor in NWFP, Pakistan

S.No	Hunting season	No. of markhor allocated (Quota)	Conservancy where hunt took place			Rate per permit (US $)	Total amount (US $)	Communities' share (US $)
			Tooshi Shasha	Gehrait	Kaigah			
1	1998-99	3	2	1	-	18,000	54,000	40,500*
2	1999-2K	3	2	-	-	25,150	50,300	40,240
3	2000-01	3	2	1		27,000	81,000	64,800
4	2001-02	4	-	1	-	28,000	28,000	22,400
5	2002-03	4	3	-	-	30,500	91,500	73,200
6	2003-04	4	3	1	-	33,000	132,000	105,600
7	2004-05	4	1	2	1	45,100	180,400	144,320
8	2005-06	4	2	1	1	52,600 55,100 52,600	212,900	170,320
9	2006-07	4	2	1	1	57,100 57,100 56,100	227,400	181,920
Total		**33**	**17**	**8**	**3**		**1057,500**	**843,300**

Communities' share was 75%

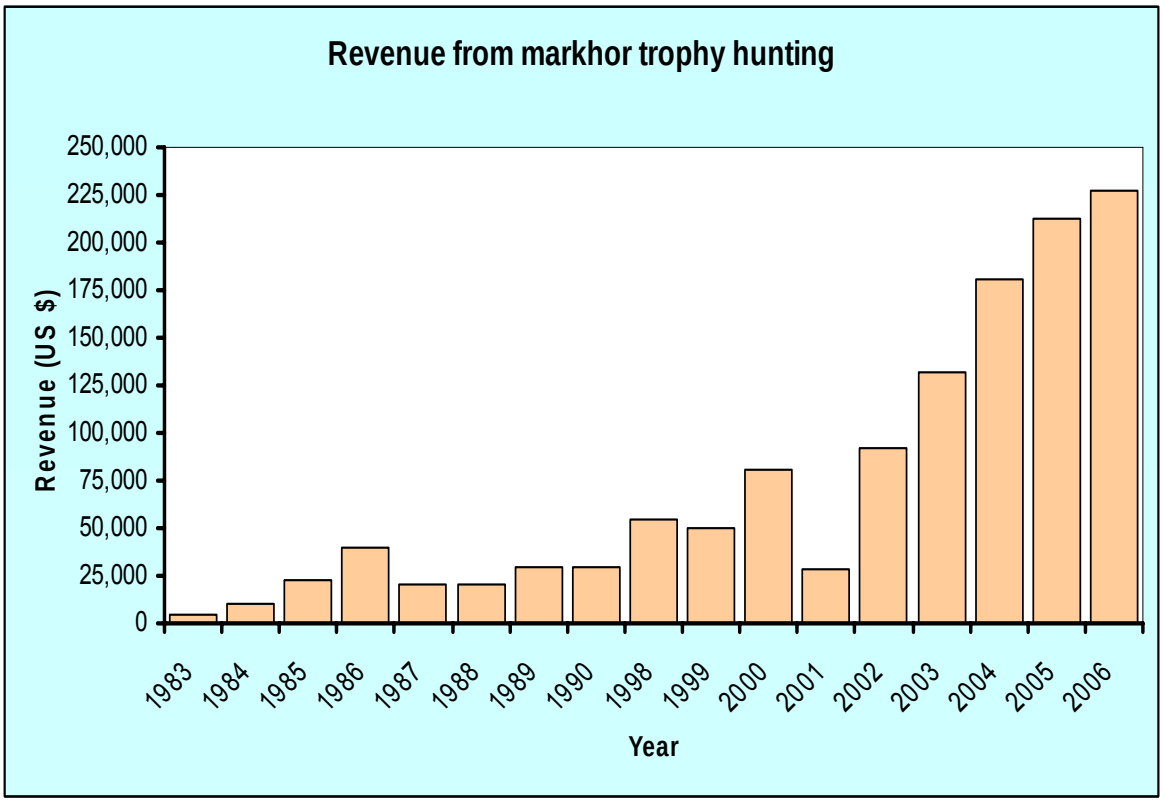

Fig. 5: Graph showing revenue from markhor hunting in NWFP, Pakistan

1.7.3. Criteria for eligibility of a community for CTHP

To become eligible for CTHP, a community must prepare and execute a management plan for its conservation area with the technical assistance of the NWFP WD. Following approval, the Wildlife Department submits the plan to NCCW for implementation of the recommendations. The plan is updated at a maximum interval of 5 years and consists of the following minimum information (WWF-P 2001b):

i. Goal and objectives of the plan;

ii. All species offered for hunting;

iii. Population size of hunted species;

iv. Terms of Partnership between the community and NWFP WD;

v. Survey techniques;

vi. Minimum population size of all species offered for hunting;

vii. Utilization of funds in different sectors, i.e. self sustaining programs, watch and ward, etc.;

viii. Conservation activities to be undertaken to achieve the goal of the management plan;

xi. Monitoring and evaluation techniques;

x. Agreements to external monitoring by the province and NCCW; and

ix. Main problems in CTHP.

1.7.4. Markhor survey schedule

The method adopted for markhor survey is called the vantage point method. Surveys are the most important component of the trophy hunting program because they provide the population size of trophy-sized markhor. The allocation of a hunting quota to a conservation area is decided on the basis of survey results. The time for conducting survey is determined by VCC of the concerned conservancy in consultation with local wildlife protection staff, keeping in view the weather conditions, elevation, and location of the survey site. To determine the number of trophy-sized markhor in a population, surveys are conducted in winter when the ground is covered with snow and animals descend to lower elevations in search of food. The rutting season is considered as the appropriate time for survey (usually in the months of December and January) during which most of the male population joins the herds of females at

low elevations. The winter surveys are not only important to determine the minimum number of trophy-sized animals, but the kid/female ratio can also be determined in markhor population (WWF-P 2001).

1.7.4. Hunting permits fee and hunting season

Markhor hunts are offered in open auction and the permit fee is received in US dollars (NWFP WD 2006). The permit fee may vary across Conservation Areas. The bid for the year 2006-7 hunting season was received as US $57,000 per package for each conservancy in the NWFP of Pakistan (e.g., Table 1). The successful and notified hunters/outfitters are required to confirm their acceptance of Trophy Hunting Permits by depositing the bid money in advance and in full with the NWFP WD for the given period up to the last week of November. If the notified highest bidder fails to deposit the bid money in the given time, the permit is offered to the next qualifying bidder (Malik 2006).

The hunting season for markhor in NWFP is from the first week of December to end of March; these are the most suitable months for trophy hunting of markhor in the mountains of NWFP (NWFP WD 2006, Malik 2006).

1.8. Objectives

The NWFP WD has a mandate to conserve and manage the wildlife resources of the province through implementation of the NWFP Wildlife Act of 1975. In light of emerging problems in the domain of resource conservation, need-based proactive policies and decisions are adopted to tackle the existing

challenges and resource conflicts. Earlier, the local communities were not involved in co-management of resources. Therefore, the local people were reluctant to support the conservation activities carried out by the Department. Realizing the importance of participation of local communities in resource conservation, the NWFP WD initiated a trophy hunting program on markhor in the 1990s in the province, to provide means of economic and social uplift to the local people with an objective to conserve markhor and other associated wildlife species. In this paper, I will evaluate the sustainability of the markhor conservation program commenced by the NWFP WD before it is extended to other areas important for wildlife conservation. This will also assist in improvement of the CBC program. For this purpose, the following objectives were evaluated for the conservation of markhor in the province:

1. Role of the NWFP WD in conservation of markhor;
2. Role of communities in conservation of markhor;
3. Problems in the conservation of markhor;
4. Incentives to the local communities; and
5. Management effectiveness of Community-based Conservation versus Government-based Conservation.

2. Study Area

2.1. Description of the Area

The northern parts of NWFP consist of mountains and associated valleys and extend over an area of 27,850 km^2. Elevations range from 1,500 m to 7,900 m (Rasheed 2007). The three famous mountain ranges, the Himalayas, the Karakurram, and the Hindukush form a diverse landscape which enhances the ecological significance of the area. The climate of the area is characterized by hot summers in the lower areas and cold summers in the upper elevations. Precipitation annually ranges from 200 mm to 800 mm and is mostly received in winter and spring, largely in the form of snow (Rasheed 2007). These areas have a very rich biological diversity and harbor many endemic and endangered floral and faunal species (Malik 2002b, Rasheed 2007). This area also boasts a rich cultural heritage.

The northern parts of NWFP remained as independent, self governed and isolated states from the rest of the world for centuries. These areas developed their own indigenous system of community organization and natural resource conservation. After the independence of Pakistan, these small states were merged into Pakistan one by one as settled areas of NWFP (Rasheed 2007). There are few livelihood options for people living in the northern parts of NWFP. Agriculture and livestock rearing are the main sources of subsistence. Subsistence hunting is a common practice in these areas. Forest and range lands are under heavy pressure from timber extraction, fuelwood collection,

grass cutting, and grazing. The per capita income is low as compared to other parts of the province (Malik 2002b).

2.2. Land Cover Types and Associated Wild Mammals

The major vegetation or land cover types of the area and associated flora and fauna can be divided broadly into the alpine, subalpine, montane and subtropical ecoregions elevationally (Roberts 1977, Malik 1987, NWFP WD 2007), and consist of the following major land cover types: permanent snow and cold deserts; alpine meadows; alpine steppe, sub-alpine scrub and birch forest; dry temperate coniferous forest; moist temperate coniferous forest; sub-tropical pine forest; dry subtropical semi evergreen forest. Markhor occur within the alpine meadows, sub-alpine scrub and birch forest, dry temperate coniferous forest, alpine dry steppe, and dry subtropical semi evergreen land cover types. I reviewed the typical vegetation and fauna communities in these important lands cover types for markhor as under:

2.2.1. Alpine zone

2.2.1.1. Alpine meadows

Alpine meadows are found above the coniferous forest tree line in the mountainous regions of Swat, Dir, Kohistan, and Chitral. Typical plant species in the area include *Saxifraga siberica*, *Euphorbia kanaorica*, *Draba trinervia*, *Polygonum affine, Thymus serpyllum, Androsace baltistanica, Bergenia strecheyi*, Potentilla spp., and *Poa* spp. This habitat supports Himalayan ibex ,

musk deer, snow leopard, brown bear (*Ursus arctos*), Himalayan lynx, lesser shrew (*Sorex minutus*), royal's pika (*Ochotona roylei*), and long tailed marmot (*Marmota caudata caudata*). Markhor occasionally use this area.

2.2.1.2. Sub-alpine scrub and birch forest

This land cover type exists as a narrow zone throughout the higher mountain ranges of the Himalayas from about 3,350 m to the tree line in Dir valley and some parts of Kohistan valley. Evergreen conifers and evergreen broad-leaved trees with deciduous shrubby undergrowth are characteristic of this habitat. *Juniperus communis*, *Betula utilis*, *Sorbus aucuparia*, *Cirsium falconeri,* and *Astragalus alpinus* are the major flora of this habitat. Associated wildlife species include Kashmir markhor, musk deer, Himalayan black bear (*Ursus thibetanus thibetanus*), wolf, and snow leopard. Additionally, according to my personal observation and information from the local people, brown bear, Himalayan wood mouse (*Apodemus rusiges*), Kashmir red fox (*Vulpes vulpes griffithi*), and royal's pika can be seen here.

2.2.2. Dry temperate coniferous forest

This habitat type is found in the lower regions of Chitral valley in Hindukush mountain ranges and Kohistan, Swat, and Dir valleys in the inner Himalayan mountain ranges between 1,225 m to 3,300 m. Flora of this habitat consists of *Pinus wallichiana*, *Cedrus deodara*, *Pinus gerardiana*, *Picea smithiana*, *Indigofera gerardiana*, *Viberburnum cotinifolium, Polygonum alpinum,*

Chenopodium foliosum, and *Sambucus ebulus*. Kashmir markhor, Himalayan black bear, small Kashmir flying squirrel (*Hylopetes fimbriatus*), and royal's pika are the major fauna of this habitat. Additionally, according to my personal observation and information from the local people common leopard (*Panthera pardus*) and stone marten (*Martes fonia*) are also found here.

2.2.3. Alpine dry steppe

Alpine dry steppe land cover types are found between 1,200 m and 2,400 m in Kohistan valley, Dir valley, and the lower regions of Chitral valley. *Pinus wallichiana*, *Pinus gerardiana*, *Quercus ibex*, *Juniperus macropoda*, *Juniperus polycarpus*, *Pistacia integerrima*, *Pistacia mutica*, *Ephedra nebrodensis*, *Rosa webbiana*, *Saphora mollis*, *Artemesia maritima*, and *Berberis* sp. are the common plant species of this habitat. Kashmir markhor, urial (*Ovis orientalis*), common leopard, Kashmir red fox, Himalayan black bear, and Asiatic jackal inhabit this habitat. This is an important summer range for Kashmir Markhor.

2.2.4. Dry subtropical semi evergreen forest

This land cover type is confined to the foothills except Chitral valley between 500 m to 1,000 m elevation. The indigenous flora of this habitat consists of *Olea ferrugiana*, *Acacia modesta*, *Acacia nilotica*, *Dodonea viscosa*, *Sisyphus numularia*, *Zizyphus mauritiana*, *Monothica buxifolia, Heteropogon contartus, Cymbopogon jawarancusa, Cynodon dactylon, Crysopogon aucheri,*

Brumus japonicus, and *Cryzopsis* sp. This habitat is inhabited by Kabul markhor, goral, common leopard, and Asiatic jackal.

2.3. Chitral Gol National Park (CGNP)

CGNP is situated in Chitral valley to the west of Chitral town. It was declared a National Park in 1984 and extends over an area of 77.5 km^2. Conservation and management of natural resources in the area is the responsibility of the NWFP WD (GoNWFP 1984).

The Park consists of mostly high, rugged, and steep mountains with slope varying from 45^0 to 120^0. The climate of the area is dry temperate with a mean annual temperature of $16.8C^0$ and mean annual precipitation of 445 mm, principally in winter and spring. The main trees and shrubs growing in the area include *Quercus ilex*, *Pinus gerardiana*, *Juniperus macropoda*, *Salix* sp., *Abies pindrow*, *Pistacia khinjuk*, *Viburnum* and *Rosa* sp. (NWFP WD 2006a).

The ownership of the park is disputed in court between the GoNWFP and the former Mehtar (ruler). The former Mehtar has provided land for accommodation and agricultural practices to some communities and rights and privileges of grazing livestock and fuel wood collection in the Park area (NWFP WD 2006a). Markhor, snow leopard, wolf, black bear and Himalayan lynx are found in the Park area (NWFP WD 2006a).

2.4. Tooshi Shasha Conservancy (TSC)

TSC lies north of Chitral town along the main Lotkoho river and encompasses 200 km^2 (NWFP WD 1998c). It was declared a conservancy in 1998; conservation and protection of wildlife species along with other natural resources in the area is the responsibility of local communities with the technical assistance of the NWFP WD (GoNWFP 1998a. TSC consists of several valleys and villages with a human population of about 4,000 (NWFP WD 1998c).

The area consists of high mountains characterized by precipitous cliffs and steep slopes which have sparse vegetation of holly oak trees (*Quercus ilex*). *Rosa webbiana*, *Artemesia maritima*, *Astragulus* spp., and *Tamarix* spp. are important shrubs (Habibi and Waheed 2001). Markhor, snow leopard, wolf, and Himalayan lynx are large mammals found in this conservancy (NWFP WD 1997a, 1997b).

The conservation area is owned by the local communities and they are entitled to use the natural resources of the area. Grazing, fuelwood collection, and agriculture are common practices. Poaching has been controlled to a great extent by the local communities but sporadic poaching still occurs (NWFP WD 1998c, Habibi and Waheed 2001).

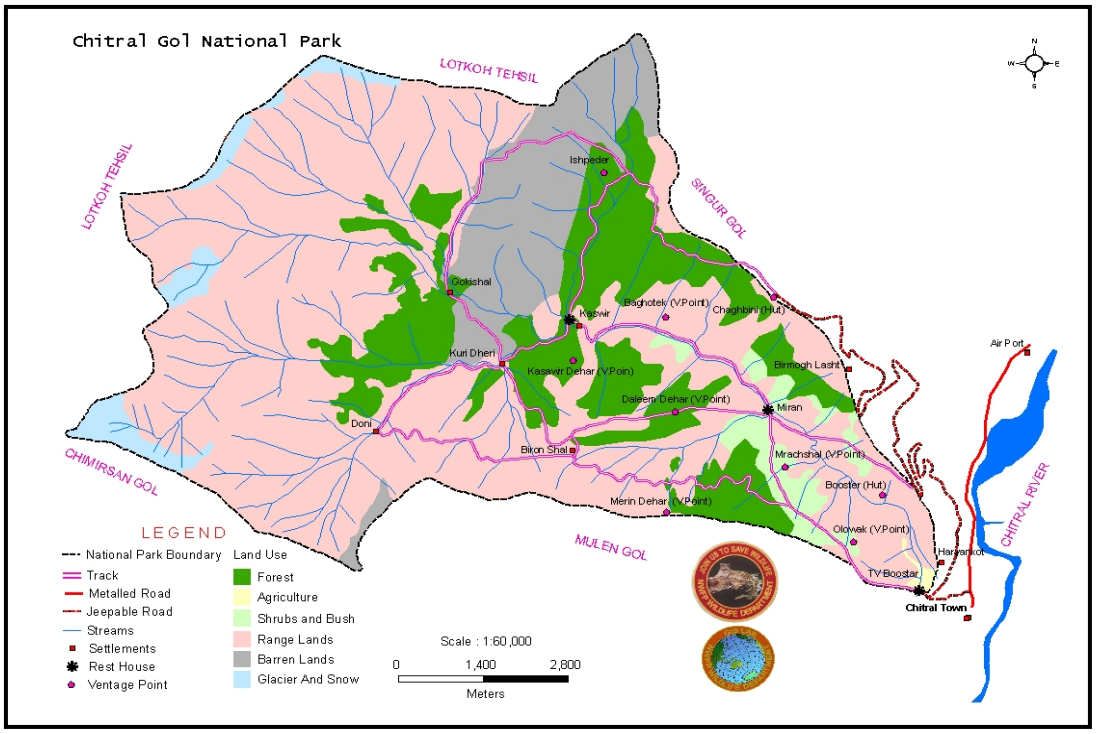

Fig.6: Map of Chitral Gol National Park in Chitral, NWFP, Pakistan

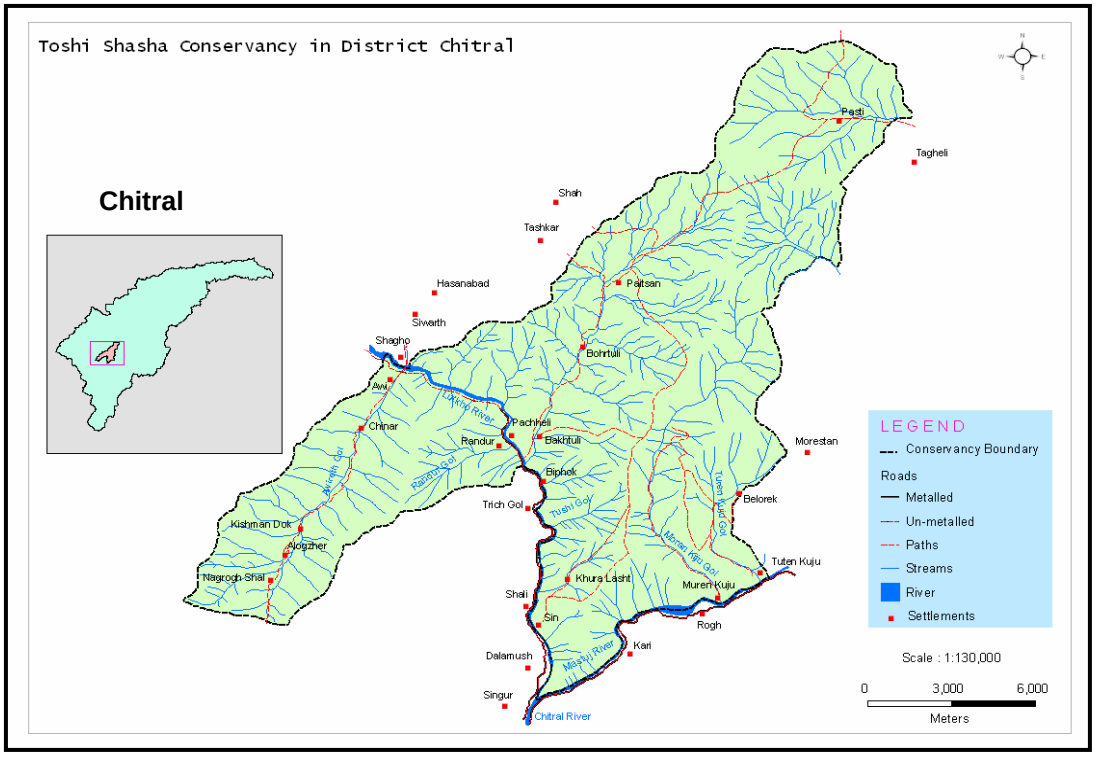

Fig.7: Map of Tooshi Shasha Conservancy in Chitral, NWFP, Pakistan

3. Role of the NWFP WD in Conservation of Markhor

The NWFP WD plays an important role in the management and conservation of wildlife in general and markhor in particular. To maintain healthy populations of wildlife species through protection, preservation, conservation, and management, the department focuses on scientific approaches, so that various kinds of benefits are drawn from these resources on sustainable basis. Malik (1993, 2004) outlined the following roles of the NWFP WD:

i. Implementation and enforcement of the NWFP Wildlife (Protection, Preservation, Conservation and Management) Act of 1975, which extends over the entire Province except Federally Administered Tribal Areas;

ii. Controlling /regulating trophy hunting, including prescribing hunting seasons and days, methods of hunting, place of hunting, etc.;

iii. Controlling /regulating possession, trade, import, and export of markhor and other wildlife species;

iv. Protecting and conserving markhor and its habitats in Wildlife Sanctuaries, National Parks, and other protected areas;

v. Monitoring and conducting surveys to determine distribution, status, and population trends of markhor and other wildlife species;

vi. Identifying, notifying, and managing protected areas such as National Parks, Wildlife Parks, Wildlife Sanctuaries, Refuges, and Reserves for the conservation of markhor and other wildlife species;

vii. Replenishing depleted populations through protection and / or reintroduction and captive breeding programs for markhor; maintaining and improving its degraded habitats;

viii. Conducting management-oriented research;

ix. Carrying out an extension education and outreach program for creating awareness about protection and conservation of markhor and other wildlife species;

x. Involving and ensuring active participation of local communities in preparation and implementation of projects for markhor conservation;

xi. Seeking financial assistance from donor agencies for markhor conservation as well as collaborating and co-coordinating conservation programs with sister departments, Non-government Organizations (NGO), and communities;

xii. Preparing and implementing various projects for institution-building and capacity development of the staff;

xiii. Identifying and analyzing issues that affect conservation of biodiversity through plans and programs to address and resolve the issues;

xiv. Monitoring and evaluating the success of conservation projects for markhor conservation; and

xv. Training and assisting community representatives in preparation and implementation of biodiversity conservation plans and subsequent monitoring and evaluation.

3.1. Markhor Conservation Strategy

Having a mandate to conserve and protect wildlife resources in the province, the NWFP WD has developed a Wildlife Conservation Strategy (Malik 1993). The strategy uses a holistic approach to floral and faunal management in the province because there is no species-specific conservation strategy. However, in light of the Wildlife Conservation Strategy, the Department has adopted the following measures for conservation of markhor:

3.1.1. Protection of the species against poaching and illegal trade

The NWFP WD strongly discourages poaching and illegal trade of markhor and other wildlife species through enforcement of the NWFP Wildlife Act of 1975 by the field staff in major markets and potential areas of wildlife importance. Legal action is taken against offenders. Wildlife property and the materials used in the offense are confiscated. Damage reports are registered against the offenders and the case is sent to the relevant court of law for trial. Stringent measures and effective protection have resulted in an increase of markhor populations in many areas as well as several other endangered species such as ibex, pheasants, and partridges found in the province.

3.1.2. Regulation of hunting

The NWFP Wildlife Act of 1975, providing a regulation mechanism for legal hunting, has categorized all the animals and birds into three schedules. The first schedule includes game animals for which lawful possession of a hunting

license from the NWFP WD is a prerequisite. The hunting season, place, days and the bag limit has been fixed under the Act. The hunting methods have also been prescribed. Schedule two of the Act includes those animals and birds whose possession is allowed subsequent to certificate of lawful possession. The third schedule comprises the species whose hunting, killing, or capturing is prohibited due to their endangered status.

Markhor is in the third schedule, but limited hunting is allowed. Hunting is used as a conservation tool and is restricted to areas where communities are involved in the conservation of markhor and other associated wildlife species through providing incentives in the form of a share of the hunting permit fee. Trophy hunting of markhor fetches handsome amounts for the communities, which has resulted in keen interest within the communities for the conservation of markhor.

3.1.3. Identification of areas for markhor conservation

Wildlife surveys are conducted in the province on a regular basis. Areas having potential for markhor conservation are identified and management protocols are developed for conservation and protection of markhor. Consequently, local communities' participation in conservation of markhor and associated wildlife species has increased and four areas have been declared as National Parks (CGNP, Sheikh Buddin National Park, Lulusar and Dodipath National Park, and Saiful Maluk National Park) (NWFP WD 2007). CGNP supports the largest surviving population (app. 700) of Kashmir markhor (NWFP

WD 2006). This park also provides intact wintering habitat for snow leopards, an extremely endangered species, while the remainder of the parks still need developmental interventions.

3.1.4. Controlling loss of habitat

Loss of habitat due to timber extraction, fuelwood collection, excessive grazing of cattle, grass cutting as fodder, and the conversion of wild land into unsustainable terraced agricultural fields significantly contributes to a decrease in markhor populations (Schaller 1977, Malik 1990). Wanton use of resources aggravates the situations due to lack of very strong legislation. However, habitat loss in protected areas is controlled to a large extent due to empowering the Wildlife Department by the 1975 NWFP Wildlife Act. Still there is an urgent need to set aside several potential areas of suitable habitats as National Parks and Wildlife Sanctuaries and to protect them completely against factors that add to habitat destruction.

3.1.5. Habitat improvement

One of the responsibilities of the NWFP WD is improvement of habitat in areas where it has been degraded due to over-grazing, fuel wood collection, and timber extraction. Without suitable habitat, conservation of wildlife is impossible. Therefore, habitat improvement practices have become an important component of wildlife management. Hence, NWFP WD not only provides protection to the species but also conducts habitat improvement measures such

as afforestation using indigenous flora, reseeding of grass species, construction of check dams to control soil erosion, and encouragement of proper grazing systems in CBC areas.

3.1.6. Replenishment of depleted wildlife populations

The NWFP WD sometimes must replenish depleted wildlife populations through reintroduction. For this purpose, the Department is planning to establish Wildlife Parks in each district of the province for breeding of endangered species of the area for ultimate release into its natural habitat. Shackleton (1997) suggested reintroduction of animals from areas where its population has reached a viable number due to conservation measures, into previously occupied habitats. The NWFP WD has established five Wildlife Parks in the representative natural habitats of the animals. Nevertheless, these parks are not suitable ecologically for markhor due to different habitat types. Therefore, the Department is planning to establish an additional Wildlife Park for the captive breeding of markhor with the objective of replenishing depleted populations. This Park will contribute to markhor conservation and provide an opportunity for wildlife viewing to the people. The Department also intends to rehabilitate the markhor population through their translocation from highly concentrated areas to habitats where it has been extirpated.

3.1.7. Extension education

As a conservation strategy in areas where markhor are found, NWFP WD launched a comprehensive extension program to create awareness among people about wildlife importance in general and conservation of markhor in particular. The purpose of the program is dissemination of information about wildlife of the province, its importance and role in the environment, benefits of sustainable use, problems in conservation, and the need for protection to ensure the support of the people and mitigate problems in conservation and management of the resource through a number of conservation and awareness tools.

For this purpose, school wildlife clubs have been established. Lectures on various aspects of wildlife are delivered and excursion visits of these clubs to various protected areas are arranged to observe the natural environment and wildlife in their natural habitat. Members of these clubs, serving as change agents, are helpful in creating awareness among the people of their respective areas for wildlife conservation which leads to cooperation in wildlife management. Besides the wildlife clubs, many other activities such as awareness walks, workshops, and seminars about the various aspects of wildlife resource are conducted. Under the extension program, documentary films on markhor and other wildlife species and their habitat are prepared and telecasted through electronic media. Promotional materials such as brochures, stickers, pamphlets, and calendars on markhor and other wildlife species are prepared and circulated among various stakeholders to enhance their awareness.

3.1.8. Research

Management of wildlife lacks a scientific approach due to less attention, meager financial resources, and weak capacity in the field of research. Research in wildlife conservation is mainly confined to periodic surveys to find out the distribution and population status of the species. Realizing the importance of research, the NWFP WD is now shifting its focus on the field of research for conservation and management on scientific bases. As a pre-requisite to build their capacity, the NWFP WD not only arranges in-service training for staff but also sends them abroad for higher studies in the field of wildlife conservation and management. With improved capacity of the staff, the NWFP WD would become able to conduct research for conservation of markhor.

3.1.9. Involvement of local communities

Local communities living in markhor habitats have limited opportunities to earn their livelihoods. They are mostly dependent on natural resources. Crude and unsustainable use of these resources has resulted in degradation of wildlife habitat and depletion of markhor populations in many areas. The only way to save markhor from extinction is the involvement of local communities in its conservation and protection. The NWFP WD has realized this since its inception in 1975 and empowered local communities under section 19 of NWFP Wildlife Act of 1975 for the conservation and management of wildlife resources. They were further empowered through Private Game Reserve Rules of 1993 made under the Wildlife Act. Under these rules, conservancies have been established

in markhor habitats where people are involved actively in conservation of markhor and other wildlife species. The Department intends to involve people in conservation activities in the best possible way. For this purpose, several conservation projects have been launched in areas where markhor are found; potential markhor habitat is also explored.

3.2. CBC projects

Conservation efforts of the NWFP WD have resulted in launching several community based conservation projects, funded by international organizations, in northern parts of the province for the conservation of natural flora and fauna in general through local communities. These projects are not entirely species specific conservation projects but have a component related to species conservation. A brief introduction of some of the projects is given below:

3.2.1. Himalayan Jungle Project (HJP)

The HJP (1991-1995) was executed by Birdlife International in collaboration with the NWFP WD, NCCW, and World Wide Fund for Nature (WWF), and the World Pheasant Association in the Palas valley, which is situated in Kohistan and Batagram Districts of NWFP. Birdlife International provided financial support to protect biodiversity of the valley and to empower and enable the local people to conserve and manage the natural resources on a sustainable basis through an integrated approach. Based on the success of HJP, Bird life International developed a follow up project on the request of the

GoNWFP, which led to another conservation project in the valley called the Palas Conservation and Development Project (PCDP) for the continuation of the works carried out under HJP (NWFP WD 1995). Kaigah valley, which is an abode of markhor, was explored during the implementation of HJP and established as a conservancy during the PCDP phase.

3.2.2. Palas Conservation and Development Project (PCDP)

PCDP was implemented during 2001-2005 to continue biodiversity conservation on the basis of lessons learned under the HJP. The PCDP was implemented by NWFP WD with the financial and technical support of the European Commission, with an aim to safeguard biodiversity in the Palas valley through community involvement and integrated/participatory approach to arrest natural resource degradation through conservation and development (NWFP WD 1995). The main objectives of the project were:

1. To catalyze and facilitate the establishment and /or strengthen viable community organizations that sustains participation in conservation and development.
2. To safeguard biodiversity and optimize the flow of local, national, and global benefits from the management and sustainable use of natural resources involving planning and implementation of biodiversity conservation and environmental awareness programs, participatory forest management including setting aside from commercial timber harvesting forests of highest biodiversity

value, sustainable use of remaining forests, conservation of biodiversity, and sustainable use of non-timber forest products in all forests.

3.2.3. Department for International Development (DFID)

After successful implementation of PCDP, DFID (2005-2008) was launched in the entire Palas valley of District Kohistan This is funded by DFID Civil Society Challenge Fund. It is implemented by WWF-P and Birdlife International in collaboration with NWFP WD. The main objective is capacity building in local communities in conservation of natural resources and self help development through already established Communities Based Organizations during the PCDP phase (Birdlife International 2005).

3.2.4. Maintaining Biodiversity in Pakistan with Rural Development Pre-Investment Feasibility (PRIF) Phase

This project, launched in Chitral valley of NWFP during 1995 to 1999, was implemented by IUCN-P in collaboration with NWFP WD and financed by the Global Environmental Facility (GEF) of the United Nations Development Program (UNDP). PRIF was a test project to assess the efficacy of biodiversity conservation through involvement of local communities by transferring technical skills and legal empowerment for the sustainable management of local wildlife resources. This project pioneered trophy hunting of markhor (*Capra falconeri cashmiriensis*) and Himalayan Ibex (*Capra Ibex sibirica*), establishment of conservancies, and involvement of local people in the conservation and

management of their wildlife resources. The success of this project paved the way to a full scale conservation project called Mountain Areas Conservancy Project (GoP et al. 1999).

3.2.5. Mountain Areas Conservancy Project (MACP)

The MACP is the progeny of the Project 'Maintaining Biodiversity in Pakistan with Rural Development', PRIF phase. The project was implemented by IUCN-P in collaboration with NWFP WD from 1999 to 2006 and was funded by the GEF, the UNDP, and GoP. The project was launched in Swat, Dir, and Chitral of NWFP, which are within markhor range. The purpose of the project is to protect the rich biological heritage of the Karakurram, the Hindukush, and the Western Himalayan Mountain Ranges through CBC programs (GoP and GEF 1999).

3.2.6. Protected Area Management Project-Chitral Gol National Park System (PAMP-CGNP)

This project focused on CGNP situated in District Chitral where the markhor is one of the flag ship species. It was a five year project with effect from 1998 to 2004, but it started in 2001 due to a delay in release of funds. It was implemented by the NWFP WD and sponsored by GEF through the World Bank. The project was framed to achieve the following objectives (NWFP WD 1998d):

1. To reduce park-people conflicts by integrating local communities into park planning and management phases.

2. To protect and manage species, habitats, and ecosystems effectively within and near the protected area.

3 To improve park planning processes and build capacity of the staff and communities.

4. To strengthen local, regional, and national support for protected areas through conservation awareness and outreach programs.

4. Role of Communities in Conservation of Markhor

Communities are one of the prime stakeholders in biodiversity conservation and are readily affected by any positive or negative trend in conservation. Because communities depend largely on biological resources for their subsistence and livelihood, over-exploitation in the past caused serious reduction in many populations.

Since 1993, the NWFP WD has promoted community participation in wildlife conservation in the Province due to the fact that the success of biological diversity conservation programs largely depends upon the cooperation and active involvement of local communities. For this purpose, Community Game Reserves and Conservancies have been established in areas where markhor are found. Communities are empowered to enforce the NWFP Wildlife Act of 1975 in community managed areas. Trophy hunting of big game animals was introduced as an additional incentive since 1998. About four trophy hunting permits of markhor are issued each year in NWFP. The permits are internationally advertised and offered to the highest bidders. Eighty percent of the hunting permit fee goes into the VCF of the local communities which is spent on conservation and developmental activities. Since 1998, about US $84,330 generated through hunting fees has been distributed among the communities as a token of economic benefits of conservation (Table 1). The local communities have largely supported the trophy hunting program and have expressed keen interest in conservation of markhor in other parts of NWFP due to the economic

value of markhor. The local communities must perform the following roles for the protection of markhor in their conservancies in coordination with and through the technical assistance of NWFP WD (NWFP WD 1998a, Malik 2004):

4.1. Formation of VCC

The main role of local communities is to organize themselves in the form of VCCs as a platform for common interest. They must elect true and dedicated representatives to support conservation initiatives at the local level. A Supra Conservation Committee (SCC) is established at the conservancy level. Each VCC nominates members for the SCC. SCC takes steps for the conservation of wildlife in the conservancy with the technical assistance of NWFP WD.

4.2. Law Enforcement

The VCC is responsible to support and enforce the NWFP Wildlife Act of 1975 in their Conservation Area and take measures for the protection of wildlife species against poaching by locals as well as outsiders. The VCC is also required to report all cases regarding violation of the Wildlife Law to the NWFP WD with full details and evidence.

4.3. Hunting Regulation

The community is responsible for regulating hunting as per provision of the NWFP Wildlife Act. The community adopts such hunting restrictions and regulations which are not inferior to the provisions of the Wildlife Act. Hunting is regulated by the communities through issuing special hunting permits and regular patrol of their conservation area to discourage poaching of markhor and other wildlife species. The VCC maintains records of wildlife offense cases including particulars of the offender, the nature of the offense, place and date of occurrence, and action taken by the community.

4.4. Habitat Management

To avoid degradation of wildlife habitat, communities take steps to prevent unchecked over-grazing, over-harvesting of vegetation, unsustainable agricultural practices, use of pesticides, and other harmful activities. In addition to these, efforts are made by VCCs to improve habitat conditions through adoption of rotational grazing, afforestation, soil conservation measures, and other suitable practices.

4.5. Active Participation

The VCC encourages participation of community members in capacity building programs and meetings organized by the NWFP WD and other conservation organizations. They also prepare and implement village developmental/biological conservation plans with the assistance of concerned

government departments and NGOs. The VCC provides voluntarily assistance in implementation of conservation programs as well as other developmental works.

4.6. Appointment of Village Wildlife Watcher (VWW)

The VCC selects and appoints an appropriate number of VWWs with mutual consent of the NWFP WD for the implementation of the Markhor Conservation Plan and to perform the following services:

i. Monitor wildlife regularly;

ii. Conduct surveys of wildlife and record the requisite information on standard forms;

iii. Record each dead animal encountered, cause of death, and also information with respect to species, age, sex, and horn size;

iv. Record the date, location, and number of predators and/or their signs observed during watch and ward;

v. Record the date, location, number, and type of livestock reported killed by predators;

vi. Help the VCC to organize and guide activities associated with hunting, deciding the sustainable hunting quota for game birds, and ecotourism activities;

vii. Protect wildlife from poaching and report any such incident to the VCC and the local Divisional Forest officer Wildlife (DFO WL);

viii. Advise VCC on pasture use by livestock and monitor village rules on grazing;

ix. Advise VCC on measures necessary to adequately protect wildlife from outside poachers;

x. Advise VCC on sustainable use of natural resources; and

xi. Record any other wildlife information as directed by VCC in monitoring and evaluating implementation of the Biodiversity Conservation Plan.

4.7. Trophy Hunting

Trophy hunting for markhor refers to a legal hunt of mature male markhor. Trophy hunting of markhor in conservation areas plays an important role in getting local communities involved in conservation of markhor and other associated wildlife species. The VCC is responsible for facilitating trophy hunting in their conservation area; its role in executing trophy hunting includes the following:

i. Conducts surveys in the months of June and December each year to identify trophy sized markhor in the population and communicates the survey results to the NWFP WD for sale/auction of trophy permit;

ii. Provides porters and guides for the hunter;

iii. Arranges a general meeting of the community with the hunter and briefs hunters on the CBC program;

vi. Provides personal security and safety to the hunter and his belongings within the boundary of the Conservancy; and

v. Facilitates setting up of field camps during the hunting operation.

4.8. Establishment of VCF

The VCC establishes and manages the VCF as an endowment fund to meet the financial needs for sustainability of the conservation program. For financial transactions, VCF is kept in a standard bank as a joint account of VCC and the NWFP WD. Sources of income that contribute to the fund include the following:

i. The community's share in trophy hunting and small game shooting permit fees;

ii. Net proceeds from sustainable use of wildlife and other natural resources excluding forests;

iii. Revenue from ecotourism in the form of trekking fees, camp site fees, entry fees, and service charges levied by the community;

iv. Donations from governments, NGOs, hunters, trekkers, and other individuals and organizations; and

v. Fines received from the violators of all conservation rules.

4.9. Utilization of Fund

The capital of the fund is not utilized by VCC and only the interest accruing upon the deposit is drawn from the bank under a multiple signature mechanism, as per conditions of the account, for sustainable development of village natural resources and socio-economic uplift of the area. VCC maintains the account and produces it for audit whenever required by the NWFP WD or any

other agency deputed by the government. Various aspects of VCF utilization include the following:

i. Payment of honorarium to the local VWWs;

ii. Expenditures on activities to promote conservation of wildlife and other natural resources, including extended watch and ward over pasture use, poaching, etc.;

iii. Afforestation and fodder production near the village, to reduce pressure on natural resources and high pastures;

iv. Development of marketing strategies and infrastructure to accommodate trophy hunting, ecotourism, etc.;

v. Development of energy efficient household means for cooling and heating;

vi. Development of a local conservation education program; and

vii. Social investments such as a community center, school, health facilities, and improvement of public health / hygiene services, etc.

5. Community Incentives

Incentives play an important role in the conservation and management of wildlife. Depending upon the nature of an action plan, these may be positive or negative in the form of benefits or penalties, respectively (Hutton and Leader-Williams 2003). Chances of wildlife conservation increase in the presence of incentives for conservation, involvement of stakeholders in the management of their natural resources, fulfillment of their needs, and sustainable utilization of the resources (Robinson 1993). Local people living in habitats of wild species can be benefited through several forms of incentives such as land ownership, empowerment, and livelihood benefits in addition to social or financial implications (Hulme and Murphree 1999). Fischer et al. (2005) pointed out that local communities usually resort to poaching and exploitation of natural resources in the absence of incentives (Fischer et al. 2005). Therefore, provisions of incentives to the local people who are affected by conservation measures are essential for their active involvement in the management of natural resources to achieve the goal of conservation.

In NWFP of Pakistan, CBC approach has resulted in delivering a range of benefits to the local communities:

5.1. Empowerment

Empowerment of local communities is an efficient and sustainable approach to conserve wildlife (Rao and Geisler 1990). This would enable local people to make good decisions regarding resource use with the conservation

agencies, foresee the outcome of their actions, and adapt to new situations. Empowerment enhances the perception of local communities about the existing situation through integration of local and traditional knowledge in the conservation of natural resources. Gibson and Marks (1995) believed that empowerment motivates local communities for the conservation of wildlife.

Prior to the CBC strategy adopted by the NWFP WD, local people had no legal authority to manage and conserve wildlife. They were not considered in the protection and management of wildlife. Consequently, some community members were involved in poaching, which brought several species to the verge of extinction. The NWFP WD realized the fact that without the involvement of local communities, the goal of conservation of wildlife was difficult to achieve. Therefore, communities were considered as one of the most important stakeholders. They were organized in the form of VCCs and a number of community game reserves and conservancies were established in the province. The communities were vested with ownership rights over wildlife and empowerment for sustainability of wildlife resources. As a result, the members of conservation committees exercise the same powers within the boundary of their conservation area as are exercisable by an official of the NWFP WD under the NWFP Wildlife Act of 1975 and the rules made there under. By virtue of these powers, they can stop, apprehend, seize the property used in the commission of an offense, confiscate the wildlife species dead or alive, and issue damage reports against the offenders (Malik 2002b). This has created a sense of ownership over wildlife among the local communities.

5.2. Share in Hunting Fee

CTHPs serve as a promising economic incentive for the communities in the form of a share in the trophy hunting permit fees. Mayaka et al. (2005) pointed out that the share to the community depended upon wildlife abundance, the market value of the species, and the size of the area managed.

The local communities receive 80% of the trophy hunting permit fee while 20% is held by the GoNWFP. The conservation committee in whose jurisdiction the actual hunt takes place gets 50% where as the rest of the community share is distributed equally among all other VCCs in a conservation area. The money so received as the community's share is deposited in the VCF (GoNWFP 1997, Malik 2006). The interest on the capital amount of the fund is used for social uplift of the area and activities related to markhor conservation. According to Amir (2007) and various official reports of the NWFP WD, the interest on VCF has been used by the concerned VCCs on the construction and repair of roads, small water supply schemes, irrigation channels, water ponds for wildlife, plantation of indigenous flora for the improvement of markhor habitat, and electricity supply from a nearby hydro powerhouse.

5.3. Donations

Trophy hunters are encouraged to make personal donations to the VCCs or the NWFP WD. These funds may be for a special purpose as specified by the hunter or for the VCF. The donation is used for the purpose indicated by the donor. The conditions of VCF are not applied on such specified donations.

However, if the donation is for VCF, it is spent as per conditions of the VCF (Malik 2006).

5.4. Development of Basic Facilities

Trophy hunting is an expensive hobby popular among affluent and influential people. Visits of such persons as hunters to game reserves benefit local communities by providing infrastructures for schools, a basic health centre, veterinary hospital, water supply, construction or repair of roads, and/or other basic facilities. Moreover, these influential hunters sometimes also appoint or transfer staff to the local schools and hospitals to meet the deficiency of staff.

Irrigation channels were constructed under foreign funded conservation and developmental projects launched in markhor conservation areas to bring arable lands under agriculture. These also increased the productivity of existing farm lands to meet the food requirement of the local people and grow fodder to reduce grazing pressure in the markhor habitat. Under these projects, water supply schemes for provision of clean drinking water and small hydro power generators to meet the energy requirements were established as social incentives for encouraging participation of local people in the conservation of wildlife resources.

5.5. Income from Tourism

Today, tourism is one of the world's largest industries and ecotourism is a substantial part of the tourism industry. Tourism provides income to a large

proportion of people through engagement in various services such as accommodation, food, guides, rent of horses, and selling of handicrafts (Richardson 2004). In NWFP of Pakistan, basic facilities are not available in areas where markhor are found, therefore, income from tourism in these areas is negligible. However, a great potential for development of the tourism industry occurs in this part of the NWFP due to the scenic beauty of the area and the presence of markhor and other associated wildlife species (Arshad 2003). Income from this sector can be enhanced provided that the natural resources are managed properly and basic facilities for tourists are made available.

5.6. Opportunities for Jobs

Involvement of local communities in the conservation of markhor has provided job opportunities for the local people. Hundreds of community watchers are engaged in watch and ward of the reserve or conservancy (Amir 2007). Wildlife protective staff is appointed from the local people by the NWFP WD to support the communities in the protection of wildlife in the area. National and international organizations working for the conservation of natural resources in the area also hire local people for better accomplishment of conservation activities. Moreover, local people are engaged as guides, porters, and cooks during the hunting season.

5.7. Exposure of the Area

Markhor conservancies are situated in far flung and remote areas which provide ample opportunities for sight seeing, unique natural landscapes, and sighting of markhor and other wildlife species to people from all over the world. Moreover, hunters prefer the area for trophy hunting due to its challenging topography and uniqueness of the markhor hunt. Information about conservation activities and the trophy hunting program are given on the internet and in national and international newspapers. These activities result in exposure of the area at the national and international levels. As a result, people come to know about the landscape, archeological sites, local traditions, and fauna of the area. Therefore, more people wish to see the area and associated wildlife species; this helps and improves the livelihoods of local people.

5.8. Capacity Building

Goodman et al. (1998) referred to capacity building as the ability of local people to identify, mobilize, and address social problems. Capacity building for all stakeholders is important so that they may comprehend the processes, connections, and essential conclusions for further activities (Kleinn 2005). It can be achieved in several ways such as providing formal and non-formal education, stakeholder deliberation opportunities, or creating similar circumstances for effective development of capacity (Raik et al. 2006).

During implementation of various conservation projects in NWFP, local communities were actively involved in various conservation activities through

dialogues and participatory planning to achieve the objectives (Ahmad and Sattar 2001). Training of local community members in management of natural resources, office management, negotiation, and leadership skills were most common (Arshad 2003). As a result of their active involvement and provision of training opportunities, the technical skill of the rural communities in various aspects of project activities was enhanced with encouraging outcomes. Moreover, exposure visits of these communities to other successful CBC areas within the country were arranged to discuss their respective conservation strategies. These activities helped to enhance the capacity of communities in management of their natural resources on a sustainable basis.

5.9. Linkage with Other Organizations

Local communities were engaged in various conservation activities and training with an objective to build their capacity and strengthen their social institutions. This process not only enabled them to develop partnerships with implementing agencies and organizations working in the area for their economic uplift and financial support, but also enhanced their capacity to explore and ensure benefits from other national and international conservation organizations.

6. Problems/Gaps in Markhor Conservation

The NWFP WD has adopted various strategies for the conservation of markhor in northern parts of the province. In some places it has involved local communities in the conservation and management of markhor through providing various incentives while in other places the Department has adopted conservation through protective staff strategy. Given improved and intensive management practices in the province, markhor populations have increased. Still certain problems discussed below affect conservation efforts of the Department.

6.1. Lack of Adequate Involvement of Local Communities

Communities are prime and important stake-holders and play an important role in the conservation of natural resources. However, community involvement in conservation activities is a new concept in Pakistan. The local communities in the northern parts of the province are poor and generally unaware of the importance of wildlife resources within their areas (Malik 2002b, Malik 2004). Further, local people would like immediate returns while wildlife conservation is a long term activity. Some people do not want to participate in natural resource management programs because they do not understand the philosophy behind conservation and at times strongly disagree with conservation objectives. Such people believe it is improbable that a significant contribution can be made at the same time to society, economic development, and provide long term solutions for sustainable use of natural resources. In the face of this social phenomenon, the department faces great difficulties to get support of the local

people and involve them in natural resource management and biodiversity conservation.

6.2. Habitat Loss

Habitat loss played a lead role in bringing markhor to the verge of extinction. Wild lands are rapidly shrinking due to the ever increasing human population and subsequent increase in demand for timber and fuel wood (Malik 1993, Schackleton 2001, Malik 2002b). Conditions outside of VCCs were exacerbated by an increased livestock density, overgrazing, lack of alternatives for rural populations, a decrease in natural dominant plant species, and invasion of alien plant species. All these factors progressively contribute to depletion of biodiversity and decrease in productivity of fodder resources (Kleinn 2005).

Malik (1993) pointed out that habitat degradation also caused the migration of markhor to remote and unsuitable habitats due to the loss of cover, which further accelerated the process of population decline. Many other mammals including chinkara (*Gazella gazella*), goral, hog deer (*Axis porcinus*), musk deer, urial, brown bear, and snow leopard are also the victims of habitat loss.

6.3. Problems of Field Staff

The field staff faces a number of problems which affect their performance. According to Malik (1993), important problems that field staff faces are as follows:

6.3.1. Sense of insecurity

The staff is often confronted with armed parties of hunters having hostile attitudes toward the staff. The staff faces arrests and lock ups due to taking legal action against officers of the civil administration for violation of the Wildlife Act of 1975 or the rules made there under. Understandably, this creates a sense of insecurity among the staff in terms of threats to life and respect.

6.3.2. Lack of incentives

The field staff does not receive any provision, consideration for promotion, nor any cash rewards for their efficiency. Although the Wildlife Act of 1975 provides for a cash reward out of compensation realized on compounding the offense cases, no reward is given if the offense case is not compounded.

6.3.3. Service in remote areas

Markhor and many other wildlife species inhabit very remote and wild areas. The wildlife staff must protect markhor and other associated wildlife species where they occur; this often involves unfavorable physical and climatic conditions as well as strict social norms. It becomes difficult to support themselves and their families at two different stations given their meager salary. This fuels their financial worries, which adversely affects their performance.

6.3.4. Availability of limited fund

Because inadequate funds are provided to the Department, the field staff gets neither uniforms nor enough traveling allowance for field trips and court attendance made in the interest of public service. Unavoidable expenditures squeeze the meager salaries of the staff, which further adds to their stress.

6.3.5. Institution of court cases against the wildlife staff

Sometimes the offenders sue the wildlife staff as revenge for action taken against them. The courts admit the case and start proceedings against the staff in spite of the provision vide section 38 of the NWFP Wildlife Act of 1975, that “No suit, prosecution or other legal proceedings shall lie against any officer for anything in good faith done or intended to be done in pursuance of any provision of this Act or the rules made there under”. In addition to the financial burden on the staff, undue harassment discourages them from future duties (Malik 1993).

6.4. Non Cooperative Attitude of District Administration

Support and effective coordination of District Administration can play a very important role in Wildlife Conservation. Unfortunately, this role has not been significantly practiced (Malik 1993). In some instances and areas, the civil administration has been involved as a pressure group for the local communities for poaching (Shackleton 2001).

The role of the police in enforcing Wildlife Law has been ineffective and unsatisfactory; police have occasionally turned down requests from the field staff under one pretext or the other. Moreover, the police show little interest in serving court summons which adversely affects the disposal of wildlife offense cases in courts of law (Malik 1993).

6.5. Slow Disposal and Inadequate Fine of Court Cases

The damage reports registered against the wildlife offenders are submitted to the court. Almost all of the cases are disposed of slowly, while other result in convictions with a nominal fine much less than the amount of a license fee or value of the property damaged. However, no imprisonment has ever been awarded in spite of the clear provision under section 20 (1) of the Wildlife Act of 1975; this has resulted in fearlessness among offenders and lack of respect for Wildlife Law. Lack of effective mechanisms for prompt disposal of wildlife offense cases encourages the offenders that would have otherwise served to discourage them. Consequently, the wildlife conservation program suffers adversely (Malik 1993).

6.6. Out-dated Wildlife Legislation

The NWFP Wildlife Act was promulgated in 1975. Certain sections of the Act and the rules made there under are out-dated and are not effective in the present socio-ecological scenario, which affects conservation measures at large made by the Department for the conservation of markhor. For example, there is

no provision in the present Act for the establishment of certain protected areas such as Wildlife Parks, Wildlife Refuges, Wilderness Areas, etc. (Malik 1993). Therefore, problems arise when the NWFP WD plans to establish these types of protected areas for the conservation of markhor or other wildlife species.

6.7. Lack of Operational Fund

The NWFP WD receives a limited budget which is inadequate for effective management and conservation activities. The budget does not even cover the minimum requirements for management of wildlife. In such a situation, the Department is unable to conduct all types of management operations which are not included in programs sponsored by developmental organizations. Therefore, conservation programs of prime importance suffer. This also results in insufficient fuel and vehicle maintenance expenditures which limit the mobility of staff for conservation, protection, and management. Low budgets put the protection of markhor and other wildlife species in great danger (Malik 1993).

6.8. Intrusion of Afghan Refuges

The Afghan war in the 1980's caused great damage to wildlife populations in general and markhor in particular due to the proximity of markhor habitat to Afghanistan on the west. A large number of arms and ammunition were brought into Afghanistan during the war. Easy availability of arms and ammunition led to indiscriminate poaching of wildlife which caused havoc to their populations (UNDP-GEF 2002). Moreover, war-affected Afghan refugees moved

into NWFP and proved to be a rising threat to management of markhor habitat due to the grazing of their cattle. Afghan nomadic herders crossed the border to graze their cattle, which further increased biotic pressure on already over-utilized resources in the area. Consequently, markhor habitat was utilized to the extent that resulted in the inability of oak trees and other palatable flora to regenerate; serious soil erosion also occurred (Anonymous 2000).

Frisina et al. (2002) reported that the domestic sheep and goats of Afghanistan have a high probability of transmitting infectious and fatal viral diseases to markhor. Eleven markhor were found dead from December 2 to December 22, 1999. The Veterinary Research Institute in Peshawar reported *Pnterotoxemis*, *Pleuropneumonia*, and contagious unidentified *Caprine* viral/bacteria infections as possible causes of mortality. The NWFP WD estimates as many as 30 to 50 markhor may have died of this fatal infection from Afghan livestock (Anonymous 2000, Shackleton 2001, Malik 2002b). Yughur village in Chitral, one of the villages involved in the Markhor Conservation Program, brought legal action against what they considered illegal grazing by Afghan nomads on their grazing lands. The Peshawar High Court ruled in favor of the Yughur village and henceforth imposed a ban on Afghan settlements and domestic livestock grazing within their grazing area. Such action helps greatly in reducing grazing pressure and competition in markhor habitats (Anonymous 2000).

6.9. Lack of Quantified Habitat Monitoring

Regular habitat analysis and monitoring is extremely important to maintain and manage sustainable wildlife habitat. This field is highly technical and laborious and has not been given due importance due to a lack of expertise. While the markhor population is monitored annually, habitat monitoring and assessment does not occur (Anonymous 2000). Vegetation analysis and consistent monitoring assesses the ability of the land to support markhor and therefore is very important.

6.10. Lack of Research and Training

Due to a lack of expertise and scientific approaches, research on population viability, landscape ecology, and stochastic effects does not occur. Additionally, extensive technical and social training are required for community and staff members to enhance their capacity to tackle issues related to management. Communities need training regarding basic principles of species and habitat conservation, techniques to deal with outfitters and hunters, effective marketing strategies for hunts, and providing services to the hunters. This will not only help them obtain technical know-how on conservation of markhor but will also be socio-economically advantageous to the communities. Capacity building of the communities is also necessary for the sustainability of CWM.

6.11. Marketing of Hunts by the Government

The NWFP WD is playing the lead role in publicizing markhor marketing through advertisement of the hunts on websites and national and international newspapers (Mir 2006). This should be shifted gradually to the communities to market their own hunts, which will encourage them to negotiate with outfitters or hunters. The government should only monitor marketing of hunts. Active involvement of local communities in marketing and advertisement of their hunts without any direct involvement of the government would enhance the confidence of foreign hunters and international conservation agencies on CTHPs (Shackleton 2001).

6.12. Domestic Hunters

The domestic market for trophy hunting did not flourish in the country due to the open auction of hunting permits (Shackleton 2001): domestic hunters can not compete financially with international hunters. Such a situation creates resentment in domestic hunters who resort to poaching.

6.13. Unknown Home Range of Markhor

The home range size of markhor is unknown but is important for their effective conservation and management. Determination of markhor movements is important: 1) to provide information about habitat preference during different seasons of the year; and 2) to identify the potential corridors between the various potential markhor habitats.

6.14. Unequal Share Distribution of Trophy Hunting Fee

Lewis and Alpert (1997) asserted that simply generating revenue from wildlife conservation does not mean that a conservation program is successful. Success depends upon boosting the local economy, the realization of the importance of wildlife to local people, an effective decision-making process, and a fair distribution of economic benefits among the communities. Butler (1995) was also of the view that inequitable distribution of wildlife resources and income from these resources usually results in hostility and friction between the communities.

In NWFP, 50% of the permit fee is given to the community where the hunt takes place, while the remaining 50% is distributed among the rest of the communities in the conservancy. Because markhor do not stay in a particular area throughout the year but travel into different valleys where respective communities are responsible for its protection, they claim an equal share in the trophy hunting fee. This unequal distribution has caused dissatisfaction and serves as fuel to create rifts among the communities which should be resolved before it becomes worse (Shackleton 2001).

6.15. Poaching

Hunting for meat as a means of subsistence or trade in wildlife parts adds to the growing problem for wildlife managers in many countries (Loibooki et al. 2002). In northern parts of NWFP where communities are involved in the conservation of markhor, poaching is controlled to a great extent (Shackleton

2001). However, outside of protected areas, poaching of markhor and other wildlife species still occurs and must be controlled either through effective watch and ward by the government or involvement of local communities.

6.16. Lack of Public Awareness

Environmental education serves as a critical conservation tool (Jacobson and Morris 1998), but unfortunately this tool has not been effectively used. Most of the local communities in NWFP are unaware of the ecological and economic benefits to sustainable conservation of wildlife resources (Malik 2002b). Jacobson (1991) attributed lack of awareness about sustainable use of wildlife in developing countries to inappropriate technical approaches, lack of intensive out reach programs, lack of funding, and geographical isolation of target sites. That is why most of the wild ungulate species face threats of extinction. Creating awareness among people through conservation education is necessary to save these species from extinction. Campilan (2000) also stressed creating awareness among the local communities about their natural resources. This would enable them to express their views about the status of natural resources in their areas, explain their needs, and negotiate a set of common objectives about natural resource management, conservation, and monitoring activities. For this purpose, the developed countries should launch intensive conservation education programs in resource-deficient countries.

6.17. Lack of coordination among conservation agencies

Many national and international NGOs work in the province for the conservation of biodiversity through implementation of different projects, but little collaboration and coordination between the Government Departments and the NGOs occurs. This drains resources and causes suspicion and mistrust among interest groups; this results in negative impacts on local participation in natural resource management and on the conservation of markhor.

6.18. Low Literacy

The literacy rate is very low in most of the areas where markhor are found (i.e. less than 21%, WWF 2003). It is difficult to deal with illiterate communities about the conservation of wildlife. They are often cynical and suspicious of efforts and interventions of the NWFP WD planned for their involvement in the conservation of wildlife. It is not easy to convince them about using development tools to achieve conservation objectives. Often, the few educated and influential people grab the benefits accruing from wildlife conservation and this practice ultimately leads to failure.

6.19. Re-election of VCC's Members

For maintaining trust among the local communities, VCC members are nominated for a fixed period of time set by their By-laws. But practically, this rule is not followed. For example, the VCCs in Goleen conservancy of Chitral District have been reorganized once since its inception in 1998. Such a situation

discourages people from full participation in the conservation of wild resources. This is why usually only a few members of the community are active in conservation efforts while most people remain indifferent to the conservation activities in their respective areas (Mir 2006).

6.20. Unclear Land Tenure System

The land tenure system is not clear in most of the areas where markhor are found; this results in a potential hurdle to the conservation of markhor through communities. Beside conflicts with the government, intra and inter village conflicts over ownership and resource use also exist. Many people show an indifferent attitude toward wildlife due to this ambiguous land tenure system. They want to settle land ownership disputes before their participation in the conservation process. Malik (2004) mentioned that all mountain range lands and forest were declared as state land in 1975 but there are numerous claims for ownership rights over these lands. For example, in Chitral valley, members of the royal family are in a dispute with the government over the ownership of certain valleys for the last three decades on the basis of rights and concessions granted by the ruler of the former state of Chitral. This has put an adverse effect on efforts made by the NWFP WD for the conservation of markhor. Malik (2004) suggested settlement of land ownership disputes will result in active participation in sustainable wildlife management and the building of trust within the communities for the initiatives taken by the department for the conservation of markhor.

8. Methods

8.1. Review of Literature

Literature from previous studies plays an important role in planning the management strategy for the conservation of a species. Planning and research are based on data collected from previous and ongoing monitoring programs. Therefore, I searched the relevant literature in the NWFP WD, NGOs, libraries, and the Internet. The available survey reports of markhor for CGNP and TSC Chitral from 1989 to 2006 were collected from the Head Office NWFP WD for the rut season survey (winter).

8.2. Surveys

Surveys were conducted by the NWFP WD in CGNP. In TSC, surveys were the responsibility of the communities with technical assistance from the NWFP WD. Surveys were conducted twice per year, during the rut and during the lambing season. The survey during the rut was conducted in December/January, mainly to determine the number of trophy-sized animals, while the lambing season survey was carried out in May/June for assessing reproduction in the population (NWFP WD 2005b, WWF-P 2006, Shackleton 2001). The number of trophy-sized animals is determined during winter because it is easy to count the males as they joins the herds of females for mating and descend to lower altitudes for food.

The most appropriate method to count markhor is “the vantage point method” because the line-transect survey method is difficult due to the rugged

mountainous habitat of the species. Vantage points are identified with the help of local wildlife staff and local people, where chances of observation of a maximum number of markhor are highest. Although some individuals may not be observed from such vantage points, this method is preferred because large distances between vantage points and observations taken by different teams at the same time minimize double counting (NWFP WD 2005b).

Each vantage point is visited by a group that includes field staff of the NWFP WD, personnel from NGOs, and community members who are well familiar with the sites where markhor can be seen (Shackleton 2001). The duration of the survey depends upon the topography, weather, and availability of funds. However observations from each vantage point are usually taken for three consecutive days (Mir 2006). All vantage points in each area are visited by different teams over a 3-day period. Information about herd size, age and sex, aspect, slope, elevation, etc. are collected using binoculars and spotting scopes. Sex and age of markhor observed are determined on the basis of horn and body size. The timing of observations by each party in the sites is recorded to adjust counts and to reduce the chances of duplication by observing the same animals. When the data from each vantage point are collected, a combined survey report is prepared for the whole area (NWFP WD 2005b, WWF-P 2006).

8.3. Population Growth Rate

The population growth rate depends upon the original size of the population. Since all individuals in a population contribute to population growth,

therefore, a population grows by multiplication (proportional increase) rather than by addition (absolute increase).The exponential growth rate in the male population, female population, and total population was calculated by dividing the difference between the natural logarithms of initial population size and final population size by the total number of years (Ricklefs 1975).

$r = [\ln N(t) - \ln N(o)]/t$

Where r = Exponential growth rate

N (o) = Initial population size

N (t) = Final population at year t

t = Number of years over which growth occurs

The larger the value of r, the more rapidly the population grows. A value of $r > 0$ indicates an increase, $r = 0$ indicates a stable population, and $r < 0$ indicates a decreasing population.

The percent growth rate was calculated by the following formula.

$\%\ \text{growth} = (\lambda - 1)100$

Where λ (lambda) is per year change in a population and was calculated by the formula, $\lambda = e^r$, where 'e' is the base of natural logs. A value of $\lambda > 1$ indicates an increase in population, $\lambda = 1$ indicates no change in population, and $\lambda < 1$ indicates a decrease in population.

8.4. Kid/female Ratio and Male/female Ratio

The kid/female ratio and male/female ratio are commonly expressed per hundred females (Bender 2006). The kid/female ratio was calculated for each

year by dividing total number of kids observed by total number of females observed, then multiplying by 100. Similarly, the male/female ratio for each year was calculated by dividing the total number of males by total number of females and multiplying by 100.

8.5. Data Analysis

Each response variable (male, female, kid, male/female ratio, kid/female ratio, and total population) was analyzed using linear regression analysis. The explanatory variables of interest was time (or year; the year 1989=0). There were 18 years of observations for each area. Hence, the total number of observations was 36.

After fitting the regression model containing both year, the residuals were examined to determine whether they satisfied the assumptions needed for hypothesis testing (specifically, constant variance, independence, and normality). The constant variance assumption was examined by plotting the residuals against the fitted values. Independence was examined by plotting the residuals against time, and the normality assumption was checked by constructing a normal probability plot. After examining the residuals, the model coefficients, and tests of significance were used to draw inferences about trend over time. Notably, the coefficient associated with the time variable is the estimated change per year in the response variable (e.g. male/female ratio) by area. The t-statistic associated with the time coefficient tests the null hypothesis of no change over time versus the research or alternative hypothesis stating that there are

differences in the response variable over time. When appropriate, 95% confidence intervals are reported for the true rate of change (that is, the true coefficient associated with time).

The process was repeated for individual area (CGNP and TSC) to find the trend for each response variable over time. The total number of observations was 18 per area. The response variables were analyzed against the explanatory variable time (or year) using linear regression analysis.

The regression model was fitted for year and the residuals were examined for the assumptions of normality, constant variance, and independence prerequisite for testing the hypothesis. The model coefficient and test of significance were used to draw inferences about trend in the response variable over time. The coefficient associated with the time variable is the estimated change per year in the response variable. The t-statistic was applied to test the null hypothesis of no change overtime versus the research or alternative hypothesis of change in the response variable over time. The coefficient of determination (R^2) was the degree of association between the response variable and explanatory variable (year). A 95% confidence interval was reported for the rate of change (Ott and Longnecker 2001). All the statistical analysis of the data was carried out through Statistical Packages for Social Science (SPSS).

9. Analysis of data

9.1. Analysis of markhor population in CGNP

9.1.1. Total population

The assumptions of normality and constant variance appeared to hold, while the assumption of independence was not met. However, the p-value was so small ($p<0.001$) that it would not affect the conclusion. There was strong statistical evidence ($t=6.803$, $p<0.001$) of an increase in the CGNP markhor population over time. The 95% confidence interval for the true rate of change was between 14.9 and 28.4. The coefficient of determination ($R^2=0.7$) showed a strong association between the total markhor population and year.

The estimated rate of increase in the markhor population was 7.7% over the 18 years of this study. The population growth rate was estimated 2.5% over 10 years (1989-1998) before CTHP was launched in 1998 in CBC areas while the growth rate was 12.8% during 9 years afterwards (1998-2006).

9.1.2. Male markhor population

The assumptions of normality, constant variance, and independence were met. I found strong statistical evidence ($t=5.897$, $p<0.001$) of an increase in the male markhor population of CGNP over time. The 95% confidence interval was between 2.9 and 6.1. The coefficient of determination was $R^2=0.7$ which showed a strong association between year and the male population.

The estimated growth rate in male population of markhor was 3.3% over 18 the years of this study. The male population growth rate was 2.7% over

10 years (1989-1998) before CTHP was launched in 1998 in CBC areas while it was estimated 3.5% over 9 years afterwards (1998-2006).

9.1.3. Female markhor population

The assumptions of normality, constant variance, and independence were met. There was strong statistical evidence (t=4.262, p=0.001) of an increase in the female markhor population over time. The 95% confidence interval was between 2.4 and 7.2. The coefficient of determination was R^2=0.5 showing a strong association between the female population of the park with time.

The growth rate in female population was estimated 7.0% over 18 years of this study. The female population growth rate was 3.9 % over 10 years (1989-1998) before CTHP was launched and was 9.9% per year during 9 years (1998-2006) after CTHP.

9.1.4. Kid population

The assumptions of normality, constant variance, and independence appeared to hold. There was strong statistical evidence (t=5.886, p<0.001) of an increase in the kid population of markhor in CGNP over time. The 95% confidence interval was between 7.9 and 16.8. The coefficient of determination (R^2=0.7) showed a strong association between the kid population of the Park and time.

The kid growth rate in CGNP was estimated 10.5% over the 18 years of this study. The kid growth rate was 1.0% per year during the years (1989-1998) before CTHP while the growth rate was 21.3% per year (1998-2006) after CTHP.

9.1.5. Male/female ratio

The assumptions of normality, constant variance, and independence were met. There was no strong statistical evidence (t=1.847, p=0.083) of a change in the male/female ratio over time.

Let MF denote male/female ratio in CGNP. Then the fitted model is

MF = 57.8 + 1.7 (year)

The estimated growth rate in male/female ratio was -3.4% over 18 years. The growth rate remained -1.2 % per year (1989-1998) before CTHP and -5.6% per year during the years afterwards (1998-2006).

9.1.6. Kid/female ratio

The assumptions of normality, constant variance, and independence were met. There was strong statistical evidence (t=3.861, p=0.001) of an increase in kid/female ratio of CGNP over time and the estimated change in ratio was 6.3 per year while the 95% confidence interval was 2.8 and 9.7. The coefficient of determination (R^2=0.5) showed a strong association between the kid/female ratio and time.

Let KF denote the kid/female ratio in CGNP. Then the fitted model is

KF = 69.9 + 6.3 (year)

The growth rate in kid/female ratio in CGNP was estimated 3.3% over 18 years. The growth rate was estimated -3.3% over 10 years (1989-1998) and 10.5% during 9 years (1998-2006).

9.2. Analysis of markhor population in TSC

9.2.1. Total markhor population

The model residuals appeared to be normally distributed and had constant variance, while the assumption of independence did not to hold. However, the p-value ($p<0.001$) was so small that one should not worry about the assumption of independence while drawing conclusions. There was strong statistical evidence ($t=11.044$, $p <0.001$) of an increase in the TSC markhor population over time. The 95% confidence interval was between 18.7 and 27.6. The coefficient of determination ($R^2=0.9$) indicated a strong association between year and total population of the conservancy.

Using the formula for the Exponential Growth Rate, the markhor population growth rate in TSC was estimated 7.9% per year over 18 years. The population growth rate was 7.7% over 10 years (1989-1998) before CTHP was launched in 1998 in CBC areas while it was 7.1% during 9 years afterwards (1998-2006).

9.2.2. Male markhor population

The model residuals appeared to be normally distributed, had constant variance, and the assumption of independence was met. There was strong statistical evidence ($t=5.154$, $p<0.001$) of an increase in the male markhor population of the conservancy over time. The 95% confidence interval was between 3.9 and 9.4. The coefficient of determination was $R^2=0.6$ which indicated a strong association between the male population of the conservancy and year.

The estimated male population growth rate of markhor was 8.3% per year over 18 years of my study. The male population growth rate was 5.8% per year over 10 years (1989-1998) before CTHP was launched in 1998 in CBC areas while it remained 10.1% over 9 years (1998-2006) after CTHP.

9.2.3. Female markhor population

The model residuals were normally distributed, had constant variance, and were independent. There was strong statistical evidence ($t=8.708$, $p<0.001$) of an increase in the female markhor population of the conservancy over time. The 95% confidence interval was between 4.9 and 8.2. The coefficient of determination ($R^2=0.8$) showed a strong association between female population and time.

The female growth rate in markhor population was estimated 6.1% per year over 18 years. The female population growth rate was 7.1% per year over

10 years (1998-1998) before CTHP was launched in 1998 in CBC areas while it was 4.3% over 9 years afterwards (1998-2006).

9.2.4. Kid population

The assumptions of normality, constant variance, and independence were met. The analysis showed strong statistical evidence ($t=8.342$, $p<0.001$) of an increase in the kid population of markhor in TSC over time. The 95% confidence interval for the true rate of increase was between 7.5 and 12.6. The coefficient of determination was $R^2= 0.8$, which showed a strong association between the kid population and time.

The kid growth rate in the conservancy was estimated 9.8% per year over 18 years of time. The kid growth rate remained 10.5% per year during 1989-1998 and 7.8% per year during 1998-2006 after the CTHP was initiated.

9.2.5. Male/female ratio

The assumptions of normality, constant variance, and independence were met. There was no statistical evidence ($t=0.551$, $p=0.589$) of change in male/female ratio over time. Let MF denotes male/female ratio in TSC. Then the fitted model for male/female ratio is

MF = 69.6 + 0.6 (year)

The estimated growth rate in male/female ratio in TSC was 2.1% over the 18 years of this study. The growth rate was -1.2% per year before CTHP was initiated in 1998 while 5.7% per year afterwards.

9.2.6 Kid/female ratio

The assumptions of normality, constant variance, and independence were met. There was a strong statistical evidence (t=3.166, p=0.006) of an increase in the kid/female ratio of TSC over time. The 95% confidence interval was 1.4 and 6.9. The coefficient of determination was R^2=0.4, which indicated a weak association between the ratio and year.

Let KF denotes the kid/female ratio in TSC. Then the fitted model for kid/female ratio is

KF= 52.1 + 4.2 (year)

The growth rate in kid/female ratio in TSC was estimated 3.4% per year over the 18 years of this study. The estimated rate was 3.2% per year before CTHP and 3.3% per year during the years afterwards.

10. Discussion

10.1. Total population

In CGNP, the total population increased over the years except in 1990, 1993, 1996, 1998, and 2005. The highest number of markhor (612) was recorded in 2006 and the lowest number (154) was recorded during 1990 (Fig. 5). The exponential growth rate showed an annual increase (7.7%) in the population of markhor in the Park (Fig. 5). Statistically, the increase in population size over years was highly significant ($p<0.001$). Fig. 5 shows an increasing trend in markhor population growth rate.

The population growth rate in CGNP during post period of CTHP was higher than during the pre period (Table 3). The reasons for the higher growth rate in post period of CTHP could be: 1) a conservation project (PAMP) was launched in the Park resulting in better management; 2) a change in attitude of the local people towards wildlife due to incentives from various conservation projects and CTHP; 3) emigration of markhor from outside habitats due to improved protection and habitat conditions in the Park.

In TSC, the total population increased over time except in 1990, 1999, and 2000. The highest number of markhor (545) was observed during 2006 while the lowest 137 were recorded in 1990 (Fig. 6). The annual population growth rate in TSC was 7.9% which indicated increase in markhor population over the period of this study (Table 2). Additionally, the increase in population was statically highly significant ($p<0.001$) (Fig. 6).

Comparison of the markhor population growth rates in TSC between the pre and post periods of CTHP showed a high growth rate during both periods (Table 3). Before community involvement, conservation of wildlife was the responsibility of the NWFP WD in the area. This could be the reason for high growth rate in markhor population during pre period of CTHP. High growth rates during both periods showed that wildlife management by both the government and community had very similar effects on conservation of markhor.

The apparent decline in population of markhor in CGNP and TSC in some years of this study was probably not due to poaching, epidemic disease, or weak management (Fig. 5, Fig. 6); rather, this might be due to a lack of consistency in following survey protocols, poor visibility during the survey period, and variability by year in the probability of detection. Also because of climatic variation that reduced the number of markhor because of climatic-induced starvation.

Comparison of population growth rates of CGNP and TSC showed an increase in the population of markhor almost with the same rate (Table 2). This indicated that management practices carried out both by the NWFP WD and local communities had very similar effects on the conservation of markhor.

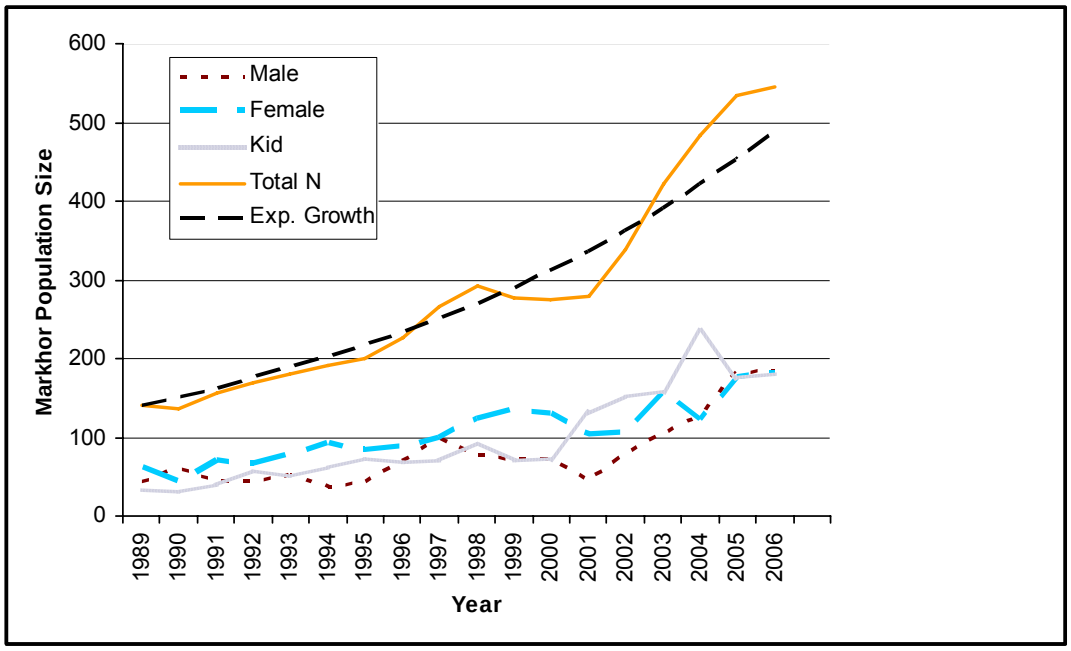

Fig. 5: Markhor population trend in Chitral GoI National Park, Chitral, NWFP, Pakistan

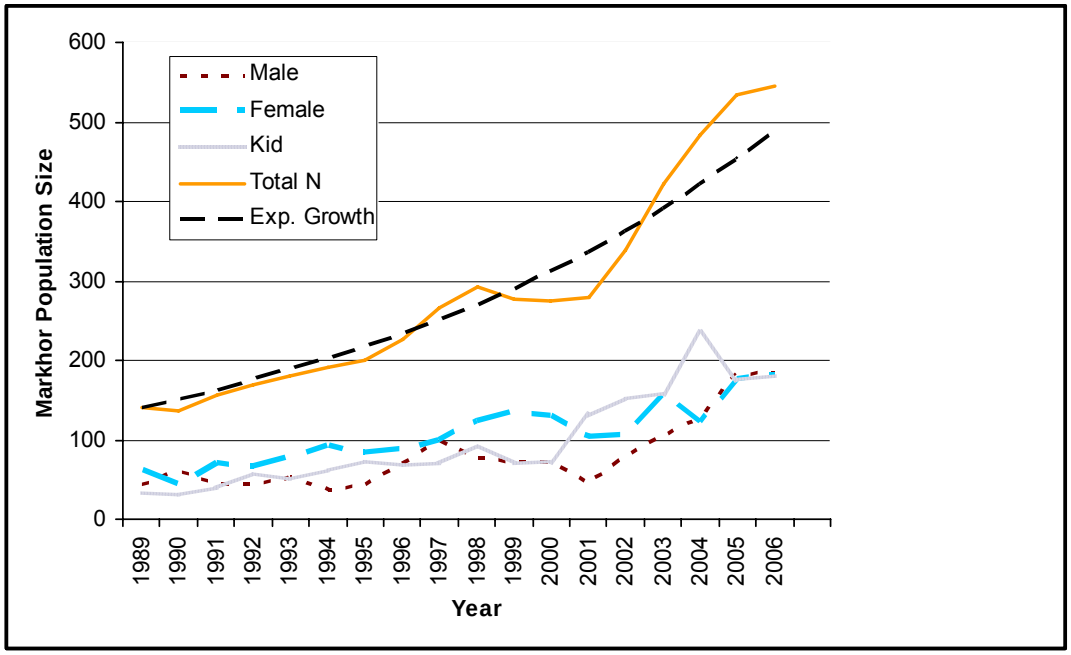

Fig. 6: Markhor Population trend in Tooshi Shasha Conservancy, Chitral, NWFP, Pakistan

10.2. Male population

The highest male population observed in CGNP was 142 (in 2005) and the minimum was 29 (in 1990). The overall population of males grew at 3.3% annually (Fig. 5). This increase was statistically highly significant ($p<0.001$). In CGNP, the estimated growth rate of male population of markhor during post period of CTHP was observed higher than the pre period (Table 3). The higher growth rate in post period of CTHP could be due to: 1) a conservation project (PAMP) that was launched in the Park resulting in better management; 2) a change in attitude of the local people towards wildlife due to incentives from various conservation projects and CTHP; and 3) emigration of male markhor from outside habitats due to improved protection and habitat condition in the Park.

In TSC, the male population ranged from 37 in1994 to 185 in 2006. The population of males grew at 8.3% per year (Fig. 6). Statistically, the increase in male population was highly significant ($p<0.001$). Comparison of growth rates of male population of markhor in TSC between the pre and post period of CTHP showed higher growth rate during the trophy hunting program (Table 3). The post period higher growth rate supported CTHP of markhor. The higher post period growth rate of male population of markhor in TSC could be due to several factors including: 1) involvement of local communities in the conservation and management of wildlife; 2) a change in attitude of the local people due to economic benefits from CTHP and incentives from various conservation projects; and 3) effective protective measures taken by the local communities.

The reason for the possible decline in the male population of CGNP and TSC in certain years was not ascertained (Fig. 5, Fig. 6). No trophy hunting was conducted in the Park while limited trophy hunting of markhor was offered in the Conservancy since 1998. Only 1-2 male markhor were hunted annually which was a small fraction of the total male population. Therefore, trophy hunting could not be a reason for the drop in the male population. Additionally, it was probably not due to weak management, poaching or some epidemic disease; this might be due to lack of consistency in following survey protocols, poor visibility during survey period, and variability by year in the probability of detection.

Table 2: Population growth rate at years 18 (1989-2006)

S.N0	Parameters	CGNP (%)	TSC (%)
1	Total population	7.7	7.9
2	Male population	3.3	8.3
3	Fem population	7.0	6.1
4	Kid population	10.5	9.8
5	Kid/fem ratio	3.3	3.4
6	Male/fem ratio	-3.4	2.1

10.3. Female population

The female population of markhor in CGNP attained the maximum value (200) in 2006 while the minimum of 59 was observed in 1989. The growth rate (7.0%) showed an increase in the female population over time (Fig. 5).

Statistically, the increase in female markhor population was highly significant ($p=0.001$). Comparison of female growth rates in CGN between the pre and post period of CTHP indicated higher post period growth rate (Table 3). The reasons for the higher growth rate in post period of CTHP could be: 1) a conservation project (PAMP) was launched in the Park resulting in better management; 2) a change in attitude of the local people towards wildlife due to incentives from various conservation projects and CTHP; and 3) emigration of markhor from outside habitats due to improved protection and habitat condition in the Park.

In TSC, the female population of markhor was maximum (180) in 2006 and minimum (45) in 1990 (Fig. 6). The female population grew at 6.1% annually (Fig 1). The increase in the female population was statistically highly significant ($p<0.001$). The post period of CTHP growth rate of female markhor was apparently lower than the pre period of trophy hunting program. The reason for the lower post period female population growth rate of markhor was not ascertained. However, the female population grew at a high rate during both periods (Table 3). This could be attributed to the effective management by the NWFP WD during pre period of CTHP and active involvement of the communities in the conservation of markhor during post period.

The data showed apparent declines in female populations in CGNP and TSC in some years of this study (Fig.5, Fig. 6). The cause of possible decline in female population was not ascertained. This might be due to lack of consistency in following survey protocols, poor visibility during survey period, and variability by year in the probability of detection.

10.4. Kid population

The markhor kid population in CGNP was highest in 2006 (325) and lowest in 1990 (52). The kid growth rate increased at a rate of 10.5% per year (Fig. 5). The increase in the kid population of markhor in CGNP was statistically highly significant ($p<0.001$). The positive growth rate could be attributed to the effective management of NWFP WD. Comparison of kid growth rates of the Park before and after the CTHP of markhor in conservancies indicated higher post period kid growth rate (Table 3). The higher growth rate of kid population in the post period of community involvement could be attributed to: 1) launching of PAMP in the Park; 2) a change in the attitudes of the local people towards wildlife due to CTHP; 3) improved habitat due to No. 1 and 2.

In TSC, the kid population was observed maximum (234) in 2004 and minimum (31) in 1990. The kid growth rate increased at 9.8% per year (Fig. 6). The increase in kid population of markhor was statistically highly significant ($p<0.001$). Comparison of the kid growth rates between the pre and post period of the CTHP indicated apparently high growth rate during pre period (Table 3). Overall, the growth rates ware high during both periods. This could be attributed to: 1) an effective management of wildlife by the NWFP WD during pre period of CTHP; 2) active involvement of the local communities in the management of wildlife during post period of CTHP; 3) improved protection measures.

The cause of the apparent fluctuation in the kid populations of CGNP and TSC over the period of this study was not known (Fig. 5, Fig. 6). This might

be due to poor visibility or lack of consistency in following survey protocols. However, there was an increase in the kid population in both areas.

Table 3: Pre and Post markhor population growth rate, NWFP, Pakistan

S. No	Particulars	CGNP		TSC	
		Pre (%)	Post (%)	Pre (%)	Post (%)
1	Total Pop	2.5	12.8	7.7	7.1
2	Male Pop	2.7	3.5	5.8	10.1
3	Female Pop	3.9	9.9	7.1	4.3
4	Kid Pop	1.0	21.3	10.5	7.8
5	Kid/fem ratio	-3.3	10.5	3.2	3.3
6	Male/fem ratio	-1.2	-5.6	-1.2	5.7

10.5. Kid/female ratio

In CGNP, the kid/female ratio was highest (211/100) in 2002 and lowest (66/100) in 1998. The growth rate showed an increase (3.3% annually) in the kid/female ratio (Table 2). Statistically, this change in ratio over time was highly significant (p=0.001). The kid/female ratio grew at higher rate during post period of CTHP than pre period (Table 3). The better post period ratio might be due to better management by the NWFP WD and improved habitat condition. In TSC, the kid/female ratio ranged from 192/100 in 2004 to 52/100 in 1999. It grew at 3.4% annually (Table 2). Statistical analysis showed that the change in ratio in

the Conservancy was highly significant over time (p=0.006). The kid/female ratio in TSC increased at similar rates during post and pre period of CTHP (Table 3).

Additionally, the kid/female ratio in CGNP was higher than the kid/female ratio in TSC (Fig. 7). The reason for this was unknown. However, there might be better habitat conditions and/or a lower mortality rate of kids in the Park which resulted in better ratio.

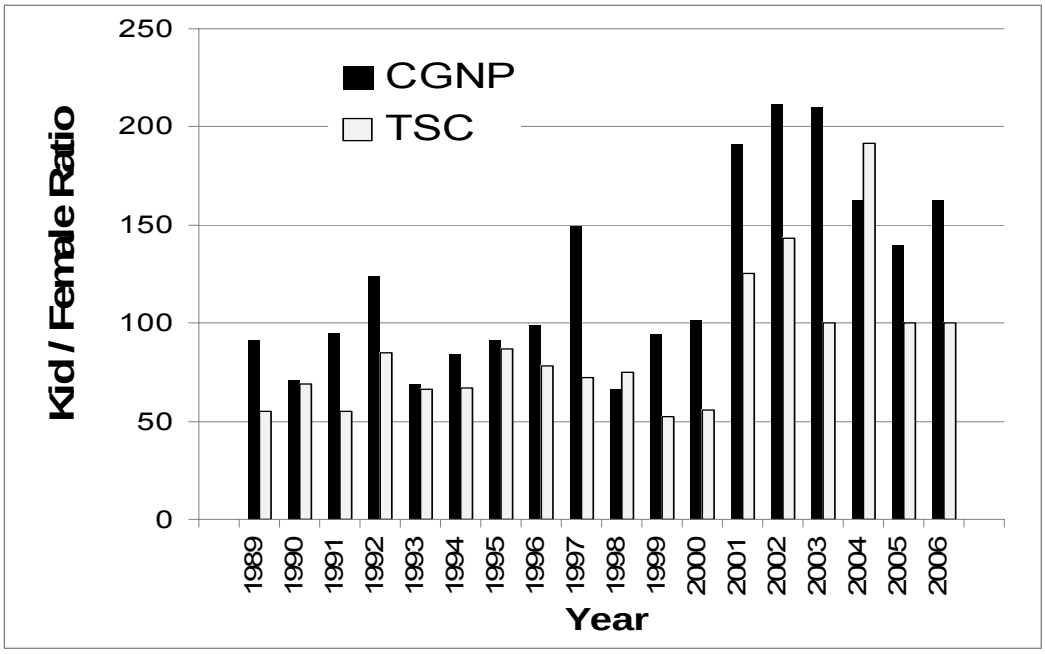

Fig. 7: Kid/female ratio in CGNP was higher than TSC, Chital, NWFP, Pakistan

10.6. Male/female ratio

In CGNP, the male/female ratio was maximum (109/100) in 2002 and 2005 and minimum (40/100) in 1990 (Fig. 8). The male/female ratio was observed decreasing by -3.4% annually (Table 2). Statistically, this change in ratio over time was not significant (p=0.083). Additionally, the male/female ratio decreased at a higher rate during post period of CTHP than the pre period (Table 3). The reason for decrease rate in ratio was unknown. In TSC, the male/female

ratio was estimated maximum (136/100) in 1990 and minimum (40/100) in 1994 (Fig. 8). It grew at 2.1% annually (Table 2). However, this change in ratio over time was not significant (p=0.589). The post period male/ratio grew at a higher rate in TSC than the pre period ratio (Table 3). The male/female ratio in both the protected areas showed fluctuation over time. There were no reports of poaching or epidemic disease which might had caused decline in the ratio. This might be due to variability by year in the probability of detection. The male/female ratios in CGNP (163/100) and TSC (100/100) for the year 2006 showed that there were enough males in the markhor population to ensure that females are bred. Moreover, markhor are polygynous in nature. Therefore, trophy hunting did not appear to cause differences in the male/female ratio between areas.

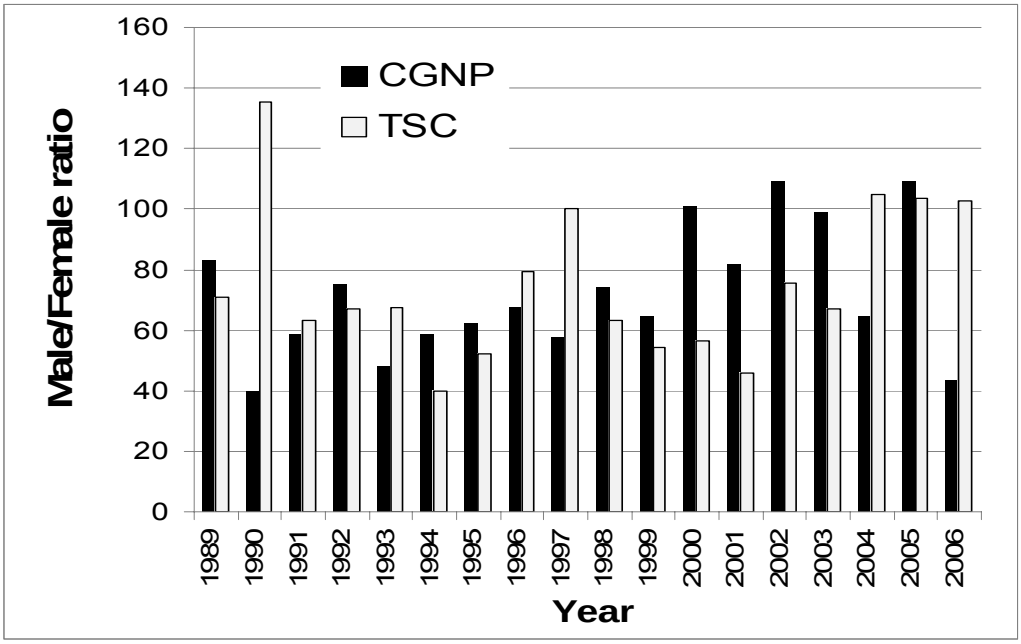

Fig. 8: Male/female ratio in CGNP and TSC, Chitral, NWFP, Pakiatan

11. Conclusions

The conservation of markhor by NWFP WD and CWM were compared using population parameters (total population, male population, female population, kid population, male/female ratio, and kid/female ratio) in CGNP and TSC. These parameters showed an increasing trend over time in both the protected areas. Additionally, no significant difference was observed in population growth rate of markhor (total population, male population, female population, and kid population) between CGNP and TSC over the 18 years of my study.

The NWFP WD adopted the strategy of watch and ward for the conservation of markhor in the CGNP, while local communities were involved and empowered for the management of wildlife resource of TSC.

Comparison of growth rates (total population, male population, male/female ratio) during pre and post period of CTHP showed higher growth rates during the trophy hunting program. This indicates that CTHP was a very successful CBC program in terms of conservation and management of markhor. This result was consistent with those found by Mir (2006) that CTHP resulted in increased awareness of communities for sustainable natural resource management. This activity provided economic incentives to the communities in the form of hunting fees which changed the attitude and perceptions of the local communities towards wildlife (Ahmad and Sattar 2001). The communities supported and became involved in conservation and protection of markhor and other wildlife species in their areas, which is one of the objectives of NWFP WD.

As a result, poaching was controlled to a large extent in almost all communities (Shackleton 2001); other communities expressed a desire to initiate similar programs for other wild fauna of the area (Mir 2006). Consequently, the population status of markhor in the CGNP as well as TSC has improved. In fact, the active involvement of communities in the conservation and management of wildlife in general and markhor in particular could be attributed to the successful strategy adopted by NWFP WD for the protection of wildlife resources in the province.

Conservation of markhor by the NWFP WD and by the communities has shown encouraging results. In fact, the Government has to expend a lot of resources for the conservation of markhor through watch and ward activities. However, communities-based wildlife management is cost effective for the Government. Therefore, involvement of local communities in the conservation of markhor should be encouraged and other means of income generation besides trophy hunting should be explored for sustainability of markhor conservation through communities.

Year	Male	Fem	Kid	Total	K/F	M/F
1989	49	59	54	162	92	83
1990	29	73	52	154	71	40
1991	45	77	73	195	95	58
1992	57	76	94	227	124	75
1993	39	81	56	176	69	48
1994	45	77	65	187	84	58
1995	51	82	75	208	91	62
1996	46	68	67	181	99	68
1997	42	73	109	224	149	58
1998	64	86	57	207	66	74
1999	53	82	77	212	94	65
2000	87	86	87	260	101	101
2001	64	78	149	291	191	82
2002	95	87	184	366	211	109
2003	96	97	204	397	210	99
2004	102	158	257	517	163	65
2005	142	130	182	454	140	109
2006	87	200	325	612	163	44

Table 4: Markhor Population data in CGNP

Year	Male	Fem	Kid	Total	K/F	M/F
1989	44	62	34	140	55	71
1990	61	45	31	137	69	136
1991	45	71	39	155	55	63
1992	45	67	57	169	85	67
1993	52	77	51	180	66	68
1994	37	93	62	192	67	40
1995	44	84	73	201	87	52
1996	70	88	69	227	78	80
1997	98	98	71	267	72	100
1998	78	123	92	293	75	63
1999	73	134	70	277	52	54
2000	73	129	72	274	56	57
2001	47	103	129	279	125	46
2002	80	106	152	338	143	75
2003	106	158	158	422	100	67
2004	128	122	234	484	192	105
2005	182	176	176	534	100	103
2006	185	180	180	545	100	103

Table 5: Markhor Population data of TSC

12. Recommendations

In light of my analysis and review of the literature, the following recommendations and suggestions are provided to improve markhor conservation in the province:

12.1. Exploration of New Sources of Revenue

Effective sustainable conservation of markhor can be ensured through provision of economic incentives for local people so that they may not reconcile wildlife poaching for subsistence. Lodhi (2006) emphasized means of income generation to reduce grazing pressure in markhor habitats.

Trophy hunting is currently the main source of revenue and a major incentive in community-based markhor conservation areas. A ban on trophy hunting or any disease will greatly affect the conservation of markhor through local communities. Therefore, in addition to trophy hunting, parallel sources of revenue generation for the local people should be identified. For this purpose, training in raising medicinal plants, honey bee rearing, poultry, local embroidery, guided tours for wildlife viewing and photography, etc., may be useful venues. Marketing opportunities for local products should be explored to supply local markets.

12.2. Capacity Building of Wildlife Managers and Local Communities

Effective management of natural resources requires trained staff who are well versant with the technical know-how of conservation. Harris and Pletscher (2002) emphasized motivated staff having capability and potential for conservation. Presently, there is insufficient expertise in management of wildlife along scientific lines in NWFP WD. Professional training of wildlife officials in social skills is needed to: 1) work more effectively with local communities; and 2) improve the capacity of the local people for proactive and sustainable management of wildlife resources. In addition, trained staff should effectively use indigenous knowledge and the leadership quality of the local people for community-based management. Additional training would broaden the manager's approach to community organization, increase the involvement of local people in wildlife management, and communities would be able to seek support from external conservation organizations.

CWM is highly dependent on active participation of communities in problem identification, planning, implementation, monitoring, and evaluation (Songorwa 1999). Baldus (2001) perceived that rural people have traditional knowledge in wildlife management and are interested to learn new techniques. Therefore, besides training of wildlife managers, capacity building of rural communities in conservation and management of natural resources on a sustainable basis is necessary for their active and meaningful participation. This will create confidence in communities to take and implement decisions about

wise use of their wildlife resource through a combination of new approaches and their traditional knowledge about the management of wildlife. Improved capacity of the rural communities in wildlife management will enable them to cope with the outbreak of an epidemic disease in a markhor population or in case of a complete ban on trophy hunting by CITES and/or GoP. Moreover, conservation education programs should be designed and implemented to create awareness among the local communities of the ecological, social, and economic value of wildlife and the importance of its conservation and management.

12.3. Transparency of VCF

Maintaining transparency in implementation of all conservation activities is essential to build the trust and confidence of the communities in the institutions and for sustaining Community-based Natural Resource Management in the long run. Baker (1997b) suggested that transparent and accountable revenue collection and disbursement mechanisms from trophy hunting must be taken into account for sustainability of wildlife. In addition, establishment of a crystal clear and accountable mechanism ensures proper utilization of the proceeds generated from the management of wildlife resource on sustainable basis. Therefore, to make the process of conservation more transparent, I recommend that the official accounts of VCF should be held by all VCCs with a conservancy and a regular annual audit should be carried out by a reputable firm to track revenue and expenditures. The audit report should be provided to all VCCs so that the stakeholders may know the sources of income of VCF and the

expenditures. The audit report should also be communicated to NCCW and to CITES, which allocates hunting quotas for provinces. Additionally, an honorarium should be fixed for members of all VCCs paid from VCF to compensate them for their daily expenditures. This will encourage them to participate actively in all conservation activities.

12.4. Habitat Conservation

Habitat conservation and management measures are essential for maintaining a healthy wildlife population. To have desired wildlife habitat, there is a need to review the existing forest policy and waive the revenue-based forest management approach in some areas. In these areas, forests should be managed for ecologically desirable values such as watershed, soil erosion, wilderness, recreation, and wildlife. Timber and fuelwood have alternatives but the ecological values of forest have no alternatives. If all the values of forest are measured quantitatively, the ecological values will outweigh the economic value from timber and fuelwood (Malik 1993). It is also important to abandon the policy of removing dead, dying, and diseased trees from the forest; they are a part of the ecosystem and provide habitats to many wildlife species. Besides, efforts should be made to declare more government- owned forests as protected areas for protection of forest and wildlife resources. Illicit felling of trees for timber and fuelwood should be controlled in government- owned forests to check habitat degradation. For this purpose, a collaborative strategy should be adopted by the

NWFP Forest and Wildlife Departments of the province to achieve far reaching results.

12.5. Encouragement of Wildlife Protection Staff

Field staff is a key element of management who should be morally encouraged and financially compensated. Staff efficiency would be enhanced to a great extent if this is taken into consideration as a priority. For this purpose, the following suggestions are recommended.

i. A regular travel allowance on a monthly basis for field staff should be provided to compensate for the financial cost incurred during field duty as well as attendance at court cases. Besides, the unattractive areas allowance should be realistically increased to encourage the staff to perform their duty in remote areas efficiently.

ii. Provision of arms and ammunition to all the field staff is essential so that they may perform their duty fearlessly and with a sense of security.

iii. In case of revengeful actions from pressure groups and influential people, the government should extend their support to the staff so that they may encourage and perform their duty more efficiently.

iv. Accelerated promotions of the wildlife staff based on qualification and merit should be ensured by making an amendment in the existing service rules to alleviate the desperation among the staff waiting for promotion for quite a long time.

v. A separate fund for rewards to the staff for extraordinary performance in conservation of markhor should be established. It would serve as a stimulus for enhanced performance.

12.6. Seek Co-operation of District Administration

District administration can play a vital role in conservation of wildlife through extending their full support to the wildlife staff in discharging their duties and strictly following rules and regulations for wildlife conservation. Police should also be persuaded to extend their timely support in apprehension of offenders and in proper distribution of summons issued by the court of law to the offenders. Letters of appreciation and cash rewards by the NWFP WD to police officials for extraordinary action in the field of protection of markhor and other associated wildlife species is recommended. It would not only encourage the police officials to extend their support but would also further strengthen co-operation and co-ordination between the two departments.

12.7. Disposal of Wildlife Offense Cases

Offense cases instituted by the NWFP WD into the court remain pending for long periods of time. In this regard, the honorable judges should be requested to dispose off wildlife offense cases on a priority basis and award proper punishment to the offenders if found guilty. To defend the wildlife offense cases in the court of law, the services of at least one lawyer should be hired in each Wildlife Division. This will not only result in speedy disposal of wildlife cases

but will also impose proper punishment to the offenders. This will ultimately discourage offenders to commit further wildlife offenses which will register positive impacts on conservation activities of wildlife in general and markhor in particular.

12.8. Amendments in NWFP Wildlife Act 1975 and the rules made there under

Some of the clauses of NWFP WD Act are outdated. Therefore, amendments in the Wildlife Act and Rules are necessary for effective management of wildlife resource of the province. The ceilings of fines for wildlife offense cases and compensation should be increased. There should be provision in the Act for certain minimum penalties in case of a conviction to safeguard against the misuse of discretionary powers by the judges of honorable courts. Delegation of magisterial power to officers of NWFP WD with a purpose to empower them for speedy disposal of offense cases and decrease burden on judges of the court of law is essential.

The Wildlife Act 1975 reflects only three categories of Protected Areas i.e. National Park, Wildlife Sanctuaries, and Game Reserves. However, keeping in view the conservation approaches, there is a need of amendments in the existing provision of protected areas and inclusion of some additional categories such as Wildlife Parks, Wildlife Refuges, Nature Parks, Conservation Areas, and Recreation Parks in the Act. Besides, penalties regarding offenses in Protected Areas should be enhanced for effective conservation and management of

markhor and other associated wildlife species. The population of markhor has not yet reached a level that it may become a pest for farmers. However, there should be provision in the Act to compensate for damage done by wildlife to the farmers.

12.9. Provision of Funding

The NWFP WD is always in dire need of an operational fund which greatly affects markhor conservation activities. Enough non developmental funds should be allocated from the government exchequer for unforeseen and unavoidable conservation activities. Besides the provision of a sufficient non developmental fund, the Department should establish and maintain a separate fund generated from the markhor trophy hunting program which should be used only on conservation activities for markhor at the discretion of the Department.

12.10. Habitat Improvement and Adoption of Grazing System

Habitat improvement measures should be carried out in markhor conservancies and other potential areas that include plantation of palatable and native species in degraded habitats; construction of check dams and water ponds in protected areas for fulfilling the water requirement of markhor and other wildlife species; and development of plant inventory and determination of the carrying capacity of protected areas and markhor conservancies in various seasons for selection and implementation of a proper grazing system. Adoption of a proper grazing system would not only allow the habitat of markhor for periodic use but plant communities would also have time for conducting essential

physiological processes during the growing season (Frisina 1991). These measures would ensure improvement in wildlife habitat and availability of cover and food for markhor. This has great applicability in winter range sites where there are more prospects of markhor and livestock competition for forage and habitat. Last but not least, contact between markhor and livestock would be minimized by adopting these measures, which will result in reduced risk of disease transmission by livestock.

12.11. Vaccination of Livestock

Some of the important diseases which are transmissible to the markhor population from livestock include *Contagious ophthalmia*, Foot and Mouth (*Aphtae epizooticae*) disease, Sheep and goat pox (*Capripoxvirus*), *Peste des petits ruminants* and *Contagious caprine pleuropneumonia* (Woodford et al. 2002). Transmission of these diseases is fatal and can cause a great loss to markhor populations. Rinderpest caused considerable loss to markhor population in Chitral in 1966 (Frisina 2001). Therefore, effective precautionary measures against these diseases are suggested to avoid one of the potential threats to the population of markhor. It is not possible to vaccinate all the markhor in the wild due to the rough nature of terrain and their habitat, however, the only way to protect wild markhor from any disease transmission is to vaccinate nearby livestock regularly against the diseases.

12.12. Establishment of a Wildlife Park for Markhor

Presently, there are five Wildlife Parks in the province which have been established for propagation of various wildlife species (NWFP WD 2007). These parks are situated in areas where environmental conditions and habitats are not suitable for markhor. Therefore, a Wildlife Park should be established in an area where markhor are naturally found for the purpose of multiplication and reintroduction into the areas where markhor have been extirpated. This will further strengthen conservation initiatives for markhor.

12.13. Adoption of Integrated Approach

All the government and NGOs with a stake in the conservation of markhor should converge their conservation activities and support cooperation and collaboration among themselves for better management and protection of markhor.

12.14. Conducting Research

It is imperative to formulate research policy, strategy, and allocate resources for scientific conservation and management of markhor. Research must focus on different aspects such as shared diseases of markhor and livestock, associated wildlife species, carrying capacity of the habitat, composition of the flora, including palatable and non palatable species; population biology and habitat requirements of markhor; markhor ecology with reference to its behavior towards predators; ecological impacts of trophy hunting;

population ecology of markhor; socio-economic condition of the people; and dependency and impacts of the local people on the habitat. These data will serve as baseline for policy formulation and preparation of various plans for the species-based conservation and management approaches.

12.15. Determination of the Population status of Markhor

Populations of markhor have increased in government-managed protected areas and conservancies where communities are involved (NWFP WD 2005a). To review the population status of markhor, an intensive survey program should be initiated throughout the country by a well equipped and expert team to collect reliable information on the current status of markhor. The survey team should strictly follow the same survey protocols. It will not only give the population status of markhor but will also help in planning conservation strategies which will result in better management of markhor.

12.16. Launching an Awareness Program

Markhor are found in areas where most people are poor and lack basic amenities and resources. These people are mostly dependent on natural resources for their livelihood. Given the existing socio-economic scenario, an intensive awareness program based on sustainable use of markhor should be initiated in villages situated in markhor habitat for long-term benefits. The local people should be motivated to insure and maximize economic returns from the conservation and management of markhor and other wildlife species. With time,

this program will help seek support of the local people for the conservation of other components of biodiversity in the region, as well.

12.17. Involvement of Local Communities

One of the objectives of the NWFP WD is to encourage and launch CBC and management of wildlife resources in their areas. Support of many communities has been obtained in this regard which has proved a very successful experience. Because this approach is yet in its infancy, the number of communities involved is small compared to the vast distribution of markhor in the province. Therefore, I suggest that efforts should be made to involve more communities in the conservation of markhor through provision of initial economic incentives. For this purpose, community-based projects like PCDP and MACP should be launched in areas where these projects currently have no jurisdiction.

12.18. Common markhor conservation strategy

The countries where markhor are found form a contiguous belt. Markhor face threats of extinction throughout their range due to poaching and habitat destruction. There is a great need to have a common platform for the conservation of markhor throughout its range to save them from extinction. Pakistan is the only country to have involved local communities in the conservation of markhor through the trophy hunting program. This program is very successful and resulted in a population increase of markhor in community-

based conservation areas. Therefore, Pakistan is in position to serve as a model and play a lead role to provide a common platform to all other countries where markhor are found. I recommend that a markhor conservation workshop should be conducted and biologists and managers from all the range countries should attend to form a common markhor conservation strategy for the whole region. International conservation agencies should come forward and provide financial support for arranging such a workshop.

12.19. Participation in international conservation events

The NWFP WD should participate in international conservation events for the promotion of CTHP. Safari Club International USA, which works for wildlife conservation and protection, organizes the world's largest hunting show. Shikar Safari International also has an Annual Hunter's Convention. Hunters from all over the world participate in these events. These events provide an opportunity for a country to promote its hunting programs. I suggest that the NWFP WD should take advantage of this opportunity and establish a booth containing pictures, documentary films, outstanding features of markhor, and procedural documents for hunting. Additionally, information should be disseminated at these events regarding the CTHP and conservation activities carried out with funds raised by trophy hunting. This will help in .advertisement of the markhor trophy hunt among the international hunting community and will boost the hunting permit fee.

12.20. Establishment of DNA data base for markhor

Trophy hunting is offered in different populations of markhor in CBC areas of NWFP. I recommend collecting a tissue sample from every harvested markhor to start collecting a DNA database for markhor in NWFP. This DNA database of markhor will be useful to help build capacity within the NWFP WD to monitor markhor populations for poaching, gene flow and dispersal, population size, and taxonomic questions using non-invasive genetic tools (Manel et al. 2002, Maudet et al. 2004, Schwartz et al. 2006). Initiation of a markhor DNA database could be very easy. The wildlife staff would be required to collect a small tissue sample from the markhor following a proscribed protocol and submitting the sample, along with information about where and when the animal was harvested, to the NWFP WD.

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