

THE DISTRIBUTION AND POPULATION OF CHILTAN
WILD GOAT (*Capra aegagrus chialtanensis*) IN ITS LAST
REMAINING REFUGE OF HAZARGANJI CHILTAN
NATIONAL PARK BALOCHISTAN, PAKISTAN

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THE DISTRIBUTION AND POPULATION OF CHILTAN WILD
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REFUGE OF HAZARGANJI CHILTAN NATIONAL PARK
BALOCHISTAN, PAKISTAN

BY

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LIST OF ABBREVIATIONS

BF&WLD	Balochistan Forest and Wildlife Department
CH	Chiltan
CGNP	Chitral Gol National Park
CWG	Chiltan wild goat
Deptt	Department
DR	Deputy Range
FG	Forest Guard
Fig	Figure
GIS	Geographic Information System
GoP	Government of Pakistan
GoB	Government of Balochistan
GPS	Global positioning System
GW	Game Watcher
HG	Hazarganji
HNP	Hingol National Park
HCNP	Hazarganji Chiltan national park
Ha	Hectare
in	Inch
IUCN	International Union for the Conservation of Nature
Km	Kilometer

KNP	Kirthar National Park
Lab	Laboratory
mm	Millimeter
NAs	Northern Areas
Nallah	Stream
NWFP	North West Frontier Province
PA	Protected Areas
PFI	Pakistan Forest Institute
Pak	Pakistan
PAMP	Protected Areas Management Project
PMD	Pakistan Meteorological Department
PWP	Pakistan Wetlands Project
SSC	Species Survival Commission
SUSG-CAsia	Sustainable Use Specialist Group Central Asia
TCP	Torghar Conservation Society
STEP	Society for Torghar Environmental Project
Tal, H & S	Tal, Haider and Surkho
WL	Wildlife
WDPA	World Database on protected Areas
WWF-Pak	World Wide Fund for Nature Pakistan

**TABURAN DAN POPULASI KAMBING CHILTAN LIAR
(*CAPRA AEGAGRUS CHIALTANENSIS*) DALAM KAWASAN
PERLINDUNGANNYA YANG TERAKHIR DI TAMAN NEGARA
HAZARGANJI CHILTAN BALOCHISTAN, PAKISTAN**

ABSTRAK

Kambing Chiltan liar (*Capra aegagrus chialtanensis*) merupakan salah satu sub-spesies yang penting bagi kambing liar di Balochistan dan sub-spesies ini adalah endemik kepada Taman Negara Hazarganji Chiltan. Suatu masa dahulu, sub-spesies ini ditemui di kawasan Koh-i-Murdar, Koh-i-Maran dan Koh-i-Gish, akan tetapi, disebabkan pemburuan haram, kehilangan habitat dan persaingan dengan haiwan ternakan domestik, kambing Chiltan liar ini pupus dari kawasan tersebut. Pada 15 Januari 1980, kawasan Hutan Negeri Hazarganji dan Hutan Simpan Chiltan telah diisytiharkan sebagai Taman Negara untuk perlindungan kepada kambing Chiltan liar termasuklah habitatnya. Terdapat persetujuan umum bahawa tiada populasi ungulat yang kekal statik. Kajian ini telah dijalankan selepas tahun 2008 iaitu ketika musim kambing Chiltan liar mengawan hingga bulan November 2012 untuk mencatat taburan kambing Chiltan liar yang selebihnya dalam perlindungan, untuk menyiasat populasinya, tingkah laku dan ancaman-ancaman yang berkemungkinan untuk berlaku terhadap kambing Chiltan liar ini. Data kajian ini telah dikumpulkan dengan menggunakan kaedah tinjauan pada tempat yang ditetapkan (pemerhatian). Sepanjang kajian ini dijalankan, sebanyak 984 ekor kambing Chiltan liar dengan populasi sebanyak 431 ekor (44%) di Hazarganji area, 401 ekor (41%) di kawasan Chiltan dan 152 ekor (15%) di kawasan Tal, Haider dan

kawasan Surkho telah diperhatikan. Keputusan kajian ini telah menunjukkan secara puratanya populasi kambing Chiltan liar telah meningkat dengan ketaranya dengan kadar pertumbuhan populasi meningkat sebanyak (8.25%) untuk sepuluh tahun lepas (1992-2012). Tambahan pula, kadar pertumbuhan populasi dilihat pada kambing Chiltan liar dengan masing-masing jantan (9.22%), betina (6.93%), kambing muda (8.44%) dan bayi (9.91%). Kajian itu juga menunjukkan, peningkatan yang ketara untuk sepuluh tahun yang lepas dalam mengkaji nisbah kambing jantan dan kambing betina, dan nisbah kambing muda dan kambing betina. Secara umumnya mencampurkan ternakan kambing jantan dan kambing betina, merawat dan membantu kambing jantan mengawan, tingkah laku agonis dalam populasi kambing jantan dan perubahan dalam tingkah laku di antara kambing muda, jantan dan betina, dan bayi diperhatikan. Pemburuan, pemangsaan, kematian akibat kemalangan dikenal pasti memberi ancaman utama terhadap populasi kambing Chiltan liar di Taman Negara Hazarganji Chiltan, Balochistan, Pakistan.

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ABSTRACT

Chiltan wild goat (*Capra aegagrus chialtanensis*) is one of the important sub-species of wild goats founds in Balochistan and endemic to Hazarganji Chiltan National Park. Previously it was found in Koh-i-Murdar, Koh-i-Maran and Koh-i- Gish but due to ruthlessly poaching, habitat loss and competition with domestic livestock all population of Chiltan wild goat locally extinct from the areas. For the protection of Chiltan wild goat and its habitat, the areas of Hazarganji State Forest and Chiltan Protected Forest were declared as National Park on 15 January 1980. There is common agreement that no ungulate population remains static. The present study was conducted after 2008 in the rut season of Chiltan wild goat until November 2012 to document the distribution of Chiltan wild goat in its last remaining refuge, to investigate its population, behaviors and potential threats. The data were collected by using fixed point survey method (vantage point). During the study 984 Chiltan wild goats with distribution of 431 (44%) in Hazarganji area, 401 (41%) in Chiltan area and 152 (15%) in Tal, Haider and Surkho areas were observed. The results of present study revealed that on average the population of Chiltan wild goat is significantly increasing with population growth rate of (8.25%) for the last ten years (1992-2012). Moreover the male, female, kids and yearlings were observed with population growth rate of (9.22%), (6.93%), (8.44%) and (9.91%) respectively. The study further revealed increasing trend in male and female

ratios, kid and female ratios for the last ten years. Generally mixed herds, tending and courting male mating tactics, agonistic behavior among males and variation in feeding behavior between male and female, kids and yearlings was observed. Poaching, predation, natural disasters and accidental deaths was found as major threat to the population of Chiltan wild goat in Hazarganji Chiltan National Park, Balochistan, Pakistan.

CHAPTER 1

INTRODUCTION

1.1 Background

Balochistan being the largest province of Pakistan expanded over an area of 347,200 square kilometer (about 43% land of Pakistan) and having a small number of population about 7 million (GoB. and IUCN-P, 2000; Ghalib *et al.*, 2007). The province has a unique position with respect to wildlife species and diverse habitats. Balochistan is the only area in the world for having fauna of three Zoogeographical Regions of the Globe, the animals of Palearctic or Eurasian region, Oriental or Indian region and Ethiopian region (Lothiya *et al.*, 2007). Although all province is rich in wildlife resources but most of the biodiversity has not been studied in detail (GoB. and IUCN-P, 2000; Lothiya *et al.*, 2007). The Chiltan wild goat (*Capra aegagrus chialtanensis*) one of the important sub-species of Wild goat founds in Balochistan and is endemic to Hazarganji Chiltan National Park (Shackleton, 1997; Ghalib *et al.*, 2007; Lothiya *et al.*, 2007). The status of Chiltan wild goat worldwide is “Critically Endangered” (GoB. and IUCN-P, 2000; GoP *et al.*, 2000; Lothiya *et al.*, 2007; Aftab, 2010; Khan and Siddiqui, 2009). The Chiltan wild goat was also found in other parts of Balochistan such as Koh-i-Murdar (Quetta district), Koh-i- Maran and Koh-i-Gish (Kalat district) (Roberts, 1997; Shackleton, 1997). However the surveys conducted in recent decades indicate that the entire populations of these areas have been wiped out, due to ruthlessly poaching, habitat loss and competition with domestic sheep and goats for forage (Roberts, 1997). Now, it is believed that throughout world Chiltan wild goat is only

found in the Hazarganji Chiltan National Park (Shackleton, 1997; Shafique and Barkati, 2002). Due to human activities the wildlife populations throughout the world are devastated and their habitats disappeared (Gundogdu, 2011).

Protected areas are accepted as an important tool for conservation of biodiversity and ecosystems (Khan *et al.*, 2010). For the protection of Chiltan wild goat and its habitat the areas of Hazarganji State Forest (2,201 ha) and Chiltan Protected Forest (10,360 ha) were declared as a National Park on 15 January 1980 by the provincial government. The purpose of declaration of areas of Hazarganji and Chiltan as National Park was to protect the last remaining population of Chiltan wild goat and to provide educational and recreational facilities to the people of Balochistan (Khan and Siddiqui, 2009).

Due to the park's nearness to provincial headquarter of Quetta City, illegal hunting has been considered as a big threat to the survival of the last remaining population of the Chiltan wild goat (Roberts, 1997). This remnant population is totally isolated in its last remaining refuge because of roads, heavy human settlements, infrastructure and intensive agriculture on the periphery of its range.

Studies related to population structure through either routine surveys of a population or through long term examining of identifying individuals and social groups, provide important information for observing changes in a population and for forecasting population dynamics, which are a necessary element in the conservation management of an endangered species (Walpole *et al.*, 2001; Marker *et al.*, 2003; Pusey *et al.*, 2007; Robbins *et al.*, 2009). Investigating how different populations of the same genus or species react against the inconsistency in ecological conditions and to the impact of

prohibited actions can be helpful for developing and monitoring of the conservation approaches that target particular populations (Ferguson and Lariviere, 2002; Nawaz *et al.*, 2008; Robbins *et al.*, 2009). Animal populations are influenced by extrinsic factors like weather and intrinsic factors like population density that acts on the birth and death rates (Shahgolzari and Yavari, 2010). The study about how weather and population density influence the crucial population parameters, is a fundamental focal point of ecology. The ecologists are using the data obtained from continuing studies of animal populations to examine the comparative importance of intrinsic and extrinsic causes on population dynamics (Shahgolzari and Yavari, 2010). A difficult but most important achievement in population ecology and wildlife management is to understand and forecast the population dynamics (Hamel *et al.*, 2006). Population age-sex composition and dissimilarities in vital rates, such as age-specific survival and reproductive rates are most important determinants of population dynamics (Hamel *et al.*, 2006).

Loss of habitat and its disintegration contribute a decrease in population viability of wildlife species (Fahrig, 2003; Lindenmayer and Fischer, 2007; Alemayehu *et al.*, 2011). Decline in valuable population size due to fragmentation in habitat may result in loss of allelic affluence or gene diversity. Species which have thin geographical distribution may be more at risk of local extirpation if reduction happens in population genetic variation due to habitat disturbance, and reproductive bottlenecks takes place (Kirkpatrick and Jarne, 2000; Alemayehu *et al.*, 2011). Endemic, endangered and rare species are frequently found to occur in small isolated populations and maintain concentrated genetic variability because of increased habitat fragmentation and inbreeding (Alemayehu *et al.*, 2011). For proper study of any wildlife a sound

knowledge of related habitat its population distribution and population dynamics is imperative. If there is a serious break down in food chain, i.e. if anyone population of a community suffers seriously, decline or incline, it affects the entire animals and plant communities of biome. Habitat is very important for the survival of any animal, because it provides food, water and shelter to animals. It is the sum of all those factors which affect the life of an animal directly or indirectly. Habitat will affect populations of wild animals and if it is unable to meet the requirements of animals, their population is adversely affected.

1.1 Study Rationale

There is common agreement that no ungulate population remains static (Arshad, 2011; Schaller., 1977). There are numerous factors that regulate changes in population sizes. One of the main factors is the climate changes especially the precipitation, which has a direct impact on the food supply and physical conditions of the animals. This afterwards affects the birth and death rates in a population, which are the basic determinants of population size (Jacobson *et al.*, 2004; Arshad, 2011). Changes in these rates influence the age distribution of the population. For instance, a favorable season may cause many young to survive the first year of life. This may then cause a decrease in the birth rate the following year when conditions are more normal because there is a temporary increase in the percentage of animals below breeding age. The rate of increase in a population depends on age distribution, sex ratio, birth and survival rates. The need to know how large a population can be maintained in a protected area is obvious, but an even more urgent need is to analyze the processes that enable a population to reach and maintain a natural equilibrium.

The main objectives of this study will be to document the distribution of Chiltan wild goat, to investigate the population of the endemic sub-species of Chiltan wild goat and to identify potential threats to the population of Chiltan wild goat for future management and to give recommendations for better management of Chiltan wild goat population and its habitat. It is hoped that this study will help the researchers, students, conservationists, protected area managers and nature loving people in their professional work. The following are specific objectives of this study:

- To document the distribution of the Chiltan wild goat in its last remaining refuge.
- To investigate the population of Chiltan wild goat in its last remaining refuge.
- To explore/identify potential threats to the population of Chiltan wild goat.

Flow Chart of study

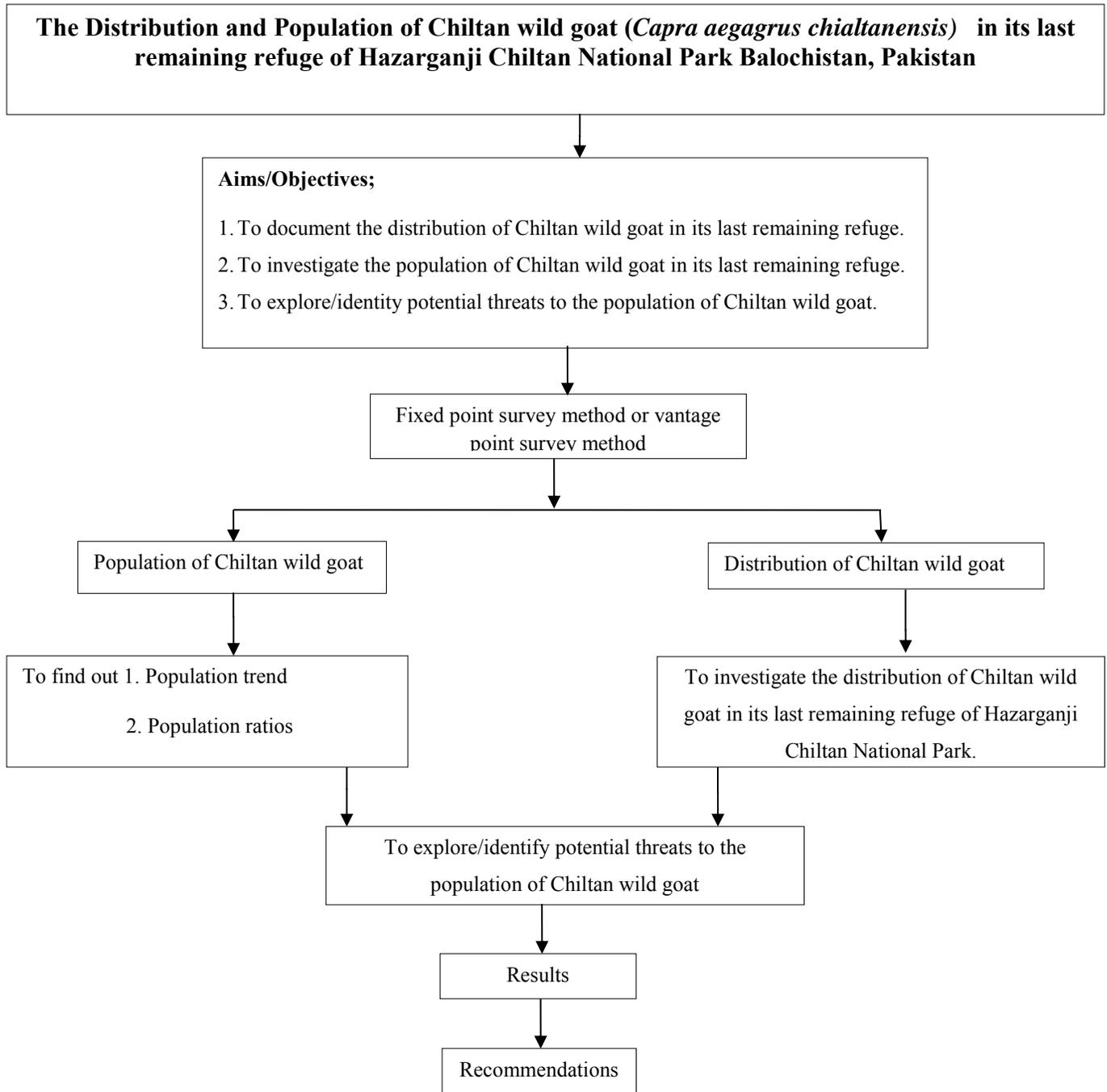


Figure 1.1. Flow Chart of the overall Research Study



Figure 1.2. Male Chiltan Wild Goats during Rut Season.



Figure 1.3. Female Chiltan Wild Goat with Kid

CHAPTER 2

REVIEW OF LITERATURE

2.1 Distribution of Wild Goats

Pakistan is considered one of the most important countries for conservation of Caprinae (Wild Sheep and Goats). In Pakistan seven species and 11 subspecies of Caprinae are found in a range of habitats from the hills in southern deserts of Sind and Balochistan provinces to the high alpine areas of Himalaya. But most of Caprinae now survive in small and scattered populations and facing the same kind of threats of illegal hunting and indirectly from an increasing in human populations with its demands for grazing lands and fuel wood. At present in Pakistan, out of 11 subspecies of Caprinae: 10 are threatened and 8 are classed as Endangered. Two types of wild goat (*Capra aegagrus*) are recognized in Pakistan. Wild goat (*Capra aegagrus*) is spread throughout the dry and often on separated mountain ranges of southern Sindh and southern Balochistan provinces. The scimitar-horned Sind wild goat (*Capra aegagrus blythi*) locally known as Sind ibex was first given sub specific position by Hume (1875) and differentiated it from the wild goat (*Capra aegagrus aegagrus*) founds in Turkey and Iran. Pakistan's second Wild goat is Chiltan wild goat (*Capra aegagrus chiltanensis*). The goat has twisted horns and is found on Chiltan and Hazarganji range in south west of Quetta. Now it is believed that the world's last remaining population of Chiltan wild goat is only found in the Hazarganji Chiltan National Park (Hess *et al.*, 1997).

Roberts (1997) reported that wild goats are found all over the mountainous regions of the South-West Asia, Middle East and the North Africa. Corbet and Hill

(1992) have distinguished the wild goats in 6 species while other taxonomists of world distinguished wild goats in 8 species by separating the Spanish Ibex and Caucasian Tur into three species. In Pakistan three different species of wild goats are found besides four subspecies of Markhors. They are Sind wild goat or Sind Ibex (*Capra aegagrus blythi*), Himalayan or Siberian Ibex (*Capra aegagrus sibirica*) and Chiltan wild goat (*Capra aegagrus chialtanensis*) (Roberts, 1997). Population wise the Himalaya or Asiatic Ibex is the most abundant wild goat in Pakistan (Shackleton, 1997).

Ashraf (2010) reported that the body pattern of all wild and domestic goats is analogous, and they can freely interbreed in captivity. The close gene pool relationships with various taxa within the genus *Capra* and the possibility of introgressive hybridization of ancestral or modern population make the entire group difficult taxonomically. The wild goat is a common species of goat, with a distribution ranging from Europe and Asia Minor to central Asian and Middle East.

Pidancier et al. (2006) stated that very little fossil information is available for genus *Capra* because their preferred mountainous habitats are not favourable for fossil preservation. In result of this the evolutionary history of *Capra* species is not understood clearly. It is confounded by the fact that the radiation of *Capra* taxa in fact takes place quickly and makes it difficult to measure the number of species and their phylogenetic relationships. The number and status of *Capra* species and subspecies is still under discussion among taxonomists and they guess them between 6 to 9 species. The taxonomic classification within genus *Capra* is mostly based on the horn morphology of mature males and on the shape of the cross-section of the horn covers and cores.

Arshad (2011) reported that Bovidae comprises the sub-family Caprinae (including tribe Caprini and genus Capra) and contains a widespread and diverse group of ungulates that are most commonly related with steep and especially mountainous topography (Shackleton, 1997). Throughout most of their distribution, Caprinae have great importance for consumptive and non-consumptive uses. The role of Caprinae in the socio-economic uplift of the mountain communities of Pakistan has been reorganized very effectively (Shackleton, 2001).

2.2 Taxonomic Classification of Capra

According to classification Wild Goats are classified in Class ‘Mammalia’, the animals which have hair on their body and feed young ones with milk. These animals are placed in Order Artiodactyla, which are identified as even-toed ungulates (Lydekker, 1913). Order Artiodactyla is used as a source for further classification (Arshad, 2011).

Table 2.1. Taxonomic Classification of Wild Goats (Shackleton, 1997)

Taxon	Examples	
Order Artiodactyla	Even-toed ungulates	
Sub-order Ruminantia	Cattle, goats, sheep, alpacas, giraffes, American bison, European bison, yaks, water buffalo, deer, wildebeest and antelope	
Family Bovidae	Cattle, sheep, goats, antelopes and relatives	
Sub-family Caprinae	Muskox, serow, goral, chamois, sheep, goats, aoudad, bharal, tahrs	
Tribe Caprini	Sheep, goats, aoudad, bharal, tahrs	
Genus Capra	Markhor, Goats and Ibexes	
Species	Sub-species	Common Name
<i>Capra falconeri</i>	Wagner, 1839	Markhor
	<i>Capra falconeri heptneri</i> Zalkin, 1945	Tajik or Bukharan Markhor
	<i>Capra falconeri falconeri</i> Wagner, 1839	Pir Panjal and Astor Markhor
	<i>Capra falconeri megaceros</i> Hutton, 1842	Suleiman and Kabul Markhor
<i>Capra aegagrus</i>	Erxleben, 1777	Wild Goat
	<i>Capra aegagrus aegagrus</i> Erxleben, 1777	Persian Wild Goat
	<i>Capra aegagrus cretica</i> Schinz, 1838	Cretan Wild Goat or Agrimi
	<i>Capra aegagrus blythi</i> Hume, 1875	Pasang or Sindh Wild Goat
	<i>Capra aegagrus chialtanensis</i> Lydekker, 1913	Chiltan wild goat
<i>Capra [ibex] ibex</i>	Linnaeus, 1758	Alpine Ibex
<i>Capra [ibex] nubiana</i>	F. Cuvier, 1825	Nubian Ibex
<i>Capra [Ibex] pyrenaica</i>	Schinz, 1838	Spanish or Iberian Ibex
	<i>C. p. hispanica</i> Schimper, 1848	Spanish Ibex
	<i>C. p. lusitanica</i> Schlegel, 1872	Portuguese Ibex
	<i>C. p. pyrenaica</i> Schinz, 1838	Pyrenean Ibex
	<i>C. p. victoriae</i> Cabrera, 1911	Gredos Ibex
<i>Capra [ibex] sibirica</i>	Pallas, 1776	Asiatic or Siberian Ibex
<i>Capra [ibex] Walie</i>	Ruppell, 1835	Walia or Ethiopian Ibex
<i>Capra [ibex] caucasica</i>	Guldenstaed & Pallas, 1783	West Caucasian Tur
<i>Kuban Tur Capra [ibex] cylindricornis</i>	Blyth, 1841	East Caucasian Tur, Daghestan Tur

(Source: Arshad, 2011)

Shackleton (1997) summarized the findings that Caprinae's current evolutionary history, its present day distribution and the generally distinctive quality of their environment has significantly contributed in their classification. Caprinae populations incline to be distributed in scattered clumps or "islands" bounded by habitats that hinder immigration and emigration and today many more are becoming fragmented due to the actions of humans. Isolation played a significant, formative part in the evolution of Caprinae. Most modern Caprin evolved during the Pleistocene which in the northern Hemisphere was a turbulent 1.6 to 2.0 million years (Arshad, 2011).

2.3 Species and Sub-Species of Caprinae

Arshad (2011) described that rough classification in the arrangement of unnecessary splitting of taxonomic units may misdirect and decrease conservation efforts. The taxonomy of *Ovis* and *Capra* and some of their relatives remained unsettled. No one has as yet undertaken the assignment of analyzing the morphology and biochemistry of sheep and goats throughout their range, using large samples to remove biases due to age, sex and individual differences. Horns have been the main taxonomic character used to classify goats. New species and sub-species have sometimes been designated on the basis of a slight variation in the shape of one set of horns, clearly an undesirable tactic with a structure that is highly flexible in evolution. The basic body pattern is alike in all goats, as shown by the fact that the females of various forms are sometimes difficult to distinguish (Arshad, 2011).

2.4 Taxonomy of Chiltan wild goat

Kingdom	Animalia	(C. Linnaeus 1758 animals)
Phylum	Chordata	(Bateson. 1885 chordates)
Sub-phylum	Vertebrata	(Luvier. 1812)
Class	Mammalia	(C. Linnaeus .1758)
Order	Artiodactyla	(Owen. 1848)
Sub order	Ruminantia	(Scopli 1777)
Family	Bovidae	(Gray. 1821)
Sub-family	Caprinae	(Gray1821, Gill 1872)
Tribe	Caprini	(Gray 1821, Simpson 1945)
Genus	Capra	(C. Linnaeus 1758)
Specific name		aegagrus
Subspecies		chialtanensis
Scientific name		<i>Capra aegagrus chialtanensis</i>

(Source [http:// zipcodezoo.com](http://zipcodezoo.com) 15th April 2012)

Manceau et al. (1999) investigated the evolutionary history of genus *Capra* and reported that it consists of a number of forms of wild goats that are found from Northern Mongolia and Russia to Western Europe and African country of Ethiopia in mountainous habitats and in mixed domesticated forms. The body pattern of all wild and domestic goats is analogous and they also can inter breed in captivity freely. On the basis of this reason Couturier (1962) recognized only one species (*Capra aegagrus*). The International Union for Conservation of Nature described five species of *Capra* (Shackleton, 1997).

Roberts (1997) and Shackleton (1997) investigated that the Chiltan wild goat was first described by Lydekker in 1913 as a different subspecies of Markhor (*Capra falconeri chiltanensis*). Afterwards it was hypothesised that Chiltan wild goat might be a hybrid either between Markhor and domestic goat (*Capra hircus*) or between wild goat and Markhor (Roberts, 1977). Roberts (1997) reported that Schaller & Khan in 1975 and Schaller in 1980 studied the population of Chiltan wild goat and reported it a wild goat (*Capra aegagrus*) and not a Markhor based upon the observations they made over the horn morphology and coat colour of mature males with following conformations,

1. That the horns of Chiltan wild goat have sharp (pointed) keel in front like horns of wild goat and not at back like the horns of Markhor (Roberts, 1997).
2. That the pelage of adult males of Chiltan wild goat lacks any chest ruff and having tendency to silvery grey hair on the body a darker mid-dorsal line and darker sternum with dark shoulder stripes that all these characteristics similar to wild goat (*Capra aegagrus*) and not to Markhor (*Capra falconeri*) (Roberts, 1997).
3. That the cross section of bony horn core of the Chiltan wild goat looks like that of wild goat (*Capra aegagrus*) and not like Markhor (*Capra falconeri*) (Roberts, 1997).

The taxonomic affiliations of genus *Capra* is mostly based on the analysis of morphological quality, basically on the horn shape of males. A number of sub-species are described in each *Capra* species on the basis of horn dissimilarities. But status of those subspecies is controversial. On the basis of investigation and analysing of

mitochondrial DNA (mDNA) sequence of the bone of Chiltan wild goat collected from field reported that haplotype of Chiltan wild goat is genetically close to one Markhor (*Capra falconeri*) and it is suggested from DNA analysis that Chiltan wild goat is either a Markhor (*Capra falconeri*) or a hybrid between a Wild Goat (*Capra aegagrus*) and Markhor (Manceau *et al.*, 1999). Maximum individuals sampled from *Capra aegagrus* share Y-chromosome haplotypes with domestic goats and hence *Capra aegagrus* looks to be most possible paternal ancestor of the domestic goat (Pidancier *et al.*, 2006).

2.5 Description of Chiltan Wild Goat

Roberts (1997) stated that the females of Chiltan wild goat are in reddish-grey colour with a dark brown mid-dorsal stripe from shoulder to rump and creamy-white legs having noticeable dark brown outline on the fore part of the shank with white knee patch, and dark brown spreading around the base of the fetlock. It is difficult to differentiate between females of Chiltan wild goat and females of Straight-horn or Suleiman Markhor (*Capra falconeri jerdoni*). The males of Chiltan wild goat as reached to the age of three or four years than they exhibit an increasing amount of white and grey hairs in the mid dorsal and shoulder regions. The adult males show varying quantity of black hair on the lower chest and a darker shoulder stripe like wild goat. They have also no ruff of hair on the chest, but such ruff of hair is present on the chest of Suleiman Markhor. Such marking support the argument that the Chiltan wild goat has a closer association with wild goat (*Capra aegagrus*) but not to Suleiman Markhor (*Capra falconeri jerdoni*). The length of a good sized horn of Chiltan wild goat hardly measures more than 29 inches if it is measured over the curve. The shape of horns of Chiltan wild goat is totally different from the shape of nearby population of Suleiman Markhor. The

shape of horns is in-between Markhor and Wild Goat. The horns of Chiltan wild goat normally have just under a complete twisting, being strongly keeled and flattered in cross section like the horns of wild goat (Roberts, 1997).

2.6 Biology of Chiltan Wild Goat

Roberts (1997) reported that the Chiltan wild goat is gregarious in habit and the females with their followers and young males regularly associate in small herds, although large herds are also common, particularly during the rut and colder, winter months when access to the higher ridges is restricted. They are diurnal in feeding. In many social ungulates, particularly those species with pronounced sexual size dimorphism, the two sexes live separately for most of the year and differ in their habitat use (Acevedo and Cassinello, 2008). Mature males of Chiltan wild goat invariably live solitary lives and frequent more inaccessible crags, joining the female and immature male herds during the rut. At other times, during most of the day, the older males lie up in some well sheltered rock overhang or, if possible, actually inside a natural cave. Chiltan wild goat is diurnal in feeding and has similar habits to the Straight horned Markhor. The rut season of Chiltan wild goat starts in the month of October and November and ends in the last week of December. Females come into oestrus at the beginning of November. The rut period of Chiltan wild goat is practically over in the third week of November. The gestation period of female Chiltan wild goat is believed to be 160 days and twins born from the end of March up to early April if there were plenty of forage for them and other favorable circumstances during the rutting season. The Chiltan wild goat can browse the leaves and bushes as well as small shrubs and forbs (Roberts, 1997; Balochistan, 1998).

2.7 Distribution of Chiltan Wild Goat

Roberts (1977) and Shafique and Barkati (2002) reported that the Chiltan wild goat up to early 1971s was confined in three hill ranges of Balochistan Koh-i-Murdar in the north-east of Quetta in Koh-i-Maran and Koh-i- Gish (Kalat) in south of Quetta but few in number the biggest population of Chiltan wild goat was found on Chiltan range only. The population of Chiltan wild goat on other hill ranges has been wipe out or so little in number it is hard to locate them. Shackleton (1997) reported that Schaller and Mirza in 1971 counted a population of 168 Chiltan wild goats in Chiltan Hazarganji ranges. After creation of Chiltan and Hazarganji ranges as National Park in 1980 and in result of effective protection management the population of Chiltan wild goat increased. It is now believed that the last remaining population of Chiltan wild goat throughout world is found only in Hazarganji Chiltan National Park (Shackleton, 1997).

2.8 Habitat of Chiltan Wild Goat

Shafique and Barkati (2002) reported that the Chiltan wild goat is generally found on the very steep slopes of the National Park. In Chiltan and Hazarganji areas there are many deep and narrow ravines and steep rocky cliff where the Chiltan wild goats take rest during mid-day. It is very much difficult to cross the undulating terrain of its habitat. The old males stay in solitary throughout the year on the highest and most steep cliffs of the range and join the herd during the rut season for mating. The Chiltan wild goat is gregarious in habit and starts grazing early in the morning and takes rest during mid-day and again starts grazing in late afternoon (Roberts, 1997).The higher

slopes of the Hazarganji and Chiltan range are little vegetation and only having a scattered Juniper (*Juniperus inacropoda*) trees locally known as Apurs, wild Pistachio (*Pistacia khinjuk*) trees locally known as Gun and little under-growth of few grasses. When the availability of food becomes scarce on the higher steep slopes the wild goat tends to descend on the lower altitudes for feeding. In winter and during rut season the Chiltan wild goat is found on the lower slopes of the Park. On lower slopes different kind of trees, shrubs and grasses are found (Balochistan, 1998).

2.9 Preferred Diet of Chiltan Wild Goat

Lothiya et al. (2007) investigated the preferred feed of Chiltan wild goat in its last remaining habitat of Hazarganji Chiltan National Park in the season of winter. For this purpose they studied food particles obtained from five stomachs of Chiltan wild goat. After analysing the stomach contents of five specimens of Chiltan wild goat on scientific grounds they found that only sixteen species of different plants were present in the stomach contents of Chiltan wild goats out of 225 plant species reported by Ali, (1978) in Hazarganji Chiltan National Park. Lothiya *et al.* (2007) found that *Fiscus palmate* was consumed (11.6%), *Pistacia khinjuk* (9.1%), *Juniper Polycarps* (8.3%), *Cynondon dactylon* (5.5%) and *Hordium murinum* (3.0%). Lothiya et al (2007) reported that the Chiltan wild goat has a narrow feeding niche in the non-crop habitats of the present study where the goat exploits about a dozen species of plants for its food and supplements the same with small quantities of grass. Results also showed that Chiltan wild goat depends mostly for its diet on the seeds and leaves available in the habitat. As their results were based only for winter season, they recommended long term studies for ecology of Chiltan wild goat.

2.10 Population Status of Chiltan Wild Goat

Shafique and Barkati (2002) reported that the early surveys about the population status of Chiltan wild goat were conducted in early 1970s, Schaller and Mirza in 1971 after a census estimated the population of Chiltan wild goat on Chiltan range about 200 animals. Actually in the survey only 107 animals were recorded. Later on Mirza in 1975 conducted a fifteen days census of Chiltan wild goat on Hazarganji and Chiltan ranges and counted 168 animals and majority of animals were restricted on the southern area on Chiltan range and the adult males kept above 2800 m in the most difficult terrains (Shafique and Barkati, 2002). After creation of Hazarganji Chiltan National Park in 1980 and onwards the Chiltan wild goat population census were conducted by the lower and untrained staff from ocular vantage points. The animal surveys conducted at that time were not based on scientific analysis. However the result of previous surveys shows that the population of Chiltan wild goat increased in its last remaining habitat (Shackleton, 1997; GoP *et al.*, 2000). According to IUCN Red Data Book the status of Chiltan wild goat is as 'least concern' (Sheikh and Molur, 2005).

2.11 Poaching

Ali (2008) reported that killing of wildlife for meat as a means for survival or doing business in wildlife parts increases the growing problem for wildlife managers in many countries. In northern areas of NWFP where local communities are engaged in the conservation of Markhor, poaching is controlled to a great extent (Shackleton, 2001). In Pakistan a lot of bird and animal species are facing reduction in their population because of illegal hunting for meat, sport, and trade. Due to spread of modern guns and better

mobility the population of big mammals declined and their ranges reduced (GoP *et al.*, 2000).

Shafique and Barkati (2002) reported that hunting happens in the habitat of Chiltan wild goat. During field visit of the park in 1997 he noticed the gun fires and signs of Chiltan wild goat hunting. Marri tribe who had migrated to Afghanistan returned back in 1992 to Pakistan. They were settled by the government of Balochistan on the lower slopes nearby to the Hazarganji Chiltan National Park. This had a devastating effect on the natural vegetation and wildlife within the National Park especially on the population of Chiltan wild goat (Roberts, 1997; Balochistan, 1998).

2.12 Distribution of other Related Species in Balochistan

2.12.1 Sind Wild Goat or Sind Ibex (*Capra aegagrus blythi*)

According to Roberts (1997) the Sind wild goat or Sind Ibex in appearance is like to other wild goats populations found in the Taurus Mountains of Turkey and Elburz Mountains of northern Iran. The males and females up to their second winter season have yellowish-brown varying to reddish –grey color and a darker brown mid dorsal line is extended from between the shoulders to the base of the tail. The males have long wide scimitar formed horns ranging up to 40 inches and silver white bodies with sooty grey chest, throat and face. The color of males at neck and body turns to white with increase in age. The females are beardless and have small backward curving horns measuring up to 6 inches (Roberts, 1997).

2.12.2 Biology of Sind Wild Goat

Roberts (1997) reported that this wild goat is gregarious in habit graze at the time of dawn and late afternoon and takes rest at mid-day. The rut season starts in the start of September and lasts at the end of October. The males during the rut season remains in the herd with female and only largest dominant male succeeds in mating with most oestrus females. The gestation period is 150 to 155 days. The young once are born from late January up to the end of March.

2.12.3 Status and Distribution of Sind Wild Goat

The IUCN Red Data Book lists the status of Sind ibex as ‘Near Threatened’ (Sheikh and Molur, 2005). In Dureji Game Reserve area of Balochistan the population of this wild goat has been reported up to 365 animals (Frisina *et al.*, 2003). The population of Sind wild goat or Sind Ibex in Hingol National Park area of Balochistan is about 800 animals (Khan *et al.*, 2010). The Sind wild goat or Sind Ibex is found from higher mountainous ranges of southern Balochistan from Mekran coastal range at Pasni up to Sindh kohistan, Kirthar Range and above sea level up to 3,350m in the Koh-i-Maran range of Kalat area (Shackleton, 1997; Roberts, 1997).

2.13 Suleiman or Straight-Horned Markhor (*Capra falconeri jerdoni*)

The name Markhor is a Persian language word where “Mar” means snake and “khor” means eater. But it is believed that the word Markhor is corrupt form of Pashto language word “Mar Akhar” in which “Mar” means snake and “Akhar” means horns. Its

horns are twisted like snake; so the word Mar Akhar with passage of time changed to Markhor (Roberts, 1997; Ali, 2008; Ashraf, 2010).

Ali (2008) reported that on the bases of body characteristics and horn forms of Markhor Schaller and Khan (1975) acknowledged two subspecies of Markhor in Pakistan the (i) flare-horned Markhor in which Kashmir Markhor (*Capra falconeri cashmeriensis*) and Astor Markhor (*Capra falconeri falconeri*) were included and the (ii) straight-horned Markhor in which Kabul Markhor (*Capra falconeri megaceros*) and Suleiman Markhor (*Capra falconeri jerdoni*) were included. Ellerman and Morrison-Scott (1951) recognized five subspecies of Markhor in Pakistan that include Astor Markhor (*Capra falconeri falconeri*), Kashmir or Pir Panjal Markhor (*Capra falconeri cashmeriensis*), Kabul Markhor (*Capra falconeri megaceros*), Suleiman Markhor (*Capra falconeri jerdoni*) and Chiltan Markhor (*Capra falconeri chialtanensis*). Roberts (1977) considered the Chiltan Markhor as a hybrid between Wild goat and Markhor. The IUCN Caprinae Specialist Group and IUCN Red List consider two subspecies of Markhor as explained by Schaller and Khan (Ali, 2008).

2.13.1 Distribution and Status of Suleiman Markhor

Suleiman Markhor is found on the mountains of Takatu, Murdar, Zarghun, Khalifat and Phil Garh in the north-east of Quetta City but the largest population of Suleiman Markhor is now found on Torghar area of Toba Kakar range of Killa Saifullah district (Roberts, 1997) The status of Suleiman Markhor according to IUCN Red list of threatened species of Pakistan is “Vulnerable” (Sheikh and Molur, 2005). In 1984 for the conservation of Suleiman Markhor and Afghan urial the tribal leaders of Torghar area of

Toba Kakar range with the help of wildlife biologist of USA developed Torghar Conservation Project (TCP). The TCP with the help of local communities controlled the poaching of wildlife in the core protected area of the Torghar area. The population of Suleiman Markhor is increasing in the Torghar conservation area and in 1997 the estimated population was 1,296 Markhors (Frisina *et al.*, 1998).

2.13.2 Description of Suleiman or Straight-Horned Markhor

Roberts (1997) reported that the male and female Markhor has reddish-grey color and the tone of color in summer appears more yellowish-buff and grey in winter. It is a sturdy animal with short thick legs and broad hooves. The height of a mature male Suleiman Markhor up to shoulder is 35 inches and length from base of tail to nose is 52 inches. The horns of female Suleiman Markhor have one twist at distal portion and having a length of 6-7 inches, while the length of mature male horns is up to 36 inches. The size of straight-horned Markhor is smaller than the size of flared-horned Markhor.

2.13.3 Biology of Suleiman Markhor

Roberts (1997) described that they are diurnal in feeding and gregarious animals. The female with their kids and young male are found in small herds, while the mature males throughout the year live in solitary on steep and inaccessible cliffs and joins the herd only during the rut season. The rut season commenced in the end of October and lasts in November. Fighting occur among male Suleiman Markhor during rut season for matting to oestrus female.

2.14 Animal Census or Surveys

Ali (2008) reported that the best technique to count the population of Markhor is the vantage point survey method because other survey methods like line-transect method cannot be applied due to rough, uneven and mountainous habitat of the species. Prior to animal survey the vantage points are identified with the help or with consensus of local wildlife staff and local people.

For selection of vantage points such an area in the habitat of the species is selected where chances of animal observation are more. Although few animals may not be observed from such vantage points but this surveying technique is best because large distances between vantage points and observations or counting made by different surveying teams at the same time minimize the chances of double counting of the animals. The length of survey depends upon the topography, weather and provision of the budget for the purpose. The observations from every vantage point are usually taken for three successive days. The information about the age, sex, herd size, aspect, slope and elevation are collected by use of binoculars and spotting scopes on the survey forms. The sex and age of Markhor observed during the survey are determined on the bases of horn and body size. After completion of survey the data from each vantage point are collected and a combined survey report about animal or area is prepared (Ali, 2008).

2.15 Population Dynamics

Robbins et al. (2009) investigated that studies related to population structure through either routine surveys of a population or through long term examining of identified individuals and social groups, provide important information for observing