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Status and Distribution of Markhor (*Capra falconeri* Wagner 1839) in Toshi Shasha and Gehrait Goleen Conservancies, District Chitral, Khyber Pakhtunkhwa, Pakistan

Syed Fazal Baqi Kakakhel*

Conservator Wildlife Northern Circle Tindodag Barikot District Swat Khyber Pakhtunkhwa, Pakistan

*Correspondence: Syedkakakhel1164@hotmail.com Received 23-06-2020, Revised: 24-07-2020, Accepted: 26-07-2020 e-Published: 30-07-2020

Markhor is an ecologically and economically important caprine species found in the highlands of Hindu Kush Himalayas in the northern Pakistan. The government of Pakistan has established a sustainable trophy hunting program in community conserved conservancies such as Toshi Shasha and Gehrait Goleen conservancies in district Chitral Khyber Pakhtunkhwa province of Pakistan. Markhor is a trophy hunting animal and inhibit Toshi Shasha and Gehrait Goleen conservancies. This study was carried out in Toshi Shasha and Gehrait Goleen conservancies with the aim to examine status and distribution of markhor. Markhor were counted in rut season during December from 31 vantage points in 2015. A total of 93 trained surveyors counted markhor. The total number of markhor observed in both Toshi Shasha and Gehrait Goleen conservancies was 1878.

Keywords: Markhor, Toshi Shasha and Gehrait, Chitral, Khyber Pakhtunkhwa, Pakistan

INTRODUCTION

Pakistan hosts an ungulate diversity rich in wild caprinae with seven species and 12 sub-species (Bhatnagar 2009; Roberts 1997; Chaudhry 2011). Among the caprine populations, markhor is a flagship species in Pakistan, which is distinguished into two subspecies (Shaller and Khan 1975): flared-horned markhor (*Capra falconeri falconeri*) and straight-horned markhor (*Capra falconeri magacerus*). The flared-horned markhor includes the Kashmir and Astor markhor. Kashmir markhor occurs in Swat, Chitral, and Dir. Astore markhor inhabits Gilgit-Baltistan. The straight-horned markhor (*Capra falconeri magacerus*) includes the critically endangered Kabal and Suleiman markhor (Robert 1977). Kabal markhor is reported from the south of Khyber Pass (Schaller and Khan 1975). Suleiman markhor is reported from Suleiman Range in Zhob and Tor Ghar in Qilla Saifullah.

Distribution of flare-horned markhor extends into Tajikistan, Uzbekistan, Afghanistan and India (Bhatnagar 2009). Markhor occurs normally in enormously disjointed populations of relatively small size (Weinberg et al. 1997). Markhor avoids deep snow and cold temperature but prefer cliffs and dry broken and rolling terrain. Markhor descends to as low as 2200 meters altitude during winters, while in summers they disperse to higher altitudes (Schaller and Khan 1975). In Chitral district of Pakistan, markhor occupies temperate coniferous forests and adjacent alpine meadows (Ali 2008). Toshi Shasha and Gehrait Goleen Conservancies in Chitral are key markhor habitats, where two distinct populations are found. The present study was carried out to examine status and distribution of markhor in Toshi Shasha and Gehrait Goleen conservancies. This study will enable conservation organizations to understand

management needs as input for management planning of markhor in the future.

MATERIALS AND METHODS

Study area

Chitral is a key habitat for markhor, where Toshi Shasha and Goleen Gehrait conservancies are famous for markhor population and the annual trophy hunting (fig-1). Toshi Shasha is located 16 kilometers to the northeast of Chitral town between 35° 57' 13" N and 31° 48' 51.70" E. Toshi Shasha conservancy extends from Khora Lasht Shali in the south to Parsan in the north. This conservancy has boundaries with ridge between Shoghor in the north, boundaries of Chitral Gol National Park in the west, watershed line between Lotkoh River and Mastuj River in the east and tehsil boundary between Lotkoh and Chitral in the south.

An area of 1045 ha of Toshi was declared a game reserve in 1979 due to its floral and faunal diversity, its topographic and climatic features. On December 16, 1998, the Toshi game reserve was re-designated as a community game reserve with conservation area of 20,000 hectares of buffer area (Ali et al. 2015; Wildlife Department Khyber Pakhtunkhwa 2010). The slopes are covered with holly oak trees and shrubs such as *Rosa webbiana*, *Artemesia maritime*, *Astragulus sp.*, *Tamarix sp.*, and alpine grasses mainly dominate the vegetation (Wildlife Department Khyber Pakhtunkhwa 2010).

Gehrait Goleen conservancy lies in the east of Chitral town between 35° 40' 9.22" N and 71° 45' 59.07" E. This conservancy over an area of 95000 ha was created as a community game reserve on December 16, 1998. It is bound by river Chitral in the north, ridge between Basqargol in the east, ridge between Shishikoh valley in the south and River Chitral in the west. The area comprises of rocky terrain and supports *Quercus ilex*, *cidrus deodara*, *pinus gerardiana* and other flora of dry temperate zone including dominant vegetation of oak (Wildlife Department Khyber Pakhtunkhwa 2010).

Methods

The study was conducted during the rut season of markhor on December 20-30 at Toshi Shasha and Gehrait Goleen conservancies in 2015. The counting was made once in each year. The counting was made using 31 vantage points established by the Khyber Pakhtunkhwa Wildlife department Pakistan for annual counting of animals covering the whole area in both conservancies. The vantage points were established at an aerial distance of 200 meters to 1200 meters. There were 31 parties deployed and each party comprised of three observers. Thus, a total of 93 trained observers took part in animals counting besides recording herd sizes. The observers spent a total of 40 hours in each point.

Table-1: Age and sex classification of Kashmir markhor established for the current study from Schaller (1977) and Bhatnagar et al. 2008 with over-all description regarding the horn shape, body size and coat color.

| Sex | Age | Description |
|---------------------|-------------------|---|
| Young (male/female) | ½ year Old | i. Born in May / June, these are easily recognizable in the field due to their sizes. |
| | | ii. Base of male horns is broader than female of same age class (less space between the bases of male horns compared to females). |
| | | iii. Colour of the female legs below knee is white while male have paler coloration. |
| Yearling males | 1½ year Old | i. Yearling males resemble adult females but still slightly smaller with 30 cm long horns |
| | | ii. which are darker and somewhat longer and broader. |
| | | iii. The males have black line on neck running from head towards back |
| Females | All age Classes | Yearling female combined with adult females can make a one group |
| Male Class I | 2½ years Old | i. These are the size of females but horns grow up to 45 cm long |
| | | ii. Pelage is dark brown with a grayish neck with no ruff |
| | | iii. The straight horns of males start showing the first curve |
| Male Class II | 3 ½ years old | i. Males in Class II resemble those of previous age group but with the addition of a fringe of white hair on forelegs and across the chest, the first intimation of ruff. |
| | | ii. The horns may be over 50 cm long and have completed the first whorl (twist or spiral) at this age |
| Male Class III | 4½ - 6½ years old | i. Class III males have a prominent black beard and a long ruff of white to gray hair flowing from neck, chest and upper parts of the forelegs. |
| | | ii. Vertical slash of almost black hair by the shoulder and before the haunch, and a conspicuous light-colored patch on the thigh. |
| | | iii. Horns are often over 75 cm long. |

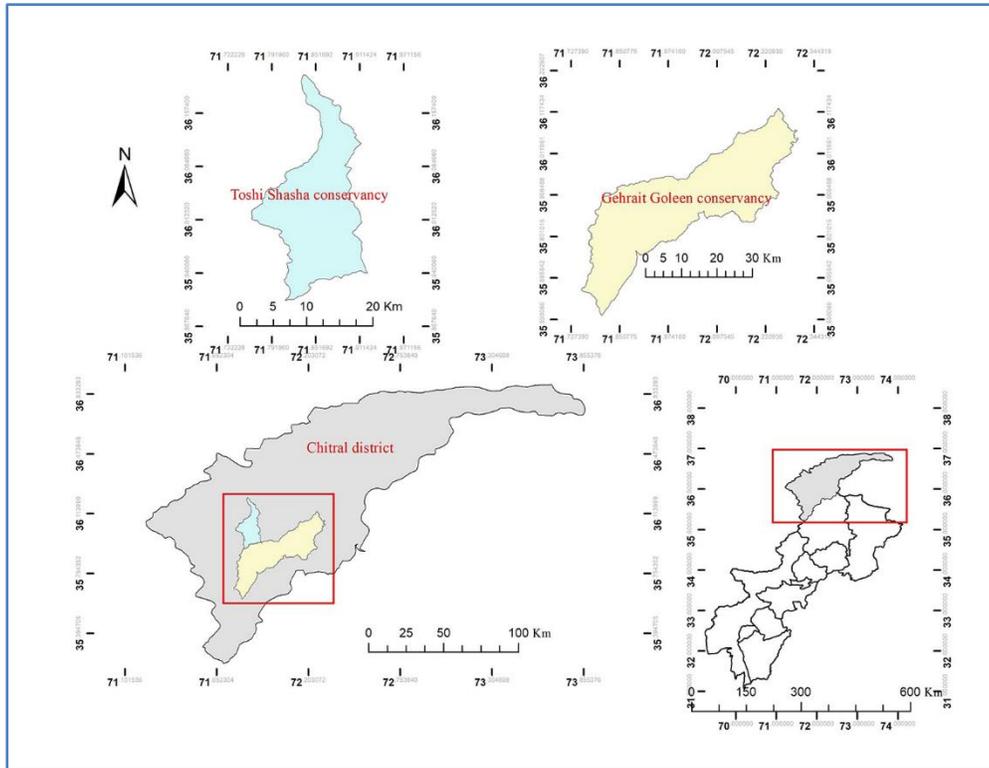


Figure1: Location of Toshi Shasha and Gehrait Goleen conservancies in district Chitral

The animals were counted in same time range of 6.30 AM to 10.30 AM each day. Animals were counted in herds thus herd size was also recorded.

The study period December was selected, as the markhor population congregates and herds sizes are maximum (Khan 2006). To implement a standardized data collection, the observers were trained prior to the survey and a pre-test was conducted to equant them with the survey techniques observation times, area to be surveyed, survey equipment, and data recording. The observers were distributed in 10 and 21 parties in Toshi Shasha and Gehrait Goleen conservancies respectively. Markhor survey was conducted using vantage fixed point count method (Arshad et al. 2012). Animals were observed with the help of 20 x 50 mm binoculars. All vantage points were identified considering geographical features of the valleys and sub valleys, the whole tributary drainage or sub drainage, particularly hill slopes and basins and a list of candidate vantage points was created. The timing of observations was noted by two parties at sites where the parties were to scan animals so as to avoid the chances of duplicating or detecting the same animal. Age and sex classes of markhor were determined using the characteristics as shown in table 1.

RESULTS

Markhor population of the study area

According to our findings the number of markhor recorded in Toshi Shasha conservancy was 1423 individuals, while that in Gehrait Goleen conservancy to 455 markhor (table-2).

Markhor populations structure in the study area:

We also recorded the markhor population structures in Toshi Shasha and Gehrait Goleen conservancies (table-2). We recorded number of markhor in age and sex classes include female, young, yearlings, males of age classes include Class-I, II, III and IV. The number of females were 597, young (200), yearlings (253), males of age classes include Class-I (153), II (140), III (47) and IV (33) in Toshi Shasha conservancy. In Gehrait Goleen conservancy the number of females were 144 young (88), yearlings (74), males of age classes include Class-I (76), II (34), III (27) and IV (12).

Table2: Number of Markhor recorded in Toshi Shasha and Gehrait Goleen conservancies in 2015

| Conservancy | Age and sex classification | | | | | | | Total | Herd size |
|---------------|----------------------------|--------------------------|--------|---------------------|----------------------|-------------------------------|---------------------------|-------|-----------|
| | Young 1/2 year old | Yearling 1 1/2 years old | Female | Male | | | | | |
| | | | | C-I 2 1/2 Years old | C II 3 1/2 Years old | CIII 4 1/2 to 6 1/2 Years old | CIV Above 6 1/2 Years old | | |
| Toshi Shasha | 200 | 253 | 597 | 153 | 140 | 47 | 33 | 1423 | 25 to 57 |
| Gehret Goleen | 88 | 74 | 144 | 76 | 34 | 27 | 12 | 455 | 10 to 21 |
| Total | 288 | 327 | 741 | 229 | 174 | 74 | 45 | 1878 | - |

Herd size

We also recorded the herd size of both populations. The herd size in Toshi Sasha conservancy ranged between 25-57. (table-2), while in Gehrait Goleen it was 10-21. The average herd size in Toshi Shasha conservancy remained 35 against the average herd size of 11 in Gehrait Goleen conservancy.

DISCUSSION

The world-wide adult markhor was reported to be less than 2,500. (Valdez 2008). Michel & Rosen (2015) reported 3000 mature markhor in Pakistan. This significant population of markhor in Pakistan is the largest population of markhor in the world. (Shackleton 1997; Weinberg et al. 1997). According to results of the this study the maximum number of markhor such as 1878 was recorded in 2015 in both conservancies include Toshi Shasha and Gehrait Goleen. Frisina (2000) found Suleiman markhor (1,684) in Torghar project area. Khan, et al. (2018) estimated 162 flare horned markhor along with age and sex classes in Jutial conservancy Gilgit Baltistan. Weinberg et al. (1997) reported Heptneri markhor (227) in Kugitang Nature Reserve of eastern Turkmenistan. Kakakhel et al. (2017) reported 36 markhor in Shahoo sub valley, 48 in Mahodand sub valley of kalam valley, Basharai sub valley (18), Tanazgah sub valley (13) and Bara dara sub valley (21) of Mankial valley, district Sway Khyber Pakhtunkhwa, Pakistan. Bhatnagar et al. (2009) reported 350-375 markhor in jammu and Kashmir. Generally, population of markhor is increasing because of the successful conservation efforts (Michel & Rosen 2015).

The dominant group in age and sex classes of markhor in Toshi Shasha conservancy was female

with 597 individuals. the number of yearlings per hundred females 33.5. The causes of reduction in number of yearlings may include predation (Haller 1992). The number of males per hundred females was 62.47 in 2015. This shows that the number of males is sufficient to fertile females. The class-IV 33. This shows sustainability in trophy size markhor and availability of adequate number of trophy size markhor.

In Gehrait Goleen the dominant group in age and sex classes of markhor was female with 144 individuals, the number of yearlings per hundred females was sixty-one (61). The number of males per hundred females was 103.4. It is evident that sufficient number of males are available to fertile females. The class-IV males were twelve (12). This shows that adequate number of trophy size males are available beside sustainability.

Michel et al. (2014) reported female to male ratio 1:0.94, female to young 1: 0.97 and female to yearling 1:0.2, in Tajikistan. Schaller and Khan, (1975) and Schaller, (1977) reported yearlings per 100 females as ranged 105 – 130. Aleem, (1978) reported female to male ratio such as 1:0.84 in CGNP.

The maximum average herd size was observed in both conservancies in 2015 (table-2). The maximum average herd size in Toshi Shasha was observed such as twenty-six (26) against the average herd size eleven (11) in Gehrait Goleen conservancy. Several researchers reported average group size or herd size in markhor population. Kakakhel and et al. (2017), reported herd size in Shahoo sub valley, 1-7, Mahodand sub valley 1-12 of Kalam valley. In Mankial valley the herd size remained 1-4 in Bashari sub valley, 1-3 in Tanazgah sub valley, 1-5 in Bara Dara sub valley. Arshad, (2011) reported more than 60 markhor groups of more than 60 animals during the

rut season in Chitral Gol National Park (CGNP). Schaller, (1977) also reported more than 60 markhor in groups in Chitral Gol National Park. Schaller and Mirza, (1971) reported 8.5 average group size in CGNP. Habibi and Wahed (2001) reported 8.6 average group size. Bhatnagar et al. (2008) estimated 4.7 average group size in Jammu and Kashmir.

There are chances with increasing age that males from the lower age class will shift to the higher age class. In Toshi Shasha conservancy forty-seven (47) males will shift from Class-III males to Class-IV (trophy size), Class-II to Class-III (140) and class-I (153) to Class-II. Ultimately, the number of trophy size markhor are increasing in Class-IV male age class. In Gehrait Goleen conservancy forty-seven (47) males will shift from Class-III males to Class-IV (trophy size) males after two years, Class-II to Class-III (34) and class-I (76) to Class-II.

Community based markhor trophy hunting is practiced in both conservancies annually. Three trophy size markhor are offered every year for trophy hunting in both conservancies include two (2) for Toshi Shasha and one (1) for Gehrait Goleen conservancy. The quota of markhor trophy hunting has fixed by the government and need to be enhanced due to the reason that males shift to the higher age class-IV (trophy size) and the number of trophies hunting male markhor are increasing annually. Moreover, Agostini, 2005., observed life span of markhor as 12 years and die on their natural deaths without benefitting the local community. Secondly, there are 33 trophy size markhor (Class-IV males) in Toshi Shasha conservancy and 12 trophy size markhor in Gehrait Goleen conservancy. Thirdly, as a scientific rule 1 to 2% of the population can be offered for trophy hunting i-e 14 to 28 in Toshi Shasha and 4 to 8 in Gehrait Goleen conservancy.

On the other hand, markhor is also facing a number of threats including human population growth (Shackleton 2001), habitat loss (IUCN 2000), hunting and poaching (Burrard 1925; Stockley 1936; Lydekker 1898), competition for food with livestock (Woodford et al. 2004; IUCN 2000; Johnson 1998; GoNWFP and IUCN, 2004; Ashraf et al. 2014), disturbance and destruction of habitat (Michel & Rosen, 2015).

Conservation of significant prey species is vital for the existence of large predator. The abundance of favored prey species can change the population status of large predators (Hayward et al. 2006 and 2007; Lyngdoh et al. 2014). Markhor (*Capra falconeri*) is one of the wild principal prey species

of snow leopard in peculiar sites (McCarthy et al. 2003). Anwar et al. (2011) reported in his study on 'food habits of snow leopard in Baltistan, that snow leopard consumed markhor as a prey species and markhor make 7% of the consumed biomass while Mallon et al. (2016) reported 7.8%. Mock and O'Neil (2003) reported that snow leopard not only prey upon weak or small markhor, but also kill trophy-sized males. However, successful conservation of *caprinae* could increase population of prey and can result an increase in number of snow leopard (Shackleton 2001). (Shackleton 2001) also recommended a quota of one snow leopard trophy hunt annually for Pakistan. O'Gara (1988) proposed snow leopard hunting as sport in Mongolia which was objected by conservation organization and ultimately the proposal was withdrawn by the officials.

CONCLUSION

A sustainable number of markhor are available in both conservancies include Toshi Shasha and Gehrait Goleen conservancies. Sufficient number of males are also available to fertile females. Number of trophy size males are viable in both the conservancies. An upward trend in number of markhor has been observed in both conservancies due to the conservation efforts of the Khyber Pakhtunkhwa Wildlife Department Pakistan. The abundant markhor being principal prey species of snow leopard in both conservancies play a vital role in changing status of snow leopard population which can also be offered for trophy hunting at higher value than markhor. Community based trophy hunting program is applied in both conservancies. Presently an annual quota of three markhor is fixed as part of the trophy hunting program of the Khyber Pakhtunkhwa Wildlife department include two (2) trophy hunts for Toshi Shasha and one (1) Gehrait Goleen conservancies. Trophy hunting program benefit local community. However, the total number of markhor and trophy size males have been increased. Therefore, the quota of three trophy hunts can also be increased such as 1 to 2% of the population. There are 1878 number of markhor in both the conservancies thus the quota of three (3) trophy hunts could be enhanced ranged between 18.78 to 37.56.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

The author SFBK fully contributed to the study at all stage from data collection to developing final manuscript

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