

Full Length Research Paper

Migratory status of the goral, *Naemorhedus goral* (Hardwicke) (Artiodactyla: Bovidae) in Kohistan, Pakistan

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The Himalayan goral, *Naemorhedus goral* (Hardwicke) (Artiodactyla: Bovidae) is classified as endangered internationally and vulnerable in Pakistan. Its migratory status was determined from 24th May to 10th July, 2010 in the Pattan and Keyal Valleys, Kohistan, Pakistan. The 165 questionnaires were filled in 15 study sites (Pattan, eight study sites; Keyal, seven study sites). It is very common in the two valleys and almost everyone has seen it more often. In both Pattan and Keyal valleys, *N. goral* migrates during winter season to lower areas (populated areas), in search of food and water, due to cold temperature and threats from predators and hunters. If it migrates due to predators and hunters, then it will never return to its native habitat. Its main predators are wolf, jackal and others; its hunter is man. Its life-span is 10 to 20 years. It gives birth throughout the year. Some others wildlife, such as sparrow, *Passer domesticus* Linnaeus, chukor, *Alectoris chukar* (Gray); koklass pheasant, *Pucrasia macrolopha* (Lesson), jackal, *Canis aureus* Linnaeus, monkey, *Macaca mulatta* Zimmermann and wolf, *Canis lupus* Linnaeus etc. were also found during the present survey. Its native habitat and migratory areas should be protected.

Key words: Keyal valley, Kohistan, migration, *Naemorhedus goral*, native habitat, Pattan valleys, vantage point.

INTRODUCTION

Kohistan is a district in Pakistan's Khyber Pakhtunkhwa (KP) with a total area of 7,492 km² and a population of 472,570. It forms border with Azad Kashmir that extends from the eastern Afghanistan province of Nuristan in the west (Biddulph, 2004). Pattan, Keyal and Dubair are the valleys of Kohistan. Pattan lies on the right side of River Indus and links with Karakorum highway through a 20 km long road. Altitude of the valley varies from 3000'-11000' above the sea level. The area consists of rocky terrain with steep mountains. People experience seasonal migration with their livestock. The Keyal Valley is situated

in the center of Pattan sub-division of Kohistan District. Both valleys are selected due to their floral diversity that supports the goral, *Naemorhedus goral* (Hardwicke) (Artiodactyla: Bovidae) population. It has the characteristics of both goats and sheep; therefore, it is a true antelope. At the present, it is found at middle slopes of Himalayas and is endemic to Asia. It migrates during winter season to lower areas to escape from hunters, predators, low temperature and in search of food (Figure 1) (Zhiwotsehenko, 1990).

It is classified as endangered with decreasing population



a



Naemorhedus goral
Himalayan Goral or Grey Goral

b



c



d



e

Figure 1. Distribution map of grey goral, *Naemorhedus goral* (a; Online, 2012) in 2 study areas of Kohistan district within Khyber Pakhtunkhwa, Pakistan; b: distribution map, black dots shows the distribution of *N. goral* in Kohistan and Margalla Hills, Islamabad, Pakistan; c: distribution of global population of *N. goral* (Shackleton, 1997); d: Pattan Valley, 1: Tankor Janchil; 2: Rasta Dong Janchil; 3: Barho Kandogay; 4: Landai Sar Bohil; 5: Hawery Kamar Bohil; 6: Barho Bohil; 7: Barho Gulkand; 8: Nabaz; e: Keyal Valley, 1: Baroon Nala Fagaiel; 2: Galto Fagaiel; 3: Shaig Bhapobanda; 4: Keero Keyal; 5: Balkhun; 6: Rodair (highlighted in red) (Perveen, 2013).

(Mead, 1989) and threatened species by the International Union for Conservation of Nature (IUCN) (Shackleton, 1997). It is known as vulnerable in Pakistan based on information gathered from different parts disseminated (Sheikh and Molur, 2005). In KP, its range extends from Abbottabad, Mansehra, Mardan, Kohistan, Swat, Dir, Malakand and Nowshera which form the western border of its distribution range. The main surviving population in Pakistan is probably in the area among the Indus Kohistan, Swat valley and watershed Kunhar. It belongs to the order, Artiodactyla or cloven-hoofed mammals (Robert, 1977) and shares the sub-order, Ruminantia with deer, antelopes, sheep, goats; it belongs to the family, Bovidae (Walker, 1964; Robert, 1977). Its sub-family, Caprinae (sheep and goats) is characterized by stickily built species, adapted for climbing on mountains (Robert, 1977; Halt and North, 1963).

Presently, the genus *Naemorhedus* Smith is represented by six species: Japanese serow, *Capricornis crispus* or *Naemorhedus crispus* (Temminck); Sumatran serows, *Naemorhedus sumatraensis* (Bechstein); Taiwan serow, *Naemorhedus swinhoei* (Gray); red goral, *N. bailey* Pocock (Groves and Grubb, 1985); Chinese long-tailed goral, *Naemorhedus caudarus* (Edwards) (Zhang, 1987) and Himalayan goral, *N. goral* (Hardwicke). Its population is divided into 3 sub-species: the goral, *N. goral goral* (Hardwicke); brown goral, *N. goral hodgsoni* (Pocock) and grey goral, *N. goral bedfordi* (Roberts).

It has broad and bell shaped ears; both sexes have slender and cylindrical horns, which are not divergent but curving backward and bearing inconspicuous annulations. The males have no beard, have small sub-orbital glands and females have four mammae (Pocock, 1908). Roberts (1977) called them the grey goral, *N. goral bedfordi* based on accounts in the literature. The small sized ones are like goat and adults are 65 to 71 cm. Its shoulders' height, head and body length average are 105 cm and weigh 25 to 28 kg (Primrose, 1911; Stockley, 1928).

The breast and belly are lighter gray with a white spot in the throat and one or two white spots on the lower muzzle and cheeks. The horns are 12.5 to 15.5 cm with slender feet (Stockley, 1928). During summer, *N. goral* goes upward the hills and in winter returns downward the hills. Sometime due to specific circumstances, it migrates to far places (Perveen, 2013). Therefore, the objective of the present research is to determine the migratory status of *N. goral* in Kohistan, Pakistan by studying the advantages of the behavior and ecology of the species.

MATERIALS AND METHODS

Study areas

In Kohistan, two potentially bio-diversified valleys, Pattan with eight study sites: Barho Bohil, Barho Gulkand, Barho Kandogay, Hawery

Kamar Bohil, Landai Sar Bohil, Nabaz, Rasta Dong Janchil and Tankor Janchil and Keyal with 7 study sites: Balkhun, Baroon Nala Fagaiel, Galto Fagaiel, Lotos, Keero Keyal, Rodair and Shaig Bhopabanda were selected for the present survey (Figure 1).

Collection of data

Data were collected during 24th May to 10th July, 2010. Field survey, direct sighting, informal discussion, interviews with community and questionnaire were the major tools of data collection. The local people and hunters were asked 32 questions in questionnaire, which explained everything about the *N. goral* hunting, migration, predators etc. The 165 questionnaires were filled in the study sites of Pattan and Keyal valleys, respectively (Perveen and Husain, 2012a).

Data analysis

For data analysis, % and Computer Program Microsoft Excel (CPME) were used (Perveen and Husain, 2012b). For the life span of the species, Boxplots analysis was employed.

RESULTS

The present survey was conducted during 24th May-10th July, 2010 to investigate the migratory status of the grey goral, *Naemorhedus goral* (Hardwicke) (Artiodactyla: Bovidae) in two valleys of Kohistan District, Khayber Pukhtunkhwa, Pakistan: 1) Pattan valley with eight study sites; 2) Keyal valley with 7 study sites.

In both valleys, 165 questionnaires were filled by the local people and hunters, respectively. All of them have seen *N. goral*. This was a great evidence of the presence of *N. goral* in these valleys (Table 1).

Migratory status

All the local people and hunters (100%) said that *N. goral* migrated from Pattan Valley. However, in Keyal Valley, most of them have the same answer but very few ($n = 2$) said that it was resident of the valley (Figure 2a). In both Pattan and Keyal valleys, *N. goral* migrates during winter season towards lower area (populated area). But few of the local people and hunters did not agree with this statement (Figure 2b and c). The reasons for its migration include: search for food and water, running from cold temperature and threats from predators. Whenever it migrates due to threat from predators, then it will never return to its original habitat (Figure 2d). According to the local people and hunters, *N. gorals* are threatened by predators in Pattan Valley; the predators are man, wolf, jackal etc. In Keyal valley, they are man, jackal, wolf etc. (Figure 2e).

N. goral has different life-spans. According to the local people and hunters, the most probable life-span in Pattan Valley is: 15 > 10 > 20 years; however, in Keyal valley: 15 > 20 > 10 years (Figure 2f). When the local people

Table 1. Sighting of the grey goral, *Naemorhedus goral* (Hardwicke) (Artiodactyla: Bovidae) by the local people and hunters in Pattan and Keyal valleys of district Kohistan during the survey, 24th May-10th July 2010

| S/N | Valley | Sits ¹ | n ² | Watching of <i>Naemorhedus goral</i> | |
|-----|--------|-------------------|----------------|--------------------------------------|--------|
| | | | | Yes (%) | No (%) |
| 1. | Pattan | 8 | 90 | 100 | 00 |
| 2. | Keyal | 7 | 75 | 100 | 00 |

¹Pattan valley with eight study sites: Barho Bohil, Barho Gulkand, Barho Kandogay, Hawery Kamar Bohil, Landai Sar Bohil, Nabaz, Rasta Dong Janchil and Tankor Janchil; Keyal valley with 7 study sites: Balkhun, Baroon Nala Fagaiel, Galto Fagaiel, Lotos, Keero Keyal, Rodair and Shaig Bhapobanda where questionnaire were distributed. ²n: number of peoples and hunters in Pattan and Keyal valleys from which data were collected; %: percentage

and hunters were asked about the birth time of fawns, most of them replied that it might be January, February or December in both valleys. It also reported that these can give birth to their fawns throughout the year (Table 2).

Some others wildlife animals like mammals: cat, *Felis catus* Linnaeus; fox, *Vulpes vulpes* (Linnaeus); jackal, *Canis aureus* Linnaeus; monkey, *Macaca mulatta* Zimmermann; squirrel, *Sciurus carolinensis* Gmelin and wolf, *Canis lupus* Linnaeus; and birds like chukor, *Alectoris chukar* (Gray); Himalayan monal pheasant, *Lophophorus impejanus* Latham; koklass pheasant, *Pucrasia macrolopha* (Lesson); parrot, *Psittacula eupatria* (Linnaeus); ram chukor, *Tetraogallus himalayensis* Gray and sparrow, *Passer domesticus* Linnaeus were also observed in the survey sites of the two valleys (Table 3).

DISCUSSION

The present survey was conducted in Kohistan, Pakistan during May-July, 2010. The suitable season for goral survey is winter, but due to academic schedule, it was conducted in summer.

This survey could not be compared with previous data because such type of survey has not been conducted before in this area. Abbas (2006) suggested that *N. goral* still persists at favorable altitudes of Mardan, Buner, Central Kohistan, Abbotabad, western Mansehra, Margalla hills and the central and southern parts of the Azad Kashmir. The present findings are in line with the general remarks of Roberts (1977) who suggests that the main *N. goral* population is present in Indus Kohistan, between Swat and Kunhar valleys and a limited population in Margalla hills, Islamabad, Pakistan. Although, *N. goral* is also found in most places, but Pattan and Keyal were selected for the present survey in Kohistan.

The local people and hunters perceive *N. goral* by direct sighting, fecal materials, sounds and foot prints. They hunt them for food, recreation and earning. In both valleys, the methods for hunting were mostly applying of coloring cloth, whistling by mouth, using special little

yellow dogs, gun shots and pellet bow. In Pattan Valley, the local people and hunters have hunting permit but in Keyal, they do not have. They have been hunting for 1 to 5 years in Pallas and 6 to 10 years in Keyal (Perveen, 2013). Therefore, *N. goral* migrates to escape from cold temperature, predators, hunting and in search of food during winter season.

For the survey, firstly, Pattan valley was visited, local hunters, watchers and villagers were contacted to obtain their guidance and formal knowledge. Eight vantage points were selected from Pattan Valley. The highest vantage point was Landi Sar Bohil while the lowest was Tankor Janchil in Pattan Valley. In these vantage points, 21 *N. gorals* were found, in which 13 adults, six sub-adults and 2 fawns were identified (Perveen and Hussain, 2012a). In Pattan Valley, the numbers of adult were more in vantage points with lower height than in Keyal Valley's vantage points.

The Keyal Valley with seven vantage points supports *N. goral* population due to its floral diversity. The highest vantage point was Shaig Bhapobanda while the lowest was Baroon Nala Fagaiel. In this valley, a total of 40 *N. goral* were found, among them 22 adults, 14 sub-adults and eight fawns were identified (Perveen and Hussain, 2012b). They were greater in number in Keyal than in Pattan. Therefore, it is clear that *N. goral* likes to live in higher than lower places because people can kill them easily in lower places. Thus, they are protected in higher places. Secondly, biodiversity is found more in higher places than lower places. Finally, higher places are more natural than lower places, that is why more natural food sources are available in higher places.

There are three methods of hunting *N. goral*, by the hunters of these valleys. First one is the use of special little yellow dogs to hunt *N. goral*. When they see them, they do not flee. Second, white cloth of one meter is encircled around them; then the hunters easily capture them. The color of cloth is changed to yellow in summer, but to dark brown in winter. When they show these cloths to *N. goral*, it stops to run and then the hunters hunt it. Third, whistling by mouth is also a technique for hunting *N. goral*. Another method which is prohibited and rarely

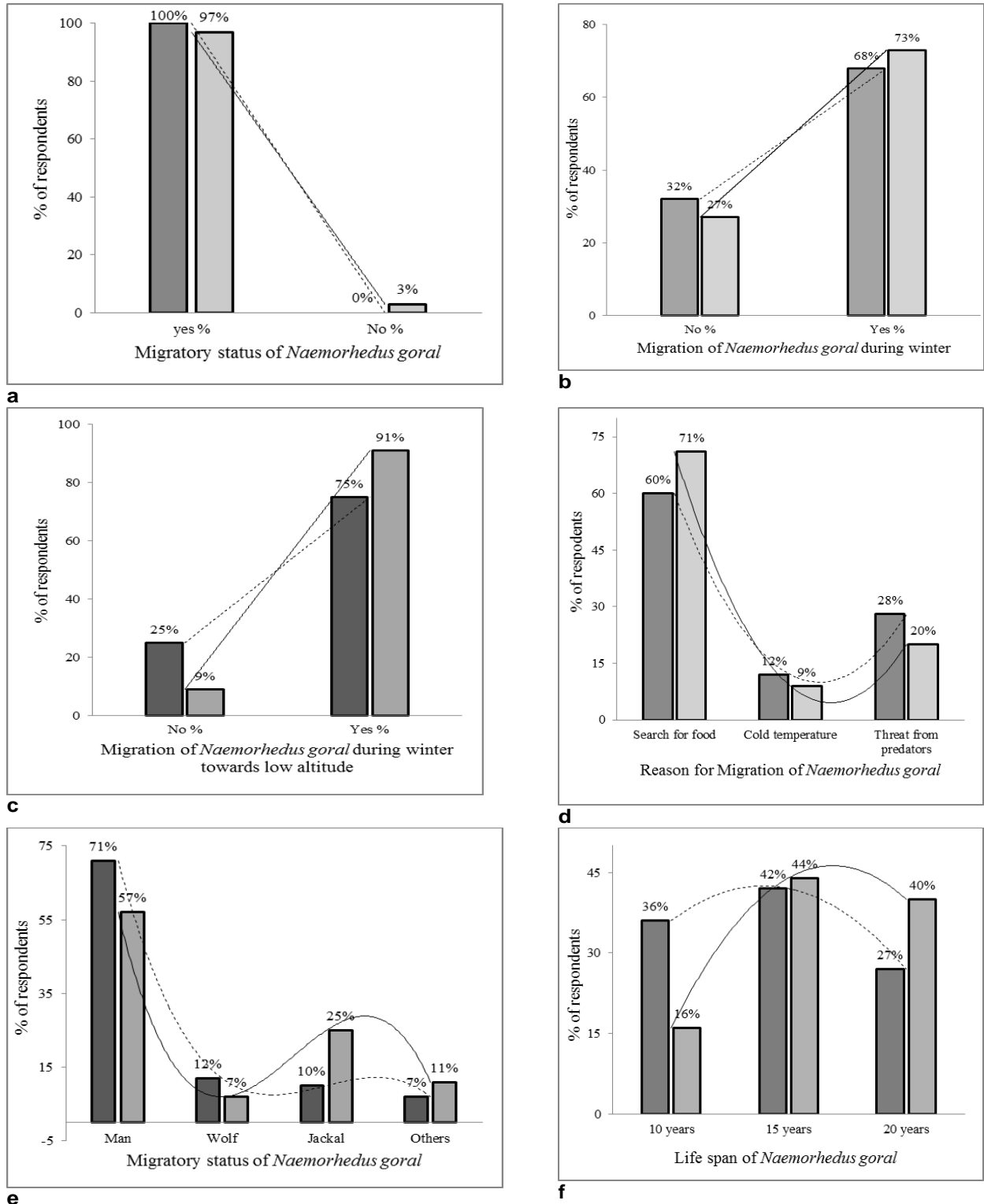


Figure 2. The survey for determining migratory status about the grey goral, *Naemorhedus goral* (Hardwicke) (Artiodactyla: Bovidae) in 2 valleys of Kohistan, Pakistan during 24th May-10th July 2010; migratory status of *N. goral*: a; migration during winter: b; migration during winter to low altitude: c; reason for migration: d; ■: Pattan valley with 8 study sites, that is, Tankor Janchil, Rasta Dong Janchil, Barho Kandogay, Landai Sar Bohil, Hawery Kamar Bohil, Barho Bohil, Barho Gulkand and Nabaz; ▒: Keyal valley with 7 study sites, that is, Baroon Nala Fagaiel, Galto Fagaiel, Shaig Bhapobanda, Keero Keyal, Balkhun and Rodair); n: number of questionnaire filled by local people and hunters; n=90 in Pattan; n=75 in Keyal, Kohistan, Pakistan; polynomial trend line for Pattan valley: ---; for Keyal valley.

Table 2. Birth time of fawns of the grey goral, *Naemorhedus goral* (Hardwicke) (Artiodactyla: Bovidae) during the survey, 24th May-10th July 2010.

| Valleys | Sites ¹ | n ² | January (%) | February (%) | December (%) | Throughout the year (%) | M±SD ³ |
|---------|--------------------|----------------|-------------|--------------|--------------|-------------------------|-------------------|
| Pattan | 05 | 90 | 7 | 11 | 4 | 78 | 23±27 |
| Keyal | 07 | 75 | 9 | 15 | 8 | 68 | 19±18 |

¹Pattan valley with 8 study sites: Barho Bohil, Barho Gulkand, Barho Kandogay, Hawery Kamar Bohil, Landai Sar Bohil, Nabaz, Rasta Dong Janchil and Tankor Janchil; Keyal valley with 7 study sites: Balkhun, Baroon Nala Fagaiel, Galto Fagaiel, Lotos, Keero Keyal, Rodair and Shaig Bhapobanda where questionnaire were distributed. ²n: number of peoples and hunters in Pattan and Keyal valleys from whom data were collected; %: percentage ³M±SD: Mean± standard deviation; the data was analyzed by t-test and $P < 0.05$; 2 populations were not significantly different.

Table 3. Other wildlife animals and birds were observed in study area during the survey, 24th May-10th July 2010.

| S/N | Common name | Scientific name | Pattan ¹ (%) ^P | Keyal ² (%) ^K |
|----------------|----------------------------------|---------------------------------------|--------------------------------------|-------------------------------------|
| Animals | | | | |
| 1. | Cat | <i>Felis catus</i> Linnaeus | 3 | - |
| 2. | Fox | <i>Vulpes vulpes</i> (Linnaeus) | 3 | 3 |
| 3. | Jackal | <i>Canis aureus</i> Linnaeus | 8 | 3 |
| 4. | Monkey | <i>Macaca mulatta</i> Zimmermann | 10 | 6 |
| 5. | Squirrel | <i>Sciurus carolinensis</i> Gmelin | 3 | 3 |
| 6. | Wolf | <i>Canis lupus</i> Linnaeus | 3 | 6 |
| Birds | | | | |
| 7. | Chukor | <i>Alectoris chukar</i> (Gray) | 13 | 20 |
| 8. | Himalayan monal pheasant | <i>Lophophorus impejanus</i> Latham | 5 | 3 |
| 9. | Koklass pheasant | <i>Pucrasia macrolopha</i> (Lesson) | 7 | 6 |
| 10. | Parrot | <i>Psittacula eupatria</i> (Linnaeus) | 8 | - |
| 11. | Ram chukor (Himalayan snow cock) | <i>Tetraogallus himalayensis</i> Gray | 5 | 3 |
| 12. | Sparrow | <i>Passer domesticus</i> Linnaeus | 32 | 47 |

¹Pattan valley with 8 study sites: Barho Bohil, Barho Gulkand, Barho Kandogay, Hawery Kamar Bohil, Landai Sar Bohil, Nabaz, Rasta Dong Janchil and Tankor Janchil. ²Keyal valley with 7 study sites: Balkhun, Baroon Nala Fagaiel, Galto Fagaiel, Lotos, Keero Keyal, Rodair and Shaig Bhapobanda where questionnaire were distributed. (%)^P and (%)^K: number of animals and birds found in Pattan and Keyal valleys

used by the hunters is gunshot which does not easily damage their coat because the coat of *N. goral* is very hard. Mostly little children and very few adults of both valleys use pellet bow as game, which they hang in their necks. They throw stones at them with power by pellet bow, which injured *N. goral* found during the present survey (Verbal Communication with Community, 2010).

The people of the study area were very religious and so said everything very clearly and firmly.

They said that they have seen 12 to 18 *N. goral*. Every hunter hunts at least 4 to 5 *N. goral* per day in winter; therefore, the population status of *N. goral* has dropped down. Most of the people do not care about the wildlife of the areas (interviews and informal discussion). However, if any hunter has hunted *N. goral*, then he cannot escape from wildlife department (interviews and discussion with community). Children like to hunt birds as well as *N. goral* in their childhood, because they like to use guns for shooting targets. Their natural attachment to guns also makes them to spoil wildlife.

In winter season, a number of *N. goral* are attacked by a disease which kills many of them. In this disease, the eyes of *N. goral* are affected seriously. They cannot open their eyes. Thus, it is impossible for them to get food and water, which leads to their death. If they are alive, it is very easy to capture or kill them.

Some people get them in ill- condition. The people said that this disease does not transmit to the meat eaters of *N. goral* (informal discussion with community). However, they are the natural food resource in backward area of Kohistan, Pakistan.

Conclusion

N. goral migrates during winter season towards lower areas, that is, populated areas, to escape from cold temperature, predators, hunters and in search of food. If it migrates due to predators, then it will never return to its native habitat. Its main predators are man, wolf, jackal

and others. Human beings are its chief predators; they hunt it for food, recreation and earning.

Recommendations

For the conservation of *N. goral*, its migrated sites, i.e., lower and populated areas, should be protected. The protected area should be established within the Kohistan. Local committees should monitor the population and hunting of *N. goral*. A comprehensive conservation action plan is required to develop the species conservation in its historic habitat. Awareness and education should be increased towards the importance of *N. goral*; therefore, attitude of the local people should be changed towards them. Deforestation should be controlled in the area.

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