# ABUNDANCE, GROUP SIZES AND HABITAT USE PATTERNS OF HIMALAYAN TAHR (*HEMITRAGUS JEMLAHICUS*) AND GORAL (*NEMORHAEDUS GORAL*) IN CHENAB VALLEY, CHAMOLI DISTRICT (UTTARAKHAND)

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## Introduction

The Western Himalayan range extends from Western Nepal (West of River Kali Gandaki) through Uttarakhand, Himachal Pradesh and Jammu and Kashmir in North-West India. The North-West and West Himalayan Biogeographic Zones (2A & 2B) cover 121,463 km$^2$ area and have 47 Protected Areas (PA) that cover 10,881 km$^2$ (Rodgers *et al.,* 2000). Substantial areas that are classified as Reserve Forests are also rich in wildlife and such areas are contiguous to PAs and in most cases, act as buffer. Chamoli District in Uttarakhand is rich in wildlife and their habitats and is well represented in the PA network and Forest Divisions. These include: three PAs, *viz.,* Nanda Devi National Park (NP), Valley of Flowers NP, Kedarnath Wildlife Sanctuary (WLS), Buffer zones of Nanda Devi Biosphere Reserve (BR), and three Divisions, namely the Kedarnath Wildlife Division, Badrinath Forest Division and Alaknanda Soil Conservation Division (Sathyakumar, 1994). Information on the mammals of Western Himalaya are from the surveys in Nanda Devi NP by Tak and Kumar (1987), Sathyakumar (1993, 2004) and from studies carried out in Kedarnath WLS, Uttarakhand, by Green (1985), Sathyakumar (1994), Kittur *et al*. (2004), as well as studies carried out in Majhatal WLS, Himachal Pradesh by Mishra (1993), and in Great Himalayan National Park, Himachal Pradesh, by Vinod and Sathyakumar (1999). Most of these surveys/studies have been carried out in Protected Areas.

This paper presents observations of the present survey on the abundance, group sizes, sex ratios, and habitat utilization patterns of Himalayan tahr (*Hemitragus jemlahicus*) and Goral (*Nemorhaedus goral*) in Chenab Valley, Urgam Reserve Forest, which is located between the PAs of Kedarnath WLS, and the Nanda Devi Biosphere Reserve, in Chamoli District, Uttarakhand and has not been explored prior to this survey.

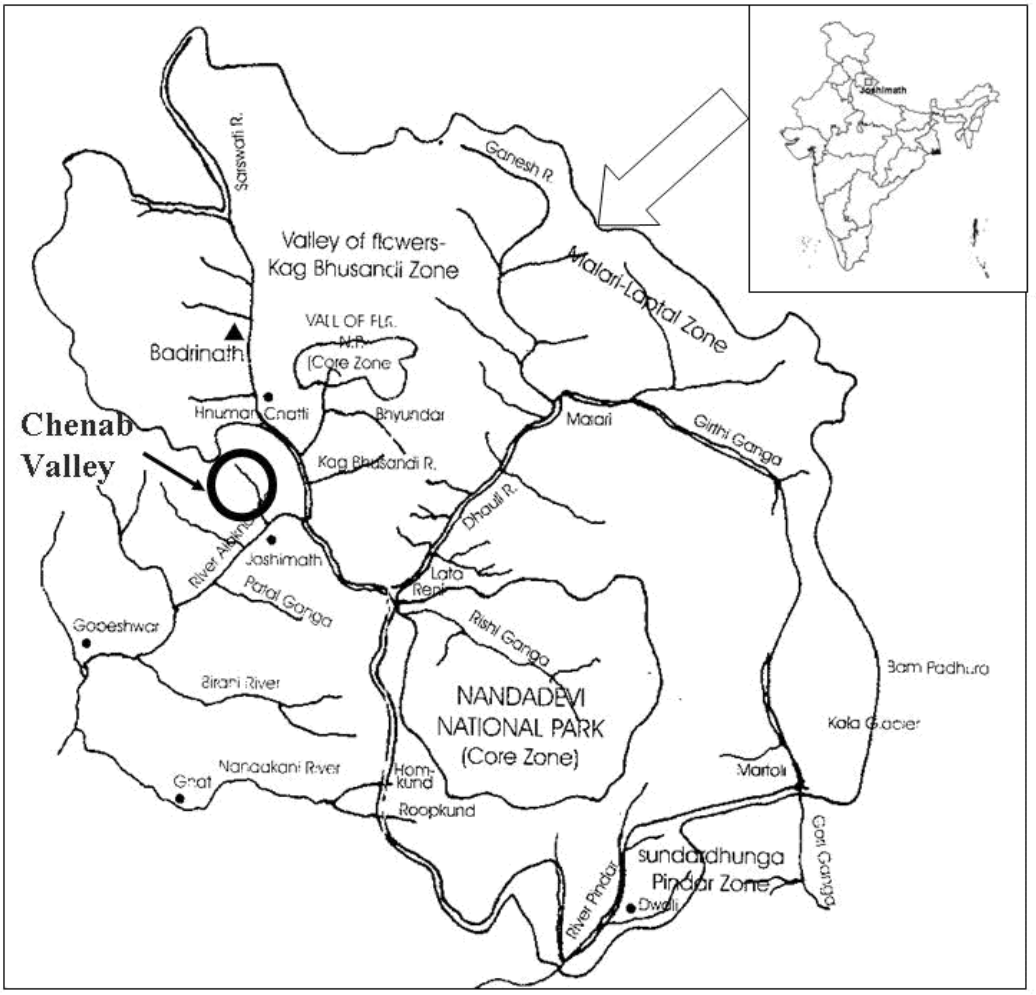
Systematic field surveys, transect walks and scan counts were carried out in Chenab Valley during March-April 2005, to collect information on the abundance, group sizes, sex ratios, and habitat utilization patterns of Himalayan tahr and Goral.

## Study Area

The Chenab Valley and the Reserve

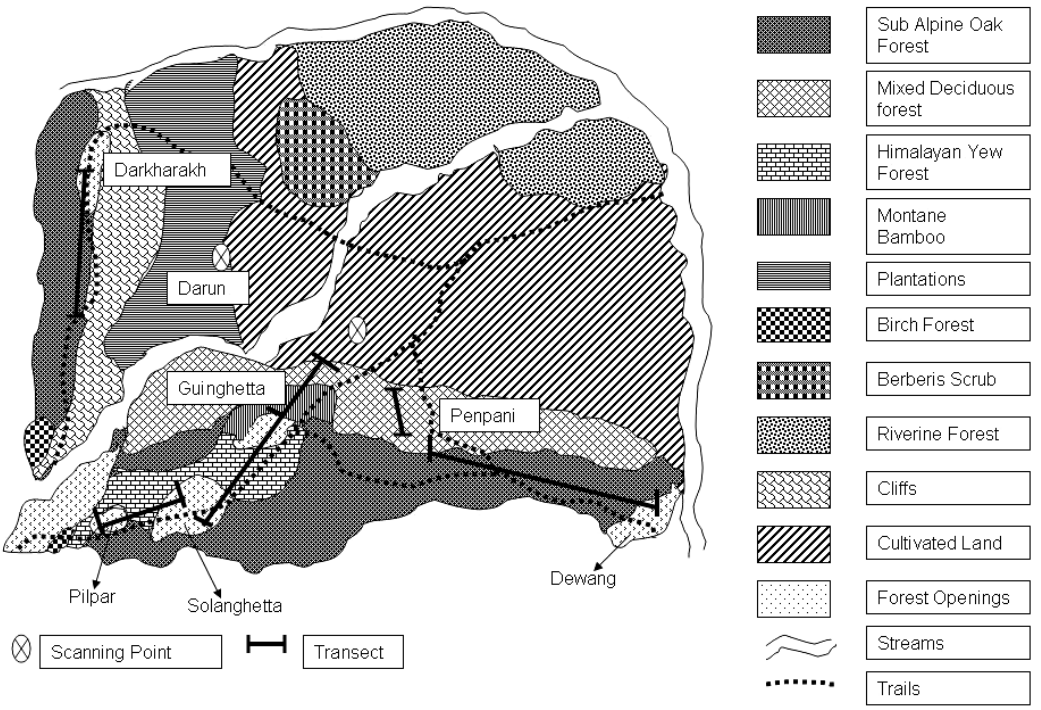
Forests of Urgam adjacent to Thang Village is situated in Chamoli District, Uttarakhand, and lies between 30° 33' 15"N to 30° 34' 50" N lat. and 79° 29' 50"E to 79° 31' 15" E long. (Fig. 1). The study area is characterized by highly rugged steep mountains with diverse slope, aspect and elevation categories. Altitude of the study area ranges from 1,200m (Lower Mulia Hamlet at the confluence of two mountain rivulets) to 4,000m (at the unnamed peak, just in front of the Chenab Valley locally called as 'Bhutkuri'). About 50% of the study area includes cultivated land and 40% is covered by forest and rest under rocky grassy slopes (Fig. 2). The plant communities are representatives of the temperate, sub-alpine and alpine regions, including Broad leaved oaks (*Quercus semicarpifolia, Quercus floribunda,*

**Fig. 1**




Chenab Valley and Nanda Devi Biosphere Reserve, Uttarakhand

**Fig. 2**




Sketch of Chenab Valley, Urgam Forest Reserve, Chamoli District (Uttarakhand) showing the major habitats and the locations of transects and scan points

*Quercus leucotrichophora*) and coniferous forest (*Taxus baccata*), high altitude mixed forest, riverine forest (*Alnus nepalensis*), sub-alpine and alpine pastures (Champion and Seth, 1968). During the study period, 106 bird species were recorded in the study area (Bhattacharya and Sathyakumar, 2007) and 17 mammals were encountered. These include: Asiatic black bear (*Ursus thibetanus*), Common leopard (*Panthera pardus*), Leopard cat (*Prionailurus bengalensis*), Sambar (*Cervus unicolor*), Serow (*Nemorhaedus sumatraensis*), Himalayan tahr (*Hemitragus jemlahicus*), and Himalayan musk deer (*Moschus chrysogaster*).

## Methods

The reconnaissance of the study area, selection and marking of transects, and identification of vantage points for scanning were made during March, 2005. The field survey was carried out during April 2005, which included systematic coverage of the study area by walks along transects (Burnham *et al.,* 1980), Scanning Method (Sathyakumar, 1994) and Dung counts in plots along the transect (Sathyakumar, 1994). Six line transects were laid in the study area covering various habitats between 2,000 and 3,000m (Fig. 2). The characteristics of these

transects are presented in Table 1. Due to patchy distribution of agricultural lands and wildlife habitats, the length of transects were shorter. Each transect was walked thrice during the month of April. For every mammal sighting, data on time, species, number, sex, sighting angle, sighting distance and animal activity were recorded.

Scan Counts were carried out for Goral and Himalayan tahr during April from two vantage points (Fig. 2) between 0600h to 0900h and 1500h to 1800h. Scan duration varied from 1.5 to 3 hours depending on the weather conditions. For every sighting, species number, their age and sex (if possible) and activity patterns were recorded. Habitat parameters were also recorded around 10m radius of the animal sighted (if solitary) or around 10m radius of the centre of the group. The location of every sighting was marked on a toposheet. Habitat factors recorded were: altitude, aspect, slope, vegetation cover (tree, shrub, ground layer) and rock cover. Altitude was measured with a GPS and also verified with the Survey of India topo sheet of the study area. Aspect was measured on a four point scale (North: 337°-67°, East: 68°- 157°, South: 158°-247°, West: 248°- 336°) with the help of a Sunnto Compass. Slope was measured on a 5 point scale *viz*. 1-15°, 16-30°, 31-45°, 46-60° and >60° by visual estimation. Vegetation Cover categories were measured on a four point scale (0-25%, 26-50%, 51-75% and >75%) based on visual estimation.

## Results and Discussion

### *Abundance of Himalayan tahr and Goral*

A total of 41 sightings (280 individuals) of Himalayan tahr, 26 sightings (68 individuals) of goral, and 4 sightings (11 individuals) of sambar were had during the study period.

The Encounter Rate for Himalayan

**Table 1**

*Characteristics of the Transects laid in Chenab Valley, Urgam Reserve Forest, Chamoli District, Uttarakhand, March-April 2005*

| T. No. | Vegetation Type | Length (m) | Altitude (m) |
|---|---|---|---|
| 1 | Temperate Mixed Broad –Leaved Forest | 500 | 2,000-2,500 |
| 2 | Temperate Coniferous Himalayan Yew and Oak Forest | 750 | 2,500-2,800 |
| 3 | Mixed Coniferous Himalayan Yew and Oak Forest with Montane Bamboo | 600 | 2,500-2,800 |
| 4 | Temperate Coniferous Himalayan Yew and Oak Forest, Alpine Meadows | 700 | 2,800-3,000 |
| 5 | Mixed Coniferous Himalayan Yew and Oak Forest with Montane Bamboo | 700 | 2,800-3,000 |
| 6 | Temperate Coniferous Himalayan Yew and Oak Forest, Alpine Meadows | 500 | 2,800-3,000 |

tahr in the Chenab Valley was 7.37 1.17/ scan which is higher than the estimates (2.98 0.67) made in Great Himalayan NP, Himachal Pradesh, during spring (Vinod and Sathyakumar 1999), but lower than the estimates (32.8 ± 1.3, 11 0.96) made for tahr in Kedarnath WLS during spring by Sathyakumar (1994) and Kittur *et al.* (2004) respectively (Table 2).

The Encounter Rate for goral in Chenab Valley ranged from 0 to 0.88/km walk with a mean of 0.47 0.19 /km. This estimate is lower when compared to the estimates made for Goral during the same season in Kedarnath WLS where it was 2.58/ km walk (Sathyakumar 1994) and in Great Himalayan NP, it was 1.17/ km walk (Vinod and Sathyakumar 1999). Goral encounter rate based on scan in Chenab Valley was 3.2 1.29/ hr scan, which is less than 6 0.28/ scan reported for Mandal area in Kedarnath WLS (Sathyakumar 1994) but marginally higher than the estimates (2.27 0.41) reported for goral in Great Himalayan NP (Vinod and Sathyakumar, 1999).

### *Group Size, Age and Sex Composition of Himalayan tahr and Goral*

During the study, data on group sizes of Himalayan tahr and Goral were collected. Group composition was recorded only in case of Himalayan tahr, as identification of sexes in goral was difficult because, it is mono-morphic.

Mean group size of Himalayan tahr (n=34), was 7.88 5.07 and for Goral (n=21), it was 2.71 1.90 (Table 3). The mean group size of Himalayan tahr in the study area is comparable to that of Great Himalayan NP (Vinod and Sathyakumar, 1999), but much lower than the group size

**Table 2**

*Comparison of Abundance estimates, Group sizes, and sex ratios for Himalayan tahr and Goral in Chenab Valley, Urgam Reserve Forest, Chamoli District, with other Protected Areas of Western Himalaya*

| Species | Parameter | Protected Area | | This study |
|---|---|---|---|---|
| | | Great Himalayan NP | Kedarnath WLS | Chenab Valley |
| Tahr : | | | | |
| | ER/Scan | 2.98 | 32.8*, 11** | 7.37 |
| | Group Size | 5.14 | 10.33*, 5.88** | 7.88 |
| | Sex Ratio (M : F) | 1:8.2 | 1:2.8*, 1:5** | 1 : 1.57 |
| Goral : | | | | |
| | ER/Walk | 1.17 | 2.58* | 0.47 |
| | ER/Scan | 2.27 | 6* | 3.20 |
| | Group Size | 1.88 | 2.0 * | 2.71 |

Source : Great Himalayan NP – Vinod and Sathyakumar (1999)
Kedarnath WS – * Sathyakumar (1994); ** Kittur *et al.* (2004)

**Table 3**

*Use of Vegetation and Rock cover by Goral and Himalayan tahr in Chenab Valley, Urgam Reserve Forest, Chamoli District, Uttarakhand, April, 2005*

| Species | Category | N | Vegetation Cover Categories | | | | $\chi^2$ |
|---|---|---|---|---|---|---|---|
| | | | 0-25% | 26-50% | 51-75% | >75% | |
| Tahr | | 34 | | | | | |
| | Tree | | 85.29 | 5.88 | 8.82 | - | 1.04E-09* |
| | Shrub | | 97.05 | 2.94 | - | - | 4.07E-088 |
| | Ground | | 2.94 | 5.88 | 29.41 | 71.77 | 1.23E-078 |
| | Rock | | 32.35 | 14.70 | 32.35 | 20.58 | 0.3750* |
| Goral | | 21 | | | | | |
| | Tree | | 52.38 | 23.80 | 9.52 | 14.28 | 0.0250* |
| | Shrub | | 90.47 | 9.52 | - | - | 0.0002* |
| | Ground | | 19.07 | 28.57 | 4.77 | 47.71 | 0.0430* |
| | Rock | | 47.70 | 4.77 | 28.57 | 19.04 | 0.0430* |

* $P < 0.05$

reported for tahr in Kedarnath WLS (10.33 ± 1.25) during spring by Sathyakumar (1994) and in Langtang NP, Nepal (mean group size 13.5, range 1-72) reported by Green (1978).

Small body size, high metabolic rate and selective feeding would favour a solitary life for goral (Cavallini, 1992; Green, 1987; Mead, 1989). Present data also support the hypothesis that goral were predominantly solitary. The largest aggregation of 8 animals observed in the study area represents the lower limit of such reports of goral aggregations by different wildlife biologists [18 (Mishra, 1993); 14 (Vinod and Sathyakumar, 1999; Lovari and Apollonio (1994); 9 (Cavallini, 1992; Sathyakumar, 1994) 7 (Green, 1985)]. Areas that are subjected to moderate to high levels of livestock grazing lead to smaller group sizes of wild mountain ungulates such as the goral. Similar observations were reported by Sathyakumar (1994) in Kedarnath WLS.

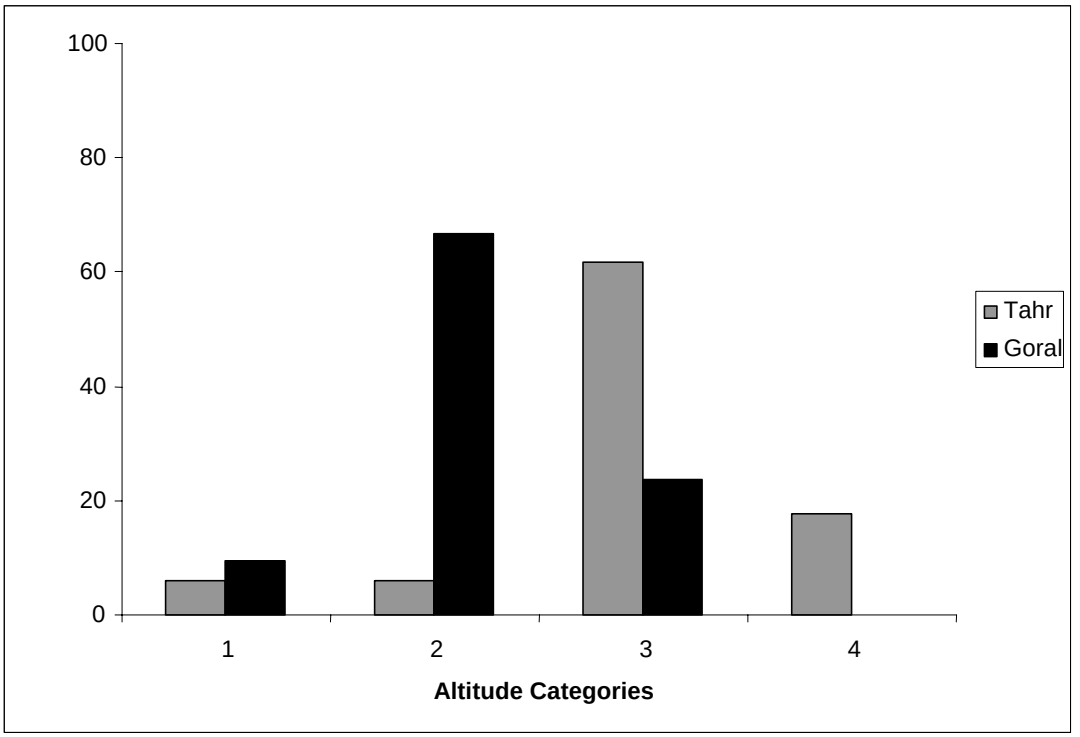
A total of 234 individuals were sighted in 34 encounters of Himalayan tahr and they were aged and sexed. The proportion of adult males were 32.05% adult female were 43.58%; subadults (male + female) were 17.23% and unknown were 8.12%. Male: Female ratio was 1:1.57. Sathyakumar (1994), Kittur *et al.* (2004), and Vinod and Sathyakumar (1999) also reported sex ratio in favour of females, i.e., 1 : 2.8 to 1 : 5 in Kedarnath WLS and 1 : 8.2 respectively (Table 2).

### *Habitat Use Patterns of Himalayan tahr and Goral*

A. *Himalayan tahr* : Himalayan tahr used a wide range of altitude ranging from

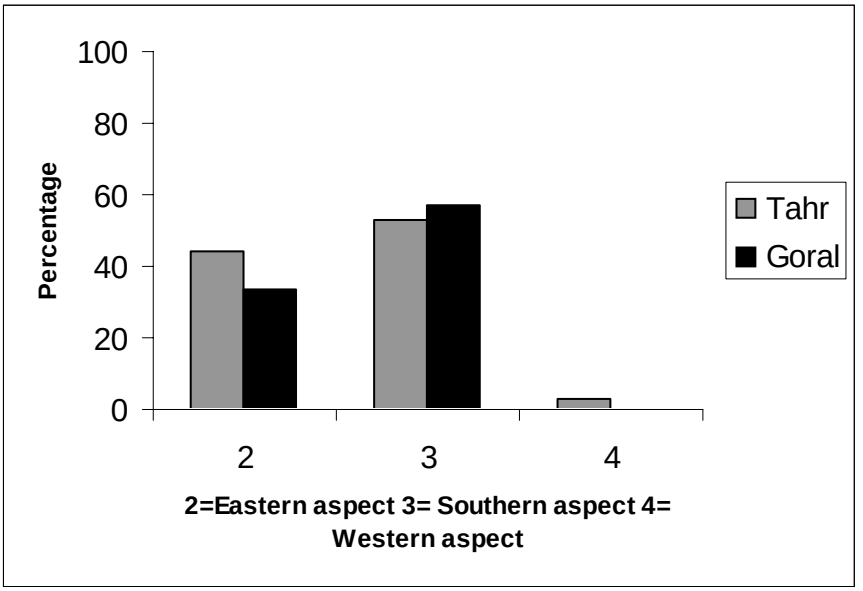
2,500-3,500m in the study area (Fig. 3) which is similar to the observations made in other parts of the Western Himalaya. Schaller (1973) reported that tahr used 2,500-4,000m altitude ranges in Bhotakosi, Nepal. Green (1978) reported that tahr used 2,700-5,000m ranges in Langtang NP, Nepal. Sathyakumar (1994) reported that tahr in Kedarnath WLS used altitudes ranging from 2,200 to 4,300m. Vinod and Sathyakumar (1999) reported that tahr used 2,800-3,800m altitude range in Great Himalayan NP. Kittur *et al.* (2004) reported that although tahr used the 2,600 to 3,700m altitude ranges in Kedarnath WLS, they used the 2,900 to 3,300m ranges more than their availability. Himalayan tahr sightings were mostly in Eastern and Southern aspects (Fig. 4) which were the steeper and warmer slopes in Chenab valley and these are similar to the observations made by Sathyakumar (1994) and Kittur *et al.* (2004), who reported more tahr sightings in the Eastern and South-eastern aspects. All tahr sightings occurred in areas that were >45° slope category and they preferred steeper areas (Fig. 5). The use of cliffs or steeper areas is an anti-predatory strategy of mountain ungulates such as tahr. Schaller (1973) Sathyakumar (1994), Vinod and Sathyakumar (1999) and Kittur *et al.* (2004) have reported similar observations.

**Fig. 3**



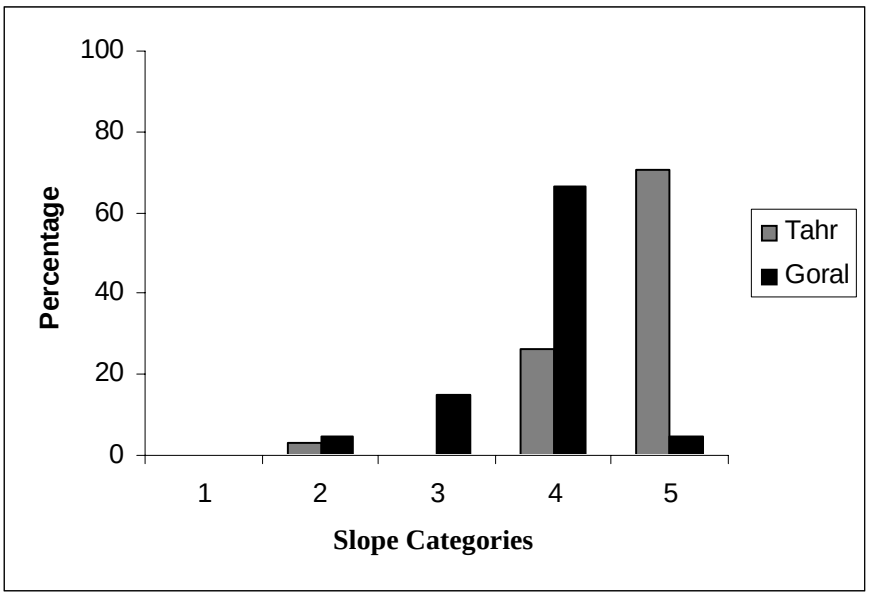

Use of Different Altitude Categories by Himalayan tahr & Goral in Chenab Valley, April, 2005. (Altitude categories: 1 - <2,000m. 2 - 2,001 to 2,500m. 3 - 2,501 to 3,000m. 4 - >3,000m)

**Fig. 4**




Use of Aspect by Himalayan tahr & Goral in Chenab Valley, April 2005
(2 = Eastern, 3 = Southern, 4 = Western)

**Fig. 5**




Use of Different Slope Categories by Himalayan tahr & Goral in Chenab Valley, April 2005
(1 - <15°, 2 - 16° to 30°, 3 - 31° to 45°, 4 - 46° to 60°, 5 - >61°)

Himalayan tahr preferred areas without tree cover and avoided all areas having > 25% tree cover. Most of the sightings were had in areas having low shrub cover, moderate and dense grass cover and moderate rock cover (Table 3). The use of cover categories were similar to that reported by Sathyakumar (1994) and Kittur *et al.* (2004) in Kedarnath WLS, and Vinod and Sathyakumar (1999) in Great Himalayan NP, Himachal Pradesh.

B. *Goral* : Goral used a wide altitudinal range extending from 1,500 to 3,000m and used the middle altitudes (2,000 to 2,500m) to a larger extent (Fig. 3). Mishra (1993) reported that the best habitat in terms of goral abundance was above 1,700m in Majhatal WLS, Himachal Pradesh. Green (1985) reported that goral used altitudes up to 3,700m whereas Sathyakumar (1994) reported that goral mostly used the 1,700 to 2,700m ranges in Kedarnath WLS. Vinod and Sathyakumar (1999) reported that goral used mostly the middle elevations (2,301- 2,700m) in Great Himalayan NP, Himachal Pradesh. Goral sightings were mostly in the Eastern and Southern aspects (Fig. 4) as they were warmer slopes with open grassy patches. Goral used areas having moderate to steep slopes (45°- 60°) to a larger extent when compared to other slope categories (Fig. 5). Mishra (1993) Sathyakumar (1994), and Vinod and Sathyakumar (1999) have also reported similar observations.

Most of the goral sightings were in areas with low tree and shrub cover (0- 25%) categories (Table 3). Green (1985), Mishra (1993), Sathyakumar (1994) and Vinod and Sathyakumar (1999) have also reported that goral used low tree and shrub cover categories in various parts of Western Himalaya. The use of dense and moderate grass and rock cover (Table 3) were also similar to the observations made by Sathyakumar (1994) in Kedarnath WLS. As a primitive caprid, goral is expected to be a forest dwelling broWLSer. However Green (1987) found that goral in Kedarnath Wildlife Sanctuary fed predominantly on grass and use more open areas.

### *Ecological Separation between Himalayan tahr and Goral*

The differential use of altitudes by tahr and goral in study area is a major reason for their ecological separation. In Chenab Valley, Goral generally avoided altitudes >2,900 m and Himalayan tahr always used the higher altitudes with the exception of one sighting that was recorded in an area that was <2,500m. Though there was an overlap in the use of altitude by Goral and Himalayan tahr, they were never sighted together. Himalayan tahr and Goral showed a preference for steep open habitats in the Southern and Eastern aspects that had low tree and shrub cover, but were ecologically separated by their preferences for different altitudinal zones. Green (1987), Sathyakumar (1994), and Vinod and Sathyakumar (1999) have reported similar observations.

### *Livestock grazing and the possible threats to Himalayan tahr and Goral*

The major threat to conservation and management of Himalayan tahr and Goral and their habitats in Chenab Valley is livestock grazing. With a livestock population of 5,000 animals, no part of the study area is free from livestock grazing. Two types of livestock grazing practices are adopted in Chenab Valley. In the months of April and May, all the villagers

assemble their livestock, mainly sheep and goat, and contract some supervisors who take them for grazing up in the alpine regions of Chenab Valley and adjacent areas. Usually such livestock herds compose of about 800 to 1,000 animals. They stay at the altitude ranges of 3,000 to 4,500m for about four to five months and their camps are situated at and around the "treeline" area, as shelter, water, firewood and fodder are easily available. This leads to use of not only alpine pastures but also the ground layer vegetation (herbs, grasses) and shrub cover of forested areas by goat and sheep (Rawat and Panwar, 1990; Sathyakumar *et al.,* 1993). Another type of practice that was observed during this study was the day visits to some mid altitude grazing lands (*kharaks*) by livestock supervised by one person. While livestock may not use Himalayan tahr habitats due to inaccessibility, the middle and relatively low altitudes of goral habitat is frequently used by the livestock and may pose a serious threat to goral in the near future due to habitat degradation.

**Conservation**

The status of Himalayan tahr and Goral in Chenab Valley, as indicated by their Encounter Rates, is comparable to that of other PAs of the Western Himalaya. The Presence of 17 species of mammals and 106 species of birds including some of the rare species in Chenab Valley makes it an important area for biodiversity conservation. As Chenab Valley is located between the Nanda Devi BR and Kedarnath WLS it has significance and potential for conservation of wildlife, particularly large mammals, as this area lies outside the PA network, but offers contiguity to animal populations and their habitats. However, the present levels of livestock grazing and associated disturbances in goral habitats may pose a threat to goral in the near future.

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**SUMMARY**

**The Chenab Valley in Urgam Reserve Forest of Chamoli District (Uttarakhand), was surveyed during March-April 2005, to estimate abundance and record observations on the group sizes, sex ratios, and habitat utilization patterns of Himalayan tahr and Goral. Encounter rate for tahr was 7.57 ± 1.17/hr scan and for goral, it was 0.47 ± 0.19 /km. Mean group size of Himalayan tahr (n=34), was 7.88±5.07 and for goral (n=21), it was 2.71±1.90. Himalayan tahr largely used the 2,500-3,500m altitude range, eastern and southern aspects, and steep slope**

**categories. Goral mostly used the 2,000-2,500m altitude range, eastern and southern aspects, and moderate to steep slopes. Habitat utilization patterns of tahr and Goral show clear ecological separation between the two species. As Chenab Valley is located between the Kedarnath Wildlife Sanctuary and Nanda Devi Biosphere Reserve, it has significance and potential for conservation of Himalayan tahr, goral and other large mammals as this area lies outside the Protected Area network, but offers habitat contiguity and consequently movement of animal populations.**

***Key words*** **: Himalayan tahr (*Hemitragus jemlahicus*), Goral (*Nemorhaedus goral*), Abundance, Group sizes, Habitat use patterns Chenab Valley, Chamoli, Uttarakhand.**

## चेनाब घाटी में हिमालयी गिरिछाग (*हेमित्रागुस जेम्लाहिकस*) और घुड़ल (*नेमोरहीडस गोरल*) की प्रचुरता, समूह–आकार और प्राकृतावास उपयोग सज्जा

टी० भट्टाचार्य व एस० सत्यकुमार

### सारांश

जिला चमोली, उत्तराखण्ड के उरगम आरक्षित वन की चेनाब घाटी का सर्वेक्षण मार्च–अप्रैल 2005 के दौरान उसमें हिमालयी गिरिछाग और घुड़ल की प्रचुरता का अनुमान लगाने तथा उनके समूह आकार, लिंग अनुपात एवं प्राकृतावास उपयोग सज्जा के प्रेक्षणों को अभिलिखित करने के लिए किया गया। गिरिछाग और घुड़ल से भेंट होने की दर क्रमशः 7.57 $\pm$ 1.17 / घंटा स्कैन और 0.47 + 1.90 (संख्या = 21) रही। हिमालयी गिरिछाग का माध्य समूह आकार (संख्या=34) 7.88 $\pm$ 5.07 तथा घुड़ल का 2.71 $\pm$ 1.90 (संख्या = 21) निकला। हिमालयी गिरिछाग 2500–3500 मी० ऊंचाई सीमा पूर्वी और दक्षिणी पर्वत रुखों तथा तीखी ढलान श्रेणियों पर मिलते हैं। घुड़ल अधिकतर 2000–2500 मी० ऊंचाई सीमा, पूर्वी और दक्षिणी पर्वत रुखों और मध्यम से तीखे ढलानों पर मिलते हैं। गिरिछाग और घुड़ल की प्राकृतावास उपयोग सज्जाओं में इन दोनों जातियों में स्पष्ट परिस्थिकीय विभेद रहते देखा जाता है। चेनाब घाटी केदारनाथ वन्यप्राणि अभयारण्य और नन्दादेवी जीवमण्डल संरक्षण क्षेत्र के मध्य अवस्थित है इसलिए हिमालयी गिरिछाग, घुड़ल और अन्य बहुत सारे स्तनियों के लिए यह महत्वपूर्ण और संरक्षण दृष्टि से संभावनापूर्ण है क्योंकि यह क्षेत्र संरक्षित किए हुए क्षेत्रों के जालकर्म से बाहर तो पड़ता है परन्तु इन प्राणियों के प्राकृतावास से सटा हुआ है और फलस्वरूप इधर–उधर उनके आने जाने की सुविधा बढ़ाता है।

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