

# SURVEY OF THE GORAL *NEMORHAEDUS GORAL* (HARDWICKE) IN HIMACHAL PRADESH<sup>1</sup>

PAOLO CAVALLINI<sup>2</sup>

(With three text-figures)

During October-November 1989, ten Wildlife Sanctuaries and a National Park in Himachal Pradesh, north-west India, were surveyed. Goral *Nemorhaedus goral* signs were recorded in eight of them. Two indices of relative abundance based on sightings and on droppings were used, and they correlated significantly ( $p = 0.03$ ). Goral were seen active most often at sunrise and sunset. Group size ranged from 2 to 9, while 38% of the animals were seen alone. The lower altitudinal limit (c. 500 m a.s.l.) was substantially lower than previously believed for Himalayan goral. The main habitat requirement appeared to be the presence of steep ( $60^\circ - 70^\circ$ ) slopes, probably as an antipredator strategy. Although widely distributed and locally abundant, goral seem to suffer from high disturbance and grazing levels.

## INTRODUCTION

Gorals (*Nemorhaedus* spp.) are medium sized, mountain-dwelling ungulates, ranging from the Himalaya (*Nemorhaedus goral*) to the Burma-China-India border (*Nemorhaedus bailey*) and from Burma through China to the Soviet Far East (*Nemorhaedus caudatus*) (e.g. Groves and Grubb 1985). In spite of its wide distribution and relatively confident habits (Prater 1980), very little published information is available on this ungulate. Moreover, most of the information available is qualitative and second-hand (Mead 1989). The present study was undertaken as a first step towards gathering information on this species. Information collected on the status and distribution of goral in Himachal Pradesh and preliminary data on its habitat ecology are presented here.

## STUDY AREA

Himachal Pradesh ( $30^\circ 12'$  to  $33^\circ 12'$  N,  $75^\circ 45'$  to  $79^\circ 4'E$ ) covers an area of 55673 sq. km. Terrain, and consequently vegetation, are very varied, from the plains covered by tropical jungle through a series of mountain ranges up to the main Himalaya, characterised by subtropical and temperate forests, to the highest peaks

around 6000 m and the Tibetan plateau, that support only low scrub and grasses.

The survey period was from 6 October 1989 to 15 November 1989. Of the 29 wildlife sanctuaries and 2 National Parks in Himachal Pradesh (Mukerji 1986) 11 were excluded from the survey for the following reasons:

Four protected areas require special permits impossible to obtain in a short period (Pin Valley National Park, Lippa-Asrang, Racksham-Chitkul, Rupi-Bhaba). Four are present largely in the alpine zone, little used by goral (see e.g. Schaller 1977) (Kugti, Sachu-Tuan Nalla, Tundah, Kanawar). Three (Naina Devi, Govind Sagar, Pong Lake) are at very low altitude, with little or no suitable habitat for goral; in fact the latter two are lakes.

Of the remaining 20 areas the following 11 were selected as the most promising (based on the suggestions of B.S. Chauhan, A.C.C.F. Wildlife Circle, Himachal Pradesh): Gamgul-Siya-Behi, Kalatop-Kajjar, Nargu, Great Himalayan National Park, Bandli, Shikari Devi, Majathal Harsang, Shimla Water Catchment Area, Chail, Renuka, Simbalbara (in north to south order; Fig.1).

## METHODS

For each area I recorded: (i) sightings, alarm calls and pellets of goral (pellets were not counted where goat and sheep grazing was

<sup>1</sup>Accepted August 1990.

<sup>2</sup>Department of Evolutionary Biology, University of Siena, via Mattioli 4, 53100 Siena, Italy.

intense), (ii) slope, aspect and cover (tree, shrub and bare rocks), (iii) intensity of grazing by domestic animals and other forms of disturbance.

Time spent in each of the protected areas is given in Table 1. Information on altitude and area were taken from the H.P. Forest Department. Statistical treatment follows Siegel (1956).

### RESULTS

Goral were sighted or heard in seven of the 11 areas surveyed. Pellets were recorded in eight of the 11 areas (Table 1). Distribution of sightings during the day is shown in Fig. 2. No goral was seen active between 0800 and 1630 hrs, while the maximum number was observed just after sunrise. This suggests a crepuscular (and possibly also nocturnal) activity. Moreover, most of the goral seen (61.4%) were moving and 11.4% were standing still, while only 4.5% were grazing or browsing. This further suggests nocturnal feeding activity, preceded and followed by crepuscular movements from and to the resting grounds.

The group sizes of the observed goral are shown in Fig. 3. The mode group size is one, but groups of two and four were also common; only

one large group (nine goral) was observed. It must be noted, however, that these are minimum estimates because of the possibility of overlooking some of the members of a group. The distance (usually 100-300 m) and the brevity of the observations (often <1 min.) prevented an accurate assessment of age and sex.

No goral was seen on slopes less steep than 60° (N=61). Most of the sightings (86%) were in areas with fairly sparse tree and shrub cover (<30%). Also pellets were very common (up to 20 pellet groups per 30 min. walking) in areas with less than 30% cover but many (6.1 to 13.5 per 30 min. walking) were found also in forested areas (<60% cover). Bare rock (5 to 50%) was always present in areas frequented by goral. Aspect appeared rather unimportant, goral being present on north- as well as south-facing slopes. The areas surveyed are shown in Fig.1 and described in Table 1.

Gamgul suffers from heavy grazing and probably also heavy poaching. As a consequence, wildlife is generally very scarce. In spite of a habitat similar to areas with good goral densities, I saw no sign of goral during the survey; also the local Range Officer did not think that there was a significant population in the sanctuary.

TABLE 1  
AREAS SURVEYED IN HIMACHAL PRADESH

Name	Area (sq. km)	Altitude m.a.s.l.	Goral Sighting	Abundance Pellets	Grazing	Visibility	Time spent in	
							Goral area (hours)	Sanctuary (days)
Gamgul	90.0	2000-3900	0	0	4	4	8.30	1.5
Kalatop	47.3	1800-2500	0 +	6.1	1	0	4.55	2
Nargu	278.4	1200-4000	0	0	4	3	0	1.5
GHNP	620.0	1500-5000	0.23	—	2	3	4.40	2.5
Bandli	41.3	600-2100	0.23	2.3	0	3	17.35	2
Shikari Devi	213.5	2300-3360	0	0	3	1	0	2
Majathal	91.1	600-1970	5.42	20	0	4	6.25	3.5
Shimla W.C.A.	10.3	2100-2600	0 +	—	0	1	2.50	0.5
Chail	23.2	1000-2200	0.19+	—	3	4	11.30	3
Renuka	13.4	660-1100	0	3.8	1	0	3.00	1.5
Simbalbara	55.4	450-660	1.00	13.5	2	1	5.30	3

Areas are listed from north to south. Goral abundance indices: Sighting — no. of goral seen per 30 min. spent in goral areas (only during 0630-0800 and 1630-1800 hrs. Pellets= no. of goral pellets per 30 min. walking in goral areas. Grazing and visibility scores are on a 0-4 scale (0 = low, 4 = high). + goral alarm call heard.



Fig. 1. Areas in Himachal Pradesh surveyed for goral.

**Kalatop** is mostly covered by deodar *Cedrus deodara*. Slopes are mostly less than  $60^\circ$ . Disturbance is low (only two small villages are located within the sanctuary). Judging from tracks and scats, wildlife (especially pheasant and carnivores) appears comparatively abundant and goral is also present. The lack of sightings is related to the low visibility.

**Nargu** was the largest sanctuary visited. It was not possible to survey the whole area

thoroughly. Goral presence appeared likely in some steep, grassy slopes, but due to the scarcity of such areas, and to heavy grazing pressure, this sanctuary is unlikely to support large goral populations.

**Great Himalayan National Park:** goral are most probably present not only in the three main valleys included in the park, but also outside, along the steep banks of the Sainji river. I surveyed only part of the northernmost valley

(Jiwa nal), where goral density is probably higher than suggested by the figures in Table 1. In fact, the area was disturbed during the days of survey by people collecting fuelwood for winter, which possibly made the goral shy. Grazing and other forms of disturbance are exceptionally rare in the core area of the park, but more important in the buffer zone.

**Bandli** possibly supports a high goral density. The low number of sightings (Table 1) is probably because of the tall grass which limited visibility, and also the presence of people cutting grass. Cover is very scarce (<15%) and slope very steep (>70°).

**Shikari Devi** is largely covered by deodar and slopes are mostly less than 50°. Disturbance (including grazing) is very high. Goral, if present, are certainly very scarce, and almost unknown to local people.

**Majathal** is by far the best area for goral among those visited. The goral is present in a habitat similar to that of Bandli, a chir pine *Pinus roxburghii* forest (actually a grassland with sparse trees). Two such areas, both very steep (60°-70°), are present in the sanctuary, together covering approximately 25 sq. km. Disturbance is very low and grazing almost absent. Only in this area were groups larger than two observed.

**Shimla Water Catchment** is an almost completely undisturbed area, not very steep (mostly <50°) and with a fairly dense tree cover (>80%). Goral, although present, did not appear to be abundant. It must, however, be stressed that the survey was too short for a definite assessment.

**Chail** suffers from very high anthropogenic pressures. People were seen throughout the goral area from early morning to late evening. It is possible (since the animal may be shyer than in other areas) that goral density is higher than suggested by Table 1. The high grazing pressure is, however, likely to limit wild herbivore populations.

**Renuka:** No goral was seen. However,

many pellets were found, all close to a very steep (>70°) slope. The habitat (very thick tropical scrub) is unique among the sanctuaries surveyed. Goral density is probably high, even if limited to restricted patches.

**Simbalbara:** The habitat is low but with very steep (up to 90°) hills (660 m a.s.l.). Goral are present in the southern part of the sanctuary. The dense vegetation and the topography limited the visibility, possibly leading to an underestimation of goral density by the 'sighting' index (Table 1). The total population in this range may be good as the same habitat extends to the neighbouring state of Haryana. More work should be done on the ecology of goral in areas such as this and Renuka, as they represent the lower altitudinal limit of goral distribution.

The two abundance indices (Table 1) are significantly correlated (Spearman's  $r_s = 0.762$ ,  $p = 0.0275$ ;  $N=8$ ) between areas, indicating that both can be used for a relative assessment of goral abundance. The 'sightings' abundance index is not significantly correlated to either the visibility ( $r_s=0.484$ ,  $p=0.129$ ;  $N=11$ ) nor the time spent in goral areas ( $r_s=0.413$ ,  $p=0.27$ ;  $N=9$ ; excluding sanctuaries with no time spent in goral areas; Table 1). This can be interpreted as an indication that none of these factors biased significantly the results of this survey.

#### DISCUSSION

From the present survey, it appears that the goral in Himachal Pradesh is widely distributed (probably even outside protected areas) and in some areas it is still common. The three sanctuaries in which no goral sign was recorded (Gangul, Nargu and Shikari Devi) are characterised by high grazing and possibly poaching pressure. More detailed research is clearly needed to assess the relative importance of these factors. Goral habitat, however, is fragmented, especially at the lower limits of its distribution. This might threaten in the long run the survival of some isolated populations, as happened in Thailand (Lovari 1986).

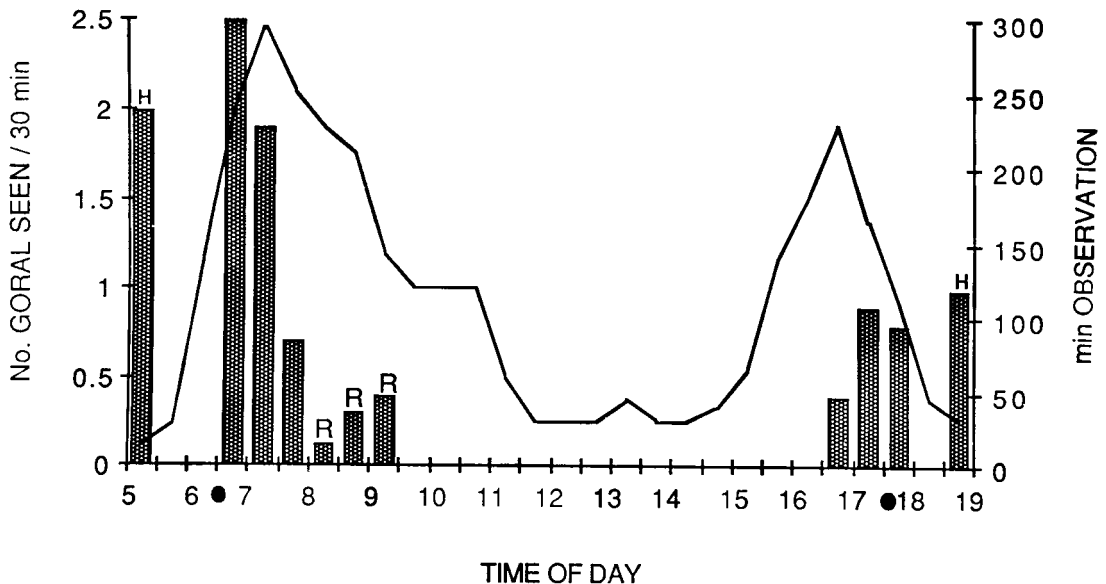


Fig. 2. Goral seen or heard per 30 min. observation (bars). Only time spent in areas in which goral were actually seen was included. R = resting animals, H = goral heard but not seen. Broken line indicates time spent in goral areas. Black dots indicate approximate sunrise and sunset times.

Gaston *et al.* (1981) found the goral altitudinal range to be between 1800 and 3700 m, with an abundance peak between 2200 and 3400 m. My results indicate a lower limit around 500 m (much lower than previously reported, see Mead 1989 for a review) with the highest densities in areas below 2000 m, which were little surveyed by Gaston *et al.* (1981). Also the preference for south-facing slopes observed by Gaston *et al.* (1981) could be a phenomenon limited to the upper part of goral range, as it could not be confirmed by the present study. On the other hand, my results agreed with those of Schaller (1977), Roberts (1977), Gaston *et al.* (1981), Lovari (1986) and Green (1987) in pointing out a preference of goral for very steep areas. The presence of leopard *Panthera pardus* in all the steep areas where goral was common

(Kalatop, Great Himalayan National Park, Bandli, Majathal, Chail, Renuka, Simbalbara) suggests that this preference may be an anti-predator strategy. My data therefore indicate that the main habitat requirement of goral is the

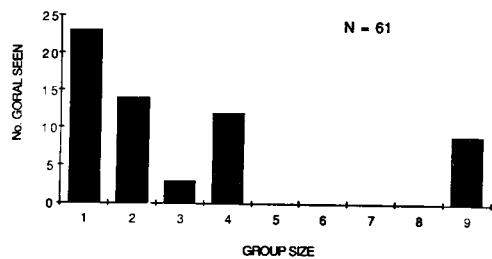


Fig. 3. Number of goral seen in groups of different sizes.

presence of steep slopes, together with low snow depth and low human disturbance.

#### ACKNOWLEDGEMENTS

Special thanks are due to B.S. Chauhan (H.P. Forest Dept.) and Prof. S. Lovari (University of Siena), without whose support and encouragement this work would not have been possible. The help given in the field by H.P.

Forest Department staff is also much appreciated. The Italian Ministry of Education and the Matsumae International Foundation provided limited financial support. I gratefully acknowledge the assistance of F. Volpi and L. Pellegrino in drawing the figures, R. Tantussi in typing, G. Checcucci in searching some of the literature, and the Best Company s.p.a. in providing clothing.

#### REFERENCES

- GASTON, A.J., HUNTER, M.L. & GARSON, P.J. (1981): The wildlife of Himachal Pradesh — Western Himalayas. Univ. Maine Sch. For Resources Tech. Notes No. 82.
- GREEN, M.J.B. (1987): Ecological separation in Himalayan Ungulates. *J. Zool. Lond. (B) 1*: 693-719.
- GROVES, C.P. & GRUBB, P. (1985): Reclassification of the serow and gorals (*Nemorhaedus*: Bovidae). pp. 45-50. *In*: Lovari, S. The biology and management of mountain ungulates. Croom Helm Ltd., Beckenham.
- LOVARI, S. (1986): Observations on the biology of the goral in Om Koi Wildlife reserve, N-W Thailand. *Boll. Zool.* 53: 88.
- MEAD, J.I. (1989): *Nemorhaedus goral*. *Mammalian Species* 335: 1-5.
- MUKERJI, A.K. (1986): Wildlife of Himachal Pradesh. Himachal Pradesh Forestry Department, Shimla.
- PRATER, S.H. (1980): The book of Indian animals. Bombay Natural History Society, Bombay.
- ROBERTS, T.J. (1977): The mammals of Pakistan. Ernest Benn, London.
- SCHALLER, G.B. (1977): Mountain monarchs. Wild sheep and goats of the Himalaya. University of Chicago Press, Chicago.
- SIEGEL, S. (1956): Nonparametric statistics for the behavioral sciences. McGraw-Hill, New York.