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Surveys of the Satyr Tragopan *Tragopan satyra* in the Singhalila National Park, Darjeeling, India using spring call counts

SARALA KHALING, RAHUL KAUL and GOUTAM KUMAR SAHA

Summary

Call counts of Satyr Tragopan *Tragopan satyra* were conducted in the Singhalila National Park, Darjeeling, India, for three years (1995–1997). Twenty-eight groups of calling birds were recorded in 1995, 19 in 1996 and 24 in 1997 with mean density estimates (groups/km^2) of 6.19/km^2, 4.52/km^2 and 5.46/km^2 respectively. During the three years, the number of calling groups varied only on one trail. Birds called early (04h45–05h00) and the calling frequency varied from 33% to 88%. Calling peaked in April and there were significant differences in the number of groups calling in April and May in 1995 and 1996. Adverse weather conditions and wind affected calling and the audibility of calls. During spring, the Satyr Tragopan was found to be associated with both open and closed habitats. The main possible threats to this species were grazing and tree lopping. Despite some shortcomings this survey method appears to be most suitable for monitoring Satyr Tragopan.

Introduction

Little is known about the population dynamics of Himalayan pheasants, although temperate-zone game birds are among the best-studied vertebrates (Gaston 1980). Monitoring changes in numbers can be seen as an important first stage in the conservation strategy of pheasants (Woodburn 1993). One of the most simple and commonly used methods of recording and monitoring pheasant numbers is by the call count method. Total counts of a species may not be possible by this method, but an index of abundance can be obtained (Gaston 1980, Duke 1990, Islam and Crawford 1992). In study areas like the Himalaya where field problems are compounded by dense vegetation, steep terrain, and difficult topography the call count method is probably the only suitable method for counting birds. Hence counting pheasants using call counts has been widely used by workers all across the Himalaya (Mirza *et al.* 1978, Severinghus *et al.* 1979, Lelliot and Yonzon 1980, Gaston and Singh 1980, Khan and Shah 1982, Picozzi 1986, Young *et al.* 1987, Duke 1990, Sharma and Pandey 1989, Pandey 1993, Kaul *et al.* 1995). Pheasants of the genus *Tragopan* show elaborate courtship displays during their breeding period and have distinctive advertisement calls probably to attract females as well as to defend their territories from other males (Islam and Crawford 1996).

The Satyr Tragopan is distributed over Garhwal, Kumaun, Nepal, Darjeeling hills, Sikkim, Bhutan, and western Arunachal Pradesh at elevations of 2400m–4300m, descending to 1800 m during severe winters (Ali and Ripley 1980). It inhabits steep and densely forested slopes comprising mainly of *Quercus* sp., *Magnolia* sp., *Rhododendron* spp. and *Abies densa* trees, with a well-developed understorey formed of ringal bamboo *Arundinaria maling*. Encounters in the wild have shown that the species is shy and wary, found generally in pairs in summer, in family groups post-breeding and solitary for the rest of the year (Gaston 1980). Satyr Tragopan is categorized as "Vulnerable" (McGowan and Garson 1995) and "Near Threatened" (Collar *et al.* 1994).

In this paper, we present results of call counts done for three breeding seasons (1995 to 1997) in the Singhalila National Park (SNP). We have commented on the suitability of this technique for estimating abundance. The spring dispersal pattern of the Satyr Tragopan and the main uncertainties preventing absolute estimate of the Satyr Tragopan population while using the call count methodology have also been discussed.

Study Area

The study area was located in the 109 km^2 Singhalila National Park (27°13′15″N–27°1′46″N; 88° 1′5″E – 88°7′5″E) in India at the extreme north-western edge of Darjeeling district, with the Singhalila spur separating the district from Nepal and Sikkim (Figure 1). Altitudes in the Park vary from 2,400m to 3,650 m and moist temperate conditions prevail throughout the year, resulting in a temperate to a subalpine vegetation. Wet temperate (*Quercus* spp., *Acer* spp., *Symplocos* sp. *Magnolia campbelli, Castanopsis tribuloides, Endospermum chinense*), moist temperate (*Q. pachyphylla, Betula utilis, Sorbus cuspidata, Rhododendron* spp. *Tsuga brunniona*) and alpine forests (*R. campanulatum, R. barbatum, R. hookeri, R.hodgsoni, Abies densa*) form the main forest cover of the National Park (Anon. 1992).

Direct threats to animal habitats, in the form of grazing and browsing by livestock from yak and cattle stations all along the Park border, firewood collection and bamboo harvesting by people from the settlements, are prevalent in the National Park. Being a popular trekking area in the district, the National Park is also affected indirectly by tourism.

Methods

Given the Park's size (108.77 km^2) it became necessary to limit the survey to selected areas that were most likely to contain Satyr Tragopan. During these extensive surveys we visited the different beats of the National Park using the pre-existing forest paths/trails of varying lengths and passing through different vegetation types. We also collected information from people living in settlements near the Park, Wildlife Department staff, shepherds and forest village dwellers. After selecting areas with maximum Satyr Tragopan concentrations (since this study formed only a part of a larger ecological study) we selected three trails each over 3 km long with good vantage points affording large area coverage in the Gairibans beat of the SNP to carry out the census exercise according to the method described by Gaston (1980) and Duke (1990). Observers were placed at

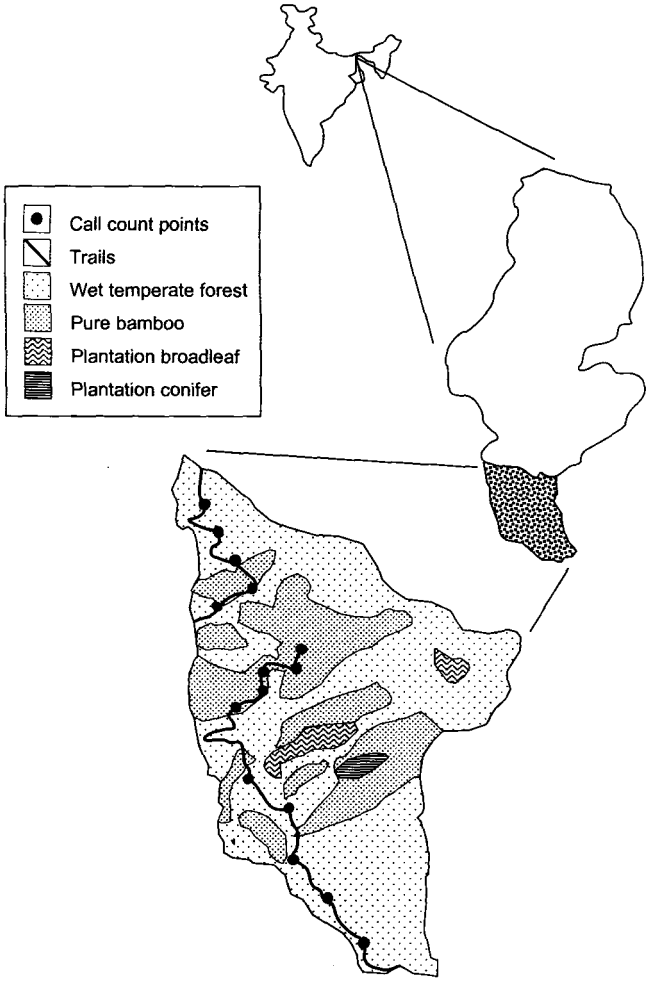

Figure 1. Location of Singhalila National Park, Darjeeling, India.

five points along each trail and each separated by a distance of 600 m. All these points were permanently marked so that the same place could be used for subsequent call counts. Only those persons who were familiar with the entire area and thus capable of recognizing the boundaries of their counting zones were involved in the exercise. Counting of calling males was recorded in appropriately designed data collection sheets, which had a circular chart designed to be orientated to north at the census point. At the census points the northerly orientation of each observer was marked the evening before the census. Observations were grouped to 50-m intervals, up to 300 m. Each observer noted the direction of the call, the approximate distance of the source of the call, the number of calls, duration of each call and the number of birds heard calling. Other important variables recorded were weather conditions including cloud cover, wind condition, temperature, relative humidity, rainfall and time of sunrise. Each transect was surveyed for three consecutive mornings. This was repeated at two-week intervals

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for each transect giving a total of 27 mornings of recordings in 1995, and 18 each in 1996 and 1997. Thirty animal sites along the three transects were located by calls and measured for vegetation parameters. The five nearest trees method was used to study the tree species diversity and cover. Using the animal as the centre of the plot a 3 m × 3 m plot was used to measure shrub cover and two 1 m × 1 m plots within the larger plot were used for ground vegetation measurements. Threats that may be affecting the Satyr habitat were also recorded in terms of intensity.

Analyses

As the most elaborate chorus (maximum calling groups) was observed in April, for the purpose of estimating the density we considered only the highest values over a constant period in April. With the progress of the calling season the number of calling birds declined, therefore mean density indices derived from total survey days would be misleading. The calling frequency was expressed as the percentage of the maximum number of birds heard at a given point on a particular day. Duration of chorus was defined as the time over which there was continuous calling and counter calling with no interval exceeding 15 minutes. A one-way analysis of variance was used to test for differences in density estimates across the three transects and in each transect across the years. The Mann–Whitney *U*-test was used to test for differences in calling groups between April and May. Pearson correlation coefficients were used to test for call duration and threat data. Weather conditions were categorized as clear, cloudy, fog and rain; while wind conditions were categorized into no wind, still wind, breeze and gale. Principal component analysis (PCA) was used to reduce the data and identify important variables in vegetation structure in the bird sites.

Results

A plot of the cumulative numbers of birds heard calling with increasing distance from the observer suggested that few were heard at >300 m (Figure 2). We therefore assumed each observer to be censusing a circle with a radius of 300 m. This indicated that a 300-m radius was optimum for counting Satyr Tragopan in the existing field conditions. A total of 28 calling groups was recorded from the three trails in 1995, 19 groups in 1996 and 24 groups in 1997 with a mean density estimate of 6.19/km^2 (± 0.87), 4.52/km^2 (± 0.58) and 5.71/km^2 (± 0.38) in the three years, respectively (Figure 3). The number of calling groups of Satyr Tragopan during the three years varied only on Trail 3 (F 2,18 = 6.38, P = 0.008). There was a difference in the number calling groups of birds across the three trails (F 2,60 = 3.15, P = 0.05). Birds appeared to be most abundant in Trail 1 and less abundant on the other two trails (Figure 4). We conducted some dawn call counts in March on a trial basis and found that calling was very sporadic and the chorus was not well established until early April. In all three years maximum groups of calling birds at dawn were recorded in April. Chorus calls by the birds declined through May and there was no chorus by the end of May or beginning of June, indicating a short calling period for this species (Figure 5). There was variation in the number of calling groups across April and May in 1995 (Z = −2.69, P = 0.007)

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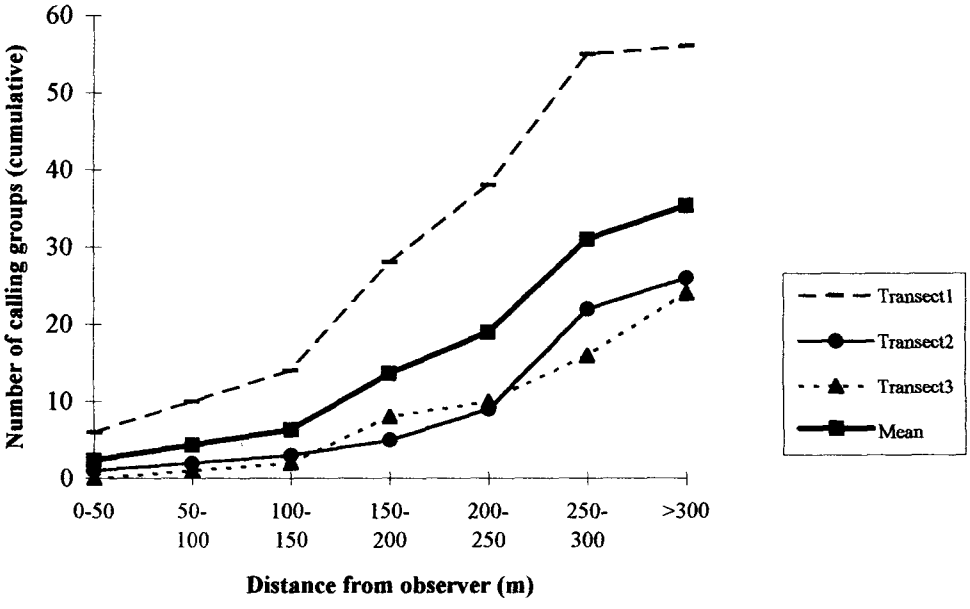

Figure 2. Relationship between number of calling groups and area of call count plot.

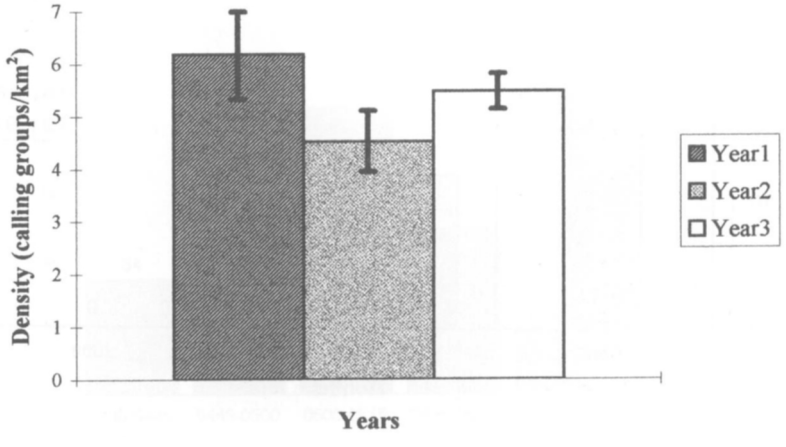

Figure 3. Density indices (x ± SE) of Satyr Tragopan during 1995–1997, Gairibans Beat, SNP, India.

and 1996 ($Z = -3.38$, $P < 0.001$) while there were no records of calling groups in May 1997. We also eliminated June from our analyses because there was negligible calling during this month. The calling frequency varied from 33% to 88% in the mornings, suggesting that very few birds call every morning even in April when calling was at a maximum. The duration of chorus was positively correlated (Figure 6) with the number of calling birds in the chorus ($r = 0.619$, $P < 0.001$, $n = 78$). On all the survey days the dawn chorus began well before sunrise and the 0445–0500 hrs time period had the maximum number of calling groups

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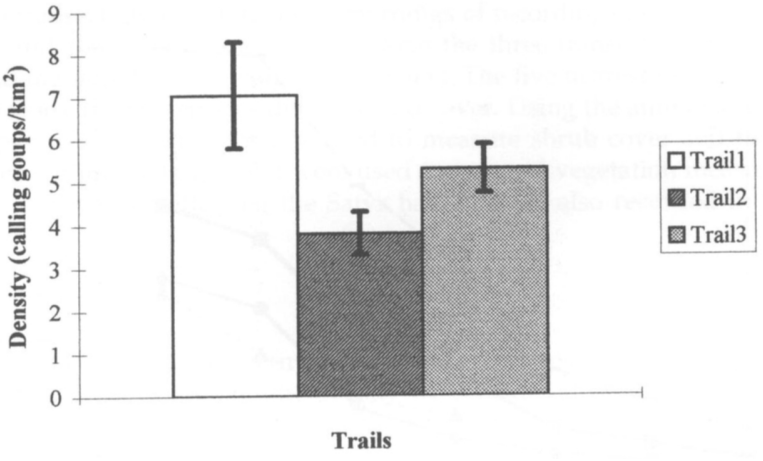

Figure 4. Density indices (x ± SE) of Satyr Tragopan on Trails 1, 2 and 3, Gairibans Beat, SNP, India.

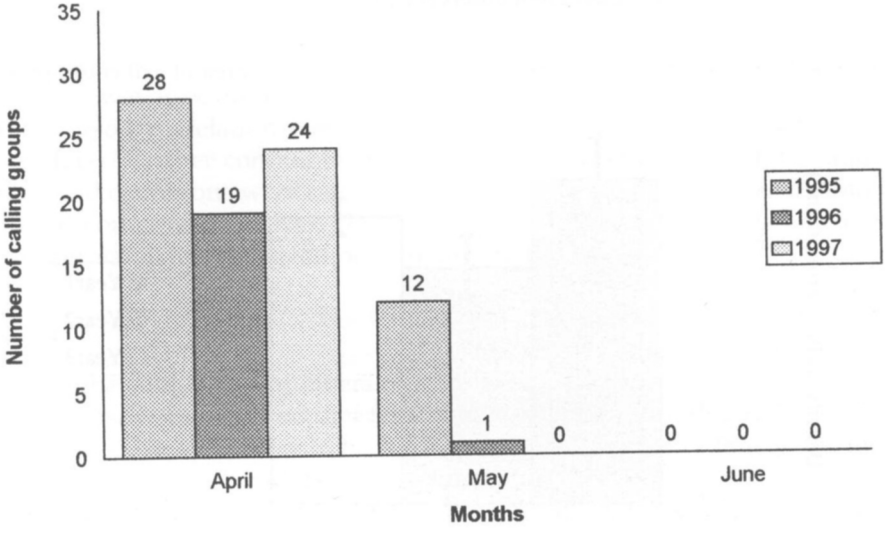

Figure 5. Monthly calling groups of Satyr Tragopan during the breeding season.

(Figure 7). After this there was a decline in the number of calling groups and no calls were heard after 06h00. Calling was negatively correlated with weather conditions ($r = -0.306$, $P = 0.001$, $n = 225$) and wind conditions ($r = -0.134$, $P = 0.04$, $n = 225$).

Principal component analysis (PCA) extracted five factors from the 30 bird sites which together explained 78% of variation in the habitat variables (Figure 8). The first two factors accounted for 44% variation. The first factor was negatively correlated with shrub cover, shrub cover height, shrub cover density and tree density, and was positively correlated to ground cover, ground-cover density and diversity. The second factor was negatively correlated to ground cover,

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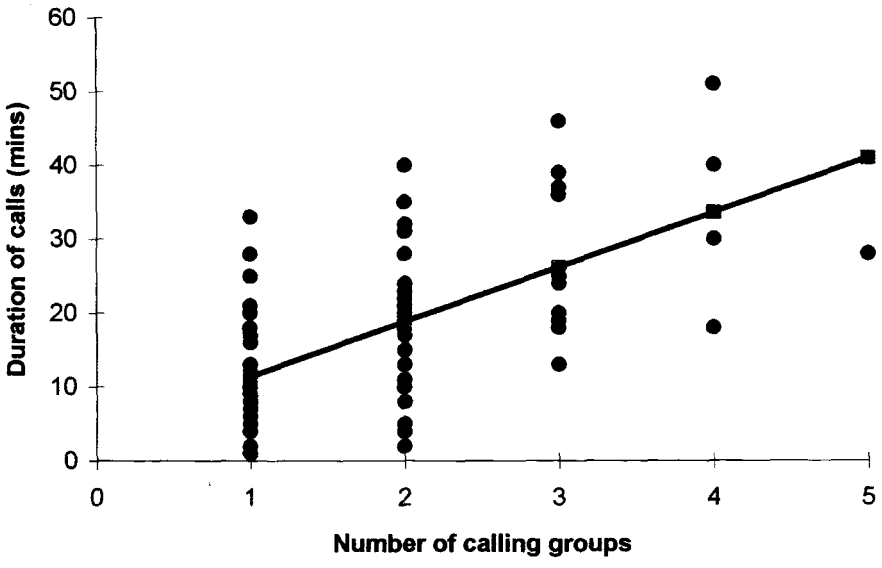

Figure 6. Relationship between number of calling groups and duration of chorus.

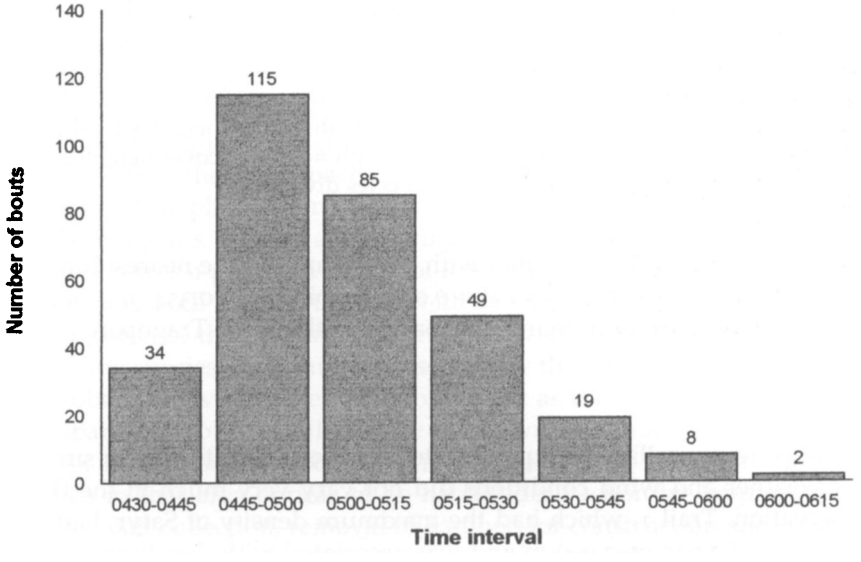

Figure 7. Number of calling bouts at different time periods during dawn chorus.

ground cover diversity, and positively correlated to canopy cover, shrub cover and density and tree density and diversity. The first factor represented open areas with low canopy and understorey cover and high ground cover. The second factor represented areas that were wooded or closed with dense understorey and therefore with little or no ground vegetation.

More birds were heard from those census points that were further from human settlements, but the relationship was not statistically significant. Grazing and

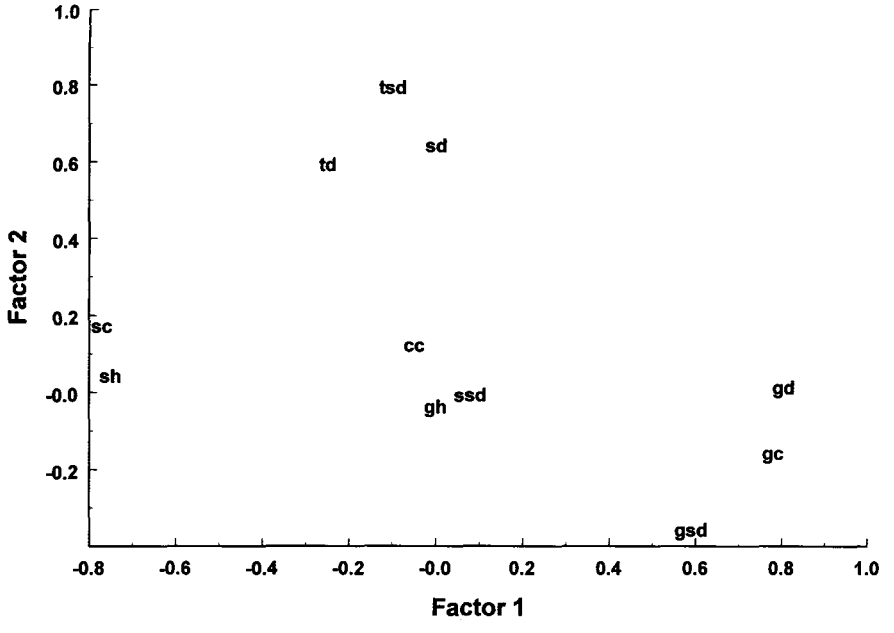

Figure 8. Principal Components Analysis of habitat variables on study plots (n = 30) Factor 1 represents open areas with low canopy and understorey cover and high ground cover. Factor 2 represents areas that were wooded or closed with dense understorey and therefore with little or no ground vegetation. cc = percent tree canopy cover; td = tree density; tsd = tree species diversity; sc = percent shrub cover; sh = shrub height; sd = shrub density; ssd = shrub diversity; gc = percent ground cover; gh = ground cover height; gd = ground cover species diversity; gsd = ground cover species diversity.

lopping were negatively correlated with the distance to the nearest human settlement (grazing r = -0.537, n = 30, P = 0.002; lopping r = -0.354, n = 30, P = 0.05) suggesting avoidance of human disturbance by the Satyr Tragopan.

Discussion

There were fewer calling groups detected in 1996 in all the three survey trails, whilst weather and wind conditions did not vary very much in the three years of observation. Trail 1, which had the maximum density of Satyr, had an elevational range of 2,625 m–2,900 m and was associated with deciduous tree species, *Acer* sp., *Magnolia* sp., *Litsaea* sp., *Corylus ferox, Endospermum chinense* and *Sorbus cuspidata,* in addition to evergreen species, *Quercus* sp. and *Rhododendron* sp. Thus this trail was associated with more open canopy cover at certain times of the year (winter and early spring) and more ground cover. Trail 2 was at an elevation of 2,600 m throughout, while the trail 3 ranged from 3,000 m to 3,200 m. Both were more closely associated with evergreen tree species and thus with less open canopy cover, which was probably preferred by the birds for roosting and cover.

The peak vocalization period in SNP was observed in April, after which there was a sharp decline in the dawn chorus and only sporadic calls were heard in

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the latter half of May. This is in contrast to observations in central Nepal (Lelliot and Yonzon 1980, Picozzi 1986) where calling groups of Satyr Tragopan were recorded even in the latter half of May. SNP is located further east where the rains set in earlier, which may cause such a reduced calling period. A similar trend has been seen in Blyth's Tragopan *Tragopan blythii* in the Phwangpui National Park, Mizoram, India where the calling period lasted less than one month (D. Ghose 1997, unpublished) apparently because the rains set in even earlier than at Singhalila National Park. Therefore the most suitable months for assessing the relative abundance of Satyr Tragopans may vary according to the climate of the area to be surveyed. In Singhalila National Park the Satyr Tragopan was amongst the first birds to call in the morning. The main chorus lasted for about half an hour in April and this period may thus be used effectively to generate presence/absence and abundance information. Cloud cover, relative humidity and amount of dew show no effect on counts but they were severely affected by precipitation (Kimball 1949). In SNP thick fog and heavy rainfall affected the calling of Satyr Trogapan. Windy conditions like gales probably had more effect on the hearing capacity of the observers than calling, by distorting the intensity and direction of the calls. According to Kimball (1949) wind velocity below 8 miles per hour (12 km/h) has no effect on call counts of Common Pheasants *Phasianus colchicus*.

From habitat studies during the calling season it appeared that the Satyr Tragopan calls were associated with two types of microhabitat. The first type were areas with less cover at the tree and shrub level but with dense ground (herb) cover, which may be categorized as open areas. The second type were wooded areas with more tree and shrub cover and sparse ground (herb) cover. The birds generally advertise their presence in the pre-monsoon or breeding season through calls and display (Islam and Crawford 1996). Such activities appear to be more advantageous in open areas. Being a ground-dwelling species the herb layer probably forms a potential source of food for this species. The Satyr Tragopan began calling well before sunrise on all survey days and this may indicate that the first phase of their calling was from the vicinity of their roost sites. The roost sites of the species were thus represented by the wooded areas from where the birds probably move to other types of habitat as the morning progresses.

The Gairibans beat of the SNP, where the dawn call counts were conducted, contained six human settlements including cattle stations. The main threats to the pheasants in that area appear to be habitat destruction by lopping trees by locals for firewood collection, removal of bamboo for construction and other uses and grazing and browsing by cattle belonging to people living within the area or nearby. The results show that the birds called mostly from those areas that were further from any human presence, indicating that they avoided disturbance. Poaching cannot be ruled out, though no recent evidence has been obtained. We observed that the birds were very vulnerable to snares, especially during the breeding season as they could be easily located through their calls.

As experienced by other workers, such as Duke (1990) and Picozzi (1986), some difficulties were encountered while using the call count method:

1. Highly dissected topography made audibility, distance assessment and

judging the direction of calls difficult. More accurate estimation of the distance of the source of call was therefore impossible and thus an accurate estimation of the area surveyed was not possible.
2. Adverse weather conditions such as thick fog and rain affected calling behaviour, while high winds distorted the direction, distance and volume of the calls.
3. Females and subadults who may or may not call were probably not taken into account.
4. All calling groups that were heard appeared not to show adherence to fixed calling sites and appeared to shift their calling position each morning.
5. Birds were assumed to start calling from near their roosts, but may move as the morning progresses thus leading to possible overcounting.

Despite all these difficulties the dawn call count method serves as an appropriate way of assessing the abundance and establishing presence/absence status of Satyr Tragopan in any area. This method can be suitably applied in often difficult habitats occupied by Satyr Tragopans where flushing and visual counting are impossible. The dawn chorus is very pronounced and the number of calling groups can be easily counted. The method involves very little expense, expertise and time and there is practically no disturbance to the birds. It can be suitably used in short surveys of new areas because with little effort the presence/absence status of the species can be ascertained. If used over the years in previously surveyed areas then changes in abundance can be judged to establish population trends. To ensure that all birds around a census point are counted it is advisable to conduct the exercise for three or more consecutive days as not all birds call every morning. In highly dissected terrain the records of call counts would be more accurate if the distance between two census points is less than 600 m. By assuming that all calls are recorded from an area of fixed radius an approximate estimation of the survey area is possible that gives a density index for that area. However, this data should be treated with caution as extrapolation to absolute counts and densities may produce erroneous results for reasons discussed above.

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