# POPULATION STATUS AND DISTRIBUTION PATTERN OF INDIAN PEAFOWL (*PAVO CRISTATUS* LINNAEUS, 1758) IN CHILLA RANGE, RAJAJI NATIONAL PARK

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## Introduction

*Pavo cristatus* (Indian peafowl) is the national bird of India. It belongs to the family Phasianidae, order Galliformes (Ali and Ripley, 1989; Johnsgard, 1986). The distribution records indicate wide presence in sub-tropical, semi-arid environments, from Indus valley in the West through the foothills of the Himalayas and more abundantly in the "Terai" to Assam in the East, to southern tip of the peninsula and Sri Lanka (Ali and Ripley, 1989; Baker, 1930; Yasmin, 1994). The breeding season of peafowl coincides with the monsoon in most parts of India, but can vary and is reportedly early in the Himalayan foothills (Madge and McGowan, 2002; Lank *et al.*, 2002; Johnsingh and Murali, 1980).

The present study was carried out in Chilla Range (29°54' to 30°00'N lat. and 77°50' to 78°16'E long.) (Fig. 1) of Rajaji National Park, an ecologically fragile ecosystem in the Shivalik Himalayas (Johnsingh and Negi, 2003). Broadly, the forests of this region can be categorized as Northern Indian Moist Deciduous Forest and Northern Tropical Dry Deciduous Forest (Champion and Seth, 1968). The southern slopes bear miscellaneous forests, consisting of Sal (*Shorea robusta*) with other associates of *Mallotus philipensis* and *Ehretia laevis* (Edgaonkar, 1995). Apart from these, plantations patches of *Tectona grandis* and *Haplophragma adenophyllum* are found intermittently (Edgaonkar, 1995). The major mammalian fauna consists of Tiger (*Panthera tigris*), Leopard (*Panthera pardus*) and Elephant (*Elephas maximus*). Except the 'chaurs' (riverside grasslands) other grasslands in Chilla range are secondary in nature and are influenced by grazing by Gujjars' livestock (Edgaonkar, 1995). The Gujjar communities, who until recently lived inside the park with large livestock holdings comprising of mainly buffaloes (*Bubalus bubalis*). Their livestock were mostly fed by the lopped fodders of *Milletia extensa, Miliusa velutina, Anogeissus latifolia, Grewia elastica* etc. (Edgaonkar, 1995). This excessive lopping and overgrazing has degraded the site quality of the existing forests, which in turn, with repeated fires has led to lack of sustainable regeneration and the proliferation of weeds and sparse patches of grasses (Edgaonkar, 1995). These occupied anthropogenic patches will be referred to as Grasslands in this paper for easy understanding. During October 2003, the Forest Department of Uttarakhand undertook a resettlement process of Gujjars from Chilla Range and evacuation was accomplished by the end of year 2004. Village relocation

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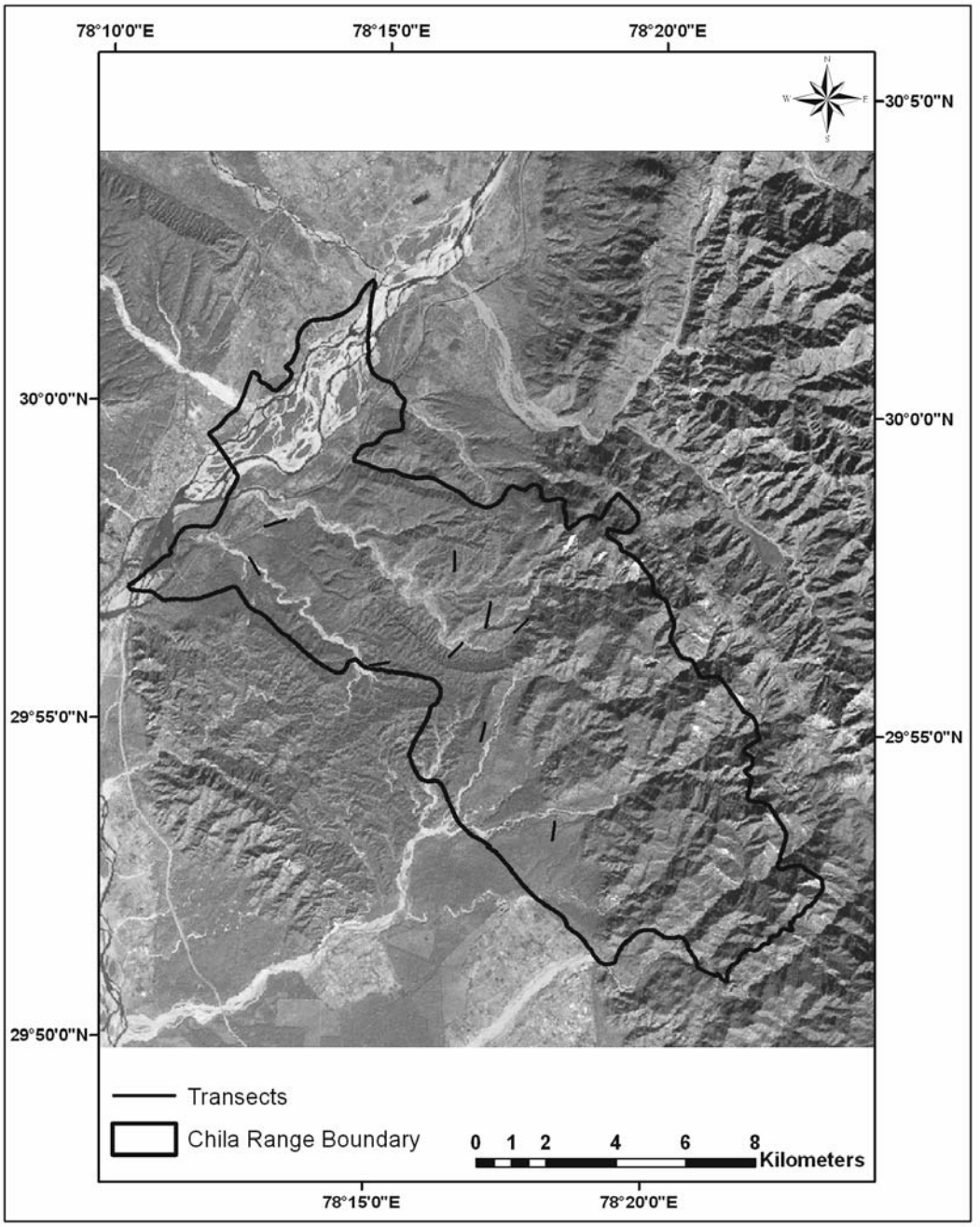
**Fig. 1**




Map of Rajaji National Park, showing the laid transects (nine) for peafowl survey

allowed habitat recovery along with ungulate abundance distribution and density in Chilla Range (Harihar, 2005; Kurien, 2005). In this connection, this study was carried out to investigate the after effect of habitat restoration on the Indian peafowl in the Rajaji National Park.

## Materials and Methods

Population status and distribution pattern of the Indian peafowl was studied from January to May 2006, that reported to be the peak breeding season for the species in the region (Ali and Ripley, 1989). A reconnaissance survey was carried out to identify the sampling sites covering different vegetation types and to assess the feasibility of the study using line transect technique (Burnham *et al.*, 1980). After the reconnaissance survey, Chilla range (Fig. 1) was divided into three blocks, i.e. Chilla (Block 1), Mundal (Block 2) and Khara (Block 3) based on different habitat types for the final survey. Three line transects (Burnham *et al.*, 1980) in each block were laid and birds were counted in both morning session (0500 - 0715 hrs), and in evening session (1630 - 1900 hrs), by a single observer. Small transect length of 600 m was chosen to maintain vegetation homogeneity within one vegetation type. The transects were covered through a total of six walks in the morning and six walks in the evening. On every walk, birds sighted, group size, sex, perpendicular sighting distance and time of sighting were recorded. Due to logistical constraints, more than two transects could not be placed on hilly terrains.

The line transects data were analysed using program DISTANCE 5.0 (Thomas *et al.,* 2005). Bird densities computed for different variables were arrived at by pooling the mean and variance estimates from each spatial replicate. To calculate the species densities from a line transect, each temporal replicate is treated as a separate effort and thus the variance is underestimated. We have used half normal/Cosine, half normal/Polynomial, Uniform/Cosine and Uniform/Polynomial models. However, the software has selected Half normal/Polynomial model (Buckland *et al.,* 1993, Laake *et al.,* 1993) over other models to estimate species density, encounter rate, detection probability, cluster size and other parameters.

## Results and Discussions

A total of 713 birds were recorded in 429 occasions during the data collection period. The peafowl density estimated for Chilla range of Rajaji National Park, during the study was, 88.24 birds per square kilometer (CV% 6.05, SE 5.34, Chi-p value 0.89, n = 426). While the males (Peacock estimation of the intensive study area) were 38.89 birds per square kilometer (CV% 9.16, SE 3.56, Chi-p value 0.98, n = 227), and peahen density was 48.72 birds per square kilometer (CV% 9.88, SE 4.81, Chi-p value 0.80, n = 203).

Male to female sex ratio of peafowl was estimated as 1:1.44, which is near similar sex ratio reported from other parts of northern India, in a sex ratio of 1:1.24 (Sharma, 1978), In the polygynous peafowl, harem-mating system was noticed as reported by Ali and Ripley (1989) but not by all adult males. Johnsingh and Murali (1980) noted a sex ratio favouring apparent females, but admitted that, they may have mistaken immature females as males, which probably affected their estimates. Perhaps only half of the females in a given

population are actually breeding birds, as some are too young and others are too old or otherwise unable to breed (Sharma, 1978).

In the study area, Chilla block had the highest density of peafowl (110.64 birds per square kilometer, CV% 6.77, SE 7.49, Chi-p value 0.91, n = 187), followed by Mundal block (64.58 birds per square kilometer, CV% 6.84, SE 4.42, Chi-p value 0.84, n = 192) and Khara block (26.68 birds per square kilometer, CV% 14.07, SE 3.75, Chi-p value 0.94, n = 46). Low density of peafowl in Khara block might have been related late relocation process in comparison to Mundal and Chilla blocks.

There were seven transects on plain terrain and only two on moderately undulating to hilly terrain. The estimated density of peafowls on plain terrain was 87.5 birds per square kilometer (CV% 7.55, SE 6.61, Chi-p value 0.89, n = 394) and on hilly transects 89.02 per square kilometer (CV% 9.66, SE 8.6, Chi-p value 0.99, n = 32). In both the terrains though there was a little difference in bird densities yet it can not be substantiated due to unequal and low sampling effort.

## Acknowledgements

This study forms a part of the long-term study on "Monitoring the changes in biological diversity after relocation of Gujjar communities in Rajaji-Corbett Conservation Area" of the Wildlife Institute of India. Grateful thanks are due to Director and Dean of the Wildlife Institute of India. Thanks are also due to Dean of the Forest Research Institute, Dehra Dun; and to Dr. K. Vasudevan, Dr. B. Pandav, Dr. B.S. Adhikari, Dr. V.P. Uniyal, Abishek Harihar, Dwaipayan Banerjee, Harikrishnan S., Imam and Dhumman, for their support during the study; Santanu Basu for preparing the GIS map and Tapajit Bhattacharya for inspiring him to do so. Our gratitude to Uttarakhand Forest Department for giving us the permission to work and stay inside the Rajaji National Park.

## SUMMARY

**A short-term study on population status and distribution pattern of Indian peafowl, *Pavo cristatus* during peak breeding season from January to May 2006 was conducted in Chilla range of Rajaji National Park. Nine line transects of 600 m in length were marked in different portions of the park. Each line transects were walked for six times in both morning and evening hours. The transect surveys recorded 713 birds in 429 observations. The overall density of 88.24 birds per square kilometre comprised female favoured population structure of 48.72 peahen per square kilometre to 38.89 peacock per square kilometer. In Chilla range of Rajaji National Park, peafowls preferred Chilla block area, followed by Mundal and Khara respectively. Low density of peafowl in Khara block might have been related late relocation process in comparison to Mundal and Chilla blocks. There was no significant differences found in the bird density distribution between plain terrain transects and moderately undulating terrain transects.**

***Key words*** **: Indian peafowl (*Pavo cristatus*), Population status, Distribution pattern, Chilla range, Rajaji National Park, Uttarakhand.**

## भारतीय मयुर (*पावो क्रिस्टेटस* लि०) की राजाजी राष्ट्रीय उपवन के चिल्ला परिक्षेत्र में संख्यागत स्थिति और उसकी वितरण रूपसज्जा

नवनील दास व के० शिवकुमार

**सारांश**

भारतीय मयूर, *पावो क्रिस्टेटस* की संख्या स्थिति और उसकी वितरण रूप सज्जा का एक अल्पकालिक अध्ययन राजाजी राष्ट्रीय उपवन के चिल्ला परिक्षेत्र में जनवरी से मई 2006 तक उसके शिखर प्रजनन काल में सम्पन्न किया गया। 600 मी० लम्बाई के नौ रेखीय संक्षेत्र उपवन के विविध भागों में चिह्नित किए गए। प्रत्येक रेखीय संक्षेत्र को प्रात और सायं काल दोनों समय 6 बार पैदल चलकर देखा गया। संक्षेत्र सर्वेक्षण के 429 पर्यवेक्षणों में 713 पक्षि आलेखित हुए। इनकी समग्र सघनता 88.24 पक्षि प्रति वर्ग किमी निकली जिसमें मोरनियों की संख्या संरचना 48.72 प्रति वर्ग किमी रही जबकि मोरो की संख्या 38.89 प्रति वर्ग किमी ही पाई गई। राजाजी राष्ट्रीय उपवन के चिल्ला परिक्षेत्र मे मोरों को पसन्द रहा जिसके बाद क्रमशः मुण्डाल और खारा परिक्षेत्र आते हैं। खारा परिक्षेत्र में मोरो की कम सघनता का संबंध मुण्डाल और चिल्ला खण्डों की तुलना में विलम्बित स्थान बनाने से हो सकता है। मैदानी भूभाग के संक्षेत्रों और मध्यम ऊंचे नीचे भूभाग में बनाए संक्षेत्रो की पक्षि सघनता वितरण में कोई खास अन्तर रहता नहीं पाया गया।

## References

Ali, S. and S.D. Ripley (1989). *The compact handbook of the birds of India and Pakistan.* Oxford University Press, Bombay.

Baker, E.C. (1930). *The fauna of British India* (2nd edn.). Vol. 5. Taylor & Francis, London.

Buckland, S.T., D.R. Anderson, K.P. Burnham and J.K. Laake (1993). *Distance Sampling: Estimating abundance of biological populations*. Chapman and Hall, New York.

Burnham, K.P., D.R. Anderson and J.L. Laake (1980). Estimation of density from line transect sampling of biological populations. *Wildlife Monogr.,* **72**: 1-202.

Champion, H.G. and S.K. Seth (1968). *A Revised Survey of the Forest Types of India*. Government of India Press, New Delhi, India.

Edgaonkar, A. (1995). *Utilisation of major fodder tree species with respect to the food habits of domestic buffaloes in Rajaji National Park, India.* M.Sc. Thesis, Wildlife Institute of India, Dehra Dun.

Harihar, A. (2005). *Population, food habits and prey densities of tiger in Chilla range, Rajaji National Park, Uttaranchal, India.* M.Sc. Thesis, Wildlife Institute of India, Dehra Dun.

IUCN (2006). *2006 IUCN Red List of Threatened Species.* http://www.iucnredlist.org/. Downloaded on 03 August 2007.

Johnsgard, P.A. (1986). *The Pheasants of the World*. Oxford University Press, New York.

Johnsingh, A.J.T. and S. Murali (1980). The ecology and behaviour of Indian peafowl *Pavo cristatus* Linn. of Injar. *J. Bombay Nat. Hist. Soc.,* **75**: 1069-1079.

Johnsingh, A.JT. and A.S. Negi (2003). Status of Tiger and Leopard in Rajaji–Corbett Conservation Unit, Northern India. *Biol. Conserv.,* **111**: 385-394.

Kurien, Amit J. (2005). Response of tiger (*Panthera tigris*), prey species and their habitat in relation to human disturbance in and around Chilla range of Rajaji National Park, Uttaranchal. *M.Sc. Thesis*, Wildlife Institute of India, Dehra Dun.

Laake, J.L., S.T. Buckland, D.R. Anderson and K.P. Burnham (1993). *DISTANCE user's guide, Version 2.0*. Colorado Cooperative Fish and Wildlife Research Unit, Colorado State University, Fort Collins, Colorado, USA.

Lank *et al*. (2002). High frequency polyandry in a lek mating system. *Oxford J. Behavioural Ecol.,* **13**: 209-215.

Madge, S. and P. McGowan (2002). *Pheasants, Partridges and Grouse*. A&C Black Publishers Ltd. pp. 341-342.

Sharma, I. K. (1978). Social and sexual behaviour of peafowl. *Environmental Awareness,* **1**: 169-171.

Thomas, L., J.L. Laake, S. Strindberg, F.F.C. Marques, S.T. Buckland, D.L. Borchers, D.R. Anderson, K.P. Burnham, S.L. Hedley, J.H. Pollard, J.R.B. Bishop and T.A. Marques [online] (2005). *Distance 5.0*. Release "x". Research Unit for Wildlife Population Assessment. University of St. Andrews. UK. http://www.ruwpa.st-and.ac.uk/distance/ (26 October 2006).

Yasmin, S. (1993/94). Characteristics of trees used for roosting by Blue peafowl in Aligarh District, India. *Annu. Rev. World Pheasant Assn.* pp. 57-63.