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IMPACT OF HUNTING ON POPULATION OF PHEASANTS IN THE WESTERN INDIAN HIMALAYAS

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ABSTRACT

The present study tested the hypothesis that "game species are lost when forest areas are subjected to hunting and populations of already threatened species may become locally extinct from many forests of the Western Indian Himalaya". The study was designed to determine effects of vegetation structure and heterogeneity, and behaviour of animal species on their encounters in hunted and protected sites. The compared forest patches are similar in abundance of trees, herbs, and shrubs. Animal densities allowed the investigator to determine whether higher densities of pheasants in the protected areas are simply due to protection efforts accorded within this zone. The study provides scientific evidence that hunting seriously impacts populations of hunted species. The results show that cheer pheasant (*Catreus wallichi*), kaleej pheasant (*Lophura leucomelanos*), koklass pheasant (*Pucrasia macrolopha*) and monal pheasant (*Lophophorus impejanus*) are seen more often in protected sites than in hunted sites. The locally common species are heavily impacted and at higher risk of local extinctions from forest patches in this landscape than the rare ones.

Keywords : Himalaya, Pheasant, Hunting and impact.

Introduction

Wildmeat harvesting is posing serious threats to survival of wildlife species populations worldwide (Diamond and Case, 1986; Robinson and Bennett, 2000; Barbusea, 2001; Peres and Palacios, 2007; Hilaluddin *et al.*, 2011 and 2012) and heads the list of factors causing global and regional extinctions (Martin and Steadman, 1999). Most efforts investigating impacts of wild animal extractions and their ecological consequences on native wildlife primarily focus on mammals and such information on other equally important animal groups remains fragmentary across the world, while specifically lacking for game birds (Hilaluddin and Kaul, 2007), in particular, across Asian Continent.

Certain top government wildlife officials (Pabla, 2006) are lobbying for regulated hunting of wild animals in India to generate conservation money, arguing that since poaching happens anyway, why not legalise it partially and make the money legtimate? However, if we are to gain the critical conservation benefits that sustainable harvesting programme can provide then we must explicitly recognize and incorporate into our calculations, costs as well as benefits that such exploitations may bring. Therefore, the present study is designed to investigate impact(s) of pheasant offtake on their wild populations in and around Chamba district of the Western Indian Himalaya.

Methods

Study area

Chamba district is located in Himachal Pradesh, falls within India's bio-geographic province "2B Western Himalaya" (Rodgers and Panwar, 1988) and forms part of "Western Himalaya Endemic Bird Area" (Satterfield *et al.*, 1998). Evergreen Temperate Pine Forests dominated by chir pine (*Pinus roxburgii*), Evergreen Temperate Oak Forests dominated by ban oak (*Quercus leucotrichophora*) and Mixed Evergreen Temperate Forests with extensive Southwest facing grasslands occur in Chamba (Champion and Seth, 1968). The associates of ban oak and chir pine are Rhododendron (*Rhododendron arboretum*), Deodar (*Cedrus deodara*), Himalayan blue pine (*Pinus wallichiana*), Yew (*Taxus baccata*), and Himalayan fir (*Abies pindrow*). The undergrowth is predominated by Barberry (*Berberis* sp.) and hybrid Berries (*Rubus* sp.) with some rose (*Rosa* sp.), Daphne (*Daphne* sp.), and Cape myrtle (*Myrsine* sp.). These vegetation communities in Chamba district support over 200 bird species (Hilaluddin, unpublished data), including restricted range Red-browed finch (*Callacanthis burtoni*) and globally threatened Cheer pheasant and Western tragopan (*Tragopan melanocephalus*) (Birdlife International, 2004).

Hunting occurs mostly outside PAs in the Western

> Hunting of game birds has deleterious impacts on their population including extinction of several species from many parts of Indian Western Himalaya.

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Indian Himalaya to provide supplementary protein to an otherwise vegetarian staple mainly targeting large mammals and galliformes (Kaul *et al.,* 2003, 2004). Effective community rules (restrictions on game extractions protecting sensitive and globally threatened species, breeding seasons, age-sex classes, bag limits) with regard to hunting are lacking and people are increasingly switching over to modern hunting devices (guns) at the cost of traditional ones. With methods varying from snaring to firearms three major types of hunting activities are prevalent: (1) Organized hunting targeting large bodied species with specific market; (2) regular snaring targeting galliformes in village vicinities, to provide food for family; (3) opportunistic hunting trips in forests for subsistence requirements.

Galliform census

Five forest fragments were studied in and adjoining Chamba town between 1410 and 3290 meters amsl during summer 2006. Forest fragments here are defined as continuous blocks of forests surrounded by agriculture fields and human settlements. In this study greatest distance between sites was <150 km and quantitative hunting pressures were not recorded. However, as an alternative, sites were selected from documented animal extraction rates and patterns in the forest fragments of Indian Western Himalayas in literature (Kaul *et al.,* 2003; Hilaluddin and Naqash, 2006) and focal discussions with hunters. These measures were used to define sites as "protected" and "hunted". The protected sites were located in Khajjayar-Kalatop and Kugti WLS; whereas, hunted sites were in Chamba and adjoining Kishtwar Territorial Forest Divisions (Hilaluddin *et al.*, 2011).

Pheasant populations were estimated using block transect (pre-defined areas) surveys following sample count strategy (Sutherland, 1996) identified on topographic maps after discussing with concerned wildlife officials and local hunters. For verification, these were re-identified on the ground during reconnaissance surveys and starting and ending points were permanently marked on trees with paint for future reference. Transect length was measured using Hip-Chain Method (Chaturvedi and Khanna, 1982). Covering all major vegetation types in two management units, transects were spaced at a minimum distance of 1 km at a site to avoid double counts. Generally, for visibility, streams and prominent trails were utilized as sampling areas not withstanding bias in estimating natural densities as unconscious bias exists in route selection if landscapes differ, even subtly. However, vegetation characteristics of hunted and protected forests measured as part of present study did not show statistically significant variations (Table-3). Thus, homogeneity in vegetation between hunted and protected sites will outweigh variations in animal densities, if any occur, as a consequence of landscape heterogeneity across two management units.

Each transect was scanned daily for pheasants, at least for three consecutive days following same census schedule. The animal counts in all transects within an area began simultaneously at sunrise and ended between 830 and 1000 hours depending upon transect length. Censuses involved walking slowly (approximately 1-1.5 km/ hour) and stopping briefly at every 50-100 m interval (Emmons, 1984) with the intention of flushing birds. A team of 5 observers trained in identifying galliformes with local names and walking transects scanned the 10-15 m area on both sides of the transect depending upon the terrain and visibility. Maintaining a fixed distance of 20-30 m from each other and silence for the calm of animals on transect, observers recorded total number of animals seen, sighting time, movement direction and activities in pilot surveys so that individuals evidently seen more than once by two different observers could be taken into account. Nawaz *et al.* (2000) used the Belt Drive Count method for estimating pheasant populations in Pakistan Himalaya in winter in extremely steep and rocky terrain covered with snow and recommended its use with some limitations for the western Himalayas. As suggested downward pilot surveys were conducted from top to bottom of hill. However, the study area hardly received snowfall during summer and had snow-free peaks during the course of the study.

Vegetation survey

The composition of trees, shrubs, and herbs within each belt transect was also assessed by selecting 5 sample points at 500 meters regular distances on 15 meters either side in order to avoid relatively disturbed vegetation due to trampling by cattle and humans. Circular plots (10 m radius) were established for estimating populations of trees (greater than 31 cm in basal girth) and shrubs (3 m radius), respectively; whereas, 1 m X 1 m square plots were established for quantifying populations of herbaceous vegetation. In addition, vegetation structure was also measured at each sample point. While Grid Mirror Method (Rodgers, 1991) was adopted to quantify canopy cover of tree species, Line Intercept Method and Crown Diameter Method (Muller-Dombois and Ellenberg, 1974) were used to estimate crown cover of herbs and shrubs, respectively.

Data analysis

Bird densities per unit area at a given day were calculated as the total number of individuals of a species

Table 1 : Pheasant species seen and number of observations recorded during Belt Transect Count sampling in the Western Indian Himalaya.

Species (Common name)	Scientific name	Number of observations
Cheer pheasant	*Catreus wallichi*	08
Kaleej pheasant	*Lophura leucomelanos*	23
Koklass pheasant	*Pucrasia macrolopha*	91
Monal pheasant	*Lophophorus impejanus*	28

seen on a particular transect on a particular day divided by the total area of that block. A non-parametric Man-Whitney U test was used to compare densities of each animal species in protected sites with their corresponding densities in the hunted sites to investigate impact(s) of hunting on their populations.

It was assumed, there might be differences in the vegetation characteristic between hunted and protected sites independent of hunting pressure, although all of the patches were once part of the same continuous forest and are of the same geological origin. Therefore, vegetation structural and compositional heterogeneity between hunted and protected sites was statistically compared using Man-Whitney U test. Vegetation densities of plant bio-morphs viz. trees, shrubs and herbs at each sampled point were calculated following Curtis and McItonish (1950). The general diversities (H') of bio-morphs were computed in accordance with Shannon-Wiener (1963), whereas species richness was calculated as total number of a species occurring in a sample unit (Ludwig and Reynolds, 1988). All statistical tests were performed in following Sokal and Rohlf (1995).

Results

Sample size and survey efforts

A total of 16 belt transects - 8 each in protected and hunted sites (Hilaluddin *et al.*, 2011) were actively scanned for pheasants. During 3 consecutive day census period, the census party traveled a total of 212.1 km (108 km in the protected site; 104.1 km in the hunted site) in 157.48 hours (77.11 hours in the protected site; 80.37 hours in the hunted site). All species were observed on more than 5 occasions (Table 1), ranging from 8 for cheer pheasant to 91 for koklass pheasant. The survey teams spent a mean of 9.65 hours/transect 0.69 CI in hunted site and an average of 10.01 hours/transect 0.88 CI in protected site actively searching pheasant.

Vegetation structure and composition

With the exception of statistically significant higher shrub densities in protected sites as compared to hunted ones, the vegetation characteristics between the two management units showed statistically non-significant differences (Table-2), although densities, diversities, richness and covers of trees, shrubs, and herbs were generally higher in protected site.

Animal abundance

The comparisons showed differences in game bird densities between hunted and protected sites (Table 3). In general, pheasants were more often seen in protected site than hunted one. Koklass pheasant and Kaleej pheasant have shown statistically significant variations in their densities between hunted and protected sites. The densities of cheer pheasant and monal pheasant did not show significant difference. Kaleej pheasant, monal pheasant, koklass pheasant and cheer pheasant are 77%, 62%, 49% and 20%, respectively, less common in hunted sites when compared to protected sites.

Discussion

Two types of sources of variations might affect animal abundance among different forest patches. First, vegetation structure and compositional heterogeneity, which independent of hunting, may cause changes in

Table 2 : Vegetation characteristics (mean median) with statistical variations in hunted and protected sites.

Plant bio-morph type	Vegetation structural and compositional variables	Hunted site	Protected site	Statistical values	
				Mann-Whitney U test	P
Tree	Density (# of plants/km^2)	307.4 ± 238.8	332.8 ± 302.54	U_{78} = 721.5	0.45
	Diversity (H')	0.6 ± 0.56	0.6 ± 0.56	U_{78} = 797.5	0.98
	Richness (N_0)	2.3 ± 2.0	2.3 ± 2.5	U_{78} = 765.5	0.73
	Tree cover (%)	36.0 ± 30.0	30.1 ± 30	U_{78} = 731.0	0.5
Shrub	Density (# of plants/km^2)	2226.4 ± 1783.45	4024.5 ± 2547.8	U_{78} = 570.5	0.03*
	Diversity (H')	0.5 ± 0.5	0.7 ± 0.68	U_{78} = 664.5	0.19
	Richness (N_0)	2.2 ± 2.0	2.9 ± 2.9	U_{78} = 663.0	0.18
	Shrub cover (%)	29.7 ± 25.0	24.1 ± 20.0	U_{78} = 730.0	0.5
Herb	Density (# of plants/km^2)	35540 ± 30500	39582 ± 32200	U_{78} = 751.5	0.64
	Diversity (H')	1.01 ± 1.01	1.3 ± 1.21	U_{78} = 603.5	0.06
	Richness (N_0)	4.6 ± 4.0	4.8 ± 4.0	U_{78} = 672.0	0.21
	Herb cover (%)	37.65 ± 30.0	31.3 ± 20.0	U_{78} = 735.0	0.53

* Denotes significant values. (Table reproduced from Hilaluddin *et al.*, 2011).

Table 3 : Pheasant densities (mean median) with statistical variations in hunted and protected sites in the Western Indian Himalaya.

Species	Number of animals/km^2			Statistical values	
	Hunted site	Protected site	Overall	Mann-Whitney U test	P
Cheer pheasant	1.2 ± 0	1.5 ± 0	1.4 ± 0 (0)	U_{14} = 29.0	0.6
Kaleej pheasant	1.2 ± 1.6	5.2 ± 4.2	3.6 ± 3.2 (0)	U_{14} = 4.0	0.003*
Koklass pheasant	4.7 ± 4.2	9.3 ± 5.4	6.1 ± 5.2 (0)	U_{14} = 8.0	0.01*
Monal pheasant	1.3 ± 0	3.5 ± 2.9	2.4 ± 0 (0)	U_{14} = 18.0	0.1

*Denotes significant values. Values in parentheses depicted in column 4 are quartiles.

species abundance between the two sites. Second, hunting affects the behaviour of animals and makes hunted species difficult to sight than non-hunted ones. Animals in the protected site may be less wary and, therefore, easier to sight than the same species in hunted site (Hill *et al.,* 1997). Comparisons of vegetation characteristics in hunted and protected sites showed that hunting pressures within the two forest types were independent of vegetation structure and composition as there is little detectable difference between the two units, at least on the basis of the vegetation heterogeneity measured as part of this study (Hilaluddin *et al.,* 2011). Moreover, the studied forest fragments were once part of the same continuous forest, and are of the same geological origin. Further, it was quite unlikely to miss animals in narrow strips as taken in this study during the census which was akin to a combing operation. Thus, animal densities between two management units are unlikely to be affected due to changed animal behaviour (more wary in protected site). However, the densities reported of certain species (e.g. cheer pheasant) here cannot be relied on for absolute comparisons with other sites, given the lack of control for differences in detectability. Such species are experts in hiding quietly without being spotted. This factor remained uniform across all transects and, therefore, made possible viable comparisons of bird abundances between two management units.

Thus, it could be concluded that hunting is resulting in decline of pheasant in this landscape of the world, severely reducing the abundances of kaleej and koklass pheasant but with insignificant impact on the densities of monal pheasant. Compound effect of population statistics at 0.7 hectare per capita (Anon., 2000), deforestation due to logging (FSI, 2005), adoption of modern hunting devices and a community devoid of hunting regulations (Kaul *et al.,* 2003) has increased the protein demand in this landscape and seems to exacerbate the hunting impact. This accentuated by logging, agriculture, and road network expansion may result in local extinctions of certain game species from several un-protected forest areas such as that of Western tragopan from the hunted forest of Kiri Beat under Lower Chamba Range - one of the survey sites.

The present study has demonstrated the impact of game bird hunting on their wild populations in the Indian Western Himalaya. It, however, remains unclear how hunting is affecting the population dynamics of game species. Further, no information exists on population age structures and demographics of hunted versus protected sites, impact of hunting on game birds of different age classes, and impact of hunting on vegetation characteristics and demographics of plant populations in hunted versus protected sites from Asia, in general, and India in particular. These require immediate investigations.

Further, vertebrate animal harvesting theory suggests that a given level of harvest is more likely to be sustainable for a species with 'faster' life history, early maturity and high reproductive rate (Stokes *et al.,* 1993; Kirkwood *et al.,* 1994; Pope *et al*., 2001). Species response to over-exploitation is similar to that of other anthropogenic threats. Sustainable harvesting acts as selective agent of extinction, unless care is taken to make it otherwise (Law, 2001); large slow species are expected to adapt to the new mortality regime by evolving smaller bodies and faster life histories. Either way some of the character diversity – an important aspect of biodiversity (Williams and Humphries, 1996) is lost. It is probable that all significant use has biodiversity survival costs. Therefore, we must look for socially acceptable, economically equitable and morally agreeable ways of minimizing hunting pressures on wild animals and there is no escape from investing sustainably in their explicit protection.

Plant species encountered in the four recovering plots are given in Table 1. while the consolidated details are given in Table 2. Altogether 216 species belonging 64 families and 58 genera were collected from the four plots. Number of tree species was recorded in each individual plot ranged from 23 to 50 with a total number of 58 species. Shrub species in the four plots ranged from 37 to 45 and the pooled number was 56. Similarly, the total number of herbaceous plants encountered in the recovery vegetation was 89. Plot 1 contained the highest number of plants in all categories while plot 2 showed the lowest number of plants. Maximum diversity of trees was found in plot 4 whereas the lowest was observed in plot 2. The pooled data of herbaceous species, shrubs, trees and climbers were recorded as 89, 56, 58, and 12 respectively.

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पश्चिमी भारतीय हिमालयों में चकोर (फीजैण्ट) की आबादी पर शिकार का प्रभाव

हिलालुद्दीन, राशीद नकेश और नईम अख्तर

सारांश

वर्तमान अध्ययन में इस परिकल्पना का परीक्षण किया गया कि ''आखेट प्रजाति तब लुप्त हो जाती हैं जब वन क्षेत्र में शिकार होता है और पहले से संकटस्थ प्रजातियों की आबादियां पश्चिमी भारतीय हिमालय के कई वनों से स्थानीय रूप से समाप्त हो सकती है।'' इस अध्ययन को वनस्पति संरचना और विजातीयता के प्रभाव और आखेटित एवं संरक्षित स्थलों में इनकी भिड़न्त पर पशु प्रजातियों के व्यवहार का निर्धारण करने के लिए अभिकल्पिक किया गया। तुलना किए गए वन खण्ड वृक्षों, शाकों और झाड़ियों की प्रचुरता में समान थे। पशु घनत्वों में अन्वेषकों को यह निर्धारित करने हेतु अक्षम बनाया कि क्या संरक्षित क्षेत्रों में चकोरों के उच्च घनत्व केवल इस क्षेत्र के भीतर उपलब्ध कराए गए सुरक्षा प्रयासों के कारण हैं। अध्ययन वैज्ञानिक प्रमाण उपलब्ध कराता है कि शिकार आखेटित प्रजातियों की आबादियों पर गंभीर प्रभाव डालता है। परिणाम दर्शाते हैं कि चीर फीजेण्ट (*केट्रीयत वालिचि*), कलीज फीजेण्ट (*लोफूरा ल्यूकोमीलेनॉस*), कोकलास फीजेण्ट (*पूक्रेसिया मैक्रोलोफा*)और मोनाल फीजेण्ट (*लोफोफोरस इम्पीजेनस*) आखेटित स्थलों की अपेक्षा संरक्षित स्थलों में प्रायः दिखाई पड़ते है। स्थानीय रूप से सामान्य प्रजातियां दुर्लभ की अपेक्षा इस भू–दृश्य में वन खण्डों से स्थानीय विलोपन के उच्च जोखिम पर हैं और अत्यधिक प्रभावित हैं।

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