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MONITORING PHEASANTS (*Phasianidae*) IN THE WESTERN HIMALAYAS TO MEASURE THE IMPACT OF HYDRO-ELECTRIC PROJECTS

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ABSTRACT

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In this study, we monitored pheasants abundance to measure the impact of a hydro-electric development project. The pheasants abundance was monitored using "call count" and line transect methods during breeding seasons in 2009-2011. Three call count stations and 3 transects were laid with varying levels of anthropogenic disturbance. To understand how the hydro power project could effect the pheasant population in the Jiwa Valley, we monitored it under two conditions; in the presence of hydro-electric project (HEP) construction and when human activity significantly declined. The Koklass Pheasant (*Pucrasia macrolopha*), Cheer Pheasant (*Catreus wallichi*) and Western Tragopan (*Tragopan melanocephalus*) were not recorded in Manjhan Adit in 2009. During 2010 and 2011 springs, the construction activity was temporarily discontinued in Manjhan Adit. The pheasants responded positively to this and their abundance increased near disturbed sites (Manjhan Adit). The strong response of pheasants to anthropogenic disturbance has ecological application and thus can be used by wildlife management in the habitat quality monitoring in the Himalayan Mountains.

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Key words: call count, anthropogenic disturbance, pheasant, monitoring, hydro-electric project

INTRODUCTION

Birds have been used extensively in environment and habitat quality monitoring. The family *Phasianidae* is sensitive to human exploitation (Fuller and Garson 2000, Nawaz *et al*. 2000). These birds are used as the barometer for the success and failure of wildlife conservation (McGowan *et al*. 2009). They capture the complexities of the

ecosystem and yet remain simple enough to be easily and routinely monitored. They remain confined to their particular habitat and usually inhabit relatively pristine and undisturbed area having understory vegetation (Ramesh 2003). Literature available on pheasants reveal that species such as the Himalayan Monal (*Lophophorus impejanus*), Koklass Pheasant (*Pucrasia macrolopha*), Cheer Pheasant (*Catreus wallichi*) and Western Tragopan (*Tragopan melanocephalus)* have strong preference for their habitat and even little change in their habitat may affect them. Grazing pressure has negative impact on pheasants abundance (Bhattacharya *et al*. 2007). Their sensitiveness is one of the reasons for their dwindling population.

Hydro power development has gained momentum in past few decades in the Indian Himalayan Region. The Indian Himalayas are a source of many perennial rivers. These rivers have been exploited extensively for harnessing hydro power. Indian government is planning to set up a number of hydro power projects in the Himalayas to meet its ever increasing energy requirements. Central Electricity Authority (CEA) formulated a Preliminary Feasibility Reports of 162 new hydro-electric schemes (47 930 MW). It is a matter of concern, because out of 162 schemes, 133 are in the Indian Himalayan Region (CEA 2009). These hydro projects often lie close to protected forests *e.g*. the Parvati Hydro Power Project is constructed near the Great Himalayan National Park. The presence of endemic and threatened bird species such as the Western Tragopan and Cheer Pheasant make this site important from a conservation point of view (BirdLife International 2001). The construction activities are likely to create disturbance in the adjoining regions of protected forests. Here, disturbance has been defined as "any relatively discrete event in time that disrupts ecosystem, community, or population structure and changes resources, substrate availability, or the physical environment" (White and Pickett 1985).

Koklass Pheasants and Himalayan Monals are usually found in oak and deodar, oak and pine or rhododendron forests (Ali and Ripley 1983). The first species is found in denser understory than the latter one (Gaston *et al*. 1983), but they are sometimes found feeding together in early spring (Gaston *et al*. 1981). The Cheer Pheasant inhabits precipitous hill sides or ravines covered with tall grass, scrub and oak forest (Kazmierczak 2009).

Pheasants are elusive birds and found in a difficult mountain terrain, which make them difficult to monitor using line transect (Ramesh 2003). Call counts of some pheasants, such as the Western Tragopan, Cheer and Koklass Pheasants, can be used in such cases. Counting the calls can give a useful index of the relative abundances of different populations in different areas (Severinghaus 1979, Gaston 1980, Duke 1990, McGowan 1990). We used this to monitor population of pheasants in a given area. We examined the following questions: (1) Does the pheasants abundance increases along a gradient of increasing disturbance (from forest to disturbed habitat types)? (2) Which species among pheasants responds the strongest to the habitat disturbance? This study will help the wildlife managers to better understand and monitor pheasant population in the Himalayan Mountains.

METHODS

Study area

The study area lies in the Jiwa Valley, encompassing Ecodevelopment Protected Area and the Great Himalayan National Park (GHNP). The site is situated in the North-Western Himalayas in the Kullu district of Himachal Pradesh, about 45 km to the south-east of Kullu. Its latitude and longitude are 31°49'20"-31°50'13"N and 77°20'24"-77°22'32"E, respectively (Fig. 1). The sites are situated on the Jiwa Nal, which originates from Khande Dhar (5445 m a.s.l.) at 4020 m. It traverses a distance of about 30 km in W-SW direction flowing through a very narrow valley with deep gorges before joining the Sainj Khad near Suind (1344 m a.s.l.) . It has a catchment area of 120 km^2 at the proposed trench weir site near village Manjhan (CISMHE 2000).

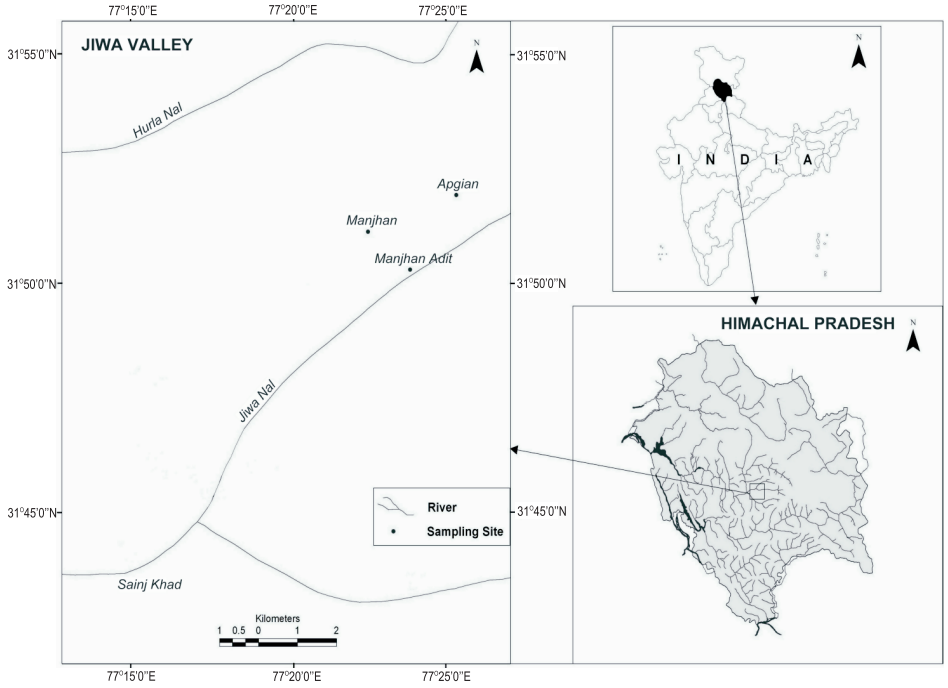

Fig. 1. Location of the study area

There are abundant semi-tropical forest vegetation including large tracts of dense pine woods, deciduous rhododendrons and ever green oaks, fir and spruce forests, *etc*. in addition to large mountain meadows and pastures. The area is a rich biodiversity zone of the Western Himalayas. The GHNP falls within one of the globally important Endemic Bird Areas (EBA 128: Western Himalayas) identified by the ICBP (now BirdLife International) Biodiversity Project (BirdLife International 2011). A total of

183 bird species including 51 non-passerines and 132 passerines have been recorded in this area. This accounts for 72% of non-passerines and 88% of passerines recorded in elevations above 1500 m in the rest of India. Moreover, the Great Himalayan National Park is under review to be included in the UNESCO's World Heritage List (UNESCO 2011).

Sampling design

We sampled three sites along the increasing habitat disturbance. The gradient was defined by land use. Manjhan Adit was identified as a disturbed site because of the the Parvati Hydro-Electric Project (PHEP). Village Manjhan is situated 3 km away from Manjhan Adit. The village was selected as one of the sampling sites because it is one of the best places for monitoring pheasant abundance in the Jiwa Valley. The GHNP has a hut near village Manjhan, which provides another advantage to stay in this area for a longer time. We selected another sampling site in Apgian, which is 7 km away from village Manjhan. It is located inside the GHNP and represents pristine habitat. The two sites lie within the Ecodevelopment Zone and the National Hydro Power Corporation Ltd. (NHPC) has been constructing trench weir canal near village Manjhan (CISMHE 2000). Thus, the study area was identified as an ideal location to evaluate human impacts on the pheasants abundance. We compared the pheasants abundance estimates between Apgian and Manjhan sites with that of Manjhan Adit.

Data collection

We travelled a total of 10 km track, starting from Manjhan Adit site to Apgian site, to conduct the presence/absence mapping for pheasants in April. Details such as the name, exact location and altitude range and general forest type was recorded using Magellan GPS. There were identified suitable call stations to be used for monitoring pheasant abundance.

We sampled three call stations three times a month in the spring season (with a total of 12 counts for each station). We conducted counts of the Koklass Pheasant, Western Tragopan and Cheer Pheasant from call stations, which were fixed circular areas with 300 m listening radii. This technique involved positioning observers at predetermined points across the study area. The observers plotted the apparent position of all calling individuals on a data-recording sheet. This protocol has been used in many studies on Himalayan pheasants (*e.g.* Garson 1983, Duke 1990, Khaling *et al.* 1998, Miller 2010). This gives an index of calling males per station in an area. Each trail contained one or two stations positioned 500 m apart to avoid listening overlap between observers. We sampled one call station each morning, with one observer measuring one station. To avoid sampling bias only one observer counted the calls and transect walk. In the morning of sampling, we positioned observers at the stations 15 minutes before first light to minimize disturbance to the pheasants (arrival time ranged from 5.30 *a.m.* in early April to 4.15 *a.m.* by late May and 6.00 *a.m.* in October and November due to seasonal light shift). We began sampling at the first audible call and ended one hour after sunrise, which is determined to be the most effective period for measuring both the Koklass Pheasant and Western Tragopan

(Ramesh 2003, Miller *et al.* 2008). Each call was recorded with respect to species, time, distance and cardinal direction. After sampling, observers compared the time and direction of calls to eliminate multiple accounts of the same birds from different stations, and no sampling occurred in adverse weather such as thick fog, heavy rainfall or strong winds, because these conditions alter normal pheasant activity and/or obscure the observers' ability to accurately measure bird presence (Khaling *et al.* 2002).

We sampled the Himalayan Monal with transect walks because this species is easily visible along trails but calls only sporadically throughout the day (Kaul and Shakya 2001). We carried out opportunistic survey with the help of GHNP staff to identify sampling sites in the Jiwa Valley. We interviewed local villagers and forest guards to get information regarding pheasant habitats. In each sampling sites, we laid transect. As it was difficult to lay transect on steep slopes we used pre-existing footpath of 1 km length in each sampling site for monitoring the Himalayan Monals abundance. We walked thrice a month on each transect with an average speed of 1 km/h. We walked transects in the mornings before 10.00 *a.m.*, when Himalayan Monals forage on the ground around their roosting sites (Ramesh 2003). This timing allowed us to sample abundance in habitat that is critical for pheasant survival. Sampling in the morning additionally lowered the chances that villagers and tourists would flush birds, as these people occasionally traversed the trails. For each encounter of a Himalayan Monal, we recorded data on sex, sighting angle, sighting distance, time and location. Walking pace was standardized to reduce irregularities in sampling effort and abundance estimates.

The samples collected were small in number because it was difficult to identify and establish calling stations on rugged and steep slopes of the Jiwa Valley. So we have used pre-existing huts of GHNP as calling station in the present study. Moreover, pheasants breed in spring season, which last only for two months so this restricted us to April and May only.

Since November 2009, adit construction was ceased in Manjhan Adit due to contract related dispute. This resulted into a reduction in anthropogenic disturbance in the adit site. We used this as an opportunity to investigate if the disturbance in the Jiwa Valley was because of the hydro-electric project. So we monitored pheasants abundance in both Manjhan and Manjhan Adit in spring 2010.

Data analysis

We calculated the mean encounter rate by dividing the number of birds observed by the total number of call count stations or transect walks.

We have classified the sites based on the land use type. Apgian and Manjhan was classified as "forest sites" using detailed topographic map (1 : 50 000), while Manjhan Adit was identified as a "disturbed site" due to the PHEP activity.

The data set was entered into PAST v. 2.05 and analysis was carried out using this statistical software.

RESULTS

Presence/absence survey

In presence/absence survey we recorded five species of pheasants: Himalayan Monal, Koklass Pheasant, Cheer Pheasant, Western Tragopan and Kalij Pheasant (*Lophura leucomelanos*). The Western Tragopan and Cheer Pheasant, which are threatened and endemic species of the Western Himalayas, were recorded in Apgian and Manjhan.

Pheasants abundances in the Jiwa Valley

In 2010, the Himalayan Monals mean abundance in Apgian was 2.7 ± 0.21 (*SE*) indiv./count, which was slightly less than in Manjhan – 2.8 ± 0.40. The mean abundance of calling male Koklass Pheasants in Apgian was recorded as 3.5 ± 0.22, while 4.3 ± 0.33 in Manjhan. The Western Tragopan was recorded only in Apgian with the mean abundance of 2.5 ± 0.42. The mean abundance of Cheer Pheasants in Apgian was 0.3 ± 0.21, while in Manjhan it was as high as 3.0 ± 0.36 (Table 1).

Table 1
Breeding season abundance of pheasants in the Jiwa valley, Himachal Pradesh, India (2009-2011)

Himalayan Monal (*Lophophorus impejanus*)							
	Apgian		Manjhan		Manjhan Adit		
No. of replicates	2010	2011	2010	2011	2009	2010	2011
1	3	3	2	1	0	2	0
2	3	3	2	1	0	2	0
3	2	2	3	3	1	2	0
4	3	2	4	1	0	3	0
5	3	3	2	1	0	4	1
6	2	3	4	3	0	4	1
Mean	2.7	2.7	2.8	1.7	0.2	2.8	0.3
SE	0.21	0.21	0.40	0.42	0.16	0.40	0.21
Koklass Pheasant (*Pucrasia macrolopha*) – calling males							
	Apgian		Manjhan		Manjhan Adit		
No. of replicates	2010	2011	2010	2011	2009	2010	2011
1	4	4	6	4	0	4	3
2	3	4	4	4	0	3	3
3	4	3	4	6	0	3	2
4	4	3	4	5	0	4	2
5	3	4	4	5	0	3	3
6	3	4	4	6	0	3	3
Mean	3.5	3.7	4.3	5.0	0	3.3	2.7
SE	0.22	0.21	0.33	0.36	0	0.21	0.21

Western Tragopan (*Tragopan melanocephalus*) – calling males							
	Apgian		Manjhan		Manjhan Adit		
No. of replicates	2010	2011	2010	2011	2009	2010	2011
1	4	3	0	2	0	0	0
2	2	3	0	2	0	0	0
3	3	2	0	1	0	0	0
4	2	3	0	1	0	0	0
5	3	3	0	1	0	0	0
6	1	3	0	1	0	0	0
Mean	2.5	2.8	0	1.3	0	0	0
SE	0.42	0.16	0	0.21	0	0	0
Cheer Pheasant (*Catreus wallichii*) – calling males							
	Apgian		Manjhan		Manjhan Adit		
No. of replicates	2010	2011	2010	2011	2009	2010	2011
1	1	0	2	4	0	0	0
2	0	0	2	4	0	0	0
3	0	0	3	0	0	1	0
4	1	0	4	0	0	1	0
5	0	0	4	0	0	1	0
6	0	0	3	0	0	0	0
Mean	0.3	0	3.0	1.3	0	0.5	0
SE	0.21	0	0.36	0.84	0	0.22	0

In 2011, in Apgian the Himalayan Monals abundance remained unchanged. In Manjhan, we recorded the lower number of Himalayan Monals (as compared to the previous year) with the mean abundance of 1.7 ± 0.42. The Koklass Pheasants mean abundance in Apgian was 3.7 ± 0.21, while 5.0 ± 0.36 in Manjhan. The Western Tragopans mean abundance in Apgian was 2.8 ± 0.16, which was slightly higher than in 2010. In Manjhan, we recorded calls of Western Tragopans with the mean abundance of 1.3 ± 0.21. We did not record Cheer Pheasants in Apgian while in Manjhan their mean abundance was 1.3 ± 0.84, which was less than in the previous year (Table 1).

Abundance of pheasants in the disturbed site

The pheasants were not recorded at Manjhan Adit site during 2009 (except for one individual of the Himalayan Monal), but the number of pheasants increased in 2010-2011 (Table 1). The cessation of hydro-electric development activities since 2009 made the conditions favourable for the birds. The mean abundance of Koklass Pheasants increased from 0 to 3.3 ± 0.21 (*SE*) in 2010 and 2.7 ± 0.21 in 2011. For the Himalayan Monal we also recorded a sharp rise in abundance from 0.2 ± 0.16 to 2.8 ± 0.40, which further declined to 0.3 ± 0.21.

We did not record the Western Tragopan and Cheer Pheasant in Manjhan Adit, except for 2010, when we did record the calls of Cheer Pheasants with the mean abundance of 0.5 ± 0.22 (Table 1).

DISCUSSION

Monitoring of Himalayan pheasants in the Jiwa Valley has revealed that this valley supports sizeable population of *Phasianidae*. The Western Tragopan, a flagship species, was confined to undisturbed forest sites (Apgian and Manjhan). The presence of this species in the interior of forest suggests that this species is sensitive to human presence. Discussion with local shepherds and local people revealed that in the past they had heard calls of Western Tragopans and other pheasants also from disturbed sites. Thus, other locations are also suitable for the Western Tragopan but anthropogenic activities make them unfavourable for survival. The species descends down below 1500 m a.s.l. during winter season (Kazmierczak 2009), but the human presence in lower altitudes makes it restricted to a higher range, which may result in higher mortality during winter. During 2011, Western Tragopans were heard from Manjhan calling station, which implied that the decrease in disturbance in the areas adjoining Manjhan Adit had made this site suitable for this species. The Cheer Pheasant is another endemic and threatened species recorded in the Jiwa valley. Manjhan supports relatively higher number of Cheer Pheasants as compared to other sites. The presence of secondary vegetation, *i.e.* grassy mountain slopes along with the moderate level of human disturbance, such as farming and grazing in upland rural areas are the preferred habitats for the Cheer Pheasant. Koklass Pheasants and Himalayan Monals were abundant both in Manjhan and Apgian. These species remain confined to the tree line and were not reported below the altitude of 2500 m a.s.l. They had responded negatively to hydro-electric project activity and were not recorded in 2009 (except for one individual of the Himalayan Monal), but their abundance increased in 2010-2011. During our study the PHEP construction activity was halted due to some contract related disputes since November 2009, which caused reduction in human disturbance and thus attracted some of the pheasants around Manjhan Adit. This implies that pheasants are sensitive to intense human activity. Moreover, the susceptibility to noise exposure is relatively higher in *Phasianidae* compared to *Passeriformes* (Ryals *et al.* 1999), thus they avoid places where noise levels are high. Blasting, labour colonies and project vehicles keep this site disturbed.

The territorial behaviour of the Koklass Pheasant and Western Tragopan is very predominant during breeding season. It is known that the size of territory is directly related to the size of birds (Schoener 1968). As pheasants are comparatively large, they need more space to defend. The congregation of pheasants in adjacent region would increase competition among males for food, sex and space, which can reduce the fitness of males.

Blasting probably disturbs the territorial behaviour of pheasants to a great extent. Blasting sounds were heard during their crowing time in both seasons and both the Koklass and Cheer Pheasants calls were not reported after blasting. The males call loudly during spring season to demarcate their territories, warn rivals and attract females. Thus, blasting should be banned at least during early morning of breeding period (CISMHE 2000).

There is a need of comprehensive long term monitoring of *Phasianidae* in the GHNP and eco-development zone by the GHNP staff. More emphasis should be put on protecting habitats of the Cheer Pheasant and Western Tragopan, as these are very important species from a conservation point of view. Their habitats are fragmented in the Western Himalayas and need special protection. The recovery of pheasants during 2010-2011 springs in Manjhan Adit showed that the PHEP activity had displaced the pheasants during 2009. So due to our finding, we suggest that large scale development activity poses a serious threat to the existence of pheasants in the Western Himalayas.

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