Survey of Western Tragopan, Koklass Pheasant, and Himalayan Monal populations in the Great Himalayan National Park, Himachal Pradesh, India

John Corder, World Pheasant Association.

Fig. 1. Himalayan Monal *Lophophorus impejanus.*

Jennifer R. B. Miller

Miller, J. R. B. 2010. Survey of Western Tragopan, Koklass Pheasant, and Himalayan Monal populations in the Great Himalayan National Park, Himachal Pradesh, India. *Indian BIRDS* 6 (3): XXX–XXX.

Jennifer R. B. Miller[1], Yale School of Forestry & Environmental Studies, 195 Prospect Street, New Haven Connecticut 06511, USA. Email: *jennifer.miller@yale.edu*

Surveys conducted in the late 1990's indicated that pheasant populations in the Great Himalayan National Park, Himachal Pradesh, India were declining. In 1999, the government legally notified the park and authorities began enforcing the Indian Wildlife (Protection) Act, banning biomass extraction within park boundaries and reducing human disturbance. Populations of three pheasant species (Western Tragopan, Koklass Pheasant and Himalayan Monal) were subsequently surveyed in the park during the breeding season (April–May) in 2008. Call counts and line transects were used to assess current abundances and gather more information on the characteristics of these species in the wild. Relative abundances of all three species were significantly higher than in previous surveys. Tragopan males began their breeding calls in late April and continued through May whereas Koklass males called consistently throughout the study period. The daily peak calling periods of the two species overlapped, but Tragopan males began calling earlier in the morning than Koklass males. Monals were most often sighted alone or in pairs and larger groups tended to have equal sex composition or a slightly higher number of females than males. This survey contributes to our understanding of the behaviors of these species in the wild and provides a preliminary indication that populations in the Great Himalayan National Park may be recovering from decline.

Methods

Pheasants play a valuable role as bio-indicators because of their vulnerability to human exploitation, sensitivity to habitat degradation, and central position in the food web (Fuller & Garson 2000). The colorful plumages and charismatic breeding displays of pheasants have made them prominent figures in traditional folklore and conservation campaigns, as well as—cultural icons appreciated by both native people, and the mainstream public (Kumar *et al*. 1997; Nawz & Malik 2000). Despite this, much is unknown about pheasant population biology and behavior in the wild because the dense forest and steep terrain of their habitats make them difficult to observe. More information on the birds' ecology is needed to aid protected area managers in forming comprehensive conservation plans that accurately prioritize the needs of wild populations threatened by poaching and habitat degradation. To this end, I report here on the abundances, behavior, and natural history of the Western Tragopan, Koklass Pheasant, and Himalayan Monal that I observed during the breeding season of 2008 in the Great Himalayan National Park (GHNP), India.

The Western Tragopan *Tragopan melanocephalus* (Cover) Koklass Pheasant *Pucrasia macrolopha* **(Fig. 6)**, and Himalayan Monal *Lophophorus impejanus* **(Fig. 1)** are three species that have not been extensively studied in their natural habitats. The Western Tragopan is listed as "Vulnerable" by the IUCN and on Schedule I of the Indian Wildlife (Protection) Act of 1972. It is a

1 Address at time of research: Wildlife Institute of India, Post Bag #18, Chandrabani, Dehradun, Uttarakhand, India 248001.

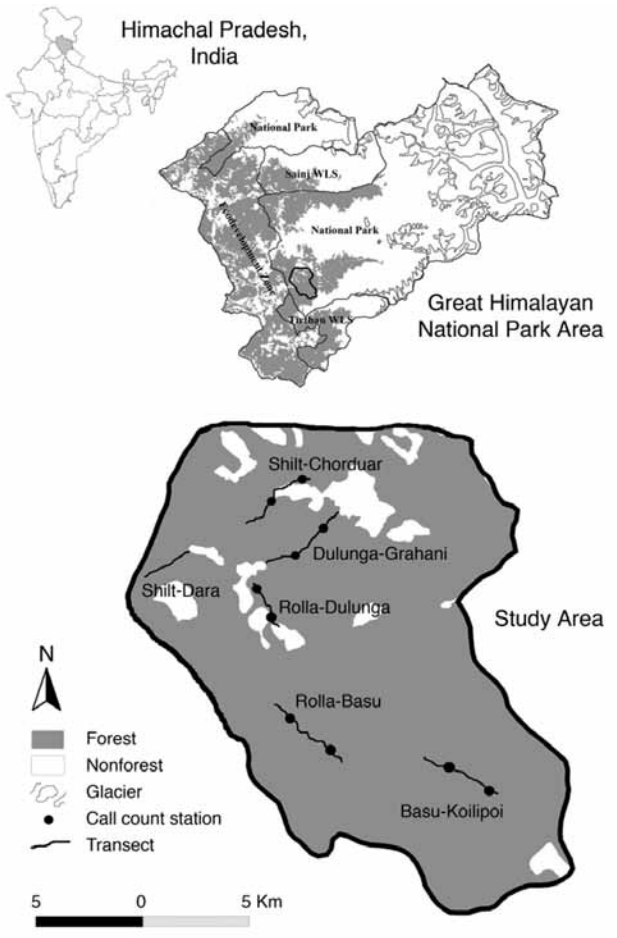
favorite among birdwatchers because of the male's brilliant red neck, colorful throat lappet, and bizarre courtship behaviors. The Western Tragopan is distributed in the western Himalaya between Hazara, Pakistan and the Bhagirathi River in Uttarakhand, India. The birds live in broadleaf and coniferous forests with thick undergrowth and bamboo at elevations of 2,400–3,600 m (Delacour 1977; Grimmett *et al.* 1998). The Koklass Pheasant is a surreptitious bird notorious for eluding observers as it skulks in the dense undergrowth and bamboo of temperate broadleaf, conifer and sub-alpine oak forests at 2,100–3,300 m in elevation. The bird ranges through Afghanistan, Pakistan, India, China, and Nepal and likely has a relatively large global population size (BirdLife International 2009). The Himalayan Monal is one of the most well recognized pheasant species of the western Himalaya because of the male's metallic, rainbow-colored plumage and iridescent blue head crest. The bird has been incorporated into the traditional folklore of many Himalayan cultures (Delacour 1977). For example, men in the Indian state of Himachal Pradesh hunted males for their crests, which adorned the men's ceremonial hats as a sign of high status, although this pressure subsided after hunting was banned in Himachal Pradesh in 1982 (Kumar *et al.* 1997; Ramesh 2003). The species is distributed through the mountainous regions of Afghanistan, Pakistan, India, China (Tibet region), Nepal, and Bhutan in temperate conifer and oak forests scattered with open grassy slopes, cliffs, and alpine meadows at elevations of 2,400–4,500 m (Delacour 1977).

The high altitudes, treacherous terrain and harsh winter climate of the Himalayan habitats make these pheasants largely inaccessible to field researchers but have also protected the birds from many of the anthropogenic pressures encountered by more accessible avian species. Nonetheless, in the late 1990s populations of the Western Tragopan, Koklass Pheasant, and Himalayan Monal were found to be declining due to human disturbance (Wildlife Institute of India 1999; Ramesh 2005). In 1999, when the park received final notification as a national protected area, the GHNP authorities implemented the Indian Wildlife (Protection) Act, banning the extraction of biomass from within the boundaries (Pandey & Wells 1997; Chhatre & Saberwal 2005, 2006). The new management laws substantially reduced the number of villagers entering the park to gather non-timber forest products, poach wildlife, and graze domestic livestock (Pandey 2008; J. R. B. Miller *pers. obs.*). It was believed that the decrease in human disturbance would enable pheasant and other wildlife populations to recover from decline.

A decade after the park's notification, I conducted a survey to assess whether or not the new management is attaining its conservation goals for pheasant species. The survey was conducted to obtain estimates of population abundance for the Western Tragopan, Koklass Pheasant, and Himalayan Monal, and to gather additional information on the species in their natural environment. The study was carried out from early April to late May of 2008, when all three species breed and the pheasants are most audibly and visibly apparent. Methodology followed the techniques used by Ramesh (2005) for the survey of these species conducted in the late 1990s to enable comparison between results. Relative abundance was sampled within a small area of the Tirthan Valley **(Fig. 2)**, an area that encompasses several vegetation types (including broadleaf, conifer, and oak forests) over an altitudinal gradient of 1,890–3,710 m with previously recorded populations of all three study species (Ramesh 2005). The study area is within close proximity of several villages and contains a system of footpaths maintained by the GHNP authorities that were frequently utilized by villagers prior to 1999 to collect non-timber forest products, and graze livestock. Since notification, human disturbance in the park has shifted primarily to tourist-related activities that are restricted to footpaths and campsites.

Population abundances were measured according to standard census techniques recommended for Himalayan pheasant species (Gaston 1980; Ramesh 2005). Call counts were employed to sample the Western Tragopan and Koklass Pheasant since the males of these species regularly emit distinct calls at dawn. In contrast, the Himalayan Monal does not call consistently during the morning but readily and conspicuously flushes from its perch, enabling the use of line transects for

Fig. 2. The study area was located in the southern-most valley (Tirthan Valley) of the Great Himalayan National Park (GHNP). The GHNP encompasses 754.4 km² and is bordered by the Sainj Wildlife Sanctuary of 90.0 km², Tirthan Wildlife Sanctuary of 61.0 km², and the Eco-development Zone of 265.6 km², forming a total protected area of 1,171.0 km².



sampling. Nine call count stations and six transects were surveyed twice per month during April and May, generating four replicates of each sampling unit. Due to the rough terrain and dense forest, sampling units were laid along existing footpaths between camp areas and situated to represent a single vegetation type so that a variety of habitats and altitudes used by the pheasants were sampled in the full survey **(Table 1)**. One transect and two call count stations were placed along each footpath except for Shilt–Dara, which contained only one call count station. Because pheasant activity and observer perception are affected by adverse weather (Gaston 1980; Khaling *et al*. 2002), factors such as wind intensity, precipitation, cloud cover, and temperature were noted for each call count and transect. No sampling conducted in thick fog, heavy rainfall, or strong winds.

Table 1. Characteristics of sampling units. Each footpath contains one transect and two call count stations except for Shilt–Dara, which contained only one transect.

Footpath	Distance (km)	Dominant forest type	Elevation (m)
Rolla–Dulunga	1.0	Broadleaf	2,290–2,640
Dulunga–Grahani	1.0	Mixed broadleaf and conifer	2,700–2,770
Shilt–Chorduar	1.2	Mixed broadleaf and conifer	2,900–2,920
Shilt–Dara	0.7	Sub-alpine oak	2,900–3,010
Rolla–Basu	1.0	Conifer	2,420–2,655
Basu–Koilipoi	1.0	Conifer	2,710–2,870

Fig. 3. Male Himalayan Monal ***Lophophorus impejanus***

Dhritiman Mukherjee

Two call counts were conducted at dawn on each morning of sampling, with one observer measuring from each station. A call count station consisted of a designated circular area with a 300 m listening radius, and one or two stations were positioned along each transect approximately 500 m apart to avoid sampling overlap. Observers arrived at the stations at least 15 min before first light to minimize disturbance to the birds and sampled from the first audible Tragopan or Koklass call until one hour after sunrise. For each call, the observer recorded species, time, distance, and cardinal direction, and later compared this information with the other observer to avoid multiple accounts of the same bird from different stations. Transects were walked in the mornings before 1000 hrs in order to flush Monals before they descended to the ground to forage (Ramesh 2003). Each bird or group was recorded with respect to sex, sighting distance, sighting angle, time, and GPS location. Transects were walked at a standardized pace to prevent bias in sampling effort. Species encounter rates were calculated for each replicate as the number of birds per station (call counts) or kilometers (transects), and the arithmetic mean for each station or transect was pooled to find the mean encounter rate over the study area. ANOVA and *t*-tests were calculated using the Excel 2004 Analysis Toolpak (Version 11.5.3 for Mac) to test for statistical differences between encounter rates in different forest types and elevations ranges for the species.

Results

Population abundance: I recorded 32 Western Tragopans, 295 Koklass Pheasants, and 115 Himalayan Monals during the sampling period. Western Tragopan was encountered least frequently and had an overall abundance of 3.2 ± 1.4 birds/station. Habitat preferences were consistent with scientific literature, with significantly more birds in broadleaf and conifer forests and at higher altitudes. Twice as many Tragopans were observed in mixed broadleaf and conifer forests than in pure conifer forests [$t(2)=0.77$, $p<0.05$; **Fig. 2A**]. Encounter rates were significantly different between elevation ranges [$F(2, 3)=12.7$, $p=0.03$; Fig. 2B], and birds were heard in approximately equal frequencies at elevations above 2,700 m.

The Koklass Pheasant was the most abundant species and observed at a rate of 10.9 ± 2.9 birds/station. Individuals were equally abundant among forest types and elevation ranges [$F(3, 4)=0.05$, $p>0.05$; $F(2, 3)=0.04$, $p>0.05$; **Fig. 2**].

The Himalayan Monal was encountered at a rate of 6.1 ± 3.0 birds/km. ANOVA tests indicated that differences in abundances across forest types and elevation ranges were not significant [$F(3, 4)=1.35$, $p>0.05$; $F(2, 3)=1.56$, $p>0.05$]; **Fig. 2**).

Daily calling schedule: Tragopan males began calling in the third week of April and the number of calling birds steadily increased until sampling ended in late May.

Koklass males were heard calling consistently throughout the study period. Seventy-three percent of the total Tragopan males heard calling were observed in May compared to only 27% in April **(Fig. 3),** indicating that the Tragopan breeding season in GHNP begins in April and extends into May, and likely continues into June. In contrast, 54% of Koklass male

Fig. 2. Encounter rate with respect to forest type (A) and elevation range (B). Encounter rates are measured in birds/station for the Western Tragopan and Koklass Pheasant and birds/km for the Himalayan Monal. Y-bars indicate standard deviation.

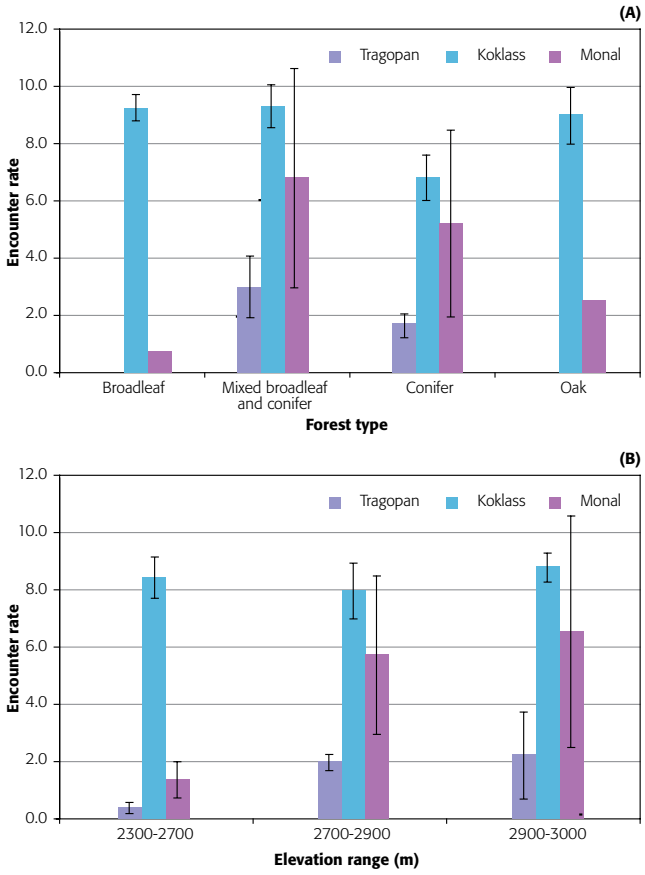
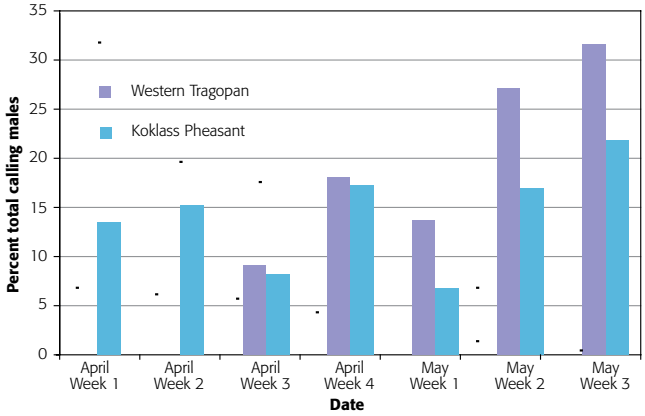


Fig. 3. Percentage of total calling males observed over the study period with respect to call count stations where species were heard.

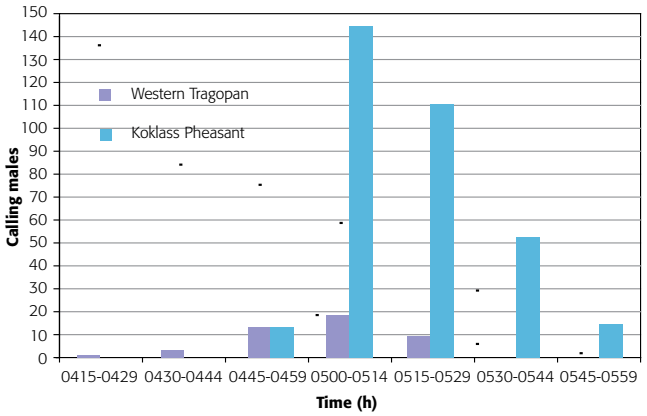


calls were heard in April, and 46% in May. Our study may have caught the population during the core of its breeding season but Koklass Pheasants are known to call year-round, and more data is necessary to determine how calling changes during the breeding season (Gaston 1980).

Tragopans began calling as early as 0415 hrs. Their calls gradually increased, with a peak at 0500–0514 hrs, and they stopped calling by 0529 hrs **(Fig. 4)**. Koklass males displayed a

reversed schedule, with males first calling at 0445 hrs followed by a sudden peak at 0500–0514 hrs, and a steady decline until the end of the sampling period at 0559 hrs. Both species called for 75 min of the sampled time period, with 45 min of calls overlapping, and a simultaneous peak in calling at 0500–0514 hrs. The displaced call timing is previously unreported in scientific literature but would be worth exploring as an adaptation to avoid direct species competition.

Fig. 4. Morning call schedule for the Western Tragopan, and Koklass Pheasant, with respect to the sampling period.



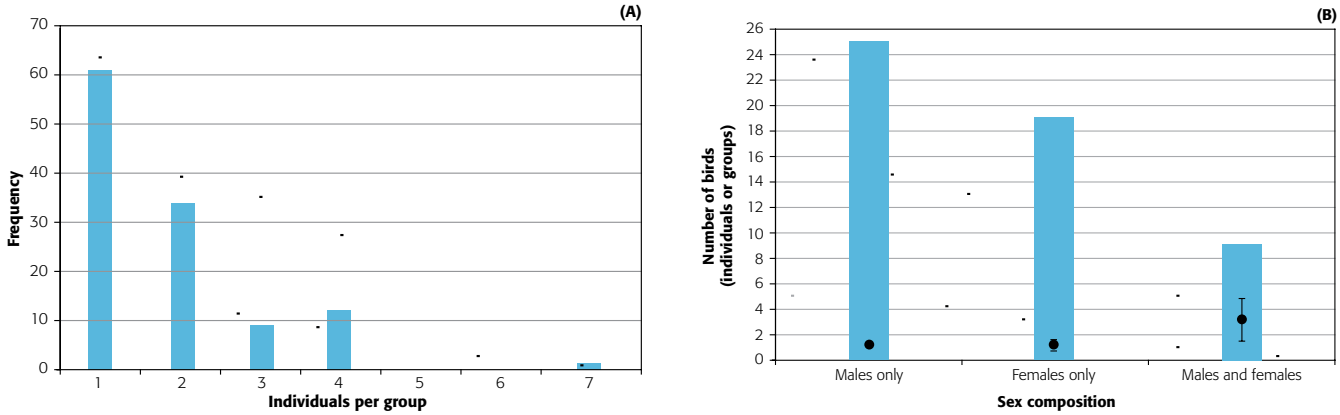
Group size & sex composition: The Himalayan Monal was most often sighted alone or in pairs. The average group size was 1.8 ± 2.1 individuals, but groups were observed with as many as seven individuals **(Fig. 5A)**. Individuals were most frequently seen alone and approximately an equal number of single males and females were observed in total, considering the relatively small sample size (n=25 and n=20, respectively; **Fig. 5B**). Groups for which sex could be accurately identified contained either equal proportions of males and females (n=7) or had one more female than the number of males (n=2).

Discussion

Relative abundances obtained in this survey suggest that populations of the Western Tragopan, Koklass Pheasant, and Himalayan Monal have grown since surveyed in the late 1990s. Encounter rates collected by Ramesh (2005) in the GHNP during spring 1998 using the same sampling units and techniques were significantly lower for the Western Tragopan by 3.0 birds/station, the Koklass Pheasant by 7.7 birds/station, and the Himalayan Monal by 3.9 birds/station. An earlier survey conducted in 1980 by the Himachal Wildlife Project recorded approximate abundances of 8.0 birds/km for the Himalayan Monals, and 10.0 birds/station for the Koklass Pheasant; the abundance of the Western Tragopan was not quantified (Gaston *et al*. 1981). At this time (1980), poaching, livestock grazing, and human disturbance were unregulated, yet abundances were remarkably close to the 2008 results. In the 1980s, rapidly growing international commercial markets generated a demand for the morel mushroom *Morchella esculenta* from the GHNP region, motivating many locals to enter the forest during spring to harvest mushrooms and potentially disrupting pheasant breeding (Tucker 1997; Ramesh 2003). It is tempting to view the three surveys as a timeline of pheasant decline and subsequent recovery but differences in survey methodologies between the 1980, 1998, and 2008 studies (the latter two followed identical study designs), as well as unknown natural fluctuations in population size (Watson *et al*. 1994; Williams *et al*. 2003), make direct comparison unwise, and conducive to erroneous interpretation. At best, we can use the 1980s' survey to indicate historical presence and utilize the more recent studies from the late 1990s and 2008 as baseline data for future monitoring.

Besides abundance, the behavioral observations from the survey provide new insight into species biology in the wild. The displaced call timing of the Western Tragopan and Koklass Pheasant is a phenomenon that has not yet been reported to the scientific community but may be demonstrative of co-adaptation. The two species compete with one another for auditory space since they occupy overlapping habitats, breed during April and May (and likely June), and call at dawn to attract mates. Males that can be heard clearly have greater fitness because they more easily attract females and establish territories (Islam & Crawford 1996). The birds in the GHNP may have shifted their call schedules as a strategy to maximize the audibility of each species' males, thus increasing their chances of being heard amongst a cacophony of calls. More research is required to compare call timings in other regions where the two species coexist as well as live apart.

Fig. 5. Group characteristics observed in Himalayan Monal. (A) Distribution of group size. (B) Sex composition of groups. Columns represent the number of groups with the designated sex composition, and points represent the mean group size. Y-bars indicate standard deviation.



Group size statistics for the Himalayan Monal differed from previously published literature. Ramesh (2003) observed groups with no more than four individuals during the breeding season, whereas I observed as many as seven individuals sitting together. However, the mean group size was consistent with previous surveys. The survey confirmed that males do not appear to maintain harems or territories because more than one adult male was present in most groups.

A formalized monitoring program would be useful to systematically continue survey efforts on pheasants in the GHNP. By executing call counts and line transects with meticulous consistency, researchers can avoid infusing data with observer's bias and obtain relative abundances that accurately reflect differences between years. This survey, in combination with the surveys from the late 1990s, provides a valuable baseline against which future abundances could be assessed in a constructive manner that informs conservation management. In addition to monitoring, experimental investigations are needed to explore ecological relationships between human presence and pheasant breeding in order to shed more light on the interplay between human activities and bird reproduction and recruitment. Only one Western Tragopan has been radio-collared in the GHNP to date (Ramesh 2003), and this type of continuous data collection from the wild would illuminate important aspects of pheasant ecology such as activity patterns, social structure, and reproduction behaviors. This survey contributes some new information on the abundances and characteristics of the Western Tragopan, Koklass Pheasant, and Himalayan Monal and hopefully will encourage further study of these magnificent species.

Acknowledgements

Research was funded and supported by a U.S. Fulbright Scholarship, the Wildlife Institute of India, and the Himachal Pradesh Forest Department. I thank Pritam Singh and Dani Rami for their dedication in the field, and the families of Kharongcha for their hospitality. I appreciate K. Ramesh and G. S. Rawat for their guidance during my research and feedback on this paper. I am grateful to O. Schmitz, D. Halwar, and several anonymous reviewers for contributing to the preparation of this manuscript.

References

BirdLife International. 2009. *Pucrasia macrolopha*. In: IUCN. IUCN Red List of Threatened Species. Version 2010.1. URL: http://www.iucnredlist.org.

Chhatre, A., & Saberwal, V., 2005. Political incentives for biodiversity conservation. *Conservation Biology* 19: 310–317.

Chhatre, A., & Saberwal, V., 2006. Democracy, development and (Re-) visions of nature: rural conflicts in the western Himalayas. *Journal of Peasant Studies* 33: 678–706.

Delacour, J., 1977. *The Pheasants of the World*. UK: Spur Publications & World Pheasant Association.

Fuller, R. A., & Garson, P. J., (Eds.). 2000. *Pheasants: status survey and conservation action plan 2000-2004*. Cambridge, UK: IUCN Publications Services Unit.

Gaston, A. J., 1980. Census techniques for Himalayan pheasants including notes on individual species. *Journal of the World Pheasant Association* 5: 40–53.

Gaston, A. J., Hunter, M. L., & Garson, P. J., (Eds). 1981. *The wildlife of Himachal Pradesh, western Himalaya*. Report of the Himachal Wildlife Project 1981. Technical notes No. 82. P. 159. Orono, Maine: School of Forest Resources, University of Maine.

Grimmett R., Inskipp, C., & Inskipp, T., 1998. *Birds of the Indian Subcontinent*. Delhi, India: Oxford University Press.

Islam, K., & Crawford, J. A., 1996. A comparison of four vocalizations of the genus *Tragopan* (Aves, Phasianidae). *Ethology* 102: 481–494.

Khaling, S., Kaul, R., & Saha, G. K., 2002. Calling behavior and its significance in Satyr tragopan, *Tragopan satyra* (Galliformes: Phasianidae) in the Singhalila National Park, Darjeeling. *Proceedings of the Zoological Society (Calcutta, India)* 55: 1–9.

Kumar, S. R., Rawat, G. S., & Sathyakumar, S., 1997. Winter habitat use by Himalayan monal (*Lophophorus impejanus*) in Kedarnath Wildlife Sanctuary, Western Himalaya. *J. Bombay Nat. Hist. Soc.* 103: 49–56.

Nawaz, R., Garson, P. J., & Malik, M., 2000. Monitoring pheasant populations in montage forests: some lessons learnt from the Pakistan Galliformes Project. Pp. 196–209. *In*: World Pheasant Association, Galliformes 2000: Proceedings of the 2nd International Galliformes Symposium. World Pheasant Association, Reading, United Kingdom. Downloaded from: *http://www.palasvalley.org/reports/paper1.pdf.*

Pandey, S., 2008. Linking ecodevelopment and biodiversity conservation at the Great Himalayan National Park, India: lessons learned. *Biodiversity Conservation* 17: 1543–1571.

Pandey, S., & Wells, M. P., 1997. Ecodevelopment planning at India's Great Himalayan National Park for biodiversity conservation and participatory rural development. *Biodiversity Conservation* 6: 1277–1292.

Ramesh, K., 2003. *An ecological study on pheasants of the Great Himalayan National Park, western Himalaya*. Dissertation, Wildlife Institute of India, Dehradun, India.

Ramesh, K., Sathyakumar, S., & Rawat, G. S., 2005. Recent trends in the pheasant population in Great Himalayan National Park, western Himalaya: conservation implications. Pp. 40–43. *In*: Wildlife Conservation, Research and Management RR-05/001. Jhala, Y. V., Chellam, R., & Qureshi, Q., (Eds.). Dehradun, India: Wildlife Institute of India.

Tucker, R., 1997. *The historical development of human impacts on the Great Himalayan National Park*. Dehradun, India: Winrock International & Wildlife Institute of India.

Watson, A., Moss, R., Parr, R., & Mountford, M., 1994. Kin landownership, diffferential aggression between kin and non-kin, and population fluctuations in red grouse. *J. Animal Ecol.* 63: 39–50.

Wildlife Institute of India. 1999. *An ecological study of the conservation of biodiversity and biotic pressures in the Great Himalayan National Park Conservation Area—an ecodevelopment approach*. Dehradun, India: Wildlife Institute of India.

Williams, C. K., Ives, A. R., & Applegate, R. D., 2003. Population dynamics across geographical ranges: time-series analyses of three small game species. *Ecology* 84: 2654–2667.

Fig. 6. Captive Koklass Pheasant *Pucrasia macrolopha*.

John Corder, World Pheasant Association.