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Cover: Green Sea Turtle *Chelonia mydas* watercolour by Elakshi Mahika Molur.



Population status and habitat use of White-crested Kalij Pheasant *Lophura leucomelanos hamiltoni* (J.E. Gray, 1829) in the Limber Wildlife Sanctuary, Jammu & Kashmir, India

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Abstract: Understanding the population status and habitat use of a species is fundamental for initiating conservation action. The present study was conducted from March 2021 to February 2022 to assess the population status and habitat use of White-crested Kalij Pheasant *Lophura leucomelanos hamiltoni* in the Limber Wildlife Sanctuary. Line transects/trails ($n = 7$) were established across all the habitat types. A total of 45 direct sightings of the bird were recorded in the study area. The highest abundance was recorded in autumn (2.25 ± 0.53 birds/km) and the lowest in spring (0.22 ± 0.53 birds/km). Flock size ranged from one individual to nine individuals. Of the different habitat types identified, most sightings occurred in coniferous forests with high understory ($n = 16$). The agricultural terracings ($n = 6$) and grassy slopes ($n = 2$) exhibited the fewest sightings. Recognizing and mapping these habitats are fundamental initial measures for conserving the species within the landscape.

Keywords: Abundance, coniferous forests, conservation, encounter rate, habitat preference, line transect, western Himalaya.

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Author contributions: ANL: data collection, data analysis and manuscript writing. BAB: helped in study design, data collection and reviewed the manuscript. KA: helped in study design and reviewed the manuscript.

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INTRODUCTION

The Kalij Pheasant belongs to a group of pheasants commonly known as the *Gallopheasants*. Nine morphologically distinct and geographically separate subspecies of Kalij Pheasant have so far been described in the world (Johnsgard 1999). These subspecies are native to southern Asia, distributed from Pakistan in the western Himalaya through India, Nepal, Bhutan, and Burma to western Thailand, and lately introduced into the United States (McGowan & Panchen 1994; BirdLife International 2016). The Kalij Pheasant exhibits conspicuous sexual dimorphism, with males brightly colored and larger in size than females, which are highly cryptic and often blend with the background (Zeng et al. 2016).

In India, four subspecies of Kalij Pheasant are known to occur, which inhabit almost all types of forests with a thick understory of shrubs (Grimmet et al. 2016). The species is primarily found on the western side of the Himalayan mountains (Barnes 1981), generally adapted to sedentary lifestyles and occurring along foothills, woodland roads, forest clearings, and bushy ravines (Bump & Bohl 1971; Ali & Ripley 1983). The subspecies White-crested Kalij Pheasant *Lophura leucomelanos hamiltonii* is found in the western Himalaya (Jammu & Kashmir) and has been reported to occupy a variety of habitat types, including primary forests through scrubs and thickets, agricultural terracings from foothills to 2,400 m elevations, and having direct contact with human habitations (Bisht et al. 2002; Sathyakumar et al. 2010).

Density and abundance are essential in monitoring the population of a species, which in turn is fundamental for devising a proper conservation strategy (Conroy & Noon 1996). Nevertheless, estimating the abundance and densities of pheasants is often cumbersome owing to their shy nature and inhabiting tough habitats (Sathyakumar & Kaul 2007; Miller 2010). Although listed as 'Least Concern', the Kalij Pheasant faces a declining population trend (BirdLife International 2021), and scanty scientific information exists about the population status, behavior, and habitat ecology of the Kalij Pheasant (Andleeb et al. 2012).

Considering the ongoing threats in the form of hunting and habitat degradation and with the recent declaration of the White-crested Kalij Pheasant (hereafter Kalij Pheasant) as the Union Territory (UT) bird of Jammu & Kashmir, the species deserves more conservation priority. No prior information, however, is available about the basic ecology of the species in the

UT of Jammu & Kashmir. In this paper, the population status and habitat use of Kalij Pheasant in Limber Wildlife Sanctuary were assessed, for these represent the pioneering steps before any comprehensive management action is undertaken for the survival of a species (McGowan & Gillman 1997).

MATERIAL AND METHODS

Study area

The Limber Wildlife Sanctuary (LWS) (34.153–34.208 °N & 74.138–74.194 °E) lies in the district Baramulla of Jammu & Kashmir and is situated on the north bank of river Jhelum, at a distance of 75 km from the capital Srinagar (Image 1). The sanctuary falls within the western Himalayan zone and spans over an area of 26 km² (Ahmad et al. 2017). The altitude of the area varies 1,500–2,500 m. The sanctuary represents one of the three protected areas from which the Kazinag National Park has been carved out to conserve one of the largest wild goats in the World, the Pir Panjal markhor *Capra falconeri cashmirensis* (Bhatnagar et al. 2009).

The LWS represents a prototype of temperate conditions. The landscape of the sanctuary is rough, with moderate to steep slopes and undulating terrain. The vegetation is mainly mixed coniferous chiefly dominated by Blue Pine *Pinus wallichiana* and Deodar *Cedrus deodara* at lower to middle elevations. The streams and brooks are dotted with Walnut *Juglans regia*, Indian horse chestnut *Aesculus indica*, and Cranberry *Viburnum grandiflorum*. The notable fauna of the sanctuary includes Common Leopard *Panthera pardus*, Himalayan Goral *Naemorhedus goral*, Black Bear *Ursus thibetanus*, Yellow-throated Marten *Martes flavigula*, Western Tragopan *Tragopan melanocephalus*, and Cheer Pheasant *Catreus wallichii*. The area witnesses four discrete seasons; spring (March–May), summer (June–August), autumn (September–November), and winter (December–February). The precipitation mainly pours down as rain during summers and as snow during winters. The winters are severe and cold with temperatures plunging as low as -10°C.

Methods

The line transect method, widely used in wildlife ecology for bird sampling, offers fair estimates of population density and abundance, particularly for Galliformes (Azhar 2008). This study, conducted from March 2021 to February 2022 followed Miller's (2010) line approach, which is deemed most appropriate for

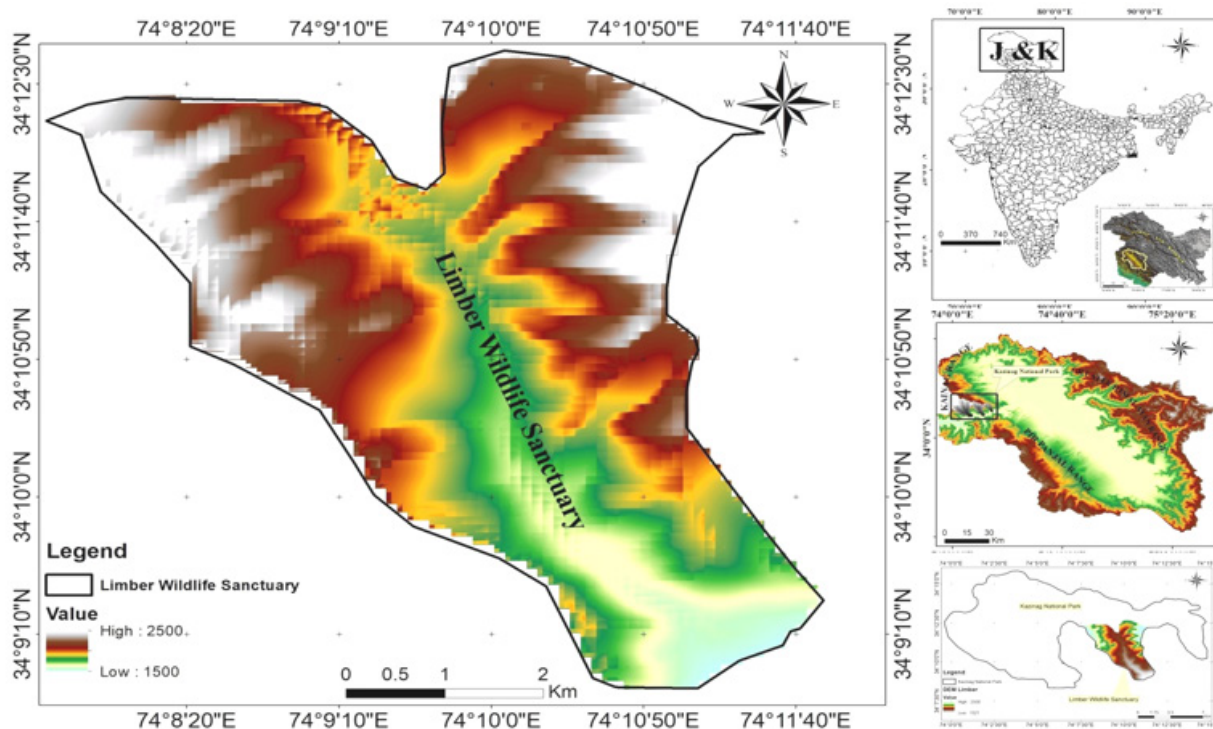


Image 1. Location map of the study area.

the pheasant survey. Seven transects of varying lengths (0.8–2 km), covering a total of 130 km and spanning altitudinal gradients from 1,500 to 2,500 m, were strategically selected across different habitats. Visits occurred seasonally and transects were walked in the early morning (0500–0900 h) and evening (1700–1900 h), aligning with the pheasants’ active feeding near roosting sites (Ramesh 2003). Morning data was exclusively used for analysis, assuming animals stayed near their resting sites during this time (Ramesh et al. 1999). To enhance data reliability and minimize bias, two observers walked the same transect. Kalij Pheasant sightings triggered data recording including time, geo-coordinates, flock size, elevation, aspect, and distance from the nearest water source. Field binoculars and cameras were used for observations and photographs respectively. Although fresh droppings were documented, they were excluded from data analysis. Abundance assessment employed the encounter rate (number of birds seen per km) following Caughly’s (1975) approach.

Habitat utilization of the Kalij Pheasant was recorded by monitoring the species in different types of habitats. The study area was divided into different habitat types which included coniferous forests with high understory (CFHU), coniferous forests with sparse understory (CFSU), open forests, terraced fields, and grassy slopes.

Ensuring that the maximum area was covered in each type of habitat at every direct bird sighting, habitat parameters (elevation, slope, aspect, habitat type, and crown cover) were quantified from 10 m, 5 m, and 1 m plots to study the habitat use of the Kalij Pheasant. The habitat preference was calculated using the Habitat Preference Rating Index (HPRI) of Mishra (1982):

$$\text{Habitat Rating Index (HRI)} = \frac{\% \text{ of animals observed in each habitat type (X)}}{\% \text{ of transect covered in each habitat type (Y)}}$$

RESULTS

In an effort of 130 km of transect walk, during the given study period, a total of 45 direct sightings of the Kalij Pheasant were recorded from the study area. Autumn provided the highest number of sightings (n = 21) and spring the lowest (n = 5). Most of the sightings (65%) were recorded early in the morning before 0700 h and late evening after 1800 h, close to the water sources. One-way ANOVA (p = 0.01, df = 3, F = 6.45) suggested a significant variation in the encounter rates of the species across different seasons (Table 1). The season-wise mean encounter rate was highest during autumn (2.25 ± 0.53 SE) and lowest during spring (0.22 ± 0.08 SE) (Table 2).

The Kalij Pheasant was recorded at different

Table 1. One-way ANOVA for encounter rates across different seasons during 2021–2022.

Source of variation	SS	df	MS	F	P-value	F crit
Between groups	7.9212966	3	2.64043	6.4522708	0.0157443	4.0661805
Within groups	3.273	8	0.7251			
Total	11.1950916	11				

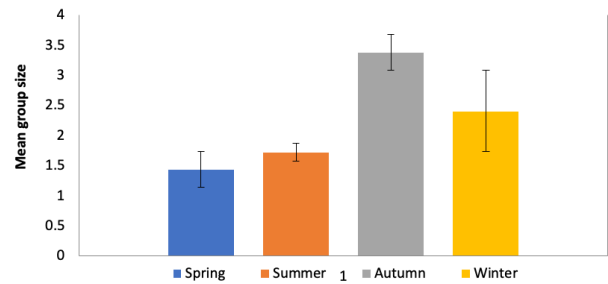
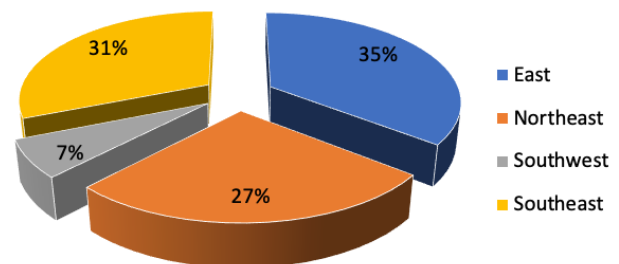
Table 2. Season-wise encounter rate of Kalij Pheasant in Limber Wildlife Sanctuary during the year 2021–2022.

Seasons	Mean Encounter rate (\pm SE)
Spring	0.22 \pm 0.08
Summer	0.31 \pm 0.07
Autumn	2.25 \pm 0.53
Winter	1.08 \pm 0.49

elevations of the sanctuary with maximum sightings (46.67%) reported between 1,800 to 2,200 m altitude. No direct evidence of the species was reported beyond 2,360 m throughout the whole study period. Four types of flocks; solitary male or female (rare), male and female pair (only at the approach of spring), mixed flocks, and unisex flocks (post summer) were encountered during the study period. Since the Kalij Pheasant exhibit prominent sexual dimorphism, males and females could easily be identified and the flocks always had more males than females and the mean flock size was highest in autumn (3.38 ± 0.30 SE) and lowest in spring (1.44 ± 0.29 SE) (Figure 1).

The Kalij Pheasant was distributed in all the different habitat types, with maximum sightings reported from coniferous forests with high understory (CFHU) ($n = 16$), followed by coniferous forests with sparse understory (CFSU) ($n = 13$). Grassy slopes ($n = 2$) had the lowest number of sightings. Habitat Preference Rating Index (HPRI) revealed that the pheasant utilized CFHU (HPRI = 1.34) and CFSU (HPRI = 1.12) in higher proportion than the open forests and terraced fields (Table 3). Except for shed feathers and fecal droppings, we did not record any direct sightings of the Kalij Pheasant in terraced fields and grassy slopes during the daytime. All the direct sightings (eight in number) observed in these two habitats were reported either in the morning or late evening during autumn and winter. No direct sighting, whatsoever, was witnessed in these two habitats during spring or summer.

This study established that the Kalij Pheasant was mostly concentrated in the east (35%), and southeast (31%) facing aspects (Figure 2). West facing aspect

**Figure 1. Mean flock size of Kalij Pheasant in different seasons.****Figure 2. Percentage of sightings in different aspects of the study area.**

seemed to be avoided by the species. No direct or indirect evidence was reported on the west-facing side during our whole study period. Also, no shift in aspect utilization across the seasons was observed. Since pheasants are extremely shy creatures, Kalij Pheasant was observed occupying dense shrub cover (50–75%) and was encountered at varying degrees of slopes with a majority of individuals (68%) occupying moderate slopes (20–40°).

DISCUSSION

The present study reported that the abundance of the Kalij Pheasant changed across the seasons; the highest abundance was recorded in autumn (2.25 ± 0.53 birds/km) and the lowest in spring (0.22 ± 0.08 birds/km). The highest number of individuals observed during the autumn season could be attributed to the high visibility due to the disappearance of vegetation

Table 3. Habitat preference rating index (HPRI) of Kalij Pheasant during the period 2021–2022.

Habitat type	Number of Kalij Pheasants observed	*X%	#Y%	HPI [^] (X/Y)
Coniferous forests with high understory (CFHU)	42	33.6	25	1.34
Coniferous forests with sparse understory (CFSU)	35	28	25	1.12
Open forests	22	17.6	25	0.70
Terraced fields	18	14.4	25	0.58
Grassy slopes	8	6.4	25	0.26
Total	125			

*X—Percentage of animals observed in each habitat type | #Y—Percentage of transect traversed in each habitat type | [^]HPI—Habitat preference rating index.

and their congregation at lower less dense areas for food and water, as these resources become depleted at upper reaches in autumn (Furqan & Ali 2022). A study conducted by Selvan et al. (2013) recorded a density of 6.7 birds/km² for Kalij Pheasant in the eastern Himalaya of Arunachal Pradesh, India. This study is in line with the results of Subedi (2005) who observed a maximum population density of 8.9 birds/km² for Nepal Kalij *Lophura leucomelanos leucomelanos* in October and a lowest density of 1.94 birds/km² in March. The least number of sightings witnessed during spring is probably because it coincides with the breeding season of the Kalij Pheasant (Ali & Ripley 1983) when they remain in pairs and prefer dense understory of shrubs for breeding and nesting purposes and therefore become difficult to sight.

Except for three solitary bird sightings, all the recordings were in groups, and this is in line with the observation of Sathyakumar et al. (2010) who documented Kalij Pheasant occurring in groups and reported an average group size of 2.1 birds/km². Selvan et al. (2013) also observed a nearly similar group size of 2.3 birds/km² for Kalij Pheasant in tropical forests of Arunachal Pradesh. Unlike other pheasants (like Himalayan Monal and Western Tragopan) which have a female-biased sex ratio (Sathyakumar 1999), the sex ratio was male-biased for the Kalij Pheasant. The flocks always had more males than females. Lewin & Lewin (1984) have proposed a monogamous behavior for the Kalij Pheasant and observed a sex ratio of 141 males to 100 females (male-biased). The occurrence of more males than females in a group may be due to cooperative breeding exhibited by the Kalij Pheasant (Zeng et al. 2016) or it might be because, unlike males which are quite sneaky and agile, females are less active and become more susceptible to local hunting and predation.

The Kalij Pheasant was recorded from all the five

habitat types identified in the study area, though with varying degrees of encounter rates. Coniferous forests with high understory (CFHU) of shrubs had the highest number of sightings (n = 16) followed by coniferous forests with sparse understory (CFSU) (n = 13). The higher percentage of sightings in forests with dense understory reflects the importance of cover in the habitat selection of the Kalij Pheasant. The Kalij Pheasant, being one of the most adaptable pheasant species, occurs in almost all types of forests having thick undergrowth of shrubs (Grimmett et al. 2016). The lowest number of sightings in terraced fields (n = 6) and grassy slopes (n = 2) is because of the virtual absence of cover in these areas and the heavy human interference which was more pronounced in spring and summer seasons when the people are busy with crop cultivation and accompany their cattle and livestock to graze in the grassy habitats. The stealthy nature of pheasants also restricts them to dense habitats to avoid open and human-influenced areas.

Since water plays an essential role in the life cycle of every animal, most of our sightings (80%) were in close proximity to water sources, which is in accord with the findings of Sathyakumar & Kaul (2007) who always found Kalij Pheasant digging and feeding nearby water sources. Furqan & Ali (2022) also noted that the Kalij Pheasant exhibited the greatest activities (54.97%) near water sources within 200 m of range.

Cover plays a consequential role in the selection of habitats by Himalayan pheasants and serves the purpose of protection from predators and vagary weather prevalent at higher altitudes and acts as a safe feeding and breeding abode (Severinghaus 1979; Nelli et al. 2012). While studying density estimates and habitat use of the Kalij Pheasant in Kedarnath Wildlife Sanctuary, Sathyakumar et al. (1992) reported that the Kalij Pheasant usually preferred moderate grass and tree cover but high shrub cover, which has also been observed in our study. The highest number of sightings

was documented from forests having dense shrub cover (50–75 %) and moderate tree cover (25–45 %). A study conducted in the Eastern Himalayas similarly observed Kalij Pheasant occupying low tree cover but high shrub cover (60–90 %) (Selvan et al. 2013).

As the topographic features influence the habitat preference in birds, most of our sightings were observed in the east (35%) and southeast (31%) facing aspects. This might be attributed to the availability of warm sunlight during most of the day hours and sufficient water availability, making these two aspects more suitable environments for survival than others. No direct or indirect records of the Kalij Pheasant were found in the west-facing aspect, probably because of lesser water availability and sparse shrub cover on that side. Norbu et al. (2013) reported similar results for Satyr tragopan *Tragopan satyra* and observed that the pheasant restricted itself towards east and southeast-facing aspects because of the warm environment provided by these aspects.

CONCLUSION

The study, a pioneering effort in the Union Territory of Jammu & Kashmir, has confirmed the presence of a substantial surviving population of Kalij Pheasant in the Limber Wildlife Sanctuary. It offers crucial baseline information on the species, including its abundance, group size, and habitat use. With this foundational data in place, a detailed ecological study is recommended for the sanctuary and its adjacent areas to ensure the species' long-term conservation in the landscape.

REFERENCES

- Ahmad, R., N. Sharma, U. Pacchnanda, I. Suhail, K. Deb, Y.V. Bhatnagar & R. Kaul (2017). Distribution and conservation status of the western tragopan *Tragopan melanocephalus* in Jammu and Kashmir, India. *Current Science* 112(9): 1948–1953.
- Ali, S. & S.D. Ripley (1983). Handbook of the Birds of India and Pakistan. Compact edition. Oxford University Press and BNHS, Mumbai.
- Andleeb, S., S. Shamim, M.N. Awan & R.A. Minhas (2012). Modified Protocol for Genomic DNA Extraction from Newly Plucked Feathers of *Lophura leucomelanos hamiltoni* (Galliformes) for Genetic Studies and its Endo-restriction Analysis: Genomic DNA Extraction from Lophura Feathers. *Biological Sciences-PJSIR* 55(2): 108–113.
- Azhar, B., M. Zakaria, E. Yusuf & P.C. Leong (2008). Efficiency of fixed-width transect and line-transect-based distance sampling to survey Red Junglefowl (*Gallus gallus spadiceus*) in Peninsular Malaysia. *Journal of Sustainable Development* 1(2): 63–73.
- Barnes, H.E. (1981). *Birds of India: A Guide to Indian Ornithology*. Cosmo Publications, New Delhi, India.
- Bhatnagar, Y.V., R. Ahmad, S.S. Kyarong, M.K. Ranjitsinh, C.M. Seth, I.A. Lone & R. Raghunath (2009). Endangered Markhor *Capra falconeri* in India: through war and insurgency. *Oryx* 43(3): 407–411. <https://doi.org/10.1017/S0030605309001288>
- Bhattacharya, T.A.P.A.J.I.T., S. Sathyakumar & G.S. Rawat (2009). Distribution and abundance of Galliformes in response to anthropogenic pressures in the buffer zone of Nanda Devi Biosphere Reserve. *International Journal of Galliformes Conservation* 1: 78–84.
- BirdLife International (2016). *Lophura leucomelanos*. IUCN Red List of Threatened Species. <http://www.birdlife.org>.
- BirdLife International (2021). *Lophura leucomelanos*. IUCN Red List of Threatened Species. <http://www.birdlife.org>.
- Bisht, M. & A.K. Dobriyal (2002). Status and distribution of Cheer Pheasant *Catreus wallichii* in Garhwal Himalaya, Uttaranchal, pp. 6–10. *Proceedings of National Symposium on Galliformes*.
- Bump, G. & W.H. Bohl (1971). *Red Jungle Fowl and Kalij Pheasant*. US Fish and Wildlife Service, Special Scientific report, Wildlife No. 62.
- Caughly, G. (1975). Analysis of vertebrate population. John Wiley & Sons, NewYork, 234 pp.
- Conroy, M.J. & B.R. Noon (1996). Mapping of species richness for conservation of biological diversity: conceptual and methodological issues. *Ecological Applications* 6(3): 763–773.
- Furqan, M. & Z. Ali (2022). Feeding Ecology, Threats and Conservation Management of Kalij Pheasant (*Lophura leucomelanos*) in Azad Jammu and Kashmir, Pakistan. *Pakistan Journal of Zoology* 54(6): 2543. <https://doi.org/10.17582/journal.pjz/20200816170856>
- Grimmett, R., C. Inskipp & T. Inskipp (2016). *Birds of the Indian Subcontinent: India, Pakistan, Sri Lanka, Nepal, Bhutan, Bangladesh and the Maldives*. Bloomsbury Publishing, London, 528 pp.
- Hussain, M.S., J.A. Khan & R. Kaul (2002). Aspects of ecology and conservation of Kalij Lophura leucomelana and Koklas Pucrasia macrolopha in the Kumaon Himalaya, India. *Tropical Ecology* 42(1): 59–68.
- Johnsgard, P.A. (1999). The Pheasants of the World. Biology and Natural History. 2nd Edition. Smithsonian Institution Press, Washington D.C., 398 pp.
- Lewin, V. & G. Lewin (1984). The Kalij pheasant, a newly established game bird on the island of Hawaii. *The Wilson Bulletin* 96(4): 634–646.
- McGowan, P.J.K. & A.L. Panchen (1994). Plumage variation and geographical distribution in the Kalij and Silver Pheasants. *Bulletin British Ornithologists Club* 114(2): 113–123.
- McGowan, P. & M. Gillman (1997). Assessment of the conservation status of partridges and pheasants in Southeast Asia. *Biodiversity & Conservation* 6(10): 1321–1337.
- Miller, J.R. (2010). Survey of Western Tragopan, Koklass Pheasant, and Himalayan Monal populations in the Great Himalayan National Park, Himachal Pradesh, India. *Indian Birds* 6(3): 60–65.
- Mishra, H.R. (1982). The ecology and behaviour of chital (*Axis axis*) in the Royal Chitwan National Park, Nepal: with comparative studies of hog deer (*Axis porcinus*), sambar (*Cervus unicorn*) and barking deer (*Muntiacus muntjak*). PhD Thesis. University of Edinburgh, Scotland.
- Nelli, L., A. Meriggi & A. Vidus-Rosin (2012). Effects of habitat improvement actions (HIAs) and reforestations on pheasants Phasianus colchicus in northern Italy. *Wildlife Biology* 18(2): 121–130. <https://doi.org/10.2981/11-022>
- Norbu, N., M.C. Wikelski & D.S. Wilcove (2017). Partial altitudinal migration of the Near Threatened satyr tragopan *Tragopan satyra* in the Bhutan Himalayas: implications for conservation in mountainous environments. *Oryx* 51(1): 166–173. <https://doi.org/10.1017/S0030605315000757>
- Ramesh, K., S. Sathyakumar & G.S. Rawat (1999). Report on the Ecology and conservation status of the pheasants of the Great Himalayan National Park, Western Himalaya. Wildlife Institute of India, Dehradun.
- Ramesh, K. (2003). An ecological study on pheasants of the Great Himalayan National Park, Western Himalaya. PhD Thesis submitted to Forest Research Institute–Deemed University, Dehradun, India, 69.
- Sathyakumar, S., S.N. Prasad, G.S. Rawat, & A.J.T. Johnsingh (1992). Ecology of Kalij and Monal Pheasants in Kedarnath Wildlife

- Sanctuary, Western Himalaya. Pheasants in Asia - Conference: Fifth International Symposium on Pheasants in AsiaAt: Lahore, Pakistan 83–90 pp.
- Sathyakumar, S. & R. Kaul (2007).** Pheasants. *Galliformes of India. ENVIS Bulletin: Wildlife and Protected Areas* 10(1): 41.
- Sathyakumar, S., K. Poudyal, T. Bhattacharya & T. Bashir (2010).** Galliformes of Khangchendzonga Biosphere Reserve, Sikkim, India. Biodiversity of Sikkim—exploring and conserving a global hotspot. Gangtok: Information and Public Relation Department.
- Selvan, K.M., S. Lyngdoh, G.G. Veeraswami & B. Habib (2013).** An assessment of abundance, habitat use and activity patterns of three sympatric pheasants in an eastern Himalayan lowland tropical forest of Arunachal Pradesh, India. *Asian Journal of Conservation Biology* 2(1): 52–60.
- Severinghaus, S.R. (1979).** Observations on the ecology and behaviour of the Koklass pheasant in Pakistan. *Journal of World Pheasant Association* 4: 52–69.
- Subedi, B. (2006).** Population Status, Habitat use and Conservation Threats of Kalij Pheasant (*Lophura leucomelana leucomelana*) in Hemja Area, Kaski. PhD Thesis. Department of Zoology, Tribhuvan University Kirtipur, Kathmandu, Nepal 25.
- Zeng, L., J.T. Rotenberry, M. Zuk, T.K. Pratt & Z. Zhang (2016).** Social behavior and cooperative breeding in a precocial species: The Kalij Pheasant (*Lophura leucomelanos*) in Hawaii. *The Auk: Ornithological Advances* 133(4): 747–760. <https://doi.org/10.1642/AUK-15-227.1>

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