

A preliminary study on avifaunal diversity of Tehsil Karsog in Mandi district, Himachal Pradesh, India

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Abstract The avifaunal diversity assessment is a valuable ecological tool, providing a significant measure for assessing the quality and quantity of various habitats. Karsog is located in Mandi district of Himachal Pradesh, India, in the Pir Panjal Himalayan range. Avifaunal study was conducted on a monthly basis in the Tehsil Karsog from December 2023 to June 2024. The study revealed the presence of 91 bird species, spanning over 63 genera, 38 families, 12 orders. The Order Passeriformes was the most diverse with 64 species, while Bucerotiformes and Strigiformes were represented by one species each. The Muscicapidae, with 12 species, was the dominant family in the study area. Analysis of data on relative abundance showed that of the 91 species recorded, 23 species (25.27%) were very common, 27 species (29.67%) were common, 26 species (28.57%) were uncommon, and 15 species (16.48%) were rare. Among the documented avifauna, 2 species, the Alexandrine Parakeet and the Himalayan Griffon are Near Threatened species as categorized by the IUCN Red List (2024). Assessment of data on feeding guild shows that, out of 91 species, 2 species (2.19%) are granivores, 3 species (3.29%) are carnivores, 11 species (12.08%) are omnivores, 17 species (18.68%) are insectivores and 58 species (63.73%) have varied type of feeding habits. It shows that 22 species (24.17%) have a narrow feeding guild meaning that they rely on limited type of food resources. Further analysis of data on the population status reveals that 17 species (18.68%) have declining population trend as per the IUCN global population trend assessment. This emphasizes the importance of implementing conservation strategies in the area under investigation.

Keywords: biodiversity, avifauna, Himalayas, threat

Összefoglalás A madarak sokféleségének mérése fontos ökológiai eszköz, amely jelentős adalékokat adhat a különböző élőhelyek minőségi és mennyiségi felmérésének hatékonyságához. Karsog az indiai Himachal Pradesh Mandi kerületében található, a Pir Panjal Himalája tartományban. A Tehsil Karsogban 2023 decembere és 2024 júniusa között havi rendszerességgel végeztek felméréseket. A vizsgálat 91 madárfaj jelenlétét tárta fel, több mint 63 nemzetségre, 38 családra és 12 rendre vonatkoztatva. Az énekesmadarak rendje volt a legfajgazdagabb 64 fajjal, míg a Bucerotiformes és Strigiformes egy-egy fajjal volt képviselve. A Muscicapidae 12 fajjal volt a legdominánsabb család a vizsgált területen. A relatív abundanciára vonatkozó adatok elemzése azt mutatta, hogy a feljegyzett 91 fajból 23 faj (25,27%) volt nagyon gyakori, 27 faj (29,67%) gyakori, 26 faj (28,57%) nem gyakori, és 15 faj (16,48%) ritka. A dokumentált madárfajok közül 2, a Nagy Sándor-papagáj és a havasi fakókeselelyű az IUCN Vörös Listáján (2024) a mérsékelten fenyegetett fajok közé tartoznak. A táplálkozási guildek adatainak értékelése azt mutatja, hogy a vizsgált területen található 91 fajból 2 faj (2,19%) a magevő, 3 faj (3,29%) a ragadozó, 11 faj (12,08%) a mindenevő, 17 faj (18,68%) a rovarvők és 58 faj (63,73%) vegyes táplálkozási stratégiákkal rendelkezik. Ezek alapján 22 faj (24,17%) szűk táplálkozási spektrummal rendelkezik, így erősen korlátozott táplálékforrásokra támaszkodnak. A populáció státuszára vonatkozó adatok további elemzése azt mutatja, hogy az IUCN globális populációtrend értékelése szerint 17 faj (18,68%) populációja csökkenő tendenciát mutat, ami alátámasztja a természetvédelmi kezelések fontosságát a vizsgált területen.

Kulcsszavak: biodiverzitás, madárfauna, Himalája, veszélyeztetettség

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Introduction

The Himalayas is a young and massive mountain range spanning approximately 2,400 km from North-West to South-East, across 6 countries viz. Afghanistan, Pakistan, India, Nepal, Bhutan, and China. They are 230–320 km wide from North-East to South-West (Gansser 1974). Approximately 27% of the land surface of our planet and 18% of the land surface of India is covered by them (Sharma & Sidhu 2016). The Himalayas have a wide range of climatic conditions based on temperature, altitude and latitude, contributing to its rich biodiversity (Jodha 2000, Pun & Mares 2000, Rautela & Lakhera 2000, Mishra *et al.* 2006). In the Himalayan ranges, the Indian state of Himachal Pradesh is situated in the northwest of India at a latitude of 30°22' – 33°13' north, and a longitude of 75°36' – 79°02' east. In the east, the state serves as the international boundary between India and Tibet. It is surrounded by the states of Jammu and Kashmir to the north, Uttarakhand to the southeast, Haryana to the south, and Punjab to the west. (Narwade *et al.* 2006). The region contains around 10.54% of the Himalayan land mass and accounts for 17% of the north-western Himalayan landscape, with an altitude range from 450 m to 7,000 m above sea level (Paliwal *et al.* 2019). The region is characterized by its intricate topography and habitats, and is home to diverse collection of temperate flora and fauna (Islam & Rahmani 2004). According to ISFR (2021), the state has a total geographical area of 55,673 km². Forests can be broadly classified into alpine, subalpine, temperate, or subtropical vegetation types (Rodgers & Panwar 1988, Sathyakumar & Bashir 2010). The state of Himachal Pradesh from South to North has been geographically divided into three regions: 1) The Outer Himalayas or Shivaliks, 2) the Inner Himalayas or Mid Mountains, and 3) the Greater Himalayas or Alpine zone. The lower Himalayas and Shivalik hills are largely covered by mixed and deciduous forests. The Inner Himalayas or Mid Mountains contain wet and Himalayan temperate vegetation like Deodar, Spruce and Kail. The Greater Himalayas comprise subalpine, and dry alpine vegetation like Kharsu, Blue Pine, etc. (Kumar 2015).

Investigating avifaunal diversity is a crucial ecological instrument that is a significant indicator for both the qualitative and quantitative assessment of various habitats (Bilgrami 1995). Birds are warm-blooded and egg-laying vertebrates, each with a unique appearance and habits. They perform several roles, including as pest management, scavenging, seed dispersion, and serve as pollinators of crop plants (Kumar *et al.* 2023). There are more than 11,000 species of birds reported globally (Birdlife International 2024). India is rich in avian diversity, as evidenced by the 1,211 bird species reported by BirdLife International (2024). Out of these species, 970 (about 80%) are found only in the Himalayas (Naithani & Bhatt 2010, Praveen *et al.* 2016). The eastern Himalayas have twice as many bird species as the western Himalayas (Price *et al.* 2003). The majority of Himachal Pradesh's avifauna has been reported from the lower Himalayas; however, a sizeable number has also been reported from the Greater and Trans Himalayan regions of the state (Singh &

Banyal 2013, Negi *et al.* 2015). Under British colonial administration, many extensive surveys were conducted to study the birds of Himachal Pradesh like Theobald (1862), Tytler (1868), Stoliczka (1868), Hume and Marshall (1879), Dodsworth (1910 to 1914) and Koelz (1937) to mention a few. Sir Norman Frederich Frome (1946) and Ganguli (1967) wrote on birds in Shimla and neighboring places whereas Gaston and Singh (1980) investigated pheasant distribution in Himachal Pradesh. Ali and Ripley (1983) described the avifauna of Himachal Pradesh, highlighting regions like Shimla, Dalhousie, and Dharamshala. Mahabal and Sharma (1992), Thakur *et al.* (2002), Besten (2004), Sharma *et al.* (2009) and Singh *et al.* (2014) examined avifauna in various areas of Himachal Pradesh. Kumar (2015) documented 618 bird species from the state, spanning 20 orders and 91 families. Even though avifaunal research has a long history in the state dating back to the British colonial era, most of these studies were restricted to specific regions within the state because of its challenging topography and adverse weather conditions. The vast majority of the state still remains unexplored by field biologists.

The avifauna is perpetually threatened by various factors including habitat loss, forest degradation, hunting, invasive species, diseases and is highly sensitive to pollution levels in both terrestrial and aquatic ecosystems (Gaston 1975, Sodhi *et al.* 2011, Mohapatra *et al.* 2019). Currently, there are approximately 1,159 species of birds in the threatened category as per IUCN (2024).

The area of Tehsil Karsog of district Mandi, Himachal Pradesh was selected for the avifaunal investigations, as this pristine area is rich in floral and faunal diversity attributable to its climatic conditions. Further, the avifauna in the region is jeopardized due to the anthropogenic activities; hence it is necessary to record the avifauna in order to implement appropriate conservation measures to the area.

Material and Methods

Study area

The Karsog Tehsil of Mandi District is an alluring valley nestled in the lap of Himalayas in Himachal Pradesh, lying between 31.3835 °N and 77.2028 °E, with an area of 524 km² (Figure 1). It is a picturesque and serene destination, located in the Pir Panjal Himalayan range and shares its boundaries with the districts of Kullu and Shimla (Kumar *et al.* 2021). It encompasses a wide spectrum of altitudes, ranging from 800 to 3,100 meters above sea level with moderate to difficult topography, having 15–65% slope (Bharti & Sharma 2022). It is situated within the agro-climatic ‘North Western Himalayan Hill Zone’ of India, which is classified as a humid sub-tropical climate. The valley experiences pleasant weather year-round with average annual temperature range of 12.4 °C to 26.4 °C and average annual precipitation of 1,010 mm, both of which contribute to its mild and temperate climate (CHP 2010). The valley is teeming with lush green landscapes and verdant vegetation, adorned with an abundance of mixed-variety trees such as Himalayan blue pine (*Pinus wallichiana*), chir pine (*Pinus wallichiana*), morinda spruce (*Picea*

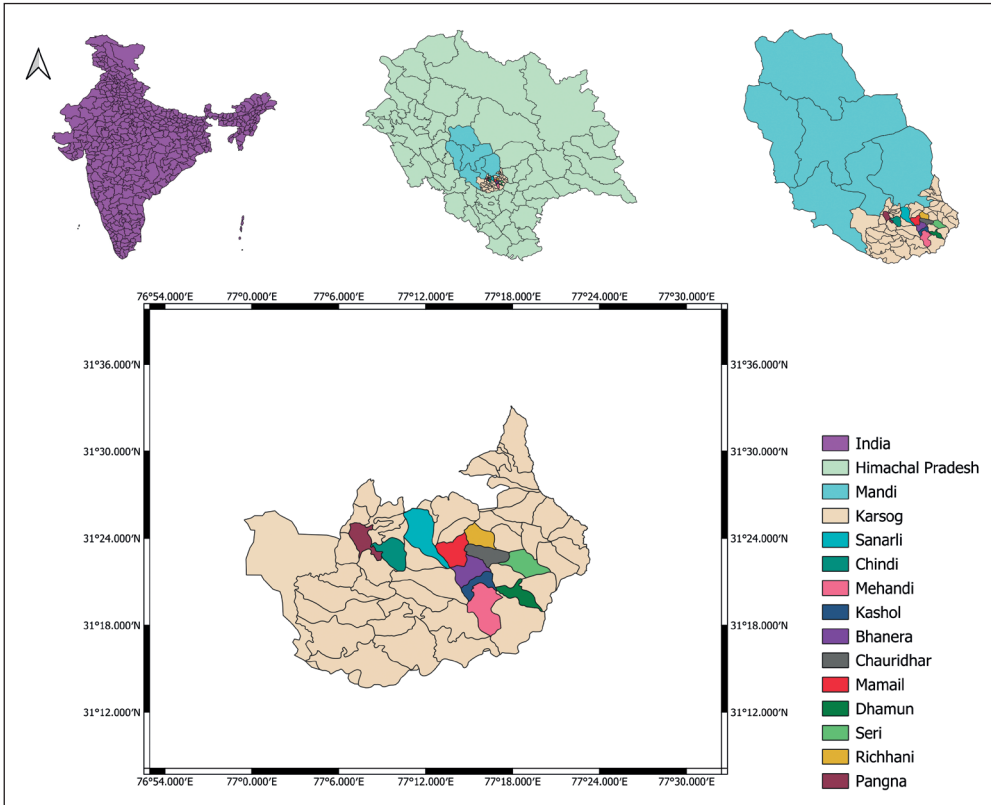


Figure 1. Map of Karsog, the study area of District Mandi, Himachal Pradesh, India
 1. ábra Karsog vizsgálati terület térképe (Mandi, Himachal Pradesh, India)

smithiana), West Himalayan fir (*Abies pindrow*), banjh (*Quercus leucotrichophora*) and apple (*Malus domestica*). The months of winter are chilly due to frost and fog (Singh *et al.* 2022). The Karsog area is divided into four forest ranges: Karsog, Pangna, Seri, and Magroo (Bharti *et al.* 2021). Some portions of the adjacent Shikari Devi Wildlife sanctuary lie in the Karsog range. The important wild fauna of the area includes Indian Leopard (*Panthera pardus*), Asiatic Black Bear (*Ursus thibetanus*), Himalayan Goral (*Naemorhedus goral*), Barking Deer (*Muntiacus muntjak*), Langur (*Semnopithecus entellus*), Rhesus Macaque (*Macaca mulatta*), Himalayan Weasel (*Mustela sibirica*), Himalayan Griffon (*Gyps himalayensis*), Alexandrine Parakeet (*Psittacula eupatria*) and Indian Peafowl (*Pavo cristatus*).

Methodology

The study area was surveyed for ornithological studies in several locations on a monthly basis from December 2023 to June 2024 spanning three seasons: winter (December 2023 to March 2024), spring (April 2024), and summer (May to June 2024). The area was primarily explored by walking. The Tehsil Karsog is divided into twelve administrative

blocks with four to six units in each block. During this study, the field surveys were conducted in 6 blocks namely Karsog, Mamail, Pangna, Chindi, Seri, and Richhani. A total of 11 units from among these blocks were selected for the survey. Four of the eleven units studied were in the Mamail block, they are Mamail, Bhanera, Mehandi, and Kashol. In the Richhani block, two units studied were Chauridhar and Dhamoon, while in the Seri block, Richhani and Seri units were explored. Sanarli, Pangna, and Chindi were the sole units evaluated from the blocks Karsog, Pangna, and Chindi respectively. Different sites in the selected units were visited during each survey. Due to the large size of the study area, a typical sample of each habitat was chosen using the stratified random sampling approach (Snedecore & Cochran 1993) to include all the diverse habitats. Throughout the survey, the line transect approach was used for estimating the abundance of the birds which is based on the principle of walking along a specified route to record the objects on or near the line (Burnham *et al.* 1980). To account for the uneven and harsh topography of the study area, piecewise linear line transects were marked and monitored monthly at various experimental sites. Moreover, these transects were observed as open width transects, meaning that birds were noted along the transect regardless of how far away they were from it (Mehta *et al.* 2002). Since, birds are most active in the few hours just after sunrise or before sunset, bird observations were made in the early morning and evening (Negi *et al.* 2015). Nikon (10x40) binoculars were used to observe the birds. To verify the identifications, pictures were captured using a Nikon DSLR D90 equipped with a 55–300 mm telephoto lens. Different field guides were employed to identify birds in the field (Ali & Ripley 1983, Grimmett *et al.* 1999) and reverified by the bird database application named Merlin Bird ID by Cornell Lab version 3.0.3 (800-2023.0) (Cornell University 2024). Taxonomical classification of birds was done with the help of Avibase – The World Bird Database (Lepage 2024). Relative abundance was computed by considering the frequency of occurrence and data collected from different habitats in the Karsog region (McKinnon & Philips 1993). Based on the data sheets, four categories were determined: VC: Very Common (Abundant number of sightings are 80–100% in field), C: Common (Regular sightings but less than VC, Sightings is 50–80% in the field), UC: Uncommon (Occasional sightings, Sightings are 6–50% in field), R: Rare (Hardly visible, Sightings are 1–5% of field visit).

The feeding guild of the birds was also assessed with the help of available literature (Ali & Ripley 1983). Based on their feeding guild, birds are categorized into five distinct groups namely Insectivores, Carnivores, Granivores, Varied type and Omnivores. Insectivores solely consume insects, Carnivores feeds exclusively on flesh, Granivores consume only seeds. The birds included in the varied feeding guild exhibit a varied but limited dietary preferences, like some may be insectivores and nectarivores, some may be granivores and frugivores and other may be carnivores and insectivores. In contrast, omnivores can consume all types of food without showing any specific preferences. They are opportunistic feeders and can consume any type of food. The IUCN Red Data list was used to examine the conservation status as well as population trends of the reported bird species (IUCN 2024).

Results

This study on the avifaunal diversity of the Tehsil Karsog in the Mandi district of Himachal Pradesh has shown the presence of 91 species of birds in the area, distributed over 63 genera, 38 families, and 12 orders. Passeriformes was the dominant order in the study area with 64 species under the 25 families. Charadriiformes and Piciformes have two families each. The remaining orders namely Galliformes, Cuculiformes, Columbiformes, Gruiformes, Accipitriformes, Strigiformes, Bucerotiformes, Coraciiformes and Psittaciformes are represented by single families each (Table 1). The Muscicapidae family, which consists of 12 species, was the dominant family of birds found in the study area, which is also the dominant family in Himachal Pradesh and India. The second largest family in the study area was represented by Motacillidae, with six species, closely followed by Corvidae, with five species. The families Columbidae and Leiotrichidae contain four species each, while the families Phasianidae, Cuculidae, Accipitridae, Picidae, Paridae, Pycnonotidae, Phylloscopidae, Cisticolidae and Fringillidae represent three species each. The families Alcedinidae, Ramphastidae, Psittaculidae, Laniidae, Nectariniidae, Passeridae, Sturnidae, Prunellidae and Emberizidae represented two species each. However, a large number of families (15 in total), viz., Strigidae, Rallidae, Charadriidae, Scolopacidae, Upupidae, Campephagidae, Dicruridae, Rhipiduridae, Oriolidae, Monarchidae, Hirundinidae, Aegithalidae, Zosteropidae, Timaliidae and Sittidae are present in the area with single species each (Table 1).

Analysis of data on relative abundance showed that of the 91 species recorded, 23 species (25.27%) were very common, 27 species (29.67%) were common, 26 species (28.57%) were uncommon, and 15 (16.48%) species were rare to the study area. The species in the rare group includes the Common Hawk Cuckoo (*Hierococcyx varius varius*), Green Sandpiper (*Tringa ochropus*), Blue-throated Barbet (*Psilopogon asiaticus asiaticus*), Rufous-bellied Woodpecker (*Dendrocopos hyperythrus*), Indian Golden Oriole (*Oriolus kundoo*), Bay-backed Shrike (*Lanius vittatus*), Wallcreeper (*Tichodroma muraria muraria*), Brahminy Starling (*Sturnia pagodarum*), Blue-fronted Redstart (*Phoenicurus frontalis*), Altai Accentor/Himalayan Accentor (*Prunella himalayana*), Rufous-breasted Accentor (*Prunella strophiatea jerdoni*), Citrine Wagtail (*Motacilla citreola*), Rosy Pipit (*Anthus roseatus*), Black-and-yellow Grosbeak (*Mycerobas icteroides*) and Chestnut-eared Bunting (*Emberiza fucata arcuata*) as they were observed only once during the survey (Table 1, Figure 2).

Assessment of data on feeding guild shows that, out of 91 species in the study area, 2 species (2.19%) are Granivores, 3 species (3.29%) are Carnivores, 11 species (12.08%) are Omnivores, 17 species (18.68%) are Insectivores and 58 species (63.73%) are classified into Varied type of feeding guild (Table 1, Figure 3). The further analysis of data shows that 22 species (24.17%) have a narrow feeding guild meaning that they rely on limited type of food resources.

The analysis of data on population trend reveals that, out of 91 species, 9 species (10%) have increasing population trend, 57 species (62.63%) have stable, 8 species (8.79%) have unknown and 17 species (18.68%) have declining population trend as provided by the IUCN population trend assessment done globally (Table 1, Figure 4). The species with decreasing population trend globally reported in area are Common Cuckoo (*Cuculus canorus*), Rock Pigeon (Rock Dove) (*Columba livia*), Himalayan Griffon (*Gyps himalayensis*) Eurasian

Table 1. List of bird species recorded in Tehsil Karsog, District Mandi, Himachal Pradesh, India
 1. táblázat A Tehsil Karsog, District Mandi, Himachal Pradesh, India térségében felmért madárfajok

S. no.	Common Name	Scientific Name	Abundance Status	Feeding Guild	IUCN Status	Population Trend
Order Galliformes						
Family Phasianidae						
1	Indian Peafowl	<i>Pavo cristatus</i>	C	O	LC	STABLE
2	Black Francolin	<i>Francolinus francolinus asiae</i>	C	O	LC	STABLE
3	Hill Partridge	<i>Arborophila torqueola</i>	UC	G, I	LC	STABLE
Order Cuculiformes						
Family Cuculidae						
4	Asian Koel	<i>Eudynamys scolopaceus</i>	C	O	LC	STABLE
5	Common Hawk Cuckoo	<i>Hierococyx varius varius</i>	R	I, C	LC	STABLE
6	Common Cuckoo	<i>Cuculus canorus</i>	VC	I	LC	DECREASING
Order Columbiformes						
Family Columbidae						
7	Rock Pigeon (Rock Dove)	<i>Columba livia</i>	VC	G, H	LC	DECREASING
8	Oriental Turtle Dove	<i>Streptopelia orientalis</i>	C	G	LC	STABLE
9	Eurasian Collared Dove	<i>Streptopelia decaocto</i>	UC	G	LC	INCREASING
10	Spotted Dove	<i>Spilopelia chinensis</i>	C	G, H	LC	INCREASING
Order Gruiformes						
Family Rallidae						
11	Brown Crake	<i>Zapornia akool akool</i>	UC	I, C, G	LC	UNKNOWN
Order Charadriiformes						
Family Charadriidae						
12	Red-wattled Lapwing	<i>Vanellus indicus indicus</i>	UC	I, C	LC	UNKNOWN
Family Scolopacidae						
13	Green Sandpiper	<i>Tringa ochropus</i>	R	I, C	LC	INCREASING
Order Accipitriformes						
Family Accipitridae						
14	Black-Winged Kite	<i>Elanus caeruleus vociferus</i>	UC	I, C	LC	STABLE
15	Himalayan Griffon	<i>Gyps himalayensis</i>	C	C	NT	DECREASING
16	Black Kite	<i>Milvus migrans</i>	C	C	LC	STABLE
Order Strigiformes						
Family Strigidae						
17	Asian Barred Owlet	<i>Glaucidium cuculoides</i>	VC	C, I	LC	INCREASING
Order Bucerotiformes						
Family Upupidae						
18	Eurasian Hoopoe	<i>Upupa epops</i>	UC	I	LC	DECREASING

S. no.	Common Name	Scientific Name	Abundance Status	Feeding Guild	IUCN Status	Population Trend
Order Coraciiformes						
Family Alcedinidae						
19	Common Kingfisher	<i>Alcedo atthis atthis</i>	UC	C	LC	UNKNOWN
20	Crested Kingfisher	<i>Megaceryle lugubris guttulate</i>	UC	Aq, C	LC	DECREASING
Order Piciformes						
Family Ramphastidae						
21	Great Barbet	<i>Psilopogon virens</i>	VC	F, I	LC	DECREASING
22	Blue-throated Barbet	<i>Psilopogon asiaticus asiaticus</i>	R	F, I	LC	STABLE
Family Picidae						
23	Rufous-bellied Woodpecker	<i>Dendrocopos hyperythrus</i>	R	I, F, G	LC	STABLE
24	Fulvous-breasted Woodpecker	<i>Dendrocopos macei</i>	UC	I, F, G	LC	DECREASING
25	Scaly-bellied Woodpecker	<i>Picus squamatus</i>	C	I, F, G	LC	STABLE
Order Psittaciformes						
Family Psittaculidae						
26	Plum-headed Parakeet	<i>Psittacula cyanocephala cyanocephala</i>	VC	F, G, H	LC	DECREASING
27	Alexandrine Parakeet	<i>Psittacula eupatria</i>	C	F, G, H	NT	DECREASING
Order Passeriformes						
Family Campephagidae						
28	Long-tailed Minivet	<i>Pericrocotus ethologus</i>	C	I	LC	DECREASING
Family Oriolidae						
29	Indian Golden Oriole	<i>Oriolus kundoo</i>	R	O	LC	UNKNOWN
Family Dicuridae						
30	Ashy Drongo	<i>Dicrurus leucophaeus</i>	C	I	LC	UNKNOWN
Family Rhipiduridae						
31	White-throated Fantail	<i>Rhipidura albicollis albicollis</i>	C	I	LC	STABLE
Family Monarchidae						
32	Indian Paradise-flycatcher	<i>Terpsiphone paradisi leucogaster</i>	UC	I, C	LC	STABLE
Family Laniidae						
33	Bay-backed Shrike	<i>Lanius vittatus</i>	R	I, C, F	LC	STABLE
34	Long-tailed Shrike	<i>Lanius schach</i>	UC	I, C, F	LC	UNKNOWN
Family Corvidae						
35	Yellow-billed Blue Magpie	<i>Urocissa flavirostris</i>	C	C, I	LC	STABLE
36	Red-billed Blue Magpie	<i>Urocissa erythroryncha</i>	VC	C, I	LC	STABLE
37	Rufous Treepie	<i>Dendrocitta vagabunda</i>	UC	O	LC	DECREASING

S. no.	Common Name	Scientific Name	Abundance Status	Feeding Guild	IUCN Status	Population Trend
38	Grey Treepie	<i>Dendrocitta formosae</i>	VC	O	LC	DECREASING
39	Large-billed Crow	<i>Corvus macrorhynchos</i>	VC	O	LC	STABLE
Family Paridae						
40	Coal Tit	<i>Periparus ater</i>	C	I	LC	DECREASING
41	Cinereous Tit (Great Tit)	<i>Parus cinereus</i>	VC	I	LC	INCREASING
42	Green-backed Tit	<i>Parus monticolus</i>	C	I, F, H	LC	STABLE
Family Pycnonotidae						
43	Himalayan Black Bulbul	<i>Hypsipetes leucocephalus</i>	C	G, F, I	LC	STABLE
44	Red-vented Bulbul	<i>Pycnonotus cafer</i>	VC	O	LC	STABLE
45	Himalayan Bulbul	<i>Pycnonotus leucogenys</i>	VC	G, F, I	LC	INCREASING
Family Hirundinidae						
46	Red-rumped Swallow	<i>Cecropis daurica erythropygia</i>	C	I	LC	STABLE
Family Aegithalidae						
47	Black-throated Tit	<i>Aegithalos concinnus</i>	VC	G, F, I	LC	STABLE
Family Phylloscopidae						
48	Hume's Leaf Warbler	<i>Phylloscopus humei humei</i>	UC	I	LC	STABLE
49	Lemon-rumped Warbler or Pale-rumped Warbler	<i>Phylloscopus chloronotus</i>	UC	I	LC	STABLE
50	Grey-hooded Warbler	<i>Phylloscopus xanthoschistos</i>	VC	I	LC	STABLE
Family Cisticolidae						
51	Himalayan Prinia	<i>Prinia crinigera</i>	C	I, C, G	LC	STABLE
52	Grey-breasted Prinia	<i>Prinia hodgsonii hodgsonii</i>	C	I	LC	STABLE
53	Common Tailorbird	<i>Orthotomus sutorius</i>	C	I, F, G	LC	STABLE
Family Zosteropidae						
54	Indian White-eye/ Oriental White-eye	<i>Zosterops palpebrosus occidentis</i>	C	I, H	LC	DECREASING
Family Timaliidae						
55	Rusty-cheeked Scimitar-babbler	<i>Erythrogonys erythrogonys erythrogonys</i>	C	I, G, F	LC	STABLE
Family Leiothrichidae						
56	Streaked Laughingthrush	<i>Trochalopteron lineatum</i>	VC	I, F, G	LC	STABLE
57	Variegated Laughingthrush	<i>Trochalopteron variegatum</i>	UC	I, F, G	LC	DECREASING
58	Rufous Sibia (capistrata)	<i>Heterophasia capistrata capistrata</i>	C	F, I	LC	UNKNOWN
59	Jungle Babbler	<i>Argya striata</i>	VC	O	LC	STABLE
Family Sittidae						
60	Wallcreeper	<i>Tichodroma muraria muraria</i>	R	I, C	LC	STABLE

S. no.	Common Name	Scientific Name	Abundance Status	Feeding Guild	IUCN Status	Population Trend
Family Sturnidae						
61	Common Myna	<i>Acridotheres tristis</i>	VC	G, F, I	LC	INCREASING
62	Brahminy Starling	<i>Sturnia pagodarum</i>	R	F, N	LC	UNKNOWN
Family Muscipidae						
63	Oriental Magpie-Robin	<i>Copsychus saularis</i>	VC	I, C, N	LC	STABLE
64	Indian Robin	<i>Copsychus fulicatus fulicatus</i>	UC	I	LC	STABLE
65	Verditer Flycatcher	<i>Eumyias thalassinus</i>	C	I	LC	STABLE
66	Spotted Forktail	<i>Enicurus maculatus</i>	UC	I, C	LC	STABLE
67	Blue Whistling-Thrush	<i>Myophonus caeruleus</i>	VC	O	LC	STABLE
68	Blue-fronted Redstart	<i>Phoenicurus frontalis</i>	R	I, F, G	LC	STABLE
69	Blue-capped Redstart	<i>Phoenicurus coeruleocephala</i>	UC	I	LC	STABLE
70	Plumbeous Water Redstart	<i>Phoenicurus fuliginosus</i>	VC	AqI	LC	STABLE
71	White-capped Redstart	<i>Phoenicurus leucocephalus</i>	UC	O	LC	STABLE
72	Grey Bushchat	<i>Saxicola ferreus</i>	VC	I, G	LC	STABLE
73	Pied Bushchat	<i>Saxicola caprata bicolor</i>	C	I, H, C	LC	STABLE
74	Siberian Stonechat	<i>Saxicola maurus</i>	UC	I	LC	STABLE
Family Nectariniidae						
75	Purple Sunbird	<i>Cinnyris asiaticus asiaticus</i>	UC	N, I	LC	STABLE
76	Crimson Sunbird	<i>Aethopyga siparaja</i>	UC	N, I	LC	STABLE
Family Passeridae						
77	Russet Sparrow	<i>Passer cinnamomeus</i>	VC	I, G, F	LC	STABLE
78	House Sparrow	<i>Passer domesticus</i>	VC	G, I	LC	DECREASING
Family Prunellidae						
79	Altai Accentor/Himalayan accentor	<i>Prunella himalayana</i>	R	I, G	LC	STABLE
80	Rufous-breasted Accentor	<i>Prunella strophciata jerdoni</i>	R	I, G	LC	STABLE
Family Motacillidae						
81	Citrine Wagtail	<i>Motacilla citreola</i>	R	I, C	LC	INCREASING
82	Grey Wagtail	<i>Motacilla cinerea</i>	C	I, C	LC	STABLE
83	White Wagtail	<i>Motacilla alba</i>	UC	I, C, G	LC	STABLE
84	Tree Pipit	<i>Anthus trivialis</i>	UC	I, H, G	LC	STABLE
85	Rosy Pipit	<i>Anthus roseatus</i>	R	I, G	LC	STABLE
86	Water Pipit	<i>Anthus rubescens japonicus</i>	UC	I	LC	STABLE
Family Fringillidae						
87	Black-and-yellow Grosbeak	<i>Mycerobas icteroides</i>	R	F, G	LC	STABLE

S. no.	Common Name	Scientific Name	Abundance Status	Feeding Guild	IUCN Status	Population Trend
88	Common Rosefinch	<i>Carpodacus erythrinus</i>	C	F, G	LC	DECREASING
89	Pink-browed Rosefinch	<i>Carpodacus rodochroa</i>	UC	F, G	LC	STABLE
Family Emberizidae						
90	Rock Bunting	<i>Emberiza cia</i>	VC	G, I	LC	INCREASING
91	Chestnut-eared Bunting	<i>Emberiza fucata arcuate</i>	R	G, I	LC	STABLE

Abbreviations: F – Frugivore; G – Granivores; O – Omnivore; N – Nectarivore; H – Herbivore; I – Insectivores; AqI – Aquatic Insectivores; C – Carnivores; LC – Least Concern; NT – Near Threatened

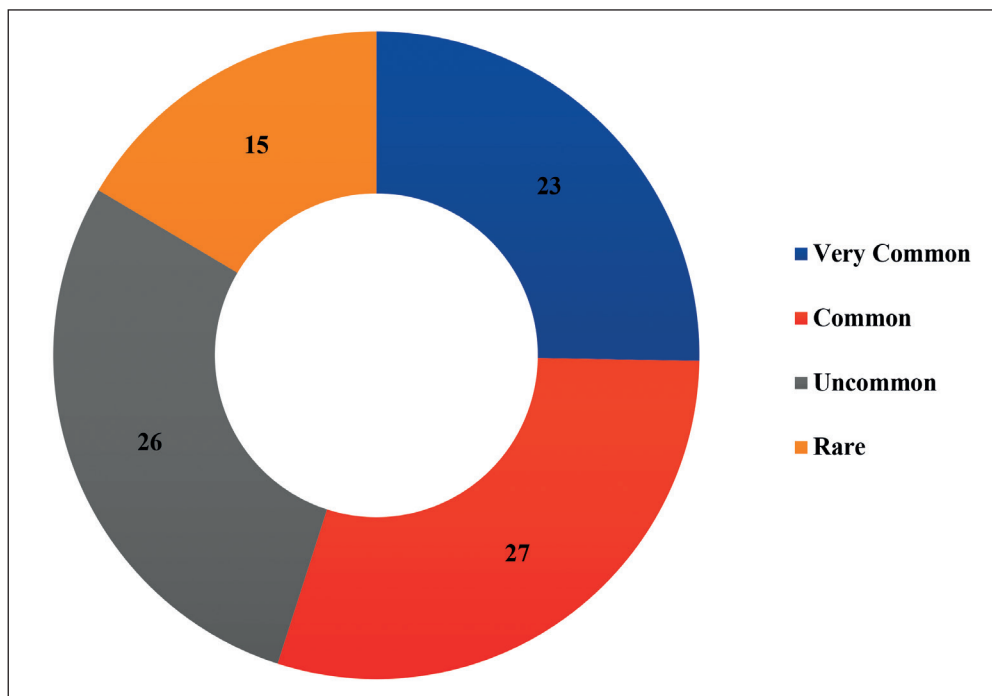


Figure 2. The abundance status of recorded bird species
2. ábra A megfigyelt madárfajok abundancia szerinti megoszlása

Hoopoe (*Upupa epops*), Crested Kingfisher (*Megaceryle lugubris guttulate*), Great Barbet (*Psilopogon virens*), Fulvous-breasted Woodpecker (*Dendrocopos macei*), Plum-headed Parakeet (*Psittacula cyanocephala cyanocephala*) Alexandrine Parakeet (*Psittacula eupatria*), Long-tailed Minivet (*Pericrocotus ethologus*), Rufous Treepie (*Dendrocitta vagabunda*), Grey Treepie (*Dendrocitta formosae*), Coal Tit (*Periparus ater*), Indian White-eye/Oriental White-eye (*Zosterops palpebrosus occidentis*), Variegated Laughingthrush (*Trochalopteron variegatum*), House Sparrow (*Passer domesticus*), Common Rosefinch (*Carpodacus erythrinus*).

The study area also harbours species of conservation importance like Himalayan Griffon and Alexandrine Parakeet which have been classified as Near Threatened in IUCN Red List (2024).

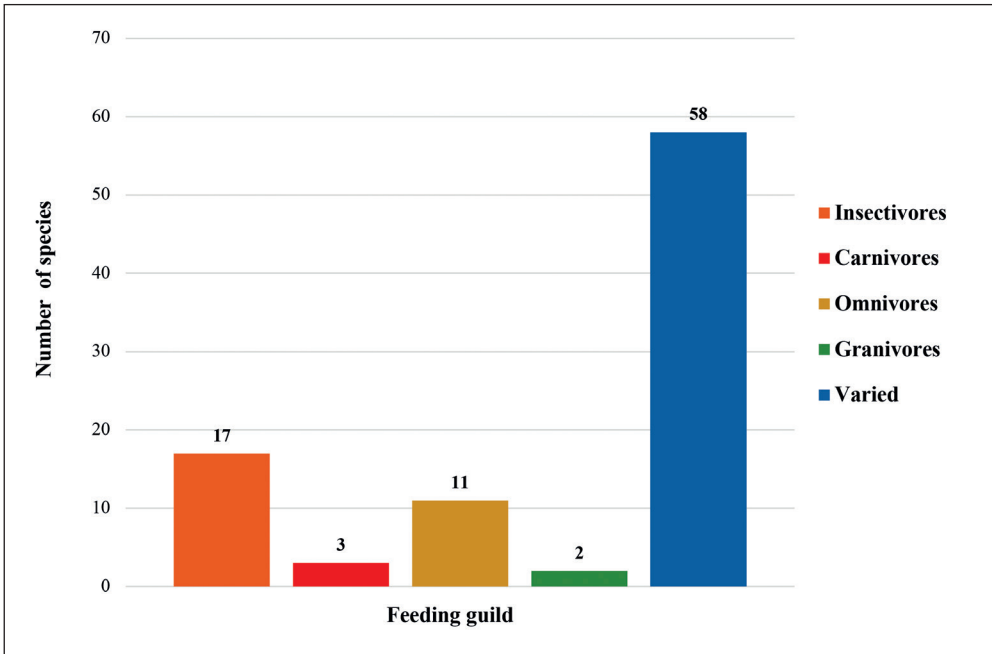


Figure 3. The distribution of the recorded bird species in the feeding guilds
 3. ábra A megfigyelt madárfajok táplálkozási guildenkénti megoszlása

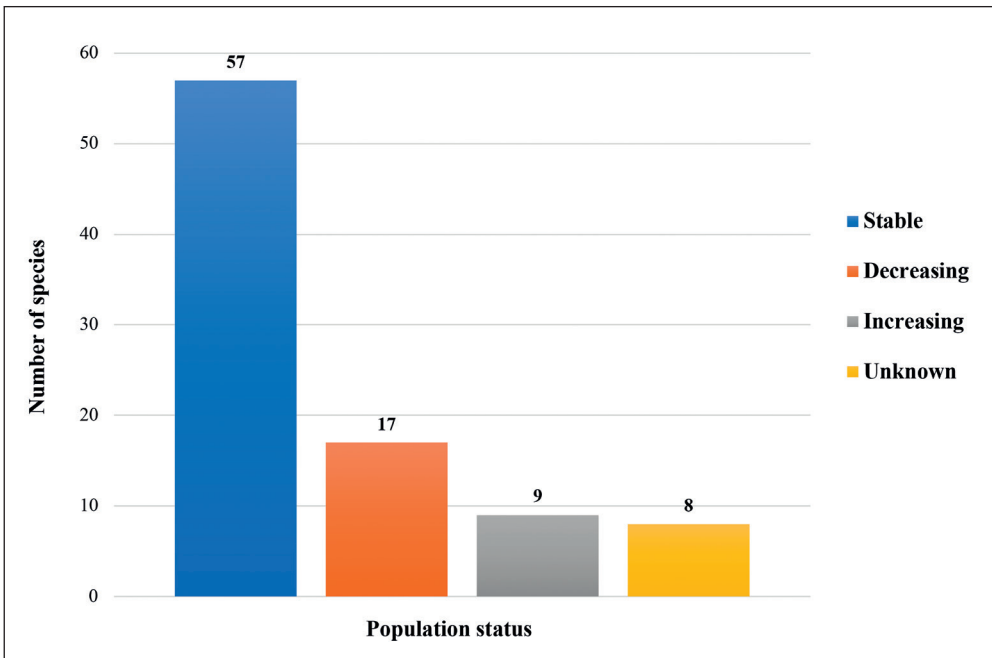


Figure 4. Population trends for recorded bird species
 4. ábra A megfigyelt madárfajok állománytrendjei

Discussion

The study represents the avifaunal diversity of tehsil Karsog, which is situated in the agro-climatic zone of the Pir Panjal Himalayan Range, Himachal Pradesh, India. The study area is characterized by a mix of forests and grasslands, distributed across an altitudinal gradient of 800-3100 m, which contributes its avian diversity. The study revealed the presence of 91 bird species, spanning over 63 genera, 38 families, and 12 orders. The present investigations align with earlier observations made by various researchers in different regions of Himachal Pradesh. Negi *et al.* (2015) unveiled the avian diversity within the Rakchham-Chhitkul Wildlife Sanctuary, encompassing 73 species. These species were spread across 52 genera, categorized into 24 families and 9 orders. Shah *et al.* (2016) studied the avian diversity within Chamba District, specifically focusing on the Kalatop-Khajjiar Wildlife Sanctuary. A total of 95 bird species, dispersed over 12 orders and 40 families, were recognized. Paliwal *et al.* (2019) conducted a comprehensive survey of avifauna at Bandali Wildlife Sanctuary, located in Mandi District, and identified 70 bird species, classified into 9 orders and 32 families. Dutta *et al.* (2022) enumerated the bird species in trans-Himalayan Lahaul and Spiti, Himachal Pradesh, and reported 278 bird species, representing 20 orders and 59 families. The avifaunal diversity study conducted by Tiwari (2023) in the unprotected Kanetiya area in Shimla, Himachal Pradesh, revealed the presence of 124 bird species, belonging to 13 orders and 43 families.

Passeriformes was the most dominant order, representing 70.3% of all recorded species. Numerous other studies have similarly highlighted the prevalence of the Passeriformes in various regions of the state of Himachal Pradesh. Singh (2015) studied the avifaunal diversity of the Mandi district. He found 94 species of birds belonging to 12 orders and 30 families. The highest number of species were found in the Passeriformes. Mohapatra *et al.* (2019) documented a total of 156 species of birds from YSPUHF campus, Solan, belonging to 16 orders, and 52 families. In their study, Passeriformes was found to be dominant (66.03% occurrence) with 33 families of birds. Kumar *et al.* (2023) prepared a checklist of avian diversity and composition in Kalatop-Khajjiar Wildlife Sanctuary, Himachal Pradesh, India. A list of 137 species was prepared pertaining to 15 orders and 46 families. Passeriformes was found to be the most dominant. Kaur and Banyal (2024) reported 216 species of birds belonging to 16 orders and 56 families from the Solan district of Himachal Pradesh. Out of the 16 orders, they also reported that Passeriformes was the most dominant. Passerine species exhibit high diversity in the study area because of their adaptability to a broad range of habitats and their consumption of numerous food items, such as invertebrates, fruits, grains, nuts, nectar, and floral buds (Beresford *et al.* 2005).

Among the 54 documented families, the avifauna in the study area was dominated by the Muscicapidae, comprising 12 species. It is noteworthy that the family Muscicapidae is the largest family of birds in India, with 370 species (Manakadan & Pittie 2001). A study conducted by Thakur *et al.* (2010) on the Arki Hills revealed similar results, with the presence of 85 species of birds belonging to 66 genera spread over 30 families and 12 orders. Their investigations also revealed that Muscicapidae dominated the avifauna, with 27 species. Singh *et al.* (2014) documented a total of 95 species of birds from Parashar Lake

and its surrounding area in Mandi district, Himachal Pradesh belonging to 11 orders, and 30 families. They found that Muscicapidae was the dominant family with a total of 24 species. Similarly, Shah *et al.* (2016) observed 95 species of birds belonging to 12 orders and 40 families in The Chamba District, Himachal Pradesh, India. Their analysis also showed that the Muscicapidae (15 species) was most dominant family. Paliwal *et al.* (2019) studied avifaunal diversity of Bandli Wildlife Sanctuary, Mandi, Himachal Pradesh and recorded a total of 70 bird species. They found Muscicapidae to be the dominant family, comprising 6 species. Kaur and Banyal (2024) studied the avifaunal diversity of Shimla region of Himachal Pradesh, and recorded a total of 52 bird species. They also found Muscicapidae to be the dominant family in their study.

During the present study, the relative abundance status of bird species was documented, considering their relative frequency of sightings in the area. Relative abundance provides insights about the increasing or decreasing populations of the bird species, which can be helpful in biodiversity monitoring and conservation (Callaghan *et al.* 2024). Several factors affect the relative number of birds in a given location. These include the size of the wetlands within the study area, the distribution and quality of food supplies, and the presence of appropriate roosting and nursery sites within the study area (Terborgh 1985). The analysis of the frequency of sightings showed that, out of the total 91 species recorded, 23 species (25.27%) were very common, 27 species (29.67%) were common, 26 species (28.57%) were uncommon, and 15 (16.48%) species were rare to the study area. Present studies on relative abundance support the earlier findings by Chopra and Sharma (2014) in the lower Shivalik foothills of the Himalayas. They categorized the observed 156 bird species as abundant (60 species, 38.46%), common (48 species, 30.77%), uncommon (41 species, 26.28%), and rare (7 species, 4.49%). Similarly, Singh (2018) studied the avifauna of Bhattiyat and Dalhousie areas of Chamba district, Himachal Pradesh. He found that out of 185 species of birds, 25 were Very Common, 28 were Common, 38 were Fairly Common, 65 were Uncommon and 29 were Rare. Recently, Quyoom *et al.* (2024) studied the avifaunal diversity of the Bani Wildlife Sanctuary, Jammu and Kashmir, India. They recorded a total of 135 bird species belonging to 45 families during their study. Further analysis of the relative abundance revealed that, among the recorded species, 36 were abundant, 40 were common, 33 were occasional, and 26 were rare.

The birds fulfill their nutritional demands by utilizing different kinds of microhabitats and using different foraging techniques (Wiens 1989). In order to maximize their chances of survival, birds use a wide variety of foraging strategies. Their habitat selection is contingent upon the proximity of their grazing grounds or reproductive areas (Raeside *et al.* 2007). Assessment of data on feeding guild shows that, out of 91 species in the study area, 2 species (2.19%) are granivores, 3 species (3.29%) are carnivores, 11 species (12.08%) are omnivores, 17 species (18.68%) are insectivores, and 58 species (63.73%) have varied types of feeding guild. Aggarwal *et al.* (2008) reported similar results, wherein they documented 75 species of birds from the Nandini Wildlife Sanctuary, Jammu and Kashmir. They observed five major feeding guilds, namely, insectivorous, granivorous, carnivorous, frugivorous, and omnivorous. Of the total 75 species reported, 23 were insectivorous, 10 were carnivorous, 6 were granivorous, 3 were omnivorous, and 6 were frugivorous, and the rest of the 27

species used more than one feeding guild. A study was conducted by Mukhopadhyay & Mazumdar (2017) on composition and foraging guilds of birds of suburban area of southern West Bengal, India. They recorded 119 species and categorized them into seven groups as, insectivorous (41.2%), carnivorous (24.4%), omnivorous (18.5%), granivorous (7.6%), frugivorous (3.4%), nectarivorous (3.4%) and herbivorous species (1.7%). In a study on avifaunal diversity in the Tilyar Lake, Rohtak, Haryana, India, Singh *et al.* (2020) recorded a total of 73 avian species belonging to 62 genera and 31 families under 15 orders. The feeding habits of the recorded birds showed that the maximum number of species (45 species) were omnivorous, followed by carnivorous (20), insectivorous (4), herbivorous (2), frugivorous (1), and granivorous (1).

The majority of birds in the study area (63.73%) have a varied type of feeding guild, which suggests the presence of a very heterogeneous habitat in terms of the availability of food in the study area. Further analysis of the data shows that more than 24% of the bird species present in the area show a restrictive feeding guild, which means they rely on very specific kinds of food for their survival. Species with a broad range of food choices have a higher degree of availability of resources. They may shift their feeding pattern from one kind of diet to another. However, the birds with restrictive food ranges have a lesser degree of resource availability. The exiguous alterations in the environment are leading to the depletion of their food resources, which may lead to their ultimate extinction.

The study area harbors species of conservation importance like the Himalayan Griffon and Alexandrine Parakeet, which have been placed in the Near Threatened category as per the IUCN Red List (2024). The study area provides habitat to threatened wild fauna as well as it includes 17 bird species with a decreasing population trend worldwide as per IUCN (2024). This raises concerns about the essential conservation efforts that need to be implemented in the study area.

The area is witnessing anthropogenic activities causing habitat destruction, modification, fragmentation, degradation over-exploitation of natural resources etc., which have devastating effect on wildlife and biodiversity of the area. Various factors, including construction projects, fast urbanization, variations in land cover, forest fires, modern farming methods, a spike in the development of roads and industries, and continued excessive resource extraction from the forest may alter the composition and structure of the vegetation, resulting in landslides and the formation of barren regions. This will therefore have an impact on avian occupancy and resource use patterns (Chettri *et al.* 2005). Frequent forest fires were seen in the study area during the study period, causing loss of habitat and food resources. Various developmental activities are ongoing in the study area such as construction of new roads and buildings, posing threat to the avifauna of the study area. The fragmentation of habitats due to the installation of cell phone towers in and around agricultural landscapes have been reported as source of disturbance to avifauna (Afrifa *et al.* 2023). Similarly, in the study area, new cell phone towers are being installed in the hill regions, which could potentially harm the local avifauna.

The study area harbors ample number of wetlands. Due to the intrinsic fragility of the ecosystems that they contain, wetlands are vulnerable to deterioration and modification due to the anthropogenic stresses such as agricultural runoff of fertilizers (Gupta & Singh

2003). The increased use of chemical fertilizers and pesticides is causing degradation of the wetlands in the study area which may affect the avian diversity of the area. All these facts underscore the importance of the study area for the conservation of wildlife. Therefore, further scientific studies and conservation measures are required to be implemented. The present study provides important preliminary data of the avian diversity of the Tehsil Karsog, which will provide a baseline data for future research and conservation efforts in this area. Moreover, regular bird surveys, systematic monitoring and assessment of the habitat, involving consideration of multiple drivers of change including climate change, should be conducted to monitor population trends, threats to local bird species and understanding their effects on bird species.

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