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# Preliminary study of Bird Diversity and Abundance in Community Game Reserves of Lower Dir District, Pakistan

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**SUMMARY**

The present study was conducted from July 2022 to July 2023 to assess the diversity and abundance of avifauna in two Community Game Reserves: Adenzai and Tangi-Darra of Lower Dir District, Khyber Pakhtunkhwa, using the Line Transect Method. A total of 3,942 individuals were recorded in the study areas, belonging to 46 bird species, 26 families, and 7 orders. The order Passeriformes was found to be the dominant order, with 20 families and 37 species. Out of the total, 15 species were identified as residents, 11 species were winter migrants, 17 were summer migrants, and 3 bird species were documented as passage migrants. Among the four study sites, Asbanr Valley recorded the highest species richness (R= 16), abundance (N =627), and diversity (H'= 2.294) in the summer season, while Khanpur Valley exhibited the lowest species richness (R= 10), abundance (N =323), and diversity (H'= 1.795) during the winter season. Species richness (R= 16) and diversity (H'= 2.318) were found to be maximum in the riparian forest during the summer; however, the cultivated area showed the highest bird abundance (N =1,071) but the lowest bird diversity (H'= 1.768). Overall, bird abundance was higher (N =2,238) in the summer season than in the winter season (N =1,704). This study provided baseline data about bird diversity in the two Game Reserves, and further studies are required for better management and conservation of species in the region.

**Keywords**: Diversity, Abundance, Avian fauna, Distribution

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## INTRODUCTION

The diversity of avian fauna is an essential component of our planet, providing different services to our environment such as aesthetic beauty, cleaning the earth, and playing a crucial role in biological control as well as in the dispersal of seeds. Their bright coloration, melodious songs, distinct calls, and attractive displays enhance our pleasure in observing their diverse plumage and behaviors (Khan et al., 2012). Bird diversity in a particular habitat is considered one of the most prominent ecological indicators, through which the quality of that habitat can be determined (Manjunath and Joshi, 2012).

The avian fauna of Khyber Pakhtunkhwa (KPK) province is very diverse and rich, but it is likely declining due to ground hunting, trapping, and poaching of

various bird species. Some protected areas in the province have been established to protect and conserve the diversity of avifaunal species in the region (Pathan et al., 2014). Similarly, some natural wooded areas that provide a wide-ranging habitat for wild fauna have also been developed to act as protective and conservational areas, such as the Adenzai and Tangi-Darra Community Game Reserves in Lower Dir District, KPK.

These Community Game Reserves provide vibrant and lively habitats for the diversity of bird species in the region; however, data on bird diversity and abundance are lacking in these areas. Therefore, the present study was conducted in these two Community Game Reserves Adenzai and Tangi-Darra of Lower Dir District to determine the baseline diversity and abundance of avifaunal species found in these unexplored Game Reserves.

## MATERIALS AND METHODS

The present study was conducted at two Community Game Reserves: Adenzai and Tangi-Darra of Lower Dir District, KPK, at an elevation range from 1200m to 2800m above sea level. The Adenzai Community Game Reserve lies between 34°43'06"N and 72°02'55"E, while the Tangi-Darra Community Game Reserve is located at 34°49'41"N and 71°50'39"E (Figure 1). The topography of the study areas consists of open valleys characterized by high mountains with basal plains where seasonal and perennial streams of varying sizes flow. The study areas experience diverse climatic conditions based on elevation, with lower plains being hot in summer and mild in winter, while higher elevations receive snowfall and cold weather during winter and enjoy pleasant temperatures in summer. Most of the rainfall in the areas occurs during the winter season, with annual rainfall being less than 750 mm (Mahmood et al., 2019).

The fieldwork was carried out in the study areas from July 2022 to July 2023 during the winter and summer seasons. The Line Transect Method described by Bibby et al. (1998) was employed for the collection of data within different habitat types of all four study sites (Laram, Khanpur, Asbanr, and Tangi-Darra Valley) in the study areas. A total of thirty-two 1 km long line transects were studied with variable widths, positioned in all three valleys (Asbanr, Khanpur, and LaramValley) of the Adenzai Community Game Reserve and in the valley of the Tangi-Darra Community Game Reserve. Out of the total thirty-two line transects, 8 transects were placed within different habitat types (riparian forests, scrubland, cultivated areas, and pine forests) of each valley, and out of the 8 transects, 2 transects were placed in each habitat type.

A total of four study sites/valleys were visited once each month during both winter and summer seasons. In winter, visits occurred in the morning from 07:00 to 10:00 AM and in the evening from 03:00 to 06:00 PM. In summer, visits were conducted from 06:00 to 09:00 AM in the morning and from 04:00 to 07:00 PM in the evening. Each transect was surveyed by walking at a pace of 1 km/h, using a stopwatch. Observations of all bird species along both sides of the transect lines were made with the aid of 10×50 mm binoculars. Where possible, photographs of the bird species were taken using a Canon D500 digital camera with a 75×300 mm lens. The geographic coordinates at the start and end points of each transect line were recorded

with a Global Positioning System (GPS) device. Bird species were identified using field guides (Grimmett et al., 2008) for the birds of Pakistan. The collected data were arranged in the Microsoft Excel Spread sheet. Relative abundance, Shannon Weiner diversity index as well as evenness index were also calculated.

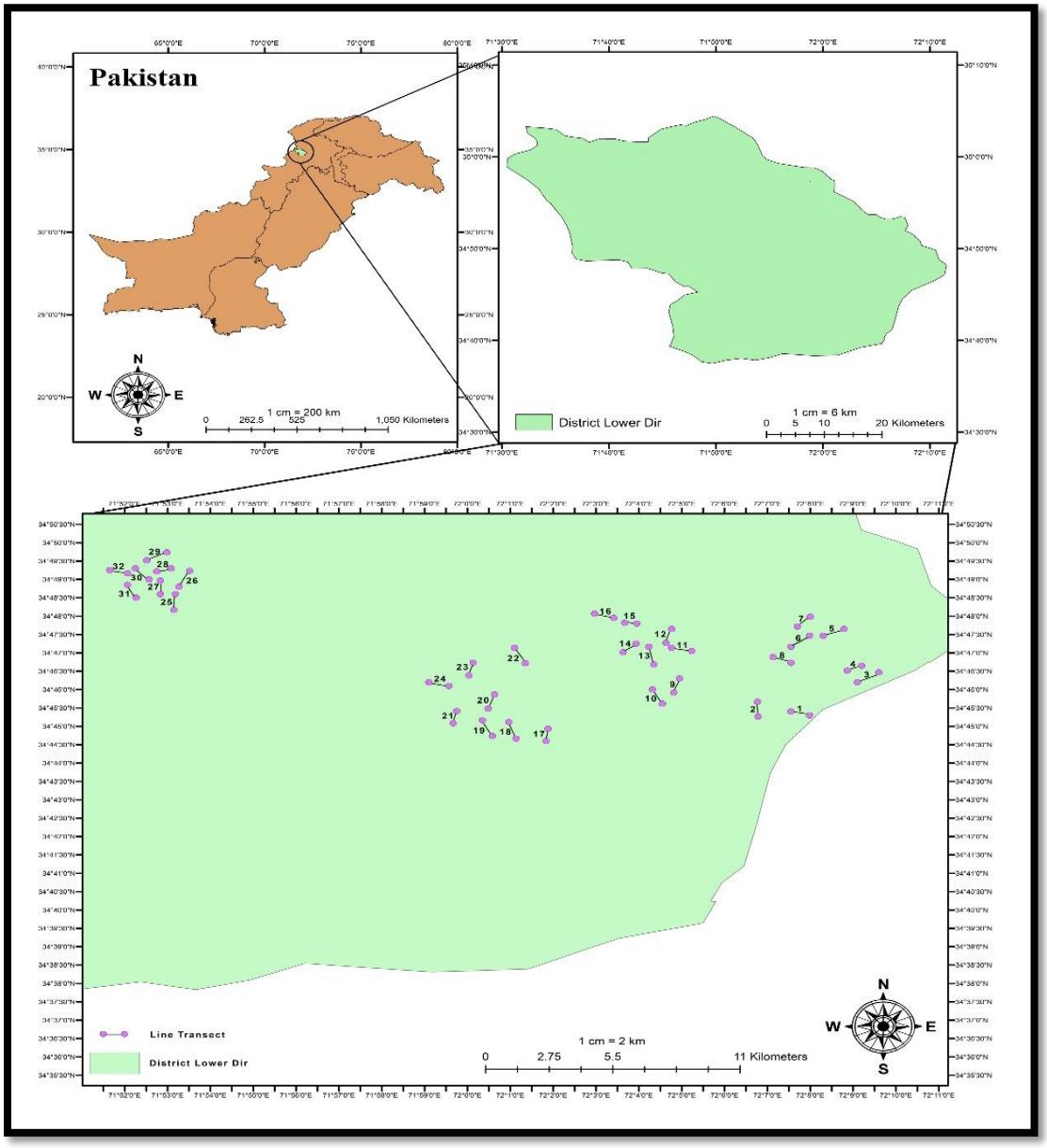


**Figure1: Showing the position of transect lines on Study areas; the violet colored line segments on the study areas represent line transects.**

## RESULTS AND DISCUSSION

A total of 3,942 bird individuals were recorded in the study areas during the winter and summer seasons, belonging to 46 bird species, 26 families, and 7 orders (Table1). The order Passeriformes was found to be the most dominant and diverse order in the study areas, with 20 families and 37 species, comprising 80.4% of the total recorded

species (Figure 2). The maximum number of bird species in the order Passeriformes was recorded in the families Muscicapidae, Corvidae, and Motacillidae, with a maximum of four bird species each. Ali et al. (2020) reported that diversity in bird species varied due to wide-ranging habitat conditions, sufficient food availability, and breeding season.

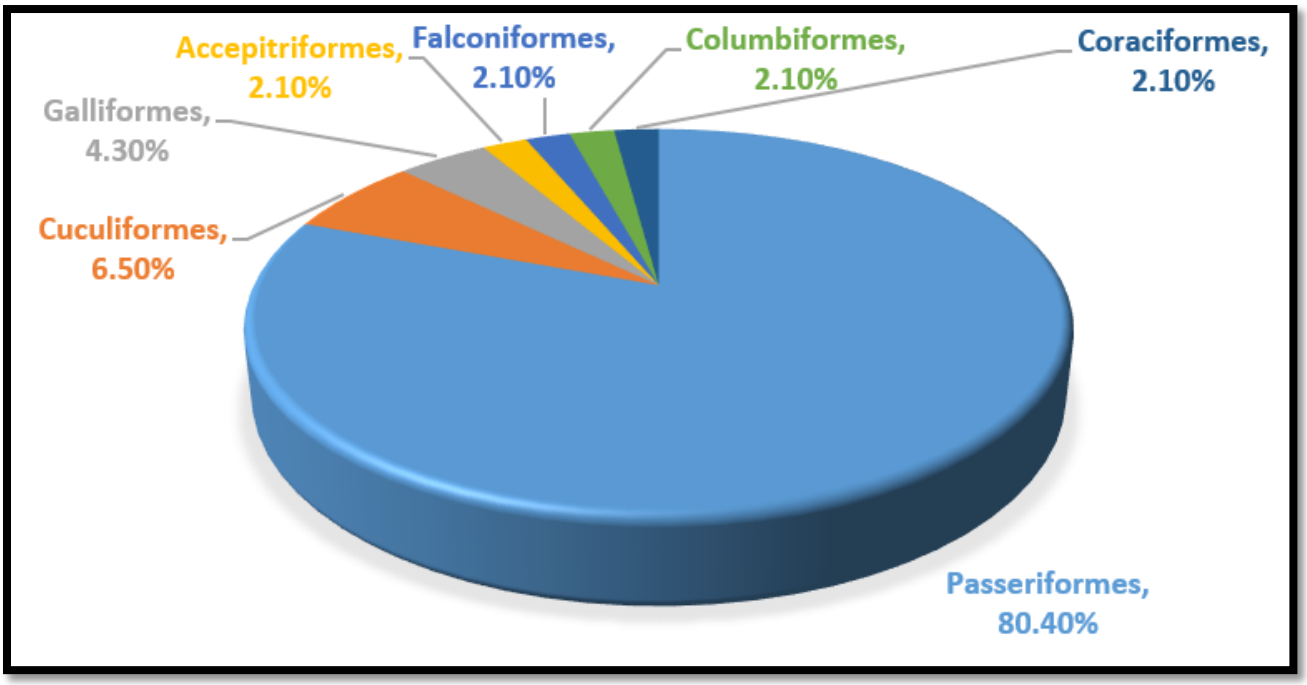


**Figure 2: The number of avian species in each order along with their percentage composition.**

The seasonal variations in the bird species were observed in the study areas during winter and summer seasons. Out of a total of 46 bird species observed in the study areas, 15 bird species were found to be resident, 11 species were winter migrants, 17 were summer migrants, and only 3 bird species were recorded as passage migrants in the study areas. The numbers of individuals of each bird species were recorded in the study areas, and the relative abundance of each species was also calculated. The Common Myna (*Acridotheres tristis*) was found to be the most abundant bird species in the study areas, with 730 individuals and a relative abundance of 0.18, followed by the Red-vented Bulbul (*Pycnonotus cafer*), which had 692 individuals and a relative abundance of 0.17. The Hen Harrier (*Circus cyaneus*) was found to be the least abundant species in the study areas, with only 1 individual and a relative abundance of 0.0002 (Table 1).

The present study was conducted at a total of four study sites: Asbanr, Khanpur, Laram, and Tangi-Darra Valley during the winter and summer seasons. Among the four study sites, Asbanr Valley recorded the highest species richness (R= 14, R= 16), abundance (N= 491, N= 627), and diversity (H'= 2.084, H'= 2.294) respectively in both winter and summer seasons, followed by Tangi-Darra Valley with (R= 12, R= 15) species richness, (N= 466, N= 600) abundance, and (H'= 1.964, H'= 2.25) diversity correspondingly in winter and summer seasons, while Khanpur Valley was found to have the lowest species richness (R= 10, R= 11), abundance (N=

323, N= 456), and diversity (H'= 1.795, H'= 2.05) during winter and summer seasons respectively. The species evenness was found to be almost the same across the four study sites but slightly higher in the summer season than in the winter season, as shown in Table 2. The differences found in species richness, abundance, and diversity of bird fauna among the four study sites could be due to dissimilarities in ecological conditions as well as vegetation types. Ullah et al. (2021) described that the variations in different dynamics such as species richness, diversity, and abundance of bird fauna are linked with the vegetation types of a specific area. Similarly, Kiros et al. (2018) also reported that, due to vegetation structure, food sources, nesting, and shelter conditions, the dynamics of avian species change according to their feeding habits and habitat preferences.

The current study was carried out in different habitat types (Riparian Forest, Scrub Land, Cultivated Area, and Pine Forest) of all study sites during both winter and summer seasons. The species richness (R= 15, R= 16) and diversity (H'= 2.072, H'= 2.318) was found to be maximum in Riparian Forest during both winter and summer seasons, respectively. The Cultivated Area was observed to have the highest bird abundance (N= 791, N =1071) but was found to have the lowest bird diversity (H'= 1.768, H'= 1.968) concerning winter and summer seasons. The Pine Forest was noted to have the least species richness (R= 9, R= 10) and abundance (N= 155, N= 224) correspondingly in both seasons; however, species evenness was recorded as maximum (E= 0.920, E= 0.942) in Pine Forest while it was found to be minimum (E= 0.716, E= 0.805) in the Cultivated Area during winter and summer, respectively (Table 3). The overall bird abundance was found to be higher (N= 2238) in the summer season than in the winter season (N= 1704). Jahangeer et al. (2023) reported that the highest bird diversity (H'= 4.5) was recorded in the Riparian Forest, while the minimum bird diversity (H'= 2.9) was noted in high-altitude pasture. Khan and Gabol (2023) reported that the highest abundance (51%) of bird fauna was found in the Cultivated Area, while the least abundance of bird species was noted in the hilly area (9.023%).

The highest species richness and diversity of avian species were observed in riparian forests, while the greatest bird abundance was found in cultivated areas (Altaf et al., 2018; Rahman et al., 2021, 2023.). This suggests that these habitat types may provide essential life requirements, such as ample food and water resources, as well as shelter and nesting sites, compared to pine forests. Altaf et al. (2013) noted that the diversity and abundance of avian fauna are often influenced by attractive habitat types that fulfill their basic survival needs. Similarly, Kiros et al. (2018) emphasized that habitats offering food resources, shelter, and nesting sites tend to exhibit rich diversity and abundance of avian species. Additionally, Girma et al. (2017) indicated that habitat types supporting a wealth of food, water, and protective nesting sites are associated with high diversity and abundance of bird species.

The results of the present study also show that the diversity and abundance of bird species collectively recorded from all study sites and habitat types were found to be higher in the summer season than in the winter season. In the same way, Khan et al. (2019) reported that the highest diversity (H'=4.3) and abundance (n=1148) of bird species were recorded in the summer season, while the lowest diversity (H'=3.64) and abundance (n=415) were noted in the winter season. Similarly, Gaston

et al. (2000) reported that seasonal changes occur in the abundance of bird fauna due to changes in the availability of food resources and climatic conditions.

## CONCLUSION

This study provides baseline data on bird diversity and abundance, but more organized, long-term scientific studies on bird habitats and breeding activities are required to highlight their issues and to develop conservation strategies and management of species in the region.

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***Authors' contributions:*** Hussain was in responsible of collecting information and planning the study. Nadeem supervised all aspects of the study providing suggestions throughout the project. Ullah, Mahmood, Kayani, and Aihetasham conducted a critical review and revision of the paper to improve its scientific content and clarity.

**Table 1: List of avian species along with their orders, families, seasonal status, number and Relative Abundance (R.A.) recorded from the study area.**

| Order | Family | Common names | Scientific names | Distribution | No. | R. A. | Status |
|---|---|---|---|---|---|---|---|
| **Galliformes** | **Phasianidae** | Black Partridge | *Francolinus francolinus* (Linnaeus,1766) | R | 14 | 0.003 | LC |
| | | Chukar Partridge | *Electorus chukar* (Gray,1830) | R | 5 | 0.0012 | LC |
| **Accipitriformes** | **Accipitridae** | Hen Harrier | *Circus cyaneus* (Linnaeus,1766) | PM | 1 | 0.0002 | LC |
| **Falconiformes** | **Falconidae** | Marlin | *Falco columbarius* (Linnaeus,1758) | PM | 2 | 0.0005 | LC |
| **Cuculiformes** | **Cuculidae** | Eurasian Cuckoo | *Cuculus canorus* (Linnaeus,1758) | SM | 3 | 0.0007 | LC |
| | | Grey-bellied Cuckoo | *Cacomantis passerines* (Vahl,1797) | SM | 13 | 0.003 | LC |
| | | Asian Koel | *Eudynamys scolopacea* (Linnaeus,1758) | SM | 6 | 0.0015 | LC |
| **Columbiformes** | **Columbidae** | Spotted Dove | *Streptopelia chinensis* (Scopoli,1786) | SM | 37 | 0.009 | LC |
| **Coraciiformes** | **Alcedinidae** | White-thoated kingfisser | *Halcyon smyrnensis* (Linnaeus,1758) | R | 2 | 0.0005 | LC |
| **Passeriformes** | **Phylloscopidae** | Greenish Warbler | *Phylloscopus trochilides* (Sundevall,1837) | PM | 179 | 0.045 | LC |
| | **Cettiidae** | Brownish-flanked Bush Warbler | *Cettia fortipes* (Hodgson,1845) | R | 12 | 0.003 | LC |
| | **Cisticolidae** | Straited Prinia | *Prinia criniger* (Hodgson,1836) | R | 130 | 0.032 | LC |
| | **Muscicapidae** | Pied Bushchat | *Saxicola caprata* (Linnaeus,1766) | SM | 97 | 0.024 | LC |
| | | White-capped Water Redstar | *Chaimarrornis leucocephalus* (Vigors,1831) | WM | 5 | 0.0012 | LC |
| | | Plumbeous Water Redstar | *Rhyacornis fuliginosus* (Vigors,1831) | WM | 6 | 0.0015 | LC |
| | | Spotted Fork-tailed | *Enicurus maculates* (Vigors,1831) | SM | 3 | 0.0007 | LC |
| | **Paridae** | Great Tit | *Parus major* (Linnaeus,1758) | WM | 138 | 0.035 | LC |
| | **Certhiidae** | Bar-tailed Tree creeper | *Certhia himalayana* (Vigors,1832) | R | 3 | 0.0007 | LC |
| | **Leiothrichidae** | Common Babbler | *Turdoides caudatus* (Dumont,1823) | R | 407 | 0.1 | LC |
| | | Streaked Loughingthrush | *Garrulax lineatus* (Vigors,1831) | R | 296 | 0.075 | LC |
| | **Pycnonotidae** | Red-vented Bulbul | *Pycnonotus cafer* (Linnaeus,1766) | R | 692 | 0.17 | LC |
| | | Himalayan Bulbul | *Pycnonotus leucogenys* (Gray,1835) | R | 242 | 0.06 | LC |
| | **Passeridae** | House Sparrow | *Passer domesticus* (Linnaeus,1758) | R | 202 | 0.05 | LC |
| | **Fringilidae** | Common Rose-finch | *Carpodacus erythrinus* (Pallas,1770) | SM | 52 | 0.013 | LC |
| | | Fire-fronted Serin | *Serinus pusillus* (Pallas,1811) | WM | 56 | 0.014 | LC |
| | **Emberizidae** | Rock Bunting | *Emberiza cia* (Linnaeus,1766) | R | 142 | 0.036 | LC |
| | | Pine Bunting | *Emberiza leucocephalos* (Gmelin,1771) | SM | 25 | 0.006 | LC |
| | | Crested Bunting | *Melophus lathami* (Gray,1831) | SM | 9 | 0.0022 | LC |
| | **Sturnidae** | Common Myna | *Acridotheres tristis* (Linnaeus,1766) | R | 730 | 0.18 | LC |
| | | Brahminy Starling | *Sturnus pagodarum* (Gmelin,1789) | SM | 7 | 0.0017 | LC |
| | **Corvidae** | Large Billed Crow | *Corvus macrorhynchos* (Wagler,1827) | R | 49 | 0.012 | LC |
| | | House Crow | *Corvus splendens* (Vieillot,1817) | R | 32 | 0.008 | LC |
| | | Rufouse Treepie | *Dendrocitta vagabunda* (Latham,1790) | WM | 21 | 0.005 | LC |
| | | Blue Jay | *Cyanocitta cristata* (Linnaeus,1758) | WM | 4 | 0.001 | LC |
| | **Motacillidae** | Rosy Pipit | *Anthus roseatus* (Blyth,1847) | WM | 17 | 0.004 | LC |
| | | Long-billed Pipit | *Anthus similis* (Jerdon,1840) | SM | 5 | 0.0012 | LC |
| | | Grey Wagtail | *Motacilla cinerea* (Tunstall,1771) | WM | 7 | 0.0017 | LC |

| | | | | | | |
|---|---|---|---|---|---|---|
| | White Wagtail | *Motacilla alba* (Linnaeus,1758) | WM | 2 | 0.0005 | LC |
| **Turdidae** | Eurasian Black Bird | *Turdus merula* (Linnaeus,1758) | WM | 16 | 0.004 | LC |
| | Dark-throated Thrush | *Turdus ruficollis* (Pallas,1776) | WM | 14 | 0.003 | LC |
| | Tickell Thrush | *Turdus unicolor* (Tickell,1833) | SM | 24 | 0.006 | LC |
| **Monarchidae** | Asian Paradise Flycature | *Terpsiphone paradise* (Linnaeus,1758) | SM | 12 | 0.003 | LC |
| **Dicruridae** | Black Drango | *Dicrurus macrocercus* (Vieillot,1817) | SM | 93 | 0.023 | LC |
| **Laniidae** | Long-tailed Shrike | *Lanius schach* (Linnaeus,1758) | SM | 33 | 0.008 | LC |
| **Hirundinidae** | Barn Swallow | *Hirundo rustica* (Linnaeus,1758) | SM | 92 | 0.023 | LC |
| **Oriolidae** | EurasianGolden Oriole | *Oriolus oriolus* (Linnaeus,1758) | SM | 5 | 0.0012 | LC |

**Note:** R i.e. Resident; SM i.e. Summer Migrant; WM i.e. Winter Migrant; PM i.e. Passage migrant

**Table 2: The overall species richness, diversity, abundance and evenness of avian species recorded from the all four study sites during winter and summer season.**

| Study Site | Season | (R) | (N) | (H') | (E) |
|---|---|---|---|---|---|
| Asbanr valley | Winter | 14 | 491 | 2.084 | 0.801 |
| | Summer | 16 | 627 | 2.294 | 0.884 |
| Khanpur valley | Winter | 10 | 323 | 1.795 | 0.865 |
| | Summer | 11 | 456 | 2.05 | 0.893 |
| Laram valley | Winter | 11 | 424 | 1.822 | 0.840 |
| | Summer | 12 | 555 | 2.079 | 0.893 |
| Tangi-Darra valley | Winter | 12 | 466 | 1.964 | 0.849 |
| | Summer | 15 | 600 | 2.25 | 0.889 |

**Note:** (R)= Species Richness, (N)= Abundance, (H') = Shannon Weiner diversity index, (E)= Evenness

**Table 3: Species richness, abundance, diversity and evenness of bird species collectively recorded from the different habitat types of the study areas during both; winter and summer seasons.**

| Habitat type | Season | (R) | (N) | (H') | (E) |
|---|---|---|---|---|---|
| Riparian Forest | Winter | 15 | 362 | 2.072 | 0.865 |
| | Summer | 16 | 542 | 2.318 | 0.904 |
| Scrub Land | Winter | 12 | 396 | 1.950 | 0.854 |
| | Summer | 14 | 401 | 2.271 | 0.907 |
| Cultivated Area | Winter | 11 | 791 | 1.768 | 0.716 |
| | Summer | 13 | 1071 | 1.968 | 0.805 |
| Pine Forest | Winter | 9 | 155 | 1.874 | 0.920 |
| | Summer | 10 | 224 | 2.116 | 0.942 |

**Note:** (R)= Species Richness, (N)= Abundance, (H') = Shannon Weiner diversity index, (E)= Evenness